Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						4	4	3	7	/	6	H	Signature	

Paper Reference(s)

4437/6H

Examiner's use only

Team Leader's use only

London Examinations IGCSE

Science (Double Award)

Physics

Paper 6H

Higher Tier

Thursday 22 May 2008 – Morning

Time: 1 hour 30 minutes

Materials required for examination
Ruler, protractor, compasses, pencil and calculator

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number and candidate number, your surname, initial(s) and signature.
The paper reference is shown at the top of this page. Check that you have the correct question paper.
Answer **ALL** the questions in the spaces provided in this question paper.
Show all the steps in any calculations and state the units.
Calculators may be used.

Information for Candidates

The total mark for this paper is 90. The marks for parts of questions are shown in round brackets: e.g. **(2)**.
Useful formulae are given on page 2.
This paper has 11 questions. All blank pages are indicated.

Advice to Candidates

Write your answers neatly and in good English.

Question Number	Leave Blank
1	
2	
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9	
10	
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Total	

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FORMULAE

You may find the following formulae useful.

energy transferred = current × voltage × time	$E = I \times V \times t$
pressure × volume = constant	$p_1 \times V_1 = p_2 \times V_2$
$\text{frequency} = \dfrac{1}{\text{time period}}$	$f = \dfrac{1}{T}$
$\text{power} = \dfrac{\text{work done}}{\text{time taken}}$	$P = \dfrac{W}{t}$
$\text{power} = \dfrac{\text{energy transferred}}{\text{time taken}}$	$P = \dfrac{W}{t}$

Where necessary, assume the acceleration of free fall, $g = 10\ \text{m/s}^2$.

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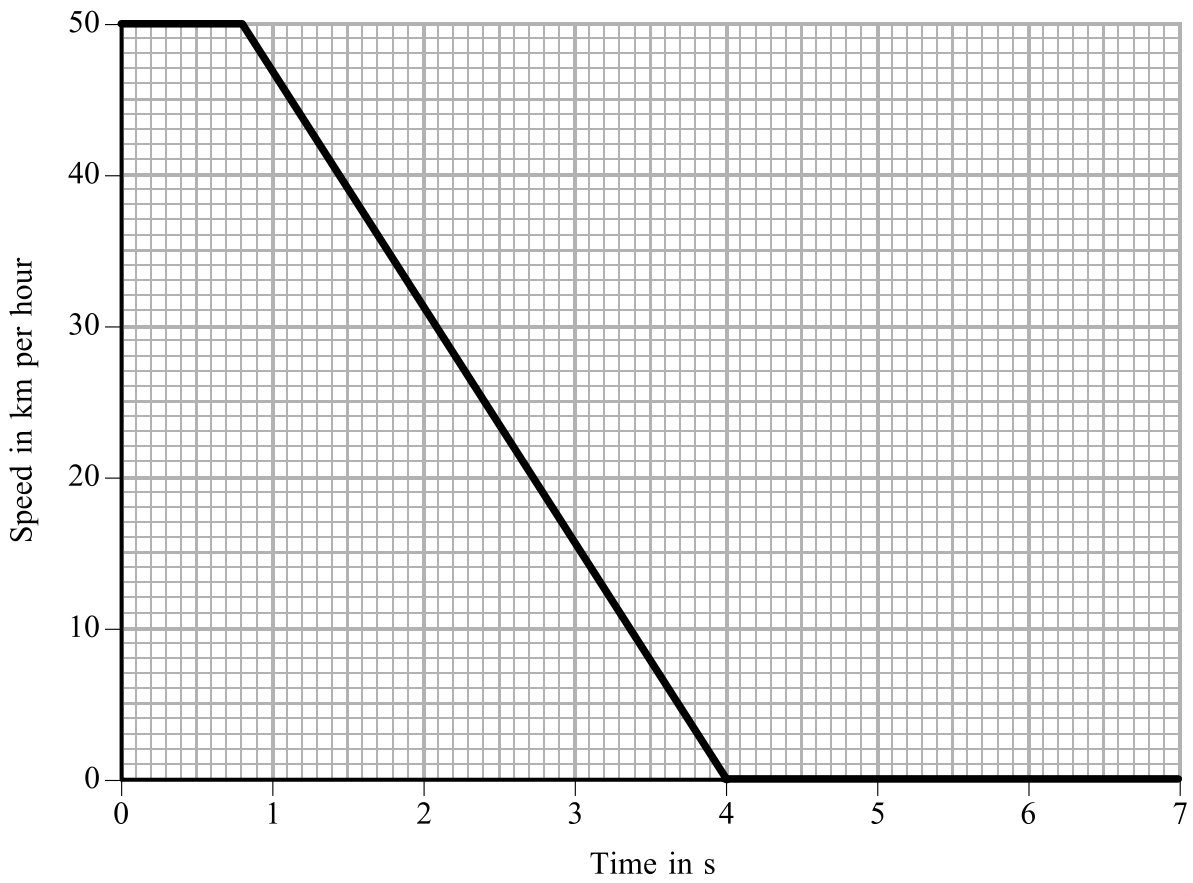
1. (a) A child runs out in front of a car. The driver makes an emergency stop. The graph shows the speed of the car from the time when the driver sees the child on the road.



(i) State the driver's reaction time in seconds.

Time = ... s

(1)

(ii) State the time in seconds for the brakes to stop the car.

Time = ... s

(1)

(iii) Draw **two** more lines on the grid above to show how the speed might change if the driver has been drinking alcohol **and** the road is slippery.

(2)

Leave blank

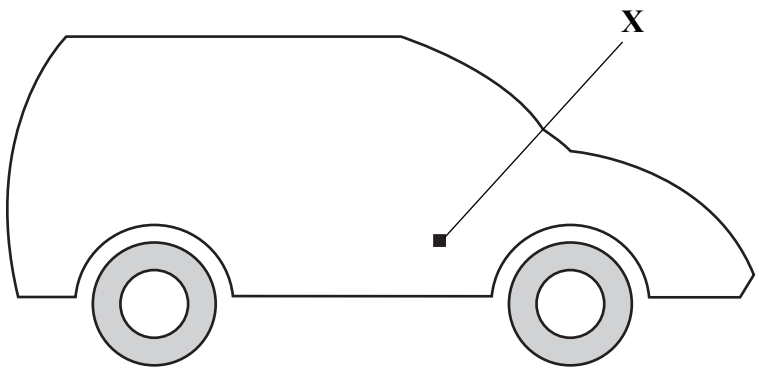
(b) The condition of the tyres and the condition of the road surface are two factors which affect the force of friction on a car.

(i) Name **one** other factor which affects the force of friction on a car.

.....

(1)

(ii) The diagram shows a car. The centre of gravity of the car is at the point labelled **X**.
Add to the diagram an arrow showing the weight of the car.



(1)

Q1

(Total 6 marks)

Leave blank

2. Parts of the electromagnetic spectrum have various uses.

(a) Which part is used for

(i) heaters and night vision equipment,

.....

(1)

(ii) sterilising food and medical equipment?

.....

(1)

(b) All the parts of the electromagnetic spectrum are transverse waves.

(i) State **one** property which all the parts have in common but which is **not** shared with other waves.

.....

(1)

(ii) Give **one** example of a transverse wave which is **not** part of the electromagnetic spectrum.

.....

(1)

(iii) Complete the sentence below.

In a transverse wave, each point on the wave is moving in a direction

which is ..... to the direction in which

the ..... of the wave is moving.

(2)

Q2

(Total 6 marks)

Leave blank

3. A student connects a light dependent resistor (LDR) to a battery.

(a) The current in the LDR is 0.050 A and its resistance is 90 Ω in the dark.

(i) State the equation which relates current, resistance and voltage.

.....

.....

(1)

(ii) Calculate the voltage across the LDR. Show your working and give the unit.

.....

.....

Voltage = ...

(2)

(b) The LDR is moved to a position in the light.

Choose words from the box to complete the table.
You may use each word once, more than once or not at all.

decrease	**increase**	**stay the same**

Effect on …	**It will …**
the resistance of the LDR	
the current in the LDR	

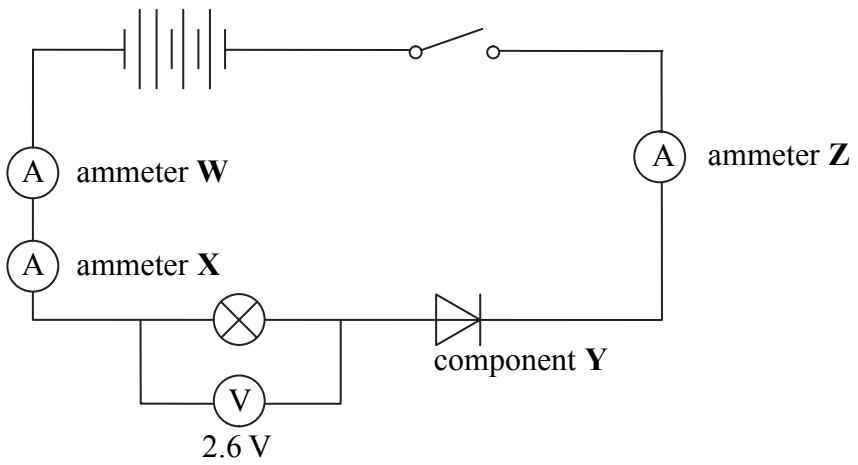
(2)

Q3

(Total 5 marks)

Leave blank

4. (a) The diagram shows how a student connects several components in a circuit. The student uses four identical 1.5 volt cells.



(i) Identify component **Y**.

.....

(1)

(ii) The reading on ammeter **Z** is 50 mA.

What is the reading in milliamps on each of the other two ammeters?

ammeter **W** = ... mA ammeter **X** = ... mA

(1)

(iii) The student expected the lamp to be brighter and the reading on the voltmeter to be 6.0 V.
The voltmeter is working correctly.

Give **two** reasons why the reading on the voltmeter is less than 6.0 V.

1 .....

.....

(1)

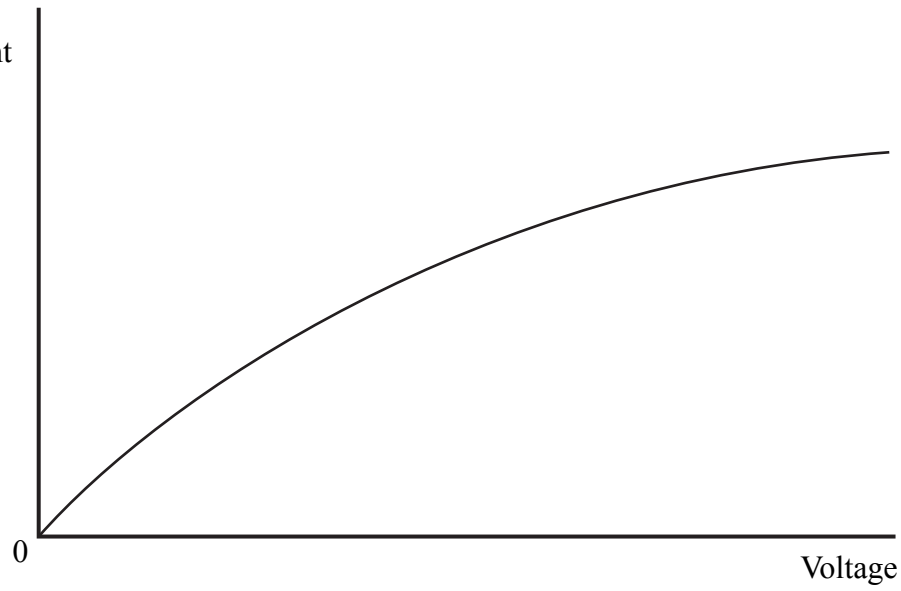
2 .....

.....

(1)

Leave blank

(b) The graph shows how the current in a filament lamp varies with the voltage across it.



Explain why the graph is not a straight line.

.....

.....

.....

.....

.....

(3) **Q4**

(Total 7 marks)

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5. (a) The kelvin scale of temperature starts at the absolute zero of temperature.

(i) Describe the motion of all molecules at absolute zero.

.....

.....

(1)

(ii) What temperature in degrees Celsius is equal to absolute zero?

..... °C

(1)

(iii) What temperature in kelvin is equal to 100 °C?

..... K

(1)

(b) Read the following passage.

> In 1827 Robert Brown, a Scottish botanist, was using a microscope to view a suspension of pollen grains in water.
>
> He noticed that the grains were moving about randomly.
>
> At first he thought that this might be caused by life hidden within the pollen grains. However when he studied particles of dye in water, he found the same erratic motion.
>
> Robert Brown could not explain the movement of the particles. However, because he was the first person to describe the movement, it is now called Brownian motion.

How do scientists now explain Brownian motion?

.....

.....

.....

.....

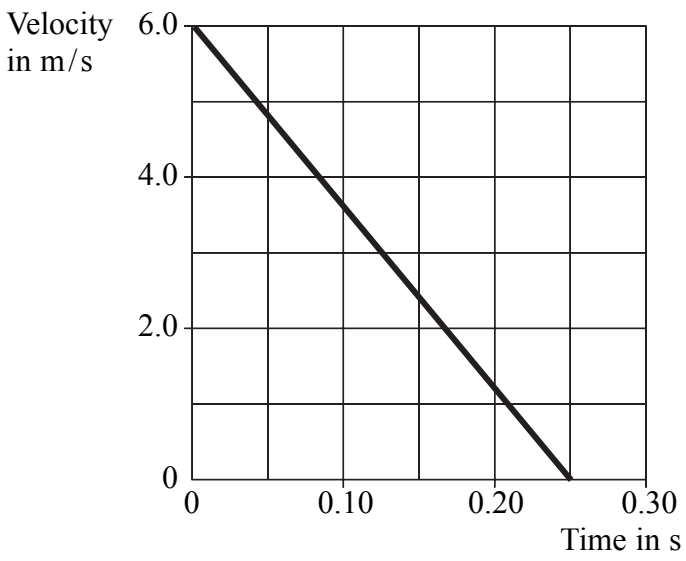
(3)

(Total 6 marks)

Q5

Leave blank

6. (a) A boy jumps off a wall and lands on the ground without bending his knees. The graph shows how the velocity of the boy varies with time as he lands.



(i) What property of a velocity-time graph can be used to determine acceleration?

.....

(1)

(ii) Use the graph to calculate the boy's deceleration and give its unit.

.....

.....

Deceleration = ...

(3)

(iii) The mass of the boy is 70 kg. Calculate the resultant force in newtons acting on the boy.

.....

.....

Force = ... N

(3)

Leave blank

(b) Explain why the boy should bend his knees as he lands.

.....

.....

.....

.....

.....

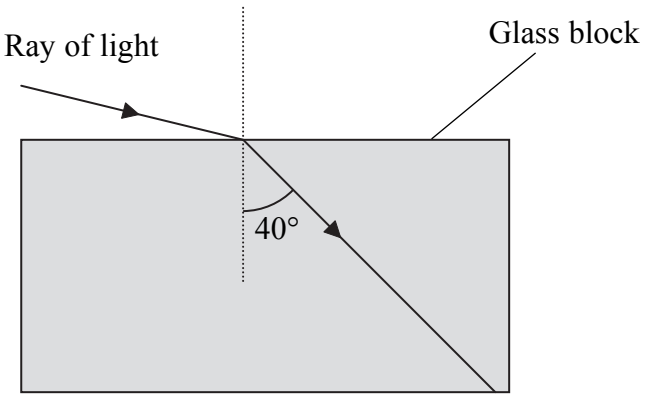
(3)

Q6

(Total 10 marks)

Leave blank

7. A student used pins to trace a ray of light through a block of glass of refractive index 1.5.
She produced the diagram shown below.
It shows a ray of light being refracted with an angle of refraction of 40°.



(a) Calculate the angle of incidence, in degrees, of the ray of light.

.....

.....

Angle of incidence = ...°

(3)

(b) The experiment is repeated with a 'block' of water. The refractive index of water is 1.3. The same angle of incidence is used.

(i) On the diagram above draw the refracted ray for a 'block' of water.

(1)

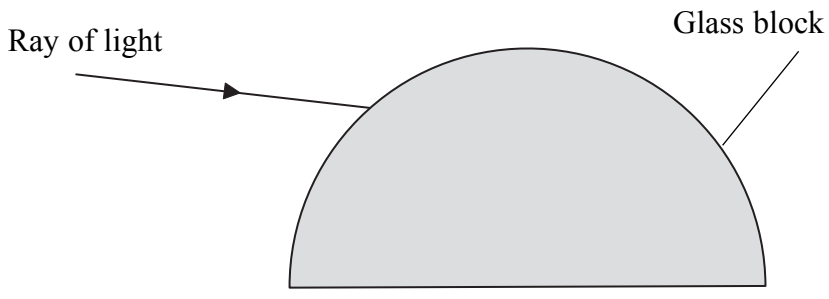
(ii) Explain the direction of the ray that you have drawn in (i).

.....

.....

(2)

(c) The diagram below shows a semicircular glass block. An incident ray is drawn.
Add one more line to the diagram and mark the angle of incidence, *i*, for this ray.



(2) **Q7**

(Total 8 marks)

Leave blank

8. A class of students was taken to a materials-testing laboratory. The diagram shows an impact tester that they saw during their visit. The tester measures how much energy is needed to fracture a specimen of a material.

The mass is raised as in Figure 1. When released it falls and collides with the specimen. If the specimen fractures, the mass may have sufficient energy to follow through up to a certain height as in Figure 2.

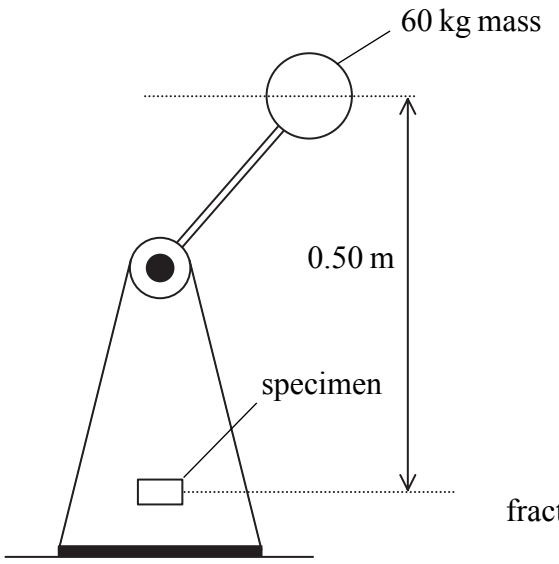


Figure 1

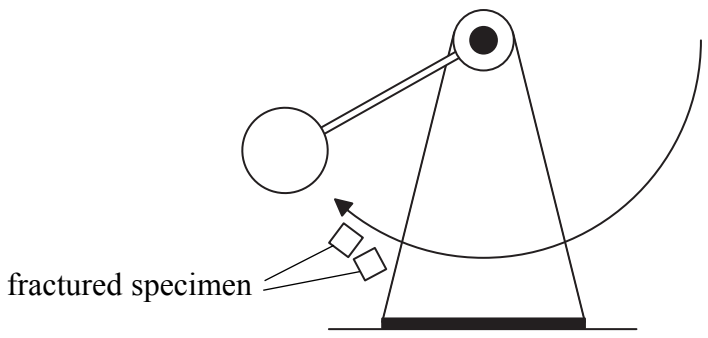


Figure 2

(a) Use the phrases from the box to write a word equation.

energy required to fracture the specimen
final gravitational potential energy of the mass
initial gravitational potential energy of the mass

.....

.....

.....

(1)

Leave blank

(b) Before the test, the 60 kg mass was raised 0.50 m.

(i) Calculate its initial increase in gravitational potential energy in joules.

.....

.....

Initial increase in gravitational potential energy = ... J

(2)

(ii) State the kinetic energy in joules of the mass just before it strikes the specimen.

Kinetic energy = ... J

(1)

(iii) Calculate the speed in metres per second of the mass just before it strikes the specimen.

.....

.....

Speed = ... m/s

(2)

(iv) Why might the speed be less than that calculated in (i)?

.....

.....

(1)

(v) The specimen fractures and the mass retains 70 J of its initial gravitational potential energy. Calculate the energy required in joules to fracture the specimen.

.....

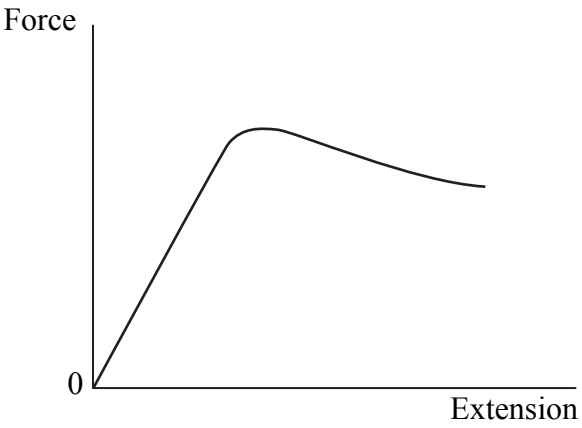
.....

Energy required = ... J

(2)

Leave blank

(c) The students also saw a material being stretched.
The graph shows the results.



(i) Name a material which would produce these results.

.....

(1)

(ii) Indicate on the graph the region associated with Hooke's law.

(1)

(iii) Explain your answer.

.....

.....

(1)

Q8

(Total 12 marks)

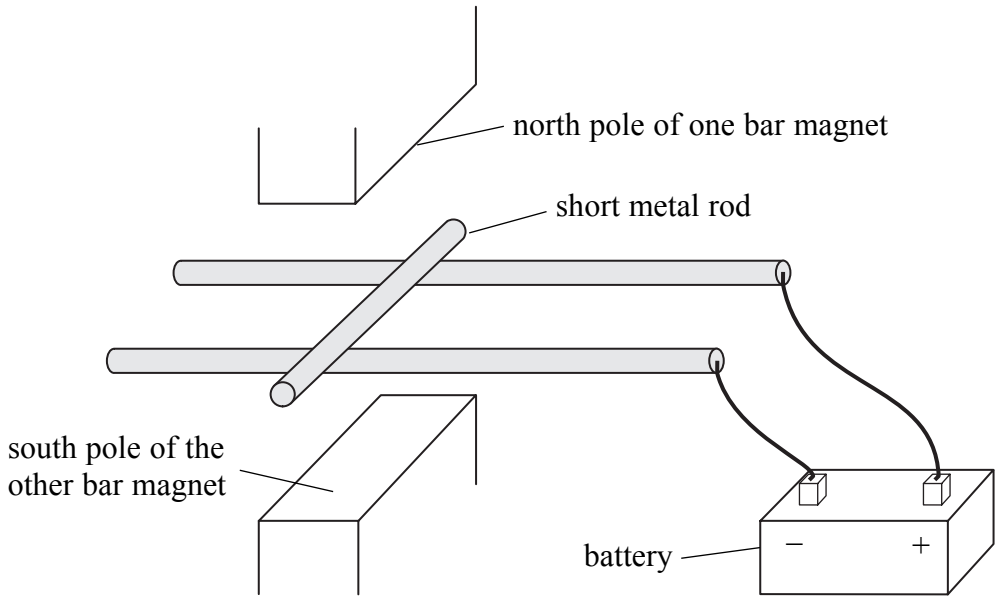
Leave blank

9. (a) When a wire carries a current perpendicular to a magnetic field it experiences a force. Name a rule that enables you to predict the direction of this force.

.....

(1)

(b) A teacher set up a demonstration using a 6 V battery, two bar magnets and three metal rods as shown in the diagram.



Add an arrow to the diagram to show the direction of

(i) the current in the short metal rod. Label it **I**.

(1)

(ii) the magnetic field between the two poles. Label it **M.**

(1)

(iii) the resulting force acting on the short metal rod. Label it **F**.

(1)

(c) State **two** changes that would increase the force acting on the short metal rod.

1 .....

2 .....

(2)

Leave blank

(d) (i) Explain what is meant by alternating current (a.c.). Illustrate your answer with a diagram.

.....

.....

.....

(3)

(ii) The 6 V battery in (b) is replaced by a 6 V a.c. 50 Hz power supply. Describe the resulting force now acting on the short metal rod.

.....

.....

.....

(2)

Q9

(Total 11 marks)

Leave blank

10. (a) During an experiment that led to the discovery of the neutron, a beryllium nucleus and a helium nucleus join to form a carbon-12 nucleus and a neutron.

The nuclear equation describing this process is shown below.

$$\text{.....}^{\text{.....}}\text{Be} + {}^{4}_{2}\text{He} \rightarrow {}^{12}_{6}\text{C} + {}^{\text{.....}}_{\text{.....}}\text{n}$$

Add to the equation the atomic and mass numbers for

(i) the neutron

(2)

(ii) the beryllium nucleus.

(2)

(b) (i) State which one of the four particles involved in the process in (a) is emitted during alpha emission.

.....

(1)

(ii) State what is emitted from a nucleus during beta emission.

.....

(1)

(c) (i) Carbon-14 is an isotope of carbon-12. Explain the term **isotope**.

.....

.....

.....

(2)

Leave blank

(ii) Show that when a nucleus of uranium-238 decays by one alpha emission followed by two beta emissions, the resulting nucleus is an isotope of uranium.
You may find the following information helpful.

Element	Symbol	Atomic number
Thorium	Th	90
Protactinium	Pa	91
Uranium	U	92
Neptunium	Np	93
Plutonium	Pu	94

.....

.....

.....

.....

.....

(3)

Q10

(Total 11 marks)

Leave blank

11. This question is about nuclear reactors.

In the process of nuclear fission a neutron collides with a uranium nucleus.

(a) Complete the sentences.

For each fission, two ..... nuclei and ..... neutrons are produced.

If these neutrons go on to collide with other uranium nuclei, a ..... reaction occurs.

The released neutrons have a greater .....than the original neutron.

(4)

(b) (i) Describe the role of the moderator in a nuclear reactor.

.....

.....

.....

.....

(2)

(ii) Describe the role of the control rods in a nuclear reactor.

.....

.....

.....

.....

(2) **Q11**

(Total 8 marks)

TOTAL FOR PAPER: 90 MARKS

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