Volume II

APPENDICES A – C

Wesley Gray
M.Ed. ELT
Rhodes University

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LETTER OF PERMISSION GIVEN TO THE LEARNERS BEFORE THE PRELIMINARY STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: +27 46 603 8700
Fax: +2746 622 8028

27 January 2006

Dear Learners

I am currently registered as a M.Ed. student in the Education Faculty at Rhodes University. My area of interest lies in the role that language plays in teaching and learning Science. Presently, I am at the initial stages of my research design and would be most appreciative if I could observe your class as part of my preliminary study.

Sincerely,

Wesley Gray

EXAMPLE OF A LETTER OF PERMISION GIVEN TO THE PRINCIPALS AND TEACHERS BEFORE THE PRELIMINARY STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: +27 46 603 8700
Fax: +2746 622 8028
Cell: 078 126 4490

27 January 2006

Dear [name]

I am currently registered as a M.Ed. student in the Education Faculty at Rhodes University. My area of interest lies in the role that language plays in teaching and learning Science. Presently, I am at the initial stages of my research design and would be most appreciative if I could observe your Grade 10 and 11 Physical Science classes as part of my preliminary study.

Sincerely,

Wesley Gray

EXAMPLE OF A THANK YOU LETTER GIVEN TO THE TEACHERS AFTER THE PRELIMINARY STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: +27 46 603 8700
Fax: +2746 622 8028
Cell: 078 126 4490

10 February 2006

Dear [name]

Thank you for being so willing to open up your classes to me for observation and for the much valued insight that you provided.

It is much appreciated.

Best regards,

Wesley

EXAMPLE OF A LETTER OF PERMISSION GIVEN TO THE SCHOOL GOVERNING BODY BEFORE THE RESEARCH STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: (046) 603 8700
Fax: (046) 622 8028

30 March 2006

To: The School Governing Body

Thank you for allowing me to conduct the preliminary study at your school during February, 2006. The proposal for the study has since been approved by the university and I would be most appreciative if I could begin the study during term 2 on the school calendar.

The purpose of this study is to understand the dialogue between a teacher and his/ her learners in grade 10 physical science. I have requested permission to do the study from the grade 10 physical science teacher, [name], who has since agreed to partake in the study. The study will entail the observation of ~3 consecutive lessons and if permitted these lessons will be video taped and transcribed.

I wish to assure [name], [name] and the learners that their anonymity will be maintained. As participation in this study is voluntary [name] and her learners may withdraw from the study at any point. During the study I will ask [name] for feedback on the conclusions drawn from the data. Furthermore, I will make the findings for the study available to the school, [name] and other interested stakeholders.

Should you have any concerns or questions, please do not hesitate to contact me at 078 126 4490, or my supervisors, Mrs. Sarah Murray and Mr. Ken Ngcoza, at the Faculty of Education at Rhodes, on (046) 603 8386.

Sincerely

Wesley Gray
(Student number: 606G3296)

EXAMPLE OF A LETTER OF PERMISSION GIVEN TO THE PRINCIPALS BEFORE THE RESEARCH STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: (046) 603 8700
Fax: (046) 622 8028

30 March 2006

Dear [name]

Thank you for allowing me to conduct the preliminary study at your school during February, 2006. The proposal for the study has since been approved by the university and I would be most appreciative if I could begin the study during term 2 on the school calendar.

The purpose of this study is to understand the dialogue between a teacher and his/ her learners in grade 10 physical science. I have requested permission to do the study from the grade 10 physical science teacher, [name], who has since agreed to partake in the study. The study will entail the observation of ~3 consecutive lessons and if permitted these lessons will be video taped and transcribed.

I wish to assure [name], [name] and the learners that their anonymity will be maintained. As participation in this study is voluntary [name] and her learners may withdraw from the study at any point. During the study I will ask [name] for feedback on the conclusions drawn from the data. Furthermore, I will make the findings for the study available to the school, [name] and other interested stakeholders.

Should you have any concerns or questions, please do not hesitate to contact me at 078 126 4490, or my supervisors, Mrs. Sarah Murray and Mr. Ken Ngcoza, at the Faculty of Education at Rhodes, on (046) 603 8386.

Sincerely

Wesley Gray
(Student number: 606G3296)

EXAMPLE OF A LETTER OF PERMISSION GIVEN TO THE TEACHERS BEFORE THE RESEARCH STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: (046) 603 8700
Fax: (046) 622 8028

30 March 2006

Dear [name]

Thank you for being so willing to open up your classes to me for observation during the preliminary study. The proposal for the study has since been approved by the university and I would be most appreciative if I could begin the study during term 2 on the school calendar.

The purpose of this study is to understand the dialogue between a teacher and his/ her learners in the grade 10 physical science classroom. The study will entail the observation of ~3 consecutive lessons. If permitted these lessons will be video taped and transcribed. I would appreciate it if at a later date a time could be arranged to obtain your much valued insight on the conclusions drawn from the data.

I wish to assure you that your anonymity, as well as the school's and learners' anonymity, will be maintained. As participation in this study is voluntary you may choose to withdraw from the study at any time. The findings for the study will gladly be made available to you, the school and other interested stakeholders.

Should you have any concerns or questions, please do not hesitate to contact me at 078 126 4490, or my supervisors, Mrs. Sarah Murray and Mr. Ken Ngcoza, at the Faculty of Education at Rhodes, on (046) 603 8386.

Sincerely

Wesley Gray
(Student number: 606G3296)

EXAMPLE OF A LETTER OF PERMISSION GIVEN TO THE PARENTS BEFORE THE RESEARCH STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: (046) 603 8700
Fax: (046) 622 8028

30 March 2006

Dear Parents

I am a M.Ed. student in the Education Faculty at Rhodes University who would like to learn more about good teaching practice by observing [name] and her learners during Physical Science. As I will need to video tape and transcribe the lessons in which your son/ daughter participates I would like to request permission from you to do so. I wish to assure you that your son's/ daughter's anonymity will be maintained. The findings from this study will also gladly be made available to you upon request.

If you have any questions or concerns please feel free to contact me at 078 126 4490 or my supervisors, Mrs. Sarah Murray and Mr. Ken Ngcoza, at the Faculty of Education at Rhodes, on (046) 603 8700.

Sincerely

Wesley Gray
(Student number: 606G3296)

CONSENT FORM

We, _____, the parents of _____ permit Wesley Gray (Student number: 606G3296) to observe, video tape and transcribe the physical science lessons in which our son/ daughter will be a participant. We understand that our son's/ daughter's anonymity will be maintained and that the findings of the study will be made available to us upon request.

Signature: _____ Date: _____

EXAMPLE OF A LETTER OF PERMISSION TRANSLATED IN ISIXHOSA AND GIVEN TO THE PARENTS BEFORE THE RESEARCH STUDY

Mzali/mmelimzali ohloniphekileyo

Igama lam ndingu Wesley Gray. Ndifunda izifundo zeMEd apha eRhodes University, izifundo ke ezimalunga nophuhliso lwezemfundo nokuhlohlwa kwezeNzululwazi ezikololweni ngenjongo zokuphuhlisa ikamva labantwan bethu eMzantsi Afrika. Ngxebe, umnqweno wam ke kukufunda ngokuphangaleleyo ngendlela zokufundisa ezeNzululwazi ngokuthi ndibonele utishala onamava kunene umnumzana uMaselwa oxelenga eNathaniel Nyaluza xa ehlohla abafundi bakhe.

Njengoko ke kuzafuneka ukuba ndiziteyipe ezizifundo zichaphazela umntwana wakho, khonokuze ndizibhale phantsi ngobunono, kufanelekile ukuba ndicela imvume kuwe okwenza oko. Ngoko ke ndiyakuthembisa ukuba igama lomtwana wakho alisokuze libhengezwe. Kananjalo, ndiyakuthembisa ukuba unalo ilungelo lokuyifumana lengxelo ngoluphando nanina uyifuna.

Ukuba ke unento ongayiqondiyo nceda uqhakamishelane nam kule nombolo: 078 126 4490 okanye umnumzana [name] kulenombolo: 6361618 okanye abafundisi ntsapho bam uNkosikazi uSarah Murray kwakunye nomnumzana uKenneth Ngcoza kwezinombolo zilandelayo: 6038386 okanye 6038385.

Ozithobileyo

Wesley Gray
(Inombolo yokuba ngumfundi: 606G3296)

ISIQINISEKISO

Mna_____

Mzali/mmelimzali

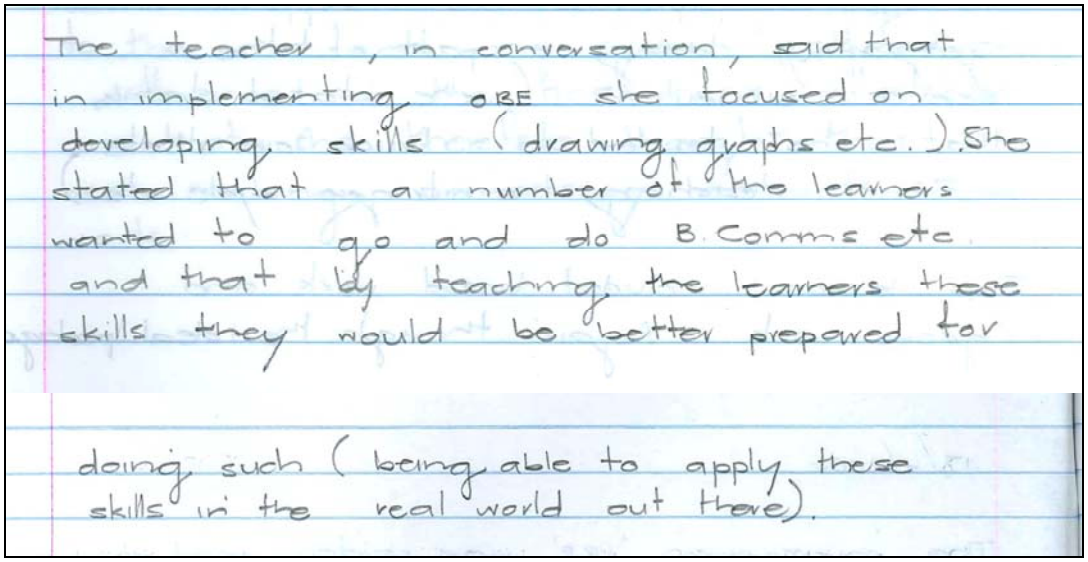
_____

Ndiyamvumela uWesley Gray ukuba abonele xa kufundiswa umntwana wam, aze acholachole nokucholachola ngeteyipu nangokubhala akubonileyo xa umnumzana [name] efundisa ezeNzululwazi. Ndiyaqonda ke ukuba igama lomntwana wam alisokuze libhengezwe ngaphandle kwemvume yam. Yaye iziphumo ngoluphando ziyakuthi zifumaneke naninina xa ndizifuna.

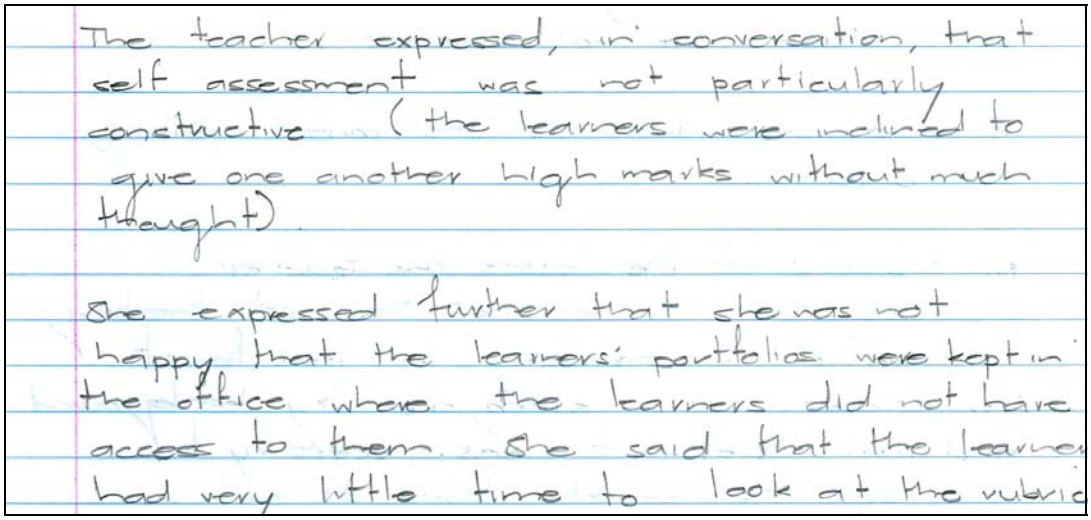
Umsayino_____Umhla_____

EXAMPLES OF JOURNAL ENTRIES

Date: 18/ 4/ 2006

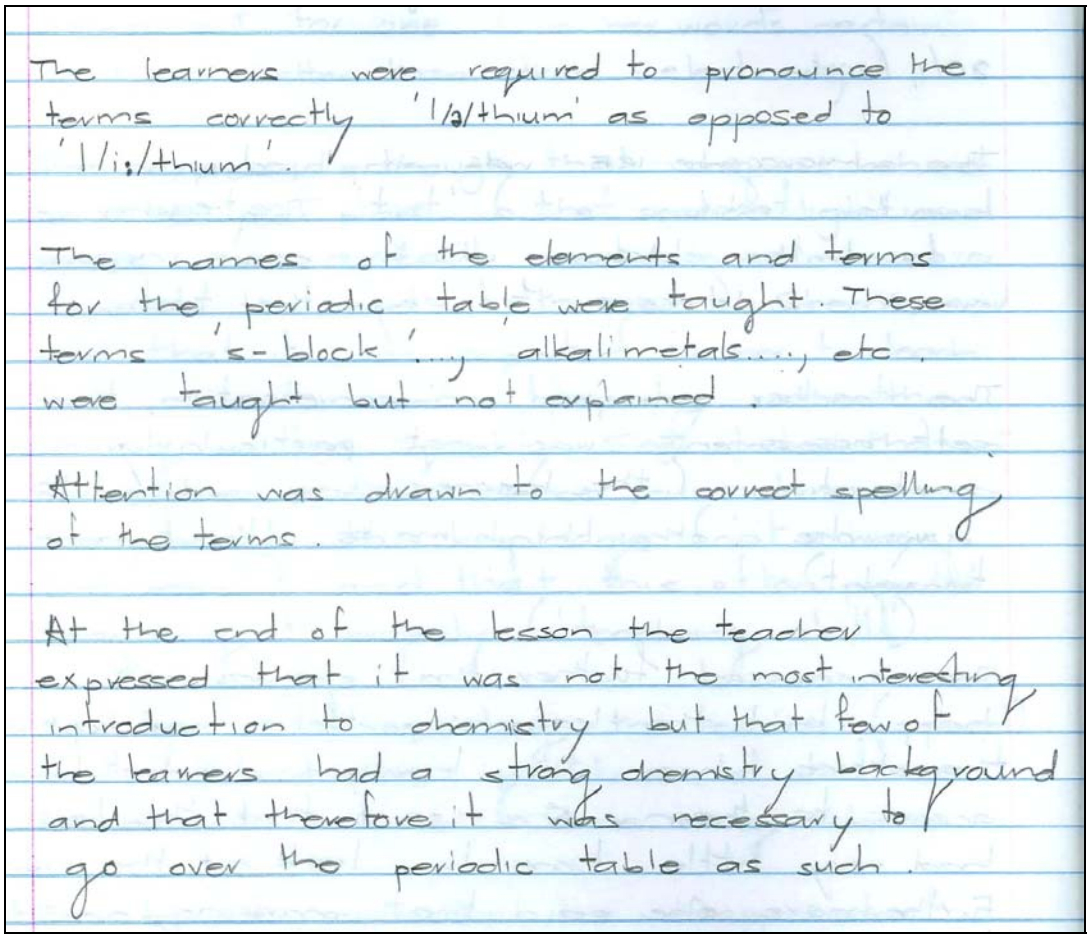

The teacher, in conversation, said that in implementing OBE she focused on developing skills (drawing graphs etc.). She stated that a number of the learners wanted to go and do B. Comms etc. and that by teaching the learners these skills they would be better prepared for doing such (being able to apply these skills in the real world out there).

Date: 20/04/ 2006


The teacher expressed, in conversation, that self assessment was not particularly constructive (the learners were inclined to give one another high marks without much thought).

She expressed further that she was not happy that the learners' portfolios were kept in the office where the learners did not have access to them. She said that the learners had very little time to look at the rubric

Date: 21/ 04/ 2006



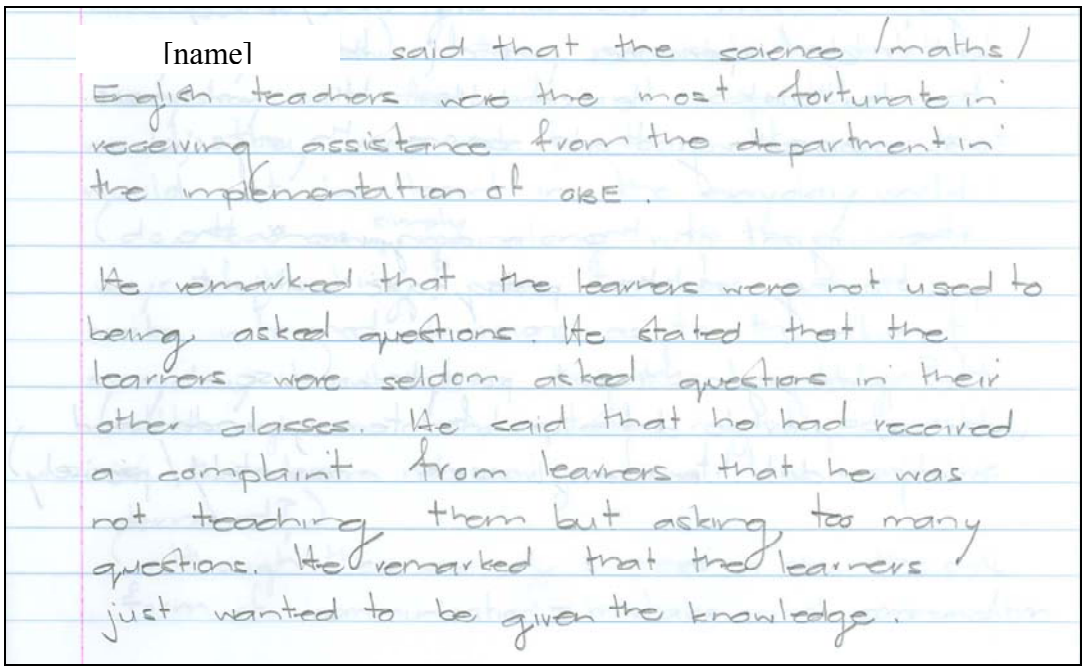
The learners were required to pronounce the terms correctly 'l/ə/thium' as opposed to 'l/i:/thium'.

The names of the elements and terms for the periodic table were taught. These terms 's-block',..., alkalimetals...., etc. were taught but not explained.

Attention was drawn to the correct spelling of the terms.

At the end of the lesson the teacher expressed that it was not the most interesting introduction to chemistry but that few of the learners had a strong chemistry background and that therefore it was necessary to go over the periodic table as such.

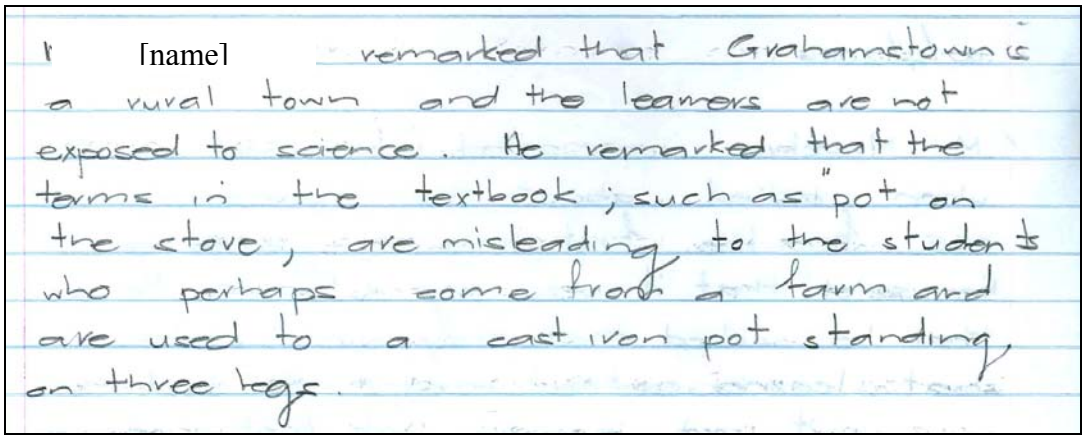
Date 12/ 04/ 2006



[name] said that the science /maths/ English teachers were the most fortunate in receiving assistance from the department in the implementation of OBE.

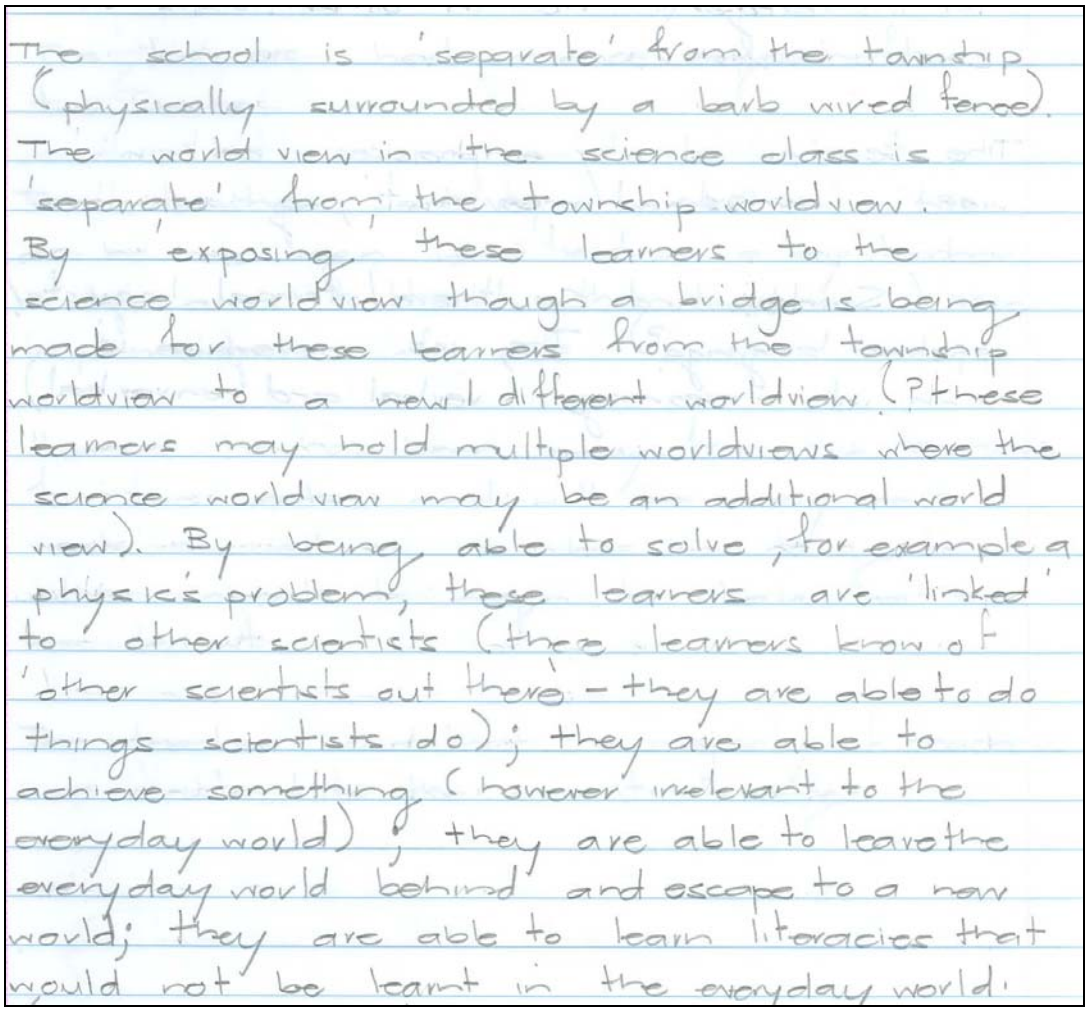
He remarked that the learners were not used to being asked questions. He stated that the learners were seldom asked questions in their other classes. He said that he had received a complaint from learners that he was not teaching them but asking too many questions. He remarked that the learners just wanted to be given the knowledge.

Date: 12/ 04/ 2006



[name] remarked that Grahamstown is a rural town and the learners are not exposed to science. He remarked that the terms in the textbook; such as "pot on the stove, are misleading to the students who perhaps come from a farm and are used to a cast iron pot standing on three legs.

Date: 12/ 04/ 2006



The school is 'separate' from the township (physically surrounded by a barb wired fence). The world view in the science class is 'separate' from the township worldview. By exposing these learners to the science worldview though a bridge is being made for these learners from the township worldview to a new/ different worldview (? these learners may hold multiple worldviews where the science worldview may be an additional world view). By being able to solve, for example a physics problem, these learners are 'linked' to other scientists (these learners know of 'other scientists out there – they are able to do things scientists do); they are able to achieve something (however irrelevant to the everyday world); they are able to leave the everyday world behind and escape to a new world; they are able to learn literacies that would not be learnt in the everyday world.

APPENDIX B

TRANSCRIPTS A – I

ACTIVITY TYPE: 'review' [1]; 'microgenre' 'IRF' [3]
FIELD [2]:
Displacement – definition(s) and units

1.1A **T** we looked at displacement and what and time yesterday we discussed what
1.2A displacement and we said what's displacement it's a change in position in a
1.3A given direction I gave many examples of how a displacement so many
1.4A ways of changing ones displacement the second one I said is yes
1.5A **L** a straight line direction
1.6A **T** no I didn't say that a straight line distance distance instead of direction
1.7A how can I get a [unclear] direction straight line distance between two
1.8A positions or two points or lastly I said or lastly I said displacement is yes it
1.9A is

ACTIVITY TYPE: 'interruption' [1] – teacher admonition

2.1A **T** you were absent from my class [name] you must wait behind you must
2.2A wait behind

ACTIVITY TYPE: 'review' cont. [1]; 'microgenre' 'IRF' [3]
FIELD [2]:
Displacement – definition(s) and units

1.10A **T** yes now we have displacement is a straight line distance between two
1.11A points or two positions in a given direction or it is the shortest the shortest
1.12A distance between two points

ACTIVITY TYPE: 'demonstration' [1]

FIELD [2]:
Displacement – definition

3.1A **T** now I said I like the first one displacement is a change in position in a
3.2A given direction okay here I change I'm in this position I move to another
3.3A position okay I've made a displacement I've made a displace I've displaced

3.4A		myself I was in that place now I'm in another place now I could have come
3.5A		this place I could have come to this place in many ways I show you I said I
3.6A		move this way right across this way right across this way I still come here
3.7A		right ne but ne but that is what what have I done to move this way I still
3.8A		have gone a a long distance of that is the actual what the actual path to
3.9A		move from one position to this one but if I were to go there directly I move
3.10A		from there or I move from here to here I've just changed my position in a
3.11A		straight line that's what I said it's a straight line distance between two
3.12A		points that is displacement
ACTIVITY TYPE: 'review' cont. [1]; 'microgenre' 'IRF' [3]		
FIELD [2]:		
Displacement – definition(s) and units		
1.13A	**T**	now we said the units of displacement are what what are the units of
1.14A		displacement yes
1.15A	**L**	the meter
1.16A	**T**	the meter which means displacement and meters have something in
1.17A		common displacement is really a straight line distance it it is distance
ACTIVITY TYPE: 'review' [1]; 'microgenre' 'IRF'[3]		
FIELD [2]:		
Speed/ velocity – equation and units		
Speed/ velocity – definition		
4.1A	**T**	now when you displace yourself from somewhere to somewhere you really
4.2A		do what you really walk a certain distance okay you accept that
4.3A	**L**	yes
4.4A	**T**	and therefore and therefore we said for displacement to happen there must
4.5A		be we said that a period a time when you take distance and divide it by
4.6A		time what do we get
4.7A	**Ls**	speed
4.8A	**T**	we got what
4.9A	**Ls**	speed

4.10A	**T**	I agree with you I agree with you and so then we actually said when we
4.11A		take when we uh so we said speed equals distance divided by time the total
4.12A		distance moved divided by the total time taken to complete that distance
4.13A		and we said here the units are what [code-switches] are meters divide by
4.14A		seconds that's units are what are meters divided by seconds or meter per
4.15A		second [chalkboard (1)] now similarly even in the case of what of
4.16A		displacement you can actually have what displacement divided by what by
4.17A		time and the units are also what meter divided by second or meter per
4.18A		second[chalkboard (2)] what is displacement divided by time who knows
4.19A		this mm who can tell me uh we know distance divided by time is speed but
4.20A		what is change in position divided by time who knows yes [name]
4.21A	**L**	it's the velocity
4.22A	**T**	it's velocity good [name] velocity okay so you say velocity uh velocity
4.23A		[chalkboard (3)] what is velocity what is velocity yes boy
4.24A	**L**	velocity is a speed with direction
4.25A	**T**	velocity is a speed with direction okay very good he says he says velocity
4.26A		is speed in a given direction [chalkboard (4)] who else has something to
4.27A		say who says velocity is speed in a given direction or a speed with
4.28A		direction uh now remember he said now later we defined what remember
4.29A		we said when we define speed how do we define speed we said speed is
4.30A	**Ls**	the rate of distance
4.31A	**T**	we said speed is
4.32A	**Ls**	the rate of
4.33A	**T**	the rate of
4.34A	**Ls**	distance
4.35A	**T**	distance
4.36A	**T**	what is the speed what is velocity what is velocity what is velocity what is
4.37A		the velocity c'mon [code-switches] yes [name]
4.38A	**L**	velocity is the rate of displacement
4.39A	**T**	the rate of

$$speed = \frac{dis\tan ce}{time} = \frac{m}{s} \ or\ m/s$$

(2)

$$speed = \frac{dis\tan ce}{time} = \frac{m}{s} \ or\ m/s$$

$$= \frac{displacement}{time} = \frac{m}{s} \ or\ m/s$$

(3)

$$speed = \frac{dis\tan ce}{time} = \frac{m}{s} \ or\ m/s$$

$$velocity = \frac{displacement}{time} = \frac{m}{s} \ or$$

m/s

(4)

velocity is speed in a given direction

4.40A	**Ls**	displacement
4.41A	**T**	displacement it's easy speed is the rate of what of
4.42A	**Ls**	distance
4.43A	**T**	distance therefore velocity is the rate of displacement okay, good, okay
4.44A		good so we now so we now have a new a new unit we now have a new unit
4.45A		here now notice how this [code-switches]

ACTIVITY TYPE: 'copying notes' [1]
FIELD [2]:
Displacement – definition(s)
Velocity – definition, equation and units

5.1A	**T**	now okay let's write this thing down now ne all of us okay lets' consolidate
5.2A		here ne and write our notes down here right now [code-switches] stop work
5.3A		[unclear] we look at what else [code-switches] time [code-switches] now
5.4A		we look at what so we first write down this one date [code-switches]
5.5A		please ne we said displacement is a change in position in a given direction
5.6A		but that is what we said about displacement are we alright or we said
5.7A		displacement is straight line distance between two places or two points
5.8A		okay again we said displacement is the shortest distance between two
5.9A		points uhh displacement is the shortest distance between two points
5.10A		displacement is the shortest distance between two points [chalkboard (5)]
5.11A		are you happy are you comfortable
5.12A	**Ls**	yes
5.13A	**T**	are you sure that you understand this but I said I like what I said that I like
5.14A		the first one ne I said I like the first one because you'll understand later ne
5.15A		they are all correct ja they are all correct then we said we now came to
5.16A		velocity sorry eone [sic] etwo [sic] velocity is the rate of what of
5.17A	**Ls**	[a number of learners talk at the same time]
5.18A	**T**	change in position the rate of change in position and we've got one word
5.19A		[code-switches] for the change in position and the word is
5.20A	**L**	displacement

5.21A **T** displacement [chalkboard (5)] good so instead of saying change your
5.22A positioning I say displace yourself okay so it is the rate of change in
5.23A position or or displacement the units are meter so v equals sorry velocity
5.24A equals uh displacement divide by time time taken to do the displacement
5.25A okay are you happy now
5.26A **Ls** yes
5.27A **T** are we happy okay now I've said in science we like to economize with the
5.28A writing it means we like to write in a short way an easy short way I haven't
5.29A shown you that right I haven't shown you that but before I do that let's
5.30A switch off all the the so here we have velocity have meter divided by
5.31A second is the same as what as meter per second or meter dot per second
5.32A [chalkboard (5)] am I right yes the same units as what as speed but
5.33A remember speed has no direction ne velocity has direction why because
5.34A displacement has what direction displacement has direction so velocity
5.35A must also have what direction displacement happens in a given direction
5.36A are we happy
5.37A **L** yes
5.38A **T** are we happy good

ACTIVITY TYPE: 'interruption' [1] [interruption/ language] – 'how to ask for help'

6.1A **T** I know that we like to say yes no child likes to say no I can't understand
6.2A why if you can't understand please say no and start saying why and where
6.3A you don't understand okay don't just say yes no don't be a [unclear] [code-
6.4A switches] uh
5.39A let's look at the last part now do you understand that from the seven base
5.40A units you can make other what other units right let's have a look at the at
5.41A the other one

ACTIVITY TYPE: 'interruption' [1] – cleaning the chalkboard

7.1A **T** okay who wants to clean the board for me please who wants to clean the
7.2A board for me
7.3A **L** [a learner cleans the chalkboard]

(5)

(1)
* Displacement is a change in position in a given direction
* Displacement is a straight line distance between two points
* Displacement is the shortest distance between two points

(2)
*Velocity is the rate of change in position

displacement

$$velocity = \frac{displacement}{time} = m/s \ \ or \ \ m.s^{-1}$$

ACTIVITY TYPE: 'microgenre' 'IRF' [3]
FIELD [2]:
Force

8.1A	**T**	let's now brainstorm again here when you move when something moves or
8.2A		when you move or we say when something is in motion what makes things
8.3A		to move what makes things what makes things to move uh when you if you
8.4A		begin to move something must be happening what makes things to move
8.5A		yes
8.6A	**L**	force
8.7A	**T**	a force ne a force makes things to move

ACTIVITY TYPE: 'demonstration' [1] [role play]

FIELD [2]:
Force

9.1A	**T**	okay okay okay okay okay a force makes things to move I'm going to force
9.2A		this wall to move I'm going to force this thing to move but you
9.3A		said a force can make things to move but you had it wrong there is
9.4A		something you don't understand you don't understand about what about
9.5A		yes
9.6A	**L**	force of gravity
9.7A	**T**	force of gravity okay okay so you mean things move because of force of
9.8A		gravity

ACTIVITY TYPE: 'interruption' [1] [interruption/ language] – 'the force of something'
FIELD [2]:
Gravitational force

10.1A	**T**	now I would like you to as from today don't speak of the force of something
10.2A		okay don't speak of the force of something because things don't have what
10.3A	**Ls**	force
10.4A	**T**	force but as but things always exert a force you I can I can

10.5A		I can I can exert I can put on force on this table it doesn't mean that I have
10.6A		force uh listen to that very carefully I don't possess force I don't possess
10.7A		force [unclear] I don't have force but I know a force is acting on me and I
10.8A		can also exert a force I can exert it means I can I can act I can exert exert a
10.9A		force [chalkboard (6)] I can exert a force on something else it means I can
10.10A		make a force to act on something I can make a force to act on something but
10.11A		I don't have force so don't speak of the force of gravity I know older people
10.12A		like ourselves and older folks speak of what force of gravity okay but I
10.13A		don't like it I'm happier you know to say gravitational force or the force
10.14A		exerted by
10.15A	**Ls**	gravity
10.16A	**T**	gravity okay that becomes more scientific that becomes more more
10.17A		scientific the force exerted by gravity or gravitational force

(6)

<u>exert a force</u>

(7)

<u>Force</u> - can change direction
- force can move an object from one place to another
- can stop moving objects
- can change the shape of an object

ACTIVITY TYPE: 'microgenre' 'IRF' cont. [3]
FIELD [2]:
Force [chalkboard (7)]

8.8A	**T**	okay now okay what can force do give me things that force can do yes
8.9A	**L**	it can change the direction
8.10A	**T**	it can change okay force let's have a look at that force [code-switches]
8.11A		force can change what
8.12A	**Ls**	direction
8.13A	**T**	direction yes I agree anybody else yes
8.14A	**L**	it can take an object from one place to another place
8.15A	**T**	it can move an object okay it can can can can displace an object it can
8.16A		make an object move from one place to another place do you agree
8.17A	**Ls**	yes
8.18A	**T**	do you agree yes yes force you know can do that okay now okay force can
8.19A		can uh move an object from eh from one place okay to another it means it
8.20A		can it can cause things to to change positions okay another one [name]
8.21A	**L**	it can make a standing object start moving
8.22A	**T**	it can cause motion yes yes [code-switches] it can make things it can move

8.23A		because you know I was here I can now move from here to here so I started
8.24A		to move yes another one yes
8.25A	**L**	it can stop moving things
8.26A	**T**	it can stop moving things okay I agree it can force can can stop moving
8.27A		objects it can make things if things are moving it can make them stop yes
8.28A		another one yes
8.29A	**L**	it can change the shape of an object
8.30A	**T**	it can change the shape of an object very good very good it can change you
8.31A		know the shape can change the shape of an object yes

ACTIVITY TYPE: 'demonstration' [1]
FIELD [2]:
Force

11.1A	**T**	[code-switches] or if you do what or if you take okay I can even take the
11.2A		I can take uh a piece of here is rubber I can force I can change the shape
11.3A		I can change the shape oh no I even broke it there okay that's what's force
11.4A		now my main interest now on force here is this one it can make things to
11.5A		move from one place to another place

ACTIVITY TYPE: 'microgenre' 'IRF' cont. [3]
FIELD [2]:
Force

8.32A	**T**	now remember it can makes things to move from one place to another
8.33A		place and you said it can also start it can it can make things to start
8.34A		moving

ACTIVITY TYPE: 'interruption' [1] [interruption/ language] – stationary and at rest
FIELD [2]:
Stationary and at rest

12.1A	**T**	okay what is the speed of something that is stationary [code-
12.2A		switches] it is stationary I say this car is stationary what do I really mean it
12.3A		is

12.4A	**L**	standing		
12.5A	**T**	it is standing it is not moving okay don't say it is standing that's literal	(8)	
12.6A		translation [code-switches] don't say it was [code-switches] no now it is		
12.7A		not moving it is stationary it is now I you know I cannot say if I you know	Stationary	
12.8A		to stand up from you know from your seat I can't say please be stationary I	Rest position	
12.9A		can't say that I will say please stand up I but but if something is stationary		
12.10A		we say it is in one in one	(9)	
12.11A	**Ls**	[a number of learners talk at the same time]		
12.12A	**T**	in one position or we say it is at who knows it is at	Stationary	
12.13A	**L**	he is relaxed		Speed = 0
12.14A	**T**	he's relaxed oh okay over there yes	Rest position	
12.15A	**L**	he's resting		
12.16A	**T**	he's at rest or he's resting [code-switches] very good he's at rest he's	(10)	
12.17A		resting so I know now that the two words at rest stationary notice you spell		
12.18A		it stationary not stationery with e the e means what stationery means what	Stationary	
12.19A	**Ls**	[a number of learners talk at the same time]		Speed = 0
12.20A	**T**	something to write on you know ball point pens you know books you know	Rest position	F = 0
12.21A		so careful there stationary and what and rest position rest position		
12.22A		[chalkboard (8)] it means it is in one place it is in one place okay do you		
12.23A		understand that		
12.24A	**Ls**	yes		
12.25A	**T**	good		
ACTIVITY TYPE: 'microgenre' 'IRF' cont. [3]				
FIELD [2]:				
Force				
8.35A	**T**	now she said force can make things to move from rest now if something		
8.36A		moves from rest okay what is the speed of something that is at rest mm ja ja		
8.37A		yes uh		
8.38A	**L**	it is stationary		
8.39A	**T**	are you sure		
8.40A	**L**	zero		

8.41A	**T**	it is zero good anybody else so the speed of something at rest is always
8.42A		what is zero so okay so stationary speed equal to zero [chalkboard (9)]
8.43A		speed equal to zero now if the speed is equal to zero what is the force acting
8.44A		on the object uh
8.45A	**L**	[unclear]
8.46A	**T**	if if the object does not have any speed what force is acting on the object
8.47A		hey
8.48A	**L**	it's standing sir
8.49A	**T**	okay listen carefully if the speed of the object is zero what force is acting
8.50A		on the object anybody yes
8.51A	**L**	no force
8.52A	**T**	no force is actually is actually acting there no force good if speed is zero
8.53A		so we say the force here equals zero [chalkboard (10)] because no speed

ACTIVITY TYPE: 'microgenre' 'IRF' [3]

FIELD [2]:
Acceleration
Speed - a change in speed and a speedometer
Velocity and a velometer [sic]

13.1A	**T**	now when the object when a force arrives on the object and the force is
13.2A		exerted on the object the object begins to like myself if somebody pushes
13.3A		me I was stationary now somebody comes and pushes me I begin to move
13.4A		when you move what is changing from nought to somewhere
13.5A	**L**	speed
13.6A	**T**	it is your speed so once I begin to move so moving from rest the speed
13.7A		changes from zero to somewhere [chalkboard (11)] it changes from zero to
13.8A		let's say two okay [code-switches] when the car is at rest when a car is at
13.9A		rest what is the speed of the car it is
13.10A	**L**	zero

13.11A	**T**	zero		
13.12A	**T**	where do you see that the speed of the car is zero in the		
13.13A	**Ls**	speedometer		
13.14A	**T**	in the speedometer so so you always so so what is actually rested on the		
13.15A		speedometer of the car [unclear] so the pointer the needle of the		
13.16A		speedometer will be at zero but once it begins to move the car will do what		
13.17A		sorry the needle of the speedometer will begin to move from zero to let's		
13.18A		say to what		
13.19A	**Ls**	to twenty		
13.20A	**T**	okay to twenty let's say to you know to twenty meters per second am I	(11)	
13.21A		right here [unclear] you know to twenty meters per second		
13.22A	**Ls**	you are wrong sir	<u>Stationary</u>	
13.23A	**T**	uh		Speed = 0
13.24A	**Ls**	you are wrong sir	<u>Rest position</u>	F = 0
13.25A	**T**	I am wrong it should be what		
13.26A	**Ls**	kilometers per hour		
13.27A	**T**	kilometers per hour good the speedometer of the car does does not register	moving from rest the speed changes	
13.28A		meters per second we speak of meters per second because we want to use	from 0 —	
13.29A		standard international units meter and second right so we can't have		
13.30A		kilometers per hour k p h or simply kilometers per hour now this means		
13.31A		kilometers per hour k p h or here right kilometers per hour how many	(12)	
13.32A		kilometers it has traveled in one hour the speed of the car [chalkboard (12)]		
13.33A		now I want one word I want one [unclear] how do you change the speed of	<u>Stationary</u>	
13.34A		the car from zero to twenty I'm in the car now grrr vroom		Speed = 0
13.35A	**Ls**	[unclear]	<u>Rest position</u>	F = 0
13.36A	**T**	I do what		
13.37	**Ls**	[unclear]		
13.38A	**T**	I engage the car into a gear do you all understand that	moving from rest the speed changes	
13.39A	**Ls**	yes	from 0 — 20Kph (km/h)	
13.40A	**T**	you engage the car into a gear and then do what		
13.41A	**Ls**	press the accelerator		

13.42A	**T**	you press the accelerator so when you change the speed of a car from zero	(13)
13.43A		to twenty what do you do to the car you a	
13.44A	**Ls**	accelerate	<u>Acceleration</u>
13.45A	**T**	accelerate the car can you see now ichange [sic] in speed has got something	
13.46A		to do with what	
13.47A	**Ls**	acceleration	
13.48A	**T**	acceleration we now have a look at what at acceleration [chalkboard (13)]	
13.49A		ne [code-switches] are you sure good ne are you sure are you comfortable	
13.50A	**Ls**	yes	
13.51A	**T**	are you happy	
13.52A	**Ls**	yes	

ACTIVITY TYPE: 'interruption' [1] – teacher admonition

14.1A	**T**	everybody just looks and says I'm happy mm I'll see when when when
14.1A		when we're writing the actual test

ACTIVITY TYPE: 'microgenre' 'IRF' cont. [3]
FIELD [2]:
Acceleration
Speed - a change in speed and a speedometer
Velocity and a velometer [sic]

13.53A	**T**	so change in speed has something to do with what with acceleration
13.54A		now we also spoke of what of velocity we also spoke of what of velocity
13.55A		and we said velocity is what define velocity velocity is the
13.56A	**Ls**	rate of
13.57A	**T**	the rate of what of
13.58A	**Ls**	[unclear]
13.59A	**T**	of uh
13.60A	**Ls**	displacement
13.61A	**T**	the rate of
13.62A	**Ls**	displacement
13.63A	**T**	the rate of displacement or the rate of

13.64A **Ls** change in position
13.65A **T** change in
13.66A **Ls** position

ACTIVITY TYPE: 'interruption' [1] [interruption/ language] – 'a change in displacement'
FIELD [2]:
Rate of displacement [sic]

15.1A **T** never say change in displacement right I know books are say that they are
15.2A wrong you see you you can't change a change in position because the word
15.3A displacement itself it means what change in position so I can't say dis
15.4A velocity is is the change is the rate of change of displacement it is just the
15.5A rate of what of change of position or if you want to put it in a nicer way
15.6A you say the rate of what of
15.7A **Ls** displacement
15.8A **T** displacement are you happy there
15.9A **Ls** yes

ACTIVITY TYPE: 'microgenre' 'IRF' cont. [3]
FIELD [2]:
Acceleration
Speed - a change in speed and a speedometer
Velocity and a velometer [sic]

13.67A **T** good now if you speak of velocity where would you see the velocity of a
13.68A car in a car where would you read it you read the speedometer sorry the
13.69A speed of a car the speedometer where would you read the velocity of the
13.70A car where would you read the velocity of a car a car keeps on changing
13.71A what position it keeps on making what displacements where would you
13.72A read what the velocity of the car uh the speed you read on a speedometer
13.73A the velocity
13.74A **L** a velometer [sic]
13.75A **T** uh
13.76A **L** a velometer

13.77A	**T**	a velometer uh anybody else anybody else she says a velometer or better a
13.78A		velo a velocometer [sic] perhaps velocity speedometer a velocometer
13.79A		there is nothing like what like a velometer so cars don't have what
13.80A		velocometer they only have speedometers okay
13.81A	**L**	yes
13.82A	**T**	the velocity is the speed remember he said velocity is speed with what with
13.83A		direction so if a car is moving towards the north for a for a particular
13.84A		instant for a particular time I would say the velocity of the car is twenty
13.85A		meters per second to the north it actually means that the speed of the car
13.86A		the car is speeding towards the the north the car is speeding towards the
13.87A		north or the car is speeding towards the east or the car is speeding towards
13.88A		the south but I use just one word I say the velocity of the car but in science
13.89A		science people are very lazy people but they think a lot uh

ACTIVITY TYPE: 'microgenre' 'IRF' [3]
FIELD [2]:
Acceleration – definition and equation
Acceleration - units

16.1A	**T**	so acceleration therefore is what okay give me a definition of acceleration
16.2A		okay acceleration happens in a given what you always change speed in
16.3A		a given
16.4A	**L**	time
16.5A	**T**	time yes you must have time to change [unclear] grr gearbox ne vroom
16.6A		now the time you press on your accelerator ne vroom the car is moving it is
16.7A		changing speed but simultaneously the time also goes on so the change in
16.8A		speed happens a change in what in time so the speed now changes in time
16.9A		or the velocity changes in time the speed in a given direction or simply the
16.10A		velocity is changing in time what can give me a definition of acceleration
16.11A		the velocity is changing in time that means simply the car is accelerating
16.12A		give me a definition of veloc sorry of acceleration hey [code-switches] yes
16.13A		try try try try try yes boy

16.14A **L** [unclear]
16.15A **T** no how do you define it how do you explain it you see you know we said
16.16A speed we said when we speak of speed there must be steps completed and
16.17A there must be time to complete that steps and we said how do we explain it
16.18A you know speed you know to people we said okay speed is the rate of what (14)
16.19A of of eh speed is the rate of
16.20A **Ls** distance $speed = \frac{dis\tan ce}{time}$
16.21A **T** distance this thing tells me that speed we said that [unclear] if you forget
16.22A distance this means speed is the rate of distance [chalkboard (14)] that's (15)
16.23A the complete explanation to people when I talk about it [unclear] that's the
16.24A next thing that I do I write down that one and I goes to mathematics I say
16.25A which one counts now as speed you always divide what the distance by acceleration
16.26A time now we have just said here acceleration [chalkboard (15)] has got
16.27A something to do with what uh acceleration has got something to do with (16)
16.28A what with
16.29A **Ls** speed 20 – 40
16.30A **T** no we never said that we said acceleration has got something to do with
16.31A what with eh we are getting lost here acceleration has got something to do
16.32A with what with eh [teacher points to chalkboard (12)] [code-switches] yes
16.33A acceleration has got something to do with what with yes eh we all know
16.34A with what yes
16.35A **L** [unclear]
16.36A **T** no it's here it's here [teacher points to chalkboard (12)] it's here yes
16.37A **L** it has something to do with speed changes
16.38A **T** with speed changes not just the speed a change in speed [code-switches]
16.39A acceleration once you speak of acceleration the speed must change from
16.40A nought to somewhere or from or from twenty to you know to to forty

16.41A [chalkboard (16)] there is a change in you know the speed then you speak
16.42A of what of acceleration you can't just speak of acceleration when there is
16.43A no change in what in speed if a car moves or is running or or is speeding at
16.44A one twenty kilometers per hour all the way from P E to Grahamstown
16.45A what is the acceleration of the car okay [code-switches] from from here
16.46A [code-switches] ne I travel the same speed to to the the junction at [name]
16.47A road what is my acceleration I travel from here to [name] street vroom
16.48A [code-switches] u50 [sic] [code-switches] what is my acceleration eh uh yes
16.49A **L** [unclear] [learner shakes head]
16.50A **T** what is my acceleration you don't have acceleration I don't have it the car
16.51A does not accelerate now in mathematics and science when you say you
16.52A have now you have no [code-switches] eh
16.53A **L** [unclear]
16.54A **T** no in science or mathematics when you say you have this means you don't
16.55A have it [code-switches] eh he
16.56A **L** zero
16.57A **T** zero zero I don't have acceleration so yes I don't have speed it's zero I
16.58A don't have force it's zero

ACTIVITY TYPE: 'lecture' [1] [lecture/ admonition and exhortation]

17.1A **T** people people please please please please be here next week otherwise
17.2A if you don't turn up here next week

ACTIVITY TYPE: 'microgenre' 'IRF' cont. [3]
FIELD [2]:
Acceleration – definition and equation
Acceleration - units

16.59A **T** [unclear] so you now know that acceleration has something to do with (17)
16.60A what with
16.61A **Ls** speed changes
16.62A **T** changes change actually it's change in what in velocity and this change in $acceleration = \frac{changeinvelocity}{time}$
16.63A velocity happens in a given time [chalkboard (17)] what is how can we
16.64A define acceleration how can we define acceleration yes

16.65A **L** accele accele
16.66A **T** acceleration
16.67A **L** acceleration is speed changes
16.68A **T** no eh people [code-switches] he he mm speed equals distance divide by
16.69A time [chalkboard (14)] that's mathematical when I talk it now speed is rate
16.70A of distance hey [code-switches] yes now [name]
16.71A **L** acceleration is an increase in speed
16.72A **T** yes
16.73A **L** acceleration is the rate of change in velocity
16.74A **T** that's all yes right acceleration is the rate of change of velocity

ACTIVITY TYPE: 'lecture' [1] [lecture/ admonition and exhortation] – 'attitude towards science'

18.1A **T** people you have got to be here you have got to be here you have got to be
18.2A here you look at things easy look at things easy man don't let your brain
18.3A dare say ooh it's tough ooh it's tough now ooh no no no I find it very
18.4A easy for you know for you [code-switches]

ACTIVITY TYPE: 'microgenre' 'IRF' cont. [3]
FIELD [2]:
Acceleration – definition and equation
Acceleration - units

16.75A **T** an example you know speed mathematically speed equals distance
16.76A over time [chalkboard (14)] but let's talk it now now this means speed is
16.77A the rate of distance oh velocity displacement time say it in in in words
16.78A [chalkboard (18)] now
16.79A **Ls** velocity is the rate of displacement
16.80A **T** that's all don't make things difficult for yourself eh [code-switches] hey so
16.81A we now have this word now acceleration right is the rate of change in
16.82A velocity [chalkboard (19)] that's the word here change in velocity that's
16.83A the important thing there must be a change if there is no change in the

16.84A		velocity or in the speed there is no acceleration do you understand
16.85A	**Ls**	yes
16.86A	**T**	do you understand now
16.87A	**Ls**	yes

ACTIVITY TYPE: 'lecture' [1] [lecture/ admonition and exhortation] – 'attitude towards science'

19.1A	**T**	[code-switches] you get into [code-switches] everyday you get into your
19.2A		fathers' cars everyday or your moms' cars everyday you don't look at these
19.3A		things you don't look at these things you see cars moving all the time you
19.4A		don't think of these things and you come and say science is tough it is not
19.5A		tough it is not tough but it is how you look at it that makes things to be
19.6A		tough now I'm here to guide you to show you that it's not tough it's not
19.7A		tough as long as you understand basic things

ACTIVITY TYPE: 'microgenre' 'IRF' cont. [3]
FIELD [2]:
Acceleration – definition and equation
Acceleration - units

16.88A	**T**	let's now look at the units here right so we said acceleration equals change
16.89A		in velocity do this first divide by time ne good now what are the units of
16.90A		what of velocity eh what do you think are the units for velocity units for
16.91A		velocity or units for speed
16.92A		yes
16.93A	**L**	meters per second
16.94A	**T**	meters per second so it's meter divide by second that's how we [code-
16.95A		switches] ne divide by what the units for time
16.96A	**Ls**	second
16.97A	**T**	second what is the answer there what is the answer there mm what is the
16.98A		answer there mm what is the answer if I divide meter per second by second

ACTIVITY TYPE: ('groupwork' [1]) – terminated due to insufficient time

FIELD [2]:

(18)

$$acceleration = \frac{changeinvelocity}{time}$$

(19)

Acceleration is the rate of change in velocity

Acceleration – units

20.1A	**T**	[chalkboard (20)] quickly quickly come together in your desks and work
20.2A		out the answer and work out the answer meter mm the answer [code-
20.3A		switches]

(20)

$$acceleration = \frac{change in velocity}{time}$$

$$= \frac{m}{s} \; x \; \frac{1}{s} = \frac{m}{s^2}$$

$$= m/s^2$$

$$= m.s$$

ACTIVITY TYPE: 'microgenre' 'IRF' cont. [3]
FIELD [2]:
Acceleration – definition and equation
Acceleration - units

16.99A	**T**	meter per second divide by second meter per second divide by second
16.100A		meter per second divide by second simplify this this becomes what meter
16.101A		divide by second multiplied by uh
16.102A	**Ls**	one over s
16.103A	**T**	one over
16.104A	**Ls**	s
16.105A	**T**	one over s and this becomes what
16.106A	**Ls**	m
16.107A	**T**	m divide by
16.108A	**Ls**	s squared
16.109A	**T**	by s squared so units are meter per second squared which is the same as
16.110A		what as same as meter multiplied or dot s what
16.111A	**Ls**	minus one
16.112A	**T**	minus one ne
16.113A	**Ls**	yes
16.114A	**T**	you see ma you see they say minus one because they used what it's minus
16.115A		what look eh it's minus two mm it's now minus two so again you see that
16.116A		we have combined two units from the base units with what with this one

ACTIVITY TYPE: 'microgenre' 'IRF' [3]
FIELD [2]:
Force – equation and units

21.1A	**T**	[chalkboard (21)] can we quickly before you go to the next period quickly
21.2A		check now force now force just just briefly when a force look at this when

21.3A		a force acts on a certain mass when a force acts on a certain mass what
21.4A		would the force make on the mass it would make the mass to
21.5A	**Ls**	move
21.6A	**T**	to move if something moves it changes what
21.7A	**Ls**	speed
21.8A	**T**	if something is changing speed it does what
21.9A	**Ls**	accelerates
21.10A	**T**	it accelerates yes so when force acts on a certain mass it makes the mass to
21.11A		accelerate yes what are the units of mass uh the kilogram multiplied by
21.12A		what are the units of acceleration eh he what are the units for acceleration
21.13A		eh
21.14A	**Ls**	meter per second squared
21.15A	**T**	meter per second squared this is meter per second squared there you have it
21.16A		now you have kilogram dot meter per second squared can you see now you
21.17A		have combined base units for mass base units for [code-switches] for
21.18A		distance base units for time to produce another unit and this is what now a
21.19A		kilogram multiplied by meter per second or mass times acceleration unit
21.20A		yes
21.21A	**L**	newton
21.22A	**T**	very good [name] the newton can you see you have now combined many
21.23A		or more than two units from the base units to produce a new unit go to your
21.24A		next class

(21)

Force = mass x acceleration

$= kg \times m/s^2$

$= kg.m/s^2$

$= newton\ (N)$

TRANSCRIPT B **LESSON 2 – N.N.** **GRADE 10 PHYSICAL SCIENCE**

TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Lemke, 1993/ [1]
- TEXT 2: Halliday, 1994 [2]
- TEXT 3: Wells, 1999/ [3]
- The teacher's notes; handouts; the learners' notebooks and the textbook(s) used by the teacher and learners

ACTIVITY TYPE: 'review' [1]; 'microgenre' 'IRF' [3]
FIELD [2]:
Problem 1 – vectors acting in the same direction
Method 1 and 2 for solving problem 1 and 2 – 'calculation'/ 'drawing and measurement' (scale drawing)

1.1B	**T**	what type of vector addition did we do the first type of addition now we we
1.2B		said vectors can act how can vectors act number one in which in which way
1.3B		can vectors act
1.4B	**L1**	in a certain direction
1.5B	**T**	no no okay yes yes let the whole class hear what you are saying
1.6B	**L1**	I'm saying that I'm saying that they can act in the same direction
1.7B	**T**	vectors can act in the same direction do you all agree now if vec yes
1.8B	**L**	vectors can act in an opposite direction
1.9B	**T**	okay fine we are coming there ne right vectors can act on the op in the same
1.10B		direction now we said if they're acting in the same direction what is the
1.11B		angle between the vectors yes [name]
1.12B	**L**	it's zero sir
1.13B	**T**	the angle between the vectors is zero okay so we said if if vectors are
1.14B		acting in the same direction we we now I think I made something like this
1.15B		I said okay the vectors I'm having a vector of what of eight newtons six

1.16B newtons now they act in the same direction same direction and the angle
1.17B between them is what is
1.18B **Ls** zero
1.19B **T** zero now when they act on the same in the same direction we said we can
1.20B get the resultant we can get resultant of of these two vectors in tw two
1.21B ways now there are two ways in which we can get the resultant now the
1.22B first one please the first one how can we get the resultant

ACTIVITY TYPE: 'interruption' [1] [interruption/ language] – 'resultant of a vector' FIELD [2]:

Resultant of a vector

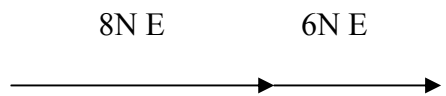
2.1B **T** oh by the way what is the resultant if I think of that you know the word
2.2B resultant of a vector what do we mean by that the resultant of a vector what
2.3B do we mean by that [code-switches] the resultant of vec [code-switches]
2.4B I'm telling you yes
2.5B **L** it is an answer of a vector
2.6B **T** it is an answer of a vector what what do you mean by that yes
2.7B **L2** a vector is
2.8B **T** a resultant resultant
2.9B **L2** it is a vector sum
2.10B **T** it is a vector sum yes
2.11B **L2** that are all taken away
2.12B **T** the resultant is the vector sum of all vectors acting together say that all of
2.13B us
2.14B **Ls** the resultant is the vector sum of all vectors acting together
2.15B **T** all vectors act taken together
2.16B and thereafter I said again you can also put it this way the resultant the
2.17B resultant is a single vector it is a single vector which has the same
2.18B effect as all vectors taken together
Ls together

ACTIVITY TYPE: 'review' cont. [1]; 'microgenre' 'IRF' [3]

FIELD [2]:
Problem 1 – vectors acting in the same direction
Method 1 and 2 for solving problem 1 and 2 – 'calculation'/ 'drawing and measurement' (scale drawing)

1.23B	**T**	for an example we said remember we said you can have a vector of what
1.24B		of let's say eight newtons east that's a vector of eight newtons east
1.25B		followed by another a vector of what of of of of let let's say uhm uh again
1.26B		what let's say six newtons east [chalkboard (1)] right so these are two
1.27B		vectors acting here but instead of having two vectors acting one after the
1.28B		other you can have one vector which would be equal to what yes
1.29B	**L**	which would be equal to fourteen newtons
1.30B	**T**	which would equal to fourteen newtons is that all
1.31B	**L**	east
1.32B	**T**	east because remember when you speak of a vector you can't just say four
1.33B		newtons you must tell me the
1.34B	**Ls**	direction
1.35B	**T**	direction if the answer is rea okay okay so so here we can have one single
1.36B		vector we can now have here one single vector we can now have here one
1.37B		single vector of fourteen newtons east so this is then the resultant it is the
1.38B		resultant of what of this vector and this vector they form the resultant this
1.39B		vector form one vector [chalkboard (2)]

(1)



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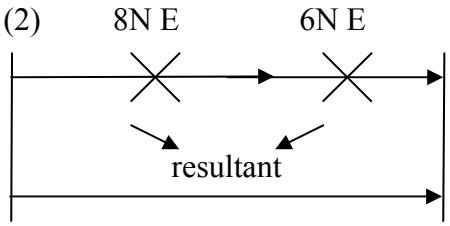

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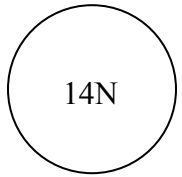


ACTIVITY TYPE: 'interruption' [1] [interruption/ language] – 'magnitude'/ 'total resultant vector'

FIELD [2]:
Magnitude and total resultant vector

3.1B	**T**	now if you say only fourteen newtons what does that imply you say the
3.2B		answer is fourteen newtons what what could it be the question [code-
3.3B		switches] if the answer is fourteen newtons what could have been the
3.4B		question
3.5B	**L**	[unclear]
3.6B	**T**	no, I don't think so any any now here the answer here the resultant is

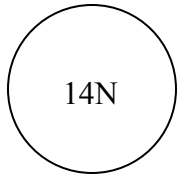
3.7B fourteen newtons east now if the answer was only fourteen newtons what
3.8B is fourteen newtons only [chalkboard (3)] don't just howl at me [name] try
3.9B try think what is fourteen newtons only aye yes [name]
3.10B **L** the magnitude
3.11B **T** it's only the magnitude so be very careful when you answer questions you
3.12B must listen to the question if the question wants magnitude then this is
3.13B correct [chalkboard (4)] but if it wants the total resultant vector you must
3.14B give the magnitude and direction [chalkboard (5)] otherwise I told you in
3.15B science we hate naked numbers one we hate naked numbers you can't
3.16B speak of what two three nine seven it's seven kilograms or ten newtons or
3.17B a ten meters per second squared or four meters per second speed and
3.18B acceleration ten meters per second squared or two meters per second
3.19B squared you can't just give what a number okay are you happy
3.20B **Ls** yes

ACTIVITY TYPE: 'review' cont. [1]; 'microgenre' 'IRF' [3]
FIELD [2]:
Problem 1 – vectors acting in the same direction
Method 1 and 2 for solving problem 1 and 2 – 'calculation'/ 'drawing and measurement' (scale drawing)

1.40B **T** now we said okay now if [unclear] now we stopped here we said that you
1.41B can add vectors acting in the same direction so we have same direction and
1.42B we said here this is the same as what as angle between vectors is what
1.43B equals zero right zero degrees okay the angle between the vectors is now
1.44B equal to zero degrees [chalkboard (6)]

ACTIVITY TYPE: 'review' [1]; 'groupwork' [1] [groupwork/ preparation for groupwork]
FIELD [2]:
Problem 1

(4) ✓✓



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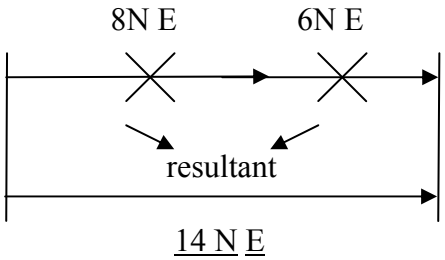

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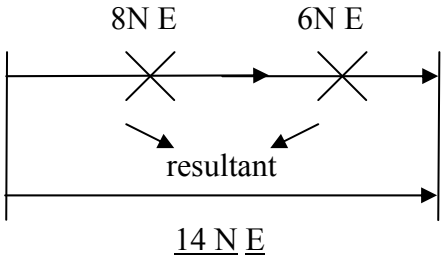


same direction
angle between vector = 0°

4.1B	**T**	now now I want you now in your groups again I want you in your groups	
4.2B		to work in your groups to look at[unclear] our first problem here was	
4.3B		[name] an athlete now read it please for me	
4.4B	**L**	an athlete runs eight kilometers east he rests and runs a further six	
4.5B		kilometers east find the resultant displacement	(7)
ACTIVITY TYPE: 'review' cont. [1]; 'microgenre' 'IRF' [3]			
FIELD [2]:			8N E and 6N E
Problem 1 – vectors acting in the same direction			
Method 1 and 2 for solving problem 1 and 2 – 'calculation'/ 'drawing and measurement' (scale drawing)			(1)
1.45B	**T**	okay fine so we look at what we look at the displacement now at then we	(8)
1.46B		said there are two ways in which we can get the resultant there are two	
1.47B		ways in which we can get the resultant give me two ways in which one can	8N E and 6N E
1.48b		get the resultant of those two vectors uh we know this we've discussed	
1.49B		this but give me two ways in which the resultant of what of eight newtons	(1) Calculation = displacement = 8N
1.50B		east and six newtons east can be found [chalkboard (7)] and the first method	+ 6N = 14N E
1.51B		the first method [code-switches] yes [name]	
1.52B	**L**	we can get it by calculation	
1.53B	**T**	we can get it by calculation yes we can get it by calculation simple	
1.54B		calculation we can get it by calculation [chalk board (8)] yes which is here	
1.55B		very easy because of the same thing you know direction so it will be you	
1.56B		know the displacement will be the displacement would be equal to what	
1.57B		eight newtons plus what six newtons and this will be fourteen newtons east	
1.58B		that's by calculation now the next one am I teaching only two people here	
1.59B		yes	
1.60B	**L**	by drawing	
1.61B	**T**	by drawing what do you mean by that yes by drawing but what do you	
1.62B		mean by that we discussed these things [code-switches] I swear I don't	
1.63B		go along with learners who don't study who don't go to their work the first	

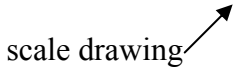
1.64B method yes I agree by calculation we can get at our displacement by
1.65B calculating by adding by calculating yes [name] the answer is
1.66B **L** by measurement
1.67B **T** by measurement yes by measurement and you measure something and
1.68B you do what you measure and
1.69B **L** draw
1.70B **T** and draw yes very good so we can get the very same displacement by by
1.71B drawing and measurement and measurement [chalkboard (9)] now when
1.72B you do a measurement what must you first find if you want to make a
1.73B drawing in science then we speak of what of drawing [code-switches] yes
1.74B **L** scale drawing
1.75B **T** scale drawing so we use what a scale drawing I use scale drawing
1.76B scale drawing and what scale drawing and what and measurement now
1.77B [unclear] and measurement remember we did it we measured what 80mm
1.78B and right plus what plus 60mm and the total was what was
1.79B **Ls** one hundred and fourty
1.80B **T** was 140mm which was equal to [code-switches] to fourteen
1.81B **Ls** kilometers
1.82B **T** kilometers east and this was equal to 6km E and this was equal to 8km E
[chalkboard (10)] that's how we did it

(9)

8N E and 6N E

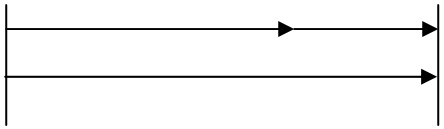
(1) Calculation = displacement = 8N + 6N = 14N E

(2) Drawing and measurement



(10)

80mm = 8km E 60mm = 6km E



140mm = 14km E

ACTIVITY TYPE: 'copying notes' [1] [copying a problem]
FIELD [2]:
Problem 2 – vectors acting in opposite directions

5.1B **T** now let's have a second type of what of vector addition let's have
5.2B a second type of what of vector addition the problem is now an athlete the
5.3B problem now is what here is now our problem you know [code-switches]
5.4B an athlete right I hope you are writing this in your notebooks an athlete
5.5B runs for eight kilometers east rests an athlete sorry runs eight kilometers
5.6B east rests turns back and runs 6km west find the displacement of the athlete
5.7B find the displacement of the athlete find the displacement of the
5.8B athlete [chalkboard (11)]

(11)

An athlete runs for 8km E, rests, turns back and runs 6km W. Find the displacement of the athlete.

ACTIVITY TYPE: 'groupwork' [1]
FIELD [2]: (12)
Problem 2 – vectors acting in opposite directions

4.6B **T** I'm going to give you how many minutes what ten minutes remember there
4.7B are two ways of getting the resultant find the resultant displacement I
4.8B should say that now find the resultant displacement okay find the
4.9B displacement find the resultant displacement right okay in each group in
4.10B each group you work as a group to find out what is the resultant and now
4.11B remember there are two ways of finding the resultant displacement you
4.12B have the calculation part and the measurement and drawing you use a
4.13B scale drawing what was the scale for the you know the last example
4.14B **L** ten millimeters equals one kilometer
4.15B **T** you use the same scale
4.16B **T** right I'm going to give you ten minutes [code-switches] don't just sit there
4.17B ne you know one person you know can can be drawing others discuss
4.18B around him or her
4.19B **Ls** [group work]
4.20B **T** [code-switches] please call me okay once you've finished please call me
4.21B so I'll have a look at the drawing call me and I can help you
4.22B **T** we said use the same scale for scale drawing uh 10mm represents what
4.23B how many kilometers
4.24B **L** one kilometer
4.25B **T** one kilometer [chalkboard (12)]
4.26B **T** you must show everything your scale your scale how you got your answer
4.27B you know you know for the scale I was just seeing the drawing only how
4.28B you got to your answer
4.29B **T** five minutes left [code-switches]
4.30B **T** let's have a look at this one
4.31B **T** let's have a look at that one there

An athlete runs for 8km E, rests, turns back and runs 6km W. Find the displacement of the athlete.
For scale drawing 10mm : 1km

ACTIVITY TYPE: 'interruption' [1] – teacher admonition

6.1B **T** right only three groups have done something that are good
6.2B **T** okay you have tried but there is no complete answer

ACTIVITY TYPE: 'review' [1]; 'microgenre' 'IRF' [3]
FIELD [2]:
Problem 2 – drawing and measurement

7.1B **T** remember okay now what is happening here an athlete runs for eight
7.2B kilometers east rests turns back and runs for six kilometers west find the
7.3B displacement of the athlete now first I must ask myself is displacement a
7.4B vector or a scalar answer is
7.5B **L** a vector
7.6B **T** it's a vector number two

ACTIVITY TYPE: 'interruption' [1] [interruption/ language] – displacement
FIELD [2]:
Displacement

8.1B **T** by the way what is meant by displacement what is meant by the term
8.2B displacement yes
8.3B **L** it's a change in position
8.4B **T** it's a change in position it's a change in position right you must say that
8.5B right it is a change in position

ACTIVITY TYPE: 'review' cont. [1]; 'microgenre' 'IRF' [3]
FIELD [2]:
Problem 2 – drawing and measurement

7.7B **T** so here I must find the change the actual final position of this person after
7.8B he ran eight kilometers east rested turned back and ran a further six
7.9B kilometers west finally where is he when you compare him with his
7.10B starting point so I told you I said there are two ways in which one can get
7.11B the answer here now first one is what is by is by what by by calculation
7.12B okay actually I think I must write down the other way round now
7.13B the first one is by measurement measurement and what and drawing

(13)

An athlete runs for 8km E, rests, turns back and runs 6km W. Find the displacement of the athlete.
For scale drawing 10mm : 1km

(1) Measurement and drawing

(14)

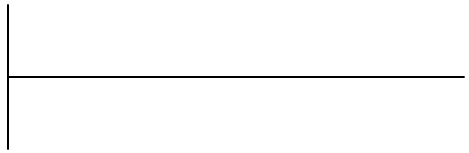
scale: 1km = 10mm

$$\therefore 8km = \frac{10mm x 8\cancel{km}}{1\cancel{km}}$$

$$= 80mm$$

7.14B		[chalkboard (13)] you can get the answer here by doing an
7.15B		actual vector diagram right measurement and drawing now whenever do a
7.16B		measurement and drawing you have to show a scale I've given you the
7.17B		scale there you must use this because you can't draw eight kilometers on
7.18B		your exercise book and you can't draw what six kilometers ugh but if you
7.19B		draw a scale you can fit this in so I must first have my scale there scale
7.20B		right uh one kilometer equals ten millimeters therefore eight kilometers
7.21B		equals ten millimeters multiplied by eight kilometers divide by one
7.22B		kilometer and so you can see these cancel off and you have eighty
7.23B		millimeters [chalkboard (14)] so for eight kilometers I'll draw what eighty
7.24B		millimeters so automatically even u six kilometers will then equal to 60
7.25B		millimeters so I'll draw I'm doing this one I'm doing this one
7.26B		measurement and drawing [chalkboard (13)] then I said I said whenever
7.27B		you are going to draw a vector you must listen whenever you draw a
7.28B		vector you must have a point a frame of what a frame of reference [code-
7.29B		switches] there must be a frame of reference so I'll start drawing from
7.30B		here I have my point there I'll start drawing from here I'll start drawing
7.31B		from there [chalkboard (15)] right and I know this is in what direction a
7.32B		vertical line drawn on a piece of paper means this part means what
7.33B		direction
7.34B	**Ls**	north
7.35B	**T**	north and this one
7.36B	**Ls**	south
7.37B	**T**	and here I tell you I only see east and what and
7.38B	**Ls**	west
7.39B	**T**	west [chalkboard (13)] so I know this is in a straight straight line right
7.40B		because east and west lie in the same straight line so I just draw a line I
7.41B		told you a line perpendicular to this line I just draw my line [chalkboard
7.42B		(15)] I showed you that did I not do that

(15)



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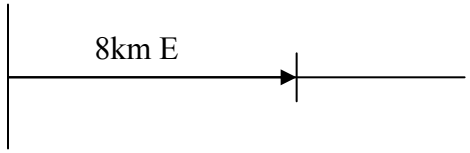
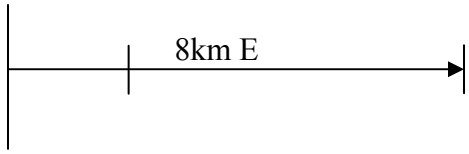


7.43B	**Ls**	yes
7.44B	**T**	yes [code-switches] and then I must take
ACTIVITY TYPE: 'interruption' [1] – teacher admonition		
9.1B	**T**	I've only seen one group doing
9.2B		this thing [the teacher takes the protractor] only one group doing this
9.3B		thing that one [code-switches] nothing I've only seen one group doing this
9.4B		thing taking the real measurement it's a measurement and drawing
ACTIVITY TYPE: 'review' cont. [1]; 'microgenre' 'IRF' [3]		
FIELD [2]:		
Problem 2 – drawing and measurement		
7.45B	**T**	I've made my drawing I've drawn a line I'm going to measure now eighty
7.46B		millimeters so I I take my ruler I measure eighty millimeters okay in my
7.47B		case here that's what eighty millimeters right [chalkboard (16)] this is
7.48B		actually what eighty millimeters or because this is eighty millimeters it
7.49B		represents what
7.50B	**Ls**	eight kilometers
7.51B	**T**	eight kilometers east that's what actually eight kilometers perpendicular
7.52B		right [code-switches] that's eight millimeters [code-switches] sorry eighty
7.53B		millimeters in here so far as my board is [unclear] concerned right [code-
7.54B		switches] should I make it longer so that everyone can see [code-
7.55B		switches] sorry eighty millimeters right eighty millimeters that's eighty
7.56B		that's actually eighty millimeters east [chalkboard (17)] but I know the
7.57B		line is exactly eighty millimeters now this man is now here he is displaced
7.58B		he was here initially originally he was here originally finally now he is
7.59B		here he is now here he rests he's now here now I'm told he turns back
7.60B		[unclear] are right six kilometers so he runs back again another six so
7.61B		he's about here now he's somewhere here he runs back again I measure
7.62B		what sixty millimeters right from here there it is it starts here again yes it
7.63B		starts from here sorry it starts from here he's now here so finally he's here

(17)



7.64B		[chalkboard (17)] now I said to you you can take a vector to any position
7.65B		provided you do what I said you can take a vector to any position
7.66B		provided you do what if I walk eight kilometers this way

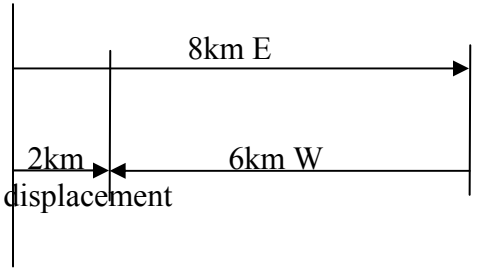
ACTIVITY TYPE: 'demonstration' [1] [role play]
FIELD [2]:
Vectors

10.1B	**T**	okay let's see one two three four I've walked four meters from there in this
10.2B		direction is this any different from this one I'm now here I was there
10.3B		one two three four in the same direction so I can take any vector to
10.4B		another position provided I do what I can take any vector look I was here
10.5B		one two three four right I do the same thing I'm now here same vector
10.6B		is now here you see what I mean one two three four same direction so I can
10.7B		take a vector from any position to another position provided I do what
10.8B		yes [name]
10.9B	**L**	you keep the same direction
10.10B	**T**	I keep the same direction and two and two yes [name] and provided I keep
10.11B		the same direction number two [name]
10.12B	**L**	you walk the same distance
10.13B	**T**	you walk the same what distance [code-switches] what are you saying
10.14B		because now I hate you know the word you know distance you know you
10.15B		know of vectors you know distance is a scalar although I know
10.16B		displacement is a distance in a certain direction yes
10.17B	**L**	[unclear]
10.18B	**T**	provided I keep the same direction or and yo I don't change what [code-
10.19B		switches] one two three four one two three four same direction and same
10.20B		what
10.21B	**L**	same magnitude

ACTIVITY TYPE: 'review' cont. [1]; 'microgenre' 'IRF' [3]
FIELD [2]:
Problem 2 – drawing and measurement

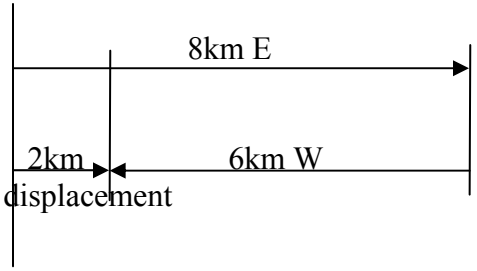
7.67B **T** same magnitude yo you can take a vector to any position provided you
7.68B keep you keep the same magnitude and the same direction so I can take
7.69B that vector of six newtons because I know it is right here that six is right
7.70B here on the same straight line but because of this knowledge I have about
7.71B vectors I can take it away from there is my vector that's the same vector
7.72B that's now six kilometers west yes same vector now where is the person
7.73B now he's here now this persons now here he's here same [unclear] what is
7.74B his displacement what is his final position from starting point here was
7.75B here initially after all the movements after all the running he finds himself
7.76B here so that's the displacement of the actual displacement is now here the
7.77B displacement the actual displacement that's my displacement that's my
7.78B displacement displacement [chalkboard (18)] is in which direction this
7.79B part is a remainder of what vector yes
7.80B **L** of eight kilometers
7.81B **T** of the vector eight kilometers that is going to the east and I write it down
7.82B now displacement sorry okay resultant displacement [chalkboard (18)] or
7.83B displacement yes equals what this is two kilometers two kilometers east
7.84B how did I find that how did I find this you know what you get two
7.85B kilometers how did I find my two kilometers yes
7.86B **L** you minused sir
7.87B **T** you see I didn't do any calculation here you see now I said there are two
7.88B methods I'm still dra you know dra doing the measurement and drawing
7.89B [chalkboard (13)] yes how did I yes
7.90B **L** you measure it sir
7.91B **T** you measure that line you measure this line you measure the displacement
7.92B you measure it after measuring it go to your ruler again and you'll find
7.93B how many millimeters how many [name]
7.94B **L** it's twenty millimeters

(18)



Resultant displacement =

(19)



$10mm = 1km$

$$\therefore 2km = \frac{1kmx20mm}{10mm}$$

$$= 2km$$

7.95B **T** twenty millimeters so then I go to my scalar I must show that here I must
7.96B show that on my on actually let me re let me remove this thing first
7.97B [chalkboard (19)] you show that and say look this scale is so some now
7.98B ten millimeters equals one kilometer therefore twenty milliliters will
7.99B equal to two kilometers am I right yes how do you get the two kilometers
7.100B you actually said one kilometer times twenty millimeter divide by ten
7.101B millimeters then you have what these cancel here and you have and you
7.102B have you know ten into twenty uh two it's two [chalkboard (19)] that's
7.103B why I wrote that down there you know two kilometers and for the person
7.104B who wants to give you marks he sees everything how you got it by that
7.105B you know only by measurement only by measurement and

ACTIVITY TYPE: 'interruption' [1] – teacher admonition

11.1B **T** there was only one group which actually did that that group there good
11.2B that group there the others did not do that [code-switches]

ACTIVITY TYPE: 'teacher monologue' [1]

FIELD [2]:

Problem 2 – calculation

12.1B **T** now the second method is by calculation we said that the second method is
12.2B by calculation [chalkboard(20)] you can help with this calculation how
12.3B to do our calculation it's very easy we have what one so our displacement
12.4B our displacement will be equal to [chalkboard (21)] we take the direction
12.5B to the east as positive we take the direction to the east as positive that's
12.6B what you do with your axis [chalkboard (22)] if you move you know
12.7B towards you know from here to here it's positive if you move from here
12.8B to the start it's what it's negative if you move downwards it's what it's
12.9B negative you move upwards it's positive you actually take any of these
12.10B as what as being if I take this direction as what as positive therefore I
12.11B would say six sorry eight kilometers plus what plus I'm adding my vectors
12.12B [unclear] the resultant plus then this one is now come back therefore

(20)

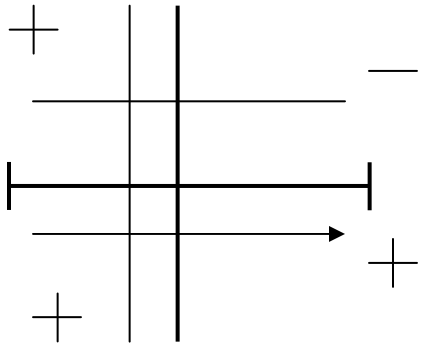
An athlete runs for 8km E, rests, turns back and runs 6km W. Find the displacement of the athlete.
For scale drawing 10mm : 1km

(1) Measurement and drawing
(2) Calculation

(21)

displacement =

(22)



12.13B I take the the opposite way as what as negative so I have what six
12.14B kilometers and the answer will actually be two kilometers now what
12.15B direction must I choose now here east and west what east and west which
12.16B one the resultant the resultant of two vectors or three vectors the resultant (23)
12.17B of two vectors I'm going to stop there the resultant of two vectors will
12.18B always take the direction of the bigger vector okay the bigger vector displacement = 8km E + (-6km W)
12.19B is what is eight kilometers so I would say it's what oh sorry I forgot
12.20B something here I should have said here ne eight kilometers east plus minus = 8km E – 6km W
12.21B six kilometers west right and therefore right the whole thing becomes you
12.22B know for those who [unclear] eight kilometers east minus six kilometers = 2km E →
12.23B west answer becomes what two kilometers two kilometers the direction
12.24B of of the bigger vector east that's my calculation that's my calculation
12.25B [chalkboard (23)] that's my calculation that's my calculation are you
12.26B happy now
12.27B **Ls** yes
12.28B **T** are you happy now
12.29B **Ls** yes

ACTIVITY TYPE: 'classroom business' [1]

13.1B **T** [code-switches] also also tomorrow the school might break early I'm
13.2B warning you now I'm not going early [code-switches] I'm not I'm
13.3B warning you tomorrow the school might break early because it's it's day
13.4B four and it's a short what the start of a short what short holiday it's the
13.5B start of a short holiday or the start of a long weekend I because we are a
13.6B bit behind in our work we'll still be here you'll hear from me okay
13.7B **Ls** yes sir
13.8B **T** are you happy
13.9B **Ls** yes sir
13.10B **T** good tomorrow we'll start from here

ACTIVITY TYPE: 'teacher summary' [1] and assigning homework

14.1B **T** now before you know we finish off what in what other way can we write
14.2B this thing these two vectors are acting in which way [chalkboard (19)] yes
14.3B boy
14.4B **L** in opposite directions
14.5B **T** they are acting in opposite directions but still in the same what
14.6B **L** straight line
14.7B **T** straight line those two vectors are acting in opposite directions so we we
14.8B have now done addition of vectors in one in the same straight line (a) one
14.9B (a) when they act in the same direction one (b) when they act in opposite
14.10B directions still in the same straight line and our next problem because I
14.11B would like you to now go home and try two right for tomorrow and and
14.12B we'll discuss it I want you to go and find out the displacement of the very
14.13B same athlete he runs eight kilometers east he rests turns not back now
14.14B turns and runs six kilometers north and stops find the displacement
14.15B [chalkboard (24)] both by measurement and by calculation for tomorrow
14.16B okay that's homework now this athlete now runs six kilometers east turns
14.17B and runs six kilometers north and stops find his resultant displacement it
14.18B means find how far is he from where he was originally his change in
14.19B position find his change in position okay we break

(24)

An athlete runs for 8km E, rests,
turns and runs 6km N and stops.
Find the displacement of the athlete.
For scale drawing 10mm : 1km

(1) Measurement and drawing
(2) Calculation

TRANSCRIPT C **LESSON 3 – N.N.** **GRADE 10 PHYSICAL SCIENCE**

TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Lemke, 1993/ [1]
- TEXT 2: Halliday, 1994 [2]
- TEXT 3: Wells, 1999/ [3]
- The teacher's notes; handouts; the learners' notebooks and the textbook(s) used by the teacher and learners

ACTIVITY TYPE: 'classroom business' [1]; 'review' [1]

1.1C **T** what did I want uh what did I want you to do actually I think I gave you
1.2C some work to do I said find out about something what was it who
1.3C remembers yes
1.4C **L** you wanted you want us to find displacement sir when a athlete runs for
1.5C eight kilometers east and then six kilometers north get the angle between the
1.6C compass [unclear]
1.7C **T** is he correct I said a person um yes yes an athlete does what
1.8C **L** [unclear]
1.9C **T** listen to yourselves a person runs what
1.10C **L** eight kilometers east
1.11C **T** eight kilometers

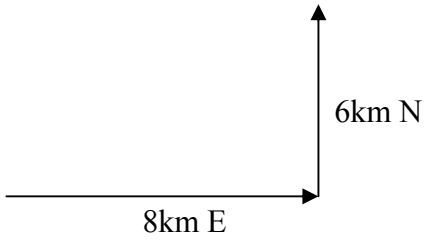
ACTIVITY TYPE: 'interruption' [1] – cleaning the chalkboard

2.1C **T** please clean the board for me

ACTIVITY TYPE: 'classroom business' [1] cont.; 'review' [1]

1.13C **T** a person runs eight kilometers east yes and then
1.14C **L** six kilometers north
1.15C **T** six kilometers north I don't think I said that because okay okay because if if
1.16C if the problem was a person runs eight kilometers east changes direction and

1.17C then what runs six kilometers north how would the drawing look like how
1.18C would the the drawing look like (1)
1.19C **L** a right angle
1.20C **T** you would have a right angle between the two vectors right you would have
1.21C a right angle between the two vectors therefore the problem would not have
1.22C been like that what was the problem yes read it again
1.23C **L** [unclear] an athlete runs for eight kilometers east rests turns and runs six
1.24C kilometers north and stops [unclear]
1.25C **T** no I don't think that I said that yes
1.26C **L** I think that you said an athlete runs for eight kilometers east and six
1.27C kilometers at one hundred and twenty degrees
1.28C **T** that's it



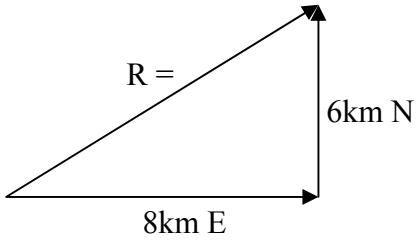
ACTIVITY TYPE: 'interruption' [1]; 'review' [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Right-angled triangles; the magnitude of the resultant displacement): (2)

Methods: a scale drawing and measurement; calculation

The theorem of Pythagoras: $R^2 = x^2 + y^2$

Formula/ Tan rule: $\tan\theta = \frac{x}{y}$

[Formula/ Cosine rule: $R^2 = P^2 + Q^2 - 2PQ\cos\theta$]

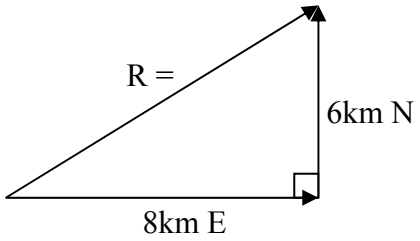


Keywords: 'resultant displacement'; 'right-angled triangles'; 'hypoteneuse'; 'x axis'; 'y axis'; 'symbol'; 'ratio'

3.1C **T** yes that is the first problem that you actually had that you know east
3.2C earlier the first problem we we dealt with was a person runs eight kilometers
3.3C eight kilometers east then this person runs changes direction and runs what
3.4C six kilometers north [chalkboard (1)] we finished that one we finished that
3.5C one we finished that one right do you remember

3.6C	**Ls**	yes
3.7C	**T**	we finished that one and how did we do it we said for the displ
3.8C		now there are two ways in which you can find the resultant displacement
3.9C		there are two ways your resultant [chalkboard (2)] give me the first
3.10C		method you can use to find the resultant there [name]
3.11C	**L**	a scale drawing and measurement
3.12C	**T**	you can use a scale drawing you can use a scale drawing and measurement
3.13C		and the second one
3.14C	**L**	calculation
3.15C	**T**	and and and and what kind of calculation do we use here what information
3.16C		or what else do we have here remember the angle here is what is ninety
3.17C		[chalkboard (3)] now remember we said here we went to mathematics and
3.18C		we said to get this line right now we said r squared equals p squared plus q
3.19C		squared minus two p q cosine theta am I right
3.20C	**Ls**	yes
3.21C	**T**	that's what we actually you know said and therefore r squared and therefore
3.22C		sorry so now our p squared is what is is
3.23C	**Ls**	eight
3.24C	**T**	is eight squared plus
3.25C	**Ls**	six
3.26C	**T**	six squared minus two what two what two times eight times what
3.27C	**Ls**	six
3.28C	**T**	times six and times what cosine what cosine ninety degrees yes that's what
3.29C		we actually we said and we found out what we found out that this becomes
3.30C		what sixty four am I right plus what plus thirty six and this becomes what
3.31C		minus what eight times six what ninety
3.32C	**Ls**	six
3.33C	**T**	ninety six ninety six times what and the cosine of what of ninety you must is

(3)



(4)

$R^2 = P^2 + Q^2 - 2PQ\cos\theta$

$= (8)^2 + (6)^2 - (2x8x6) \times \cos90°$

$= 64 + 36 - 96 \times 0$

(5)

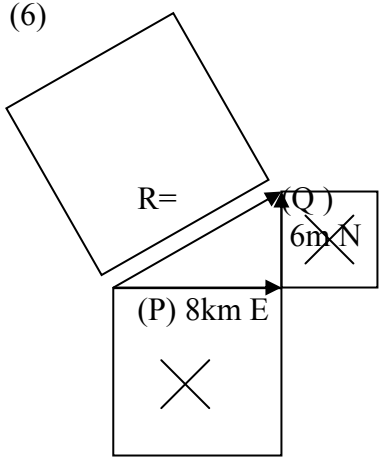
$R^2 = \underline{P}^2 + \underline{Q}^2 - 2PQ\cos\theta$

$= (8)^2 + (6)^2 - (2x8x6) \times \cos90°$

$= 64 + 36 - 96 \times 0$

3.34C		look at these the cosine of zero [chalkboard (4)] so so is actually zero
3.35C		so this whole thing so this whole thing this whole thing [chalkboard (5)] is
3.36C		what becomes zero so the only thing left what is this and this so in the case
3.37C		of what of ninety degrees if this angle is ninety degrees then this whole part
3.38C		[chalkboard (5)] becomes zero that's why only this part is left then we
3.39C		said r squared then becomes what p squared plus what plus q squared but we
3.40C		said oh in this case we can use what this is the same as what as the theorem
3.41C		of what of
3.42C	**Ls**	Pythagoras
3.43C	**T**	Pythagoras if this is p and this is what q and this is r but the square on the
3.44C		hypotenuse equals the sum of the two squares of the other two sums if you
3.45C		add this square here plus this square here if you add this square and this
3.46C		square you will get the total sum of the bigger what of the bigger square in
3.47C		[chalkboard (6)] right and then we said let's make things easier for
3.48C		ourselves here and then replace what with p with what we said now r
3.49C		squared and then now actually the case of p it will be what who remembers
3.50C		a symbol here yes
3.51C	**L**	x squared
3.52C	**T**	x squared why x squared why do we choose x as a symbol here I told you
3.53C		we actually did this yes yes
3.54C	**L**	[unclear]
3.55C	**T**	because the p lies along the x axis in our mathematics that's x and the y
3.56C		vertical line in our mathematics is normally called what the y axis that's
3.57C		therefore this becomes y squared and that's why we kept this what as
3.58C		another method [chalkboard (7)] this is only applicable when when yes
3.59C		that formula or the usage or the use of Pythagoras is only valid or applicable
3.60C		when when when the angle between two vectors is what is remember this
3.61C		thing comes from that formula so this formula works for all triangles but
3.62C		when we come to this triangle here this formula works for all triangles ne all

(6)



3.63C triangles for all triangles [chalkboard (8)] but when the triangle is a right (7)
3.64C angle triangle like this one [chalkboard (6)] then the whole thing
3.65C becomes short and it becomes like that [chalkboard (7)] [code-switches]

$R^2 = P^2 + Q^2$

$\boxed{R^2 = x^2 + y^2}$

ACTIVITY TYPE: 'review' [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Obtuse-angled triangles; calculation):

Methods: scale drawing and measurement; calculation

Formula/ The cosine rule: $\boldsymbol{R^2 = P^2 + Q^2 - 2PQcos\theta}$

Formula/ The sine rule: $\frac{b}{\sin B} = \frac{a}{\sin A} = \frac{c}{\sin C}$

Key utterances/ definitions: 'it [the cosine rule] works for all triangles'; 'in science you can't have naked numbers'; 'a vector is a physical quantity that has both magnitude and direction'

4.1C **T** then I think I gave you now different work to check what when the angle (8)
4.2C this is six kilometers right and what and one fifty degrees and this is eight
4.3C kilometers and what and ninety degrees am I right yes then you have your a
4.4C resultant is line drawn from there to there am I right yes [code-switches]
4.5C that's your resultant [chalkboard (9)] right how did you get this line
4.6C what is the [unclear] there [code- the switches]

$R^2 = \underline{P}^2 + \underline{Q}^2 - \boxed{2PQcos\theta}$ (all triangles)

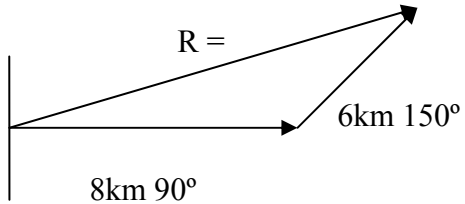
$= (8)^2 + (6)^2 - (2x8x6) \times cos90°$

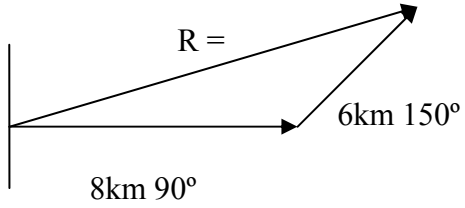
$= 64 + 36 - 96 \times 0$

ACTIVITY TYPE: 'interruption' [1]; 'collecting homework' [1]
5.1C **T** can I get the work now can I get the work now

ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
FIELD [2] (Obtuse-angled triangles; calculation)
4.7C **T** let's see whether you are right ne
4.8C [code-switches] let's see let's see now ne [code-switches] now again there
4.9C are always two ways there are always two ways there are always two ways
4.10C to get what to get the answer as far as resultant is concerned and you will

4.11C		write measurement or by calculation scale drawing and measurement and (9)
4.12C		calculation right [code-switches] let's see if we do it by calculation I'll first
4.13C		begin with what with calculation now in science remember whenever you
4.14C		are going to do a calculation in science you've got to draw a little sketch to
4.15C		show where you [unclear] right for instance if you just make a calculation I
4.16C		won't know where it comes from yes so for the calculation part there I have
4.17C		my drawing notice that my drawing need not be in a particular scale now do
4.18C		you understand
4.19C	**Ls**	yes
4.20C	**T**	when you are going to do a calculation there is no need for you to draw a be
4.21C		scale drawing or to make a scale drawing you just draw a diagram but
4.22C		[code-switches] so my one fifty is somewhere there and then you have that
4.23C		you have that that's your resultant that would be your resultant that would
4.24C		your resultant that would be the resultant so I've got eight kilometers at
4.25C		ninety degrees and I've got six kilometers right at one fifty degrees
4.26C		[chalkboard (10)] are you happy are you happy (10)
4.27C	**Ls**	yes
4.28C	**T**	then in this case we know this angle here is what is one fifty look I put all I
4.29C		I insert all the given information in my drawing right I know my angle
4.30C		actually starts from there so I say now I want that one so I want here but
4.31C		squared equals p squared plus q squared minus two p q cosine theta that's
4.32C		the formula it's the formula for you to [unclear] okay are you happy
4.33C	**Ls**	yes
4.34C	**T**	then we have what is my p I've got my eight squared plus my
4.35C	**L**	six
4.36C	**T**	six squared minus yes two what two what
4.37C	**Ls**	eight
4.38C	**T**	eight times what
4.39C	**Ls**	six
4.40C	**T**	times six times what cosine one fifty degrees this is what this is sixty four
4.41C		am I right this is thirty six minus what





4.42C	**Ls**	ninety six
4.43C	**T**	minus what
4.44C	**Ls**	ninety six
4.45C	**T**	ninety six times what cosine of what of one fifty is what ne
4.46C	**Ls**	minus zero point eight six six
4.47C	**T**	minus zero point eight six six because a minus times a minus becomes what
4.48C		a plus are you correct minus becomes what yes answer becomes what
4.49C	**Ls**	[unclear]
4.50C	**T**	[name] total answer here
4.51C	**L**	one eighty three point one four
4.52C	**T**	what
4.53C	**L**	one eighty three point one four
4.54C	**T**	one eighty three are you correct here is she correct
4.55C	**Ls**	yes
4.56C	**T**	one eighty three one eighty three
4.57C	**Ls**	point one four
4.58C	**T**	point one four okay we'll leave it at what at one eighty three and then we
4.59C		look at what and therefore r equals what the square root of what of one
4.60C		eighty three and the answer is and the answer is
4.61C	**L**	thirteen point five
4.62C	**T**	what
4.63C	**L**	thirteen point five
4.64C	**T**	thirteen point five thirteen point five is that the answer what is the answer
4.65C	**L**	yes that is the answer
4.66C	**T**	are you sure
4.67C	**L**	check the direction
4.68C	**T**	are you sure I am very sorry [code-switches] is that the answer there yes

4.69C	**L**	that is not the answer because in science you can't have naked numbers
4.70C	**T**	you are right so answer is
4.71C	**L**	thirteen point five kilometers
4.72C	**T**	thirteen point five kilometers thirteen point five kilometers [chalkboard
4.73C		(11)] but I'm dealing here with a vector now can I what is a vector what is a
4.74C		vector yes [code-switches] what is a vector what is a vector [code-switches]
4.75C		yes
4.76C	**L**	it is a physical quantity which has direc magnitude and direction
4.77C	**T**	it is a physical quantity which has both magnitude and direction in our
4.78C		answer here what do we only have now yes
4.79C	**L**	magnitude
4.80C	**T**	we only have here the magnitude of this resultant we only have the only
4.81C		magnitude of this resultant and the question does not want the magnitude
4.82C		it wants what the total resultant which means we must still get what the
4.83C		direction alright so we go on how do we get our direction how do we get our
4.84C		direction we want this in our drawing we want that thing [chalkboard (12)]
4.85C		that part our direction right we want that part but for us to get that part we
4.86C		must get this angle here which I will call alpha or a [chalkboard (12)] alright
4.87C		I can call [code-switches] a because before I get that I must get a I must
4.88C		now use another rule which rule is that one eh anybody yes what do we call
4.89C		this rule first who knows eh yes what do you call this rule in mathematics
4.90C		[chalkboard (11)] it is eh what
4.91C	**L**	the cosine rule
4.92C	**T**	the cosine rule it's the cosine rule [chalkboard (13)] it is the cosine rule it
4.93C		works for all triangles it works for all triangles right now to get the angle
4.94C		now what rule do we have to use we can use the tan rule why can we use
4.95C		here why can we say tan rule tan theta now why can't we get tan theta
4.96C		equals something or x over y why why can't I use this ratio here why [code-
4.97C		switches]

(11)

$R^2 = P^2 + Q^2 - 2PQcos\theta$

$= (8)^2 + (6)^2 - 2(8x6) \text{ x } cos150°$

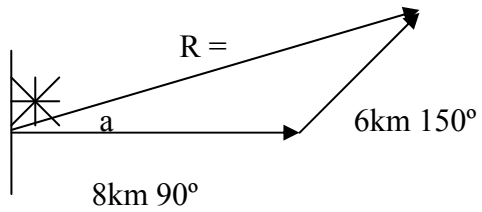
$= 64 + 36 - 96 \text{ x } - 0.866$

$= 183.14$

$R = \sqrt{183}$

$= 13.5km$

(12)



ACTIVITY TYPE: 'interruption' [1] – teacher admonition

6.1C **T** for two weeks you were playing

ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
FIELD [2] (Obtuse-angled triangles; calculation)

4.98C **T** why why can't I use this one or when do we use that rule or that ratio tan
4.99C theta when do we use that ratio tan theta yes [name]
4.100C **L** when the triangle is a right angle
4.101C **T** when the triangle is a right angle we only use this one when we have a
4.102C triangle to get this angle [chalkboard (14)] to get what the y or the x tan
4.103C theta here tan of this angle here equals the opposite y over x and you can get
4.104C this angle we can't use this one here now [chalkboard (14)] why why can't
4.105C you use that one here now to get that angle eh
4.106C **L** that triangle is not a right angle triangle
4.107C **T** up up
4.108C **L** that triangle is not a right angle triangle
4.109C **T** the triangle the triangle we have here is not a right angle triangle so you can
4.111C use yes c'mon speak speak [name]
4.112C **L** sin [sic] theta
4.113C **T** no you can't use sine theta sine theta sine theta is also applicable here
4.114C [chalkboard (14)] which rule do we use here [code-switches] yes to get this
4.115C line here I used a rule the cosine rule I could say cosine theta the cosine rule
4.116C [code-switches] to get the angle here ne I cannot use the ratio I cannot use
4.117C the ratio I can't use the ratio I must use a rule which is a piece I've used in
4.118C mathematics right now this rule I mean how do we [unclear] it ne you know
4.119C the angle how do you do it anybody

ACTIVITY TYPE: 'boardwork' [1]; 'going over boardwork' [1]

7.1C **T** [name] come and show us what you have done to get the angle ne to get
7.2C direction where do you get the three from now I can see one fifty on the
7.3C board I know the thirteen comma five [unclear] you know from the resultant
7.4C [chalkboard (15)] and the three [chalkboard (16)] eh now now okay okay
7.5C okay just stand aside you can stand by the board if you want to now if sine

(13)

$R^2 = P^2 + Q^2 - 2PQcos\theta$ (cosine Rule)

$= (8)^2 + (6)^2 - 2(8x6) \times cos150°$

$= 64 + 36 - 96 \times - 0.866$

$= 183.14$

$R = \sqrt{183}$

$= 13.5km$

7.6C		one fifty okay don't [code-switches] I don't think we have a sine one fifty
7.7C		there I don't think we have a sine one fifty there no you know on the board I
7.8C		don't think so I don't think we've got a sine one fifty on the board yes boy
7.9C	**L**	[unclear]
7.10C	**T**	sine one fifty degrees [chalkboard (17)]
		ACTIVITY TYPE: 'interruption' [1]; 'review' [1]
		FIELD [2] (The definition of the Multiplicative Inverse):
		The definition of the Multiplicative Inverse: a x (1/a) = 1
4.120C	**T**	now in mathematics if you have got two over x equals two over x it is as
4.121C		much as writing the same thing here as what which is the simplest way of
4.122C		writing this thing if it was two divide by something divide by two divide by
4.123C		something x [code-switches] it is the same thing it is the same thing as
4.124C		writing what yes [code-switches] yes
4.125C	**L**	one equals one
4.126C	**T**	two divide by x equals two divide by x I said a simple way of writing this is
4.127C		thing down is just writing what [code-switches] two just equals two [code-
4.128C		switches] two equals two [chalkboard (18)]
		ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
		FIELD [2] (Obtuse-angled triangles; calculation)
4.129C	**T**	now if you look at these things sine one fifty degrees over what thirteen
4.130C		point five equals [code-switches]therefore usine [sic] one fifty degrees
4.131C		equals sine theta [chalkboard (19)]
		ACTIVITY TYPE: 'interruption' [1] – teacher admonition
8.1C	**T**	you played for three two weeks whilst I was away [code-switches] that thing
8.2C		wrong help her out [code-switches]
		ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
		FIELD [2] (Obtuse-angled triangles; calculation)

(15)

$$\frac{\sin 150}{13.5} = \frac{\sin\theta}{3}$$

$sin\theta$

(16)

$$\frac{\sin 150}{13.5} = \frac{\sin\theta}{13.5}$$

$sin\theta$

(17)

$$\frac{\sin 150°}{13.5} = \frac{\sin\theta}{13.5}$$

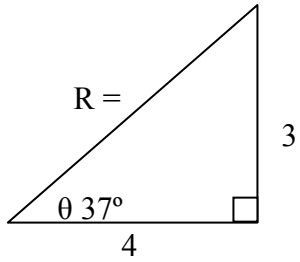
$sin\theta$

(18)

$$\frac{2}{x} = \frac{2}{x}$$

$2 = 2$

4.132C	**T**	yes sine one fifty degrees over what equals what can you go now right sit	(19)
4.133C		down	
ACTIVITY TYPE: 'interruption' [1] ; 'review' [1]			$\frac{\sin 150°}{13.5} = \frac{\sin\theta}{13.5}$
FIELD [2] (Tan rule)			
4.134C	**T**	when I introduced you to this thing I said when you have a right angle	
4.135C		triangle like this one [chalkboard (20)] and you have what four and three	
4.136C		you remember and angle here is what ninety degrees what is there what is	*sin150°=sinθ*
4.137C		this one r equals what yes	
4.138C	**L**	r equals five	
4.139C	**T**	five r equals five [code-switches] then I said if I want the angle now this is	(20)
4.140C		ninety and we said if we want this angle if we want this angle right this	
4.141C		angle if we make it theta we can say we can use a trig ratio we can say tan	
4.142C		theta equals y y axis equals y over x which is the same as what as three	
4.143C		divide by four which is the same as what as zero point seven five	
4.144C		[chalkboard (20)] do you remember now do you remember now	
4.145C	**L**	yes	
4.146C	**T**	then we now said then we get now now I said theta therefore theta will then	
4.147C		be equal to tan to the power of minus one zero point seven five and the	
4.148C		answer was what answer was	
4.149C	**Ls**	thirty seven degrees	$\tan\theta = \frac{y}{x} = \frac{3}{4} = 0.75$
4.150C	**T**	thirty seven degrees thirty seven degrees this angle this angle here we know	
4.151C		[chalkboard (22)] let say this side is what is a this side is what is	
4.152C		now thirty seven degrees [chalkboard (20)] that's how we [unclear]	$\therefore \theta = \tan^{-1} 0.75$
4.153C		but in this case we don't have a right angle here [chalkboard (12)] so we	
4.154C		can't use that formula for the trigonometrical ratio tan theta we can't use	$= 37°$
4.155C		this one now we can't use this one	
ACTIVITY TYPE: 'interruption' [1]; 'review' [1]			
FIELD [2] (Sine rule)			
9.1C	**T**	now then I said this one for this one [chalkboard (12)]	
9.2C		now we use the sine rule [chalkboard (21)] we now use the sine rule what	



9.3C does the sine rule say what does the sine rule say now if you take any
9.4C triangle let us just take any triangle just if you take any triangle a b c let say
9.5C this side is what is a this side is what is c small c and this one is small b
9.6C right then the sine rule says b sorry b over sine b equals a over sine a equals
9.7C c over sine c you can invert the whole thing if you want that is the sine rule
9.8C formula in mathematics [unclear]

ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
FIELD [2] (Obtuse-angled triangles; calculation)

10.1C **T** now I can use now now since this rule can be used for all triangles I can also
10.2C use it now for this one [chalkboard (12)] how do we do it here now we've
10.3C got this line is opposite to that angle which I call a this line is opposite to
10.4C that one this angle [code-switches] this angle is opposite to this line and this
10.5C angle is opposite to this line you see that technically you see now if I want
10.6C to get that one r over sine one fifty equals equals [code-switches] six over
10.7C sine a equals eight over no no no one fifty eight over sine [code-switches]
10.8C eight over sine b same thing here [chalkboard (22)] right same thing
10.9C therefore now I can take any any two I can make any two here ne I can take
10.10C this one [code-switches] I can remove that actually [unclear] or remove this
10.11C one [unclear] I still have what an equation [chalkboard (23)] it means I can
10.12C then come here and say okay sin [code-switches] sine what one fifty degrees
10.13C over r now r is what r is thirteen comma five thirteen comma five equals I
10.14C want this one and I know that [unclear] equals sine a over what over six now
10.15C solve you know for what sine a solve for sine a solve for sine a I've given
10.16C you now the clue solve for sine a [chalkboard (23)]

ACTIVITY TYPE: 'interruption' [1] ; 'do now' [1]
FIELD [2] (Otuse-angled triangles; calculation – angle)

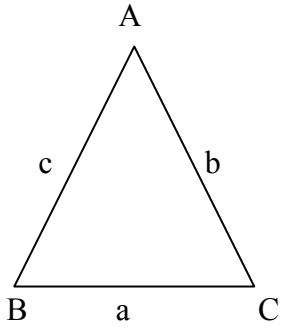
11.1C [the learners solve the problem]

ACTIVITY TYPE: 'review' [1] cont.
FIELD [2] (Obtuse-angled triangles; calculation)

(21)

Sine Rule

(22)



$$\frac{b}{\sin B} = \frac{a}{\sin A} = \frac{c}{\sin C}$$

$$\frac{R}{\sin 150} = \frac{6}{\sin a} = \frac{8}{\sin B}$$

4.156C **T** sine a yes sine a okay sine a [code-switches] sine okay sine a will be equal
4.157C to okay let's make it simpler sine a times thirteen comma five equals what
4.158C equals what yes

4.159C **L** sine one fifty degrees times six
4.160C **T** sine one fifty degrees times six that's the equation therefore I can now say
4.161C therefore sine a must therefore be equal to [code-switches] yes
4.162C **L** [unclear]
4.163C **T** sine one fifty degrees times what
4.164C **L** six
4.165C **T** times six divide by
4.166C **L** thirteen point five
4.167C **T** thirteen point five right that's what we get then yes now we go and find fifty
4.168C one fifty yes find one fifty

ACTIVITY TYPE: 'interruption' [1] – teacher admonition

12.1C **T** I can see people don't have calculators I can see people don't have
12.2C calculators I can see people don't have calculators and I had a strong
12.3C warning on those calculators

ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
FIELD [2] (Obtuse-angled triangles; calculation)

4.169C **T** sine one fifty is nought point five zero point five times six divide by thirteen
4.170C point five answer is answer is yes zero point five times six divide by thirteen
4.171C point five

4.172C **L1** zero point two two two
4.173C **T** [name]
4.174C **L1** zero point two two two
4.175C **T** zero point two two two two two okay zero point two two we'll leave it at
4.176C two two decimal places zero point two two are you sure that sine oh point
4.177C [unclear] good so I now know that that this is equal so sine a equals zero
4.178C two two that means the size of this part [chalkboard (12)] is zero point two
4.179C two the ratio is that part but what do I really want I want what I want a the
4.180C actual angle and the angle is

(23)

Sine Rule

$$\frac{\sin 150°}{13.5} = \frac{\sin a}{6}$$

sina x 13.5 = sin150° x 6

$$\sin a = \frac{\sin 150° x 6}{13.5}$$

$$= \frac{0.5 x 6}{13.5} = 0.22$$

sina = 0.22

a = $\sin^{-1}$0.22

a = 12.7º

a = 13 º

Direction = 90 – 13

= 77º →

Displacement = 13.5km at 77 º

ACTIVITY TYPE: 'interruption' [1]; 'review' [1] – tan rule

13.1C **T** how do you get it how do you get it how do you get it how do you get it
13.2C how did we tan theta equals y over x which is three over four this becomes
13.3C zero point seven five so tan theta equals tan theta equals zero point seven
13.4C five therefore theta equals what [code- switches] the inverse of tan the
13.5C inverse of tan zero point seven five that's how you get the angle itself
13.6C [chalkboard (25)]

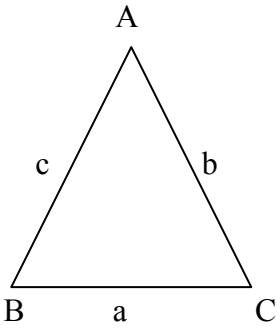
ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
FIELD [2] (Obtuse-angled triangles; calculation)

4.181C **T** [code-switches] yes
4.182C **L** [unclear]
4.183C **T** you get the inverse on sine yes sine inverse minus one [code-switches] zero
4.184C point two two the answer is
4.185C **L** twelve point seven
4.186C **T** what
4.187C **L** twelve point seven
4.188C **T** twelve point seven twelve point seven degrees that's about thirteen degrees
4.189C that's about thirteen degrees okay I'll accept that ne that's about thirteen
4.190C degrees okay but it's actually that one so we now know that the angle there
4.191C ne is about what thirteen degrees about thirteen degrees about thirteen
4.192C degrees [chalkboard (26)] [chalkboard (23)] what is this angle there
4.193C **L** [unclear]
4.194C **T** so I now know that my direction [code-switches] my direction will be equal
4.195C to ninety minus what thirteen and the answer is what is
4.196C **L** seventy seven
4.197C **T** seventy seven [chalkboard (23)]

ACTIVITY TYPE: 'interruption' [1] – teacher admonition

14.1C **T** it's very funny it's very funny [code- switches]

(24)



$$\frac{b}{\sin B} = \frac{a}{\sin A}$$

$$\frac{R}{\sin 150} = \frac{6}{\sin a}$$

ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
FIELD [2] (Obtuse-angled triangles; calculation)

4.198C **T** so I now now the total displacement here so my final answer now
4.199C right now displacement will be displacement will be thirteen point five
4.200C kilometers at seventy seven degrees that's the actual answer now final
4.201C answer now that's the final answer [chalkboard (23)] that's the final answer
4.202C [code-switches] can I have these please do you have any questions now do if
4.203C you have any questions do you have any questions do you have any
4.204C questions do you have any questions do you have any questions do you
4.205C understand what I have done here do you understand what I have done on
4.206C the board the only way for you to have grasped it ne is to go home and
4.207C repeat all the steps I have done until you are sure you understand

(25)

$$\tan\theta = \frac{y}{x}$$

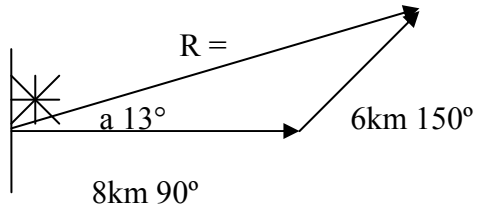
$$= \frac{3}{4}$$

$$= 0.75$$

$$\tan\theta = 0.75$$

$$\theta = \tan^{-1}0.75$$

(26)



TRANSCRIPT D **LESSON 4 – N.N.** **GRADE 10 PHYSICAL SCIENCE**

TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Lemke, 1993/ [1]
- TEXT 2: Halliday, 1994 [2]
- TEXT 3: Wells, 1999/ [3]
- The teacher's notes; handouts; the learners' notebooks and the textbook(s) used by the teacher and learners

ACTIVITY TYPE: 'interruption' [1] – cleaning the chalkboard (1)

1.1D **T** okay clean the board for me

ACTIVITY TYPE: 'interruption' [1]

2.1D **T** we are going very very slow we are going very slow we are going very slow

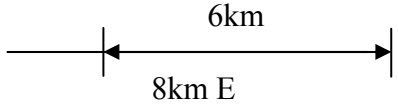
ACTIVITY TYPE: 'review' [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; 'measurement and drawing')

3.1D **T** the first example we made was an athlete runs eight kilometers east rests
3.2D runs a further eight kilometers [unclear] [code-switches] addition of two or
3.3D more vectors okay it's up to b now okay [code-switches] let's first finish off
3.4D all what we have been discussing let's first finish off all what we have
3.5D discussing right now we look at b we now look at b in this case we want to
3.6D add displacements we want to add displacements acting in the same straight
3.7D line we want to add displacements acting in the same straight line but in
3.8D opposite directions so we're going to have eh displacements ehm in the
3.9D same straight line same straight line opposite directions these things are now
3.10D going to be acting in opposite directions [chalkboard (1)] do you follow me
3.11D **Ls** yes
3.12D **T** right ne the first type of displacement was in the same straight line but these

Displacements in the same straight line – opposite directions

Example: An athlete runs 8km E, rests and runs back for 6km W

3.13D		acting in the same direction [code-switches] right now let's have a look at (2)
3.14D		now example here let us have a look at an example here an athlete an athlete
3.15D		runs again eight kilometers east an athlete runs eight kilometers east right
3.16D		comma rests and runs back uh for let say okay six kilometers that means
3.17D		west he runs back because he would be running towards [chalkboard (1)]
3.18D		now if it if it was moving east if the athlete was moving moving east eight
3.19D		kilometers east he rests he runs back now again what ehm what six
3.20D		kilometers east [code-switches] now how [code-switches] I said there are
3.21D		two ways in which one can add vectors [chalkboard (2)] now first one first
3.22D		method of adding vectors yes [name]
3.23D	**L**	scale
3.24D	**T**	scale what yes [name] yes
3.25D	**L**	scale drawing
3.26D	**T**	we actually use a scale drawing by measurement and drawing by scale is
3.27D		measurement and drawing that's the first way of adding our vectors by
3.28D		measurement and drawing now in this case we can also have do this by
3.29D		measurement and drawing so we can first have a scale our scale I said our
3.30D		what now give me a scale here [code-switches]
3.31D	**L**	one kilometer equals ten millimeters
3.32D	**T**	what
3.33D	**L**	one kilometer equals ten millimeters
3.34D	**T**	one kilometer one kilometer equals what
3.35D	**L**	ten millimeters
3.36D	**T**	ten [code-switches]
3.37D	**L**	millimeters
3.38D	**T**	millimeters that's our scale right that is our scale ten milli you know you
3.39D		know one kilometer equals ten millimeters so now there now if if our
3.40D		scale is is like that therefore eh eight kilometers will be equal to what
3.41D	**Ls**	eighty millimeters



3.42D	**T**	what	(3)
3.43D	**Ls**	eighty millimeters	
3.44D	**T**	eighty millimeters and what six kilometers will be equal to	Scale: 1km = 10mm
3.45D	**Ls**	sixty millimeters	
3.46D	**T**	sixty millimeters yes that's right [chalkboard (3)]	∴ 8km = 80mm

ACTIVITY TYPE: 'do now' [1]
FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; 'measurement and drawing')

6km = 60mm

4.1D		right now I'm going to eighty millimeters to the east I'm going to give you
4.2D		five minutes you know allow you now to draw eighty millimeters towards
4.3D		the east [code-switches] you know to do that no less than that three minutes
4.4D		[code-switches] I've shown you how to draw to make measurements with
4.5D		your pair of compasses your pencils must be sharp [code-switches]

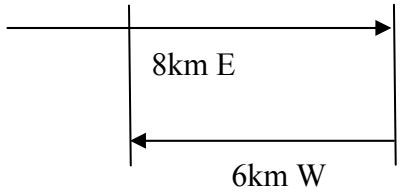
ACTIVITY TYPE: 'review' [1] cont. ; 'IRF' 'microgenre' [3]
FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; 'measurement and drawing')

3.47D	**T**	now we are told the person rests the person rests an athlete running rests
3.48D		sorry rests and runs back for six kilometers now of course if he runs back it
3.49D		means he's going towards the west

ACTIVITY TYPE: 'interruption' [1]; 'review' [1]; 'IRF' 'microgenre' [3]
FIELD [2] ('rule'):
'rule': 'a vector can be changed to another place as long as the magnitude stays the same and the direction'

5.1D	**T**	now there is a certain thing I told you about vectors which includes
5.2D		magnitude and direction what did I say yes
5.3D	**L**	you said a vector is a physical quantity
5.4D	**T**	no I didn't say that that is a definition of or it is when I explained what a one
5.5D		vector is but I told you something about what about about the position of a
5.6D		vector and the magnitude of a vector I told you something about the

5.7D		magnitude of a vector and the position of a vector [code-switches] I told you (4)
5.8D		something about what about I even made examples here I said if I move this
5.9D		two three four places I'm moving this way the same thing is the same even
5.10D		if I move here one two three four remember you remember I did that
5.11D	**Ls**	yes
5.12D	**T**	what did I try to explain there what did I try to explain about a vector



ACTIVITY TYPE: 'interruption' [1]; 'demonstration' [1]
FIELD [2] ('rule')

6.1D	**T**	[code-switches] yes I was in this position one two three four but even if
6.2D		I'm here same thing one two three four yes

ACTIVITY TYPE: 'interruption' [1]; 'review' cont. [1]; 'IRF' 'microgenre' [3]
FIELD [2] ('rule')

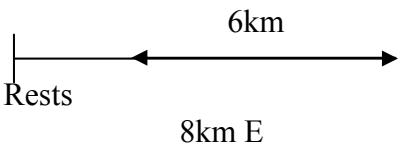
5.13D	**L**	a vector can be changed to another place
5.14D	**T**	a vector can be changed to another place yes as long as you do what yes
5.15D	**L1**	[unclear]
5.16D	**T**	as long as yes
5.17D	**L1**	the magnitude stays the same
5.18D	**T**	the magnitude stays the same and two things
5.19D	**L1**	the direction
5.20D	**T**	and the direction stays the same

ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; 'measurement and drawing')

3.50D	**T**	so so this person runs eight kilometers east
3.51D		he is now here he runs back [code-switches] right here six kilometers but I
3.52D		can take that vector backwards away from there [code-switches] right and
3.53D		therefore draw what and come here [code-switches] then draw exactly what
3.54D		six millimeters sorry sixty millimeters eh in this direction [code-switches]
3.55D		this is eight kilometers sorry what this is six kilometers ne what west
3.56D		[chalkboard (4)] right I've taken you see this person did this thing this

3.57D		person ran eighty eight kilometers towards the east eight kilometers east
3.58D		he he is here now right the person is here now he rests here that's why you
3.59D		say he rests then turns back you know he turns back he runs back again for
3.60D		what for six kilometers ten twenty twenty forty fifty sixty alright he runs
3.61D		back again what six he is now here again he is now here so he he ran back
3.62D		he is now here he was here first he ran there he came back there he is now
3.63D		here [chalkboard (5)] what is his change in position that means what is his
3.64D		displacement what is his change in position yes
3.65D	**L**	two kilometers east
3.66D	**T**	it is two kilometers two kilometers east yes so this person is actually here
3.67D		now and [code-switches]
ACTIVITY TYPE: 'interruption' [1]; 'review' cont. [1]; 'IRF' 'microgenre' [3] FIELD [2] ('rule')		
5.21D	**T**	so here remember this thing that you can move a vector to another position
5.22D		provided you do not do not change what what the change what you've had it
5.23D		change what [code-switches] you can take a vector to another position
5.24D		provided you do not change what what the change what you've had it
5.25D		change what eh [code-switches] you can take a vector to any position as
5.26D		long as you don't change what
5.27D	**Ls**	direction
5.28D	**T**	direction [code-switches] change the direction and what else
5.29D	**Ls**	magnitude
5.30D	**T**	and the magnitude [code-switches] [chalkboard (6)] as long as you keep this
5.31D		thing the same and that one you can it there
ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3] FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; 'measurement and drawing')		
3.68D	**T**	so I've taken now that vector see that I've taken now [code-switches] I've
3.69D		not changed what the direction it's still backwards I've not changed what so

(5)

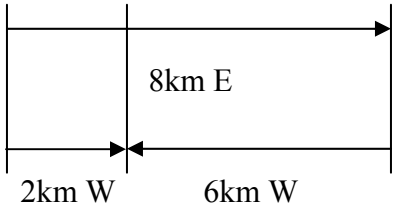


(6)

you can take a vector to another position provided you do not change the direction and the magnitude

3.70D		the magnitude and the resultant my resultant is now here [code-switches] the
3.71D		resultant is now here so to [unclear] in the first vector the part that is left is
3.72D		now this one so this is two kilometers west [chalkboard (7)] that is the
3.73D		magnitude sorry the resultant displacement

(7)



ACTIVITY TYPE: 'interruption' [1] – the learner corrects the teacher

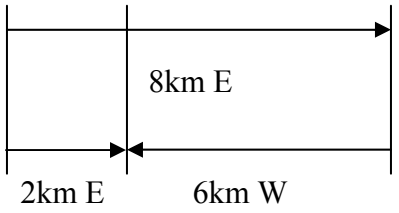
7.1D	**T**	yes boy
7.2D	**L**	[unclear] two kilometers east
7.3D	**T**	what sorry oops sorry two kilometers east very good very good very good
7.4D		two kilometers east two kilometers east two kilometers east [chalkboard (8)]

ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; 'measurement and drawing')

3.74D	**T**	now we have made or we have found the resultant using a drawing using a
3.75D		drawing ne any questions any que do you understand that now do you
3.76D		understand [code-switches] ne

ACTIVITY TYPE: 'review' [1]; 'IRF' 'microgenre' [3] (8)
FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; 'calculation')

8.1D		I said you can also get the same answer using what a
8.2D	**L**	a calculation
8.3D	**T**	a what ne
8.4D	**L**	a calculation
8.5D	**T**	a calculation [code-switches] why now you can still get the same answer
8.6D		using what a calculation so the first one there we use what a scale drawing
8.7D		now the second part we now use a calculation so my calculation my
8.8D		calculation the resultant displacement or displacement displacement equals
8.9D		how do you do it [code-switches] do the calculation your answer will be
8.10D		what your answer must be what
8.11D	**L**	[unclear]
8.12D	**T**	your answer must be two kilometers west how do you get that



ACTIVITY TYPE: 'interruption' [1] – teacher admonition

9.1D	**T**	you can't tell me to add you know to get resultant there now eight plus six
9.2D		[unclear] a calculator [code-switches] one plus one I need a calculator
9.3D		[code-switches] three plus four a calculator aye aye aye

ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; 'calculation')

8.13D	**T**	yes
8.14D	**L**	minus six
8.15D	**T**	you know why do you minus now we spoke of vector addition I never spoke
8.16D		of minusing vectors how do we get it how do we get it how do we get the
8.17D		how how do we get the the two kilometers east yes
8.18D	**L**	eight kilometers plus negative six

ACTIVITY TYPE: 'interruption' [1] – teacher admonition

10.1D	**T**	[code-switches] you never get enter my class having funny things on you
10.2D		know on your ears [code-switches]

ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; 'calculation')

8.19D	**T**	now how do we get the answer
8.20D	**L**	eight plus negative six
8.21D	**T**	you you you you you you add okay so it's eight kilometers east plus right do
8.22D		why do we put a negative sign here why do we put a negative sign here why
8.23D		we put a negative sign here why do we put a negative sign we say minus six
8.24D		kilometers why do we say you know do that why do we use a negative I'm
8.25D		adding yes I'm adding quite correct addition of vectors eight kilometers east
8.26D		plus but I put a minus sign here why why yes
8.27D	**L**	because the direction is not the same
8.28D	**T**	because the direction yes of of this vector is not the same as that one now
8.29D		how would you describe you know you know the direction of these two
8.30D		vectors how do these two vectors act as far as direction is concerned how do

8.31D those two vectors eight and six act in as far as direction is concerned yes
8.32D **L** they act in opposite directions
8.33D **T** they act in opposite directions if one goes positive the other one must go the
8.34D what negative so answer here is what is two kilometers east [chalkboard (9)]

ACTIVITY TYPE: 'teacher monologue' [1]

FIELD [2] (The direction of vectors):
'the direction of vectors': 'positive direction'; 'negative direction'

11.1D now notice notice that notice that if I chose if I chose the direction towards
11.2D east as what as I could also have said displacement minus eight kilometers
11.3D alright plus what plus two kilometers yes answer is what is minus two
11.4D kilometers which actually means what two kilometers east now this minus
11.5D means that it is moving in the opposite direction to this one [code-switches]
11.6D [chalkboard (10)] but don't worry too much about this one so far just get to
11.7D know that one it depends whether you chose this one as positive direction or
11.8D this one as the negative direction but so far I'm choosing it for you that this
11.9D side is positive this side is what is negative [code-switches] your axis in
11.10D mathematics this side goes where positive this side goes where negative and
11.11D this side goes what negative and that side goes what positive [chalkboard
11.12D (11)] that's why otherwise later you'll know that you can have any direction
11.13D [code-switches]
11.14D **Ls** yes

ACTIVITY TYPE: 'review' [1] cont.; 'IRF' 'microgenre' [3]
FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; 'calculation')

8.35D **T** good now so we have here with what with addition of what of vectors in the
8.36D same straight line vectors in the same straight line in opposite directions
8.37D now yes when you look at vectors when you look at vectors acting in the

(9)

by calculation

Displacement = 8km E + (– 6km)

= 2km E

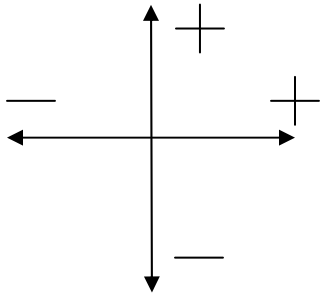
(10)

Displacement = – 8km E + 6km

= – 2km

2km E

(11)



8.38D		same straight line the angle between the vectors can be what or what if if if
8.39D		two vectors act in the same direction what would be the angle between them
8.40D		we've got two vectors here they act in the same direction what what is the
8.41D		angle between them you know you know the two vectors
8.42D	**Ls**	zero
8.43D	**T**	it is zero if the vectors act in opposite directions what is the angle between
8.44D		the vectors
8.45D	**Ls**	one eighty
8.46D	**T**	[code-switches]
8.47D	**Ls**	one eighty
8.48D	**T**	one eighty

ACTIVITY TYPE: 'teacher monologue' [1]
FIELD [2] (Force)

12.1D	**T**	notice that but we'll explain that better when we deal with force as a
12.2D		vector you can have a force acting on one object or two forces acting on one
12.3D		object will be in the same direction or have two forces acting on the same
12.4D		object but in opposite directions [code-switches]
12.5D	**Ls**	yes

ACTIVITY TYPE: 'review' [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'measurement and drawing')

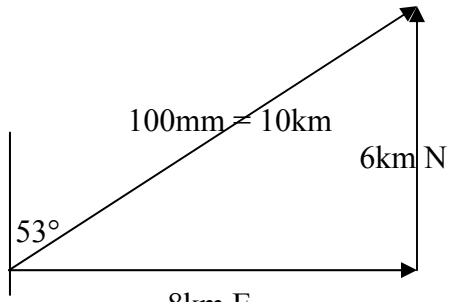
13.1D	**T**	good now we now look at c we now look at c we now look at c still addition
13.2D		of what of vectors we now look at what at c displacements in directions in
13.3D		different directions let's say that in different directions displacements sorry
13.4D		in different directions displacements in different directions now the
13.5D		direction in which is when we have a person running from here a person
13.6D		runs eight kilometers to the
13.7D	**Ls**	east
13.8D	**T**	east changes direction runs six kilometers what to the
13.9D	**Ls**	north
13.10D	**T**	north that's two displacements where the direction sorry the angle between

13.11D		the two vectors one displacement another displacement the angle between	(12)
13.12D		them is what is	
13.13D	**Ls**	ninety degrees	Displacements in different directions
13.14D	**T**	ninety degrees right so that the angle between the displacements is what is	so that the angle between the
13.15D		ninety degrees so let's make it again in the form of a problem we want to	displacements is 90º
13.16D		solve the problem now an athlete again an athlete runs eight kilometers east	
13.17D		comma changes direction and runs six kilometers north [chalkboard (12)]	An athlete runs 8km E,
13.18D		now remember when he runs eight kilometers east what is the direction or	changes direction
13.19D		what is the direction of east in terms of degrees yes	and runs 6km N
13.20D	**L**	ninety degrees	
13.21D	**T**	ninety degrees [code-switches] what is the direction of north in terms of	
13.22D		degrees yes boy	(13)
13.23D	**L**	zero degrees	
13.24D	**T**	zero degrees that means I could have said an athlete runs eight kilometers on	Displacements in different directions
13.25D		a bearing of what of ninety degrees [chalkboard (13)] changes direction and	so that the angle between the
13.26D		runs six kilometers on a bearing of what of nought degrees knowing exactly	displacements is 90º
13.27D		that he ran to the east and then he ran to the north he ran to the east and then	
13.28D		ran to the he ran you know to the east and then ran to the north do you know	An athlete runs 8km E, (0 º)
13.28D		[unclear] do you know [unclear]	changes direction
13.30D	**L**	[unclear]	and runs 6km N (90 º)
13.31D	**T**	north is facing this side yes and east and east this side	
ACTIVITY TYPE: 'interruption' [1], 'IRF' 'microgenre'			
FIELD [2] ('the everyday' - the school)			
14.1D	**T**	why is the school built this way not the doors and the windows face north	
14.2D		and south why why why yes	
14.3D	**L2**	because towards the east sir to face the light	
14.4D	**T**	to face the light	
14.5D	**L2**	yes	
14.6D	**T**	but the light comes but the sun comes from east [code-switches] what do	
14.7D		you think made the planning of the buildings face north just just to prevent	
14.8D		what too much sunlight getting into the classroom imagine in summer time	

14.9D		[code-switches] the whole sunlight gets through the windows direct rays ne	(14)
14.10D		afternoon the sun you know the sun west the sun rays you know strong rays	
14.11D		coming inside we need light but we don't need what the direct rays	Scale: 1km = 10mm
ACTIVITY TYPE: 'review' [1]; 'IRF' 'microgenre' [3] FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'measurement and drawing')			∴ 8km = 80mm 6km = 60mm
13.32D	**T**	scale again [code-switches] one kilometer equals what ten millimeters that is	
13.33D		our scale that is our scale quickly do it quickly so we now know that eight	
13.34D		kilometers so therefore eight kilometers equals eighty millimeters and and	
13.35D		what six kilometers equals sixty millimeters [chalkboard (14)] [code-	
13.36D		switches]	
ACTIVITY TYPE: 'do now' [1] FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'measurement and drawing')			
15.1D	**T**	faster faster faster …some of you don't want to think some of you don't	
15.2D		want to think because you always start with the the the direction you know	
15.3D		towards the east [code-switches] you want all the time someone must think	
15.4D		for you it doesn't go like that it doesn't go like that there must be a time	
15.5D		when you have to think for yourselves use your brain [code-switches]…you	
15.6D		can't draw a thick line like this…finished	
ACTIVITY TYPE: 'review' [1]; 'IRF' 'microgenre' [3] FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'measurement and drawing')			
13.37D	**T**	[unclear] you can't just draw a vector and you don't know you know the	
13.38D		length then of course this person was eight kilometers east he then then	
13.39D		changes direction I showed you how to make sure that this is right this is six	
13.40D		kilometers north now the displacement the change in position displacement	
13.41D		means what change in position remember that hey what is the change from	
13.42D		here to there how long is is the line how long is the line [code-switches]	
13.43D	**Ls**	ten kilometers	

13.44D **T** [code-switches]
13.45D **Ls** ten kilometers
13.46D **T** when you use your ruler how long is the line
13.47D **Ls** ten kilometers
13.48D **T** ten millimeters
13.49D **L** one hundred millimeters
13.50D **T** one hundred millimeters which is equal to [code-switches] according to our
13.51D scale according to our scale so this is one hundred millimeters which of
13.52D course according to our scale is what is ten kilometers ten kilometers how
13.53D did you get ten kilometers how did you get it how did you get you know you
13.54D know ten kilometers [chalkboard (15)] mm
13.55D **Ls** by calculation sir
13.56D **T** no you only measured what the line and you found out the line the length of
13.57D line is what is hundred millimeters how did you change the hundred
13.58D millimeters you know to get ten kilometers
13.59D **L** because according to the scale one kilometer is ten millimeters
13.60D **T** then
13.61D **L** so then definitely one hundred millimeters is ten kilometers
13.62D **T** so you must look at your scale and say ten millimeters equals one kilometer
13.63D [code-switches] therefore one hundred millimeters so ask yourself if ten
13.64D kilometers sorry ten millimeters equals ten kilometers will a hundred
13.65D millimeters be less or will it be more [code-switches]
13.66D **Ls** [Xhosa]
13.67D **T** [code-switches] it will be big so if you in mathematics if you want to get a
13.68D big number always multiply by the big number right one hundred
13.69D millimeters multiplied by one kilometer divide by the small millimeters
13.70D there you can see this cancels there your answer will be in kilometers and
13.71D also again there you have ten [code-switches] [chalkboard (16)] alright and
13.72D then so so so here we have displacement equals ten kilometers is that answer
13.73D correct yes
13.74D **L** it is not correct

(15)



Displacement = 10km at 53°

(16)

$10mm = 1km$

$$\therefore 100mm = \frac{100mm x 1km}{10mm}$$

$10km$

13.75D	**T**	why or it is not complete why
13.76D	**L**	because there is no direction
13.77D	**T**	because there is no direction okay how do you get the direction how do you
13.78D		get the direction how do get the direction yes how do you get the direction
13.79D		you know over there yes
13.80D	**L**	the tan rule
13.81D	**T**	what
13.82D	**L**	the tan rule
13.83D	**T**	the tan rule yes
13.84D	**L**	the sine rule
13.85D	**T**	the sine rule yes
13.86D	**L**	use a protractor
13.87D	**T**	very good we are doing measurement here we are doing measurement here
13.88D		we are doing the first one here we are doing it by measurement how can I
13.89D		make some calculations now we are doing it here by measurement so we use
13.90D		what a
13.91D	**L**	protractor
13.92D	**T**	a protractor and measure angle from from the
13.93D	**L**	north
13.94D	**T**	so we say that displacement equals ten kilometers at fifty three degrees
13.95D		that's my measurement that's my measurement [chalkboard (15)] that's my
13.96D		measurement

ACTIVITY TYPE: assigning homework

FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'calculation')

[the learners are required to do the calculation part of the question for homework]

TRANSCRIPT E **LESSON 5 – N.N.** **GRADE 10 PHYSICAL SCIENCE**

TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Lemke, 1993/ [1]
- TEXT 2: Halliday, 1994 [2]
- TEXT 3: Wells, 1999/ [3]
- The teacher's notes; handouts; the learners' notebooks and the textbook(s) used by the teacher and learners

ACTIVITY STRUCTURE: 'classroom business' [1]

1.1E **T** who's absent these two girls
1.2E **Ls** [names]

ACTIVITY STRUCTURE: 'going over the homework' [1]
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'calculation')

2.1E **T** um let's see now we are still busy with what with calculation when an that
2.2E athlete running eight kilometers to the east and then turning and running a
2.3E further six kilometers to the north and then I said go home and and finish up
2.4E one how do you do it so how do you do that one how do you do that one
2.5E anybody

ACTIVITY STRUCTURE: 'going over the homework'[1]; 'boardwork' [1]
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'calculation')

2.6E **T** who would like to come and show us anybody who would like to come and
2.7E show us how that one was done anybody who would like to come and show
2.8E us hey anybody who would like to come and show us how that one

ACTIVITY STRUCTURE: 'interruption' – teacher admonition

3.1E [code- switches] can I leave you then uh can I leave you [code-switches]

ACTIVITY STRUCTURE: 'going over the homework'[1]; 'boardwork' [1] cont.

(1)

FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'calculation')

Scale: 1km

2.9E **L1** we first did it by scale drawing our scale was or my scale was one kilometer

2.10E [chalkboard (1)]

ACTIVITY STRUCTURE: 'interruption' [1] <u>one</u>; 'going over boardwork' [1]; 'IRF' 'microgenre' [3]

FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'calculation')

4.1E **T** can you stop there is he correct eh

4.2E **L** no sir he is not

4.3E **T** why

4.4E **L** because the scale was ten millimeters [unclear]

4.5E **T** is he correct to do a scale drawing yes

4.6E **L** no sir

4.7E **T** why

4.8E **L** we want to do a calculation

4.9E **T** because we

4.10E **L** we want to do a calculation

4.11E **T** we want to find the answer by doing a calculation so there is no need to do

4.12E what

4.13E **Ls** a scale drawing

4.14E **T** a scale drawing I said that to you I said that to you [code-switches]

ACTIVITY STRUCTURE: 'interruption' [1] – teacher admonition

5.1E **T** next time for these people don't talk I won't come to your class [code-

5.2E switches]

ACTIVITY STRUCTURE: 'interruption' [1] <u>one</u> cont.; 'going over boardwork' [1]; 'IRF' 'microgenre' [3]

FIELD [2]:
Key utterance: 'I need what a drawing that depicts exactly how the person ran'

4.15E	**T**	so you know you remove that but I said for any calculation you must do
4.16E		what but for any calculation you must do what [code-switches] yes
4.17E	**L**	you must have a drawing
4.18E	**T**	you must have a drawing I said for any calculation you must have a drawing
4.19E		you must have a drawing and the drawing did they tell you what what must
4.20E		be you know you know how do you you know you know do we need to
4.21E		have a scale drawing do we need to have a scale drawing

ACTIVITY STRUCTURE: 'interruption' [1] – teacher admonition

6.1E	**T**	do you want to talk
6.2E	**Ls**	yes
6.3E	**T**	well then talk now

ACTIVITY STRUCTURE: 'interruption' [1] <u>one</u> cont.; 'going over boardwork' [1]; 'IRF' 'microgenre' [3]
FIELD [2]:
Key utterance: 'I need what a drawing that depicts exactly how the person ran'

4.22E	**T**	when we do a calculation in a problem in physical science do we need to do
4.23E		a scale drawing yes
4.24E	**L**	yes sir
4.25E	**T**	eh
4.26E	**L**	yes sir
4.27E	**T**	why
4.28E	**L**	because you can't you can't draw draw eight kilometers in your book

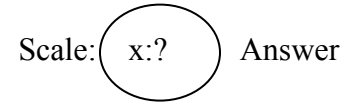
ACTIVITY STRUCTURE: 'interruption' [1] <u>one</u> cont.; 'going over boardwork' [1]; 'teacher monologue' [1]
FIELD [2]:
Key utterance: 'I need what a drawing that depicts exactly how the person ran'

4.29E	**T**	look look look look look [code-switches] I said to you [code-switches] when

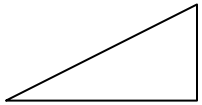
4.30E you do [code-switches] in a science problem it's either you do it one scale
4.31E drawing scale drawing then here you have a scale which you say something
4.32E something is equal to something then you draw that drawing according to
4.33E the scale you have drawn then I said number two you can still get the same
4.34E answer here if you have an answer here you still have the same answer here
4.35E by making a calculation by making a calculation in the case of a calculation
4.36E I said there is no need for a scale drawing no need for a scale drawing
4.37E but there must be what a drawing there must be a drawing the drawing need
4.38E not be a scale drawing that's why [code-switches] I said here is a small
4.39E [code-switches] a small drawing the drawing need not be a scale drawing it
4.40E will help you to solve the problem mathematically but you look at the
4.41E drawing and you solve it mathematically so I don't need any scale drawing
4.42E there but I need what a drawing that depicts exactly how the person ran

(2)

(1) Scale drawing

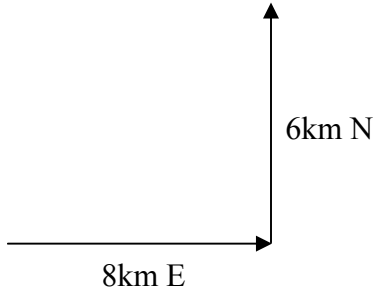


(2) Calculation



4.43E [chalkboard (2)]

(3)



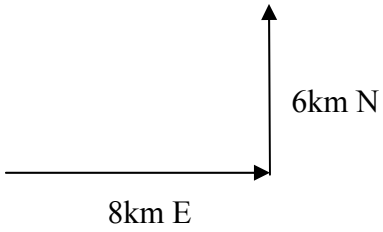
ACTIVITY STRUCTURE: 'going over the homework'[1]; 'boardwork' [1] cont.
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'calculation')

2.11E **L1** the person ran eight kilometers east
2.12E **T** yes you know there is my ruler
2.13E **L1** he ran six kilometers north [chalkboard (3)]

ACTIVITY STRUCTURE: 'interruption'[1] <u>two</u>; 'going over boardwork' [1]; 'IRF' 'microgenre' [3]
FIELD [2]:
Key utterance: 'your drawing must actually depict at least be close to what is actually happening'

7.1E **T** before you go further do you think that's a very nice drawing
7.2E **L** no sir
7.3E **T** why
7.4E **L** because [unclear] have no direction

7.5E	**T**	[code-switches] okay but okay fine yes	(4)
7.6E	**L**	because the vectors look like they are equal	
7.7E	**T**	the vectors look like they are equal the vectors look like they are equal you	
7.8E		know your drawing must actually depict at least be close to what is actually	
7.9E		happening that's better now eight kilometers east what longer than what six	
7.10E		kilometers [chalkboard (4)]	

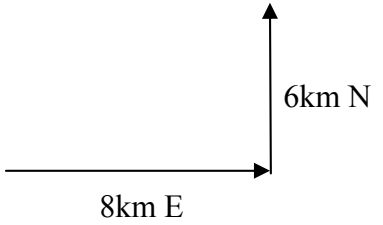


ACTIVITY STRUCTURE: 'going over the homework'[1]; 'boardwork' [1] cont.
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'calculation')

2.14E	**L1**	we used the theorem of Pythagoras r is equal to x plus x squared plus y	
2.15E		squared [chalkboard (5)]	

ACTIVITY STRUCTURE: 'interruption' [1] <u>three</u>; 'going over boardwork' [1]; 'IRF' 'microgenre' [3]
FIELD [2]:
The theorem of Pythagoras: $R^2 = x^2 + y^2$

(5)



8.1E	**T**	is that correct is that correct is that correct eh	
8.2E	**L**	no	
8.3E	**T**	what is wrong there	
8.4E	**L**	it's r squared sir	

[code-switches] [the teacher leaves the classroom to talk to a learner from another class]

Calculation

$R = x^2 + y^2$

ACTIVITY STRUCTURE: 'going over the homework'[1]; 'boardwork' [1] cont.
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'calculation')

2.16E	**L1**	eight kilometers squared plus six squared equals is equal to now we've got
2.17E		the magnitude we want the direction so we say tan theta is equal to six over

2.18E eight is equal to zero point seven five is equal to theta is equal to tangent is (6)
2.19E equal to thirty seven degrees direction ninety degrees minus thirty seven
2.20E degrees [chalkboard (6)]

$R^2 = x^2 + y^2$

[the teacher returns to the classroom]

$= (8)2 + (6)2$

$= 64 + 36$

ACTIVITY STRUCTURE: 'going over boardwork' [1]; 'teacher-student duolog' [1] FIELD [2] (Right-angled triangles; the magnitude and <u>direction</u> of the resultant displacement; 'calculation')

$= 100$

9.1E **T** [unclear] okay I understand why you I understand why you wanted eh r
9.2E okay r equals ten kilometers okay now you want what you know you know
9.3E you want direction now you know you know where is theta look I'm going
9.4E to mark your book where is theta

$R = \sqrt{100}$

9.5E **L1** theta is here [chalkboard (7)]

$= 10km$

9.6E **T** can you see the reason why you must have a drawing why when you put
9.7E things like these theta I must see in your calculation where is the theta is you
9.8E know you know [code-switches] where is the I can now see you know you
9.9E know so you actually got the angle so okay I agree tan theta yes tan theta
9.10E equals six over eight which is equal to zero point seven five and therefore
9.11E theta would then be equal to the eh inverse of what of tan zero point seven
9.12E five and eh which is equal to thirty seven degrees good now why do you
9.13E now subtract the thirty seven degrees you know from the ninety why why do
9.14E you subtract why do you now subtract thirty seven degrees from ninety why

$\tan\theta = \frac{6}{8}$

$= 0.75$

9.15E **L1** ninety degrees
9.16E **T** why do you subtract why do you subtract thirty seven degrees from ninety
9.17E degrees
9.18E **L1** when he was going to the east from that point it is ninety degrees to the
north
9.19E

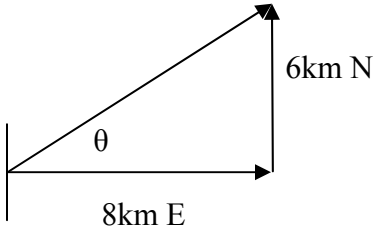
$\theta = \tan^{-1} 0.75$

$= 37°$

direction = 90° - 75°

9.20E **T** I agree why do we subtract can anybody help him why do we subtract thirty

9.21E seven from ninety why do we subtract thirty seven from ninety why yes (7)



9.22E **L** to get that angle
9.23E **T** which angle yes
9.24E **L** [unclear]
9.25E **T** to get what why do we subtract thirty seven from ninety yes
9.26E **L** to get the value of theta
9.27E **T** but we already eh he but we already calculated the value of theta thirty
9.28E seven degrees why do we subtract the thirty seven degrees from ninety yes
9.29E **L2** because we want that angle there
9.30E **T** okay what name the angle
9.31E **L2** [unclear] theta thirty seven degrees
9.32E **T** why
9.33E **L2** so
9.34E **T** then show us go to the board and show us
9.35E **L2** [Xhosa]
9.36E **T** you see yes [code-switches]
9.37E **L** [Xhosa]
9.38E **T** yes why

ACTIVITY STRUCTURE: 'interruption' [1] – teacher admonition

10.1E **T** [code-switches] you are really playing

ACTIVITY STRUCTURE: 'going over boardwork' [1] cont.; 'IRF' 'microgenre' [3] FIELD [2] (Right-angled triangles; the magnitude and <u>direction</u> of the resultant displacement; 'calculation')

9.39E **T** I never said that we never said that why do subtract the thirty seven from
9.40E ninety theta here theta theta here we know is thirty seven degrees why do we
9.41E subtract this thirty seven from ninety

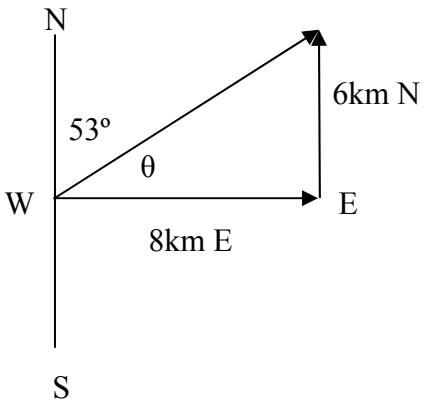
ACTIVITY STRUCTURE: 'interruption' [1] – teacher admonition

11.1E **T** it's May it's May it's May month and we are struggling getting
11.2E through that that thing

ACTIVITY STRUCTURE: 'going over boardwork' [1] cont.; 'IRF' 'microgenre' [3] FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; 'calculation')

9.39E	**T**	there why you know why do we subtract thirty seven from ninety what is
9.40E		the magnitude of the resultant of eight kilometers and six kilometers what is
9.41E		the magnitude of the resultant of eight kilometers and six kilometers what is
9.42E		the magnitude of the resultant of ten eight kilometers and six kilometers
9.43E	**Ls**	ten kilometers
9.44E	**T**	it is ten kilometers that is that is only the magnitude now what is what else
9.45E		is missing in this magnitude because the resultant vector there ne is is is
9.46E		having a magnitude of what of ten kilometers what is missing now in this
9.47E		ten kilometers
9.48E	**L**	direction
9.49E	**T**	it is direction how do we get direction yes
9.50E	**L**	ninety degrees minus thirty seven degrees
9.51E	**T**	why do we do that how do we measure direction how do we measure
9.52E		direction how did I show you
9.53E	**L**	you take your protractor sir
9.54E	**T**	yoh we always measure our direction from the north we always measure
9.55E		from the north how this is east this is west we always measure from the
9.56E		north whether you calculate it or use a protractor any hey [code-switches]
9.57E		we now know that this angle ne [code-switches] now what do call the
9.58E		direction that moves this way clockwise of a vector what word did we use
9.59E		when we measured the angle from nought degrees clockwise what word did
9.60E		we use to indicate the angle that we measured from north to you know if
9.61E		you go clockwise yes
9.62E	**L**	opposite direction
9.63E	**T**	[code-switches]
9.64E	**L**	opposite direction
9.65E	**T**	opposite direction what's that yes

9.66E	**L**	the bearing	(8)
9.67E	**T**	the bearing we used the bearing we measured from here we we found out	
9.68E		the vector I say it had a bearing of what [code-switches] it's a bearing of	
9.69E		what of fifty three degrees this vector hey that vector hey that vector [code-	
9.70E		switches] a resultant has a bearing of what of fifty three degrees we meas we	
9.71E		subtract this thirty seven degrees from this ninety to get the bearing [code-	
9.72E		switches] that is ninety that's ninety that's why to get the direction the	
9.73E		bearing and that is why there ne we say the displacement is what now once I	
9.74E		say displacement it means the total vector is what is one hundred kilometers	
9.75E		at a bearing of [code-switches] at fifty three degrees [chalkboard (8)/ (9)]	



ACTIVITY STRUCTURE: 'lecture' [1]

[the teacher requested that the video camera be stopped]

ACTIVITY STRUCTURE: 'review' [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Vectors):
Vector (definition): 'a vector is a physical quantity which has magnitude and direction'
Magnitude
Keywords: size, unit
Direction
Keywords/ phrases: 'four cardinal points of a compass'; 'clockwise'/ 'anticlockwise'; 'lies on a bearing of 60°' / 'lies at 60°'/ 'Boat N 60° E'; 'to bisect'; 'point of reference'/ 'frame of reference'

(9)

Displacement 10km at 53°

12.1E	**T**	what is a vector
12.2E	**L**	a vector is a physical quantity which has magnitude and direction
12.3E	**T**	a vector is a physical quantity which has magnitude and direction so
12.4E		magnitude plus direction magnitude plus direction I said a vector must have
12.5E		magnitude and direction now so magnitude alone is what magnitude alone is

12.6E		what yes
12.7E	**L**	[unclear]
12.8E	**T**	[unclear] magnitude only is what how now give me an example of a
12.9E		magnitude give me an example of a magnitude only a vector is magnitude
12.10E		is any quantity any quantity which has magnitude and direction but
12.11E		magnitude alone can be what give me an example of anything with
12.12E		magnitude only yes
12.13E	**L**	scalar
12.14E	**T**	okay okay now I'm not asking scalars here ne I'm saying how else can
12.15E		you write magnitude two things two things must be there to make the word
12.16E		you know the word magnitude two things must be there to make the word
12.17E		magnitude magnitude is made up of what two things magnitude is made up
12.18E		of two things [code-switches] magnitude is made up of two things what and
12.19E		what [name]
12.20E	**L**	size and unit
12.21E	**T**	[code-switches]
12.22E	**L**	size
12.23E	**T**	size and a unit [code-switches] size plus unit ten size unit ten kilometers so
12.24E		[code-switches]

(10)

(1) Vector? Magnitude + direction

size + unit		points in a
10	km	compass
		(bearing)

ACTIVITY STRUCTURE: 'interruption' [1] – teacher admonition

13.1E	**T**	is that difficult is that thing [unclear] hey [chalkboard (10)]

ACTIVITY STRUCTURE: 'review' [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Vectors)

12.25E	**T**	so then I go now if I speak of magnitude only there is no direction here if I
12.26E		speak of what of magnitude but once I now include direction direction let's
12.27E		now begin where now this one then I have what the north the east the south
12.28E		and the west those are the four cardinal points of a compass the four cardinal
12.29E		points of a compass four cardinal points of a compass

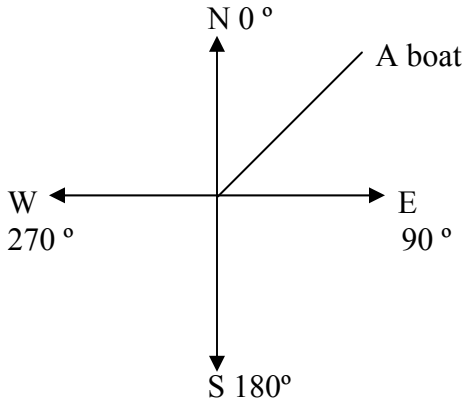
ACTIVITY STRUCTURE: 'interruption' [1] – teacher admonition

14.1E	**T**	this I dealt with [code-switches] February

ACTIVITY STRUCTURE: 'review' [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Vectors)

12.30E **T** four cardinal points of a compass now this is north direction [code-switches]
12.31E now in terms of degrees for our compass what is nought sorry north
12.32E **Ls** zero degrees
12.33E **T** zero degrees and east
12.34E **Ls** ninety degrees
12.35E **T** ninety degrees and south
12.36E **Ls** one eighty degrees
12.37E **T** and west
12.38E **Ls** two seventy degrees [chalkboard (11)]
12.39E **T** we always measure clockwise in science to get the [unclear]

(11)

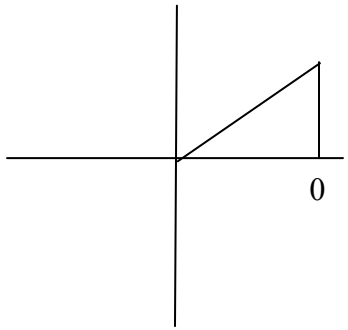


ACTIVITY STRUCTURE: 'review' [1]; 'teacher monologue' [1]
FIELD [2]
Key utterance: 'move this way…anticlockwise in mathematics'

15.1E **T** but in mathematics you can still have the very same four cardinal points but
15.2E in mathematics we like to do it this way [code-switches] in trigonometry we
15.3E move from here and say our starting point is here therefore it is now zero
15.4E and move up this side so our points move this way north and this way means
15.5E anticlockwise in mathematics but it will still nought even there nought
15.6E it's where I start I start from here it's my point of reference it's my frame of
15.7E reference take a note of these things a person is actually four steps to the
15.8E right and five steps in front [code-switches] [chalkboard (12)]
15.9E **Ls** yes

4 cardinal points of a compass

(12)



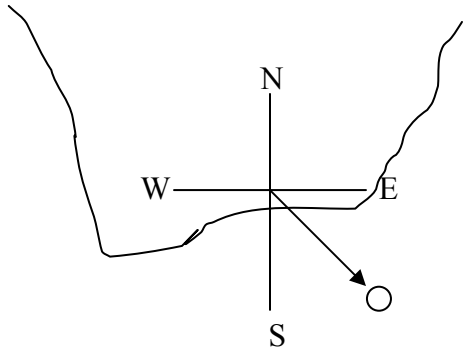
ACTIVITY STRUCTURE: 'review' [1]; 'IRF' 'microgenre' [3]

FIELD [2] (Vectors)

12.40E **T** then we went on now from here and said how do you draw a vector or
12.41E direction we said okay let's have a look at this one now this is east this is

12.42E		north this is south this is west now if you have a vector if you have a a a a
12.43E		person or a a boat here [code-switches] there is a boat at point a [chalkboard
12.44E		(11)]
ACTIVITY STRUCTURE: 'review' [1]; 'IRF' 'microgenre' [3]		
FIELD [2] ('the everday' – 'in the news')		
12.45E	**T**	now [unclear] the one in P E now I'm sure have you heard of that boat
12.46E	**Ls**	yes
12.47E	**T**	which one [code-switches]
12.48E	**L**	[Xhosa]
12.49E	**T**	there is a boat almost what south east of what of Port Elizabeth it's crew
12.50E		members all drowned [code-switches] there it's all science in your news eh
12.51E		direction south east of Port Elizabeth yes that's where it is now here is your
12.52E		direction south east of Port Elizabeth yes that's where it is now here is your
12.53E		[code-switches] north east west south so the boat is somewhere here it's
12.54E		almost what south east [chalkboard (13)] so direction is important
ACTIVITY STRUCTURE: 'review' [1]; 'IRF' 'microgenre' [3]		
FIELD [2] (Vectors)		
12.55E	**T**	now we then said if we had a boat placed at that point there you measure
12.56E		from here and say okay ne boat let's say sixty degrees here ne [chalkboard
12.57E		(14)] so the boat lies the boat lies at or on a bearing of sixty degrees that's
12.58E		what we said that's what we said if the boat lies here now on its bearing
12.59E		[unclear]
12.60E	**Ls**	ninety degrees
12.61E	**T**	ne
12.62E	**Ls**	ninety degrees
12.63E	**T**	on a bearing of what of
12.64E	**Ls**	ninety degrees
12.65E	**T**	[code-switches] if the boat is now here it's lying where now

(13)



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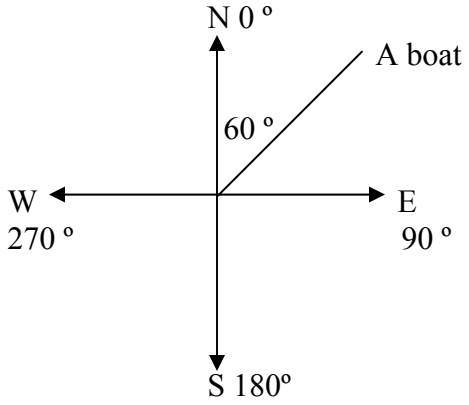
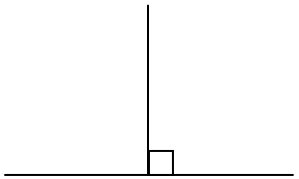


lies at a bearing of 60 º

12.66E **Ls** one eighty degrees

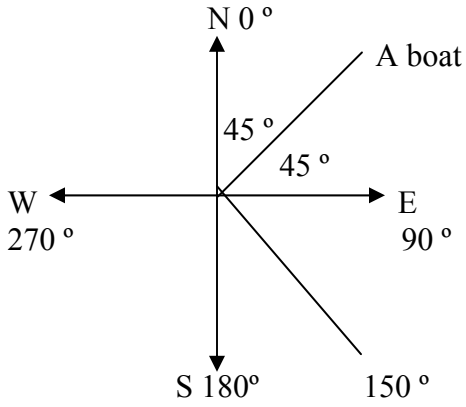
(15)

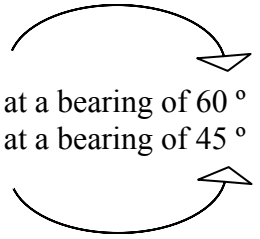


12.67E **T** on a bearing of what of
12.68E **Ls** one eighty degrees
12.69E **T** now if the boat if the boat lies in between [chalkboard (16)] if the boat lies
12.70E now in between what east and what and north what is what is this angle if
12.71E this line is a line bisecting do you know the word bisecting uh you did
12.72E mathematics in grade nine to bisect what do you mean to bisect do you
12.73E know
12.74E **Ls** yes
12.75E **L** to have two sections
12.76E **T** yes okay okay to bisect to have two sections to have two sections that in this
12.77E case when you speak of a particular bisector that means this line joins this
12.78E other line that angle is what is ninety degrees that's what you did in
12.79E mathematics when we use mathematics [chalkboard (15)] here now if if if
12.80E this vector is a line bisecting this angle then this side is what forty five
12.81E degrees and this side is then what fourty five degrees [code-switches] now
12.82E this lies on a bearing of what of
12.83E **Ls** forty five degrees
12.84E **T** forty five degrees [chalkboard (16)] [code-switches] now sometimes we lose
12.85E out or we neglect what the bearing and we say it lies at sixty degrees lies at
12.86E forty five degrees and then we say eh this is ten kilometers at forty five from
12.87E degrees [chalkboard (16)] you know once it's like this we have measured
12.88E the north clockwise forty five degrees let's say there is a boat here and here
12.89E you have got fifty degrees
12.90E **T** what is the bearing of the boat what is the bearing of the boat what is the
12.91E bearing of the boat [code-switches] you must measure from where [code-
12.92E switches] you take the bearing you know when you measure the bearing of a

12.93E		vector from where do you measure
12.94E	**L**	from the north
12.95E	**T**	from the north from the north you measure from the north and you move in
12.96E		which direction
12.97E	**Ls**	clockwise
12.98E	**T**	in a
12.99E	**Ls**	clockwise
12.100E	**T**	clockwise why do say then that this boat lies at direction thirty
12.101E		degrees yes
12.102E	**L**	one fifty degrees
12.103E	**T**	one
12.104E	**L**	one hundred and fifty degrees
12.105E	**T**	how do you get that
12.106E	**L**	because from north to east it's ninety degrees
12.107E	**T**	from north to east it's ninety degrees
12.108E	**L**	plus sixty degrees
12.109E	**T**	plus sixty you know you know degrees [code-switches] if you subtract thirty
12.110E		from ninety you get what sixty here so total from north to there is one fifty
12.111E		degrees [chalkboard (16)] that is what we meant by what by a vector a
12.112E		vector has magnitude and what direction then [code-switches] take the
12.113E		direction as points in a compass what a bearing [chalkboard (10)] and we
12.114E		said bearing is the one that we normally use although there are other
12.115E		methods frame of reference and I have shown you that bearing of what of
12.116E		sixty degrees I've shown you that a bearing [code-switches] of sixty degrees
12.117E		a bearing the bearing from here is sixty degrees that point there that's north
12.118E		it's east it's south it's west the point the boat there is the boat [code-
12.119E		switches] the boat lies [chalkboard (17)] where is our frame of reference
12.120E		where is our frame of reference [code-switches]

(16)





lies at a bearing of 60 º
lies at a bearing of 45 º

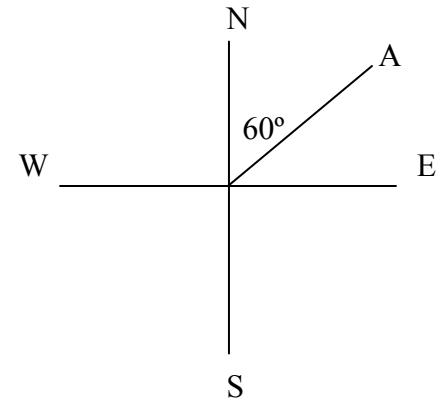
10km at 45 º

ACTIVITY STRUCTURE: 'interruption' – teacher admonition

16.1E **T** I'm only teaching one person because this girl and this girl are not here

ACTIVITY STRUCTURE: 'review' [1]; 'IRF' 'microgenre' [3] (17)

FIELD [2] (Vectors)



Boat N 60° E

12.121E **T** yes
12.122E **L** the frame of reference is north
12.123E **T** it's north so I put down my north in this case I put down my north and then
12.124E what do I have to do now yes
12.125E **L** sixty degrees
12.126E **T** you move sixty degrees yes
12.127E **L** east
12.128E **T** you know why east why why you have moved [code-switches] you have
12.129E moved you have moved sixty degrees to the east to the east that is another
12.130E way of what of expressing that [chalkboard (17)] but [code-switches] north
12.131E sixty degrees east east [code- switches] at sixty degrees I know you have
12.132E already measured from what
12.133E **Ls** north
12.134E **T** from north and you have moved towards the east

TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Lemke, 1993/ [1]
- TEXT 2: Halliday, 1994/ [2]
- TEXT 3: Wells, 1999/ [3]
- The teacher's notes; handouts; the learners' notebooks and the textbook(s) used by the teacher and learners

ACTIVITY TYPE: 'testing' [1]
FIELD [2]:
Symbol for the physical quantity and unit – force, weight, velocity, distance, displacement, mass, acceleration due to gravity, work, time, power

1.1F **T** symbol for the physical quantity symbol for the unit number one is force
1.2F force weight velocity distance or displacement distance or displacement
1.3F where is your jotter don't waste full scap it costs money mass mass
1.4F acceleration acceleration acceleration due to gravity acceleration due to
1.5F gravity work work time number nine is time two four six eight nine nine
1.6F number ten power any more

ACTIVITY TYPE: 'classroom business' [1]

2.1F **T** okay files here tomorrow one two three four
2.2F **Ls** [unclear]
2.3F **T** actually that you're right that is fair I started [unclear]
2.4F **Ls** yes
2.5F **T** you four files tomorrow
2.6F **Ls** [unclear]

ACTIVITY TYPE: 'lecture' [1]

3.1F **T** ladies keep your files properly all the time it shouldn't be you should be
3.2F able to produce it any time and I can tell you that it does not have to have
3.3F what you're working on at present because that should be in your

3.4F		traveling file that you bring to school with all your other subjects
ACTIVITY TYPE: 'going over the test dialogue' [1]; 'IRF' 'microgenre' [3]		
4.1F	**T**	right let's start at the back corner today let's go force
4.2F	**L**	capital n capital n
4.3F	**T**	correct capital n capital n weight
4.4F	**L**	capital w capital n
4.5F	**T**	well done velocity
4.6F	**L**	capital uh small v and m s minus one
4.7F	**T**	correct displacement
4.8F	**L**	small s small m
4.9F	**T**	correct mass
4.10F	**L**	small m and small k g
4.11F	**T**	correct acceleration
4.12F	**L**	small a m s to the minus one
4.13F	**T**	units what's your velocity units
4.14F	**L**	units
4.15F	**T**	look at your number three which was velocity what
4.16F	**L**	oh m s minus two
4.17F	**T**	right velocity is m s to the minus one acceleration is m s to the minus two
4.18F		why it is the rate of change of velocity what is rate of mean divided by
4.19F		time always rate of change of velocity okay um acceleration due to
4.20F		gravity did you do one
4.21F	**L**	[unclear]
4.22F	**L1**	[unclear]
4.23F	**T**	yes
4.24F	**L1**	it's um small m and then small a and then k g m s to the minus two
4.25F	**T**	just the physical quantity you're going into it's acceleration so the m s to
4.26F		the minus two for the units is right what's acceleration due to gravity it's
4.27F		not an a it's got a special letter because it's used so much yes

4.28F	**L**	small g
4.29F	**T**	small g remember w equals m g it's the g um so number what is it six is g
4.30F		and m s to the minus two okay um work yours
4.31F	**L**	capital w capital j
4.32F	**T**	capital w capital j is good well done uh time
4.33F	**L**	small t small s
4.34F	**T**	small t small s is good well done power
4.35F	**L**	capital p capital w
4.36F	**T**	well done count out of twenty twenty well done you two nineteen that's
4.37F		good eighteen still good seventeen sixteen less than sixteen are you happy
4.38F		now
4.39F	**Ls**	yes
4.40F	**T**	talk to me about the ones you got wrong if you're not happy okay

ACTIVITY TYPE: 'going over the homework' [1]; 'groupwork' [1]
FIELD [2]:
S.I. Units
Force diagrams
Equations:
$W = m.g$
$F_{res} = m.a$
$F_g = m.a_g$

5.1F	**T**	okay take out your worksheets from last night girls right now listen aye
5.2F		let's have you listening I'm still waiting for some ladies right in your
5.3F		groups your same groups remember fours so swing round so you're in your
5.4F		groups this is not practical so you only need four and wait wait wait till I
5.5F		tell you what you've got to do you then look at your answers now I'm not
5.6F		giving you the answers you're going to look at the answers and see for
5.7F		example that these four all have three each one if they don't agree
5.8F		between them they've got to sort out amongst each other which answer

5.9F		they think is correct and why I'll give you a few minutes to do that when
5.10F		you've done that then I'll go through just to check that all of us have got
5.11F		the correct answers right swing round into your groups
5.12F	**Ls**	[groupwork]

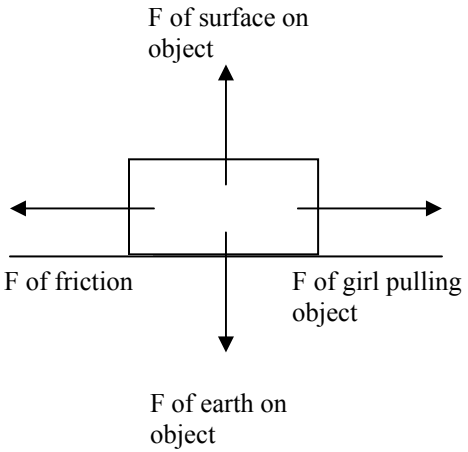
ACTIVITY TYPE: 'going over the homework' [1]; 'IRF' microgenre' [3]
FIELD [2]:
S.I. Units
force diagrams
Equations:
$W = m.g$
$F_{res} = m.a$
$F_g = m.a_g$

6.1F	**T**	right ladies let's swing round into your own seats again and let's go
6.2F		through the answers come that group
6.3F	**L**	um zero point zero zero one k gs
6.4F	**T**	how many zero comma how many zeros
6.5F	**L**	two zeros I got
6.6F	**T**	nought nought one correct keep going because we're only on number one
6.7F		that group
6.8F	**L**	zero point zero two five k gs
6.9F	**T**	correct
6.10F	**L**	zero point four eight five k gs
6.11F	**T**	correct
6.12F	**L**	one comma nought three eight k gs
6.13F	**T**	correct please note that you must have those k gs on your answers keep
6.14F		going next group
6.15F	**L**	thirty newtons
6.16F	**T**	correct
6.17F	**L**	one hundred and fifty newtons

6.18F	**T**	correct
6.19F	**L**	one thousand two hundred and fifty newtons
6.20F	**T**	correct
6.21F	**L**	nought comma three eight newtons
6.22F	**T**	nought comma three eight newtons is correct well done number three
6.23F	**L**	sixty netwons
6.24F	**T**	six o newtons correct
6.25F	**L**	three hundred and fifty newtons
6.26F	**T**	correct [name]
6.27F	**L**	um nought comma four nought newtons
6.28F	**T**	correct
6.29F	**L**	fourty seven newtons
6.30F	**T**	correct number four we're on
6.31F	**L**	zero comma five kilograms
6.32F	**T**	correct
6.33F	**L**	two comma eight kilograms
6.34F	**T**	correct at the back
6.35F	**L**	thirty two kilograms
6.36F	**T**	correct
6.37F	**L**	zero comma zero zero one kilograms
6.38F	**T**	how come you've suddenly gone back there
6.39F	**L**	she's in our group and [name] is not here
6.40F	**T**	oh okay alright right number five have you done one
6.41F	**L**	eighteen newtons
6.42F	**T**	eighteen newtons is good number six a
6.43F	**L**	a stays the same
6.44F	**T**	the mass is unchanged is everybody happy
6.45F	**Ls**	yes
6.46F	**T**	okay the weight [name]

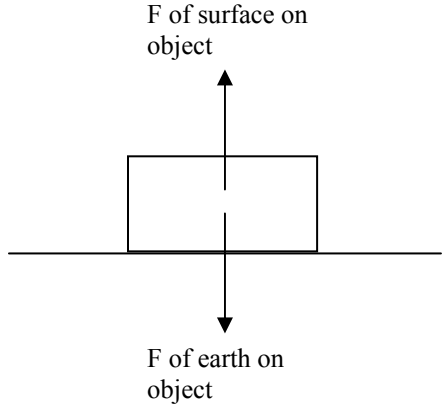
6.47F	**L**	um it decreases
6.48F	**T**	the weight decreases everybody alright
6.49F	**Ls**	yes
6.50F	**T**	because your acceleration due to gravity that little g that we know is ten m
6.51F	**L**	it decreases
6.52F	**T**	decreases well done okay onto number seven
6.53F	**L**	four m s to the minus two
6.54F	**T**	four m s to the minus two is good um number eight
6.55F	**L2**	[unclear]
6.56F	**T**	uh how have you numbered yours one two three four five six seven nine
6.57F	**L2**	[unclear]
6.58F	**T**	next time check that you've got it what is it
6.59F	**L**	two k gs
6.60F	**T**	two k gs is good

(1)



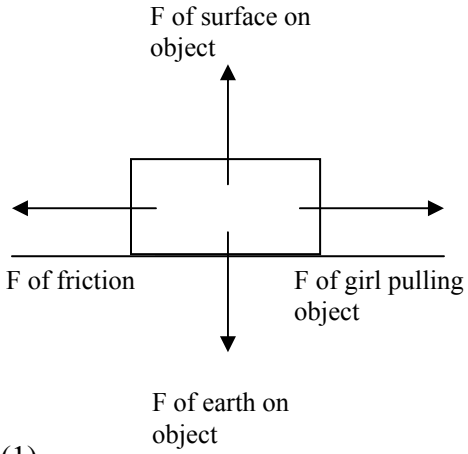
ACTIVITY TYPE: 'boardwork' [1]; 'going over boardwork' [1]
FIELD [2]:
Force diagrams

(1)



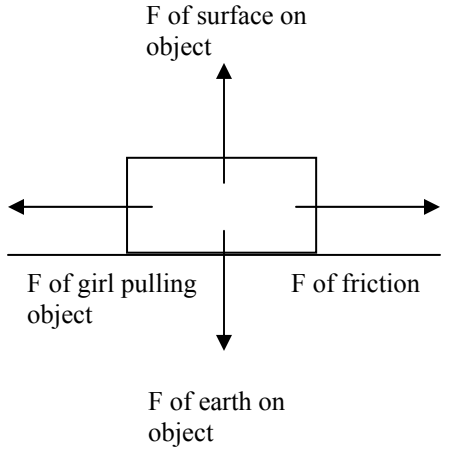
7.1F	**T**	right number nine are you going on the board please nine
7.2F		a nine b on the board you can do nine c you haven't done one in this
7.3F		group yet you're doing nine c on the board and we're back again you're
7.4F		doing nine d on the board please put a b c d right along and I have seen
7.5F		some of these ladies that are not labeled without labels they are going to
7.6F		be wrong you have got to have an arrow approximately the right length
7.7F		and a label you don't have to label the ones that are already there just the
7.8F		ones that you've selected [chalkboard (1)] right let's go through if you
7.9F		look at 'a' what you were given was the force of the girl on the object and
7.10F		the force of the earth on the object you were told these objects are
7.11F		stationary which means there must be no resultant force so first of all you
7.12F		know that you must balance the force of the earth and you must balance

7.13F the force of the girl pulling the object right what balances the force of the
7.14F earth is the force of the surface on the object and what balances her (1)
7.15F pulling is the friction between the object and the surface so it's the force
7.16F of friction okay everybody happy there



7.17F **Ls** yes
7.18F **T** arrows should look approximately the same size they must have
7.19F arrowheads on and they must be labeled okay look at 'b' what you were
7.20F given for 'b' was the force of the earth on the object in other words the
7.21F weight of the object it wasn't being pulled by a girl it is stationary so you
7.22F do not need any horizontal forces to balance the force of the earth is the
7.23F force of the surface so these good who put horizontal forces into 'b' you
7.24F didn't need them okay um 'c' the two horizontals were in now do you
7.25F need the verticals
7.26F **Ls** yes

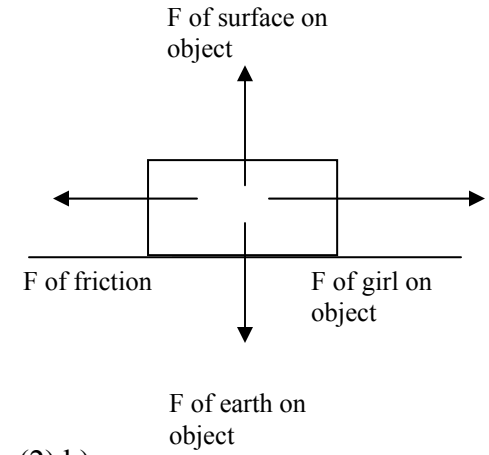
7.27F **T** yes because the earth is there the earth is pulling down on this object so (1)
7.28F the force of the earth on the object the force of the surface on the object
7.29F balancing the force of the earth and then the last one you were given the
7.30F force of the surface and you were given the friction remember what we
7.31F said about friction it acts in the opposite direction to the motion so
7.32F something must have been pulling it this way so she's called it the force
7.33F of the girl on the object which is quite fine if you want to put a force of a
7.34F motor vehicle or a force of a boy or whatever that's also fine and then to
7.35F balance the force of the surface you must balance the force of the earth the
7.36F weight of the object okay well done all those ladies that's good



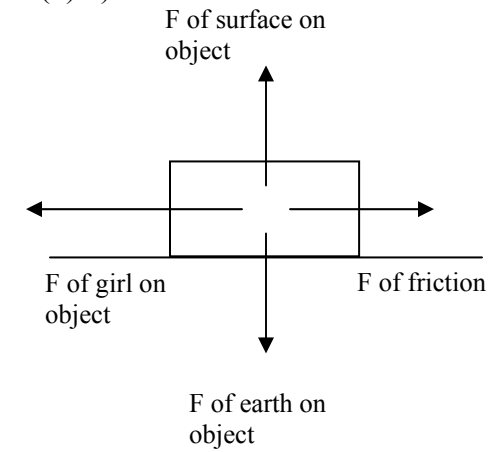
ACTIVITY TYPE: 'boardwork' [1]; 'going over boardwork' [1]
FIELD [2]:
Force diagrams

8.1F **T** okay last one um who did we get up to who hasn't done one on the board in
8.2F that back group one two three on the board did you do one no okay 'a' 'b'
8.3F 'c'no she's doing 'a' [name]'s doing 'a' you're doing 'b' she's doing 'c'
8.4F rub theirs off and put 'a' 'b' or 'c' [name] rub that bit off there please put
8.5F your letters ladies 'a' 'b' or 'c' [chalkboard (2)] listening to the girls at the
8.6F board this one probably caused more problems than any of the others right
8.7F let's talk about it while they're drawing the object has got to be
8.8F accelerating to the right so first of all the vertical forces don't go away so
8.9F there is the force of the earth on the object and the force of the surface on
8.10F the object right they're there then it's accelerating to the right so there
8.11F must be a force of something pulling it to the right the force of the girl
8.12F pulling it or whatever to the right then there's likely to be some friction to
8.13F the left but it's accelerating right so there must be a resultant force to the
8.14F right so the right hand side must be longer than the left hand side get it
8.15F that's looking good [name] now you need your verticals right look at 'c'
8.16F look at 'c' it's finished stationary on the table the weight is still there the
8.17F force of the earth on the object is still there and the force of the surface to
8.18F balance that weight is still there and nothing to the right so there is no
8.19F resultant force so it is stationary on the table so 'c' is good um right let's
8.20F talk about 'b' 'b' was going to the left now here's where the catch comes
8.21F in it was going at a constant velocity that means there is no resultant force
8.22F so if it's going at constant velocity it's almost like it's stationary in terms
8.23F of the forces so this force should be the same length as the force of
8.24F friction [chalkboard (3)] the force of the girl pulling the object has got to
8.25F be the same length as the friction right the verticals are still there so the
8.26F verticals are good now it's constant velocity ladies you are in a car you

(2) a)

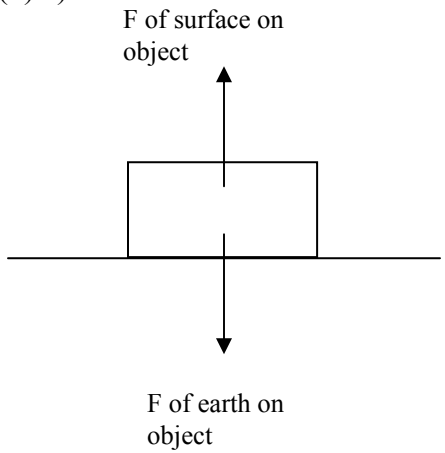


(2) b)

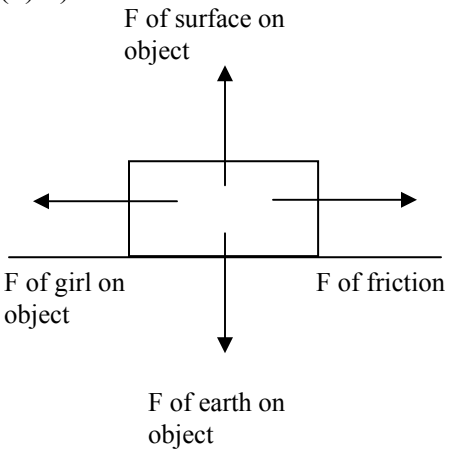


8.27F are on a motorway going to Port Elizabeth and you are sitting there at a
8.28F hundred and twenty kilometers per hour constant velocity going in a
8.29F straight line towards Port Elizabeth there is the force of the engine driving
8.30F the car forwards and there is the force friction between the tyres and the
8.31F tar and the friction in the engine there's a lot of friction going in the
8.32F opposite direction the friction is balancing the force of the engine driving
8.33F the car forwards only when you want to break the speed limit and go from
8.34F a hundred and twenty to a hundred and forty do you have to press the
8.35F accelerator and make the forward force bigger than the frictional force
8.36F backwards and then you are accelerating not going constant velocity at
8.37F there is a resultant force so very important stationary or constant velocity
8.38F no resultant force maybe write that somewhere near number ten stationary
8.39F or constant velocity no resultant force it doesn't mean there's no force
8.40F there are forces there's no resultant force
8.41F **L** they are balanced
8.42F **T** they are balanced forces well done right then let's look at 'a' the object is
8.43F accelerating to the right so something is pulling it to the right so she's got
8.44F a girl pulling the object to the right okay her verticals are balanced please
8.45F remember to make sure your forces touch so make them touch the object
8.46F okay and try and make them the same length hers are more or less the
8.47F same length right so her verticals are fine her horizontals it's going to the
8.48F right accelerating so there's got to be a resultant force to the right so she's
8.49F put her friction quite correct it's to the left this arrow must be shorter than
8.50F that arrow to indicate that there is a resultant force to the right everybody
8.51F happy with that
8.52F **Ls** yes
8.53F **T** sure
8.54F **Ls** yes
8.55F **T** right put your homework away you may now put it into your files at home

(2) c)



(3) b)



ACTIVITY TYPE: 'IRF' 'microgenre' [3]
FIELD [2]:
Formula:
$E_k + E_p$ = mechanical E
Key terms/ utterances:
- 'gravitational potential energy'; 'potential energy'; 'stored energy'
- 'kinetic energy'; 'energy due to movement'
- 'mechanical energy'
- 'energy is transferred'; 'transformed'; 'changed from one form into another'

9.1F	**T**	right the last thing we are going to talk about in the mechanics section it's
9.2F		getting quite hot in here today right the last little bit that we do in the
9.3F		mechanics section is a little bit more than you did last year about energy
9.4F		hopefully last year you learnt several different forms of energy did you
9.6F	**Ls**	yes
9.7F	**T**	maybe not last year maybe grade eight
9.8F	**Ls**	yes
9.9F	**T**	okay grade seven eight nine it doesn't matter the different forms of energy
9.10F		things like heat energy and sound energy and light energy and electrical
9.11F		energy chemical energy right the two we are going to talk about cause this
9.12F		is a mechanics section the two we are going to talk about is potential
9.13F		energy and kinetic energy right now let's be more specific we are going to
9.14F		talk about gravitational potential energy now remember you are doing
9.15F		your own notes for your own sakes so subheading would be energy and
9.16F		then we are going to talk about gravitational potential energy remember
9.17F		some of you put your notes into rough and then put them into no neat
9.18F		others of you go straight into neat it's up to you some people write
9.19F		nothing they know it already that's not a problem if you know it already
9.20F		they're your notes you are learning to keep notes one of your skills right

9.21F		can anybody remember another similar name for potential energy
9.22F	**L3**	still energy
9.23F	**T**	say that loudly what was it
9.24F	**L3**	still energy
9.25F	**T**	not still it begins with an s though s t
9.26F	**Ls**	stored energy
9.27F	**T**	stored energy
9.28F	**L3**	oh yes
9.29F	**T**	right now you can get stored in terms of things like a spring all of you
9.30F		think of a spring when a spring is pushed in tight it's got the potential to
9.31F	**Ls**	expand
9.32F	**T**	expand and spring out hasn't it right you lot have all got the potential to
9.33F		pass matric to develop your grey cells to do well in life you've all got the
9.34F		potential it doesn't mean you're all going to that's up to each and
9.35F		everyone one of you hopefully each and everyone of you are going to but
9.36F		you've got the potential right now gravitational potential energy you can
9.37F		define it as energy due to height specifically so like the energy in a spring
9.38F		wouldn't come under gravitational potential energy okay gravitational
9.39F		potential energy is energy due to height the other way of talking of
9.40F		potential energy when you were in grade nine is position sometimes you
9.41F		may have used that word energy due to position but what we're going to
9.42F		think of this year is energy due to height cause it's got the gravity bit in
9.43F		um where's that okay here's her eraser is it moving
9.44F	**Ls**	no
9.45F	**T**	what sort of energy did it have up there
9.46F	**Ls**	potential energy
9.47F	**T**	gravitational potential energy
9.48F	**Ls**	oh
9.49F	**T**	okay you can just call it potential energy but bear in the back of your minds
9.50F		that it's gravitational potential energy energy due to height so it's got the
9.51F		potential to do what

9.52F	**Ls**	to fall down	
9.53F	**T**	to fall down alright water at the top of a waterfall has	
9.54F	**Ls**	(gravitational) potential energy	(4)
9.55F	**T**	potential energy gravitiational potential energy alright anything that is at a	
9.56F		height compared to something else alright has got potential energy okay	$E_k + E_p$ = mechanical E
9.57F		now what about the second one we're going to [unclear] which is kinetic	
9.58F		energy kinetic energy is what sort of energy	
9.59F	**Ls**	[unclear]	
9.60F	**T**	energy due to movement right as soon as there's movement there is	
9.61F		kinetic energy and then together what are gravitational potential energy	
9.62F		and kinetic energy called	
9.63F	**Ls**	(yoh gravitational potential kinetic energy)	
9.64F	**T**	some strange names coming out of here today kinetic energy and potential	
9.65F		energy together make mechanical energy [chalkboard (4)] right let's think	
9.66F		again about the water at the top of a waterfall and it's going to fall down	
9.67F		you can't lose or gain energy it gets	
9.68F	**Ls**	transferred	
9.69F	**T**	transferred some books say transformed some books say changed I don't	
9.70F		mind which word you use it can get changed from one form to another so	
9.71F		for the water for the waterfall or her eraser it started with potential energy	
9.72F		what in the end changed into	
9.73F	**Ls**	kinetic energy	
9.74F	**T**	kinetic energy it got faster and faster as it went down okay there was	
9.75F		movement and there was more and more movement alright mechanical	
9.76F		energy at the top let's think about the mechanical energy at the top was it	
9.77F		[unclear] kinetic or potential	
9.78F	**Ls**	potential	
9.79F	**T**	the top don't put your eraser away we're using this eraser alright at the top	
9.80F		here is it moving	
9.81F	**Ls**	no	

9.82F	**T**	so the mechanical energy is all potential halfway down so it's going from
9.83F		there to the desk halfway down half will be kinetic and half will be
9.84F	**Ls**	potential
9.85F		potential and at the bottom now it's got no potential it's not going to fall
9.86F		any further all the mechanical energy is
9.87F	**Ls**	kinetic energy
9.88F		kinetic energy the table is going to stop it think of examples tonight please
9.89F		I'm going to ask you for examples tomorrow off you go ladies

TEXTS USED IN THIS ANALYSIS:

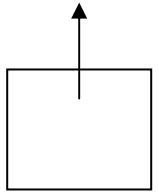
- TEXT 1: Lemke, 1993/ [1]
- TEXT 2: Halliday, 1994/ [2]
- TEXT 3: Wells, 1999/ [3]
- The teacher's notes; handouts; the learners' notebooks and the textbook(s) used by the teacher and learners

ACTIVITY TYPE: 'testing' [1]
FIELD [2]: (1)
Force diagram
Weight
The force of the earth

1.1G **T** number one I want a force diagram for this stapler which I am pushing
1.2G towards the south a force diagram for that stapler and I am pushing it
1.3G towards the south it's not moving it's not moving look at it one two three
1.4G four files tomorrow hey don't forget your arrows and your labels number
1.5G two what is the weight of a two kilogram object what is the weight of a
1.6G two kilogram object what is one word for the force of the earth on an (2)
1.7G object one word for the force of the earth on an object one word for the
1.8G force of the earth on an object number four the force of the earth acts on
1.9G you does it pull you or does it push you the force of the earth acts on you
1.10G does it pull you or does it push you

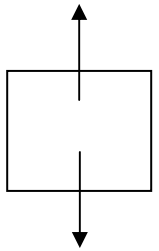
ACTIVITY TYPE: 'going over the test dialogue' [1]; 'IRF' 'microgenre' [3]

2.1G **T** right let's start here today [chalkboard (1)]
2.2G **Ls** [unclear]
2.3G **T** hey here here here let's go tell me one force that you've got



2.4G **L** um the arrow goes up [chalkboard (2)]
2.5G **T** and what have you labeled it
2.6G **L** um force of the surface
2.7G **T** force of the surface on the object well done okay one mark you've got to
2.8G have an arrow you've got to have labeled force of the surface on the
2.9G object another force you've got
2.10G **L** [unclear] [chalkboard (3)]
2.11G **T** of approximately the same size please and labeled
2.12G **L** force of the earth on the object
2.13G **T** force of the earth on the object well done another one
2.14G **L** arrow to the left
2.15G **T** force of friction well done [chalkboard (4)] and
2.16G **L** arrow to the right
2.17G **T** approximately the same size please [chalkboard (5)]
2.18G **L** force of [name]
2.19G **T** [name] force of [name] on stapler or whatever force of person on object I
2.20G was pushing that way hey
2.21G **Ls** yes
2.22G **L** but what if you drew your arrow on the back
2.23G **T** if you did this right question [chalkboard (6)] if you did this that's alright
2.24G it's same thing hey okay then your friction your friction you could have
2.25G done your friction like that [chalkboard (7)] or you could have done your
2.26G friction like that [chalkboard (8)] it doesn't matter hey okay either's good
2.27G it is exactly the same thing remember there's lots of alternatives which
2.28G mean exactly the same thing in science okay so there's four marks there
2.29G ladies right um next one two k gs force of the earth on a two k g body
2.30G **L** twenty
2.31G **T** twenty newtons how did she do that she said w equals m g w equals two
2.32G times ten which equals twenty then she thought about her units twenty

(3)



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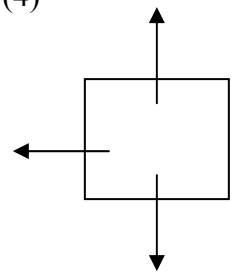

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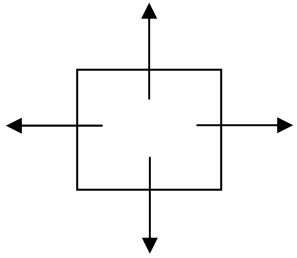

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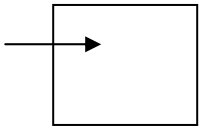

2.33G		newtons to make your answer even better twenty newtons down but
2.34G		you don't have to do that at the moment twenty newtons one mark another
2.35G		word for the force of the earth
2.36G	**L**	gravity
2.37G	**T**	no because we would have to say force of gravity remember I said to you
2.38G		don't ever just say gravity either say force of gravity or acceleration due
2.39G		to gravity and you haven't told me in saying gravity whether you mean
2.40G		you mean force of gravity or whether you mean acceleration due to
2.41G		gravity and I said one word so I'm not going to take gravity it's kind of
2.42G		it's partially alright there but it's not good enough next [name]
2.43G	**L**	weight
2.44G	**T**	weight's good weight is what I was looking for force of gravity is right
2.45G		but it's not one word okay weight is um [name] the earth does what to you
2.46G	**L**	it pulls you
2.47G	**T**	the earth so so don't do that to show me it pulls you down yes the earth
2.48G		pulls on you it does not push you up I can't tell you how many times I've
2.49G		seen exam papers with arrows pointing up for the force of the earth which
2.50G		is obviously not you know if I drop my pen what does it do it goes down
2.51G		the earth pulls on it right four five six seven it's out of seven add it up
2.52G		hands up seven well done six good five four less than four were you
2.53G		asleep yesterday are you awake today do you understand

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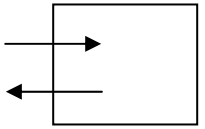

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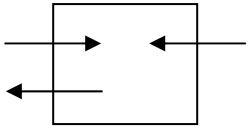


ACTIVITY TYPE: 'review' [1]
FIELD [2]:
Formula:
$E_k + E_p$ = mechanical E
Key terms/ utterances:
- 'kinetic energy is energy due to movement'
- 'gravitational potential energy is energy due to height'
- 'if energy does not get lost potential energy changes into kinetic energy when something falls from a height'

3.1G	**T**	right we were talking about mechanical energy yesterday and we basically	(9)
3.2G		said mechanical energy is the total together of your potential energy and	
3.3G		your kinetic energy [chalkboard (9)] and we said kinetic energy was energy	
3.4G		due to movement and we said potential energy you're talking about	$E_k + E_p = E_{mechanical}$
3.5G		gravitational potential energy and that is energy due to height okay now if	
3.6G		energy does not get lost when something falls from a height and no	
3.7G		energy is lost then your potential energy changes into kinetic energy	

ACTIVITY TYPE: 'motivation' [1]; 'teacher monologue' [1]; 'IRF' 'microgenre' [3]
FIELD [2]:
Units for energy
Formula:
$E_k + E_p$ = mechanical E
Key terms/ utterances:
- kinetic energy is energy due to movement
- gravitational potential energy is energy due to height
- if energy does not get lost potential energy changes into kinetic energy when something falls from a height

4.1G	**T**	so I've got a nice transparency here that I found sometime ago in a book
4.2G		I used to be in charge of diving and I always liked this part of the book it
4.3G		is an American book hence they call it P E and K E instead E subscript p
4.4G		and E subscript k obviously it's the same thing okay and there is
4.5G		somebody diving right and there is what they are diving into it was very
4.6G		nice because I used to have the diving captain was nearly always in the
4.7G		class so [unclear] in Matric that was doing this because this remember
4.8G		you've got change in syllabus and you're doing a simplified version of
4.9G		what used to be done in Matric here and it always happened to be done in
4.10G		diving season and so it was a very nice thing there is the person diving
4.11G		into a bucket and I always used to have to tell the diving captain that it
4.12G		would knock some brains into him

5.1G right let's have a look at it what sort of energy is a person got at the top (10)
5.2G **Ls** got potential
5.3G **T** potential energy and they say the potential energy is ten thousand joules
6.1G and the kinetic energy the person is not yet moving is nought is everybody
6.2G happy with the units for energy joules okay work and energy both have
6.3G the same units joules because energy is the ability to do work right then
6.4G the person dives at the bottom he's no longer got any height so he's
6.5G potential energy is now nought and all his potential energy has changed
6.6G into kinetic energy now we come to halfway there's halfway halfway
6.7G down he loses height basically because it is halfway down and it is in
6.8G proportion to the distance of the ten thousand joules five thousand of
6.9G those joules are potential energy that changes into kinetic energy so now
6.10G that person has five thousand joules of potential energy and five thousand
6.11G of kinetic if we look only a quarter of the way down think about a quarter
6.12G and three quarters of ten thousand a quarter is two thousand five hundred
6.13G three quarters is seven thousand five hundred everybody happy there now
6.14G where you have to be careful with this is you must think is it above
6.15G halfway or is it below halfway the moment we're looking above halfway
6.16G above halfway the potential energy must be bigger than the kinetic energy
6.17G cause he's still high up this person is still high up so of those three
6.18G quarters is the potential one quarter is kinetic everybody happy with how
6.19G it's divided up then we go down we've now got three quarters of the way
6.20G down if you look there the division in terms of the distance is still three
6.21G quarters and one quarter so in terms of the energy it is three quarters and
6.22G one quarter so it's your seven thousand five hundred and your two
6.23G thousand five hundred again but now look at the difference this time he's
6.24G nearer the bottom so the big bit the three quarters is kinetic energy and the
6.25G one quarter is potential energy everybody happy there so it's divided in
6.26G proportion to the distance remembering that the biggest portion you've
6.27G got to make a decision is it kinetic or is it potential if it's above halfway

PE = 7500J
KE = 2500J

PE = 5000J
KE = 5000J

PE = 2500J
KE = 7500J

PE = 0J
KE = 10000J

6.28G		the biggest portion will be potential if it's below halfway the biggest
6.29G		portion will be kinetic now let's look at the mechanical energy
5.4G		hands up those who can tell me what the mechanical energy is at the top
5.5G	**L**	ten thousand
5.6G	**T**	aye where's your hand [name]
5.7G	**L**	ten thousand
5.8G	**T**	ten thousand everybody happy
5.9G	**Ls**	yes
5.10G	**T**	how did she find that she said potential plus kinetic is ten thousand plus
5.11G		nought makes ten thousand joules okay what is the mechanical energy
5.12G		sleepy head at the back the mechanical energy at the bottom
5.13G	**L**	at like right at the bottom
5.14G	**T**	right at the bottom here
5.15G	**L**	ten thousand
5.16G	**T**	ten thousand joules okay don't forget your units everybody happy
5.17G	**Ls**	yes
5.18G	**T**	right now go to halfway uh at the back right on the in the middle there
5.19G	**L**	uh ten thousand joules
5.20G	**T**	ten thousand joules everybody happy mechanical energy is still ten
5.21G		thousand joules right let's go three quarters of the way down what is the
5.22G		mechanical energy
5.23G	**L**	ten thousand joules
5.24G	**T**	ten thousand joules everybody happy

(10)

KEY

diver

bucket

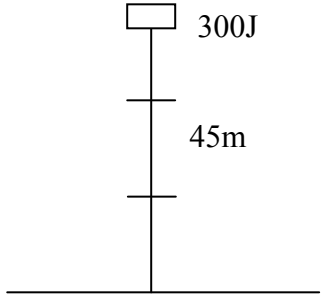
ACTIVITY TYPE: 'IRF' 'microgenre' [3]

FIELD [2]:
Units for energy
Formula:
$E_k + E_p$ = mechanical E

Key terms/ utterances:
- 'kinetic energy is energy due to movement'
- 'gravitational potential energy is energy due to height'
- 'if energy does not get lost potential energy changes into kinetic energy when something falls from a height'

7.1G	**T**	right a brick falls off a scaffolding here is the ground and it's going for
7.2G		forty five metres here's the brick it's going to fall the brick has three
7.3G		hundred joules of mechanical energy okay three hundred joules of
7.4G		mechanical energy [chalkboard (11)] now we're going to do a whole
7.5G		lot of questions um let's go to the back corner what's the mechanical
7.6G		energy at the bottom everybody try hey you can write it in your jotters if
7.7G		you want whilst she's busy thinking
7.8G	**L**	three hundred joules
7.9G	**T**	three hundred joules if you are unhappy and don't see where somebody is
7.10G		getting their answer from please say so loudly so that we can sort out the
7.11G		problem what is the potential energy at the top
7.12G	**L**	three hundred joules
7.13G	**T**	three hundred joules next lady coming down that row what is the kinetic
7.14G		energy at the top
7.15G	**L**	nought joules
7.16G	**T**	nought joules everybody happy I'm going to call these positions A and B
7.17G		[chalkboard (12)] next lady at A what is the mechanical energy
7.18G	**L**	[unclear]
7.19G	**T**	no it's sorry good question oh they're fifteen alright right what did I asked
7.20G		you mechanical energy at A [chalkboard (13)]
7.21G	**L**	three hundred joules
7.22G	**T**	three hundred joules is good everybody alright
7.23G	**L**	[unclear]

(11)



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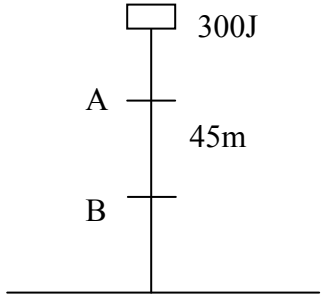
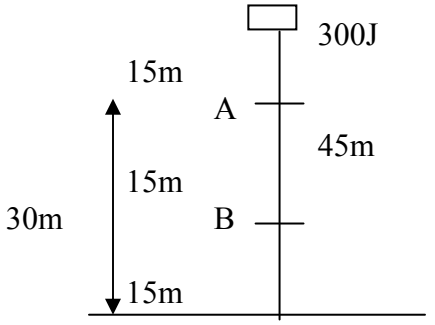


7.24G	**T**	mechanical energy at A not kinetic or potential mechanical the total can
7.25G		the total change
7.26G	**Ls**	no
7.27G	**T**	no she didn't actually for that bit need to ask me the question about the
7.28G		heights but obviously to do the rest of it we need to know those heights
7.29G		alright next lady the potential energy at A
7.30G	**L**	two hundred joules
7.31G	**T**	two hundred joules is good everybody alright
7.32G	**Ls**	[a number of learners talking at the same time]
7.33G	**T**	no no two thirds it's divided the distance is divided into thirds right so it
7.34G		has fallen one third of the way its fallen fifteen metres that's one third
7.35G		fifteen over forty five is one third okay it's fallen one third of the way so
7.36G		your looking at two thirds and one third the big bit is potential so the two
7.37G		thirds of three hundred is potential okay one third is going to be kinetic
7.38G		next lady who's turn is it what's the kinetic energy of A
7.39G	**L**	one hundred
7.40G	**T**	one hundred joules [unclear] okay let's go to B mechanical energy of B
7.41G	**L**	three hundred joules
7.42G	**T**	three hundred joules kinetic energy at B
7.43G	**L**	two hundred joules
7.44G	**T**	two hundred joules well done and the potential energy at B
7.45G	**L**	a hundred joules
7.46G	**T**	a hundred joules and at the bottom the mechanical energy
7.47G	**L**	three hundred joules
7.48G	**T**	three hundred joules and kinetic energy [name]
7.49G	**L**	[unclear]
7.50G	**T**	no at the bottom
7.51G	**L**	at the bottom it's three hundred joules
7.52G	**T**	three hundred joules everybody happy and [name] the potential energy at
7.53G		the bottom

(13)



7.54G **L** at the bottom it's zero
7.55G **T** correct everybody

ACTIVITY TYPE: 'groupwork'

8.1G **T** alright okay what you've got to do now you go into your same groups
8.2G again now you're doing an assessment task this assessment task is a little
8.3G bit different you've got to devise a question okay on kinetic energy
8.4G potential energy and mechanical energy alright the whole thing alright the
8.5G whole concept okay you've got to make up a question worth ten marks it
8.6G can have like four parts it can have three parts however you like but your
8.7G group has got to make up a question with a situation you can't have a diver
8.8G or a brick because I've used the diver and the brick okay you've got to
8.9G make up a situation alright and you've got to make up a question that's
8.10G going to be worth ten marks in your group and then you've got to put that
8.11G question onto a piece of paper obviously with the answers either
8.12G underneath or clearly in pencil as against pen or something and you hand
8.13G it in cause it's it's an assessment task alright so swing round into your
8.14G groups

[groupwork]

TRANSCRIPT H **LESSON 1 – N.N.** **GRADE 11 PHYSICAL SCIENCE**

TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Lemke, 1993/ [1]
- TEXT 2: Halliday, 1994 [2]
- TEXT 3: Wells, 1999/ [3]
- The teacher's notes; handouts; the learners' notebooks and the textbook(s) used by the teacher and learners

ACTIVITY STRUCTURE: 'review' [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Systems in equilibrium – apparatus (1))

1.1H **T** [code-switches] good now now where were what were we discussing the
1.2H last time in my class almost three weeks ago two weeks ago am I right
1.3H [code-switches] tell me what [code-switches] good let's start

ACTIVITY STRUCTURE: 'interruption' – cleaning the chalkboard

2.1H **T** go clean the board for me please

ACTIVITY STRUCTURE: 'review' cont. [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Systems in equilibrium – apparatus (1))

1.4H **T** let's see what [unclear] systems in equilibrium systems in equilibrium
1.5H systems in equilibrium I think we looked at this

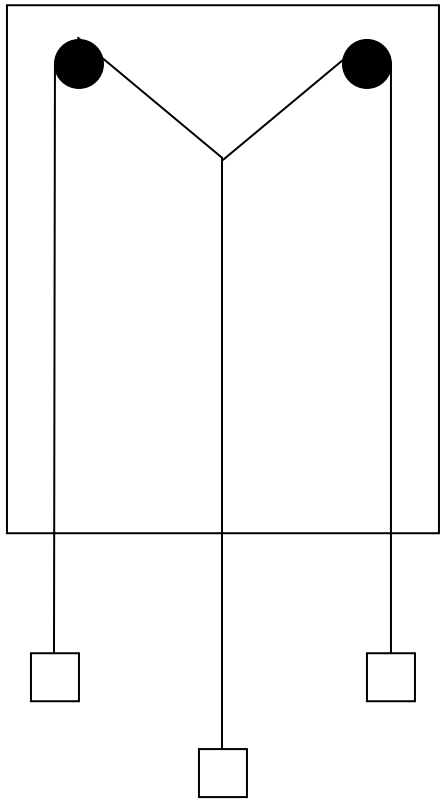
[the teacher and a learner set up apparatus (1)]

ACTIVITY STRUCTURE: 'review' cont. [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Systems in equilibrium – apparatus (1)):
Equation(s):
$F = mg$
$R = F_1 – F_2$

Key terms/ utterances:
- 'a pulley'; 'a mass piece'
- 'the whole thing [system] remains at rest'; 'the whole system is in equilibrium'; 'the whole thing [system] changed'
- 'accelerate'; 'at rest'
- 'magnitude'
- 'resultant force'; 'three forces'

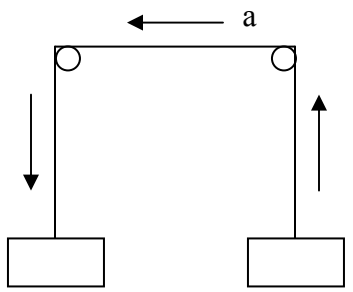
1.6H	**T**	so that's approximately level okay now we were discussing something like
1.7H		that there I think I think initially we had something like this no initially I
1.8H		think we had something like this we had something like that and and we had
1.9H		a pulley here sorry we something like that and we had here and we had we
1.10H		had seventy grams and seventy grams eh and and we said the whole thing
1.11H		remains at rest right because I've got two the two systems or the whole
1.12H		system is in equilibrium the whole system is in equilibrium I think it's
1.13H		where we stopped writing things right ne [chalkboard (2)]
1.14H	**Ls**	yes
1.15H	**T**	and then we removed this one we removed sorry no no you know we kept
1.16H		that one there and we added here what another what another eighty and
1.17H		immediately we saw that the system was no longer were
1.18H	**Ls**	in equilibrium
1.19H	**T**	in equilibrium the system was no longer in equilibrium the system began to
1.20H		do what to
1.21H	**Ls**	accelerate
1.22H	**T**	to accelerate which side towards where the bigger mass which is of course
1.23H		here now what makes things to accelerate it is a it is a resultant force so
1.24H		before we got there we first got the force here we said now the force here is
1.25H		what is m g and we said zero point seven zero point seven kilograms
1.26H		multiplied by what no no
1.27H	**Ls**	zero point zero seven

(1)



1.28H	**T**	zero point zero seven sorry zero point zero seven kilograms multiplied by
1.29H		ten and we have zero point seven newtons so we have here zero point seven
1.30H		newtons and of course here automatically is what
1.31H	**Ls**	zero point eight newtons
1.32H		zero point eight newtons and of course here the resultant is what is f one
1.33H		minus f two which is f one zero point eight minus zero point seven and this
1.34H		becomes zero point one newtons so the resultant is what zero point one
1.35H		newtons and whole thing begins to accelerate towards this side we've got a
1.36H		this side a this side we've got a now the whole system has the same
1.37H		acceleration the whole system has the same what
1.38H	**Ls**	acceleration
1.39H	**T**	acceleration [chalkboard (2)] and then we said but how can we keep that
1.40H		thing again [unclear] how can we make it again to be at rest now we added
1.41H		another what another mass piece here we've now added another mass piece
1.42H		here and the whole thing changed and became like this the whole thing
1.43H		changed and became like that the whole thing changed and became like this
1.44H		and then we had something like this here we had something like this here so
1.45H		uh sorry seventy grams eighty grams and one hundred which is one newton
1.46H		and of course zero point eight newtons and zero point seven newtons are we
1.47H		alright [chalkboard (3)]
1.48H	**Ls**	yes
1.49H	**T**	and we and we this this point this point here is where I have forces acting on
1.50H		one point so at this point here at this point here I've got forces acting on one
1.51H		point how many forces are acting on that point [apparatus (1)]
1.52H	**L**	three forces
1.53H	**T**	three forces what is their magnitude three forces are acting are acting on on
1.54H		on that point now give me the magnitude of those forces yes eh give me
1.55H		the magnitude I've got three forces acting on on this point here give me the
1.56H		magnitude of of those forces acting at that point eh yes eh he yes

(2)



$F = mg = 0.07kg \times 10$

$= 0.7N$

$R = F_1 - F_2$

$= 0.8 - 0.7$

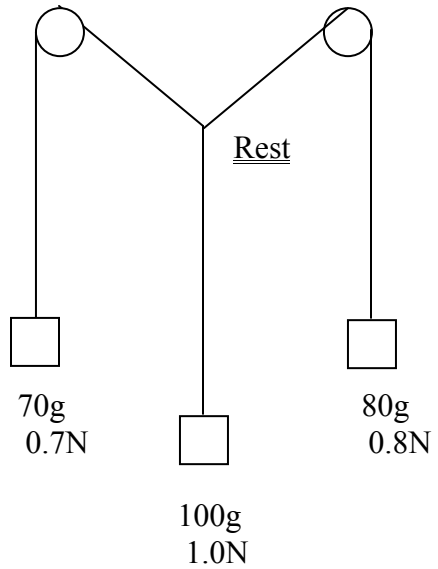
$= 0.1N$

ACTIVITY STRUCTURE: 'interruption' [1] – teacher admonition (3)

3.1H		eh he three weeks of playing

ACTIVITY STRUCTURE: 'review' cont. [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Systems in equilibrium – <u>apparatus (1)</u>)

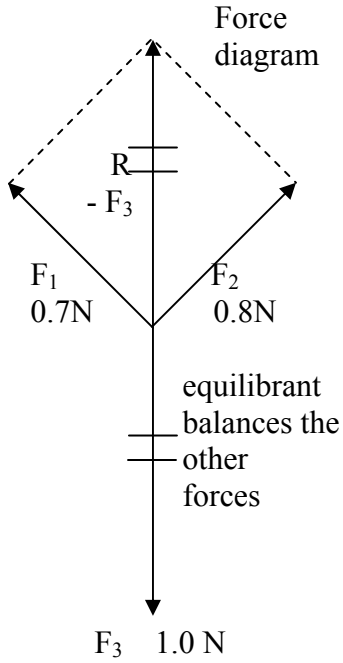
1.57H	**T**	yes
1.58H	**L**	the zero point seven newton force the one point zero newton force
1.59H	**T**	yes
1.60H	**L**	and the zero point eight newton force
1.61H	**T**	so there are three forces there zero point seven newtons [code-switches]
1.62H		zero point seven newtons one newton and what and
1.63H	**Ls**	zero point eight newtons
1.64H	**T**	zero point eight newtons you know are actually acting there you've got three
1.65H		forces acting there and I've got zero point seven newtons zero point eight
1.66H		and
1.67H	**Ls**	one newton
1.68H	**T**	one newton acting there



ACTIVITY STRUCTURE: 'review' cont. [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Systems in equilibrium – <u>a force diagram</u>):
Key terms/ utterances:
- 'experiment'; 'pair of compasses'
- 'balanced'; 'at rest'; 'accelerated'
- 'the whole thing [system] shifted'; 'the whole system would collapse'
- 'magnitude'; 'direction'
- 'resultant'; 'force acting downwards'; 'force acting upwards'
- 'the diagonal of this rectangle'

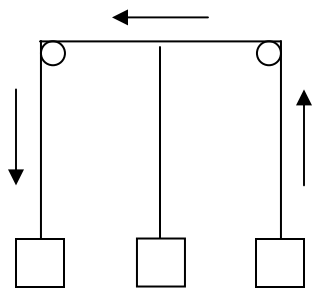
4.1H	**T**	alright now what we then did here was to find the resultant now now we
4.2H		then drew something like that we had something like this [code-switches] in
4.3H		our experiment [code-switches]
4.4H	**Ls**	yes
4.5H	**T**	right in our experiment we had something like that we had something like

4.6H		that we had something like that then you made your experiment and then
4.7H		you you said there's a force this side a force this side (4)
4.8H		and a force here I've got one newton zero point eight newtons zero point
4.9H		seven the point is acting here and we then wanted to find what the resultant
4.10H		of these two forces and of course it was quite easy because you used what
4.11H		you used your pair of what of your your your pair of what of
4.12H	**Ls**	compasses
4.13H	**T**	compasses to get that there and of course again here to get it there I hope I'll
4.14H		be right here then we joined the two then we joined the two I'm lucky not
4.15H		very we joined the two and we found out that the resultant is like that
4.16H		and then I asked you a few questions so this is the resultant of this force and
4.17H		this force mm this line is the resultant of these forces now if this sorry if this
4.18H		is the resul if this line the diagonal of this rectangle is the resultant of these
4.19H		two forces what do you find you actually found that its magnitude is equal
4.20H		to what its magnitude is equal to what [chalkboard (4)] yes boy
4.21H	**L**	to the one newton force acting downwards
4.22H	**T**	to the one newton force acting downwards we found that it is almost equal
4.23H		here we found out that this force here is also that force there so the resultant
4.24H		of these two forces is one newton but these two forces these two forces of
4.25H		eight and seven were balanced by this force remember these two forces they
4.26H		accelerated and needed a a force to balance those force not to accelerate
4.27H		which force balanced them yes
4.28H	**L**	the one newton force
4.29H	**T**	the one newton force was used to balance what the resul sorry
4.30H		these two forces but these two forces had a resultant this way so this
4.31H		force is a force that does what that balances what
4.32H	**L**	[unclear]
4.33H	**T**	no zero point eight and zero point seven have a resultant of one newton
4.34H		[code-switches] right now these two forces when we did not have this force
4.35H		downwards here this accelerated this way we then put in another force here

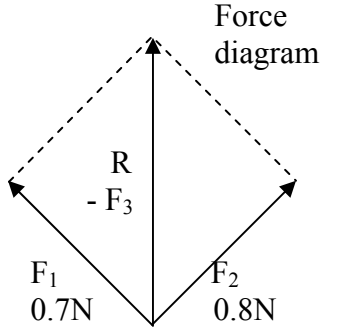


4.36H		to do what
4.37H	**L**	to balance the two forces
4.38H	**T**	to balance the two forces so this is a force that does what that
4.39H	**L**	balances
4.40H	**T**	that balances these two forces [apparatus (1)] it is a force that balances we
4.41H		actually put a force here of what of of a hundred grams equal one newton
4.42H		[chalkboard (5)] and it became it the whole of thing shifted and became like
4.43H		this it it made this thing come to rest [chalkboard (3)] it actually made the
4.44H		resultant to do what it made the resultant do what yes
4.45H	**L**	it made it zero
4.46H	**T**	I agree you are quite correct once something is at rest the resultant is
4.47H	**Ls**	zero
4.48H	**T**	zero the resultant force acting on that thing is zero now now can you give
4.49H		can you define this force the force acting downward [apparatus (1)] is a
4.50H		force that does what [name]
4.51H	**L**	that balances
4.52H	**T**	that balances
4.53H	**L**	all forces
4.54H	**T**	all forces acting at this point now we think there is a point here ne now we
4.55H		think you know there is a point here [code-switches] there is a point here
4.56H		and I've got two forces acting on this point but now suddenly I have now
4.57H		[code-switches] this force balances the forces acting on that point
4.58H		[chalkboard (5)] why because this force acts in this direction [chalkboard
4.59H		(4)] and this one acts in that direction if this force was not here [chalkboard
4.60H		(6)] sorry if this force was not there what would be what do you think would
4.61H		actually happen yes
4.62H	**L**	the whole system would collapse
4.63H	**T**	the whole system would collapse [code-switches] right so so this force is a
4.64H		force that balances that balances the two forces so this force we found out is
4.65H		equal to what

(5)



4.66H	**L**	to the resultant	(6)
4.67H	**T**	to the resultant force so this force so a force that balances other forces a	
4.68H		force that balances other forces must be equal to what	
4.69H	**Ls**	to the resultant force	
4.70H	**T**	to the resultant force so here this force balances the the other forces it	
4.71H		balances them right it balances them but this force is the resultant now these	
4.72H		two forces are equal [chalkboard (4)] now we want to use a special name	
4.73H		here to to to give you know this force that balances other forces who knows	



ACTIVITY STRUCTURE: 'interruption' – teacher admonition

5.1H		am I teaching three people here am I teaching three people here it's very
5.2H		easy for me to say you know get out of here and run back [code-
5.3H		switches]

ACTIVITY STRUCTURE: 'review' [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Systems in equilibrium – <u>a force diagram</u>):
Key definition/ 'conditions':
The equilibriant: 'the equilibrant is always equal to the resultant force' and 'it [the equilibriant] acts in the same straight line as the resultant…but in the opposite direction'

equilibrant balances the other forces

4.74H	**T**	yes [code-switches] yes yes eh he this force is equal to this force let's now	F_3 1.0 N
4.75H		form a new word you know for this force yes	
4.76H	**L**	equilibrant	
4.77H	**T**	it's the	
4.78H	**L**	equilibrant	
4.79H	**T**	the equilibrant yes so this is called the equilibrant [chalkboard (4)] it is a	
4.80H		force that balances other forces what do we know about a force that	
4.81H		balances other forces is that [code-switches] is equal to what	
4.82H	**Ls**	to the resultant	
4.83H	**T**	to the resultant of those two forces what is the second condition of the	

4.84H		equilibrant what is the second thing about you know about the equilibrant
4.85H		eh one condition is that the equilibrant is always equal to the resultant force
4.86H		number two [name]
4.87H	**L**	it acts in the same straight line as the resultant
4.88H	**T**	it acts in the same straight line as the resultant very good yes
4.89H	**L**	but in the opposite direction
4.90H	**T**	but in the opposite direction very good boy very good in the opposite
4.91H		direction that's what the equilibrant is now now now [unclear]

ACTIVITY STRUCTURE: 'interruption' [1] – cleaning the chalkboard

6.1H	**T**	clean the board for me please you know this side [unclear]

ACTIVITY STRUCTURE: 'interruption' [1] – teacher admonition

7.1H	**T**	I'm not teaching only three people [code-switches]

ACTIVITY STRUCTURE: 'review' [1]; 'IRF' 'micorgenre' [3]
FIELD [2] (Systems in equilibrium – <u>a vector diagram</u>):
'Rule': 'you can take any vector and put it into the other position as long as you… don't change it's magnitude and direction'

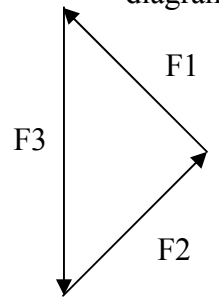
8.1H	**T**	right now earlier I said something about vectors I said something about take
8.2H		a vector who remembers I said something about direction or position of a
8.3H		vector do you remember [name]
8.4H	**L1**	you said yes you can take any vector and put it into the other position as
8.5H		long as long as you don't change it's direction
8.6H	**T**	very good boy very good you can take any vector and put it into the other
8.7H		position as long as you keep two things [unclear] what are they
8.8H	**L1**	you don't change it's magnitude and direction
8.9H	**T**	you don't change what its direction and
8.10H	**L1**	its magnitude
8.11H	**T**	its magnitude

ACTIVITY STRUCTURE: 'review' [1]; 'IRF' 'microgenre' [3]

FIELD [2] (Systems in equilibrium – <u>a vector diagram</u>):
A closed figure

(7)

Vector diagram



8.12H	**T**	I'm going to use that knowledge I'm going to take this vector I'm going to
8.13H		take this vector approximately same direction same direction I'm going to
8.14H		take this vector [code-switches] this vector approximately direction the
8.15H		same yes I'm going to take this vector this one direction I don't change they
8.16H		form what [chalkboard (4, 7)]
8.17H	**Ls**	a triangle
8.18H	**T**	they form a
8.19H	**Ls**	triangle
8.20H	**T**	or now what do you call this [chalkboard (8)] I don't want its name it's a
8.21H		[code-switches] it's a four sided figure is it open or closed
8.22H	**Ls**	closed
8.23H	**T**	it's closed you know I have what a closed figure I don't want you to say it's
8.24H		a triangle yes I agree it's a triangle but I want you to get used to what what's
8.25H		the word a closed figure but in this case the closed figure is what is a
8.26H		triangle you can have different closed figures like this one it's also a closed
8.27H		figure but not a triangle [chalkboard (8)] right now okay so I'll call this
8.28H		vector force number one I'll call this one force number two I'll call this one
8.29H		force number three do you follow me do you follow me force one equals
8.30H		you know the magnitude zero point seven force two zero point eight force
8.31H		three one newton are you with me [chalkboard (4,7)]
8.32H	**Ls**	yes

(8)

ACTIVITY STRUCTURE: 'interruption' [1]; 'review' [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Systems in equilibrium – <u>apparatus (1)</u>):
Equilibriant(s)

9.1H	**T**	right now what is before we come here before we come here how many

9.2H		equilibrants do you see here how many equilibrants do you see there only
9.3H		yes [chalkboard (4)]
9.4H	**L**	one
9.5H	**T**	are you sure one yes okay let's go back now how many equilibrants here
9.6H		[apparatus (1)] yes how many yes yes how many
9.7H	**L**	[unclear]
9.8H	**T**	why do you say that
9.9H	**L**	[unclear]
9.10H	**T**	this force yes
9.11H	**L**	[Xhosa]
9.12H	**T**	why do you say that
9.13H	**L**	because it they make the object to balance look they balance the object
9.14H	**T**	they balance you know the object now actually what I'm trying to say is that
9.15H		this point here because we have found out that this point remains at rest so
9.16H		anyone of those forces balances any other two yes let's check now [code-
9.17H		switches] take this one now off and we put this one [unclear] yes yes you
9.18H		have a new way of the forces now [apparatus (1)] and the system does not
9.19H		fall it's again the system is in equilibrium alright I can take another one now
9.20H		and I can move it the other way round the other way round now this side
9.21H		[code-switches] this side now [unclear] there even if I take any one of them
9.22H		still remains at rest [code-switches] the system is at
9.23H	**Ls**	rest
9.24H	**T**	rest so any one of those two forces or three forces is the equilibrant of any
9.25H		other two forces so I've got how many equilibrants here
9.26H	**Ls**	three
9.27H	**T**	I've got three equilibrants zero point eight is the equilibrant of what
9.28H		and what
9.29H	**Ls**	zero point seven
9.30H	**T**	zero point seven and

9.31H	**Ls**	one
9.32H	**T**	and one and zero point seven is the equilibrant of
9.33H	**Ls**	zero point eight
9.34H	**T**	zero point eight and
9.35H	**L**	one
9.36H	**T**	and one good very good

ACTIVITY STRUCTURE: 'review' cont. [1]; 'IRF' 'microgenre' [3]
FIELD [2] (Systems in equilibrium – <u>a force diagram</u>):
Resultant (the magnitude and the direction of the resultant)

10.1H	**T**	now fine now I'm going to call this f one f one I'm going to call this f two
10.2H		I'm going to call this f three [chalkboard (4)] what is the resultant what is
10.3H		the resultant of f one and f two what is the resultant of f one of f one and f
10.4H		two yes
10.5H	**L**	zero point seven
10.6H	**T**	what is the resultant of zero point sorry of f one and f two the resultant yes
10.7H	**L**	it will be one newton
10.8H	**T**	I don't know now there are no numbers what is the resultant of f one and f
10.9H		two what is the equilibrant of f one and f two
10.10H	**Ls**	f three
10.11H	**T**	it is
10.12H	**Ls**	f three
10.13H	**T**	f three this equilibrant I know [code-switches] about the equilibrant it acts
10.14H		where yes
10.15H	**L**	in the opposite direction
10.16H	**T**	and in the
10.17H	**L**	same straight line
10.18H	**T**	in the same straight line keeping that in mind if f three is the equilibrant of f
10.19H		two and f one therefore what is therefore the resultant of f one and f two yes

10.20H	**L**	f three
10.21H	**T**	eh but we have said f three is the equilibrant of f one and f two so f three so
10.22H		f three can't be the resultant of f one and f two but f one and f two are the or
10.23H		f is are are so what f three is the equilibrant of f one and f two what is the
10.24H		resultant of f one and f two
10.25H	**L**	I think it's the [unclear]
10.26H	**T**	are you sure are you sure yes [name] try
10.27H	**L**	I think it's [unclear]
10.28H	**T**	are you sure
10.29H	**L**	yes
10.30H	**T**	eh yes
10.31H	**L**	I think it is the other force that acts in the opposite direction to f three
10.32H	**T**	give that now put that mathematically put what you are saying in words
10.33H		mathematically I said keeping in mind that the resultant is equal to the
10.34H		equilibrant it acts in the same straight line but in the opposite direction what
10.35H		is the resultant of f two and f one you must put on your thinking caps [code-
10.36H		switches] yoh what is the resultant of f one and f two we know that the
10.37H		equilibrant of f one and f two is f three but we know something about f
10.38H		three but one is equal in magnitude [code-switches]
10.39H	**Ls**	the resultant
10.40H	**T**	to the resultant [code-switches] the resultant is always acting in the
10.41H		opposite direction [code-switches]
10.42H	**Ls**	equilibrant
10.43H	**T**	to the equilibrant [code-switches] what
10.44H		is the resultant of f one and f two [code-switches] f one and f two the
10.45H		resultant put what you are saying opposite in mathematics [code-switches]
10.46H		yes
10.47H	**L**	minus f three
10.48H	**T**	[code-switches] it's minus f three once you say minus f three I know you are

10.49H		saying to me it's equal in magnitude and acts in the opposite direction it's
10.50H		simple I now know now I can take this thing I have three forces there I have
10.51H		three forces there we made an experiment we found out all about these
10.52H		things the only force that we see there is minus f three right but we
10.53H		constructed it to be there right so I can remove this force vector even if it is
10.54H		now there I know that the resultant of what of f one and f two is
10.55H	**Ls**	minus f three
10.56H	**T**	minus f three if I if I left you know my equilibrant there the resultant of f
10.57H		one and f two is what is
10.58H	**Ls**	minus f three
10.59H	**T**	minus f three [code-switches]

ACTIVITY STRUCTURE: 'review' [1]; 'teacher monologue' [1]
FIELD [2]:
Key definitions:
Force diagram: 'represent[s] the actual direction of the forces originally'
Vector diagram: 'a diagram that results from taking the vectors from a force diagram rearrang[ing] them till they form…a closed figure'

11.1H	**T**	when I draw it like a this let me draw it represent the actual direction of the
11.2H		forces originally it's called a force force diagram [chalkboard (4)] that's a
11.3H		force diagram of [code-switches] of this situation [apparatus (1)] it's a force
11.4H		diagram I have a force diagram of this situation [code-switches] I've got that
11.5H		force I've got that force I've got that you can draw a diagram of that [code-
11.6H		switches] now you can also be required to draw a vector diagram
11.7H		[chalkboard (7)] we now know the vector difference between a vector
11.8H		diagram and a force diagram uh a vector diagram will be a diagram that
11.9H		results from taking the vectors from a force diagram rearrange them till they
11.10H		form what a closed figure then we have a diagram

ACTIVITY STRUCTURE: 'review' cont. [1]; 'IRF' microgenre' [3]

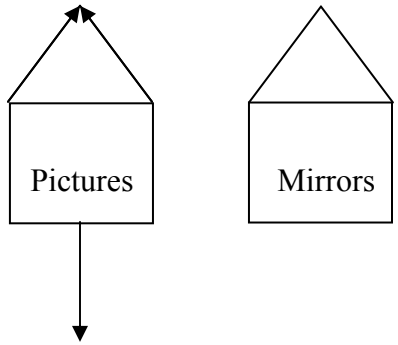
FIELD [2] (Systems in equilibrium – <u>a force diagram and a vector diagram</u>):
Resultant(s)
Equilibriant(s)

12.1H	**T**	right now what is the resultant of what is the resultant of f what is the
12.2H		resultant of f one and f two answer is f one and f two the resultant is what is
12.3H		what is the resultant of f one and f two what is the resultant of f one and f
12.4H		two [code-switches] it is minus f three it is minus f three what is the
12.5H		resultant of f two and f three
12.6H	**Ls**	minus f one
12.7H	**T**	minus
12.8H	**Ls**	f one
12.9H	**T**	what is the resultant of f three and f one
12.10H	**Ls**	minus f two
12.11H	**T**	minus
12.12H	**Ls**	f two
12.13H	**T**	minus f two what is the equilibrant of f two and f three
12.14H	**Ls**	f one
12.15H	**T**	it is
12.16H	**Ls**	f one
12.17H	**T**	f one so any one of these is the equilibrant so as they are here they are all
12.18H		equilibrants to get the resultant is opposite [code-switches] right now let's
12.19H		take a look at how these can be arranged

ACTIVITY STRUCTURE: 'IRF' 'micorgenre' [3] (largely monologic)
FIELD [2] ('the everyday' – 'mirrors'; 'pictures')

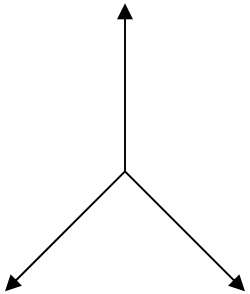
13.1H	**T**	where do you get such things you get such things you know from other
13.2H		things you know where you know in nature and in our homes where do you
13.3H		normally get forces acting like this uh [code-switches] is there anything at

13.4H your home that you think it will have forces acting in this way eh there are (9)
13.5H so there are so many but you don't observe these things yes [code-switches]
13.6H yes [code-switches] yes
13.7H **L** [Xhosa]
13.8H **T** yes yes pictures frames [code-switches] mirrors [chalkboard (9)] have you
13.9H not seen them uh uh different things pictures mirrors [code-switches] lots of
13.10H things



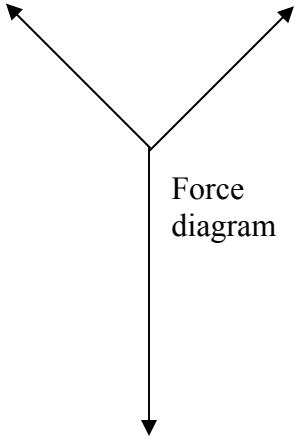
ACTIVITY STRUCTURE: 'boardwork' [1]; 'going over boardwork' [1]
FIELD [2]:
Key terms/ utterances:
- 'picture'; 'in equilibrium'; 'at rest'; 'hanging'
- 'a force acting on this picture'
- 'a force diagram'; 'a free body diagram'

14.1H **T** let's take this one can you draw a force diagram of the forces acting (10)
14.2H here who can do this a picture is hanging on a wall twine there twine there
14.3H it's hanging twine there twine there it's also hanging can you draw a force
14.4H diagram of this picture that way now is this picture in equilibrium
14.5H **L** yes
14.6H **T** why do you say that
14.7H **L** because it's at rest
14.8H **T** because it is resting because it's stuck there it's actually [unclear]
14.9H **T** right now now who can draw the forces acting on this picture anybody
14.10H [code-switches] [chalkboard (10)] can you explain to us there which forces
14.11H are acting this way which forces are acting this way in this picture this way
14.12H **L** [unclear]
14.13H **T** in the picture here in the picture in the picture no no no no in the picture in
14.14H the picture the forces are acting on that picture [code-switches] anybody
14.15H help her please there are three forces acting on that picture [code-switches]



14.16H	**L**	[Xhosa]
14.17H	**T**	draw that force diagram [code-switches] and [name] has actually drawn the
14.18H		picture that way there now when we draw something [code-switches] like
14.19H		that then we say we have drawn what
14.20H	**L**	a free body diagram
14.21H	**T**	a free body diagram of this thing [name] says there is a picture right right
14.22H		and he says there is a force acting on this picture this way there is a force
14.23H		acting on this picture this way there is a force acting on this picture this way
14.24H		I can't I can't understand next anybody else anybody else

(11)



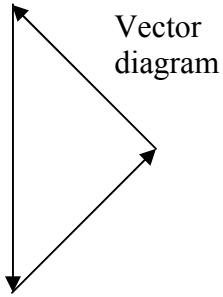
ACTIVITY STRUCTURE: 'IRF' 'microgenre' cont. [3] (largely monologic)
FIELD [2] ('the everyday' – 'mirrors'; 'pictures')
Key terms/ utterances:
- 'gravity'; 'gravitational force'

13.11H	**T**	what makes this picture to face downwards to hang downwards what force
13.12H		is acting on the picture so that it actually hangs downwards what force is
13.13H		acting on this thing hangs downward
13.14H	**Ls**	gravitation
13.15H	**T**	[code-switches] gravitational force [code-switches] so now I've got a force
13.16H		acting downwards here ne this way so if I've got a force acting this way
13.17H		[chalkboard (9)] [code-switches] please I've got a force acting downwards
13.18H		here I've got a force acting downward that's why the picture by the way is
13.19H		actually hanging it's hanging downwards gravitational force and then I've
13.20H		got what you also have a force coming from this [unclear] this way [code-
13.21H		switches] you also have a force coming from this [unclear] this way
13.22H		[chalkboard (11)] [code- switches]

ACTIVITY STRUCTURE: 'IRF' 'microgenre' cont. [3] (largely monologic)
FIELD [2] ('the everyday' – 'mirrors'; 'pictures')

13.23H **T** this is not in the textbook it's there around you all the time [code- switches] (12)

ACTIVITY STRUCTURE: 'IRF' 'microgenre' cont. [3] (largely monologic)
FIELD [2] ('the everyday' –'mirrors'; 'pictures'):
Key terms/ utterances:
- 'the system must be in equilibrium'; 'those three forces are in equilibrium'
- 'force diagram'; 'vector diagram'; 'a closed figure'



13.24H **T** once I can draw the force diagram once I can draw the force diagram I then
13.25H go onto the vector diagram here is the force downwards here is this one yes
13.26H then this one yes it forms a closed figure [chalkboard (12)] therefore that
13.27H system must be in equilibrium [code-switches] they form a closed figure we
13.28H know that the forces are in equilibrium those three forces are in equilibrium
13.29H those three forces are you know in equilibrium do you understand now
13.30H **Ls** yes

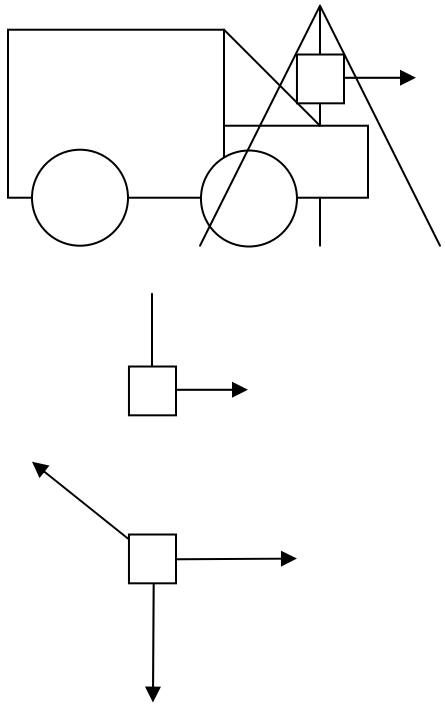
ACTIVITY STRUCTURE: 'IRF' 'microgenre' [3] (largely monologic)
FIELD [2] ('the everyday' – 'block and tackle'; 'the engine of a car'):
Key terms/ utterances:
- 'force'; 'gravity'; 'gravitational force'
- 'the forces are in equilibrium'
- 'arrow'; 'a free body diagram'; 'a closed figure'; 'a vector diagram'

15.1H **T** we have another situation here [code-switches] situations like this like um
15.2H have you ever heard of the word block and tackle block and tackle block and
15.3H tackle block and tackle do you know this thing
15.4H **Ls** no
15.5H **T** block and tackle is the thing they use or the combination of chains and
15.6H blocks and wood that they use to lift up the engine of a car from a car [code-
15.7H switches] here is the car there is the car okay that's my a van you know I'm
15.8H going to you know remove the engine now they normally have something
15.9H like this [code-switches] and there is a chain here hanging and then they pull

15.10H		out the engine of the car alright then now the engine of the car there's the
15.11H		engine the engine of the car now here that they pull it away from here
15.12H		alright they pull it this way so I've got the force [code-switches] in which
15.13H		direction must the arrow face the force is coming from here [code-switches]
15.14H		the direction of the arrow here [chalkboard (13)]
15.15H	**Ls**	upwards
15.16H	**T**	upwards coming from here [unclear] now as the engine is being pulled
15.17H		sideways which are the forces which are actually acting on it so this thing
15.18H		now once it is pulled like this [code-switches] the whole thing changes eh
15.19H		engine [code-switches] gravity now this is the pulling force which other
15.20H		forces are is actually acting on the engine which other forces are actually
15.21H		acting on the engine [name]
15.22H	**L**	gravitational force
15.23H	**T**	[code-switches]
15.24H	**L**	gravitational force
15.25H	**T**	which other forces are actually acting on the engine on the engine as you see
15.26H		it there [code-switches] I pull it away I pull it away what are the other forces
15.27H		which are actually acting on the engine [code-switches] yes
15.28H	**L**	gravitational force
15.29H	**T**	gravity you know gravitational force [chalkboard (13)] yoh aye aye aye aye
15.30H		a force acting downwards yoh aye aye aye aye then again we made what we
15.31H		now made a [code-switches] a free body diagram [chalkboard (14)] right
15.32H		now are these forces in equilibrium are these forces in equilibrium now we
15.33H		check we take this force downwards we take that one we take this one mm
15.34H		they form a closed figure these three forces are in equilibrium once you take
15.35H		three forces acting at a point and the three forces make a closed figure
15.36H		vector diagram force diagram once they make a sorry once they make a
15.37H		closed figure [chalkboard (15)] then the forces are in e
15.38H	**Ls**	equilibrium

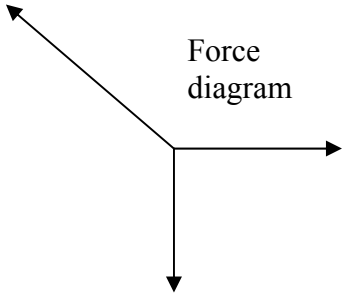
(13)

block and tackle



15.39H **T** quilibrium do you understand now (14)

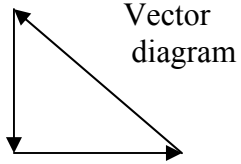
15.40H **Ls** yes



ACTIVITY STRUCTURE: 'IRF' 'microgenre' [3]
FIELD [2] ('the everyday' – 'advertisement boards')

16.1H **T** yoh aye aye aye aye yoh let's now check again here's a building
16.2H [chalkboard (16)] where do you normally see things like those mm
16.3H **L1** town
16.4H **T** town very good [unclear] where
16.5H **L1** around Edgars
16.6H **T** shops around Edgars yes there around Edgars I'm very glad that you know
16.7H that it is around Edgars you know around town there now somewhere
16.8H around Edgars

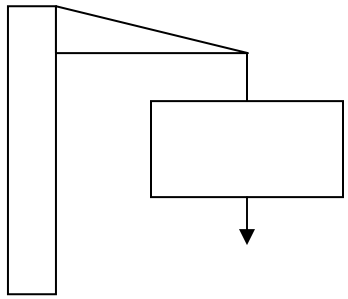
ACTIVITY STRUCTURE: 'review'; 'teacher monologue' [1]
FIELD [2] ('the everyday' – 'advertisement boards'): (15)
Key terms/ utterances:
- 'force'; 'weight' ('weight will always be there as long as something is hanging'); 'gravitational force'
- 'the system is in equilibrium'
- 'a free body diagram'; 'a force diagram'; 'a closed figure'



17.1H **T** you've got you actually have this advertisement boards [unclear] a wire like
17.2H that there this is actually hanging something like that [unclear] and this
17.3H thing is actually hanging it is hanging [code-switches] you have got to
17.4H calculate those things [code-switches] how many forces around here acting
17.5H here there is a force acting here [code-switches] yes there is also a force
17.6H acting downwards here weight and there is also a force pushing towards this
17.7H thing that way [code-switches] there is a force pushing this way now I can
17.8H take this thing to make a free body diagram I've got this the weight weight
17.9H will always be there as long as something is hanging gravitational force then

17.10H you've got this force is acting in this direction yes this one is acting that way
17.11H [chalkboard (17)] that's a force diagram then if this force diagram when you
17.12H rearrange the forces and redraw them and they form [code-switches] a
17.13H closed figure then the system is in equilibrium yes it is equilibrium why
17.14H because [code-switches] are you happy now
17.15H **Ls** yes
17.16H **T** that's the end of the period

(16)



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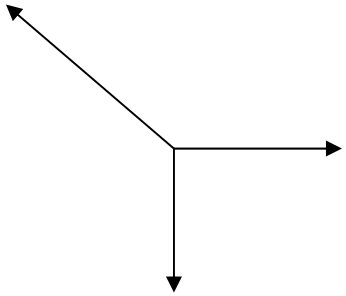


TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Lemke, 1993/ [1]
- TEXT 2: Halliday, 1994 [2]
- TEXT 3: Wells, 1999/ [3]
- The teacher's notes; handouts; the learners' notebooks and the textbook(s) used by the teacher and learners

ACTIVITY STRUCTURE: 'review' [1]; 'groupwork' [1]; 'teacher monologue' [1] (1)
FIELD [2] (Activity – three spring balances)

1.1I	**T**	[code-switches] I said go and design I said go and design [code-	(Hands on)
1.2I		switches] I said go and design an experiment how must we do it to find out	Design an activity to investigate
1.3I		what would happen to the equilibrant when you change you know the	how the equilibrant changes when
1.4I		[unclear] I said go and design I said go and design design an activity to to	the angle between two forces change
1.5I		investigate design an activity now of course the activity must be hands on	using three (3) spring balances
1.6I		right design an activity to investigate how the equilibrant do you know	
1.7I		something about the equilibrant now ne	
1.8I	**Ls**	yes	
1.9I	**T**	how the equilibrant changes when the angle between two forces change	
1.10I		that's the activity [chalkboard (1)] actually I said [code-switches] now you	
1.11I		need you need	

ACTIVITY STRUCTURE: 'teacher monologue' [1]
FIELD [2] (A spring balance)

2.1I	**T**	now okay now here I'm going to give you a hint I'm going to give you a
2.2I		hint now here using using three three spring balances three spring balances
2.3I		now a spring balance is something that actually looks like this [code-
2.4I		switches] okay that is a spring balance

ACTIVITY STRUCTURE: 'interruption' [1]; 'review' [1]; 'do now' [1] (2)

FIELD [2] (Problem):

Equation: 500g = 0.5kg

F = mg

Key terms/ utterances: F = m x g

- 'weight'

- 'the force which the earth exerts on the falling object' = 0.5kg x 10m/s^2

- 'freefall acceleration'

- 'it [the object] is falling freely' = 5N

3.1I **T** okay now if we take a mass okay number one what is the weight of a mass
3.2I of one kilogram [code-switches] sorry five hundred grams I've got five
3.3I hundred grams here [code-switches] if I'm going to let this thing fall what is
3.4I the force which the earth exerts on the falling object five hundred grams it
3.5I won't just come in the head you sit down you write down and use the
3.6I correct formula there [code-switches] and show me how you got the answer
3.7I I've got a mass of five hundred grams I've got a mass of five hundred grams
3.8I it falls right what is the force which or with which the earth exerts on the
3.9I object to cause it to fall
3.I0I
3.11I [the teacher walks around the classroom and checks]
3.12I
3.13I **T** you must be finished by now good [code-switches] so others got it answer
3.14I answer is five newtons right good [code-switches]

ACTIVITY STRUCTURE: 'interruption' – teacher admonition

4.1I **T** what do you really want I really don't know what you really want I really
4.2I don't know what you really want

ACTIVITY STRUCTURE: 'interruption' cont. [1]; 'review' [1]; 'teacher-student duolog' [1]

FIELD [2] (Problem)

3.15I **T** tell us [name] how do you get the answer
3.16I **L1** five hundred grams
3.17I **T** five hundred grams five hundred grams yes
3.18I **L1** you change the five hundred grams to zero point five kilograms
3.19I **T** why
3.20I **L1** because I change five hundred grams to kilograms
3.21I **T** you first change the five hundred grams to kilograms which of course which
3.22I is of course five hundred grams has the same value as what as how many
3.23I kilograms if I divide this by a thousand

ACTIVITY STRUCTURE: 'interruption' [1] – teacher admonition

5.1I **T** a grade eleven child I can't understand why using a calculator ne that
5.2I doesn't know that if I divide five hundred by one thousand the answer is
5.3I what is zero point five kilograms I can't believe it I can't believe that a
5.4I grade eleven child doing mathematics cannot divide five hundred by what
5.5I by by one thousand

ACTIVITY STRUCTURE: 'interruption' cont. [1]; 'review' [1]
FIELD [2] (Problem)

3.24I **T** to you change this to kilograms so we now know the mass [code-switches]
3.25I in kilograms then we want the force exerted by the earth now of course the
3.26I force will be equal to the mass of the object multiplied by freefall
3.27I acceleration because it is falling freely right therefore and this is what this is
3.28I zero point five kilograms multiplied by ten meters per second squared which
3.29I would of course be five newtons

ACTIVITY STRUCTURE: 'interruption' [1] – teacher admonition

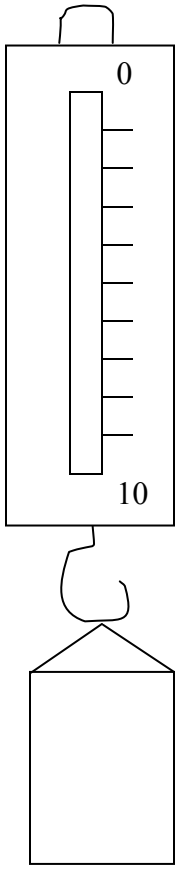
6.1I **T** I cannot understand it I can't understand it why [unclear] [code-
6.2I switches] who do not know how to change grams into kilograms I really
6.3I don't understand it I'm telling you I cannot believe it

ACTIVITY STRUCTURE: 'interruption' cont. [1]; 'review' [1]
FIELD [2] (Problem)

3.30I **T** now we are able to get this the mass sorry the weight of the object by (3)
3.31I calculation [chalkboard (2)]

ACTIVITY STRUCTURE: 'teacher monologue' cont. [1]
FIELD [2] (A spring balance)
A spring balance: 'a little gadget'; 'a spring'; 'numbers'; 'zero'; 'ten'; 'pointer'; 'hook'; 'scale'

spring balance



2.5I [code-switches] I've got here a spring balance inside here it is a little gadget
2.6I here inside it has a spring inside it has a spring that's the little gadget [code-
2.7I switches] it has things like this it has numbers here and the numbers go
2.8I down to ten it's zero here and it has a pointer there of course it's like that
2.9I and it has a hook there you hang it you know you know on this hook
2.10I anything you hang it there and the reading will actually be on this scale
2.11I but [code-switches][chalkboard (3)]

ACTIVITY STRUCTURE: 'labwork' [1]; 'groupwork' [1]
FIELD [2]
Key terms/ utterances:
- 'a spring balance'; 'a mass piece'
- 'the reading'

7.1I **T** right now I'm going to give each table one you join here you join there
7.2I there's some more here now take a mass piece of a mass piece of one k g a
7.3I mass piece of okay I'm going to put this one here ne a mass piece of what of
7.4I one hundred grams can you weigh the mass sorry you know weigh that mass
7.5I and see the reading on the what on the spring balance have a mass piece
7.6I after finishing you know give the mass piece you know to the others you
7.7I know you know to the other groups secondly secondly everybody must see
7.8I [code- switches]

[the learners weigh the mass pieces using the spring balances]

ACTIVITY STRUCTURE: 'review' [1]; 'labwork' [1]; 'IRF' 'microgenre' [1]
FIELD [2]
Key terms/ utterances:
- 'the reading'; 'the expected reading'; 'the real answer'; 'there is nothing wrong with those answers'
- 'the difference in weights'; 'similar'; 'the reason'
- 'well adjusted'; 'well balanced'; 'the pointer is not at zero'
- 'friction'; 'what makes it difficult for things to move over one another'; 'what makes it so…difficult for things to grind over one another on the surface of the earth'; 'friction is always there'
- 'elasticity'

8.1I	**T**	now the mass of the mass of five hundred grams what is the
8.2I		reading on the spring balance what is the reading on the spring balance yes
8.3I	**L**	one kilogram
8.4I	**T**	it is it is in your case what
8.5I	**L**	one kilogram
8.6I	**T**	it is one kilogram so the reading on the on the spring balance is what is
8.7I	**L**	ten newtons
8.8I	**T**	ten newtons this one
8.9I	**L**	four point one
8.10I	**T**	what
8.11I	**L**	four point one
8.12I	**T**	four point one four point one why do you think the reading you know the
8.13I		reading is actually four point one it's why because it's similar to that one
8.14I		okay okay I must first adjust it okay borrow that one reading here reading
8.15I		here
8.16I	**L**	four point nine
8.17I	**T**	four point nine newtons now why do you think it it it is only four point nine
8.18I		newtons it should have been what

8.19I	**L**	five newtons
8.20I	**T**	why do you think that it was four point nine newtons because why do you
8.21I		think it was now they got five you know you know ten there ne and there
8.22I		they got
8.23I	**Ls**	five
8.24I	**T**	five they now got five there ne but but here you know same mass here five
8.25I		hundred grams same mass there ne but they got five there ne and here you
8.26I		got what here you get what four point nine what do you think is the reason
8.27I		for the difference you know in weights [code-switches] now what makes
8.28I		this difference two things two things uh what [code-switches] yes
8.29I	**L**	[unclear]
8.30I	**T**	so it could be the whole thing is not well adjusted right so I'm going to
8.31I		adjust it for you good the pointer was not at zero good right so that's why it
8.32I		was what something like what point sorry nine point in this case what was
8.33I		the [code-switches]
8.34I	**L**	the pointer is not at zero sir
8.35I	**T**	how do you know that how do you know that the pointer is at zero the real
8.36I		pointer there is at zero what is the reason why I cannot get the the the real
8.37I		answer here of what of of five newtons anybody now anybody anybody can
8.38I		you can you can you think hard now all of us why in some cases in this
8.39I		spring balances the reading is not the same as others others got what nine
8.40I		point nine others got what five others got four point nine and there's nothing
8.41I		wrong with those answers why [code- switches] what makes it difficult for
8.42I		things to move over one another what makes it so you know difficult for
8.43I		things to grind over one another on the surface of the earth yes
8.44I	**L**	friction [unclear]
8.45I	**T**	there is friction there might be friction here here let's see so it's holding this
8.46I		thing down friction is always there so in most cases you will get that you
8.47I		will not get the expected reading because but now but there must be a reason

8.48I		friction in this case could be the reason number two it could be that our
8.49I		spring balance is not well what well balanced right no there not well bal but
8.50I		in this case it is well balanced but I said it is well well balanced yes it is well
8.51I		balanced but here that's about four point nine yes no problem because and
8.52I		also there and also there what could be the reason friction yes friction and
8.53I		balancing them the scale or also again what the elasticity [code-switches]

ACTIVITY STRUCTURE: 'IRF' 'microgenre' [3]
FIELD [2] (A spring balance)
Key terms/ utterances:
- 'this spring will always be extended whenever a mass is put in the hook'
- 'it's called a spring balance…because the object doesn't fall because it is balanced by the spring'
- 'the force…exerted by the surface of the earth…downwards'
- 'the force coming from this spring…upwards'

9.1I	**T**	so so here this is called a spring balance spring balance aye man aye aye this
9.2I		is called a spring balance [chalkboard (3)] because inside there inside there
9.3I		is a spring this spring will always be extended whenever a mass is put in the
9.4I		hook here the spring you know becomes extended now it's called a spring
9.5I		balance why do we call it a spring balance what do you think is the reason
9.6I		why we call this a spring yes boy
9.7I	**L**	I think because there is a spring inside
9.8I	**T**	eh
9.9I	**L**	I think because there is a spring inside
9.10I	**T**	so because inside there's a spring so that's called a spring balance so is ne
9.11I		anything inside it has a spring so in the boot of a car there are springs there
9.12I		so the boot of a car has got a spring balance why is this thing called a spring
9.13I		balance why
9.14I	**L**	because the object doesn't [unclear]
9.15I	**T**	the object doesn't fall because

9.16I	**L**	it is balanced by the spring
9.17I	**T**	it is balanced by the spring look this mass piece this mass piece this mass
9.18I		piece this mass piece if it was not [unclear] right this mass piece if it is if it
9.19I		is if it is not hooked here and I release it it will fall down but if I have it here
9.20I		reading is is five why the spring inside there ne acts in what direction the
9.21I		force acting on this thing acts in what direction [code-switches] exerted by
9.22I		the surface of the earth on this mass piece is in what direction
9.23I	**Ls**	downwards
9.24I	**T**	downwards this thing is at rest the force coming from this spring must be
9.25I		acting in what direction
9.26I	**Ls**	upwards
9.27I	**T**	yoh upwards and this force coming from the spring balances what
9.28I	**Ls**	the force coming from
9.29I	**T**	the force coming from the surface of the earth that's why it's called what a
9.30I		spring balance

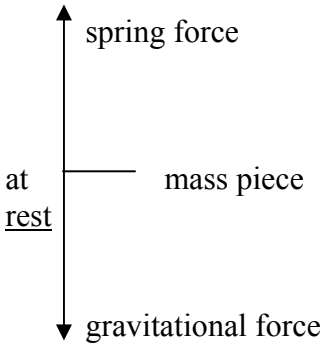
ACTIVITY STRUCTURE: 'interruption' [1] – teacher admonition

10.1I	**T**	why do I why do I have to be angry before you understand this [code-
10.2I		switches] I must change my face [code-switches]

ACTIVITY STRUCTURE: 'IRF' 'microgenre' cont. [3]
FIELD [2] (A spring balance)
Key terms/ utterances:
- 'it's called a spring balance because the spring inside here balances…the gravitational force'
- 'spring force'; 'gravity'; 'gravitational force'
- 'mass piece'
- 'at rest'; 'in equilibrium'
- 'the resultant'; 'the equilibriant'

9.31I	**T**	why it's called a spring balance because the spring inside here balances
9.32I		what the gravitational force that is why it is called a spring balance now you

9.33I		see here I've got two forces acting [unclear] I've got two forces acting two	(4)
9.34I		forces acting here they act on what on the mass piece here is the mass piece	
9.35I		I've got a force coming from the spring spring force [code-switches] the	
9.36I		gravity gravitational force the mass piece is now at rest [chalkboard (4)] so	
9.37I		it is in	
9.38I	**Ls**	equilibrium	
9.39I	**T**	equilibrium so any one of these two is the resultant okay so this is the	
9.40I		resultant you know equilibrant of this one this is the equilibrant of that one	
9.41I		the system is in equilibrium	



ACTIVITY STRUCTURE: 'groupwork' [1]
FIELD [2] (Activity – three spring balances)

11.1I	**T**	now now I want you now to think in your groups I want you now to think in
11.2I		your groups how you would use three spring balances to keep on changing
11.3I		what to get the resultant and use the spring balances to get the resultant and
11.4I		the equilibrant and on the same piece of paper you make a drawing to show
11.5I		that if you open up the spring balance or if you change the angle between
11.6I		the spring balances something also happens to the what to the equilibrant
11.7I		[code-switches] right now I'll give you five minutes discuss in your groups
11.8I		back to your groups now remember you have three spring balances you have
11.9I		three spring balances

[the learners start to do the activity in their groups]

ACTIVITY STRUCTURE: 'IRF' 'microgenre' [3]
FIELD [2] (Two spring balances)
- 'two spring balances'
- 'the force exerted by this spring balance on this one is equal to the force exerted by this spring balance on this one'
- 'difference'; 'different directions'

12.1I	**T**	by the way before we start suppose I have these two spring balances right
12.2I		both of them are well yes you know zero nought nought and let them pull
12.3I		one another what do you think would be the reading on both of them I pull
12.4I		you know using the same force okay let's have it like this two spring
12.5I		balances there they are there they are facing one another now which one of
12.6I		these two balances as they are now here which one of these will actually
12.7I		change the reading [code-switches] people use your brains think this spring
12.8I		balance is actually here [code-switches] right now nought nought right no
12.9I		weights on them both no weights right no weights then I'm going to take
12.10I		this one which one will now actually change this reading which one yes
12.11I	**L1**	[unclear]
12.12I	**T**	why
12.13I	**L1**	[unclear]
12.14I	**T**	what's that so the reading on this one will actually change why
12.15I	**L1**	[unclear]
12.16I	**T**	it's simple it will rest [code-switches] the weight of this one [code-
12.17I		switches] the force of the gravitational force of so I have a reading there
12.18I		zero point one [code-switches] simple simple simple thinking the weight of
12.19I		this one if I hold them like this if I hold them like this and I pull them apart
12.20I		or I I you know I only hold one and pull the other one reading on this one is
12.21I		what reading on this one is what if you say it's nought [code-switches]
12.22I		nought [code-switches] it will have a certain value on one side it's zero on
12.23I		one side or it's three on one side
ACTIVITY STRUCTURE: 'interruption' [1] – teacher admonition		
13.1I		you don't just sit there and look at me [code-switches]
ACTIVITY STRUCTURE: 'IRF' 'microgenre' cont. [3]		
FIELD [2] (Two spring balances)		
12.24I	**T**	if I do that and I just pull them together yes
12.25I	**L1**	it will be the same reading

12.26I	**T**	[code-switches] same reading
12.27I	**L1**	yes
12.28I	**T**	right okay let us see if it is true what is the reading on yours [code-switches]
12.29I	**L**	[unclear]
12.30I	**T**	why now so if this spring balance exerts a force of two newtons on this one
12.31I		this one does what
12.32I	**L1**	it does the same
12.33I	**T**	[code-switches]
12.34I	**L1**	it does the same
12.35I	**T**	it does the same what
12.36I	**L1**	[unclear]
12.37I	**T**	[code-switches] if this spring balance or if I exert or if the reading on this
12.38I		spring balance is what is two the reading on this one is also two but I'm
12.39I		only pulling this one I'm only pulling this one I'm not pulling this one I'm
12.40I		pulling this one the reading is four the reading also here is four five also five
12.41I		it's because when the force exerted by this spring balance on this one is
12.42I		equal to the force exerted by this spring balance on this one what is different
12.43I	**L**	direction
12.44I	**T**	direction another difference I've got two forces here ne two forces acting on
12.45I		different directions and the other difference is what
12.46I	**L**	the direction
12.47I	**T**	we have you know we have said we have got two forces acting
12.48I		here two forces are actually acting here these two forces act in the opposite
12.49I		direction so [code-switches] number two where are these two forces acting
12.50I	**L**	[unclear]
12.51I	**T**	where not how are they acting what are these forces pulling at [code-
12.52I		switches] spring balances are these forces the same as this thing are they
12.53I		pulling on the same thing are they pulling on the same thing are these two
12.54I		forces pulling on the same thing

12.55I **L** yes
12.56I **T** where [code-switches] but this [unclear] belongs to this one but
12.57I this[unclear] belongs to this one [code-switches] in this case I have two
12.58I forces acting this object pulls this one and this one pulls this one this one

ACTIVITY STRUCTURE: 'demonstration' [1]
FIELD [2] (Two spring balances)
Key terms/ utterances:
- 'difference'; 'these are two forces [are] not acting on the same object so in this case we can't speak…of equilibrium'

14.1I it's like me and you [code-switches] now I am pulling him and he is also
14.2I what pulling me these are now two forces acting not on the same object
14.3I these are two forces not acting on the same object so in this case we can't
14.4I speak of what of equilibrium be very careful be very careful of how you
14.5I speak when I speak of equilibrium the forces acting there in that system
14.6I must be acting on one object in this case I don't have two forces [code-
14.7I switches] two forces acting on the same object he is pulling me I am pulling
14.8I him but [code-switches] but I can pull him and I pulling him but if I pull
14.9I him he is still pulling me he is still pulling me but we are moving so the
14.10I system is not in equilibrium although there are two forces acting in opposite
14.11I directions [code-switches]
14.12I **Ls** yes

ACTIVITY STRUCTURE: 'interruption' [1]
15.1I **T** I know that learners like to say yes because yes is the shortest answer yes
15.2I yes

ACTIVITY STRUCTURE: 'groupwork' cont. [1]
FIELD [2]
11.10I **T** now go on now quickly my students think of a way of using three spring
11.11I balances to show you the resultant and also the equilibrant right and after

11.12I that you can use the very same three spring balances to show that when you
11.13I change the angle between two what two spring balances something else
11.14I happens to what you know to the equilibrant make a start a nice drawing a
11.15I rough drawing
11.16I **T** [code-switches] in science you never discuss without drawings you never
11.17I solve problems without making a drawing to have a picture of what was
11.18I happening

APPENDIX C

TRANSCRIPTS J – M:

THE ANALYSIS OF TRIADIC DIALOGUE 8A – 4H

TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Bloor and Bloor, 2004
- TEXT 2: Christie, 2002
- TEXT 3: Eggins, 1994
- TEXT 4: Halliday, 1994
- TEXT 5: Lemke, 1993
- TEXT 6: Martin and Rose, 2003
- TEXT 7: Probyn, 2004
- The teacher's notes; handouts; the learners' notebooks and the textbook(s) used by the teacher and learners

HETEROGLOSSIA (INTERPERSONAL)	Projection; Modality; Concession
TAXANOMIC RELATIONS (EXPERIENTIAL)	Class to member; Wholes to parts; Equivalence and Contrast
THEME (TEXTUAL)	The Theme-Rheme boundary is shown by #. [4]
PERIODICITY AND SERIAL EXPANSION (TEXTUAL)	macro-/ hyperTheme; macro-/ hyperNew; Metadiscourse; Headings

		PEDAGOGIC DISCOURSE	REGULATIVE REGISTER METAFUNCTIONS	INSTRUCTIONAL REGISTER METAFUNCTIONS
J1	**T**	**let's # now**, **brainstorm again here**	INTERPERSONAL	INTERPERSONAL
J2		when YOU # move**…** [repetition 1]	POSITIVE POLARITY	SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'what makes things to move?' [J7]; 'what makes things to move?' [J8]; 'what makes things to move?' [J9] ('individual response') [7]
J3		when..SOMETHING # moves		
J4		or when YOU # move**…** [repetition 1]		
J5		**OR we # say**		
J6		when SOMETHING # is in MOTION		MODALIZATION -'something must be happening' [J14] (finite: modal) [3] (degree of modalization: high) [4]
J7		>what # makes things to move?<**…** [repetition 2]		
J8		>what # makes things to move?<**…** [repetition 2]	EXPERIENTIAL	EXPERIENTIAL
J9		>what # makes things to move?<**…** [repetition 2]	PROCESSES - '**let's now brainstorm again here**' [J1] (Pr: behavioural) - '**or we say**' [J5] (Pr: verbal)	KEY LEXICAL ITEMS - 'something'[1] [J6]; 'things'[2] [J15]; 'motion' [J6]
J10		uh?		EQUIVALENCE AND CONTRAST - 'when something moves' [J3]; 'when something is in motion' [J6]
J11		[code-switches]		

[1] something (x10)
[2] things (x20)

J12		when you # **..**		(parallel environments) [5] - ‘when you move’ [J2]; ‘when something moves’ [J3] (parallel environments) [5]
J13		if you # begin to move		
J14		something # must be happening	LOGICAL	LOGICAL
J15		what what # makes things to move?**..** repetition 2	CONJUNCTION 1) external conjunction: -‘**or**’ [J5] (conjunction type: ‘addition’; ‘alternative’)	CONJUNCTION 1) external conjunction: - ‘when’ [J2]; ‘when’ [J3]; ‘when’ [J4]; ‘when’ [J6]; ‘when’ [J12] (conjunction type: ‘time’; ‘simultaneous’) [6] - ‘or’ [J4] (conjunction type: ‘addition’; ‘alternative’) - ‘if’ [J13] (conjunction type: ‘consequence’; ‘condition’) [6]
J16		yes?	TEXTUAL CONJUNCTION 1) circumstances: - ‘**now**’ [J1] REFERENCE 1) first person pl. - ‘**let’s now brainstorm again here**’ [J1] - ‘**or we say**’ [J5] METADISCOURSE	

			- '**or we say** when something is in motion' [J5; J6]	
J17	**L**	force		EXPERIENTIAL KEY LEXICAL ITEMS - 'force' [J17]
J18 **J19** **J20** **J21** **J22** **J23** **J24** **J25**	**T**	a FORCE ne? a FORCE # makes things to move,[repetition 3] (**okay**, **okay**, **okay**, **okay**, **okay**, a FORCE # makes things to move**…**[repetition 3] I # 'm going to FORCE this wall to move I # 'm going to FORCE [The teacher knocks three times against the wall with his hand] this thing to move**…** º**but you # said**	INTERPERSONAL SPEECH FUNCTION QUESTION - '**there is something you don't understand you don't understand about what? about**?' [J28] ('individual response') [7] CONCESSION [6] - '**but**' [J25]; '**but**' [J27] (conjunction type: 'consequence'; 'cause'; 'concessive') [6] EXPERIENTIAL PROCESSES - '**but you said**' [J25] (Pr: verbal) - '**you don't understand**' [J28]; '**you don't understand about what**? **about**?' [J28] (Pr: cognition)	INTERPERSONAL MODALIZATION -'a force can make things to move' [J26] (finite: modal) [3] (degree of modalization: low) [4] EXPERIENTIAL KEY LEXICAL ITEMS - 'wall' [J23] EQUIVALENCE AND CONTRAST - 'I'm going to force this wall to move' [J23]; 'I'm going to force this

J26 **J27** **J28** **J29**		a FORCE # can make things to move°**…**) **but you # had it WRONG..** °**there # is something you # don't understand**°**..** °**you # don't understand about WHAT**? **about**°? **yes**?	 TEXTUAL CONJUNCTION 1) internal conjunction: - '**okay**'; '**okay**'; '**okay**'; '**okay**'; '**okay**' [J21] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) reference: - '**but you said** a force can make things to move' [J25-J26]	thing to move' [J24] (parallel environments) [5] TEXTUAL REFERENCE 1) exophoric: - 'I'm going to force this wall to move' [J23]
J30	**L**	force of gravity		EXPERIENTIAL KEY LEXICAL ITEMS - 'force of gravity' [J30]
J31 **J32** **J33** **J34**	**T**	°FORCE of GRAVITY° (**okay, okay, so you # mean** things # move because of force of gravity?**…** **now..I # would like you to..as from today..**	INTERPERSONAL SPEECH FUNCTION COMMAND (expressed by typical clause Mood imperative) - '**don't speak** of the force of something' [J35] - '**okay don't speak** of the force of something' [J36]	INTERPERSONAL NEGATION [6] - 'things don't have what force' [J38-J39]

J35 **J36** **J37** **J38**		**don't speak #** of the force of something [repetition 4] **<u>okay</u> don't speak #** of the force OF something [repetition 4] <u>because</u>?**..** THINGS # don't have what?**...**	MODULATION - '**now I <u>would</u> like you to as from today**' [J34] (finite: modulated) [3] (degree of modulation: median) [4] <u>EXPERIENTIAL</u> PROCESSES - '**okay okay so you <u>mean</u>** things move because of force of gravity' [J32-J33] (Pr: cognition) - '**I <u>would like</u> you as from today**' [J34] (Pr: affection) - '**don't <u>speak</u>** of' [J35]; '**okay don't <u>speak</u>** of' [J36] (Pr: behavioural) LOGOGENESIS - '**now I would like you to as from today don't speak** of the force of gravity' [J34-J35] <u>TEXTUAL</u> CONJUNCTION	<u>EXPERIENTIAL</u> EQUIVALENCE AND CONTRAST - '**don't speak** of the force of <u>something</u>' [J35]; '**so don't speak** of the force of <u>gravity</u>' [J64] (parallel environments) [5] <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - 'because' [J37] (conjunction type: 'consequence'; 'cause') [6]

			1) circumstances: - '**today**' [J34] 2) internal conjunction: - '**now**' [J34]; '**okay**'[J32]; '**okay**' [J32]; '**okay**' [J36] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) first person sing. - '**now I would like you to as from today**' [J34] METADISCOURSE - '**don't speak** of the force of something' [J35] - '**okay don't speak** of the force of something' [J36]	
J39	**Ls**	force [a couple of learners respond]		
J40 **J41** **J42** **J43**	**T**	force**…** but as but things # always EXERT**..**a force**...** you # **..** I can, I can, I can, I # can EXERT	INTERPERSONAL SPEECH FUNCTION COMMAND (expressed by typical clause Mood imperative) - '**listen to that very carefully**' [J48] - '**so don't speak** of the force of gravity' [J64]	INTERPERSONAL MODALIZATION [6] - but as but things always exert a force' [J41] NEGATION [6] - 'I don't possess force I don't possess force I don't have force'

J44		I # can, put ON force on this table**..**		[J49]
J45		it # doesn't mean	APPRAISAL [6] 1.1) attitudinal lexis: - '**I'm <u>happier</u> you know to say**' [J68]	CONCESSION [6] - 'but' [J41]; 'but' [J41]; 'but' [J63] (conjunction type: 'consequence'; 'cause'; 'concessive') [6]
J46		that I # have force		
J47		uh?**..**	1.2) attitude (judgement – criticize; direct; personal): - '**I know <u>older</u> people like ourselves and <u>older</u> folks speak** of what force of gravity' [J65; J66]	MONOGLOSSIA [6] - 'I can exert it <u>means</u> I can I can act I can exert exert a force I can exert a force on something else it <u>means</u> I can make a force to act on something' [J55-J61]
J48		**listen # to that very carefully..**		
J49		I # don't possess force**..** repetition 5	CONCESSION - '**but**' [J52]; '**but**' [J67] (conjunction type: 'consequence'; 'cause'; 'concessive') [6]	
J50		I # DON'T possess force repetition 5		
J51		[unclear] >I # don't have force< repetition 6		
J52		**<u>but</u> I # KNOW**	<u>EXPERIENTIAL</u>	<u>EXPERIENTIAL</u>
J53		a force # is ACTING on me**…**	PROCESSES - '**<u>listen</u> to that very carefully**' [J48]; '**so don't <u>speak</u>**' [J64]; '**older people like ourselves and older folks <u>speak</u>** of what force of gravity' [J66] (Pr: behavioural) - '**but I <u>know</u>**' [J52]; '**I <u>know</u>**' [J65] (Pr: cognition) - '**okay but I <u>don't like</u> it**' [J67] (Pr: affection) - '**<u>to say</u>** gravitational force or the force exerted by gravity' [J68] (Pr:	KEY LEXICAL ITEMS - 'table' [J44]; 'gravitational force' [J69]; 'the force exerted by gravity' [J69] EQUIVALENCE AND CONTRAST - 'I don't <u>possess</u> force' [J50]; 'I don't <u>have</u> force' [J51] (parallel environments) [5]
J54		**<u>and</u>..**I # can also**..**EXERT**..**a force		
J55		I # can EXERT		
J56		it # means		
J57		I can**..**I # can**..**act**..**		
J58		I # can exert**…**exert a force**…**		
		[chalkboard (8)]		

			verbal)	
J59		I # can EXERT a force on SOMETHING else	LOGICAL	LOGICAL
J60		it # means	CONJUNCTION 1) external conjunction:	CONJUNCTION 1) external conjunction:
J61		>I # can make a force to ACT on something< repetition 7	- '**and**' [J54] (conjunction type: 'addition'; 'addition') [6]	- 'or' [J68] (conjunction type: 'addition'; 'alternation') [6]
J62		>I # can make a force to ACT on something< repetition 7	- '**so**' [J64] (conjunction type: 'consequence'; 'cause') [6]	
J63		>but I # don't have force< repetition 6	- '**and**' [J66] (conjunction type: 'addition'; 'addition') [6]	
J64		**so don't speak # of..**the force of gra:vity	TEXTUAL	TEXTUAL
J65		**I know #**	CONJUNCTION 1) internal conjunction:	REFERENCE 1) exophoric:
J66		**older people like ourselves and older folks # speak** of what force of gravity**…**	- '**okay**' [J67] (conjunction type: 'addition'; 'staging'; 'framing') [6]	- 'I can put on force on this table' [J44] 2) comparative:
J67		**okay but I # don't like it**	REFERENCE 1) first person sing.	- 'I can exert a force on something else' [J59]
J68		**I # 'm happier you know to say…** GRAVI:TA:TIONAL force OR..the force EXERTED by?	- '**I know older people like ourselves and older folks speak** of what force of gravity' [J65; J66] - '**okay but I don't like it**' [J67] - '**I'm happier you know to say** gravitational force or the force exerted by gravity' [J68]	
			2) reference: - '**I know older people like**	

			ourselves and older folks speak of what force of gravity' [J65; J66] METADISCOURSE - '**so don't speak** of the force of gravity' [J64] - '**I'm happier you know to say** gravitational force or the force exerted by gravity' [J68-J69]	
J69	**Ls**	gravity		
J70 **J71** **J72** **J73** **J74** **J75** **J76**	**T**	gravity **okay** >**that # becomes more scientific**< repetition 8 >**that # becomes more more scientific**< repetition 8 the force exerted by gravity or GRAVI:TA:TIONAL force) **okay now..okay** what # can FORCE do? **give # me** things that force can do**..** yes?	INTERPERSONAL SPEECH FUNCTION COMMAND (expressed by typical clause Mood imperative**)** **- 'give me** things that force can do' [J75] ('individual extended response unassisted') [7] APPRAISAL [6] 1.1) attitude (appreciation - positive): - '**okay that [term] becomes more scientific**' [J71] - '**that becomes more more scientific**' [J72] 1.2) graduation (quantity) - '**okay that [term] becomes more**	INTERPERSONAL SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'what can force do?' [J73] ('individual extended response unassisted') [7] MODALIZATION -'what can force do?' [J73]; '**give me** things that force can do' [J74]

			scientific’ [J71] <u>EXPERIENTIAL</u> PROCESSES - ‘**okay that <u>becomes</u> more scientific**’ [J71]; ‘**that <u>becomes</u> more more scientific**’ [J72] (Pr: intensive) <u>TEXTUAL</u> CONJUNCTION 1) internal conjunction: - ‘**okay**’ [J71]; ‘**okay**’ [J74]; ‘**now**’ [J74]; ‘**okay**’ [J75] (conjunction type: ‘addition’; ‘staging’; ‘framing’) [6] METADISCOURSE - ‘**okay that [<u>term</u>] becomes more scientific**’ [J71] - ‘**that [<u>term</u>] becomes more more scientific**’ [J72]	<u>LOGICAL</u> CONJUNCTION 1) external conjunction: - ‘or’ [J72] (conjunction type: ‘addition’; ‘alternation’) [6]

J77	**L**	it # can CHANGE the direction		INTERPERSONAL MODALIZATION - 'it <u>can</u> change the direction' [J77] <u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'direction' [J77] <u>TEXTUAL</u> THIRD PERSON SING. - '<u>it</u> can change the direction' [J77]
J78 **J79** **J80** **J81** **J82** **J83**	**T**	it # can change **<u>okay</u>** force **let's have a look at** that**..** force # **…** [code-switches] force # **…**can change? what?	<u>EXPERIENTIAL</u> PROCESSES - '**let's <u>have a look at</u>** that' [J80] (Pr: cognition) <u>TEXTUAL</u> CONJUNCTION 1) internal conjunction: - '**okay**' [J79] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) first person pl.	<u>TEXTUAL</u> REFERENCE 1) text reference: - 'let's **have a look at** <u>that</u> [the following statement to be written on the chalkboard]' [J80]

			- '**let<u>'s</u> have a look at** that' [J80]	
J84	**Ls**	direction		
J85 **J86** **J87** **J88** **J89**	**T**	direction [chalkboard] [code-switches] **yes I # agree** **anybody else**? **yes**?	<u>INTERPERSONAL</u> SPEECH FUNCTION Offer - '**anybody else**?' [J88] ('individual extended response unassisted') [7] <u>TEXTUAL</u> REFERENCE 1) first person sing. - '**yes <u>I</u> agree**' [J87] 2) comparative: - '**anybody <u>else</u>**' [J88]	
J90	**L**	it # can TAKE an object from one place to another place		<u>INTERPERSONAL</u> MODALIZATION - 'it <u>can</u> take an object from one place to another place' [J90] <u>EXPERIENTIAL</u>

				KEY LEXICAL ITEMS - 'object'[3] [J90]; 'place'[4] [J90] TEXTUAL REFERENCE 1) third person sing. - 'it can take an object from one place to another place' [J90] 2) comparative: - 'it can take an object from one place to another place' [J90]
J91 **J92** **J93** **J94**	**T**	it # can MO**:**VE an object **okay** it # can, can, can, can DISPLACE an object it # can MAKE an object move from ONE place to? ANOTHER place **do you # agree**?	INTERPERSONAL SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - '**do you agree**?' [J94]	INTERPERSONAL MODALIZATION - 'it can move an object' [J91] - 'it can…displace an object' [J92] - 'it can make an object move from one place to another place' [J93] EXPERIENTIAL EQUIVALENCE AND CONTRAST - 'it can move an object' [J91]; 'it can displace an object' [J92] (parallel environments) [5]

[3] object (x15)
[4] place (x5)

			TEXTUAL CONJUNCTION 1) internal conjunction: - '**okay**' [J92] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) second person pl. - '**do <u>you</u> agree**?' [J94]	
J95	**Ls**	(yes)		
J96 **J97** **J98** **J99** **J100** **J101**	**T**	**do you # agree**? yes, yes, force # you know can do that **<u>okay</u>..** **<u>now</u> <u>okay** force # **…**can**…**can uh move an object**..**from**..**eh**..**from one place **<u>okay</u>** to another [chalkboard] it # means it # can**..**it can cause things to**..**to change positions**…** **okay**?**..**	INTERPERSONAL SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - '**do you agree**?' [J96] SPEECH FUNCTION OFFER - '**another one**' [J102] ('individual extended response unassisted') [7]	INTERPERSONAL MODALIZATION - 'force…<u>can</u> do that' [J97] - 'it <u>can</u> cause things to…change positions' [J100] MONOGLOSSIA [6] - 'it <u>means</u> it can it can cause things to to change positions' [J101-J102] EXPERIENTIAL KEY LEXICAL ITEMS - 'positions' [J100]

J102 **J103**		**another one**?**...** [name]	TEXTUAL CONJUNCTION 1) internal conjunction: - '**okay**' [J101]; '**now**' [J98]; '**okay**' [J98]; '**okay**' [J98] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) comparative: - '**an<u>other</u> one**' [J102]	
J104	**L**	it # can make a STANDING object START moving		<u>INTERPERSONAL</u> MODALIZATION - 'it <u>can</u> make a standing object start moving' [J104] <u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'a standing object' [J104] <u>TEXTUAL</u> REFERENCE 1) third person sing. - '<u>it</u> can make a standing object start moving' [J104]

J105 **J106** **J107** **J108** **J109** **J110** **J111** **J112** **J113** **J114**	**T**	it # can CAUSE motion**..** **yes, yes,** [code-switches] it # can make things it # can move <u>because</u> you know I # was HERE I # can now move from HERE to HERE <u>so</u> I # started to move **yes, another one**? **yes**?	<u>INTERPERSONAL</u> SPEECH FUNCTION OFFER - '**yes another one**' [J113] ('individual extended response unassisted') [7] <u>TEXTUAL</u> REFERENCE 1) comparative: - '**yes an<u>other</u> one**' [J113]	<u>INTERPERSONAL</u> MODALIZATION - 'it <u>can</u> cause motion' [J105] - 'because you know I was here I <u>can</u> now move from here to here' [J110-J111] <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - 'because' [J110] (conjunction type: 'consequence'; 'cause') [6] - 'so' [J112] (conjunction type: 'consequence'; 'cause') [6] <u>TEXTUAL</u> CONJUNCTION 1) circumstances: - 'now' [J111] REFERENCE 1) location in space: - 'because you know I was <u>here</u> I can now move from <u>here</u> to <u>here</u>' [J110; J111]
J115	**L**	it # can STOP moving things		<u>INTERPERSONAL</u>

				MODALIZATION - 'it <u>can</u> stop moving things' [J115] <u>TEXTUAL</u> REFERENCE 1) third person sing. - '<u>it</u> can stop moving things' [J115]
J116 **J117** **J118** **J119** **J120** **J121** **J122** **J123**	**T**	>it # can STOP moving things< **<u>okay</u> I # agree..** it # can**..**force can**…**can stop**…**moving**…** objects [chalkboard] it # can make things**…** if things # are moving it # can make them stop **yes, another one**? **yes**?	<u>INTERPERSONAL</u> SPEECH FUNCTION OFFER - '**yes another one**' [J122] ('individual extended response unassisted') [7] <u>TEXTUAL</u> CONJUNCTION 1) internal conjunction: - '**okay**' [J117] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) comparative: - '**yes an<u>other</u> one**' [J122]	<u>INTERPERSONAL</u> MODALIZATION - 'if things are moving it <u>can</u> make them stop' [J119-J121]
J124	**L**	it # can CHANGE the SHAPE of an object		<u>INTERPERSONAL</u> MODALIZATION

				- 'it <u>can</u> change the shape of an object' [J124] <u>TEXTUAL</u> REFERENCE 1) third person sing. - '<u>it</u> can change the shape of an object' [J124]
J125 **J126** **J127** **J128** **J129** **J130** **J131** **J132** **J133**	**T**	it # can CHANGE the SHAPE of an object **very good..very good..** it # can change you know the shape can change**…**the shape**…**of an object yes [chalkboard] ([code-switches]) (**<u>or</u>..<u>if</u> you # do what**? **<u>or</u> <u>if</u> you # ..take..** **<u>okay</u> I # can even take the..** **I # can take uh** a piece of**..** **here # is** RUBBER	<u>INTERPERSONAL</u> APPRAISAL [6] 1.1) attitude (appreciation – positive) - '**very <u>good</u> very <u>good</u>** [answer]' [J126] 1.2) graduation (force; intensifiers) - '**<u>very</u> good <u>very</u> good** [answer]' [J126] 2) attitudinal lexis: - '**now my <u>main interest</u> now on** force **here is this one** [this statement]' [J140] CONTINUATIVES [6] **- okay I can <u>even</u> take the**' [J131] <u>EXPERIENTIAL</u> PROCESSES	<u>INTERPERSONAL</u> MODALIZATION - 'I <u>can</u> change the shape' [J135] CONTINUATIVES [6] - 'oh no I <u>even</u> broke it there' [J137] <u>EXPERIENTIAL</u> KEY LEXICAL ITEMS

J134		I # can FORCE	- '**now my main interest now on force <u>is</u> this one**' [J140] (Pr: intensive)	- 'shape' [J125]; 'rubber' [J133]
J135		I # can CHANGE the SHAPE [repetition 9]	- '**now <u>remember</u>**' [J142] (Pr: cognition)	
J136		I # can CHANGE the SHAPE[repetition 9]	- '**and you <u>said</u>**' [J144] (Pr: verbal)	
J137		oh no I # even broke it there)	<u>LOGICAL</u>	
J138		**okay**?	CONJUNCTION	
J139		that # 's what's force	1) external conjunction: - '**and**' [J144] (conjunction type: 'addition'; 'addition') [6]	
J140		**<u>now</u>..my MAIN interest now on** force **here # is THIS one…**	- '**or**' [J129]; '**or**' [J130] (conjunction type: 'addition'; 'alternation') [6]	
J141		it can make things to move from one place to another place	- '**if**' [J129]; '**if**' [J130] (conjunction type: 'consequence'; 'condition') [6]	
J142		**<u>now</u> remember** #	<u>TEXTUAL</u>	<u>TEXTUAL</u>
J143		it # can make things to move from one place to another place**..**	CONJUNCTION 1) circumstances: - '**now**' [J140]	REFERENCE 1) location in space: - '<u>here</u> is rubber' [J133]
J144		**<u>and</u> you # said..**	2) internal conjunction: - '**okay**' [J131]; '**now**' [J140]; '**now**' [J142]; '**okay**' [J147] (conjunction type: 'addition'; 'staging'; 'framing') [6]	
J145		it # can also >START<**...**		
J146		it # can it can make things**..**to >START<**..**moving	REFERENCE	

J147		**okay** [ACTIVITY TYPE: 'interruption' [interruption/ language] – stationary and at rest; FIELD: stationary and at rest]	1) text reference: - '**now my main interest now on** force **here is this one** [this statement]' [J140] METADISCOURSE - '**now my main interest now on force here is this one** [statement written on the chalkboard] [J140]	
J148 **J149** **J150** **J151** **J152** **J153** **J154**	**T**	**now..she # said..** force # can make things to move from REST**..** **now** if something # moves from REST**…** **okay…**what # is the SPEED of something that is at REST?**...** mm ja ja**…** yes? uh?	EXPERIENTIAL PROCESSES - '**now she said**' [J148] (Pr: verbal)	INTERPERSONAL SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'what is the speed of something that is at rest?' [J151] ('individual response') [7] EXPERIENTIAL KEY LEXICAL ITEMS - 'rest' [J151]; 'speed' [J151] LOGICAL CONJUNCTION 1) external conjunction: - 'if' [J150] (conjunction type: 'consequence'; 'condition') [6]

			TEXTUAL CONJUNCTION 1) internal conjunction: - '**now**' [J148]; '**now**' [J150]; '**okay**' [J151] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) reference: - '**now she said** force can make things to move from rest' [J148-J149]	
J155	**L**	it # is stationary		EXPERIENTIAL KEY LEXICAL ITEMS - 'stationary' [J155]
J156	**T**	**are you # sure**?	INTERPERSONAL SPEECH FUNCTION OFFER - '**are you sure**?' [J156] ('individual response') [7]	
J157	**L**	zero		EXPERIENTIAL KEY LEXICAL ITEMS - 'zero' [J157]

J158	**T**	it # is zero	INTERPERSONAL	INTERPERSONAL
J159		**good**	SPEECH FUNCTION OFFER	SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative)
J160		**anybody else**?**...**	- '**anybody else**' [J160]	- 'what is the force acting on the object?' [J165]
J161		>so the SPEED of something at rest # is always what? is ZERO<	APPRAISAL 1) attitude (appreciation – positive) - '**good** [answer]' [J159]	('individual response') [7]
J162		so**..okay..**so**…**STATIONARY**…**SPEED**…** equal to zero**…**		MODALIZATION [6] - 'so the speed of something at rest is always what is zero' [J161]
		[chalkboard (11)]		LOGICAL
J163		SPEED [is] # equal to ZERO**..**		CONJUNCTION 1) external conjunction: - 'so' [J161]; 'so' [J162]; 'so' [J162] (conjunction type: 'consequence'; 'cause') [6] - 'if' [J164] (conjunction type: 'consequence'; 'condition') [6]
J164		**now** if the SPEED is # equal to ZERO**..**		
J165		what # is the force ACTING on the object?		
J166		uh?		
			TEXTUAL	
			CONJUNCTION 1) internal conjunction: - '**okay**' [J162]; '**now**' [J164] (conjunction type: 'addition'; 'staging'; 'framing') [6]	
			REFERENCE	

			1) comparative: - '**anybody <u>else</u>**' [J160]	
J167	**L**	[unclear]		
J168 **J169** **J170**	**T**	<u>if</u> <u>if</u> the object # does not have any SPEED**..** what FORCE # is acting on the object?**..** hey?		<u>INTERPERSONAL</u> SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'if the object does not have any speed what force is acting on the object?' [J168-169] ('individual response') [7] <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - 'if' [J168]; 'if' [J168] (conjunction type: 'consequence'; 'condition') [6]
J171	**L**	it # 's standing sir		
J172 **J173** **J174** **J175**	**T**	°**<u>okay</u>..listen # carefully**°**..** <u>if</u> the SPEED of the object is # **..**ZERO what FORCE # is acting on the object?**...** **anybody**?	<u>INTERPERSONAL</u> SPEECH FUNCTION COMMAND (expressed by typical clause Mood imperative) - '**okay listen carefully**' [J172]	<u>INTERPERSONAL</u> SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'if the speed of the object is zero what force is acting on the object?'

J176		**yes**?	SPEECH FUNCTION OFFER - '**anybody**?' [J175] ('individual response') [7] <u>EXPERIENTIAL</u> PROCESSES - '**okay <u>listen</u> carefully**' [J172] (Pr: behavioural) <u>TEXTUAL</u> CONJUNCTION 1) internal conjunction: - '**okay**' [J172] (conjunction type: 'addition'; 'staging'; 'framing') [6]	[J173-J174] ('individual response') [7] <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - 'if' [J173] (conjunction type: 'consequence'; 'condition') [6]
J177	**L**	no force		
J178 **J179**	**T**	>no force # is actually is actually acting there<**..** no force # **..**	<u>INTERPERSONAL</u> APPRAISAL 1.1) attitude (appreciation – positive)	

J180		**good..**	- '**<u>good</u>** [answer]' [J180] <u>EXPERIENTIAL</u> PROCESSES - '**so we <u>say</u>**' [J182] (Pr: verbal)	
J181		<u>if</u>**..**speed is # zero		
J182		**<u>so</u>..we # say**		
J183		the force here # **..**equals**..**zero [chalkboard (12)]	<u>LOGICAL</u> CONJUNCTION 1) external conjunction:	<u>LOGICAL</u> CONJUNCTION 1) external conjunction:
J184		<u>because</u> [there # is] no speed	- '**so**' [J182] (conjunction type: 'consequence'; 'cause') [6] <u>TEXTUAL</u> REFERENCE 1) first person pl. - '**so <u>we</u> say**' [J182]	- 'if' [J181] (conjunction type: 'consequence'; 'condition') [6] - 'because' [J184] (conjunction type: 'consequence'; 'cause') [6]

TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Bloor and Bloor, 2004
- TEXT 2: Christie, 2002
- TEXT 3: Eggins, 1994
- TEXT 4: Halliday, 1994
- TEXT 5: Lemke, 1993
- TEXT 6: Martin and Rose, 2003
- TEXT 7: Probyn, 2004
- The teacher's notes; handouts; the learners' notebooks and the textbook(s) used by the teacher and learners

HETEROGLOSSIA (INTERPERSONAL)	Projection; Modality; Concession
TAXANOMIC RELATIONS (EXPERIENTIAL)	Class to member; Wholes to parts; Equivalence and Contrast
THEME (TEXTUAL)	The Theme-Rheme boundary is shown by #. [4]
PERIODICITY AND SERIAL EXPANSION (TEXTUAL)	macro-/ hyperTheme; macro-/ hyperNew; Metadiscourse; Headings

		PEDAGOGIC DISCOURSE	REGULATIVE REGISTER METAFUNCTIONS	INSTRUCTIONAL REGISTER METAFUNCTIONS
K1	**T**	**what** # **TYPE of** vector **addition did we do**?	INTERPERSONAL POSITIVE POLARITY	INTERPERSONAL SPEECH FUNCTION
K2		**the FIRST type of addition**	SPEECH FUNCTION	QUESTION (expressed by typical clause Mood interrogative)
K3		**now we we** # **said**	QUESTION (expressed by typical clause Mood interrogative)	- 'how can vectors act?' [K5] - 'in which…way can vectors act?'
K4		vectors # can ACT**..**	- '**what type of** vector **addition did we do**?' [K1]	[K7] ('individual response') [7]
K5		HOW # can vectors act?**..**		MODALIZATION - 'vectors can act' [K4]; 'how can vectors act?' [K5]; 'in which in which way can vectors act?' [K7] (finite: modal) [3] (degree of modalization: low) [4]
K6		**number one..**		
K7		in which**..**in which # WAY can vectors ACT?	EXPERIENTIAL KEY LEXICAL ITEMS - '**the first type of** [vector] **addition**' [K2]	EXPERIENTIAL KEY LEXICAL ITEMS - 'vector' [K1]
			PROCESSES - '**what type of** vector **addition did we do**?' [K1] (Pr: material) - '**now we we said**' [K3] (Pr: verbal)	
			TEXTUAL	

			CONJUNCTION 1) internal conjunction: - '**now**' [K3] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) first person pl. - '**what type of** vector **addition did <u>we</u> do**?' [K1] - '**now <u>we</u> we said**' [K3] 2) comparative: - '**the <u>first</u> type of addition**' [K2] 3) anaphoric: - '**<u>the</u> first type of addition**' [K2] 4) reference: - '**now we we said** vectors can act' [K3; K4]	
K8	**L_1**	in a certain direction		
K9 **K10**	**T**	**no no <u>okay</u> YES?..YES?..** **let the whole class.. # HEAR what you are saying**	<u>INTERPERSONAL</u> SPEECH FUNCTION COMMAND (expressed by the typical clause Mood imperative) - '**let the whole class hear what you are saying**' [K10] (=raise your voice) ('individual extended response unassisted') [7]	

			EXPERIENTIAL PROCESSES - '**let the whole class <u>hear</u>**' [K10] (Pr: perception) - '**what you are <u>saying</u>**' [K10] (Pr: verbal) <u>TEXTUAL</u> CONJUNCTION 1)internal conjunction: - '**okay**' [K9] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) second person sing. **- let the whole class hear what <u>you</u> are saying**' [K10] METADISCOURSE - '**let the whole class hear what you are saying**' [K10]	
K11 **K12** **K13** **K14**	**L_1**	I # 'm saying that**..** I # 'm saying that they # can ACT in the same direction		<u>INTERPERSONAL</u> MODALIZATION - 'I'm saying that they <u>can</u> act in the same direction' [K13; K14] (finite: modal) [3] (degree of modalization: low) [4]

				EXPERIENTIAL KEY LEXICAL ITEMS - ‘same direction’ [K14] TEXTUAL REFERENCE 1) first person sing. - ‘I’m saying’ [K11]; ‘I’m saying’ [K13] 2) comparative: - ‘I’m saying that they can act in the same direction’ [K13; K14]
K15 **K16**	**T**	vectors # can ACT in the same direction[repetition1] **..** **do you** # **ALL agree**?	INTERPERSONAL SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - ‘**do you all agree**?’ [K16] TEXTUAL REFERENCE 1) second person pl. - ‘**do you all agree**?’	INTERPERSONAL MODALIZATION - ‘vectors can act in the same direction’ [K15] (finite: modal) [3] (degree of modalization: low) [4] TEXTUAL REPETITION - ‘act/ ing in the same direction’ [repetition1]

K17	**Ls**	yes		
K18 **K19** **K20**	**T**	**yes..** **now** if vec- **yes**?	TEXTUAL CONJUNCTION 1) internal conjunction: - '**now**' [K19] (conjunction type: 'addition'; 'staging'; 'framing') [6]	EXPERIENTIAL EQUIVALENCE AND CONTRAST - 'vectors can act in the same direction' [K15] - 'vectors can act in the opposite direction' [K21]
K21	**L**	vectors # can act in an OPPOSITE direction		INTERPERSONAL MODALIZATION - 'vectors can act in an opposite direction' [K21] (finite: modal) [3] (degree of modalization: low) [4] EXPERIENTIAL KEY LEXICAL ITEMS - 'opposite direction' [K21]

				TEXTUAL REFERENCE 1) comparative: - 'vectors can act in an opposite direction' [K21]
K22 **K23** **K24** **K25** **K26** **K27** **K28** **K29**	**T**	**okay FINE..** **we # are coming there** **ne?** **right** vectors # can act on the op- in the same direction [repetition1] **now we # said** if they # 're ACTING in the same direction[repetition1] **…** what # is the ANGLE between the vectors [repetition2]?**..** **yes** [name]?	INTERPERSONAL SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'if they're acting in the same direction what is the angle between the vectors?' [K27; K28] ('individual response') [7] EXPERIENTIAL PROCESSES - '**now we said**' [K26] (Pr: verbal) TEXTUAL	INTERPERSONAL MODALIZATION - '**right** vectors can act on the op in the same direction' [K25] (finite: modal) [3] (degree of modalization: low) [4] EXPERIENTIAL KEY LEXICAL ITEMS - 'angle' [K28] LOGICAL CONJUNCTION 1) external conjunction: - 'if' [K27] (conjunction type: 'consequence'; 'condition') [6] TEXTUAL

			CONJUNCTION 1) internal conjunction: - '**okay**' [K22]; '**right**' [K25]; '**now**' [K26] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) reference: - '**now we said** if they're acting in the same direction what is the angle between the vectors' [K26-K28]	REPETITION - 'the angle between the vectors/ them' repetition2
K30	**L**	it # 's zero sir		EXPERIENTIAL KEY LEXICAL ITEMS - 'zero' [K30]
K31 **K32** **K33** **K34** **K35** **K36**	**T**	the ANGLE between the vectors repetition2 # is ZERO**..** **OKAY**,..**so we** # **said..** if if vectors # are acting in the same direction repetition1 **WE**,..**WE**,.. **now I** # **think** **I** # **made something like THIS**,..	INTERPERSONAL DEMANDING INFORMATION [4] - 'and the angle between them is what is' [K43] ('whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence') [7] MODALIZATION - '**I think**' (Modal Adjunct) (degree of modalization: median)	

			EXPERIENTIAL	EXPERIENTIAL
K37		**I # said**		
			PROCESSES	KEY LEXICAL ITEMS
K38		**OKAY**,**..**the vectors**..**	- '**okay so we said**' [K32]; '**I said**' [K37] (Pr: verbal)	- 'eight newtons' [K39]; 'six newtons' [K40]
K39		**I # 'm having** a vector **of what of** EIGHT,**..**newtons**..**	- '**I made something like this**' [K36] (Pr: material)	
K40		SIX, newtons	LOGICAL	LOGICAL
		[chalkboard (1)]	CONJUNCTION 1) external conjunction:	CONJUNCTION 1) external conjunction:
K41		**now** they # ACT in the SAME direction,[repetition1]**..**	- '**so**' [K32] (conjunction type: 'consequence'; 'cause') [6]	- 'if' [K33]; 'if' [K33] (conjunction type: 'consequence'; 'condition') [6]
K42		same direction,		- 'and' [K43] (conjunction type: 'addition'; 'addition') [6]
K43		and the ANGLE between them[repetition2] # is what? is?	TEXTUAL	
			CONJUNCTION 1) internal conjunction: - '**okay**' [K32]; '**now**' [K35]; '**okay**' [K38] (conjunction type: 'addition'; 'staging'; 'framing') [6]	
			REFERENCE 1) exophoric: - '**I made something like this**' [K36] 2) reference: - '**okay so we said**' [K32]	

			- '**I said**' [K37]	
K44 **K45**	**Ls**	zero [a number of learners talk at the same time]		
K46 **K47** **K48** **K49** **K50** **K51** **K52** **K53** **K54**	**T**	ZERO **now**,..when they # ACT on the SAME..>in the SAME direction< repetition1 **…** **we** # **said** **we** # **can..GET** the <RESULTANT> repetition3 **..** **we** # **can GET** the <RESULTANT> repetition3 of of these two vectors**..in tw- two ways** **now there** # **are TWO ways in which we can get** the resultant repetition3 **..** >**now the FIRST one please**<**…** °**the first one**°**…** **HOW** # **can we get** the resultant repetition2?**..**	INTERPERSONAL SPEECH FUNCTION COMMAND - '**now the first one please**' [K52] (=please give me the first one) - '**the first one**' [K53] (=give me the first one) SPEECH FUNCTION QUESTION - '**how can we get** the resultant?' [K54] MODALIZATION - '**we can get** the resultant' [K49]; '**we can get** the resultant of of these two vectors **in tw- two ways**' [K50]; '**now there are two ways in which we can get** the resultant' [K51]; '**how can we get** the resultant?' [K54] (finite: modal) [3] (degree of modalization: low) [4]	

			EXPERIENTIAL KEY LEXICAL ITEMS - ‘**two ways in which we can get** the resultant’ [K51] PROCESSES - ‘**we said**’ [K48] (Pr: verbal) - ‘**we can get** the resultant’ [K49] (Pr: material) TEXTUAL CONJUNCTION 1) internal conjunction: - ‘**now**’ [K47]; ‘**now**’ [K51]; ‘**now**’ [K52] (conjunction type: ‘addition’; ‘staging’; ‘framing’) [6] REFERENCE 1) reference - ‘**we said**’ [K48]	EXPERIENTIAL KEY LEXICAL ITEMS - ‘resultant’ [K49] LOGICAL CONJUNCTION 1) external conjunction: - ‘when’ [K47] (conjunction type: ‘time’; ‘simultaneous’) [6] TEXTUAL REPETITION - ‘get the resultant’ repetition3

K55 **K56** **K57** **K58** **K59** **K60** **K61** **K62** **K63** **K64**	**T**	**>oh <u>by the way</u>** WHAT # is the resultant<?**...** **<u>if</u> I** # **think of that you know** the word <RESULTANT> of a vector >**what** # **do we mean by that**? repetition4 <**..** the <RESULTANT> of a vector**…** >**what** # **do we mean by that**? repetition4 <**…** [code-switches] the <RESULTANT of vec> [code-switches] **I** # **'m telling you** **yes**?	<u>INTERPERSONAL</u> SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'oh by the way what is the resultant?' [K55] - '**if I think of that you know** the word resultant of a vector **what do we mean by that**?' [K56; K57] - 'the resultant of a vector **what do we mean by that**?' [K58; K59] ('individual extended response unassisted') [7] <u>EXPERIENTIAL</u> PROCESSES - '**if I <u>think</u> of that you know** the word resultant of a vector' [K56] (Pr: cognition) - '**what do we <u>mean</u> by that**?' [K57]; '**what do we <u>mean</u> by that**?' [K59] (Pr: verbal) - '**<u>I'm telling</u> you**' [K63] (Pr: behavioural) CONJUNCTION 1) external conjunction: - '**if**' [K56] (conjunction type: 'consequence'; 'condition') [6]	<u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'resultant' [K55]

			TEXTUAL CONJUNCTION 1) internal conjunction: - '**by the way**' (conjunction type: 'addition'; 'staging'; 'sidetracking') [6] REPETITION - '**what do you/ we mean by that**?' repetition4 METADISCOURSE - '**what do we mean by that** [term]?' [K57]; '**what do we mean by that** [term]?' [K59]	TEXTUAL METADISCOURSE - '**if I think of that you know** the word resultant of a vector' [K56]
K65	**L**	it # is an ANSWER of a vector		EXPERIENTIAL KEY LEXICAL ITEMS - 'an answer of a vector' [K65]
K66	**T**	[code-switches]		
K67	**L**	it # is an ANSWER of a vector		
K68 **K69**	**T**	it # is an ANSWER of a vector?**…** **what what # do you mean by**	INTERPERSONAL SPEECH FUNCTION	

K70		**that**?[repetition4]**...** **yes**?	QUESTION (expressed by typical clause Mood interrogative) - 'it is an answer of a vector **what do you mean by that**?' [K68; K69] ('individual extended response assisted') [7] <u>EXPERIENTIAL</u> PROCESSES - '**what what do you <u>mean</u> by that**?' [K69] (Pr: verbal) <u>TEXTUAL</u> REFERENCE 1) second person sing. - '**what what do <u>you</u> mean by that**?' [K69]	
K71	**L_2**	a vector is		
K72	**T**	a RESULTANT,**..**RESULTANT,		
K73	**L_2**	it # is a vector sum		<u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'a vector <u>sum</u>' [K73]
K74 **K75**	**T**	it # is a VECTOR SUM**..** **yes**?		

K76	**L_2**	that are all taken away		
K77 **K78**	**T**	<the RESULTANT # IS the VECTOR SUM of ALL vectors ACTING together> **say** # **THAT all of us**	INTERPERSONAL SPEECH FUNCTION COMMAND (expressed by the typical clause Mood imperative) - '**say that all of us**' [K78] EXPERIENTIAL PROCESSES - '**say that all of us**' [K78] (Pr: verbal) TEXTUAL REFERENCE 1) first person pl. - '**say that all of us**' [K78] METADISCOURSE - 'say that [definition] all of us' [K78]	EXPERIENTIAL KEY LEXICAL ITEMS - 'the vector sum of all vectors acting together' [K77]
K79	**L**	<the resultant # is the vector sum of all vectors acting together>		
K80	**T**	the RESULTANT…<ALL vectors ACT taken together>		

K81 **K82** **K83**	**T**	°**and thereafter I # said again you can also put it this way**° the RESULTANT**..**the RESULTANT**..** # IS a SINGLE vector**..** it # is a SINGLE vector**..**which has the SAME**..**EFFECT**..**as <ALL vectors taken? together>	INTERPERSONAL MODALIZATION - '**and thereafter I said again you can also put it this way**' [K81] (finite: modal) [3] (degree of modalization: low) [4] CONTINUATIVES [6] - '**and thereafter I said again you can also put it this way**' [K81] EXPERIENTIAL PROCESSES - '**and thereafter I said again**' [K81]; '**you can also put it this way**' [K81] (Pr: verbal) LOGICAL CONJUNCTION 1) external conjunction: - '**and**' [K81] (conjunction type: 'addition'; 'addition') [6] - '**thereafter**' [K81] (conjunction type: 'time'; 'successive') [6] TEXTUAL	EXPERIENTIAL KEY LEXICAL ITEMS - 'a single vector which has the same effect as all vectors taken together' [K83]

			REFERENCE 1) first person sing. - '**and thereafter <u>I</u> said again you can also put it this way**' [K81] 2) reference: - '**and thereafter I said again you can also put it this way**' [K81] METADISCOURSE - '**and thereafter I said you can also put it** [<u>the term resultant</u>] **this way**' [K81]	
K84	**Ls**	<u>together</u>		
K85 **K86** **K87** **K88** **K89**	**T**	**for an example**,**..** **we** # **said..remember**,**..** **we** # **said** **you** # **can have** a VECTOR**..of what**, **of**,**..let's say** EIGHT newtons**..**EAST that # 's a vector of EIGHT newtons EAST**..**followed by another, a vector **of**	<u>INTERPERSONAL</u> MODALIZATION - '**you <u>can</u> have** a vector **of what of let's say** eight newtons east' [K88] (finite: modal) [3] (degree of modalization: low) [4] CONTINUATIVES [6] - 'that's a vector of eight newtons east followed by another a vector of	<u>INTERPERSONAL</u> DEMANDING INFORMATION [4] - 'but instead of having two vectors acting one after the other you can have one vector which would be equal to what' [K91; K92] ('individual response') [7] MODALIZATION - 'you <u>can</u> have one vector which

		what of, **of**, **of**, **of let**, **let's say uhm**, **uh**, **again**, **what let's say** SIX newtons, EAST [chalkboard (1)]	**what of of of of let's say uhm uh <u>again</u> what let's say** six newtons east' [K89]	would be equal to what?' [K92] (finite: modal) [3] (degree of modalization: low) [4] - 'you can have one vector which <u>would</u> be equal to what?' [K92] (finite: modal) [3] (degree of modalization: median) [4]
K90		**<u>right</u>** <u>so</u> these # are TWO vectors acting here**..**		
K91		<u>BUT</u> instead of having TWO vectors**…**ACTING one after the other		CONCESSION [6] - 'but' [K91] (conjunction type: 'consequence'; 'cause'; 'concessive') [6] - 'instead of' [K91] (conjunction type: 'comparison'; 'concessive')
K92		you # can have ONE vector**..>**which would be equal to what<?**...**		
K93		**yes**?		
			<u>EXPERIENTIAL</u> PROCESSES - '**we <u>said</u>**' [K86]; '**we <u>said</u>**' [K87]; '**let's <u>say</u>**' [K88]; '**let's <u>say</u>**' [K89] (Pr: verbal) - '**<u>remember</u>**' [K86] (Pr: cognition)	<u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'eight <u>newtons</u> east' [K89]; 'six <u>newtons</u> east' [K89]; 'two <u>vectors</u>' [K90]; 'one <u>vector</u>' [K92]
				<u>LOGICAL</u> CONJUNCTION 1) external conjunction: - 'so' [K90] (conjunction type: 'consequence'; 'cause') [6]
			<u>TEXTUAL</u>	<u>TEXTUAL</u>

			CONJUNCTION 1) internal conjunction: - '**right**' [K90] (conjunction type: addition; staging; framing) [6] REFERENCE 1) reference: - '**we said**' [K86]; '**we said**' [K87]	REFERENCE 1) exophoric: - 'that's a vector of eight newtons east followed by another a vector of **what of of of of let's say uhm uh again what let's say** six newtons east' [K89] - 'right so these are two vectors acting here' [K90] 2) location in space: - 'right so these are two vectors acting here' [K90] 3) comparative: - 'that's a vector of eight newtons east followed by another a vector of **what of of of of let's say uhm uh again what let's say** six newtons east' [K89]
K94	**L**	which would be equal to fourteen newtons		INTERPERSONAL MODALIZATION - 'which would be equal to fourteen newtons' [K94] (finite: modal) [3] (degree of modalization: median) [4] EXPERIENTIAL KEY LEXICAL ITEMS - 'fourteen newtons' [K94]

K95 **K96**	**T**	which would be equal to FOURTEEN newtons?**..** **is that** # **all**?**..**	INTERPERSONAL SPEECH FUCTION QUESTION (expressed by typical clause Mood interrogative) - '**is that all**?' [K96] ('individual response') [7]	INTERPERSONAL DEMANDING INFORMATION [4] - 'which would be equal to fourteen newtons' [K95] MODALIZATION - 'which would be equal to fourteen newtons?' [K95] (finite: modal) [3] (degree of modalization: median) [4]
K97	**L**	east		EXPERIENTIAL KEY LEXICAL ITEMS - 'east' [K98]
K98 **K99** **K100** **K101** **K102**	**T**	>EAST< **because remember..** # **when you** # **speak** of a vector**..** **you** # **CAN'T just say** fourteen newtons**..** **you # must tell me** the?	INTERPERSONAL DEMANDING INFORMATION [4] - '**you must tell me** the' [K102] ('individual response') [7] MODALIZATION - '**you can't just say** fourteen newtons' [K101] (finite: modal) [3] (degree of modalization: high) [4] - '**you must tell me** the?' [K102] (finite: modal) [3] (degree of modalization: high) [4]	

			NEGATION [6] - '**you <u>can't</u> just say** fourteen newtons' [K101] CONTINUATIVES [6] - '**you can't <u>just</u> say** fourteen newtons' [K101] <u>EXPERIENTIAL</u> PROCESSES - '**because <u>remember</u>**' [K99] (Pr: cognition) - '**when you <u>speak</u>** of a vector' [K100]; '**you must <u>tell</u> me** the?' [K102] (Pr: behavioural) <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - '**because**' [K99] (conjunction type: 'consequence'; 'cause') [6] - '**when**' [K100] (conjunction type: 'time'; 'simultaneous') [6] <u>TEXTUAL</u> REFERENCE 1) second person pl.	

			- '**when <u>you</u> speak** of a vector' [K100] - '**<u>you</u> can't just say** fourteen newtons' [K101] - '**<u>you</u> must tell me** the' [K102] 2) first person sing. - '**you must tell <u>me</u>**' [K102] METADISCOURSE - '**because remember when you speak** of a vector' [K99; K100] - '**you can't just say** fourteen newtons' [K101] - '**you must tell me** the direction' [K102; K103]	
K103	**L**	direction		<u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'direction' [K103]
K104 **K105** **K106** **K107**	**T**	direction**..** <u>if</u> the answer # is rea- **<u>okay</u>**, **<u>okay</u>**, <u>so</u>, <u>so</u>, HERE**..** # we can have,**...**ONE single vector [repetition5]**..** we # can now have here,**..**ONE single vector [repetition5]**..**		<u>INTERPERSONAL</u> MODALIZATION - '**okay okay** so so here we <u>can</u> have one single vector' [K106]; 'we <u>can</u> now have here one single vector' [K107]; 'we <u>can</u> now have here one single vector of fourteen newtons east' [K108] (finite: modal) [3] (degree of modalization: low) [4]

K108 **K109** **K110** **K111** **K112**		we # can now have here ONE,**..**single vector [repetition5] of fourteen newtons east**..** so THIS # is then the resultant**..** it # is the resultant of what? of? THIS vector and THIS vector**..** >they # form the resultant<**..** this vector # form ONE vector [chalkboard (2)]	TEXTUAL CONJUNCTION 1) internal conjunction: - '**okay**' [K106]; '**okay**' [K106] (conjunction type: 'addition'; 'staging'; 'framing') [6]	LOGICAL CONJUNCTION 1) external conjunction: - 'if' [K105] (conjunction type: 'consequence'; 'condition') [6] - 'so' [K106]; 'so' [K106]; 'so' [K109] (conjunction type: 'consequence'; 'cause') [6] - 'and' [K110] (conjunction type: 'addition'; 'addition') [6] TEXTUAL CONJUNCTION 1) circumstances: - 'we can now have here one single vector' [K107] REFERENCE 1) exophoric: - 'so this is then the resultant' [K109] - 'it is the resultant of what of this vector and this vector' [K110] - 'this vector form one vector' [K112] 2) location in space: - '**okay okay** so so here we can have one single vector' [K106]

				- 'we can now have <u>here</u> one single vector' [K107] - 'we can now have <u>here</u> one single vector of fourteen newtons east' [K108] REPETITION - 'one single vector' repetition5
		ACTIVITY TYPE: 'interruption' [1] [interruption/ language] – 'magnitude'/ 'total resultant vector' **FIELD [2]:** **Magnitude and total resultant vector**		
K113 **K114** **K115** **K116** **K117** **K118** **K119** **K120**	**T**	**<u>NOW</u>..we # said** **<u>okay</u> <u>NOW</u> <u>if</u>** [unclear] **<u>now</u> we # STOPPED here..** **we # said** **that you # can ADD** vectors acting in the same direction repetition1 <u>so</u> we # have**..**SAME,**..**direction,**..** **<u>and</u> we # said here** this # is the same as what? as?	<u>INTERPERSONAL</u> MODALIZATION - '**we said that you <u>can</u> add** vectors acting in the same direction' [K116; K117] (finite: modal) [3] (degree of modalization: low) [4] <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - '**if**' [K114] (conjunction type: 'consequence'; 'condition') [6] - '**and**' [K119] (conjunction type: 'addition'; 'addition') [6]	<u>LOGICAL</u> CONJUNCTION 1) external conjunction: - 'so' [K118] (conjunction type: 'consequence'; 'cause') [6]

K121 **K122** **K123** **K124** **K125**		ANGLE,**..**between,**..**vectors, [repetition2] # is what? equals zero**..** **right**?**..** zero degrees **okay**? [chalkboard (6)] >the angle between the vectors [repetition2] # is now equal to zero degrees<	<u>EXPERIENTIAL</u> PROCESSES - '**now we <u>said</u>**' [K113]; '**we <u>said</u>**' [K116]; '**and we <u>said</u> here**' [K119] (Pr: verbal) - '**that you <u>can add</u>** vectors acting in the same direction' [K117] (Pr: behavioural) <u>TEXTUAL</u> CONJUNCTION 1) internal conjunction: - '**now**' [K113]; '**okay**'[K114]; '**now**' [K114]; '**now**' [K115] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) first person pl. - '**now <u>we</u> stopped here**' [K115] 2) location in space: - '**and we said <u>here</u>**' [K115] 3) reference: - '**we said**' [K113]; '**we said**' [K116]; '**we said**' [K119]	<u>TEXTUAL</u> REFERENCE 1) exophoric: - '<u>this</u> is the same as what as' [K120]
		ACTIVITY TYPE: 'review' [1]; 'groupwork' [1] [groupwork/		

		preparation for groupwork] **FIELD [2]:** **Problem 1**		
K126 **K127** **K128** **K129** **K130** **K131** **K132** **K133** **K134**	**T**	**<u>okay</u> FINE..<u>so</u>..we # look at WHAT**? at the displacement **<u>now</u>,..<u>and then</u> we # said** **there # are TWO ways in which we can get** the resultant [repetition3]**..** **there # are TWO ways in which we can get** the resultant [repetition3]**..** **>give # me two ways in which one can get** the resultant [repetition3] of those two vectors<**..** **uh**?**..** **we # KNOW this**,**..** **we # 've DISCUSSED this**,**..** **<u>BUT</u> give # me TWO ways..in which** the resultant of what? of EIGHT newtons, EAST AND SIX newtons, EAST **can be found..** [chalkboard (7)]	<u>INTERPERSONAL</u> SPEECH FUNCTION COMMAND (expressed by the typical clause Mood imperative) - '**give me the two ways in which one can get** the resultant of those two vectors' [K130] - '**but give me two ways in which** the resultant of what of eight newtons east and six newtons east **can be found**' [K134] SPEECH FUNCTION COMMAND - '**and the first method**' [K135] (=give me the first method) - '**the first method**' [K136] (=give me the first method) MODALIZATION - '**there are two ways in which we <u>can</u> get** the resultant' [K128]; '**there are two ways in which we <u>can</u> get** the resultant' [K129]; '**give me two ways in which one <u>can</u> get** the resultant of those two vectors' [K130]; '**but give me two ways in**	<u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'displacement' [K126] EQUIVALENCE AND CONTRAST - 'we <u>know</u> this' [K132] - 'we've <u>discussed</u> this' [K133]

K135 **K136** **K137** **K138**		>**<u>and</u> the FIRST method**,<[repetition6] **…** >**the FIRST method**,<[repetition6]**..** [code-switches] **YES** [name]?	**which** the resultant of what of eight newtons east and six newtons east **<u>can</u> be found**' [K134] (finite: modal) [3] (degree of modalization: low) [4] CONCESSION [6] - '**but**' [K134] (conjunction type: 'consequence'; 'cause'; 'concessive') [6] <u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - '**the first <u>method</u>**' [K135] PROCESSES - '**okay fine so we <u>look at</u> what** at the displacement' [K126]; '**we <u>discussed</u> this**' [K133] (Pr: behavioural) - '**now and then we <u>said</u>**' [K127] (Pr: verbal) - '**<u>give</u> me the two ways**' [K129]; '**in which we <u>can get</u>** the resultant' [K129]; '**but <u>give</u> me two ways in which** the resultant of what of eight newtons east and six newtons east **can be found**' [K134] (Pr: material) - '**we <u>know</u> this**' [K132] (Pr: cognition)	

			LOGICAL CONJUNCTION 1) external conjunction: - '**so**' [K126] (conjunction type: 'consequence'; 'cause') [6] - '**and**' [K127]; '**and**' [K135] (conjunction type: 'addition'; 'addition') [6] - '**then**' [K127] (conjunction type: 'time'; 'successive') [6] TEXTUAL CONJUNCTION 1) internal conjunction: - '**okay**' [K126]; '**now**' [K127] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) first person pl. - '**we know this**' [K132] - '**we've discussed this**' [K133] 2) first person sing. - '**but give me two ways in which** the resultant of what of eight newtons east and six newtons east **can be found**' [K134] 3) comparative:	TEXTUAL REPETITION - 'the first method' repetition6

			- '**and the <u>first</u> method**' [K135] 4) reference: - '**we said**' [K127] METADISCOURSE - '**we've discussed this**' [K133]	
K139	**L**	we # can get it by calculation	<u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'calculation' [K139]	
K140 **K141** **K142** **K143** **K144** **K145** **K146**	**T**	**we # can get it by calculation**, repetition7 **yes,..we # can get it by calculation**, repetition5**..** **SIMPLE calculation,..** **we # can get it by <calculation>** repetition7 **yes,..which is here VERY EASY,..** [chalk board (8)] <u>because</u> of the same thing >you know direction< <u>SO</u> it # will be?**..** you know the displa:cement # will be?**..**	<u>INTERPERSONAL</u> SPEECH FUNCTION QUESTION - '**now the next one**' [K150] (=what is the next one?) ('individual response') [7] SPEECH FUCTION COMMAND - '**am I teaching only two people here**?' [K151] (=start participating in the lesson) APPRAISAL 1.1) attitude (appreciation – positive) - '**<u>simple</u> calculation**' [K142] - '**we can get it by calculation yes which is here very <u>easy</u>**' [K143]	<u>INTERPERSONAL</u> MODALIZATION - 'so it <u>will</u> be' [K145]; 'you know the displacement <u>will</u> be' [K146] - 'the displacement <u>would</u> be equal to what eight newtons plus what plus six newtons' [K147]; 'and this <u>will</u> be fourteen newtons east' [K148] (finite: modal) [3] (degree of modalization: median) [4]

K147 **K148** **K149** **K150** **K151** **K152**		the displa:cement # WOULD be equal to what? EIGHT newtons,**..**plus WHAT? plus? SIX newtons, and this # will be FOURTEEN newtons, EAST **that # 's by calculation..** **now the next one**?**…** **am I # teaching only two people here**?**..** **yes?**	1.2) graduation (force; intensifiers) - '**we can get it by calculation yes which is here very easy**' [K143] MODALIZATION - '**we can get it by calculation**' [K140]; '**yes we can get it by calculation**' [K141]; '**we can get it by calculation yes which is here very easy**' [K143] (finite: modal) [3] (degree of modalization: low) [4] CONTINUATIVES [6] - '**am I teaching only two people here**?' [K151] EXPERIENTIAL PROCESSES - '**we can get it by calculation**' [K140] (Pr: material) - '**am I teaching only two people here**' [K151] (Pr: behavioural)	LOGICAL CONJUNCTION 1) external conjunction: - 'because' [K144] (conjunction type: 'consequence'; 'cause') [6] - 'so' [K145] (conjunction type:

			TEXTUAL CONJUNCTION 1) internal conjunction: - '**now**' [K150] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE - '**am <u>I</u> teaching only two people here**?' [K151]	'consequence'; 'cause') [6] - 'and' [K148] (conjunction type: 'addition'; 'addition') [6] <u>TEXTUAL</u> REPETITION - 'we can get it by calculation' repetition7
K153	**L**	by drawing	<u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - '[a] drawing' [K153]	
K154 **K155** **K156** **K157** **K158** **K159**	**T**	**by drawing**, **what # do you mean by that** repetition4? **yes by drawing..** **<u>but</u> what # do you mean by that** repetition4? >**we # DISCUSSED these things**<.. [unclear]	<u>INTERPERSONAL</u> SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - '**what do you mean by that**?' [K155] - '**but what do you mean by that**?' [K157] DEMANDING INFORMATION [4]	

K160		**I # SWEAR**,	- '**the answer is**' [K165] ('individual response') [7]	
K161		**I # DON'T go along with learners who don't study..you know who don't go through their work..**	APPRAISAL 1) attitudinal lexis: - '**I <u>swear</u> I don't go along with learners who don't study you know who don't go through their work**' [K160; K161]	
K162		**the FIRST method** [repetition6]**..** # <<**yes I agree**>>[is] **..by calculation**		
K163		**we # can get at** our displacement **by calculating**, **by ADDING**, **by calculating…**	MODALIZATION - '**we <u>can</u> get at** our displacement **by calculating by adding by calculating**' [K163] (finite: modal) [3] (degree of modalization: low) [4]	
K164		°**yes [name]**°**?**		
K165		°**the answer # is**°**?**	NEGATION [6] - '**I swear I <u>don't</u> go along with learners who don't study you know who don't go through their work**' [K160; K161]	
			CONCESSION [6] - '**but**' [K157] (conjunction type: 'consequence'; 'cause'; 'concessive') [6]	
			<u>EXPERIENTIAL</u>	
			PROCESSES - '**what do you <u>mean</u> by that**?'	

			[K155]; '**but what do you mean by that**?' [K157]; '**I swear**' [K160] (Pr: verbal) - '**we've discussed these things**' [K158]; '**I don't go along with learners who don't study you know who don't go through their work**' [K161]; '**we can get at** our displacement **by calculating by adding by calculating**' [K163] (Pr: behavioural) - '**we can get at** our displacement **by calculating by adding by calculating**' [K163] (Pr: material) TEXTUAL REFERENCE 1) second person sing. - '**what do you mean by that**? [K151]; '**but what do you mean by that**?' [K157] 2) first person pl. - '**we discussed these things**' 3) first person sing. - '**I swear I don't go along with learners who don't study you know who don't go through their work**' [K160; K161] - '**the first method is yes I agree by calculation**' [K162]	

			4) possessive: - '**I swear I don't go along with learners who don't study you know who don't go through <u>their</u> work**' [K160; K161] METADISCOURSE - '**we discussed these things**' [K158]	
K166	**L**	by measurement	<u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'measurement' [K166]	
K167 **K168** **K169** **K170** **K171** **K172**	**T**	**by MEASUREMENT?..** **yes? by MEASUREMENT <u>and</u>?..** **you # MEASURE something** **<u>and</u> you # do what?...** **you # measure** **<u>and</u>?**	<u>INTERPERSONAL</u> DEMANDING INFORMATION [4] - '**by measurement**' [K167] - '**yes by measurement and**' [K168] - '**and you do what**' [K170] - '**you measure and**' [K171; K172] ('individual response') [7] <u>EXPERIENTIAL</u> PROCESSES - '**you <u>measure</u> something**' [K169]; '**you <u>measure</u>**' [K171] (Pr: behavioural)	

			LOGICAL CONJUNCTION 1) external conjunction: - '**and**' [K168]; '**and**' [K170]; '**and**' [K172] (conjunction type: 'addition'; 'addition') [6]	
K173	**L**	draw		
K174 **K175** **K176** **K177** **K178** **K179** **K180** **K181**	**T**	**and** # **DRAW** **yes**, **very good..** **so we** # **can get** the very SAME, displacement **by**,**..by drawing**,**..and measurement..and measurement..** [chalkboard (9)] **now when you** # **do a measurement** **what** # **must you first find**?**..** **if you** # **want to make a DRAWING..in SCIENCE** **then we** # **speak of**? **what**? **of drawing**? [code-switches]	INTERPERSONAL SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - '**now when you do a measurement what must you first find**?' [K177; K178] DEMANDING INFORMATION [4] - '**if you want to make a drawing in science then we speak of what of drawing**' [K179; K180] ('individual response') [7] APPRAISAL 1.1) attitude (appreciation – positive) - '**yes very good** [answer]' [K175] 1.2) graduation (force; intensifiers) - '**yes very good** [answer]' [K175]	

K182		**yes?**	MODALIZATION - '**so we <u>can</u> get** the very same displacement **by by drawing and measurement and measurement**' [K176] (finite: modal) [3] (degree of modalization: low) [4] - '**now when you do a measurement what <u>must</u> you first find**?' [K177; K178] (finite: modal) [3] (degree of modalization: high) [4] <u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - '**a <u>drawing</u> in science**' [K179] PROCESSES - '**and <u>draw</u>**' [K174]; '**so we can get the very same displacement by by <u>drawing</u> and measurement and measurement**' [K176]; '**then we <u>speak</u> of what of drawing**' [K180] (Pr: behavioural) - '**if you <u>want</u> to make a drawing in science**' [K179] (Pr: affection) <u>LOGICAL</u> CONJUNCTION 1) external conjunction:	

			- '**and**' [K174]; '**and**' [K176]; '**and**' [K176] (conjunction type: 'addition'; 'addition') [6] - '**so**' [K176] (conjunction type: 'consequence'; 'cause') [6] - '**when**' [K177] (conjunction type: 'time'; 'simultaneous') [6] - '**if**…**then**' [K179; K180] (conjunction type: 'consequence'; 'condition') [6] <u>TEXTUAL</u> CONJUNCTION 1) internal conjunction: - '**now**' [K177] (conjunction type: 'addition'; 'staging'; 'framing') [6] METADISCOURSE - '**if you want to make a drawing in science then we speak of what of drawing**' [K179; K180]	<u>TEXTUAL</u> REFERENCE 1) comparative: - '**so we can get** the very <u>same</u> displacement **by by drawing and measurement and measurement**' [K176]
K183	**L**	scale drawing		<u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - '[a] scale drawing' [K183]
K184	**T**	SCALE drawing**..**		<u>INTERPERSONAL</u>

K185		**so we use what**? a scale drawing**..**		DEMANDING INFORMATION [4] - 'and the total was what was' [K193] ('individual response') [7]
K186		**I** # **use** scale drawing**..**SCALE drawing, **and what?** SCALE drawing, **and what? and? measurement**	EXPERIENTIAL	EXPERIENTIAL
K187		**now** [unclear]	PROCESSES - '**remember**' [K189] (Pr: cognition) - '**we did it**' [K190] (Pr: material) - '**we measured what**?' [K191] (Pr: behavioural)	KEY LEXICAL ITEMS - 'eighty millimeters' [K192]; 'sixty millimeters' [K192]; 'total' [K193]
K188		**and measurement**		
K189		**remember** #		
K190		**we** # **did it**	LOGICAL	LOGICAL
K191		**we** # **measured what**?	CONJUNCTION 1) external conjunction: - '**so**' [K185] (conjunction type: 'consequence'; 'cause') [6] - '**and**' [K186]; '**and**' [K186]; '**and**' [K186]; '**and**' [K188] (conjunction type: 'addition'; 'addition') [6]	CONJUNCTION 1) external conjunction: - 'and' [K192]; 'and' [K193] (conjunction type: 'addition'; 'addition') [6]
K192		EIGHTY,**..**millimeters and? right plus what? plus?**..**SIXTY, millimeters		
K193		and the TOTAL # was what? was?	TEXTUAL CONJUNCTION 1) internal conjunction: - '**now**' [K187] (conjunction type: 'addition'; 'staging'; 'framing') [6]	

K194	**L**	one hundred and fourty		EXPERIENTIAL KEY LEXICAL ITEMS - 'one hundred and fourty' [K194]
K195 **K196** **K197**	**T**	was one hundred and fourty, millimeters which was equal to [code-switches] to fourteen?		INTERPERSONAL DEMANDING INFORMATION [4] - 'to fourteen' [K197] ('whole class prompted cloze chorus') [7] EXPERIENTIAL KEY LEXICAL ITEMS - 'one hundred and fourty millimeters' [K195]; 'fourteen' [K197]
K198	**Ls**	kilometers		EXPERIENTIAL KEY LEXICAL ITEMS - 'kilometers' [K198]
K199 **K200** **K201**	**T**	kilometers east and THIS # was equal to, SIX kilometers**..**east and THIS # was equal to, EIGHT kilometers**..**east	EXPERIENTIAL PROCESSES - '**that's how we did it**' [K202] (Pr: material)	EXPERIENTIAL KEY LEXICAL ITEMS - 'six kilometers east' [K200]; 'eight kilometers east' [K201] LOGICAL

K202		[chalkboard (10)] **that # ’s how we did it**	 <u>TEXTUAL</u> REFERENCE 1) first person pl. - ‘**that’s how <u>we</u> did it**’ [K202]	CONJUNCTION 1) external conjunction: - ‘and’ [K200]; ‘and’ [K201] <u>TEXTUAL</u> REFERENCE 1) exophoric reference: - ‘and <u>this</u> was equal to six kilometers east’ [K200] - ‘and <u>this</u> was equal to eight kilometers east’ [K201]

TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Bloor and Bloor, 2004
- TEXT 2: Christie, 2002
- TEXT 3: Eggins, 1994
- TEXT 4: Halliday, 1994
- TEXT 5: Lemke, 1993
- TEXT 6: Martin and Rose, 2003
- TEXT 7: Probyn, 2004
- The teacher's notes; handouts; the learners' notebooks and the textbook(s) used by the teacher and learners

HETEROGLOSSIA (INTERPERSONAL)	Projection; Modality; Concession
TAXANOMIC RELATIONS (EXPERIENTIAL)	Class to member; Wholes to parts; Equivalence and Contrast
THEME (TEXTUAL)	The Theme-Rheme boundary is shown by #. [4]
PERIODICITY AND SERIAL EXPANSION (TEXTUAL)	macro-/ hyperTheme; macro-/ hyperNew; Metadiscourse; Headings

		PEDAGOGIC DISCOURSE	REGULATIVE REGISTER METAFUNCTIONS	INSTRUCTIONAL REGISTER METAFUNCTIONS
L1	**T**	**RIGHT the LAST thing we are going to TALK about..**in the MECHANICS section **#...**	INTERPERSONAL POSITIVE POLARITY	INTERPERSONAL SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'did you?' [L5] ('whole class chorus 'yes'/ 'no'') [7]
L2		(it's getting quite hot in here today) [the teacher takes off her jacket]	MODAL ADJUNCT -'**hopefully last year you learnt** several different forms of energy' [L4] (Comment Adjunct)	
L3		**RIGHT the LAST little bit that we do** in the mechanics section **#...is a little bit MORE than you did last year about..**ENERGY**…**	EXPERIENTIAL PROCESSES - '**we are going to talk about**' (Pr: behavioural) [L1]	EXPERIENTIAL KEY LEXICAL ITEMS - 'mechanics' [L1]; 'energy' [L3]
L4		**HOPEFULLY LAST YEAR # ..YOU learnt..**SEVERAL different FORMS of ENERGY**..**	- '**is**' (Pr: identifying) [L3] - '**the last little bit that we do**' (Pr: material) [L3]	
L5		DID you?	TEXTUAL CONJUNCTION 1) circumstances: - '**last year**'[L3]; '**last year**' [L4] 2) internal conjunction: - '**right**' [L1]; '**right**' [L3]	

			(conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) first person pl. - '**the last thing <u>we</u> are going to talk about'** [L1] 2) second person pl. - '**hopefully last year <u>you</u> learnt** several different forms of energy did <u>you</u>?' [L4; L5] 3) comparative: - '**right the <u>last</u> thing we are going to talk about** in the mechanics section' [L1] - '**right the <u>last</u> little bit that we do** in the mechanics section **is <u>a little bit more</u> than you did last year about energy**' [L3] **-** '**hopefully <u>last</u> year you learnt** several different forms of energy' [L4]	
L6	**Ls**	yes		
L7 **L8**	**T**	**maybe not LAST year..** **maybe..GRADE 8**	<u>INTERPERSONAL</u> MODALIZATION - '**<u>maybe</u> not last year**' [L7] (Modal Adjunct) - '**<u>maybe</u> grade 8**' [L8] (Modal	

			Adjunct) TEXTUAL CONJUNCTION 1) circumstances: - '**last year**'[L7]; '**grade 8**' [L8] REFERENCE 1) comparative: - '**maybe not <u>last</u> year**' [L7]	
L9	**Ls**	yes [a number of the learners talk at the same time]		
L10 **L11** **L12** **L13** **L14**	**T**	**<u>okay</u>..grade 7 8 9…** **it # doesn't MATTER…** the different FORMS of energy**..**things**..**like**..**>HEAT energy, <u>and</u> SOUND energy, <u>and</u> LIGHT energy, <u>and</u> ELECTRICAL energy<**..**CHEMICAL energy**…** **<u>RIGHT</u> the TWO we are going to talk about [is] #..** <**<u>cause</u> this # is** a mechanics **section>..**	<u>INTERPERSONAL</u> SPEECH FUNCTION COMMAND (expressed by the non-typical clause Mood declarative) - '**now remember you are doing your own notes for your own sakes**' [L18; L19] (=take notes) - '**so subheading would be energy**' [L20] (=write the subheading energy) - '**remember some of you put your notes into rough and then put them into neat**' [L22-L24]; '**others**	<u>INTERPERSONAL</u> SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - '**right can anybody remember another similar name for** potential energy?' [L34] ('individual response') [7]

			of you go straight into neat' [L25]; '**it's up to you**' [L26] (=write neat notes)	
L15		**the TWO we are going to talk about #..is** POTENTIAL energy**..and** KINETIC energy	APPRAISAL	
L16		**RIGHT..NOW..let's # be MORE specific..**	1.1) attitude (appreciation): - '**remember some of you put your notes into rough**' [L22; L23]	
L17		**we # are going to talk about..<**gravitational potential energy>	- '**and then put them into…neat**' [L24]	
L18		**now remember #**	MODALIZATION - '**so subheading would be** energy' [L20] (finite: modal) [3] (degree of modalization: median) [4]	
L19		**you # are doing your OWN notes**, **for your OWN sakes**,**..**	- '**right can anybody remember another similar name for** potential energy' [L34] (finite: modal) [3] (degree of modalization: low) [4]	
L20		**so..SUBHEADING # would be** ENERGY,		
L21		**and then we # are going to talk about** gravitational POTENTIAL energy**…**	NEGATION [6] - '**it doesn't matter**' [L11]	
L22		**REMEMBER #**	- '**that's not a problem**' [L29]	
L23		**some of you # put your notes into ROUGH**	CONTINUATIVES [6] - '**they know it already**' [L28] - '**if you know it already**' [L30]	
L24		**and then # put them into no- NEAT..**		
L25		**others of you # go straight into neat**,**..**	EXPERIENTIAL PROCESSES	EXPERIENTIAL KEY LEXICAL ITEMS

L26		**it # ’s up to YOU…**	- ‘**we are going to talk about**’ [L15] (Pr: behavioural)	- ‘heat energy’ [L12]; ‘sound energy’ [L12]; ‘light energy’ [L12]; ‘electrical energy’ [L12]; ‘chemical energy’ [L12]; ‘potential energy’ [L12]; ‘kinetic energy’ [L12]; ‘gravitational potential energy’ [L17]
L27		>**some people # write NOTHING**,	- ‘**we are going to talk about**’ [L17] (Pr: behavioural)	
L28		**they # KNOW it already**	- ‘**some people write nothing**’ [L27] (Pr: behavioural)	
L29		**that # ’s NOT a problem**	- ‘**you are learning to keep notes**’ [L32; L33] (Pr: behavioural)	
L30		**if YOU # know it already**	EQUIVALENCE AND CONTRAST	
L31		**they # ’re YOUR notes**	- ‘**they know it already**’ [L28]; ‘**you know it already**’ [L30] (parallel environments) [5]	
L32		**you # are learning to keep NOTES**<		
L33		**ONE of your skills…**	LOGICAL	LOGICAL
L34		**RIGHT can anybody # remember another similar NAME for** potential energy?	CONJUNCTION 1) external conjunction**:** **-** ‘[be]**cause**’ [L14] (conjunction type: ‘consequence’; ‘cause’) [6] - ‘**so**’ [L20] (conjunction type: ‘consequence’; ‘cause’) [6] - ‘**and**’ [L21]; ‘**and**’ [L24] (conjunction type: ‘addition’; ‘addition’) [6] - ‘**then**’ [L21]; ‘**then**’ [L24] (conjunction type: ‘time’; ‘successive’) [6] - ‘**if**’ [L30] (conjunction type: ‘consequence’; ‘condition’) [6]	CONJUNCTION 1) external conjunction: - ‘and’ [L17]; ‘and’ [L17]; ‘and’ [L17] (conjunction type: ‘addition’; ‘addition’) [6]

			TEXTUAL CONJUNCTION 1) circumstances: - '**grade 7**' [L10]; '[grade] **8**' [L10]; '[grade] **9**' [L10] 2) internal conjunction: - '**okay**' [L10]; '**right**' [L13]; '**right**'[L16]; '**now**' [L16]; '**now**' [L18]; '**right**' [L35] (conjunction type: addition; staging; framing) [6] REFERENCE 1) second person pl. - '**you are doing your own notes for your own sakes**' [L19] - '**remember some of you put your notes into rough and then put them into neat**' [L22-L24] - '**others of you go straight into neat**' [L25] - '**it's up to you**' [L26] - '**that's not a problem if you know it already**' [L29; L30] - '**you are learning to keep notes one of your skills**' [L32-L33] 2) possessive: - '**you are doing your own notes for your own sakes**' [L19] - '**remember some of you put your**	

			notes into rough and then put them into neat' [L22-L24] - '**they're <u>your</u> notes**' [L31] - '**you are learning to keep notes one of <u>your</u> skills**' [L32-L33] 3) comparative: - '**right can anybody remember <u>another</u> similar name for** potential energy' [L34] - '**remember <u>some</u> of you put your notes into rough**' [L22; L23] - '**<u>some</u> people write nothing**' [L27] REPETITION - '**notes**' [L19]; '**notes**' [L23]; '**notes**' [L31]; '**notes**' [L32] (lexical cohesion, repetition) [1] - '**your own notes**' [L19]; '**your own sakes**' [L19] METADISCOURSE - '**so <u>subheading</u> would be** energy' [L20] - '**and then we are going to talk about** gravitational potential energy [<u>heading</u>] ' [L21] - '**right can anybody remember another similar <u>name</u>** for potential energy' [L34]	
L35	**L**	still energy		<u>EXPERIENTIAL</u>

				LEARNER'S RESPONSE - 'still energy' [L35]
L36	**T**	**say # that loudly**?		
L37	**L**	still energy		
L38 **L39** **L40**	**T**	not still it # begins with an s though s t?**..**		INTERPERSONAL CONCESSION [6] - 'though' [L39] (conjunction type: 'consequence'; 'cause'; 'concessive') [6]
L41	**Ls**	stored energy [a couple of learners call out 'stored energy']		
L42	**T**	STORED energy		EXPERIENTIAL KEY LEXICAL ITEMS -'stored energy' [L42]
L43	**L**	oh yes		
L44	**T**	**RIGHT..NOW..**you # CAN get STORED in TERMS of things like**..**a SPRING	INTERPERSONAL	INTERPERSONAL

L45 **L46** **L47**		**all of you # think of** a spring**…** <u>WHEN</u> a SPRING # is PUSHED in TIGHT**…** IT # ’s got the potential**..**TO?	SPEECH FUNCTION COMMAND (expressed by the typical clause Mood imperative) - ‘**<u>all of you</u> <u>think</u> of** a spring’ [L45] (‘an imperative consisting of a MOOD element of subject only’) [3] <u>EXPERIENTIAL</u> PROCESSES - ‘**all of you <u>think of</u>** a spring’ [L45] (Pr: cognition) <u>TEXTUAL</u> CONJUNCTION 1) internal conjunction: - ‘**right**’ [L44]; ‘**now**’ [L44] (conjunction type: addition; staging;	DEMANDING INFORMATION [4] - ‘it’s got the potential to’ [L47] (‘whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence’) [7] MODALIZATION - ‘right now you <u>can</u> get stored in terms of things like a spring’ [L44] (finite: modal) [3] (degree of modalization: low) [4] <u>EXPERIENTIAL</u> KEY LEXICAL - ‘spring’ [L44]; ‘potential’ [L47] <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - ‘when’ [L46] (conjunction type: ‘time’; ‘simultaneous’) [6]

			framing) [6]	
L48	**Ls**	expand [a couple of learners call out 'expand'**]**		
L49 **L50** **L51** **L52** **L53** **L54** **L55** **L56** **L57** **L58**	**T**	**..**expand and # spring out hasn't it **RIGHT..YOU LOT # have ALL got the** POTENTIAL**..to pass matric..to develop your GREY cells..to do well..in LIFE** **you # 've all got the** potential**…** **it # doesn't mean you're all going to**,**..** **that # 's UP to EACH and every ONE of you**,**..** **hopefully each and every one of you # ARE going to**,**..** **BUT you # 've GOT the** POTENTIAL**..** **right..NOW..**<GRAVITATIONAL potential energy>**..**	INTERPERSONAL MODAL ADJUNCT - '**hopefully each and every one of you are going to**' [L56] (Comment Adjunct) MODALIZATION - '**so like** the energy in a spring **wouldn't come under** gravitational potential energy' [L60] (finite: modal) [3] (degree of modalization: median) [4] - '**sometimes you may have used that word** energy due to position' [L63] (Modal Adjunct) - '**sometimes you may have used that word** energy due to position' [L63] (finite: modal) [3] (degree of modalization: low) [4] MODULATION - '**you can define it as** energy due to height specifically' [L59] (finite: modulated) [3] (degree of	INTERPERSONAL SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'okay here's her eraser is it moving?' [L67; L68] ('whole class chorus 'yes'/ 'no') [7] MONOGLOSSSIA - 'okay gravitational potential energy is energy due to height' [L61]

L59		**you # can define it as <**ENERGY due to HEIGHT> specifically	modulation: low) [4]	
L60		**so like** the energy in a SPRING # **..wouldn't come under** <GRAVITATIONAL potential energy>**..**	NEGATION [6] - '**it doesn't mean you're all going to**' [L54]	
L61		**okay** gravitational potential energy # is <ENERGY due to HEIGHT>**…**	CONCESSION [6] - '**but**' [L57] (conjunction type: 'consequence'; 'cause'; 'concessive') [6]	
L62		**the other way of talking of** potential energy **when you were in grade 9 # is…**position	MONOGLOSSIA [6] - '**it doesn't mean that you're all going to**' [L54]	
L63		º**sometimes you # may have used that word** energy due to positionº**..**	COLLOQUIAL/ INFORMAL ENGLISH	
L64		**but what we're going to think of THIS year # is** ENERGY due to HEIGHT**..**	- '**so like** the energy in a spring **wouldn't come under** gravitational potential energy okay?' [L60] (colloquial English)	
L65		**CAUSE it # 's GOT the** GRAVITY **bit in…**	-'**but what we're going to think of this year is** energy due to height cause it's got the gravity bit in' [L64; L65] (informal English; colloquial English)	
L66		um**..**WHERE # 's that?		
L67		**OKAY..**here # 's her ERASER**…**		
L68		is it # MOVING?	EXPERIENTIAL PROCESSES - '**the other way of talking of**'	EXPERIENTIAL KEY LEXICAL ITEMS - 'position' [L62]; 'height' [L59];

			[L62] (Pr: behavioural) - '**we're going to <u>think</u> of**' [L64] (Pr: cognition) EQUIVALENCE AND CONTRAST - '**to pass matric**' [L52]; '**to develop your grey cells**' [L52]; '**to do well in life**' [L52] (parallel environments) [5] LOGOGENESIS - '**the other way of talking of** potential energy **<u>when you were in grade 9</u> is** position' [L62] <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - '**and**' [L55]; '**and**' [L56] (conjunction type: 'addition'; 'addition') [6] - '**so**' [L60] (conjunction type: 'consequence'; 'cause') [6] - '**when**' [L62] (conjunction type: 'time'; 'simultaneous') [6] - '**but**' [L64] (conjunction type: 'comparison'; 'contrast') [6] - '[be]**cause**' [L65] (conjunction type: 'consequence'; 'cause') [6]	'gravity' [L65]; 'eraser' [L67] <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - 'and' [L50] (conjunction type: 'addition'; 'addition') [6] - 'due to' [L61] (conjunction type: 'consequence'; 'cause') [6]

			TEXTUAL CONJUNCTION 1) circumstances: - '**grade 9**' [L62]; '**this year**' [L64] 2) internal conjunction: **-** '**right**' [L52]; '**right**' [L58]; '**now**' [L58]; '**okay**' [L61]; '**okay**'[L67] (conjunction type: addition; staging; framing) [6] REFERENCE 1) second person pl. - '**right <u>you</u> lot have all got the** potential' [L52] - '**<u>you</u>'ve got the** potential' [L53] - '**it doesn't mean <u>you</u>'re all going to**' [L54] - '**that's up to each and everyone of <u>you</u>**' [L55] - '**hopefully each and everyone of <u>you</u> are going to**' [L56] - '**but <u>you</u>'ve got the** potential' [L57] 2) comparative: - '**the <u>other</u> way of talking of** potential energy **when you were in grade 9** is position' [L62] REPETITION - '**you lot have all got the potential**'	TEXTUAL REFERENCE 1) exophoric: - 'okay here's <u>her</u> eraser' [L67]

			[L52]; '**you've all got the potential**' [L53]; '**you've got the potential**' [L57] - '**each and every one of you**' [L55]; '**each and every one of you**' [L56] METADISCOURSE - '**you can define it as** energy due to height specifically' [L59] - '**the other way of talking of** potential energy **when you were in grade 9 is** position' [L62] - '**sometimes you may have used that <u>word</u>** energy due to position' [L63]	
L69	**Ls**	no		
L70	**T**	what # sort of ENERGY did it have up there?		<u>INTERPERSONAL</u> SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'what sort of energy did it have up there?' [L70] ('whole class response unprompted – one word answer to real question from teacher') [7]
L71	**Ls**	potential energy		

L72	**T**	GRAVITATIONAL potential energy		
L73	**Ls**	oh		
L74 **L75** **L76** **L77**	**T**	**<u>okay</u>..you # can <u>just</u> call it** potential energy **<u>but</u>..bear # in the back of your minds** **that it # 's** GRAVITATIONAL potential energy**..**<ENERGY due to HEIGHT>**..** <u>SO</u> IT# 's GOT the POTENTIAL to do WHAT?	<u>INTERPERSONAL</u> MODULATION - '**okay you <u>can</u> just call it** potential energy **but bear in the back of your minds that it's** gravitational potential energy energy due to height' [L74-L76] (finite: modulated) [3] (degree of modulation: low) [4] CONCESSION [6] - '**but**' [L75] (conjunction type: 'consequence'; 'cause'; 'concessive') [6] CONTINUATIVES [6] - '**okay you can <u>just</u> call it** potential energy' [L74] <u>EXPERIENTIAL</u> PROCESSES - '**you can just <u>call</u> it**' [L74] (Pr: behavioural) - '**but bear in the back of your**	<u>INTERPERSONAL</u> SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'so it's got the potential to do what?' [L77] ('whole class response unprompted') [7]

			minds that it's [know] gravitational potential energy' (Pr: cognition) [L75; L76] TEXTUAL CONJUNCTION 1) internal conjunction: - '**okay**' [L74] (conjunction type: addition; staging; framing) [6] REFERENCE: 1) reference: - '**okay you can just call it** potential energy' [L74] METADISCOURSE - '**okay you can just call it** potential energy' [L74]	LOGICAL CONJUNCTION 1) external conjunction: - 'so' [L77] (conjunction type: 'consequence'; 'cause') [6]
L78	**Ls**	to fall down		
L79	**T**	ºto fall downº**..**		INTERPERSONAL

L80		**alright** WATER # at the TOP of a WATERFALL**…**HAS?	TEXTUAL CONJUNCTION 1) internal conjunction: - '**alright**' [L80] (conjunction type: addition; staging; framing) [6]	DEMANDING INFORMATION [4] - 'water at the top of a waterfall has' [L80] ('whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence') [7] EXPERIENTIAL KEY LEXICAL ITEMS 'water' [L80]; 'waterfall' [L80]
L81	**Ls**	(gravitational) potential energy		
L82 **L83** **L84** **L85** **L86**	**T**	potential energy**..**gravitiational potential energy **alright..**ANYTHING that is at a HEIGHT**..**compared to something else # **..** **alright**? has got potential energy **okay..NOW what about the second one**		INTERPERSONAL SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'kinetic energy is what sort of energy?' [L87] ('whole class response unprompted') [7] MONOGLOSSIA - 'kinetic energy is energy due to

L87		**we're going to [unclear] which is** <KINETIC energy>**…** kinetic energy # is what sort of energy?	TEXTUAL CONJUNCTION 1) internal conjunction: '**okay**' [L86]; '**now**' [L86]; '**alright**' [L83] (conjunction type: addition; staging; framing) [6] REFERENCE 1) comparative: - '**okay now what about the <u>second</u> one we're going to [unclear] which is** kinetic energy' [L86]	movement' [L87-L89] <u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'kinetic energy' [L86]
L88	**Ls**	[unclear]		
L89 **L90** **L91** **L92**	**T**	<ENERGY due to MOVEMENT> **<u>right</u>** <u>as soon as</u> there # 's MOVEMENT there # is KINETIC energy**…** <u>AND</u> <u>then</u> TOGETHER # what are gravitational potential energy <u>and</u> kinetic		<u>INTERPERSONAL</u> SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'and then together what are gravitational potential energy and kinetic energy called?' [L92] ('whole

		energy called?	TEXTUAL CONJUNCTION 1) internal conjunction: **-** '**right**' [L90] (conjunction type: addition; staging; framing) [6]	class response unprompted') [7] LOGICAL CONJUNCTION 1) external conjunction: - 'as soon as' [L90] (conjunction type: 'time'; 'simultaneous') [6] - 'and' [L92]; 'and' [L92] (conjunction type: 'addition'; 'addition') [6] - 'then' [L92] (conjunction type: 'time'; 'successive') [6]
L93	**Ls**	(yoh**..**gravitational potential kinetic energy) [a number of the learners attempt to come up with names]		
L94 **L95**	**T**	**some strange names coming out of here today…** <KINETIC energy**..**and POTENTIAL	INTERPERSONAL SPEECH FUNCTION COMMAND (expressed by the	INTERPERSONAL DEMANDING INFORMATION [4] - 'and it's going to' [L97]

		energy # together**…**make MECHANICAL energy>**…** [chalkboard (4)]	typical clause Mood imperative) - '**right <u>let's</u> <u>think</u> again about** the water at the top of a waterfall' [L96] ('an imperative consisting of a MOOD element of subject only') [3]	- 'you can't lose or gain energy it gets' [L98-L100] ('whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence') [7]
L96		**<u>RIGHT</u> let's # think AGAIN..about** the WATER at the top of a WATERFALL**..**	APPRAISAL 1.1) attitude (appreciation):	
L97		<u>and</u> it # 's going to?**..**FALL down**…**	- '**some <u>strange</u> names coming out of here today**' [L94]	
L98		you # can't LOSE	1.2) graduation (quantity): - '**<u>some</u> strange names coming out of here today**' [L94]	
L99		<u>or</u> # gain energy		
L100		it # gets?	<u>EXPERIENTIAL</u> PROCESSES - '**let's <u>think</u> again**' [L96] (Pr: cognition)	<u>LOGICAL</u> CONJUNCTION 1) external conjunction: - 'and' [L95]; 'and' [L97] (conjunction type: 'addition'; 'addition') [6] - 'or' [L99] (conjunction type: 'addition'; 'alternation') [6]
			<u>TEXTUAL</u>	

			CONJUNCTION 1) circumstances: - '**today**' [L94] 2) internal conjunction: '**right**' [L96] (conjunction type: addition; staging; framing) [6] REFERENCE 1) anaphoric: - '**right let's think again about** <u>the</u> water at the top of a waterfall' [L96] METADISCOURSE - '**some strange <u>names</u> coming out of here today**' [L94]	
L101	**Ls**	Transferred		
L102 **L103** **L104** **L105** **L106**	**T**	TRANSFERRED, >**some books # say** TRANSFORMED, **some books # say** CHANGED **I # don't mind which WORD you USE<…** it # can get CHANGED from ONE form,**..**to ANOTHER**…**	<u>INTERPERSONAL</u> NEGATION [6] - '**I don't mind which word you use**' [L105]	<u>INTERPERSONAL</u> DEMANDING INFORMATION [4] - 'it started with' [L108] - 'what in the end changed into' [L109] ('whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence') [7] <u>EXPERIENTIAL</u>

L107 **L108** **L109**		SO..for the WATER for the WATERFALL or her ERASER… it # STARTED with?.. potential energy what in the end changed into?	TEXTUAL REFERENCE 1) first person sg. - '**I don't mind which word you use**' [L105] 2) reference: -'**some books say** transformed' [L103] -'**some books say** changed' [L104] METADISCOURSE - '**I don't mind which word you use**' [L105]	PROCESSES - 'transferred' [L102]; 'transformed' [L103]; 'changed' [L104] (Pr: intensive) LOGICAL CONJUNCTION 1) external conjunction: - 'so' [L107] (conjunction type: 'consequence'; 'cause') [6] -'or' [L107] (conjunction type: 'addition'; 'alternation') [6] TEXTUAL REFERENCE 1) comparative: - 'it can get changed from one form to another' [L106]
L110	**Ls**	kinetic energy		

L111	**T**	KINETIC energy	INTERPERSONAL	INTERPERSONAL
L112		it # GOT**..**FASTER	SPEECH FUNCTION COMMAND (expressed by the typical clause Mood imperative) - '**let's think about** the mechanical energy at the top' [L119] ('an imperative consisting of a MOOD element of subject only') [3]	SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'kinetic or potential?' [L120; L122] ('whole class response unprompted – one word answer to real question from teacher') [7]
L113		and # FASTER		
L114		as it # went**..**down**..**		
L115		**okay..**there # was MOVEMENT		
L116		and there # was more	EXPERIENTIAL	
L117		and # MORE**..**movement**..**	PROCESSES - '**let's think about**' [L119] (Pr: cognition)	
L118		**alright..**MECHANICAL energy**..**at the TOP**..**		
				LOGICAL
L119		º**let's # think about** the mechanical energy at the TOPº**..**		CONJUNCTION 1) external conjunction: - 'and' [L113]; 'and' [L114]; 'and' [L115] (conjunction type: 'addition'; 'addition') [6] - 'as' [L114] (conjunction type: 'time'; 'simultaneous') [6] - 'or' [L122] (conjunction type: 'addition'; 'alternation') [6]
L120		was it # [unclear]		
L121		KINETIC		
L122		or # POTENTIAL?		
			TEXTUAL	TEXTUAL
			CONJUNCTION	REFERENCE

			1) internal conjunction: - '**okay**' [L115]; '**alright**' [L118] (conjunction type: addition; staging; framing) [6]	1) comparative: - 'and there was <u>more</u> and <u>more</u> movement' [L116; L117]
L123	**Ls**	potential		
L124 **L125** **L126** **L127** **L128**	**T**	the TOP °**don't put** your eraser **away** **we # 're using** this eraser° **<u>ALRIGHT</u>** at the TOP HERE is it # MOVING?	<u>TEXTUAL</u> CONJUNCTION 1) internal conjunction: - '**alright**' [L127] (conjunction type: addition; staging; framing) [6] REFERENCE 1) exophoric reference: - '**don't put <u>your</u>** eraser **away we're using <u>this</u>** eraser' [L125; L126]	<u>INTERPERSONAL</u> SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'alright at the top here is it moving?' [L127; L128] ('whole class chorus 'yes'/ 'no'') [7]
L129	**Ls**	no		

L130	**T**	so the mechanical energy # is ALL potential**..**		INTERPERSONAL DEMANDING INFORMATION [4] - 'and half will be' [L134] ('whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence') [7]
L131		HALFWAY DOWN**..**		
L132		so it # 's going from THERE to the DESK**..**		
L133		HALFWAY DOWN # **..**HALF will be kinetic**..**		MODALIZATION - 'halfway down half will be kinetic' [L133] (finite: modal) [3] (degree of modalization: median) [4] - 'and half will be potential' [L134; L135] (finite: modal) [3] (degree of modalization: median) [4]
L134		and # HALF will be?**..**		LOGICAL CONJUNCTION 1) external conjunction: - 'so' [L130]; 'so' [L132] (conjunction type: 'consequence'; 'cause') [6] - 'and'[L134] (conjunction type: 'addition'; 'addition') [6] TEXTUAL REFERENCE 1) exophoric reference: - 'so it's going from there to the

				desk' [L132] 2) comparative: - 'so the mechanical energy is <u>all</u> potential' [L130] - 'halfway down <u>half</u> will be kinetic' [L133] - 'and <u>half</u> will be' [L134] 3) location in space: - 'so it's going from <u>there</u> to the desk' [L132]
L135	**Ls**	<u>potential</u>		
L136 **L137** **L138** **L139**	**T**	<u>POTENTIAL</u> <u>and</u> at the BOTTOM # **..**now it's got NO potential it # 's not going to fall any further all the mechanical energy # is?		<u>INTERPERSONAL</u> DEMANDING INFORMATION [4] - 'all the mechanical energy is' [L139] ('whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence') [7] NEGATION [6] - 'it's not going to fall any further' [L138] <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - 'and' [L137] (conjunction type: 'addition'; 'addition') [6]

				TEXTUAL CONJUNCTION 1) circumstances: - 'now' [L137] REFERENCE 1) comparative: - 'all the mechanical energy is' [L139]
L140	**Ls**	kinetic energy [a couple of learners call out 'kinetic energy']		
L141 **L142** **L143** **L144** **L145**	**T**	KINETIC energy the table # is going to stop it**…** [the bell rings] **THINK # of EXAMPLES TONIGHT PLEASE**, **I # 'm going to ASK you for EXAMPLES TOMORROW**, **OFF you GO LADIES**	INTERPERSONAL SPEECH FUNCTION COMMAND (expressed by the typical clause Mood imperative) - '**think of examples tonight please**' [L143] ('an imperative consisting of only a RESIDUE') [3] EXPERIENTIAL PROCESSES - '**think of examples**' [L143] (Pr: cognition)	

			TEXTUAL CONJUNCTION 1) circumstances: - '**tonight**' [L143]; '**tomorrow**' [L144] REFERENCE 1) second person pl. - '**I'm going to ask <u>you</u> for examples tomorrow**' [L144]	TEXTUAL REFERENCE 1) exophoric: - '<u>the</u> table is going to stop it' [L142]

TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Bloor and Bloor, 2004
- TEXT 2: Christie, 2002
- TEXT 3: Eggins, 1994
- TEXT 4: Halliday, 1994
- TEXT 5: Lemke, 1993
- TEXT 6: Martin and Rose, 2003
- TEXT 7: Probyn, 2004
- The teacher's notes; handouts; the learners' notebooks and the textbook(s) used by the teacher and learners

HETEROGLOSSIA (INTERPERSONAL)	Projection; Modality; Concession
TAXANOMIC RELATIONS (EXPERIENTIAL)	Class to member; Wholes to parts; Equivalence and Contrast
THEME (TEXTUAL)	The Theme-Rheme boundary is shown by #. [4]
PERIODICITY AND SERIAL EXPANSION (TEXTUAL)	macro-/ hyperTheme; macro-/ hyperNew; Metadiscourse; Headings

		PEDAGOGIC DISCOURSE	REGULATIVE REGISTER METAFUNCTIONS	INSTRUCTIONAL REGISTER METAFUNCTIONS
M1	**T**	**alright..NOW..what we then did here..** # **was to find** the RESULTANT	INTERPERSONAL POSITIVE POLARITY	
M2		**NOW..now..**°**we** # **then..drew something like** that**…**	EXPERIENTIAL	EXPERIENTIAL
M3		**we** # **had something like** this°	KEY LEXICAL ITEMS - '**experiment**' [M5]	KEY LEXICAL ITEMS - 'resultant' [M1]
M4		[code-switches]	PROCESSES	
M5		**in our experiment**	- '**alright now what we then did here was to find** the resultant' [M1] (Pr: intensive)	
M6		[code-switches]	- '**now now we then drew something like** that' [M2] (Pr: behavioural)	
			- '**we had something like** this **in our experiment**' [M3; M5] (Pr: possession)	
			EQUIVALENCE AND CONTRAST - '**we then drew something like** that' [M2]; '**we had something like** this' [M3]	
			LOGICAL	

			CONJUNCTION 1) external conjunction: - '**then**' [M1]; '**then**' [M2] (conjunction type: 'time'; 'successive') [6] <u>TEXTUAL</u> CONJUNCTION 1) internal conjunction: - '**alright**' [M1]; '**now**' [M1]; '**now**'[M2]; '**now**' [M2] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) first person pl. - '**alright now what <u>we</u> then did here was to find** the resultant' [M1] - '**now now <u>we</u> then drew something like** that' [M2] 2) possessive: - '**we had something like** this **in <u>our</u> experiment**' [M3; M5] 3) location in space: - '**alright now what we then did <u>here</u> was to find** the resultant' [M1]	<u>TEXTUAL</u> REFERENCE 1) exophoric: - '**now now we then drew something like** <u>that</u>' [M2] - '**we had something like** <u>this</u>' [M3]
M7	**Ls**	yes		

M8	**T**	**right in our experiment** # [unclear] **we had something like** that[repetition1] **…**	INTERPERSONAL DEMANDING INFORMATION	
M9		°**we** # **had something like** that [repetition1] **…**	[4] - '**and we then wanted to find**	
M10		**we** # **had something like** that° [repetition1] **..**	**what**' [M20] - '**because you used what you used**	
M11		**then..you** # **made your experiment..**	**your** pair of what of **your your**	
M12		**and then you…** # **you said..**	**your** pair of what of' [M22] ('whole class prompted cloze chorus') [7]	
M13		there # 's a FORCE, this side	APPRAISAL 1.1) attitude (appreciation)	
M14		[there # is] a FORCE, this side	- '**and of course it** [the problem] **was quite easy**'	
M15		and [there # is] a force here	1.2) graduation (force; intensifiers) - '**and of course it** [the problem]	
M16		**I** # **'ve got** one NEWTON,	**was quite easy**'	
M17		zero point eight NEWTONS,	EXPERIENTIAL	EXPERIENTIAL
M18		zero point seven	PROCESSES - '**right in our experiment**	KEY LEXICAL ITEMS - 'force' [M13]; 'one newton'
M19		the POINT # is acting here	[unclear] **we had something like**	[M16]; 'zero point eight newtons'
M20		**and we** # **then wanted to find WHAT**? the RESULTANT of these two forces	that' [M8] (Pr: possession) - '**then you made your experiment**' [M11] (Pr: material)	[M17]; 'zero point seven [newtons]' [M18]; 'the point' [M19]; 'pair of compasses' (sic) [M22-M24]
M21		**and of course it** # **was quite EASY**	- '**and then you said**' [M12] (Pr: verbal)	
M22		**because you** # **used WHAT**?**..you used**	- '**and then we wanted to find what** the resultant of these two	

		your PAIR of WHAT? of your **your your** PAIR of WHAT? of?	forces' [M20] (Pr: affection) - '**and of course it <u>was</u> quite easy**' [M21] (Pr: intensive) - '**because you <u>used</u> what you used your** pair of what of **your your** your pair of what of compasses' [M22; M23] (Pr: material) <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - '**then**' [M11]; '**then**' [M12]; '**then**' [M20] (conjunction type: 'time'; 'successive') [6] - '**and**' [M12]; '**and**' [M20]; '**and**' [M21] (conjunction type: 'addition'; 'addition') [6] - '**because**' [M22] (conjunction type: 'consequence'; 'cause') [6] <u>TEXTUAL</u> CONJUNCTION 1) internal conjunction: - '**right**' [M8] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) reference: '**and then you <u>said</u>** there's a force	<u>TEXTUAL</u> REFERENCE 1) exophoric: - '**right in our experiment** [unclear] **we had something like <u>that</u>**' [M8]; '**we had something like <u>that</u>**' [M9]; '**we had something like <u>that</u>**' [M10]; 'there's a force <u>this</u> side' [M13]; 'a force <u>this</u> side'

			this side' [M12; M13] (Pr: verbal) REPETITION - '**we had something like** that' repetition1	[M14]; '**and then we wanted to find what** the resultant of <u>these</u> two forces' [M20] 2) location in space: - 'and a force <u>here</u>' [M15]; 'the point is acting <u>here</u>' [M19]
M23	**Ls**	compasses		<u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'compasses' [M23]
M24 **M25** **M26** **M27** **M28** **M29** **M30** **M31** **M32**	**T**	COMPASSES (sic)**.. to get** THAT **there**, **<u>and</u> of course again HERE**, **to get** it **THERE**, >**I** # **hope** **I** # **'ll be RIGHT here**<, **<u>then</u> we** # **joined** the TWO repetition2**…** **<u>then</u> we** # **JOINED** the two repetition2**..** >**I** # **'m lucky..** **not very**<**..** **we** # **JOINED** the two repetition2,	<u>INTERPERSONAL</u> SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - '**what do you find**?' [M44] DEMANDING INFORMATION [4] - '**you actually found that**? [M45; M46] APPRAISAL 1.1) judgement (social esteem; positive; normality) - '**I'm <u>lucky</u> not very**' [M30; M31] 1.2) graduation (force; intensifiers) - '**I'm lucky not <u>very</u>**' [M30; M31]	<u>INTERPERSONAL</u> DEMANDING INFORMATION [4] - 'its magnitude is equal to what' [M47] - 'its magnitude is equal to what' [M48] ('individual response') [7]

M33		**and we # found out**	NEGATION [6] - '**I'm lucky not very**' [M30; M31]	
M34		**that…**the resultant # is like that		
M35		°**and then I # asked you a few questions**	CONTINUATIVES [6] - '**and of course again here to get** it **there**' [M25]	
M36		so THIS # is the resultant of this force		
M37		and # this force**..**	EXPERIENTIAL KEY LEXICAL ITEMS	EXPERIENTIAL KEY LEXICAL ITEMS
M38		**mm**?**..**	- '**questions**' [M35]	- 'the diagonal of this rectangle' [M43]; 'magnitude' [M47]
M39		this # is the resultant	PROCESSES - '**to get** that **there**' [M24]; '**and of course again here to get it there**' [M25] (Pr: material) - '**I hope I'll be right here**' [M26; M27] (Pr: affection) - '**I hope I'll be right here**' [M26; M27] (Pr: intensive) - '**then we joined** the two' [M28] (Pr: material) - '**and then I asked you a few questions**' [M35] (Pr: verbal)	
M40		this line # is the resultant of these forces°		
M41		**now..**IF THIS**..sorry..**		
M42		if this**.. #** is the resul-		
M43		if this line**..**the DIAGONAL of this**..**RECTANGLE**.. #** is the RESULTANT of these two forces		
M44		**what** # **do you find**?	LOGICAL	LOGICAL
M45		**you** # **actually found**	CONJUNCTION	CONJUNCTION
M46		**that**?	1) external conjunction: - '**and**' [M25]; '**and**' [M35] (conjunction type: 'addition';	1) external conjunction: - 'so' [M36] (conjunction type: 'consequence'; 'cause') [6]
M47		its magnitude # is equal to what?		

		repetition3 **…**	‘addition’) [6] - ‘**then**’ [M28]; ‘**then**’ [M29]; ‘**then**’ [M35] (conjunction type: ‘time’; ‘successive’) [6]	- ‘and’ [M37] (conjunction type: ‘addition’; ‘addition’) [6] - ‘if’ [M41]; ‘if’ [M42]; ‘if’ [M43] (conjunction type: ‘consequence’; ‘condition’) [6]
M48		°its magnitude # is equal to what?° repetition3 **..** [chalkboard (4)]	TEXTUAL	TEXTUAL
M49		**yes boy**?	CONJUNCTION 1) internal conjunction: - ‘**now**’ [M41] (conjunction type: ‘addition’; ‘staging’; ‘framing’) [6] REFERENCE 1) first person sing. - ‘**I hope I’ll be right here**’ [M26; M27] - ‘**I’m lucky not very**’ [M30; M31] - ‘**and then I asked you a few questions**’ [M35] 2) reference: - ‘**yes boy**’ [M49] 3) location in space: - ‘**to get** that **there**’ [M24] - ‘**and of course again here to get** it **there**’ [M25] - ‘**I hope I’ll be right here**’ [M26; M27] REPETITION - ‘**then we joined** the two’ repetition2	REFERENCE 1) exophoric: - ‘**to get** that **there**’ [M24]; ‘**that** the resultant is like that’ [M34]; ‘so this is the resultant of this force and this force’ [M36; M37]; ‘this is the resultant’ [M39]; ‘this line is the resultant of these forces’ [M40]; ‘if this line the diagonal of this rectangle is the resultant of these two forces’ [M43] REPETITION - ‘its magnitude is equal to what’ repetition3

			METADISCOURSE - '**and then I asked you a few <u>questions</u>**' [M35]	
M50	**L**	to the one newton force acting downwards		
M51	**T**	to the one newton force acting DOWNWARDS	<u>INTERPERSONAL</u> CONTINUATIVES [6]	<u>INTERPERSONAL</u> SPEECH FUNCTION
M52		**we** # **found**	- '**that** this force here is <u>also</u> that force there' [M55]	QUESTION (expressed by typical clause Mood interrogative)
M53		**that** it # is almost EQUAL here		- 'which force balanced them?' (passive construction) [M63]
M54		>**we** # **found out**		('individual response') [7]
M55		**that** this force here # is also that force there<		NEGATION [6] -'they accelerated and needed a a force to balance those forces <u>not</u> to
M56		<u>so</u> the RESULTANT of these two forces**..**< # is one newton>		accelerate' [M60-M62]
M57		°<u>but</u>**..**these two forces**..**these two forces**..**of EIGHT and seven**.. #** were balanced by this force°**…**	<u>EXPERIENTIAL</u>	CONCESSION [6] - 'but' [M57] <u>EXPERIENTIAL</u>
M58		**remember** #	PROCESSES - '**<u>remember</u>** these two forces'	KEY LEXICAL ITEMS - 'to balance' [M61]; 'to accelerate'
M59		these two forces**..**	[M58; M59] (Pr: cognition)	[M62]

M60 **M61** **M62** **M63** **M64**		they # accelerated**..** and # needed a a force to BALANCE those forces not to ACCELERATE**…** °which # force balanced them?°**..** **yes**?		EQUIVALENCE AND CONTRAST - '**that** this force here is also that force there' [M55] LOGICAL CONJUNCTION 1) external conjunction: - 'so' [M56] (conjunction type: 'consequence'; 'cause') [6] - 'and' [M61] (conjunction type: 'addition'; 'addition') [6] TEXTUAL REFERENCE 1) exophoric: - '**we found out that** this force here is also that force there' [M54; M55]; 'so the resultant of these two forces is one newton' [M56]; 'but these two forces these two forces of eight and seven were balanced by this force' [M57]; 'these two forces they accelerated and needed a force to balance those forces' [M59-M61] 2) location in space: - '**we found that** it is almost equal here' [M52; M53] - '**we found out that** this force here

				is also that force <u>there</u>' [M54; M55]
M65	**L**	the one newton force		<u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'the one newton force' [M65]
M66 **M67** **M68**	**T**	the?**..**ONE newton force # **was used** to balance what?**..**the resul- sorry these two forces <u>but</u> these two forces # had a resultant**..**this way**..** <u>so</u> THIS force is a force that does what?**..**that balances what?	<u>EXPERIENTIAL</u> PROCESSES - 'the one newton force **<u>was used</u>** to balance what the resul- sorry these two forces' [M66] (Pr: material)	<u>INTERPERSONAL</u> DEMANDING INFORMATION [6] - 'so this force is a force that does what that balances what' [M68] (active construction) CONCESSION [6] - 'but' [M67] <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - 'so' [M68] (conjunction type: 'consequence'; 'cause') [6]

				TEXTUAL REFERENCE 1) exophoric: - 'the one newton force **was used** to balance what the resul- sorry <u>these</u> two forces' [M66]; 'but <u>these</u> two forces had a resultant this way' [M67]; 'so <u>this</u> force is a force that does what that balances what?' [M68]
M69	**L**	[unclear]		
M70 **M71** **M72** **M73** **M74** **M75** **M76**	**T**	no zero point eight and zero point seven # have a resultant of one newton**..** [code-switches] **<u>right</u> <u>now</u>..**these two forces **<u>when</u> we** # **did not have** this force downwards here this # ACCELERATED this way **we** # **<u>then</u> put in** another force here to do what?	<u>INTERPERSONAL</u> NEGATION [6] - '**when we <u>did not have</u>** this force downwards here this accelerated this way' [M74; M75] <u>EXPERIENTIAL</u> PROCESSES - '**we then <u>put in</u>** another force here to do what?' [M76] (Pr: material) <u>LOGICAL</u>	<u>INTERPERSONAL</u> DEMANDING INFORMATION [4] - '**we then put in** another force here to do what' [M76] ('individual response') [7]

			CONJUNCTION 1) external conjunction: - '**when**' [M74] (conjunction type: 'time'; 'simultaneous') [6] - '**then**' [M76] (conjunction type: 'time'; 'successive') [6] <u>TEXTUAL</u> CONJUNCTION 1) internal conjunction: - '**right**' [M73]; '**now**' [M73] (conjunction type: 'addition'; 'staging'; 'framing') [6]	<u>TEXTUAL</u> REFERENCE 1) exophoric: - '**right now** <u>these</u> two forces' [M73]; '**when we did not have** <u>this</u> force downwards here' [M74]; '<u>this</u> accelerated <u>this</u> way' [M75] 2) location in space: - '**when we did not have** this force downwards <u>here</u>' [M74]; '**we then put in** another force <u>here</u> to do what?' [M76] 3) comparative: - '**we then put in** <u>another</u> force here to do what?' [M76]
M77	**L**	to balance the two forces		
M78 **M79**	**T**	to BALANCE the two forces**..** <u>so</u> this # is a force that does what?**…**that?		<u>INTERPERSONAL</u> DEMANDING INFORMATION [4] - 'so this is a force that does what

				that' [M79] ('individual response') [7] <u>LOGICAL</u> CONJUNCTION 1) external conjunction: - 'so' [M79] (conjunction type: 'consequence'; 'cause') [6] <u>TEXTUAL</u> REFERENCE 1) exophoric: - 'so <u>this</u> force is a force that does what that' [M79]
M80	**L**	balances		
M81 **M82** **M83** **M84**	**T**	that BALANCES these two forces**..** [apparatus (1)] it # is a FORCE that BALANCES **we** # **actually put** a force **here** of what? of, of a hundred**..**grams equal**..**one newton [chalkboard (5)] <u>and</u> it # became		<u>INTERPERSONAL</u> DEMANDING INFORMATION [4] - '**we actually put** a force **here** of what of of a hundred grams equal one newton' [M83] - 'it actually made the resultant to do what it made the resultant do what' [M89; M90] ('individual response') [7]

M85		it	EXPERIENTIAL	EXPERIENTIAL
M86		the whole thing # shifted	PROCESSES - '**we actually <u>put</u>** a force **here** of what of of a hundred grams equal one newton' [M83] (Pr: material)	KEY LEXICAL ITEMS - 'to come to rest' [M88]
M87		<u>and</u> # became like this**..**		
M88		it it # made this thing to come**...**to rest**..** [chalkboard (3)]		LOGICAL
M89		it # actually made**..**the resultant**..**to do what? repetition4 **…**		CONJUNCTION 1) external conjunction: - 'and' [M84]; 'and' [M87] (conjunction type: 'addition'; 'addition') [6]
M90		it # made the resultant do what? repetition4		
M91		yes?	TEXTUAL REFERENCE 1) location in space: - '**we actually put** a force **<u>here</u>** of what of of a hundred grams equal one newton' [M83]	TEXTUAL REFERENCE 1) exophoric: - 'that balances <u>these</u> two forces' [M81]; 'the whole thing shifted and became like <u>this</u>' [M86; M87] REPETITION - 'it [actually] made the resultant to do what?' repetition4
M92	**L**	it # made it zero		EXPERIENTIAL

				KEY LEXICAL ITEMS - ‘zero’ [M92]
M93 **M94** **M95** **M96**	**T**	**I # agree** **you # are actually quite correct** once something # is at rest the resultant # is	EXPERIENTIAL PROCESSES - ‘**I <u>agree</u> you are actually quite correct**’ [M93; M94] - ‘**I agree you <u>are</u> actually quite correct**’ [M93; M94] (Pr: intensive) <u>TEXTUAL</u> REFERENCE 1) first person sing. - ‘<u>I</u> agree’ [M93]	<u>INTERPERSONAL</u> DEMANDING INFORMATION [4] - ‘once something is at rest the resultant is’ [M95; M96] (‘whole class prompted cloze chorus’) [7]
M97	**Ls**	<u>zero</u>		
M98 **M99**	**T**	<u>zero</u> the resultant force acting on that THING # is zero	<u>INTERPERSONAL</u> SPEECH FUNCTION COMMAND (expressed by non-	<u>INTERPERSONAL</u> DEMANDING INFORMATION [4]

M100 **M101** **M102** **M103**		**<u>NOW</u>**, **<u>NOW</u> ..°can you** # **give**,**..** **can you** # **define..**this force?**..** [apparatus (1)] the force acting downward**..** # is a force that does what?° [name]	typical clause Mood modulated interrogative) - '**now now can you give**' [M100] - '**can you define** this force?' [M101] MODULATION - '**now now <u>can</u> you give**' [M100]; '**<u>can</u> you define** this force?' [M101] (finite: modulated) [3] (degree of modulation: low) [4] <u>TEXTUAL</u> CONJUNCTION 1) internal conjunction: - '**now**' [M100]; '**now**' [M100] (conjunction type: 'addition'; 'staging'; 'framing') [6] REFERENCE 1) second person sing. - '**now now can <u>you</u> give**' [M100] - '**can <u>you</u> define** this force?' [M101] METADISCOURSE - '**can you <u>define</u>** this force?' [M101]	- 'the force acting downward is a force that does what' [M102] ('individual response') [7] <u>TEXTUAL</u> REFERENCE 1) exophoric: - 'the resultant force acting on <u>that</u> thing is zero' [M99] - '**can you define** <u>this</u> force?' [M101]

M104	**L**	that balances		
M105	**T**	that BALANCES?		INTERPERSONAL DEMANDING INFORMATION [4] - 'that balances' [M105] ('individual response') [7]
M106	**L**	all forces		
M107 **M108** **M109** **M110** **M111** **M112** **M113** **M114** **M115**	**T**	ALL forces acting at this point**..** **NOW we** # **THINK** there # is a point here [repetition5] **ne**?**..** **now we** # **think** you know there # is a point here [repetition5]**..** [code-switches] there # is a point here [repetition5] **and I** # **'ve got** two forces acting on this point	INTERPERSONAL SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'if this force was not there what would be **what do you think would actually happen**?' [M121-M125] ('individual response') [7] MODALIZATION - '**now we think** there is a point here **ne**?' [M108-M110]; '**now we think** you know there is a point here' [M111-M112]; 'if this force was not there what would be **what do you think would actually happen**?' [M125] (Modal Adjunct) (degree of	INTERPERSONAL MODALIZATION - 'if this force was not here…if this force was not here…what do you think would actually happen?' [M121-M125] NEGATION [6] - 'if this force was not here…if this force was not here…what do you think would actually happen?' [M121-M125]

			modalization: median)	
M116		**<u>but</u> now <u>suddenly</u> I # have now**	- 'if this force was not there what would be **what do you think <u>would</u> actually happen**?' [M125] (finite: modal) [3] (degree of modalization: median) [4]	
M117		[code-switches]		
M118		THIS force # balances the forces acting on that point	CONCESSION	
		[chalkboard (5)]	- '**but**' [M116]	
			- '**suddenly**' [M116]	
M119		WHY? <u>because</u> this force # ACTS in this direction	<u>LOGICAL</u>	<u>LOGICAL</u>
		[chalkboard(4)]	CONJUNCTION	CONJUNCTION
			1) external conjunction:	1) external conjunction:
M120		<u>and</u> this one # ACTS in that direction**…**	- '**and**' [M115] (conjunction type: 'addition'; 'addition') [6]	- 'because' [M119] (conjunction type: 'consequence'; 'cause') [6]
M121		<u>if</u> this force # was not here**..**		- 'and' [M120] (conjunction type: 'addition'; 'addition') [6]
M122		**sorry..**		- 'if' [M121]; 'if' [M123] (conjunction type: 'consequence'; 'condition') [6]
		[chalkboard(6)]		
M123		<u>if</u> this force # was not there**..**	<u>TEXTUAL</u>	<u>TEXTUAL</u>
M124		what # would be	CONJUNCTION	REFERENCE
			1) circumstances:	1) exophoric:
M125		**what # do you think would actually happen**?**…**	- '**but <u>now</u> suddenly I have <u>now</u>**' [M116]	- 'all forces acting at <u>this</u> point' [M107]; '**and I've got** two forces acting on <u>this</u> point' [M115]; '<u>this</u> force balances the forces acting on
			1) internal conjunction:	
M126		**yes**?	- '**now**' [M108]; '**now**' [M111]	

			(conjunction type: 'addition'; 'staging'; 'framing') [6] REPETITION - '[now we think] [you know] there is a point here' repetition5	that point' [M118]; 'why because this force acts in this direction' [M119]; 'and this one acts in that direction' [M120]; 'if this force was not here' [M121]; 'if this force was not here' [M123] 2) location in space: - 'there is a point here ne?' [M109; M110]; 'you know there is a point here' [M112]; 'there is a point here' [M114]; 'if this force was not here' [M121]; 'if this force was not there' [M123]
M127	**L**	the whole system # would collapse		INTERPERSONAL MODALIZATION - 'the whole system would collapse' [M127] (finite: modal) [3] (degree of modalization: median) [4] EXPERIENTIAL KEY LEXICAL ITEMS - 'whole system' [M127]; 'collapse' [M127]
M128 **M129**	**T**	>the WHOLE SYSTEM # would COLLAPSE< [code-switches]		INTERPERSONAL DEMANDING INFORMATION - 'so this force we found out it is

M130 **M131**		**right**..SO,SO, **t**his force # is a force**..**that BALANCES**..**that balances the two forces**..** °so**..**this force we found out it is equal to what?°	TEXTUAL CONJUNCTION 1) internal conjunction: - '**right**' [M130] (conjunction type: 'addition'; 'staging'; 'framing') [6]	equal to what' [M131] ('individual response') [7] MODALIZATION - 'the whole system would collapse' [M128] (finite: modal) [3] (degree of modalization: median) [4] LOGICAL CONJUNCTION 1) external conjunction: - 'so' [M130]; 'so' [M130]; 'so' [M131] (conjunction type: 'consequence'; 'cause') [6] TEXTUAL REFERENCE: 1) exophoric: - '**right** so so this force is a force that balances the two forces' [M130]; 'so this force we found out it is equal to what?' [M131]
M132	**L**	to the resultant		
M133 **M134**	**T**	to the resultant force so this force		INTERPERSONAL DEMANDING INFORMATION [4]

M135 **M136** **M137**		so a force**..**that BALANCES**..**OTHER FORCES [code-switches] a force**..**that BALANCES**..**OTHER FORCES**..** # MUST be equal to what?		- 'a force that balances other forces must be equal to what' [M137] ('whole class prompted cloze chorus') [7] MODALIZATION - 'a force that balances other forces must be equal to what to the resultant force' [M137; M138] (finite: modal) [3] (degree of modalization: high) [4] LOGICAL CONJUNCTION 1) external conjunction: - 'so' [M134]; 'so' [M135] (conjunction type: 'consequence'; 'cause') [6] TEXTUAL REFERENCE 1) exophoric: - 'so this force' [M134]
M138	**Ls**	to the resultant force		
M139 **M140**	**T**	>TO THE RESULTANT FORCE<**..** so here THIS FORCE**..** # BALANCES	INTERPERSONAL SPEECH FUNCTION	INTERPERSONAL DEMANDING INFORMATION

		the**..**the other**..**forces**..**	QUESTION (expressed by typical clause Mood interrogative)	[4] - '**now** these forces are' [M145]
M141		it # balances them repetition6**..**	- '**now we want to use a special name here to to to give** you know this force that balances you know other forces **who knows**?' [M146; M147]	CONCESSION - 'but' [M144]
M142		right?**..**		
M143		°it # balances them° repetition6**..**		
M144		<u>but</u> this force**.. #** is the resultant**..**	SPEECH FUNCTION COMMAND (expressed by non-typical clause Mood declarative)	
M145		**<u>now</u>..**these two forces # ARE? EQUAL	- '**let's now form a new word** you know for this force yes' [M157; M158] (=form a new word for this force) ('individual response') [7]	
		[chalkboard (4)]		
M146		**<u>now</u> we** # **want to use a SPECIAL name here to to to give** you know this force that balances you know other forces	APPRAISAL 1) attitude (appreciation):	
M147		>**who knows**<?**…**	- '**now we want to use a <u>special</u> name here to to to give** you know this force that balances you know other forces' [M146]	
M148		**am I** # **teaching three people here**? repetition7 **…**		
M149		**am I** # **teaching three people here**? repetition7	<u>EXPERIENTIAL</u>	
			PROCESSES	
M150		**it** # **'s very easy for me to say you know**	- '**now we <u>want</u> to use a special name here to to to give** you know this force that balances you know other forces' [M146] (Pr: affection)	
M151		**get out** #		
M152		**<u>and</u>** # **run back** (sic)	- '**who <u>knows</u>**' [M147] (Pr:	

			cognition)	
M153		[code- switches]	- '**am I <u>teaching</u> three people here**?' [M148] ; '**am I <u>teaching</u> three people here**?' [M149] (Pr: behavioural)	
M154		**yes**?		
M155		[code-switches]	- '**it's very easy for me <u>to say</u> you know get out and run back**' (sic) [M150-M152] (Pr: verbal)	
M156		**yes**?**..yes**?**..eh he..**THIS FORCE # is EQUAL to THIS FORCE	- '**it's very easy for me to say you know <u>get</u> out and <u>run</u> back**' (sic) [M150-M152] (Pr: material)	
M157		**let's** # **now form a NEW word..**you know for this force**…**	- '**let's now <u>form</u> a new word** you know for this force' [M157] (Pr: material)	
M158		yes?		
			<u>LOGICAL</u>	<u>LOGICAL</u>
			CONJUNCTION 1) external conjunction: - '**and**' [M152] (conjunction type: 'addition'; 'addition') [6]	CONJUNCTION 1) external conjunction: - 'so' [M140] (conjunction type: 'consequence'; 'cause') [6]
			<u>TEXTUAL</u>	<u>TEXTUAL</u>
			CONJUNCTION 1) '**let's <u>now</u> form a new word** you know for this force' [M157] 1) internal conjunction: '**now**'[M145]; '**now**' [M146] (conjunction type: 'addition'; 'staging'; 'framing') [6]	REFERENCE 1) exophoric: - 'so here <u>this</u> force balances the the other forces' [M140]; 'but <u>this</u> force is the resultant' [M144]; '**now we want to use a special name here to to to give** you know <u>this</u> force that

			REFERENCE 1) first person pl. - '**now <u>we</u> want to use a special name here to to to give** you know this force that balances you know other forces' [M146] 2) first person sing. - '**am <u>I</u> teaching three people here**?' [M148] - '**am <u>I</u> teaching three people here**?' [M149] - '**it's very easy for <u>me</u> to say you know get out and run back**' (sic) [M150-M152] 3) location in space: - '**now we want to use a special name <u>here</u> to to to give** you know this force that balances you know other forces' [M146] - '**am I teaching three people <u>here</u>**?' [M148] - '**am I teaching three people <u>here</u>**?' [M149] REPETITION - '**am I teaching three people here**?' repetition7 METADISCOURSE - '**now we want to use <u>a special</u>**	balances you know other forces' [M146]; 'yes yes eh he <u>this</u> force is equal to <u>this</u> force' [M156]; '**let's now form a new word** you know for <u>this</u> force' [M157] 2) location in space: - 'so <u>here</u> this force balances the the other forces' [M140] 3) comparative: - '**now we want to use a special name here to to to give** you know this force that balances you know <u>other</u> forces' [M146] REPETITION - 'it balances them' repetition6

			<u>name</u> here to to to give you know this force that balances you know other forces' [M146] - '**let's now form <u>a new word</u>** you know for this force' [M157]	
M159	**L**	equilibrant		<u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'equilibrant' [M159]
M160	**T**	it # 's the?		<u>INTERPERSONAL</u> DEMANDING INFORMATION [4] - 'it's the' [M160] ('individual response') [7]
M161	**L**	equilibrant		
M162 **M163** **M164** **M165**	**T**	the equilibrant **yes** <u>so</u>**..**this # is called**…**the equilibrant **..** [chalkboard (4)] it # is a force that BALANCES**..**other forces**..**		<u>INTERPERSONAL</u> DEMANDING INFORMATION [4] - '**what do** (sic) **we know** about a force that balances other forces is that [it] is equal to what' [M166-M168] ('whole class prompted cloze chorus') [7] <u>LOGICAL</u>

M166 **M167** **M168**		**what do** (sic) **we know** about a force that balances other forces # is that [code-switches] [it] # is equal to what?		CONJUNCTION 1) external conjunction: - 'so' [M164] (conjunction type: 'consequence'; 'cause') [6] <u>TEXTUAL</u> REFERENCE 1) exophoric: - 'so <u>this</u> is called the equilibrant' [M164] 2) comparative: - 'it is a force that balances <u>other</u> forces' [M165]; '**what do** (sic) **we know** about a force that balances <u>other</u> forces is that [it] is equal to what' [M166-M168]
M169	**Ls**	to the resultant		
M170 **M171** **M172** **M173**	**T**	to the RESULTANT of those two forces what # is the SECOND**..**condition**..**of the equilibrant? what # is the SECOND thing about you know about the equilibrant?**…** **eh**?		<u>INTERPERSONAL</u> SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - 'what is the second condition of the equilibrant?' [M171] - 'what is the second thing about you know about the equilibrant?' [M172]

M174 **M175** **M176** **M177**		one condition # is that the equilibrant # is always equal to the?**..**resultant force number two?**…** **[name]**?		SPEECH FUNCTION QUESTION - 'number two' [M176] (=what is number two?) ('individual extended response unassisted') [7] <u>EXPERIENTIAL</u> KEY LEXICAL ITEMS - 'second condition' [M171]; 'equal' [M175] <u>TEXTUAL</u> REFERENCE 1) exophoric: - 'to the resultant of <u>those</u> two forces' [M170] 2) comparative: - 'what is the <u>second</u> condition of the equilibrant?' [M171]; 'what is the <u>second</u> thing about you know about the equilibrant?' [M172]
M178	**L**	it # acts in the same straight line as the resultant		<u>TEXTUAL</u> REFERENCE 1) comparative: - 'it acts in the <u>same</u> straight line as

				the resultant' [M178]
M179 **M180** **M181**	**T**	it # ACTS in the SAME STRAIGHT LINE as the RESULTANT, **very good**, **yes**?	INTERPERSONAL APPRAISAL 1.1) attitude (appreciation – positive) - '**very good** [answer]' [M180] 1.2) graduation (force; intensifiers) - '**very good** [answer]' [M180]	INTERPERSONAL DEMANDING INFORMATION [4] - 'it acts in the same straight line as the resultant…yes' [M179-M181]
M182	**L**	but [it # acts] in the opposite direction		INTERPERSONAL CONCESSION - 'but' [M182] EXPERIENTIAL KEY LEXICAL ITEMS - 'opposite direction' [M182] TEXTUAL REFERENCE 1) comparative: - 'but in the opposite direction' [M182]
M183 **M184**	**T**	BUT [it # acts] in the opposite direction **very good boy**, **very good..**	INTERPERSONAL SPEECH FUNCTION	INTERPERSONAL CONCESSION [6]

M185 **M186** **M187** **M188**		in the opposite direction that # ’s what the equilibrant is**..** **NOW**, **now**, **now** [unclear]**…** **clean # the board for me please you know this side** [unclear]	COMMAND (expressed by typical clause Mood imperative) - ‘**clean the board for me please you know this side** [unclear]’ [M188] APPRAISAL 1.1) judgement (social sanction; positive; propriety) - ‘**very good boy very good**’ [M184] 1.2) graduation (force; intensifiers) - ‘**very good boy very good**’ [M184] EXPERIENTIAL PROCESSES - ‘**clean the board for me please you know this side** [unclear]’ [M188] (Pr: material) TEXTUAL CONJUNCTION 1) internal conjunction: - ‘**now**’[M187]; ‘**now**’[M187]; ‘**now**’ [M187] (conjunction type: ‘addition’; ‘staging’; ‘framing’) [6] REFERENCE	- ‘but’ [M183]

			1) first person sing. - '**clean the board for <u>me</u> please you know this side** [unclear]' [M188] 2) exophoric: - '**clean the board for me please you know <u>this</u> side** [unclear]' [M188] 3) reference: - '**very good <u>boy</u> very good**' [M184]	