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Index Number	Class	Name
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CHI J ST JOSEPH'S CONVENT SEMESTRAL ASSESSMENT 2



Lower Sec SCIENCE: PHYSICS module

5076

Secondary 2 Express

Thursday, 5 October 2017
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

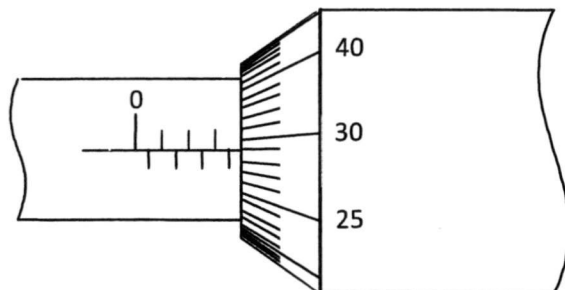
This document consists of **13** printed pages.

Setter(s) : Ms Nur Syazana & Mr Tan Teck Nam

Section A

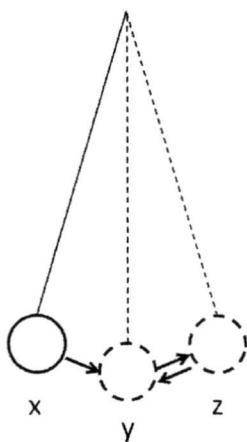
Answer all questions.

- 1 A micrometer screw gauge is used to measure the thickness of a thin wire.



What is the thickness of the wire?

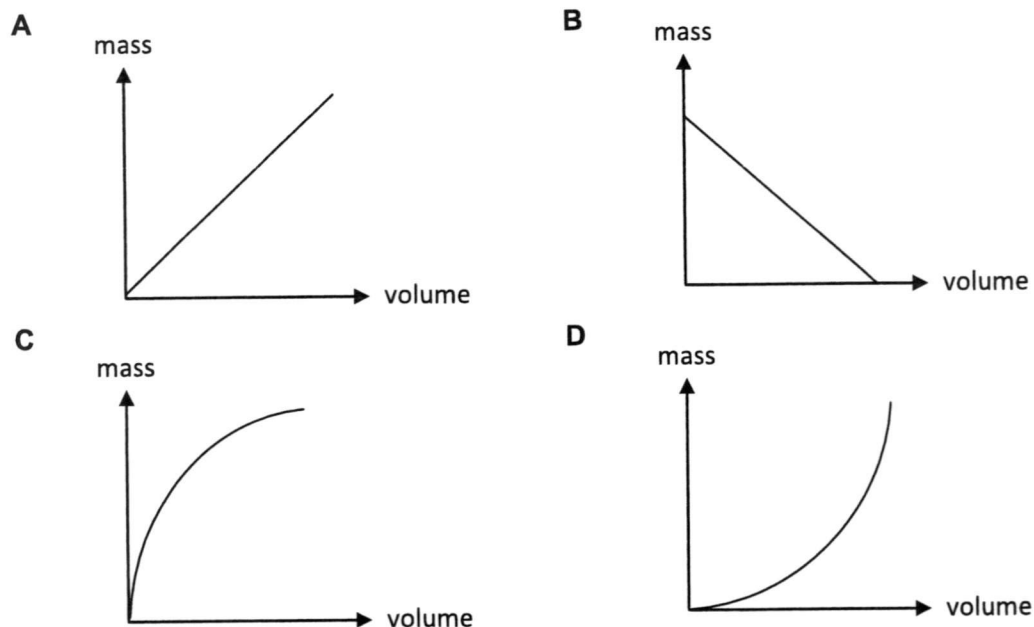
- A 2.29 mm B 3.29 mm
C 3.79 mm D 7.29 mm
- 2 The diagram shows a pendulum oscillating between positions X and Z. It takes 1.5 s to go from X to Y to Z and back to Y.



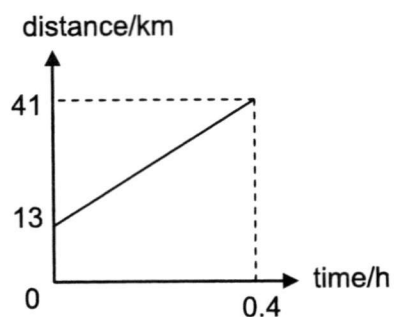
What is the period of the pendulum?

- A 0.75 s B 1.5 s C 2.0 s D 3.0 s
- 3 Benny carried out an experiment to find the density of a type of plastic. He measured the mass and volumes for different sizes of the plastic and plotted his

results. Which of the following graphs shows Benny's results?



- 4 Part of a journey of a car is shown in the distance-time graph below.



Find the speed of the car.

- A** 32.5 km/h
- B** 70 km/h
- C** 103 km/h
- D** 135 km/h
- 5 A student is on her way home on a bus. Halfway through her journey, the bus driver steps hard on the brakes to avoid knocking down a young boy who has dashed onto the road. What happens to the student who is seated facing the front

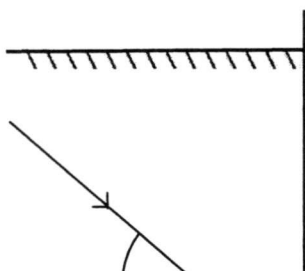
of the bus?

- A Her body moves forward due to her inertia.
- B Her body moves forward due to friction with her seat.
- C Her body moves backwards due to her inertia.
- D Her body moves backwards due to friction with her seat.

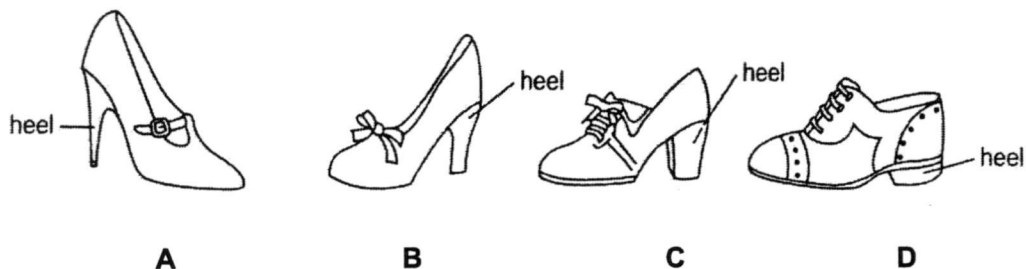
- 6 Two mirrors are placed perpendicular to each other. A ray of light hits the mirror at an angle of 50° to the mirror. Find the angle of reflection as it is reflected from the second mirror.

50°

- A 40°
- B 50°
- C 80°
- D 100°



- 7 A student wears each of the shoes below in turn and steps on soft ground. For which shoe will the heel exert the least pressure on the ground?



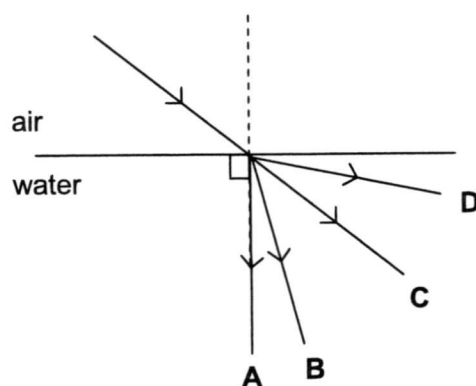
- 8 Adna pushes a trolley of weight 200N for 13 m. She exerts a forward force of 350 N on the trolley. Calculate the power if Adna pushed the trolley for 15 s.
- A 17.3W
 - B 173 W
 - C 303 W
 - D 68250 W

- 9 A high jumper with a mass of 70 kg can jump a height of 2.0 m on Earth. He jumps up with the same starting speed on the moon where the gravitational field strength is weaker than that on Earth.

Which of the following statements regarding the height he can jump on the moon and the corresponding reason is correct?

	height he can jump on the moon	reason
A	lower than 2.0 m	his weight is greater
B	2.0 m	his mass remains the same
C	2.0 m	he applies the same force in his jump
D	higher than 2.0 m	the gravitational field strength is weaker

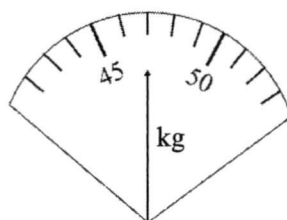
- 10 A ray of light coming from air is incident at an air-water boundary. Which of the following shows the path of the ray?



Section B Structured Questions (40 marks)

- 11 Barbara's mass reading on Earth is shown below.
Take gravitational field strength to be 10 N/kg.

For
Examiner's
Use



- a) Find Barbara's weight on Earth.

weight = [2]

- b) Barbara now stands on Planet X. Her weight on planet X is 212 N.

- i) Write down Barbara's mass on Planet X.

mass = [1]

- ii) Determine the gravitational field strength of Planet X.

gravitational field strength = [2]

- c) Each of Barbara's foot has a surface area of 0.010 m^2 . Calculate the pressure exerted by Barbara's feet on the weighing scale on Earth.

pressure = [2]

- 12 A soccer ball is placed on a flat, sandy ground as shown in Fig. 1.

For
Examiner's
Use

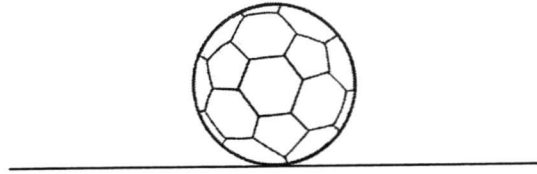


Fig. 1

- (a) Draw the force(s) acting on the soccer ball in the figure below. Label your forces clearly.

[1]



- (b) A student kicks the ball. Draw and label clearly, in the figure below, all the forces acting on the ball at the moment of contact between the student's foot and the ball.

[2]



- (c) The ball flies through the air after being kicked by the student. Draw and label clearly, in the figure below, all the force(s) acting on the ball as it is moving through the air. Air resistance is not negligible.

[1]



- 13 Figure 2 shows the track used in a roller coaster ride. The roller coaster of mass 500 kg drops from rest at position A. It rolls down the track and passes through positions B and C. Assume that the track is frictionless.

For
Examiner's
Use

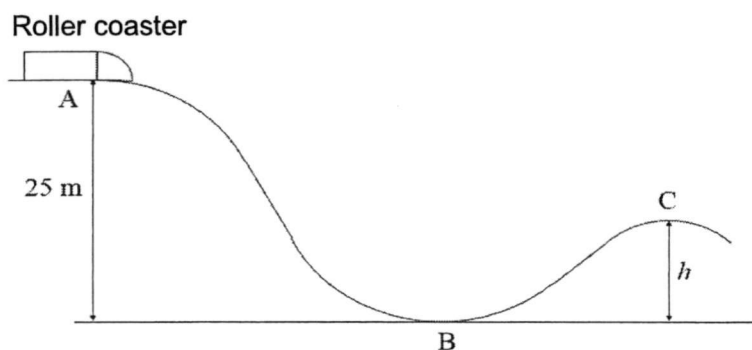


Fig. 2

- a) Calculate the change in gravitational potential energy of the roller coaster as it moves from A to B. Take gravitational field strength to be 10 N/kg.

gravitational potential energy = [1]

- b) State the energy conversion from A to B.

.....
 [1]

- c) Calculate the speed of the roller coaster at position B.

speed = [2]

- d) Given that the speed of the roller coaster at C is 16 m/s. Find the height, h , of C.

For
Examiner's
Use

height = [2]

- 14 Fig. 3 shows a coal mine in the early days of mining. A fire is often set up to improve ventilation.

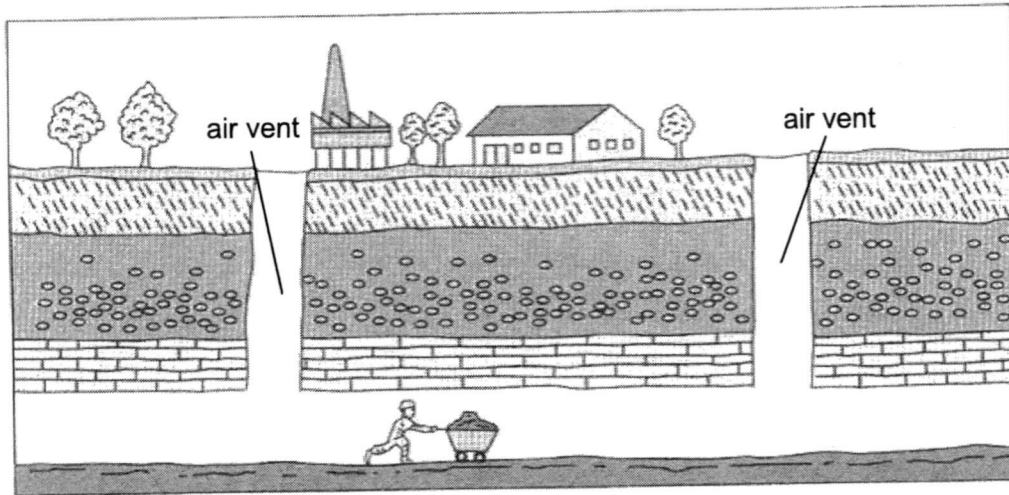


Fig. 3

- (a) On Fig. 3, mark the position in the mine you will set up a fire with a 'X'. [1]
- (b) Indicate the direction of air flow in the mine due to the fire on Fig. 3. [1]
- (c) Explain how the fire causes fresh air to enter the mine and thus improve ventilation.

.....

.....

.....

.....

[2]

- 15 At a school orientation night for new students, a campfire is lit up as shown in Fig.4.

For
Examiner's
Use

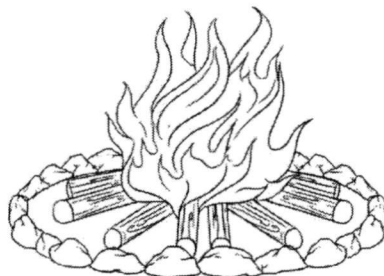


Fig. 4

- (a) Students gathered around the campfire can feel the heat from the fire.
State the main thermal transfer process which causes the students to feel the heat from the campfire.

[1]

- (b) A student has to decide between the following T-shirts to wear for the camp fire:

1. matt black
2. dark green and dull
3. white and reflective

State which T-shirt she should choose so that she feels less of the heat from the camp fire. Explain your answer.

[2]

- (c) The students decided to compete in a race around the campfire. Shown below are the distance-time graphs for two students.

For
Examiner's
Use

Distance/m

A B

- (i) Describe the motion of student **A** from $t = 0$ s to $t = 15$ s.

[1]

.....

- (ii) Which student is faster? Explain your answer.

.....

.....

[1]

- (iii) Given that the speed of student **B** is 15 m/s, express his speed in km/h.

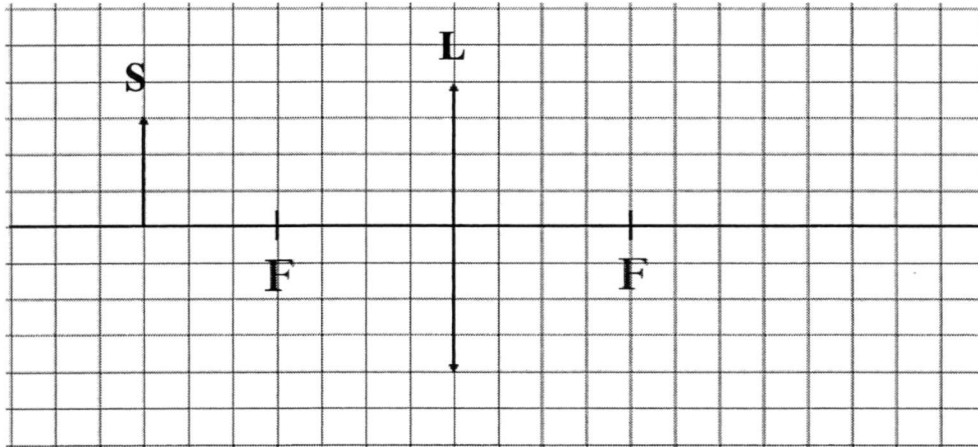
speed = [1]

- 16** Gary sets up a projector to project an object onto a screen. The diagram below

For
Examiner's

represents the lens, L , of the projector and the slides, S , being projected.

Use



- a) In the diagram above, draw rays to determine the position of the screen to be placed to capture a sharp image of the slide. Label this position I . [3]
- b) Based on the ray diagram drawn in part (a), find this magnification factor.

magnification factor = [1]

- c) Write down three characteristics of the image formed on the screen.

..... [1]

- d) Gary found the image produced to be too small. Suggest a method for him to produce a larger sharp image using the same slide and lens.

..... [1]

- 17 In an experiment, a student sets a simple pendulum into oscillation. She obtains the results as shown in Table 1, where l is the length of the pendulum, t is the time taken for a number of oscillations and T is the period of oscillation.

For
Examiner's
Use

l / m	t / s	T / s	T^2 / s^2
0.300	21.98	1.10	1.21
0.400	24.41	1.22	1.49
0.500	28.40	1.42	2.02
0.600	30.38	1.52	2.31
0.700	34.18	1.71	2.92

Table 1

- (a) What is the number of oscillations the student used in the experiment?

Number of oscillations = [1]

- (b) Using 2 cm to represent 0.20s^2 on the T^2 -axis and 2 cm to represent 0.05 m on the l -axis, plot a graph of T^2 against l on the graph paper provided.

Draw a best-fit straight line.

Your starting value(s) need not be zero on both axes. [3]

- (c) Determine the gradient of your graph.

Gradient = [2]

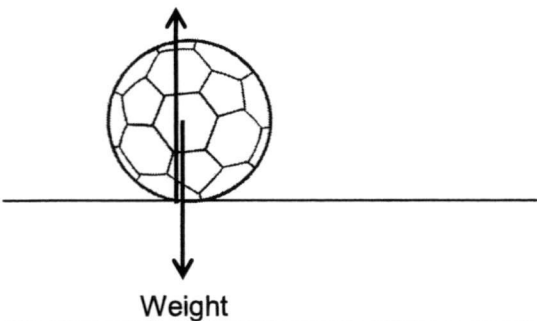
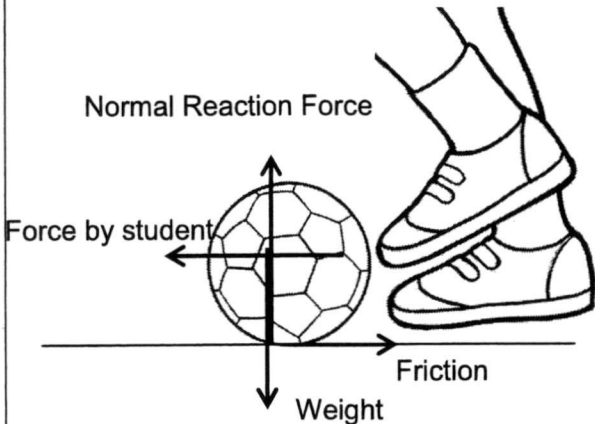
- (d) State the relationship between T^2 and l .

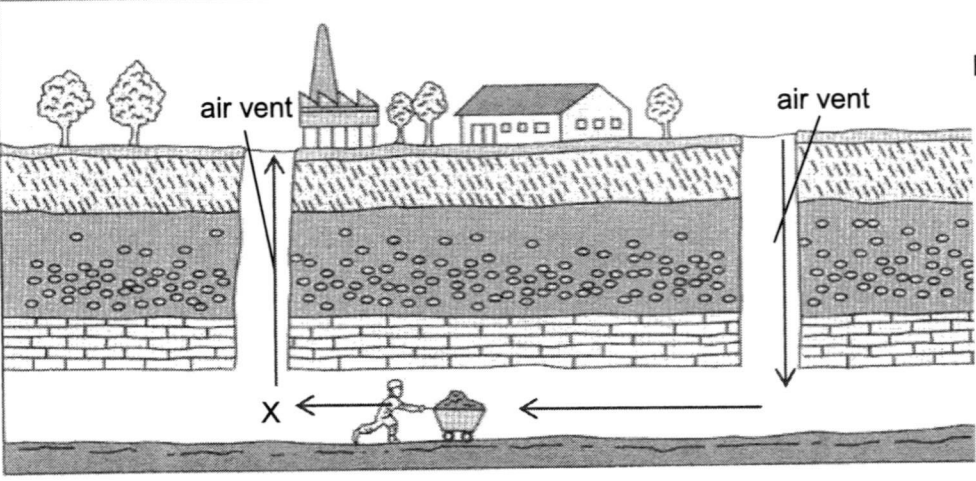
..... [1]

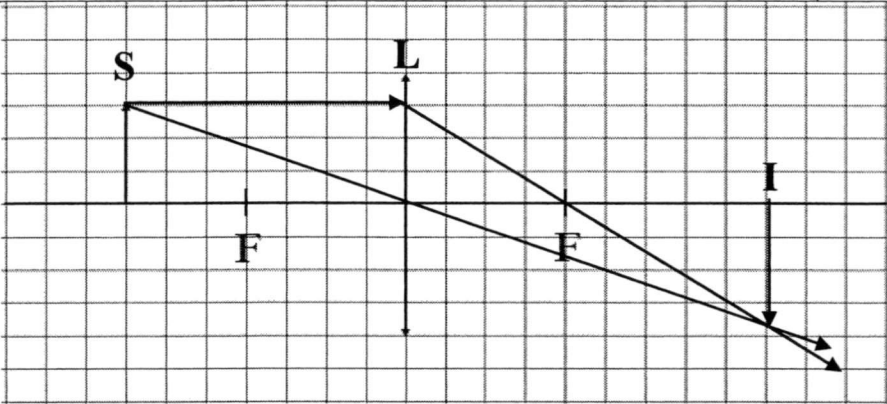
End of Paper

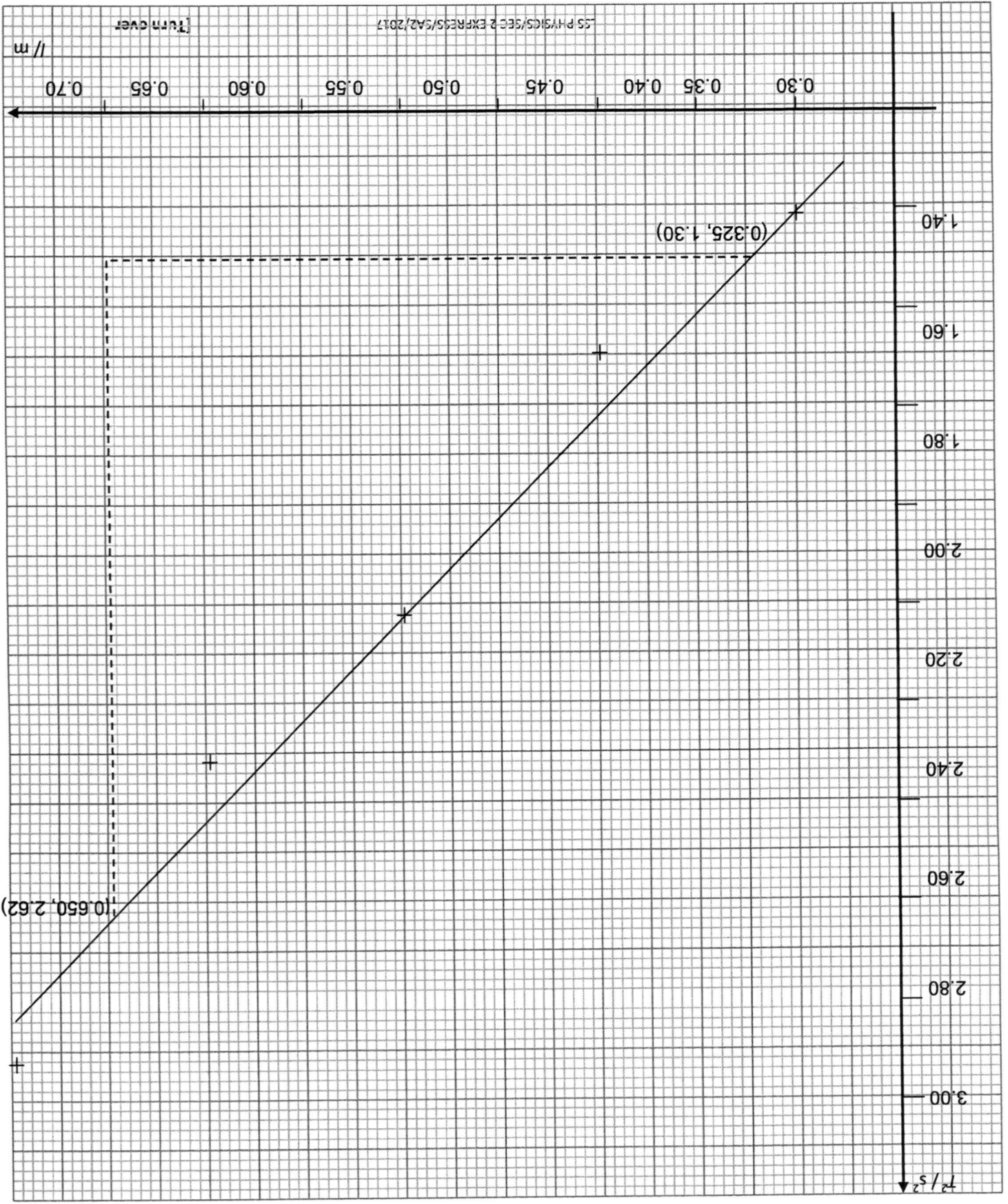
Answers for 2017 Physics Sec 2 Express SA2CHIJ St Joseph's Convent

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

Qns	Answers	Marks	Total Mark	Remarks
11a	$W = mg$ $= 47 \times 10$ $= 470 \text{ N}$	M1 A1	2	M1 is for the reading of the scale correctly (ie.47)
11bi	47 kg	B1	1	
11bii	$W = mg$ $212 = 47 \times g$ $g = 4.51 \text{ N/kg}$	M1 A1	2	
11c	$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$ $= \frac{470 \div 2}{0.01}$ $= 23500 \text{ Pa}$	M1 A1	2	
12a	Normal Reaction Force  Weight	B1	1	
12b	Normal Reaction Force  Weight	M1[for any two forces correct] A1	2	

12		B1	1	
13a	Potential energy = mgh $= 500 \times 10 \times 25$ $= 125000 \text{ J}$	B1	1	
13b	<u>Loss in gravitational potential</u> energy is equal to the <u>gain in kinetic energy.</u>	B1	1	
13c	Kinetic energy at B = 125000 J $\frac{1}{2}mv^2 = 125000$ $\frac{1}{2}(500)v^2 = 125000$ $v = 22.36$ $v = 22 \text{ m/s}$	M1 A1	2	
13d	Total energy = 125000 J $KE = \frac{1}{2}mv^2$ $= \frac{1}{2}(500)(16)^2$ $= 64000 \text{ J}$ $GPE = mgh$ $125000 - 64000 = (500)(10)(h)$ $h = 12.2 \text{ m}$	M1 A1	2	
14a 14b	 Fig. 3	B1 [X] B1 [with arrows]		
14c	Air above the fire gets heated up and <u>expands in volume</u> . Its <u>density decreases</u> and it <u>rises up the vent on the left</u> . This causes cooler <u>fresh air with higher density to come in through the other vent</u> on the right. A convection current is set up that continuously bring fresh air into the mine.	M1 M1	2	
15 a	(Infrared) Radiation	B1	1	

15b	White and reflective T-shirt. A white and shiny T-shirt will absorb less infrared radiation from the camp fire. So the student will feel cooler in it.	A1 M1	2	
15ci	Student A is running at increasing speed/ accelerating.	B1	1	
15cii	Student A because the curve is steeper. Accept: Student A because she took lesser time to travel the same distance.	B1	1	
15ciii	$\frac{15 \text{ m}}{1 \text{ s}} = \frac{0.015 \text{ km}}{\frac{1}{3600} \text{ h}} = 54 \text{ km/h}$	B1	1	
16a			B1 [line cuts the optical centre] B1 [second ray passes focal point] B1 [Image correctly drawn] No marks if arrows missing	
16b	Magnitude = $\frac{\text{image distance}}{\text{object distance}}$ or $\frac{\text{image height}}{\text{object height}}$ $= \frac{5.7}{4.3} = 1.325 = 1.33$	M1 A1	1	Allow 1.28-1.38
16c	Real, inverted, magnified	B1	1	
16d	Move the object towards the lens. Move the lens towards the object.	B1	1	
17a	(take any t value divided by its corresponding T value) 20 oscillations	B1	1	
17b	Correct axes with label Correct plotting of points Best fit line	B1 B1 B1	3	
17c	gradient = $\frac{2.62 - 1.30}{0.650 - 0.325}$ $= 4.06$	M1 A1	2	
17d	T^2 is linearly related to l .	B1	1	



Index Number	Class	Name
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CHI J ST JOSEPH'S CONVENT SEMESTRAL ASSESSMENT2



SCIENCE (CHEMISTRY)

Secondary 2 Express

Thursday, 5 October 2017
50 minutes

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.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

There are **ten** questions. 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 Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

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 13.

FOR EXAMINER'S USE	
A	
B	
Total	40

This document consists of **13** printed pages.

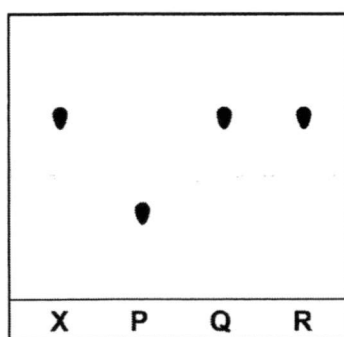
Setter(s) : Mrs. Lee-Tan Yu Jun and Mr. Jansen Tan

Section A (10 marks)Answer **all** questions.

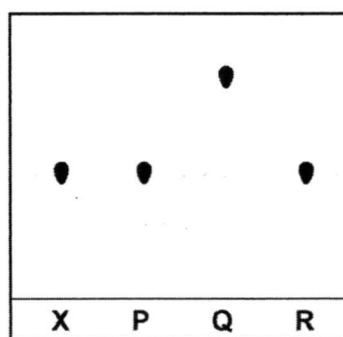
- 1 The table below compares the luminous flame and non-luminous flame of a Bunsen burner. Which row is **incorrect**?

	luminous flame	non-luminous flame
A	very hot	less hot
B	yellow	pale blue
C	unsteady flame	steady flame
D	easily seen	not easily seen

- 2 An unknown sample, **X**, was tested by paper chromatography alongside three known pigments, **P**, **Q** and **R**, using ethanol and acetone as solvents, respectively.



using ethanol as solvent

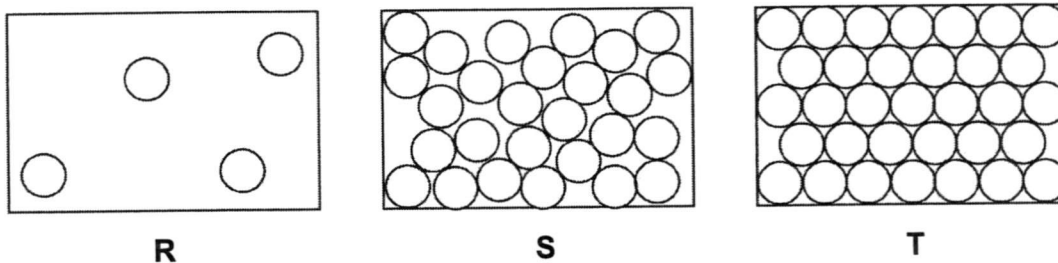


using acetone as solvent

Which of the three pigments, **P**, **Q** or **R**, is sample **X** likely to be?

- A** **P** only
B **R** only
C **Q** and **R** only
D **P**, **Q** and **R**
- 3 Which of the following statement about air is **incorrect**?
- A** Air is a mixture of compounds and elements.
B Elements in air are from Group 0.
C Physical processes can separate the components in air.
D There is a greater proportion of elements than compounds in air.

- 4 Diagrams **R**, **S** and **T** represent the three states of matter.



Which change is a result of gain in heat from the surrounding?

- A **R** → **S**
 B **R** → **T**
 C **S** → **T**
 D **T** → **R**
- 5 The table shows the atomic structures of four particles, represented by the letters **P** to **S**. The letters are not the symbols of the elements.

particle	number of protons	number of neutrons	number of electrons
P	8	10	8
Q	8	10	10
R	12	12	10
S	12	12	12

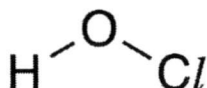
Which two particles are an atom and a cation of the **same** element?

- A **P** and **Q**
 B **Q** and **R**
 C **Q** and **S**
 D **R** and **S**

- 6 Which of the following pairs of elements are most likely to form a compound by sharing electrons?

A carbon and hydrogen
 B helium and hydrogen
 C sodium and hydrogen
 D sodium and nitrogen

- 7 The diagram shows the structural formula of the covalent molecule hypochlorous acid, HClO .



Which description below fits the arrangement of electrons in the molecule of hypochlorous acid?

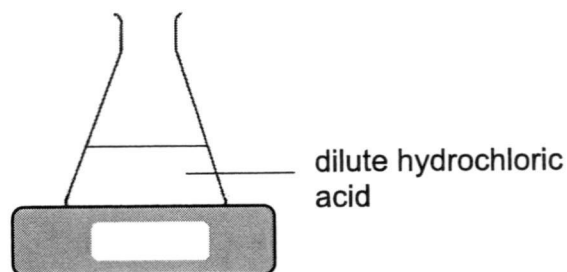
	number of electrons involved in bonding	number of valence electrons not involved in bonding
A	2	10
B	4	10
C	2	22
D	4	22

- 8 Farmers spread slaked lime on their fields to neutralise soils that are too acidic for crops to grow well.

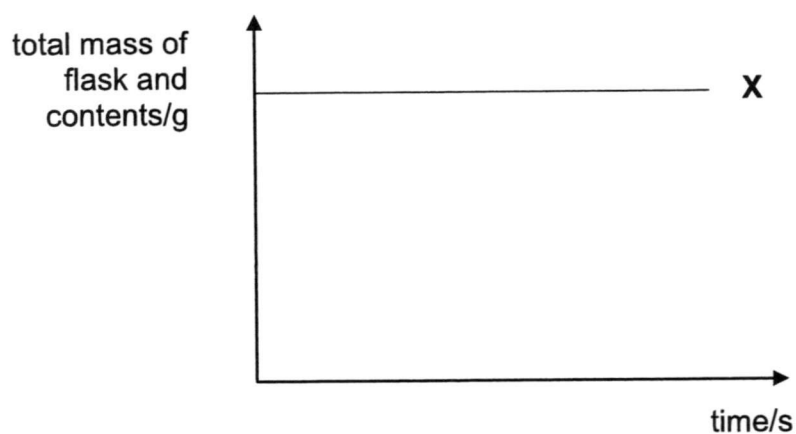
Which ion in slaked lime neutralises the acid in the soil?

A Ca^{2+}
 B H^+
 C O^{2-}
 D OH^-

- 9 An investigation is conducted on an unknown solid **X** using the following setup.



1g of **X** is added into a flask containing 20.0cm^3 of dilute hydrochloric acid on a top-pan balance. The total mass of the flask and its contents is recorded every ten seconds.

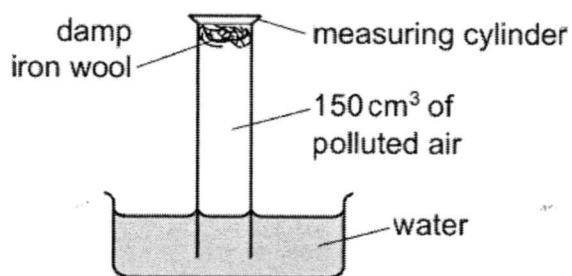


Which one correctly identifies **X**?

- A lithium
- B sodium oxide
- C zinc
- D zinc carbonate

- 10** Iron reacts with oxygen in the presence of moisture. An experiment is conducted to find the percentage of oxygen in 150cm^3 of polluted air. The apparatus is left for one week.

At the end of experiment, the volume of gas in the measuring cylinder is 122cm^3 .



What is the percentage of oxygen in the polluted air?

- A** 19%
- B** 21%
- C** 28%
- D** 81%

Section B (30 marks)Answer **all** questions in the spaces provided.For
Examiner's
Use

- 1 The list shows some common substances.

ammonia
carbon dioxide
magnesium
nitrogen
oil
sulfur dioxide

- (a) Choose from the following substance to answer the questions below.
Each of these substances can be used once, more than once or not at all.

Which substance

- (i) forms a suspension with water,

.....

- (ii) is an element in period 2,

.....

- (iii) reacts with calcium hydroxide to form water and a white precipitate?

..... [3]

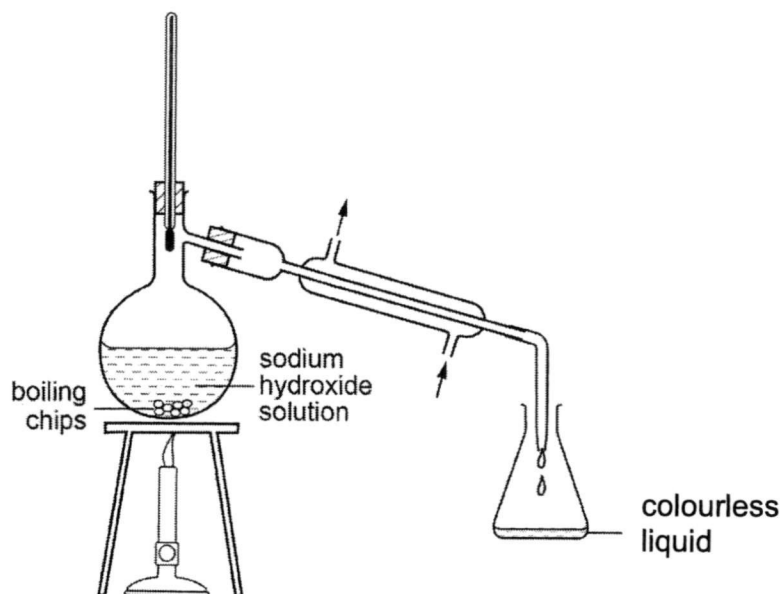
- (b) Give the chemical formula of the white precipitate in (a)(iii).

..... [1]

[Total: 4]

- 2 Simple distillation was carried out on a solution of sodium hydroxide.

For
Examiner's
Use

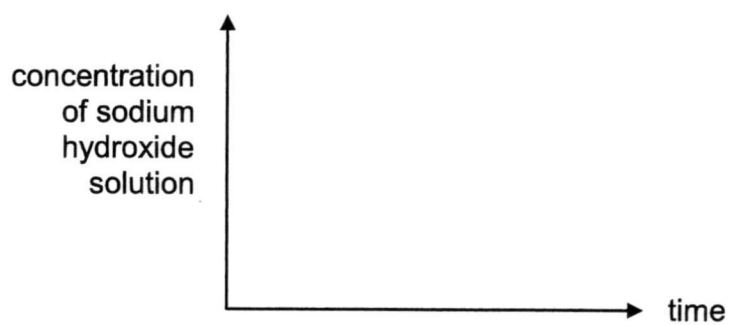


A colourless liquid is collected in the conical flask and a few drops of Universal Indicator is added to it. The liquid turned green.

- (a) Suggest the reading on the thermometer when the liquid is being collected in the conical flask.

..... [1]

- (b) (i) Sketch a graph to show how the concentration of sodium hydroxide solution in the distilling flask changes with time.



[2]

- (ii) Explain your answer for (b)(i).

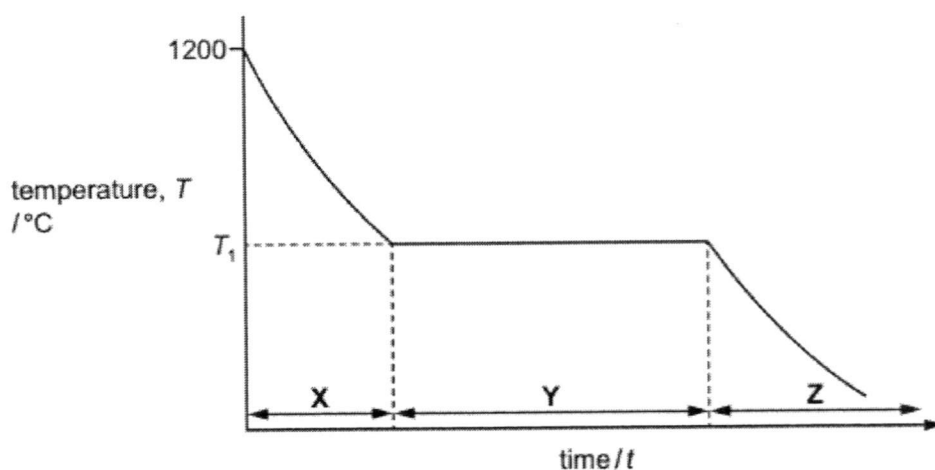
.....

..... [1]

[Total: 4]

- 3 (a) The graph represents how the temperature of a sample of copper (melting point 1085°C) changes as it is gradually cooled from 1200°C .

For
Examiner's
Use



- (i) Identify the state(s) of matter present during each stage of the process shown in the graph.

X.....

Y.....

Z..... [2]

- (ii) Describe and explain the changes in the movement and arrangement of the particles in copper during stage X.

.....

.....

.....

..... [2]

- (b) Copper is an unreactive metal and does not react under normal circumstances with dilute acids. However, copper can react with concentrated nitric acid, forming copper (II) nitrate, nitrogen dioxide and water.

- (i) Write an equation for the above reaction.

..... [2]

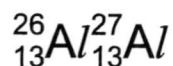
- (ii) Explain why it is advisable for the person conducting the experiment to wear safety goggles and mask.

For
Examiner's
Use

.....
..... [1]

[Total: 7]

- 4 (a) The symbols below represent two isotopes of aluminium.



Compare and contrast the nuclei of these two isotopes.

.....
.....
..... [2]

- (b) In terms of the movement of electrons, describe the formation of aluminium oxide.

.....
.....
..... [2]

- (c) Aluminium can be extracted from aluminium oxide found naturally in the Earth's crust. This process involves first melting aluminium oxide and then passing an electric current through the molten aluminium oxide.

Explain why solid aluminium oxide must be melted first.

.....
.....
..... [2]

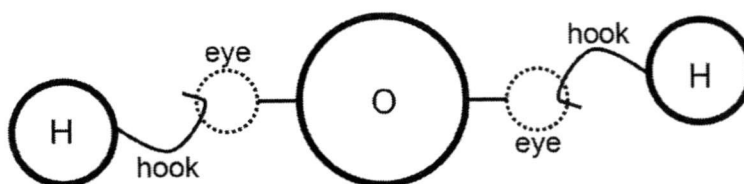
[Total: 6]

- 5 Below is an article on the great scientist Linus Pauling (1901 – 1994).

For
Examiner's
Use

When Linus Pauling was 13, his best friend had a toy chemistry set. He recalled watching a simple manipulation that involved boiling water over an alcohol lamp and went home to read about it. Soon, he had his own chemistry lab in the basement of his mother's boarding house in Portland.

In college, Pauling learned the most widely accepted model of chemical bonding back then *the hook and eye model* a name borrowed from the clothing fasteners used at the time. This model proposed that chemical bonds form when the hook of one atom connects with the eye of another atom.



Hook and eye model for a water molecule, H₂O

Pauling continued to seek answers to these questions and made significant contributions to scientists' understanding of the nature of the chemical bond.

- (a) Name **one** scientific attitude demonstrated by Pauling in the article.

..... [1]

- (b) (i) Write the electronic configuration of an oxygen atom.

..... [1]

- (ii) Hence, explain why there are two 'eyes' on the oxygen atom in the diagram above.

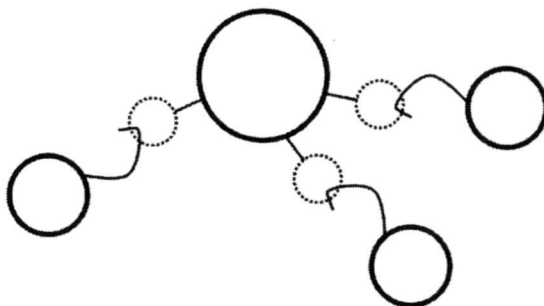
..... [1]
.....

- (iii) Draw the dot-and-cross diagram for a water molecule, showing only valence electrons.

[2]

- (c) The hook and eye model of a compound with a simple molecular structure is shown below.

For
Examiner's
Use



- (i) Suggest the chemical formula of a molecule that can be represented by this diagram.

..... [1]

- (ii) Suggest the physical state of the molecule in (c)(i) at room temperature and pressure. Explain your answer.

.....

 [3]

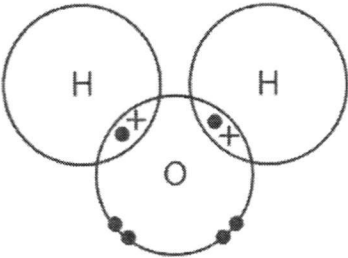
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End of Paper

Sec 2 Exp Science Chemistry SA2 MS 2017

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

1	(a) oil (ii) nitrogen (iii) carbon dioxide/Sulfur dioxide (b) $\text{CaCO}_3/\text{CaSO}_3$	1 1 1 1
2a	(i) 100°C (with unit) bi) starting point cannot be zero [1] graph increasing [1] If heating curve was drawn, zero marks. ii) water has a lower boiling point (than sodium hydroxide) + water will be distilled first/ water will be removed/water is first collected in the conical flask/ water is evaporated	1 2 1
3a	X: liquid Y: solid and liquid Z: solid 3 correct ☐ 2marks 2 correct ☐ 1mark (otherwise ☐ 0m)	
ii	Allow ECF from (i) provided the process of cooling discussed is correct - Particles lose (heat/kinetic) energy/ move slower/ speed of motion of particles decreases Any 1 award 1m - Particles move closer/ spacing between particles decreases/ more orderly Any 1 award 1m	
bi	$\text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{NO}_2 + 2\text{H}_2\text{O}$ Chemical formula must be correct for all in order to be awarded 1 m. Equation must be balanced for 1m.	
ii	nitrogen dioxide can irritates eyes / causes breathing difficulties Concentrated nitric acid is corrosive so needs to prevent splashing onto skin/ eyes Vague answers without identifying the gas/ acid used is not awarded a mark.	1
4a	both have 13 protons $^{27}_{13}\text{Al}$ has one more neutron than $^{26}_{13}\text{Al}$ OR $^{27}_{13}\text{Al}$ has 14 neutrons while $^{26}_{13}\text{Al}$ has 13 neutrons	1 1

	Reject comparison on mass number or nucleon number Reject heavier and lighter Ignore answers without reference to the exact number Ignore answers that did not specify the isotope/atoms	
b	Aluminium (atom) <u>loses 3 electrons</u> (to form aluminium ions) Oxygen (atom) <u>gains 2 electrons</u> (to form oxide ions) Transfer electrons from aluminium to oxygen 1m Transfer 6 electrons from 2 aluminium atoms to 3 oxygen atoms 2m Reject answers with wrong concept on sharing/ covalent Reject answers on ions losing or gaining electrons Ignore answers on total number of electrons lost by 3 aluminium atoms and total number of electrons gain by 2 oxygen atoms	1 1
c	In molten state, <u>free and mobile ions</u> are present to act as charge carriers. In the solid state, <u>ions are held in fixed positions</u>, therefore not mobile. Ignore answers without reference to IONS Ignore answers on charged particles Reject answers on wrong concept of covalent compound/ molecules	1 1
5a	curiosity/open-mindedness/perseverance/ curious/ determination/ inquisitive accept spelling error up to 1 letter difference	
bi	2.6	
ii	oxygen has 6 valence electrons, hence it <u>need/share two electrons</u>, which are represented by the eyes. Reject gain of 2 electrons Ignore answers without reference to number	
iii	 1 mark for shared electrons between two H-O atoms 1 mark for correct number of valence electrons for H and O	

Ci	NH ₃ /PH ₃ /AsH ₃ /BH ₃ /PCl ₃ /NF ₃ /any other logical answer	1
cii	Gas/gas/liquid (accept liquid or solid provided correct for less common compound mentioned) little energy required to overcome the weak intermolecular forces of attraction reject concept on ions/ ionic compounds reject answers on covalent <u>bond</u> contains weak intermolecular forces of attraction reject answers on weak intermolecular forces of attraction between <u>atoms</u> ignore answers with incomplete phrasing	1 1 1 1