London Examinations IGCSE

Physics
Paper 2H

Higher Tier

Wednesday 16 June 2010 – Morning

Time: 2 hours

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, 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. Write your answers in the spaces provided in this question paper.
Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).
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 120. The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**. There are 17 questions in this question paper.
Any blank pages are indicated.
Useful formulae are given on page 2.

Advice to Candidates

Write your answers neatly and in good English.

Turn over

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FORMULAE

You may find the following formulae useful.

energy transferred = current × voltage × time $\qquad E = I \times V \times t$

pressure × volume = constant $\qquad p_1 \times V_1 = p_2 \times V_2$

$\dfrac{\text{pressure}}{\text{kelvin temperature}} = \text{constant} \qquad \dfrac{p_1}{T_1} = \dfrac{p_2}{T_2}$

$\text{frequency} = \dfrac{1}{\text{time period}} \qquad f = \dfrac{1}{T}$

$\text{power} = \dfrac{\text{work done}}{\text{time taken}} \qquad P = \dfrac{W}{t}$

$\text{power} = \dfrac{\text{energy transferred}}{\text{time taken}} \qquad P = \dfrac{W}{t}$

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

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1. The circuit diagram shows how a student connects several components. These include four identical 1.5 volt cells.
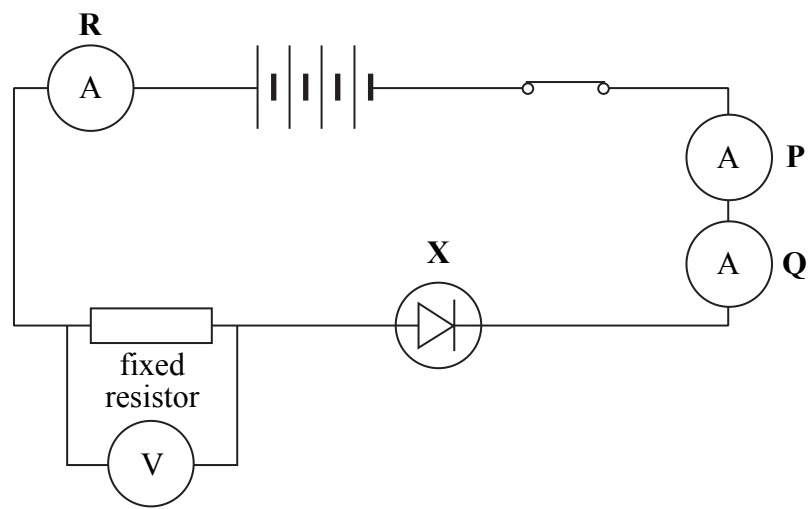
(a) Identify component **X**.

....
(1)

(b) State a difference between a fixed resistor and a variable resistor.

....

....
(1)

(c) (i) Complete the sentence.

The four 1.5 volt cells are called a ....
(1)

(ii) Calculate the voltage, in volts, across the four cells.

....

Voltage = ... V
(1)

(iii) The voltage across the fixed resistor is 3.8 V.
Calculate the voltage, in volts, across the rest of the circuit.

....

Voltage across the rest of the circuit = ... V
(1)

(d) The reading on ammeter **R** is 40 mA.
State the reading in milliamps on each of the other two ammeters.

ammeter **P** = ... mA   ammeter **Q** = ... mA

(1)

(Total 6 marks)

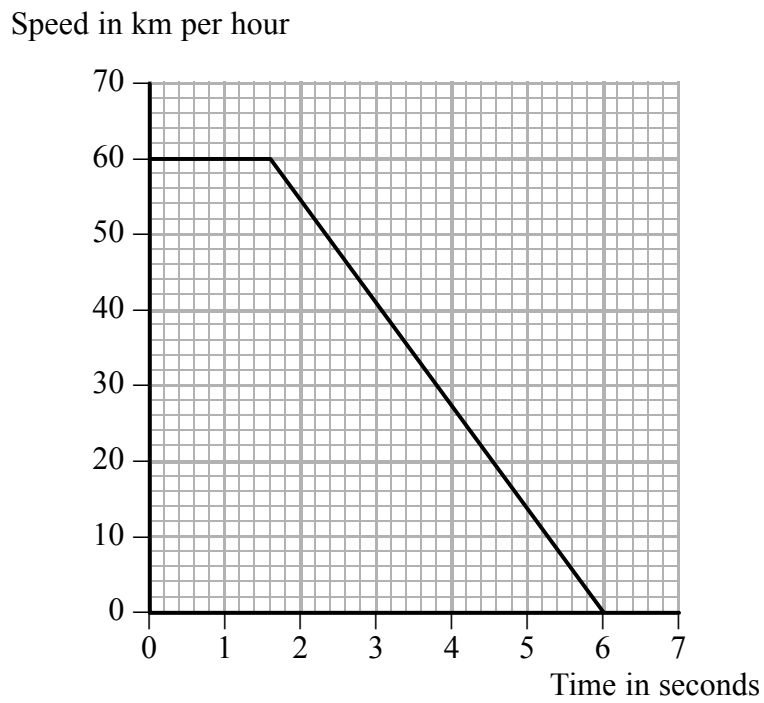**2.** A child runs out in front of a truck. The driver makes an emergency stop.
The graph shows the speed of the truck from the time when the driver first sees the child.

Speed in km per hour

Time in seconds

(a) (i) State the time, in seconds, for the driver to react.

Time = ... s

(1)

(ii) Calculate the time, in seconds, for the brakes to stop the truck.

Time = ... s

(1)

(b) The driver had been drinking alcohol. State the effect this may have had on:

(i) the time for the driver to react;

....

(1)

(ii) the time for the brakes to stop the truck.

....

(1)

(c) Give one feature of the road conditions which may increase the stopping distance of a vehicle.

....
(1)

(d) The diagram shows a truck.

(i) The centre of gravity of the truck and its load is at the point labelled **C**.
Add to the diagram an arrow showing the total weight.

(1)

C
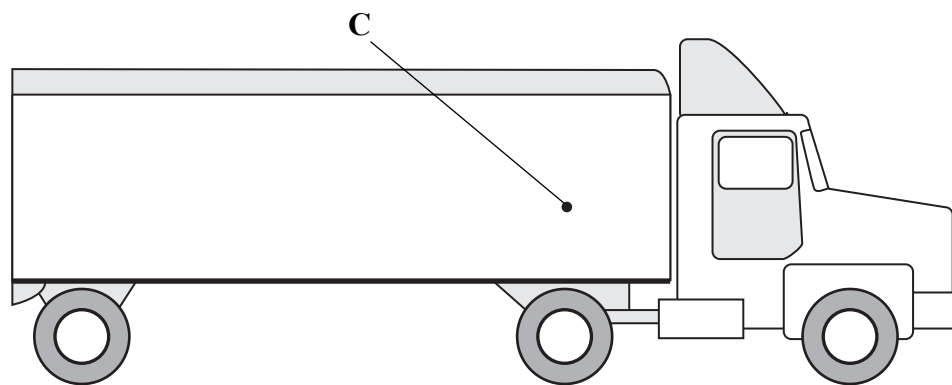
(ii) State the name of a force which opposes the motion of the truck.

....
(1)

Q2

(Total 7 marks)
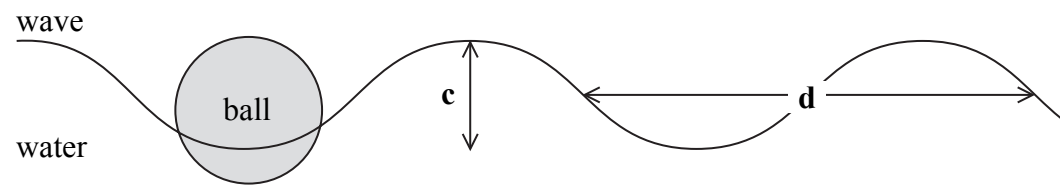
3. The diagram shows a wave on the surface of the water of a swimming pool and a ball floating on the water.

(a) Identify the features of the wave shown by:

(i) distance **c**;

....

(1)

(ii) distance **d**.

....

(1)

(b) A student observes the wave.
There are thirty complete cycles in one minute.

Calculate the frequency, in hertz, of the waves.

....

....

Frequency = ... Hz

(2)

(c) (i) Identify the type of wave.

....

(1)

(ii) Describe the motion of the ball as the wave occurs.

....

....

(1)

(Total 6 marks)

4. This question is about two types of power station.
In each case complete the sentences to identify the forms of energy involved in the energy transfers.

(a) In an oil-burning power station, oil is burned to heat water.
The water boils to give steam.
The steam spins a turbine connected to a generator.

    (i) The oil has .... energy.

(1)

    (ii) The spinning turbine has .... energy.

(1)

    (iii) The useful energy output from the generator is ....
energy.

(1)

(b) In a hydroelectric power station, water from a high dam falls down a pipe and spins a turbine.

    (i) The useful energy transfer in the pipe is

    from .... energy to .... energy.

(2)

    (ii) Some energy is wasted as .... energy.
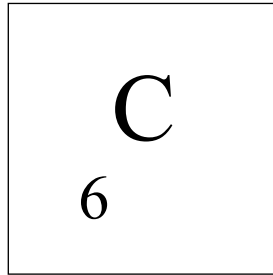
(1)   **Q4**

(Total 6 marks)

5. (a) Complete the symbol in the box to describe the nucleus of carbon-14.

$$C_{6}$$

(1)

(b) The atomic number of carbon is 6.
Complete the sentence.

The atomic number is the number of .... in the

....

(1)

(c) Complete the sentence.

Carbon-12 and carbon-14 are .... of carbon.

(1)

(d) Alpha, beta and gamma are ionising radiations.
Complete the sentences.

(i) The two which are particles are .... and ....

(1)

(ii) Ionising radiations are emitted from unstable nuclei in a radioactive decay

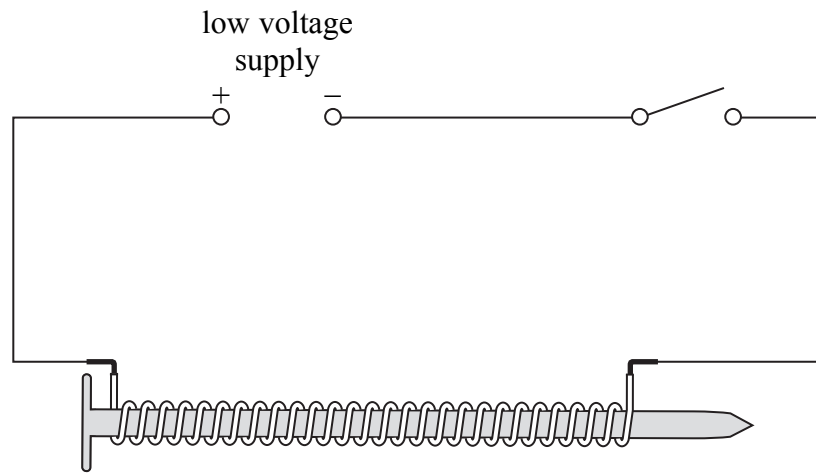process which is ....

(1)

(Total 5 marks)

Q5

6. A student wraps an insulated wire around a large iron nail.
She removes the insulation from the ends of the wire.
Then she connects the wire in the circuit shown.

low voltage
supply

(a) State the name of the device which the student has made.

....
(1)

(b) Explain why the student uses insulated wire.

....

....

....
(2)

(c) (i) Explain how the student can show that the device works.

....

....
(1)

(ii) Explain how the student can use the device to show that iron is a magnetically soft material.

....

....
(1)

(Total 5 marks)

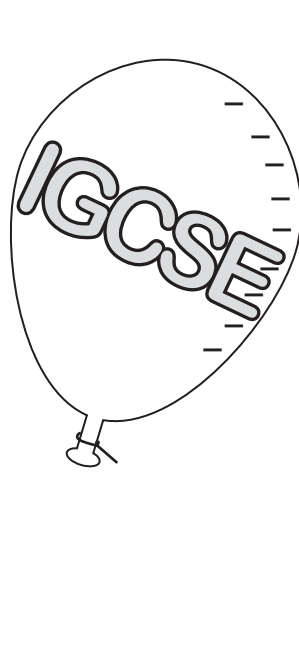**BLANK PAGE**

7. A balloon is rubbed with a dry cloth on a dry day.
The balloon then sticks to a wall.
This is because the balloon has gained negative charge.

Complete the following sentences.

(a) As the balloon is rubbed, ... are transferred

from the .... to the ....

by ....

(3)

(b) The surface of the wall near to the balloon has a ....charge.

This is because objects with .... charges attract each other.

(2)

(Total 5 marks)

Q7

8. The diagram shows a large irregular-shaped block of ice floating in the sea.

air

water vapour
in the air

ice
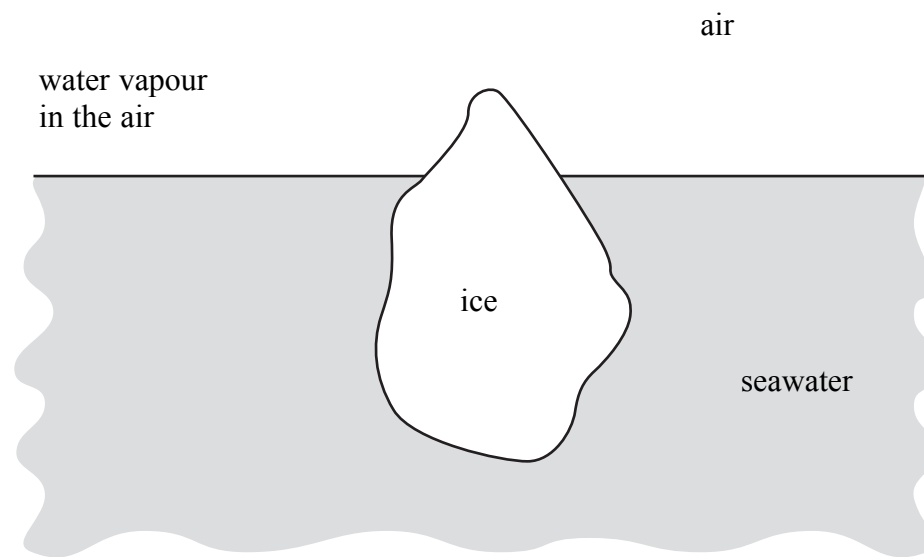
seawater

(a) Everything is made of particles.

Which label in the diagram fits the description in the following box?

> The particles vibrate about fixed positions
> within a close-packed regular structure.

Put a cross (☒) in the correct box.

☐ **A** air

☐ **B** ice

☐ **C** seawater

☐ **D** water vapour in the air

(1)

(b) Complete the sentences.

(i) The ice changes to water by the process of ....

(1)

(ii) Water molecules in the sea usually become water molecules in the air by the

process of ....

(1)

(c) Complete the sentence.

In a liquid, the particles are in a .... irregular structure

and their motion is ....

(2)

(Total 5 marks)

9. (a) Put a cross (⊠) in two boxes to show which of the following statements are correct.

☒ **A** 1 V is the ratio of energy transferred to charge passed.

☒ **B** 1 V is the voltage when a current of 1 A dissipates 1 W of power.

☒ **C** 1 V is the voltage when 1 J of energy is transferred when 1 C of charge passes.

☒ **D** 1 V is the ratio of resistance to current.

(2)

(b) The diagram shows a battery connected to a resistor.
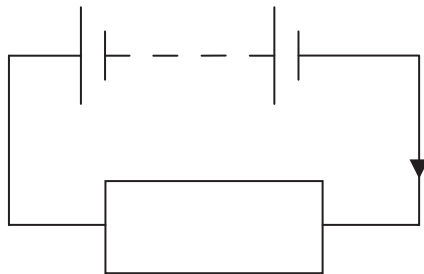
The terms 'conventional flow' and 'electron flow' are both used in current electricity.

(i) Which one is represented by the arrow in this circuit?

.... flow

(1)

(ii) Explain your answer in (i).

....

....

....

(1)

(iii) A student set up this circuit.
She added an ammeter to measure the current in the circuit and a voltmeter to measure the voltage across the resistor.
Add these meters to the circuit diagram.

(2)

(c) The student also had a stopwatch.
She recorded the following readings:

$V = 3.0$ V
$I = 0.75$ A
$t = 2.0$ minutes.

Calculate:

(i) the charge, in coulombs, passing through the resistor in 2.0 minutes

....

....

Charge =.............................. C.

(2)

(ii) the energy, in joules, transferred to the resistor in 2.0 minutes.

....

....

Energy transferred = ... J

(2)

Q9

(Total 10 marks)

10. The diagram shows a torch emitting a beam of light from two different positions **A** and **B** under water.
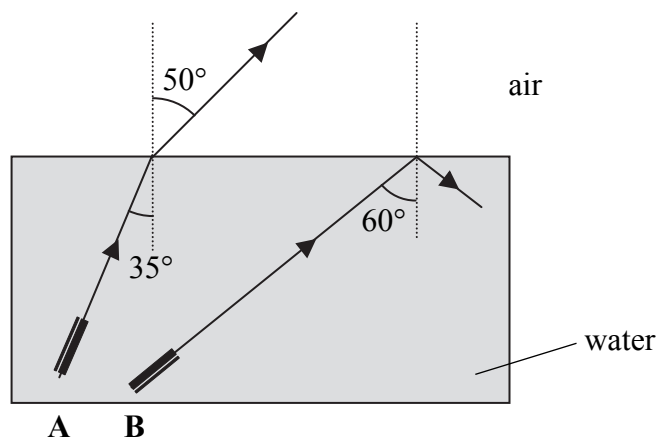
(a) What is the name of the two dotted lines on the diagram?

....
(1)

(b) State the relationship between critical angle and refractive index.

....

....
(1)

(c) Explain the paths followed by the two beams of light.
Refer to the critical angle in your answers.

(i) Path from position **A**.

....

....

....
(2)

(ii) Path from position **B**.

....

....

....
(2)

(d) Explain why it is not possible to use the relationship in (b) to find the refractive index of water using an angle from the diagram.

....

....

(1)

(e) (i) State the relationship between refractive index, angle of incidence and angle of refraction.

....

....

(1)

(ii) Use angles from the diagram to calculate the refractive index of water.

....

....

....

Refractive index = ...

(2)

(Total 10 marks)

Q10

Turn over

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11. A weightlifter lifts a bar of mass 240 kg through a vertical distance of 2.5 m.

(a) Calculate the gain in gravitational potential energy, in joules, of the bar.

....

....

Gain in gravitational potential energy = ... J

(2)

(b) She then lowers the bar halfway, stops and then drops the bar.
Calculate:

(i) the loss in gravitational potential energy, in joules, of the bar when it is halfway down;

....

Loss in gravitational potential energy = ... J

(1)

(ii) the remaining gravitational potential energy, in joules, of the bar when it is halfway down;

....

Remaining gravitational potential energy = ... J

(1)

(iii) the speed, in metres per second, of the bar just before it hits the floor.

....

....

....

Speed = ... m/s
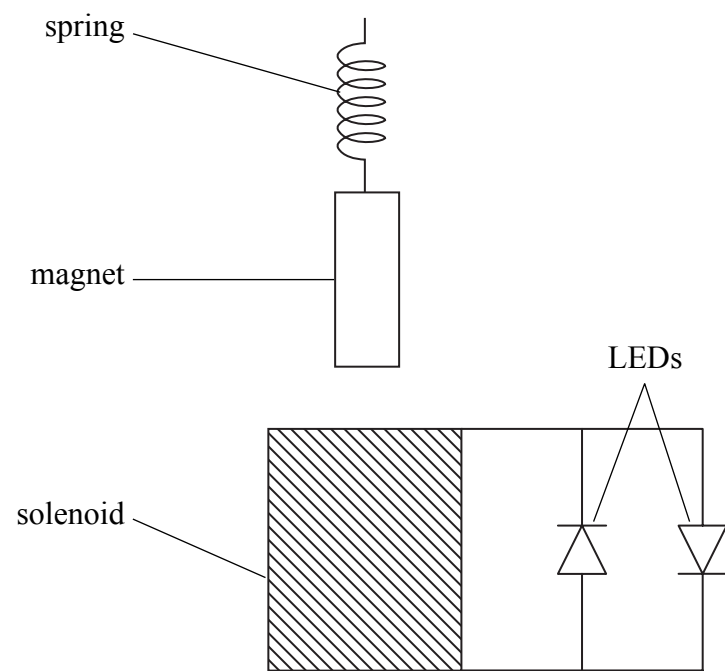
(3)

Q11

(Total 7 marks)

12. A teacher demonstrates electromagnetic induction to her class using the apparatus shown below.

A magnet suspended from a spring moves up and down along the axis of a solenoid.

The solenoid is connected to two light-emitting diodes (LEDs).

An LED is a diode that emits light when a current passes through it.

(a) Explain why there is a current in the solenoid when the magnet is moving.

....

....

....

....

(2)

(b) Explain why only one of the LEDs lights up when the magnet moves down.

....

....

....

....

(2)

(c) What is the purpose of the other LED in this demonstration?

....

....

....

(1)

(d) Explain why the average brightness of both LEDs decreases with time.

....

....

....

....

....

....

....

....

....

(3)

(e) Suggest two ways in which this demonstration could be improved.

1 ....

....

2 ....

....
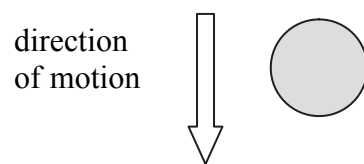
(2)

Q12

(Total 10 marks)

13. In 1907, a tradition started of dropping a ball, made from wood and iron, into Times Square in New York at midnight on New Year's Eve.
The ball had a mass of 300 kg and was dropped from a great height.

(a) Calculate the weight, in newtons, of the ball.

....

Weight = ... N

(2)

(b) The diagram shows a falling ball.

direction
of motion

(i) Add a labelled arrow to the diagram to show the weight of the ball.

(1)

(ii) Add another arrow to the diagram to show another force acting on the ball during its fall through the air.

(1)

(iii) State the name of this force.

....

(1)

(c) Eventually the ball reached terminal velocity when it was travelling at constant speed.

Explain why the ball reached terminal velocity.

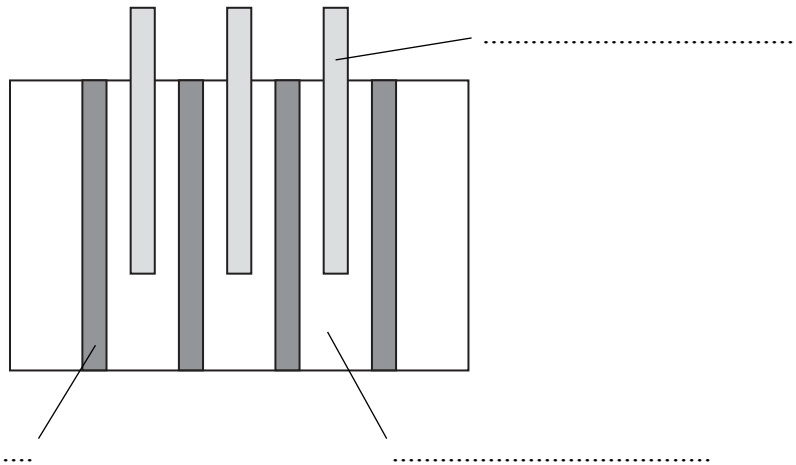..

....

....

....

....

....

....

(3)

(Total 8 marks)

14. (a) The diagram represents the inside of a nuclear reactor.

....

....

....

Complete the labels.

(3)

(b) State a material from which each part of a nuclear reactor may be made.

Part	Material
control rod	
fuel rod	
moderator	
outer shield	

(2)

(c) (i) State the part in which nuclear fission takes place.

....

(1)

(ii) Describe the process of nuclear fission.

....

....

....

....

....

....

....

....

....

(4)

Q14

(Total 10 marks)

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15. In 1897, J.J.Thomson suggested a model for the atom that consisted of a cloud of positive charge surrounding a number of small particles called electrons.
This model of the atom was known as the 'plum pudding' model and is shown in **Figure 1**.

cloud of positive charge

atom

electrons
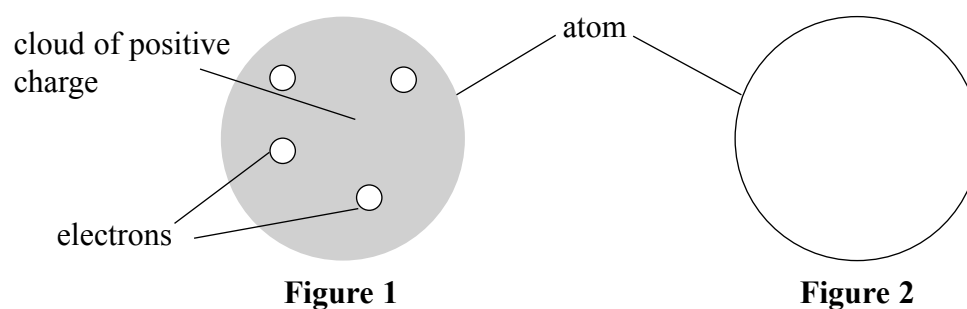
Figure 1

Figure 2

(a) In 1910, E.Rutherford proposed the 'nuclear' model of the atom.
Add two labels to **Figure 2** to show the positions of the nucleus and the electrons in the nuclear model.

(2)

(b) The evidence for the nuclear model was provided by the results of alpha particle scattering experiments carried out by Geiger and Marsden.
In these experiments they directed alpha particles at a thin gold foil.
The path of one of these alpha particles is shown in **Figure 3**.
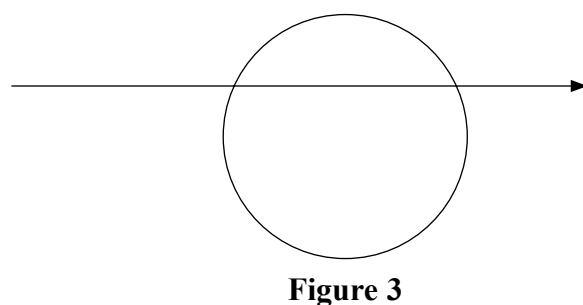
Figure 3

(i) Explain this straight-line path.

....

....
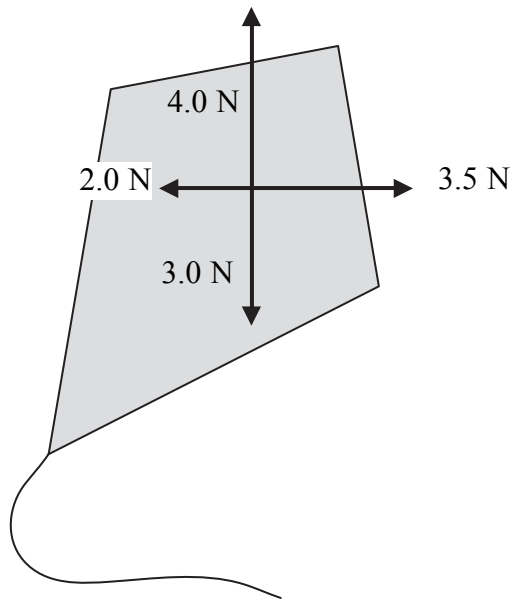
(1)

(ii) Draw another possible path on **Figure 3** which is not a straight line.

(1)

(iii) State a property of the nucleus that accounts for the path you have drawn.

....

(1)

Q15

(Total 5 marks)

16. The diagram shows a kite in the air and the size and direction of the forces which act on it.

(a) Calculate the resultant upward force, in newtons, on the kite.

....

Resultant upward force = ... N

(1)

(b) Calculate the resultant sideways force, in newtons, on the kite and state its direction.

Resultant sideways force = ... N

Direction ....

(2)

(c) The air temperature is 17 °C.
   Temperature is a scalar quantity.
   Explain what is meant by a scalar quantity.

   ....

   ....

   (2)

(d) State the word which is used to describe quantities, such as force and acceleration, which are **not** scalar quantities.

   ....

   (1)

(Total 6 marks)

17. (a) The temperature of absolute zero is –273 °C.

What is a temperature of –73 °C on the kelvin scale?

Temperature = ... K

(1)

(b) Some gas at a temperature of –73 °C and a pressure of 100 kPa has its temperature reduced by 50 °C.

(i) Calculate the new pressure, in kilopascals.

....

....

....

Pressure = ... kPa

(2)

(ii) State two assumptions that you have made in your calculation.

1 ....

2 ....

(2)

(c) The graph shows how the average speed of gas molecules varies with temperature.

Average
speed
in m/s
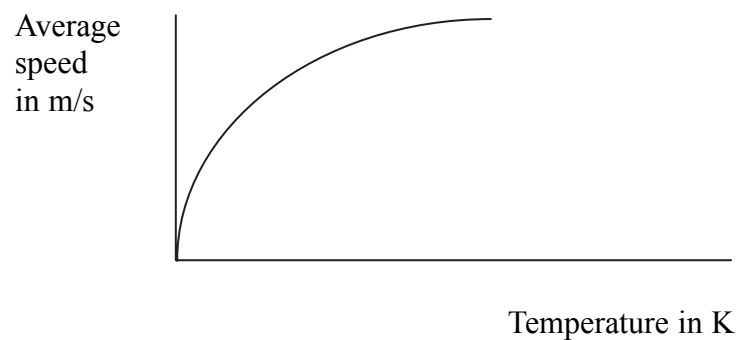
Temperature in K

(i) Mark the value of absolute zero on the graph.

(1)

(ii) What feature of the graph shows that average speed and temperature are **not** directly proportional to each other?

....

(1)

(iii) State a property of gas molecules that is directly proportional to the kelvin temperature.

....

....

(2)

(Total 9 marks)

TOTAL FOR PAPER: 120 MARKS

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