2

Index Number	Class	Name

CHIJ ST JOSEPH'S CONVENT
SEMESTRAL ASSESSMENT 2

O

O

Lower Sec SCIENCE: PHYSICS module **5076**

Secondary 2 Express

Monday, 10 October 2016
1 hour 15 minutes

Candidates answer on the Multiple Choice Answer Sheet and Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your index number, class and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working
Do not use staples, paper clips highlighters, glue or correction fluid.

There are **2** sections.

Section A
There are **10** questions in Section A. 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 the Multiple Choice Answer Sheet provided.

Section B
Answer **all** questions in Section B in the spaces provided.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.
The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is **50**.

FOR EXAMINER'S USE	
Section A	10
Section B	40
Total	50

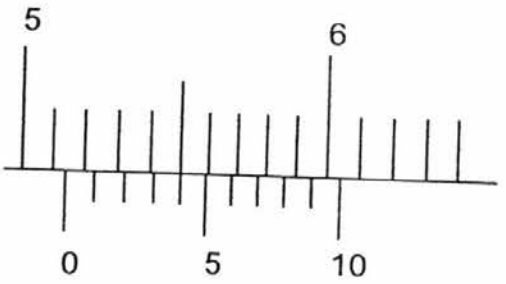
This document consists of **15** printed pages.

Setter(s) : Mr Pang Heng Cheun and Mr Tan Thuan Hock

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Section A [10 marks]

1 A pair of vernier calipers is used to measure the width of a plastic block.



What is the width of the block?

A	5.14 cm	**B**	5.50 cm
C	5.54 cm	**D**	6.04 cm

2 An object that has a mass of 15 kg on Earth is taken to the Moon. The gravitational field strengths on Earth and on the Moon are 10 N/kg and 1.6 N/kg respectively.

What is the weight of the object on the Moon?

A	16 N	**B**	24 N
C	150 N	**D**	160 N

3 The table shows the observations of an experiment in which a sample of a solid is placed in four different liquids.

liquid	density of liquid / kg/m^3	observation
mercury	14 000	floats
sea-water	1 100	floats
pure water	1 000	sinks
paraffin	700	sinks

What is the density of the sample?

A between 700 kg/m^3 and 1 000 kg/m^3
B between 1 000 kg/m^3 and 1 100 kg/m^3
C exactly 700 kg/m^3
D exactly 1 000 kg/m^3

4 When a metal block is cooled, which property does not change?

A	density	**B**	mass
C	volume	**D**	surface area

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5 A 10 kg ball, initially at rest at position **A**, rolls down a perfectly smooth slope.



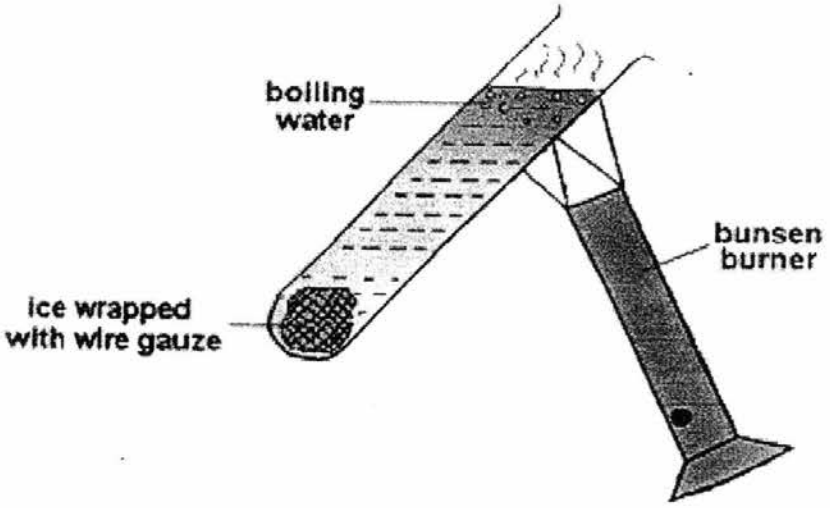
What is the kinetic energy of the ball when it is at position **B**? Gravitational field strength = 10 N/kg

A	50 J	**B**	125 J
C	250 J	**D**	500 J

6 Rays from an object O, after passing through a converging lens, come to a focus on the focal point. Which of the following is true?

A the object is very small
B the object is very large
C the object is very far away
D the object is at a distance equal to the focal length from the lens

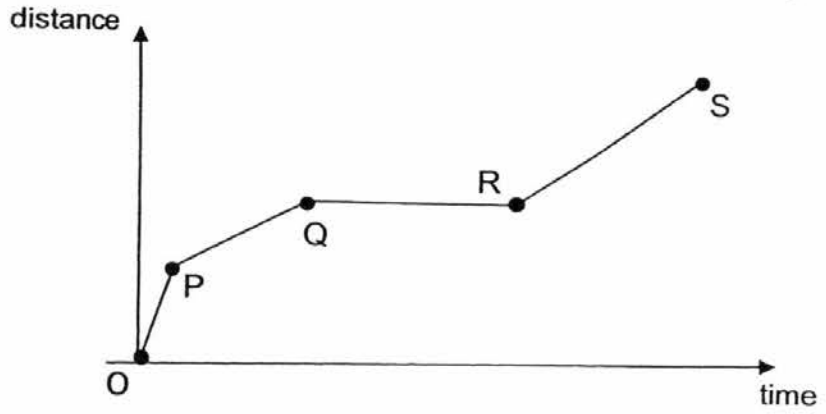
7 Boiling water and ice can exist at the same time in a test tube. What does this experiment show?



A water conduct heat well
B water conducts heat badly
C ice conducts heat well
D wire gauze conducts heat badly

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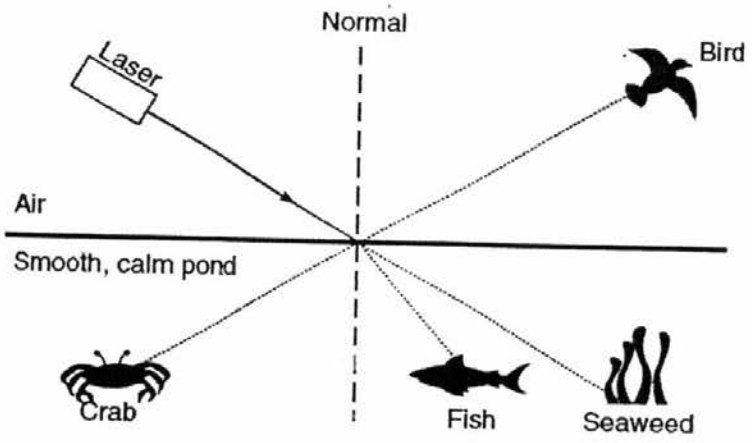
8 The graph shows how the distance travelled by a car changes with time.



Which section of the graph shows the car moving at the highest constant speed?

A	OP	**B**	PQ
C	QR	**D**	RS

9 A laser beam is directed at the surface of a smooth, calm pond as shown. Which organism could be illuminated by the laser light?

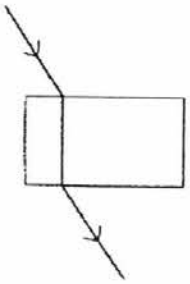


A the bird and the fish only
B the bird and the seaweed only
C the crab and the seaweed only
D the crab and the fish only

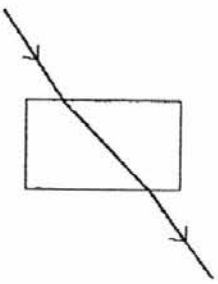
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10 Which diagram correctly shows the path of a ray of light passing through a rectangular glass block?

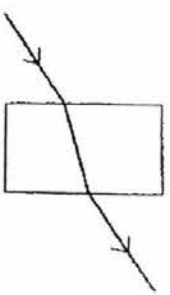
A



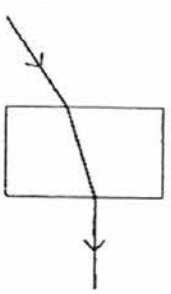
B



C



D



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Section B [40 marks]

Answer **all** questions in the spaces provided.

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1 A simple pendulum is made by hanging a metal ball of mass 350 g from a point **P** as shown in Fig. 1.1. Gravitational field strength is 10 N/kg.

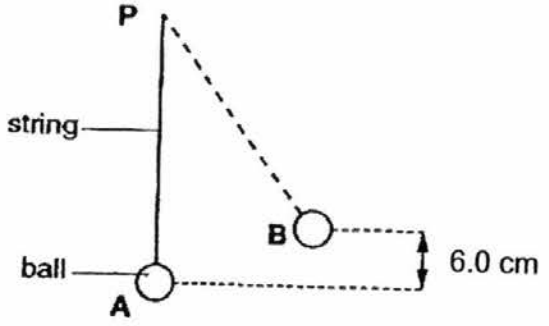


Fig. 1.1

(a) On Fig. 1.1, draw and label clearly the forces which act on the metal ball at position **A**. [2]

(b) The metal ball is displaced to **B**, released from rest at **B** and allowed to swing freely. The period of the pendulum is 1.4 s.

(i) What is the time taken for the metal ball to move from **B** to **A** when released?

time taken = ... [2]

(ii) What is the minimum work done needed to displace the metal ball from **A** to **B**?

minimum work done = ... [2]

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2 Fig. 2.1 shows an arrow that represents a girl standing in front of a mirror. **F** represents the position of her forehead, **E** represents the position of her eyes while **T** represents the position of her toes.

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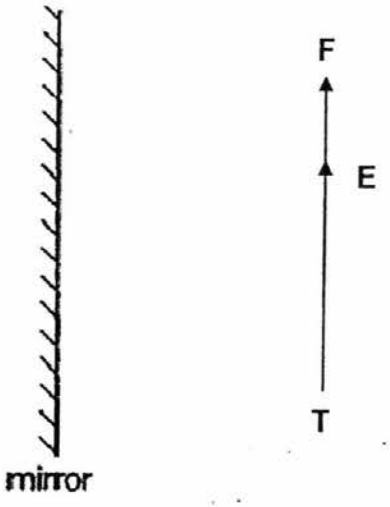


Fig. 2.1

(a) On Fig. 2.1, draw a ray to show how she can see the image of her toes in the mirror. [2]

(b) Indicate on the mirror the highest and lowest section of the mirror for the girl to see herself full-length in the mirror. Mark the highest point **H** and the lowest point **L**. [2]

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3 Fig. 3.1 shows a 30 kg wooden crate being pushed at a constant speed to the top of a rough slope by applying a 80 N force along the direction of the slope. The crate takes 15 s to travel a distance of 60 m from the bottom to the top of the slope. The gravitational field strength is 10 N/kg.

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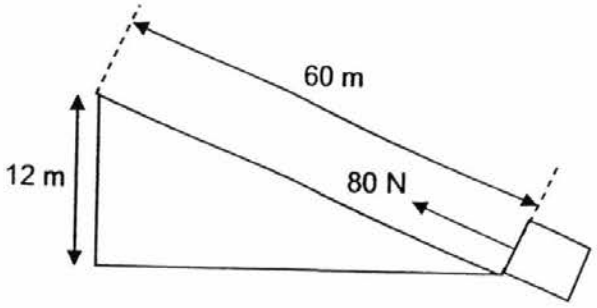


Fig. 3.1

(a) Calculate

(i) the work done when the 80 N force is used to pull the crate through a distance of 60 m up the slope,

work done = ... [2]

(ii) the power required to pull the crate up the slope.

power = ... [2]

(iii) the gain in gravitational potential energy of the wooden crate at the top of the slope,

gravitational potential energy = ... [2]

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(b) **(i)** Calculate the work done against friction in pulling the crate up the slope.

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work done = ... [1]

(ii) Determine the magnitude of the frictional force on the slope as the crate travels on it.

frictional force = ... [1]

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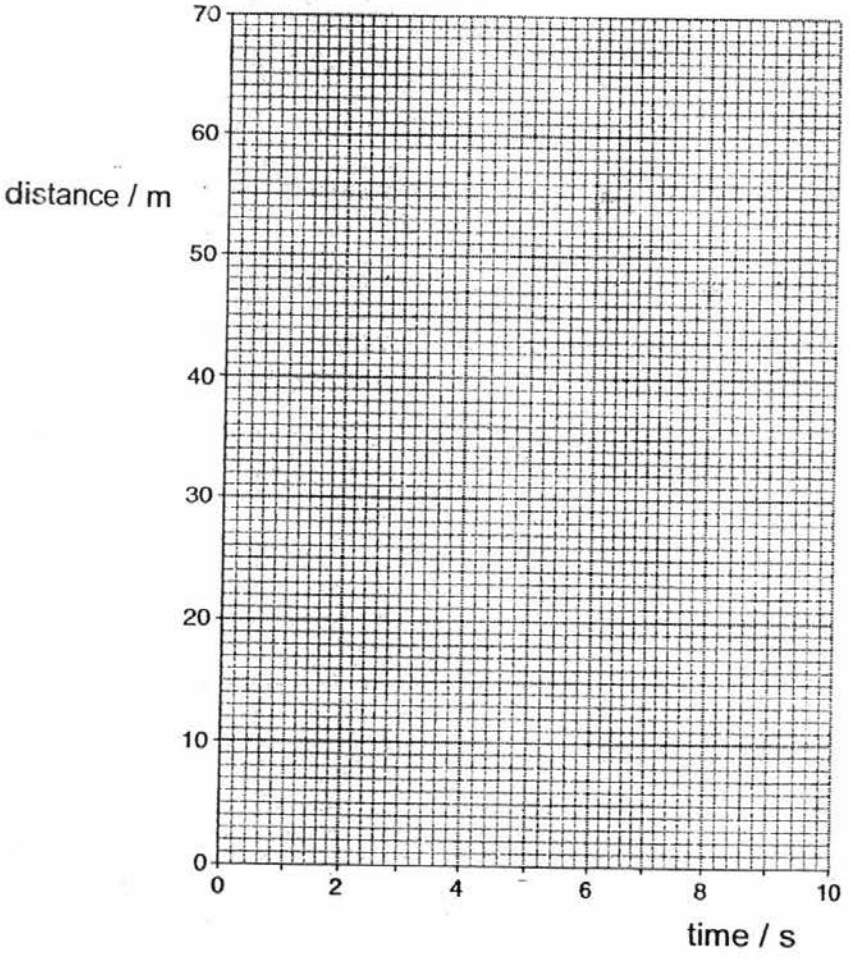
4 The total distance a cyclist travels from her start point is measured every second. The results for the first 10 seconds are shown in Table 4.1.

For Examiner's Use

time / s	distance travelled from the starting point / m
1	6
3	20
5	30
8	50
10	60

Table 4.1

(a) On the grid provided below, plot the results. Mark each point with a cross (x). Draw a line of best fit for your plotted points. [2]



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(b) Calculate the gradient of the line drawn. Show your working and indicate on your graph how you do this.

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gradient = ... [2]

5 A ray of light approaches the surface of a triangular glass prism as shown in Fig. 5.1.

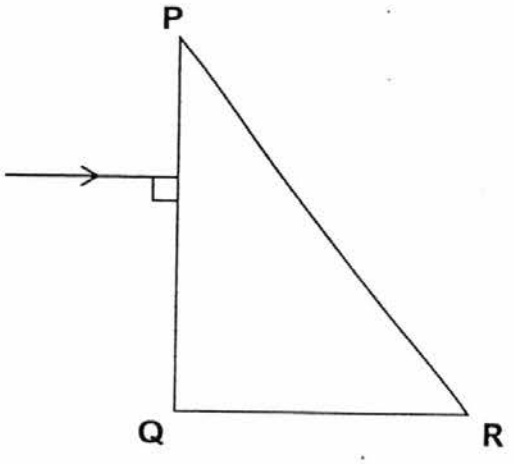


Fig. 5.1

(a) On Fig. 5.1, draw

(i) the ray of light when it enters at side **PQ** of the object,

(ii) the normal when the light ray strikes side **PR**,

(iii) the ray of light when it emerges from the object.

[3]

(b) State the change in the speed of light, if any, when the ray of light enters the side **PQ** of the glass prism.

..... [1]

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6 Fig. 6.1 shows an object **O** placed in front of a thin converging lens. The focal length of the lens is 3.0 cm.

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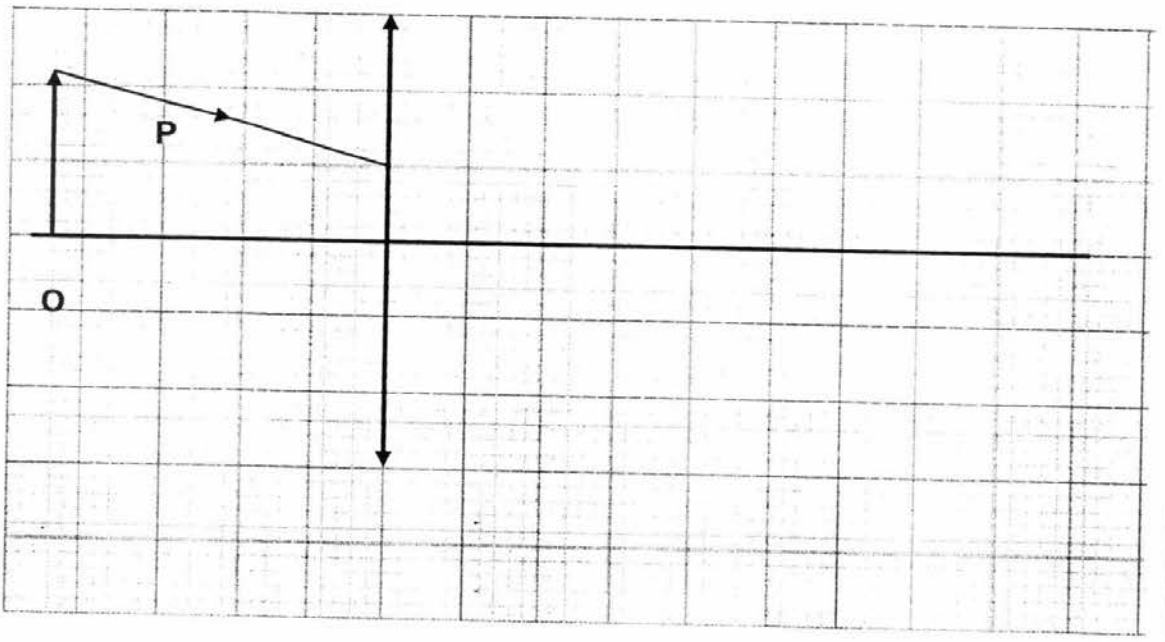


Fig. 6.1

(a) On Fig. 6.1,

(i) mark with "F" the focal point of the lens, [1]

(ii) draw light rays to locate the image of object **O** formed by the lens, [1]

(iii) complete the ray **P**. [1]

(b) The object is now moved to a position 6.0 cm away from the lens. Describe the image formed.

.....

.....

.....

..... [1]

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7 (a) Fig. 7.1 shows a filament lamp placed above a metal sheet. A thumbtack is attached to the other side of the metal sheet using wax.

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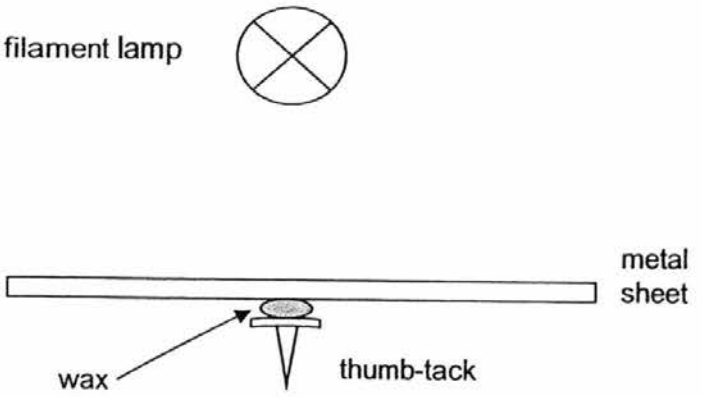


Fig. 7.1

The filament lamp is switched on. After some time, the wax holding the thumb-tack melts and the thumb-tack drops off.

(i) Explain how thermal energy from the filament lamp reaches the top part of the metal sheet.

.....

.....

.....

..... [2]

(ii) Explain how thermal energy from the top part of the metal sheet reaches the wax.

.....

.....

.....

..... [2]

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(b) Fig. 7.2 shows a set of equipment placed on top of a house that uses solar energy to produce hot water.

For Examiner's Use

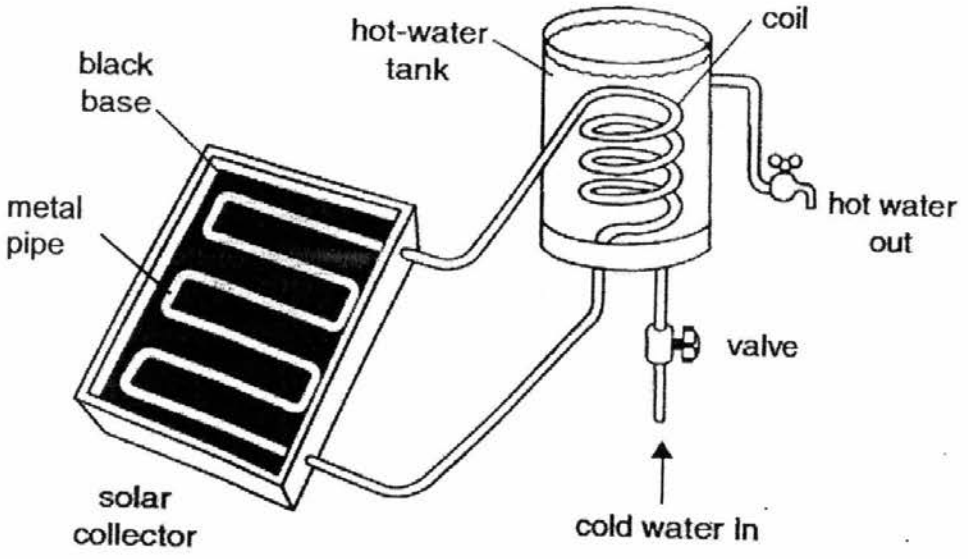


Fig. 7.2

(i) Which method of heat transfer takes place between the Sun and the solar collector?

..... [1]

(ii) The light rays from the Sun travels at a certain speed in air. State the magnitude and unit of the speed of these light rays.

..... [1]

(iii) Explain two features of the solar collector that increase the rate at which energy is absorbed from the Sun.

.....

.....

.....

.....

.....

..... [2]

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(iv) The hot water tank loses heat rather quickly. Suggest a practical method to reduce the rate of heat loss from the tank. Explain.

For Examiner's Use

.....

.....

.....

.....

.....

..... [2]

End of Paper

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Sec 2 Physics SA2 2016

Answer Scheme

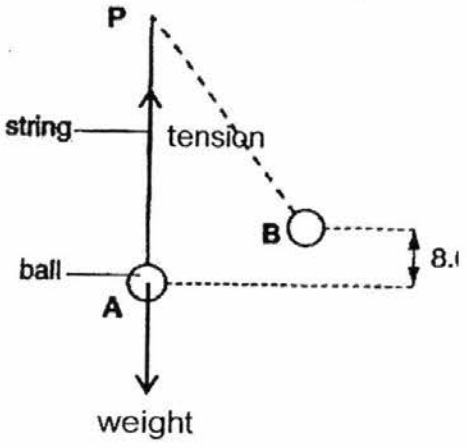
Section A

Question	1	2	3	4	5	6	7	8	9	10
Answer	A	B	B	B	D	C	B	A	A	C

Section B

Deduct 1 m per question for missing / wrong units
Deduct 1 m per question for answers not in 2~3 s.f.

1a)



1 mark for the downward force acting on the metal ball, labelled weight or W

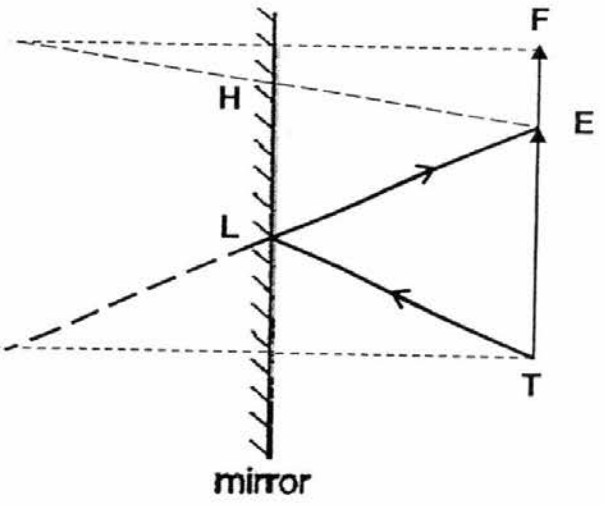
1 mark for the upward force acting on the metal ball, labelled tension or T
[this force should be on the string]

1bi) time taken from B to A
= 1.4 s / 4 [M1]
= 0.35 s [A1]

1bii) Min work done
= gain in GPE
= mgh M1
= (0.35 kg) (10 N/kg) (0.06 m)
= 0.21 J A1

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2a)



1 mark for correct image position

1 mark for the light ray with correct direction arrows from point T to the eye

2b) 1 mark for both **H** and **L** correctly marked at midpoint
No need to show working / draw lines to locate position H

3ai) work done = Fd
= 80 x 60 [1]
= 4 800 J [1]

3aii) E_p gained = mgΔh
= 30 x 10 x 12 [1]
= 3 600 J [1]

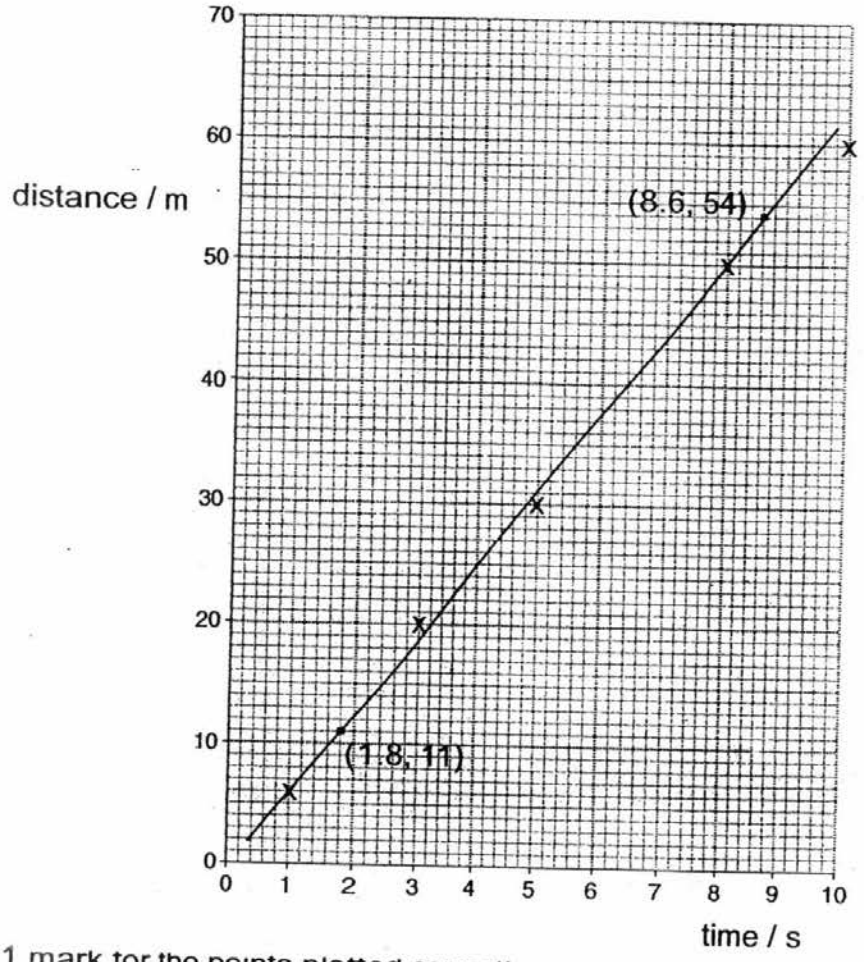
3aiii) P = W.D. / t
= 4 800 / 15 [1]
= 320 W [1]

3bi) work done against friction
= 4800 – 3600
= 1200 J [1]

3bii) work done against friction = frictional force x d
1 200 = frictional force x 60
frictional force = 1 200 / 60
= 20 N [1]

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4a)



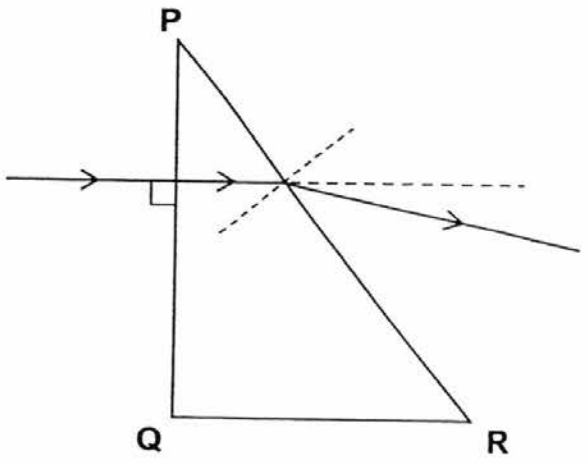
1 mark for the points plotted correctly
1 mark for the line of best fit

4b) 1 mark for the two selected points on the line of best fit, relatively far away points with coordinates clearly written

gradient = $(y_2 - y_1) / (x_2 - x_1)$
= $(54 - 11) / (8.6 - 1.8)$
= 6.3235
≅ 6.32 (3 sf) [1]

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5a)



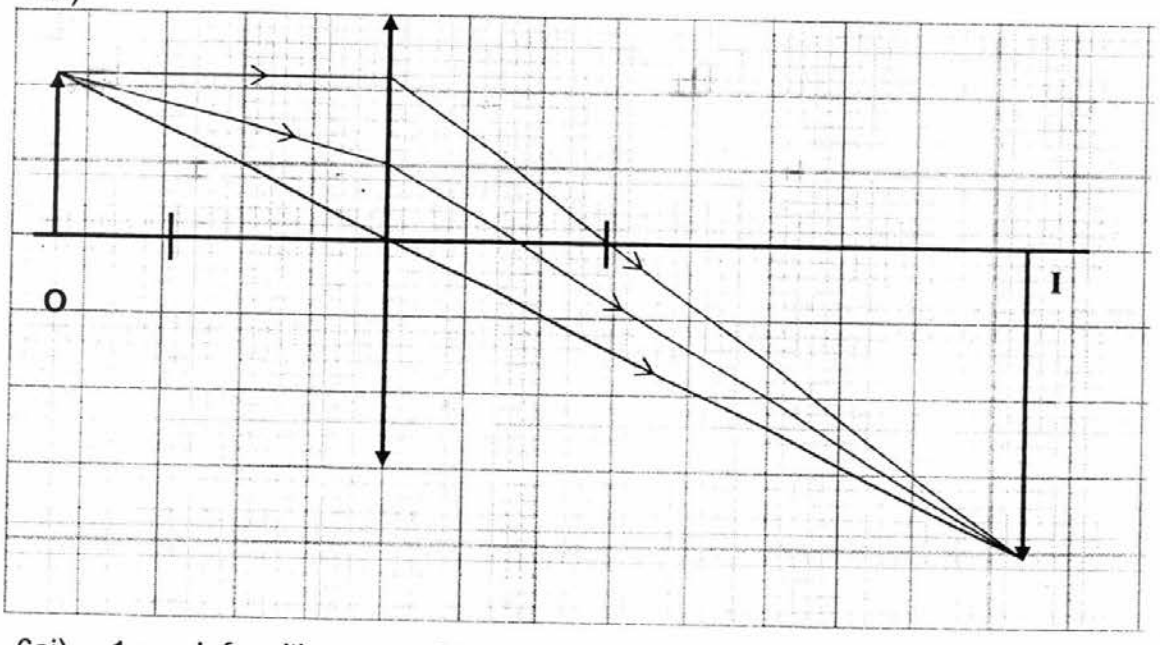
(i) 1 mark for the refracted ray of light which enters side **PQ** with no change in direction

(ii) 1 mark for the normal on side **PR** at the point where the refracted ray strikes the surface

(iii) 1 mark for the emergent ray of light refracted away from the normal

5b) The speed of light decreases. [1]

6ai)



6ai) 1 mark for either one of the two focal points labelled by 'F' [1]

6aii) 1 mark each for correct light ray with arrow [1]

6aiii) 1 mark for correct light ray with arrow [1]

6b) The image is still real and inverted, but the same size. [1]

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7ai) Thermal energy is transferred from the filament lamp to the top part of the metal sheet by radiation [1] OR infra-red radiation [2]

Deduct 1 mark if candidate include conduction and/or convection

7aii) Thermal energy is transferred from the top part of the metal sheet to the wax by conduction. [1]

Via molecular vibration and/or free electrons diffusion [1]

7bi) radiation or infra-red radiation [1]

7bii) 3.0×10^8 m/s [1]

7biii) Black surfaces are good absorbers of infra-red radiation.

OR Metal is a good conductor of heat

OR The long pipe increases surface area and rate of infra-red radiation

2 marks for either 2 of the 3 stated

7biv) **Note:** There are various possible answers to this question. Marks can be given so long as sound use of physics concepts is shown in the students' responses.

1. The external surfaces of the water tank can be wrapped with a layer of aluminium foil. The shiny surface of the foil is a poor emitter of infra-red radiation.

2. The external surfaces of the water tank can be wrapped with a few layers of wool or cloth or styrofoam. These materials trap numerous pockets of air, which is a good heat insulator.

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Index Number	Class	Name

CHIJ ST JOSEPH'S CONVENT
SEMESTRAL ASSESSMENT 2

O **O**

SCIENCE CHEMISTRY

Secondary 2 Express

Friday, 7 October 2016
50 minutes

Candidates answer on the Question Paper.
Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your index number, class and name on all the work you hand in.
Write in dark blue or black pen.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
There are **10** questions. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C**, and **D**. A mark will not be deducted for a wrong answer. Choose the **one** you considered correct and record your choice in **soft pencil** on the separate Answer Sheet.

Section B
Answer **all** questions in the spaces provided.

The number of marks is given in brackets [ ] at the end of each question or part question.
Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
Electronic calculator may be used in this paper.
The total of the marks for this paper is **40**.

A copy of the Periodic Table is printed on page **12**.

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A	
B	
Total	40

This document consists of **12** printed pages.

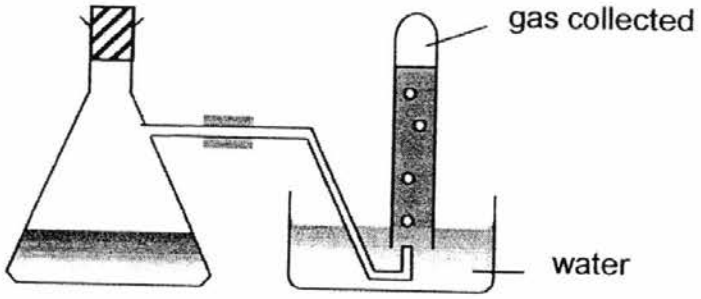
Setter(s) : Miss Ho Yan Yi and Mrs Ken Oh

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Section A (10 marks)

Answer **all** questions.

1 A gas produced in a chemical reaction can be collected by the arrangement shown in the diagram below.



Some properties of four gases are given in the table below.

Which gas **cannot** be collected by this arrangement?

	name of gas	density of gas (g/cm^3)	solubility of gas in water
A	carbon dioxide	0.0018	slightly soluble
B	hydrogen chloride	0.0015	very soluble
C	methane	0.0007	insoluble
D	oxygen	0.0013	slightly soluble

2 Which of the following list of substances contains an element, a compound and a mixture?

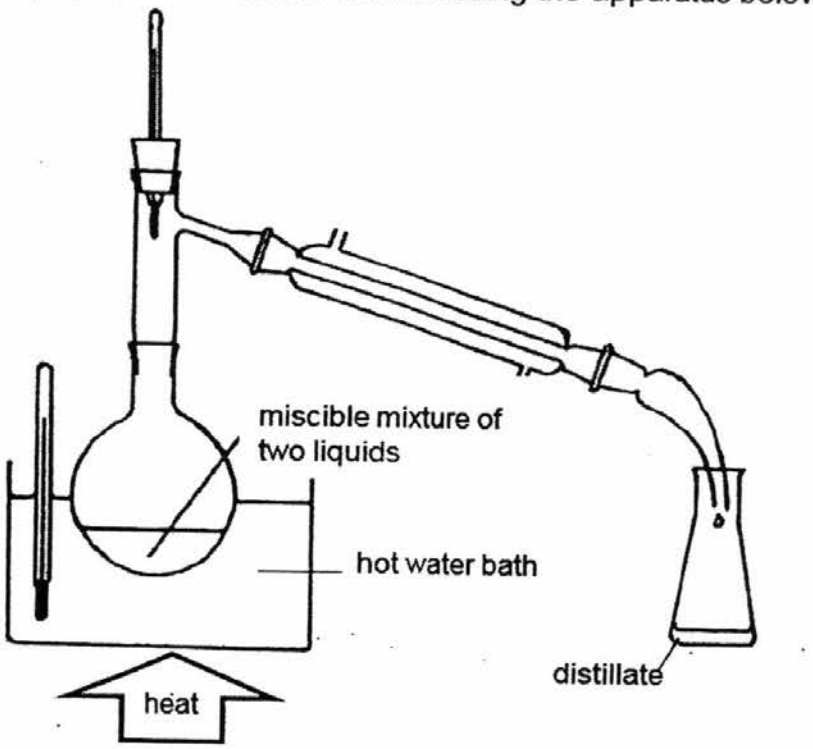
A argon, copper, ice
B carbon dioxide, bronze, nitrogen
C dry air, tap water, wax
D ethanol, crude oil, methane

3 When dry ice sublimes at room temperature,

A the temperature remains constant.
B the molecules rotate and slide over one another.
C the molecules breakdown to form gaseous atoms.
D the molecules move closer together in an orderly manner.

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4 Which substance, **A**, **B**, **C** or **D** can be distilled using the apparatus below?



	melting point/ °C	boiling point/ °C
A	-138	0
B	-123	50
C	0	108
D	41	182

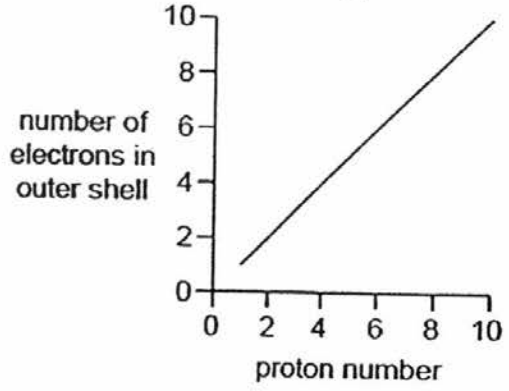
5 Both magnesium oxide, MgO, and aluminium oxide, Al_2O_3, are solids at room temperature, 25 °C.
MgO has a boiling point of 2852 °C and a melting point of 2600 °C.
Al_2O_3 has a melting pint of 2072 °C and a boiling point of 2880 °C.
Over which temperature range will both compounds conduct electricity?

A 25 to 2852 °C
B 2072 to 2852 °C
C 2852 to 2880 °C
D 2880 to 3600 °C

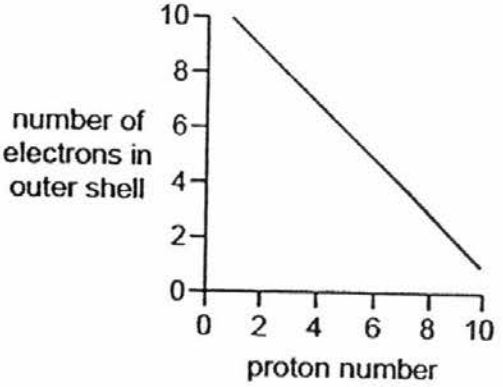
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6 Which graph shows the number of electrons in the outer shell of an atom, plotted against the proton (atomic) number for the first ten elements in the Periodic Table?

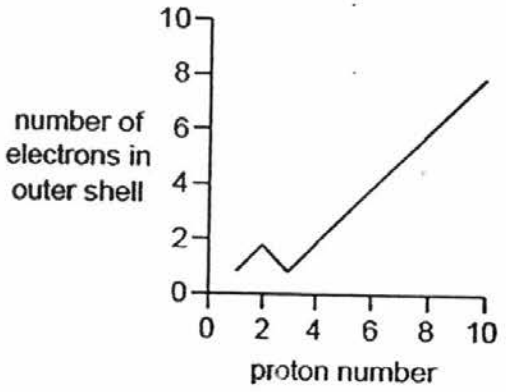
A



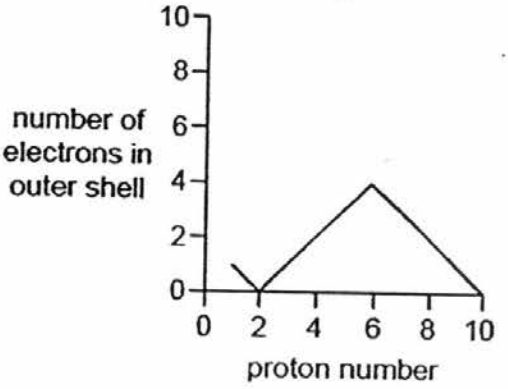
B



C



D



7 An ion of an element X has 18 electrons, 20 protons and 19 neutrons. An isotope of atom of element X may have

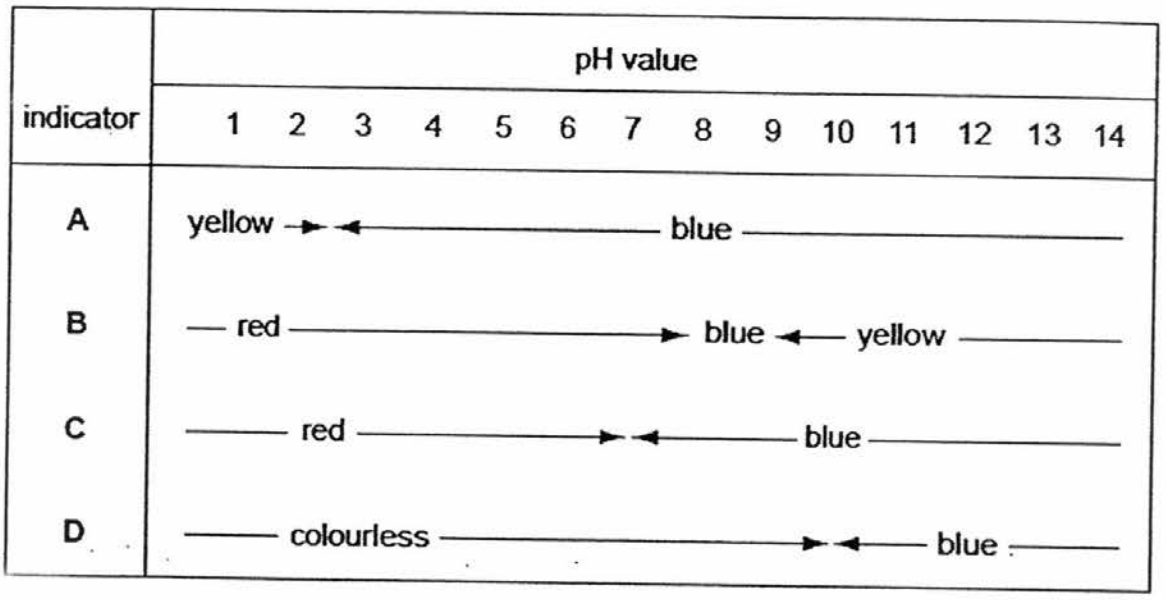
A 18 protons, 22 neutrons and 20 electrons.
B 20 protons, 19 neutrons and 20 electrons.
C 18 protons, 22 neutrons and 18 electrons.
D 20 protons, 22 neutrons and 20 electrons.

8 Which compound would not form copper(II) sulfate by reaction with sulfuric acid?

A copper
B copper(II) oxide
C copper(II) carbonate
D copper(II) hydroxide

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9 The chart shows the colour ranges of four different indicators.
Which indicator is blue in an acidic solution?



10 Carbon dioxide, sulfur dioxide and carbon monoxide are gases which have an adverse impact on the environment. In what ways do these gases affect our environment?

	carbon dioxide	sulfur dioxide	carbon monoxide
A	global warming	oxygen depletion in blood	forms acid rain
B	oxygen depletion in blood	oxygen depletion in blood	global warming
C	global warming	forms acid rain	oxygen depletion in blood
D	oxygen depletion in blood	global warming	forms acid rain

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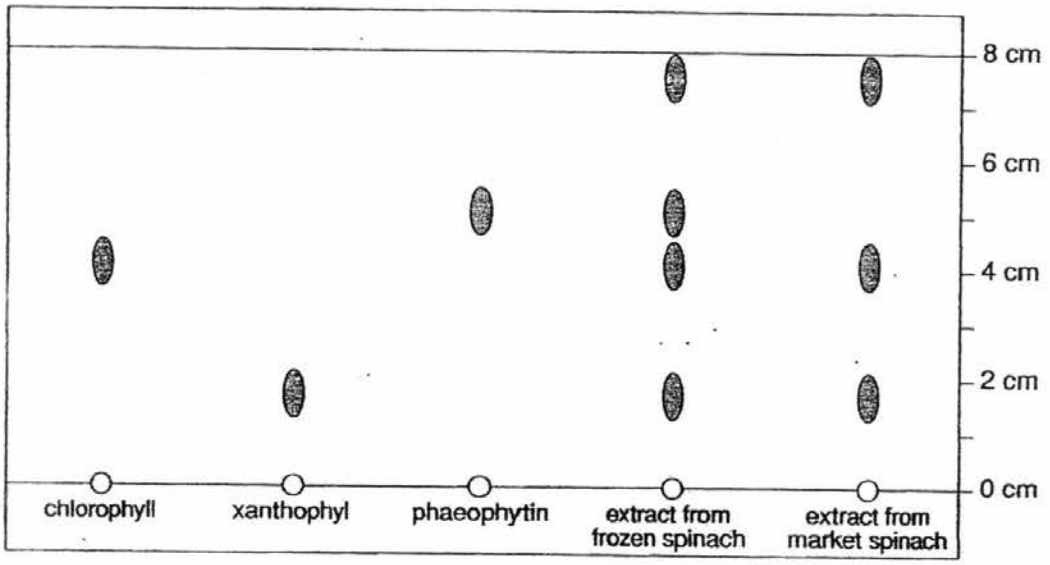
Section B (30 marks)

Answer **all** questions.

For examiners use

1 Chlorophyll is a green pigment found in green leaves. 'Old chlorophyll' can decompose into phaeophytin, a grey pigment molecule.

A student carried out a chromatographic exeriment to compare the extract of spinach leaves obtained from two different sources, using ethanol as the solvent, and he obtained the following chromatogram.



(a) Describe a difference in the property between chlorophyll, xanthophyll and phaeophytin as shown in the chromatographic above.

.....

..... [1]

(b) Describe the result obtained for the extract from frozen spinach.

.....

..... [2]

(c) The student concluded that spinach bought from the market is fresher than frozen spinach. Explain his reasoning.

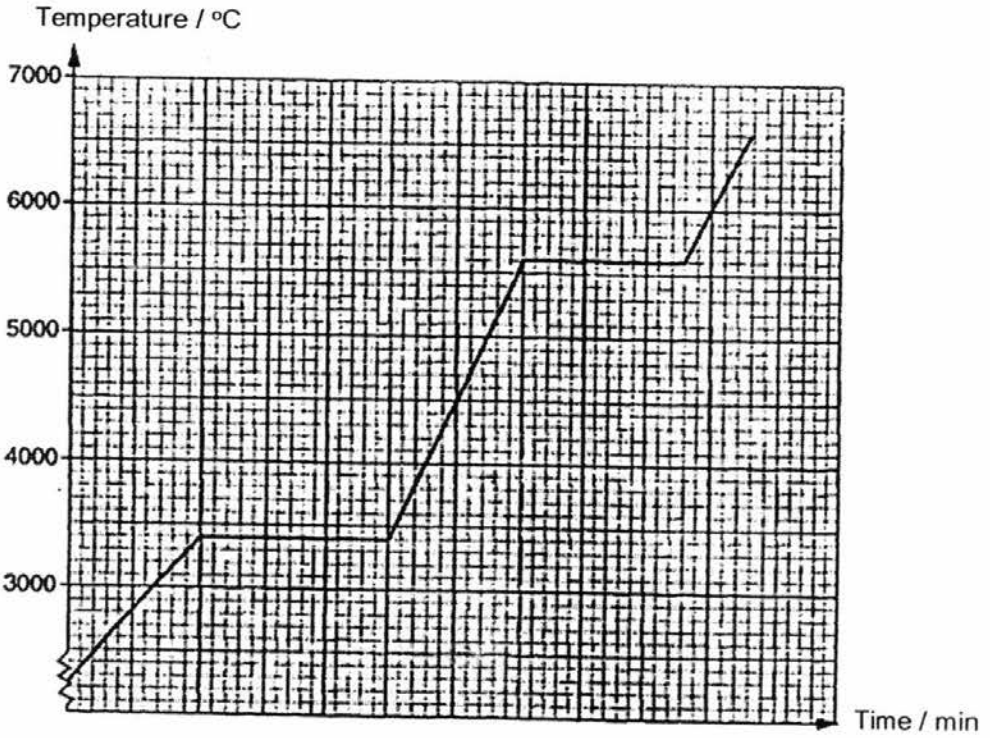
.....

..... [2]

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2 In a light bulb, the tungsten wire may get so hot that it melts and breaks. The graph below shows the heating curve for tungsten.

For examiners use



(a) From the graph, state the temperature at which tungsten wire breaks.

..... [1]

(b) Using the graph, explain whether the wire is made up of pure tungsten or an alloy containing mainly tungsten.

.....

..... [1]

(c) Describe the changes, if any, in the movement of the particles in tungsten if it is heated from 5000 °C to 6000 °C.

.....

..... [2]

(d) When tungsten, W, is heated strongly in the presence of oxygen, it oxidises, forming **only** a bronze-coloured solid, tungsten (IV) oxide.

(i) Write the chemical formula of tungsten (IV) oxide: .....

(ii) Hence, write the equation to represent the reaction in **d(i)**.

..... [3]

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(e) If there is a leakage of oxygen into the bulb and the reaction in **d(i)** occurs, would the bulb still be able to light up?

For examiners use

Explain with reference made to bonding and structure.

.....

.....

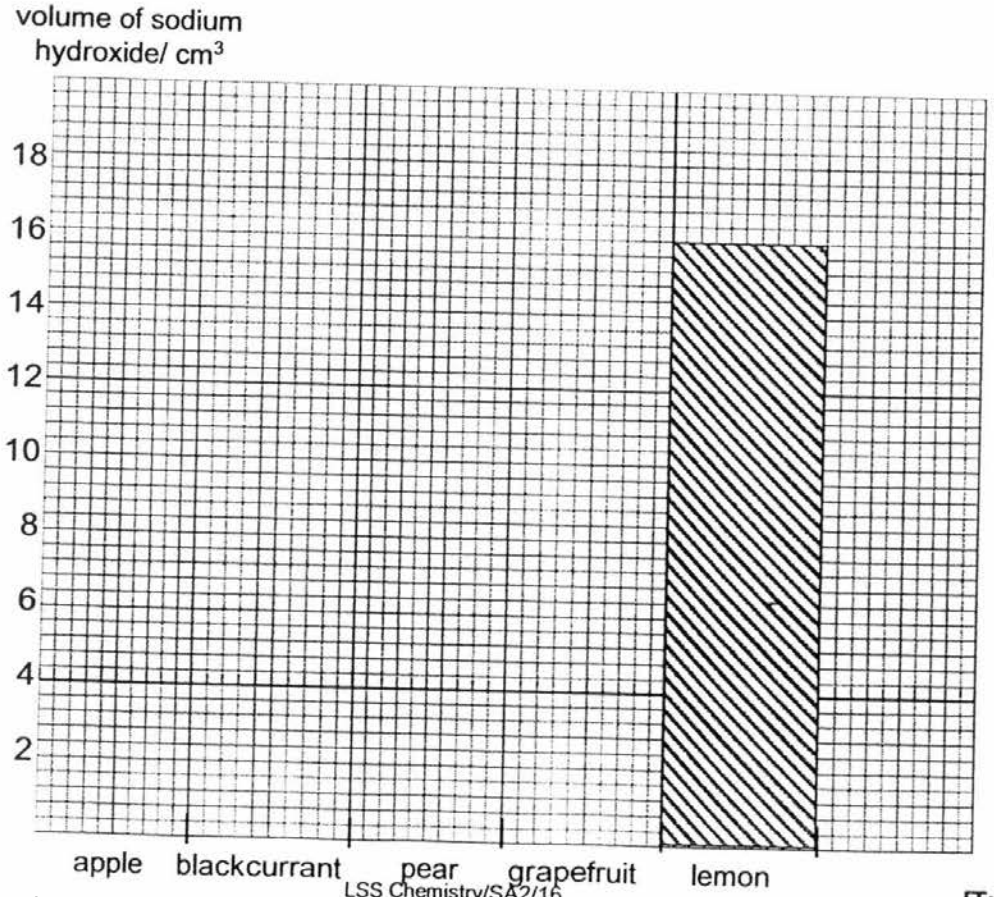
..... [3]

4 An experiment is carried out to compare the acidity of various fruit juices. Five drops of Universal Indicator are added to exactly 25.0 cm^3 of each fruit juice. Aqueous sodium hydroxide is then added to each sample until the Universal Indicator shows that the solution is neutral.

The results obtained are shown in the table.

fruit juices	volume of sodium hydroxide added/ cm^3
apple	9.00
blackcurrant	12.00
grapefruit	14.00
lemon	16.00
pear	6.00

(a) Complete the bar chart below, an example has been shown.



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[2]

(b) Which fruit juice is the most acidic? ..... [1]

For examiners use

(c) Circle the following list, four items of apparatus you need to carry out this experiment.

pipette	**Bunsen burner**	**conical flask**	**plastic dropper**
test tube	**thermometer**	**burette**	**measuring cylinder**

[2]

5 Ammonium chloride is a white crystalline solid which decomposes upon strong heating to form ammonia gas and hydrogen chloride gas. Both gases diffuse into the air.

(a) Construct a balanced chemical equation to show the decomposition reaction of ammonium chloride.

..... [1]

(b) (i) Define relative molecular mass.

.....

.....

(ii) Calculate the relative molecular mass of ammonia gas and hydrogen chloride gas.

You **must** show your working clearly to be awarded marks.

relative molecular mass of ammonia gas: .....

relative molecular mass of hydrogen chloride gas: .....

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[3]

(c) The rate of diffusion of gases is closely related to its molecular mass. The table below shows this relationship.

For examiners use

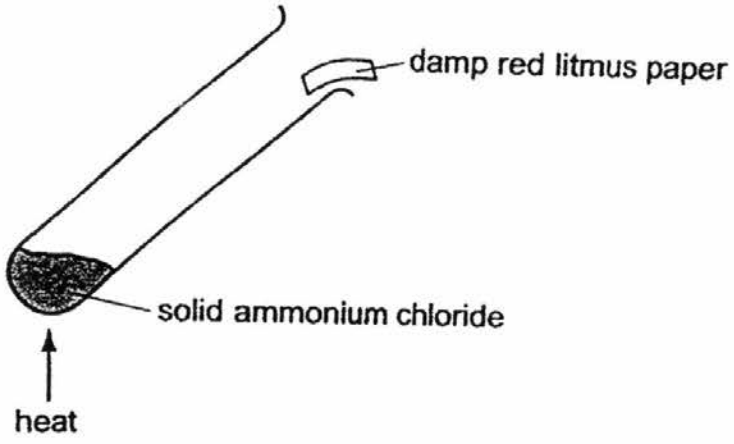
gas	relative molecular mass	rate of diffusion
helium	4	1.0
methane	16	0.5
oxygen	32	0.35
sulfur dioxide	64	0.25
heptane	100	0.2

From the above table, state the relationship between the molecular mass and the rate of diffusion.

.....

..... [1]

(d) A sample of ammonium chloride was heated in the experiment shown below. A piece of moist red litmus paper was placed at the mouth of the test tube to follow the reaction.



Describe the changes, if any, to the moist red litmus paper from the start of the experiment until all the white crystalline solid has decomposed. Explain using all relevant information from parts **(b)** and **(c)**.

.....

.....

.....

..... [2]

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(e) Shortly after the heat was removed, some white crystalline powder was observed at the mouth of the test tube.

(i) Suggest the identity of the white crystalline powder.

.....

(ii) Using Kinetic Particle theory, suggest an explanation for the formation of the white crystalline powder.

.....

.....

.....

..... [3]

End of Paper

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The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	– Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57 *	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

Key: a / X / b
a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

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

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2016 Sec 2 Exp Sci Chem Mark Scheme

MCQs

1	B		**6**	C
2	B		**7**	D
3	A		**8**	A
4	B		**9**	A
5	~~C void~~ all students to be awarded 1m		**10**	C

Section B (30 marks)

Q1	**(a)**	**Phaeophytin** is the **most** soluble/ **Xantophyl** is the **least** soluble/ **Chlorophyll** is **less** soluble **than phaeophytin**/ Chlorophyll **more** soluble than xanthophyll Accept answers as long as students **compare** the solubility between phaeophytin, chlorophyll and xantophyl	[1]	
	(b)	Frozen spinach contains 4 pigments/ **Phaeophytin, Xantophyl and Chlorophyll** and **an unknown** substance Surprisingly, many students are not able to do well in this question. Many gave discussion on phaeophytin only. Also, many students ignored the unknown substance. Some students did not realise that this chromatogram is on plants pigments and discuss their answers in terms of colours from inks and dyes. These will not be awarded any credit.	[1] [1]	
	(c)	Spinach bought from the market **does not contain phaeophytin** which can **only be found when old chlorophyll decomposes/ decomposition**. Weaker students did not pinpoint correctly phaeophytin as the pigment that indicates the freshness. Some did not elaborate on their answers hence losing the 2nd marking point.	[1] [1]	
2	**(a)**	3400 °C Students failed to read the information given in the question that it "melts and break". Hence the correct temperature should be at the melting point.	[1]	

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	(b)	It is **pure** as it **melts/ boils at a fixed temperature**/at one temperature. • Many students wrongly identified that tungsten is an alloy as they have based their answers on HIGH melting point/boiling point. • All students should note that most metals do also have high melting and boiling point. • The graph shows that there is a FIXED melting point and a FIXED boiling point, hence based on this tungsten is a PURE metal.	[1]	
	(c)	PARTICLES **sliding over one another** **to move rapidly/faster in all directions** Irrevelant discussion on energy and arrangement seen in several scripts. Students must focus their discussion on CHANGES in MOVEMENT of PARTICLES during boiling process. Weaker students have based their answers on melting process and will not be awarded any marks.	[1] [1]	
	(d)	**(i)** WO_2 /allow BOD for W_2O_4 **(ii)** $W + O_2 \rightarrow WO_2$ /allow ecf; marking on balancing equation	[1] [1]	*1m shifted to Q5b*
	(e)	The bulb will not light up as **TUNGSTEN OXIDE** has **a giant ionic lattice structure** with **strong electrostatic forces of attraction / ionic bond** (between oppositely charged ions) Hence the **ions are fixed in position** / ions are **not free** and **mobile** to conduct electricity. Students must mention that a new compound/ tungsten oxide is formed. No credit will be given to ***IT*** *has a giant ionic lattice structure/ there is an ionic lattice structure, if* throughout the answers with no reference to the new compound/tungsten oxide. Also, some students regurgitate the points on ions in aqueous and molten state. These are irrelevant to the scenario which is on SOLID STATE IONIC COMPOUND. Many weak students wrongly identify tungsten oxide as a covalent compound.	[1] [1] [1]	

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4	(a)	All heights must be correct for 2 m, only accept 1 mistake for 1 mark. Some students were **imprecise in their drawing** such that the height of the bars are not exactly at the required level. Some even **drew with pen** such that when there is a mistake, they had to cancel their answers. This made the **bar chart hard to read/ unclear** thus losing marks. Some students also **didn't read the labels** given on the X axis carefully such that they drew the incorrect height for the wrong fruit.	[2]	
	(b)	Lemon Common mistake is pear → students **mistook the value in the table as the pH**	[1]	
	(c)	Pipette ('**exactly** 25.0 cm^3 of each fruit juice') Conical flask (conical flask is for containing and mixing of substances so they would not splash out) Plastic dropper ('drops of Universal indicator') Burette ('sodium hydroxide added to each sample… neutral') Any 2 for 1m	[2]	
5	(a)	$NH_4Cl \rightarrow NH_3 + HCl$ Cannot have 'heat' or 'ΔH' at reactants or products side of the equation, but accepted if these are put on arrows. Many students wrote the equation in **the opposite direction** which is **not** the decomposition of ammonium chloride.	[1]	
	(b)	**(i)** Relative molecular mass is the **<u>average mass of a molecule compared to 1/12 the mass of a C-12 atom</u>**. 2 points marked separately Very few students obtained the full marks for this because they missed out important words like 'mass' and 'average' or mistook M_r for A_r. **(ii)** NH_3= 17; HCl =36.5 No working→ Minus 1m Mr write as Ar→ Minus 1m Units (%, ug, g)→ Minus 1m Final answer write opposite but working all correct→ Award 1m only Final answers entirely wrong with some form of working→ 0m Allow full ecf if formula is stated wrongly in part (a). Many students used the proton number as the mass number! Proton number is not the mass number! Many students also thought that magnesium chloride is MgCl. It should be $MgCl_2$.	[1] [1] [1] [1]	

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	(c)	The greater the molecular mass and slower the rate of diffusion.	[1]	
	(d)	**Moist red litmus will turn blue then red again**. Mr of NH_3 is smaller than Mr of HC*l*, **NH_3 will diffuse faster than HCl**, therefore reaches the red litmus paper first. Allow 1m if students mention moist red litmus paper turns blue due to ammonia gas. Many students are vague in their answer, repeating that both ammonia and hydrogen chloride gas are given out so the litmus paper turns blue. It is not clear if it was due to ammonia or hydrogen chloride gas. There was however, a handful of hopefuls who managed to accurate give an account of why red turns blue then red again.	[1] [1]	
	(e)	**(i)** NH_4Cl **(ii)** When NH_3 and HC*l* reaches the **top of the testtube/ mouth** of the testtube, it is **cooler**, **molecules loses energy**, cools and **combine/ react/form** back NH_4Cl Majority failed to read the question. Question asked for formation of white crystalline solid but many wrote to explain about the opposite process.	[1] [1] [1]	

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