Candidate Name	Centre Number	Candidate Number
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WJEC CBAC

GCSE

247/01

SCIENCE PHYSICS
FOUNDATION TIER
PHYSICS 3

P.M. WEDNESDAY, 11 June 2008

45 minutes

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

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

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 of the examination paper. 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

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

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

where x = distance
u = initial velocity
v = final velocity
a = acceleration
t = time

momentum = mass × velocity

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Answer **all** *questions.*

1. When an earthquake occurs, two types of shock wave, **P** and **S**, travel through the Earth.

(i) State which shock wave, **P** or **S**, cannot travel through a liquid. .....

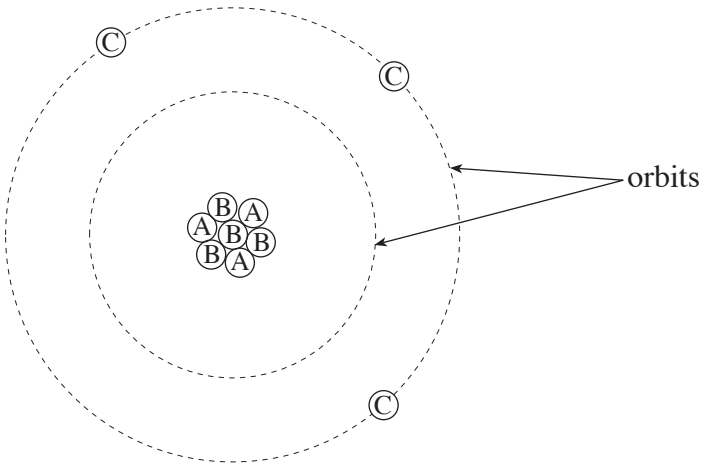
(ii) State which shock wave, **P** or **S**, travels faster. .....

(iii) State which shock wave, **P** or **S**, produces vibrations in the direction of travel of the wave. .....

(iv) State which shock wave travels as a longitudinal wave. ..... [4]

4

2. The diagram shows how the particles (electrons, protons and neutrons), making up a **neutral** atom, are arranged.
The diagram is not to scale.



(a) (i) Name the particles marked C on the diagram. .....

State the charge on the particles marked C. ..... [2]

(ii) Name the particles marked B on the diagram. .....

State the charge on the particles marked B. ..... [2]

(b) Use the information on the diagram to answer the following questions.

(i) Find the atomic number [proton number] of the element containing this atom. .....

(ii) Find the mass number [nucleon number] of the atom. .....
[2]

6

Turn over.

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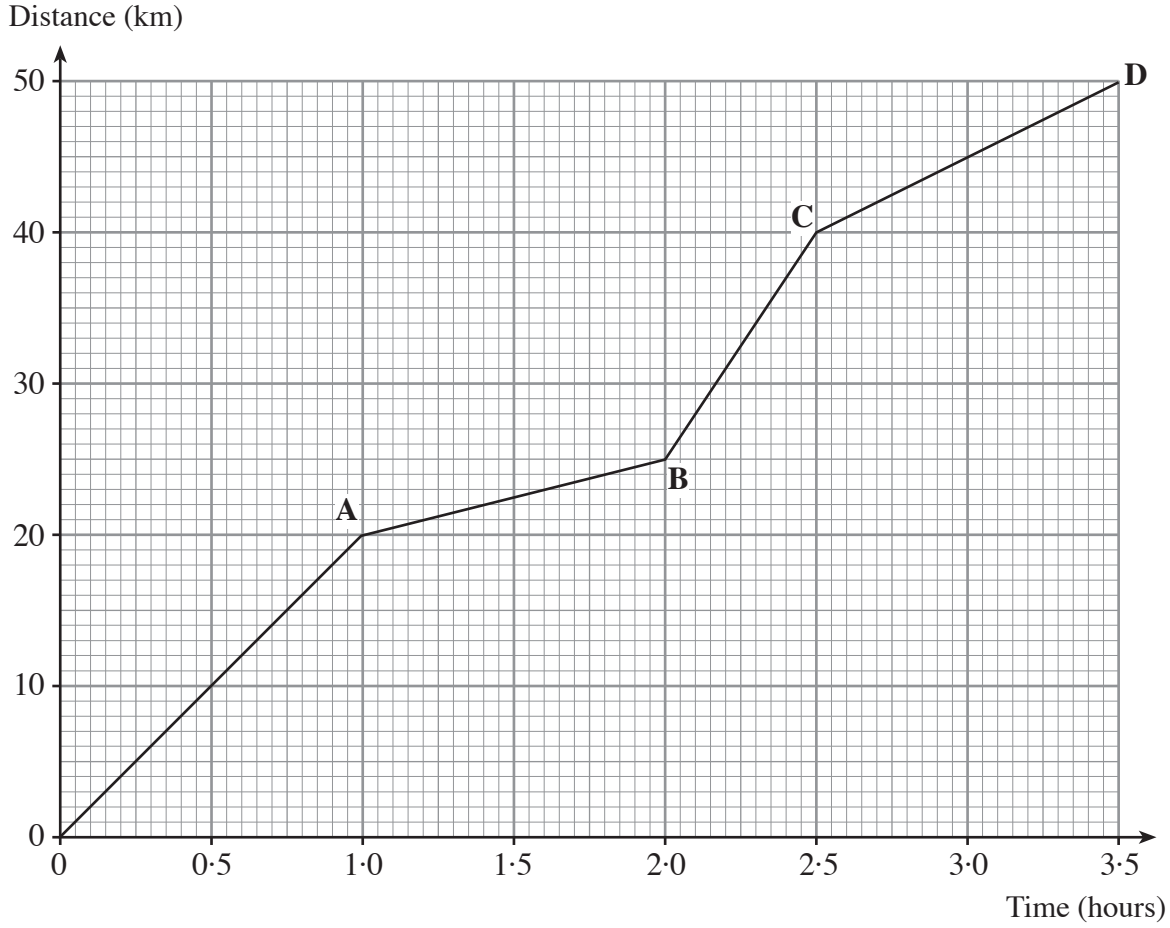
3. A cyclist takes part in a 50 km race.
Part of the race requires the competitors to cycle **up a very steep mountain** and **down the other side**.
The graph shows the motion of the cyclist during the race.



(a) How far did the cyclist travel in the first hour? ..... km
[1]

(b) (i) In which region of the graph, **OA**, **AB**, **BC** or **CD**, did the cyclist travel at the lowest speed? .....

(ii) Give a reason for your answer to (i).

.....

.....

(iii) Explain why B is most likely to represent the top of the mountain.

.....

..... [3]

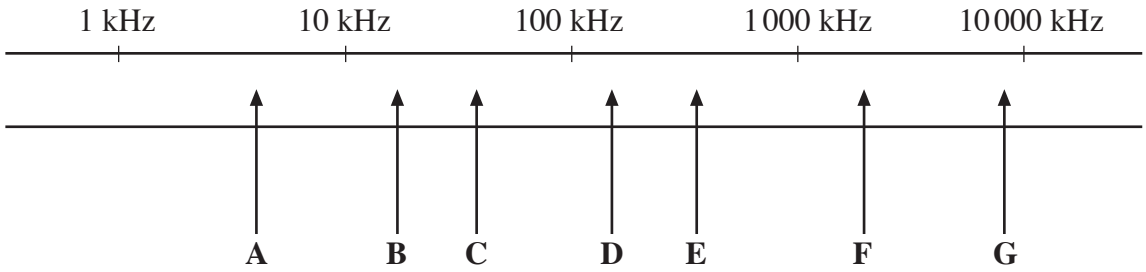
(c) (i) State how far the cyclist travelled between 2 hours and 2·5 hours. ..... km

(ii) What was the cyclist's average speed, in km/h, between 2 hours and 2·5 hours?

..... km/h
[2]

4. Sounds above the range of human hearing are called **ultrasound**.

The diagram shows a spectrum of sound frequencies with some frequencies labelled **A** ⟶ **G**.



Some animals can hear ultrasound and many practical applications of ultrasound have been developed.

(a) The table below shows some typical ultrasound frequencies.
Complete the table by selecting the most appropriate letter from the sound spectrum.
The first has been completed for you. [3]

	Frequency	Letter from the sound spectrum
The upper limit of human hearing	20 kHz	**B**
The upper limit for bats and dolphins	120 kHz	
The frequency used in echo sounding equipment on ships	50 kHz	
The frequency used in medical equipment	2 000 kHz	

(b) State **two** examples of how ultrasound is used in medicine. [2]

1. .....

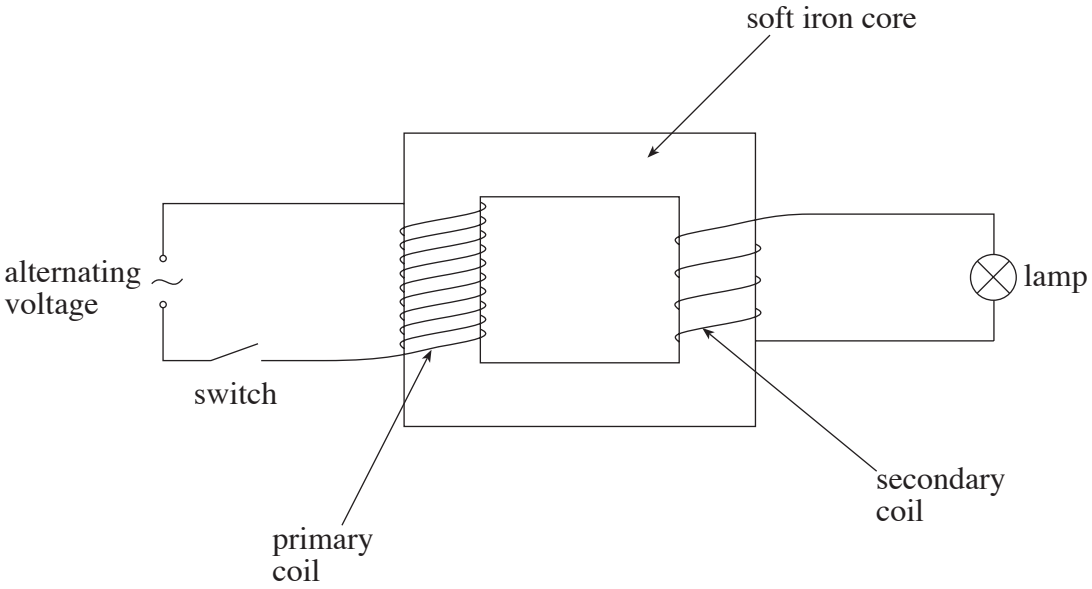
.....

2. .....

.....

5

5. 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 coils 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]

.....

.....

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6.

plum pudding		Fleming	electron
Rutherford	proton	Thomson	nuclear

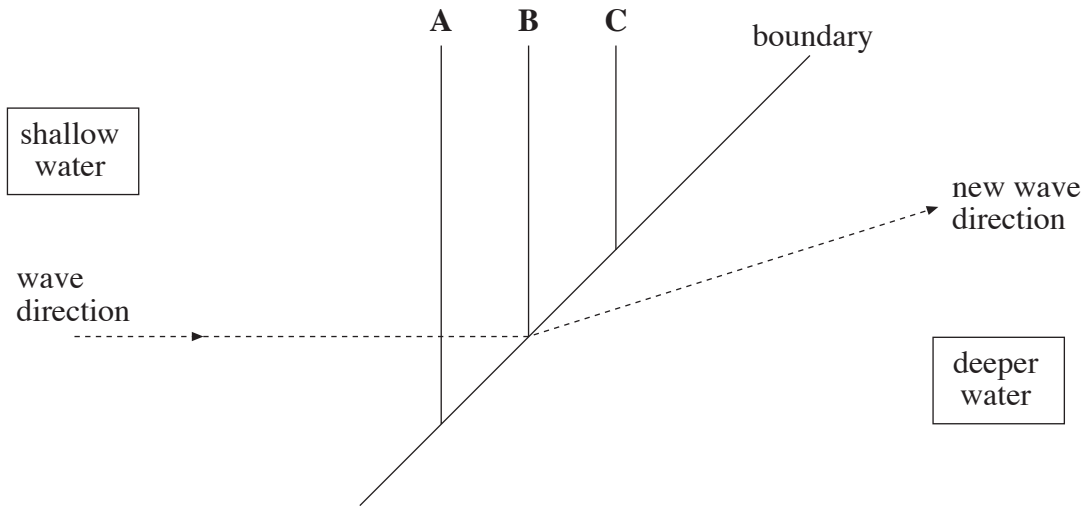
Select a word or phrase from the box to correctly complete the sentences below. [4]

(i) The alpha particle scattering experiment led ..... to put forward the ..... model of the atom.

(ii) This model replaced the ..... model that had been put forward earlier by ..... .

4

7. The diagram shows the crests, **A**, **B** and **C**, of water waves travelling from shallow to deeper water. At the boundary, the waves change direction.



(a) **Complete the diagram** to show the crests of waves **A**, **B** and **C**, in the deeper water. [2]

(b) (i) Give a reason why the waves change direction at the boundary.

.....

(ii) State how the wavelength of the waves changes as they enter the deeper water.

..... [2]

4

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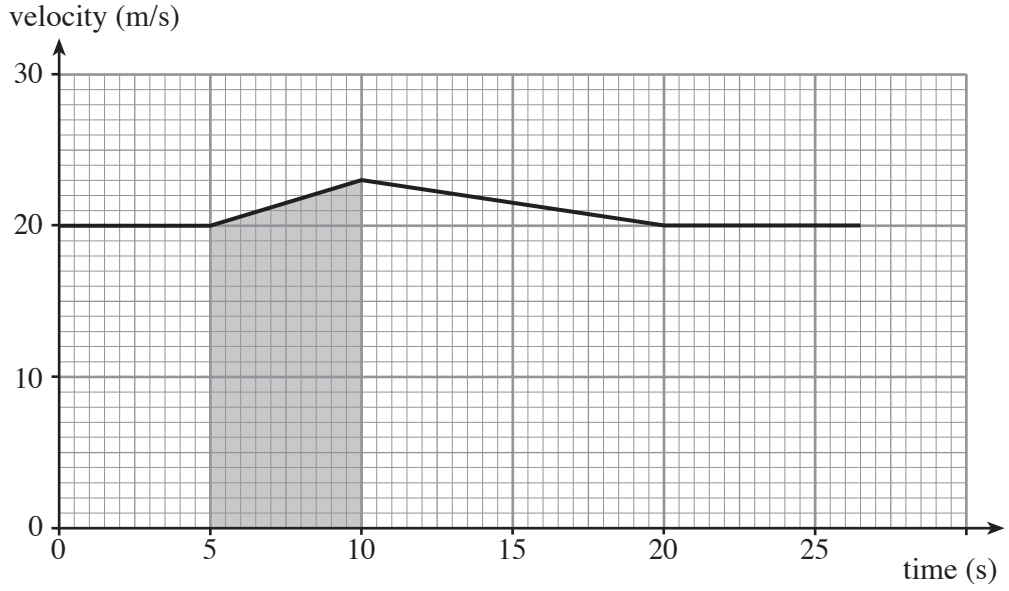
8. A car overtakes a lorry. In doing so, the car accelerates and, after overtaking safely, returns to its original speed.
The graph represents the motion of the car when overtaking the lorry.



(a) Use the graph to find:

(i) the maximum speed of the car when overtaking;

Maximum speed = ... m/s

(ii) how long it took for the car to overtake and return to its original speed.

Time taken = ... s
[2]

(b) Describe the motion of the car between 10 s and 20 s. [1]

.....

.....

(c) Write down an equation, as it appears on page 2, and then use it, together with data from the graph, to calculate the acceleration of the car during overtaking.

Equation: .....

..... [1]

Calculation: [2]

Acceleration = ... m/s^2.

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(d) Describe clearly what the shaded area of the graph represents. [2]

.....

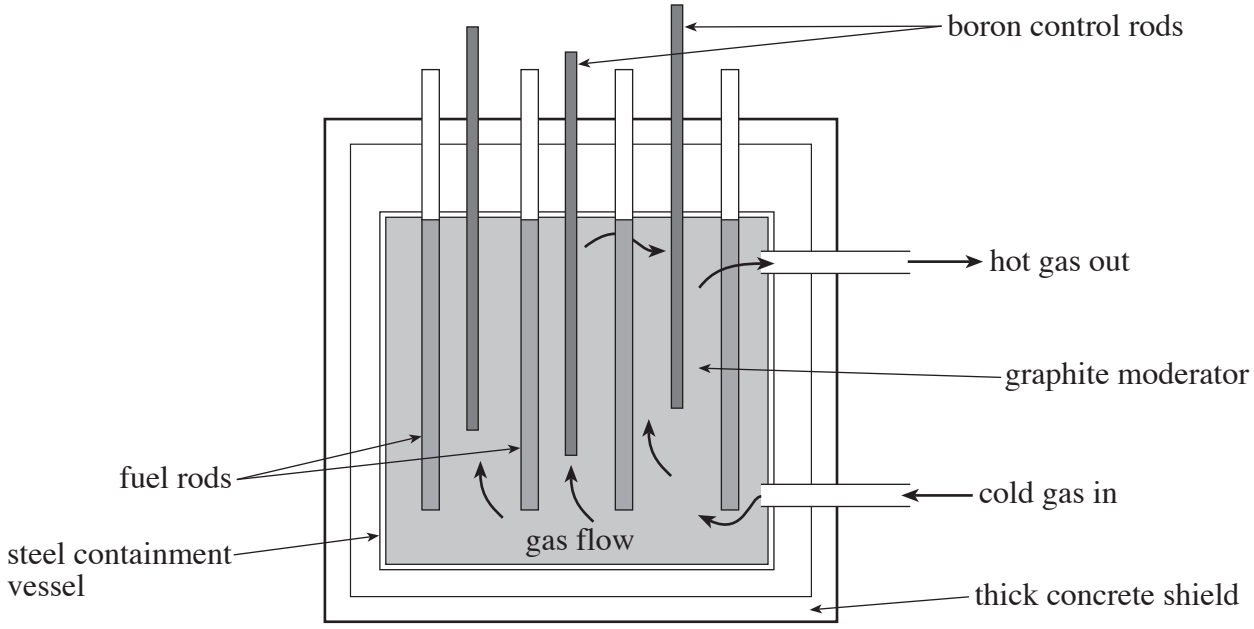
.....

.....

8

9. Read the information in the passage and study the diagram before answering the questions that follow.

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



In the reactor, energy is released by fission and is the result of a controlled chain reaction.

Fuel rods are made of U-238 (uranium 238) enriched with 3% of U-235. Only U-235 produces energy by fission. The U-235 nucleus captures a slow-moving neutron and splits to produce two new radioactive nuclei and up to three fast-moving extra neutrons plus energy.

The graphite moderator, surrounding the fuel rods, slows down the neutrons produced during fission. The extra neutrons, once slowed down, can produce more fission with other U-235 nuclei, which results in the release of even more energy and more neutrons.

The boron control rods readily absorb neutrons to reduce their number so that the chain reaction can be slowed or stopped. This prevents an uncontrolled chain reaction occurring.

Gas circulating the reactor carries away the heat energy produced to be used in electricity generation.

The whole core is encased in a steel-lined concrete shield to absorb stray neutrons and other radiation produced in the reactor.

(a) (i) Which isotope of uranium produces energy in the reactor? .....

(ii) Give a reason why the control rods are made of boron.

.....

(iii) State how the energy released in the reaction is removed to be used for the generation of electricity.

.....

..... [3]

(b) (i) Describe the process of fission as it occurs in a gas-cooled reactor. [2]

.....

.....

.....

.....

(ii) Explain how the moderator helps the reaction. [2]

.....

.....

.....

(iii) Explain how and why the partial removal of the boron control rods would affect the energy production in the reactor. [2]

.....

.....

.....

.....

9