Name: ………………………………………………………… (   )   Class: ……………

ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2018

SCIENCE (PHYSICS)
5076 / 01

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LEVEL: 4 Express / 5 Normal (Academic) **DATE:** 15 August 2018

CLASSES: Sec 4/1, 4/2 & 5/1 **DURATION:** 1 hour (Both Physics & Chemistry)

Additional Materials provided: 1 sheet of OAS paper

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

Write your NAME, INDEX NUMBER and CLASS at the top of this page and on the OAS paper. **Shade your index number on the OAS paper.**

There are 20 questions in this paper. Answer **ALL** questions. For each question, there are four possible answers A, B, C and D. Choose the correct answer and record your choice in soft or 2B pencil on the OAS paper provided. **DO NOT fold or bend the OAS paper.**

For Examiner's use:	
Paper 1	/ 20
Paper 2	/ 65
Paper 5	/ 15
Total	/ **100**

At the end of the examination, hand in your OAS paper and Question Papers separately.

This Question paper consists of 9 printed pages including this page.

[Turn Over

Answer **ALL** questions on the OAS paper provided.

1 A stone is dropped from the top of a building to the ground.
Which is a vector quantity?

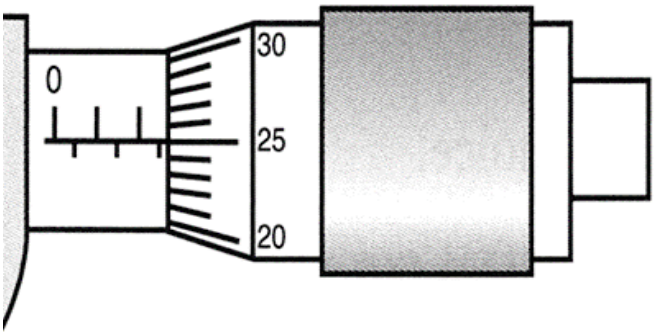
A gravitational potential energy to bring the stone to the top of the building

B kinetic energy of the stone as it reaches the ground

C time taken for the stone to reach the ground

D velocity of the stone as it reaches the ground

2 The diagram below shows the reading of a micrometer screw gauge.



What is the correct reading?

A 2.25 mm

B 2.75 mm

C 5.25 mm

D 5.75 mm

3 Which object has the greatest inertia?

A a 2 kg mass at rest

B a 5 kg mass moving at constant acceleration

C a 5 kg mass moving at constant velocity

D a 10 kg mass at rest

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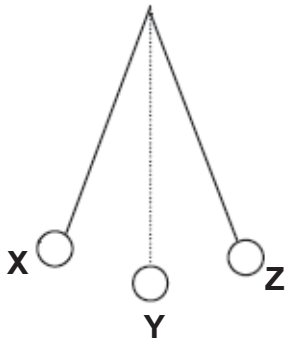
4 The diagram below shows a simple pendulum oscillating between positions **X** and **Z**.



Which sequence should be timed to measure the period of the pendulum?

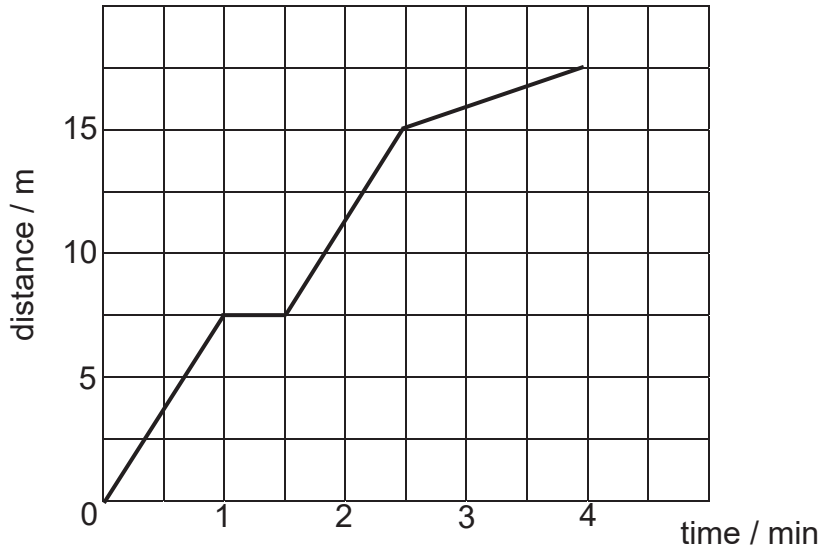
A **X → Y**

B **X → Z**

C **X → Z → Y**

D **X → Z → X**

5 The graph shows the distance-time graph of a cyclist who cycled towards the end of the park and back to the starting point.



Which statement correctly describes the motion of the cyclist in the stated time interval?

A From 0 to 1 min, the cyclist is moving at uniform acceleration.

B From 1 to 1.5 min, the cyclist is moving at uniform speed.

C From 1.5 to 2.5 min, the cyclist is moving at non-uniform speed.

D From 2.5 to 4 min, the cyclist is moving at uniform speed.

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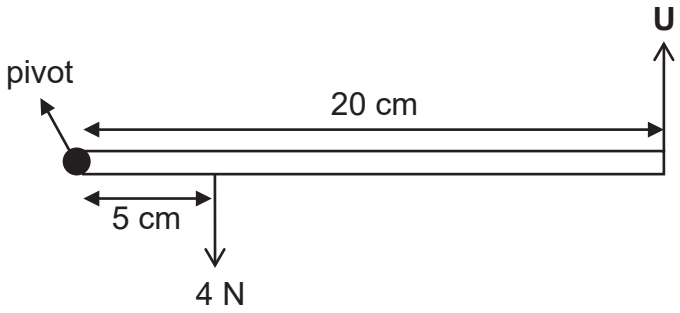
6 A force is applied to an object on a frictionless surface. It produces an acceleration of 3.5 m/s².
What are possible values for the applied force and for the mass of the object?

	force / N	mass / kg
A	2.0	1.5
B	2.0	7.0
C	7.0	0.5
D	7.0	2.0

7 A uniform beam 20 cm long is pivoted at one end. The weight of the beam is 3 N and a 4 N weight hangs 5 cm from the pivot.



An upward force **U** is needed to keep the beam horizontal.
What is the value of this force?

A 1 N
B 2.5 N
C 4 N
D 5 N

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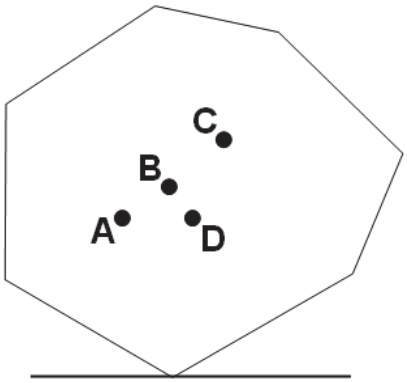
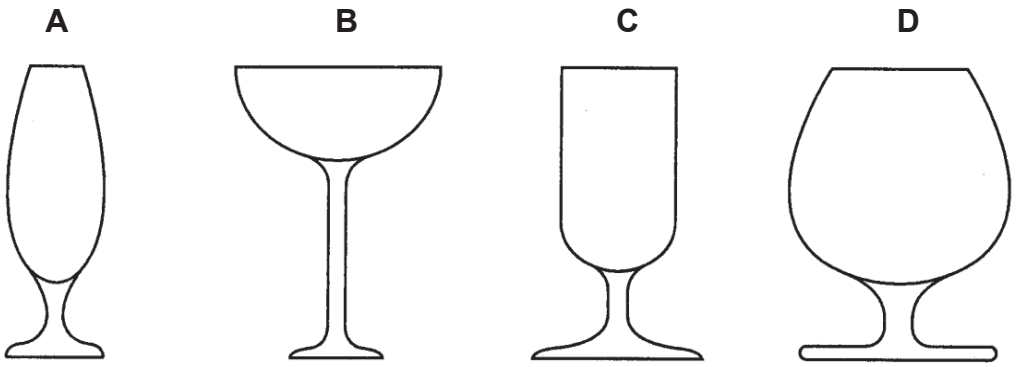
8 In the figure shown below, an object is tilted such that it is at the point of falling over. Where would be the likely position of the centre of gravity of the object?



9 The diagrams below show the cross-sections of different glasses. Which glass is the most stable when filled with water to the brim?



10 A builder carrying five bricks climbs a ladder. Each brick weighs 20 N and the builder climbs a vertical distance of 6.0 m in 25 s.

What is the average power used to raise the bricks?

A 4.8 W
B 24 W
C 120 W
D 15000 W

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11 The following objects all lose heat.
Which object loses all of its heat by radiation?

A an iron block at 120 °C with black surface, in the air

B a shiny metal of a spaceship at 25 °C, in space

C a wooden block with white surfaces at 60 °C

D the heating element of a kettle at 150 °C, in water

12 Which statement about evaporation is true?

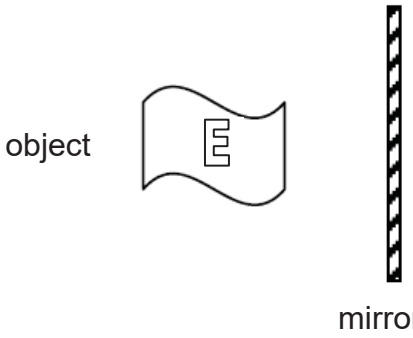
A Evaporation causes the temperature of a liquid to be higher.

B Evaporation occurs throughout the liquid.

C Evaporation takes place at any temperature.

D Evaporation takes place by releasing heat to the surroundings.

13 An object is placed in front of a plane mirror as shown below.



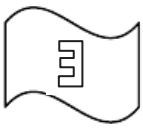
Which diagram shows the correct mirror image of the object?

A

B

C

D



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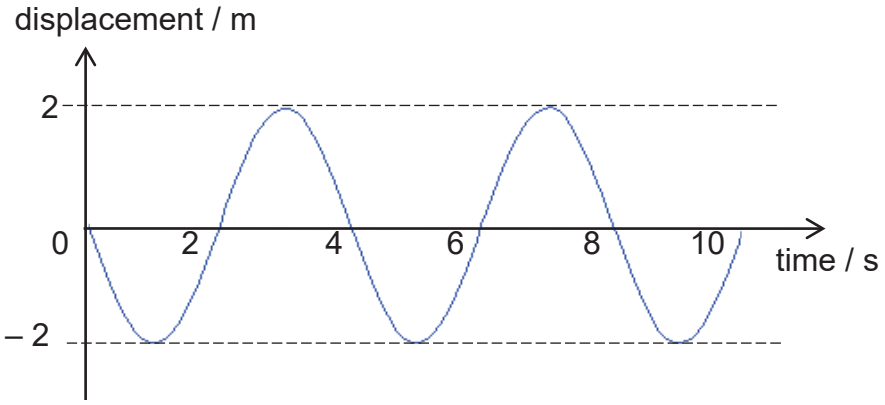
14 The diagram shows how displacement varies with time as a wave passes a fixed point.

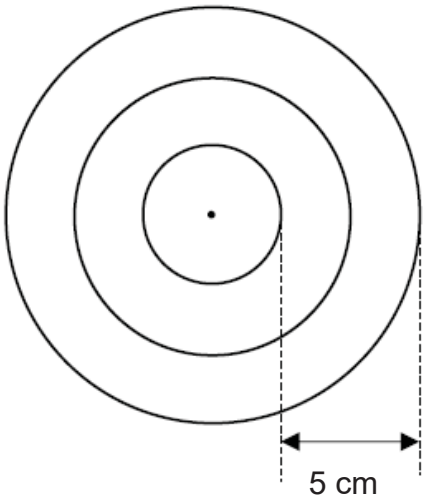


What is the frequency of this wave?

A 0.25 Hz **B** 0.50 Hz

C 2 Hz **D** 4 Hz

15 The dipper in a ripple tank vibrates at a frequency of 8 Hz and forms the wave pattern shown in the diagram below. The distance between the two crests as shown is 5 cm.



What is the speed of the wave?

A 1.6 cm/s **B** 3.2 cm/s

C 20 cm/s **D** 40 cm/s

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16 Which is an application of microwaves?

A used in global positioning system (GPS) to communicate with satellites

B used in scanning of luggage

C used in treatment of cancer

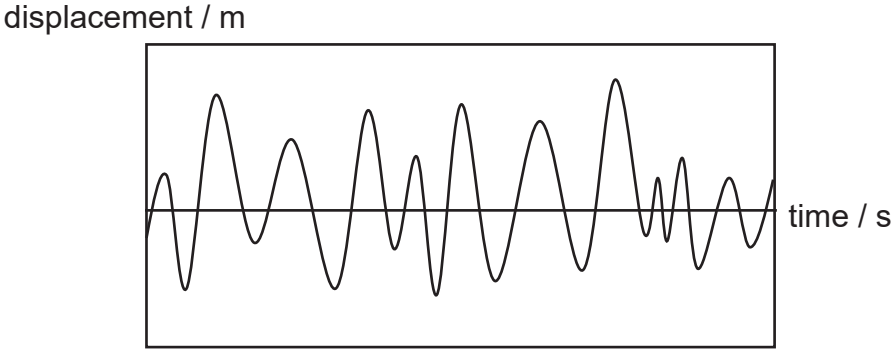
D used in TV-remote controllers

17 Radio waves, infra-red radiation and ultra-violet radiation are all part of the electromagnetic spectrum.

What is the correct order of increasing wavelength?

	shortest →		longest
A	radio waves	infra-red radiation	ultra-violet radiation
B	radio waves	ultra-violet radiation	infra-red radiation
C	ultra-violet radiation	infra-red radiation	radio waves
D	ultra-violet radiation	radio waves	infra-red radiation

18 The diagram below shows a displacement-time graph of a note produced by strumming a guitar string.



If the same note is produced again but at a louder volume, how will the wave change?

A The amplitude of the wave would decrease.

B The amplitude of the wave would increase.

C The peaks of the wave would be closer to one another.

D The peaks of the wave would be further from one another.

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19 The current in a hand dryer is 12 A. It is switched on for three minutes.
How much charge flows through the hand dryer?

A 0.0667 C
B 4 C
C 36 C
D 2160 C

20 A dry cell of e.m.f. 4.0 V has a wire connected to its terminals.
If 10 C of charge passes through the circuit, what is the amount of chemical energy transformed into electrical energy?

A 0.4 J
B 2.5 J
C 14 J
D 40 J

- END OF PAPER -

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Name: .... (   )   Class: ....

ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2018

SCIENCE (PHYSICS)
5076 / 02

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LEVEL: 4 Express / 5 Normal (Academic)   **DATE:** 24 August 2018

CLASS(ES): Sec 4/1, 4/2 & 5/1   **DURATION:** 1 hour 15 minutes

Additional Materials provided: NIL

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

Write your NAME, INDEX NUMBER and CLASS at the top of this page. This paper consists of 2 sections.

SECTION A (45 marks)
Answer **all** questions. Write your answers in the spaces provided on the question paper.

SECTION B (20 marks)
Answer any **two** questions. Write your answers in the spaces provided on the question paper.

In calculations, you should show all the steps in your working, giving your answer at each stage.

For Examiner's use:	
Section A	/ 45
Section B	/ 20
Total	/ **65**

At the end of the examination, hand in this question booklet.

This Question paper consists of 17 printed pages including this page.

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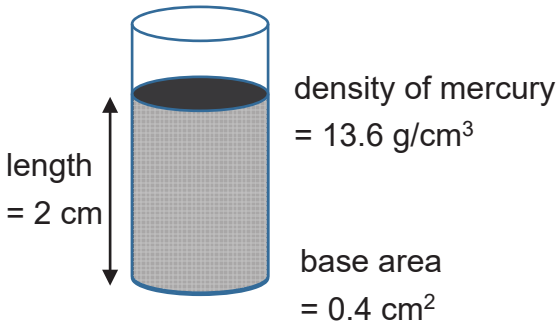
SECTION A (45 marks)

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

1 A vertical uniform cylinder contains some mercury, as shown below.



The cross-sectional area of the cylinder is 0.4 cm^2.
The vertical length of the liquid is 2 cm.
The density of the mercury is 13.6 g/cm^3.

(a) Calculate the mass of the mercury in the cylinder.

mass = ...g [2]

(b) Determine the weight of mercury in the cylinder. (Let the gravitational field strength be 10 N/kg.)

weight = ...N [2]

(c) Calculate the pressure exerted by the mercury on the base of the cylinder.

pressure = ...N/cm^2 [2]

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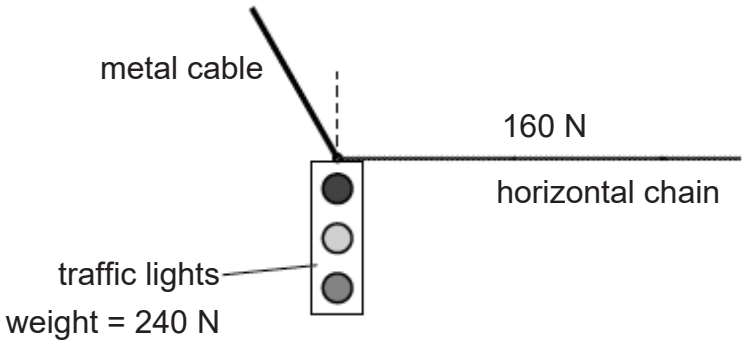
2 A set of traffic lights hangs from the end of a metal cable. A horizontal chain pulls the traffic lights to the right so that they are above the middle of the road. The diagram below shows the metal cable inclined to the vertical.



The weight of the traffic lights is 240 N and the tension in the horizontal chain is 160 N.

Use a scale diagram to determine the size of the resultant force of the weight and the tension in the chain. State the scale used for the diagram and the direction of the resultant force from the weight of the traffic lights.

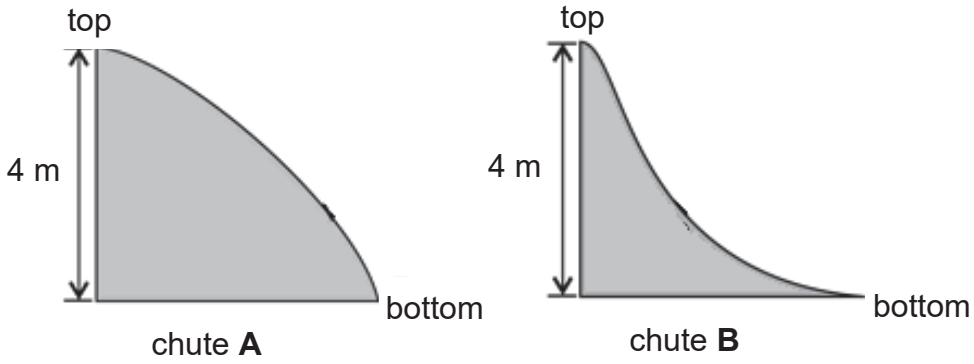
scale = 1 cm represents ……N

resultant force = ……N

direction from weight of traffic lights = ……...

…….. [4]

3 Annie visited a water-themed park. She found two different sliding chutes, **A** and **B**, in a swimming pool, which are both 4 m high. She has a mass of 45 kg. The gravitational field strength is 10 N/kg. Assume both slides are frictionless.



(a) Annie plays in chute **A**.
Calculate the gain in gravitational potential energy as she climbs to the top of the chute.

gravitational potential energy = ……J [1]

(b) Calculate the maximum speed of Annie as she slides to the bottom of chute **A**.

speed = ……m/s [2]

(c) Annie thinks that chute **B** will be more exciting than chute **A** as the maximum speed of chute **B** should be faster than chute **A** since the slide is "steeper".

Do you agree with her? Explain.

……

……

…… [2]

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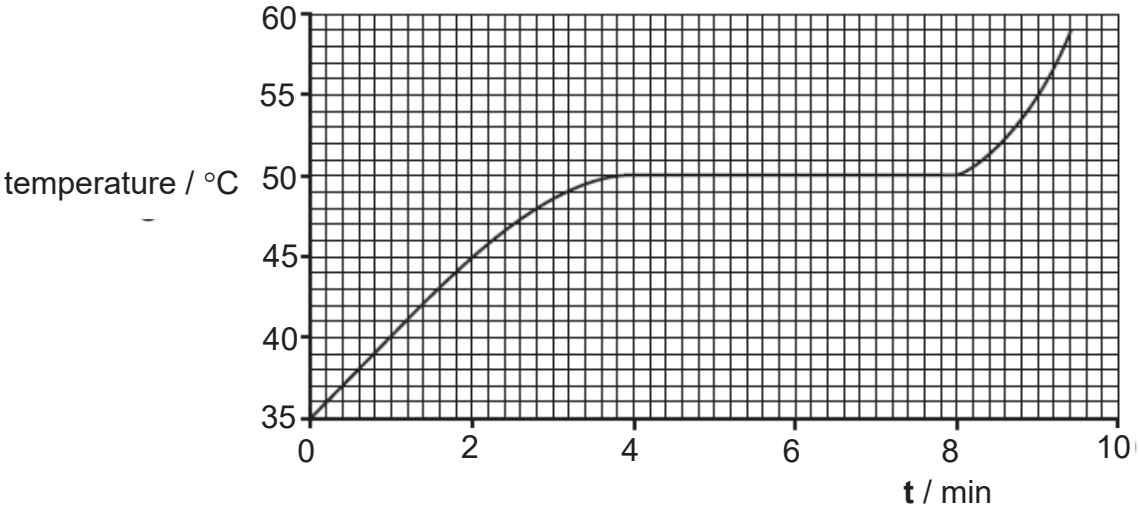
4 A student slowly heats a sample of solid wax in a test tube.
The graph shows how the temperature of the wax varies with time **t**.



(a) State the melting point of the wax.

melting point = ……°C [1]

(b) Thermal energy passes into the wax throughout the experiment.

(i) Describe what effect this energy has on the kinetic energy and the potential energy of the wax particles between the time t = 0 and t = 4 min.

……...

……...

……...

……... [2]

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(ii) Describe the changes, if any, that occur to the arrangement and motion of the wax particles between t = 4 to t = 8 min.

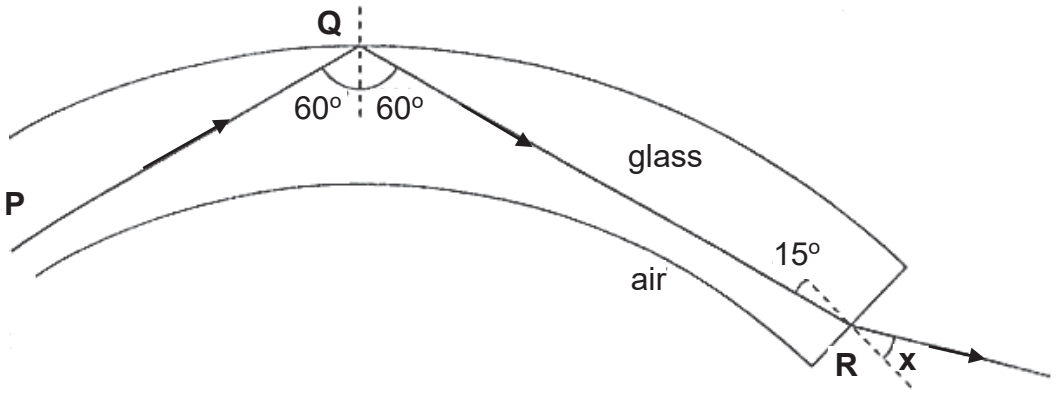
……...

……...

……...

……... [2]

5 The diagram below shows a ray of light travelling along **PQR** inside a simple optical fibre and emerges into the air at point **R**.



The refractive index of glass is 1.45.

(a) (i) Calculate the critical angle of glass.

angle = ……° [2]

(ii) Explain why the light ray did not emerge into the air after it is incident at point **Q**.

……...

……...

……... [2]

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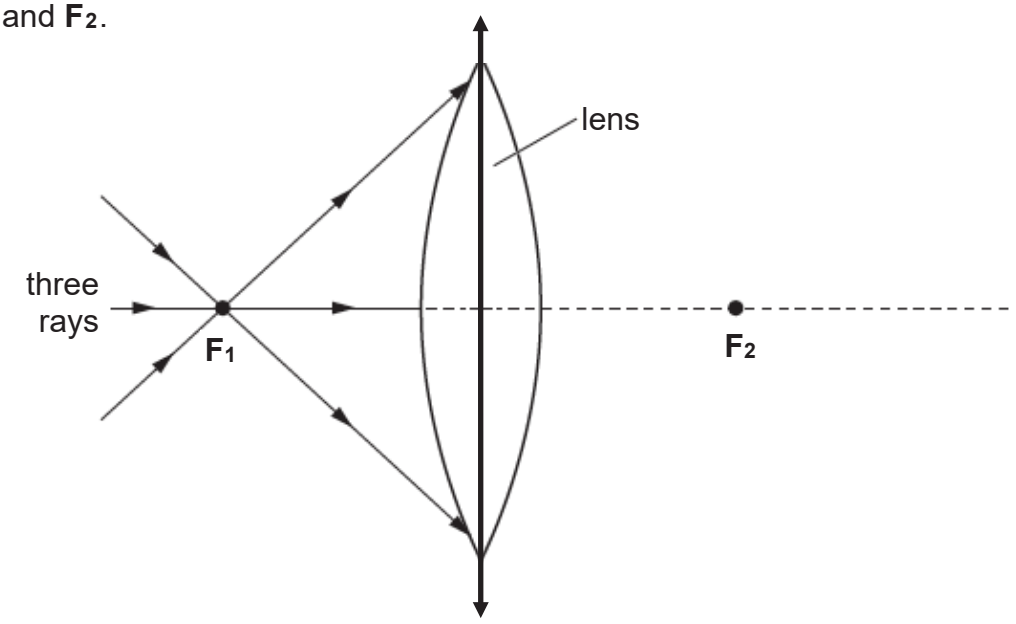
(iii) The light ray makes an angle of 15° with the normal to the glass surface as it emerges from point **R**. Calculate the angle ***x***.

x = ……° [2]

(b) The diagram below shows a glass lens in air and its two focal points F_1 and F_2.



Three rays of light pass through F_1 to the lens.

(i) On the diagram, continue the paths of the three rays through the lens and into the air. [2]

(ii) State what happens to the speed of light after leaving the lens and returning to the air.

…… [1]

6 The diagram below shows a siren located some distance from a tall building. The siren is sounded once briefly. A short while later, an observer standing next to the siren hears the reflected sound.

(a) The reflected sound is heard 4.86 s later. Given that the speed of sound in air is 330 m/s, calculate the distance between the siren and the tall building.

distance = ……m [2]

(b) Explain how the sound waves propagate from the siren to the tall building through air.

……

……

……

…… [2]

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7 **(a)** A refrigerator, when connected to a 240 V mains supply has a maximum power of 100 W.

(i) Calculate the maximum current for this refrigerator.

current = ……A [2]

(ii) The refrigerator is designed with a fuse as a safety device. Explain how the fuse works and suggest if a fuse rating of 1 A or 3 A is more suitable for the kettle.

……...

……...

……... [2]

(b) The refrigerator on average uses 1.1 kWh every 24 hours. The cost of electricity is about $0.22 for every kWh.

(i) Calculate the average output power.

power = ……W [2]

(ii) Calculate the cost of using the refrigerator each day.

cost = $…… [1]

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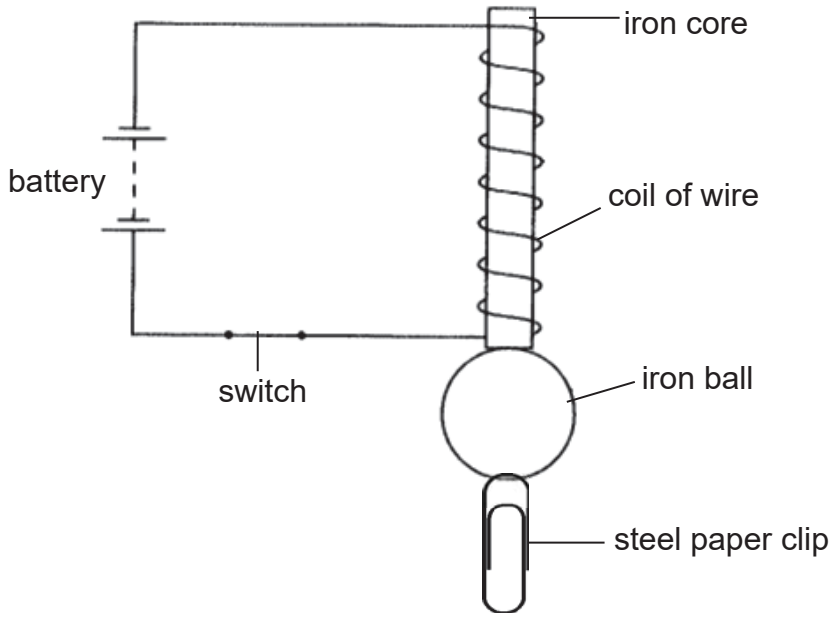
8 A simple electromagnet is shown below.



When the switch is closed, an iron ball is attracted to the iron core. The steel paper clip is attracted to the iron ball.

(a) **(i)** State the magnetic pole that is formed at the end of the iron core closest to the iron ball.

……..... [1]

(ii) Explain why there is an attractive force between the iron ball and the paper clip.

……...

……...

……... [2]

(b) The switch is now open. Predict and explain what would happen to both the iron ball and the steel paper clip.

…….....

……..

…….. [2]

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Section B (20 marks)
Answer 2 out of 3 questions. Each question carries 10 marks. Write your answers in the spaces provided on the question paper.

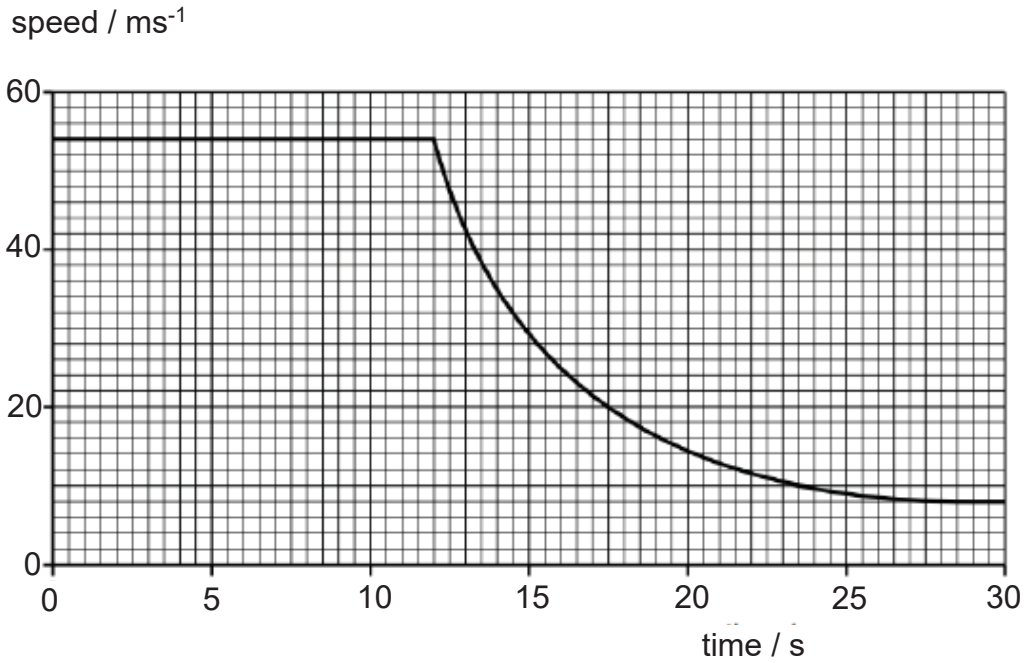
9 The diagram below shows a skydiver falling towards the Earth at constant speed, a long time after jumping from an airplane.

(a) (i) State the initial acceleration of the skydiver.

initial acceleration = …… [1]

(ii) On the diagram, draw and label all the vertical forces acting on the skydiver. [1]

(b) At time t = 0 s, he receives a radio signal. After a while, he opens his parachute. The speed-time graph for the skydiver is shown below.



(i) State the time when the skydiver opens the parachute.

t = …… [1]

(ii) State the type of acceleration the skydiver undergoes from the time he receives the signal to the time he opens the parachute.

……..... [1]

(iii) Use your answer to **b(ii)** to explain how the weight of the skydiver relates to the air resistance before he opens the parachute.

……..

……..

…….. [2]

(c) Calculate the total distance travelled by the skydiver after he receives the signal between t = 0 to t = 10 s.

total distance = …… [2]

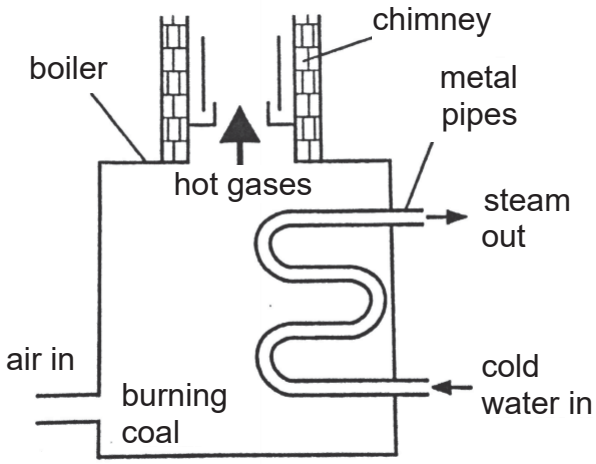
(d) Describe the motion of the skydiver after he opens his parachute.

……..

……..

…….. [2]

10 **(a)** The diagram below shows the boiler of a coal-fired power station. Hot gases rise and thermal energy from the hot gases heats the cold water inside the metal pipes, forming steam.



(i) Fill in the blanks to describe the energy conversions that take place as the coal burns.

……..... energy of the coal → thermal energy

of hot gases →…….. energy of the water particles [2]

(ii) Using ideas about particles, explain how heat is transferred through the metal pipes by conduction.

……...

……...

……... [2]

(iii) Suggest what might happen if cold water enters the boiler from the top of the metal pipes instead of the bottom.

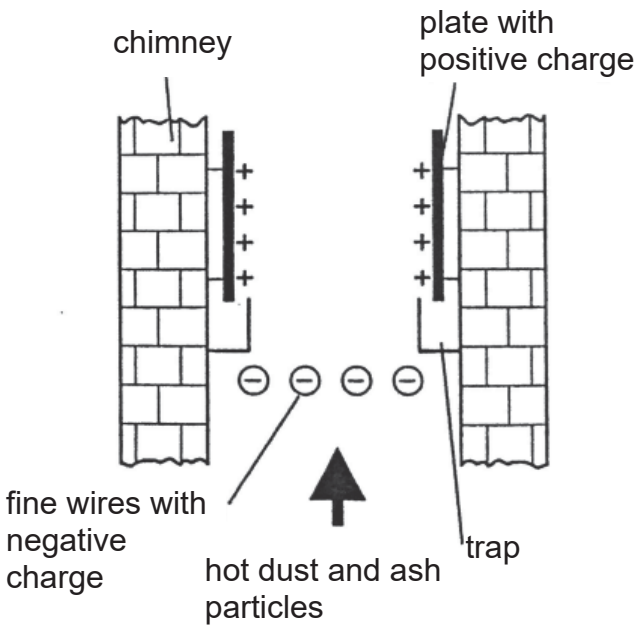
Give a reason for your answer.

……...

……...

……... [2]

(b) The diagram below shows an electrostatic precipitator that stops dust and ash emerging from the chimney.

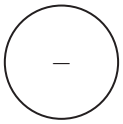


(i) Define *electric field*.

……...

……... [1]

(ii) On the diagram below, draw the electric field lines of a negatively charged particle.



[1]

(iii) Describe what would happen to the hot ash and dust particles after it passes through the fine wires. Explain your answer.

……...

……...

……... [2]

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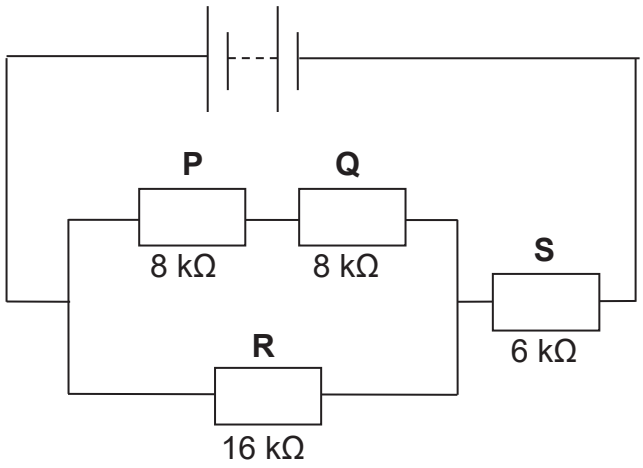
11 The diagram below shows a circuit containing four resistors **P**, **Q**, **R**, **S** and a battery of e.m.f. 8 V is connected as shown.



Resistors **P** and **Q** each has a resistance of 8 kΩ. Resistor **R** has a resistance of 16 kΩ and resistor **S** has a resistance of 6 kΩ.

(a) Fill in the blanks for the following statements.

(i) Resistor …… and Resistor **Q** have the same current in them. [1]

(ii) The potential difference across resistor **R** is the same as the sum of potential difference across resistor …… and resistor …… [1]

(b) **(i)** Show that the total resistance of the circuit is 14 kΩ.

[2]

(ii) Calculate the current in resistor **S**.

current = …… [2]

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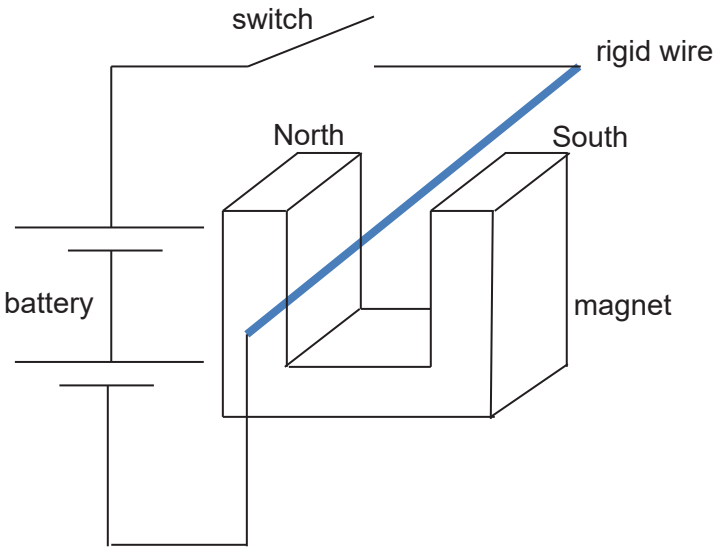
(c) The diagram below shows a rigid wire held between the poles of a magnet.



When the current is switched on, there is a force acting on the wire.

(i) State the direction of the force acting on the wire.

…….. [1]

(ii) Describe what would happen to the wire if the terminals of the batteries is reversed.

…….. [1]

(iii) Suggest two ways to increase the magnitude of the force acting on the wire.

……..

……..

…….. [2]

- END OF PAPER -

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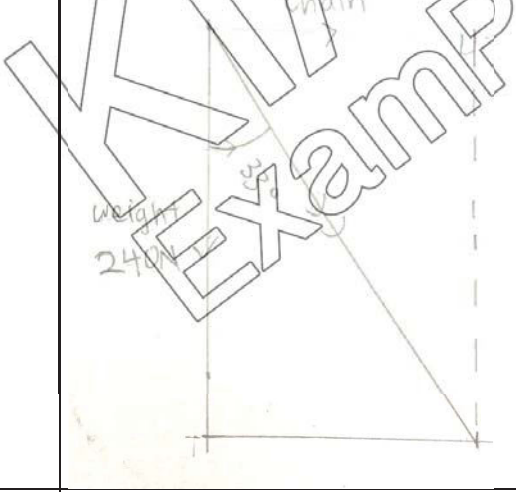
4E5N Sc(Physics) Prelim Marking Scheme 2018

Paper 1: MCQ [20]

1	2	3	4	5	6	7	8	9	10
D	**B**	**B**	**D**	**D**	**D**	**B**	**B**	**D**	**B**
11	12	13	14	15	16	17	18	19	20
A	**C**	**B**	**A**	**C**	**A**	**C**	**B**	**D**	**D**

Section a: Short Structured Questions [45]

Qn	Ans	Marks
1 (a)	Mass = density × volume Mass = 13.6 g/cm^3 × (0.4 cm^2 × 2 cm) Mass = 10.9 g (3sf)	 **C1** **A1**
1(b)	Weight = mg = 0.0109 kg × 10 N/kg (marks awarded for conversion to kg) = 0.109 N **(ECF)**	 **C1** **A1**
1(c)	$P = \frac{F}{A}$, $P = \frac{0.109}{0.4}$ *P* = 0.273 N/cm^2 **(ECF)** (Accept 0.272 if students use 108.8)	**C1** **A1**
2	 Accept any suitable scale (to draw vectors of 160 N and 240 N) Diagram drawn accurately using parallelogram or triangle method. Direction of vectors must be correct. Resultant = 288 N ± 4 N Direction = 33 ± 1º **anticlockwise** from 240 N weight	**B1** **B1** **B1** **B1**
3(a)	GPE = 45 kg × 4 m × 10 N/kg = 1800 J	**B1**
(b)	K.E = 1800 J $1800 = \frac{1}{2}mv^2$	**C1**

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	$v = \sqrt{\frac{1800 \times 2}{45}}$ $v = 8.94 m/s$	**A1**
(c)	I do not agree with her because the **height of both slides are the same**. Based on the conservation of energy, the amount of **gravitational potential energy being converted to kinetic energy is the same**. Hence there would be no difference in the speed.	**B1** **B1**
4(a)	50 °C	**B1**
(b)(i)	The thermal energy **is converted into the kinetic energy (or cause the particles to vibrate faster)** of the particles and hence the **kinetic energy increases**. However, the **potential energy remains constant** as there is no change in state of the substance. (Marks not awarded if student mention change of state as substance just reach melting point)	**B1** **B1**
(ii)	Motion: Instead of **vibrating about its fixed position**, the particles can now **move freely and randomly** (or particles slide across one another). Arrangement: The particles are **no longer arranged in a regular pattern (orderly manner)** although the particles are still closely packed.	**B1** **B1**
5(a) **(i)**	$\sin c = \frac{1}{1.45}$ c = 43.6°	**C1** **A1**
(ii)	Since the light ray is **travelling from an optically denser medium to an optically less dense medium** and the **angle of incidence is greater than the critical angle**, the light ray undergoes **total internal reflection** and therefore did not emerge into the air. (Any 1 point on traveling and critical angle give 1 m)	**B1** **B1**
(iii)	$\frac{\sin x}{\sin 15} = 1.45$ x = 22.0°	**C1** **A1**

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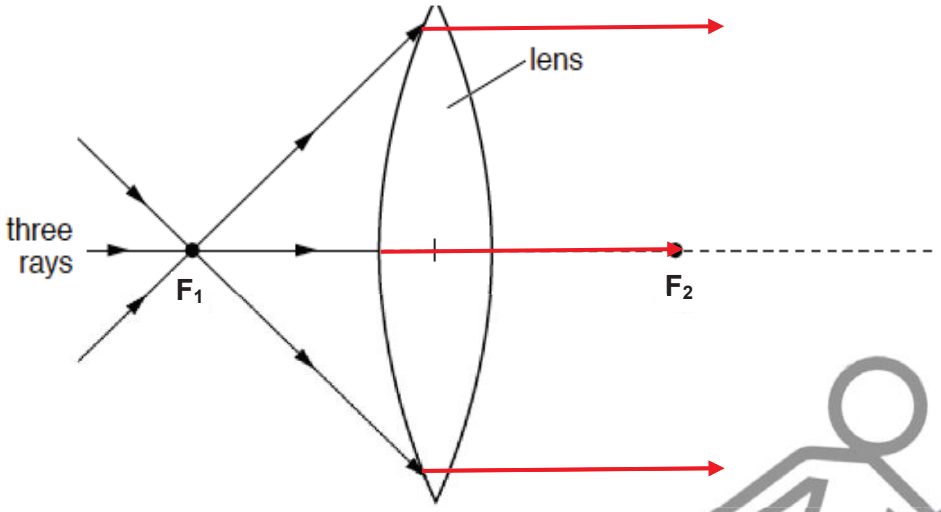
(b)(i)	 1 m for the light ray passing through the middle of the lens 1 m for the other two light rays to become parallel	 **B1** **B1**
(ii)	The speed of light increases. (Do not award marks if student say speed increases as its unclear)	**B1**
6(a)	$Distance = \frac{4.86 \times 330}{2}$ = 802 m	**C1** **A1**
(b)	As the siren **vibrates**, it causes the surrounding air particles to **vibrate in the direction parallel to the direction of wave travel**, producing a **longitudinal wave**. Or As the siren **vibrates**, it **displaces** the surrounding **air particles**, causing them to vibrate as well. The sound wave is propagated through the air through a series of **compressions and rarefactions** before it reaches the large building.	**B1** **B1** **B1**
7(a) **(i)**	100 W = 240 V × I I = 0.417 A	**C1** **A1**

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(ii)	A fuse **melts** when the current across it is greater than the fuse rating. This cause the **circuit to be open** and **prevents excessive current** from flowing to the electrical appliance. A 1 A fuse would be suitable for the kettle. (ECF)	**B1** **B1**
(b) **(i)**	1.1 kWh = P × 24 h P = 0.0458 kW, P = 45.8 W	**C1** **A1**
(ii)	$0.24 (Accept 0.242)	**B1**
8 **(a)(i)**	North	**B1**
(a)(ii)	The electromagnet attracts the iron ball and the **iron ball becomes an induced magnet**. (accept magnetized) The iron ball **behaves like a magnet** and hence it is able to attract the steel paper clip as **steel is a magnetic material**. (accept double induction)	**B1** **B1**
(b)	The iron ball would **drop off** from the electromagnet as it is a **soft magnetic material** The steel paper clip would **remain attach** to the iron ball as **its a hard magnetic material**. <u>Or</u> The paper clip will still attract the iron ball as it is a **hard magnetic material**. and the iron ball will continue to attract the iron core because of **induced magnetism**.	**B1** **B1** **B1** **B1**

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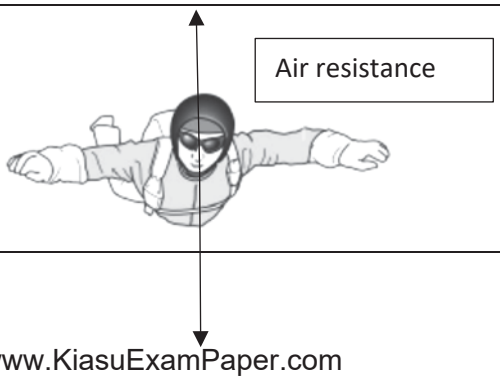
<u>Section C: Free Response Answer</u> [30]

Qn	Ans	Marks
9 **(a)(i)**	10 m/s^2	**B1**
(a)(ii)		**B1**

	Weight 1m awarded for highlighting each force. (Accept gravitational pull)	
(b)(i)	12 s	**B1**
(b)(ii)	The acceleration is **zero**. / no acceleration	**B1**
(b)(iii)	The **air resistance is equal to the weight** of the skydiver. The **resultant force acting on the skydiver would be zero**, hence based on Newton's first law, the acceleration would also be zero, therefore the skydiver would be travelling at constant speed.	**B1** **B1**
9(c)	The total distance travelled = Area under the graph = 54 × 10 = 540 m	 **C1** **A1**
(ii)	The skydiver is traveling at **decreasing deceleration** from t = 12 to t = 27.5 and it travels at **constant speed** from t = 27.5 to t = 30 s.	**B1** **B1**
10(a)(i)	**Chemical potential energy** of the coal → thermal energy of hot gases →**internal** energy of the water particles	**B1** **B1**
(ii)	As the hot air heats up the pipes, **the heat is converted into kinetic energy of the particles in the metal and it vibrates more vigorously**. It collides with its neighbouring particles and causes **them to vibrate more vigorously as well, passing the kinetic energy to them**. This continues until all the heat is transferred through the pipes.	**B1** **B1**
(iii)	Steam is **less dense than cold water and hence it would rise**. Therefore, most of the **steam would rise and escape from the top** thus reducing the efficiency of the boiler.	**B1** **B1**
(b)	It is a region where **an electric charge experiences a force**.	**B1**

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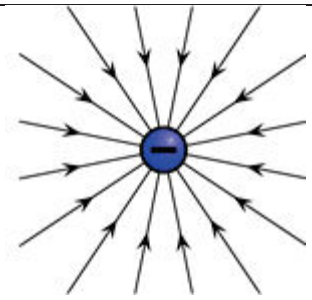
(i)		
(ii)	 1m for the direction of the arrows with straight lines	**B1**
(iii)	The dust becomes **negatively charged**. As **unlike charges attract**, it would be **attracted to the positively charged plate**.	**B1** **B1**
11(a)(i)	**P**	**B1**
(ii)	**P** and **Q**	**B1**
(b)(i)	$\frac{1}{16}+\frac{1}{16}=\frac{1}{R}$ $\frac{1}{R}=\frac{1}{8}, R=8\Omega$ Total resistance = 8 + 6 = 14 kΩ 1m for correct substitution for parallel resistors.	**C1** **A1**
(b)(ii)	14 kΩ = 14000 Ω $I=\frac{8V}{14000\Omega}$ I = 0.000571 A	**C1** **A1**
(c)(i)	It is acting **upwards**.	**B1**
(ii)	The wire would move **downwards**.	**B1**
(iii)	Increase the number of batteries Use a stronger magnet Thicker wire	**B1** **B1**

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