Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0247/01

SCIENCE
FOUNDATION TIER
PHYSICS 3

A.M. WEDNESDAY, 30 January 2013

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**3**	
2.	**4**	
3.	**2**	
4.	**4**	
5.	**6**	
6.	**3**	
7.	**5**	
8.	**4**	
9.	**4**	
10.	**5**	
11.	**5**	
12.	**5**	
Total	**50**	

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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.

EQUATIONS

speed = gradient of a distance-time graph

distance travelled = area under a velocity-time graph

acceleration = gradient of a velocity-time graph

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

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

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

where u is the initial velocity
v is the final velocity
a is the acceleration
t is the time
x is the distance travelled

momentum = mass × velocity

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Answer **all** *questions.*

1. When an earthquake occurs, two types of seismic waves, P and S travel through the Earth. Tick (✓) the boxes that contain true facts about S waves. [3]

A transverse wave	
A longitudinal wave	
Can travel through solids	
Can travel through liquids	
Travel slower than P waves	
Travel faster than P waves	

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3

Turn over.

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2. Draw a labelled diagram of a $^{7}_{3}Li$ atom to show the number and arrangement (or position) of the protons, neutrons and electrons.

Use the following key for your diagram:

- ● proton
- ○ neutron
- × electron [4]

4

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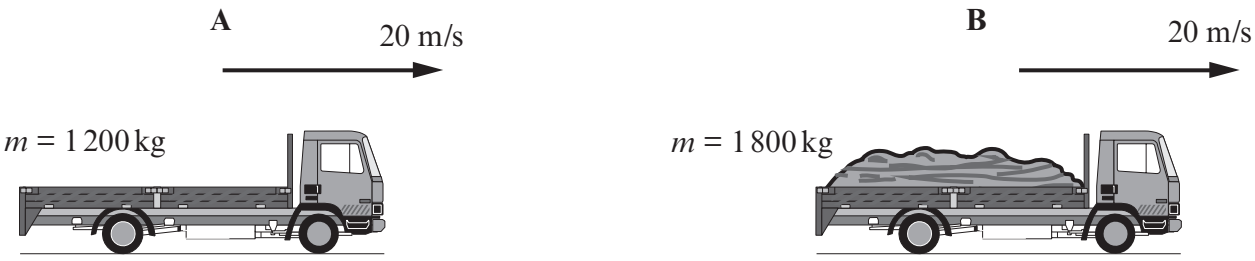
3. The diagram gives information about two lorries, **A** and **B**, coming to rest under the action of the **same braking force**.



Use information from the diagram to:

(i) calculate the change in momentum of lorry **A** when it is brought to rest; [1]

momentum = mass × velocity

Change in momentum of **A** = ... kg m/s

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(ii) Give a reason why **B** will take longer than **A** to be brought to rest under the same braking force. [1]

.....

.....

2

Turn over.

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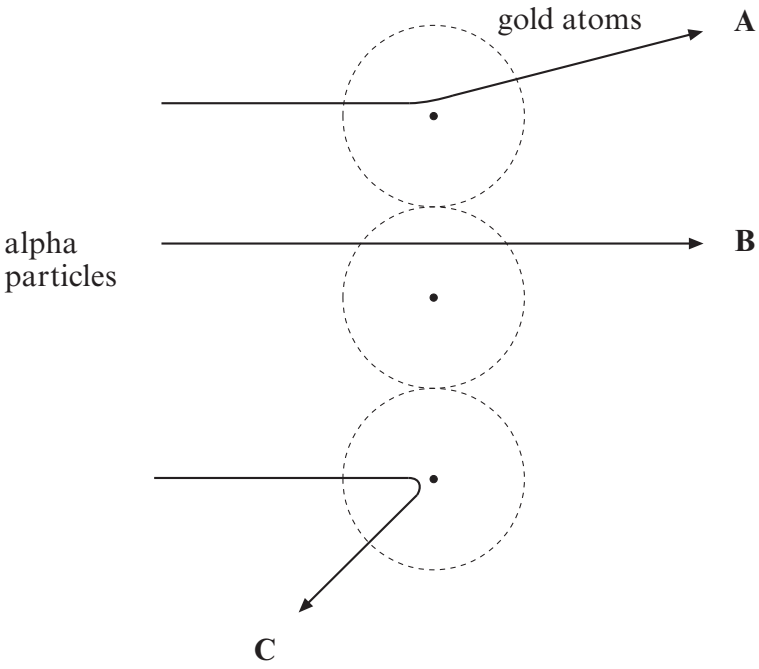
4. In the Rutherford alpha particle scattering experiment, alpha particles were passed through thin gold foil.
The results showed that many alpha particles passed straight through (like alpha particle **B** in the diagram). Some alpha particles were deflected through small angles (like alpha particle **A**). Very few alpha particles were deflected by a large angle (like alpha particle **C**).



Complete the sentences below by using a word or phrase from the box. Each word or phrase may be used **once**, **more than once or not at all**. [4]

	orbit	neutron	solid	**A**
nucleus	proton	empty space	**B**	**C**

(i) The fact that most alpha particles follow path ..... shows that most of the atom is ..... .

(ii) The fact that a small number of alpha particles follow path ..... shows that a positive charge exists in the ..... .

4

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Turn over.

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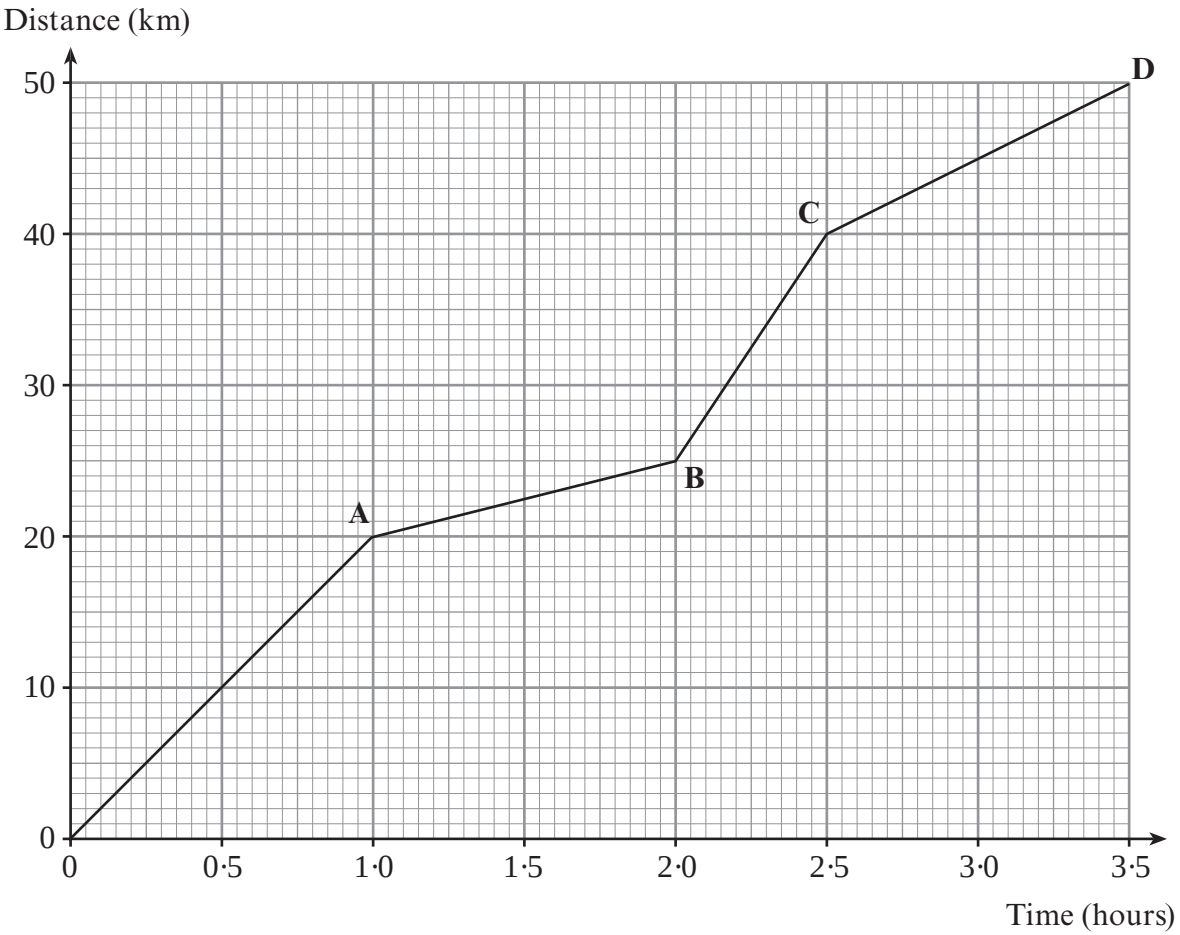
5. A cyclist takes part in a 50 km race.
Part of the race requires the competitors to cycle **up a very steep mountain** and **down the other side**.
The graph shows the motion of the cyclist during the race.



(a) The speed of the cyclist is the gradient of the line.

(i) Over which region **OA**, **AB**, **BC**, **CD** did the cyclist travel at his greatest speed? [1]

.....

(ii) Give a reason for your answer to *(a)*(i). [1]

.....

(iii) Explain why point **B** is most likely to be the top of the mountain. [2]

.....

.....

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(b) Use the equation:

$$\text{mean speed} = \frac{\text{total distance}}{\text{time}}$$

to calculate the cyclist's mean speed for the race. [2]

Mean speed = ... km/h

6

6. *(a)* State **two** differences between nuclear fission and nuclear fusion. [2]

.....

.....

.....

.....

(b) Give **one** reason why it is difficult to achieve controlled nuclear fusion on Earth. [1]

.....

.....

3

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Turn over.

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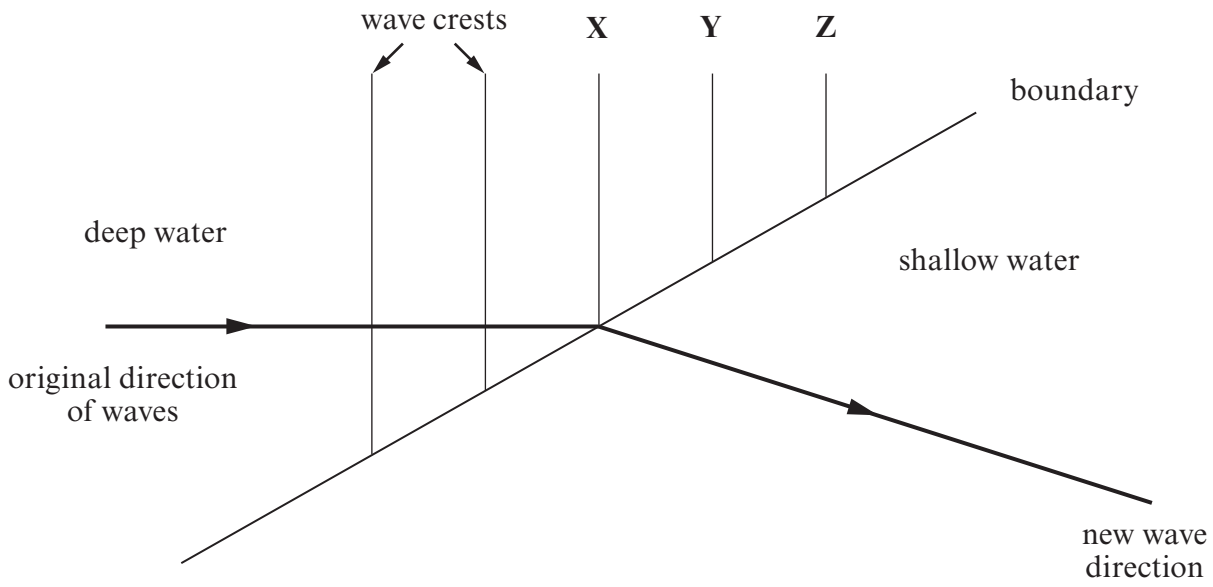
7. The diagram below shows the crests of water waves in a ripple tank moving from deep to shallow water.



(a) **Complete the diagram** to show the crests of waves **X**, **Y** and **Z** in the shallow water. [2]

(b) As the wave moves into the shallow water the direction changes. What name is given to this change of direction? ..... [1]

(c) Complete the following sentences by underlining the correct word or phrase in the brackets.

(i) When the wave passes into shallow water the wavelength (**increases / decreases / stays the same**).

(ii) When the wave passes into shallow water the speed of the wave (**increases / decreases / stays the same**). [2]

5

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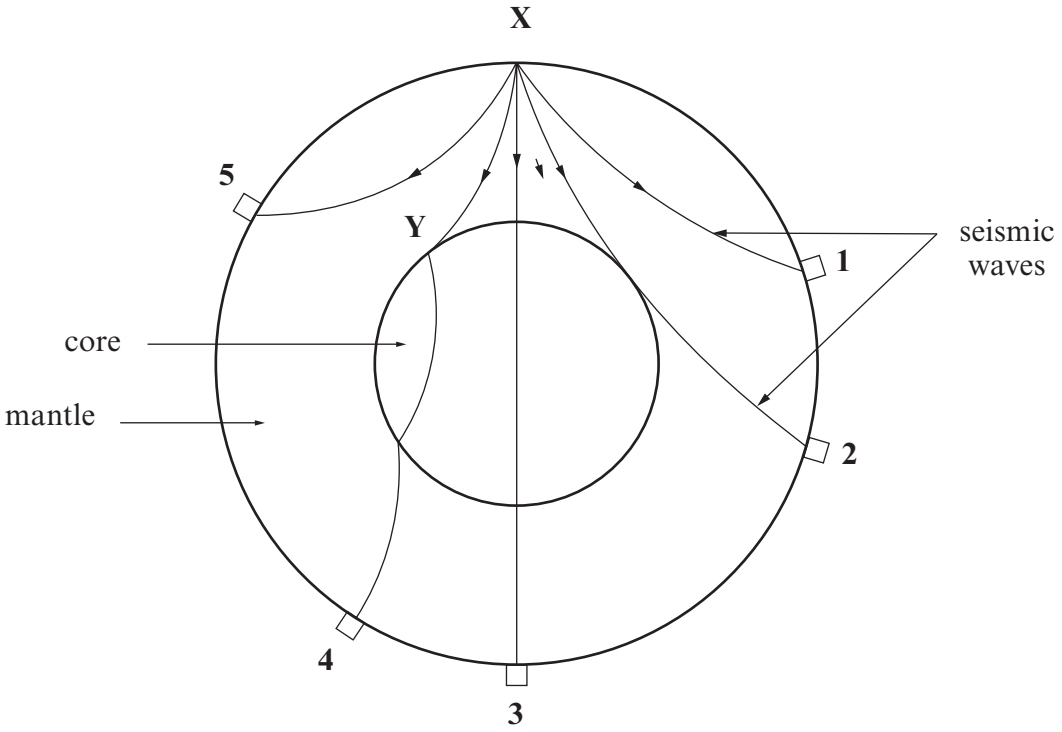
8. The diagram below shows a cross-section of the Earth. An earthquake occurs at **X** and detectors **1**, **2**, **3**, **4** and **5** pick up seismic waves.



(a) (i) State which detectors pick up both P and S waves. .....

(ii) Explain why the P waves always arrive before the S waves at the detector.

.....

.....

(iii) Give a reason why detector **5** is likely to be the first to detect the earthquake.

.....

.....

[3]

(b) Give a reason why there is a change in direction of the seismic wave when it passes from the mantle to the core at **Y**. [1]

.....

.....

4

Turn over.

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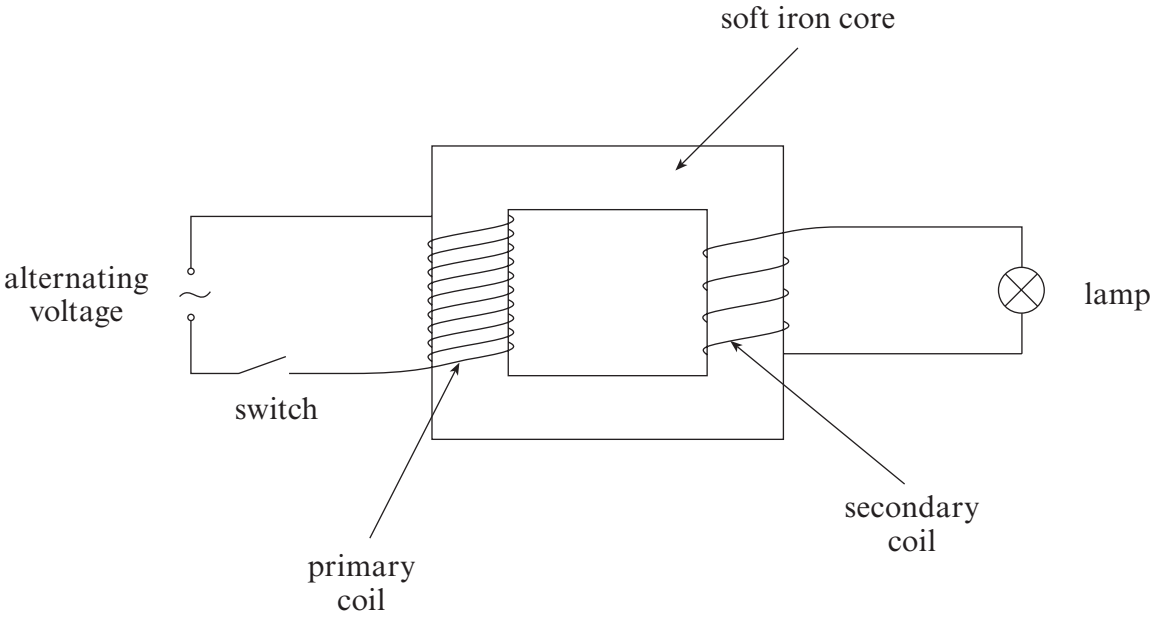
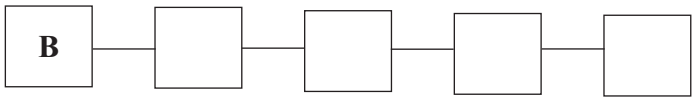
9. The diagram represents a transformer.
The lamp lights, when the switch is closed.



(a) The following sentences, **A** to **E**, describe how the transformer works.
The sentences are in the wrong order.

A	A changing magnetic field is also produced in the soft iron core.
B	When the primary circuit is switched on, an alternating current flows through the primary coil.
C	An alternating current is induced in the secondary coil and the lamp lights.
D	The changing field in the iron core links with the secondary coil.
E	A changing magnetic field is produced in the primary coil.

Arrange the sentences in the right order, starting with **B**.
Show your order in the boxes below. [3]



(b) How can you tell that the transformer shown in the diagram is a step-down transformer? [1]

.....

.....

4

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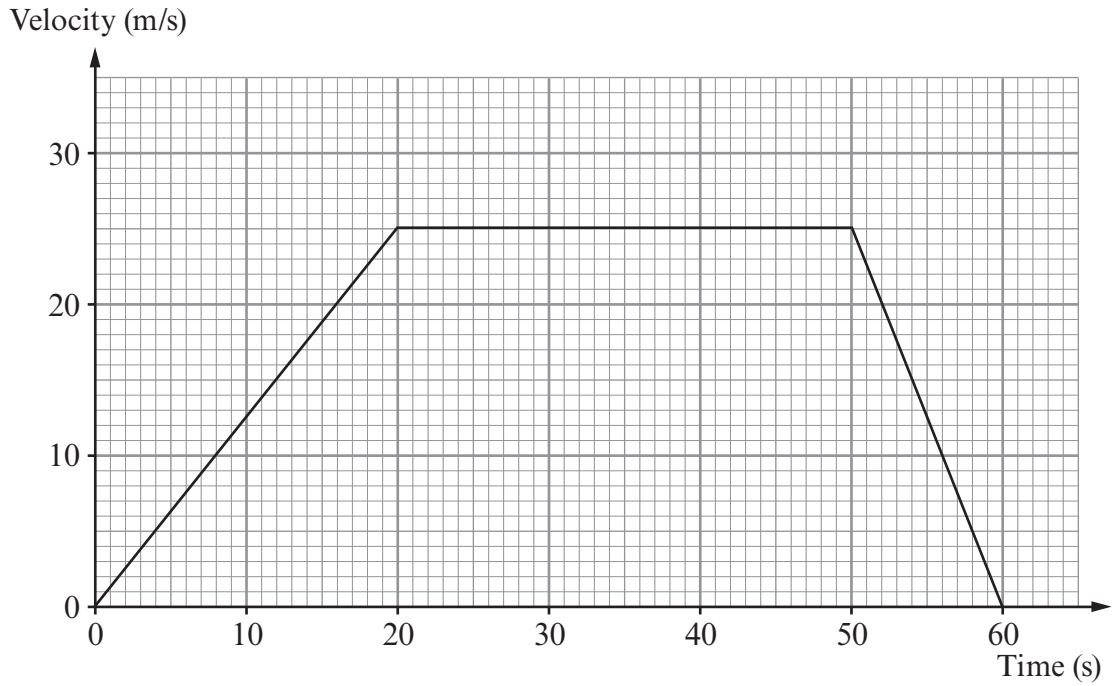
10. The graph shows part of the motion of an underground train as it travels from one station to the next station.



(a) The acceleration/deceleration is the gradient of the appropriate line of a velocity-time graph. Calculate the deceleration of the train. [2]

Deceleration = ... m/s^2

(b) The distance travelled is the area under the line of a velocity-time graph. Calculate the distance travelled when the train was accelerating. [2]

Distance travelled = ... m

(c) State how the graph shows that the train travelled further in the last 30 s of its motion than in the first 30 s of its motion. [1]

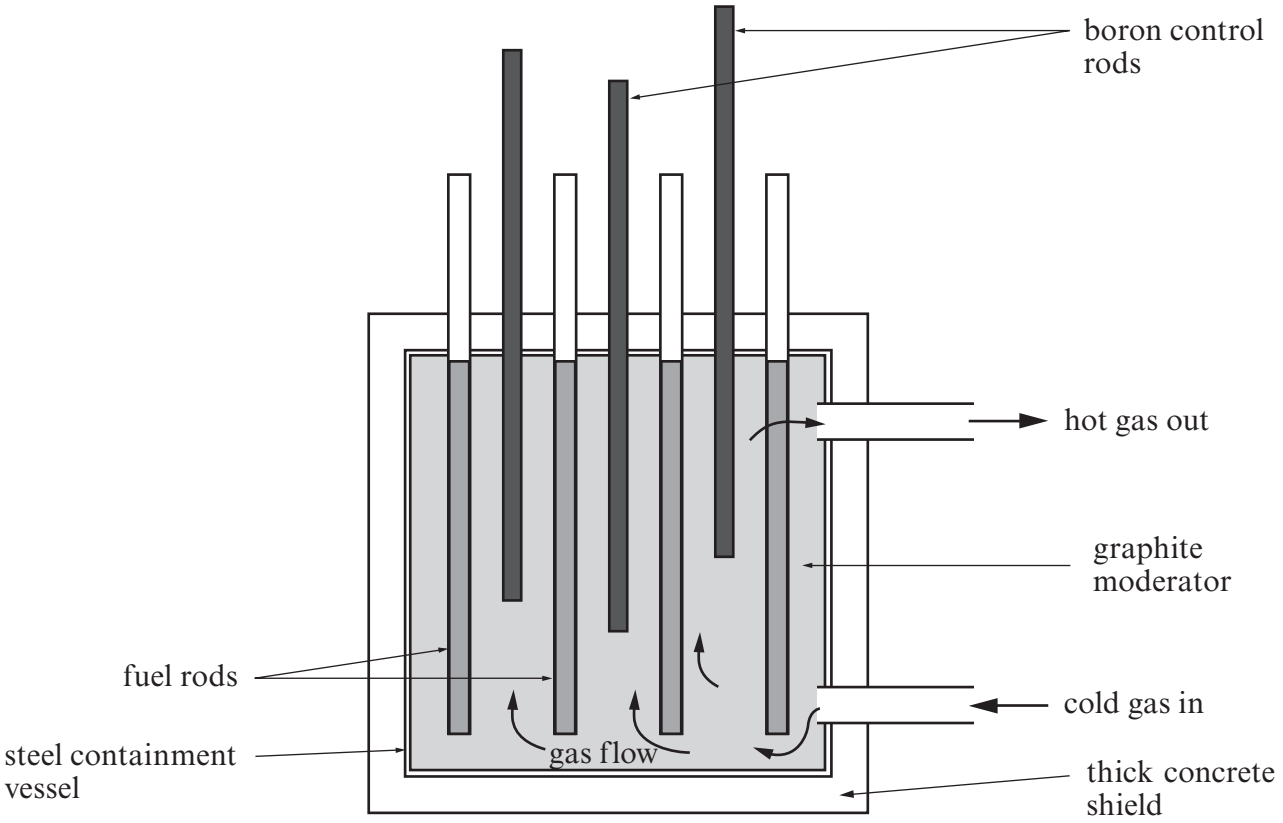
.....

.....

5

11. Read the information in the passage and look carefully at the diagram before answering the questions that follow.

The diagram shows the important parts of the core of a gas-cooled nuclear reactor.



The fuel rods used in the core of a gas-cooled reactor are made of U-238 (Uranium-238) enriched with 3% of U-235 (Uranium-235). Only U-235 undergoes fission. Its atoms capture slow moving neutrons and split to produce two new radioactive nuclei and up to three new fast moving neutrons.

The fuel rods are surrounded by graphite which slows down the fast moving neutrons to allow more fission to take place.

Boron rods, which readily absorb neutrons, can be raised or lowered into the core and enable the rate of fission to be controlled.

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(a) (i) What causes U-235 to undergo fission?

.....

.....

(ii) Explain why graphite is important to the fission process.

.....

.....

.....

[3]

(b) Describe the effect that lowering the boron control rods into the core has on the output from the reactor. [2]

.....

.....

.....

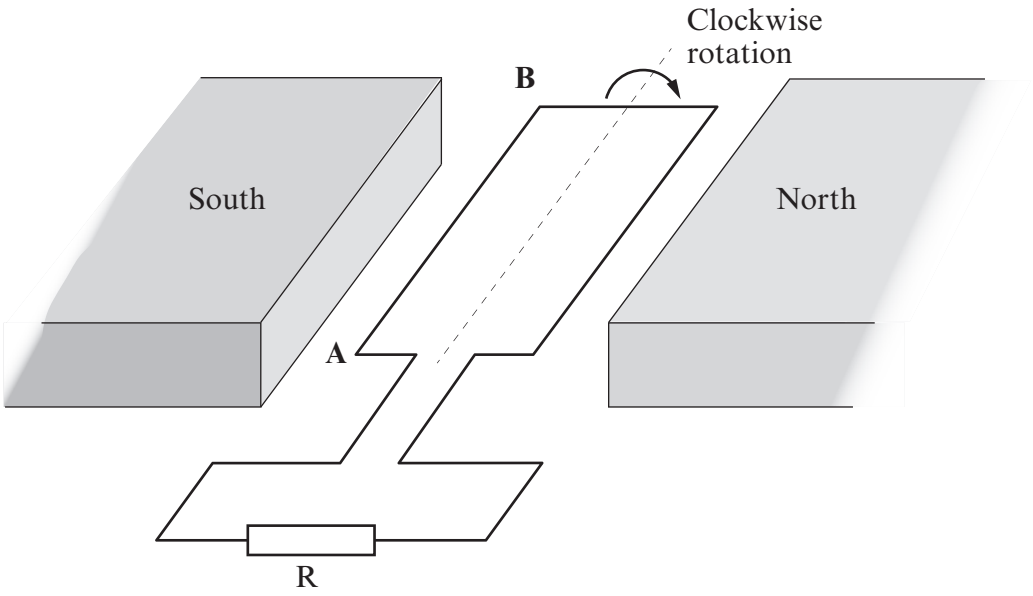
.....

5

Turn over.

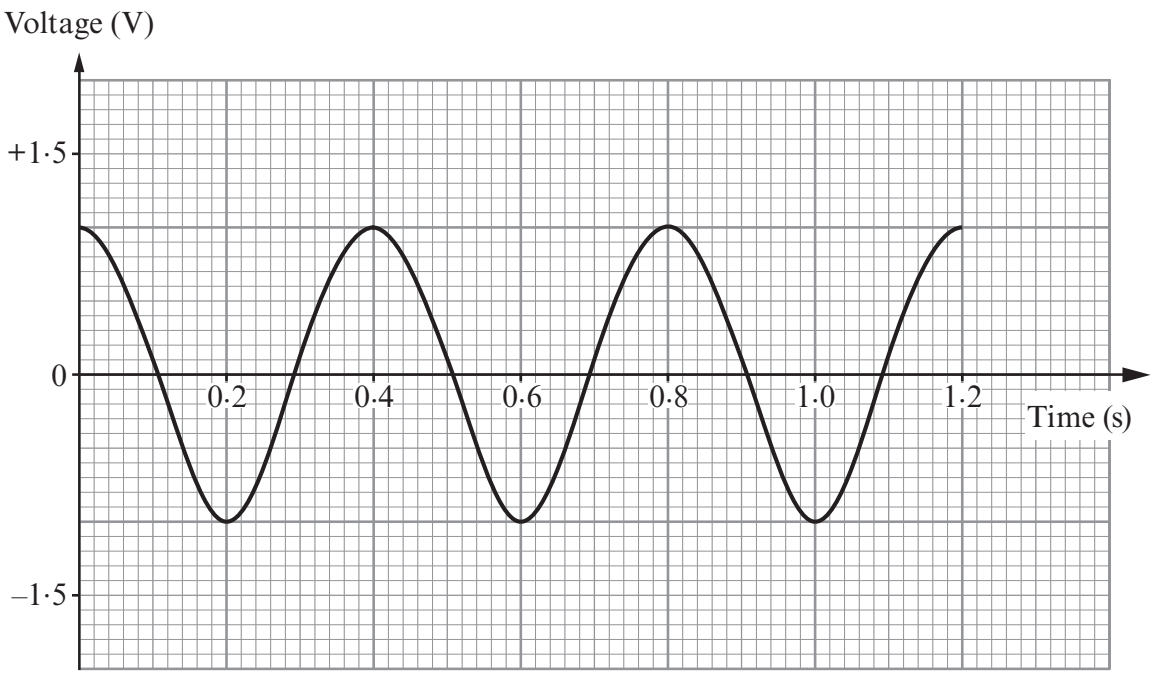
Examiner only

12. The diagram shows a simple a.c. generator. It consists of a single coil which is rotated at constant speed in a magnetic field.



As the coil rotates, it 'cuts through' the magnetic field lines producing a voltage which drives an alternating current through the coil and the resistor R.

The graph below shows how this voltage varies with time.



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(a) Use the graph to find the time taken to make one complete rotation of the coil. [1]

Time = ... s

(b) Use Fleming's right hand rule to **mark on the diagram** the direction of the current through **AB** when the coil is moving through the position shown. [1]

(c) Complete the table below to state the effect, if any, the following separate changes would have on the output voltage. Parts of the table have been completed for you. [3]

Change	Effect on the maximum voltage	Effect on the time for one rotation of the coil
Increasing the strength of the magnetic poles and turning the coil at the same speed	Increased	No change
Turning the coil at a slower speed	.....	Increased
Increasing the number of coils and turning the coil at a faster speed	.....	.....

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END OF PAPER