Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4503/01

PHYSICS

PHYSICS 3
FOUNDATION TIER

P.M. MONDAY, 19 May 2014

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**3**	
2.	**8**	
3.	**5**	
4.	**5**	
5.	**8**	
6.	**7**	
7.	**12**	
8.	**6**	
9.	**6**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.
You are reminded of the necessity for good English and orderly presentation in your answers.
A list of equations is printed on page 2. In calculations you should show all your working.
You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **9**.

Equations

speed = $\frac{\text{distance}}{\text{time}}$	
u = initial velocity v = final velocity t = time a = acceleration x = displacement	$v = u + at$ $x = \frac{1}{2}(u + v)t$
momentum = mass × velocity	$p = mv$
pressure = $\frac{\text{force}}{\text{area}}$	$p = \frac{F}{A}$
	$T / \text{K} = \theta / ^\circ\text{C} + 273$
density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$

SI multipliers

Prefix	Multiplier	
m	10^{-3}	$\frac{1}{1\,000}$
k	10^{3}	1 000
M	10^{6}	1 000 000

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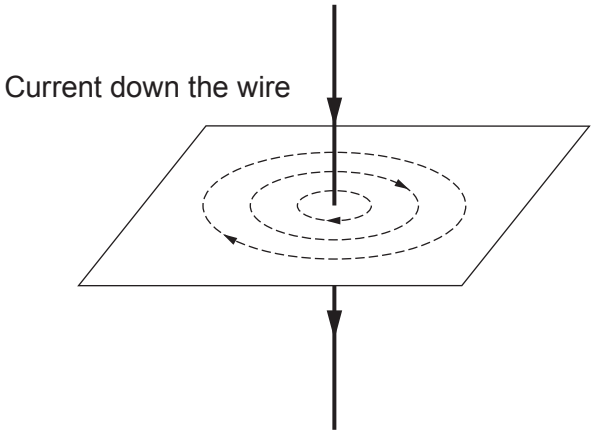
Answer **all** *questions.*

1. The diagram shows the shape of the magnetic field (as dashed lines) around a long straight wire. A current flows down the wire.



(a) Describe the shape of the magnetic field lines. [1]

.....

(b) The current is then reversed. It flows up the wire. State how the magnetic field changes. [1]

.....

(c) State what happens to the magnetic field when the current is turned off. [1]

.....

3

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Turn over.

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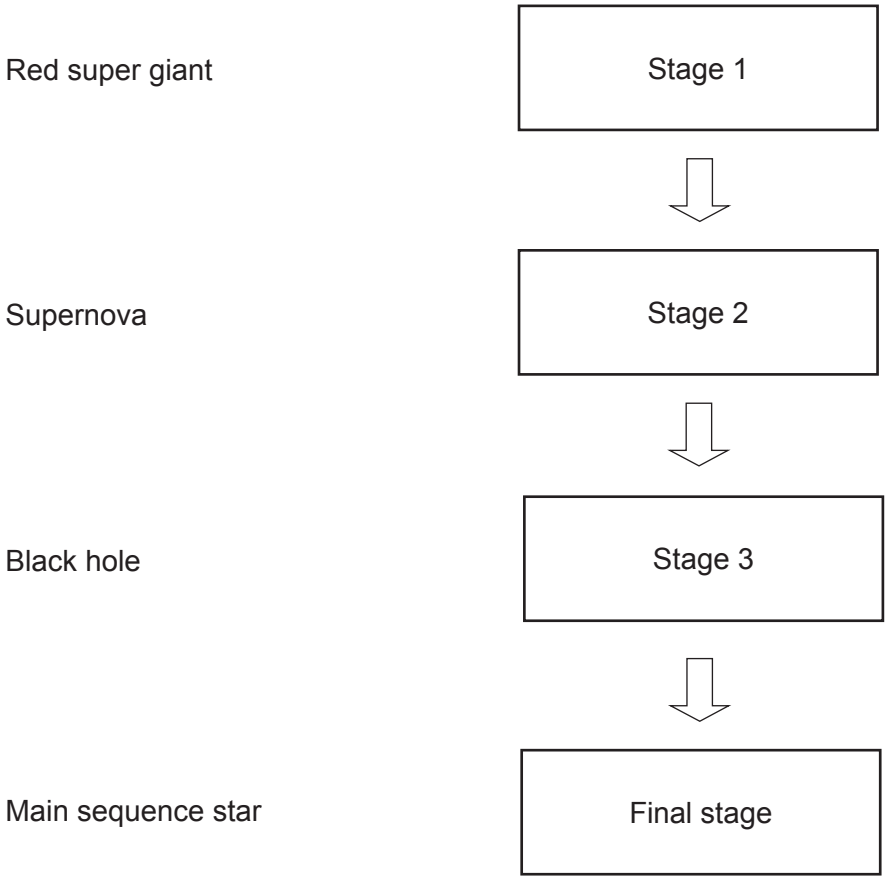
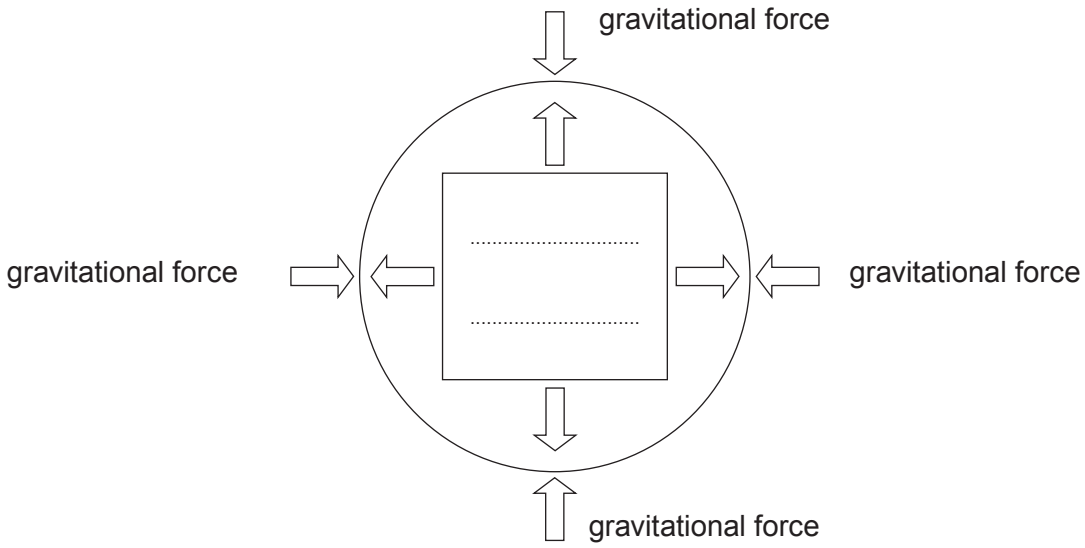
2. *(a)* The block diagram below shows the life cycle of a star much larger than our Sun.
Draw lines from the names on the left to the correct box on the right to put them in order. [3]



(b) The following diagram shows the major forces acting on a main sequence star.
Label the outward acting force. [1]



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(c) Choose words from the box below to complete the sentences that follow. Each word may be used **once, more than once or not at all**. [4]

uranium	iron	fission	fusion	helium

Main sequence stars generate energy by ..... of hydrogen into ..... . Heavier elements are created when stars much larger than our Sun collapse. These heavier elements include ..... which we use in our fission reactors on Earth. We only have elements heavier than ..... because they are created during a supernova explosion.

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Turn over.

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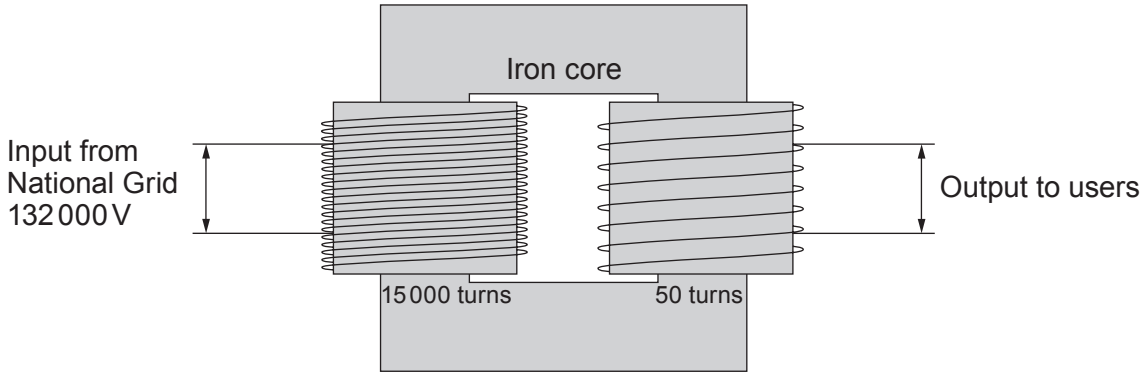
3. The diagram shows a transformer that is used to change the voltage in the National Grid.



(a) **Underline** the correct statement in each bracket of the following sentences.

(i) This transformer (**steps-down / steps-up / increases the power of**) the voltage supplied to it. [1]

(ii) The voltage supplied to the users by the secondary coil is (**440 / 132 000 / 440 000**) volts. [1]

(iii) The current through the input coil must alternate so that the iron core (**doesn't get hot / has a constant magnetic field / has a changing magnetic field**). [1]

(b) Explain how the magnetic field produces a current in the secondary coil of the transformer. [2]

.....

.....

.....

5

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4. A star in its main sequence generates its energy by the nuclear reaction that is shown below.

$$4\,{}^{1}_{1}\mathrm{H} \longrightarrow {}^{4}_{2}\mathrm{He} + 2\,{}^{0}_{1}\mathrm{e}$$

(a) State the number of helium atoms produced in this reaction. [1]

.....

(b) Name the particle that is written as ${}^{0}_{1}\mathrm{e}$. [1]

.....

(c) An electron is written as ${}^{0}_{-1}\mathrm{e}$. State how an electron is different from ${}^{0}_{1}\mathrm{e}$. [1]

.....

.....

(d) Describe what happens when ${}^{0}_{1}\mathrm{e}$ and ${}^{0}_{-1}\mathrm{e}$ collide with each other. [2]

.....

.....

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Turn over.

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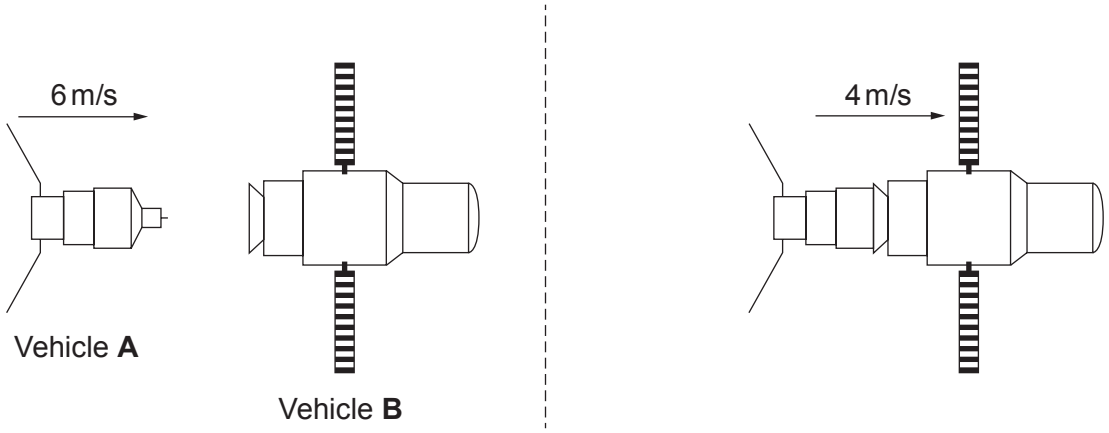
5. The diagram shows two space vehicles docking (joining together).



Vehicle **A** has a mass of 50 000 kg.

Vehicle **B** is at rest before the collision and vehicle **A** is moving to the right with a velocity of 6 m/s.

(a) (i) Use the equation:

$$\text{momentum} = \text{mass} \times \text{velocity}$$

to calculate the momentum of vehicle **A** before the collision. [2]

momentum = ... kg m/s

(ii) After the collision **the two vehicles join together** and move with a velocity of 4 m/s. No momentum is lost in the collision.

Use your answer to part (i) and the equation:

$$\text{total mass} = \frac{\text{total momentum}}{\text{velocity}}$$

to calculate the total mass after they join together. [2]

total mass = ... kg

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(iii) Use your answer to part (ii) to calculate the mass of vehicle **B**. [1]

mass = ... kg

(b) (i) Calculate the loss of momentum of vehicle **A** in the collision. [2]

momentum lost = ... kg m/s

(ii) **Write down** the **gain** in momentum of vehicle **B**. [1]

momentum gained = ... kg m/s

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Turn over.

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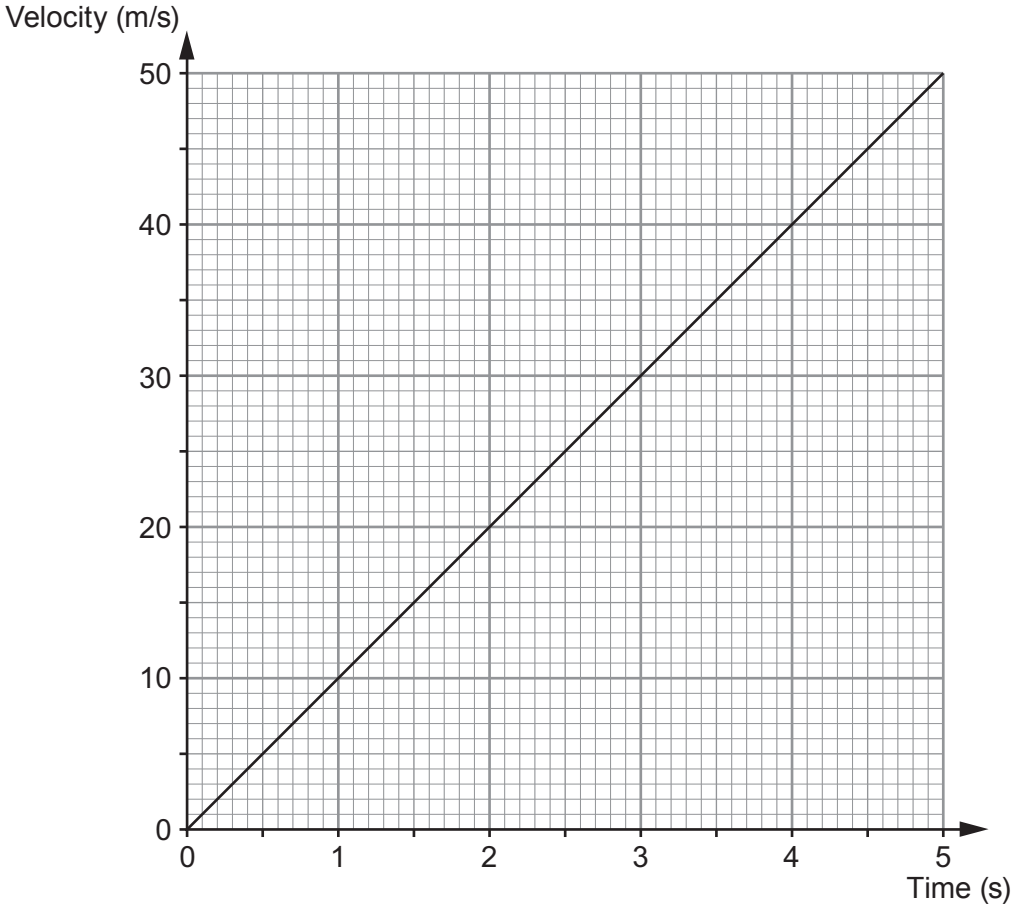
6. A hammer falls to the ground. The graph below shows how the velocity of the hammer changes with time.



(a) Describe the relationship between the velocity of the hammer and time. [2]

.....

.....

.....

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(b) (i) Use information from the graph and the equation:

$$a = \frac{v - u}{t}$$

to calculate the acceleration. [2]

acceleration = ... m/s^2

(ii) Use information from the graph and the equation:

$$x = \frac{1}{2}(u + v)t$$

to calculate the distance that the hammer fell **in the first 4 s**. [2]

distance = ... m

(c) If a feather had fallen to the ground, the equations in *(b)* could not be used. Give a reason why. [1]

.....

.....

7

Turn over.

Examiner only

7. A balloon is filled with 2.0 m^3 of helium and released. The following table shows data for the balloon as it rises.

Height of balloon above the ground (km)	Volume of balloon (V) (m^3)	Helium pressure (p) (kN/m^2)	pV (kN m)
0	2.0	100	200
2	2.4	80	.....
4	3.0	60	180
6	3.6	50	180
8	4.4	40	176
10	5.8	30	174
12	8.1	.....	162

(a) (i) **Complete** the table. [2]

(ii) Use the data in the table to plot a graph of **volume** against **height** of the balloon on the grid opposite. [3]

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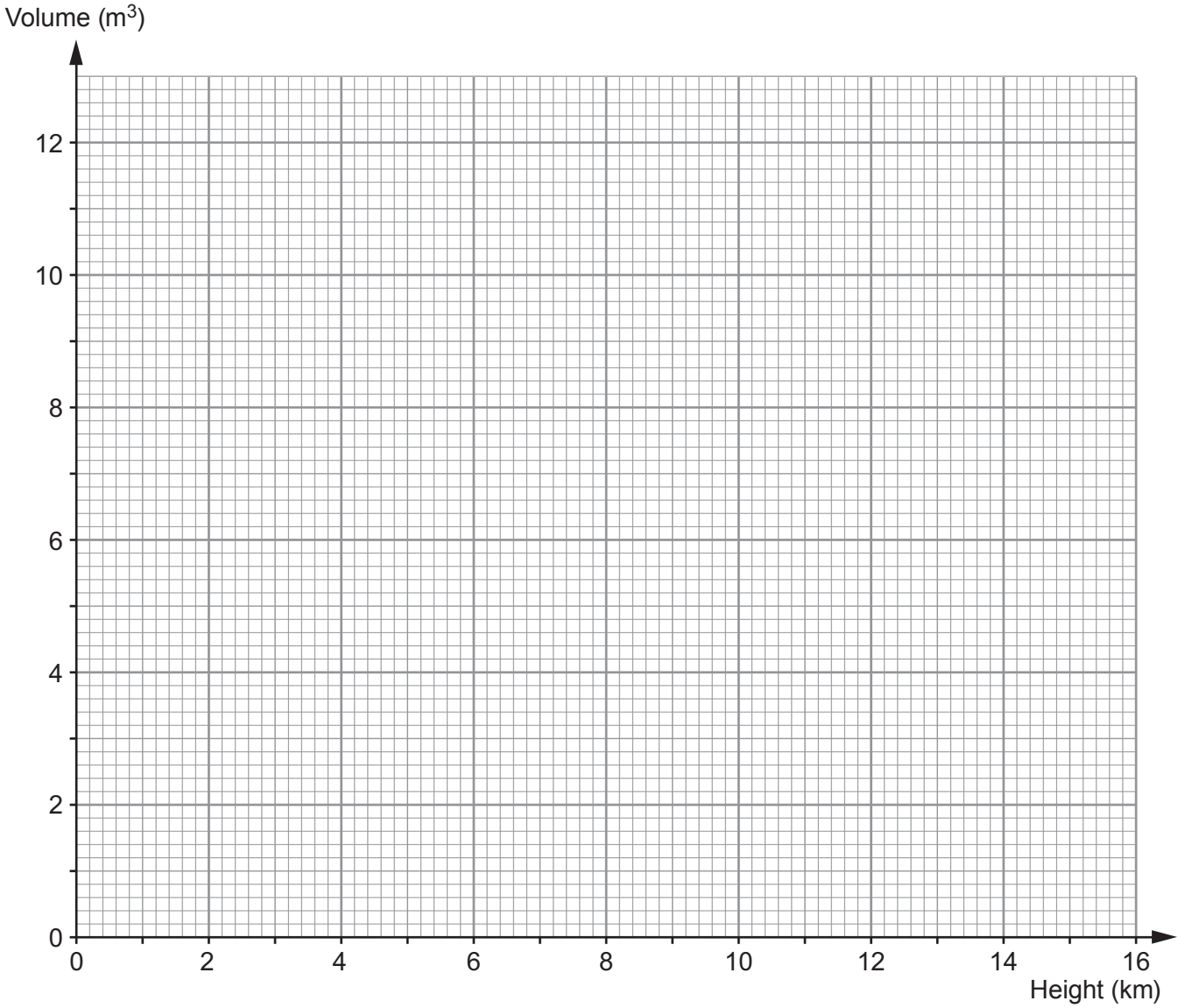

(b) (i) Use your graph to describe how the **volume** of the balloon changes as the **height** increases. [2]

.....

.....

.....

(ii) Use the information in the table to give a reason why this volume change occurs. [1]

.....

.....

(iii) The balloon bursts when its volume reaches 12 m^3. **Continue** your graph to estimate at what height this happens. [2]

height = ... km

Turn over.

Examiner only

(c) The volume of the balloon is also affected by changes in temperature.

(i) State how a decrease in temperature affects the volume of the balloon. [1]

.....

(ii) Give a reason for your answer in terms of molecules. [1]

.....

.....

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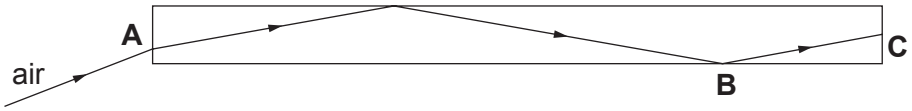
8. The diagram shows the path of a signal through a glass fibre.



(a) State the name given to the change in direction of the signal: [2]

(i) at **A**; .....

(ii) at **B.** .....

(b) (i) Give a reason why the signal changes direction at **A**. [1]

.....

.....

(ii) State the **two** conditions needed for the signal to change direction at **B**. [2]

1. .....

2. .....

(c) **Add** a line to the diagram to show how the signal leaves the glass fibre at **C**. [1]

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TURN OVER FOR THE LAST QUESTION

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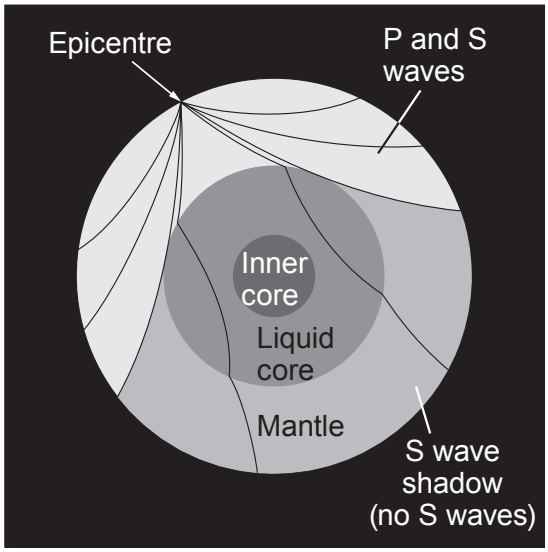
9. Use the diagram below **and** your knowledge to compare the properties of seismic P waves, S waves and surface waves. [6 QWC]



END OF PAPER

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