UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **5054/02**

Paper 2 Theory **May/June 2007**

1 hour 45 minutes

Candidates answer on the Question Paper.

Additional Materials: Answer Booklet/Paper.

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 soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE ON ANY BARCODES.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer any **two** questions.
Write your answers on the lined page provided, and, if necessary, continue on the separate answer paper provided.

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	
Section A	
Q9	
Q10	
Q11	
Total	

This document consists of **16** printed pages.

For Examiner's Use

Section A

Answer **all** the questions in this section.

1 Two athletes, A and B, run a 100 m race. At time $t = 0$, a gun is fired to start the race.

Fig. 1.1 shows the distance-time graph for the two athletes.

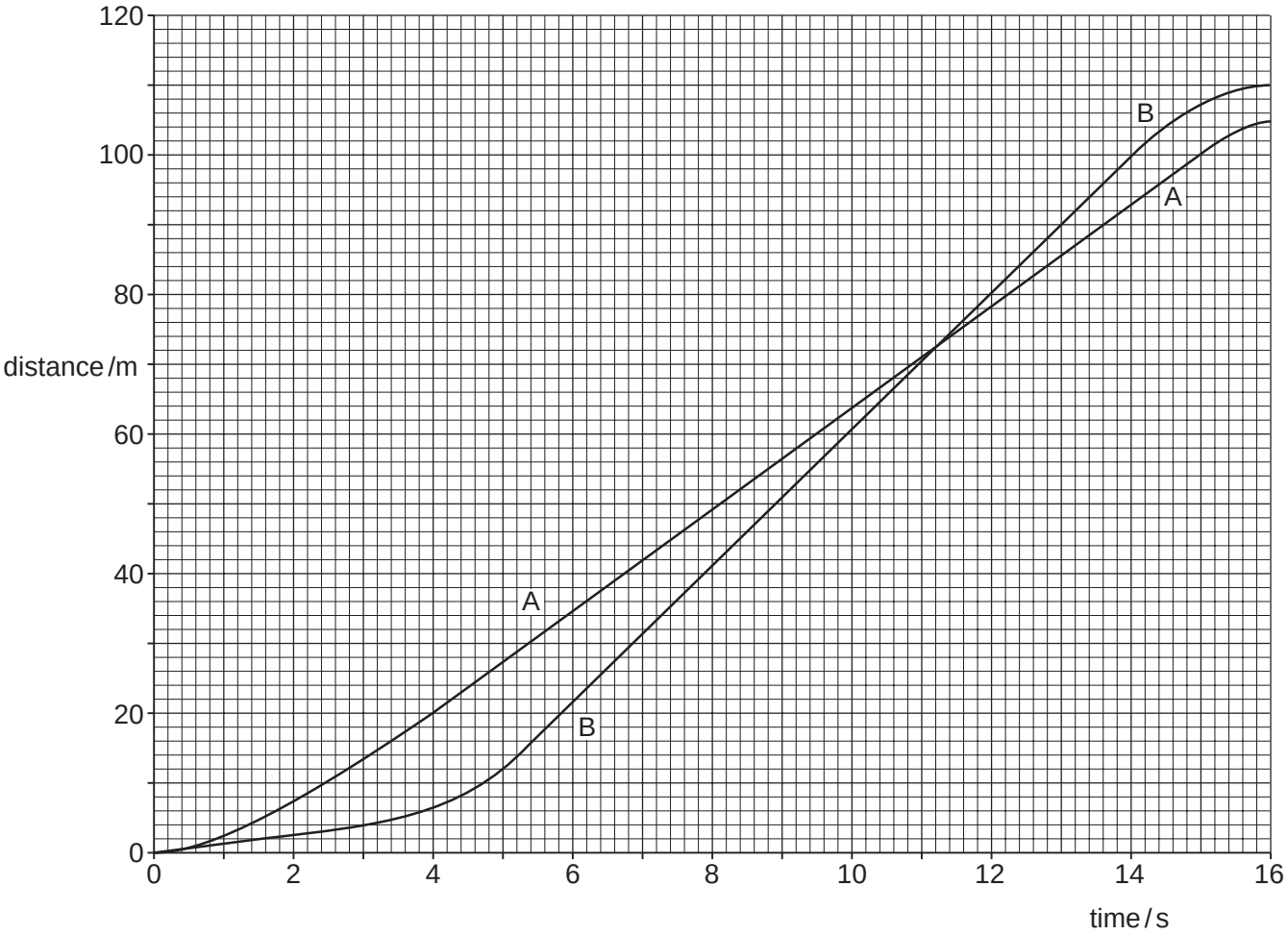

Fig. 1.1

(a) Describe the motion of athlete A during the first 8 s of the race.

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.....

..... [2]

(b) State the distance between the two athletes as the winner passes the 100 m mark.

..... [1]

(c) Calculate the speed of athlete A between $t = 4$ s and $t = 15$ s.

speed = ... [2]

[Turn over

2 A student investigates the evaporation of water. He pours 100 cm^3 of water into measuring cylinder A and 100 cm^3 of water into measuring cylinder B. Measuring cylinder A is kept at 40 °C and B is kept at 80 °C in the same part of the laboratory. Fig. 2.1 shows the two measuring cylinders after 3 days.

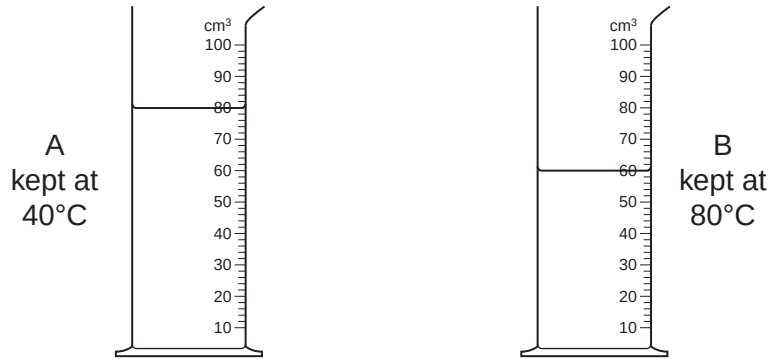

Fig. 2.1

(a) (i) Using ideas about molecules, explain why more water evaporates when the water is kept at 80 °C.

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.....

..... [2]

(ii) Apart from an increase in temperature, state one change that causes water to evaporate faster.

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..... [1]

(b) The specific latent heat of vaporisation of water is 2300 J/g and the density of water is 1.0 g/cm^3. During the three days, the water level in B drops from the 100 cm^3 mark to the level shown in Fig. 2.1. Calculate the energy used to evaporate water from B during the three days.

energy = ... [2]

3 Fig. 3.1 shows a thermometer.

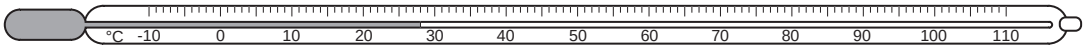

Fig. 3.1

(a) Explain how to calibrate a thermometer.

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.....

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..... [3]

(b) **(i)** State the range of the thermometer in Fig. 3.1.

..... [1]

(ii) State how you know that the scale of the thermometer in Fig. 3.1 is linear.

.....

.....

..... [1]

(c) Fig. 3.2 shows a thermometer which is more sensitive than the thermometer in Fig. 3.1. Only 0 °C is marked on this new thermometer.

On Fig. 3.2, draw the temperature markings for 10 °C and 20 °C. [1]

Fig. 3.2

4 Fig. 4.1 shows part of an optical fibre.

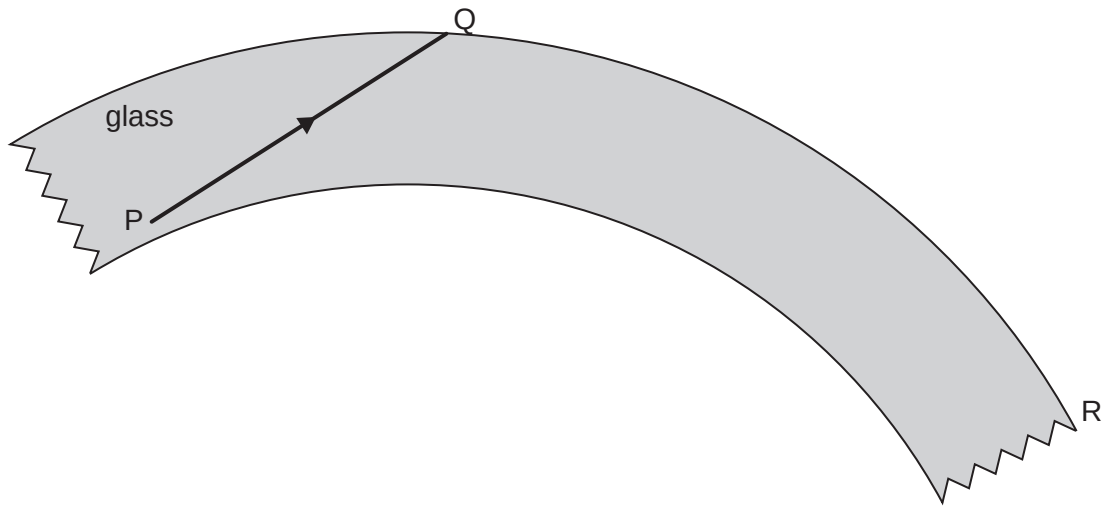

Fig. 4.1

The ray PQ undergoes total internal reflection in the optical fibre.

(a) On Fig. 4.1, continue the path of ray PQ until it reaches end R. [1]

(b) Explain what is meant by *total internal reflection*.

.....

.....

..... [1]

(c) Optical fibres are cheaper and lighter than copper wires. State one other advantage of using optical fibres rather than copper wires for telephone communications.

.....

.....

..... [1]

(d) The light in the optical fibre is travelling at a speed of 2.1×10^8 m/s and has a wavelength of 6.4×10^{-7} m.

Calculate the frequency of the light.

frequency = ... [2]

5 Fig. 5.1 is drawn full scale. The focal length of the lens is 3.0 cm.

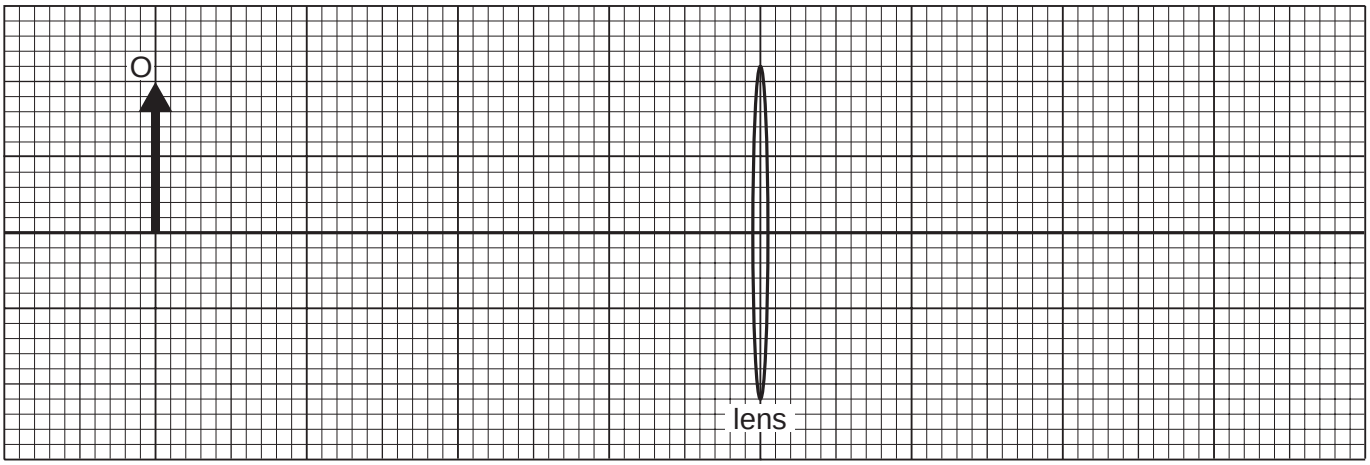

Fig. 5.1

(a) On Fig. 5.1, draw two rays from the top of the object O that meet at the image. [2]

(b) **(i)** Define the term *linear magnification*.

.....

.....

..... [1]

(ii) Determine the magnification produced by the lens in Fig. 5.1.

magnification = ... [1]

(c) Fig. 5.2 shows a normal eye viewing an object close to it. Fig. 5.3 is a long-sighted eye viewing an object at the same distance.

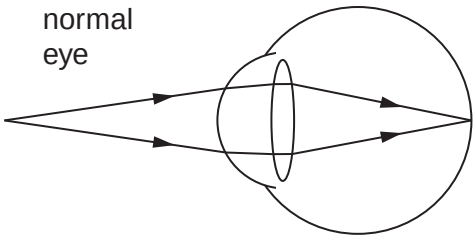

Fig. 5.2

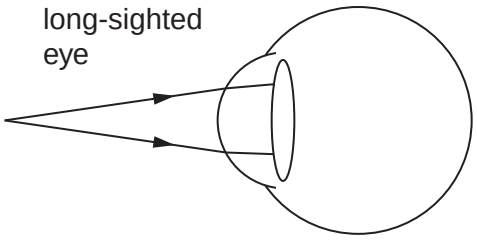

Fig. 5.3

Complete Fig. 5.3 to show the rays travelling through the eye. [1]

6 Fig. 6.1 shows a coil of wire wound on a cardboard tube.

There is a d.c. current in the coil. The direction of the current is shown in the key.

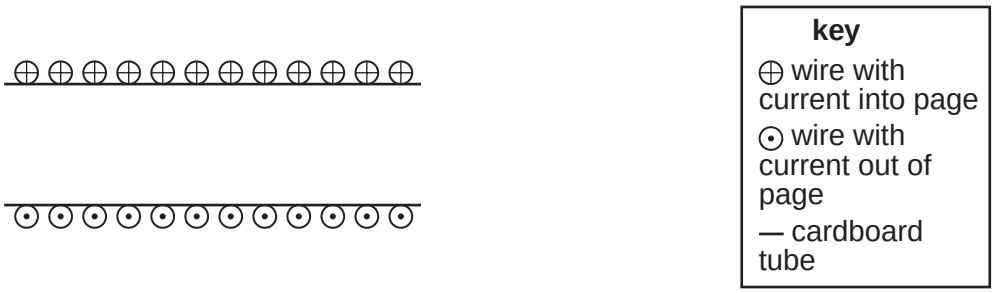

Fig. 6.1

(a) On Fig. 6.1, draw the magnetic field produced by the coil. [3]

(b) Fig. 6.2 shows a simple loudspeaker that uses the coil shown in Fig. 6.1 attached to a paper cone.

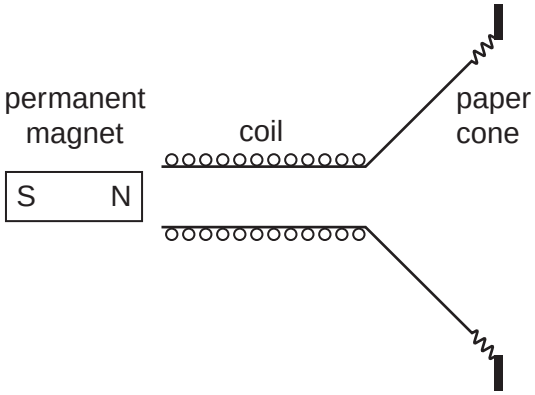

Fig. 6.2

The coil is connected to a signal generator.

There is an alternating current of frequency 100 Hz in the coil.

(i) State what is meant by a *frequency of 100 Hz*.

.....

..... [1]

(ii) Describe and explain the movement of the coil.

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..... [3]

7 Fig. 7.1 shows an electrical circuit containing a 12V power supply and a number of resistors.

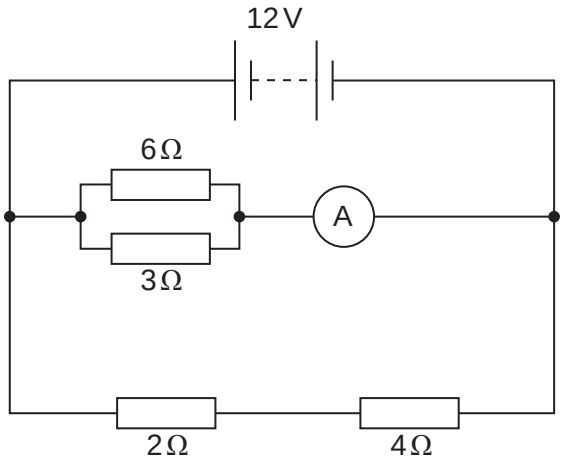

Fig. 7.1

(a) Calculate the combined resistance of

(i) the 2Ω and 4Ω resistors in series,

resistance = ... [1]

(ii) the 3Ω and 6Ω resistors in parallel.

resistance = ... [2]

(b) Calculate the reading of the ammeter in Fig. 7.1.

ammeter reading = ... [2]

(c) Determine the potential difference across the 4Ω resistor.

p.d. = ... [2]

8 **(a)** Explain how it is possible for an element to have different isotopes.

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..... [1]

(b) State what is meant by the *half-life* of a radioactive isotope.

.....

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.....

..... [2]

(c) Fig. 8.1 shows how the number of atoms of a radioactive isotope changes with time.

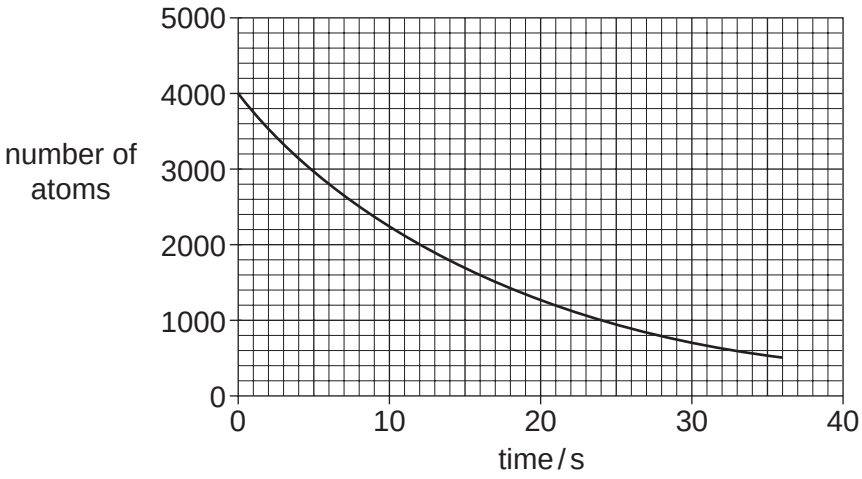

Fig. 8.1

Determine the half-life of the radioactive isotope. On Fig. 8.1, show how you obtained your result.

half-life = ... [2]

Section B

Answer **two** questions from this section.

Use the lined page provided and, if necessary,
continue on the separate sheets available from the Supervisor.

9 Fig. 9.1 shows the horizontal forces acting on a moving car.

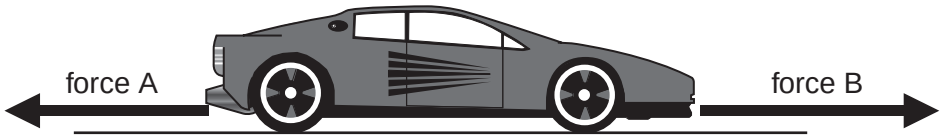

Fig. 9.1

(a) Compare the sizes and directions of the two forces when the car is

(i) moving along a straight road at constant speed, [1]

(ii) accelerating. [1]

(b) Suggest the direction of the resultant force on the car when the car turns a corner at constant speed. [1]

(c) Fig. 9.2 shows the speed-time graph for the first 24 s of the motion of the car along a straight road.

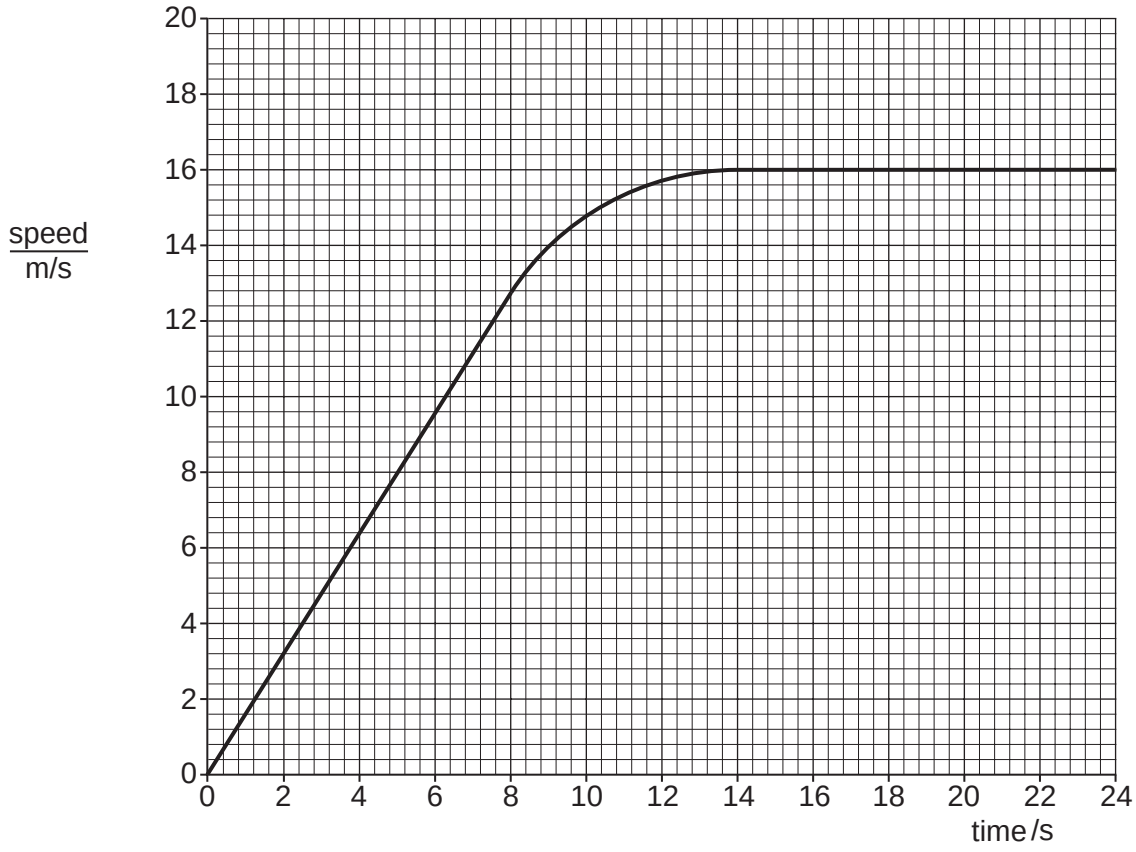

Fig. 9.2

(i) During the motion there is a period of uniform acceleration. State both the start and finish times of this period. [1]

(ii) State the main energy changes that occur in the 24 s. [3]

(iii) Calculate the acceleration of the car during the first 5 s. State clearly the equation that you use. [3]

(iv) Determine the distance travelled in the first 5 s. [3]

(d) The car is stopped by applying the brakes. Various factors can affect the distance travelled by the car during the time that the brakes are applied. Apart from the force applied by the brakes, state **two** of these factors. [2]

10 A farmer connects a house to the mains electricity. The house is a long way from the nearest 230V mains electricity supply.

Fig. 10.1 shows the mains supply connected to the house.

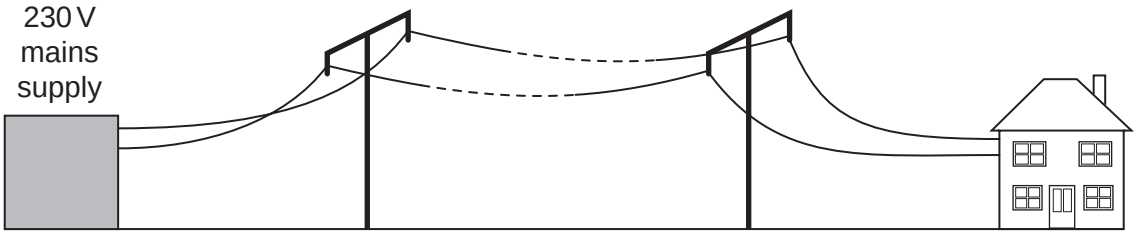

Fig. 10.1

(a) The farmer uses 230V lamps in the house but they do not light up at full brightness. Explain why the lamps are dim. [2]

(b) The farmer adds transformers, as shown in Fig. 10.2.

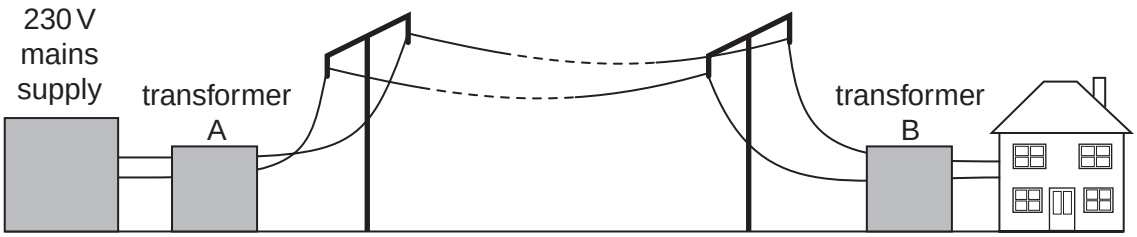

Fig. 10.2

The lamps in the distant house light up at full brightness.

Explain why the lamps are now bright. [3]

(c) **(i)** Describe the structure of a transformer. You may draw a diagram to help your explanation. [3]

(ii) Explain in detail how a transformer produces an output voltage. [3]

(d) The 230V mains supply provides 690W of power to transformer A in Fig. 10.2.

(i) Calculate the current supplied to the transformer. [2]

(ii) Calculate the energy supplied to the transformer in 10 minutes. Give your answer in joules. [2]

11 A plastic rod is rubbed with a cloth and becomes negatively charged.

(a) Explain how the rod becomes negatively charged when rubbed with a cloth. [2]

(b) An uncharged metal-coated sphere hangs from an insulating thread. The sphere is brought near to the rod. The sphere is attracted to the rod, as shown in Fig. 11.1.

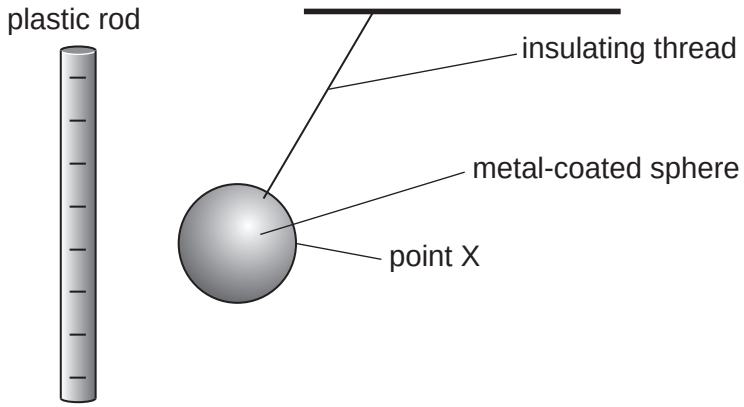

Fig. 11.1

(i) Describe and explain what happens to the free electrons in the metal-coated sphere as it approaches the rod. [2]

(ii) Draw a diagram to show how charge is distributed on the sphere. [1]

(iii) Explain why the uncharged sphere is attracted to the negatively-charged rod. [2]

(c) With the charged rod still close, point X on the metal-coated sphere is earthed.

(i) State what is meant by *earthing* the sphere. [1]

(ii) Describe and explain what happens to the free electrons in the metal-coated sphere as it is earthed. [2]

(iii) Draw a diagram to show how the charge is now distributed on the sphere. [1]

(d) Describe **one** device where electrostatic charging is used. In your answer include a diagram and explain how and why the charge is produced. [4]