UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **0625/33**

Paper 3 Extended **May/June 2012**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall = 10 m / s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total	

This document consists of **19** printed pages and **1** blank page.

© UCLES 2012

UNIVERSITY of CAMBRIDGE International Examinations

1 Fig. 1.1 is a distance / time graph showing the motion of an object.

For Examiner's Use

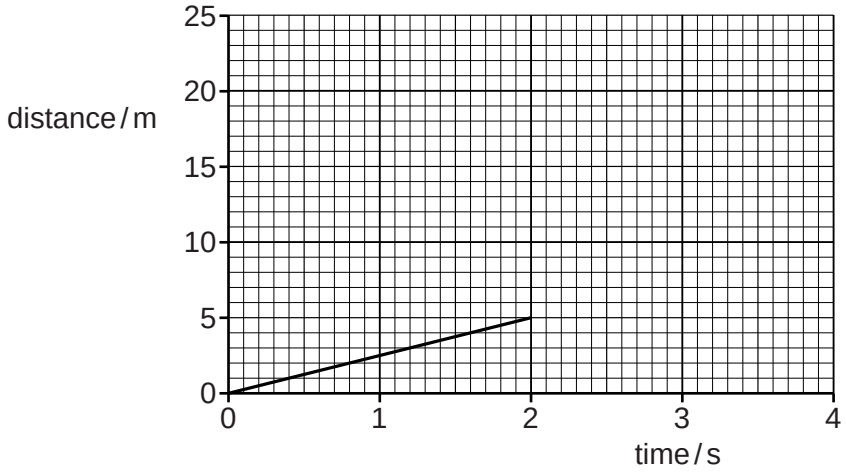


Fig. 1.1

(a) (i) Describe the motion shown for the first 2 s, calculating any relevant quantity.

.....

.....
[2]

(ii) After 2 s the object accelerates.

On Fig. 1.1, sketch a possible shape of the graph for the next 2 s.
[1]

(b) Describe how a distance / time graph shows an object that is stationary.

.....

..... [1]

© UCLES 2012

(c) Fig. 1.2 shows the axes for a speed / time graph.

For Examiner's Use

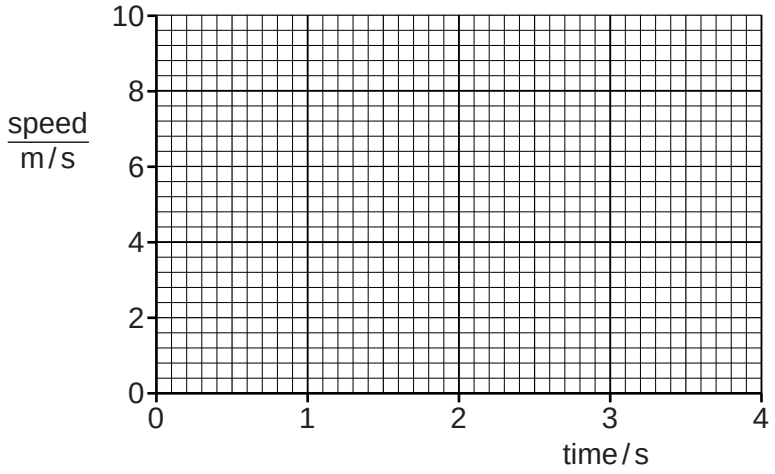


Fig. 1.2

On Fig. 1.2, draw

(i) the graph of the motion for the first 2 s as shown in Fig. 1.1,

(ii) an extension of the graph for the next 2 s, showing the object accelerating at 2 m / s^2.
[3]

(d) Describe how a speed / time graph shows an object that is stationary.

.....

..... [2]

[Total: 9]

2 Fig. 2.1 shows a mobile bird sculpture that has been created by an artist.

For Examiner's Use

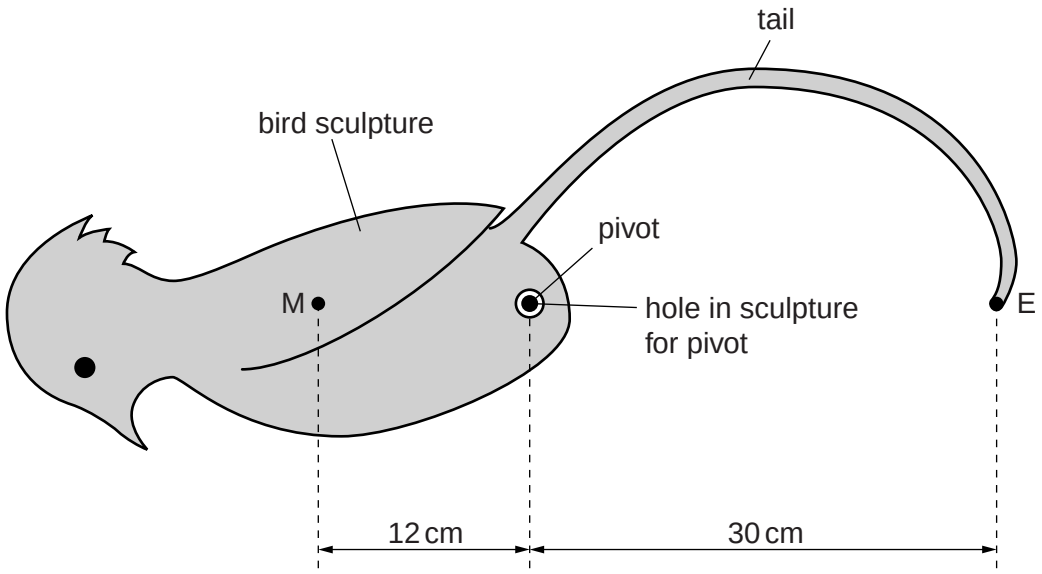


Fig. 2.1

M is the centre of mass of the bird sculpture, including its tail (but not including the counter-weight that will be added later). The mass of the bird and tail is 1.5 kg.

The bird sculpture is placed on a pivot.

The artist adds the counter-weight at the end E of the tail so that the bird remains stationary in the position shown.

(a) Calculate the mass of the counter-weight.

mass = ... [2]

(b) The centre of mass of the sculpture with counter-weight is at the pivot.

Calculate the upward force acting at the pivot.

force = ... [1]

© UCLES 2012

(c) The sculpture is rotated clockwise to the position shown in Fig. 2.2. It is held still, then carefully released.

For Examiner's Use

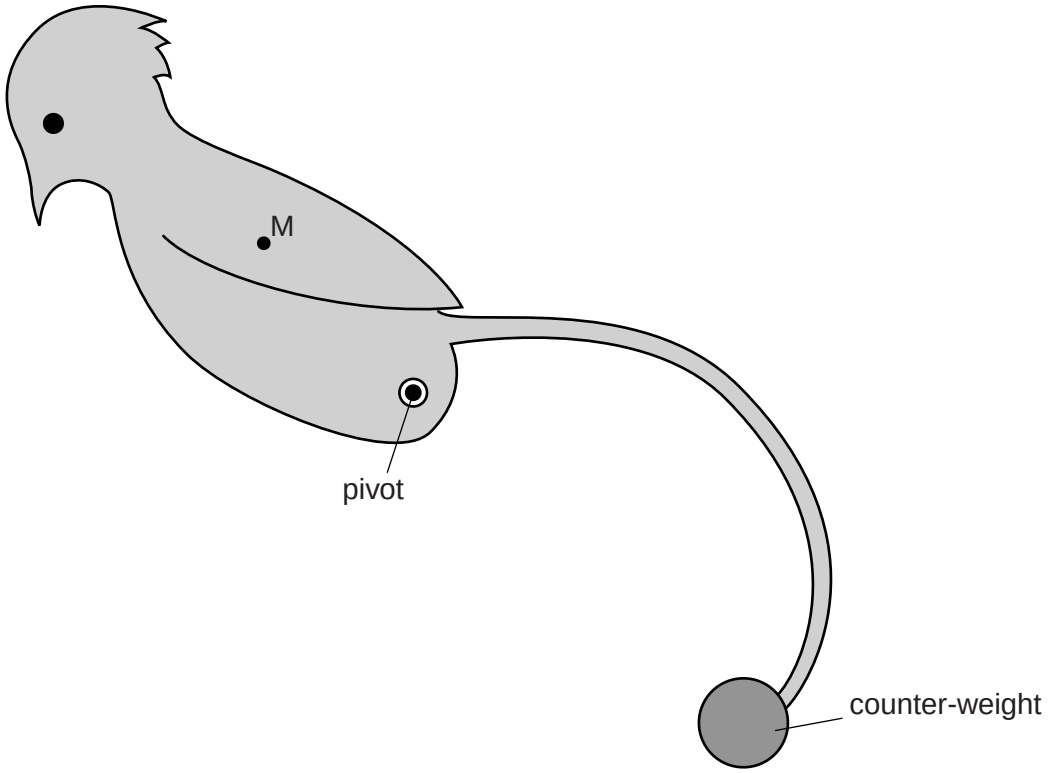


Fig. 2.2

(i) State whether the sculpture will stay in that position, rotate further clockwise or rotate back anticlockwise.

.....

.....

(ii) Explain your answer to **(i)**.

.....

.....

.....

.....

[3]

[Total: 6]

3 Fig. 3.1 shows a water turbine that is generating electricity in a small tidal energy scheme.

For Examiner's Use

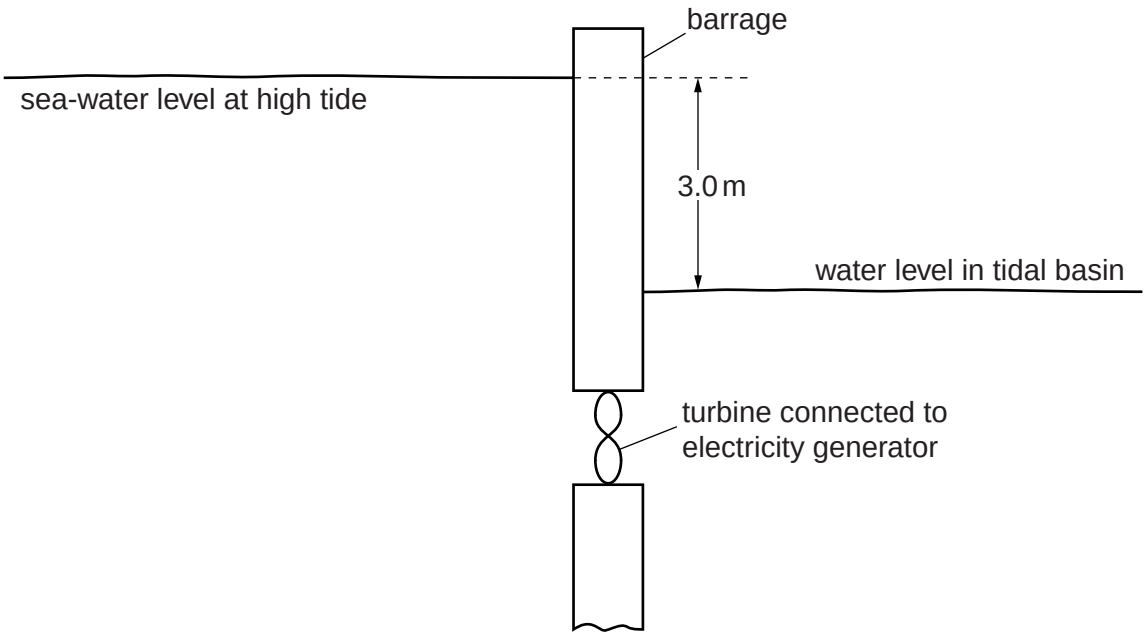


Fig. 3.1

At high tide, 1.0 m^3 of sea-water of density 1030 kg/m^3 flows through the turbine every second.

(a) Calculate the loss of gravitational potential energy when 1.0 m^3 of sea-water falls through a vertical distance of 3.0 m.

loss of gravitational potential energy = ... [3]

(b) Assume that your answer to **(a)** is the energy lost per second by the sea-water passing through the turbine at high tide. The generator delivers a current of 26 A at 400 V.

Calculate the efficiency of the scheme.

efficiency = ...% [3]

© UCLES 2012

(c) At low tide, the sea-water level is lower than the water level in the tidal basin.

For Examiner's Use

(i) State the direction of the flow of water through the turbine at low tide.

.....

(ii) Suggest an essential feature of the turbine and generator for electricity to be generated at low tide.

.....

.....

.....

[2]

[Total: 8]

For Examiner's Use

4 Figs. 4.1 and 4.2 show a semi-circular glass block as rays of blue light are directed into the block at different angles. The rays are directed towards the centre C of the semi-circle so that no refraction occurs as the rays enter the block.

(a) At the angle shown in Fig. 4.1, no refracted ray emerges from the block at C.

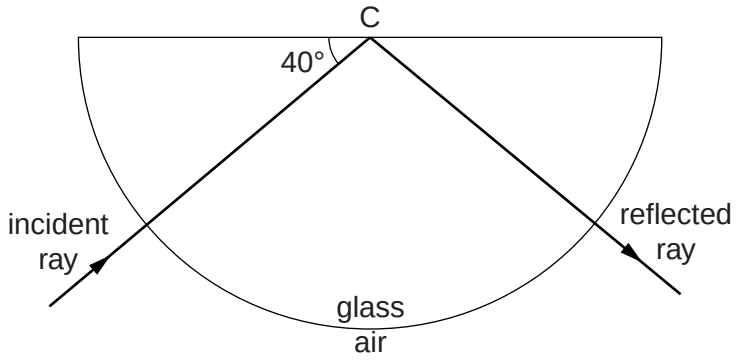


Fig. 4.1

(i) Determine the angle of reflection at C.

angle of reflection = ...

(ii) State the type of reflection occurring at C.

.....
[2]

(b)

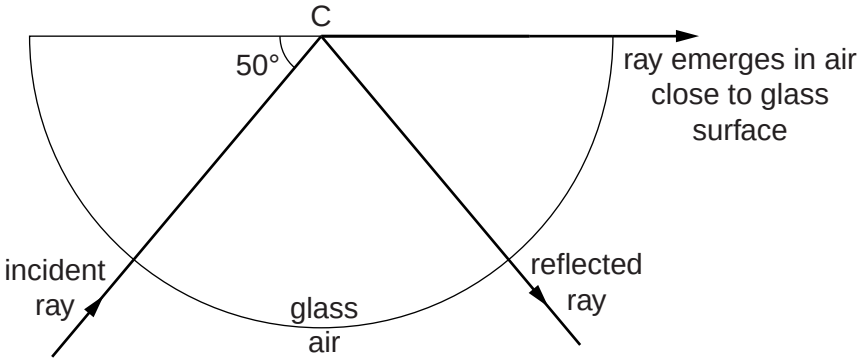


Fig. 4.2

Calculate the refractive index of the glass.

refractive index = ... [3]

© UCLES 2012

(c) The experiment in **(b)** is now repeated with red light.

For Examiner's Use

On Fig. 4.3, draw and label the paths of the reflected and refracted rays of red light. The dashed lines show the paths taken by the blue light in **(b)**.

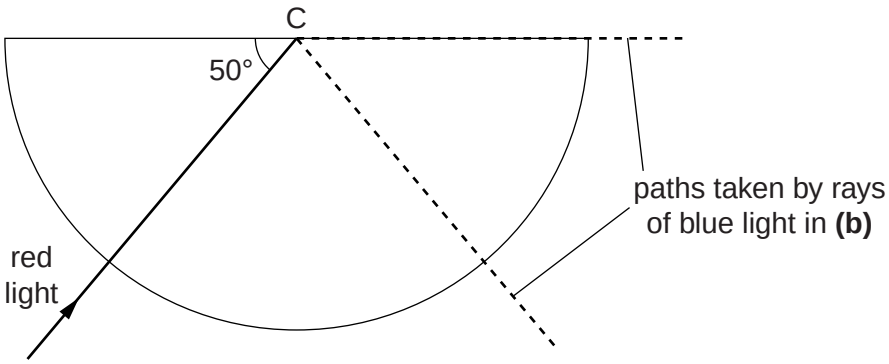


Fig. 4.3 [2]

(d) Fig. 4.4 shows a 45° – 45° – 90° prism used in an optical instrument. Part of the path of a ray of light passing through the instrument is also shown. Light leaves the instrument along path B.

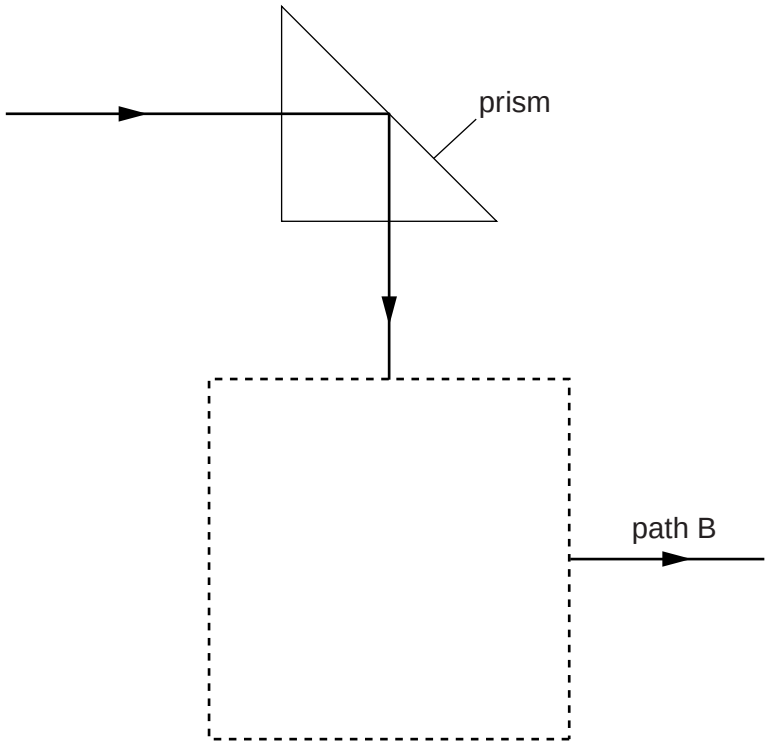


Fig. 4.4

In the dashed box, draw another 45° – 45° – 90° prism and complete the path of the light through this box. [2]

[Total: 9]

5 Fig. 5.1 shows a view from above of waves on the surface of water in a water tank.

For Examiner's Use

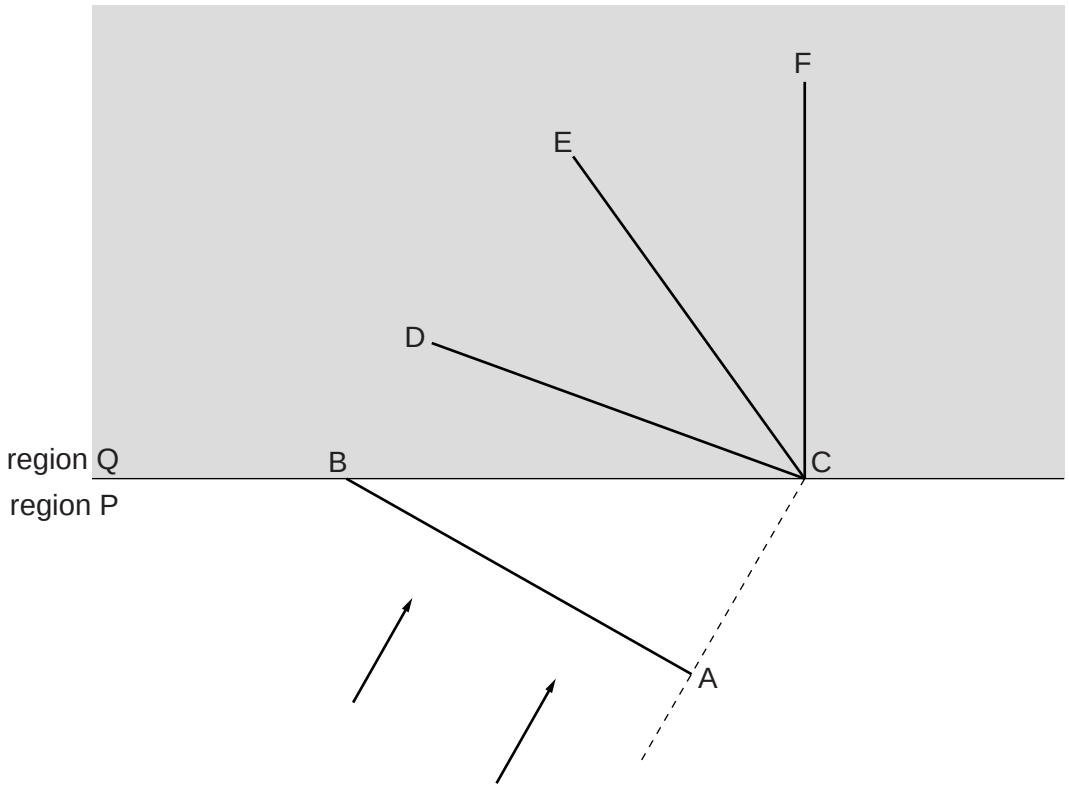


Fig. 5.1

The wavefront AB is travelling in region P towards region Q, where the water is shallower and the waves travel more slowly.

(a) Some time later, the wavefront has moved into region Q.

CD, CE and CF are suggested positions of the new wavefront.

(i) State which is the correct position of the new wavefront.

.....

(ii) Explain your answer to **(i)**.

.....

.....

.....

.....

[4]

(b) Fig. 5.2 shows the waves after a change is made to the way the tank is set up, and the experiment is repeated.

For Examiner's Use

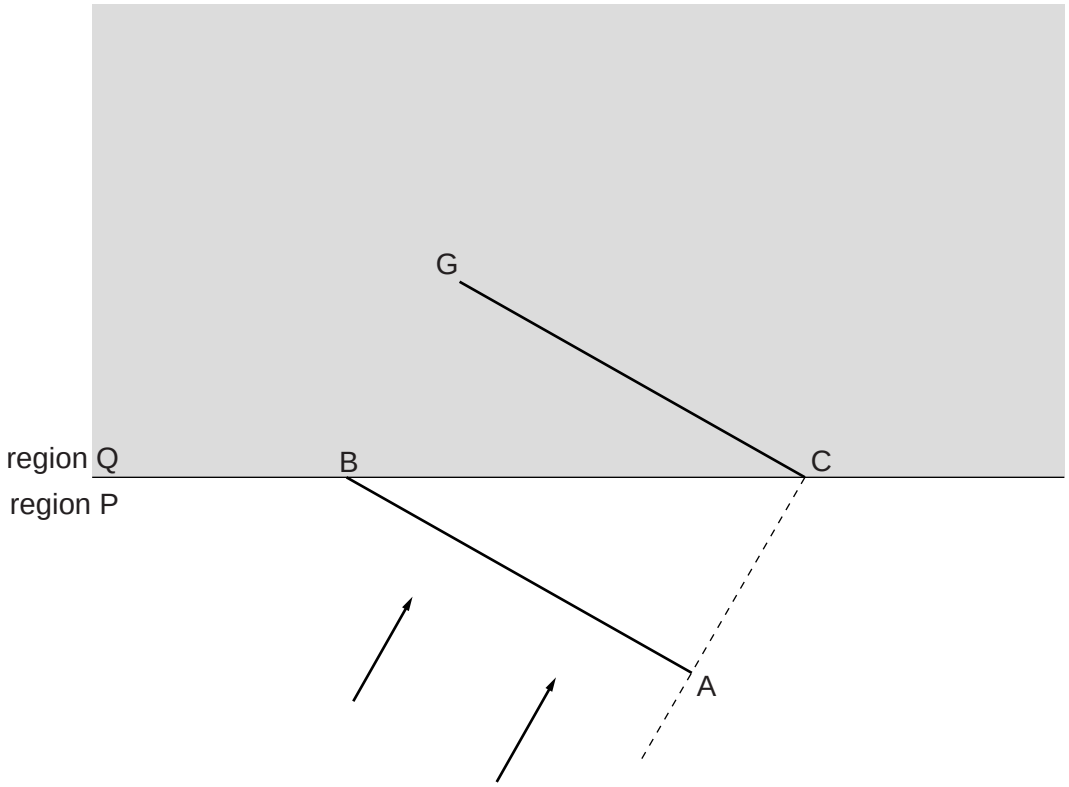


Fig. 5.2

The wave from position AB in region P now moves to position CG in region Q.

State the change that has been made and explain your reasoning.

change .....

explanation .....

.....

..... [2]

[Total: 6]

For Examiner's Use

6 **(a)** Two students hang out identical T-shirts to dry at the same time in the same neighbourhood. The only difference between the drying conditions is that one T-shirt is sheltered from any wind and the other is in a strong breeze, as shown in Fig. 6.1.

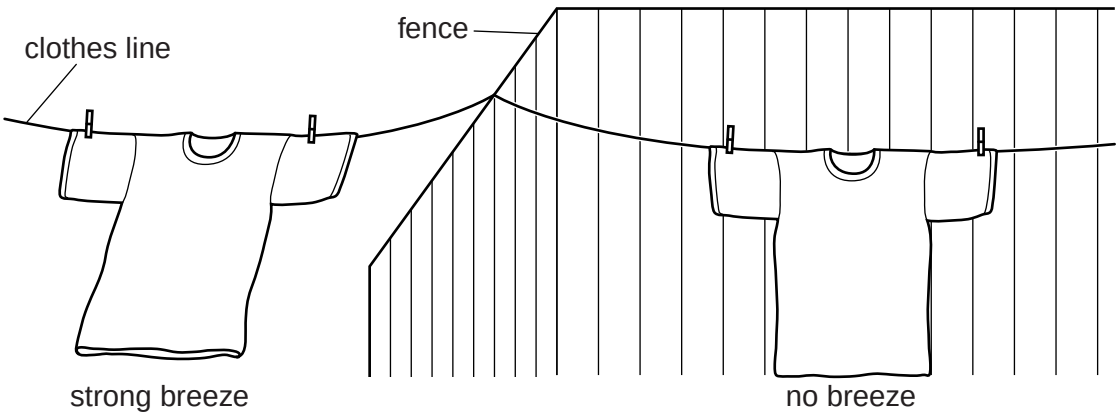


Fig. 6.1

State and explain, in terms of water molecules, the difference between the drying times of the T-shirts.

.....

.....

.....

.....

..... [2]

(b) Fig. 6.2 shows another occasion when a student hangs out two identical T-shirts to dry next to each other on a line. One T-shirt is folded double as shown in Fig. 6.2.

For Examiner's Use

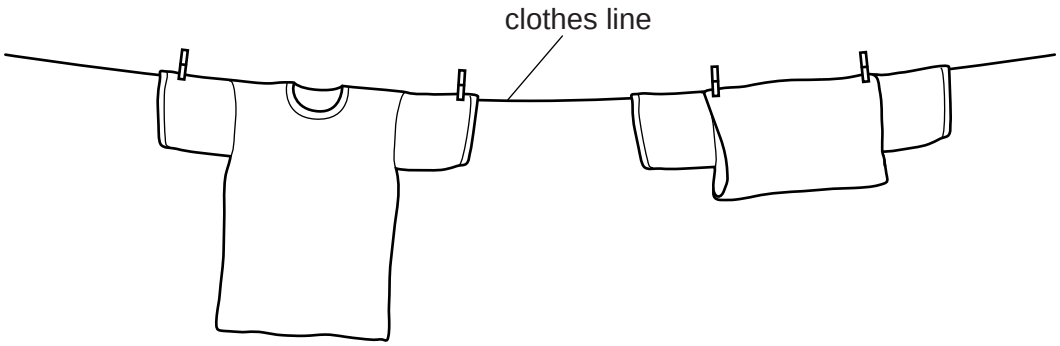


Fig. 6.2

State and explain, in terms of water molecules, the difference between the drying times of the T-shirts.

.....

.....

.....

.....

..... [2]

(c) A runner in a hot country feels cooler if she pours water over her hair to keep it wet, even when the water is at the same temperature as the air around her.

Explain, in terms of a change of state of water, why she feels cooler.

.....

.....

.....

..... [2]

[Total: 6]

© UCLES 2012

[Turn over

For Examiner's Use

7 **(a)** Fig. 7.1 shows a conducting sphere A, initially uncharged, mounted on an insulating base. The positively-charged, non-conducting sphere B is brought close to sphere A without touching the sphere.

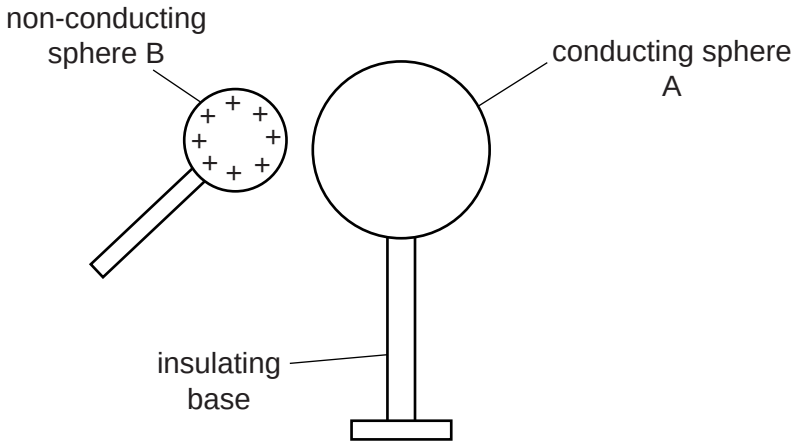


Fig. 7.1

(i) On Fig. 7.1, draw the resulting distribution of any positive and negative charges on sphere A. [2]

(ii) The sphere A is now earthed as shown in Fig. 7.2.

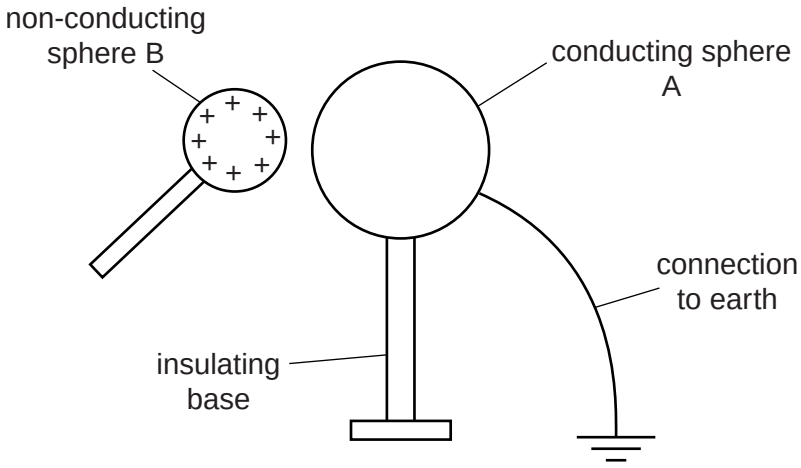


Fig. 7.2

On Fig. 7.2, draw the distribution of any positive and negative charges on sphere A after it is earthed. [1]

© UCLES 2012

(b) (i) On Fig. 7.3, draw lines of force with direction arrows to represent the electric field pattern in the plane of the paper around a negative point charge at point X.

For Examiner's Use



Fig. 7.3

(ii) State what is represented by the directions of the arrows on the lines.

.....

.....
[2]

[Total: 5]

8 A student holds a magnet above a solenoid, which is connected to a centre-zero milli-ammeter as shown Fig. 8.1.

For Examiner's Use

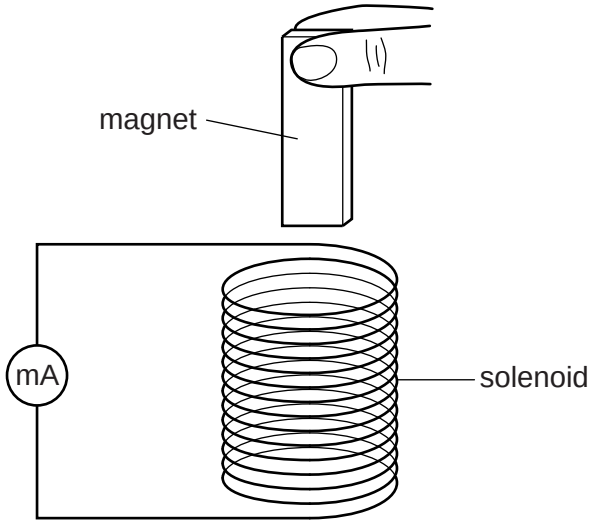


Fig. 8.1

(a) The student drops the magnet so that it falls through the solenoid.

State and explain what would be observed on the milliammeter

(i) as the magnet enters the solenoid,

.....

.....

..... [2]

(ii) as the magnet speeds up inside the solenoid.

.....

.....

..... [2]

(b) As the magnet passes into the coil in part **(a)**, the coil exerts a force on the magnet even though there is no contact between them.

(i) State the direction of this force.

.....

(ii) Explain how this force is caused.

.....

.....

.....
[3]

[Total: 7]

© UCLES 2012

9 40 lamps, each of resistance 8.0 Ω, are connected in series to a 240 V supply in order to decorate a tree.

For Examiner's Use

(a) Calculate

(i) the current in each lamp,

current = ... [2]

(ii) the power dissipated in each lamp.

power = ... [2]

(b) The lamps are designed to "fail-short". If a filament fails, the lamp shorts so that it has no resistance. The other lamps continue to light and the current increases.

The lamps are connected through a fuse that blows when the current rises above 0.9 A. At this current, the resistance of each lamp is 5% greater than its normal working resistance.

Calculate the maximum number of lamps that can fail before the fuse blows.

number of lamps = ... [4]

[Total: 8]

10 A student is designing a digital electronics circuit and needs to use the logic gate X shown in Fig. 10.1.

For Examiner's Use

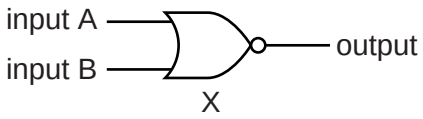


Fig. 10.1

(a) Name the logic gate X. ..... [1]

(b) Write down the values of the output when the inputs are

(i) input A low (logic 0), input B low (logic 0), output .....

(ii) input A low (logic 0), input B high (logic 1), output .....

(iii) input A high (logic 1), input B low (logic 0), output .....

(iv) input A high (logic 1), input B high (logic 1). output .....

[2]

(c) When the student starts to build the circuit, he finds that the store room has run out of this type of logic gate. There is a supply of AND, OR and NOT gates. The student's teacher explains that a combination of two of these gates may be used instead of logic gate X.

(i) State the two gates he should use to replace logic gate X.

..... and .....

(ii) Draw clearly in the space below these two logic gates, correctly connected, using standard symbols.

[3]

(d) Fig. 10.2 shows a block diagram, not using standard symbols, of a combination of gates.

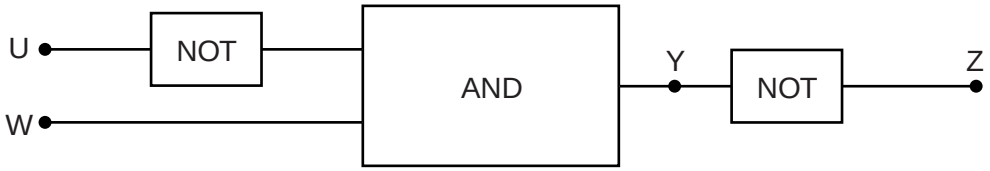


Fig. 10.2

State the logic levels of points Y and Z when the logic levels of points U and W are both 1.

logic level at point Y .....

logic level at point Z .....

[2]

[Total: 8]

© UCLES 2012

11 In a research laboratory, a radioactive sample is placed close to a radiation detector. The graph in Fig. 11.1 shows the decay of the sample.

For Examiner's Use

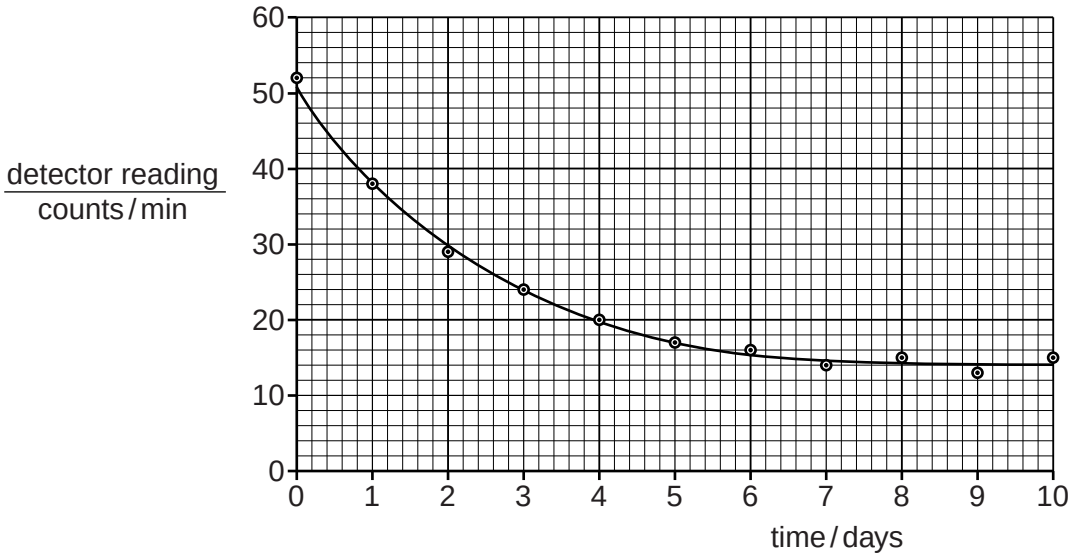


Fig. 11.1

(a) After 6 days the count rate hardly decreases and, in fact, increases a little at times. Explain these observations.

.....

.....

.....

..... [2]

(b) Use the graph to determine the half-life of the sample. Explain your working carefully.

half-life = ... [4]

(c) Another radioactive sample is a strong emitter of α-particles and γ-rays. A junior researcher suggests that a sufficient safety precaution, when working with this sample, would be to hold the sample with long forceps. Explain why this suggestion, although helpful, may be insufficient.

.....

.....

.....

..... [2]

[Total: 8]

© UCLES 2012

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2012