Pasir Ris Secondary School

Name	Class	Register Number

SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC
PRELIMINARY EXAMINATION 2018

SCIENCE (PHYSICS, ~~CHEMISTRY~~)   5076/01

PAPER 1   Multiple Choice   **12 September 2018**

Wednesday   0800 – 0900   **1 hour**

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid or tape.

Write your name, class and register number on the Answer Sheet in the spaces provided and at the top of this page.

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 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.

A copy of the Data Sheet is printed on page 18.

A copy of the Periodic Table is printed on page 19.

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

This document consists of **19** printed pages including the cover page.

[Turn over

1   The diagram shows a vernier scale.
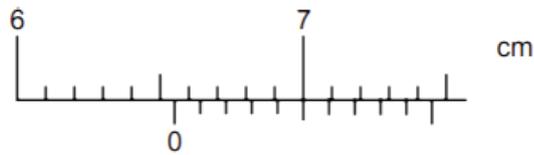
What is the reading on the vernier scale?

A   6.50 cm   **B**   6.55 cm   **C**   7.00 cm   **D**   7.05 cm

2   A moon rover of mass 15 kg on the Earth is taken to the Moon to collect data. The gravitational field strength on the Earth is 10 N/kg and on the Moon is 1.6 N/kg.

What are the mass and weight of the moon rover on the Moon?

	mass / kg	weight / N
A	15	24
B	15	150
C	24	15
D	24	150

3   Three objects are cut from the same sheet of metal. They are different in shapes but they all have the same mass.

hexagon   trapezoid   triangle
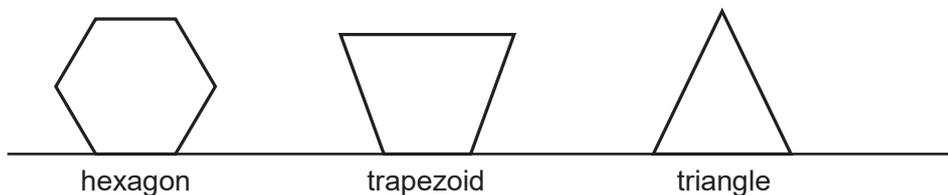
Which object has the greatest density?

A   the hexagon   **B**   the trapezoid
C   the triangle   **D**   all have the same density

4   A measuring cylinder has a mass of 120 g when empty. When 50 cm^3 of liquid is added, the total mass of the liquid and the measuring cylinder is 160 g. What is the density of the liquid?

A   0.80 g/cm^3 **B**   1.25 g/cm^3 **C**   2.40 g/cm^3 **D**   3.20 g/cm^3

5   A hydraulic system is used to lift a load of 80 N.
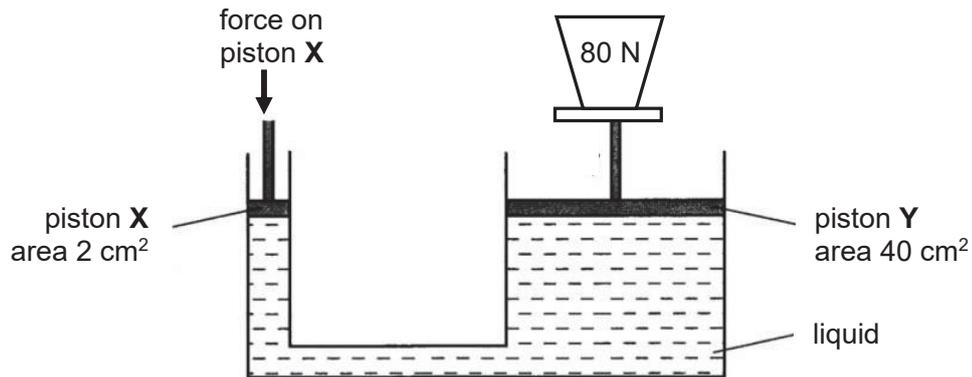
When piston **X** is pushed down, pressure is applied on the liquid. The same pressure is applied throughout the entire liquid. What is the minimum downward force that needs to be applied at piston **X** to lift the 80 N load on piston **Y**?

**A**   1 N   **B**   4 N   **C**   80 N   **D**   1600 N

6   Visible light and radio waves are different types of waves. How may these waves be correctly described?

	visible light	radio waves
A	longitudinal	longitudinal
B	longitudinal	transverse
C	transverse	longitudinal
D	transverse	transverse

7   Which electromagnetic wave travels at the highest speed through a vacuum?

A   gamma rays
B   microwaves
C   ultraviolet rays
D   All electromagnetic waves travel at the same speed through a vacuum.

8　Four objects, **P**, **Q**, **R** and **S** are arranged in a line and in contact with each other as shown. The arrows show the directions in which thermal energy travels between the objects.
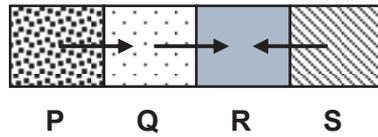
Which statement about the temperatures of the objects is correct?

A　**P** is colder than **Q** and **R**.
B　**Q** is hotter than **R** but colder than **P**.
C　**R** is the hottest object.
D　**S** and **R** have the same temperature.

9　A solid is heated from room temperature. The graph shows how its temperature changes with time as it is heated constantly.
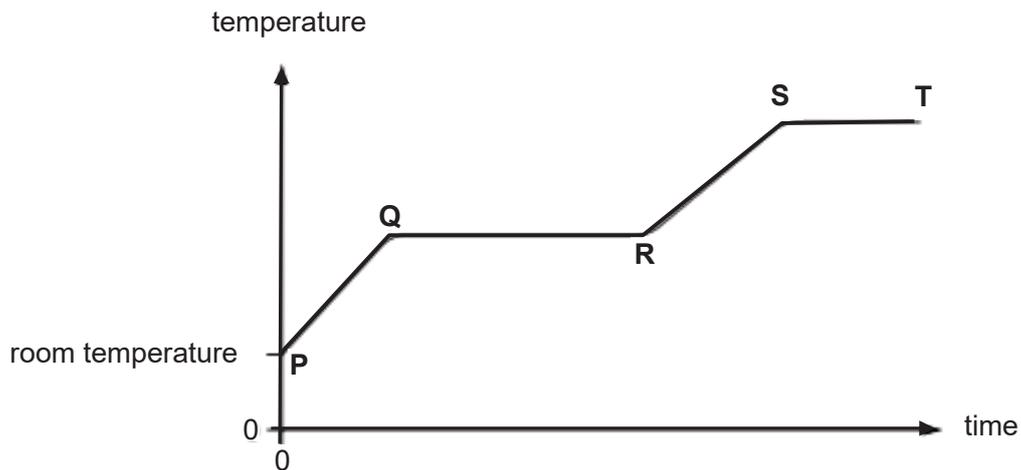
Which section of the graph will the substance be in the liquid state?

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

10 Megan draws three rays of light from point **P** through a converging lens. Each point labelled **F** is the principal focus of the lens.
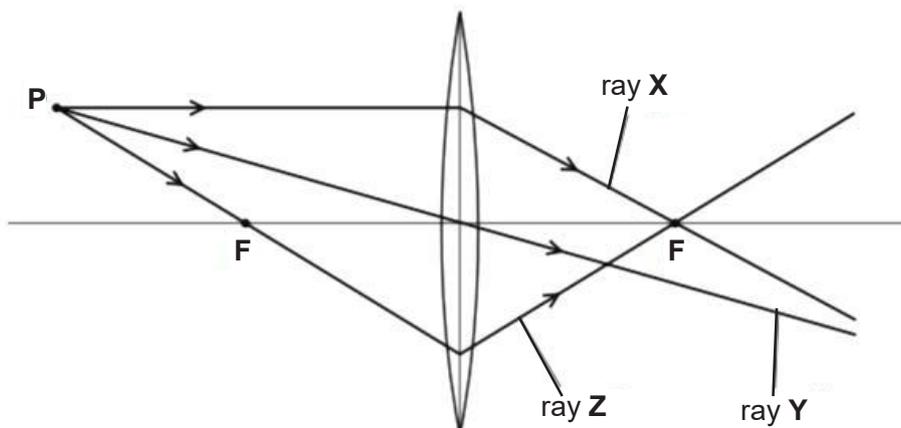
Which of the rays are drawn correctly?

A ray **Y** only   **B** ray **Z** only   **C** rays **X** and **Y**   **D** rays **X** and **Z**

11 The diagram shows a buoy floating in water with a weight attached so that the buoy floats upright.
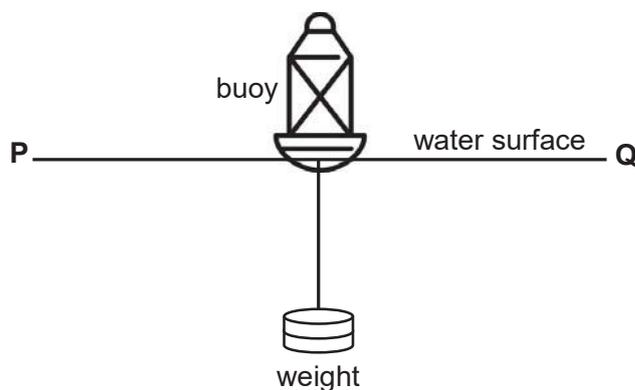
Transverse waves travel across the water from **P** to **Q**. Which diagram shows the movement of the buoy as the wave passes?
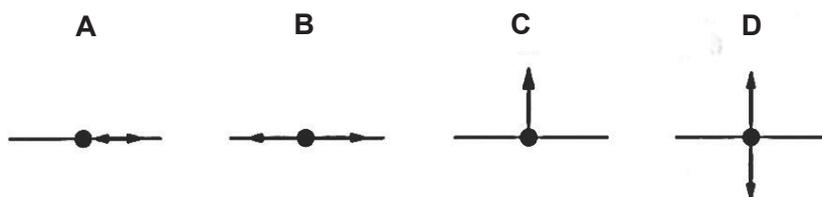
12 The diagrams represent the waves produced by four sources of sound. The scales are the same for all the diagrams. Which sound has the highest frequency?

A   time

B   time

C   time

D   time
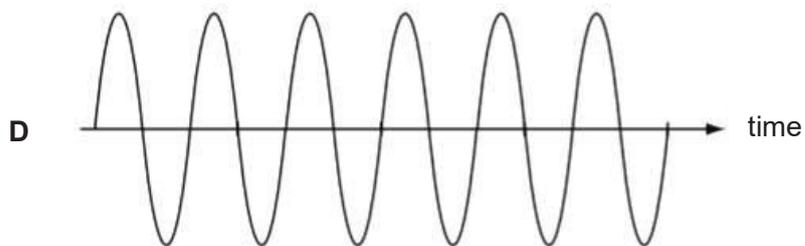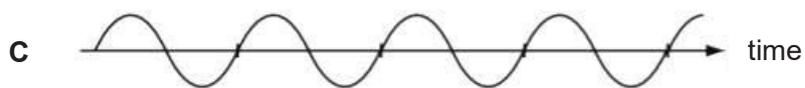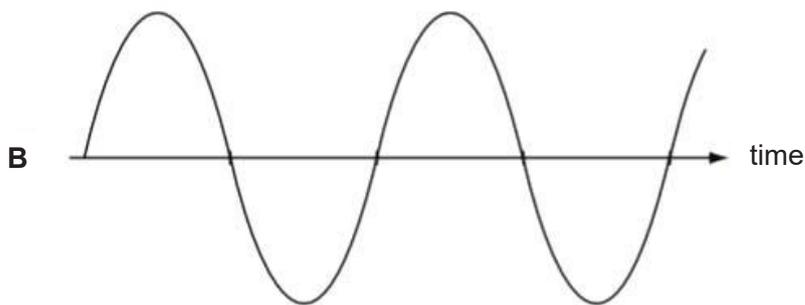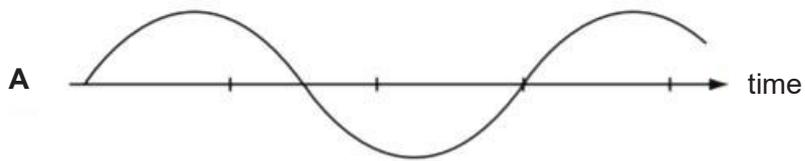
13 Two astronauts are assigned to conduct repair works on a damaged satellite in space. Astronaut 1 uses a hammer to knock out a dent on the satellite. Astronaut 2 is nearby.

astronaut 1   hammer   astronaut 2
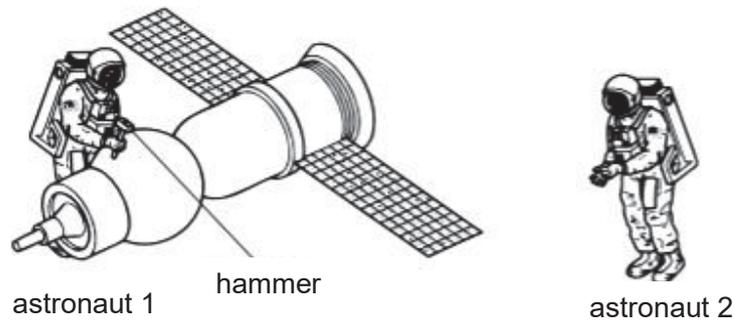
Compared with the sound heard if they are working on the Earth, what does astronaut 2 hear?

A   a quieter sound
B   a louder sound
C   a sound of the same loudness
D   no sound at all

14 Two very light, charged balls **P** and **Q** are hung, one above the other, from nylon threads. When a negatively charged plastic sheet is placed alongside them, **P** is repelled and **Q** is attracted.
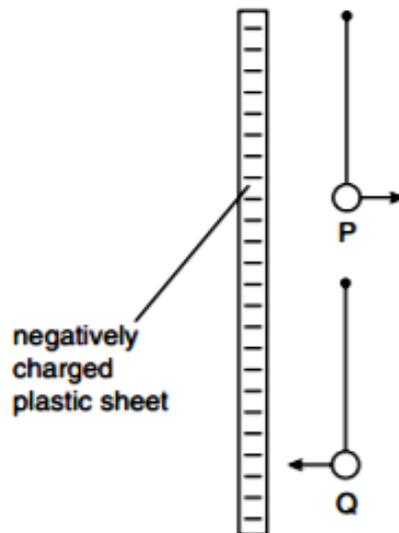
What are the original charges on **P** and **Q**?

	charge on **P**	charge on **Q**
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

15   The diagram shows the electric field pattern between two isolated point charges.
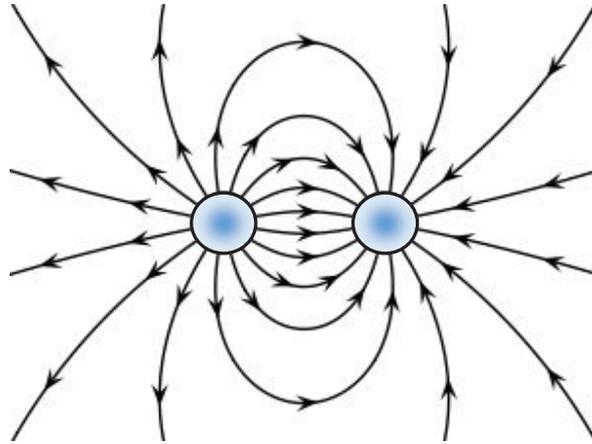
Which two point charges produce this pattern?

A		B	
(+)	(+)	(+)	(-)

C		D	
(-)	(-)	(-)	(+)
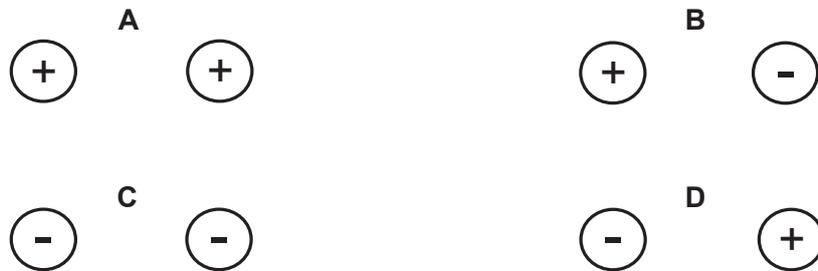
16   The reading of the ammeter in the circuit is 1.0 A. When a second ammeter is connected to the circuit, it also reads 1.0 A.
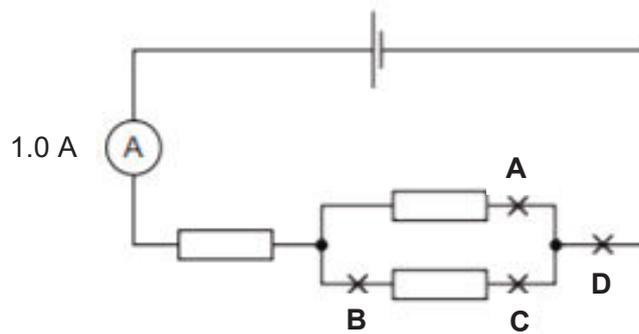
At which point, **A**, **B**, **C** or **D** is the second ammeter connected?

17 Four students, **A**, **B**, **C** and **D**, are asked to draw a circuit showing three lamps connected in parallel. The circuit also requires a switch that controls all three lamps.
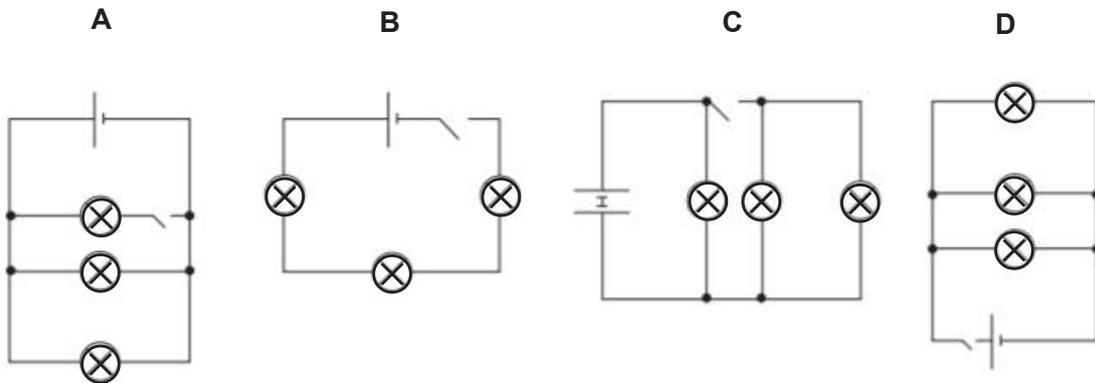
Which student has drawn the circuit correctly?

18 One end of a rod picks up the N-pole of a bar magnet when in position 1. The same end of the rod is then brought to position 2. The rod picks up the S-pole of the bar magnet when in position 2.
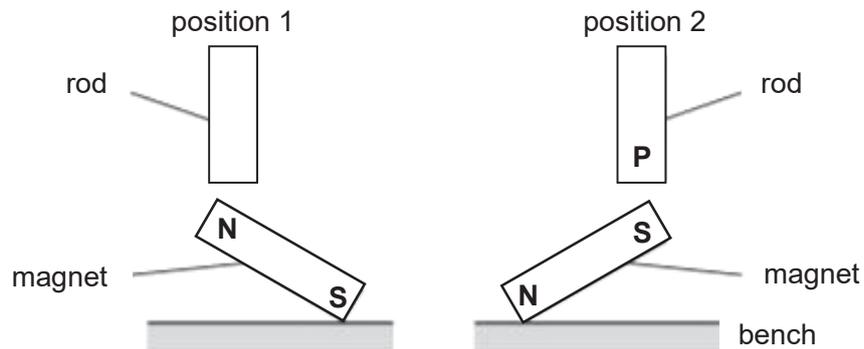
Which material is the rod made from and what is the pole at end **P** of the rod when in position 2?

	material	pole at **P**
A	iron	N - pole
B	iron	S - pole
C	steel	N - pole
D	steel	S - pole

19 A current-carrying wire passes between the poles of a horse-shoe magnet causing a force to act on the wire.
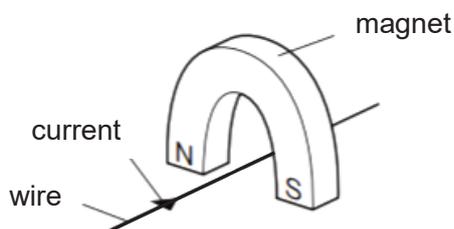
Three other arrangements, **P**, **Q** and **R**, of the wire and magnet are set up as shown.

P	**Q**	**R**
magnet turned around	current direction reversed	current direction reversed and magnet turned around
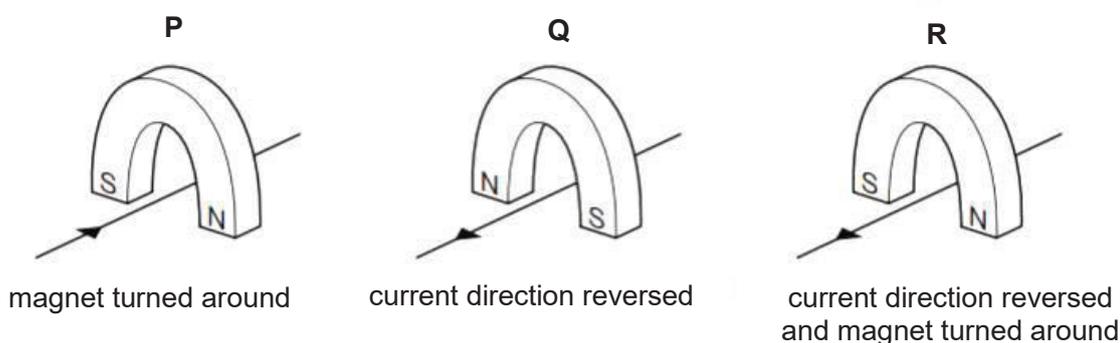
Which arrangement(s) will produce a force in the same direction as the original arrangement?

A   **P** only   B   **R** only

C   **P** and **Q** only   D   **P**, **Q** and **R**

20 The diagram shows a beam of electrons entering a magnetic field.
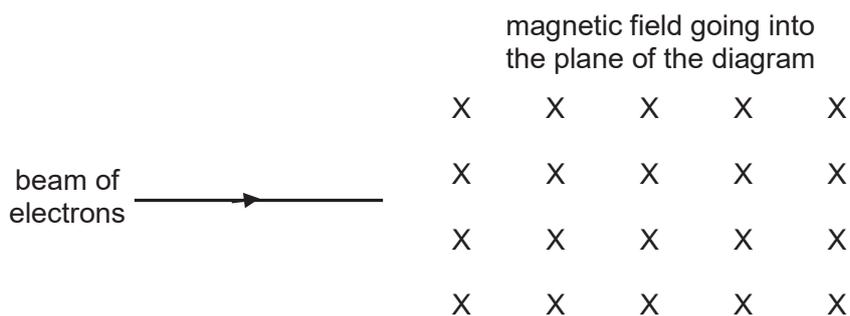
What is the effect of the magnetic field on the beam of electrons?

A   They are deflected into the plane of the diagram.
B   They are deflected out of the plane of the diagram.
C   They are deflected towards the bottom of the diagram.
D   They are deflected towards the top of the diagram.

Pasir Ris Secondary School

Name	Class	Register Number

SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC
PRELIMINARY EXAMINATION 2018

SCIENCE (PHYSICS, CHEMISTRY)	**5076/02**

Paper 2 Physics	11 September 2018
Tuesday 0800 – 0915	**1 hour 15 minutes**

Additional Materials: Nil

READ THESE INSTRUCTIONS FIRST

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

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 [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.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total mark for this paper is 65.

For Examiner's Use	
Section A	
Section B	
Qn :	
Qn :	
Total	/ **65**

This document consists of **15** printed pages, including the cover page.

[Turn over

Section A (45 marks)
Answer **all** questions. Write your answers in the spaces provided.

1   Para-sailing is a leisure sport where a person is attached to a parachute and towed over the sea by a tow-rope. The tow-rope is attached to a motor-boat as shown in Fig. 1.1.
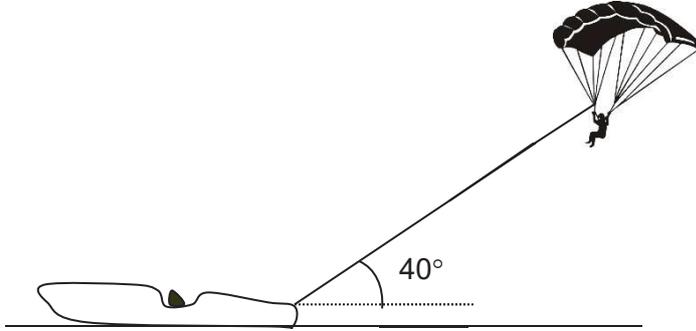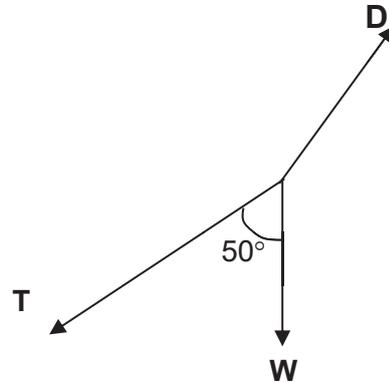
Fig. 1.1   **Fig. 1.2**

Fig. 1.2 shows the directions of the forces acting on a person who has a weight, **W**, of 800 N. The tension **T** in the tow-rope is 1600 N and **D** is the drag force. The person is being towed horizontally at a constant speed of 8.5 ms^{-1}.

(a)   Using a vector diagram and a scale of 1.0 cm to represent 200 N, determine the magnitude and direction of the resultant force of **T** and **W**.   [4]

magnitude :…………………………………..

direction :…………………………………..

(b)   State the magnitude of the drag force **D**.   [1]

magnitude of the drag force **D** : …………………………………

2

2   Fig. 2.1 shows two **horizontal** forces acting on a cyclist and his bicycle as he moves forward.

Fig. 2.1

The cyclist produces a driving force that acts on the back wheel. (You may ignore any frictional force acting on the front wheel.)

(a)   The cyclist accelerates until a constant speed is reached. State how the size of the air resistance changes, if any, when the cyclist is accelerating.   [1]

....

(b)   Compare the sizes of the two horizontal forces acting on the cyclist and his bicycle when he is moving at a constant speed.   [1]

....

(c)   The total mass of the cyclist and his bicycle is 75 kg. When the speed of the bicycle is 4.0 ms^{-1}, the driving force is 30 N and air resistance is 20 N. Calculate the total kinetic energy of the cyclist and his bicycle at this speed.   [2]

(d)   On Fig. 2.1, draw and label three **vertical** forces acting on the bicycle.   [2]

3 Fig. 3.1 shows a tractor. The bucket in front of the tractor is used to push the fence post into the ground. The bucket pushes the fence post down with a force of 6500 N. The area of the post in contact with the ground is 100 cm^2.
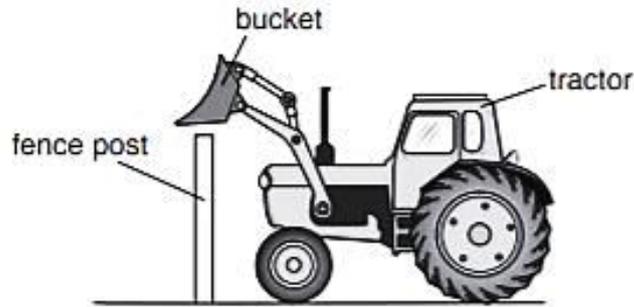
Fig. 3.1

(a) Calculate the pressure that the fence post exerts on the ground. [2]

(b) A farmer cuts the bottom of the post to make it more pointed. He then uses the same force to push the post into the ground.

Explain why he makes the post more pointed. [2]

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

4

4   Fig. 4.1 shows a marathon runner sweating profusely during a race.

Fig. 4.1

At the end of the race, evaporation and convection help to cool the runner.

(a) **(i)**   Describe how evaporation helps the runner to cool down. Use ideas about molecules in your answer.   [1]

…………………………………………………………………………………………….

…………………………………………………………………………………………….

…………………………………………………………………………………………….

(ii)   Explain how convection currents are set up around the runner at the end of the race.   [2]

…………………………………………………………………………………………….

…………………………………………………………………………………………….

…………………………………………………………………………………………….

(b)   Fig. 4.2 shows the runner wearing a shiny foil blanket to stop him from cooling down too quickly.

Fig. 4.2

Explain how the shiny foil blanket is able to stop him from cooling down too quickly.   [2]

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

5

5 Fig. 5.1 shows a ray of light from the tip of the flame of a burning candle incident on a mirror.
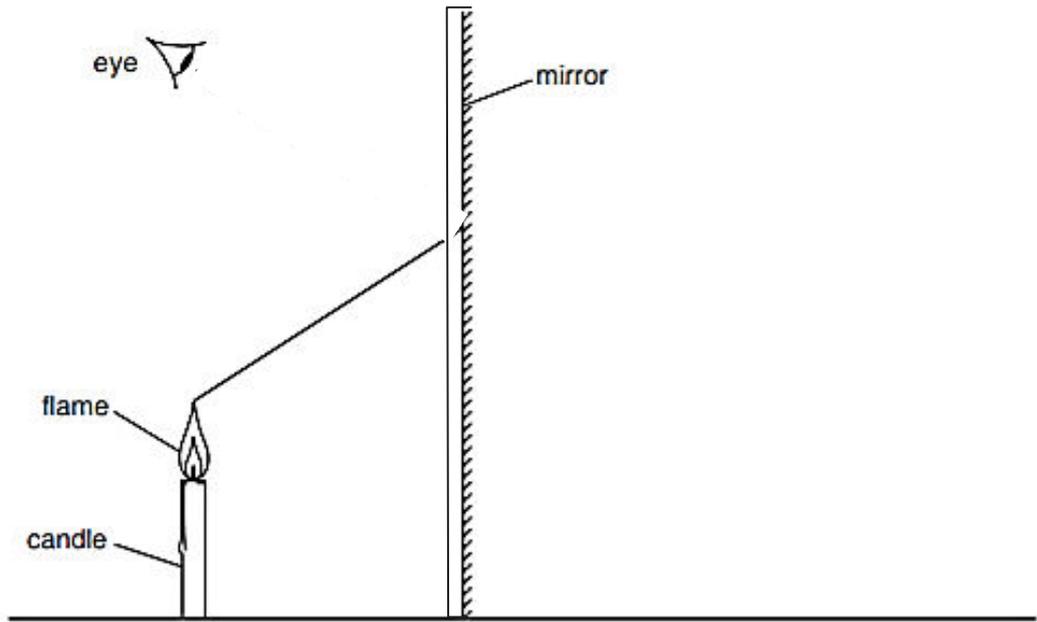
Fig. 5.1

(a) On Fig. 5.1, mark out the position of the image of the tip of the flame. Label the image I. [1]

(b) Complete the ray diagram to show how the eye sees the image of the tip of the flame. [2]

(c) The image of the candle produced by the mirror is a *virtual image*. Explain what is meant by *virtual image*. [1]

....

6 Fig. 6.1 shows a ray of light **PQR** passing along a simple optical fibre to its end at **R**.
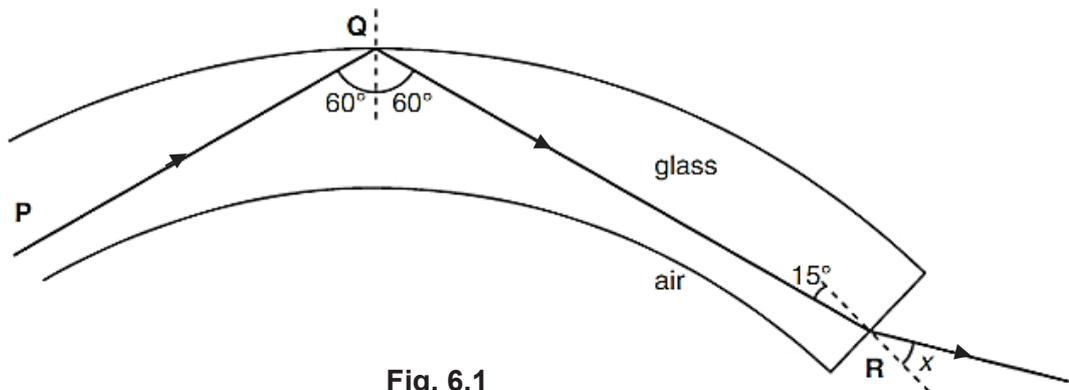
Fig. 6.1

(a) **(i)** Explain why the ray **PQ** does not leave the optical fibre at **Q**. [3]

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

(ii) Explain what causes the ray **QR** to change direction at **R**. [2]

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

(b) The refractive index of glass is 1.5. Calculate the angle, *x*, as shown in Fig. 6.1. [2]

7 Fig. 7.1 and Fig. 7.2 show a thumbprint and its virtual image as seen through a converging lens respectively.

Fig. 7.1   **Fig. 7.2**

7

On Fig. 7.3, sketch a ray diagram to show how the image in Fig. 7.2 is formed by the lens. You may use an arrow to represent the thumbprint. [3]

lens

2F   F   F   2F
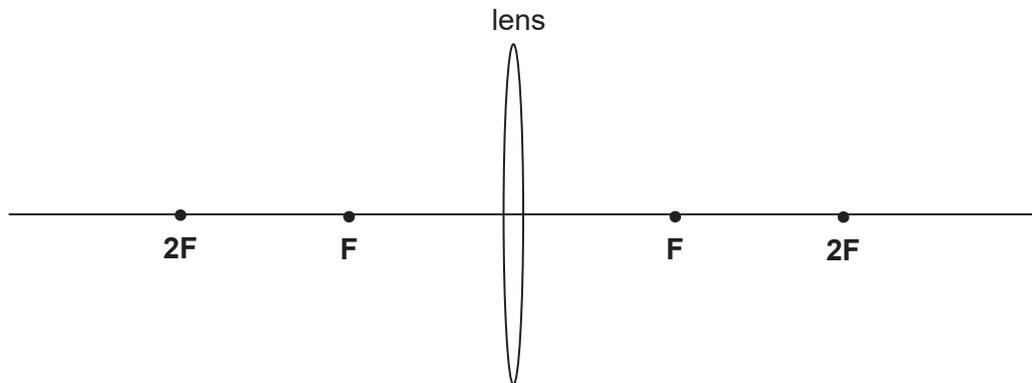
Fig. 7.3

8   Fig. 8.1 shows an electric kettle connected to a 240 V mains supply by a flexible cable. The kettle has a power rating of 2500 W.

flexible cable
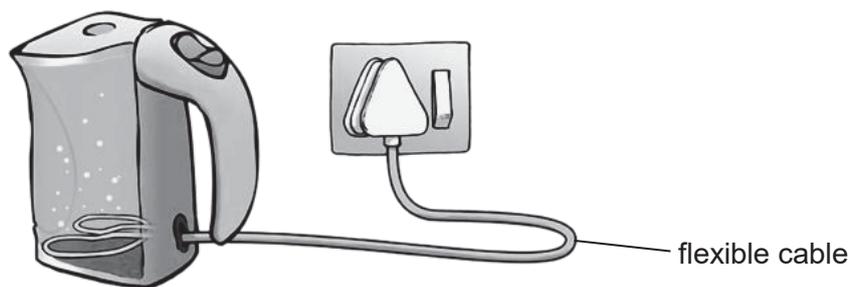
Fig. 8.1

Fig. 8.2 shows the maximum current that may be carried safely by wires of various diameters.

wire diameter / mm	maximum current / A
0.50	3
0.75	6
1.00	10
1.25	13
1.50	15

Fig. 8.2

(a)   Show that the current in the cable when the kettle is in use is 10.4 A. State clearly any equation that you use. [1]

8

(b) **(i)** From Fig. 8.2, select the smallest diameter of wire that can be safely used for this kettle. [1]

....

(ii) Explain why it is dangerous to use a wire thinner than that in **(b)(i)**. [2]

....

....

(c) Describe one fault that may occur in the flexible cable that will cause the fuse in the plug to melt. [2]

....

....

**9** Fig. 9.1 shows an electromagnetic relay being used to operate an electric motor.
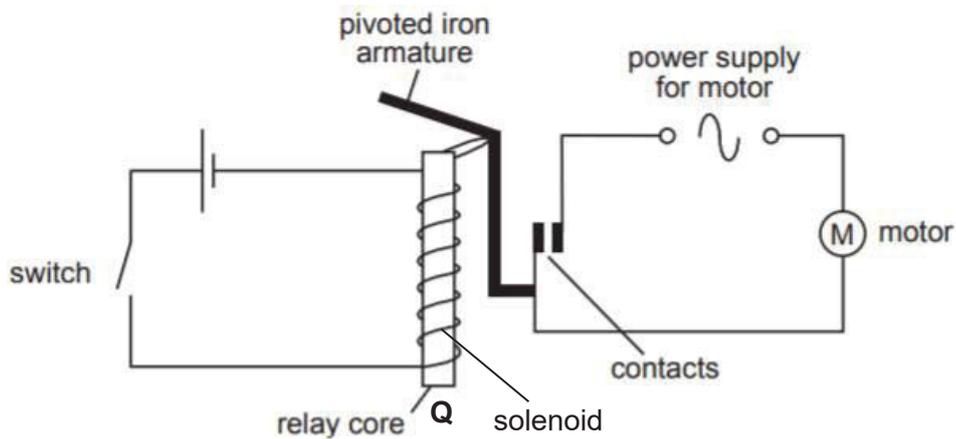
Fig. 9.1

(a) Below are sentences that describe stages of the process by which the circuit works.

A The armature pivots and the contacts close.
B The relay core is magnetised.
C The switch is closed and the current flows through the solenoid.
D A current flows through the motor, making it work.
E The core attracts the top part of the armature.

Put the sentences so that the stages are in the correct order by filling in the appropriate letters in the boxes below. One box has been filled in as an example.

C ⟶ ☐ ⟶ ☐ ⟶ ☐ ⟶ ☐

[2]

9

(b) What is the polarity of the relay core at point **Q** when it is magnetised? [1]

polarity at point **Q** : …………………………

(c) The solenoid in Fig. 9.1 creates a magnetic field as shown in Fig. 9.2.
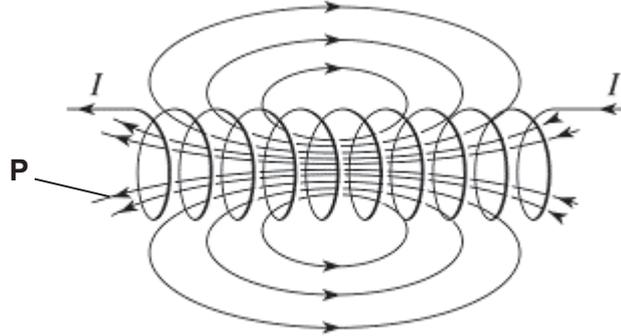
Fig. 9.2

What is the effect on the strength and direction of the magnetic field at point **P** if a larger current is passed through the solenoid in the opposite direction? [2]

……………………………………………………………………………………………………

……………………………………………………………………………………………………

10

Section B (20 marks)

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

10 Fig. 10.1 shows the variation with time of the speed of a car as it travels along a level road. The car brakes when time t = 20 s, and comes to rest when t = 24 s.

speed / ms⁻¹

time, t / s
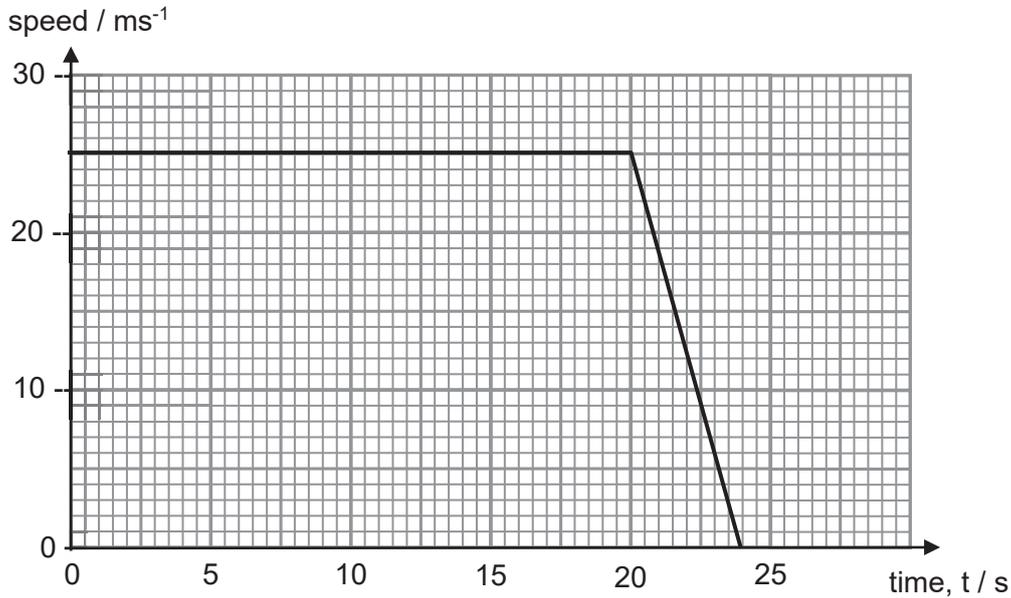
Fig. 10.1

The car has a mass of 800 kg and the forward driving force on the wheels is 1200 N.

(a) For the first 20 s of the motion shown in Fig. 10.1, calculate

(i) the distance travelled, [1]

(ii) the work done by the driving force, [2]

(iii) the power supplied by the driving force. [2]

11

(b) During braking, the speed of the car decreases uniformly. The engine no longer provides a driving force.

(i) Calculate the deceleration of the car between t = 20 s and t = 24 s. [1]

(ii) Calculate the total braking force acting on the car during this period. [2]

(iii) Explain why the power dissipated in the brakes to slow down the car is greater at the beginning of the braking period than at the end. [2]

………………………………………………………………………………..…………

………………………………………………………………………………..…………

………………………………………………………………………………………..

11 (a) Fig. 11.1 shows an object of weight 2.5 N tilted about point **P** by a force **F**. The point **G** is the centre of gravity of the object.
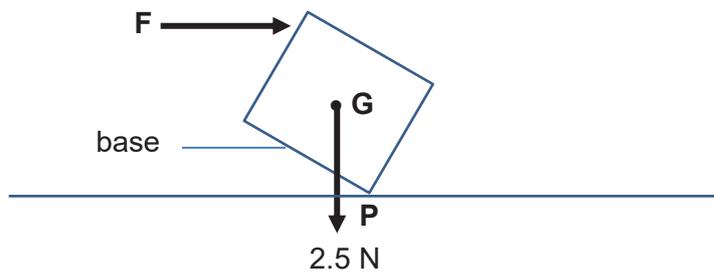
Fig. 11.1

(i) Explain what is meant by *centre of gravity*. [1]

…………………………………………………………………………………..

…………………………………………………………………………………..

12

(ii) Describe and explain what will happen to the object when force **F** is removed.   [2]

....

....

....

(b) The object is then placed on a uniform beam as shown in Fig. 11.2. The beam is pivoted at its centre and balanced by a 1.5 N load suspended from a string.

object
(2.5 N)   18 cm   *x*

string

load of
1.5 N
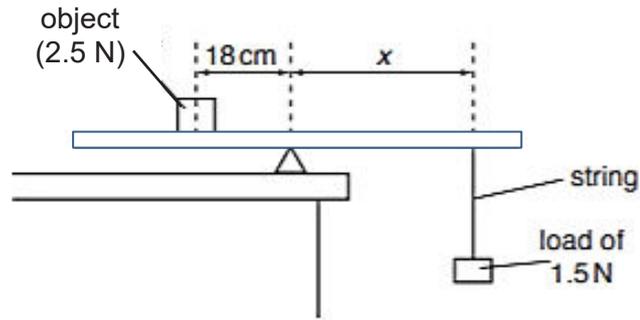
Fig. 11.2

(i) State the *principle of moments*.   [2]

....

....

....

(ii) On Fig. 11.2, indicate and label the centre of gravity, **Q**, of the beam.   [1]

(iii) Explain if the weight of the beam produce any moment about the pivot.   [1]

....

....

(iv) Calculate the distance *x*.   [2]

(iv) The pivot is shifted to the edge of the table. Without changing the weight of the object and the load, suggest one possible way to balance the beam again.   [1]

....

....

12 Fig. 12.1 shows a variable resistor **R** connected to a light bulb **Q** and a 10 V battery of negligible resistance. Resistor **R** is adjusted until the voltmeter reading is 2.5 V and the ammeter reading is 0.5 A.
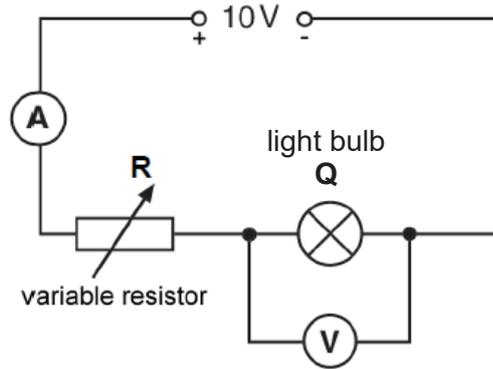
Fig. 12.1

(a) Calculate

(i) the resistance of light bulb **Q**,   [2]

(ii) the resistance of variable resistor **R**.   [2]

(b) The resistance of the variable resistor **R** is now increased to 30 Ω. Assuming that the resistance of light bulb **Q** remains unchanged, state and explain what happens to the brightness of light bulb **Q**.   [2]

....

....

....

14

(c) Light bulb **Q** is then used in a different circuit. It is connected to 2 other light bulbs **A** and **B** as shown in Fig. 12.2.
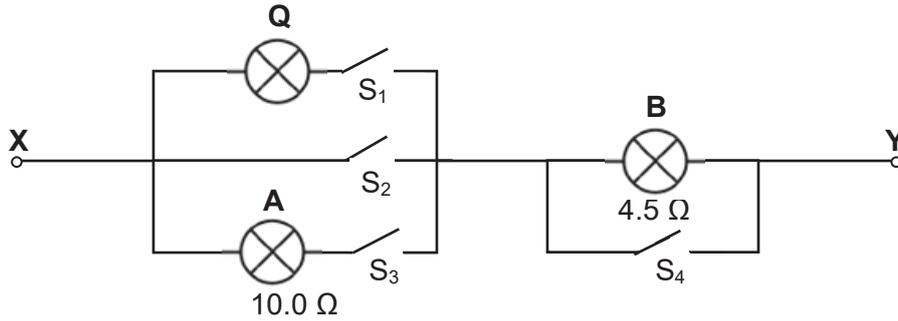
Fig. 12.2

(i) Calculate the effective resistance between **X** and **Y** when S_1 and S_3 are closed. [2]

(ii) Suggest which light bulb(s) will light up when switches S_1, S_3, and S_4 are closed. Explain your answer. [2]

....

....

....

END OF PAPER

Paper 1 (Multiple Choice Questions)

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

SECTION A [45 marks]

1 **(a)** component vectors correctly drawn according to scale with correct direction and angle   [1]

resultant drawn correctly with correct direction   ecf [1]

resultant force = 2200 N (Accept 2160 N ≤ F ≤ 2240N)   [1]

direction = 17° from T (1600 N) or 35° from W (800 N) ± 2°   [1]
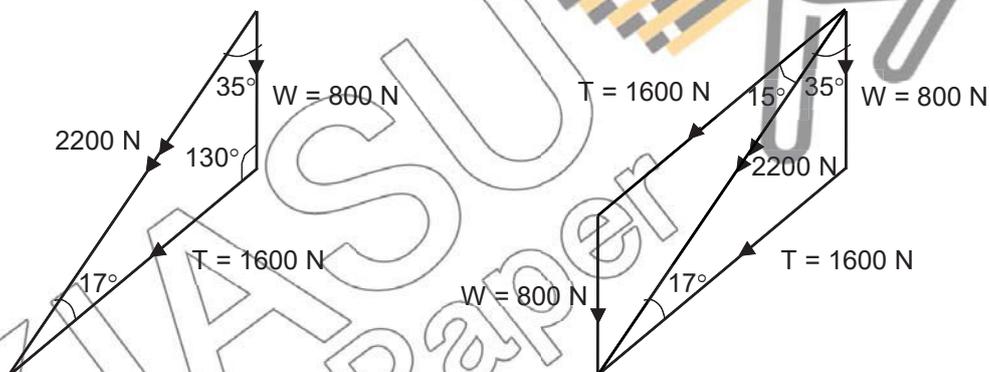
(b) Drag force = resultant force   ecf [1]

2 **(a)** Air resistance increases.   [1]

(b) Air resistance is equal to the driving force.   [1]

(c) Kinetic energy = ½ mv^2

= ½ x 75 x 16   [1]

= 600 J   [1]

1

(d)

[2] - for any 3 vertical forces correctly drawn and labelled

[1] - for 2 forces vertical forces correctly drawn and labelled.
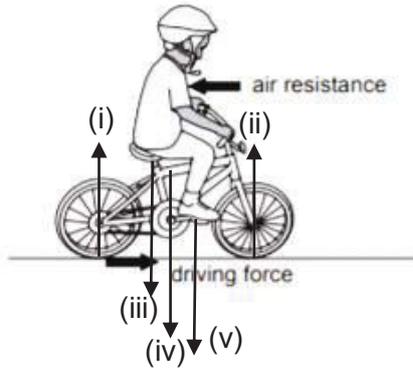
(i)   normal contact force from road on bicycle
(ii)   normal contact force from road on bicycle
(iii)   normal contact force from cyclist on bicycle seat
(iv)   weight of bicycle
(v)   normal contact force from cyclist on bicycle pedal

3   **(a)**   Pressure = F/A

$= 6500 / 100$ [1]

$= \underline{65 \text{ N } /cm^2}$ or   650 kPa   [1]

(b)   This is to <u>reduce the area of contact</u> of the post with the ground.   [1/2]
<u>Pressure is now greater</u>   [1]
to enable the post to be <u>pushed more easily</u> into the ground.   [1/2]

4   **(a)**   **(i)**   The water molecules in the perspiration <u>absorb thermal energy from the body</u> to evaporate.   [1]

     (ii)   The air molecules surrounding the runner get heated up by <u>conduction</u>.   [1/2]
The <u>heated air expands, become less dense and then rises</u>.   [1/2]
The <u>cooler air, being more dense, sinks (to replace the heated air)</u>.   [1/2]
The <u>cooler air is then heated and the process repeats.</u>   [1/2]
Convection currents are set up.

(b)   Shiny surface is <u>a good reflector /poor emitter</u> of infrared <u>radiation</u>.   [1]
<u>Heat loss</u> from the body to the surroundings is <u>minimized</u>.   [1]

5   **(a)**

correct direction of arrow on both rays   [1]

dotted line behind mirror from point of incidence   [1]

I [1]
- I correctly marked out with object distance = image distance
- line joining I and tip of candle is perpendicular to mirror

2
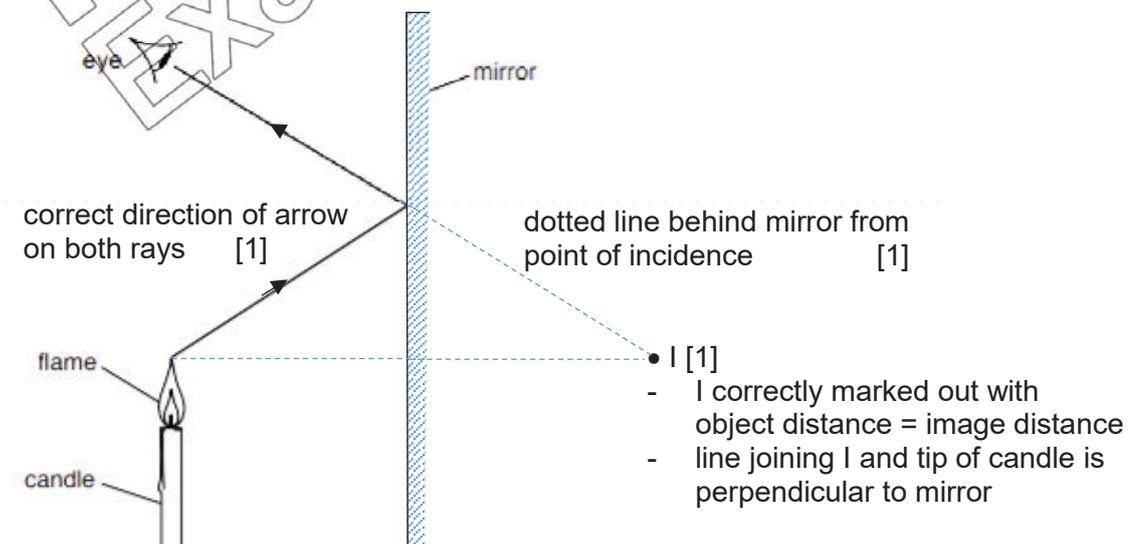
(b) A virtual image is an image that <u>cannot be captured on a screen</u>. [1]

6 (a) (i) Ray **PQ** is travelling from a <u>more optically dense medium to an optically less dense medium</u>. [1]
It is <u>incident at point Q at an angle greater than the critical angle.</u> [1]
<u>Total internal reflection</u> takes place reflecting the ray back into the optical fibre. [1]

(ii) The ray **QR** is <u>incident at an angle that is smaller than the critical angle</u>. [1/2]
The ray exits the optical fibre, which is an optically denser medium [1/2]
and changes direction as the <u>speed of light in air is greater</u>. [1]

(b) n $= \sin x / \sin 15$
1.5 $= \sin x / \sin 15$ [1]
$\boldsymbol{x} = \sin^{-1} (1.5 \times \sin 15)$
$= \underline{22.8°}$ [1]

7

[1/2] – virtual rays to locate image

lens

magnified, upright & virtual object [1/2]

[1/2] – ray parallel to principal axis and pass through F after the lens*

2F F F 2F

position of object between optical centre and **F** - [1]

[1/2] – ray passing through optical centre without changing direction*

Fig. 7.3
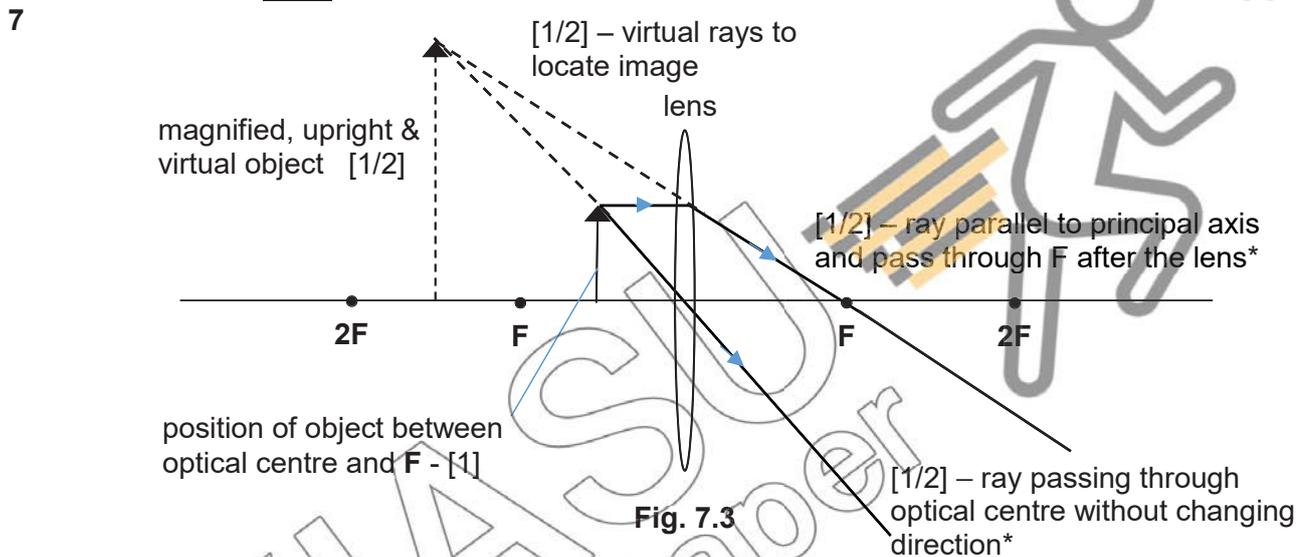
*Maximum of [1] only if object is placed beyond F provided the rays are drawn correctly.

8 (a) P = VI
I = 2500 / 240   No mark if P = VI is not stated. [1]
= <u>10.4 A</u>

(b) (i) 1.25 mm [1]

(ii) Thinner wire has a <u>higher resistance</u>. [1]
This will cause the wire to <u>overheat</u> and result in an [1/2]
<u>electric fire</u>. [1/2]

(c) <u>Damaged insulation</u> in the flexible cable can cause [1]
the <u>live wire to come into contact with the neutral wire / earth wire</u> resulting in a [1/2]
<u>short circuit</u>. [1/2]

9 (a)

$$C \rightarrow B \rightarrow E \rightarrow A \rightarrow D$$

[1/2] for each correctly labelled box

3

(b)   polarity at point **Q** : <u>South</u>   [1]

(c)   The strength of the magnetic field increases.   [1]
         The direction of the magnetic field reverses.   [1]

SECTION B [20 marks]

10   **(a)**   **(i)**   Distance travelled = area under graph
                                   = 25 x 20
                                   = <u>500 m</u>   [1]

           (ii)   Work done = force x distance
                             = 1200 x 500   [1]
                             = <u>600 000 J</u>   [1]

           (iii)   Power = work done / time
                             = 600 000 / 20   [1]
                             = <u>30 000 W</u>   [1]

    (b)   **(i)**   a = (v-u) / t
                   = (0 – 25) / 4
                   = - 6.25 ms^{-2} [1/2]

                Deceleration = 6.25 ms^{-2} [1/2]

           (ii)   driving force – braking force   =   resultant force
                    0   - braking force   = mass x acceleration
                       -     braking force   = 800 x (- 6.25)   [1]
                            braking force = 5000 N   [1]

   Award only 1 mark if student uses braking force = mass x deceleration.

           (iii)   <u>Speed is higher at the beginning of the braking period</u>   [1/2]
                <u>so kinetic energy is higher.</u>   [1/2]
                <u>The brakes have to do more work</u>   [1/2]
                <u>per unit time to slow down the car.</u>   [1/2]

11   **(a)**   **(i)**   <u>Centre of gravity is the point on an object where the (entire) weight of the</u>
                <u>object appears to act on.</u>   [1]

           (ii)   The object will turn anticlockwise / fall to the left and come to <u>rest on its</u>   [1/2]
                <u>base.</u>
                <u>Line of action of the weight lies within the base area</u>.   [1/2]
                The <u>weight produces an</u> <u>anticlockwise moment about **P**</u>.   [1]

    (b)   **(i)**

                    [1] CG to be labelled
                        above the pivot point
                        on the beam
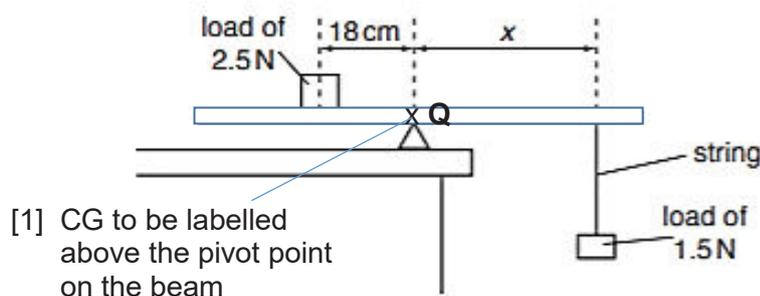
(ii) When an object is in <u>equilibrium</u>, [1/2]
the sum of <u>clockwise moment about a point is equal to the sum of</u> [1]
<u>anticlockwise moment</u>
<u>about the same point</u>. [1/2]

(iii) No, because <u>perpendicular distance from the weight to the pivot is zero</u>. [1]

(iii) Sum of clockwise moment = sum of anticlockwise moment
about pivot about pivot
$1.5 \times x = 2.5 \times 18$ [1]
$x = \underline{30 \text{ cm}}$ [1]

(iv) Shift the 2.5 N load closer to the pivot or [1]
Shift the 1.5 N further away from the pivot.

12 (a) (i) $R_Q = V/I$
$= 2.5 / 0.5$ [1]
$= \underline{5 \, \Omega}$ [1]

(ii) $R_R = V/I$
$= (10 - 2.5) / 0.5$ [1]
$= 7.5 / 0.5$
$= \underline{15 \, \Omega}$ [1]

(b) The <u>effective resistance</u> of the circuit <u>increases</u>. [1/2]
The <u>current</u> in the circuit <u>decreases</u>. [1/2]
<u>Potential difference</u> across the bulb also <u>decreases</u>. [1/2]
<u>Brightness of bulb Q decreases</u>. [1/2]

(c) (i) Effective resistance in parallel $= (1/5 + 1/10)^{-1}$
$= 3.33 \, \Omega$ ecf from **(a)(i)** [1]

Effective resistance between X and Y $= (3.33 + 4.5) \Omega$
$= 7.83 \, \Omega$ ecf [1]

(ii) Bulbs **A** and **Q** will light up. [1]
Current will <u>flow through the short circuit path</u> below bulb **B** when switch S_4 [1/2]
is closed.
There is no current flowing through **B**. [1/2]