Class	Index Number	Name

PEI HWA SECONDARY SCHOOL

END OF YEAR EXAMINATIONS 2017

Secondary Two Express

LOWER SECONDARY SCIENCE

6 Oct 2017

2 hours

Additional Materials : Optical Answer Sheet (OTAS)
Periodic Table (Page 26)

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

1. Write your name, class and index number in the spaces above and on the OTAS. Shade your index number in the boxes provided.
2. **Section A: Multiple Choice Questions**
   There are 30 questions in this section. Answer **ALL** questions. For each question, there are four possible answers **A, B, C** and **D.**
   Choose the **one** you consider correct and record your choice in **soft pencil** on the separate OTAS provided.
3. **Section B: Structured Questions**
   Answer **ALL** questions in the space provided.
4. **Section C: Free Response Questions**
   Answer **ALL** questions on the space provided.
5. Candidates are to show all their working in a clear and orderly manner.

Hand in OTAS, Sections A with B and Section C separately.

Section	Mark
A	/30
B	/40
C	/30
Total	/100

This question paper consists of **26** printed pages, inclusive of this cover page.

Section A – Multiple Choice Questions [30 marks]
For each question, four options are given. Choose the most appropriate answer and shade it on the Optical Answer Sheet (OTAS).

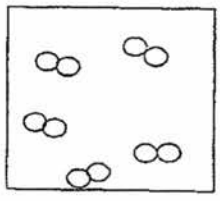
1 Which of the following consists of an element, compound and mixture?

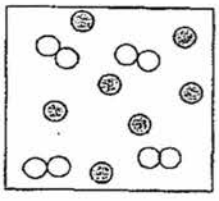
A bromine, limewater, air
B iodine, barium, water
C copper, limewater, table salt
D lead, water, limewater

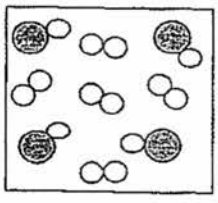
2 Two elements Y and Z combined to form a new substance YZ_2. Which of the following description is true?

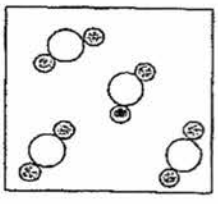
A The ratio of Y: Z atoms is 2: 1.
B YZ_2 will have the properties of both Y and Z.
C An energy change occurs when YZ_2 is formed.
D YZ_2 will have a colour in between those of Y and Z.

3 Which of the following diagram shows a mixture of elements?

A 

B 

C 

D 

4 X, Y and Z are in the same period of the Periodic Table. X is a non-metal, Y is a metal and Z shows the properties of both metals and non-metals.

Which of the following represents the order of these three elements in the Periodic Table?

A X, Z, Y
B Y, X, Z
C Y, Z, X
D Z, X, Y

5 The table shows some information about the solubility of three solids.

solid	solubility in water	solubility in ethanol
P	insoluble	soluble
Q	soluble	insoluble
R	insoluble	insoluble

The following operations could be carried out to obtain pure Q from a mixture of P, Q and R.

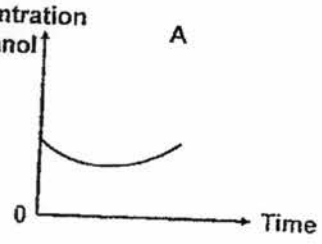
I Filter
II Evaporate filtrate to dryness
III Add ethanol
IV Add water

In what order should the operations be carried out?

A I, II, III, IV
B III, IV, I, II
C III, I, II (omit stage IV)
D IV, I, II (omit stage III)

6 Simple distillation can be used to separate ethanol (boiling point 78°C) from a mixture of ethanol and water. Which of the following graphs best shows the change in concentration of the ethanol in the boiling mixture as distillation proceeds?

A



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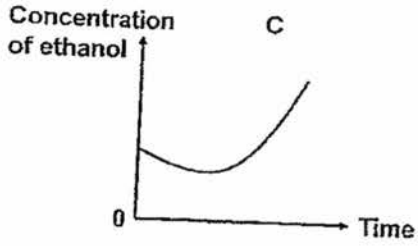

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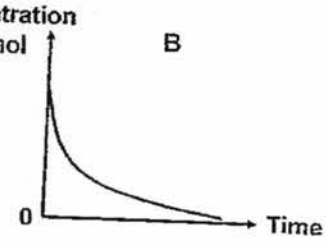

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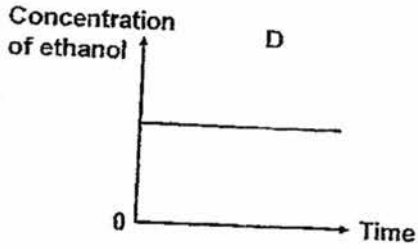


7 An unknown element has an atomic number of 4.
Which statement about this element is correct?

A It is a good conductor of electricity.
B It forms ions by gaining electrons.
C It is in Group III of the Periodic Table.
D It is found in Period 1 of the Periodic Table.

8 Which of the following information can be obtained from the chemical formula of a compound?

I The number of atoms in each molecule.
II The types of atoms present in each molecule.
III The elements present in the compound.
IV The mass of the compound.

A I and II
B II and III
C I, II and III
D All of the above

9 How many atoms are there present in two molecules of $(NH_4)_3PO_4$?

A 20
B 26
C 36
D 40

10 The pH of an aqueous solution of nitric acid is 3. What will be the pH of the acid after addition of 10 g of sodium chloride?

A 1
B 3
C 7
D 9

11 Carbon monoxide is a pollutant emitted from car exhausts.
Which of its properties makes it harmful to humans?

A It has no colour, taste or smell.
B It combines with oxygen in the lungs.
C It forms a stable compound with blood.
D It has a corrosive action on lung tissue.

12 The table gives information about three indicators.

indicator	colour at pH 1	pH at which colour changes	colour at pH 12
thymol blue	red	3	yellow
congo red	blue	5	red
phenolphthalein	colourless	10	red

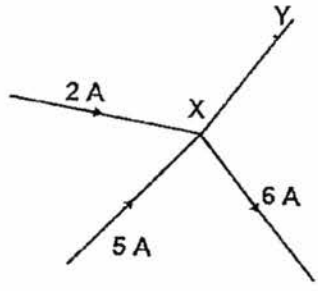
Which colours would be obtained when each indicator was added separately to pure water?

	thymol blue	congo red	phenolphthalein
A	red	blue	red
B	yellow	blue	colourless
C	yellow	red	red
D	yellow	red	colourless

13 Methane, sulfur dioxide and carbon dioxide are gases which affect the atmosphere and the environment.
In what way do these gases affect the environment?

	methane	sulfur dioxide	carbon dioxide
A	depletion of ozone layer	acid rain	photochemical smog
B	global warming	photochemical smog	acid rain
C	photochemical smog	global warming	depletion of ozone layer
D	global warming	acid rain	global warming

14 The diagram shows the magnitude and directions of the electric currents entering and leaving junction X. What will be the magnitude and directions of the current in the wire XY?



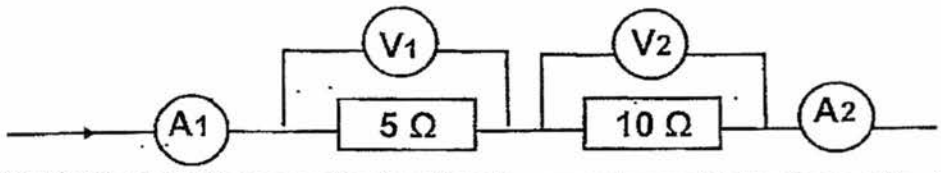
	magnitude	direction
A	1 A	X to Y
B	1 A	Y to X
C	7 A	X to Y
D	7 A	Y to X

15 Which of the following methods can be used to increase the strength of an electromagnet?

I Use a bigger iron core
II Increase the size of current flowing in the coil
III Increase the number of coil winding around the iron core

A I and II
B I and III
C II and III
D All of the above

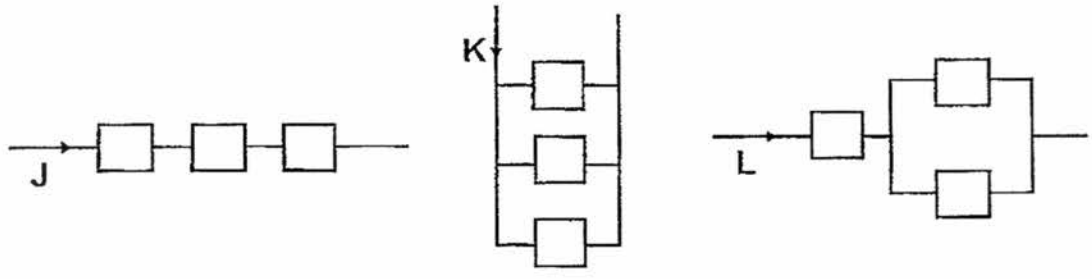
16 A current flows into two resistors connected in series as shown in the diagram. A_1 and A_2 are the readings on the ammeter, V_1 and V_2 are the reading on the voltmeters.



Which of the following correctly describes the ammeter and voltmeter readings?

	ammeter reading	voltmeter reading
A	$A_1 < A_2$	$V_1 < V_2$
B	$A_1 < A_2$	$V_1 > V_2$
C	$A_1 = A_2$	$V_1 < V_2$
D	$A_1 = A_2$	$V_1 = V_2$

17 Three identical heating elements are wired up to the mains in three different ways as shown.



What is the increasing order of current drawn from the mains supply of these arrangements?

	current drawn from mains supply lowest ⟶ highest		
A	J	K	L
B	J	L	K
C	K	L	J
D	K	J	L

18 Many houses have an electricity meter that is read so that the cost of the electricity used by the customer may be calculated.

What does the electricity meter record?

A voltage
B current
C energy
D power

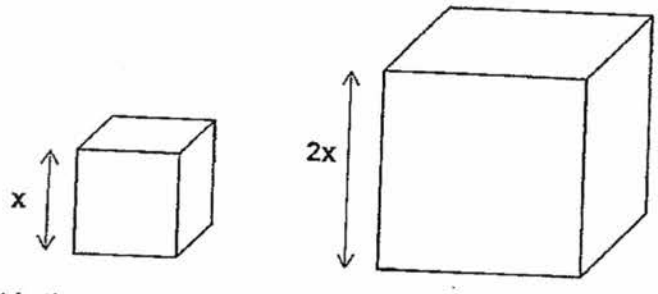
19 A house owner replaced a failed fuse for lights in the house. When the lights were switched on, the new fuse also failed. The house owner then put in another fuse with a higher rating than the previous two. Why was this not a sensible thing to do?

A Fuse allow the circuit to work only if the rating is exactly right.
B The fuse has already melted because the rating was too high.
C Using a fuse with too high a rating would cause electric shock.
D A fuse with a higher rating might allow the circuit to work but the fault would not be corrected.

20 A satellite is launched from Earth into orbit in outer space. What happens to the mass and weight of the satellite?

	mass	weight
A	stays constant	decreases
B	stays constant	stays constant
C	decreases	decreases
D	decreases	stays constant

21 The diagram shows two cubes made out of the same material. One cube has sides that are twice as long as the other cube. Standing on one face, the smaller cube exerts a pressure $p = \frac{w}{a}$, where a is the area of the face.



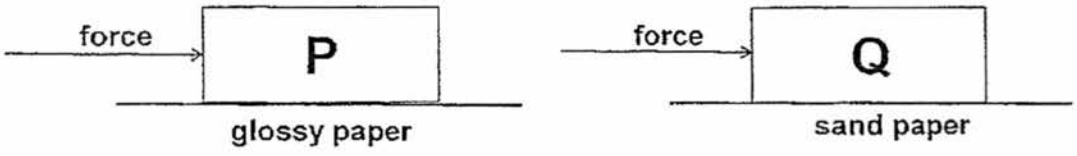
What is the pressure exerted by the larger cube standing on one of its faces?

A $2p$
B $4p$
C $8p$
D $16p$

22 The original length of a spring is 4 cm. A 50 g mass hanging on the spring will cause it to extend by 2 cm. What would be the length of the spring if a 3 N weight is hanged on it?

A 1.2 cm
B 5.2 cm
C 12 cm
D 16 cm

23 Two identical blocks, P and Q are being pushed when placed on two different types of paper as shown.



Which of the following is true?

A Block P experiences more frictional force than block Q.
B Block P moves slower than block Q if the same forces are applied to both blocks.
C There is more heat being generated in block P than block Q.
D Block P requires lesser force than block Q to initiate its movement.

24 The diagram below shows the image of a clock formed in a plane mirror.

What is the actual time?

A 3 : 20
B 4 : 15
C 8 : 40
D 9 : 35

25 A girl stands at a distance of 4 m in front of a plane mirror. A boy stands at a distance of 3 m behind the girl.

What is the distance from the girl to the image of the boy?

A 4 m
B 7 m
C 10 m
D 11 m

26 Which of the following is not a property of light?

A It is a form of energy.
B It always travels in a straight line.
C It travels at a speed of 3.0×10^5 km/s.
D We are able to see things because light is refracted into our eyes.

27 Which of the following statements is true?

A Puberty starts at the same age for all girls.
B An ovum is the largest cell in the human body.
C One sperm is ejected from the penis every time.
D Unripe eggs are formed in a girl's ovaries when she reaches puberty.

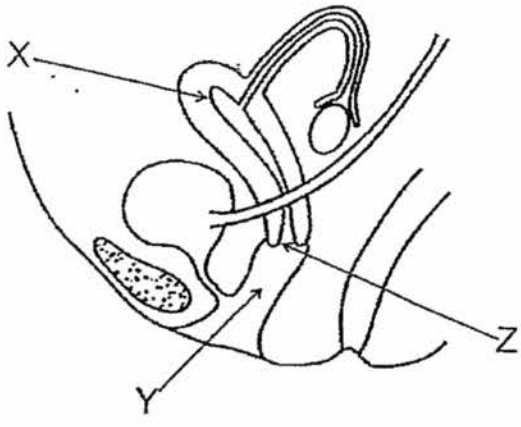
28 Which of the following is false about a zygote?

A A human zygote contains 46 chromosomes.
B It is the first single cell formed after fertilisation.
C Its nuclei contains one type of sex cells.
D The zygote starts to develop into a ball of cells during its journey for implantation.

29 Which statement best describe how an intra-uterine device prevents pregnancy?

A By reducing the number of sperms entering the vagina.
B By preventing the fusion of sperms and eggs.
C By preventing the implantation of a fertilized egg.
D By producing hormones that reduced the production of sex cells.

30 The diagram below shows the reproductive system of a woman.



What are the structures X, Y and Z?

	X	Y	Z
A	uterus	vagina	cervix
B	urethra	cervix	vagina
C	uterus	cervix	vagina
D	urethra	vagina	cervix

End of Section A

Section B: Structured Questions [40 marks]
Answer all questions and write your answers in the spaces provided.

1 The following labels describe the contents of four different bottles.

Content of bottle P	Content of bottle Q
P is speckled yellow and white. The white particles are soluble in water but the yellow particles are not.	Q is white. It is formed by burning lithium in air.

Content of bottle R	Content of bottle S
R is slivery-grey in colour and magnetic. It cannot be decomposed into anything simpler.	S has a constant composition. It breaks down into three substances when exposed to heat.

(a) Which content found in the bottle(s) can be classified as compound? Explain your answer.

.....

.....

..... [2]

(b) Name the possible content(s) found in

(i) bottle P. .....

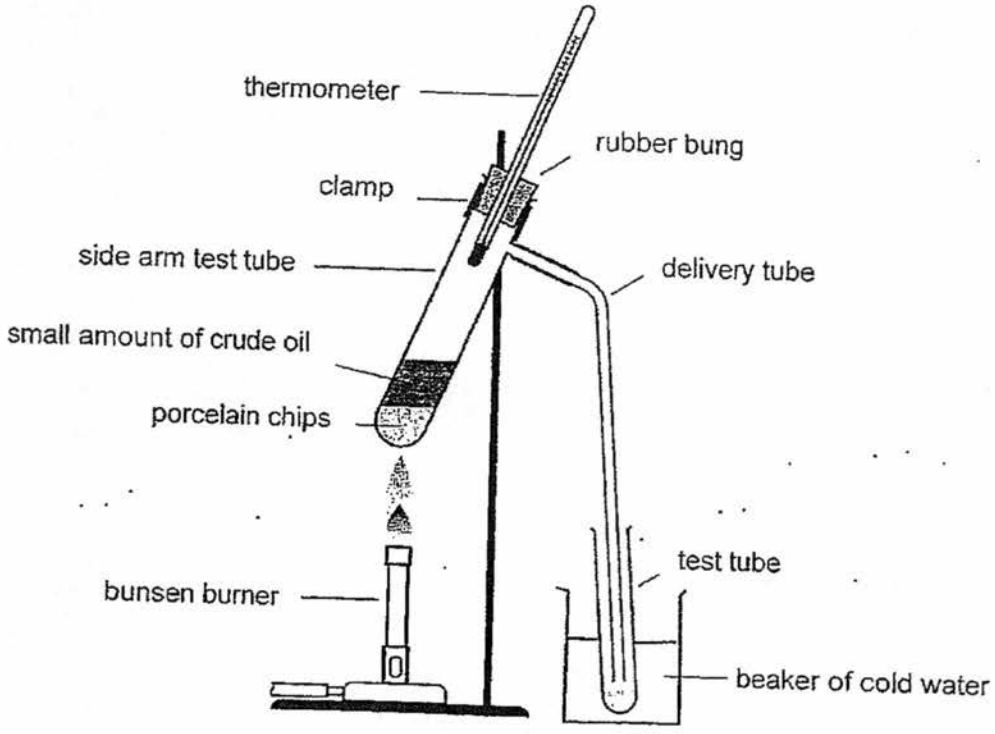
(ii) bottle R. ..... [2]

(c) Identify the chemical reaction that occurs when content of bottle S breaks down into three substances when exposed to heat.

..... [1]

[Total 5 marks]

2 A student used the experimental set-up as shown to separate a small amount of crude oil into four fractions, I, II, III and IV using different test tubes.



The temperature range and the use of each fraction is listed below.

Fraction	Temperature Range (°C)	Use
I	35 – 70	Fuel for motor cars and vehicles
II	70 – 115	Chemical feedstock for making drugs, plastics and other chemicals
III	115 – 250	Fuel for heating, lighting and cooking
IV	250 – 360	Fuel for buses, trucks and taxis

(a) Name the separation technique shown.

..... [1]

(b) What is the use of porcelain chips?

..... [1]

(c) What is the purpose of the beaker of cold water?

.....

..... [1]

(d) Why is the bulb of the thermometer placed next to the entrance of the delivery tube?

.....

..... [1]

(e) (i) Briefly explain why conducting this experiment using the set up shown is highly dangerous.

.....

.....

..... [1]

(ii) Hence, what change would you make to the experimental set up so that the experiment can be conducted safely?

.....

..... [1]

[Total 6 marks]

3 The table shows the chemical formula of some atoms and ions of elements found in the Periodic Table.

Mg^{2+}	He	P^{3-}	Li^{+}	Cs	Br^{-}	In^{3+}	O^{2-}

(a) Which elements have similar chemical properties?

..... [1]

(b) Which atoms or ions have the electronic configuration of 2.8?

..... [1]

(c) Which element does not take part in any chemical reaction?

..... [1]

(d) Using the Periodic table, find the number of protons, neutrons and electrons present in In^{3+}.

Number of protons	
Number of neutrons	
Number of electrons	

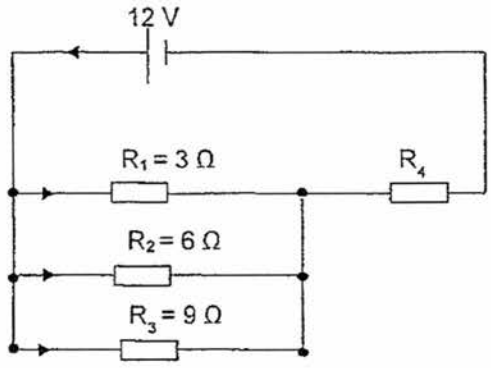
[1]

(e) Draw the electronic configuration of P^{3-}.

[2]

6 marks]

4 The diagram below shows a circuit consisting of four resistors, R_1, R_2, R_3 and R_4.



(a) Given that the current flowing through R_3 is 0.5 A, what is the potential difference across R_3?

[1]

(b) Hence, what is the potential difference across R_4?

[1]

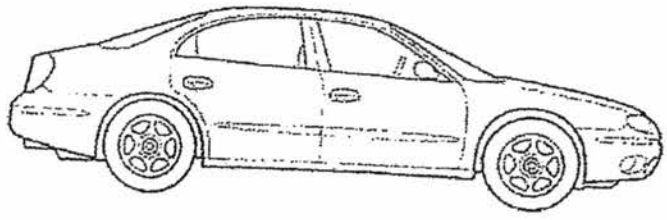
(c) Calculate the amount of current flowing into R_4.

[2]

(d) Find the value of R_4.

[2]
[Total 6 marks]

5 The diagram shows the exterior design of a sedan car.



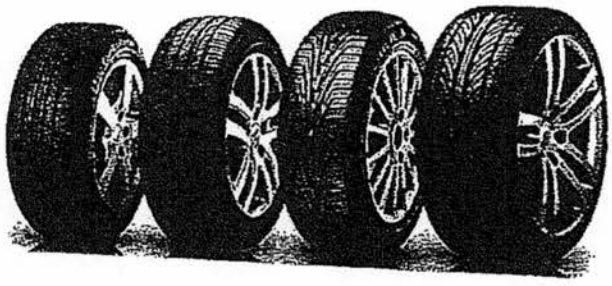
(a) Explain how the exterior design of the car helps to reduce friction when it is moving.

.....

.....

..... [1]

(b) The marking on the cars' tyres can have many designs and patterns as shown.



State an advantage of this feature to the car.

.....

.....

..... [1]

(c) An architect is tasked to design a car park on the top floor of a building that can accommodate as many cars as possible. The building's top floor is rectangular in shape with the dimension, 0.068 km by 0.04 km. If the construction material can withstand a pressure of 520 Pa, calculate the maximum number of cars that this car park can accommodate, assuming that a normal car has a maximum mass of 2000 kg.

[3]

[T... 5 marks]

6 Alice standing at point **A** in Fig 6.1 sees the reflection in a shop window of her friend, Bryan standing at point **B**.

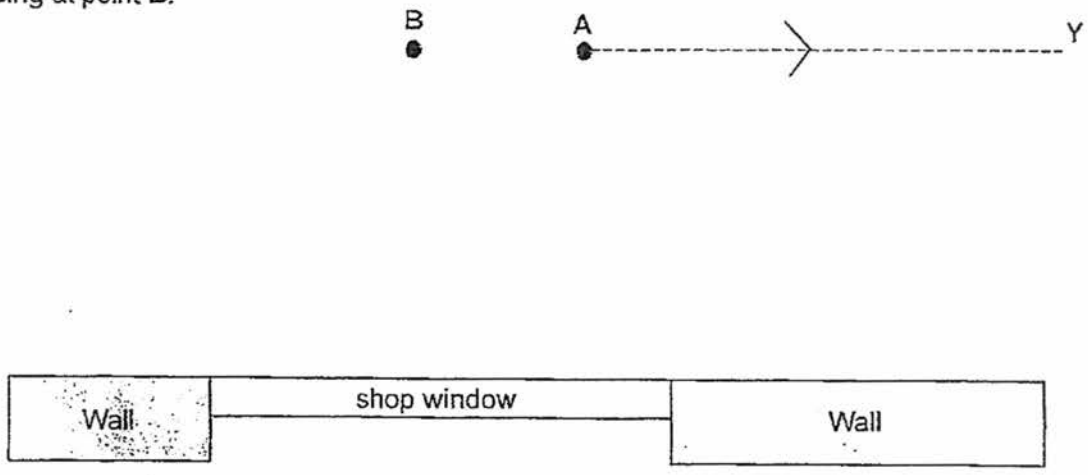


Fig 6.1

(a) On Fig 6.1, draw light rays to show how by reflection, Alice is able to see Bryan. [1]

(b) Hence, by drawing another light ray and indicate with a letter, **I**, show where the image of Bryan will be. [2]

(c) Alice moves further away from Bryan towards **Y** in the direction of the arrow shown in Fig 6.1. Mark with a letter **X** the furthest position along **AY** to which Alice can move so that the two people will still be able to see each other by reflection in the shop window.

Briefly explain how you decide on the position of **X**.

.....

..... [2]

(d) Bryan is holding a shopping bag with the word, 'SALE'. Write down the image of the words that he will see if he is standing in front of a mirror.

[1]

[Total 6 marks]

7 Fig 7.1 shows a ray of light entering material S and material T from material R.

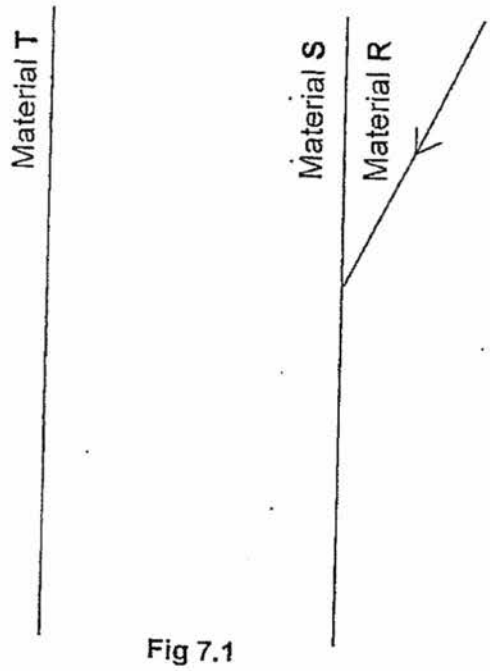


Fig 7.1

(a) Measure and state the angle of incidence.

Angle of incidence = ...

[1]

(b) Refractive index of a material is a number that indicates the number of times slower that a light wave would be in that material than it is in a vacuum. The table below shows the refractive index of material R, S and T.

material	refractive index
R	1.00
S	1.52
T	1.33

Draw two light rays to show how light travels in material S and T in Fig 7.1

[2]

(c) Hence, briefly explain how light travels from material R to material S.

.....

.....

..... [2]

(d) If another light ray meets the boundary of material R and S at 90°, draw the path of the light ray in Fig 7.2 as it enters material S and into material T.

[1]

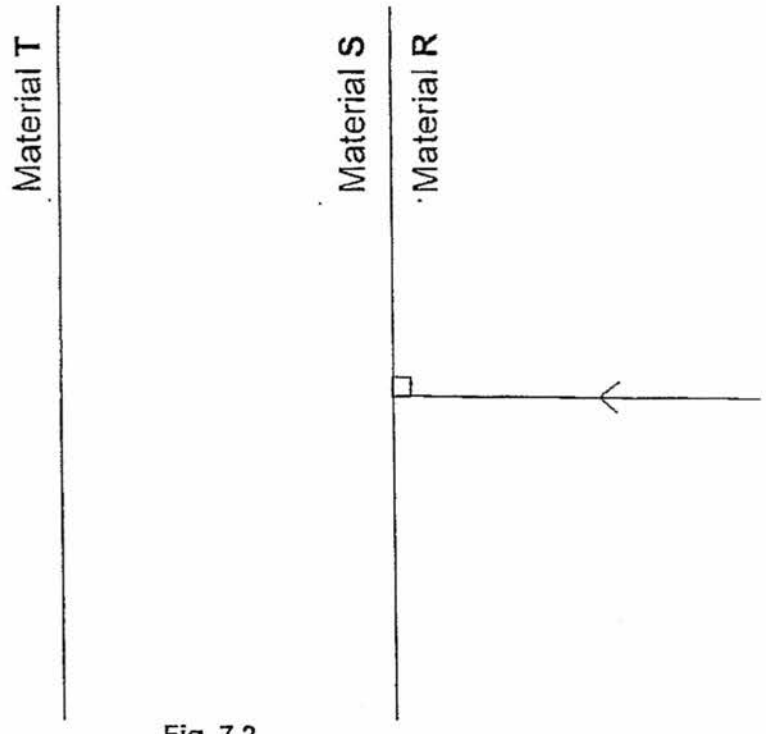


Fig. 7.2

[Total 6 marks]

End of Section B

Class	Index Number	Name	/ 30

LOWER SECONDARY SCIENCE
Section C: Free Response Questions [30 marks]
Hand in Section C separately
*Answer **all** questions on the space provided.*

8 To investigate the rate of reaction between calcium carbonate and a strong acid, Sean placed 20 g of calcium carbonate in a conical flask filled with a known volume of hydrochloric acid. He then placed a cotton wool plug at the mouth of the flask and observed the mass of the flask and its content at half minute interval until reaction ceased as shown in Fig 8.1

Examining the flask at this stage, he could still see pieces of calcium carbonate present in the colourless solution formed in the flask after the effervescence is evolved.

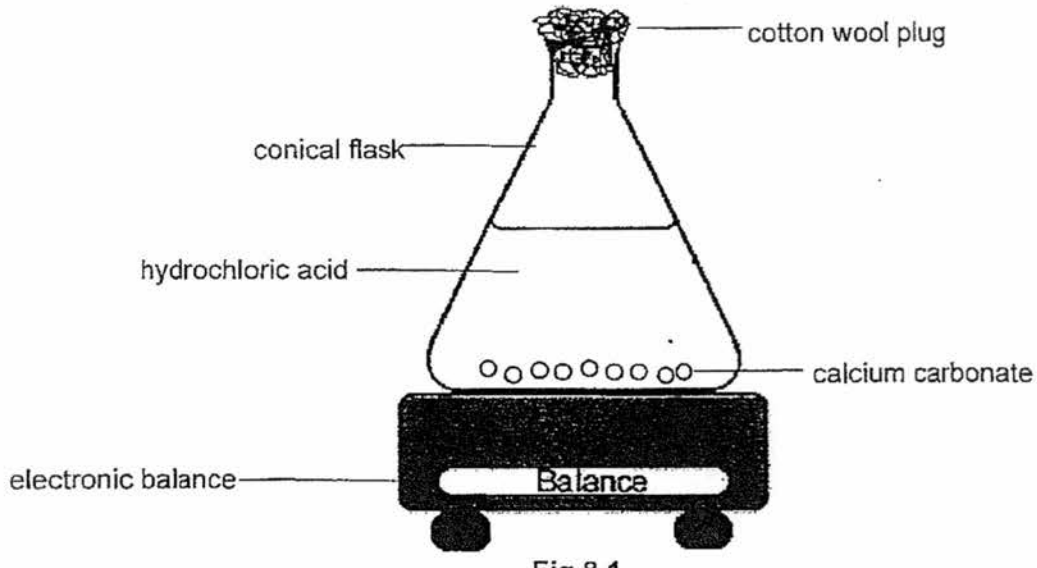


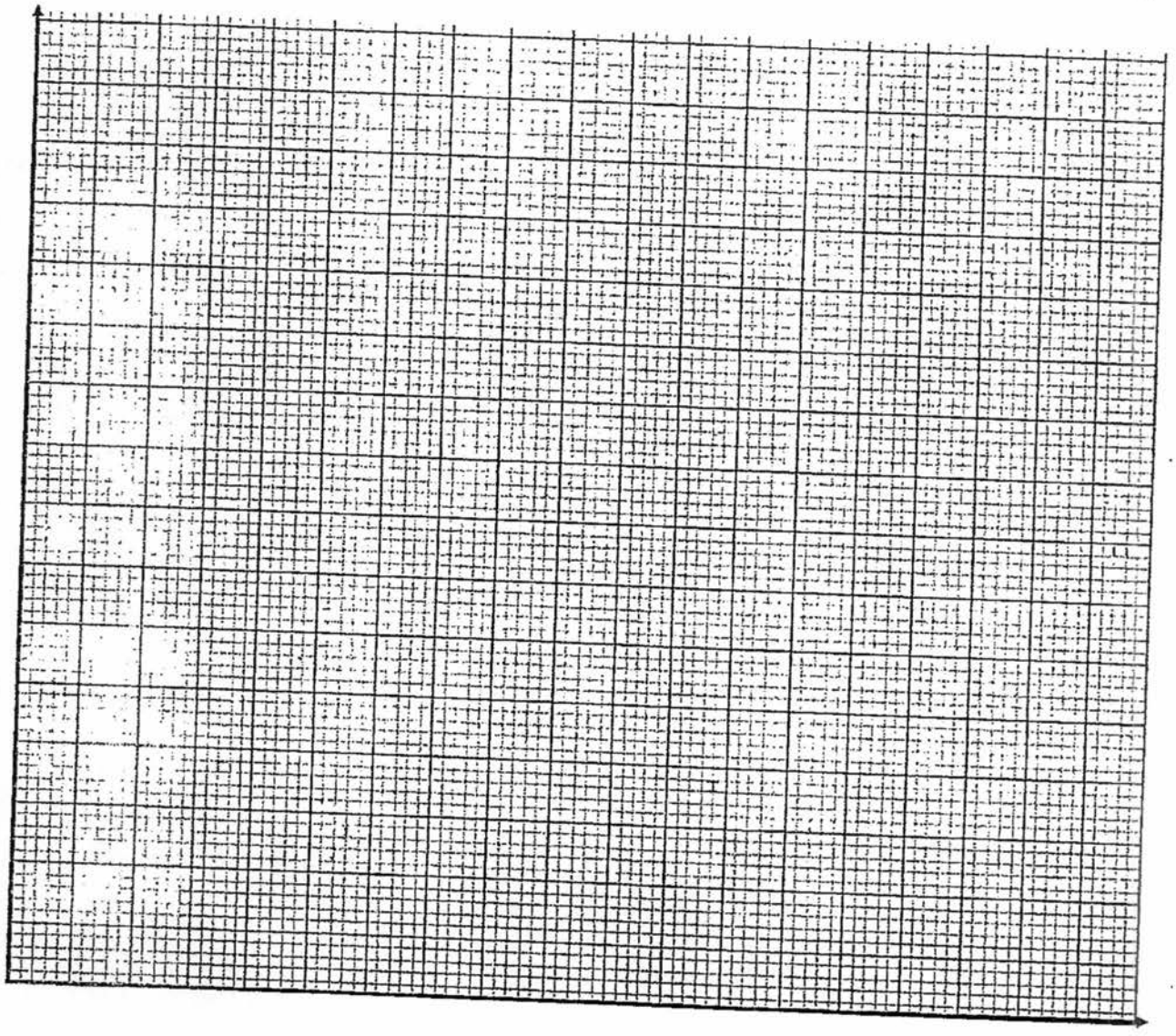
Fig 8.1

The table below shows the result obtained.

Time / min	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Mass loss of flask and content / g	0	0.67	1.11	1.45	1.74	1.98	2.20	2.40	2.55

Time / min	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5
Mass loss of flask and content / g	2.70	2.82	2.90	2.94	2.97	2.99	3.00	3.00	3.00

(a) Plot a graph of mass loss of flask and content against time and draw a curve to show the relationship between these two quantities. [3]



(b) Why is a cotton wool plug placed at the mouth of the conical flask?

.....

..... [1]

(c) State an observation that Sean will see if a reaction occurred.

.....

..... [1]

(d) Why did the mass of the flask and its contents decrease during the first 7.5 minutes?

.....

..... [1]

(e) Write a word equation for the reaction between calcium carbonate and hydrochloric acid.

..... [1]

(f) Using the graph, state the time at which the reaction was half complete.

..... [1]

(g) In a second experiment, Sean repeated the same experiment adding 20 g of calcium carbonate into a known volume of dilute boric acid, H_3BO_3 which has a pH of 6.12.

(i) Suggest an instrument to measure the pH of boric acid accurately.

..... [1]

(ii) If the volume and concentration of boric acid added is the same as hydrochloric acid in the first experiment, suggest how the time taken for the reaction to be completed would change.

.....

..... [1]

[Total 10 marks]

9 Fig 9.1 shows an electrical circuit connecting a 4100 W commercial electrical oven to a 240 V mains socket found in a pizza shop.

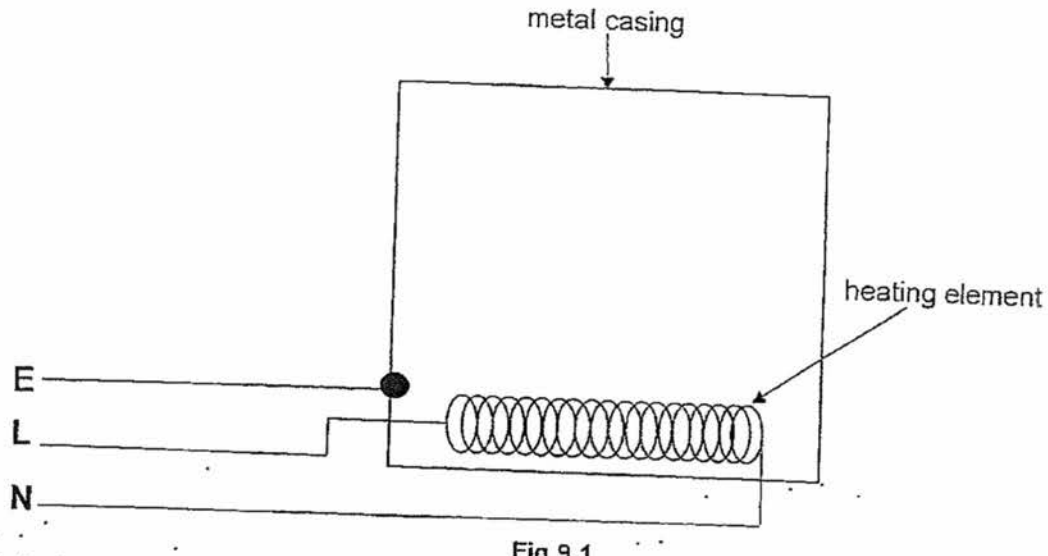


Fig 9.1

(a) Calculate the steady current flowing in the circuit.

[2]

(b) Hence, draw a fuse with a suitable fuse rating on Figure 9.1 to show where it should be placed.

[1]

(c) What is the voltage experienced by live, neutral and earth wires when the oven is working normally?

Wire	Live	Neutral	Earth
Voltage / V			

[1]

(d) Suggest a suitable material that can be used as a heating element and explain your answer.

.....

..... [2]

(e) The pizza shop has the following operation hours:

Day	Operating hours
Weekday	11 am to 9.30 pm
Weekend	10 am to 10.30 pm

(i) Given that the electrical oven is always in use during the shop's operation hours, calculate the amount of electrical energy consumed in a week.

[2]

(ii) If the electrical bill for using the oven in February this year is $272, find the unit cost of electricity, leaving your answers in cents.

[2]

[Total 10 marks]

10 (a) A group of women between the ages of 30 to 40 participated in a survey on the type of contraceptive methods they used in the years 2015 and 2016 respectively. The results are tabulated in the form of a bar chart as shown in Fig 10.1.

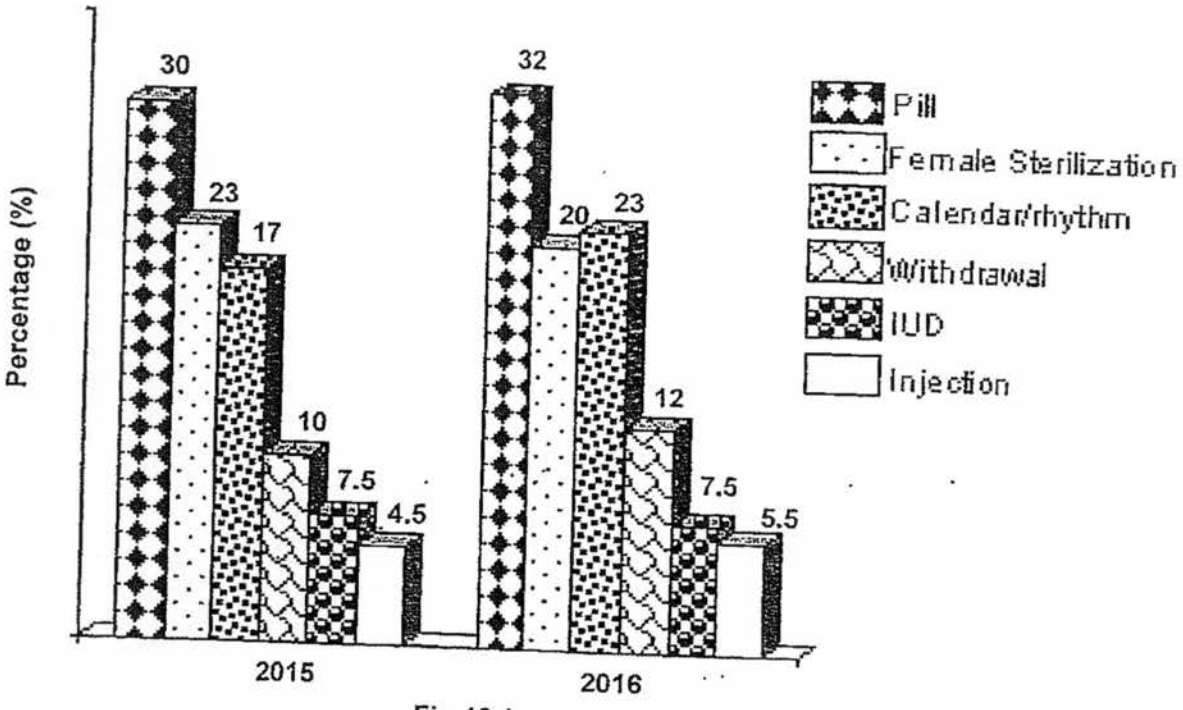


Fig 10.1

(i) Which contraceptive method saw the greatest jump in usage from 2015 to 2016?

..... [1]

(ii) In 2015, a group of women who participated in the survey did not use any form of contraception. If a total of 600 women participated in this survey, how many women did not use any form of contraception?

[1]

(iii) State which contraceptive method is the least popular. Suggest a possible reason why this method is least popular.

.....

..... [2]

(iv) Susan, who is a mother of three children, decided not to have any more babies. From the contraceptive methods listed in Fig 10.1, suggest which method she should use and explain how it prevents pregnancy.

.....

..... [2]

(b) Mrs Lee, a healthy woman in her late twenties, has her menstruation regularly every month.

(i) Define 'menstruation'.

.....

.....

..... [1]

(ii) Assuming that Mrs Lee has a 28 days menstrual cycle, write down the date of her next menstruation if her period starts on 18 March.

..... [1]

(iii) When Mrs Lee is pregnant, placenta develops in the wall of her uterus. Briefly explain the importance of placenta during her pregnancy.

.....

.....

..... [2]

[Total 10 marks]

End of Section C

DATA SHEET

The Periodic Table of the Elements

I	II											III	IV	V	VI	VII	0
							1 H Hydrogen 1										2 He Helium 4
3 Li Lithium 7	4 Be Beryllium 9											5 B Boron 11	6 C Carbon 12	7 N Nitrogen 14	8 O Oxygen 16	9 F Fluorine 19	10 Ne Neon 20
11 Na Sodium 23	12 Mg Magnesium 24											13 Al Aluminium 27	14 Si Silicon 28	15 P Phosphorus 31	16 S Sulfur 32	17 Cl Chlorine 35.5	18 Ar Argon 40
19 K Potassium 39	20 Ca Calcium 40	21 Sc Scandium 45	22 Ti Titanium 48	23 V Vanadium 51	24 Cr Chromium 52	25 Mn Manganese 55	26 Fe Iron 56	27 Co Cobalt 59	28 Ni Nickel 59	29 Cu Copper 64	30 Zn Zinc 65	31 Ga Gallium 70	32 Ge Germanium 73	33 As Arsenic 75	34 Se Selenium 79	35 Br Bromine 80	36 Kr Krypton 84
37 Rb Rubidium 85	38 Sr Strontium 88	39 Y Yttrium 89	40 Zr Zirconium 91	41 Nb Niobium 93	42 Mo Molybdenum 96	43 Tc Technetium -	44 Ru Ruthenium 101	45 Rh Rhodium 103	46 Pd Palladium 106	47 Ag Silver 108	48 Cd Cadmium 112	49 In Indium 115	50 Sn Tin 119	51 Sb Antimony 122	52 Te Tellurium 128	53 I Iodine 127	54 Xe Xenon 131
55 Cs Caesium 133	56 Ba Barium 137	57 – 71 lanthanoids	72 Hf Hafnium 178	73 Ta Tantalum 181	74 W Tungsten 184	75 Re Rhenium 186	76 Os Osmium 190	77 Ir Iridium 192	78 Pt Platinum 195	79 Au Gold 197	80 Hg Mercury 201	81 Tl Thallium 204	82 Pb Lead 207	83 Bi Bismuth 209	84 Po Polonium -	85 At Astatine -	86 Rn Radon -
87 Fr Francium -	88 Ra Radium -	90 - 103 actinoids	104 Rf Rutherfordium -	105 Db Dubnium -	106 Sg Seaborgium -	107 Bh Bohrium -	108 Hs Hassium -	109 Mt Meitnerium -	110 Ds Darmstadtium -	111 Rg Roentgenium -	112 Cn Copernecium -		114 Fl Flerovium -		116 Lv Livermorium -		

lanthanoids	57 La Lanthanum 139	58 Ce Cerium 140	59 Pr Praseodymium 141	60 Nd Neodymium 144	61 Pm Promethium -	62 Sm Samarium 150	63 Eu Europium 152	64 Gd Gadolinium 157	65 Tb Terbium 159	66 Dy Dysprosium 163	67 Ho Holmium 165	68 Er Erbium 167	69 Tm Thulium 169	70 Yb Ytterbium 173	71 Lu Lutetium 175
actinoids	89 Ac Actinium -	90 Th Thorium 232	91 Pa Protactinium 231	92 U Uranium 238	93 Np Neptunium -	94 Pu Plutonium -	95 Am Americium -	96 Cm Curium -	97 Bk Berkelium -	98 Cf Californium -	99 Es Einsteinium -	100 Fm Fermium -	101 Md Mendelevium -	102 No Nobelium -	103 Lr Lawrencium -

Key: proton (atomic) number; atomic symbol; name; relative atomic mass

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

Pei Hwa Sec School

Sec 2 Express Lower Sec Science

End of Year Exam

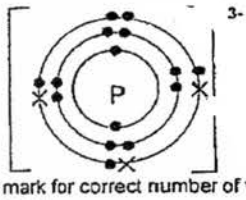
Mark Scheme

Section A : Multiple Choice Questions (30 marks)

1	A	11	C	21	D
2	C	12	D	22	D
3	B	13	D	23	D
4	C	14	A	24	
5	D	15	D	25	D
6	B	16	C	26	D
7	A	17	B	27	B
8	C	18	C	28	C
9	D	19	D	29	C
10	B	20	A	30	A

Section B (40 marks)

In			Answers	Mark	Rejected Answers
	(a)		Bottle Q and S. The content in Q are formed by chemical reactions and content in S can be broken down into simpler substances by chemical reaction.	1 1	
	(b)	(i)	Both answers must be correct to get 1 mark. Sulfur / Chalk (Accept any yellow particles insoluble in water) Sugar / salt (Accept any white particles soluble in water)		
		(ii)	Iron / Nickel / Cobalt (Do not accept other answers)	1	
	(c)		thermal decomposition	1	
				[Total 5 marks]	
	(a)		Fractional distillation (Do not accept simple distillation)	1	
	(b)		To ensure a smooth boiling when crude oil is heated.	1	
	(c)		Beaker of cold water acts as a condenser which cools the vapour back into the various liquid fractions.	1	
	(d)		The bulb of the thermometer is placed next to the entrance of the delivery tube to measure the boiling point of the various fraction/ to measure the temperature at which the liquid turns in a vapour.	1	

	(e)	Crude oil is highly flammable, hence direct heating should not be used in the experiment.	1	
	(f)	Heat the crude oil using a oil bath / a beaker of hot oil / sand bath.	1	
		[Total 6 marks]		
3	(a)	Lithium and caesium		
	(b)	Mg^{2+} and O^{2-}		
	(c)	Helium	1	
	(d)	1 mark award if all 3 answers are correct. In^{3+}: No of protons 49; No of neutrons 66; No of electrons 46	1	
	(e)	 1 mark for correct number of valence electrons draw with another 3 electrons gained 1 mark for correct overall charge with brackets.	2	

			[Total 6 marks]	
4	(a)	Potential difference across R_3 = 0.5 x 9 = 4.5 V	1	
	(b)	Potential difference across R_4 = 12 – 4.5 = 7.5 V		
	(c)	Current flowing in R_1 = 4.5 / 3 = 1.5 A Current flowing in R_2 = 4.5 / 6 = 0.75 A Current flowing in R_3 = 4.5 / 9 = 0.5 A Amount of current flowing into R_4 = 1.5 + 0.75 + 0.5 = 2.75 A	1 1	
	(d)	R_4 = 7.5 / 2.75 = 2.73 Ω (3 s.f)	1 1	
			[Total 6 marks]	
	(a)	The car is streamline in shape to reduce air resistance.	1	
	(b)	The markings on the cars' tyres allow the car to have better grip / control when moving on the road.	1	
	(b)	Force = Pressure x Area		

= 520 x (68 x 40) 1

= 1414400 N

Weight of 1 car = 20000 N

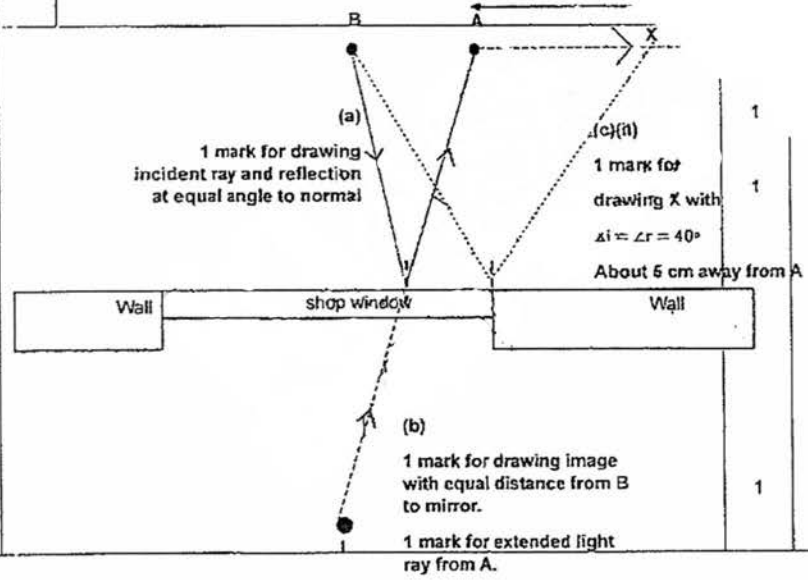
Maximum number of cars = $\frac{1414400}{20000}$ 1

= 70.72

= 70 *cars*

[Total 5 marks]

6



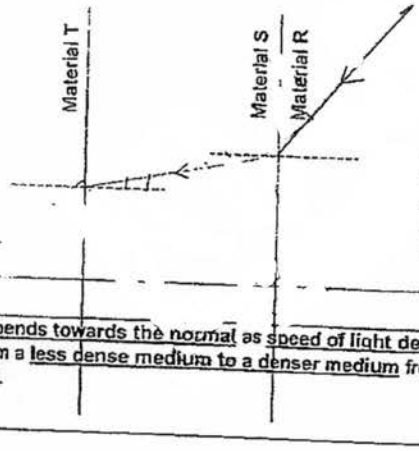
1

1

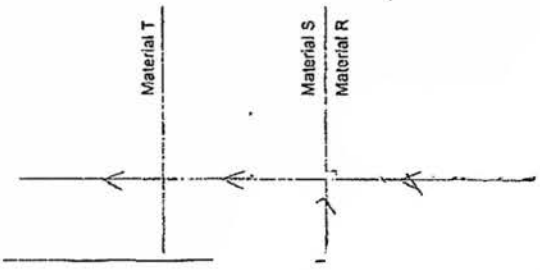
1

1

357

	(c)	For an image to be observed by reflection, angle of incidence must be equal to angle of reflection	1	
	(d)	∃ ⅃∀S	1	
				[Total 6 marks]
7	(a)	Angle of incidence = 56° (Accept 55° and 54°)		
	(b)	 1 mark for refracted ray bend nearer to the normal in medium S with arrow 1 mark for refracted ray bend to the normal in medium T with arrow	2	
	(c)	Light ray bends towards the normal as speed of light decreases when it enters from a less dense medium to a denser medium from medium R to medium S.	1 1	

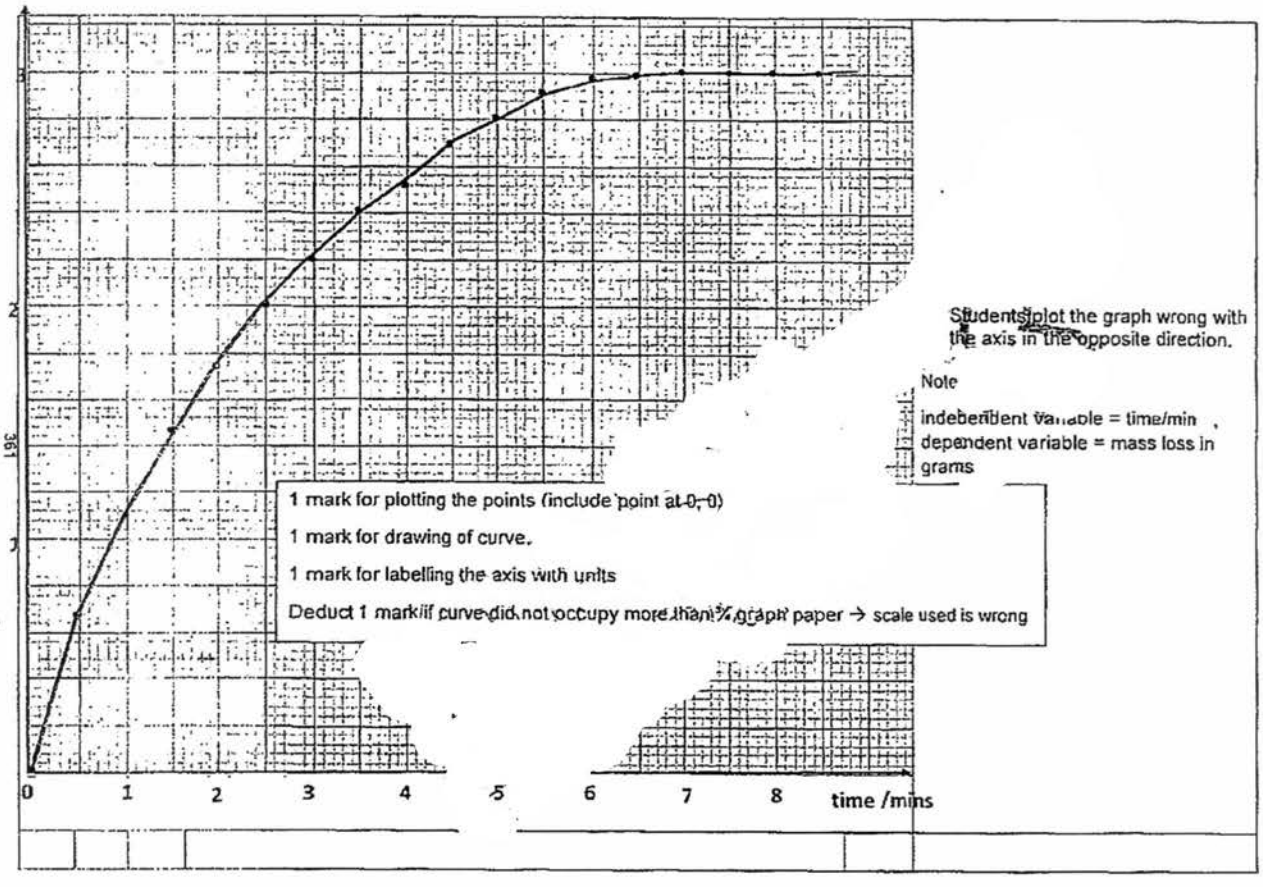
(d) Light ray will leave medium N without any refraction. 1



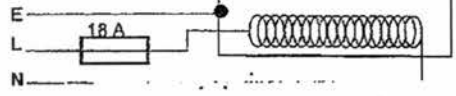
[Total 6 marks]

Section C (30 marks)			
8	(a)		
Mass loss / g			

	3	


0
1
2
3
4
5
6
7
8
time /mins
Students plot the graph wrong with the axis in the opposite direction.
Note
indebendent variable = time/min
dependent variable = mass loss in grams
1 mark for plotting the points (include point at 0, 0)
1 mark for drawing of curve.
1 mark for labelling the axis with units
Deduct 1 mark if curve did not occupy more than ½ graph paper → scale used is wrong

	(b)	To prevent spillage from the chemicals in the flask.		1	× Prevent the liquid from evaporation × Prevent the gas from escaping
	(c)	Solid calcium carbonate will dissolve / effervescence is observed.		1	× bubbles will be observed/ mass of the liquid will decrease.
	(d)	Carbon dioxide gas is produced and escaped from the flask.			× new substances are formed × A gas is formed in this chemical reaction.
	(e)	Calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide + water			
	(f)	1.6 minutes (Refer to student's graph for answer)		1	No graph plotted but time is correct
	(g)	(i)	pH data logger	1	× pH indicator / data logger without stating pH
		(ii)	Time taken for the reaction to be completed increased / will be longer	1	× Time taken is slower. (Note that it is the rate of the chemical reaction become slower resulting in time taken to be longer)
			[Total 10 marks]		
	(a)	I = P / V = 4100 / 240 = 17. 1 A		1 1	× Student leave answer in fraction.

	(b)		1	× wrong unit is written × fuse is drawn on the live wire but inside metal casing.
	(c)	Wire: Live / Neutral / Earth Voltage: 240 / 0 / 0	1	
363	(d)	Tungsten / Nichrome / Chromium It has a very high resistance, hence more electrical energy will be converted to heat energy.	1 1	× High resistance without explaining further. × Reject strong resistance.
	(e) (i)	Total number of hours on weekdays = 10.5 hours × 5 = 52.5 h Total number of hours on weekends = 12.5 hours × 2 = 25 h Amount of electrical energy consumed for a week = 4.1 x (52.5 + 25) = 317.75 kWh = 318 kWh (3 sign. fig)	1 1	× Never leave final answer as 3 significant figures.

		(ii)	Total units of electrical energy consumed in February = 317.7 x 4 = 1270.8 kWh Cost per unit of electricity = 272 / 1270.8 = $0.214 = 21 cents	1	× leave final answer in dollars and to 3 significant figures. Note: February has 28 days.
				[Total: 10 marks]	
10	(a)	(i)	Calendar / rhythm	1	
		(ii)	Number of women that did not used any contraception = 8/100 x 600 = 48	1	
		(iii)	Injection. Many women scared of pain or unable to endure the pain from the needle.	1 1	× sharing of needles can cause HIV/ADIS. × injection can cause side effects Note: contraceptive pills also cause side effects.
		(iv)	Female sterilization. (Do not accept 'ligation') The fallopian tubes are cut and tied so that the ovum produced is unable to get fertilized by the sperm in the fallopian tubes.	1 1	× Prevents the egg from entering the uterus. (Need to highlight to students is to prevent sperm from fertilizing the egg) Additional notes: Every month, the ovary will release the egg and the fallopian tube will transport it, but it will be stopped when it reaches the blockage. The mature egg has a lifespan and it dies if

					fertilization doesn't happen and be absorbed by the body.
	(b)	(i)	Menstruation is the <u>discharge</u> of the <u>disintegrated uterus lining, unfertilized egg and blood through the vagina</u>.	1	Menstruation is the <u>shredding</u> of the uterus lining, unfertilized egg and blood remove from the vagina.
		(ii)	15th April	1	Note: March has 31 days
		(iii)	Placenta • allow the <u>embryo receives food and oxygen nourishment</u> from the mother • <u>pass waste substances</u> back through the umbilical cord attached. • <u>Stops infections</u> and <u>harmful substances</u> from reaching the embryo. (Must have all 3 points to award 2 marks; 2 points award 1 mark)	1 1	
				[Total 10 marks]	

3365