Class	Register Number	Name

BARTLEY SECONDARY SCHOOL

GCE O-LEVEL PRELIMINARY EXAMINATIONS

SCIENCE (PHYSICS, CHEMISTRY) 5076/01

Sec 4 Express / 5 Normal (Academic)

Paper 1 Multiple Choice **23 September 2019**

1 hour

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

READ THESE INSTRUCTIONS FIRST

Write your class, register number and name on all the work you hand in.
Do not use staples, paper clips, glue or correction fluid.

There are **forty** questions in this paper. 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 Multiple Choice Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

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

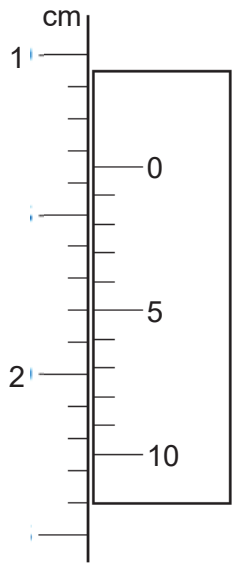
At the end of the examination, submit the Multiple Choice Answer Sheet.

This document consists of **9** printed pages and **1** blank page.

Set by: OGK

[Turn over

1 The diagram shows part of a vernier scale.



What is the correct reading of the vernier scale?

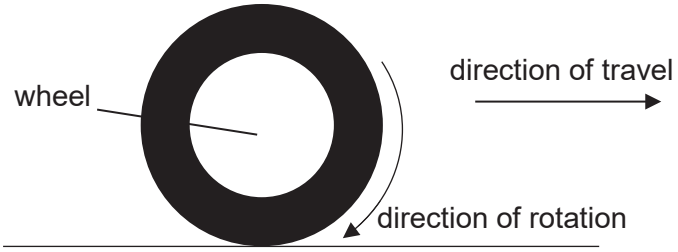
A 1.05 cm **B** 1.35 cm **C** 1.85 cm **D** 2.65 cm

2 An object falls through a vacuum.

Which row describes the acceleration and the velocity of the object?

	acceleration	velocity
A	constant	constant
B	constant	increasing
C	increasing	constant
D	increasing	increasing

3 A car is accelerating along a road in the direction shown. The wheel shown is connected to the engine.



Which row shows the correct directions of air resistance on the car and friction acting on the wheel?

	air resistance	friction
A	←	←
B	←	→
C	→	←
D	→	→

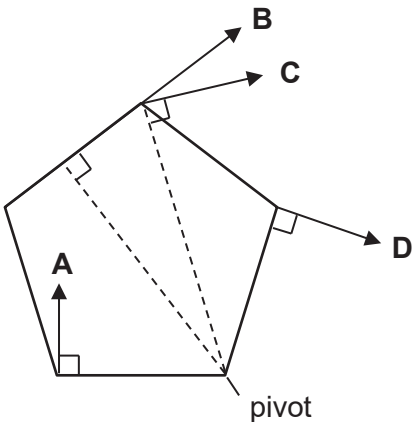
4 The weight and density of a gold bar are measured on Earth. The weight and density of the same gold bar are now measured on the Moon.

Which row describes how the density and weight of the gold bar change as the gold bar is brought to the Moon?

	density of gold bar on the Moon	weight of gold bar on the Moon
A	decrease	decrease
B	decrease	unchanged
C	unchanged	decrease
D	unchanged	unchanged

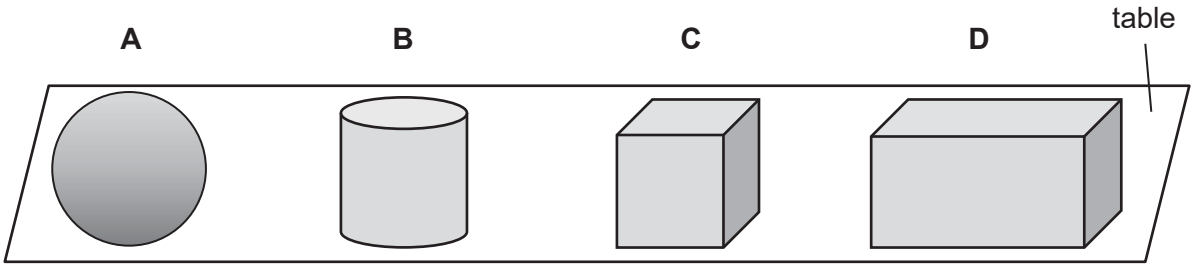
5 The diagram shows four forces acting on a pentagon-shaped object.
The four forces shown have the same magnitude.

Which force will give the greatest turning effect about the pivot?

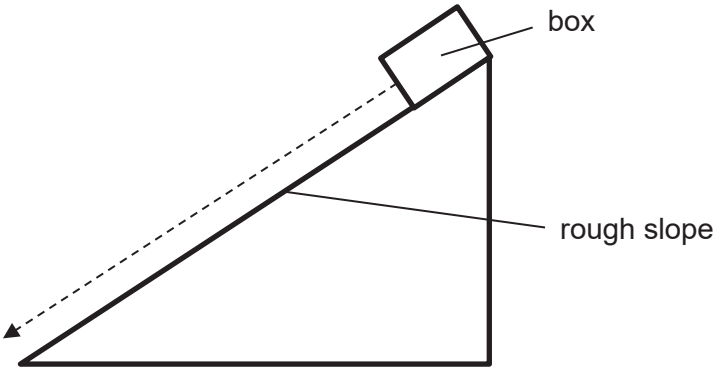


6 Four objects, each of the same weight, are placed on a table as shown.

Which object exerts the **least** pressure on the table?



7 A box at the top of a rough slope has an initial kinetic energy of 60 J and gravitational potential energy of 40 J. It then moves from the top to the bottom of the slope.



Given that the work done against friction is 10 J, what is the kinetic energy of the box at the bottom of the ramp?

A 0 J **B** 30 J **C** 90 J **D** 110 J

8 A substance consists of particles that are close together and slide past one another. The average speed of the particles is gradually **decreasing**.

Which statement best describes the substance?

A a liquid being cooled

B a liquid being heated

C a solid being cooled

D a solid being heated

9 Four metal cans are identical except for the colour and texture on their outer surfaces. The same volume of tap water at room temperature is poured into each can.

Which can will give the **lowest** temperature reading after being put in the sun for a period of time?

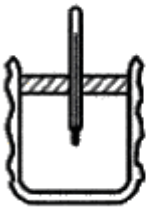
A

black,
rough surface

B

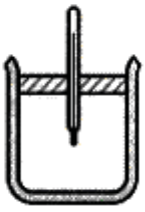
black,
shiny surface

C



white,
rough surface

D



white,
smooth surface

10 An ice cube at 0 °C is heated.

What is the immediate change to the internal energy of the ice cube?

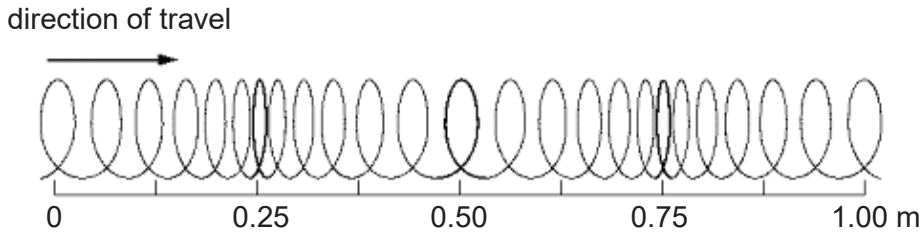
A The internal kinetic energy decreases.

B The internal kinetic energy increases.

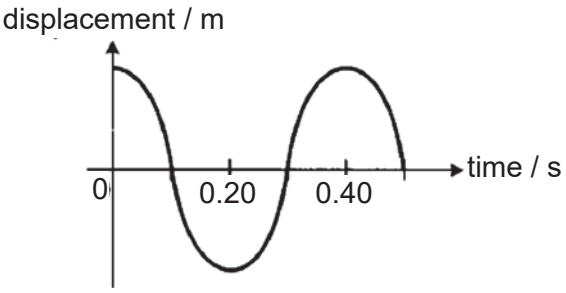
C The internal potential energy decreases.

D The internal potential energy increases.

11 A longitudinal wave is generated along a slinky coil as shown in the diagram.



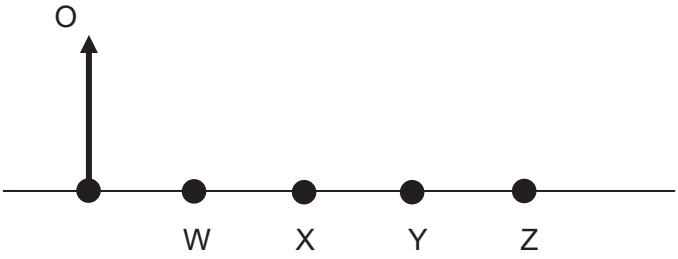
The graph below shows the variation of the displacement of a particle in the wave with time.



What is the speed of the wave?

A 0.20 m/s **B** 0.625 m/s **C** 1.25 m/s **D** 2.5 m/s

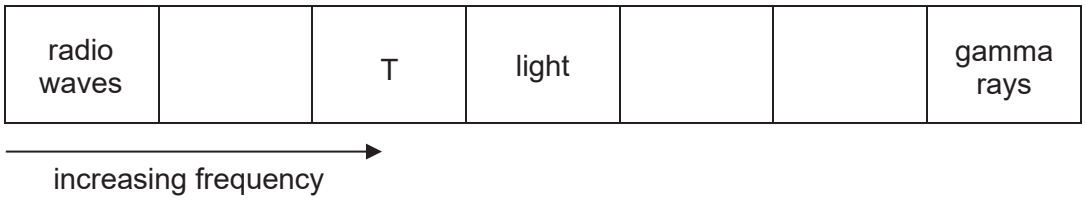
12 The image of an object O formed using a converging lens has the following properties: same size as the object, real and inverted.



Which are the positions of the focal point, image and lens?

	position of focal point	position of image	position of lens
A	X	Y	W
B	X	Z	W
C	Y	W	X
D	Y	Z	X

13 The diagram shows the main components of the electromagnetic spectrum in order of increasing frequency. Some of the components are labelled.



What is an application of the electromagnetic waves in component T?

A intruder alarm

B kill cancerous cells

C satellite television

D sterilisation of medical equipment

14 The speed of a sound wave is doubled when it passes from medium X to medium Y.

Which statement describes the change in the sound wave correctly?

A The frequency is doubled.

B The frequency is halved.

C The wavelength is doubled.

D The wavelength is halved.

15 A positive test charge in an electric field experiences a force in the direction shown.

Ignoring the effects of gravity, what is the direction of the electric field lines?

A horizontally to the left

B horizontally to the right

C vertically downwards

D vertically upwards

16 A resistor with resistance *R* is made from a resistance wire with a cross-sectional area *A* and length *L*.

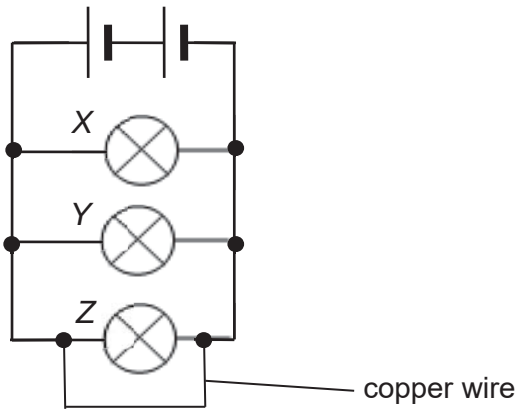
A second resistor made from the wire of the same material has a cross-sectional area of $\frac{A}{4}$ and a length of $\frac{L}{2}$.

What is the resistance of the second resistor?

A $\frac{R}{2}$ **B** *R* **C** 2*R* **D** 8*R*

17 Three lamps *X*, *Y* and *Z* are initially of the same brightness in a circuit.

If a piece of copper wire is connected across *Z* as shown, what effect does it have on the lamps?



A Lamps *X*, *Y* and *Z* will all go off.

B Lamps *X* and *Y* become brighter and lamp *Z* will go off.

C Lamps *X* and *Y* become dimmer and lamp *Z* will go off.

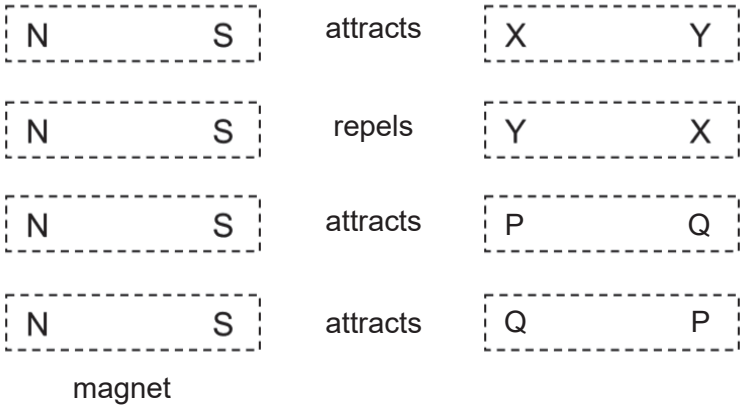
D Lamps *X* and *Y* have the same brightness as before and lamp *Z* will go off.

18 An electric kettle with the rating “240 V, 1.5 kW” is fitted with a 7.0 A fuse.

When the kettle is operating normally, which row shows the currents flowing in the respective wires?

	earth wire	live wire	neutral wire
A	0 A	6.25 A	0 A
B	0 A	6.25 A	6.25 A
C	0 A	7.0 A	7.0 A
D	6.25 A	6.25 A	6.25 A

19 The diagram shows the interaction between two specimens XY and PQ with a magnet.

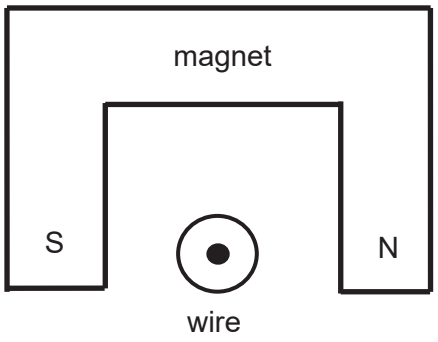


Which position(s) is/are the north pole of a magnet?

A X only
B Y only
C P and Q
D P, Q and X

20 The diagram shows a wire that is placed within the magnetic field of a U-shaped magnet.

An electric current passes through the wire and the direction of the current is out of the page.



What is the direction of the force acting on the wire?

A downwards
B towards the N pole
C towards the S pole
D upwards

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Class	Register Number	Name

BARTLEY SECONDARY SCHOOL

GCE O – LEVEL PRELIMINARY EXAMINATIONS

SCIENCE (PHYSICS, CHEMISTRY) 5076/02

Sec 4 Express / 5 Normal (Academic)

Paper 2 Physics

18 September 2019

1 hour 15 minutes

Candidates answer on the Question Paper.
Additional Materials: Answer Paper

READ THESE INSTRUCTIONS FIRST

Write your class, register number 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.

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	
Section A	
Section B	
Total	

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Section A

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

1 Fig. 1.1 below shows a hydraulic system that consists of two pistons and a flexible pipe. The cross-sectional area of the smaller piston is 500 cm^2 and cross-sectional area of the larger piston is 1440 cm^2.

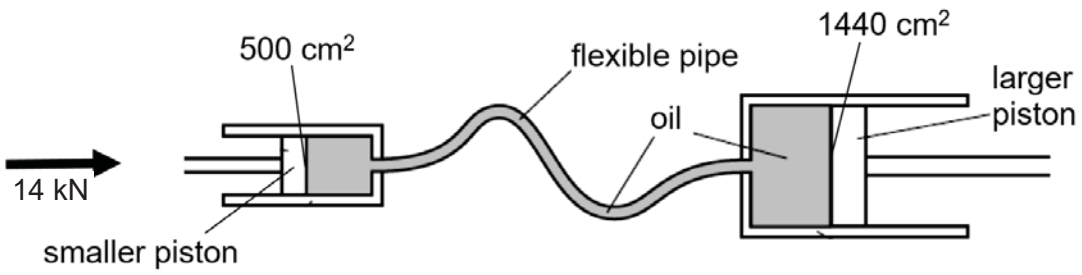

Fig. 1.1

A force of 14 kN is exerted by the smaller piston on the oil

(a) Calculate the pressure on the oil exerted by the small piston.

pressure = ……..……...N/cm^2 [2]

(b) The pressure on the oil by the smaller piston is the same as the pressure of the oil on the larger piston.

Show that the force on the larger piston is greater than the force by the smaller piston.

[2]

2 An archer shoots an arrow vertically upward into the air as shown in Fig. 2.1.

Fig. 2.1

The archer uses an average force of 85 N to pull the bowstring back by a distance of 42 cm. The arrow has a mass of 0.16 kg. Assume that the energy transferred to the arrow when the string is released is 100% of the energy stored in the stretched bow.

Take gravitational field strength, g = 10 N/kg and ignore any effects of friction.

(a) State the energy conversion when the arrow is released from the stretched bowstring.

……..... [1]

(b) Calculate

(i) the work done in pulling back the bowstring,

work done = ……..…… J [2]

(ii) the maximum height reached by the arrow.

maximum height = ……..... m [2]

(c) In practice, the maximum height reached will be lower than the actual value calculated in **(b)(ii)**. Explain why this is so.

……..

……..... [1]

3 Fig. 3.1 shows a metal plate-warmer. The plate-warmer contains two small candle heaters. Plates of food are placed on top of the warming-tray.

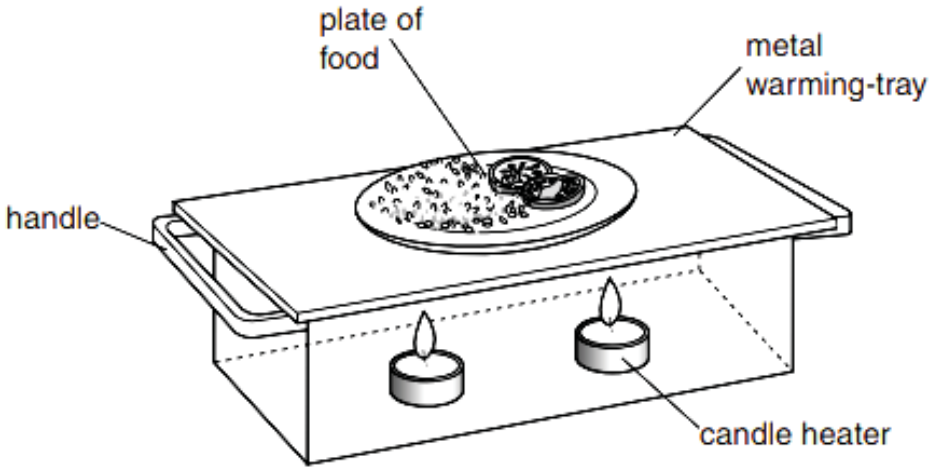

Fig. 3.1

(a) Describe how the metal warming-tray is heated by the candle heaters through convection.

……

……

……

……

……

…… [2]

(b) The handles of the plate-warmer are made of metal. Describe the potential hazard.

……

……

……

…… [2]

4 Fig. 4.1 shows the temperature of a solid substance when it absorbs heat from a 600 W heater over a period of 40 minutes.

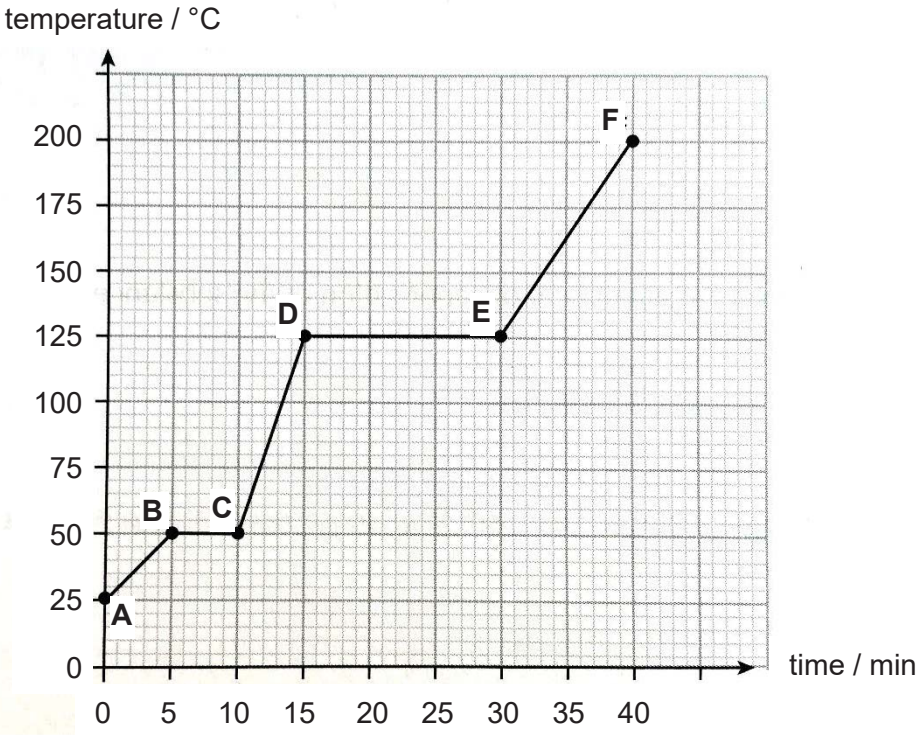

Fig. 4.1

(a) Calculate the amount of energy supplied by the heater for region **DE** to boil.

energy = ……..……..... J [2]

(b) Explain why the temperature remains constant throughout region **BC**.

……..

……..

……..

……..

……..

……..... [3]

(c) Describe how the kinetic energy and spacing of the molecules change in region **CD**.

……..

……..

……..

……... [2]

5 Fig. 5.1 shows a ray of light incident on a triangular glass prism **ABC**.
The critical angle of light in the glass prism is 43°.

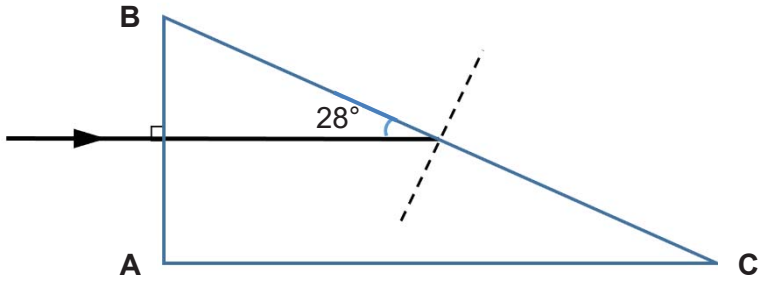

Fig. 5.1 (not drawn to scale)

(a) State whether the light ray will emerge from the face **BC**. Explain your answer.

……..

……..

……..

……..

……... [2]

(b) Calculate the refractive index of the glass.

refractive index = ……..….. [2]

6 Sound travels from a loudspeaker to a microphone 10 m away as shown in Fig. 6.1.

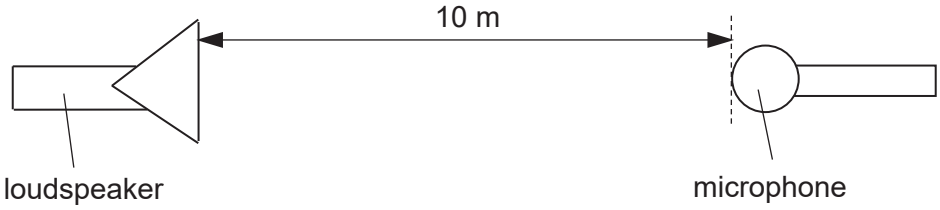

Fig. 6.1 (not to scale)

The microphone is connected to a cathode-ray oscilloscope (c.r.o.). The trace on the screen of the c.r.o. is shown in Fig. 6.2.

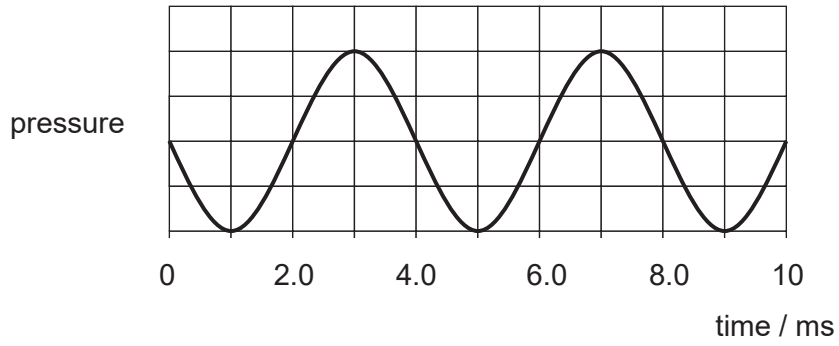

Fig. 6.2

(a) Explain how sound energy is transferred from the loudspeaker to the microphone.

……..

……..

……..

……..

……... [2]

(b) Using Fig. 6.2, calculate the frequency of the sound.

frequency = ……..... Hz [2]

(c) The speed of sound in air is 330 m/s.

Hence, calculate the wavelength of the sound.

wavelength = ……... m [2]

7 Thunderclouds contain charges. Water drops are carried up by air currents and become charged. Fig. 7.1 shows a positively-charged cloud, a negatively-charged ground and a negatively-charged water drop.

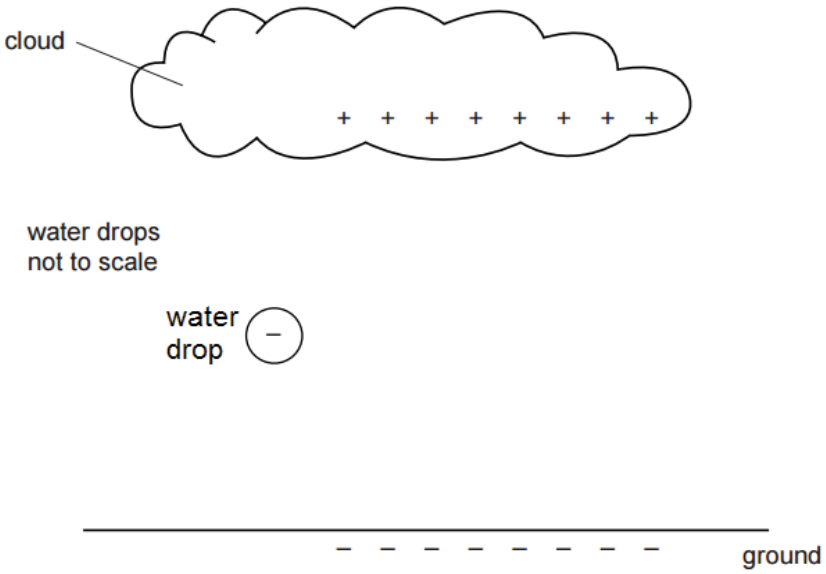

Fig. 7.1

(a) On Fig. 7.2, draw the electric field pattern due to the negatively-charged water drop. Show the direction of the field.

Fig. 7.2

[1]

(b) Describe and explain the movement of the water drop as it passes under the thundercloud.

……..

……..

……..

…….. [2]

8 Fig. 8.1 shows a part of the wiring circuit that connects a 240 V, 1 500 W metallic electric kettle to the household mains.

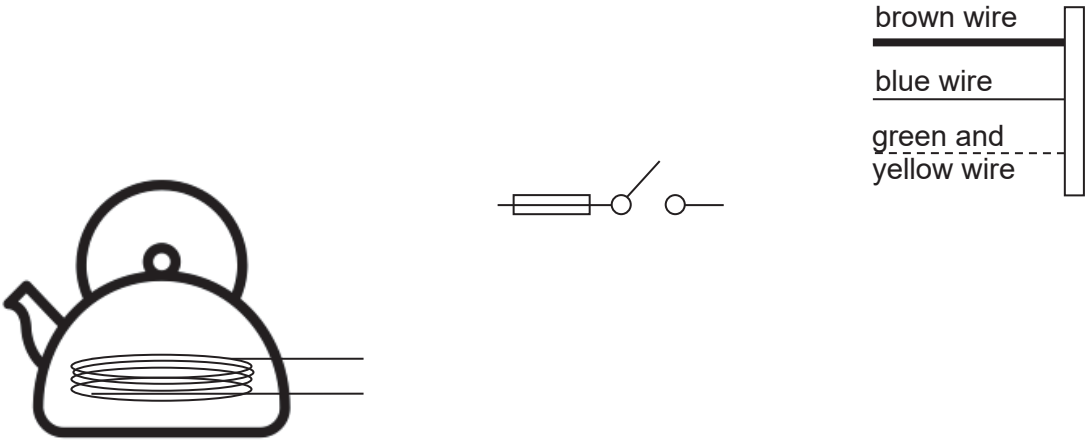

Fig. 8.1

(a) On Fig. 8.1, connect all the wires to complete the connections so that the kettle can operate normally. [3]

(b) The fuses that are available are rated 1 A, 2 A, 5 A and 8 A.

Determine which is the most suitable fuse for the kettle.

fuse rating = ……..……... A [2]

(c) The cost of 1 kWh of electricity is 20 cents. The kettle is used to boil water for 30 minutes daily. Calculate the cost of using the kettle for 30 days.

cost = $ ……..…….. [3]

9 Fig. 9.1 shows a nail, a magnet and two compasses.

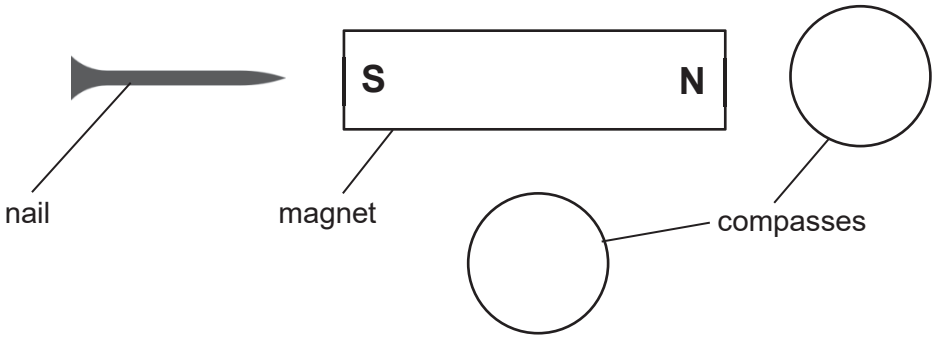

Fig. 9.1

(a) On Fig 9.1, draw an arrow in each compass to show the direction of the magnetic field of the magnet at the two positions. [2]

(b) The magnet causes the nail to become magnetised by induction.
When the magnet is removed, the nail are still magnetised.

Identify the material that the nail is made of.

…….... [1]

Section B

Answer any **two** questions in this section.

Write your answers in the spaces provided.

10 An object falls through the air from rest until it hits the ground.

Fig. 10.1 shows how the speed of the object changes with time.

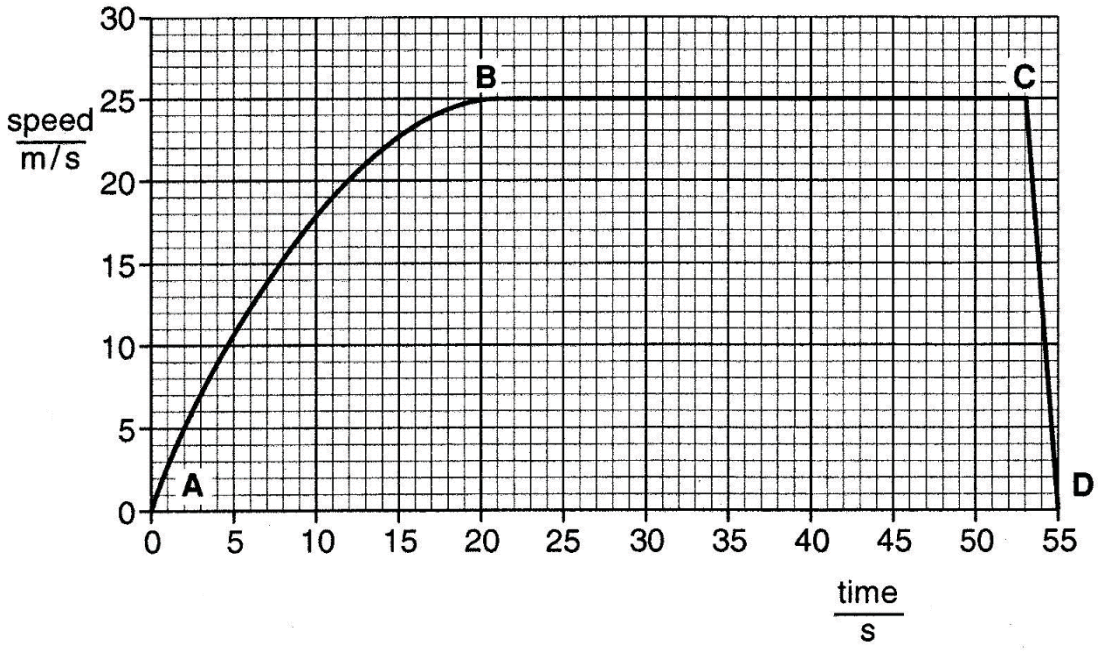

Fig. 10.1

(a) State the magnitude of the acceleration of the object between points **B** and **C**.

acceleration = ……..…….....….. [1]

(b) Describe the motion of the object between points **A** and **B**.

…….....……..……

……..…...[1]

(c) Explain, in terms of the weight of the object and air resistance, why the acceleration changes between points **A** and **B**.

……..

……..

……..

……..

……..

……..... [3]

(d) Calculate the distance moved by the object between points **B** and **D**.

distance moved = ……..……...….. [2]

(e) The mass of the object is 5.0 kg.

Calculate the resultant force on the object between points **C** and **D**.

resultant force = ……..……...….. [3]

11 A 50 kg woman is doing push-ups and is in the position shown in Fig. 11.1.

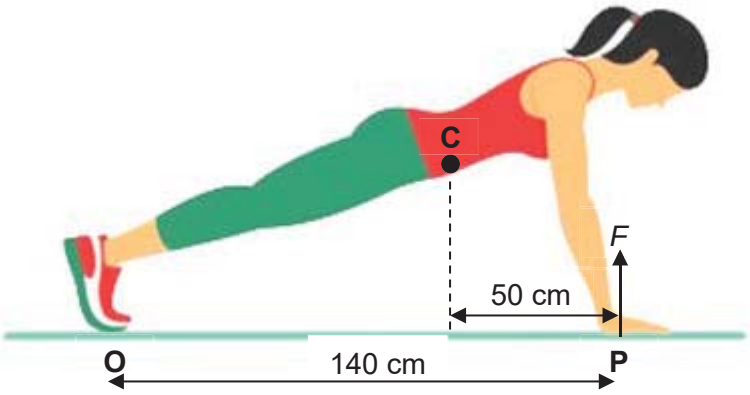

Fig. 11.1

C is the centre of gravity of the woman, **P** is the position of her hands on the ground, and **O** is the position of her feet. A combined vertical force *F*, acts on her hand by the ground.

Gravitational field strength g = 10 N/kg.

(a) Define *centre of gravity*.

…….……

……..…..[1]

(b) Calculate the weight of the woman.

weight = ……..….. [1]

(c) Calculate the clockwise moment about the point **O**.

clockwise moment = ……..….. [2]

(d) Calculate the combined vertical force *F* exerted on the woman's hands by the ground.

vertical force *F* = ……..……...….. [2]

(e) The woman decides to make the exercise more challenging by strapping weights above her shoulders, as shown in Fig. 11.2.

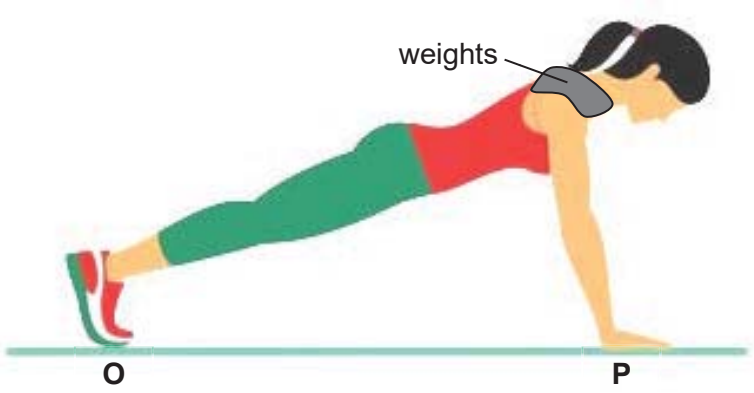

Fig. 11.2

(i) State how the clockwise moments about point **O** change, if at all, when the weights are strapped above the woman's shoulders. Explain your answer.

……

……

……

……

……...[2]

(ii) State how the combined vertical force *F* changes, if at all, when the weights are strapped above the woman's shoulders. Explain your answer.

……

……

……

……

……...[2]

12 Fig. 12.1 shows a circuit containing a switch, a 120 Ω resistor, a 90 Ω resistor, two ammeters, A_1 and A_2, and a lamp connected to a dry cell with an electromotive force of 24 V.

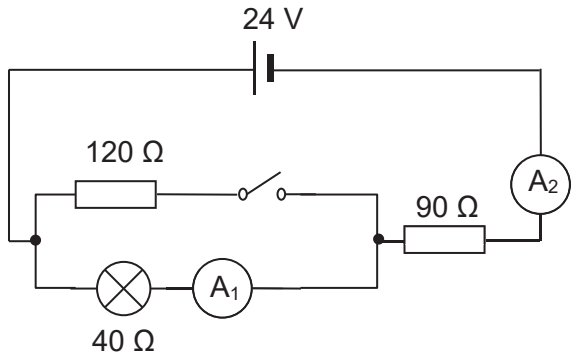

Fig. 12.1

(a) Define *electromotive force*.

…….....……..……

……..…...[1]

(b) Without any calculations, explain why the brightness of the lamp decreases when another resistor is connected in series with the 90 Ω resistor.

…..……

…..……

…..……

…..……..[2]

(c) The switch is now closed.

(i) Explain why the current through ammeter A_2 increases.

……

……

……

……...[2]

(ii) Calculate the effective resistance of the circuit.

effective resistance = ……..……...….. [2]

(iii) Calculate the reading on ammeter A_2.

reading on ammeter A_2 = ……..……...….. [1]

(iv) Calculate the reading on ammeter A_1.

reading on ammeter A_1 = ……..……...….. [2]

4E5N Sci(Physics) Preliminary Examinations (2019) suggested answers

Paper 1

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
B	**B**	**B**	**C**	**C**	**D**	**C**	**A**	**D**	**D**
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
C	**D**	**A**	**C**	**B**	**C**	**A**	**B**	**A**	**A**

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Paper 2

Section A

1 (a) $P = \frac{F}{A}$

$= \frac{14\,000\ N}{500\ cm^2}$ [C1]

$=$ **28 N/cm²** [A1]

(b) $P_{larger} = P_{smaller}$

$\frac{F_{larger}}{A_{larger}} = \frac{F_{smaller}}{A_{smaller}}$ [B1]

$\frac{F_{larger}}{F_{smaller}} = \frac{A_{larger}}{A_{smaller}}$

$= \frac{1440\ cm^2}{500\ cm^2} > 1$ [B1]

Therefore $F_{larger} > F_{smaller}$.

OR

$F_{larger} = 28\ N/cm^2 \times 1440\ cm^2$

$= 40\,230\ N$ [B1]

Since $F_{smaller} = 14\,000\ N$, $F_{larger} > F_{smaller}$ [B1]

2 (a) elastic potential energy to kinetic energy and gravitational potential energy [B1]

(b) (i) $W = F \times d$

$= 85\ N \times 0.42\ m$ [C1]

$=$ **35.7 J** [A1]

(ii) G.P.E gained = work done

$0.16\ kg \times 10\ N/kg \times h = 35.7\ J$ [allow e.c.f. from **(b)(i)**] [C1]

$h =$ **22.3 m** (3 s.f.) [A1]

(c) Some of the **energy is converted to thermal energy** due to work done against air resistance. [B1]

3 **(a)** The **air above the candles is heated** and **becomes less dense** so **it rises to** the **warming tray**. [B1]
The **cooler air below the warming tray is denser** and **sinks to takes its place**. [B1]
The whole process is repeated and forms a convection current to heat the warming tray.

(b) As the **handles are made of metal** and **metal is a good conductor of thermal energy/ heat**, [B1]
the **handles** may **become hot** and **injure the user**. [B1]

4 **(a)** t = 15 min = 15 × 60 = 900 s

E = Pt
= 600 W × 900 s [C1]
= **540 000 J** [A1]

(b) At BC, **thermal energy is absorbed to break the intermolecular bonds**. [B1]
The **kinetic energy of the molecules remains constant** [B1]
but the **potential energy of the molecules increases**. [B1]

(c) The **kinetic energy increases** and [B1]
the **spacing between the molecules remains constant / increases slightly**. [B1]

5 **(a)** The **light ray** will not emerge from BC as it **undergoes total internal reflection at face BC**. [B1]
The **angle of incidence** (62°) **is larger than the critical angle** (43°), and the light ray is going from a optically denser medium to a optically less dense medium. [B1]

(b) $n = \frac{1}{\sin 43}$ [B1]
= **1.47** (3 s.f.) [A1]

6 **(a)** The **air particles travel** through a **series of compressions and rarefactions parallel to the direction that the sound wave travels**. [B1]
The sound energy is transferred as the **air particles collide with each other**. [B1]

(b) T = 4 ms

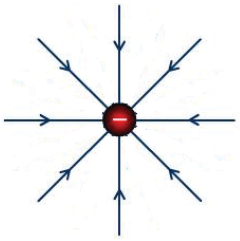
$f = \frac{1}{4 \times 10^{-3}}$ [C1]
= **250 Hz** [A1]

(c) $v = f\lambda$

$\lambda = \dfrac{330 \text{ m/s}}{250 \text{ Hz}}$ [allow e.c.f. from **(b)**] [C1]

$= \underline{\mathbf{1.32 \text{ m}}}$ [A1]

7 (a)



[A1]

(b) The **water drop will move upwards** as it is **attracted to the positively-charged cloud** [B1]
since **unlike charges attract** [B1]

8 (a) Join brown wire to fuse to heating coil [B1]
Join heating coil to blue wire [B1]
Join green wire to metallic casing [B1]

(b) $I = \dfrac{P}{V} = \dfrac{1\,500 \text{ W}}{240 \text{ V}}$ [C1]

$= 6.25 \text{ A}$

Fuse = $\underline{\mathbf{8 \text{ A}}}$ [A1]

(c) $E = Pt$

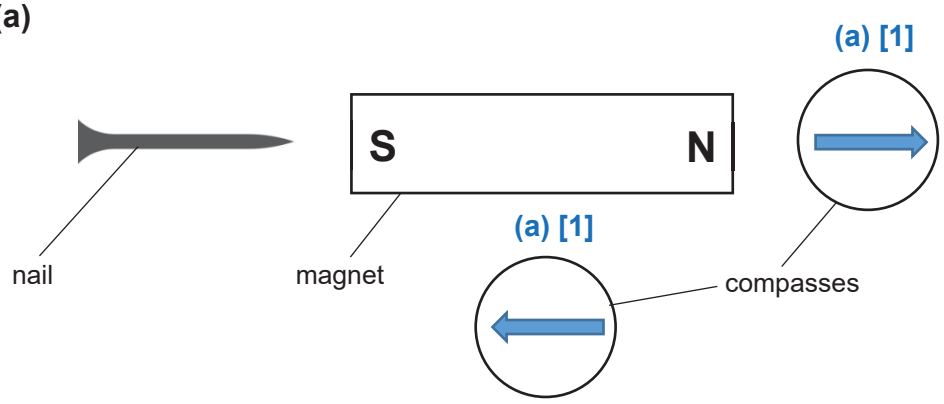
$= 1.5 \text{ kW} \times \dfrac{30}{60} \text{ hour}$

$= 0.75 \text{ kWh}$ [C1]

Cost per day = 0.75 kWh × \$0.20
= \$0.15 [C1]

Cost for 30 days = \$0.15 × 30 days
= $\underline{\mathbf{\$4.50}}$ [A1]

9 (a)



(b) Steel [B1]

Section B

10 (a) 0 m/s^2 [A1]

(b) The object falls at **decreasing acceleration**. / increasing speed at decreasing rate.
[A1]

(c) As the **object falls**, **air resistance increases**. [B1]
The **weight remains unchanged**, hence the **resultant force of the object decreases**
[B1]

From F = ma, the **acceleration of the object decreases**. [B1]

(d) distance = area under the graph
= ½ × (35 + 33) × 25 [C1]
= **850 m** [A1]

(e) $a = \frac{v - u}{t}$

$= \frac{0 - 25}{2}$ [C1]

$= -12.5\ m/s^2$ [C1]

F = ma
= 5.0 kg × (-12.5 m/s^2)
= **- 62.5 N** (accept 62.5 N) [A1]

11 (a) Centre of gravity is a point on an object where the entire weight appears to act on .
[B1]

(b) W = mg
= 50 kg × 10 N/kg
= **500 N** [A1]

(c) clockwise moment = 500 N × 0.90 m [allow e.c.f. from **(b)**] [C1]
= **450 Nm** [A1]

(d) F × 1.4 m = 450 Nm [allow e.c.f. from **(c)**] [C1]
F = **321 N** [A1]

(e) (i) The **total clockwise moments about O increases**. [B1]
The **additional weights provide an additional clockwise moment about O**. [B1]

(ii) Since **the total clockwise moments is increased, the total anti-clockwise moments increased too**. [B1]
Hence **F increases**. [B1]

12 (a) Electromotive force is the work done required to move a unit charge around the complete circuit. [B1]

(b) The **total resistance of the circuit increases** [B1]
and the **current through the circuit and lamp decreases**. [B1]
The brightness of the lamp will decrease.

(c) (i) When switch is closed, the **total resistance of the circuit decreases**, [B1]
hence **current in the circuit and through the lamp increases**. [B1]
The ammeter A_2 reading will increase.

(ii) $R = \left(\frac{1}{120} + \frac{1}{40}\right)^{-1} + 90$ [C1]
= **120 Ω** [A1]

(iii) $I = \frac{24\ V}{120\ \Omega}$ [allow e.c.f. from **(c)(ii)**]
= **0.20 A** [A1]

(iv) $V_{lamp} = 24\ V - (0.20\ A \times 90\ \Omega)$
$= 6.0\ V$ [C1]

$I = \frac{6.0\ V}{40\ \Omega}$
= **0.15 A** [A1]

or

$I = \frac{120\ \Omega}{160\ \Omega} \times 0.20\ A$ [C1]
= **0.15 A** [A1]