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**Anglo-Chinese School
(Barker Road)**

PRELIMINARY EXAMINATION 2016

SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

**SCIENCE (PHYSICS, CHEMISTRY) 5076
PAPER 1**

TIME: 1 HOUR

INSTRUCTIONS TO CANDIDATES:

Write your name and exam index number on the OMR Answer Sheet.

There are **forty** 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 OMR sheet.

The OMR Sheet is to be **submitted separately**.

INFORMATION FOR CANDIDATES:

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

Any rough working should be done in this booklet.

A copy of the Data Sheet is printed on page 19.

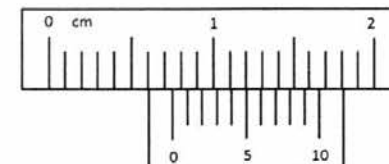
A copy of the Periodic Table is printed on page 20.

The use of an approved scientific calculator is expected, where appropriate.

This question paper consists of 20 printed pages.

**PAPER 1
[40 marks]**

- 1 A student uses a vernier calliper to measure the diameter of a cylinder.



What is the reading shown?

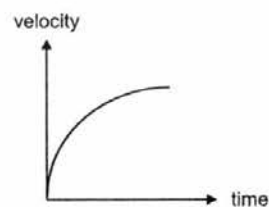
- A 0.62 cm
- B 0.65 cm
- C 0.72 cm
- D 0.75 cm

- 2 Acceleration is defined as the

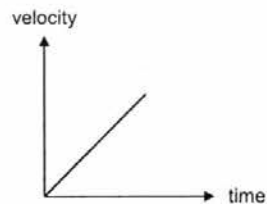
- A change in velocity
- B rate of change of displacement
- C rate of change of speed
- D rate of change of velocity

- 3 An astronaut dropped a feather on the moon's surface, where there was no air resistance.

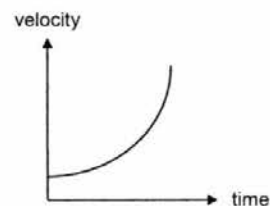
Which velocity-time graph correctly shows the motion of the feather?



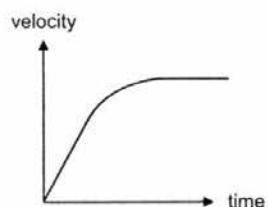
A



B

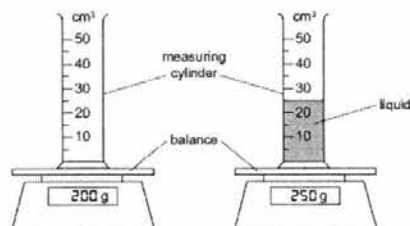


C



D

- 4 The diagram shows an experiment to find the density of a liquid.



What is the density of the liquid?

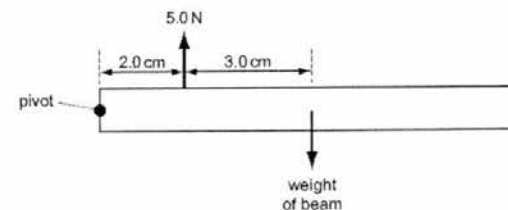
- A 1.25 g/cm^3
 B 2.0 g/cm^3
 C 8.0 g/cm^3
 D 10.0 g/cm^3

- 5 An astronaut in his spacesuit has a mass of 70 kg on Earth. He can jump 20 cm high off the surface of Earth. When he is on Jupiter, he jumps lower than this.

This is because, on Jupiter,

- A his mass is greater than on Earth.
 B his mass is the same as on Earth.
 C his weight is greater than on Earth.
 D his weight is the same as on Earth.

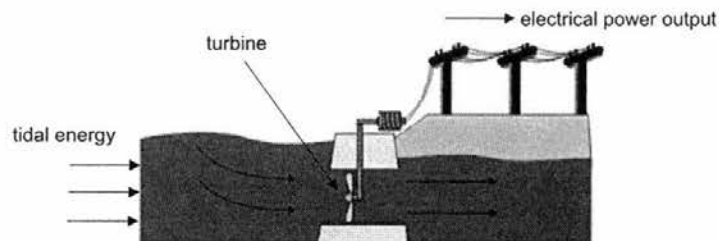
- 6 A beam pivoted at one end has a force of 5.0 N acting vertically upwards on it as shown. The beam is in equilibrium.



What is the weight of the beam?

- A 2.0 N
 B 3.0 N
 C 3.3 N
 D 5.0 N

- 7 The diagram shows seawater flowing through a turbine. The turbine turns and the tidal energy generates electricity.



The turbine receives 325 000 000 J of tidal energy every 15 minutes. 80% of the tidal energy is converted to electrical energy output.

What is the electrical power output?

- A 289 kW
B 451 kW
C 1040 kW
D 3900 kW
- 8 A pool of water evaporates. As molecules escape from the liquid, the temperature of the water left in the pool changes. Where do the molecules escape from and what is the effect on the temperature of the water in the pool?

	molecules escape from	temperature of water in the pool
A	all parts of the liquid	decreases
B	all parts of the liquid	increases
C	only the liquid surface	decreases
D	only the liquid surface	increases

- 9 What is meant by the term *period*?

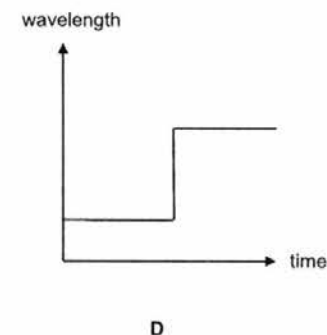
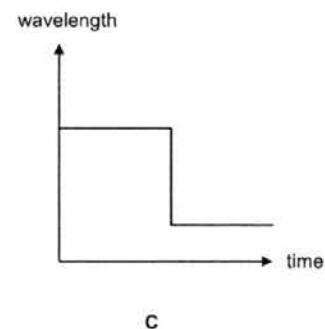
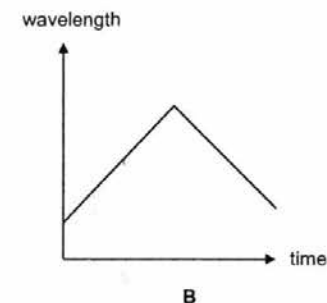
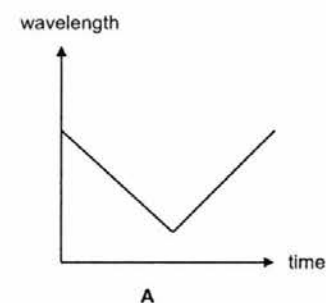
- A a line joining points along the peak of a wave
B distance between the trough and peak of a wave
C number of complete waves generated in a second
D time taken to generate one complete wave

- 10 Which is not an application of X rays?

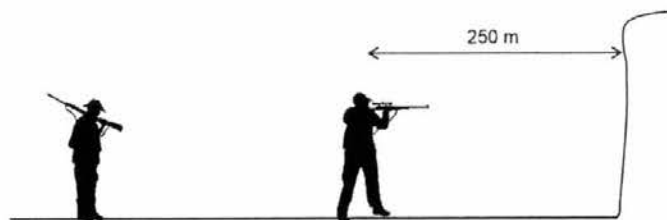
- A detect flaws in welding
B detect forgery of currency notes
C detect fractures in bones
D sterilise medical equipment

- 11 A sound wave travels from water into air.

Which graph correctly shows how the wavelength of the sound wave changes with time (assume the frequency of the sound wave remains constant throughout)?



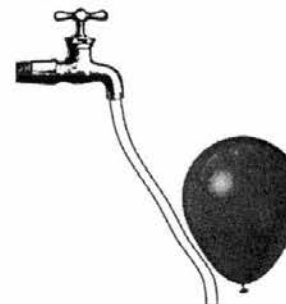
- 12 A hunter standing 250 m from a cliff, fires a shot. His friend standing behind him hears 2 shots, 1.5 seconds apart.



What is the speed of sound in air?

- A 325 m/s
 - B 330 m/s
 - C 333 m/s
 - D 335 m/s
- 13 Which scenario will not produce a sound wave?
- A A ball dropped and rebounding upwards from a frictionless ground surface
 - B An explosion in deep space
 - C A phone ringing in a sound proof room
 - D A torpedo hitting a submarine underwater
- 14 Which statement regarding an electric field is not correct?
- A An electric field is a region in which an electric charge experiences a force.
 - B Electric field lines exit from an isolated positive charge.
 - C The closer the electric field lines, the stronger the electric force.
 - D The direction of electric field lines gives the direction of the force acting on a negative test charge.

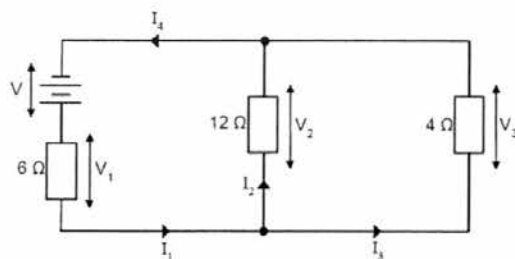
- 15 The diagram shows a balloon being held close to a stream of water flowing out from a tap. The stream of water is observed to deflect towards the balloon.



Which statement explains this observation?

- A The balloon and water are both neutral.
 - B Positive charges travel from the water to the balloon.
 - C Negative charges on the balloon attract the positive charges in the water.
 - D The balloon has more charges than the water.
- 16 A wire has a resistance of $3\ \Omega$. Another wire, made of the same material, is twice as long and twice the cross-sectional area.
- What is the resistance of the second wire?
- A $0.75\ \Omega$
 - B $1.5\ \Omega$
 - C $3\ \Omega$
 - D $12\ \Omega$

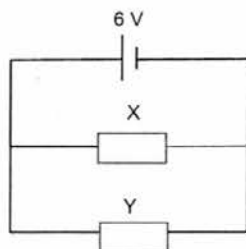
- 17 A circuit contains three resistors and a battery as shown.



Which relationships are correct?

- | | | |
|----------|-------------------------|-------------------|
| A | $I_1 = I_2 + I_3 + I_4$ | $V = V_1 + V_2$ |
| B | $I_4 = I_2 + I_3$ | $V_2 = V_3 > V_1$ |
| C | $I_1 > I_3 > I_2$ | $V_2 = V_3 < V_1$ |
| D | $I_4 > I_2 > I_3$ | $V > V_1 > V_2$ |

- 18 The diagram shows an e.m.f. source of 6 V connected to 2 resistors, X and Y.

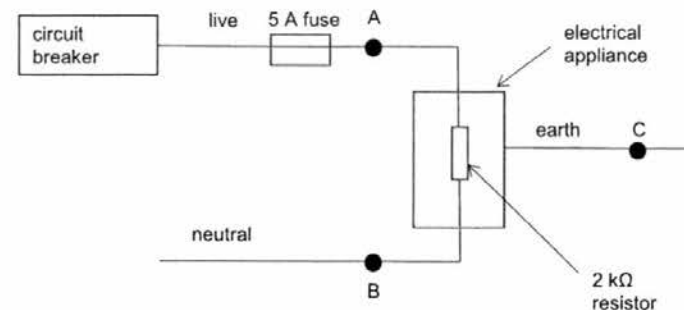


The e.m.f. source is now replaced with a 3 V cell.

What happens to the power dissipated in resistor X?

- A** It is doubled.
B It is halved.
C It is reduced to 25% of its original power.
D It is unchanged.

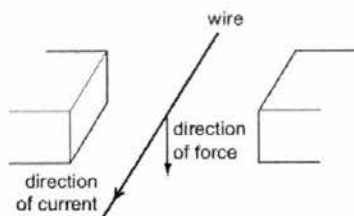
- 19 The diagram shows part of a household circuit where a circuit breaker is connected to an electrical appliance.



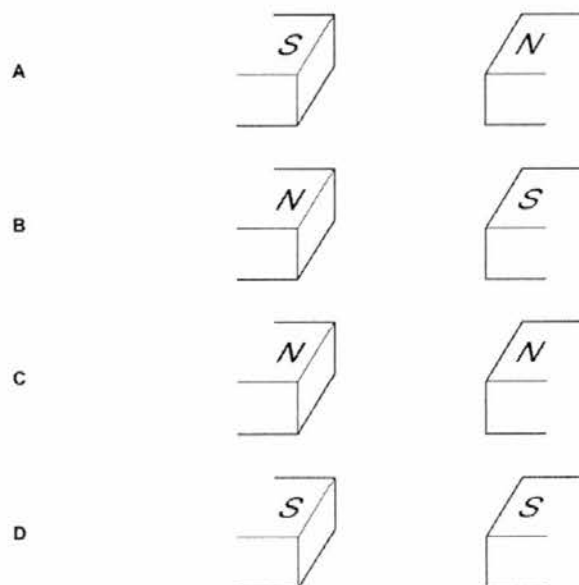
Which scenario will not cause the circuit breaker to "trip"?

- A** The fuse is replaced with a 9 A fuse.
B The live wire at A is connected directly to the earth wire at C.
C The live wire at A is connected directly to neutral wire at B.
D The 2 kΩ resistor is replaced with a conductor wire.

- 20 The diagram shows a wire placed between two magnetic poles of equal strength. A current passes through the wire in the direction shown. The current causes a downward force on the wire.



What is the arrangement of the magnetic poles?



- 21 The diagrams show two methods of collecting gases.

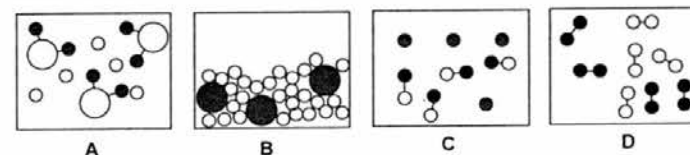
Which row gives the properties of a gas which can be collected by both methods?



Which row gives the properties of a gas which can be collected by both methods?

	property 1	property 2
A	insoluble in water	denser than air
B	insoluble in water	less dense than air
C	soluble in water	denser than air
D	soluble in water	less dense than air

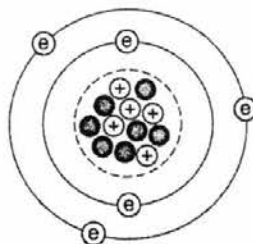
- 22 Which diagram best represents a gaseous mixture of two elements only?



- 23 Which of the following changes will result in the particles moving at a higher speed?

- A $\text{CO}_2(\text{s}) \rightarrow \text{CO}_2(\text{g})$
 B $\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{O}(\text{s})$
 C $\text{I}_2(\text{g}) \rightarrow \text{I}_2(\text{s})$
 D $\text{N}_2(\text{g}) \rightarrow \text{N}_2(\text{l})$

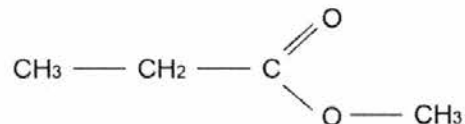
- 24 The diagram shows the structure of an atom.



Which atom is represented by the diagram shown?

- A ${}^{11}_5\text{B}$ C ${}^{12}_5\text{C}$
 B ${}^{12}_5\text{B}$ D ${}^{12}_6\text{C}$
- 25 Which set of particles contain the same number of electrons?
- A Ca^{2+} , Ar, Cl
 B He, Ne, Ar
 C Li^+ , Na^+ , K^+
 D Na^+ , He, O^{2-}

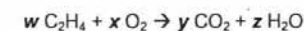
- 26 The diagram shows the molecule ethyl ethanoate.



How many bonding pairs of electrons are there in the molecule?

- A 6 C 13
 B 8 D 14

- 27 An equation is shown.

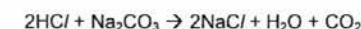


Which numbers will correctly balance this equation?

	w	x	y	z
A	1	2	2	2
B	1	3	2	2
C	2	3	2	4
D	2	6	4	4

- 28 0.1 mol/dm³ hydrochloric acid reacts with 25 cm³ of 0.2 mol/dm³ aqueous sodium carbonate.

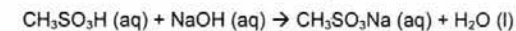
The equation for this reaction is shown.



What is the volume of acid required to neutralize sodium carbonate?

- A 6.25 cm³ C 50 cm³
 B 25 cm³ D 100 cm³
- 29 Substance Y is an oxide that dissolves in water to form $\text{CH}_3\text{SO}_3\text{H}$.

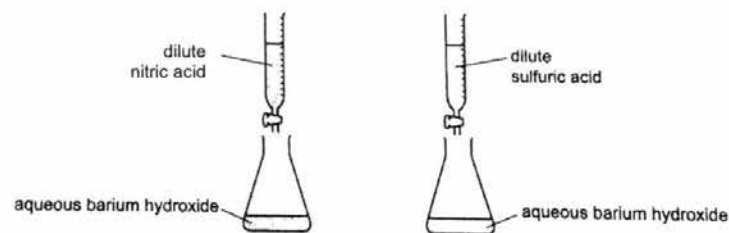
$\text{CH}_3\text{SO}_3\text{H}$ does not react with acid but its aqueous solution reacts according to the following equation:



What type of oxide is substance Y?

- A acidic oxide
 B amphoteric oxide
 C basic oxide
 D neutral oxide

- 30 The diagrams show two experiments, one to make barium nitrate and the other to make barium sulfate.

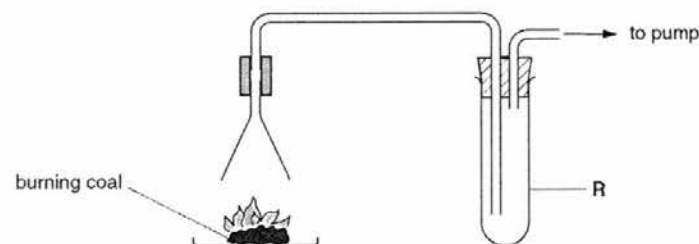


In each experiment, the acid is run into the conical flask until the pH is 7.

Which are the next steps needed to obtain the solid salts?

	barium nitrate	barium sulfate
A	crystallisation	crystallisation
B	crystallisation	filtration
C	filtration	crystallisation
D	filtration	filtration

- 31 The diagram shows the apparatus used to test the gases produced by burning coal.



Which chemical is placed in tube R to show that sulfur dioxide is produced?

- A acidified potassium manganate(VII)
- B aqueous calcium hydroxide
- C aqueous potassium iodide
- D aqueous sodium hydroxide

- 32 What does **not** increase across a period of the Periodic Table?

- A the nucleon number
- B the number of electron shells
- C the number of protons
- D the number of outer shell electrons

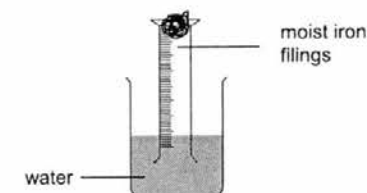
- 33 The table gives the composition of the atmosphere of three newly discovered planets.

planet	composition of atmosphere
1	argon, carbon dioxide and oxygen
2	argon, carbon dioxide and methane
3	methane, nitrogen and oxygen

On which planet(s) is greenhouse effect likely to occur?

- A 2 only
- B 1 and 2 only
- C 2 and 3 only
- D 1, 2 and 3

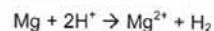
- 34 The apparatus below was set up with 80 cm³ of air in the inverted measuring cylinder. The volume of air in the cylinder was measured until no further change was observed.



What is the volume of air that would remain?

- A 16 cm³
- B 20 cm³
- C 63 cm³
- D 80 cm³

- 35 The reaction between magnesium and dilute sulfuric acid may be represented by the equation below.



Which statement best describes the conversion of magnesium atoms to magnesium ions?

- A The change is oxidation because there has been a gain of electrons.
 - B The change is oxidation because there has been a loss of electrons.
 - C The change is reduction because there has been a gain of electrons.
 - D The change is reduction because there has been a loss of electrons.
- 36 Iron is extracted from haematite, Fe_2O_3 , by a reduction process in the blast furnace.
- Which reaction in the blast furnace shows the formation of the reducing agent?
- A $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$
 - B $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
 - C $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$
 - D $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$
- 37 Which metal oxide can be reduced to the metal using carbon?
- A calcium oxide
 - B magnesium oxide
 - C sodium oxide
 - D zinc oxide
- 38 Most aluminium cans are made from recycled aluminium.
- Why are some aluminium cans still made from aluminium extracted from its ore?
- A Aluminium ore produces better quality aluminium.
 - B Demand is not met by the recycling of aluminium alone.
 - C Extraction from the ore uses electricity and is expensive.
 - D There are only a limited number of times that aluminium can be recycled.

- 39 Petroleum is fractionally distilled to produce useful fractions.

Which row matches the fraction to its use?

	fraction	use
A	bitumen	fuel in cars
B	lubricating oils	for making waxes and polishes
C	paraffin (kerosene)	for making roads
D	petrol (gasoline)	aircraft fuel

- 40 What are the products formed when yeast act on simple sugars?

- A ethanoic acid and oxygen
- B ethanol and carbon dioxide
- C ethanol and oxygen
- D starch and carbon dioxide

DATA SHEET

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of the Elements

Group																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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7 Li lithium 3	9 Be beryllium 4	23 Na sodium 11	24 Mg magnesium 12	39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	50 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	65 Ga gallium 31	71 Ge germanium 32	73 As arsenic 33	75 Se selenium 34	79 Br bromine 35	80 Kr krypton 36	84 Rb rubidium 37	85 Sr strontium 38	88 Y yttrium 39	89 Zr zirconium 40	91 Nb niobium 41	93 Mo molybdenum 42	96 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	127 Te tellurium 52	128 I iodine 53	131 Xe xenon 54	136 Ba barium 55	137 Cs cesium 56	178 La lanthanum 57	179 Ce cerium 58	180 Pr praseodymium 59	182 Nd neodymium 60	184 Pm promethium 61	186 Sm samarium 62	188 Eu europium 63	190 Gd gadolinium 64	192 Tb terbium 65	194 Dy dysprosium 66	197 Ho holmium 67	201 Er erbium 68	203 Tm thulium 69	207 Yb ytterbium 70	209 Lu lutetium 71	223 Fr francium 87	226 Ra radium 88	227 Ac actinium 89	232 Th thorium 90	238 Pa protactinium 91	238 U uranium 92	238 Np neptunium 93	241 Pu plutonium 94	244 Am americium 95	247 Cm curium 96	251 Bk berkelium 97	252 Cf californium 98	257 Es einsteinium 99	261 Fm fermium 100	265 Md mendelevium 101	270 No nobelium 102	277 Lr lawrencium 103	285 104	289 105	293 106	297 107	301 108	305 109	309 110	313 111	317 112	321 113	325 114	329 115	333 116	337 117	341 118	345 119	349 120	353 121	357 122	361 123	365 124	369 125	373 126	377 127	381 128	385 129	389 130	393 131	397 132	401 133	405 134	409 135	413 136	417 137	421 138	425 139	429 140	433 141	437 142	441 143	445 144	449 145	453 146	457 147	461 148	465 149	469 150	473 151	477 152	481 153	485 154	489 155	493 156	497 157	501 158	505 159	509 160	513 161	517 162	521 163	525 164	529 165	533 166	537 167	541 168	545 169	549 170	553 171	557 172	561 173	565 174	569 175	573 176	577 177	581 178	585 179	589 180	593 181	597 182	601 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Pr

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Th

thorium

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Pa

protactinium

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Th

thorium

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Nd

neodymium

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Pm

promethium

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euroium

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samarium

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402



**Anglo-Chinese School
(Barker Road)**

PRELIMINARY EXAMINATION 2016

SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

**SCIENCE (PHYSICS) 5076
PAPER 2**

TIME: 1 HOUR 15 MINUTES

Exam Index Number	
-------------------------	--

READ THESE INSTRUCTIONS FIRST

Write your Exam Index Number in the box provided at the top of this page.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **two** questions.

Write your answers in the spaces provided on the question paper.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [] at the end of each question or part question.

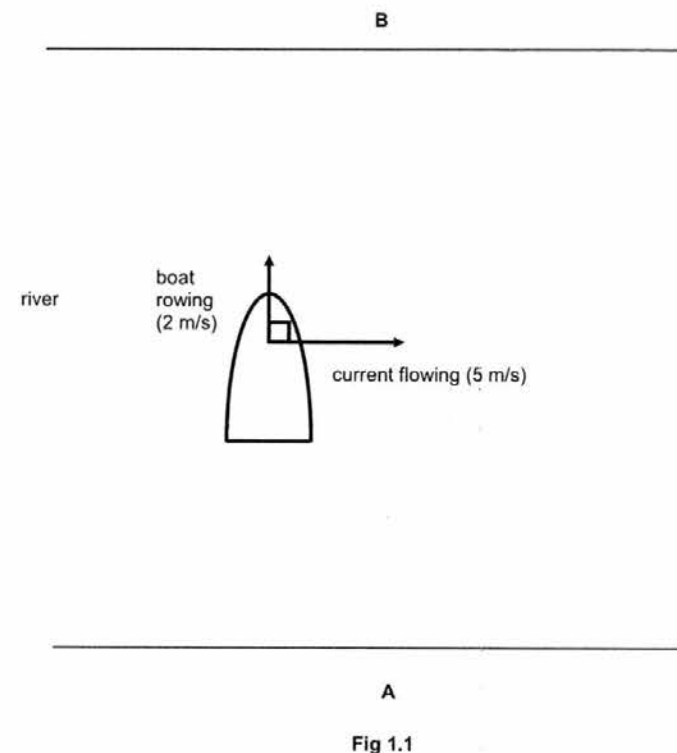
For Examiner's Use	
PAPER 1	/20
PAPER 2	
Section A	/45
Section B	/20
Total	/ 85

This question paper consists of 20 printed pages

Section A (45 marks)

Answer all the questions in the spaces provided on the question paper.

- 1 A man rows a boat to get across a river from bank **A** to **B**. Fig 1.1 shows the boat rowing at a velocity of 2 m/s and the river current flowing at a velocity 5 m/s. Fig 1.1 is not drawn to scale.



On Fig. 1.1, draw a scaled diagram to determine the resultant velocity of the boat.

resultant velocity =m/s [4]

- 2 Alvin pulls a 3.0 kg block with a constant force of 15 N across two surfaces **PQ** and **QR** as shown in Fig. 2.1.

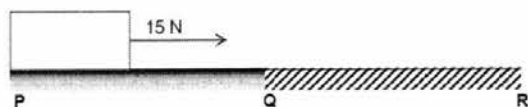


Fig 2.1

Fig. 2.2 shows the distance-time graph of the block as it moves across the two surfaces.

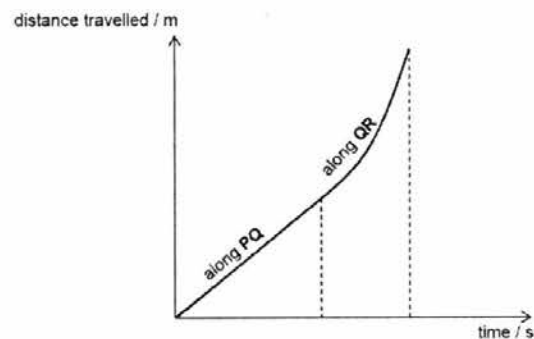


Fig 2.2

- (a) Describe the motion of the block as it moves across **PQ** and **QR**.

PQ:

QR:[2]

- (b) State the magnitude of the frictional force acting on the block along surface **PQ** and explain how you arrived at your answer.

.....

[2]

- (c) The block accelerates at 3.0 m/s^2 on surface **QR**.

Calculate the frictional force acting on the block along surface **QR**.

frictional force along **QR** =N [2]

- 3 In a laboratory experiment to find the centre of gravity of a triangular piece of plastic, the plastic is freely suspended first from point A and then from point B, as shown in Figs. 3.1 and 3.2.

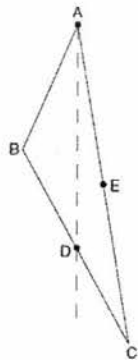


Fig 3.1

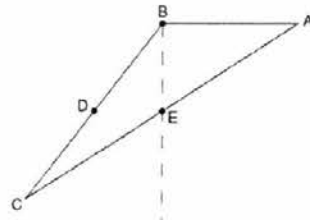


Fig 3.2

- (a) On Fig. 3.3, draw construction lines to find the position of the centre of gravity of the piece of plastic.

Label this point clearly with the letter G.

[1]

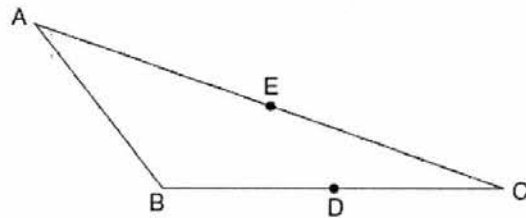


Fig 3.3

- (b) On Fig. 3.3, indicate the weight of the plastic with an arrow.

[1]

- 4 Fig. 4.1 shows a high velocity bullet, just about to penetrate a block of wood.



Fig 4.1

Fig. 4.2 shows the speed–time graph of the bullet from the point of penetration into the wood to the point the bullet came to rest.

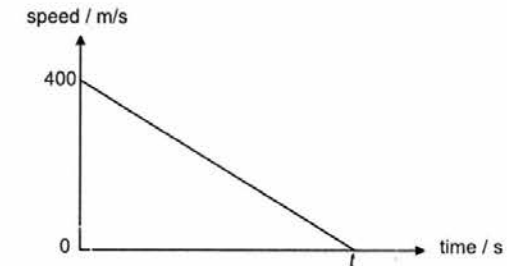


Fig 4.2

- (a) The mass of the bullet is 0.0042 kg.

Calculate the kinetic energy of the bullet at the point of penetration into the wood.

kinetic energy =J [2]

- (b) The bullet penetrated into the wood by 0.05 m.

Calculate the time t in Fig 4.2.

time, t =s [2]

- (c) State the *Principle of Conservation of Energy*.

.....
[1]

- (d) State the energy conversion(s) involved.

.....[1]

- 5 Fig. 5.1 shows two wooden blocks, resting on a horizontal frictionless surface.

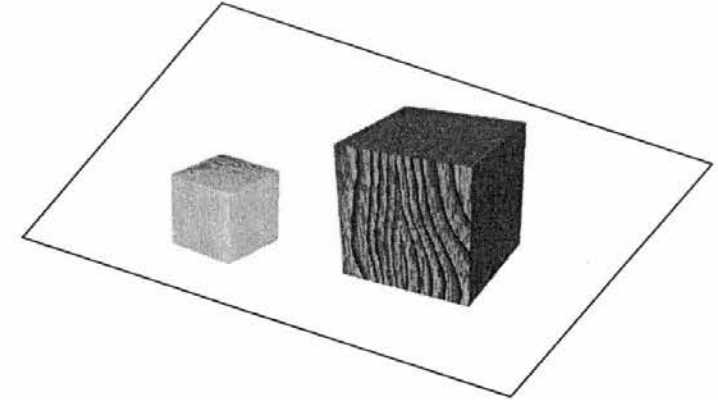


Fig 5.1

The two blocks are now placed next to each other, while still resting on the horizontal frictionless surface.

Fig. 5.2 shows the plan (top) view of the two blocks, acted upon by two forces, X and Y .

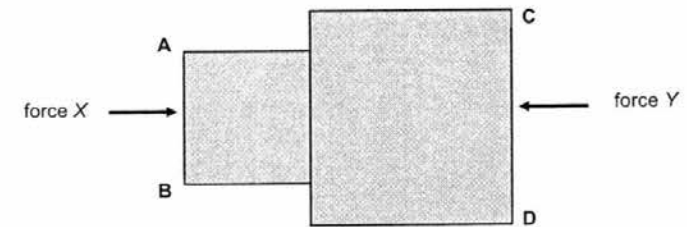


Fig 5.2

Forces X and Y are evenly distributed across surfaces AB and CD respectively.

The pressure acting on AB is 10 Pa . The areas of AB and CD are 2 m^2 and 3 m^2 respectively.

- (a) State what is meant by *pressure*.

.....[1]

- (b) Calculate the force X .

force $X = \dots\dots\dots \text{N}$ [2]

- (c) The blocks experience a resultant force of 5 N to the right.

Calculate the pressure acting on surface **CD**.

pressure = $\dots\dots\dots \text{N/m}^2$ [2]

- 6 A heated substance is cooled to the temperature of its surroundings.
Fig. 6.1 shows more information on the substance.

initial temperature of heated substance	110 °C
temperature of surroundings	- 30 °C
boiling point	70 °C
melting point	- 10 °C

Fig 6.1

- (i) On Fig 6.2, sketch a graph of temperature against time as the substance is cooled.

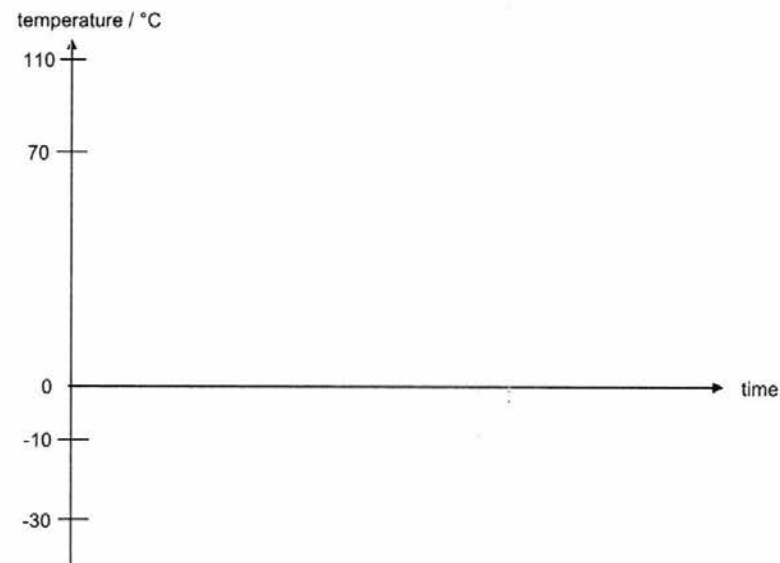


Fig 6.2

- (ii) Describe the changes to

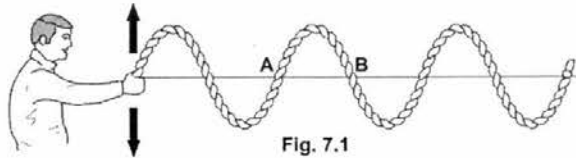
the arrangement of molecules at -10 °C.

the motion of molecules from 80 °C to 60 °C

[2]

[3]

- 7 Fig. 7.1 shows a man holding a long rope and swinging it sharply up and down to send waves along the rope.



- (a) Explain why the wave generated is a transverse wave.
[1]
- (b) State what distance **AB** represents.
[1]
- (c) The man now swings his hand up and down at twice the current rate.
 Explain how this will affect the period of the new wave.
[1]
- (d) Ultra-violet radiation, microwaves, visible light, infra-red radiation and X rays are electromagnetic waves.
- (i) Arrange the above 5 electromagnetic waves in decreasing frequency.
[1]
- (ii) State which electromagnetic wave is used for burglar alarms.
[1]
- (iii) State a difference between the 5 electromagnetic waves (excluding frequency and uses)
[1]

- 8 Fig. 8.1 shows a circuit with an e.m.f. source and a variable resistor connected with a fixed resistor.

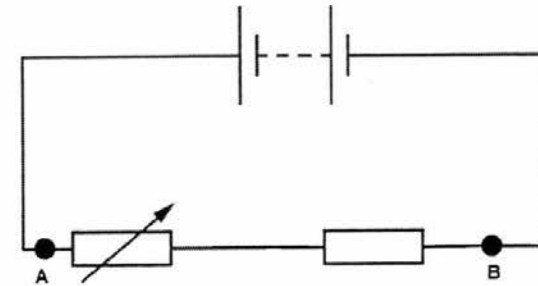


Fig 8.1

- (a) The resistance of the variable resistor is increased.
 State and explain what happens to
- (i) the current flowing through the variable resistor,
[2]
- (ii) the potential difference across points A and B.
[2]
- (b) If the current flowing through the variable resistor is 1.5 A, calculate the charge flowing through the fixed resistor in 40 s.

charge =C [2]

- 9 Fig. 9.1 shows the rating plate for an electric lawn mower.

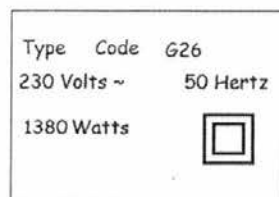


Fig 9.1

- (a) The lawn mower is doubly insulated.

Explain if an earth wire is needed.

.....
[1]

- (b) Calculate the current in the lawn mower when it is turned on in normal operating conditions.

current = A [2]

- (c) The lawn mower was used for 30 minutes.

Calculate the cost of using the lawn mower if the electrical cost per kWh is 25 cents.

cost = cents [2]

Section B (20 marks)

Answer any **two** questions in this section. Write your answers in the spaces provided.

- 10 An endoscope is an instrument a doctor uses to see the inside of a patient's digestive system. Fig 10.1 shows a simplified diagram of how an endoscope works.

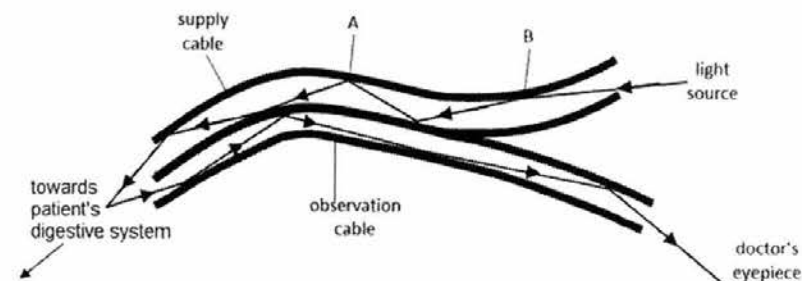


Fig. 10.1

A light source is sent through the supply cable. Total internal reflection occurs along the length of the cables and the light from the source eventually arrives at the doctor's eyepiece.

- (a) (i) One condition for total internal reflection to occur is that the light ray needs to travel from an optically denser to less dense medium.

State the other condition.

.....

- (ii) With reference to Fig. 10.1, explain why total internal reflection occurs more easily at B than A.

.....

- (iii) Fig. 10.2 shows how light intensity varies with the distance from the light source in the endoscope.

Location	Light intensity / candela
at source	700
patient's digestive system	600
doctor's eyepiece	300

Fig. 10.2

Explain why there are different light intensities at various locations of the endoscope.

.....

.....

.....

.....

[4]

- (b) The speed of light in the optical fibre of the endoscope is 2.07×10^8 m/s and the speed of light in vacuum is 3.0×10^8 m/s.

Calculate the refractive index of the optical fibre.

refractive index = [2]

- (c) Fig. 10.3 shows a convex lens inside the doctor's eyepiece. F is the focal point.

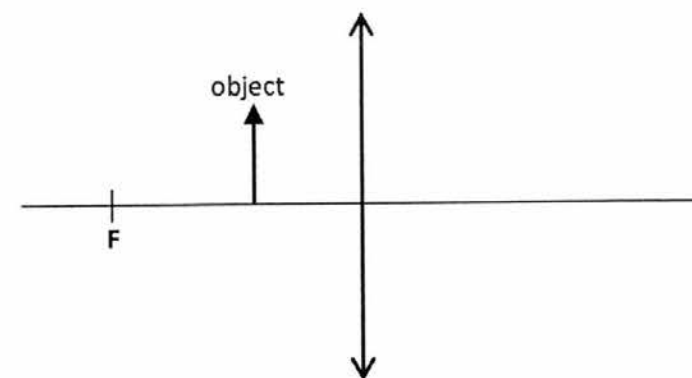


Fig. 10.3

- (i) On Fig. 10.3, draw a ray diagram to determine the location of the image for the object shown. Label the image "I".
- (ii) State two characteristics of the image formed.

..... [4]

- 11 Fig. 11.1 shows a hydraulic brake system in a car. When the driver steps on the brake pedal, it pushes the cylinder containing brake liquid. The force from the brake fluid is then transmitted across the brake liquid to the brake pads, which in turn push and press on the brake discs.

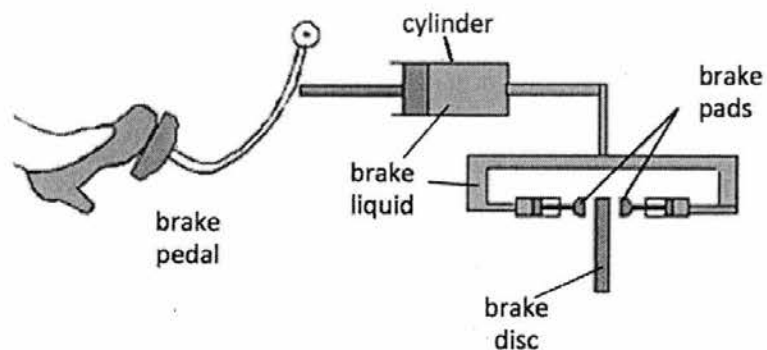


Fig 11.1

- (a) Using Kinetic Theory, explain why
- (i) brake liquid is used to fill the cylinder instead of air,
- (ii) the brake pads are more sensitive when the temperature of the brake liquid rises.

[5]

- (b) To reduce the heat gained by the brake liquid, the car manufacturer considers using two materials to be wrapped around the cylinder. Material A is a shiny metallic sheet and material B is a black rubber sheet.

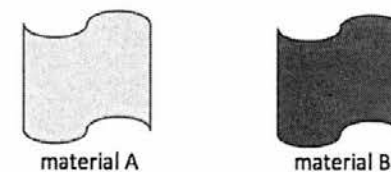


Fig 11.3

- (ii) Discuss the suitability of each material in reducing heat gain by the brake liquid.

- (iii) Suggest how A and B can be put together to minimise heat gain by the brake liquid.

[5]

- 12 Two iron rods are placed inside a solenoid as shown in Fig. 12.1. The solenoid is connected to a battery and switch S.

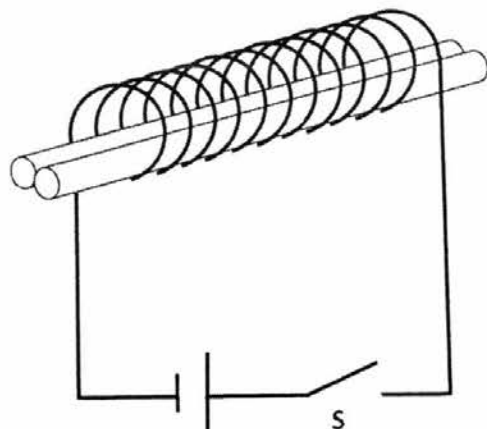


Fig. 12.1

- (a) Describe and explain what would happen to the iron rods when

(i) switch S is closed,

.....

.....

.....

(ii) switch S is opened again.

.....

.....

.....

[4]

- (b) The iron rods are now replaced with steel rods. Describe and explain the changes observed when switch S is closed and then opened again.

.....

.....

.....

[2]

- (c) On Fig. 12.1, draw the magnetic field pattern around the solenoid when switch S is closed. [2]

- (d) The battery is replaced with a source of alternating current as shown in Fig. 12.2.

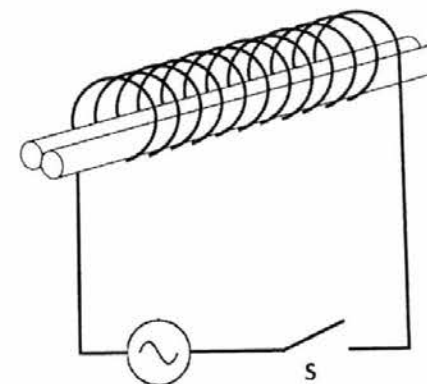


Fig. 12.2

Two magnetised steel rods attracting each other are placed in the solenoid when the switch is open.

The switch is now on and the rods are pulled out slowly from the right side. Describe and explain the changes observed.

.....

.....

.....

.....

[2]

End of Paper

Combined Science (Physics) Answers

Paper 1

Qn	Ans
6	A
7	A
8	C
9	D
10	B

Qn	Ans
11	C
12	C
13	B
14	D
15	C

Qn	Ans
16	C
17	C
18	C
19	A
20	A

Paper 2

Section A

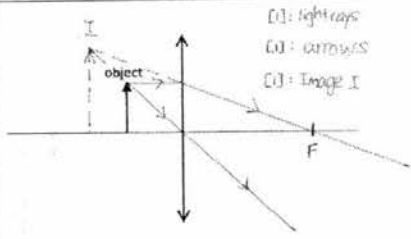
1	1 cm rep 2 m/s $10.8 \text{ cm} \rightarrow 5.4 \text{ m/s}$ ☐ - Scale (1 cm rep 2 m/s) ☐ - Shape ☐ - arrows ☐ - Answer within range 5.2 to 5.6 m/s	B1 B1 B1 B1	
2a	PQ: uniform / constant speed QR: increasing speed (do not accept acceleration or all other types of acceleration)	B1 B1	
2b	15 N Balanced forces / resultant force is zero and frictional force is equal to pulling force	B1 B1	
2c	$F = ma$ $15 - f = 3 \times 3$ $F = 6 \text{ N}$	M1 A1	
3a 3b	1 mark - G 1 mark - arrow for weight (must draw vertically down from G)	B1 B1	
4a	$KE = \frac{1}{2} mv^2$ $= 0.5 \times 0.0042 \times 400^2$ $= 336 \text{ J}$	M1 A1	

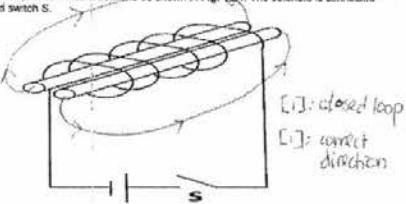
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4b	$\frac{1}{2} \times 400 \times t = 0.05$ $t = 2.5 \times 10^{-4} \text{ s}$	M1 A1	
4c	Energy cannot be created or destroyed but converted from one form to another form (Don't need the total amount of energy remains constant)	B1	
4d	Kinetic energy is converted to heat and sound. (Chemical potential energy to kinetic energy to heat and sound not accepted)	B1	
5a	Fore acting per unit area (no other acceptable answers)	B1	
5b	$p = F / A$ $10 = F / 2$ $= 20 \text{ N}$	M1 A1	
5c	Force X – Force Y = Resultant force $20 - \text{Force Y} = 5$ Force Y = 15 N $p = F / A$ $= 15 / 3$ $= 5 \text{ Pa}$	M1 A1	
6i	*1 mark deducted for every incorrect part or missing part of graph	B1 B1 B1	
6ii	arrangement of molecules: not fixed / not orderly / not regular / random to fixed / orderly / regular motion of molecules: move randomly at very high speeds to move freely	B1 B1 B1	
7a	The direction of vibration of the rope particles is perpendicular to the direction of the wave travel.	B1	
7b	Half a wavelength	B1	

7c	Frequency of the wave is doubled, period will be halved (need both correct to earn the mark) *Do not accept frequency increase and period is decreased as answer must be specific	B1	
7di	X rays, ultra-violet radiation, visible light, infra-red radiation and microwaves	B1	
7dii	infra-red radiation	B1	
7diii	wavelength / energy / period	B1	
8ai	The overall / total resistance of the circuit increases and the current flowing through the variable resistor decreases (do not accept if only resistance is stated)	B1 B1	
8aii	The p.d across points A and B does not change. It is always equal to the e.m.f. of the source.	B1 B1	
8b	$Q = It$ $= 1.5 \times 40$ $= 60 \text{ C}$	M1 A1	
9a	Earth wire is not required. The live wire is insulated from touching the external casing. *Do not accept double insulation prevents electric shock, must be specific to state live wire is insulated from touching external or metal casing.	B1	
9b	$P = IV$ $1380 = I \times 230$ $I = 6 \text{ A}$	M1 A1	
9c	$E = Pt$ $= 1.38 \text{ kW} \times (30/60) \text{ h}$ $= 0.69 \text{ kWh}$ Cost = $0.69 \times 25 \text{ cents} = 17.25 \text{ cents}$	M1 A1	

Section B

10ai	Angle of incidence is greater than the critical angle.	B1	
10aii	Angle of incidence is greater at B than at A.	B1	
10aiii	The difference in light intensity is due to losses as total internal reflection did not occur along the entire length of the cables. Some light is absorbed by the digestive system.	B1 B1	
10b	$n = c/v$ $= 3 \times 10^8 / 2.07 \times 10^8$ $= 1.45$	M1 A1	
10c	 *Image must be drawn with dotted lines (virtual) ** Image must be labelled as I *** Only 1 arrow needed for light ray from top of object through optical centre of lens	B1 B1 B1	
10cii	enlarged, virtual, upright (any two)	B1	
11ai	Particles are closely packed / incompressible/fixed volume. Pressure can be transmitted from particle to particle more easily / pressure can be transmitted evenly compared to air.	B1 B1	
11aii	Particles gain KE OR move faster. Liquid particles exert a force against the brake pads. Brake pads move closer to brake disc resulting in brakes becoming more sensitive.	B1 B1 B1	

11bi	Shiny is a <u>poor absorber</u> of radiation and <u>Black</u> is <u>good absorber</u> of radiation. Thus <u>material A</u> is more suitable than material B in reducing heat gain by <u>radiation</u>. <u>Metal</u> is <u>good conductor</u> / bad insulator of heat and <u>Rubber</u> is <u>good insulator</u> / bad conductor of heat. Thus <u>material B</u> is more suitable than material A in reducing heat gain by <u>conduction</u>.	B1	
		B1	
		B1	
		B1	
11bii	Wrap shiny sheet (A) outside onto black rubber (B) inside (poor absorber of radiation must be outside)	B1	
12ai	Both rods magnetised with same polarity on each side. Like poles repel and rods repel.	B1	
		B1	
12aii	As iron is soft magnetic material, the rods will lose their magnetism. Rods will stop repelling each.	B1	
		B1	
12b	When switch is closed, steel rods are magnetised. When switch is open, rods retain magnetism and continue to repel each other as steel is made from hard magnetic material.	B1	
		B1	
12c	are placed inside a solenoid as shown in Fig. 12.1. The solenoid is connected and switch S. 	B1 B1	
12d	The two steel rods will lose their magnetism. Rods will stop attracting each other.	B1 B1	