GRADE 10 EXEMPLAR EXAMINATION
2006

PHYSICAL SCIENCE: PAPER 1
PHYSICS FOCUS

MEMORANDUM

Time: 1½ hours 100 marks

QUESTION 1

1.1 45 $m.s^{-1}$ (1)

1.2 20 s (1)

1.3 Staying the same (1)

1.4 Gears (1)

1.5 Car stops accelerating for half a second (constant speed) before it continues accelerating as the driver changes gears (1)

1.6 1 kilometer = 1000 m and 1 hour = 60x60 = 3600 seconds (2)

1.7 $\frac{40m}{1s} = \frac{40x10^{-3}}{\frac{1}{60x60}} = 144\ km.h^{-1}$

1.8

- Initial velocity, u, is zero not 40
- final velocity, v is 40 (or even 45, easier to read and acceleration is constant)
- Calculation a = $\frac{9}{40}$ $km.h^{-1}.s^{-1}$ mathematical mistake
- Unit is incorrect: m/s^{-1} (3)

1.9

Time /s	0	2	4	6	8	10
Position /m	0	9	36	81	144	**222.5**

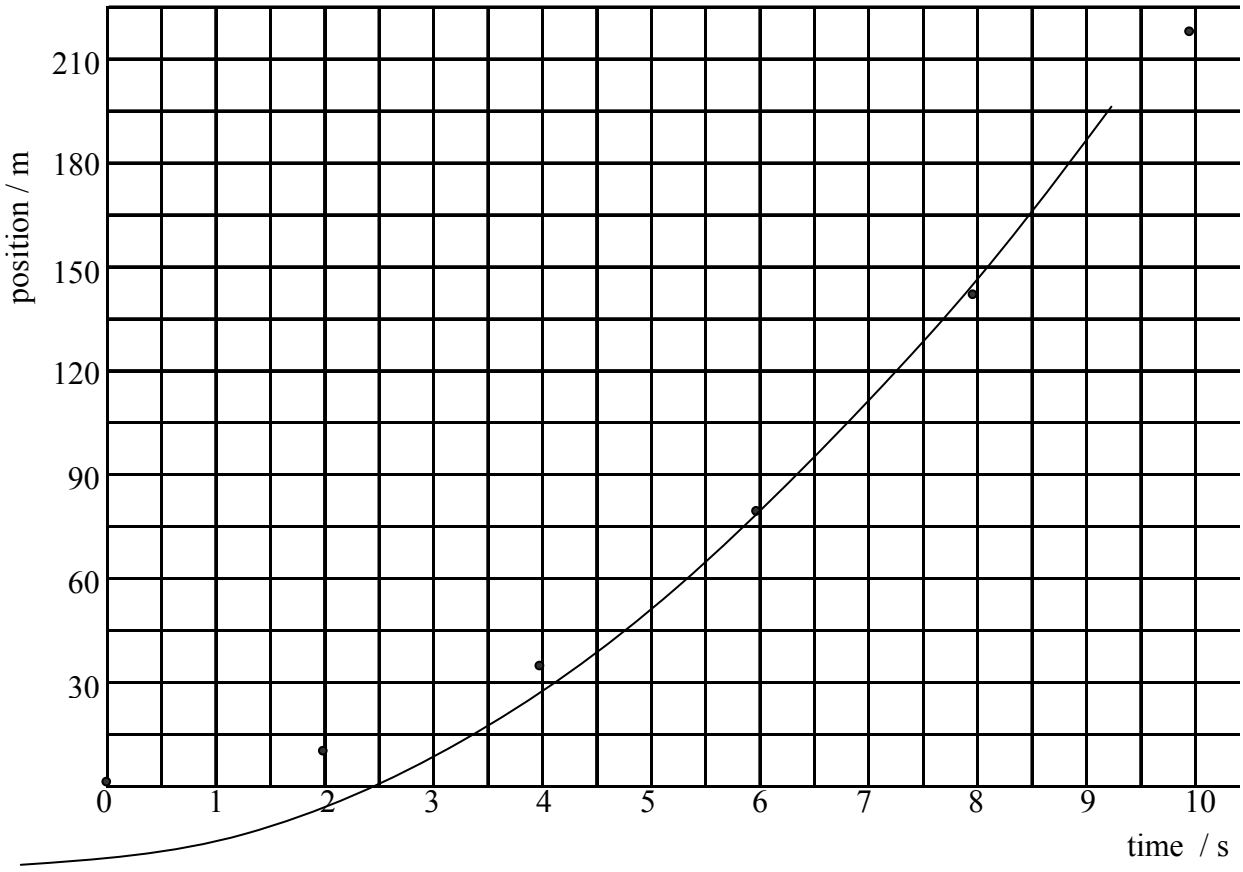
$s = ut + ½at^2$

$= 0 + ½(\mathbf{4,5})(10)^2$ (Remember to use $\frac{45}{10}$; since it is a straight line, take value easiest to read)

$= 222,5$ m (3)

Graph: (5)

Scales on each axis	2
Labels	1
Shape	1
Points plotted	1



QUESTION 2

2.1 The petrol car: it stops in the shortest time interval (or distance). (2)

2.2 Difference in area = ½(6)(40) - ½(5)(40) = 20 m. (3)
Or ½(1)(40) = 20 m.

2.3 The hybrids kinetic energy is used to charge the batteries which are used to power the car later. This saves fuel, reduces greenhouse gas emissions and reduces global warming by not using brakes which get hot and heat the surroundings. (1)

2.4 $\Delta E_k = ½mv^2 - ½mu^2$
$= ½(1500)(40)^2 – 0$
$= 1\ 200\ 000$ J (4)

QUESTION 3

3.1 Mechanical energy = $E_p + E_k$
$= mgh + ½mv^2$
$= 0 + ½(1500)(10)^2$
$= 75\ 000$ J (3)

3.2 Mechanical energy = $E_p + E_k$
$= mgh + ½mv^2$
$= (1500)(10)(3,5) + ½(1500)(20)^2$
$= 352\ 500$ J (5)

3.3 Change in mechanical energy = 352 000 – 75 000 = 277 500 J (2)

QUESTION 4

4.1 $R = \frac{V}{I} = \frac{300}{100} = 3\ \Omega$ (3)

4.2 $Q = It = (100)(2x60) = 12\ 000$ C (4)

4.3 From the petrol engine (1)

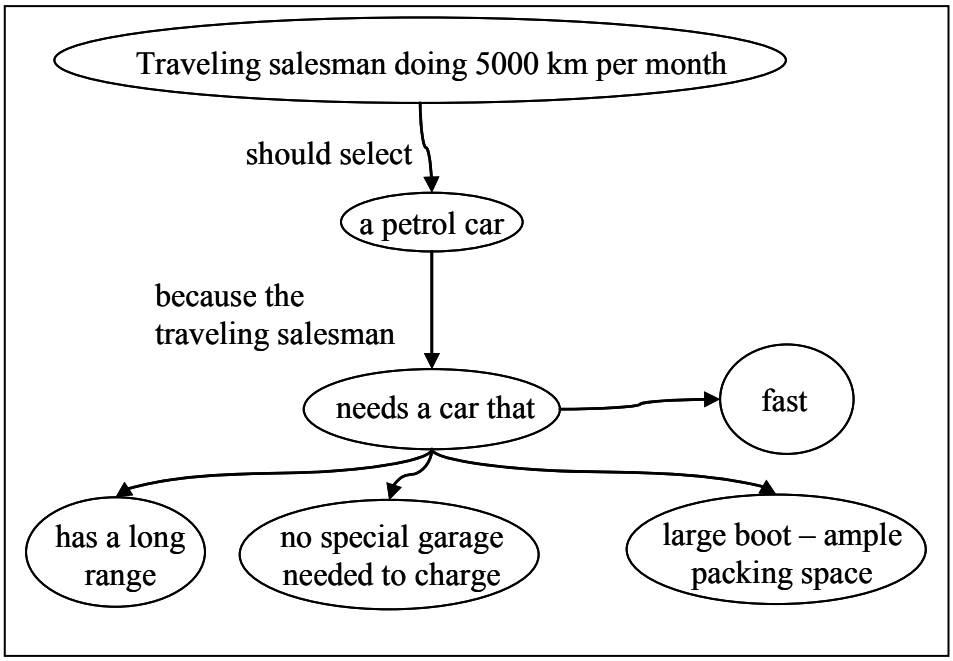
QUESTION 5

Possible pro's and con's

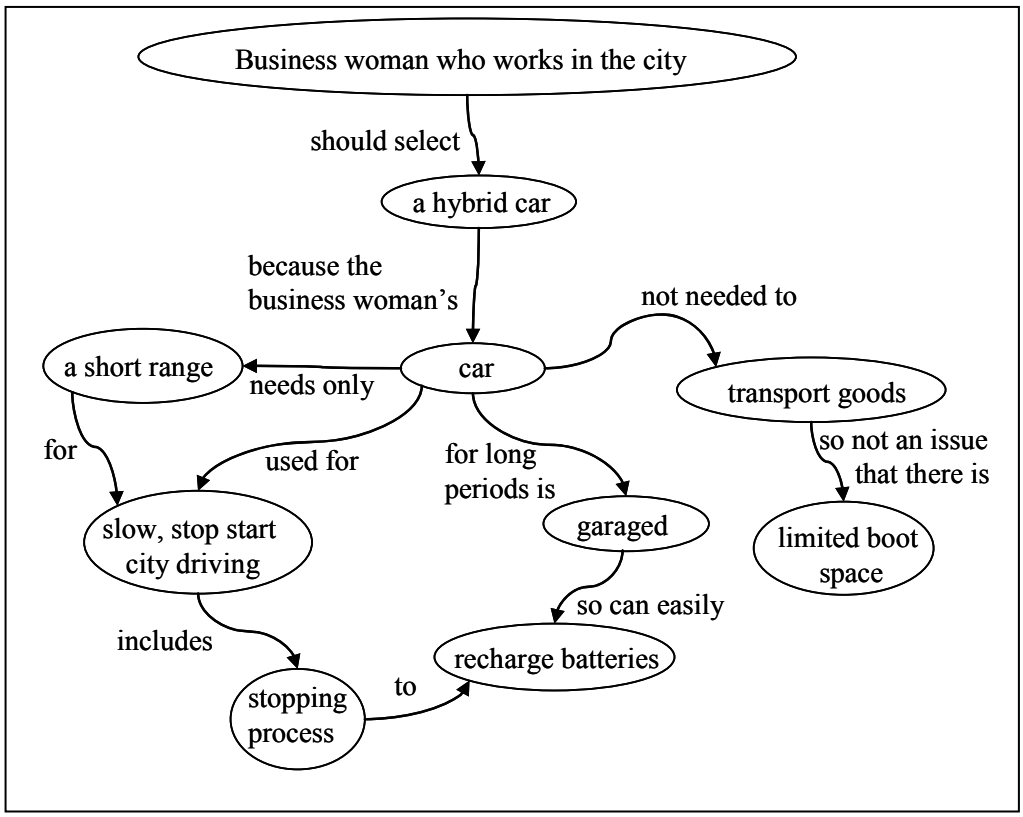
5.1.1

HYBRID		PETROL	
pro	**con**	**pro**	**con**
Reduced NO_2 emissions Cheaper fuel costs Braking system charges battery – energy conserved = less heating through braking, less fuel used	Initially cost more Smaller; Slower Weight and space required for batteries - reduced boot size Replacement of batteries Needs to be charged Regularly Shorter range Charged using electricity powered by coal burning power stations = SO_2 emissions because of space	More power Faster Lighter More convenient Lower initial cost Much greater range	CO_2 and NO_2 emission Acid rain Heat from braking

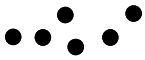
5.2.1


Traveling salesman doing 5000 km per month
should select
a petrol car
because the traveling salesman
needs a car that
fast
has a long range
no special garage needed to charge
large boot – ample packing space

5.2.2


Business woman who works in the city
should select
a hybrid car
because the business woman's
not needed to
a short range
needs only
car
transport goods
for
used for
for long periods is
so not an issue that there is
slow, stop start city driving
garaged
limited boot space
so can easily
includes
recharge batteries
to
stopping process

Use the following rubric to mark question 5 as a whole:
Generic rubric for assessing an argument

Marks	Description	
82-100% (14-16)	To score 14 both recommendations must form a coherent meaningful whole, link salesman to petrol car and link business woman to hybrid, and be substantiated using 2 arguments as shown in the possible answers above; To score 16 each substantiated with at least 3 arguments	
70-81% (12-13)	To score 12 arguments supporting one of the recommendations must form a coherent meaningful whole. To score 12 link at least 1 person to one car e.g. Business woman to hybrid (substantiated using 2 arguments as shown in the possible answers above; for 13 substantiate with at least 3 arguments as shown in the possible answers above)	
60-69% (10-11)	To score 10 links four (quadruplets) issues e.g. (hybrid pollutes with SO_2 during charging because electricity from coal powered power station) or (hybrid conserves energy during braking by charging the battery) To score 11 links at least two quadruplets No need to link to person	
50-59% (9-10)	To score 9 links three (triplets) issues e.g. (petrol car has a greater range and this is an advantage) or (hybrid conserves energy during braking To score 8 make links at least two triplets No need to link to person	
40-49% (7-8)	To score 7 links two issues (in pairs) e.g. (petrol car has greater range) or (greater range is an advantage). To score 8 links at least 2 pairs. No need to link to person	
30-39% (5-6)	Supplies bits of unconnected information that makes no further sense. To score 6: credit for listing up to 6 unconnected pros and/or cons	
0-29% (0-4)	Supplies bits of unconnected information that makes no further sense. To score 4: credit for listing up to 4 unconnected pros and/or cons	

(16)

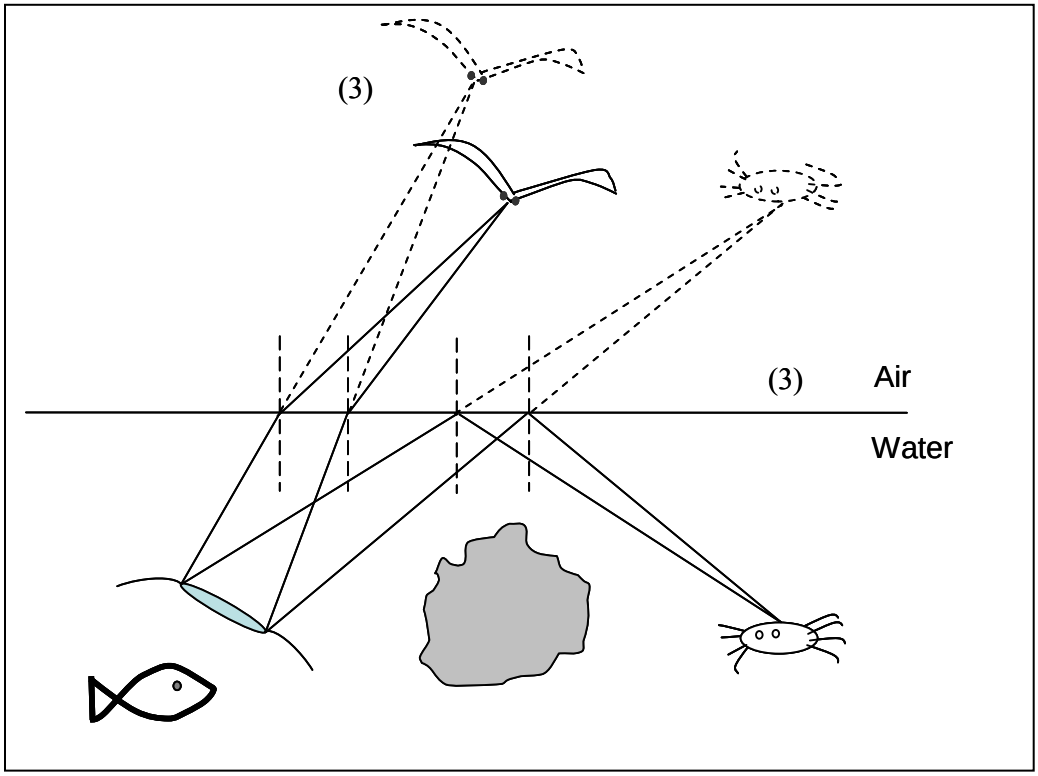
QUESTION 6

6.1 $\mu = \frac{1}{\sin c}$ (1)

6.2 $\mu = \frac{1}{\sin 48{,}6^{o}} = 1{,}33$ (2)

6.3 B (2)

6.4



6.5

6.5.1 total internal **reflection** (1)

6.5.2 bends/refracts (1)

QUESTION 7

7.1 Like charges repel (2)

7.2.1 nature of the forces (attract, repel) (2)

7.2.2 charges on the rods (2)

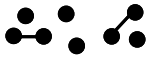
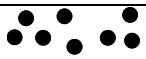
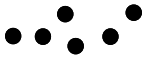
7.3

	Suspended rod	test rod (also suspended)	Observation	Explanation
1	pvc-rod	pvc- rod	repulsion	Like charges on rods
2	glass-rod	pvc- rod	attraction	Unlike charges on rods
3	knitting needle	pvc-rod	attraction	Knitting needle is not charged and charged glass rod induces opposite charge in end of knitting needle close to rod
4	pvc-rod	glass-rod	attraction	Unlike charges on rods
5	glass-rod	glass-rod	repulsion	Like charges on rods
6	knitting needle	glass-rod	attraction	Knitting needle is not charged and charged pvc-rod induces opposite charge in end of knitting needle close to rod
7	pvc-rod	knitting needle	attraction	Knitting needle is not charged and charged pvc-rod induces opposite charge in end of knitting needle close to rod
8	glass-rod	knitting needle	attraction	Knitting needle is not charged and charged glass-rod induces opposite charge in end of knitting needle close to rod
9	knitting needle	knitting needle	nothing happens	Neither of knitting needles have been charged by rubbing because they are earthed by contact

(12)

7.4 like charges repel
unlike charges attract
knitting needles cannot be charged by friction (rubbing)
charged objects attract uncharged objects any three (3)

This question can either be marked by using a check list or a rubric: If a rubric is used, 7.3 and 7.4 will be marked with the rubric and add up to 15 marks

Marks	Description	
80-100% (13-15)	To score 11, links, on a table ,three pieces of information (a single triplet) e.g. (identically charged PVC rods repel) to explanation i.e. – like charges repel and the conclusion – like charges repel To score 15 links 4 conclusions in the above way.	
70-79% (11-12)	To score 11, links, on a table ,three pieces of information (a single triplet) e.g. (identically charged PVC rods repel) to explanation i.e. – like charges repel and the conclusion – like charges repel To score 12 links two conclusions in the above way	
60-69% (10)	To score 10, links, on a table ,three pieces of information (a single triplet) e.g. (identically charged PVC rods repel) to explanation i.e. – like charges repel	
50-59% (8-9)	To score ,9 links, on a table , two pieces of information (three pairs) e.g. (identically charged PVC rods repel)	
40-49% (7)	To score 7, links, on a table , two pieces of information (a sigle pair) e.g. (identically charged PVC rods repel)	
30-39% (5-6)	Supplies bits of unconnected information that makes no further sense. To score 6: credit for listing up to 6 pieces of correct but unconnected information e.g. a correct column heading, an observation, and so on	
0-29% (0-4)	Supplies bits of unconnected information that makes no further sense. To score 4: credit for listing up to 4 pieces of correct but unconnected information e.g. a correct column heading, an observation, and so on	

does not signify a mark but a piece of the information required

				Levels of cognitive demand targeted by the questions					
Question	**LO1**	**LO2**	**LO3**	**1**	**2**	**3**	**4**	**5**	**6**
				knowing	**understanding**	**applying**	**analysing**	**synthesising**	**evaluating**
1.1		1			1				
1.2		1			1				
1.3		1			1				
1.4		1			1				
1.5		1				1			
1.6		2				2			
1.7		3				3			
1.8		4					4		
1.9	5	3			1	4	1	2	
2.1		2				1		1	
2.2		3					3		
2.3		1						1	
2.4		4				3	1		
3.1		3					3		
3.2		5					5		
3.3		2			2				
4.1		3			3				
4.2		4			4				
4.3		1					1		
5.1			16				8		
5.2.1								2	2
5.2.2								2	2
6.1		1		1					
6.2		2			2				
6.3		2					2		
6.4.1		3					3		
6.4.2		3					3		
6.5.1		1			1				
6.5.2		1			1				
7.1	2						2		
7.2	4						4		
7.3	12							12	
7.4	3							3	
total	**26**	**58**	**16**	**1**	**18**	**14**	**40**	**23**	**4**
total				**73**				**27**	
aim	**30**	**50**	**20**	**60**				**40**	
grand total			**100**						

FORMULA SHEET

KINEMATICS	ENERGY
$v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$ $s = \left(\frac{u+v}{2}\right)t$	$W = Fs$ $E_k = \frac{1}{2}mv^2$ $E_p = mgh$ $P = \frac{W}{t}$
ELECTRICITY	**OPTICS**
$Q = It$ $R = \frac{V}{I}$ $V = \frac{W}{Q}$	$\mu = \frac{1}{\sin c}$ $n_i \sin i = n_r \sin r$

