بسم الله الرحمن الرحيم

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IGCSE

PHYSICS
Examination

PAPER 3

Good luck

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
INTERNATIONAL EXAMINATIONS

Physics O.L

contents

Paper 3:- Page

Candidate Name ....

Centre Number	Candidate Number

0625/3 IGCSE JUNE

PHYSICS

PAPER 3

Monday 24 MAY 1993 Morning 1 h 15 min

Candidates answer on the question paper.
Additional materials:
Mathematical tables

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

Instructions to candidates:

Write your name and examination number in the spaces provided at the top of this page.

Answer **all** *the questions in the spaces provided.*

The intended marks for questions or parts of questions are given in brackets [ ].

This Question Paper consists of 17 printed pages and 3 blank pages.

[Turn over

1 (a) An aircraft is coming in to land. It is at a point P 500 m above the ground and has a speed of 65 m/s. The total mass of the aircraft at P is 150 000 kg.

Calculate

(i) *the potential energy of the aircraft,*

(ii) its kinetic energy.

[4]

(b) At P, the landing wheels of the aircraft are lowered. The aircraft then descends, touches down and rolls to a stop at the end of the runway. The pilot maintains a constant compass course during the landing.

Sketch on the axes below (Fig. 1.1) graphs to show how the three quantities indicated change during the landing.

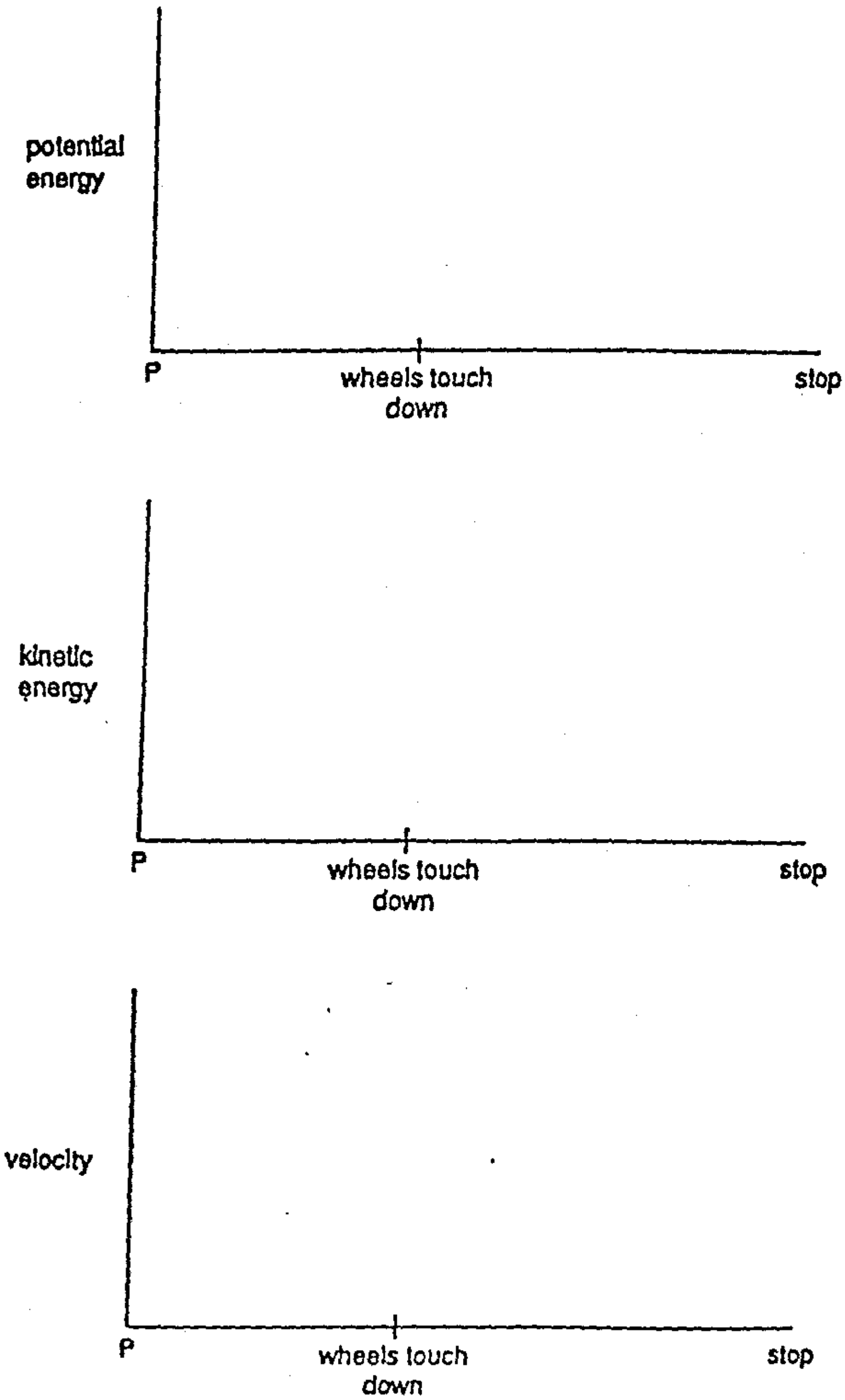

Fig. 1.1

For each quantity write a brief explanation of the changes you have shown.

potential energy

....

....

....

kinetic energy

....

....

....

velocity

....

....

....[5]

(c) A pendulum hangs from the roof of the cabin of the aircraft. A vertical angular scale was placed alongside the pendulum, as shown in Fig. 1.2, before the aircraft began to land.

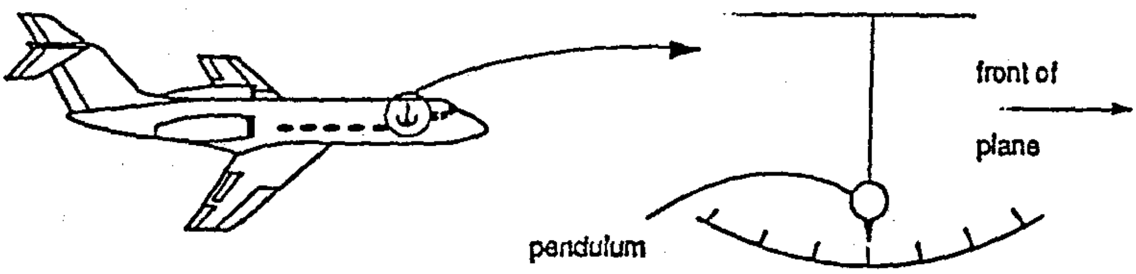

Fig. 1.2

Describe how the reading of the pointer would vary (if at all) as the aircraft travelled between P and the end of the runway. Give reasons for your answers.

....

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....[4]

2 (a) Two students, Maria and Elena, had a discussion about the efficiency of two types of domestic freezer. The two types are shown in the diagrams in Fig. 2.1.

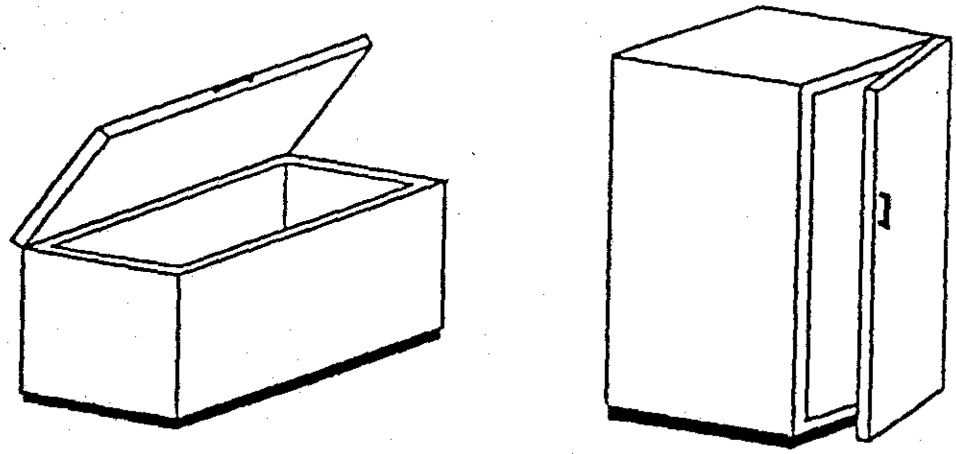


Fig. 2.1

(b) (i) Maria said, "The chest freezer is more efficient when you consider what happens to the air inside when the freezer is opened".

What actually happens to the air inside each freezer when the freezer is opened? Give a reason for each answer.

chest freezer

....

....

....

upright freezer

....

....

....[2]

(ii) Elena replied, "The air in the freezer isn't important when the freezer is full". Comment on her statement given the following information:

Amount of space occupied by food = 80% of total volume of freezer

density of air at −20 °C = 1.0 kg/m^3 average density of food = 500 kg/m^3

specific heat capacity of air = 1000 J/(kgK)

average specific heat capacity of food in freezer = 3500 J/(kgK)

....

....

....[3]

(b) The outline of a heat pump system is illustrated in Fig. 2.2. A suitable refrigerating liquid or its vapour is circulated round a loop of pipes. In one part of the loop (the compressor) the vapour condenses into liquid; in another part (the expansion valve), this liquid evaporates.

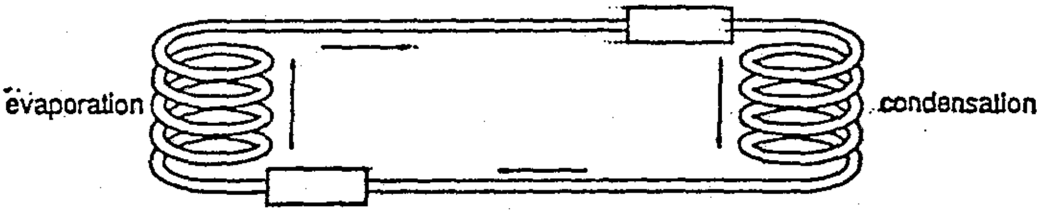


Fig. 2.2

(i) Explain what transfer of thermal energy occurs

1. when a liquid evaporates,

....

....

2. when a vapour condenses.

....

....[2]

(ii) An arrangement of this kind is installed in Stockholm harbour. Heat is drawn from the sea and a net power output of 160 megawatts (1.60×10^8 watts) is given out to heat local houses. The system is illustrated in outline in Fig. 2.3.

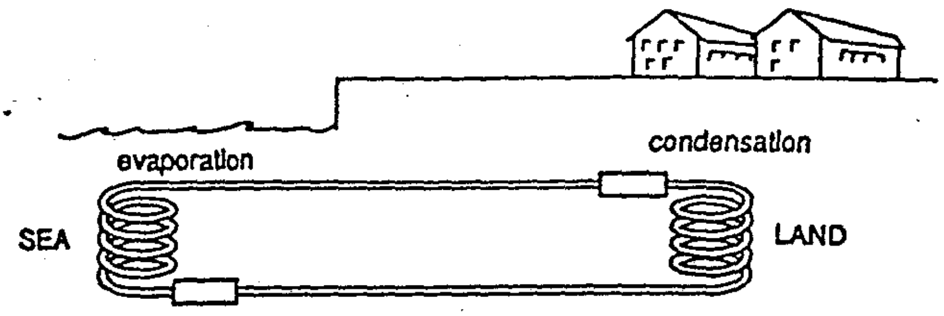


Fig. 2.3

Only 35% of the heat drawn from the sea is transferred to the houses.

The refrigerating liquid has a specific latent heat of 550 000 J/kg. What mass of the liquid must evaporate per second to produce this output?

[3]

3 (a) Some of the ideas of the kinetic molecular model of matter are given in Column 1 of the table.

In Column 2 give one fact from the physics of solids, liquids or gases which each idea helps to explain.

One example has been done for you.

Column 1: Ideas	Column 2: explains the fact that
molecules are very small	molecules cannot be seen with even the best microscope
molecules are in random motion	....
kinetic energy of molecules increases when temperature rises	....
molecules have mass	....
there are attractive forces between molecules	....
the molecules of a gas are much further apart than the molecules of a liquid	....

[5]

4 (a) The table below (Fig. 4.1) shows the values of the angles of incidence and the corresponding values of the angles of refraction when rays of light pass from air into a plane glass surface.

ray	angle of incidence i	angle of refraction r
1	10.0	6.9
2	25.0	17.0
3	40.0	26.3
4	55.0	34.4
5	70.0	40.4

Fig. 4.1

Use one set of values to calculate the refractive index of the glass.

[3]

(b) When the rays of light fall on the surface travelling from glass to air, some of the corresponding sets of angles are as shown in Fig. 4.2.

ray	angle of incidence in glass, i	angle of refraction in air, r
1	10.0	14.6
2	25.0	37.8
3	40.0	68.8
4	55.0	
5	70.0	

Fig. 4.2

What happens to the fourth and fifth rays? Support your answer with a calculation.

....

....

[3]

5 (a) (i) A boy has a 2 V, 3 W lamp.
Calculate the normal working current through the lamp.

(ii) The boy wished to light the lamp but had only a 12 V battery available. He set up the circuit shown in Fig. 5.1.

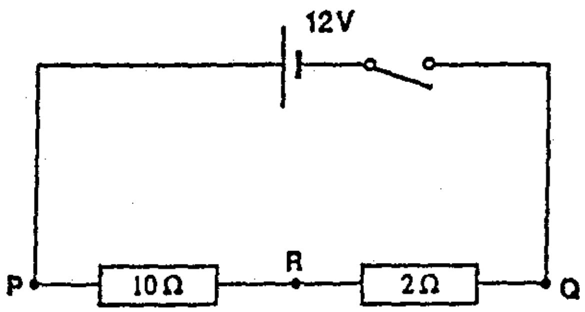


Fig. 5.1

Calculate

1. the total resistance between P and Q,

2. the potential difference between R and Q.

[3]

(iii) The boy connected his lamp in parallel with the 2 Ω resistor.
Would the lamp work normally when connected across the 2 Ω resistor? Give a reason for your answer.

....

....

....

....[2]

(b) It is extremely dangerous to connect several appliances to the same electric socket. The diagram Fig. 5.2 shows a situation in which that has been done.

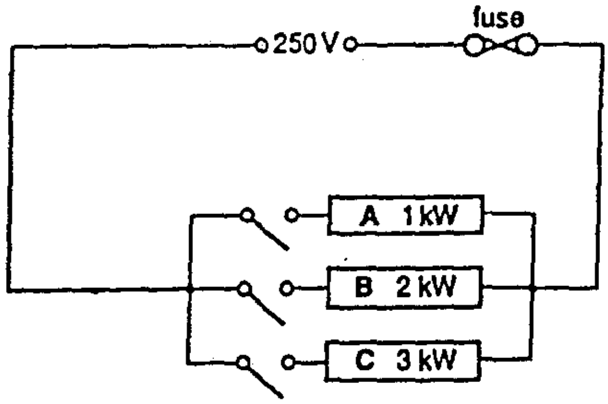


Fig. 5.2

Calculate

(i) the current through each appliance when it is in use:

A

B

C

[3]

(ii) the current through the fuse when all three appliances are used.

Explain two dangers involved in making such a multiple connection.

....

....

....[3]

6 (a) The arrangement illustrated in Fig. 6.1 consists of an open coil connected in a circuit, with several small magnetic compasses set around it. The first diagram shows the positions of the compasses when no current flows through the coil.

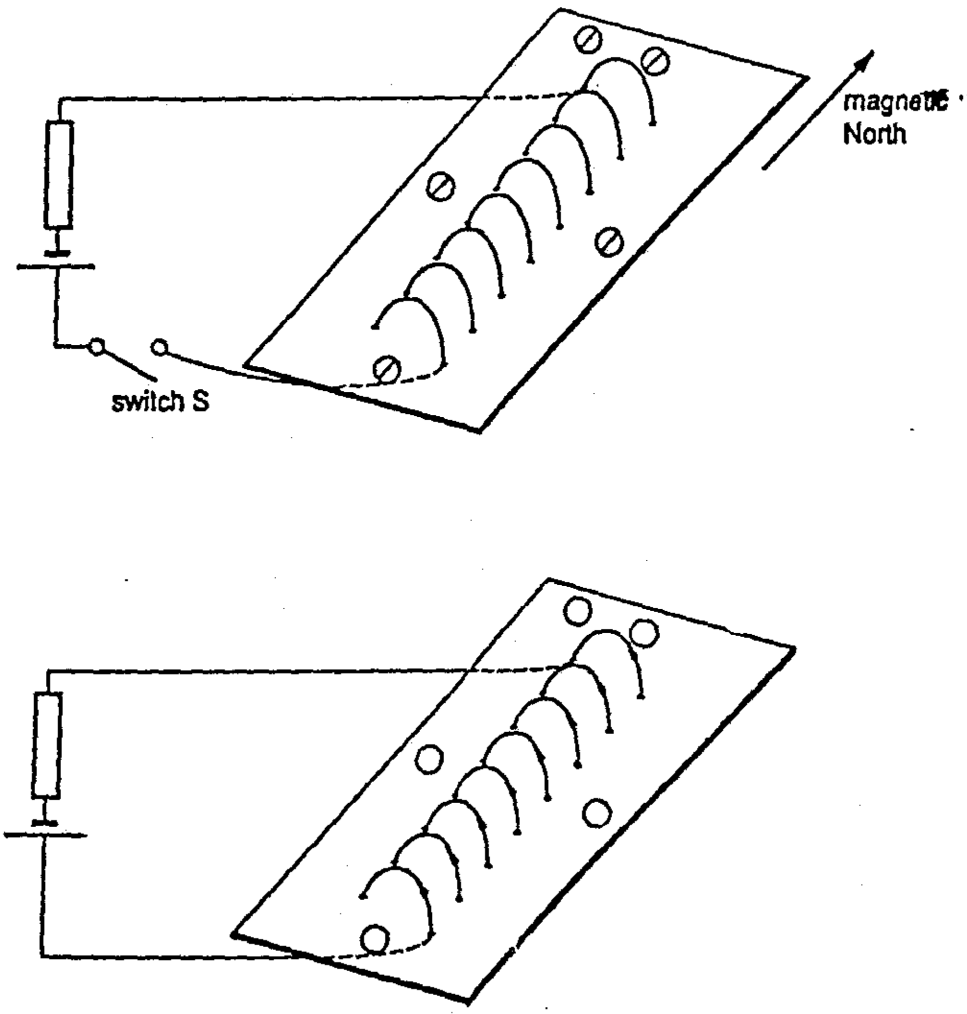


Fig. 6.1

Show on the second diagram the directions in which the different compasses will point when a large current flows through the coil in the direction shown.

Draw the magnetic field pattern around the coil due to the current. [4]

(b) A similar coil is wound round a soft-iron ring as shown in Fig. 6.2. Draw lines to indicate the direction of the magnetic field (flux) through the iron when a direct current is passed through the coil AB.

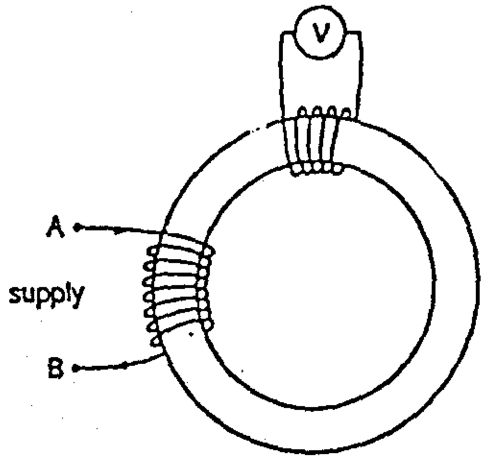


Fig. 6.2

What will happen to the field (flux) when the same current is passed through two coils wound round the ring as in Fig: 6.3?

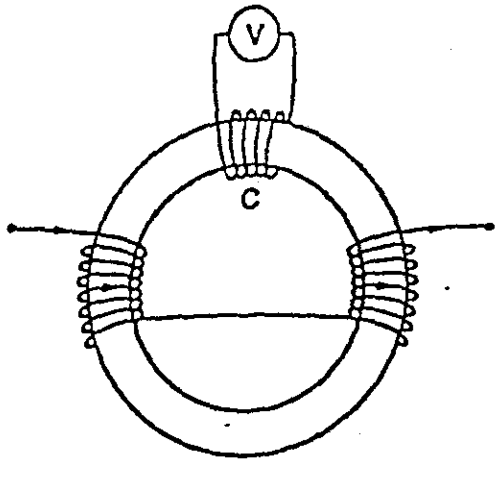


Fig. 6.3 [3]

(c) Another coil, C, is wound round the iron ring shown in Figs. 6.2 and 6.3. The voltmeter connected to it can register both d.c. and a.c. voltages. What would you expect to observe on the meter when:

(i) the current through the other coils is direct;
(for Fig. 6.2)

....

....

....

(ii) the current is alternating?
(for Fig. 6.3)

....

....

....

Give a reason for your answer in each case. [3]

(d) An arrangement similar to that in Fig. 6.3 can be used to cut off the power to an appliance if it develops a fault, e.g. an accidental connection of the appliance to earth. The circuit diagram of the arrangement is illustrated in Fig. 6.4.

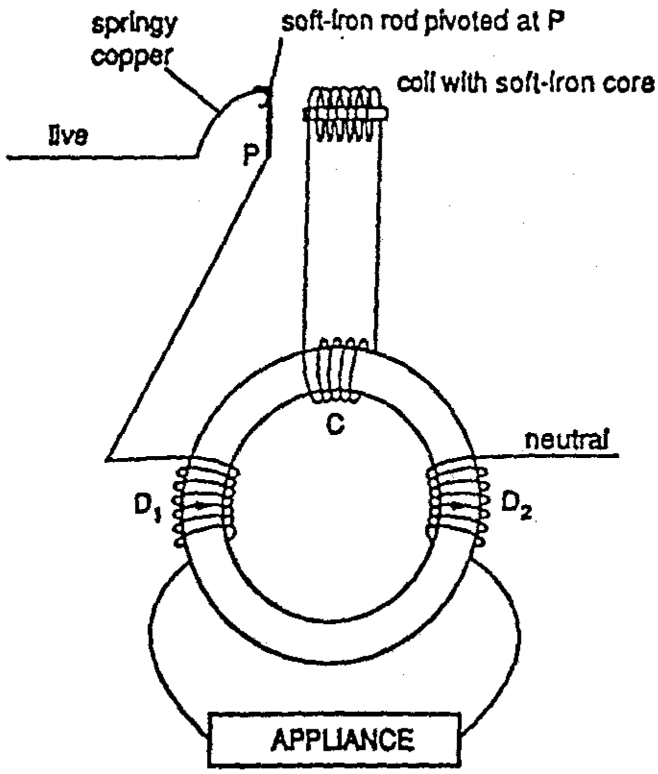


Fig. 6.4

If the effect of the fault is that the current in D_2 is less than the current in D_1, the power supply to the live wire will be cut off. Explain why this occurs.

....

....

....

....

....[4]

7 (a) Much of our understanding of atomic physics is based on the idea of a nuclear atom.

In the space below draw a labelled diagram to represent the model of the carbon atom $^{14}_{6}C$. Include details of the nucleus.

[3]

(b) The diagram illustrates a famous scattering experiment, the results of which led to the acceptance of the idea of the nuclear atom.

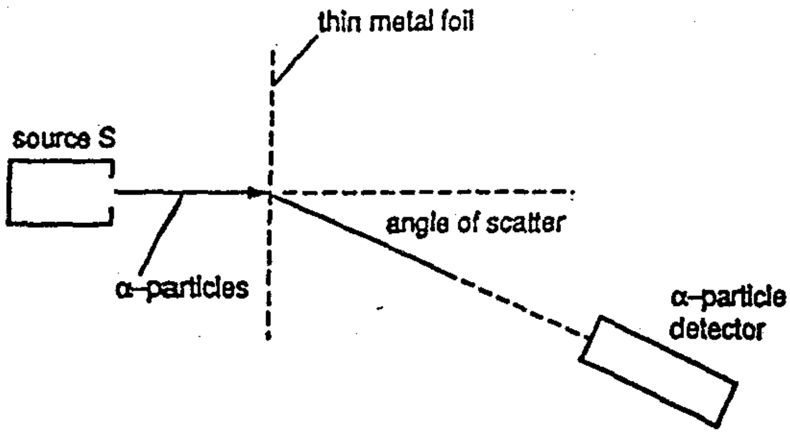


Fig. 7.1

State how the results of the experiment support the idea of the nuclear atom.

....

....

....

....[3]

(c) (i) 1 g of carbon from a living plant always contains the same amount of radioactive carbon. As soon as the plant dies the radioactive carbon in it begins to decay and is not replaced.

A carbon-dating experiment was carried out in a laboratory where the background count was 300 counts per hour.

When a 1 g-sample of carbon obtained from a living plant was tested, the count rate was 1300 counts per hour.

A 1 g-sample of carbon from an ancient religious scroll gave a count rate, in the same laboratory using the same equipment, of 1100 counts per hour.

Identify on the graph in Fig. 7.2 the two points to which these observations apply. Hence determine the age of the ancient scroll.

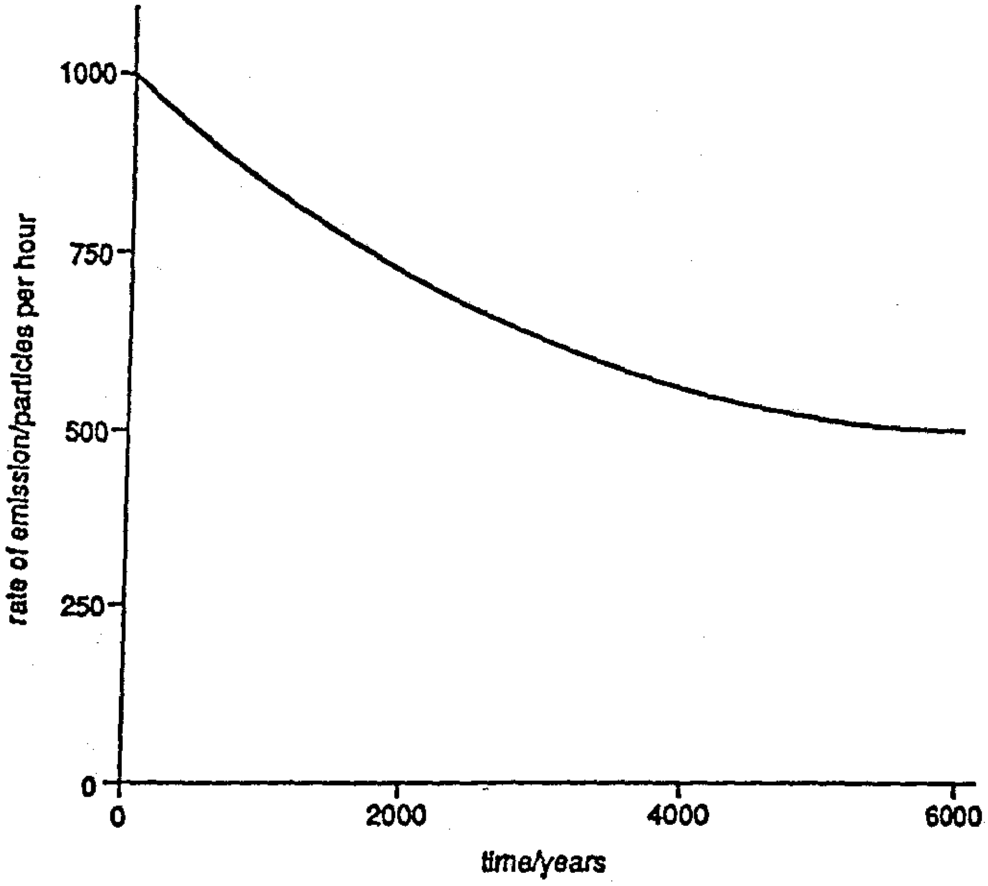


Fig. 7.2

[4]

(ii) What detection difficulties arise, in carbon-dating old materials, from the fact that for every radioactive carbon atom in the sample, there are 8×10^{11} normal carbon atoms?

....

....

....[2]

(d) Radioactivity on the Earth is as old as the planet itself. Suggest two reasons why radioactivity was not discovered until the nineteenth century.

1. ....

2. ....[2]

Candidate Name ....

Centre Number	Candidate Number

0625/3 IGCSE NOV

PHYSICS

PAPER 3

Tuesday 16 NOVEMBER 1993 Morning 1 h 15 min

Candidates answer on the question paper.
Additional materials:
Mathematical tables
Graph paper

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

Instructions to candidates:

Write your name and examination number in the spaces provided at the top of this page.
Answer **all** *the questions in the spaces provided.*
The intended marks for questions or parts of questions are given in brackets [ ].

This Question Paper consists of 16 printed pages.

[Turn over

Answer **all** *the questions.*

1 (a) Figure 1.1 shows a bubble of air in water.

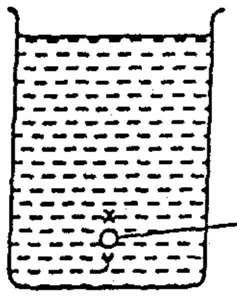


Fig. 1.1

(i) Why is the pressure at y greater than the pressure at x?

....

....

(ii) Explain why the pressure difference causes an upward force on the bubble.

....

....

(iii) Suggest a reason why the bubble will rise to the surface.

....

.... [4]

(b) *Figure 1.2 shows the same weighted balloon in cold liquid and in hot liquid.*

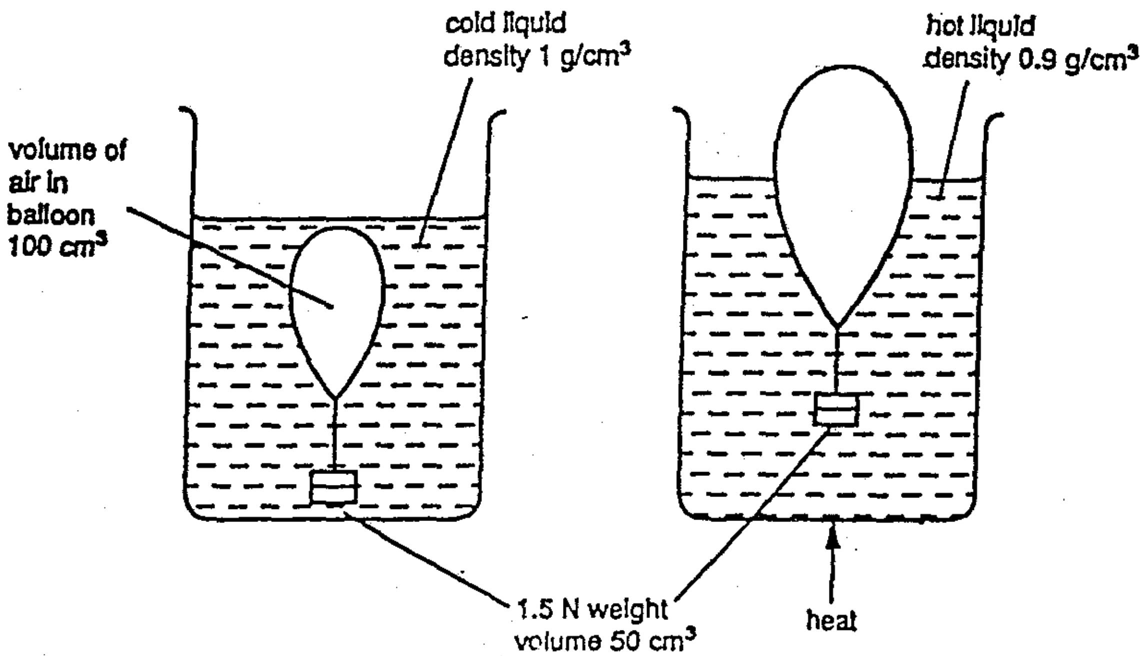


Fig. 1.2

When any object is immersed in a liquid it displaces a volume of liquid equal to the volume of the object (i.e. a volume which would occupy the space taken up by the object).

In carrying out the following calculations, you may assume that the balloon itself has no mass and that the atmospheric pressure does not affect the balloon.

The balloon and weight are in equilibrium in both cases.

(I) Find

1. *the total volume of cold liquid displaced by the balloon and weight,*

2. the mass of the cold liquid displaced,

3. the weight of the cold liquid displaced (take the force of gravity on 1 kg to be 10 N),

4. *the upward force on the balloon and weight, given that the upward force is equal to the weight of the liquid displaced.*

(II) The liquid is then heated to a constant temperature and the balloon rises to a new equilibrium position as shown in Fig. 1.2.
Remembering that the balloon itself has no mass, find

5. the upward force on the balloon and weight in the new equilibrium position,

6. *the weight of liquid displaced,*

7. *the total volume of hot liquid displaced,*

8. the volume of hot liquid displaced by the balloon.

20

2 (a) Theresa set up an experiment to determine how far a wire stretches when a weight is hung from it. The arrangement she set up is shown in Fig. 2.1.

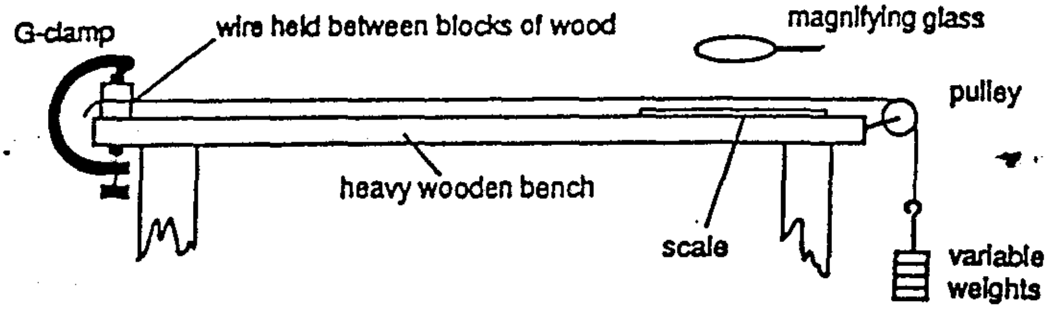


Fig. 2.1

What procedures would Theresa need to use to find by how much the wire stretched per newton of weight hung from it?

....

....

....

....

....[3]

(b) Figure 2.2 shows the graph of extension against load for a particular spring.

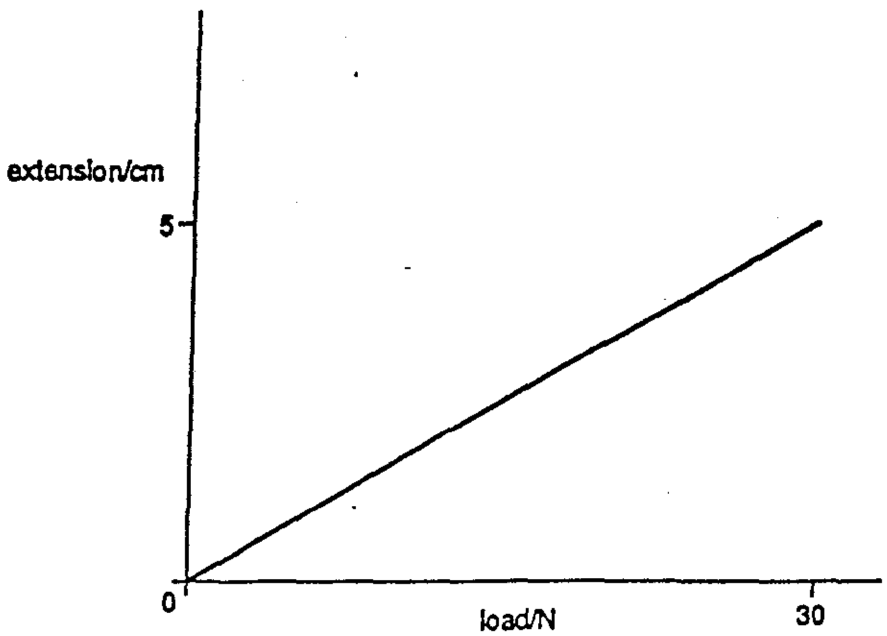


Fig. 2.2

A load was suspended by two such springs in two different ways, as illustrated in Figs. 2.3(a) and 2.3(b).

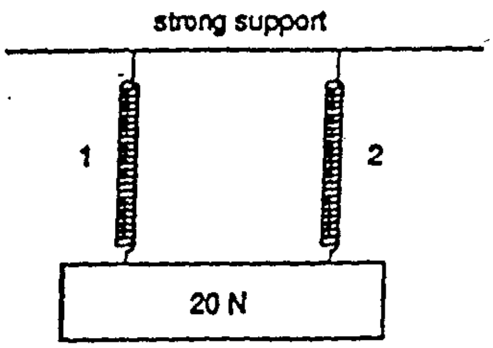


Fig. 2.3(a)

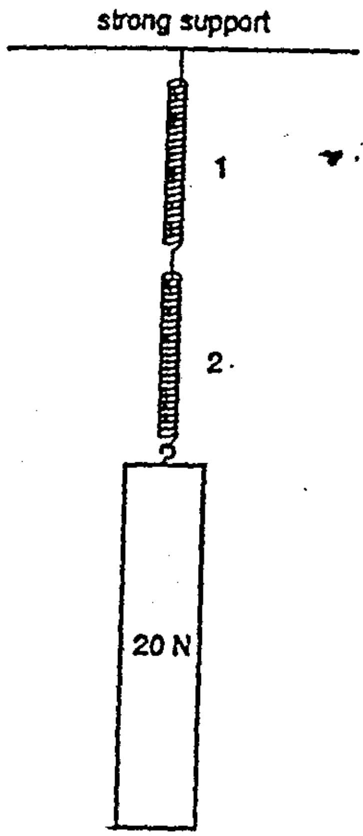


Fig. 2.3(b)

State, with a reason, the extension of each spring in each case.

	(a)	(b)
spring 1	extension = ...	extension = ...
	reason:	reason: ....
	....	....
spring 2	extension = ...	extension = ...
	reason:	reason: ....
	....	....

[5]

3 A student's meal has an average energy content of 6.5×10^6 J and he eats two such meals every day.

(a) Calculate the energy he uses each day in carrying out each of the following activities.

(i) He cycles to and from school every day, a total distance of 8 km, and applies an average force of 100 N while doing so.

Calculate the energy he uses cycling to and from school.

(ii) In school, he has to climb some stairs four times during the day. The difference in levels is 4 m and his mass is 60 kg. Calculate the energy used each day in climbing up the stairs in school. Take the force of gravity on a mass of 1 kg to be 10 N.

(iii) He walks a distance of 8 km during the day, exerting an average force of 50 N when he does so. Calculate the energy used in walking about.

(iv) He goes swimming every day, exerting a force of 70 N whilst he swims 20 lengths of a pool which is 50 m in length.

Calculate the energy used for swimming.

[4]

(b) A person's "work efficiency" may be defined as

$$\frac{\text{energy used in the activities in (a) per day}}{\text{total energy intake from his meals}}.$$

Use your results, and the information at the beginning of the question, to calculate a value for the student's work efficiency.

Comment on your result.

....

....[3]

(c) The student's body gives off heat all through the day and night at a rate of 100W. Calculate the total energy given off by the student in this way during a 24-hour period.

Work out a value for

$$\frac{\text{energy given out as heat by student in 24 hours}}{\text{total energy intake from his meals}}.$$

Suggest one method by which this value could be reduced.

....

....[3]

24

[Turn over

4 (a) (i) Calculate the wavelength in air of the sound of the musical note middle C (frequency $f = 256$ Hz).

Take the speed of sound in air to be 330 m/s.

[2]

(ii) A source of this sound ($f = 256$ Hz) is placed in a tube in which there is also a microphone (see Fig. 4.1); the terminals of the microphone are connected to the Y-plates of a cathode-ray oscilloscope (c.r.o.).

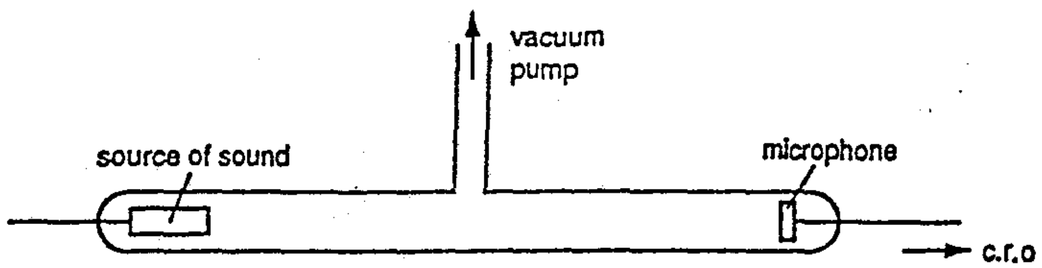


Fig. 4.1

Draw a sketch on Fig. 4.2 to show how many waves would be seen on the screen of the c.r.o. if the spot is set to cross the screen in about 1.0×10^{-2} s.

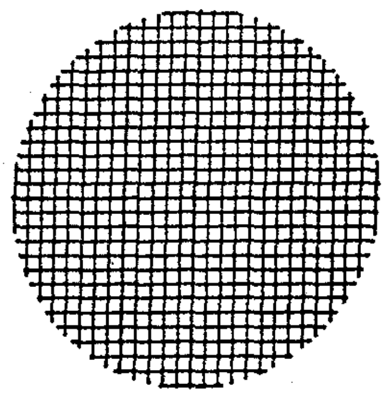


Fig. 4.2

[2]

(iii) Show, giving a reason for your answer in each case, what you would expect to see on the screen of the oscilloscope in (ii) when

1. the air between the source and the microphone is pumped out of the tube (use Fig. 4.3).

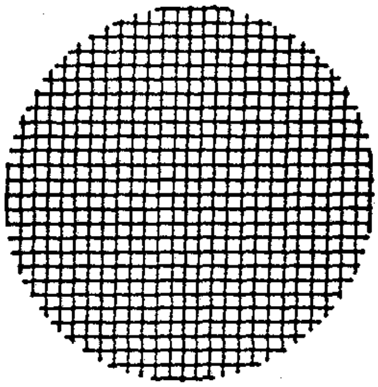


Fig. 4.3

2. the air is replaced by a liquid in which both the source and the microphone continue to work normally (use Fig. 4.4).

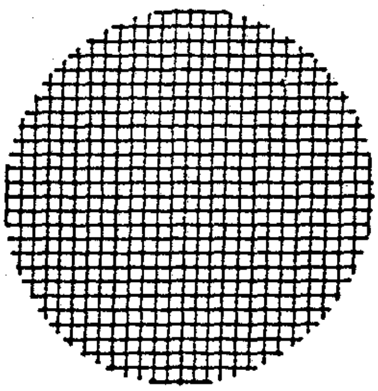


Fig. 4.4 [3]

(iv) A particular species of bird can just be heard clearly, in still air, from a distance of 100 m. The human ear will respond to a minimum incident power of 1.00×10^{-12} W/m^2.

Given that the sound from the bird is propagated equally in all directions and that the area of a sphere of radius 100 m is 1.2×10^5 m^2, calculate the total power received over the surface of the 100 m sphere.

Why will this be less than the power emitted by the bird?

....[3]

26

5 (a) Two students, Jorge and Emil, decided to investigate how the resistance of a wire varied with its thickness and its temperature. They began by setting up the circuit shown in Fig. 5.1.

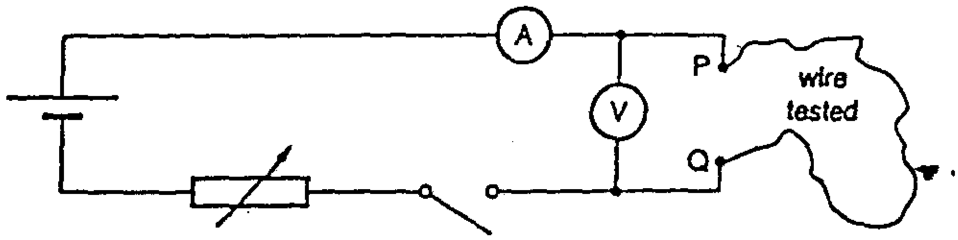


Fig. 5.1

(i) In their first experiment, they used a wire 50 cm long with a cross-sectional area of $0.25\,mm^2$.

The ammeter reading was 0.25 A and the voltmeter reading 0.55 V. Calculate the value they obtained for the resistance of the wire.

[2]

(ii) The two students repeated the experiment several times with different wires of the same material. They used the same length of wire in each experiment, but the wires were of different diameters. They recorded the readings on the ammeter and the voltmeter for each experiment. From diameter measurements they calculated the radius of the wire and its cross-sectional area.

Jorge plotted a graph of resistance against radius of wire whilst Emil plotted a graph of resistance against 1/(cross-sectional area).

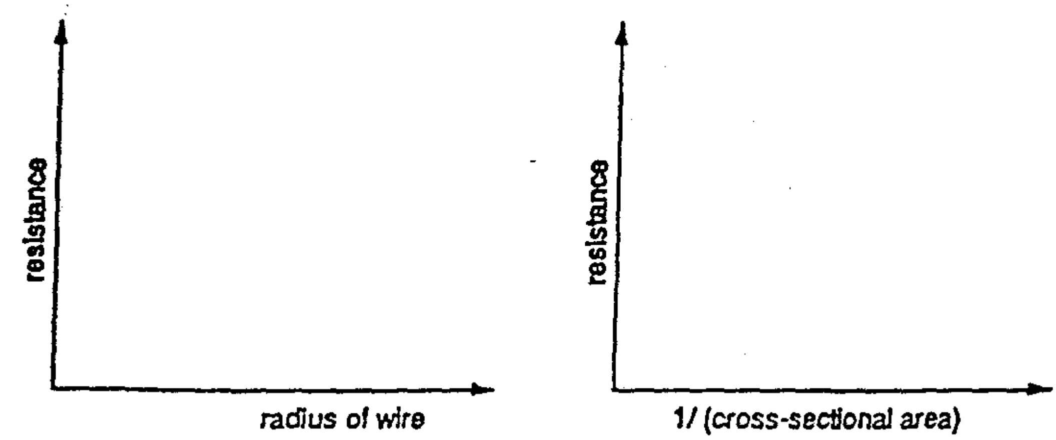


Fig. 5.2

Sketch, on the axes in Fig. 5.2 above, the graphs you would expect them to obtain. [3]

(b) When they tried to measure how the temperature of the wire changed when a current was passing through it, they had to decide how to measure the temperature of the wire. Jorge suggested winding the wire round a thermometer (Fig. 5.3), whilst Emil said it would be better to immerse the wire in oil and to put the thermometer in the oil (Fig. 5.4).

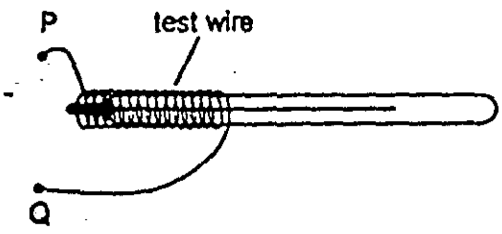


Fig. 5.3

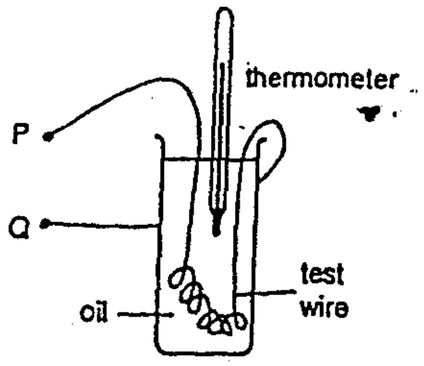


Fig. 5.4

Comment on each of these arrangements as a way of measuring the temperature of the wire during the experiment.

....

....

....

....

....[3]

(c) In a data sheet about lamps, the two students discovered some facts about a particular filament lamp.

These facts were:

Filament:	
length	= 800 mm
diameter	= 0.01 *mm*
temperature when hot	= 2000 °C
resistance when hot	= 500 Ω
Operating voltage of lamp	= 250 V
Efficiency of lamp as a source of light	= 15%

Calculate

(i) the current through the lamp when hot,

(ii) the power it dissipates.

[3]

6 (a) The arrangement shown in Fig. 6.1 represents an experiment to investigate electromagnetic induction.

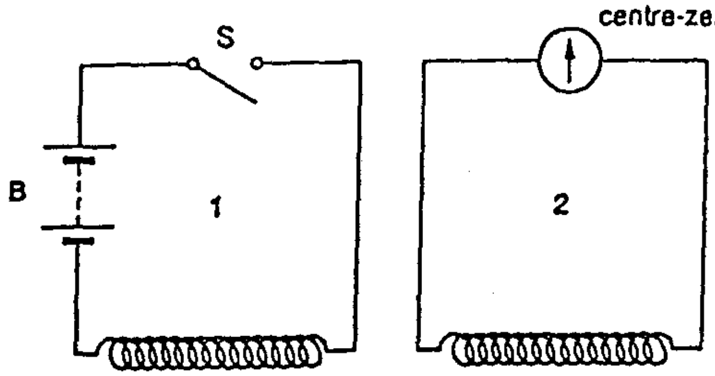


Fig. 6.1

State, giving a reason for your answer in each case, what is observed as

(i) switch S is closed, observation: ....

reason: ....

....

(ii) switch S remains closed, observation: ....

reason: ....

....

(iii) switch S is then re-opened. observation: ....

reason: ....

....

[3]

(b) The battery B of Fig. 6.1 is replaced by an a.c. supply as shown in Fig. 6.2.

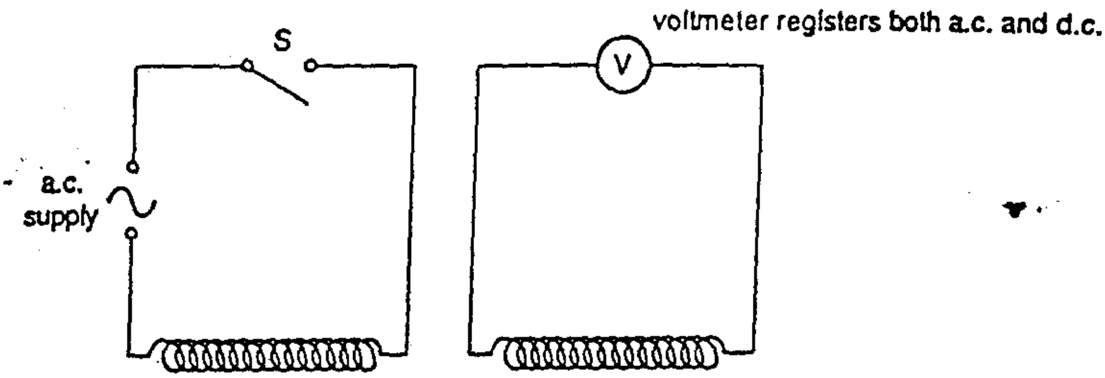


Fig. 6.2

With switch S closed, what will be observed?

....

....

Give a reason for the observation.

....

....[2]

(c) Using the outline provided in Fig. 6.3, draw a diagram to illustrate the structure of a *step-down transformer.*

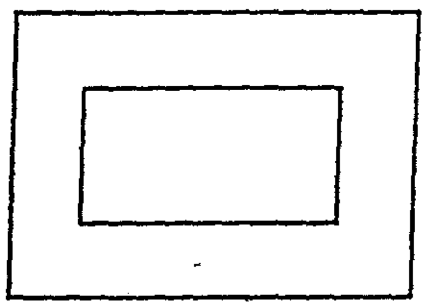


Fig. 6.3

Select two *differences* between the *arrangements* shown in *Figs. 6.1* and *6.3* and *explain* the advantage gained in the performance of the transformer by each of them:

Difference 1 ....

Advantage ....

....

Difference 2 ....

Advantage ....

....[2]

(d) Front-door bells in houses are often connected to the main electricity supply through a step-down transformer.

Two circuits by which this can be done are shown in Figs. 6.4(a) and 6.4(b).

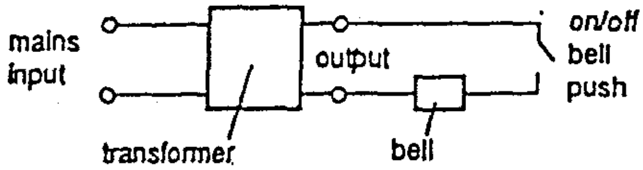


Fig. 6.4(a)

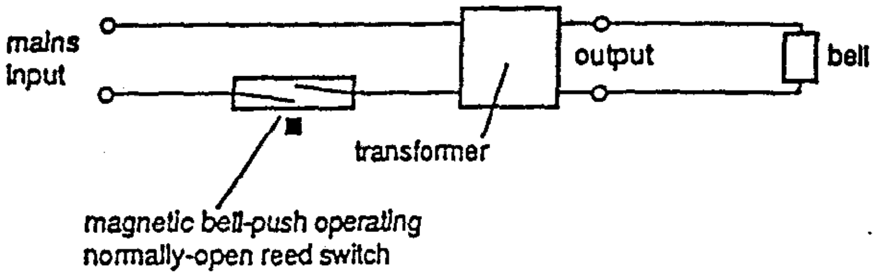


Fig. 6.4(b)

Which circuit, (a) or (b), do you consider less expensive to operate once it has been installed? State the reasons for your choice.

....

....

....[3]

7 (a) *Figure 7.1 illustrates the apparatus used to determine how the absorption of radioactive emissions varies with the thickness of the absorber.*

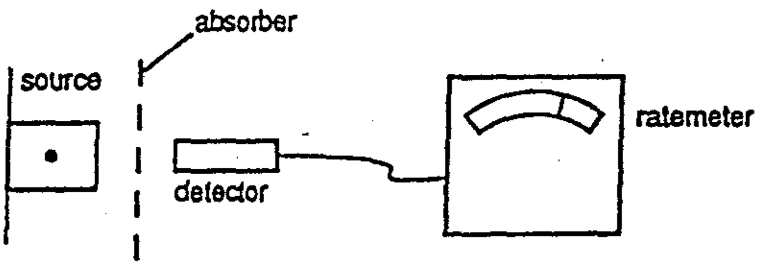


Fig. 7.1

State what readings would be necessary to find the percentage absorption caused by a particular absorber.

....

....

....

32

(b) In one experiment, absorbers of different thicknesses of the same material were placed in the position shown in Fig. 7.1. The ratemeter reading was taken using each absorber and the results were plotted on a graph which is illustrated in Fig. 7.2. The absorbers used were aluminium sheets.

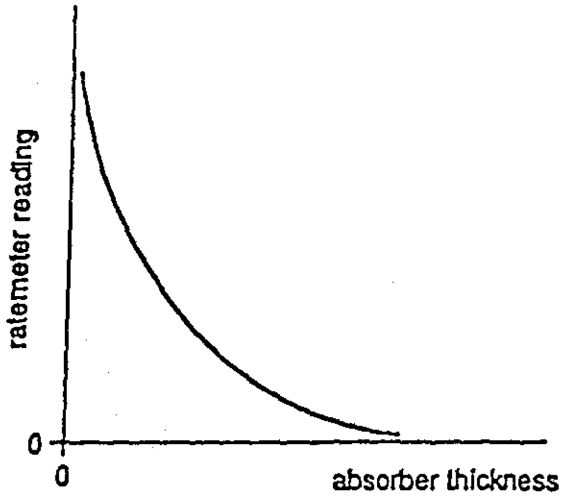


Fig. 7.2

The source was known to have a long half-life and to emit only one type of radiation. State the type of radiation emitted and your reasons for rejecting the other two possibilities.

(i) Type emitted: ....

(ii) Reasons for rejecting

-radiation ....

....

-radiation ....

....

(iii) Explain why small ratemeter readings were obtained even when thick absorbers were used.

....

....[3]

(c) A nuclear power station produces an output of 75 megawatts (i.e. 7.5×10^7 W). If the process for converting nuclear energy into electrical energy has an efficiency of 30%, calculate the rate at which the mass of the uranium fuel must be converted into other forms of energy.

Take the speed of light to be 3×10^8 m/s.

Centre Number	Candidate Number

Candidate Name ____________________

International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3

PAPER 3

Wednesday 18 MAY 1994 Morning 1 hour 15 minutes

Candidates answer on the question paper.
No additional materials are required.

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

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	
TOTAL	

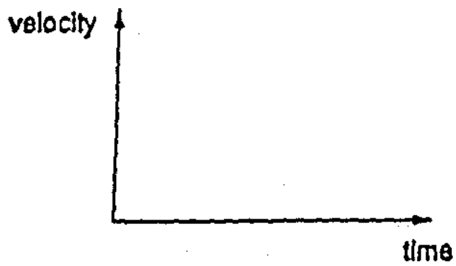
This question paper consists of 14 printed pages and 2 blank pages.

SB (SC) OF41325

[Turn over

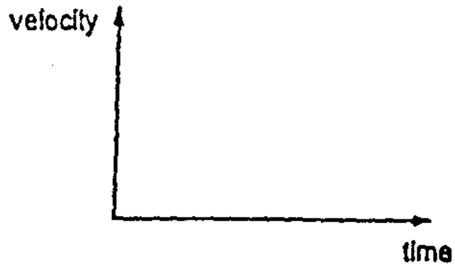
For Examiner's Use

1 (a) (i) Use the axes of Figs. 1.1 and 1.2 to illustrate the difference between *uniform velocity* and *uniform acceleration*.



shows uniform velocity

Fig. 1.1



shows uniform acceleration

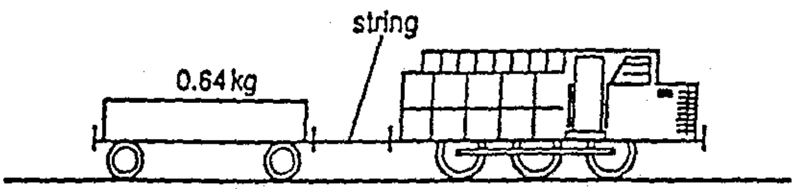
Fig. 1.2

(ii) Explain how your graph in Fig. 1.2 shows that the acceleration is uniform.

....

....

.... [2]



(b) David has a model train. The engine pulls a loaded truck of mass 0.64 kg along a horizontal track as shown in Fig. 1.3.

Fig. 1.3

When the train is moving at a uniform speed, the force in the string is 0.10 N.

(i) What is the total force opposing the motion of the truck?

.... [1]

(ii) Calculate the force in the string when the acceleration of the truck is $0.25\ m/s^2$. (Assume that the force opposing the motion of the truck remains as in (i).)

(c) David devises an instrument to show directly whether his train is travelling at uniform speed, accelerating, or slowing down. This instrument is illustrated in Fig. 1.4.

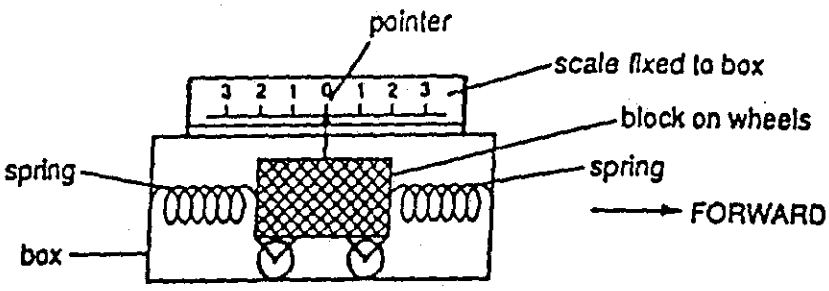


Fig. 1.4

The instrument is fixed to the truck. David makes the truck accelerate forward and watches the pointer on the instrument.

(i) Draw on Fig. 1.5 a line showing where the ppinter could be.

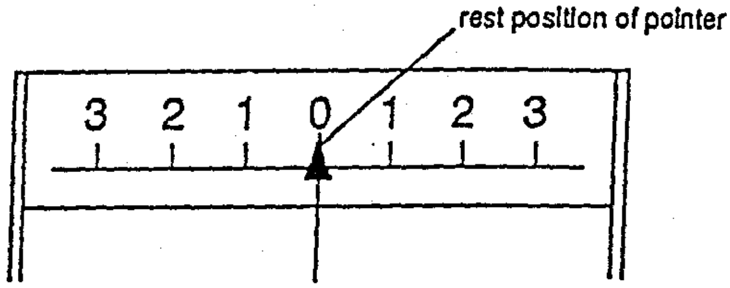


Fig. 1.5

(ii) Explain your choice for the position of the line.

....

.... [2]

(iii) What is the advantage of having two springs in the instrument?

....

....

What can you say about the springs if the scale on the instrument is to be uniform?

....

.... [3]

36

For Examiner's Use

2 (a) A sample of air has volume 6000 cm^3 at 20 °C and is at atmospheric pressure. Calculate the volume the sample will occupy if it is heated to 70 °C whilst the pressure on it is kept constant.

[3]

(b) Another sample of air of mass equal to that in (a), and at 20 °C, was contained in a glass bottle which was held with its open end downwards as shown in Fig. 2.1.

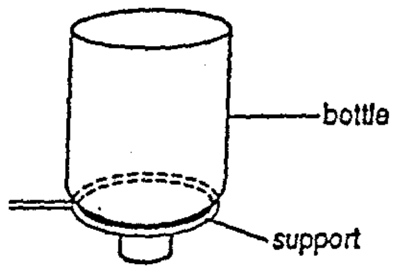


Fig. 2.1

The temperature of the air was again raised to 70 °C. Calculate the fraction of the mass of the sample which would escape from the bottle. (Assume that the expansion of the flask is negligible and that atmospheric pressure remains constant.)

[4]

(c) A hot-air balloon can float clear of the ground if its total weight is less than the weight of the cold air it displaces (i.e. the weight of cold air which occupies the same volume).

(i) A balloon is inflated with cold air to a volume of 250 m^3. The density of cold air is 1.3 kg/m^3. Calculate the mass of cold air in the balloon.

For Examiner's Use

(ii) The air inside the balloon is now heated to 70 °C. The volume of the balloon remains constant, but the density of the air inside it decreases to 0.975 kg/m³. Calculate the mass of hot air in the balloon.

(iii) There is an upward force on the balloon given by

upward force = weight of cold air balloon displaces − weight of hot air in balloon

Calculate the upward force on the balloon.

Take the force of gravity on 1 kg to be 1 N.

[4]

(d) The bottom of the balloon is open to the air so that the pressure inside it is equal to atmospheric pressure. Explain, in molecular terms,

(i) how the less dense air inside the balloon can exert a pressure equal to that of the atmosphere,

....

....

....

....

(ii) how, in the absence of further heating, the air in the balloon will cool down.

....

....

....

3 (a) An electric heater has a label attached to it by the manufacturer.

The label is illustrated in Fig. 3.1.

FOR USE WITH 200/240 V 50 Hz SUPPLY
POWER : 2 kW
NOTE : This appliance must be connected to earth when in use.

Fig. 3.1

(i) Explain the meaning of the following terms used on the label.

240 V ....

....

50 Hz. a.c. ....

....

Power 2 kW ....

....

(ii) How should the appliance be 'connected to earth'?

....

....

(iii) Why should the appliance be connected to earth?

....

.... [7]

For Examiner's Use

(b) Calculate

(i) the current in the heating element when it is used on a 240 V supply,

(ii) the resistance of the heating element when in use.

[4]

(c) A different electric heater has two heating elements, A and B. These are usually connected to a 220 V supply as shown in Fig. 3.2.

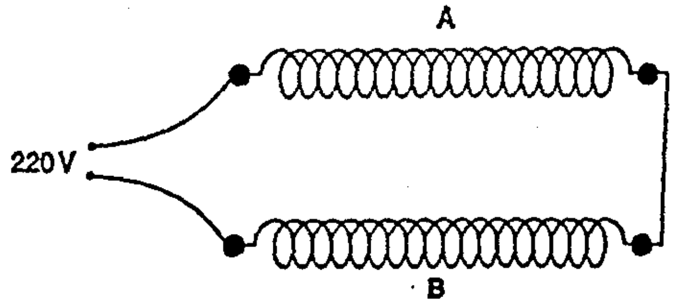


Fig. 3.2

This heater now needs to be operated from a 110 V supply. Draw on Fig. 3.3 to show how the two elements and the supply should be connected to give the same power as the arrangements in Fig. 3.2.

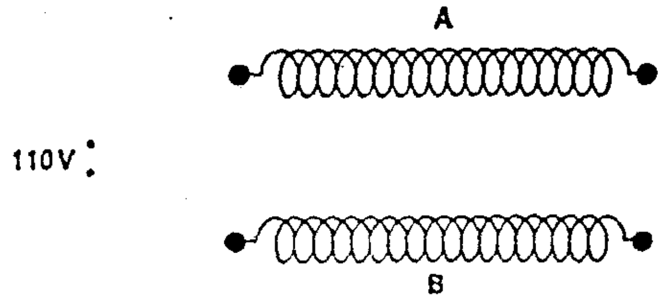


Fig. 3.3

For Examiner's Use

4 Figure 5.1 shows the structure of a tube used in a cathode-ray oscilloscope (c.r.o.).

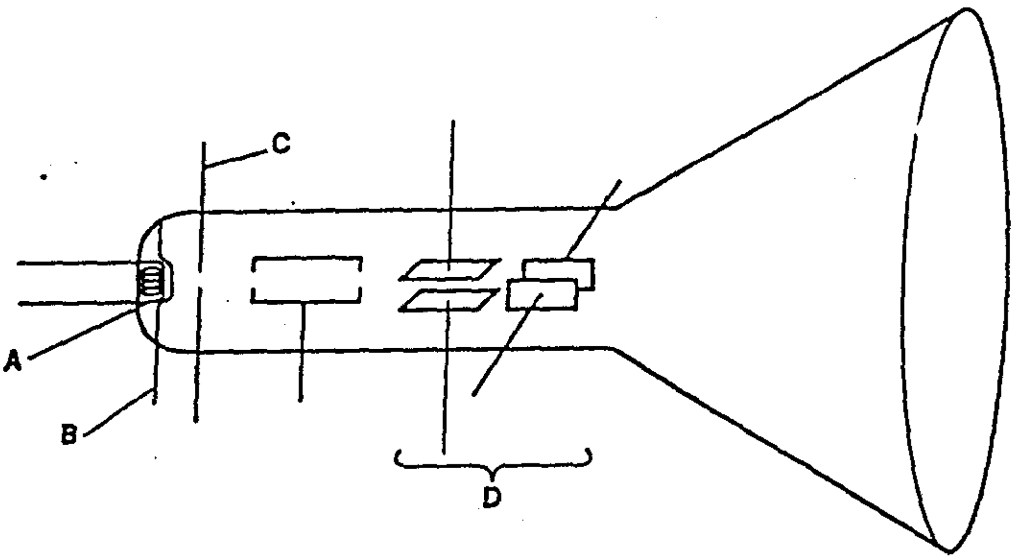


Fig. 4.1

(a) (i) State the *function* of each of the lettered components.

A ....

....

B ....

....

C ....

....

D ....

....

[4]

(ii) Calculate the number of electrons per second which flow through the tube when the tube current is 1.0×10^{-4} A. The charge on an electron is 1.6×10^{-19} C.

For Examiner's Use

(iii) State the energy changes which take place after an electron has been emitted until energy is released as light from the screen.

....

....

....

.... [1]

(b) The c.r.o. is used to display the output of a simple a.c. generator. See Fig. 4.2.

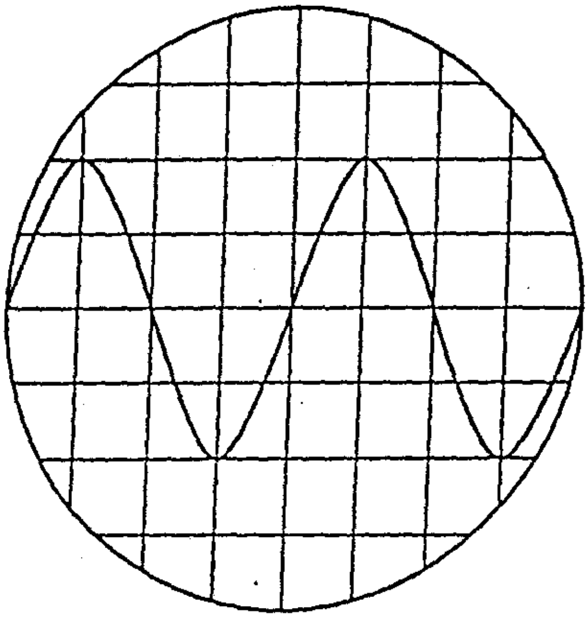


Fig. 4.2

Explain how the p.d. produced by the generator causes this trace.

....

....

....

....

.... [3]

For Examiner's Use

5 Figure 5.1 shows one design for a detector badge to be worn by workers who may be exposed to radioactive emissions.

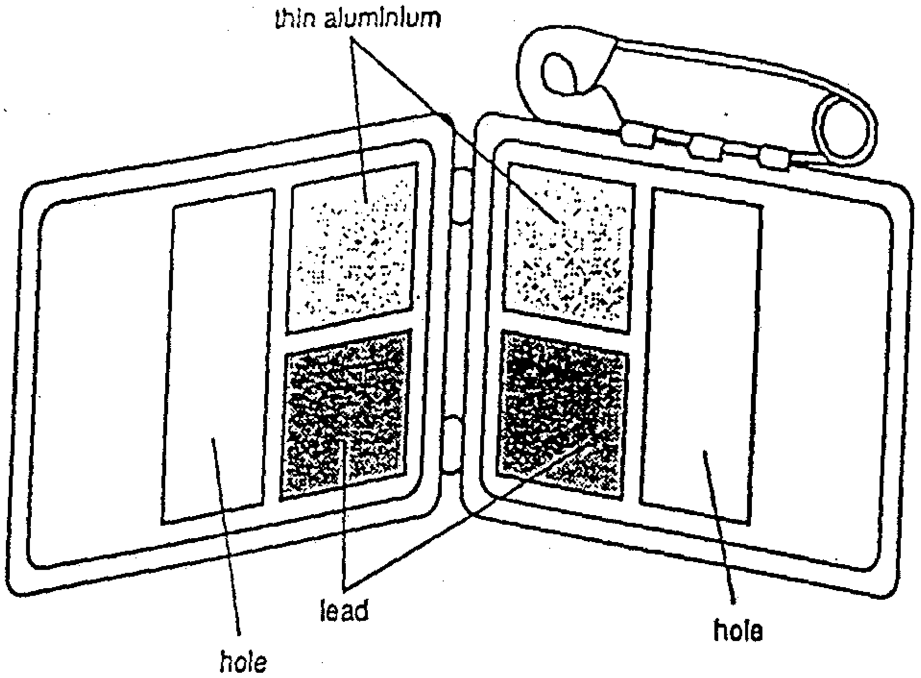


Fig. 5.1

In use, the badge is as shown in Fig. 5.2.

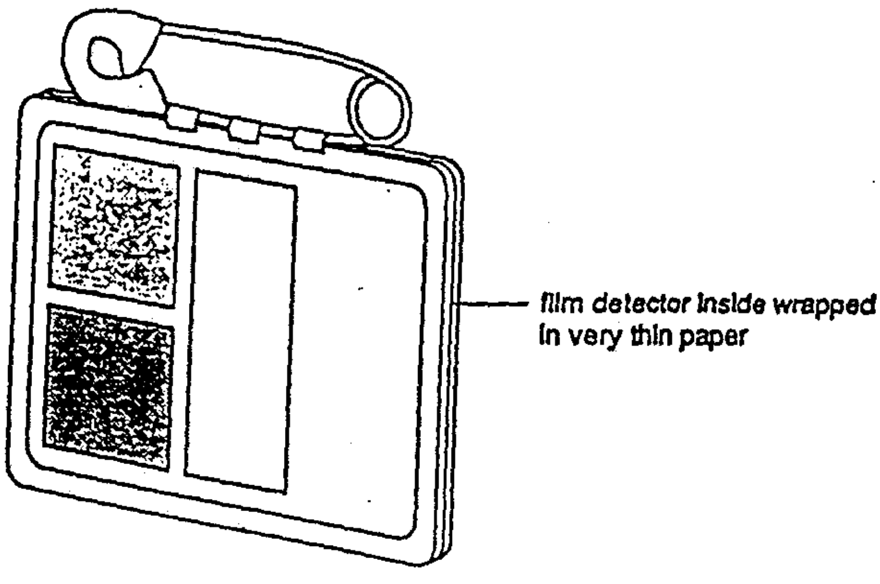


Fig. 5.2

For Examiner's Use

(a) Describe and explain how the film would appear after development if it had been exposed to

(i) α-radiation only, + ...

....

....

(ii) β-radiation only, + ...

....

....

(iii) γ-radiation only. + ...

....

....

[9]

(b) Suggest why the badge is not suitable for detecting short, intense bursts of radiation.

....

.... [1]

44

For Examiner's Use

6 (a) Draw a circuit diagram to show how a transformer and a diode can be used in a circuit to charge a 12 V battery from a 240 V a.c. mains supply.

[5]

(b) Many electrically powered tools now have rechargeable batteries built into them.

Some of the characteristics of three types (A, B and C) of battery are shown in Fig.6.1.

BATTERY	MAXIMUM VOLTAGE	MAXIMUM CURRENT/A	CAPACITY A–h
A	12V	6 A	60
B	12V	12 A	25
C	24V	8 A	45

Fig. 6.1

State, giving a reason for your answer in each case,

(i) which battery could give the greatest power,

....

....

(ii) which battery will last longest when supplying a steady current of 1 A.

....

.... [2]

(c) A circuit is arranged as shown in Fig. 6.2.

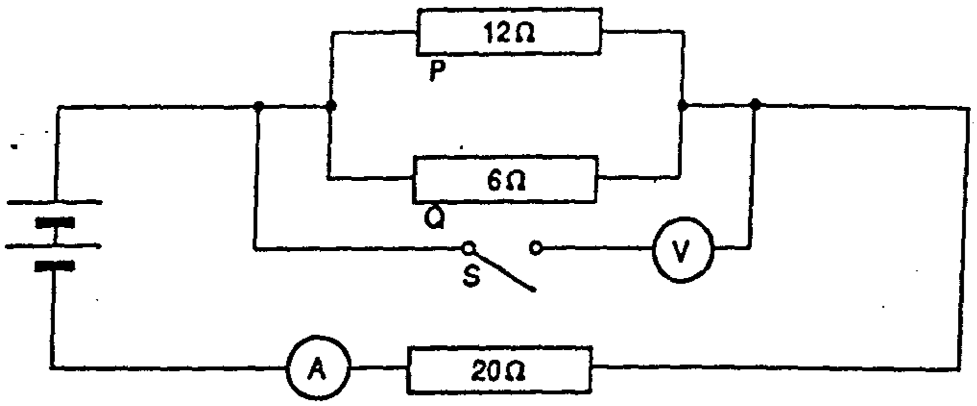


Fig. 6.2

The ammeter and the battery have negligible internal resistance, and the switch S is open.

(i) Calculate the effective resistance of resistances P and Q connected in parallel.

(ii) Calculate the current registered by the ammeter, if the e.m.f. of the battery is 3 V.

For Examiner's Use

(iii) Resistors P and Q are constructed of wires of the same material but of different thicknesses. The wire used for Q is 5.0 m long and has a cross-sectional area 16 times greater than the wire used in P. What is the length of the wire used to make resistor P?

(iv) Explain why closing switch S will have very little effect on the ammeter reading.

....

....

.... [8]

Candidate Name ______________________

Centre Number	Candidate Number

International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS **0625/3**

PAPER 3

Tuesday 15 NOVEMBER 1994 Morning 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials required:
Electronic calculator and/or Mathematical tables

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
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2	
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TOTAL	

This question paper consists of 14 printed pages and 2 blank pages.

SB (CE) QK42314

[Turn over

For Examiner's Use

1 *Fig. 1.1 shows part of a children's roundabout (carousel).*

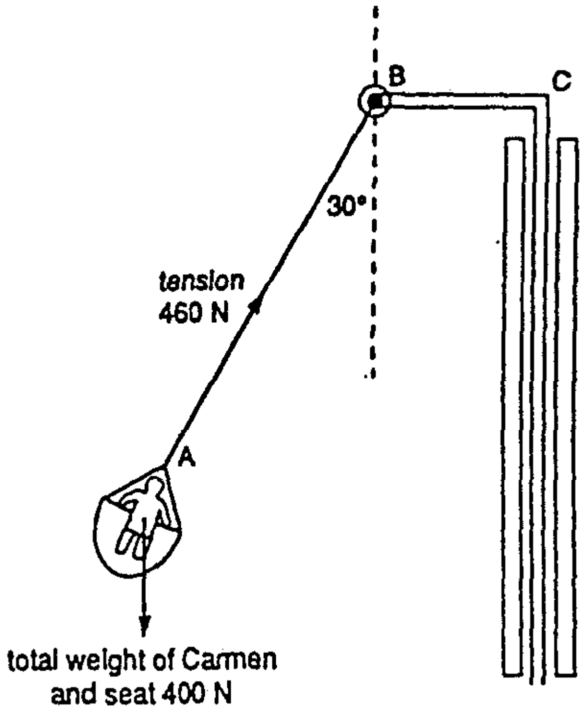


Fig. 1.1

At one instant, Carmen is sitting in a seat attached by a cable AB to the horizontal arm BC which rotates around a vertical axis through C. Carmen is going round in a circular path at steady speed.

For Examiner's Use

(a) By means of a scale diagram, determine the resultant of the tension and the total weight. [6]

(b) Explain how Carmen can be travelling at a steady speed but still have an acceleration.

....

....

....

....

....[3]

(c) Explain how the resultant force enables Carmen and the seat to travel in a circular path.

....

....

....

....

....[3]

50

For Examiner's Use

(d) As she moves round, Carmen drops a small ball. Describe the motion of the ball and the path it follows after it starts to fall.

....

....

....[3]

2 (a) A fully loaded, flat-bottomed tanker with vertical sides has a weight of 135×10^7 N. It is floating in sea-water of density 1.05×10^3 kg/m^3, and the keel of the tanker is 18 m below the surface of the sea.

Assume $g = 10$ m/s^2.

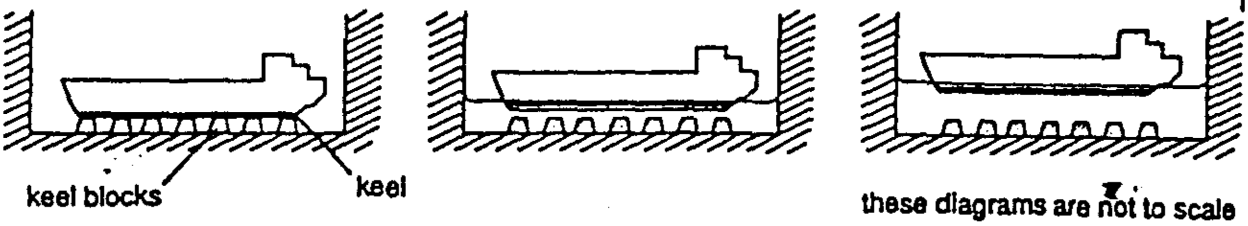
Calculate the water pressure at a depth of 18 m. [3]

(b) The tanker, unloaded, is taken into a dry dock and settled on to keel blocks of total area 1000 m^2. The unloaded weight of the tanker is 60×10^7 N.

Calculate the pressure which the tanker exerts on each, i.e. any one, of the keel blocks. [2]

For Examiner's Use

(c) Sea-water is gradually allowed into the dry dock until the keel blocks, which are each 2 m high, are immersed and the sea-water reaches a final depth of 20 m (see Fig. 2.1).



these diagrams are not to scale

Fig. 2.1

On the axes of Fig. 2.2, sketch a graph to show how the pressure on each of the keel blocks changes as the depth of water increases. [5]

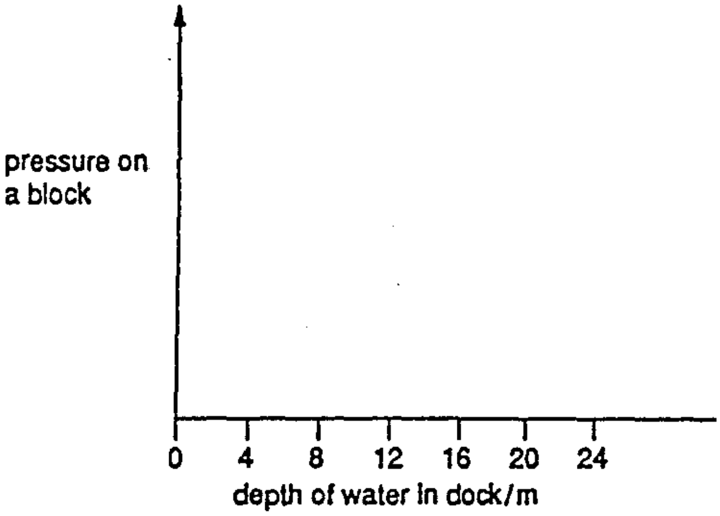


Fig. 2.2

(d) The power of the tanker's engines is 45 000 kW whilst the tanker is travelling at a constant speed of 7 m/s. Calculate the magnitude of the forces resisting the tanker's motion. [3]

For Examiner's Use

3 (a) What is meant by the *specific heat capacity* of a substance?

....

....

....[2]

(b) Describe a single experiment to show that different liquids (e.g. water and glycerine) have different specific heat capacities.

....

....

....

....

....

....

....

....[6]

(c) The heat capacity of a thermocouple is small. Give two advantages resulting from this.

advantage 1 ....

....

advantage 2 ....

....[2]

For Examiner's Use

(d) Fig. 3.1 shows an experiment to investigate the radiating properties of different surfaces. Heat energy is radiated down from the surface S of a metal shell and is detected by a blackened thermocouple.

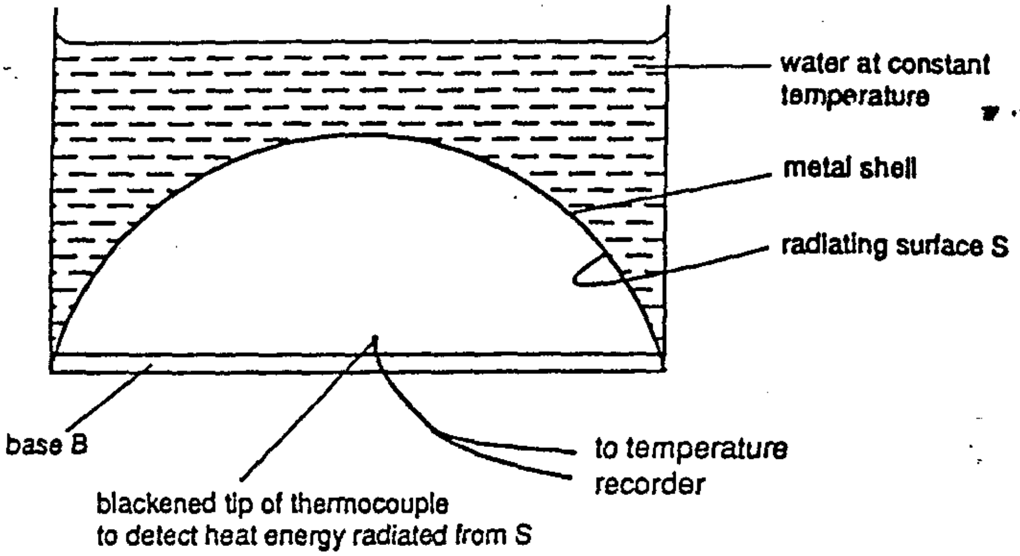


Fig. 3.1

(i) Two experiments were carried out. In the first, surface S was matt black and, in the second, surface S was silvery.

How does the temperature recorded in the second experiment compare with that in the first?

....

....

(ii) State one advantage of having the radiating surface S *above* the tip of the thermocouple.

....

....[2]

For Examiner's Use

4 (a) State a law of reflection of light.

....

....[2]

(b) Figs. 4.1(a) and (b) show rays reflected from the surface of each of two mirrors, one plane and the other curved. The normals ,N, at the points of incidence have been drawn in.

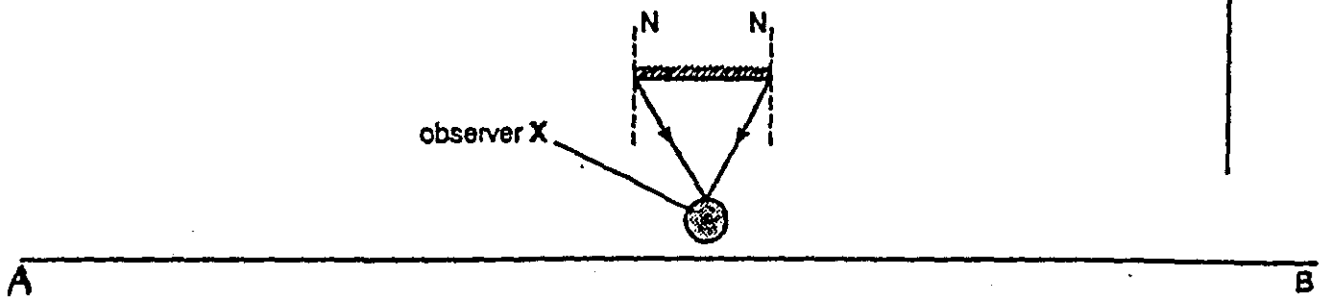


Fig. 4.1(a)

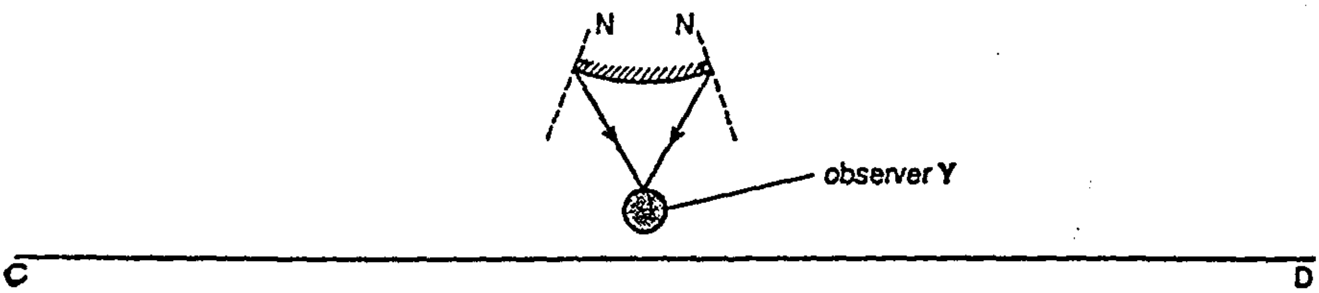


Fig. 4.1(b)

(i) Complete the diagrams in Figs. 4.1 (a) and (b) by drawing in incident rays which have started from the line AB or the line CD, respectively.

(ii) Measure, and record below, the different lengths of lines AB and CD which observers X and Y can see in the two mirrors.

Length of AB in Fig. 4.1 (a) ....

Length of CD in Fig. 4.1 (b) ....

(iii) Most cars have a plane mirror as the rear-view mirror inside the car and a curved mirror outside.

Give one advantage of each mirror as compared with the other.

advantage of plane mirror

....

....

advantage of curved mirror

....

....[6]

56

(c) Rays from a lamp immersed in some water are incident from below on the water surface, as shown in Fig. 4.2.

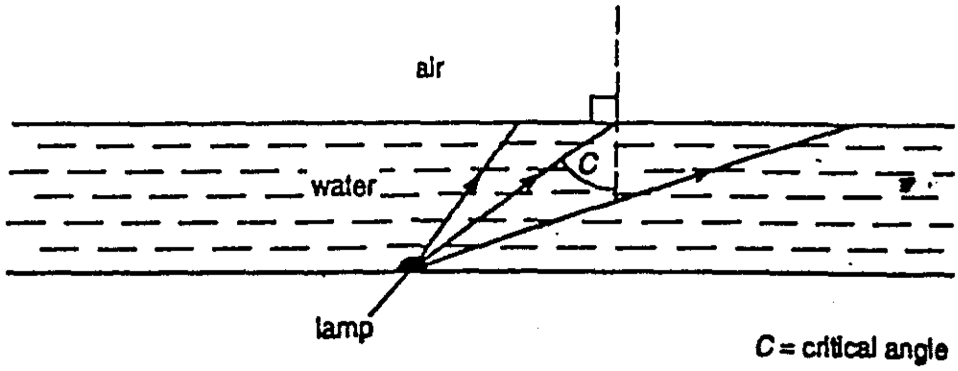


Fig. 4.2

On Fig. 4.2, sketch the possible paths of the rays after they meet the water surface. [3]

(d) Fig. 4.3 shows an optical fibre.

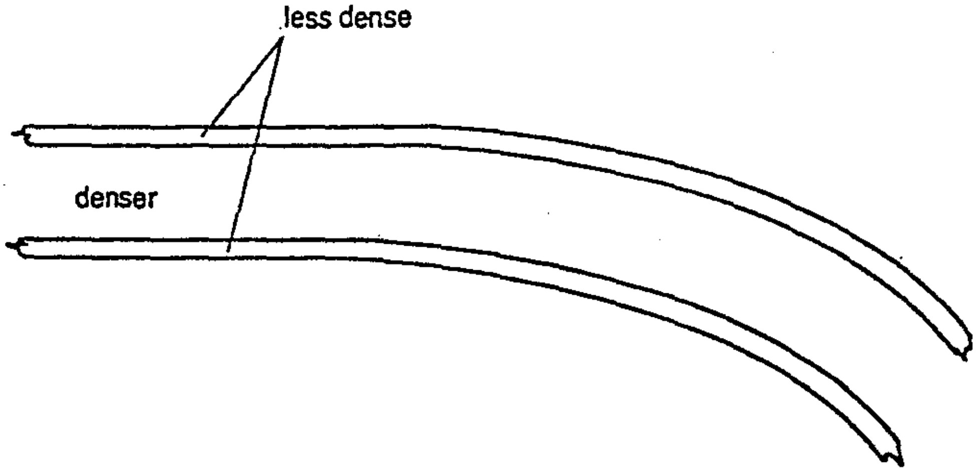


Fig. 4.3

(i) Explain the action of an optical fibre. You may draw on Fig. 4.3 if you wish.

....

....

....

(ii) Optical fibre cables can be used to examine the inside of a human body.

Suggest a reason for having a cable made up of many thousands of very fine fibres.

....

For Examiner's Use

5 (a) Describe how you would show

(i) that there is a magnetic field around a long straight wire carrying an electric current,

....

....

....

....

(ii) that the *direction* of the magnetic field is determined by the direction of the current.

....

....

....

....[5]

(b) Complete Fig. 5.1 and Fig. 5.2 to show the pattern of the magnetic field around each of the coils when currents pass through them in the directions shown. [4]

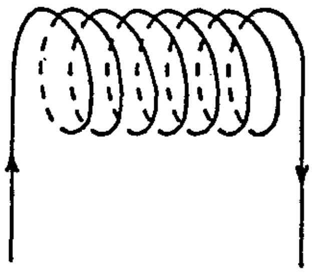


Fig. 5.1

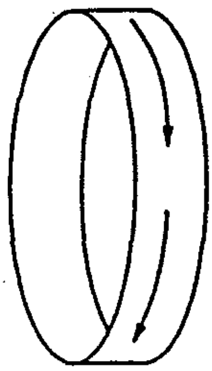


Fig. 5.2

(c) The circuit which operates the starter motor in a car is similar to that illustrated in Fig. 5.3.

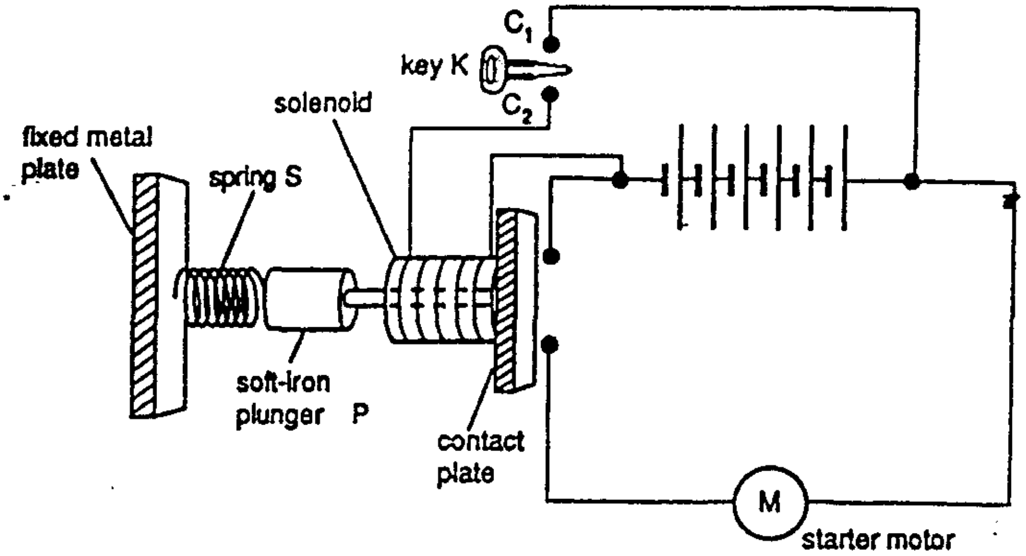


Fig. 5.3

(i) When the spring-loaded key K is turned, it completes the connection between C_1 and C_2.

Explain why this causes the soft-iron plunger P to move.

....

....

....

....

(ii) Explain why the movement of P causes a current in the starter motor.

....

....

(iii) When the car engine starts, key K is released so that C_1 and C_2 are no longer connected.

What is the function of spring S?

....

....[6]

For Examiner's Use

6 (a) $^{234}_{90}Th$ and $^{230}_{90}Th$ are two isotopes of the element thorium.

(i) *What is meant by the term isotopes?*

....

....

....

(ii) What information about the nuclei of the atoms of these two isotopes can be deduced from the numbers 90, 230 and 234?

90 ....

....

230 ....

....

234 ....

....[3]

(b) Two equations which describe the decay of radioactive nuclei are

$^{24}_{11}Na \longrightarrow ^{24}_{12}Mg$ + particle A,

$^{226}_{88}Ra \longrightarrow ^{222}_{86}Rn$ + particle B.

(i) State, giving a reason for your answer in each case, the nature of each particle.

particle A ....

....

particle B ....

....

(ii) *It is not possible to tell from these nuclear equations whether or not γ-radiation is emitted in the process of decay. Suggest a reason why the emission of γ-radiation is not always written into nuclear equations.*

....

....[4]

60

For Examiner's Use

(c) A method of monitoring the level of fuel in a storage tank is shown in Fig. 6.1.

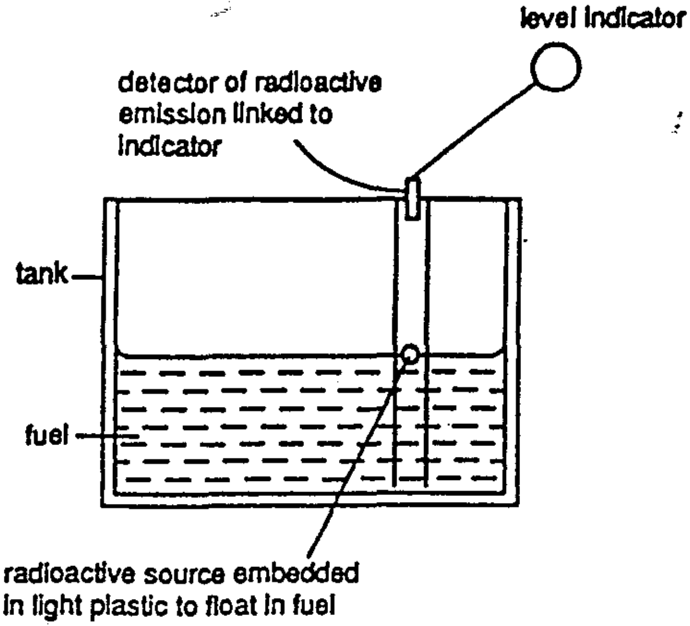


Fig. 6.1

Explain how the detector could give a reading appropriate to the level of fuel in the tank.

....

....

....

....[2]

	Centre Number	Candidate Number
Candidate Name ______________________		

International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3

PAPER 3

Wednesday 17 MAY 1995 Morning *1 hour 15 minutes*

Candidates answer on the question paper.
Additional materials:
Electronic calculator and/or Mathematical tables

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

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	
TOTAL	

This question paper consists of 15 printed pages and 1 blank page.

MFK (5249) OF53724

[Turn over

For Examiner's Use

1 A high-speed train has a mass of 4×10^5 kg and runs at a maximum speed of 100 m/s. A simplified speed-time graph of a journey lasting two hours is shown in Fig. 1.1.

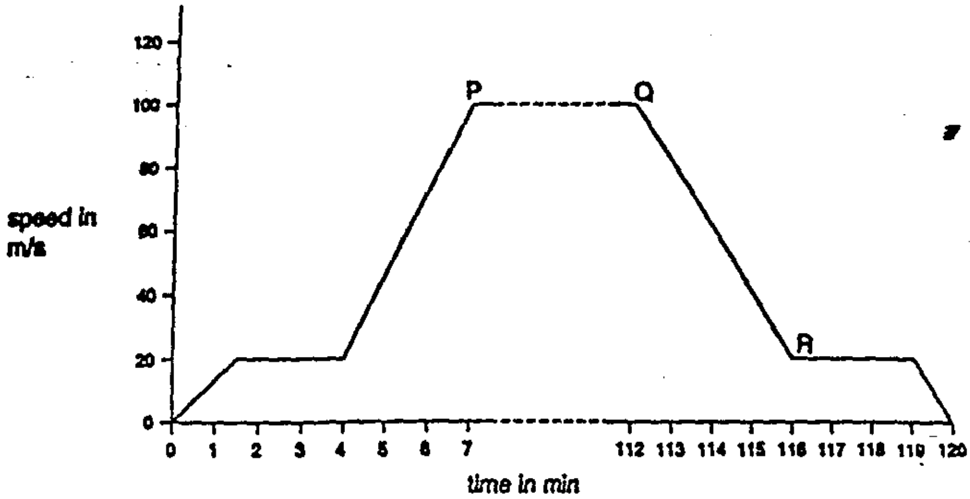


Fig. 1.1

(a) Although the *speed* of the train is constant between points P and Q on the graph, its *velocity* may vary. Explain how that is possible.

....

.... [2]

(b) It is not possible to calculate the acceleration of the train from a speed-time graph. Suggest a reason for this.

....

.... [2]

(c) (i) Use the graph to determine the rate at which the speed of the train decreases during the part of the journey marked QR. [2]

For Examiner's Use

(ii) If this part of the journey is over a horizontal straight track, calculate

1 the force required to slow down the train at this rate,

2 how far the train travels whilst it is slowing down. [4]

(d) The curves in tracks used for high-speed trains have much larger radii than those in tracks used for slower trains. From your knowledge of motion in a circle, explain why this is necessary.

....

....

....

.... [2]

For Examiner's Use

2 (a) State what is meant by the *specific latent heat of vaporisation of water.*

....

....

.... [2]

(b) Apparatus you could use to measure this quantity is illustrated in Fig. 2.1.

The method does not involve any temperature change; all the measurements are made after the water starts to boil.

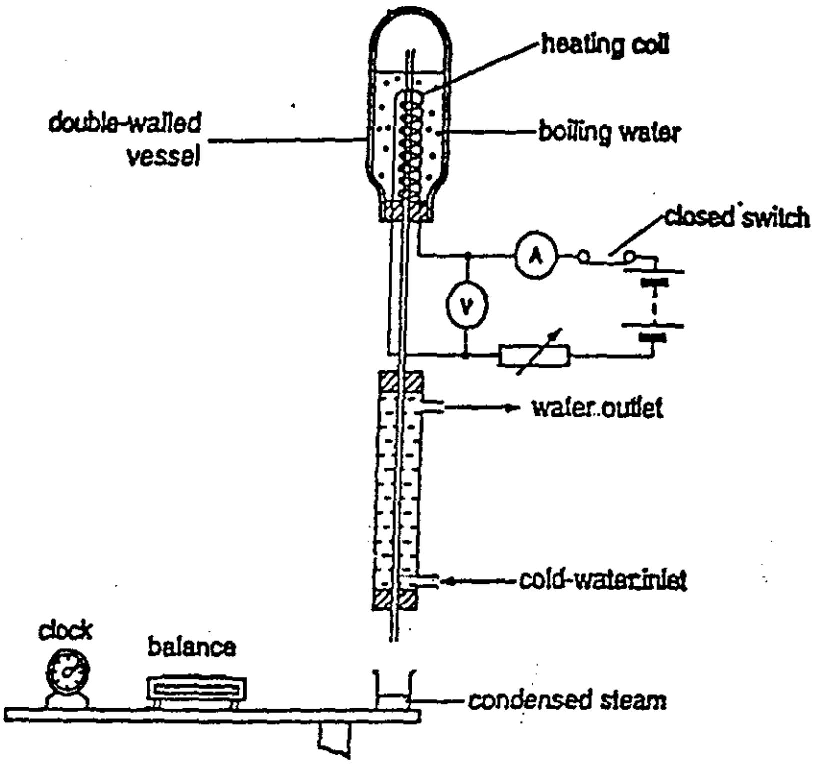


Fig. 2.1

(i) *Describe, in outline, how the experiment is carried out.*

....

....

....

....

....

For Examiner's Use

(ii) List the measurements you would need to take, giving each measurement a symbol. Show how to calculate the specific latent heat of vaporisation of water from the measurements.

....

....

....

....

....

....

....

....

[7]

(c) Calculate the maximum mass of snow which will melt when a kilogram of water vapour at 0 °C condenses on a snow surface also at 0 °C. (Take the specific latent heat of vaporisation of water at 0 °C to be 25×10^5 J/kg and the specific latent heat of fusion of snow to be 3.4×10^5 J/kg.) [3]

3 (a) (i) Complete the scale diagram (Fig. 3.1) to show how the converging lens forms an image of the object O, adding any necessary labels. [3]

scale: 1 cm represents 6 cm

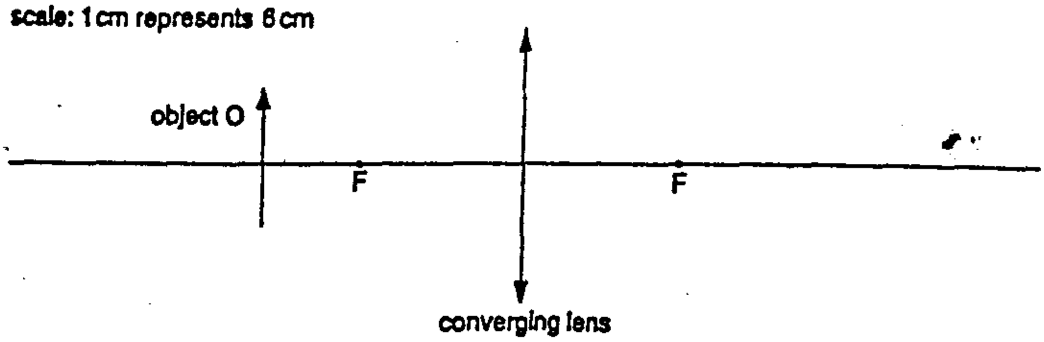


Fig. 3.1

(ii) State what is meant by an *image*.

....

.... [2]

(iii) Explain how the light coming from a white card placed in the image position enables the eye to see the image.

....

.... [2]

(iv) Using measurements made on the scale diagram, write down values for

1 the distance of the image from the lens ....,

2 the magnification of the image (i.e. the length of the image ÷ the length of the object) ....

[2]

(b) Figure 3.2 shows the lens from (a) used in a photographic enlarger. The object is a photographic negative. This arrangement forms an image on the photographic paper.

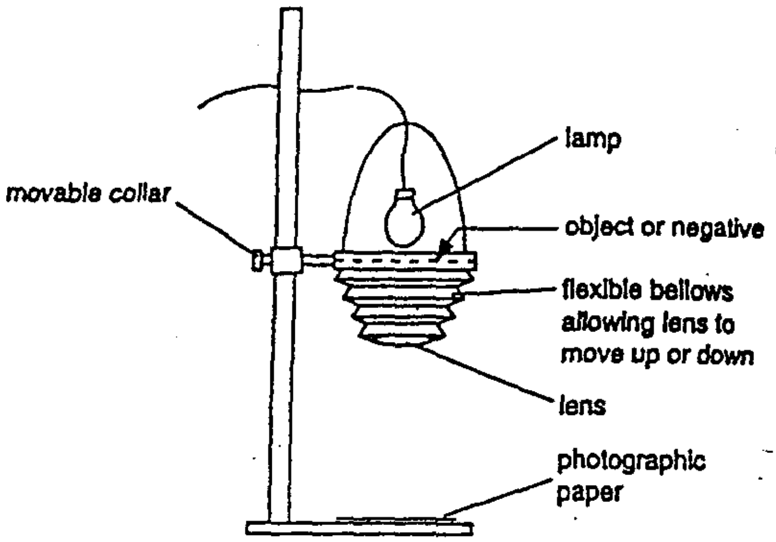


Fig. 3.2

(i) In an enlarger, the lens can be moved nearer to, or further away from, the object. Assuming that the lens and the object were originally positioned as shown in Fig. 3.1, what is the effect on the *size* of the image of moving the lens in the enlarger a small distance upwards?

....

.... [1]

(ii) When the lens in the enlarger is moved upwards, the image distance changes also. Suggest one way of making sure that the image on the photographic paper is still sharply in focus.

....

.... [2]

(iii) The image formed on the photographic paper is a rectangle of sides *L* and *B*. How does the amount of light reaching unit area of the photographic paper change when an image of sides 2*L* and 2*B* is produced? Give a reason for your answer.

....

....

.... [2]

4 (a) Maria was presented with three small metal bars, identical in appearance and size, marked A, B and C respectively. She was also given a small pivoted compass. She was asked to investigate the magnetic properties of each bar. To do so, she used the small pivoted compass which she allowed to come to rest (Fig. 4.1).

She then brought one of the bars near to the compass, placing it first in position X, then moving it round to Y, observing the movement of the compass in each case. The results she obtained are shown in the diagrams in Fig. 4.2.

Maria marks line in which compass sets with no bar present

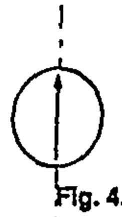


Fig. 4.1

Maria uses bar A

Maria uses bar B

Maria uses bar C

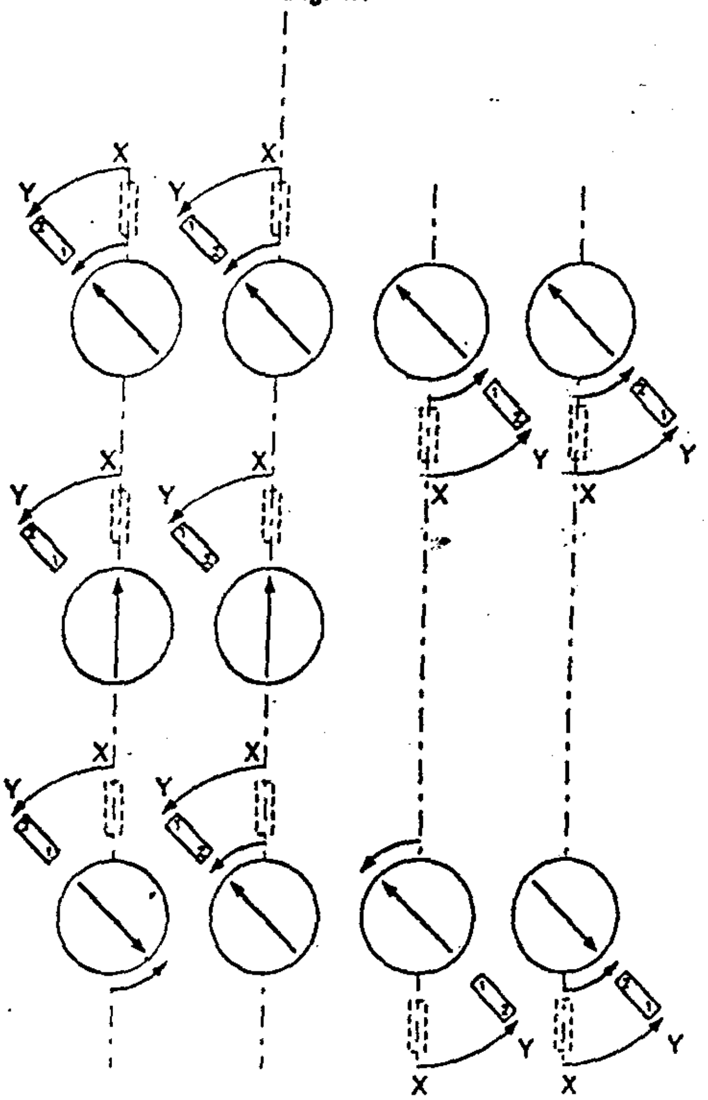


Fig. 4.2

For Examiner's Use

(i) *Write down the conclusions Maria could draw from her tests, giving reasons for your answers.*

bar A ....

....

....

bar B ....

....

....

....

bar C ....

....

....

.... [6]

(ii) Suggest one precaution Maria should have taken in selecting the *place* where she made her tests, giving a reason for your suggestion.

....

.... [1]

(b) One form of burglar alarm which can be fitted to a window is illustrated in Fig. 4.3.

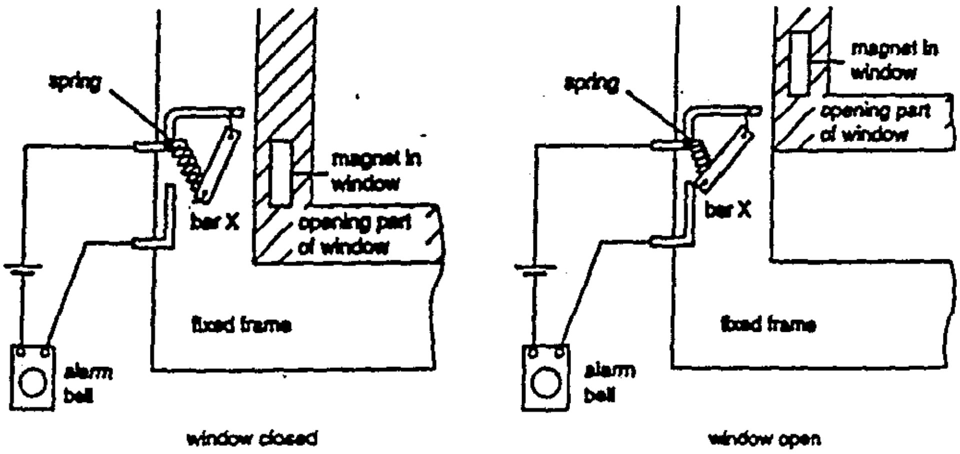


Fig. 4.3

For Examiner's Use

(i) Explain why opening the window will cause the alarm to ring.

....

....

....[2]

(ii) Suggest a suitable material for bar X, giving a reason for your answer.

....

....[1]

5 An electric light consisting of three connected lamps is wired as shown in Fig. 5.1.

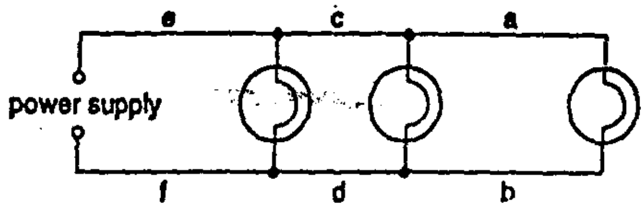


Fig. 5.1

(a) Each lamp was marked '240 V, 150 W'. Calculate the current through each of the lamps when in normal use. [2]

(b) Write down the currents in the wires a, d, and e when the set of three lamps was connected to the 240 V supply.

current in wire a ....

current in wire d ....

current in wire e ....

[3]

(c) When connected to a supply voltage of only 120 V, the lamps were found to be much less bright than before. Use your knowledge of the heating effect of an electric current to explain the change in brightness.

....

....

.... [2]

(d) When the light was used on the 120 V supply, each of the original lamps was replaced by a new one marked '120 V, 150 W'. Write down the current in the wires a and b in this situation.

current in wires a and b .... [1]

(e) All the wiring used in the circuit illustrated in Fig. 5.1 was labelled 'maximum current 1.25 A'. Suggest a way in which the wiring could be changed to make it safer.

....

.... [2]

[Turn over

6 (a) (i) Complete the diagram (Fig. 6.1) to show the structure of a transformer designed to produce an output of 12 V from a 240 V supply. Add to the diagram all the labels necessary to make the structure clear. [1]

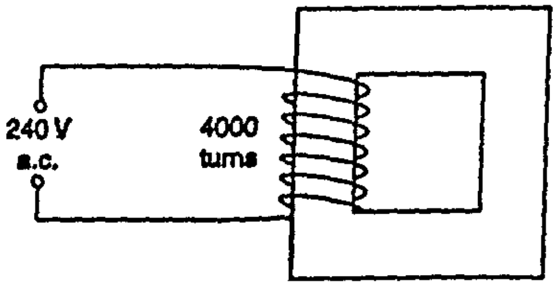


Fig. 6.1

(ii) 1 The current in the primary coil is 0.5 A. Calculate the *maximum power* available from the output of the transformer.

2 What is the *maximum current* available from the *output terminals*?

....

[3]

(iii) Why does the transformer work only if it is connected to an a.c. supply?

....

....

....[1]

(iv) Suggest two reasons why the metal core becomes warm when the transformer is in use.

....

....

....[2]

For Examiner's Use

(b) A metal detector, used for finding pieces of metal a short distance below the surface of the ground, works by electromagnetic induction (see Fig. 6.2).

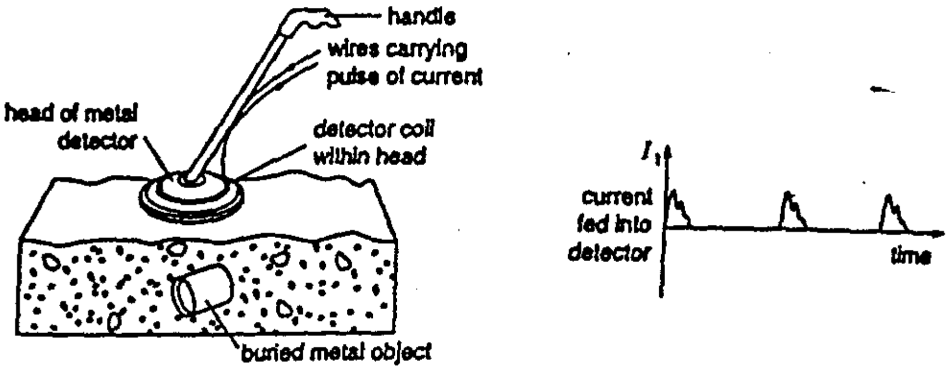


Fig. 6.2

Short pulses of current I_1 are passed through the detector coil, as indicated. When the detector is held over a metallic object, a set of pulses of another current I_2 occurs in the detector coil. I_2 is in the opposite direction to I_1.

Why does I_2 occur?

....

....

Why are I_1 and I_2 in opposite directions?

....

....

[3]

74

7 The principle of one type of smoke detector is illustrated in Fig. 7.1.

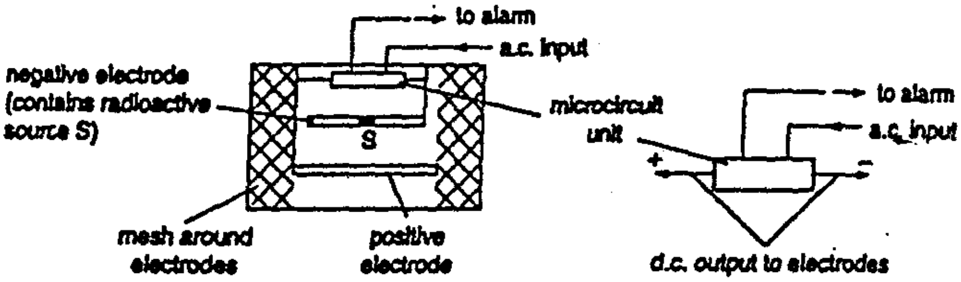


Fig. 7.1

A weak radioactive source S ionises the air between the electrodes of the detector so that a current passes between them. When smoke is present, the ions produced by the radioactive source are attracted to the smoke particles and are neutralised. This reduces the current through the detector and an alarm sounds.

(a) Explain

(i) what is meant by an *ion*,

....

....

(ii) the expression 'ionises the air',

....

....

(iii) how a current passes through the air in the detector.

....

.... [4]

(b) From your knowledge of radioactive emissions, suggest which type of source is most appropriate for use in the detector. Give a reason for your answer.

....

.... [3]

For Examiner's Use

(c) Describe one other arrangement with which you are familiar in which the ionising properties of radioactive radiations enable their presence to be detected and their type to be determined. You may draw a labelled diagram if you wish.

....

....

.... [2]

(d) (i) Explain the meaning of the term *half-life* as applied to a radioactive source.

....

....

.... [2]

(ii) Comment on the relevance of half-life to the choice of the radioactive source to be used in the smoke detector.

.... [1]

Centre Number	Candidate Number

Candidate Name ______________________________

International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3

PAPER 3

Thursday 16 NOVEMBER 1995 Morning 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator and/or Mathematical tables

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

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	
TOTAL	

This question paper consists of 13 printed pages and 3 blank pages.

MFK (5248) OK54842

[Turn over

1 (a) The results obtained in an experiment to determine the density of a plastic material are illustrated in Fig. 1.1.

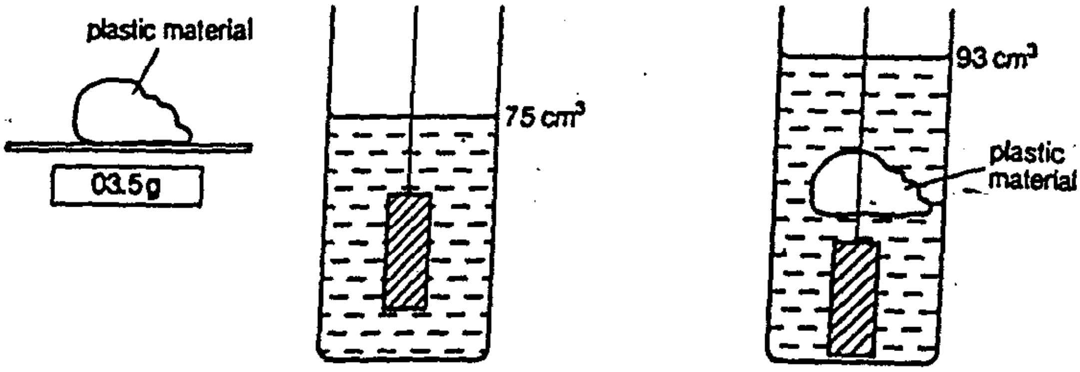


Fig. 1.1

(i) Calculate the density of the plastic from these results, making your method clear. [3]

(ii) Suggest, in terms of molecules and the way they are arranged in different states of matter, why substances vary in density.

....

....

....

.... [2]

For Examiner's Use

(b) The beaker illustrated in Fig. 1.2(a) shows equal volumes of two liquids (densities $0.65\,g/cm^3$ and $0.85\,g/cm^3$ respectively) which do not mix naturally, stirred together to produce temporarily a uniform mixture of the same total volume.

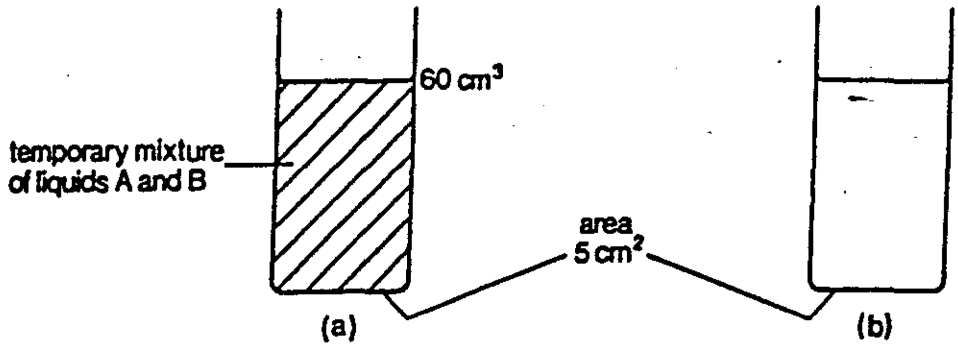


Fig. 1.2

(i) Complete Fig. 1.2(b) to show the contents of the beaker some time after the liquids are left to separate. [1]

(ii) Calculate the change in gravitational potential energy which occurs in the interval between the two diagrams. (Take the force of gravity on 1 kg to be 10 N.) [4]

(iii) What becomes of the energy involved in this change?

....

.... [1]

F.
Exam
U

2 (a) The action of one type of temperature gauge used in motor cars is shown in Fig. 2.1(a) and Fig. 2.1(b). A thermistor is a device which has less electrical resistance when it is hot than when it is cold. A bimetallic strip is made from two strips of different metals which expand by different amounts.

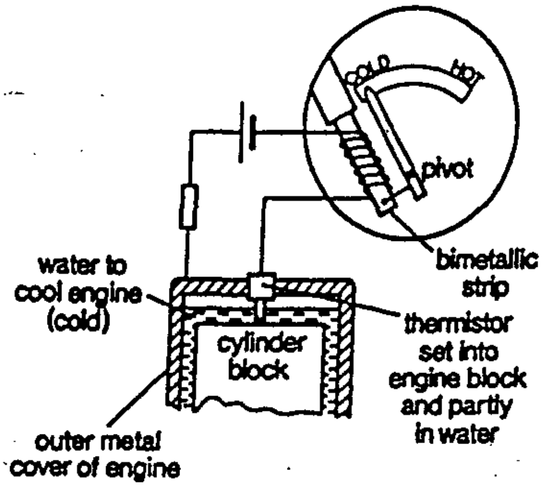


Fig. 2.1(a)

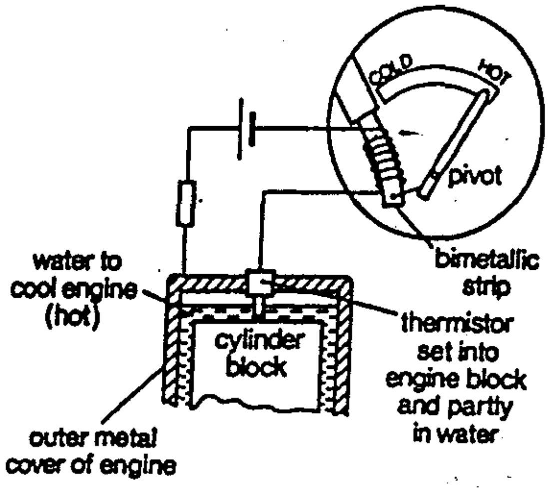


Fig. 2.1(b)

(i) Explain why the gauge shows different indications when the engine is cold and when it is hot.

....

....

....

.... [3]

(ii) How is the distance the pointer moves related to the expansion of the two metals in the bimetallic strip?

....

....

.... [2]

For Examiner's Use

(b) A student made herself a thermometer which is illustrated in Fig. 2.2, using *air* as the thermometric substance.

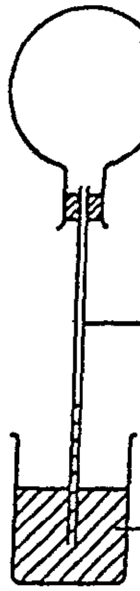


Fig. 2.2

(i) Describe how she could mark the 0 °C and 100 °C fixed points.

....

....

....

....

....

.... [4]

(ii) Mark on Fig. 2.2 possible positions for these two points. Label the positions. [1]

(iii) State the effect on the temperature recorded by the thermometer of a *decrease* in atmospheric pressure. Give a reason for your answer.

....

....

.... [2]

3 (a) What is meant by the *refractive index* of a substance, e.g. glass?

....

.... [2]

(b) The first part of the path of a ray of light emitted from an object under water is shown in Fig. 3.1.

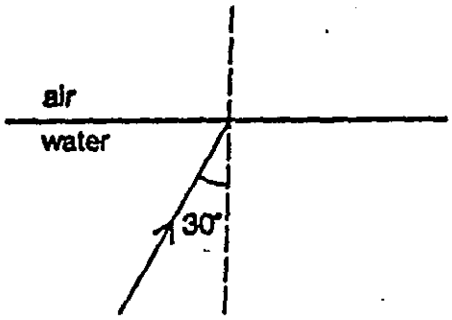


Fig. 3.1

Given that the refractive index of water is 1.33, calculate the angle at which the ray emerges from the water. On Fig. 3.1, show the approximate path of the ray as it emerges into the air. [3]

(c) Calculate the critical angle *C* for a ray of light travelling from water to air.

[3]

For Examiner's Use

(d) A row of six equally spaced lamps L_1, L_2, L_3, L_4, L_5, L_6 is fitted to the side of a swimming pool, as shown in Fig. 3.2.

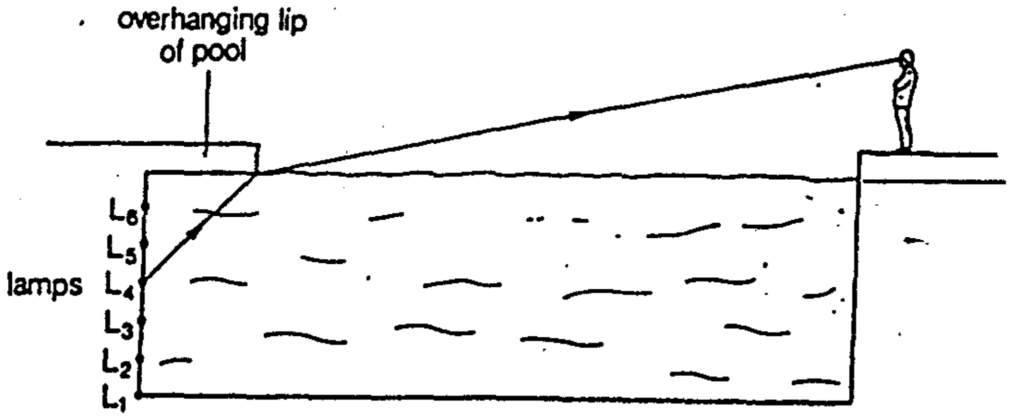


Fig. 3.2

A man stands on the side of the pool opposite to the lamps. With his feet flat on the ground, he can see L_4. When he stands up on his toes, he is unable to see this lamp.

(i) When he stands with his feet flat on the ground, which other lamps is he able to see?

....

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

....

....

....

(iii) Explain why he is unable to see the other lamps.

....

....

.... [4]

4 (a) Light is transmitted as transverse waves and sound travels as longitudinal waves. Fig. 4.1 shows a diagram of a transverse wave. Fig. 4.2. shows a diagram which represents the oscillations of a point as a different transverse wave passes.

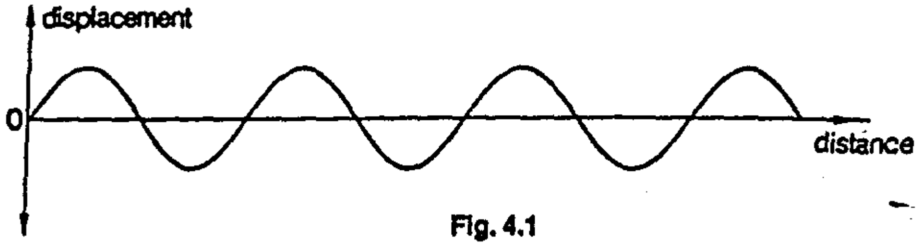


Fig. 4.1

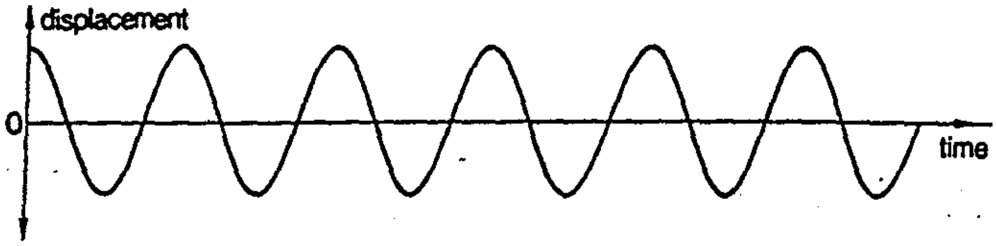


Fig. 4.2

(i) One light wave may be distinguished from another light wave by three quantities: amplitude, wavelength and time period. Label Fig. 4.1 and Fig. 4.2, so as to show the meaning of these three quantities. [3]

(ii) When sound passes through air, it causes the molecules of air to move. State how the motions of the molecules are affected by the loudness and the pitch of sound.

loudness

....

....

pitch

....

.... [3]

(b) Sound travels through air as a series of *rarefactions and compressions*. Mark on Fig. 4.3 the positions of some of these rarefactions and compressions for a sound of frequency 250 Hz passing through air at a speed of 330 m/s. [3]

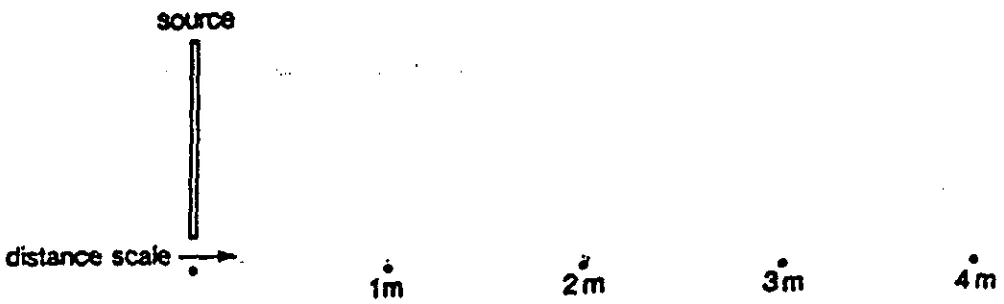


Fig. 4.3

(c) Sound waves are emitted from ships and are reflected from objects below the surface of the sea. There is a 2.0 s interval between the emission of a sonar wave and its return to the ship from an object 1500 m below the surface.

Calculate the speed of the wave in sea-water.

State why it is necessary to emit waves used in this way in short bursts.

....

.... [3]

5 (a) An electrically charged sphere S is held near a long metal bar B which is suspended on insulating threads, as shown in Fig. 5.1.

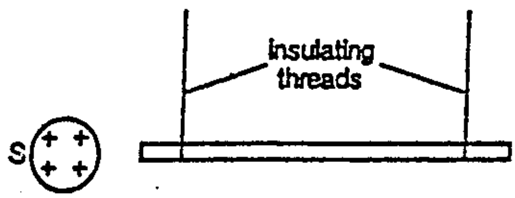


Fig. 5.1

(i) Complete Fig. 5.1 to show the distribution of charges you would expect to find on the bar.

(ii) State the effect on the charges you have shown of earthing the bar without removing S.

....

....

.... [4]

(b) To clean the air in a restaurant where smoking is still allowed, an air cleaner is used. The *principles of operation of the cleaner are shown in Fig. 5.2.*

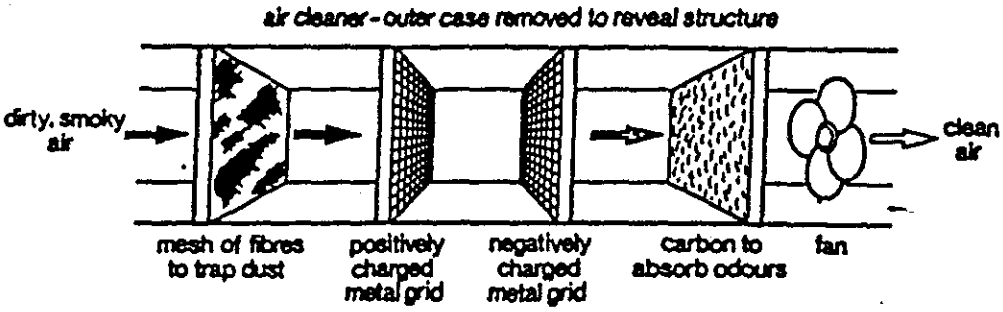


Fig. 5.2

(i) Explain how the cleaner removes particles of smoke (some of which are positively charged and some of which are negatively charged) from the air.

Action of positively charged grid

....

....

....

Action of *negatively charged grid*

....

....

....

Action of fan

....

[6]

(ii) In practice, there is a battery connected between the two charged grids. Why is this needed?

....

....

.... [3]

6 (a) Figure 6.1 shows the structure of a simple electric motor and two positions of its armature as the coil turns.

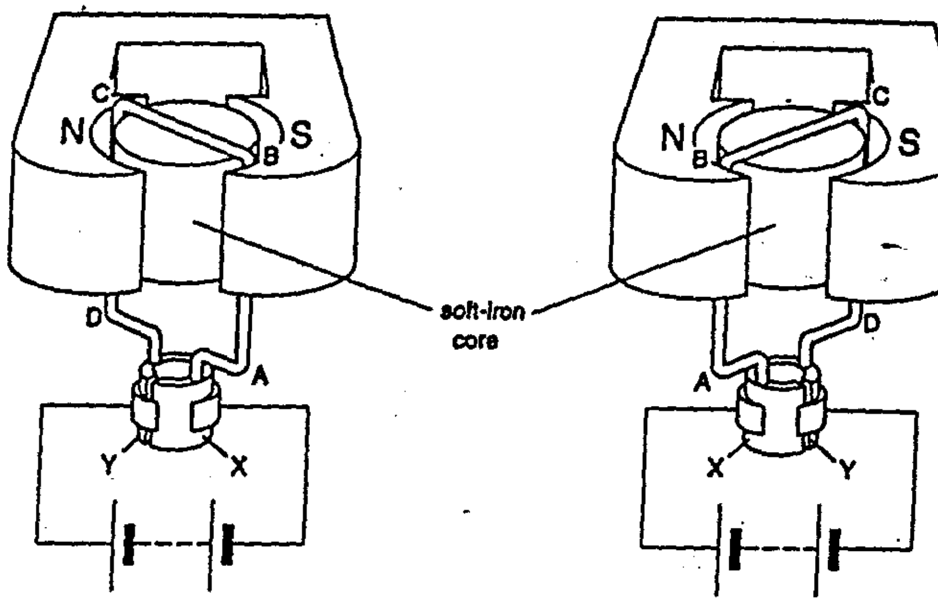


Fig. 6.1

(i) Mark *on each diagram* the direction of the current through the side BC of the coil.

(ii) Figure 6.2 shows the coil from above. On each diagram in Fig. 6.2, mark the directions of the forces acting on each of the coils.

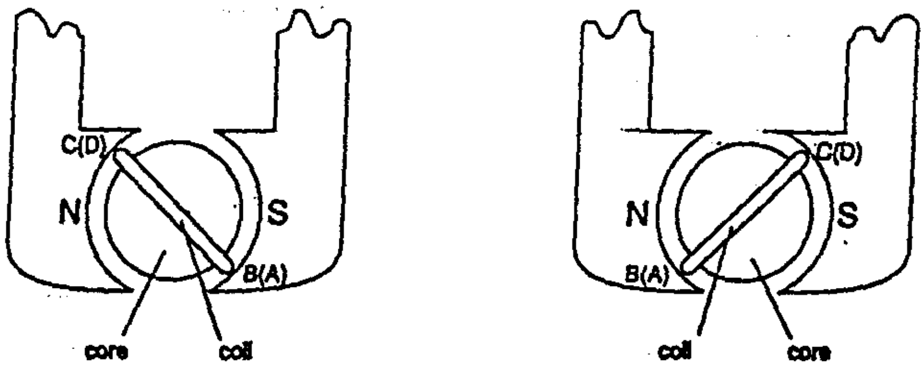


Fig. 6.2

(iii) Using the information on the completed diagrams, explain why the motor will rotate continuously.

....

....

....

(iv) Indicate *two* ways in which a practical electric motor differs from this simple model.

....

....

(b) The electric motor driving an escalator has to drive the stairway and has to raise the weight of the people using it.

(i) The motor works on a supply voltage of 480 V and needs a power of 12 kW to keep the escalator moving at a steady speed without any people on it.

Calculate the current through the motor under these conditions.

(ii) At one time when the escalator is in use, it raises 20 people, of average mass 80 kg, through a height of 15 m in 45 s. Calculate the *extra* power which the motor must develop in order to do this. (Take the force of gravity on 1 kg to be 10 N.) [6]

For Examiner's Use

7 (a) Figure 7.1 illustrates the results of a famous experiment in which α-particles were fired at a thin metal foil.

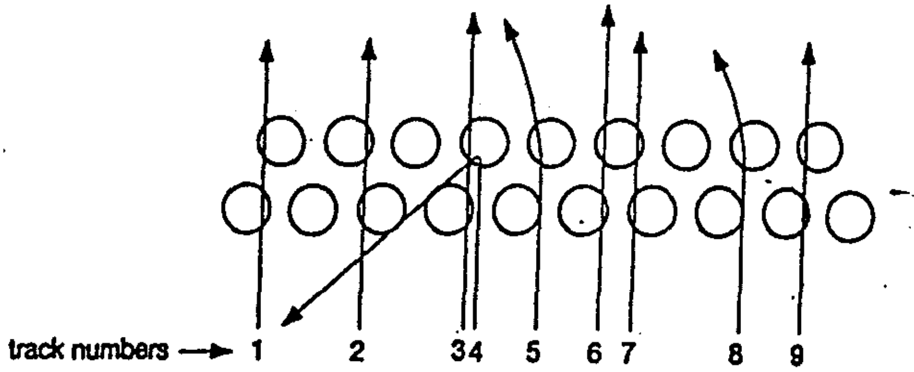


Fig. 7.1

By referring to some of the numbered tracks, explain how the results shown help us to understand the structure of the atom.

....

....

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....

.... [4]

(b) The sodium isotope $^{24}_{11}Na$ is radioactive. The equation representing the disintegration of an atom of the isotope may be written as

$$^{24}_{11}Na \rightarrow ^{24}_{12}Mg + \text{emission R.}$$

Identify R, showing how you reached your conclusion, and write the completed equation.

Emission R is ....

....

....

.... [4]

Equation:

	Centre Number	Candidate Number
Candidate Name ______________________		

International General Certificate of Secondary Education
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3

PAPER 3

Wednesday 15 MAY 1996 Morning 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator and/or Mathematical tables
Ruler (30 cm)

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
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TOTAL	

This question paper consists of 15 printed pages and 1 blank page.

90

SB (PU) QF66550

[Turn over

1 A manufacturer of motor car tyres tested a tyre to see how well it gripped the road in dry and in wet conditions.

To do this, velocity-time data were taken with the same car.

The test was done on a level straight track. Pressure pads were placed on the track at suitable points. The positions of the pads are labelled A, B, C, D, E and F in Fig. 1.1.

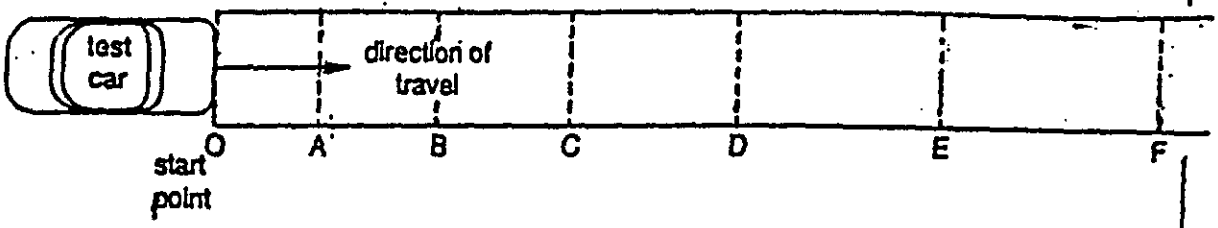


Fig. 1.1

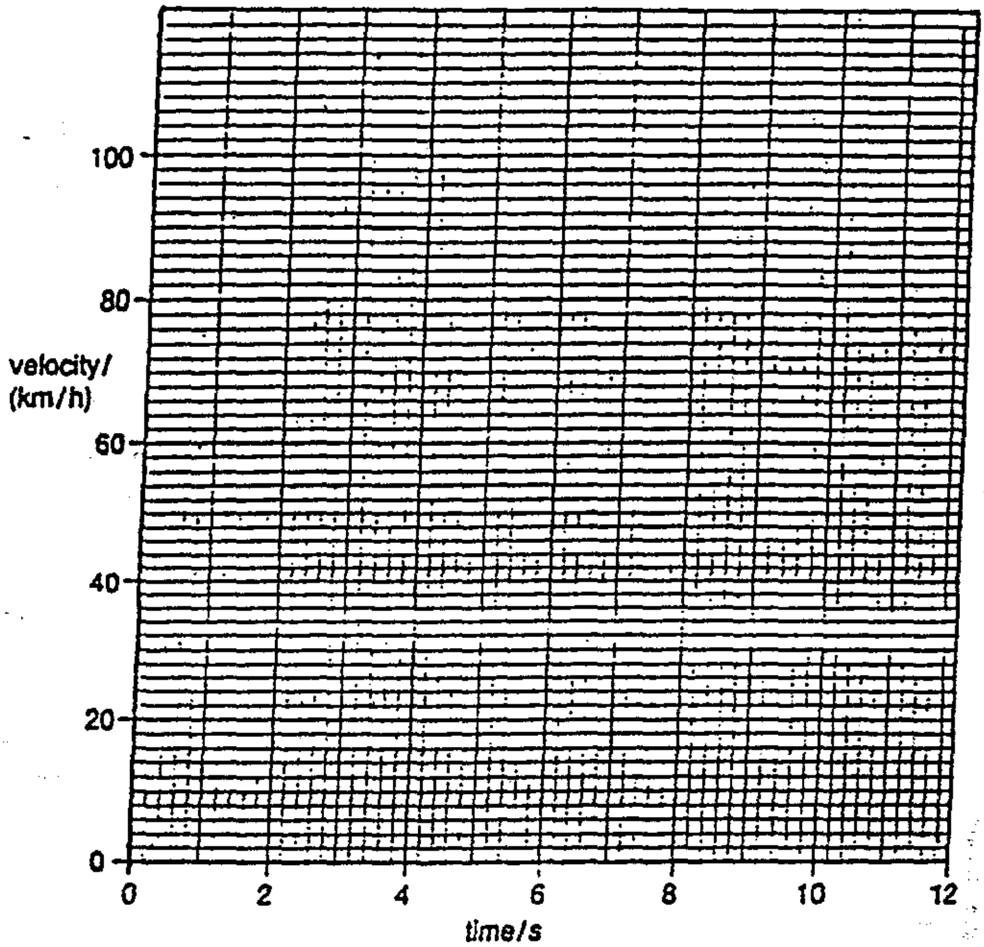
All the pads were connected to a computer. As the test car passed over a pad, the velocity of the car was recorded. The test started with the car at rest.

The test results are given in the table below.

		Start Point	A	B	C	D	E	F
Dry	Velocity, km/h	O	25	44	65	79	85	90
	Time/s	O	2.2	3.8	5.6	7.2	8.7	10
Wet	Velocity, km/h	O	16	32	45	53	60	65
	Time/s	O	1.8	3.4	5.0	6.4	8.0	10

For Examiner's Use

(a) On the grid shown, plot two graphs of velocity/(km/h)(y-axis) against time/s (x-axis) for the dry and the wet conditions. [3]



(b) (i) Why were both tests done with the car starting at rest?

....

....

(ii) Why is the manufacturer correct in using velocity rather than speed in this test?

....

(iii) Suggest what calculation the computer might be working out in order to determine the velocity at any one pad.

....

....

[4]

(c) During both tests, the car engine was set to produce a constant driving force *F*.

(i) Describe the motion of the car on dry tyres, over the 10 s of the test.

....

....

(ii) Compare the motion of the car on dry tyres and on wet tyres.

....

....

(iii) Suggest a reason for the shape of the graph for dry tyres.

....

....

(iv) Suggest why the motion with wet tyres and with dry tyres is different.

....

....

[5]

(d) The car and driver had a total mass of 750 kg. Using the dry-tyre information for the time interval 8.7 s to 10 s, calculate

(i) the change in velocity, in m/s, of the car,

(ii) the change in momentum,

(iii) the average force causing the car to accelerate.

[5]

For Examiner's Use

(e) The constant driving force exerted by the engine was 2500 N and the average accelerating force between 8.7 s and 10 s in the wet was 400 N.

(i) *Calculate the average force of resistance on the car between 8.7 s and 10 s in the wet.*

(ii) Calculate the average force of resistance on the car between 8.7 s and 10 s in the dry.

(iii) Suggest why the average force of resistance in the wet and dry are different between 8.7 s and 10 s.

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....

[4]

2 Figure 2.1 shows the principle of a domestic hot water system, using a solar heating panel.

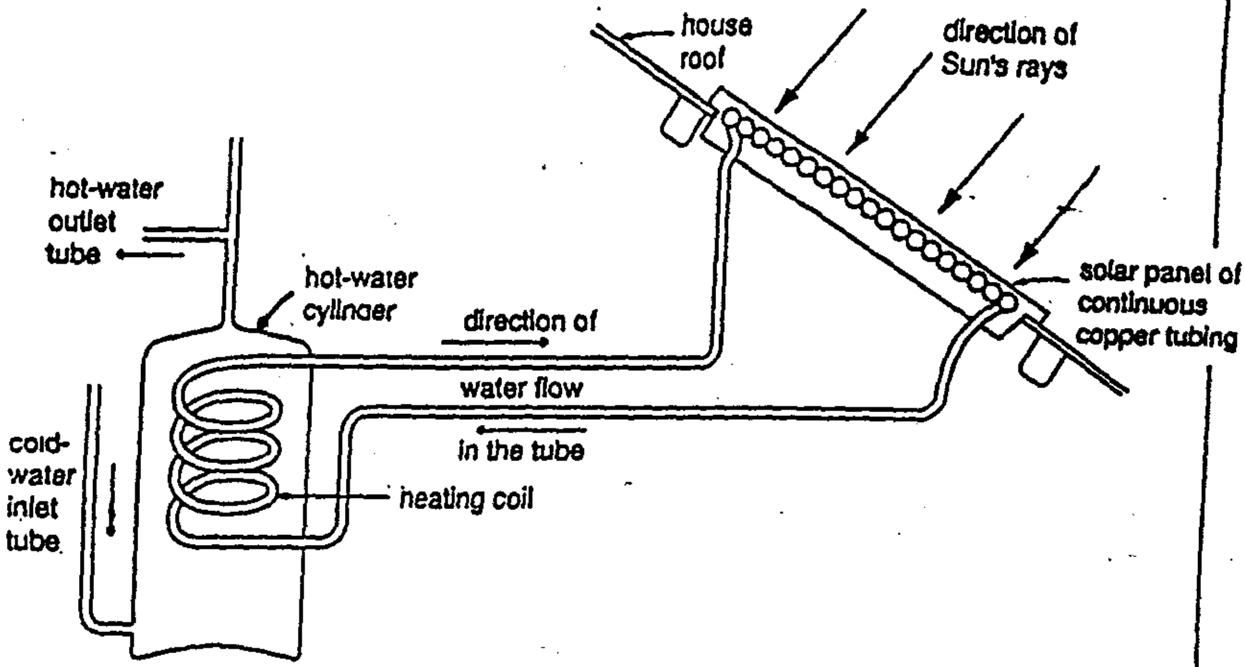

Fig. 2.1

(a) (i) Explain how some of the energy of the Sun's rays is transferred into the tubes of the solar heating panel.

....

....

....

State what is done so as to make the proportion of this energy absorbed by the tubes as large as possible.

....

....

....

(ii) Explain how the energy absorbed by the tubes is transferred to the water in the tubes, and why the water circulates through the heating coil in the hot-water cylinder as shown.

....

....

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For Examiner's Use

(iii) Suggest what difference it would make to the heating of the water in the cylinder, and on the quantity of hot water stored, if the heating coil was positioned nearer the bottom of the cylinder.

....

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....

....

.... [5]

(b) Water is a good fluid to use as the circulating fluid in the solar panel and the heating coil, because it has a high specific heat capacity.

(i) State what is meant by *specific heat capacity.*

....

....

(ii) *Outline a method of finding the specific heat capacity of a liquid under the following headings.*

Labelled sketch of the apparatus.

For Examiner's Use

List of readings taken.

State the equation you would use to calculate the specific heat capacity. [4]

3 Figure 3.1 shows how a biologist uses a magnifying glass to view a fly. The lens is placed *over the fly and quite close to it.*

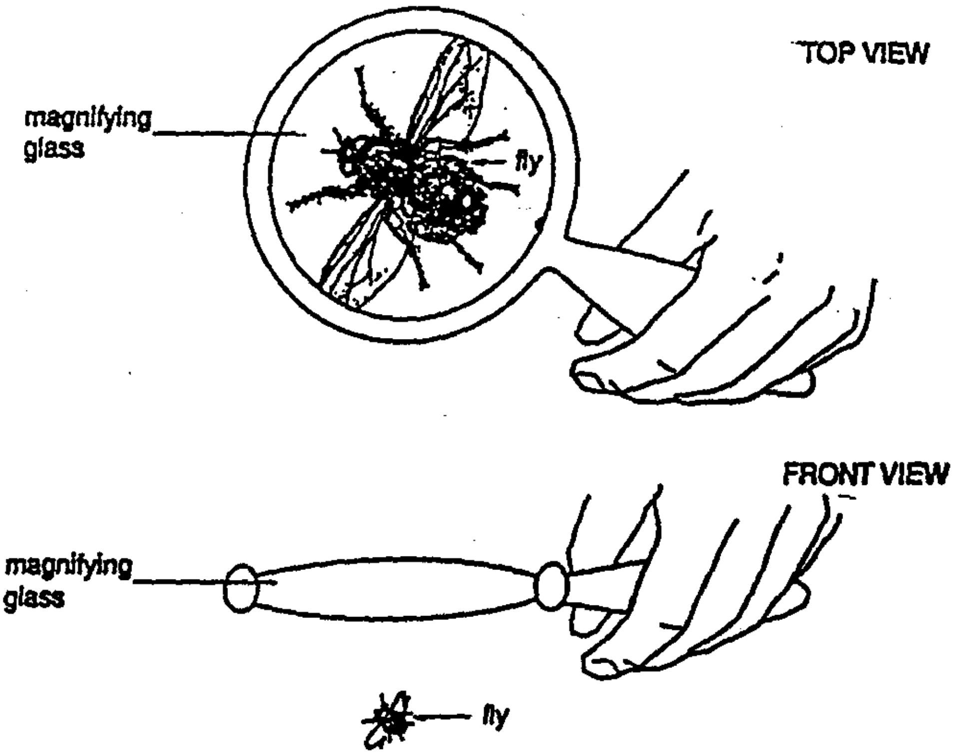

Fig. 3.1

For Examiner's Use

(a) *On Fig. 3.2, draw rays to determine the position and nature of the image of the fly. To make it easier to draw, the fly is shown as an arrow labelled 'object'.*

The points marked F are each at a distance from the lens equal to the focal length of the lens.

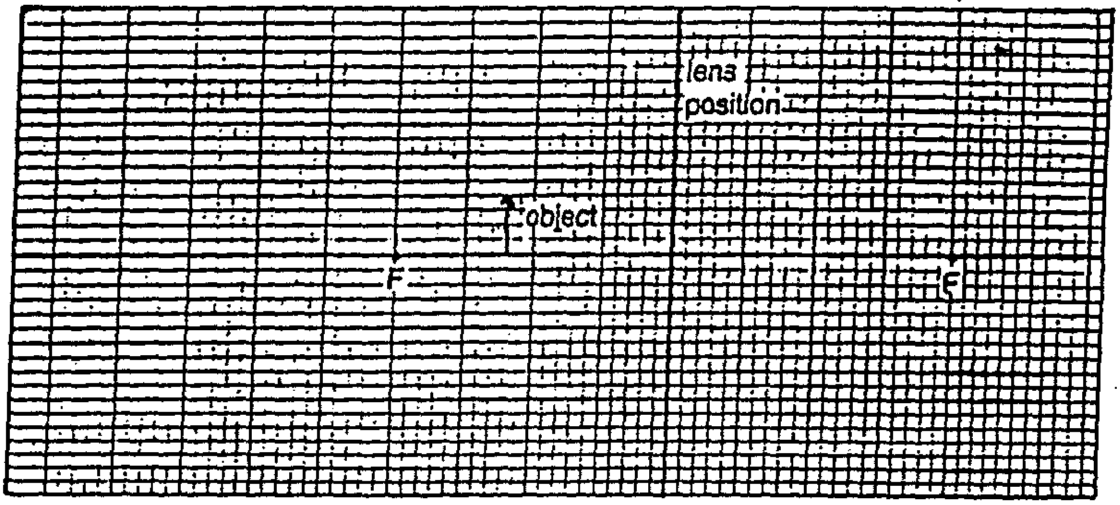

Fig. 3.2

[2]

(b) The type of lens used is ....

Lenses of focal length 100 cm, 10 cm and 2 cm were available.

Which one would you use as a magnifying glass? ....[1]

(c) The magnification of the image produced by the magnifying glass is given by

$$\text{Magnification} = \frac{\text{length of image}}{\text{length of object}}$$

From your diagram, work out the magnification.

Magnification = ... [1]

(d) *State the nature of the upright, enlarged image.*

....[1]

(e) The light falling on the lens is represented by a wave, as shown in Fig. 3.3.

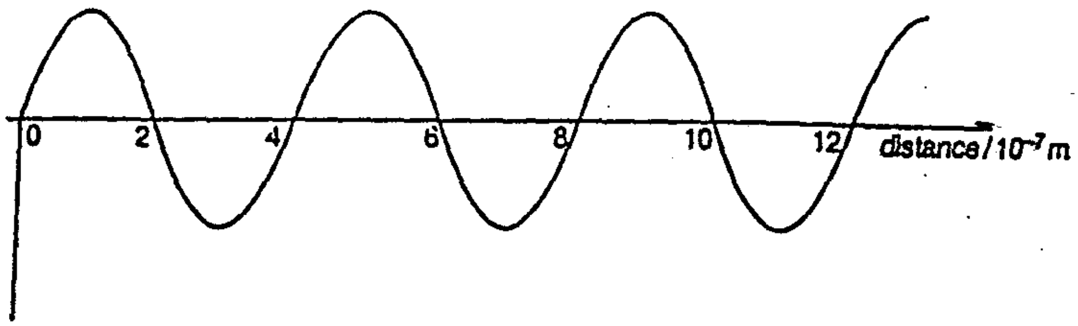

Fig. 3.3

(i) What is the wavelength of the light? ....

(ii) Given that the speed of light is 3×10^8 m/s, calculate the frequency of the light. [3]

(f) The biologist noticed that the image of the fly had edges which were coloured like the rainbow.

The colour was due to the thickness and curvature of the lens.

Figure 3.4 shows the lens outline.

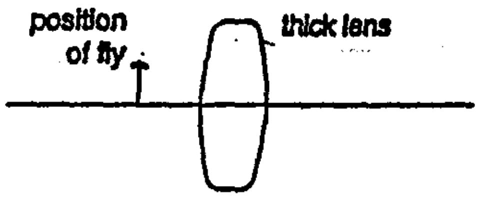

Fig. 3.4

Explain the colour in terms of refraction and dispersion. You may draw on the diagram if it makes your answer clearer.

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....

....[3]

For Examiner's Use

4 Figure 4.1 shows the main parts of a medium-sized wind turbine which could be used to generate electricity for a small community.

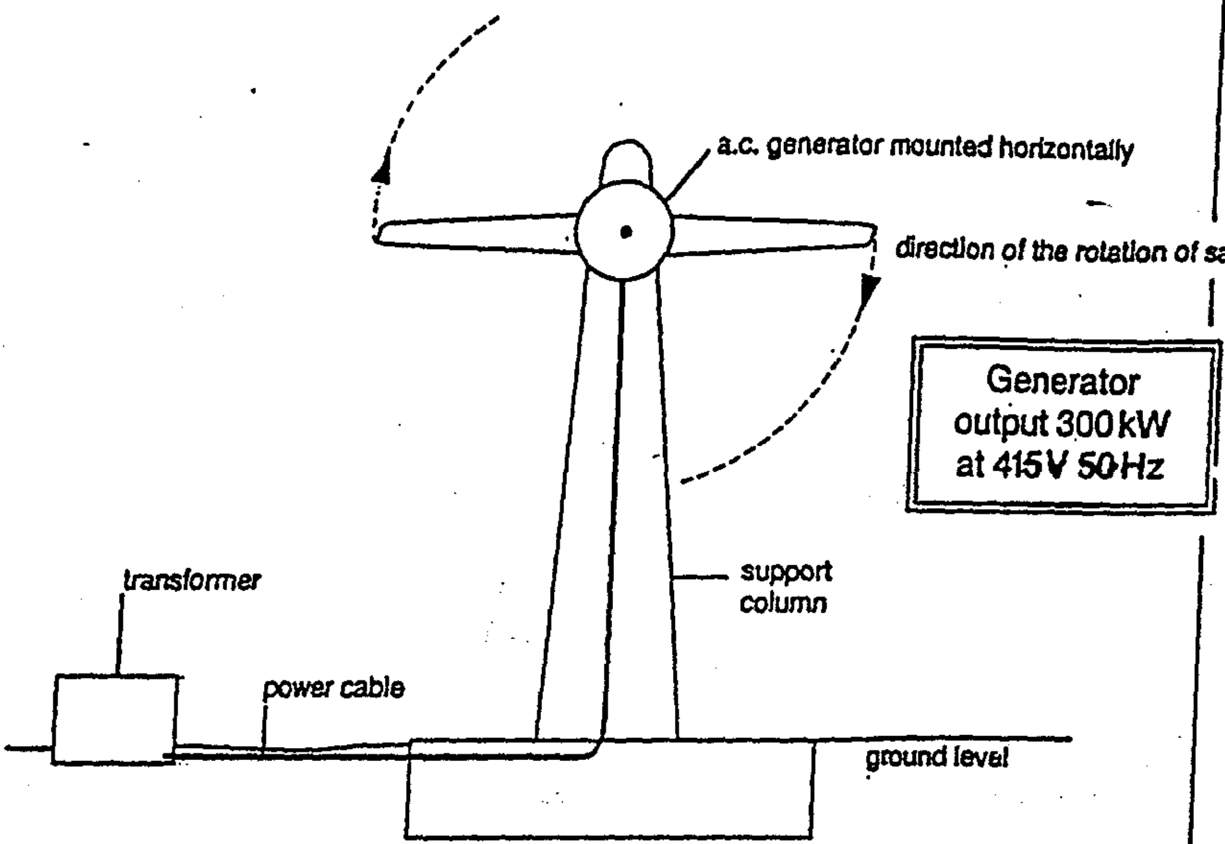

Fig. 4.1

(a) Explain what is meant by a *generator output of* 300 kW.

....

....

....[2]

(b) Starting with the wind, state the energy changes which occur in the generation of an electric current.

Include any changes which are usually stated as *losses*.

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....

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....[4]

100

For Examiner's Use

(c) Assume that the generator is a rotating coil type. On Fig. 4.2, sketch the form of the expected output voltage.

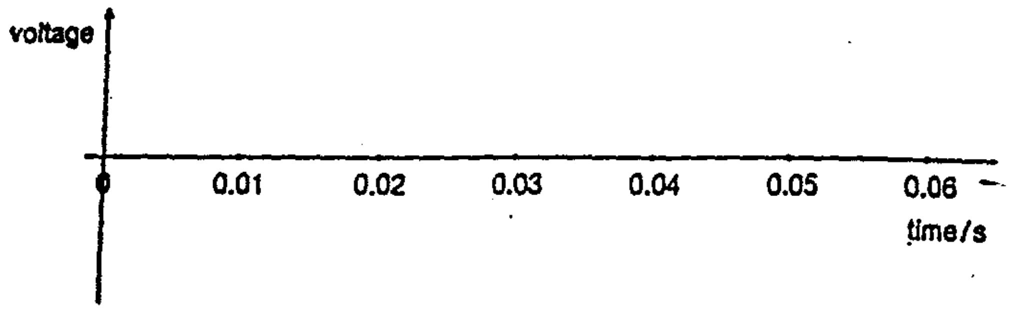

Fig. 4.2

Using your sketch graph or otherwise, answer the following.

(i) What is the time interval between successive changes of voltage direction?

....

(ii) Explain why the direction of the voltage reverses.

....

....

(iii) State and explain one factor which changes the magnitude of the voltage in this generator.

....

....

(iv) As the speed of the wind changes, the sail turns at different rates. Why must there be some arrangement to make sure that the generator rotates at a fixed rate?

....

....

.... [9]

(d) (i) Given that the output is as shown in the box on Fig. 4.1, calculate the current.

(ii) Figure 4.1 shows the generator connected to a transformer by a power cable. Describe the essential features of the power cable, bearing in mind your answer to (d)(i).

....

....

(iii) The total resistance of this power cable is 0.1 Ω. Calculate the power loss in the cable.

Calculate by how much the voltage across the transformer primary is *less* than the 415 V output of the generator.

Hence explain why a transformer is needed.

....

....[7]

(e) In a particular arrangement, the potential difference across the transformer primary is 400 V and the power input to the transformer is 275 kW. The transformer primary coil has 500 turns.

(i) If the voltage is to be increased from 400 V to 33 kV in one step, calculate the number of turns which would be required on the secondary coil of the transformer.

(ii) What would you expect the output power to be? Explain your answer in terms of transformer efficiency.

....

....

....[4]

5 Figure 5.1 and Fig. 5.2 represent two ways of obtaining electrons.

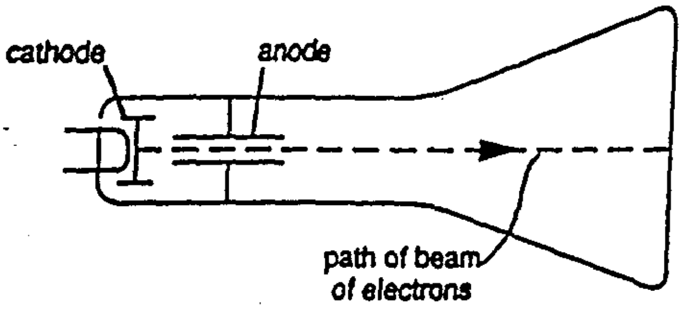

Fig. 5.1

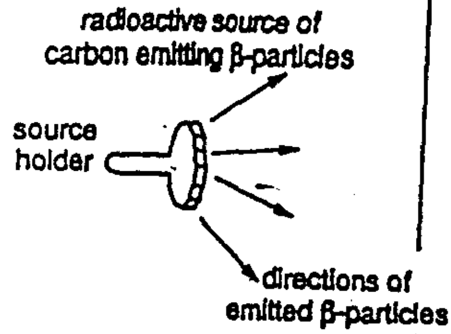

Fig. 5.2

(a) Write brief notes about the conditions required for electrons to be emitted and the origin of these electrons in the case of

(i) the cathode-ray tube, see Fig. 5.1,

....

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....

....

(ii) the radioactive carbon, see Fig. 5.2.

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....

.... [4]

(b) The symbol for radioactive carbon is $^{14}_{6}C$.

(i) State the name, charge and the number of each type of particle in the nucleus of one of these carbon atoms.

....

....

(ii) After the emission, the nucleus of the carbon atom becomes the nucleus of a nitrogen atom, symbol N.

Write an equation for the emission of β-particles from one of the carbon atoms.

[4]

(c) With the aid of a sketch, describe how you could use a magnetic field to show that the charge on an electron and the charge on a β-particle both have the same sign.

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....

....[5]

Centre Number	Candidate Number

Candidate Name ______________________________

International General Certificate of Secondary Education
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3

PAPER 3

Thursday 14 NOVEMBER 1996 Morning 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator and/or Mathematical tables
Ruler (30 cm)

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
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TOTAL	

This question paper consists of 12 printed pages.

SB (PU) QK67359

1 Safety tests were carried out on a hotel lift. The tests involved finding the velocity V of the lift at various times t throughout its journey through three floors without stopping at either of the intermediate floors.

The velocity was determined by a series of sensors at various points connected to a computer.

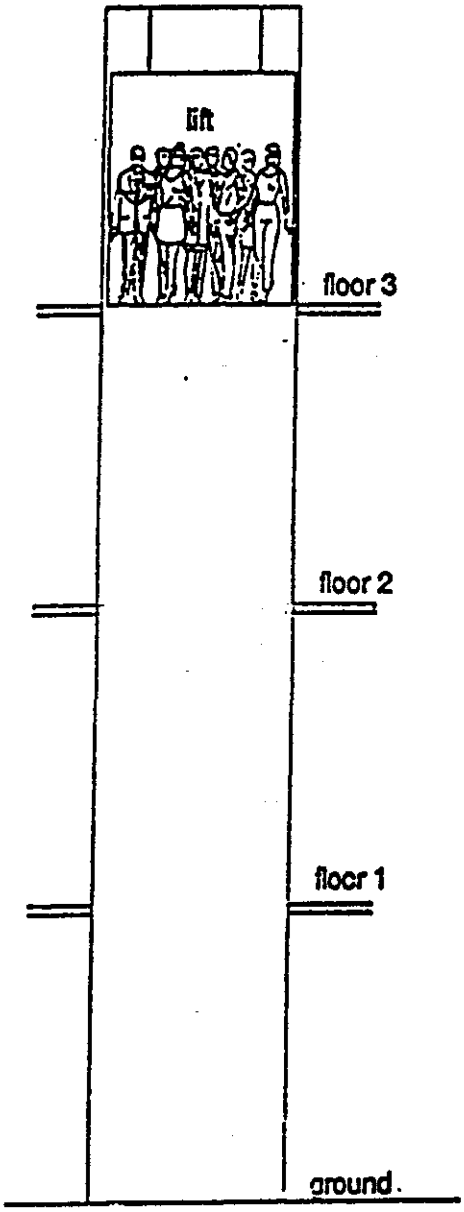

Fig. 1.1

The test results are presented in graphical form on Fig. 1.2.

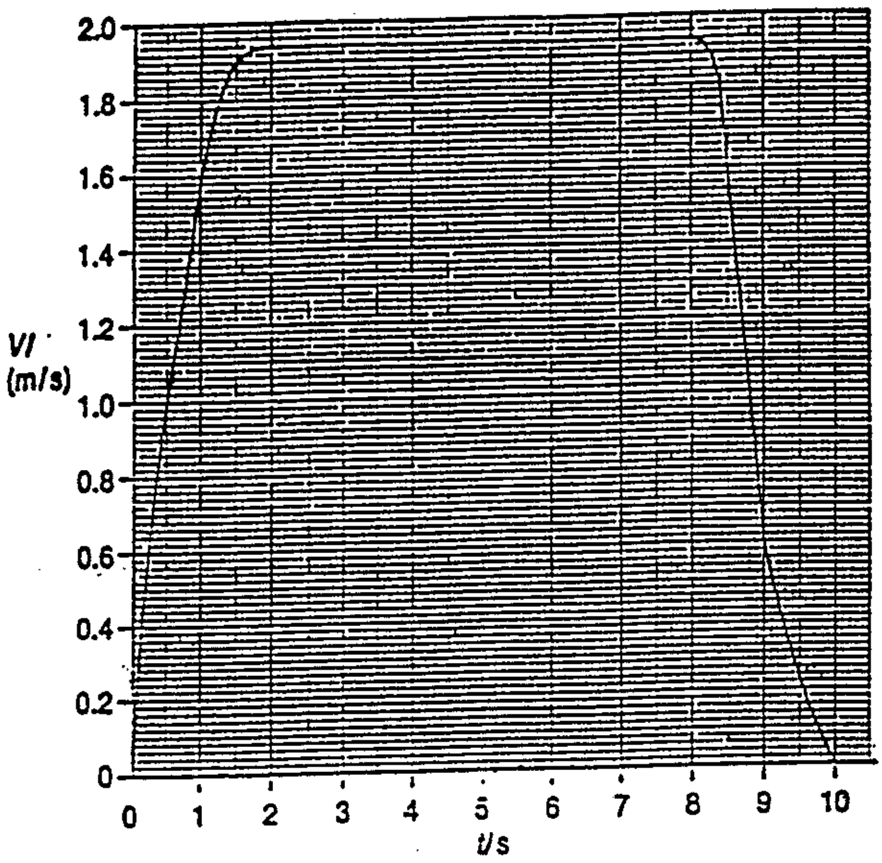

Fig. 1.2

(a) Describe the motion of the lift over the two periods of time below:

(i) 0 to 2 s.

....

....

(ii) 8 to 10 s.

....

.... [5]

(b) Use the graph to estimate the distance travelled over the whole journey, and hence find the average distance between the floors of the hotel. [4]

(c) The mass of the lift, without passengers, is 350 kg.

The acceleration of free fall is 10 m/s^2. A normal load is six passengers.

The average mass of a passenger is 65 kg.

Calculate

(i) the total weight of the lift and a normal load of passengers,

(ii) the increase in potential energy of the lift and passengers after having risen through three floors to the position shown in Fig. 1.1,

(iii) the power of the electric motor needed to raise the lift and passengers. (Assume that only potential energy needs to be supplied and that there are no power losses.)

[5]

(d) The hotel lift actually completes the journey in 10 s. Give three reasons why the electric motor, working the lift, should have a higher power than the answer you have calculated in (c)(iii).

....

....

....

....[3]

(e) One of the passengers in the lift noticed, at the start of the upwards journey, that the floor of the lift seemed to be pushing hard upwards on her feet. After about two seconds, she could no longer feel an upward force. On approaching the third floor, after about eight seconds, she felt as though her feet were coming off the floor. Explain these observations, using 'physics-terms'. You may find it helpful to refer to the graph.

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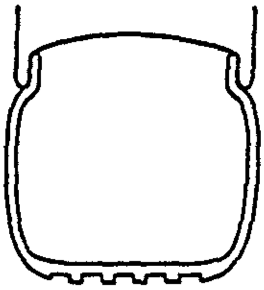
For Examiner's Use

(f) In a further test on the lift, the velocity reduced from 1.9 m/s to zero in 2.2 s.

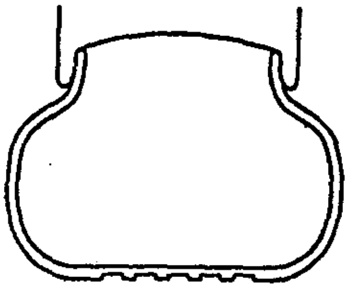
Calculate the average deceleration. [2]

2 Fig. 2.1 shows a section through a car tyre when it was new and Fig. 2.2 shows a section through the same tyre when it was old and had stretched.



new, unstretched tyre

Fig. 2.1



old, stretched tyre

Fig. 2.2

The table shows test information for both tyres.

	Old tyre	New tyre
Atmospheric pressure/Pa	1.0×10^5	1.0×10^5
Excess pressure in tyre/Pa	0.9×10^5	1.1×10^5
Temperature/°C	23	23
Mass of air/kg	0.019	0.019
Volume of air/m^3		0.015

(a) From the values in the table,

(i) calculate the volume of the old tyre. [4]

(ii) determine by how much the volume of the tyre changed during use. [4]

For Examiner's Use

(b) A further test was done on the old tyre by raising its temperature considerably. This caused no detectable change in the volume of the tyre.

State what happened to the pressure of the air in the tyre.

Explain your answer, using the ideas of the kinetic theory.

....

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....[4]

(c) A tyre on a stationary vehicle was found to contain a small quantity of water when the temperature of the air in the tyre was 0 °C. The temperature of the air in the tyre was raised to 20 °C, and the new pressure was noted as P_2. The same tyre, under exactly the same conditions at 0 °C, except that it contained no water, had a pressure of P_1 at 20 °C.

Suggest a reason why P_2 was greater than P_1.

....

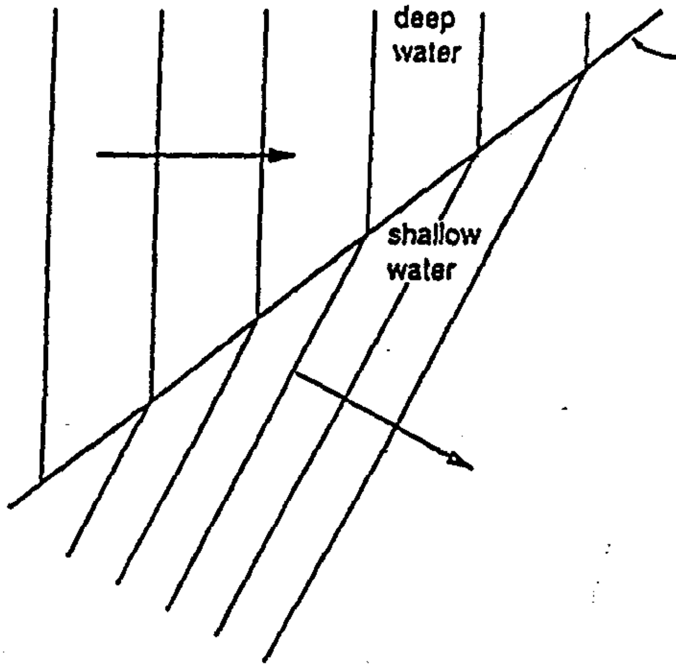
....

....

....[3]

3 (a) Fig. 3.1, which is drawn to full scale, shows how the direction of plane waves changes when the waves pass from deep water to shallow water.

The waves are produced by a horizontal strip of wood vibrating 45 times per minute.



Each line is a wavefront separated from the next wavefront by one wavelength. The arrows indicate the directions of travel of the wavefronts.

Fig. 3.1

(i) Calculate the speed of the waves both in the deep water and in the shallow water.

State any assumptions you make in working out these speeds.

....

(ii) State two changes to the arrangement which would increase the amount by which the direction of the plane waves would change.

1. ....

2. ....

For Examiner's Use

(b) Fig. 3.2 illustrates how the direction of plane light waves changes when the light passes from air to glass.

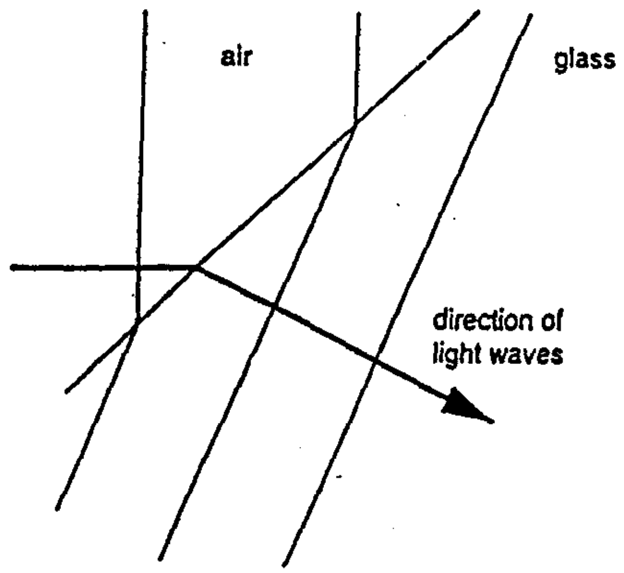


Fig. 3.2

(i) In air, the speed of the wavefront is 3×10^8 m/s and, in glass, it is 2×10^8 m/s.

Show how to obtain the refractive index of glass from this information.

(ii) Describe what happens to the direction of a ray of light when it is refracted at the air-glass boundary.

....

....

....

(iii) A ray of light strikes a glass block at an angle of incidence of 55°.

At the point of incidence, the ray changes direction by 22°.

Calculate the refractive index of the glass.

[5]

For Examiner's Use

4 Fig. 4.1 is the wiring diagram for three lamps A, B and C.

A and B are each marked 240 V, 100 W.

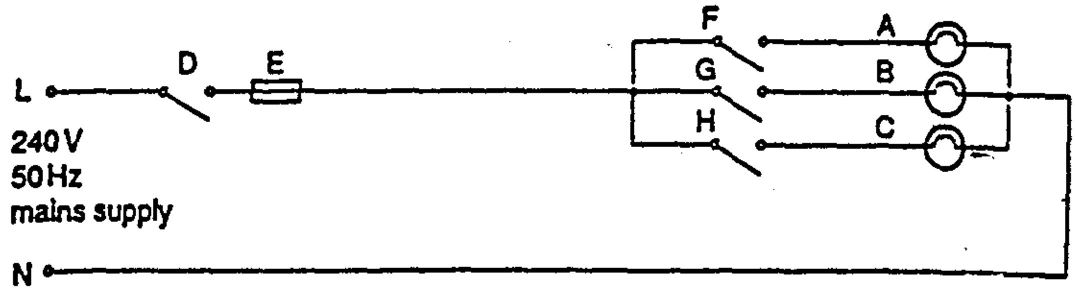


Fig. 4.1

(a) Identify the components D, E and F. Outline the purpose, in this circuit, of each of these three components.

D .... Purpose of D. ....

....

E .... Purpose of E. ....

....

F .... Purpose of F. ....

.... [4]

(b) When the circuit is connected as shown in Fig. 4.1 and all three lamps are working, the current in E is 1.46 A.

(i) Calculate the power of lamp C.

(ii) Calculate the resistance of the filament of lamp A.

For Examiner's Use

(c) The three lamps in Fig. 4.1 are connected in parallel. Explain what would happen if the electrician connected the three lamps, each with a switch, in series. Include in your answer a reference to the potential differences across the lamps and to the currents through the lamps.

....

....

....

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....

....

....[6]

(d) A manufacturer mistakenly made a batch of the lamps, using the same metal for the filament as lamp A but using wire of half the cross-sectional area and of half the length.

How does this mistake affect the resistance of the filament of one of the lamps in this batch?

....

....

....[3]

(e) An electrician checked the mains supply to the lamps, using a test meter connected to an oscilloscope.

From the oscilloscope trace, the electrician found that the maximum potential difference was 280 V and that the frequency was 50 Hz.

On Fig. 4.2, draw the trace that the electrician obtained. [4]

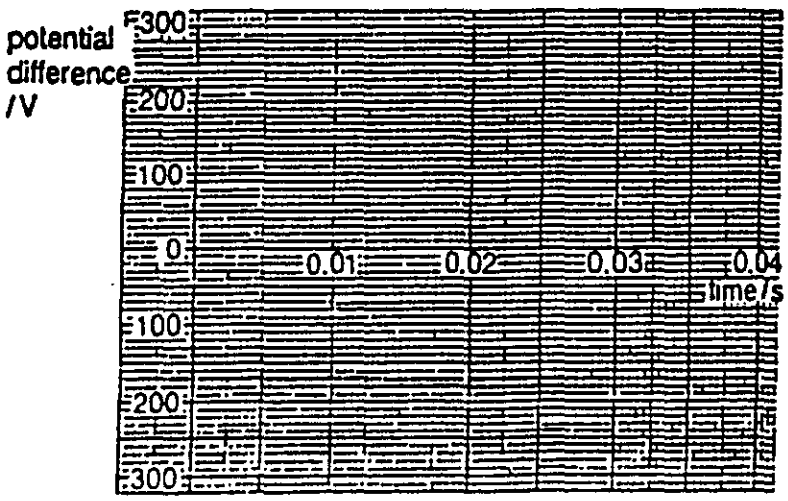

Fig. 4.2

For Examiner's Use

(f) On another occasion, the mains supply voltage was reduced. The electrician then measured the p.d. across the 240 V, 100 W lamps and found that it was 200 V.

Explain the effect that this lower p.d. would have on the lamps.

....

....

....[2]

5 Fig. 5.1 is a researcher's idea for controlling the thickness of aluminium cooking foil during manufacture. It uses a radioactive source emitting fast β - particles.

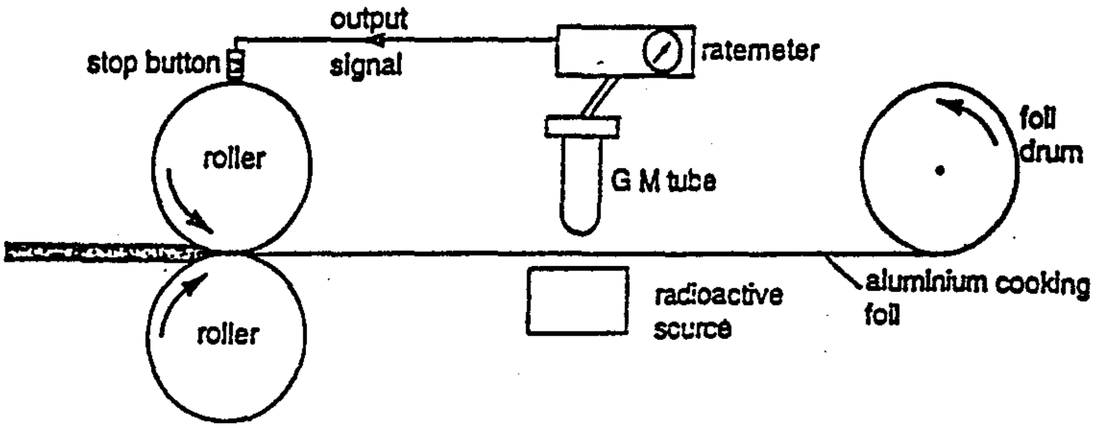

Fig. 5.1

(a) The researcher had previously tried

(i) an α - particle source,

(ii) a γ - ray source.

Explain why these sources were not satisfactory.

(i) α - particle source ....

....

(ii) γ - ray source ....

....
[3]

(b) If the foil was too thick, or too thin, the ratemeter output was used to switch off the motor driving the rollers. This stopped the production of the foil.

Explain how the ratemeter readings changed when the thickness of the foil changed.

....

....[2]

(c) Further experiments showed that strontium-90 is a suitable isotope to use, because it emits β-particles of high energy and it has a long half-life.

(i) Given that the symbol for strontium-90 is $^{90}_{38}Sr$ and that the decay product is yttrium, symbol Y, write an equation for this decay process.

(ii) What is the meaning of the term *half-life*?

....

....

Explain why an isotope with a long half-life would be helpful in this piece of equipment.

....

....

[4]

Centre Number	Candidate Number

Candidate Name ______________________________

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS [illegible]

PAPER [illegible]

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
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TOTAL	

This question paper consists of 14 printed pages and 2 blank pages.

SB (NH) QF71574

[Turn over

For Examiner's Use

1 Fig. 1.1 shows a model railway track.

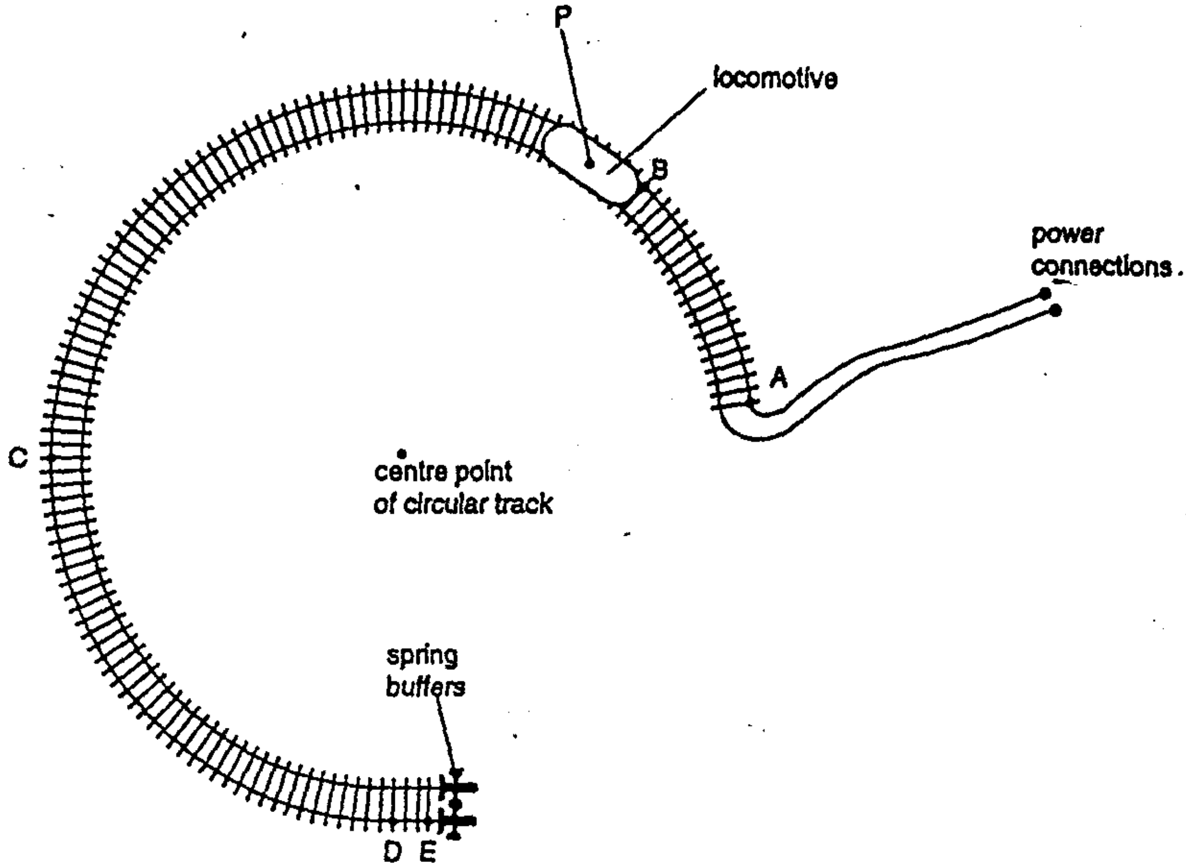

Fig. 1.1

The power is switched on and the locomotive starts at A. It reaches its maximum speed at B, then moves at a constant speed to D. At D, the power is switched off and the locomotive continues until it hits the spring-loaded buffers at E, where it rebounds.

(a) Although the locomotive travels around the circular track at a constant speed from B to C, there is a constant net force acting on the locomotive.

(i) On Fig. 1.1, draw an arrow to show the direction of this force, when the locomotive is at P.

(ii) State where this force is applied to the locomotive and how it is produced.

....

....

....

For Examiner's Use

(iii) *The mass of the locomotive is 0.40 kg and the constant force acting on it is 0.032 N. Calculate the acceleration of the locomotive.*

(iv) Explain why the locomotive is accelerating, even though its speed is constant.

....

....

....[7]

(b) Between D and E the speed of the locomotive, of mass 0.40 kg, decreases from 0.20 m/s to 0.15 m/s. It takes 0.30 s to travel from D to E.

(i) For this locomotive travelling from D to E, calculate

1. the change in momentum,

2. the average force acting,

3. the average power loss.

For Examiner's Use

(ii) explain why the locomotive rebounds from the spring buffers.

....

....[9]

(c) Fig. 1.2 shows the design of the spring buffers used.

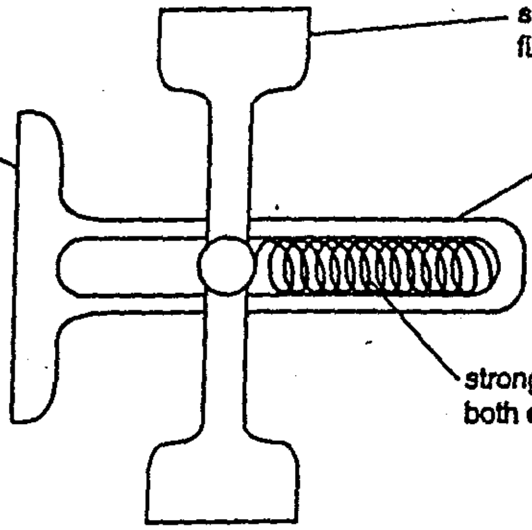

Fig. 1.2

The limit of proportionality of the springs used was found to be too low.

(i) With the aid of a labelled sketch graph, explain what limit of proportionality means.

For Examiner's Use

(ii) In a laboratory test to find a replacement spring, that has a suitable limit of proportionality, describe how you would

1. apply the force and accurately measure its size,

....

....

....

....

2. work out the value of the limit of proportionality.

....

....

....[6]

2 (a) A thin-walled metallic petrol can had a small amount of petrol left in it. The cap was screwed on firmly enough for it to be gas-tight. The can was thrown on to a rubbish dump where it was exposed to the Sun on a very hot day. After a time, the can burst open.

(i) Using kinetic theory ideas, explain why the can burst open.

....

....

....

....

(ii) Suggest why the can might not have burst open if it had been made of plastic.

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....

....[5]

(b) Fig. 2.1 shows the path in air taken by a slow-moving smoke particle. (This is an example of what is often called *Brownian motion.*)

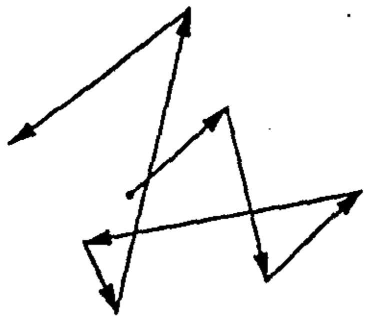

Fig. 2.1

(i) Explain the path of the slow-moving smoke particle. Include in your answer a reference to the mass of the smoke particles and the motion of the air molecules.

....

....

....

....

(ii) Write down two conclusions about air molecules which can be drawn from the movement of smoke particles in air.

conclusion 1 ....

....

conclusion 2 ....

....[5]

(c) A cylinder of volume 0.15 m^3 is full of gas at a pressure of 5.0×10^5 Pa. In use, 70% of the mass of gas in the cylinder is removed, leaving 30% of the mass of the gas in the cylinder. The temperature of the gas does not change throughout. What is the final gas pressure in the cylinder?

[3]

3 A thunderstorm lasted for 12 minutes. During this time, the following observations were made.

time from start of storm/minutes	0.0	2.0	4.0	6.0	8.0	10.0	12.0
time between seeing lightning and hearing thunder/s	3.0	2.2	1.6	0.1	1.9	2.5	3.1

(a) (i) Explain why there was a time interval between the lightning being seen and the thunder being heard.

....

....

....

(ii) The speed of sound in air is 340 m/s. Estimate how far the centre of the storm was away from the observer when the last reading was taken (i.e. at 12.0 minutes from the start of the storm).

(iii) Estimate the speed, in km/h, at which the storm was moving.

(iv) Suggest which path the storm is taking relative to the observer.

....

....

....[5]

(b) (i) *The type of wave carrying the light energy from the lightning may be illustrated as in Fig. 3.1.*

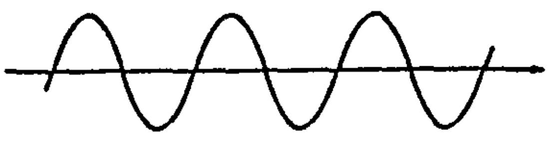

Fig. 3.1

Name the type of wave illustrated and explain what the trace shows.

....

....

....

[Turn over

(ii) The type of wave carrying the sound energy from the thunder may be illustrated as in Fig. 3.2.

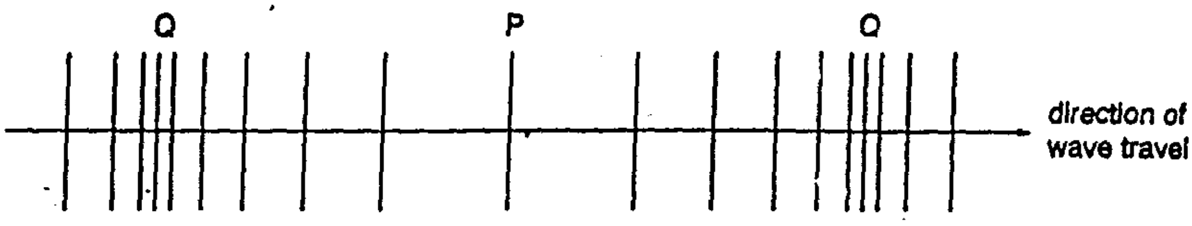

Fig. 3.2

On Fig. 3.2, label one region of rarefaction and one region of compression. Explain what is happening at P and at Q.

....

....

....[5]

(c) As the storm passed, a rainbow was seen. This was caused by light passing through raindrops. Fig. 3.3 illustrates one way that this may happen.

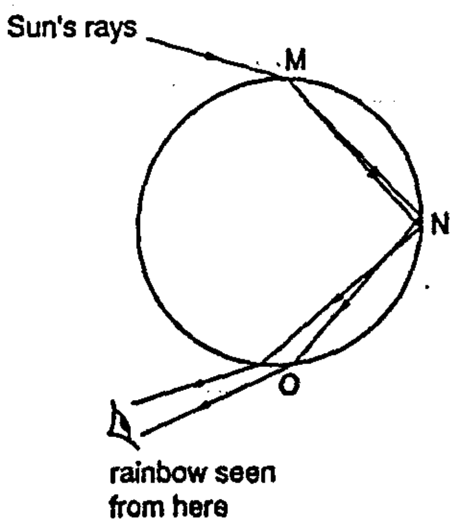

Fig. 3.3

Describe what is happening at each of the points M, N and O.

at M: ....

....

at N: ....

....

at O: ....

....

For Examiner's Use

4 Fig. 4.1 is a possible wiring diagram for a fan convector heater.

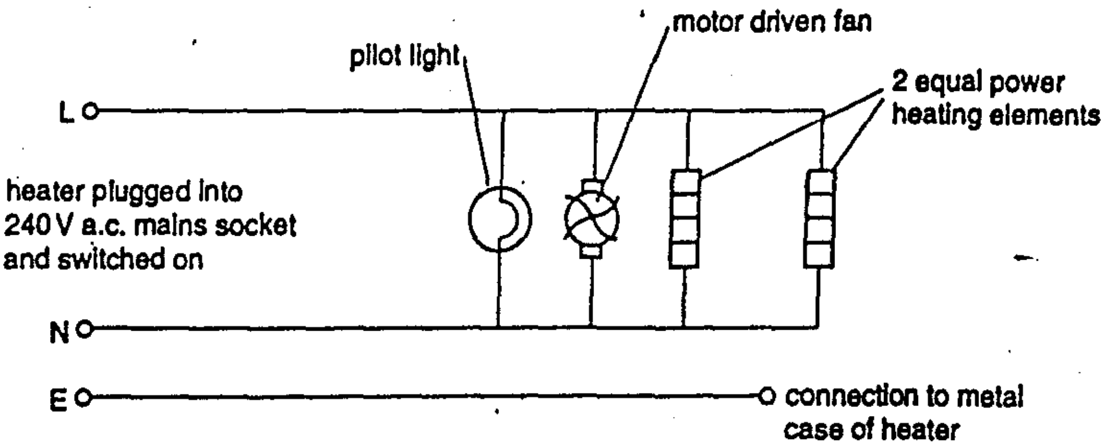

Fig. 4.1

(a) (i) Why would the pilot light, the fan and both heating elements all come on as soon as the heater is plugged in and switched on at the socket?

....

....

(ii) Only the pilot light should come on when the heater is plugged in and switched on at the socket. Mark, with a cross and a letter A, a point in the circuit where a switch could be placed to allow this to happen.

(iii) When the pilot light is on, it must be possible to switch on the fan without the heating elements. Mark, with a cross and a letter B, a switch position to allow this to happen.

(iv) The heater must have two heating levels, maximum and minimum. Mark, with a cross and a letter C, a switch position to allow this to happen.

(v) Explain how another component could be included in the circuit to change the speed of the fan.

....

....[5]

(b) In the table are the power ratings of the parts of the heater.

name of part	*power*/W
pilot light	15
fan at maximum speed	75
first heating element	850
second heating element	850

The mains supply is rated at 240 V.

For Examiner's Use

(i) Calculate the greatest current from the socket for this heater.

(ii) 1. Suggest a value for the rating of the fuse to be used in the plug on the heater.

....

2. Explain your choice of fuse rating.

....

....

....

3. Explain how the fuse would be affected if the insulation on the live lead was worn and this allowed the live wire to touch the metal case of the heater.

....

....

....

(iii) Calculate the circuit resistance when just the fan (running at maximum speed) and the pilot light are switched on.

(iv) This socket is in a country which uses 50 p coins.
The socket is wired to a pre-payment meter which takes 50 p coins. One kW h of energy costs 6.2 p. The heater was switched to maximum power and maximum fan speed. Two 50 p coins were put in the pre-payment meter. Calculate how long it would be before the heater switched off. [12]

For Examiner's Use

(c) The heater gave out heat at a lower rate and the pilot light was dimmer than normal. An electrician, called to test the mains supply, used a cathode ray oscilloscope (c.r.o.) connected as shown in Fig. 4.2.

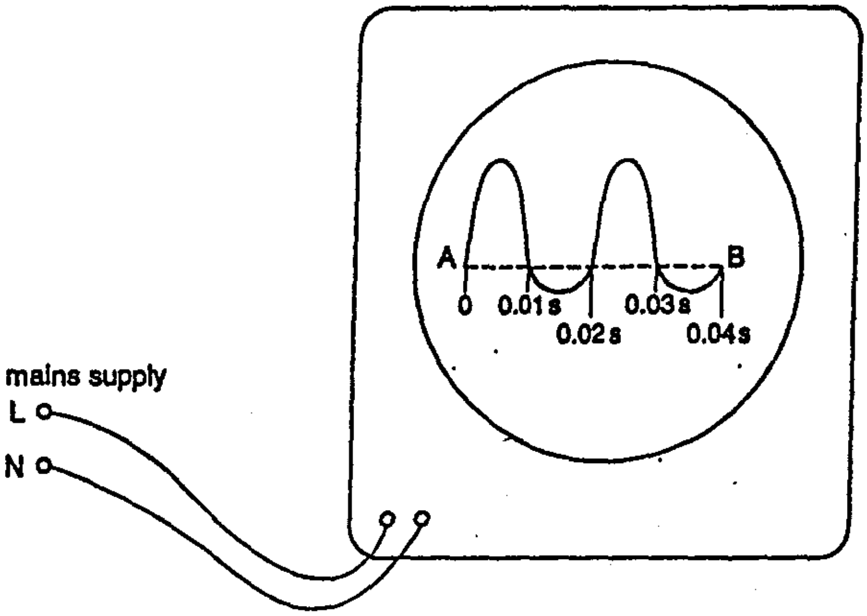

Fig. 4.2

Fig. 4.2 also shows the trace the electrician obtained. The spot on the screen took 0.04 s to travel from A to B.

(i) On Fig. 4.3, sketch the trace which the electrician would have seen if the mains supply had not been faulty.

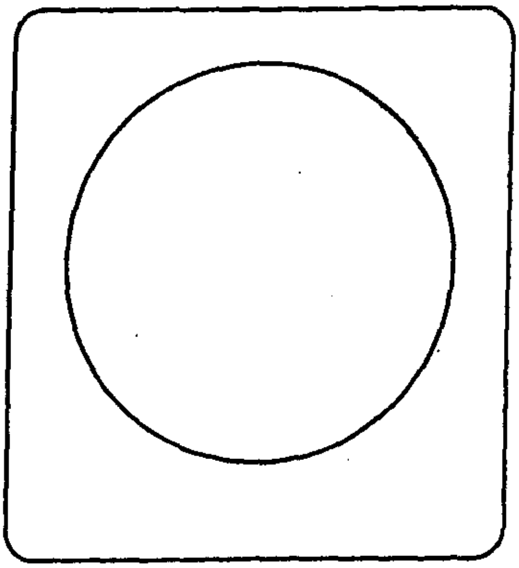

Fig. 4.3

For Examiner's Use

(ii) Suggest a reason why the faulty supply would give a dimmer light and less heat, quoting evidence from Fig. 4.2.

....

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....

(iii) The normal mains frequency is 50 Hz. Using the trace shown in Fig. 4.2, show that the frequency of the supply was correct.

[5]

5 (a) When α-particles bombard a very thin sheet of metal, most of the α-particles pass through the metal sheet but a few are scattered through a very large angle. This effect is shown in Fig. 5.1.

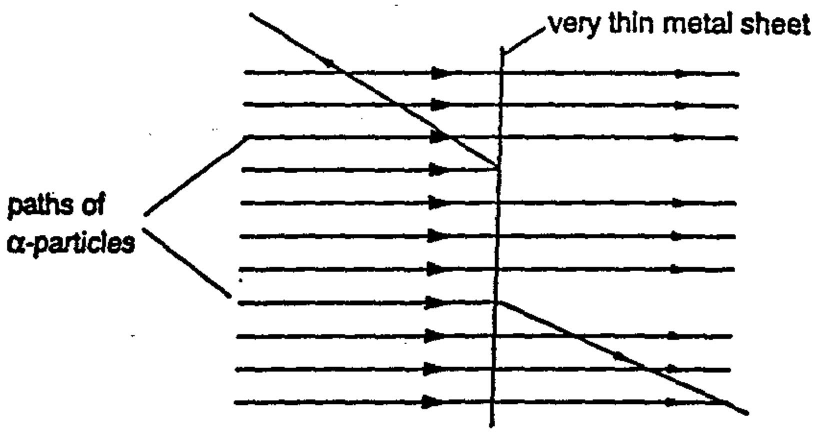

Fig. 5.1

(i) An α-particle is made up of other smaller particles. State the names and numbers of the particles in an α-particle and also the types of charge on these particles.

....

....

For Examiner's Use

(ii) Why do most α-particles pass through the metal sheet without any scattering?

....

....

....

(iii) Why do one or two α-particles become scattered through large angles?

....

....

(iv) What conclusions about atomic structure can be drawn from this experiment?

....

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....

....[6]

(b) Fig. 5.2 shows the outline of a tube (called a Geiger-Muller tube) which is used to detect α-particles, β-particles and γ-rays.

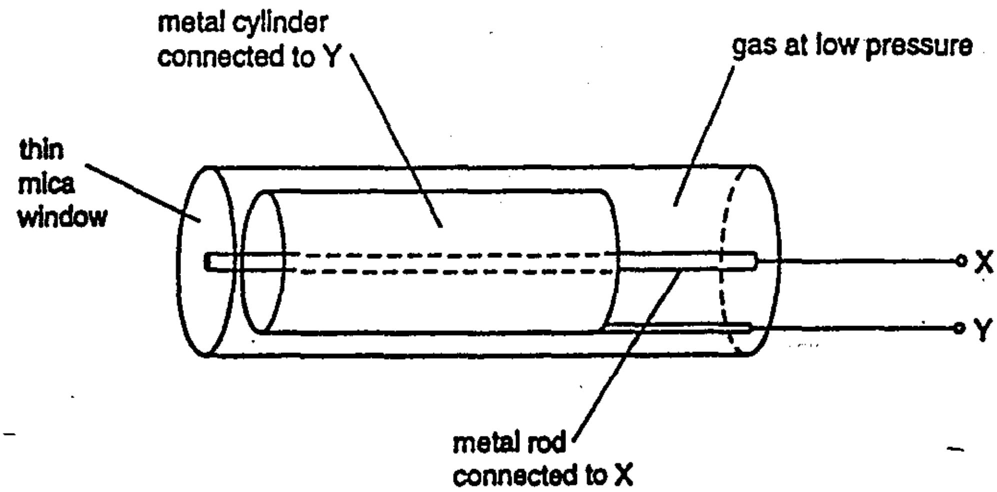

Fig. 5.2

For Examiner's Use

When radiation enters the tube through the thin mica window, pulses of current occur in a circuit connected to X and Y.

(i) What effect does the radiation have on the low-pressure gas in the tube?

....

....

....

....

(ii) Why must there be a potential difference connected between X and Y?

....

....

(iii) Explain why pulses of current occur in the circuit connected to X and Y.

....

....

....

(iv) How are these pulses of current used to measure the activity of a radioactive source?

....

....

....[4]

Centre Number	Candidate Number

Candidate Name ______________________________

International General Certificate of Secondary Education
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3

PAPER 3

Tuesday 18 NOVEMBER 1997 Morning 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator and/or Mathematical tables
Protractor

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

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	
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TOTAL	

This question paper consists of 14 printed pages and 2 blank pages.

SB (SLC) QK73109

[Turn over

For Examiner's Use

1 Fig. 1.1 shows a capsule from a space mission as it is returning to Earth and when it is close to the Earth's surface and the parachute has opened.

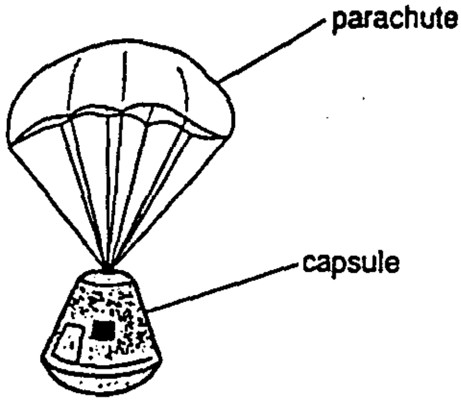

Fig. 1.1

(a) The capsule has a volume of $36\,m^3$ and an average density of $765\,kg/m^3$. It is at a point in the Earth's gravitational field where the gravitational field strength is 9.5 N/kg.

Calculate

(i) the mass of the capsule,

(ii) the weight of the capsule.

[4]

For Examiner's Use

(b) To estimate the average density of the capsule, some scientists made an air-tight scale model, 0.0001 times the volume of the capsule. This model had an overall height of 0.22 m and a maximum diameter of 0.18 m.

(i) With the aid of labelled diagrams, describe an experimental method to find the average density of the model. Put your answer under the headings below.

labelled diagrams

description of experimental procedure

....

....

....

....

....

how the result is worked out

....

....

....

(ii) Explain why the materials used to make the model must be the same as those used to make the actual capsule.

....

....

....

....

(c) Fig. 1.2 is a graph showing the variation of the speed of the capsule with time as the capsule approaches the Earth, starting at the point P when the parachute opens.

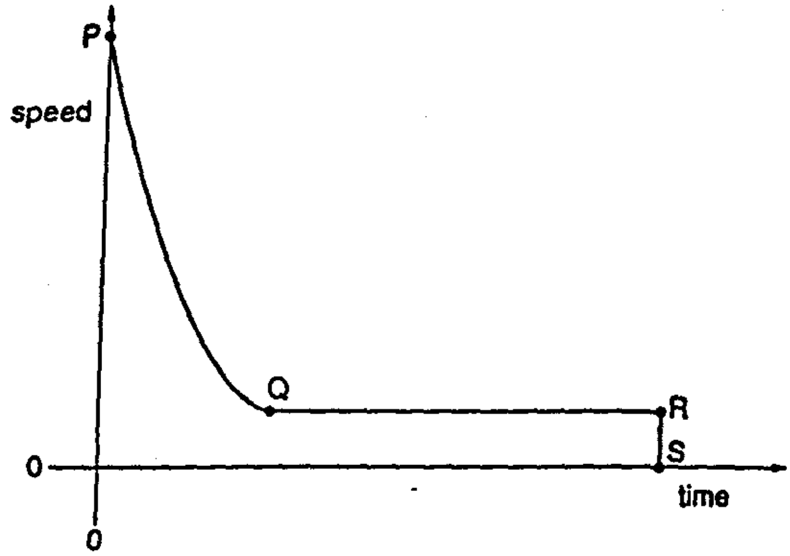

Fig. 1.2

(i) Explain, in terms of the forces acting on the capsule, what is happening to the capsule during its fall, as shown by the section QR on the graph.

....

....

....

(ii) State what happens at R and explain why the section RS of the graph is a vertical line.

....

....

....

[5]

For Examiner's Use

(d) Another falling capsule, with its parachute open and of total mass 1200 kg, was observed whilst it fell from 800 m above the Earth until it was stationary on the ground. The average gravitational field strength over this distance was 9.7 N/kg.

(i) Calculate the decrease in potential energy during the fall.

(ii) State the form of energy that increases throughout the fall, as the potential energy decreases.

....

....

(iii) Explain the energy transformation that is taking place.

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....

[5]

2 Fig. 2.1 shows an outdoor water storage tank.

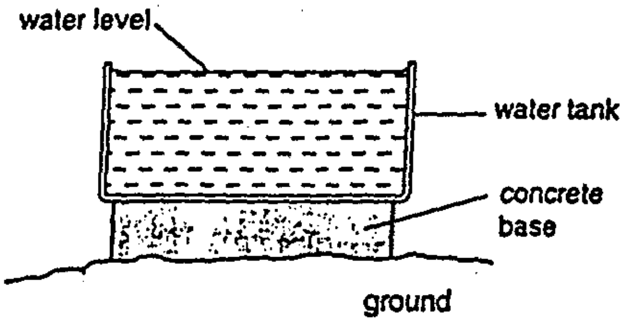


Fig. 2.1

(a) (i) For the water molecules in the tank,

1. describe the distance between the molecules compared to those in solids and gases,

....

....

....

2. describe the movement of the water molecules.

....

....

(ii) Explain in molecular terms why water is a liquid, and not a solid, at a temperature of 20 °C.

....

....

....
[3]

(b) In terms of molecular movement, explain how evaporation takes place.

....

....

....[2]

(c) Water tank designers wished to reduce the amount of water evaporating during hot weather. They investigated three factors, which they thought would affect evaporation. In each case write down the most likely conclusion reached, explaining your answer in terms of the water molecules. All other factors were kept constant.

(i) changing the depth of the tank (assuming it is always full)

....

....

....

(ii) fitting a lid

....

....

....

(iii) changing the temperature of the water

....

....

.... [3]

(d) In further tests, open-topped tanks of the same size were constructed and placed in the shade for the whole of the day. These tanks were made of steel, concrete and a rigid plastic, only one material being used for each tank. The tanks were all filled, at the beginning of the day, with water at a temperature of 15 °C. Suggest which one would have the lowest rate of evaporation during a day when the air temperature averaged 35 °C, and explain your answer.

....

....

....[2]

(e) On a hot day the water level in an open tank of cross-sectional area 100 m^2, dropped by 0.005 m in 8 hours (3×10^4 s). The density of water is 1000 kg/m^3 and the average specific latent heat of vaporisation of the water is 2×10^6 J/kg. Calculate the average rate at which energy is taken from the Sun's rays to evaporate the water. [3]

For Examiner's Use

3 (a) Fig. 3.1, shows the crests of plane waves incident on a reflector. The diagram is drawn to a scale of $\frac{1}{20}$th full size.

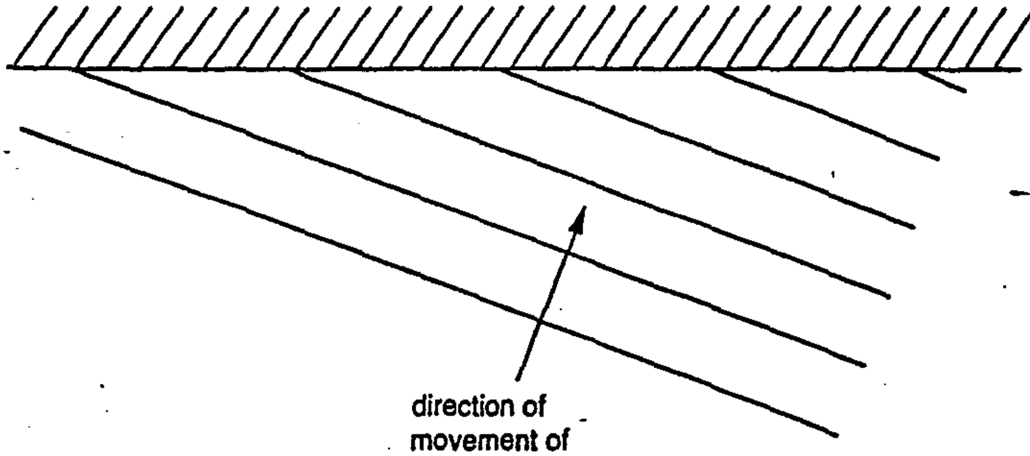


Fig. 3.1

(i) On Fig. 3.1 draw in the reflected wave crests.

(ii) Label the angle of reflection and write down its value.

Angle of reflection = ...

(iii) The speed of the waves is 3×10^8 m/s. Calculate the frequency of the reflected waves.

[5]

(b) A coach driver has a plane mirror arranged to that passengers on the coach can be seen without the driver turning round.

(i) Write down a description of the type of image seen.

....

(ii) State two advantages and one disadvantage of using a plane mirror in this situation.

advantage 1 ....

advantage 2 ....

disadvantage ....

[4]

For Examiner's Use

(c) Fig. 3.2 shows a length of optical fibre with a ray of light passing through.

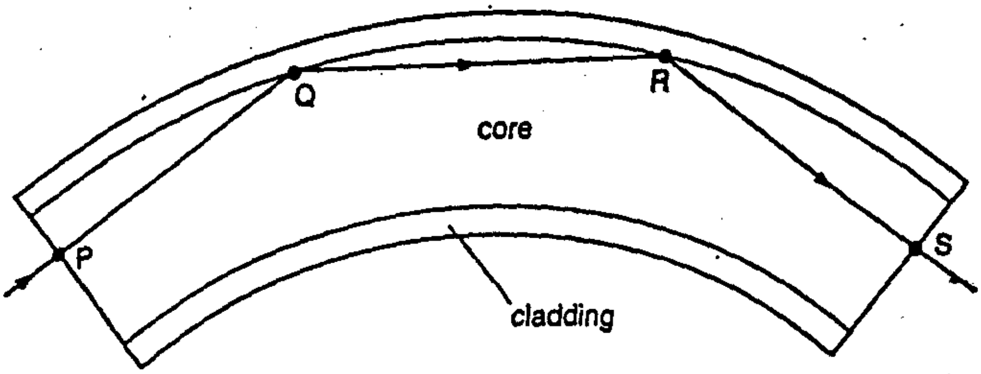


Fig. 3.2

(i) Explain why the ray of light

1 does not change direction at P or at S,

....

....

2 is totally reflected at Q and at R.

....

....

(ii) The refractive index of the glass of the cladding is less than that of the core. Suggest why a fibre with cladding is better than a fibre without cladding.

....

....

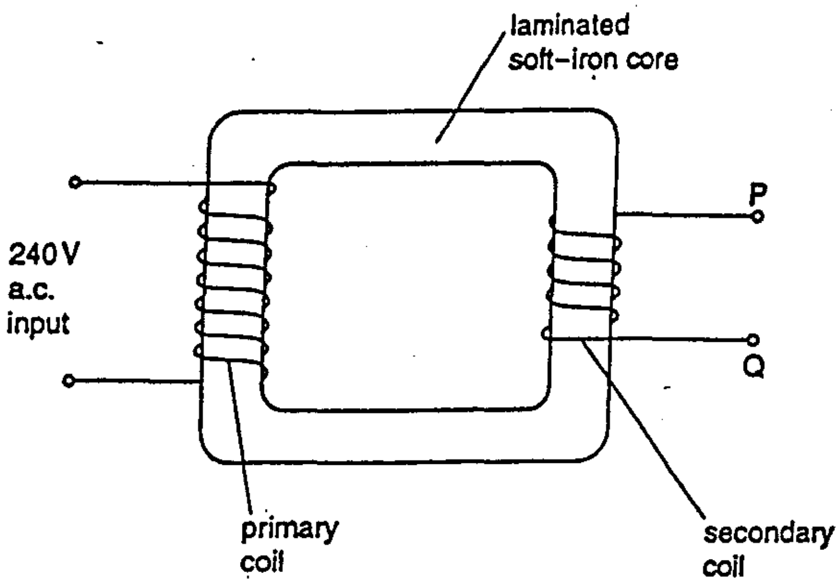
....

[4]

For Examiner's Use

4 A model car runs on a track and is powered by an electric motor rated 12 V d.c., 24 W. The power supply is a 240 V a.c. mains transformer–rectifier unit with a variable low-voltage d.c. output.

(a) Fig. 4.1 is part of the transformer–rectifier circuit.



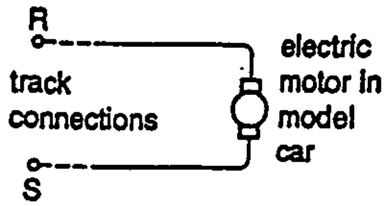


Fig. 4.1

(i) Complete the circuit between PQ and RS so that there is a low–voltage d.c. output across RS, which can be varied from 0 to 12 V. Label all components added to the circuit.

(ii) Explain why varying the p.d. across RS varies the speed of the model car.

....

....

(iii) To enable the p.d. across RS to reach 12 V d.c., it is found that the e.m.f. across PQ must be 15 V a.c. There are 960 turns on the transformer primary coil. Calculate the number of turns needed on the secondary coil.

(iv) Explain why the e.m.f. across PQ should be 15 V a.c. and not 12 V a.c.

....

....

....

For Examiner's Use

(v) The current in the primary coil produces a magnetic field. On Fig. 4.1, draw the pattern of the field lines. Why is it not possible to state the direction of this magnetic field?

....

(vi) Explain how an e.m.f. is induced across PQ.

....

....

....
[11]

(b) The e.m.f. across PQ is 15 V a.c.

(i) Explain what is meant by *an e.m.f. of 15 V.*

....

....

(ii) When the p.d. across RS is 12 V d.c., then the electric motor in the car has a power rating of 24 W. Explain what is meant by *a power rating of 24 W.*

....

....

(iii) Calculate the resistance of the electric motor.
[6]

(c) Fig. 4.2 shows the basic construction of the electric motor used in the model car. The motor in the car picks up the electric current by means of two contacts with the track.

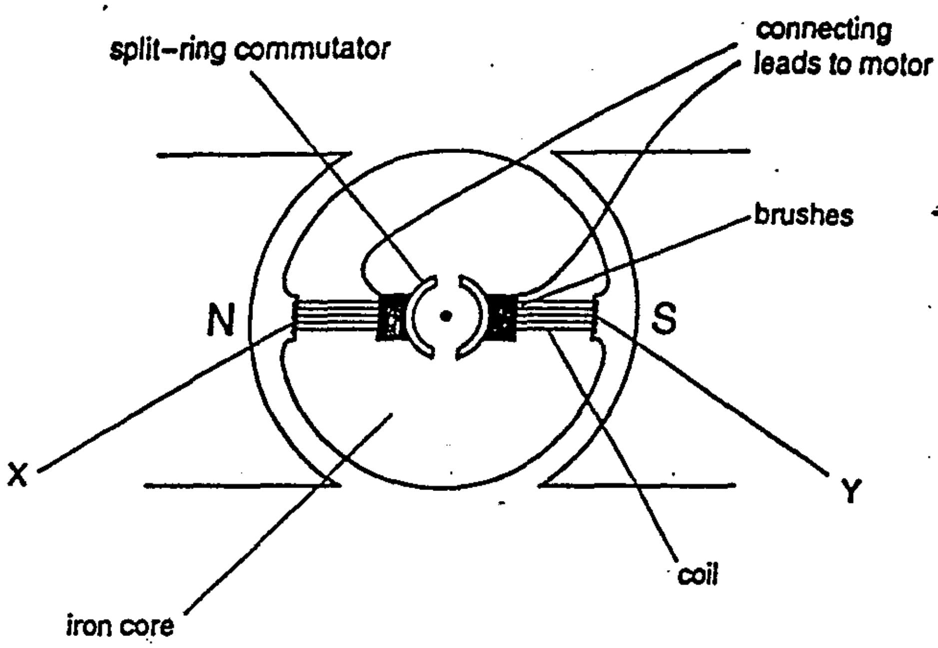


Fig. 4.2

(i) When the current flowing is maintained at the same value, state two changes that could be made to the construction of the motor to increase the turning effect.

change 1 ....

....

change 2 ....

....

(ii) In Fig. 4.2, the current in the coil is into the paper at X and out of the paper at Y. Draw two arrows, one on the coil at X and one on the coil at Y, to show the direction of movement of the coil.

(iii) After some time the car began to make poor electrical contact with the track. Explain why this made the car slow down.

....

....

....

[5]

5 (a) A piece of cloth made from synthetic fibres is generally more easily charged with static electricity than a piece made from natural fibres like wool. Suggest reasons for this statement.

....

....

....[2]

(b) A cloth made from synthetic fibres was rubbed on a piece of rigid plastic. The fibres were found to be negatively charged and the solid plastic was found to be positively charged.

(i) Suggest what might have happened to the atoms of both the cloth and the plastic.

....

....

....

(ii) Why would the cloth not become charged if it were rubbed against a metal comb?

....

....

....

[4]

(c) Fig. 5.1 shows the outline of a piece of equipment which could be used to remove solid particles out of the waste gases from a power station.

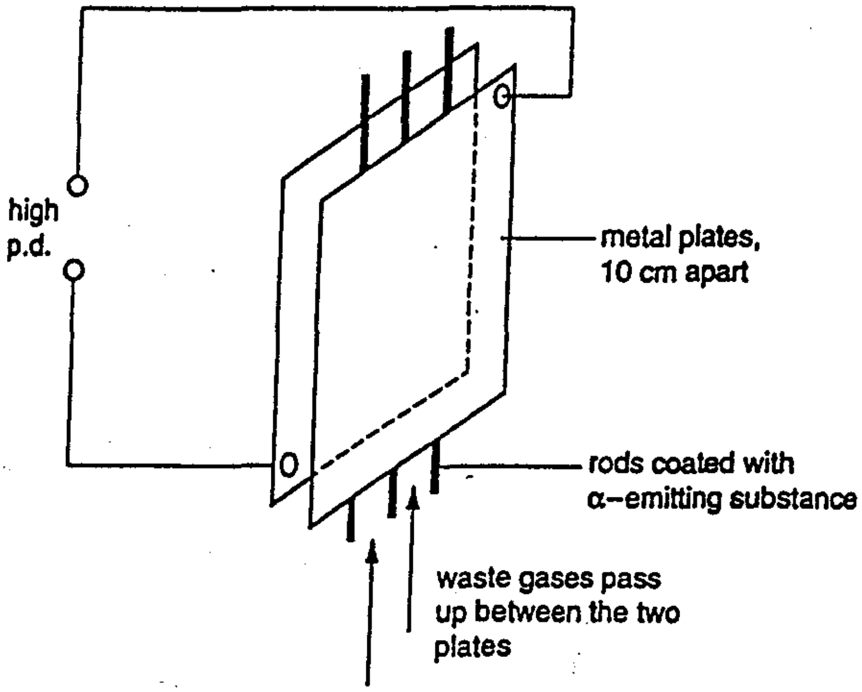


Fig. 5.1

(i) Explain the purpose of the α–particle source.

....

....

....

(ii) State the advantage of using an α–particle source rather than a β–particle source or a γ–ray source.

....

....

....

(iii) Explain why a large potential difference is applied across the plates.

....

....

....

[4]

Centre Number	Candidate Number

Candidate Name ______________________________

International General Certificate of Secondary Education
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3
PAPER 3

Tuesday 19 MAY 1998 Afternoon 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator and/or Mathematical tables
Protractor
Ruler (30 cm)

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
1	
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TOTAL	

This question paper consists of 15 printed pages and 1 blank page.

MML 242986 5/97 OF85556/3

[Turn over

1 **(a)** Fig. 1.1 shows two breakdown vehicles pulling a heavy lorry out of a ditch and back on to a road.

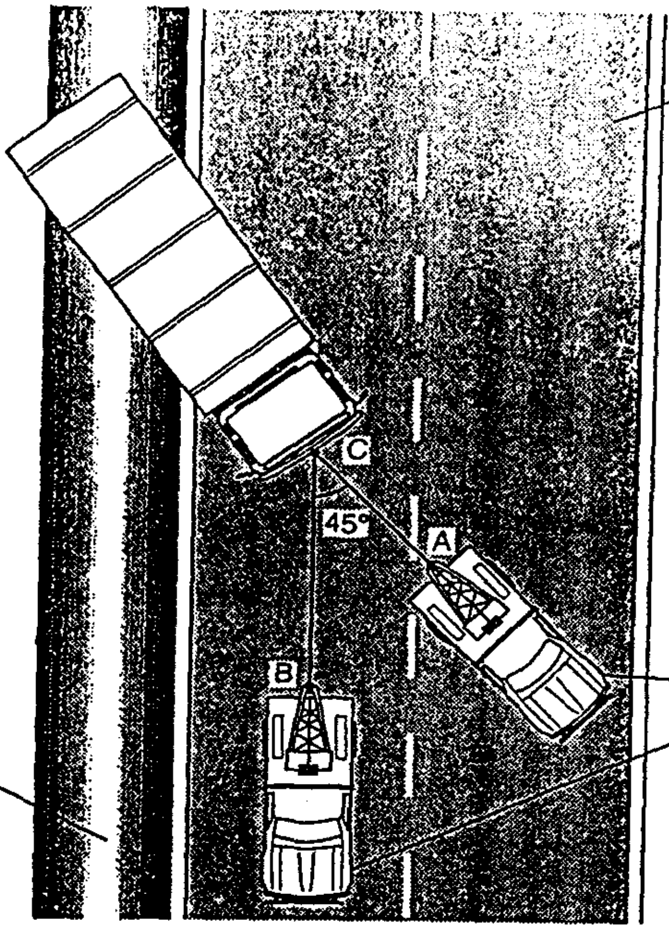


Fig. 1.1

The constant tensions in the steel tow-ropes are 25 kN in CA and 35 kN in CB. The angle between the two ropes is 45°.

(i) On Fig. 1.1, draw arrows to show the directions of the forces exerted on the lorry by the two breakdown vehicles.

State why these forces are described as vector quantities rather than as scalar quantities.

....

....

.... [3]

For Examiner's Use

(ii) In the space below, determine, by means of a scale diagram, the magnitude of the resultant force exerted by the two breakdown vehicles on the lorry and the angle it makes with CA.

Use a scale of 1 cm : 5 kN.

[6]

(b) When the lorry is back on the road, the rope CA is detached. The lorry is towed, in a straight line, by one breakdown vehicle, using the rope CB.

Fig. 1.2 shows how the velocity of the lorry changes over the first 100 s from rest.

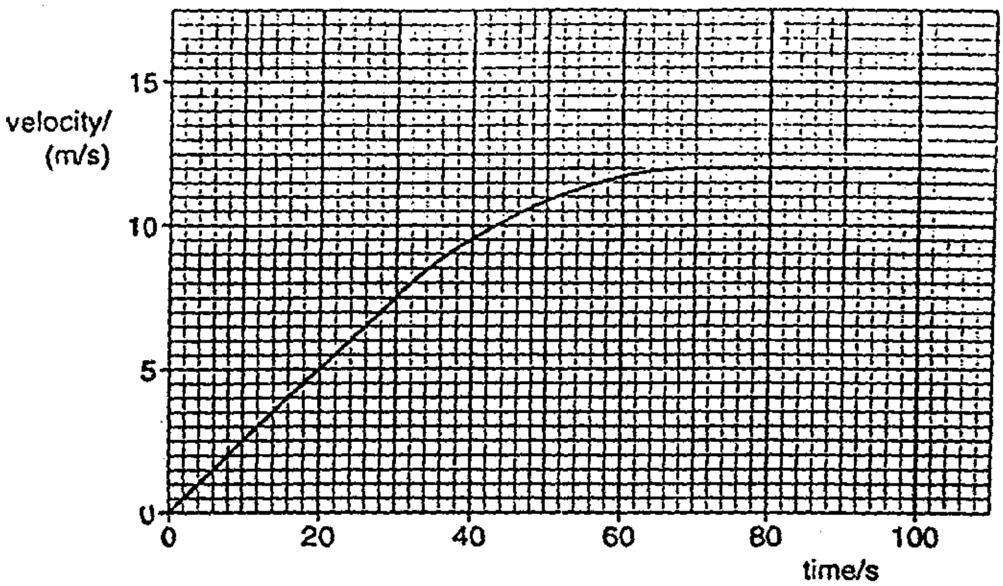


Fig. 1.2

(i) By reference to the values on Fig. 1.2, describe the motion of the lorry throughout this period of 100 s.

....

....

....

.... [3]

(ii) What can be deduced about the resultant force acting on the lorry from the facts that

1. the velocity at 90 s is the same as that at 100 s,

....

....

....

2. the acceleration has the same value when the velocity is 2 m/s as it has when the velocity is 4 m/s?

....

....

.... [3]

For Examiner's Use

(iii) The mass of the lorry is 1.5×10^4 kg. Calculate

1. its momentum change over the first 20 s of its movement along the road,

2. the resultant force on the lorry over the first 20 s,

3. the kinetic energy of the lorry when it has been moving for 20 s.

[7]

For Examiner's Use

2 Fig. 2.1 shows an evaporator which is a piece of industrial equipment used for boiling a solution in order, to separate a solid and a liquid.

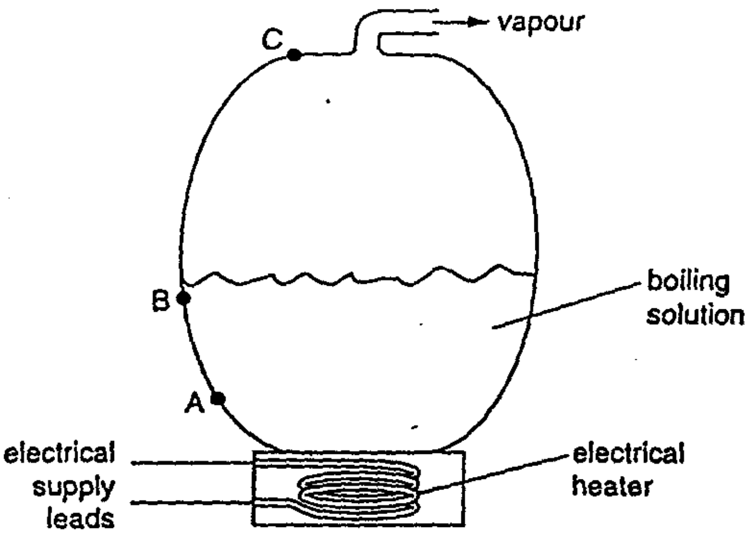


Fig. 2.1

(a) When the evaporator in Fig. 2.1 is in use, the values of the temperatures at A, B and C are to be measured. The range of temperature is from 150 °C to 250 °C. The temperatures at the points A, B and C are likely to change quickly.

(i) Name a suitable type of thermometer for this use.

....

(ii) What feature of your chosen type of thermometer makes it suitable for measuring

1. the stated temperature range,

....

....

2. rapidly changing temperatures?

....

.... [5]

For Examiner's Use

(b) (i) Using kinetic theory ideas, explain the process of evaporation.

....

....

....

....

(ii) The inside of the evaporator is designed to allow as much liquid as possible to evaporate. State two factors which affect the rate of evaporation in this evaporator.

1. ....

2. .... [5]

(c) The heater used in the evaporator has a power of 30 kW. The evaporator is now kept at a constant temperature and the rate of evaporation of the liquid is constant. The specific latent heat of vaporisation of the liquid is 210 kJ/kg. Assuming that all the energy supplied is used to evaporate the liquid, calculate the rate of evaporation.

[4]

For Examiner's Use

3 Fig. 3.1, which is drawn to scale, shows the shape of a small harbour into which waves are travelling.

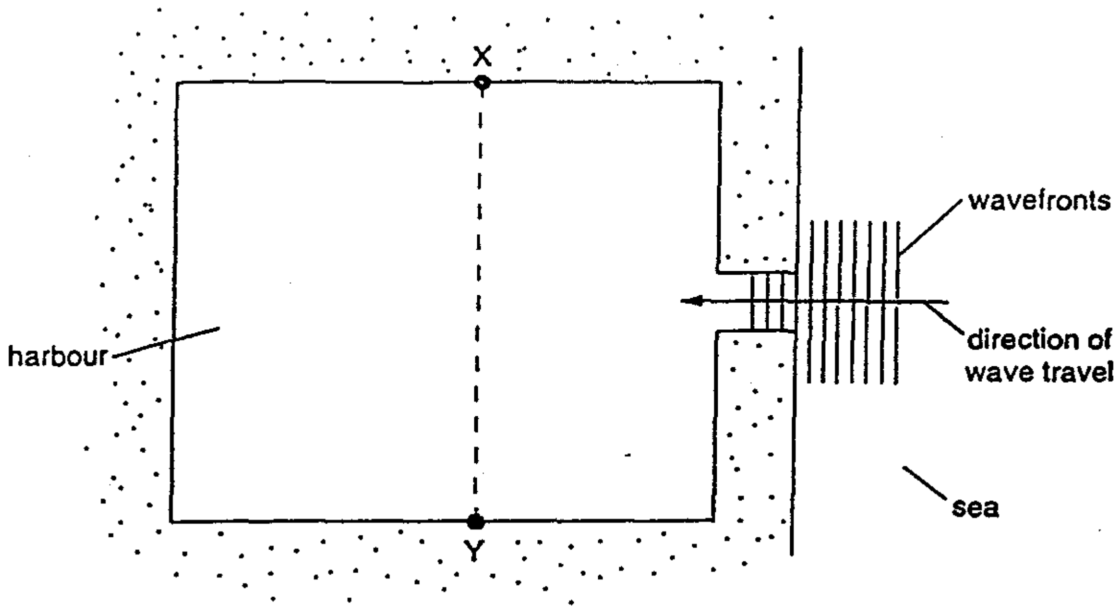


Fig. 3.1

(a) On Fig. 3.1, complete the wave pattern inside the harbour as far as the dotted line XY. Use the same scale as shown on Fig. 3.1. [3]

(b) Name the effect which produces the wave pattern you have drawn.

.... [1]

For Examiner's Use

(c) (i) The width of the harbour entrance is 4 times the wavelength of the incoming waves. State how the pattern would change if the width of the harbour entrance was reduced to 0.5 times the wavelength of the incoming waves.

....

....

....

....

(ii) Explain why the effect you have shown on Fig. 3.1 is not observed when light passes through a window.

....

....

.... [5]

(d) The distance from one trough to the next trough of the same wave is 2.2 m and the wave speed is 2.0 m/s. Calculate the frequency of the wave.

[3]

For Examiner's Use

4 A small generator is labelled as having an output of 5 kW, 240 V a.c. (at constant frequency). It is used to provide emergency lighting for a large building in the event of a breakdown of the mains supply. The circuit is shown in Fig. 4.1.

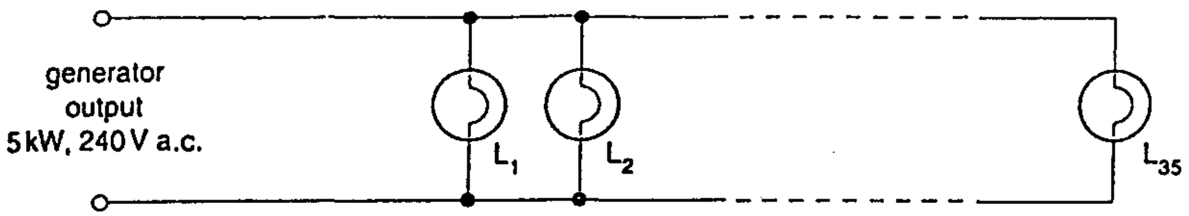


Fig. 4.1

There are 35 light fittings on the circuit, each with a 240 V, 60 W lamp.

(a) Calculate the maximum current which the generator is designed to supply.

[2]

(b) (i) Calculate the power needed when all the lamps are turned on at the same time.

(ii) Explain why this generator is suitable for supplying the power required but would not be suitable if all the 60 W lamps were exchanged for 150 W lamps.

[4]

For Examiner Use

(c) Write down two reasons why all the lamps are connected in parallel rather than in series. In each answer, you should refer to both types of circuit.

reason 1 ....

....

....

reason 2 ....

....

.... [4]

(d) Calculate the resistance of the filament of each 60 W lamp.

[4]

(e) Fig. 4.2 shows the current output of the generator when it is supplying all 35 of the 60 W lamps.

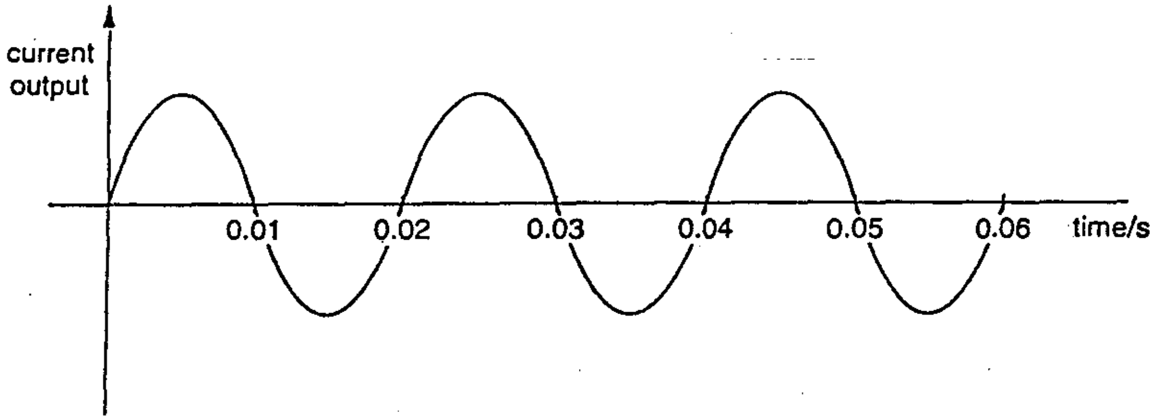


Fig. 4.2

(i) Calculate the frequency of the supply from the generator.

(ii) On Fig. 4.2, sketch another graph to show the approximate current output of the generator when 17 lamps are removed from their fittings. [4]

For Examiner's Use

(f) The generator is a fixed magnet, rotating-coil type.

(i) Explain how this arrangement generates an e.m.f.

....

....

....

....

(ii) State two factors, either in the construction or the operation of the generator, which would increase the maximum power output. In each case, state whether the factor is increased or decreased.

factor 1 ....

....

....

factor 2 ....

....

.... [5]

For Examiner's Use

5 (a) Fig. 5.1 shows the trace on an oscilloscope which was being used to time the interval between two runners, A and B, completing a 100 m race.

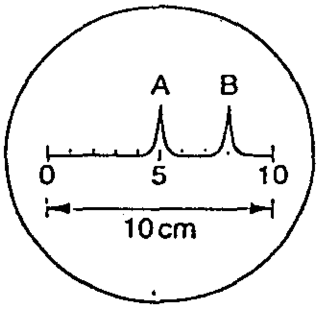


Fig. 5.1

The time-base of the oscilloscope was set at 1 ms/cm.

(i) Which runner wins the race? Suggest a reason for your answer.

....

....

....

....

(ii) Calculate the time interval between the runners.

[4]

For Examiner Use

(b) Fig. 5.2 shows an arrangement for investigating the effect of a magnetic field on the emissions from a radioactive source. The apparatus is placed in an evacuated box.

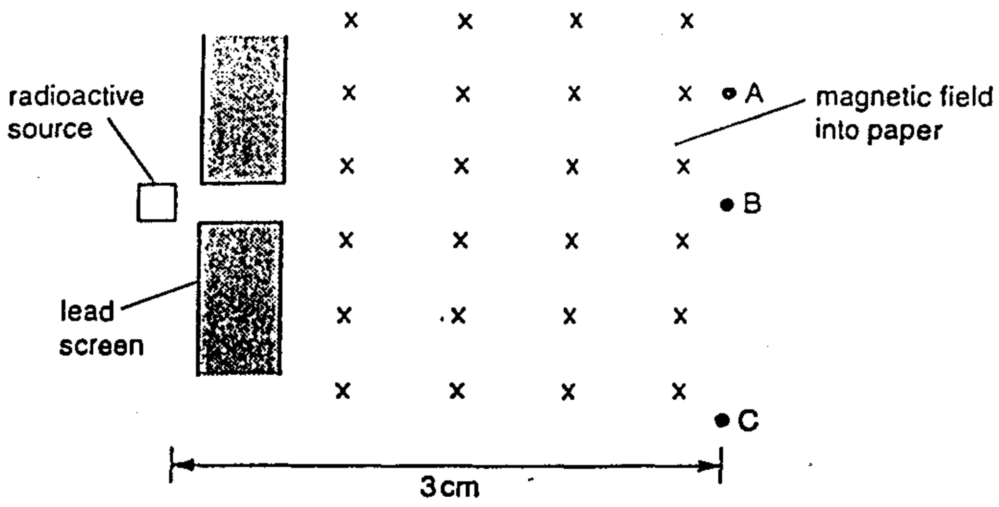


Fig. 5.2

In Fig. 5.2, a Geiger-counter is placed at A, B and C in turn. The results are given in the table.

position	A	B	C
counts/minute when no isotope is present	20	22	21
counts/minute when the isotope is present	21	186	163

(i) Explain why there are counts, and why they are slightly different, when no isotope is present.

....

....

....

....

For Examiner's Use

(ii) State which of the three types of emission, α-particles, β-particles and γ-rays, are coming from the radioactive source.

....

....

(iii) Explain your answers to (ii), quoting figures from the table.

....

....

....

....

.... [5]

	Centre Number	Candidate Number
Candidate Name ______________________________		

International General Certificate of Secondary Education
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3
PAPER 3

Tuesday 17 NOVEMBER 1998 Morning 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator and/or Mathematical tables

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

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	
TOTAL	

This question paper consists of 13 printed pages and 3 blank pages.

160

MP.R 242986 5/97 OK87441

[Turn over

1 A student was asked to design two simple methods for lifting building materials up to a platform.

Fig. 1.1 shows two designs suggested by the student.

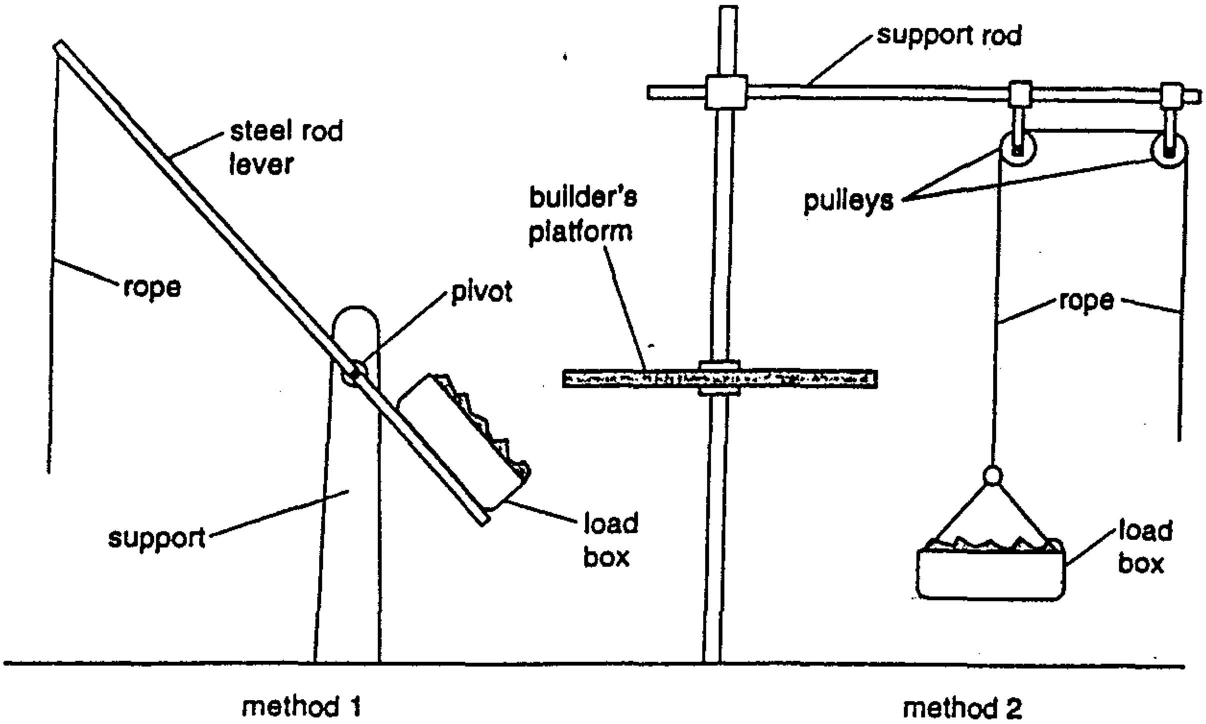


Fig. 1.1

(a) Method 1 is based on an idea called the principle of moments.

(i) Explain the conditions for the lever in method 1 to be in equilibrium.

....

....

....

....

(ii) State and explain two reasons why this method is better than trying to lift the load directly.

reason 1 ....

....

....

reason 2 ....

....

....

(iii) Suggest one change that might be made to this arrangement to make it more effective. Explain your answer.

....

....

....

.... [7]

(b) The student feels that method 1 has disadvantages and suggests that method 2 is better.

(i) State and explain one advantage of method 2 when compared to method 1.

....

....

....

(ii) The student does experiments which show that method 2 requires a larger effort force than method 1 for the same load. Explain why this is so.

....

....

.... [4]

(c) In a test on a building site, a load of 1700 N was raised 2.4 m using method 2.

(i) State the nature of the energy gained by the load.

....

....

(ii) Calculate the energy gained by the load.

(iii) During a test with the student's design, the load had just reached 2.4 m above the ground when the rope snapped and the load fell. Calculate the speed at which the load hit the ground. (g = 10 N/kg)

[7]

Turn over

(d) As a precaution against this type of accident when raising the load 2.4 m, the student suggested fitting two long springs. Each spring was of 1 m unstretched length and was attached as shown in Fig. 1.2.

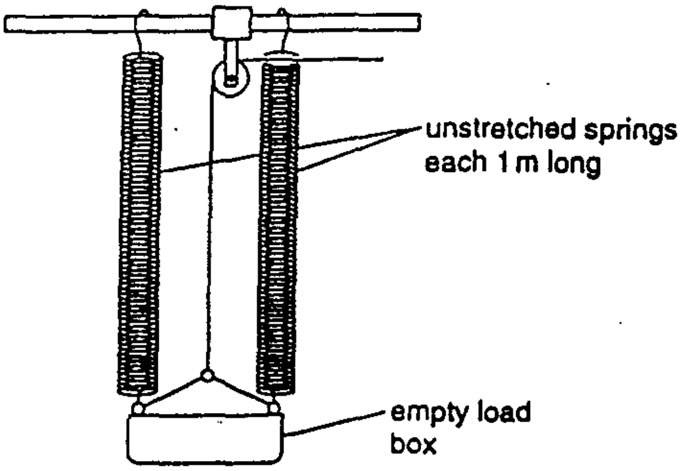


Fig. 1.2

Before use, each spring was tested for loads up to 1000 N. The results of these tests were the same for each spring and are shown in Fig. 1.3.

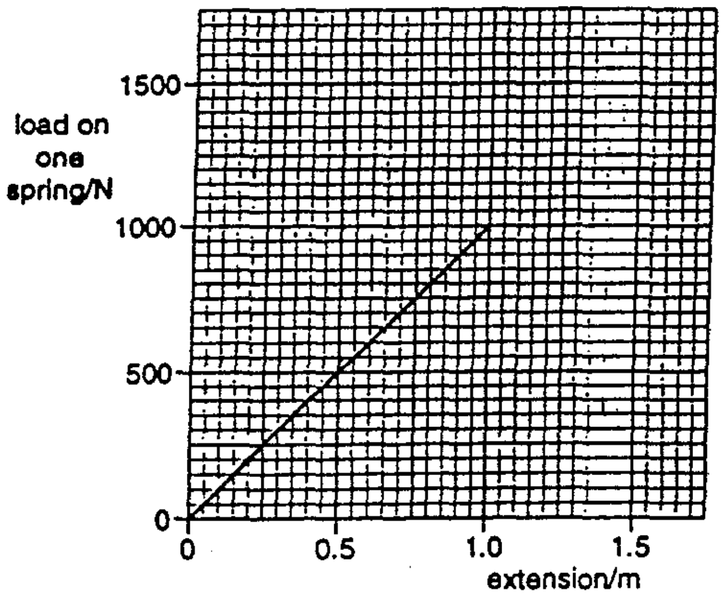


Fig. 1.3

By reference to Figs. 1.2 and 1.3,

(i) describe how each spring extends as the load increases from 0 to 1000 N,

....

....

....

(ii) find the length of each spring when a load of 1700 N is placed in the load box,

(iii) comment on the suitability of the design as a way of preventing the load falling to the ground if the rope breaks.

....

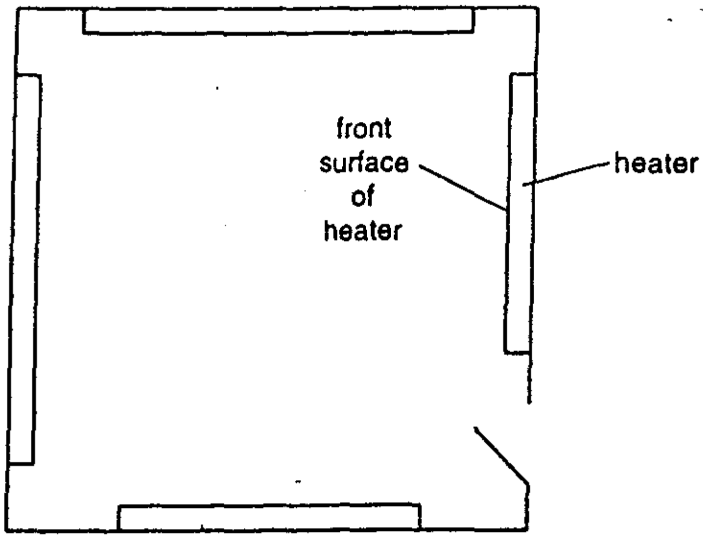
....

....

.... [6]

[Turn over

2 Fig. 2.1 shows the plan of a room designed so that it can be used to dry crops.



plan of drying room

Fig. 2.1

The walls of the room are lined with radiant heaters, with enclosed heating elements. Four different coatings are available for the front surfaces of the heater casings. These are matt black paint, white gloss paint, aluminium paint and black gloss paint.

(a) Describe an experiment, which could be done in the laboratory, that could be used to investigate which of the four coatings would give the highest rate of emission of infra-red radiation from its surface.

Place your answer under the headings given.

Labelled diagram of the apparatus

Method

List of readings taken

How to use the readings to form a conclusion

[7]

(b) Once the drying room was at operating temperature, an average of 70% of the energy of the heaters was absorbed by the crop and produced water vapour. The total power of the heaters was 12 kW and the specific latent heat of vaporisation at the operating temperature was 2500 kJ/kg.

Calculate the average rate of production of water vapour.

[5]

3 Fig. 3.1 shows a swimming pool with a spectator looking down into it.

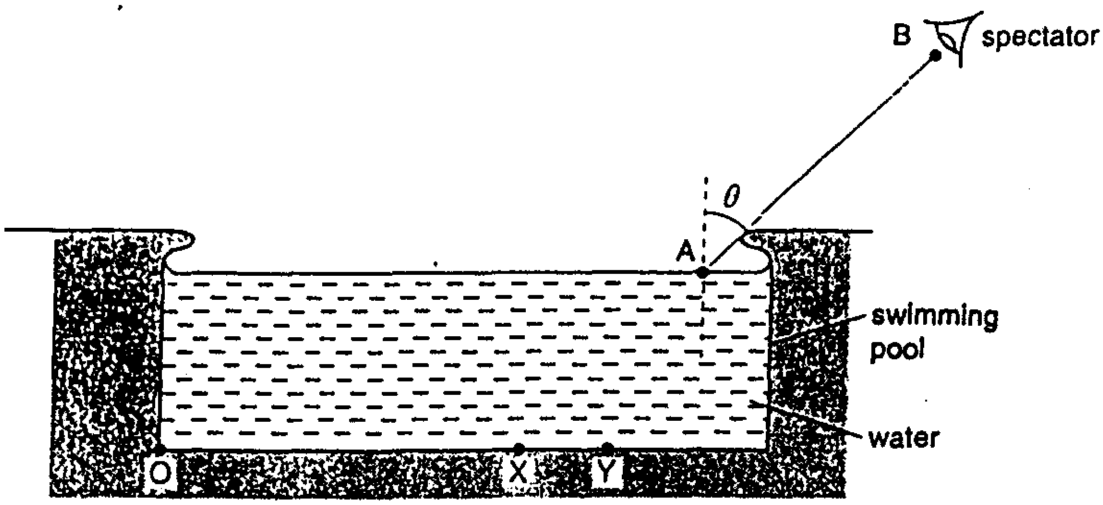


Fig. 3.1

The spectator might be expected to see the bottom over the length OX but can actually see the bottom over the length OY.

AB is a ray of light emerging from the water which just misses the corner of the pool on its direct path to the spectator's eye when the spectator can see the region OY.

(a) On Fig. 3.1, draw the path of the ray in the water which emerges along AB. Explain with reference to the diagram why the whole of OY can be seen.

....

....

....

.... [3]

(b) The spectator also sees a lamp which appears to be at point X but knows that it is actually the reflection of a lamp which is over the top of the pool. On Fig. 3.1, draw a dot to mark the actual position of the lamp and label it L. Explain your choice of the position of the dot L.

....

....

....

.... [2]

(c) The light travels from A to B at a speed of 3.00×10^8 m/s and has a wavelength of 5.00×10^{-7} m. Calculate its frequency.

[3]

(d) Light travels through the water at a speed of 2.25×10^8 m/s. Write down an expression for the refractive index of the water.

....

.... [2]

(e) On Fig. 3.1, the angle θ is 45°. Calculate the angle of the ray in the water, from the normal at A, which continues in the air as the ray AB. Assume that the refractive index of water has a value of 1.3.

[3]

4 Fig. 4.1 shows a possible design for a transformer.

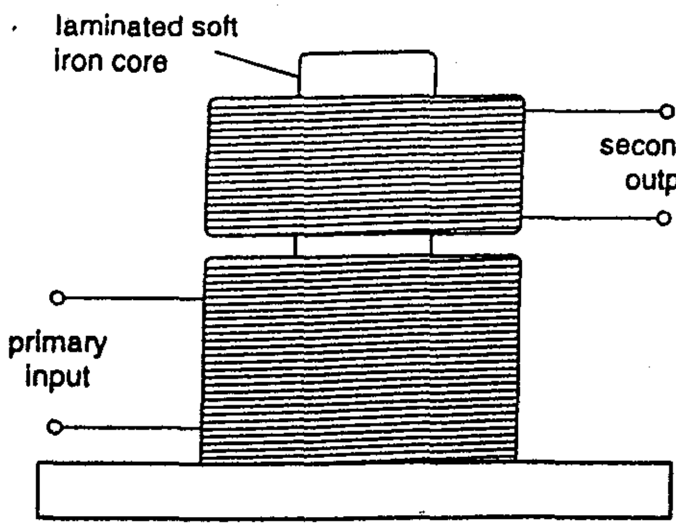


Fig. 4.1

(a) Explain how, in the transformer,

(i) a continuously varying magnetic flux is produced in the primary coil,

....

....

....

....

(ii) the varying magnetic flux is passed from the primary to the secondary coil,

....

....

....

....

(iii) an e.m.f. is generated across the secondary coil.

....

....

....

.... [5]

(b) The primary coil has 600 turns and the secondary coil has 30 turns. Assuming that no energy is lost in the transformer, calculate the input voltage when the output voltage across the secondary coil is 12 V.

[2]

(c) A lamp of resistance 48 Ω is connected across the secondary coil of the transformer. The resistances of the primary and secondary coils are negligible.

Calculate

(i) the current in the secondary coil,

(ii) the charge flowing through the lamp in 20 s,

(iii) the current in the primary coil.

[6]

(d) The lamp across the secondary coil is removed and replaced by a circuit which would give a d.c. output to re-charge a 6 V battery.

Complete Fig. 4.2 with a suitable circuit, marking the positive and negative terminals of the final output.

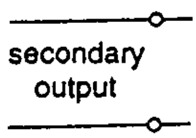


Fig. 4.2

Explain the purpose of each component in your circuit.

....

....

....

.... [5]

(e) Fig. 4.3. shows an ammeter and a length of resistance wire connected across a 6 V d.c. output.

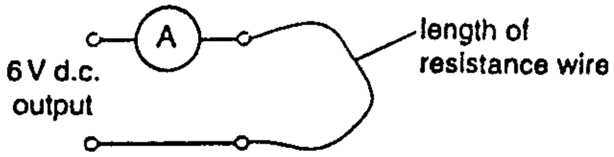


Fig. 4.3

The ammeter reads 2 A. Using as many more identical lengths of resistance wire as you require, explain how you could change the circuit so that the ammeter would read the following values. (You may use circuit diagrams if you wish.)

(i) 1 A

(ii) 4 A

[3]

5 (a) $^{238}_{92}U$ and $^{235}_{92}U$ are isotopes of uranium.

(i) State the similarity and the difference in properties of isotopes, using $^{238}_{92}U$ and $^{235}_{92}U$ as examples.

similarity ....

....

difference ....

....

(ii) Name, and state the numbers of, the particles present in a nucleus of $^{238}_{92}U$.

....

....

.... [5]

(b) The results of an α-particle scattering experiment are given in the table.

angle of scatter	*0°*	*between 0° and 90°*	*greater than 90°*
number of α-particles in one minute	1641	54	3

(i) Explain in terms of atomic structure why most of the α-particles are not scattered.

....

....

....

....

....

....

(ii) Explain in terms of atomic structure why a small number of α-particles are scattered through an angle greater than 90°.

....

....

....

....

.... [5]

Centre Number	Candidate Number

Candidate Name ____________________

International General Certificate of Secondary Education
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3

PAPER 3

Tuesday 25 MAY 1999 Morning 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator and/or Mathematical tables
Protractor
Ruler (30 cm)

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
1	
2	
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5	
TOTAL	

This question paper consists of 13 printed pages and 3 blank pages.

SB (SLC) QF91700/5

[Turn over

For Examiner's Use

1 Fig. 1.1 shows a plan view of a rotating sprayer used for the watering of crops.

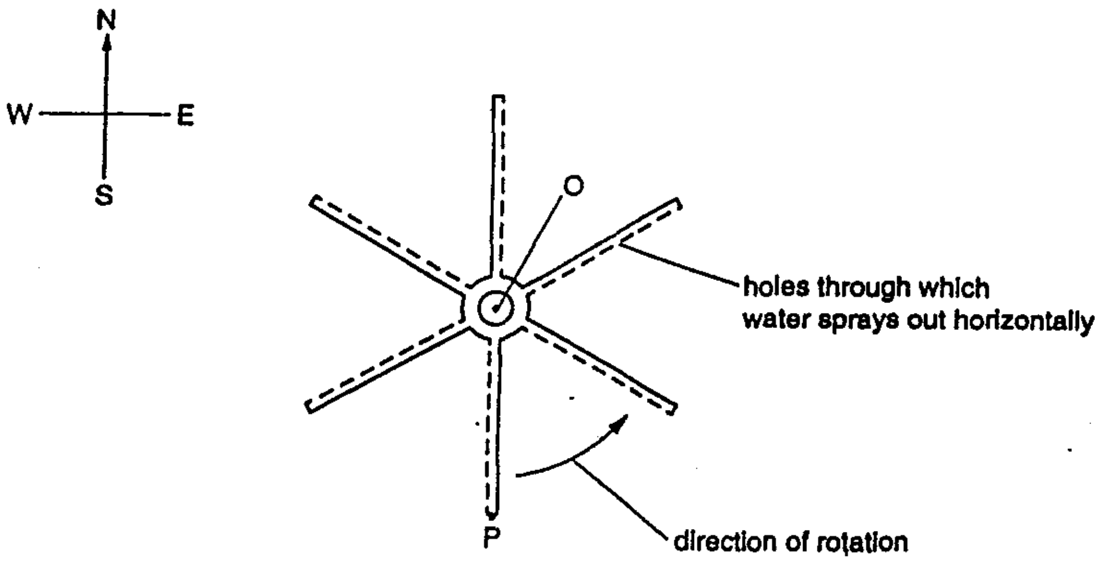

Fig. 1.1

(a) The device rotates about O at a constant rate of 0.2 revolutions per second. OP is 10 m long.
Calculate the speed of the point P. (The circumference of a circle is 2π x radius.)

speed = ... [4]

(b) (i) Use your answer to (a) to write down the **velocity** of the point P when P is at the point shown in Fig. 1.1.

....

....

(ii) Explain why the **speed** of point P is constant but its **velocity** changes as the sprayer rotates.

....

....

....

....

[4]

For Examiner's Use

(c) Explain how you know that there is a net force at the end of the arm P, acting towards O.

....

....

....

....

....[3]

Question 1 is continued on page 4

For Examiner's Use

(d) Water is forced out of the sprayer horizontally. Fig. 1.2 shows how the horizontal speed of the water changes between leaving the sprayer and hitting the ground.

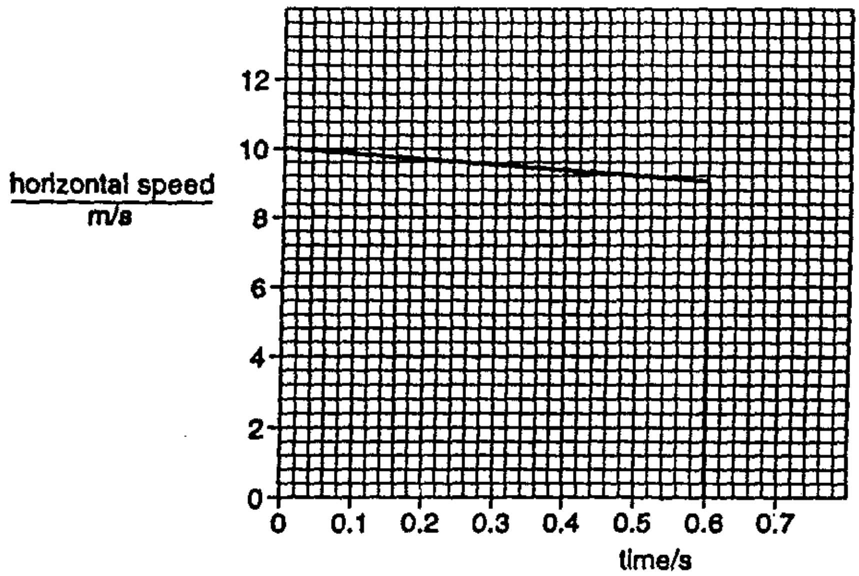

Fig. 1.2

(i) Explain

1. why the horizontal speed decreases slightly over the 0.6 s of the motion,

....

....

2. why the line is approximately vertical at 0.6 s.

....

....

(ii) The acceleration of free fall is 10 m/s^2. Calculate

1. the height above the ground at which the water leaves the sprayer,

height = ...

2. the horizontal distance travelled by the water.

distance = ...

[7]

For Examiner's Use

(e) Fig. 1.3 shows the path of the water at one instant. The pressure of the water on an object placed at point Q is much greater than the pressure of the water on the same object when placed at point R.

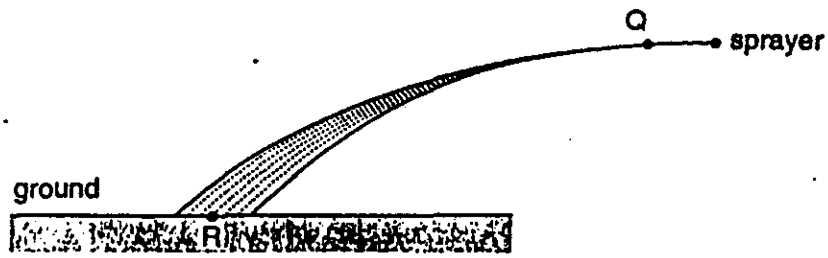

Fig. 1.3

The pressure exerted by the water on the object at point Q is $5 \times 10^5 N/m^2$ and the pressure on the object at R is $1 \times 10^5 N/m^2$.
Explain this decrease in pressure.

....

....

....

....

....[4]

For Examiner's Use

2 A student attempted to find the specific heat capacity of water using the following data obtained from the heating system of a small swimming pool:

mass of water in the pool, heating system and circulation pipes, 54 000 kg;
power of the heating system, 30 kW;
rise in temperature, 2 °C in 5 hours (18 000 s).

(a) Assuming no energy loss, use these data to calculate a value for the specific heat capacity of water. Show your working.

specific heat capacity .... [6]

(b) The student found that the value for the specific heat capacity of water, worked out by this method, was higher than the accepted value.

The average temperature of the water in the pool during the test period was 24 °C, whilst the average temperature of the air was 19 °C.

(i) Describe, in molecular terms, ways in which the water loses heat from its surface.

....

....

....

....

....

....

....

....

(ii) Explain why the loss of heat from the water led to the student's higher value.

....

....

....

.... [7]

3 (a) A converging lens of focal length 4.0 cm is used to produce a virtual image which is 3 times the height of the object.
Fig. 3.1 shows the lens position and the focal length PF. The length PF is to scale.
The object and the image are both on the left-hand side of the lens but their positions are not shown.

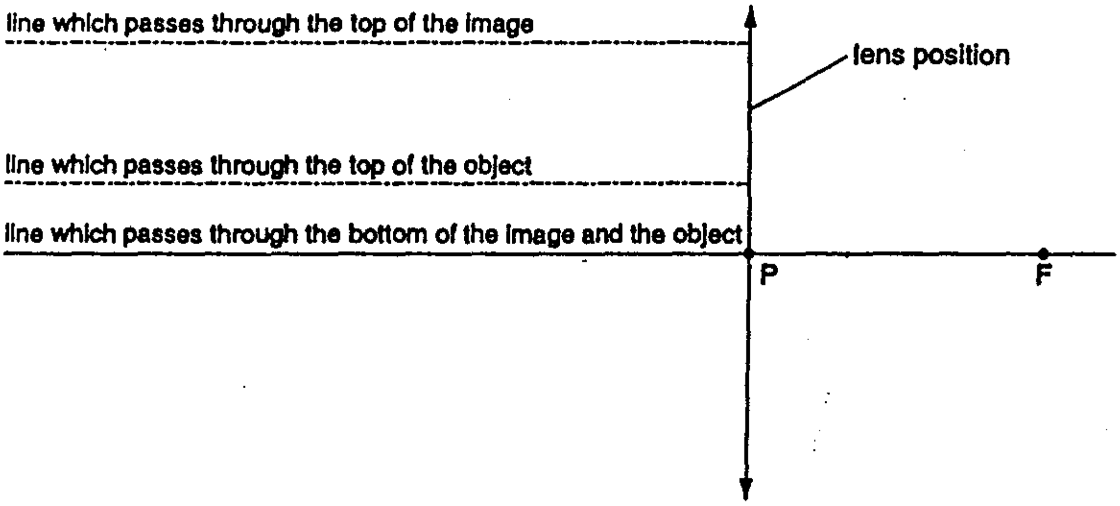

Fig. 3.1

Draw rays on Fig. 3.1 and determine

(i) the scale used, ...

(ii) the distance of the image from the lens, ...

(iii) the distance of the object from the lens. .... [6]

For Examiner's Use

(b) Fig. 3.2 shows a wide parallel beam of monochromatic light incident on a block of glass at an angle of 37°.

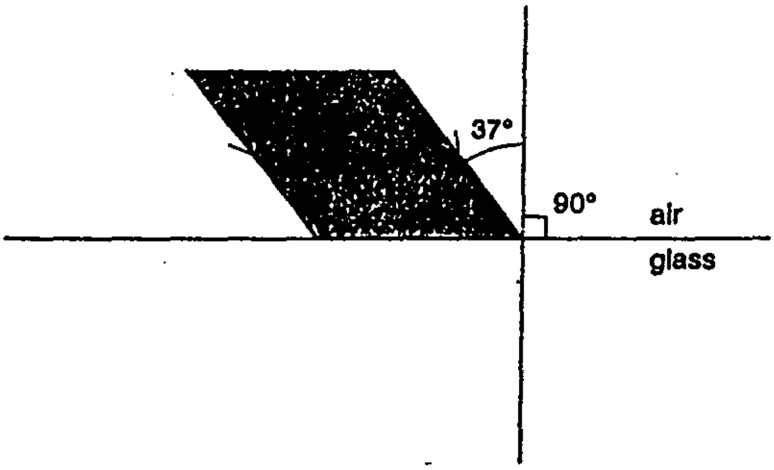

Fig. 3.2

(i) What is meant by the word *monochromatic*?

....

....

(ii) State the approximate speed of light in air.

....

(iii) The angle of refraction in the glass is 22°. Calculate the refractive index of this glass.

refractive index = ...

(iv) On Fig. 3.2, use your protractor to draw in the path of the beam of light in the glass. [7]

For Examiner's Use

4 Fig. 4.1 shows part of a cathode-ray tube.
An electron beam PQ is entering the region between two horizontal, charged metal plates.

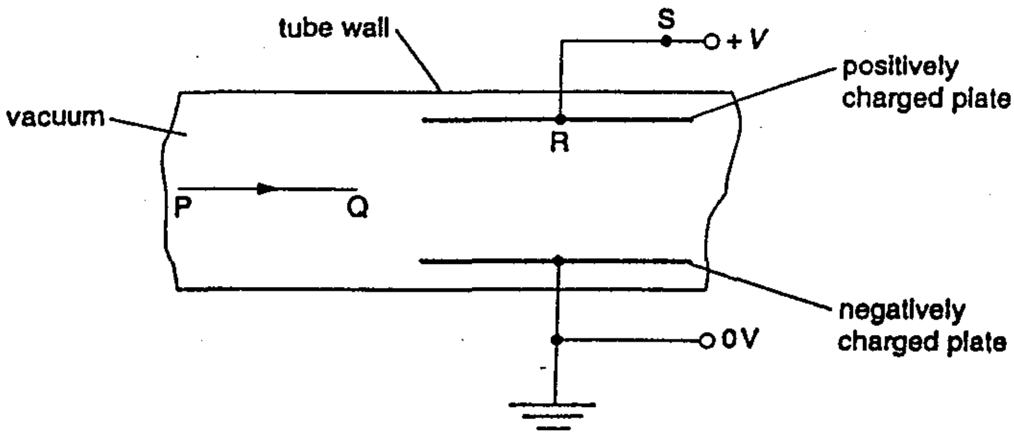

Fig. 4.1

(a) (i) On Fig. 4.1, draw the electron beam from Q to show its path between the charged plates.

(ii) Explain any change of direction of the electron beam when it is between the charged plates.

....

....

....

(iii) On Fig. 4.1, show the direction of the conventional current in the electron beam by drawing an arrow and labelling it D.

[5]

(b) The voltage across the plates is increased so that one of the plates collects 10^{14} electrons in 10 s. Each electron carries a charge of 1.6×10^{-19} C.

(i) Calculate the total charge collected by the plate in 10 s.

charge = ...

(ii) State an equation linking charge and current. Hence calculate the current in wire RS.

....

current = ...

[4]

For Examiner's Use

(c) Air containing charged dust particles flows between two metal plates. A high potential difference is connected across the plates as illustrated in Fig. 4.2.

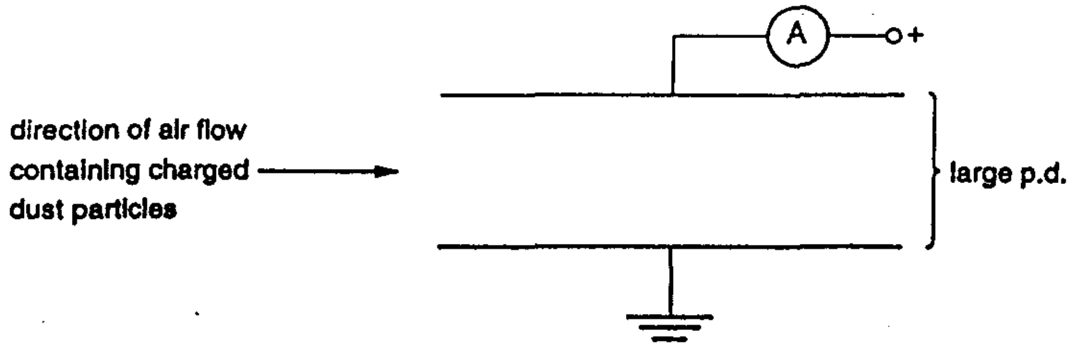

Fig. 4.2

The charged particles are attracted to the upper plate and move through a potential difference of 10 000 V. The ammeter records a current of 2.1×10^{-6} A.

Calculate

(i) the energy supplied by the voltage source in 10 minutes (600 s),

energy = ...

(ii) the power supplied.

power = ...

[6]

(d) Fig. 4.3 shows a beam of electrons entering the magnetic field of a coil. This magnetic field is directed into the paper.

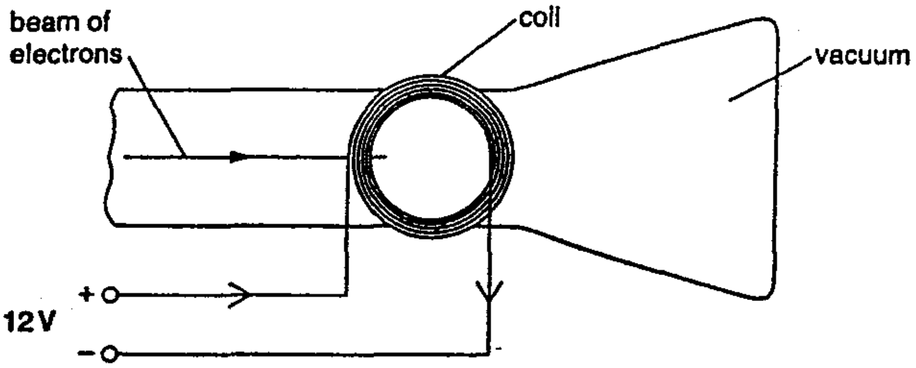

Fig. 4.3

(i) On Fig. 4.3, sketch the path of the electron beam until it hits the end of the tube. Explain your choice of path.

....

....

....

....

(ii) The resistance of the coil producing the magnetic field is 100 Ω. Calculate the current in the coil.

current = ...

(iii) State the effect on the electron deflection of increasing and reversing the potential difference connected across the coil.

....

....

[7]

For Examiner's Use

5 (a) A laboratory needs to find a radioactive isotope which will produce very intense ionisation of air.

The apparatus is shown in Fig. 5.1.

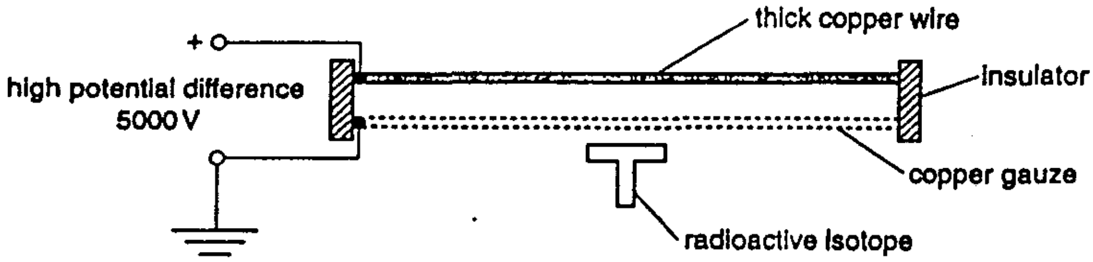

Fig. 5.1

(i) Explain why sparks jump between the gauze and the wire when a radioactive isotope with high ionising properties is brought near the gauze.

....

....

....

....

(ii) An α-emitting source, a β-emitting source and a γ-emitting source, each of the same activity, are tested. One source gives no sparks at all, the second gives only a few sparks per second and the third many sparks per second. State the relative quantities of ionisation produced by each type of emitter.

....

....

....
[6]

(b) Some of the results of a comparison between α-particles, β-particles and γ-rays are shown in the table below.

	α	β	γ
mass	4 units		
constitution	2 protons + 2 neutrons		
charge	+2 units		

Complete the table by filling in the blank boxes. [4]

	Centre Number	Candidate Number
Candidate Name ______________________________		

International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS **0625/3**

PAPER 3

Thursday **16 NOVEMBER 1999** Morning 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator and/or Mathematical tables

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
1	
2	
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4	
5	
TOTAL	

This question paper consists of 12 printed pages.

SB (CW/DJ) OK92706/2

186

[Turn over

For Examiner's Use

1 Fig. 1.1 shows the outline of a machine for driving steel pillars (called piles) into the ground.

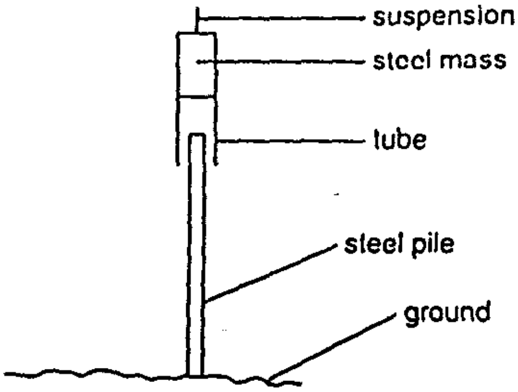

Fig. 1.1

The steel mass is raised by an electric motor and then falls under gravity.
The falling steel has a mass of 200 kg and falls a distance of 6.0 m.

(a) The acceleration of free fall is 10 m/s². Calculate

(i) the potential energy gained by the mass each time it is raised,

potential energy gained = ...

(ii) the maximum speed at which the mass hits the pile.

speed = ...

[7]

187

For Examiner's Use

(b) When the mass hits the pile, it has kinetic energy. This energy is transformed into other forms of energy as the speed of the falling mass rapidly reduces to zero. As this happens, the pile is forced a small distance into the ground.

(i) State the energy conversions which take place, starting from the kinetic energy of the falling mass.

....

....

....

....

(ii) Explain how a large force is produced when the pile is driven a short distance into the ground.

....

....

....

....

[8]

(c) In raising the steel mass 6.0 m, the electric motor uses more energy than that calculated in (a)(i).

Write down and explain **two** causes of this higher energy requirement.

1. ....

....

....

....

2. ....

....

....

....[4]

(d) The equipment design is changed so that when the mass falls once, the pile is driven further into the ground than before the design was changed.

Suggest **three** changes that could be made to do this.

1. ....

....

2. ....

....

3. ....

....[3]

2 Fig. 2.1 shows a piece of apparatus which could be used to find the specific heat capacity of a metal at high temperatures.

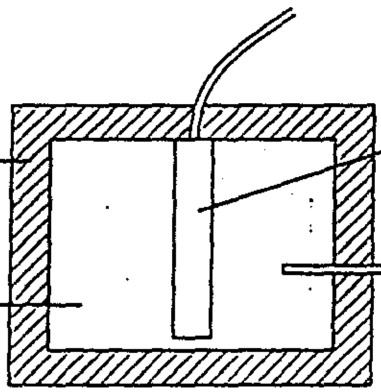

Fig. 2.1

Results from an experiment using the apparatus are recorded as follows:
mass of the metal block, 1.0 kg;
power of the heater, 200 W;
time for which the heater is switched on, 2.5 minutes (150 s);
rise in temperature during this time, from 160 °C to 210 °C.

(a) Describe the experimental steps which were taken to obtain these results.

....

....

....

....

....

....[3]

(b) Use the results to calculate an average value for the specific heat capacity of the metal over this temperature range.

specific heat capacity = ... [4]

(c) The temperature of the metal was measured by using a thermocouple.

(i) Draw a labelled diagram of a thermocouple being used as a thermometer.

(ii) Describe the action of a thermocouple when measuring a temperature change.

....

....

....

....

(iii) Suggest two reasons why use of a thermocouple might have an advantage over a mercury-in-glass thermometer.

1. ....

....

2. ....

....

[6]

For Examiner's Use

3 Fig. 3.1 shows a ray of light, PQRS, passing along a simple optical fibre.

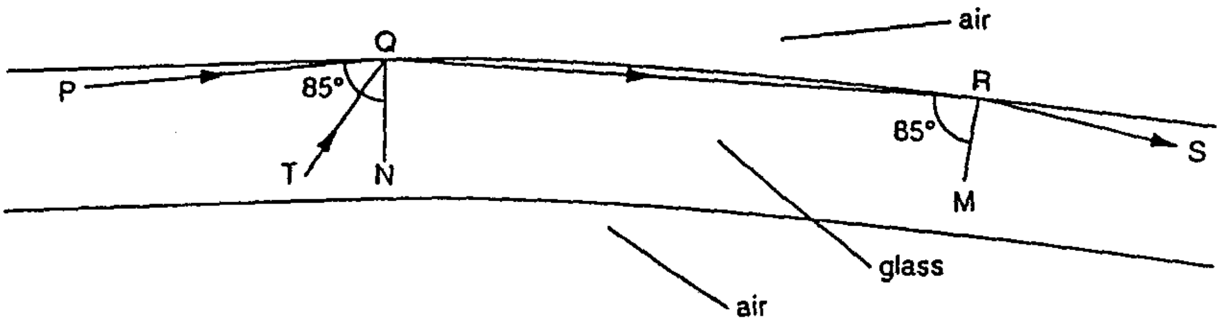

Fig. 3.1

(a) Calculate the angle between the ray PQ and the ray RS.

angle = ... [2]

(b) Explain why the ray PQ does not leave the fibre at Q.

....

....

....[2]

(c) Another ray TQ also strikes the surface at Q.
The refractive index of the glass is 1.50.

(i) Calculate the critical angle for this glass.

critical angle = ...

(ii) Explain why the ray TQ leaves the fibre.

....

....

....

[4]

[10]

For Examiner's Use

(d) The light waves travelling towards Q are monochromatic and have a frequency of 4×10^{14} Hz and a wavelength of 5×10^{-7} m.

(i) What is meant by *monochromatic*?

....

....

(ii) Calculate the speed of these waves in the glass.

speed = ...

(iii) Waves travelling along TQ pass into the air. The refractive index of the glass is 1.50.

Write down an expression from which the speed of the light waves in air could be found.

....[5]

For Examiner's Use

4 Fig. 4.1 is a block diagram of an electrical generating and distribution system.

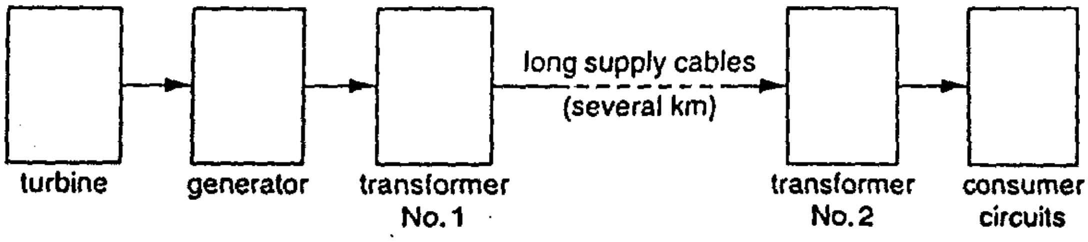

Fig. 4.1

(a) The generator produces an e.m.f. by a process called electromagnetic induction.

(i) Name two factors and state how they are changed in order to increase the output e.m.f. of the generator.

1. ....

....

2. ....

....

(ii) Explain what is meant by the statement 'the induced e.m.f. acts in such a direction as to produce effects to oppose the change causing it'.

....

....

....

....

[6]

(b) (i) Fig. 4.2 shows the basic parts of transformer No. 1 which is 100% efficient.

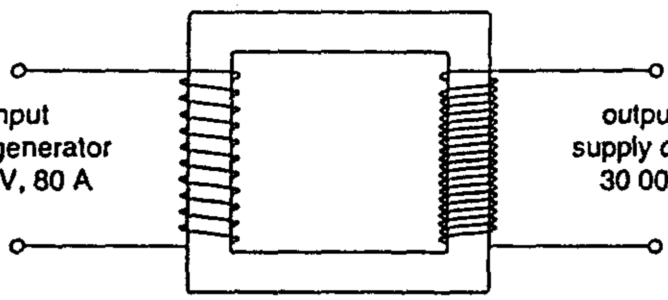

Fig. 4.2

Using the information on Fig 4.2, calculate the current in the supply cables.

current = ...

(ii) Describe the function of transformer No. 2.

....

....

(iii) Explain why the use of the two transformers results in a big reduction in power loss in the supply cables.

....

....

....

....

[6]

(c) Fig. 4.3 shows one of the consumer circuits with three electrical appliances R, S and T, connected into the circuit.

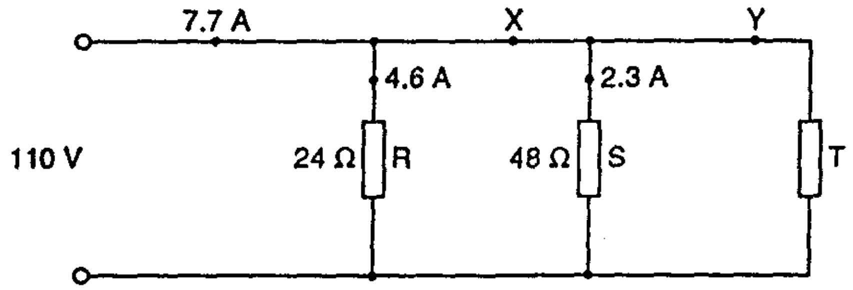

Fig. 4.3

Using the current, voltage and resistance values shown on Fig. 4.3, calculate

(i) the current at point X and at point Y,

current at X = ...

current at Y = ...

(ii) the resistance of appliance T,

resistance = ...

(iii) the combined resistance of appliances R and S,

resistance = ...

(iv) the power developed in appliance R,

power = ...

(v) the energy converted by the appliance S in 2 minutes (120 s).

energy converted = ...

[10]

For Examiner's Use

5 Lengths of steel may be joined by welding them together, as iillustrated in Fig 5.1.

Fig. 5.1

A liquid radioactive source is to be used to test that the welds joining lengths of steel pipe are of equal thickness.

The diameter of the pipes is 120 mm and the pipe wall thickness is 5 mm.

The liquid runs through the pipes whilst a suitable detector moves around the outside of the joints.

(a) With the aid of a labelled diagram, explain how this method detects places where the welds are thinner than 5 mm.

....

....

....

....[3]

For Examiner Use

(b) In order to find out the most suitable type of isotope for this purpose, tests were carried out on the ability of the radiations from an α-emitter, a β-emitter and a γ-emitter to penetrate steel.

(i) Write down what you would expect to be the results of these tests.

α-emitter ....

....

β-emitter ....

....

γ-emitter ....

....

(ii) State and explain which type of emitter would be most useful for testing these welds.

....

....

.... [4]

(c) Describe three precautions which should be taken to ensure the safety of the operator who is making these tests.

1. ....

....

2. ....

....

3. ....

....[3]

	Centre Number	Candidate Number
Candidate Name ____________________		

International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3

PAPER 3

MAY/JUNE SESSION 2000 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
- Electronic calculator and/or Mathematical tables
- Protractor
- Ruler (30 cm)

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

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FOR EXAMINER'S USE	
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This question paper consists of 14 printed pages and 2 blank pages.

(NH) QF05709/2

[Turn over

1 A firework leaves the ground with an initial velocity of 45 m/s, travelling vertically upwards. It reaches a maximum height of 100 m.

At this point the firework fails to explode and falls back down the same vertical path to the ground.

At any point on its path, the firework has both a velocity and a speed.

(a) Using the terms **vector** and **scalar**, explain the difference between velocity and speed.

....

....

....

....[3]

(b) Fig. 1.1 is a graph which shows the height of the firework above the ground during the first 5 s of its journey.

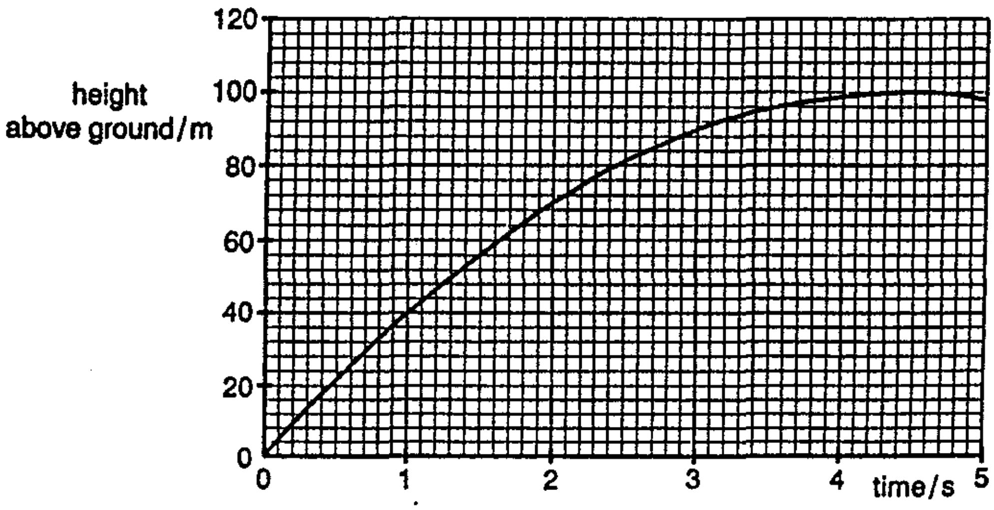

Fig. 1.1

(i) Use the information on the graph to

1. find the time taken for the firework to reach its maximum height above the ground,

....

2. describe how the motion of the firework changes over the first 5 s of its journey.

....

....

....

....

For Examiner's Use

(ii) The acceleration of free fall is $10\,m/s^2$ and air resistance on the firework is negligible.

State

1. the deceleration of the firework as it is rising,

deceleration = ...

2. the total time taken for the firework to rise 100 m and then to fall back to the ground.

time taken = ...

(iii) State the velocity with which the falling firework hits the ground.

velocity = ...

[8]

For Examiner's Use

2 In an experiment to find the specific latent heat of fusion of ice, an electric heater, of power 200 W, is used.

The following readings are taken.

mass of ice at 0 °C, before heating started, 0.54 kg
mass of ice at 0 °C, after 300 s of heating, 0.36 kg

(a) Calculate a value of the specific latent heat of fusion of ice.

specific latent heat of fusion of ice = ... [4]

(b) Explain, in molecular terms, how heat is transferred from the surface of a block of ice to its centre.

....

....

....

....

....[2]

3 Fig. 3.1 shows a simple beam balance made from a pivot and a metre rule.

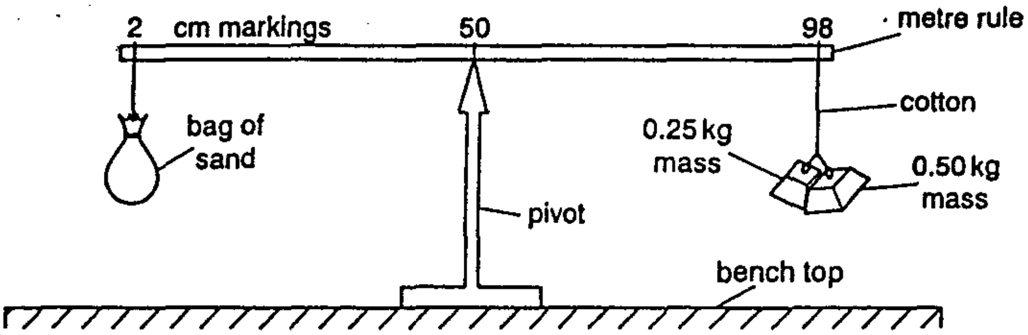

Fig. 3.1

(a) Find

(i) the mass of the bag of sand,

mass = ...

(ii) the weight of the bag of sand. (The acceleration of freefall is $10\,m/s^2$.)

weight = ... [3]

(b) Explain, in terms of moments of forces, why the beam balances.

....

....

....

....[3]

(c) The cotton holding the 0.50 kg mass snaps and the mass falls to the bench. It strikes the bench at a speed of 1.2 m/s.

Calculate its kinetic energy just before it hits the bench.

kinetic energy of the mass = ... [3]

(d) On impact with the bench, the mass bounces up a small distance. Some transformation of energy occurs during the impact. State the forms of the energy just before and just after the impact.

before: ....

after: ....

202

[Turn over

4 Fig. 4.1 shows a sealed box containing only dry air. At a particular instant, one of the air molecules in the box is situated at P and it is moving towards face ABCD along the direction shown by the arrow.

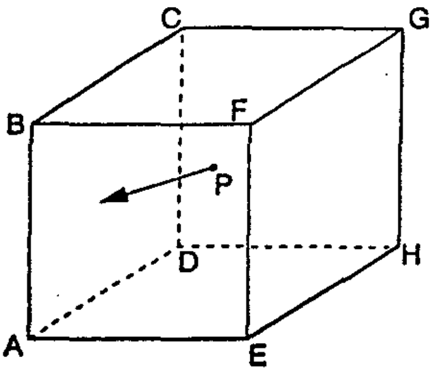

Fig. 4.1

(a) Describe and explain a possible path of the molecule within the box.

....

....

....

....

....[2]

(b) Explain how this molecule

(i) helps to cause a pressure on the side ABCD,

....

....

....

(ii) helps to cause an equal pressure on all the sides.

....

....

....[2]

(c) The box is squashed but no air leaks out. By calculation, complete the table below.

	volume of box /m^3	pressure /Pa	temperature /°C
before squashing	0.09	1.0×10^5	20
after squashing	0.04		20

[2]

5 Fig. 5.1 shows how a right-angled prism may be used to change the direction of a ray of light.

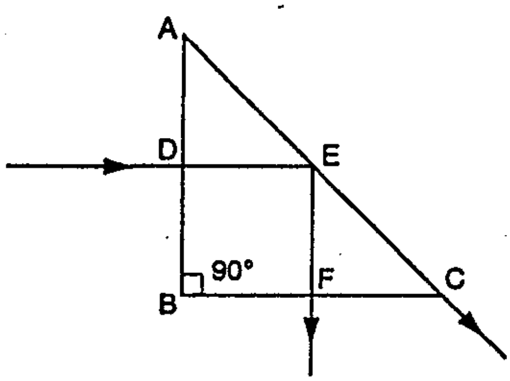

Fig. 5.1

(a) Explain why the ray of light does not change direction at D and at F.

....[1]

(b) State **one** property of the light which does change at D and at F. At each point say whether it increases or decreases.

....

....[2]

(c) At E the light splits, with one ray along the surface of the prism and one ray along EF. Draw the normal at E. Label the critical angle with the letter X and state its value.

critical angle = ... [2]

(d) The refractive index of this glass may be calculated using the formula

refractive index of glass = 1/sin c,

where c is the critical angle.

Use your value of the critical angle of this glass to calculate its refractive index.

refractive index = ... [2]

6 (a) A sound wave in air is made up of compressions and rarefactions.

(i) State what is meant by a *compression*.

....

(ii) State what is meant by a *rarefaction*.

....
[2]

(b) The distance between two consecutive rarefactions in a sound wave is 2.5 m. The speed of sound in air is 330 m/s.

Calculate the frequency of this sound wave.

frequency = ... [2]

(c) A person makes a loud sound and hears the echo of this sound 1.2 s later.

Calculate how far the person is from the object causing the echo. Assume that the speed of sound is 330 m / s.

distance = ... [2]

For Examiner's Use

7 A student is given a battery, a switch, two insulated thick copper leads and a coil of resistance wire. On Fig. 7.1 only the coil is drawn in.

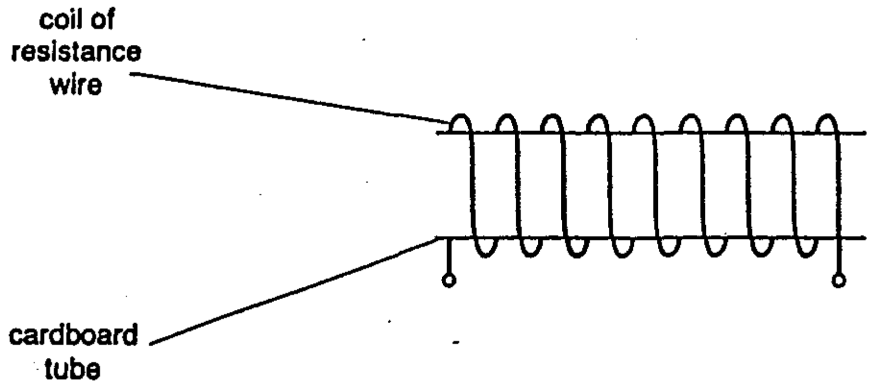

Fig. 7.1

(a) The student set up the apparatus to make a current flow through the coil.
Using standard symbols for components, complete a circuit diagram on Fig. 7.1. Also on Fig. 7.1, draw the magnetic field lines in and around the coil, with arrows to indicate the direction of the lines. [4]

(b) A charge of 16 C flows through the coil in 40 s.

Calculate the current in the coil.

current = ... [2]

For Examiner's Use

(c) The potential difference across the coil is 1.2 V.

(i) Calculate the energy released as heat in the coil in 40 s.

energy = ...

(ii) Calculate the resistance of the coil.

resistance = ... [4]

(d) The battery supplies 24 J of energy to drive 16 C of charge around the circuit. Define the e.m.f. of this battery.

....

....[2]

For Examiner's Use

8 Fig. 8.1 shows a transformer.

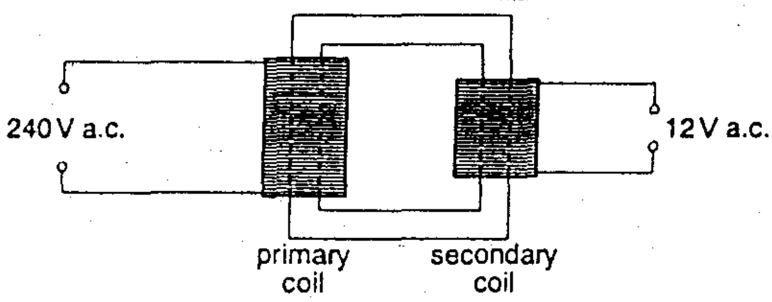

Fig. 8.1

(a) Explain why there is an e.m.f. across the secondary coil even though there is no electrical connection between the primary and secondary coils.

....

....

....

....

....[3]

(b) When the transformer is in use, the current in the secondary circuit is 3.2 A. The transformer may be considered 100% efficient.

Calculate the current in the primary coil.

current = ... [3]

For Examiner's Use

9 (a) Fig. 9.1 shows a beam of electrons about to enter the region between two charged metal plates.

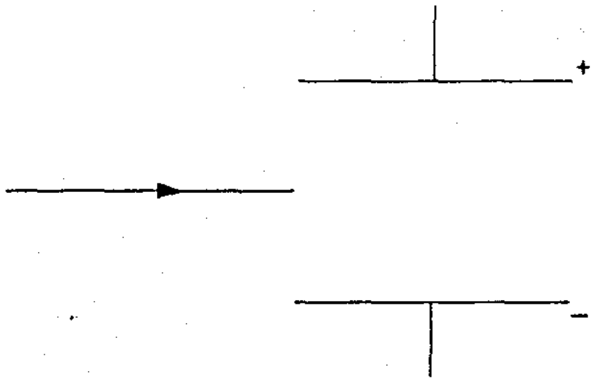

Fig. 9.1

On Fig. 9.1 continue the path of the electron beam between the plates

(i) for plates with a very small charge (label this path **P**),

(ii) for plates with the opposite charges to those shown on Fig. 9.1 (label this path **R**). [3]

(b) Fig. 9.2 shows another arrangement, similar to the first, but in this case the electron beam continues in a straight line because a magnet (which is not shown) has been placed near the plates.

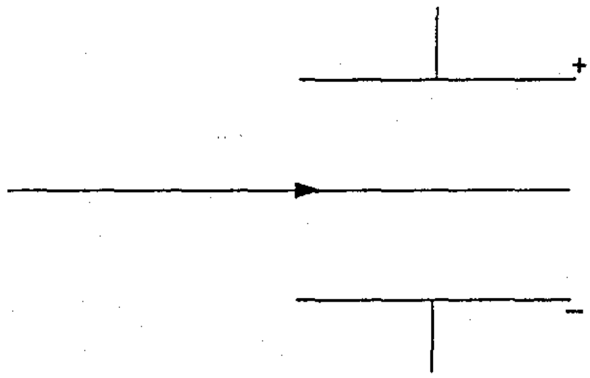

Fig. 9.2

Explain where you would place the N-pole of the magnet in order to achieve this effect. You may draw on the diagram if you feel that it will make your answer clearer.

....

....

....

....[3]

For Examiner's Use

10 (a) A radioactive source contains an isotope of thorium.
Thorium ($^{228}_{90}Th$) decays by α-particle emission to radium (Ra).
Write an equation to show this decay.

[2]

(b) The radium produced is also radioactive. Fig. 10.1 shows a laboratory experiment to test for the presence of the radioactive emissions from the thorium source, using a radiation detector.
In the laboratory there is a background count of 20 counts/minute.

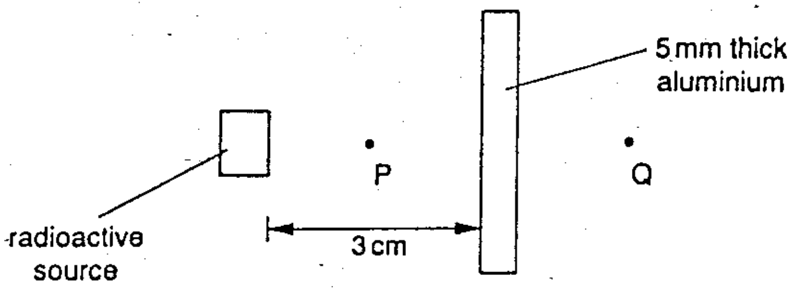

Fig. 10.1

The readings are given in the table.

position	reading in counts/minute
P	2372
Q	361

State and explain

(i) which radiation could be causing the count at Q,

....

....

....

(ii) which radiations could be causing the count at P.

....

....

....

[4]

For Examiner's Use

(c) All three types of radioactive emission cause some ionisation of gases.

(i) Explain what is meant by the term *ionisation of gases*.

....

....

....

(ii) Suggest a reason why γ-radiation produces very little ionisation.

....

....

....
[3]

Centre Number	Candidate Number

Candidate Name ______________________________

International General Certificate of Secondary Education
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3

PAPER 3

Tuesday 14 NOVEMBER 2000 Morning 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator and/or Mathematical tables
Protractor
Ruler (30 cm)

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

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FOR EXAMINER'S USE	
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TOTAL	

This question paper consists of 14 printed pages and 2 blank pages.

[Turn over

For Examiner's Use

1 Fig. 1.1 shows a 0.5 kg mass hanging freely on a length of steel wire.

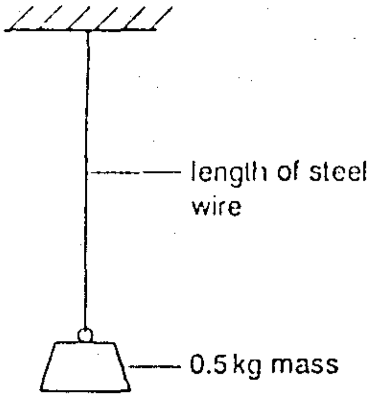


Fig. 1.1

(a) On Fig. 1.1 use labelled arrows to indicate the direction and line of action of each of the two forces acting on the 0.5 kg mass.

The acceleration of free fall is 10 m/s^2. Calculate the values of the two forces which you have indicated.

first force = ... second force = ... [4]

(b) Suggest what causes the two forces to act on the mass.

....

....

....[2]

For Examiner's Use

(c) The 0.5 kg mass is increased by steps of 0.5 kg up to 10 kg. The corresponding extensions of the steel wire are measured. When the mass on the wire is 10 kg, the wire snaps. Fig. 1.2 shows part of the graph of extension against load for the wire.

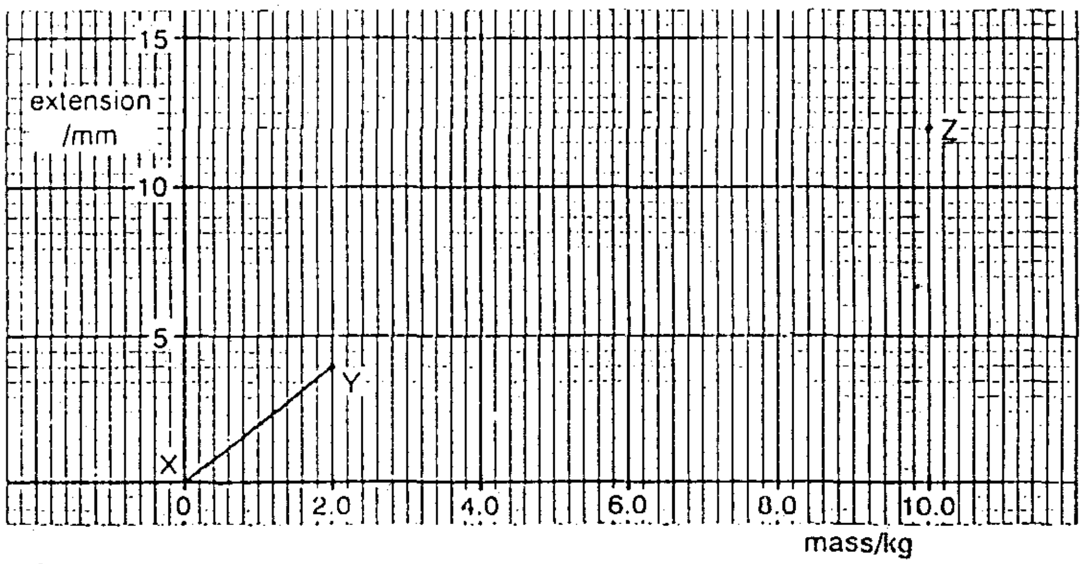


Fig. 1.2

(i) On Fig. 1.2, sketch a possible graph line between Y and Z.

(ii) Determine the mass needed to produce an extension of 3 mm.

mass = ...

(iii) Determine the extension of the wire just before it snaps.

extension = ...

[4]

For Examiner's Use

2 Fig. 2.1 shows a student's design for a thermometer. The student stated that the material labelled M could be a copper rod, alcohol or nitrogen gas.

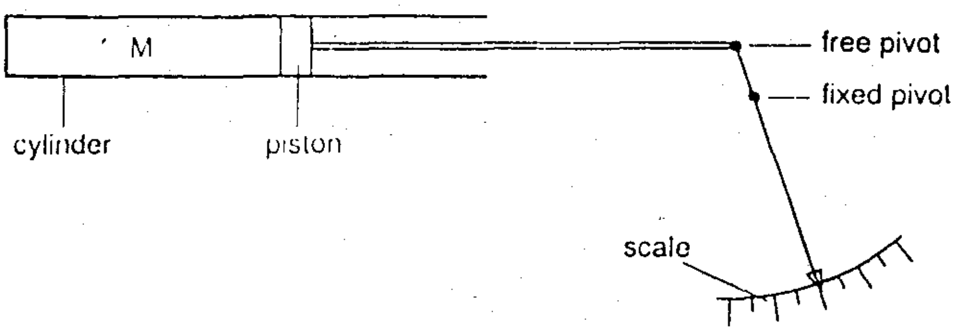


Fig. 2.1

(a) Explain what is meant by the term *sensitivity of the thermometer.*

....

....[1]

(b) (i) State which of the three suggested materials would give a thermometer of greatest sensitivity.

....

(ii) Explain your answer.

....

....

[2]

(c) (i) State which of the three materials would allow the thermometer to measure the largest range of temperature.

....

(ii) Explain your answer.

....

....

[2]

(d) The student found that the temperature scale of this thermometer was *non-linear.* Explain what this means.

....

....[2]

For Examiner's Use

3 Fig. 3.1 shows a person raising a concrete block from a river bed by using two pulleys.

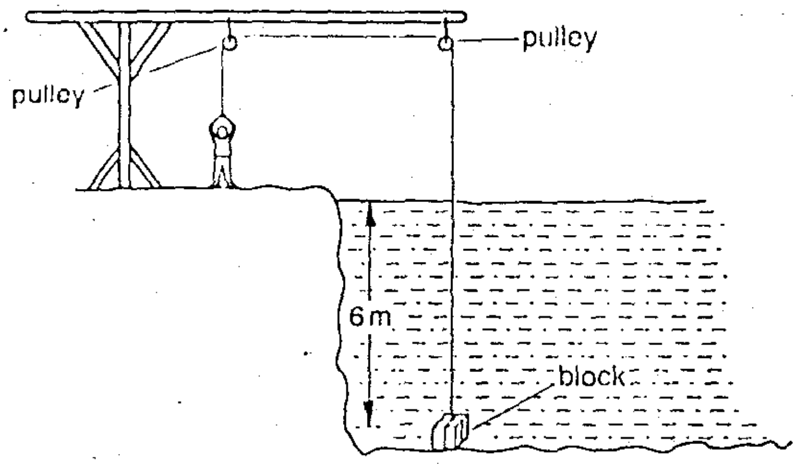


Fig. 3.1

(a) As shown in Fig. 3.1, the top of the block is 6.0 m below the water surface. The density of water is 1000 kg/m^3 and the acceleration of free fall is 10 m/s^2.

Calculate the water pressure acting on the top of the block.

pressure = ... [3]

(b) The block is raised through the water. At one point, the water pressure acting on the top of the block is 4.5×10^4 Pa. The area of the top of the block is 0.015 m^2. Calculate the downward force exerted by the water on the top of the block.

force = ... [2]

(c) When the block is clear of the water, it is raised a further 4.0 m. The weight of the block is 550 N. Calculate the work done on the block as it is raised the 4.0 m through the air.

work = ... [2]

(d) Some of the energy the person uses to raise the block is converted into heat energy. Indicate on the Fig. 3.1, using an arrow and the letter H, **two** places where heat is released. For each place, explain why heat is released there.

....

....

....

....[4]

4 Fig. 4.1 shows water wavefronts which are approaching a small gap in a wall which divides two stretches of water of the same depth. The diagram is drawn to scale.

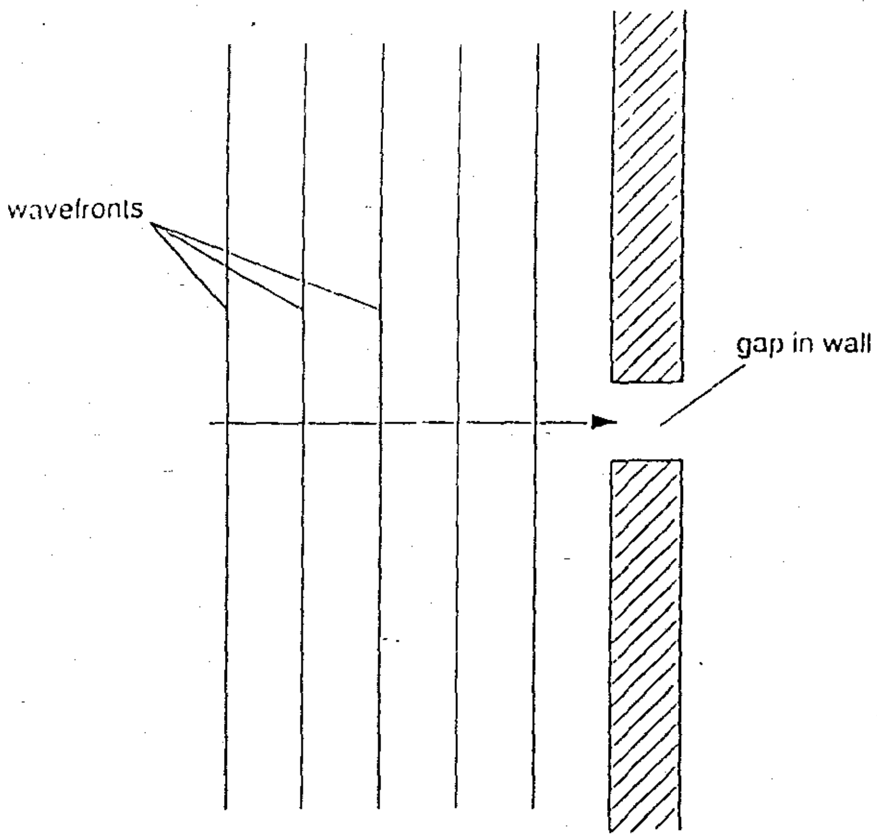


Fig. 4.1

(a) The waves moving towards the wall have a wavelength of 1.6 m and a frequency of 0.80 Hz.

Calculate the speed of these water waves.

speed of waves = ... [2]

(b) State the wavelength and frequency of the waves after they have passed through the gap in the wall.

wavelength = ...

frequency = ... [2]

(c) On Fig. 4.1, complete the pattern of wavefronts to the right of the wall. [3]

For Examiner's Use

5 (a) A student determines the specific heat capacity of water. It is found that 15.5 kJ of energy supplied raise the temperature of 0.45 kg of water by 8.2 °C.

Calculate the specific heat capacity of water.

specific heat capacity of water = ... [4]

(b) A cylinder, which is closed by a gas-tight moveable piston, contains 0.0060 m^3 of gas. The gas has its pressure raised from 2.0×10^5 Pa to 3.5×10^5 Pa, without any change in temperature.

(i) Describe how this could be achieved.

....

....

....

(ii) Calculate the volume when the pressure is 3.5×10^5 Pa.

volume = ...
[4]

For Examiner's Use

6 Fig. 6.1 shows an object placed 2.0 cm from a thin lens, which is to be used as a magnifying glass.

The focal length of the lens is 3.0 cm. The diagram is drawn to full scale.

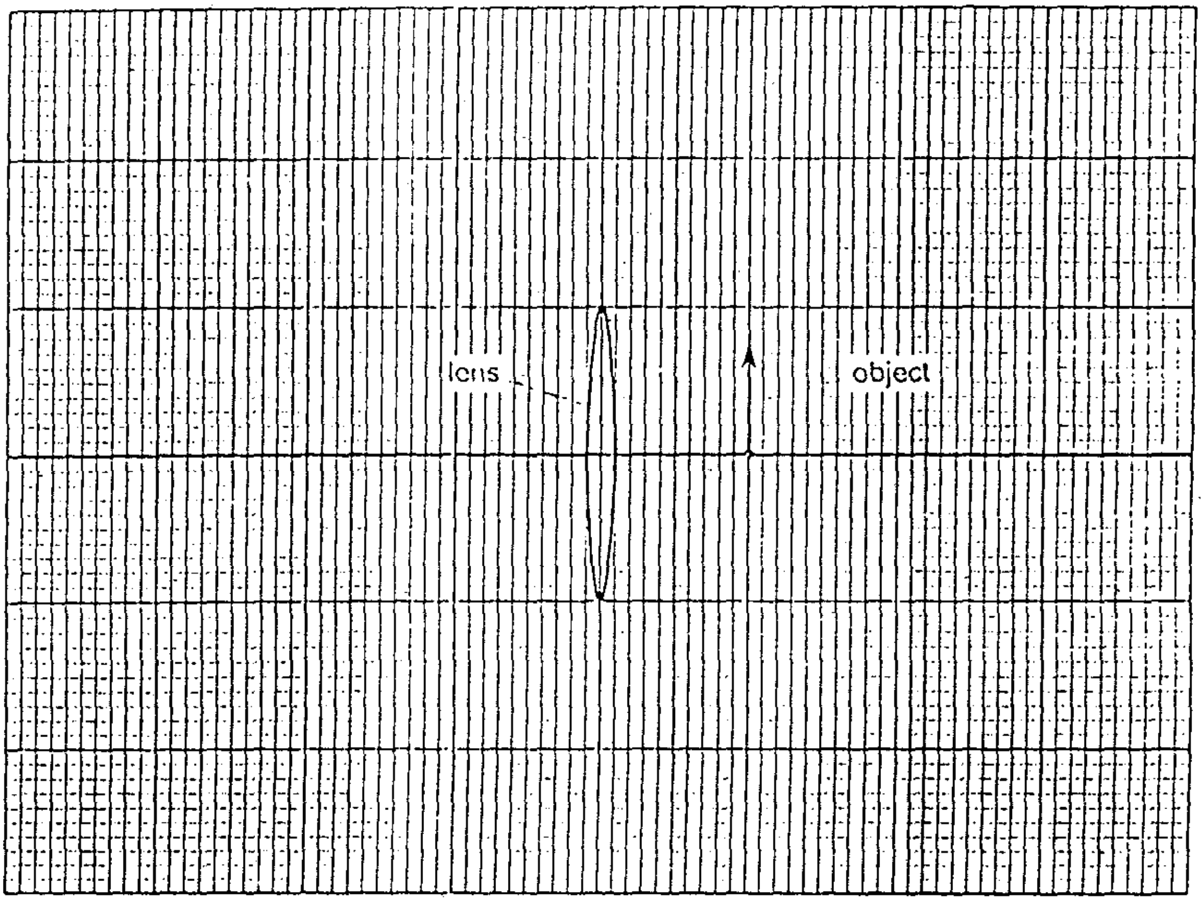


Fig. 6.1

(a) On Fig. 6.1, draw any two rays from the tip of the object which enable you to locate the tip of the image. Draw in the image and label it I. [3]

(b) On Fig. 6.1, draw in an eye position which would enable image I to be seen. [1]

(c) By taking measurements from Fig. 6.1, work out how many times bigger the image is than the object.

The image is .... times bigger than the object. [2]

7 Fig. 7.1 shows how a student set up a circuit using three identical lamps. Assume that the resistance of each lamp does not change with the brightness of the lamp.

Each lamp is labelled 12 V, 2.0 A.

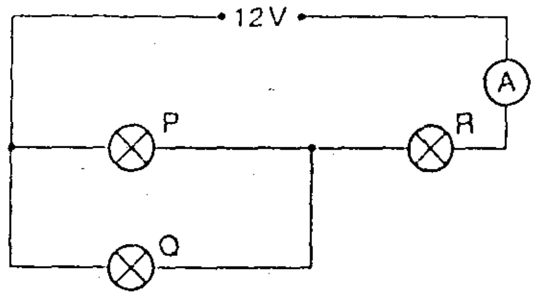


Fig. 7.1

(a) Calculate the resistance of one of the lamps.

resistance = ... [2]

(b) Calculate the combined resistance of the three lamps as connected in Fig. 7.1.

combined resistance = ... [2]

(c) Calculate the current which would be shown on the ammeter in Fig. 7.1.

current = ... [2]

(d) Explain why lamp R is less bright than normal and why lamps P and Q are both equally very dim.

....

....

....

....[3]

[Turn over

(c) In the space below draw a circuit diagram which shows P, Q and R connected so that they will all work at normal brightness.

[1]

8 Fig. 8.1 shows a simple electrical generator. By turning the handle, the single coil may be spun between the poles of the magnet.

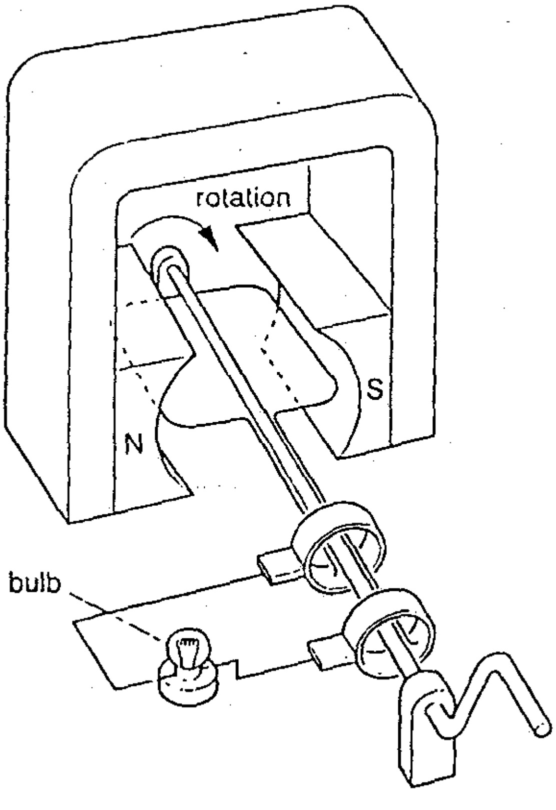
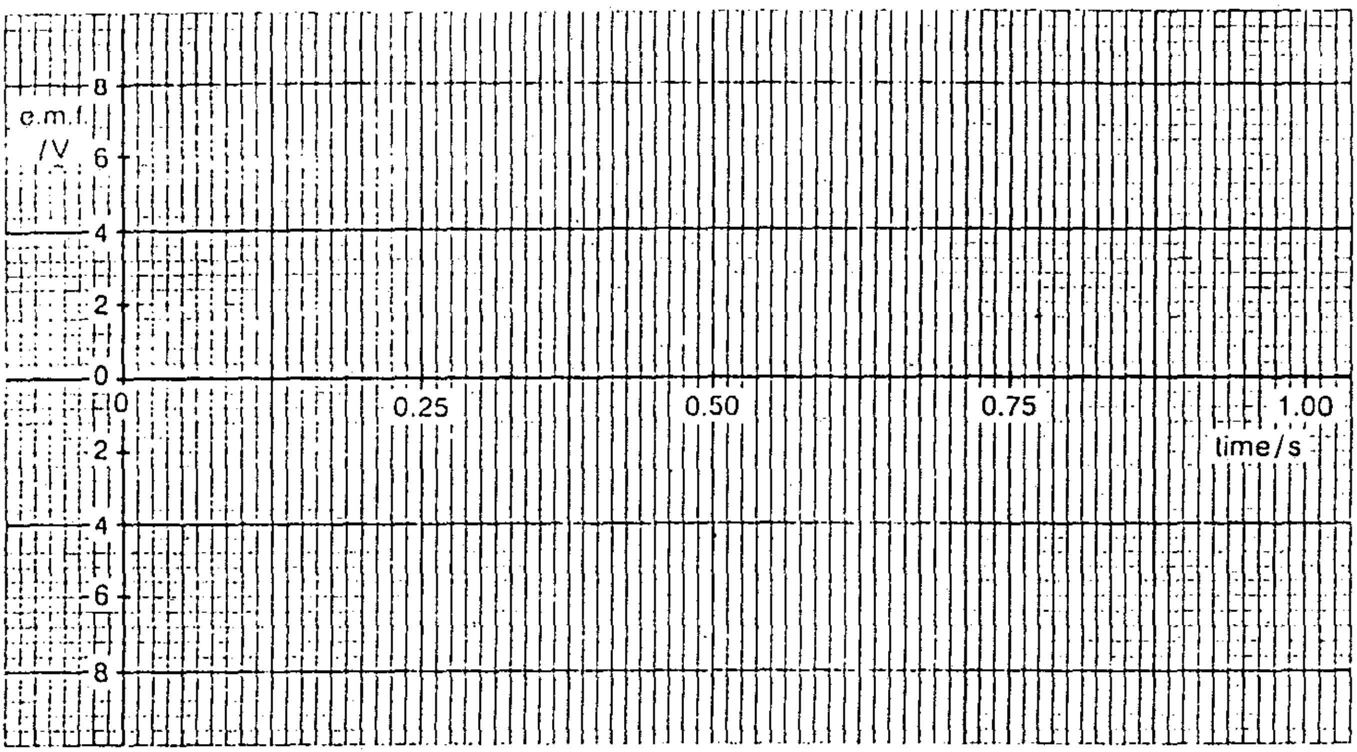


Fig. 8.1

(a) The handle is turned so that the coil makes two complete revolutions per second. The maximum output is 7 V. On Fig. 8.2, sketch this output over a period of 1 s.



[3]

Fig. 8.2

(b) Explain

(i) how an e.m.f. is induced,

....

....

....

....

(ii) why the e.m.f. varies in magnitude and direction.

....

....

....

....

[4]

9 Fig. 9.1 shows an uncharged metal plate held in a wooden clamp and stand.

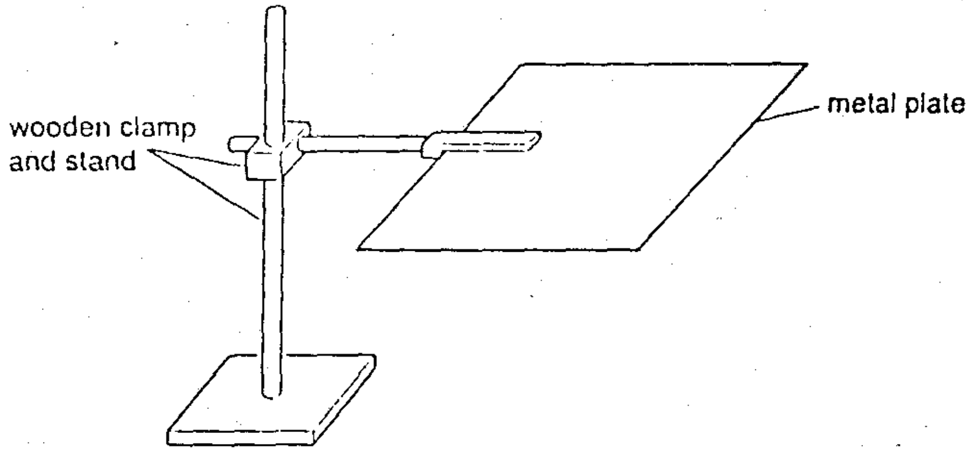


Fig. 9.1

(a) A polythene rod is charged negatively by rubbing it with a duster.

Suggest, in terms of the movement of electrons,

(i) how the polythene becomes negatively charged,

....

....

....

(ii) how the metal plate can be positively charged without the polythene touching the plate.

....

....

....

....

[4]

(b) A strong α-particle emitting source is brought close to, but not touching, the positively charged metal plate.

Explain why the plate rapidly loses its charge.

....

....

....

....[2]

For Examiner's Use

10 (a) A nuclide, symbol $^{A}_{Z}X$, decays by β-particle emission to a nuclide, symbol Y.
A β-particle has the symbol $^{0}_{-1}e$.

Write an equation for this decay.

[2]

(b) Fig. 10.1 shows how a β-particle source may be used to measure the thickness of paper as it is being produced.

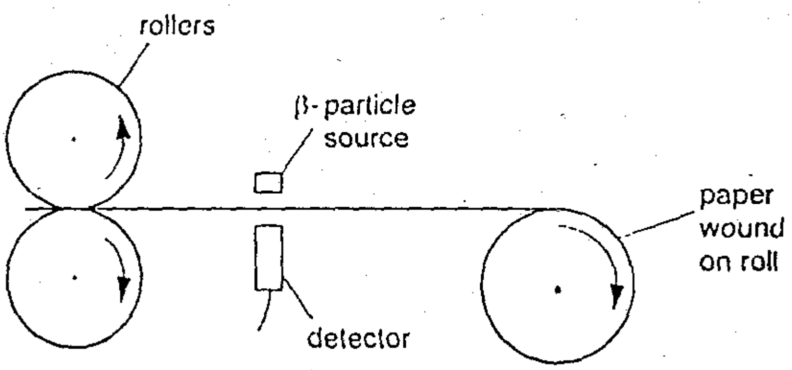


Fig. 10.1

(i) Explain why the reading of the detector changes with the thickness of the paper.

....

....

....

(ii) Write down two reasons why β-particles are more useful than γ-rays for this purpose.

reason 1. ....

....

....

reason 2. ....

....

....[4]

[Turn over

(c) Fig. 10.2 shows a beam of β-particles entering a magnetic field, the direction of which is into the paper.

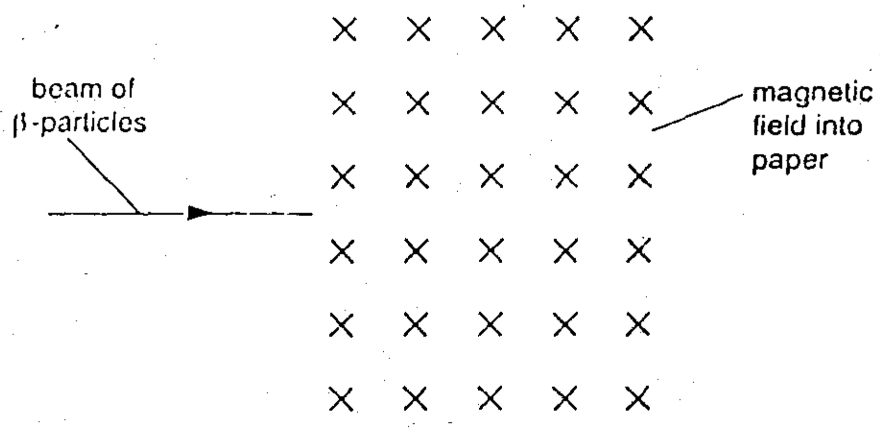


Fig. 10.2

On Fig. 10.2 continue the path of the beam of β-particles as they pass through the magnetic field. [2]

	Centre Number	Candidate Number
Candidate Name ______________________		

International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3

PAPER 3

MAY/JUNE SESSION 2001 1 hour 15 minutes

Candidates answer on the question paper.
No additional materials required.

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
1	
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9	
10	
TOTAL	

This question paper consists of 14 printed pages and 2 blank pages.

SB (CW/KN) QF10310/2

[Turn over

1 Fig. 1.1 shows the speed of a small, very dense object which is falling vertically from an aeroplane, up to the point at which it hits the ground. The air resistance on the object is negligibly small for the first 5 s of its fall. The object is fitted with a parachute which springs open after a certain time of fall.

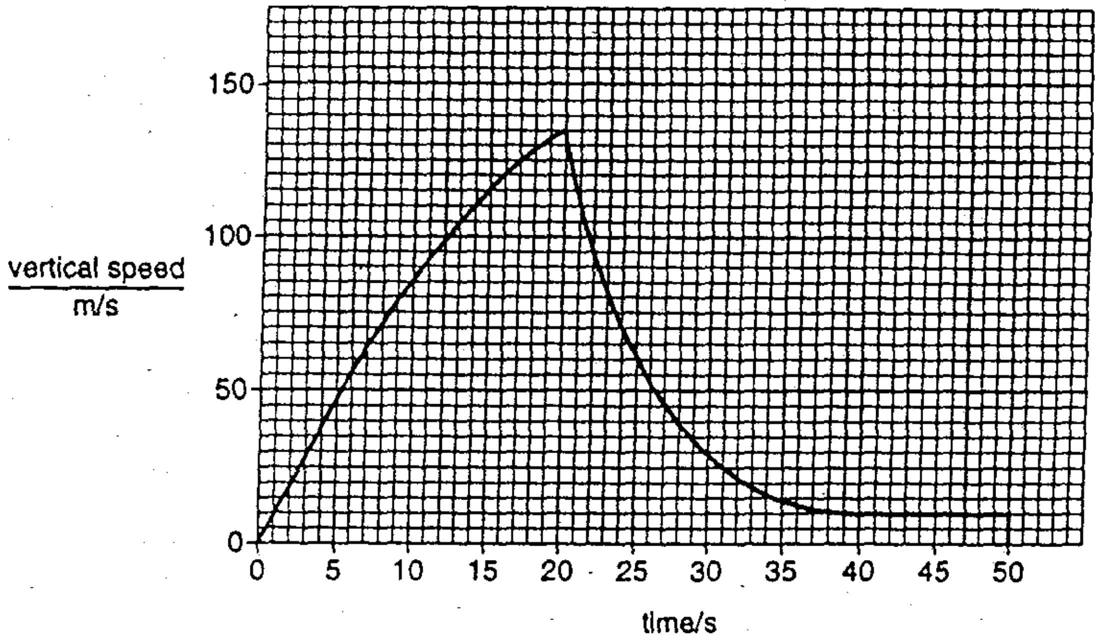

Fig. 1.1

(a) State the type of motion

(i) between 0 and 5 s,

....

(ii) between 42 s and 47 s.

.... [2]

(b) Estimate the time at which the parachute opens.

.... [1]

(c) On Figs 1.2 and 1.3, indicate by labelled arrows the vertical forces acting on the falling object

(i) after 3 s of fall,

Fig. 1.2

(ii) after 45 s of fall.

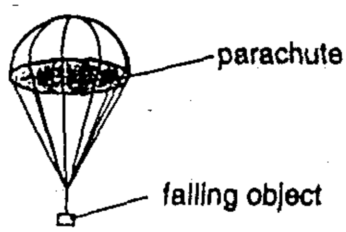

Fig. 1.3 [3]

(d) State whether or not there is a resultant vertical force acting on the falling object

(i) after 3 s of fall,

....

(ii) after 45 s of fall.

....

[1]

(e) Calculate the distance fallen in the first 5 s of fall.

distance fallen = ...[2]

2 Fig. 2.1 shows a moving car on a level road.

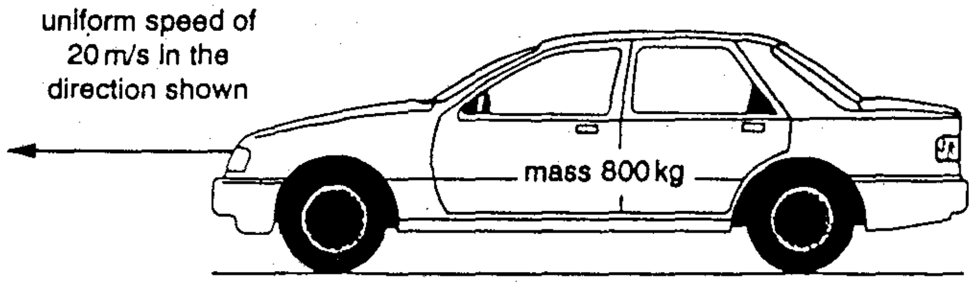

Fig. 2.1

(a) Calculate the momentum of the car.

momentum of car = ... [2]

(b) The brakes of the car are applied for 4 s, which reduces the speed of the car to 5 m/s.

(i) Calculate the average force of the brakes.

average force = ...

(ii) Calculate the average deceleration of the car.

average deceleration = ...
[6]

For Examiner Use

3 Describe an experiment to find the average density of a small rock sample of approximately 100 g mass.

(a) In the space below draw a labelled diagram of the apparatus.

[2]

(b) List all the measurements which must be taken.

[2]

(c) Explain how to work out the average density from the measurements taken.

....

....

....[2]

230

For Examiner's Use

4 Fig. 4.1 shows a very magnified view of tiny dust particles suspended in still air, as seen under a microscope.

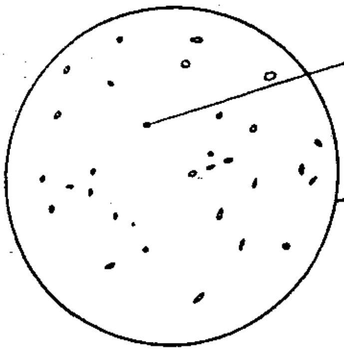

Fig. 4.1

(a) In the space below, draw a diagram to show how the particle labelled **P** would move when it is observed for a short time.

[1]

(b) With reference to dust particles and air molecules, explain the movement which you have drawn.

....

....

....

....[2]

(c) Describe and explain how the movement would change if the temperature of the air in the container increased.

....

....

....

....[2]

5 Fig. 5.1 shows apparatus which may be used to find the specific heat capacity of a liquid.

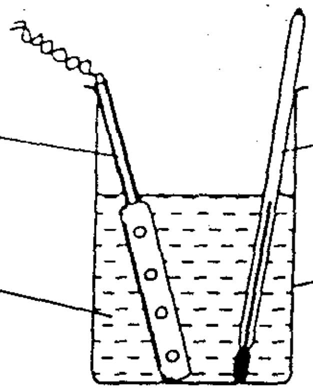

Fig. 5.1

The readings taken are:

power of the heater,	50 W
time heater is switched on,	600 s
initial temperature of the liquid,	20 °C
final temperature of the liquid,	65 °C
mass of the liquid heated,	200 g

(a) Use the data to calculate the specific heat capacity of the liquid.

specific heat capacity = ... [5]

(b) (i) Explain why the value obtained from this data will be higher than the actual value.

....

....

....

....

(ii) Describe one addition to the apparatus which would make the calculated experimental value nearer to the actual value.

....

....

[3]

232

[Turn over

For Examiner's Use

6 Fig. 6.1 shows some apparatus in use in an experiment to find the critical angle for blue light.

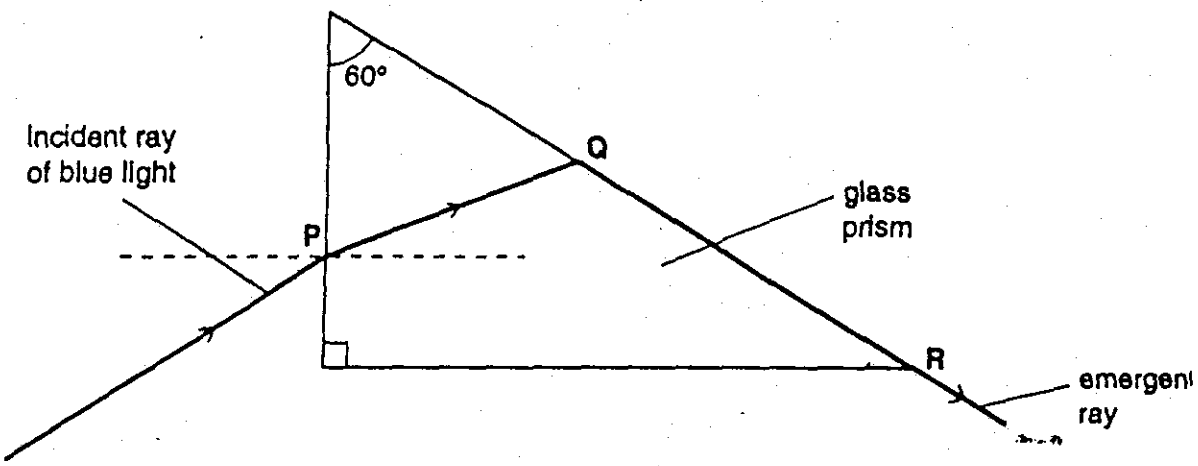

Fig. 6.1

The ray hits the prism at point P, then crosses the prism to point Q. Part of the ray emerges along the surface QR as shown.

(a) (i) By using measurements taken from the diagram, find the critical angle of the glass for blue light.

critical angle = ...

(ii) Use your value to explain how total internal reflection of blue light could be made to occur at point Q.

....

....

....
[4]

(b) Using measured angles on the diagram, calculate the refractive index of the glass for blue light.

refractive index = ... [4]

For Examiner's Use

7 Fig. 7.1 shows an unlabelled diagram which a teacher draws to represent a sound wave in air.

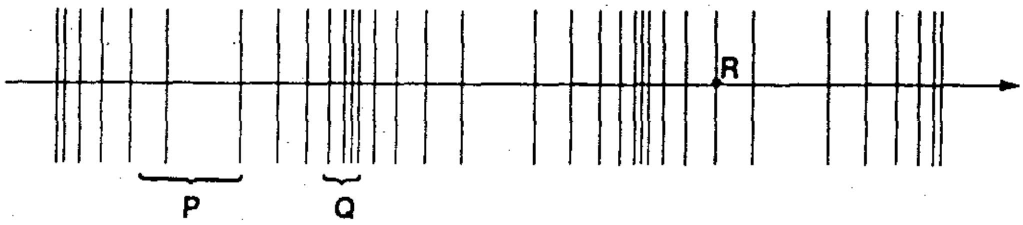

Fig. 7.1

(a) What label should be put on the line with the arrow?

....[1]

(b) (i) What does the uneven spacing of the lines show?

....

(ii) What is being shown at P?

....

(iii) What is being shown at Q?

....

[2]

(c) Describe the motion of an air particle at R.

....

....

....[2]

(d) From Fig. 7.1, measure the wavelength of the sound wave.

wavelength = ... [1]

For Examiner Use

8 (a) Fig. 8.1 shows a coil of thin wire and a lamp connected to a 4 V supply.

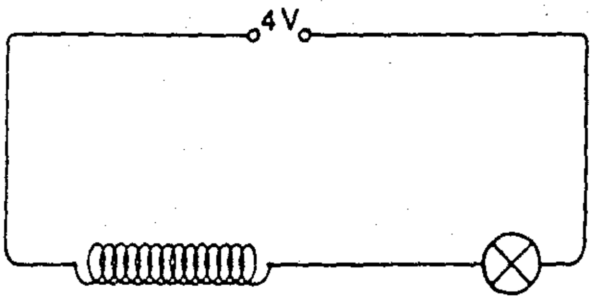

Fig. 8.1

The lamp is marked 1.5 V, 0.6 W. The lamp lights at normal brightness.

Calculate

(i) the current in the lamp,

current = ...

(ii) the resistance of the lamp,

resistance = ...

(iii) the charge flowing through the lamp in 20 s.

charge = ...
[5]

For Examiner's Use

(b) The resistance of the coil of wire shown in Fig. 8.1 is 6.2 Ω and its length is 1.0 m. Using only 1.0 m lengths from the same reel of wire, and without cutting any of them, state how you would produce a resistance of

(i) 3.1 Ω,

....

(ii) 12.4 Ω.

....

Complete the circuits in Fig. 8.2 and in Fig. 8.3 to show how the lengths of wire are connected in each case. [3]

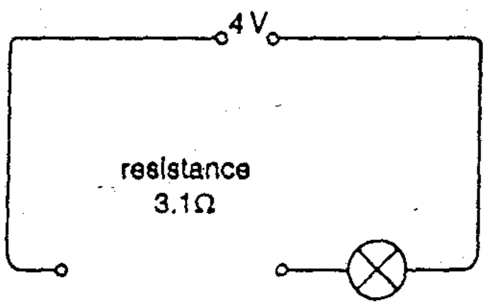

Fig. 8.2

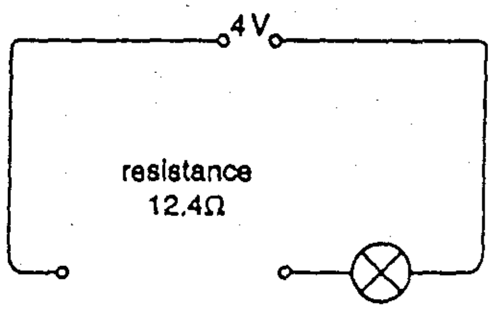

Fig. 8.3

(c) In a similar circuit to that shown in Fig. 8.1, the resistance of the coil is 5.0 Ω and the current through it is 0.6 A.
Calculate the heat energy produced in the coil in 20 s.

energy = ... [3]

236

9 Fig. 9.1 shows a transformer.

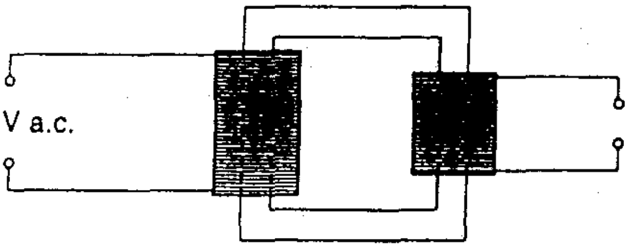

Fig. 9.1

(a) Explain

(i) why a secondary output is obtained even though there is no electrical connection between the primary and secondary coils,

....

....

....

....

....

(ii) why there would be no output voltage if the primary coil were connected to a 240 V d.c. supply.

....

....

....

....
[5]

(b) The transformer is assumed to be 100% efficient.

(i) There are 100 turns on the secondary coil. How many turns are there on the primary coil?

turns on the primary = ...

(ii) The output current is 4.0 A. Calculate the input current.

input current = ...
[4]

For Examiner's Use

10 (a) Complete the following table for α-particles. The first answer has been given.

property/nature	complete this column	
symbol	$^{4}_{2}He$	(hint: it is a helium nucleus)
mass number		
charge		(hint: write down the number of proton charges)
ionisation of gases		(hint: choose from: strong, weak or almost none)
deflection in a magnetic field		(hint: choose from: towards N, towards S or at right angles to the magnetic field lines)
deflection in an electric field		(hint: choose from: towards +ve, towards -ve or no deflection)

[5]

238

(b) Fig.10.1 shows the paths of α-particles scattered by the nuclei of metal atoms in thin foils.

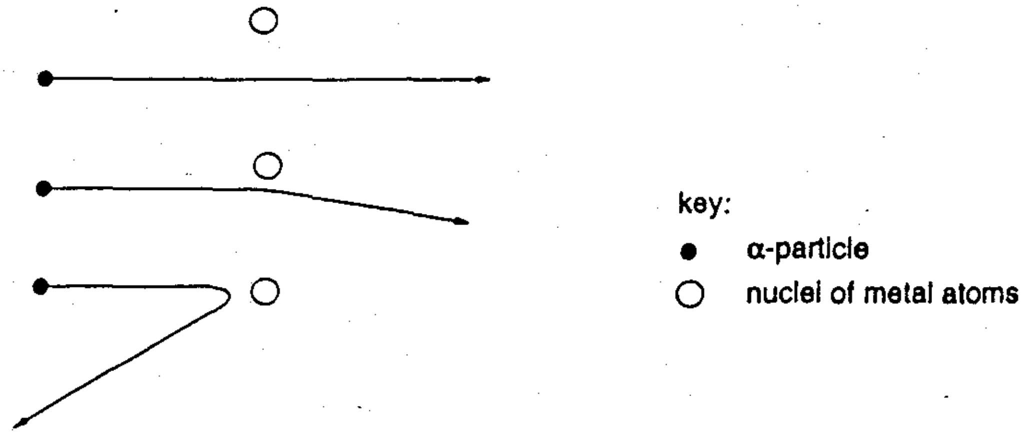

Fig. 10.1

Explain what can be deduced from the paths shown in Fig. 10.1 about

(i) the mass of the nucleus of a metal atom compared to the mass of an α-particle,

....

....

....

(ii) the charge on the nucleus of a metal atom,

....

....

....

(iii) the volume occupied by a metal atom compared to its nucleus.

....

....

....

[5]

	Centre Number	Candidate Number
Candidate Name ______________________		

International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/3

PAPER 3

OCTOBER/NOVEMBER SESSION 2001 — 1 hour 15 minutes

Candidates answer on the question paper.
No additional materials are required.

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
1	
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TOTAL	

This question paper consists of 16 printed pages.

SB (CW/KN) S107642

For Examiner's Use

1 Fig. 1.1 shows the motion of a train over a section of track which includes a sharp bend.

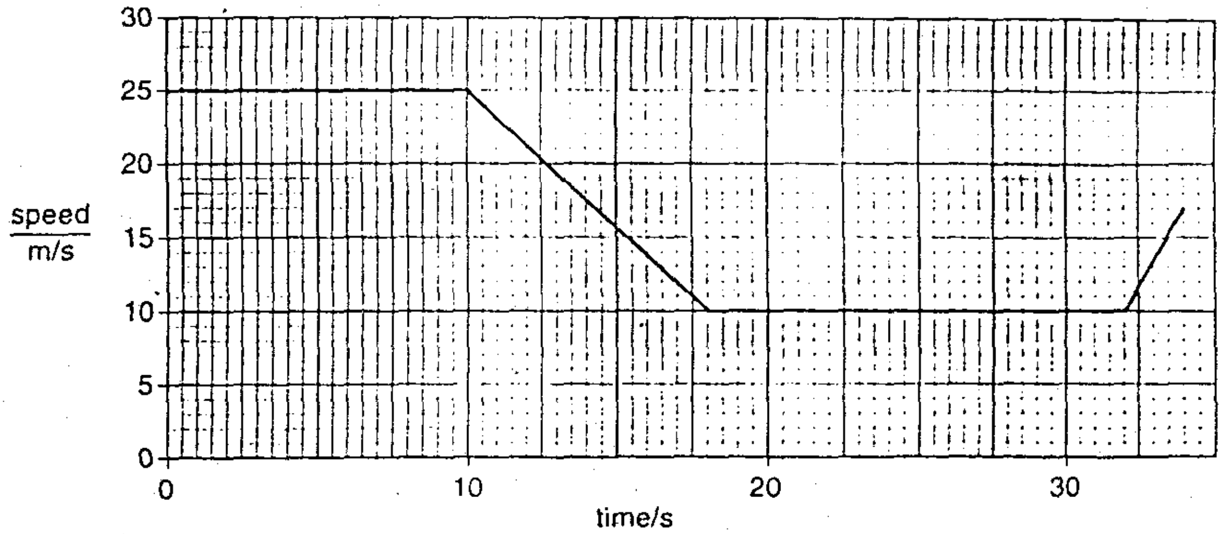

Fig. 1.1

(a) The section of the track with the sharp bend has a maximum speed restriction. The train decelerates approaching the bend so that at the start of the bend it has just reached the maximum speed allowed. The train is driven around the bend at the maximum speed allowed and accelerates immediately on leaving the bend.

(i) What is the maximum speed allowed round the bend in the track?

maximum speed = ...

(ii) How long does the train take to travel the bend of the track?

time taken = ...

(iii) Calculate the length of the bend.

length of bend = ...

[3]

(b) The train has to slow down to go round the bend. Calculate the deceleration.

deceleration = ...[2]

241

1562

(c) As the train is driven round the bend, there is an extra force acting, called the centripetal force.

(i) On Fig. 1.2, draw an arrow to show the direction of this force.

Fig. 1.2

(ii) State the effect that this force has on the motion.

....

....

(iii) State how this force is provided.

....

.... [3]

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For Examiner's Use

2 Fig. 2.1 shows a car with a dummy driver before and after a collision test.

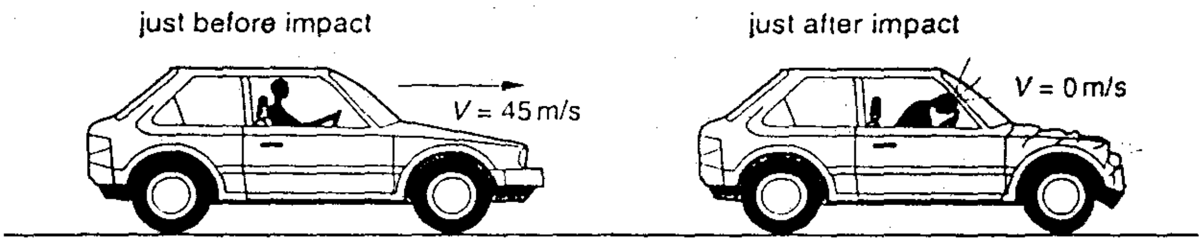

Fig. 2.1

The mass of the dummy driver is 90 kg. The impact time to reduce the dummy's speed from 45 m/s to zero is 1.2 s.

(a) Calculate

(i) the momentum of the dummy just before impact,

momentum = ...

(ii) the average force on the dummy during impact.

force = ...
[4]

(b) State the main energy transformation during the collision.

....[1]

(c) Calculate how much of the dummy's energy is transformed during the collision.

energy = ... [3]

243

1562

For Examiner's Use

3 A body is in equilibrium and is acted upon by two vertical downward forces in such a way that there is no net moment about a pivot. A student is asked to show this experimentally. The student is provided with a suitable pivot, a metre rule with a hole drilled in the centre, two sets of masses and strong cotton.

(a) In the space below, draw a labelled diagram of the apparatus set up ready for use.

[2]

(b) Describe how two sets of readings are taken, explaining how equilibrium is achieved in each case.

....

....

....

....[2]

(c) Write down, in table form, two possible sets of values and use them to show that there is no net moment. [3]

244

4 Fig. 4.1 shows the path that one molecule, M, in a gas might take.

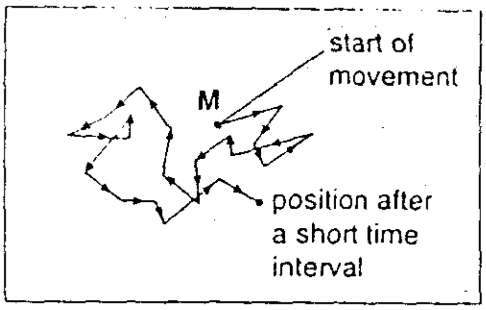

Fig. 4.1

(a) Explain why, in Fig. 4.1, the path of M has sudden, sharp changes of direction.

....

....

....

....[2]

(b) At the end of the short time interval, M is a short distance from its starting point. Use this observation to explain why a gas spreads slowly through air.

....

....

....[2]

245

For Examiner's Use

5 (a) A student concludes that the results of his experiments show that it requires more energy to convert 1 g of water into steam at 100 °C than it does to raise the temperature of 1 g of water from 0 °C to 100 °C.
Use the student's data to confirm that this conclusion is correct and calculate the difference between the two amounts of energy.

experiment 1	*experiment 2*
mass of water used 250 g	mass of water evaporated at 100 °C 15 g
heat energy supplied 10 500 J	heat energy supplied 33 900 J
rise in temperature 10 °C	

energy difference = ... [5]

(b) Explain, in molecular terms, why considerable heat energy is needed to convert 1 g of water into 1 g of steam at 100 °C, without any change in temperature taking place.

....

....

.... [2]

(c) The mercury-in-glass thermometer used in *experiment 1* above is said to have
– moderate sensitivity,
– a good range,
– a linear scale.

By reference to this thermometer, explain what is meant by

(i) *sensitivity*,

....

....

(ii) *range*,

....

....

(iii) *linear scale*.

....

....

[3]

For Examiner's Use

6 (a) Figs 6.1 and 6.2 show what happens to waves at two different types of boundary.

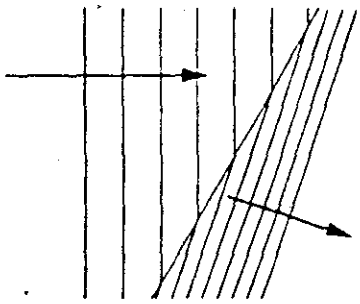

Fig. 6.1

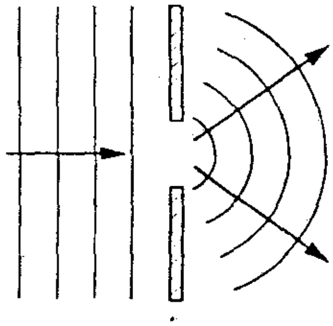

Fig. 6.2

Complete the table below.

	Fig. 6.1	Fig. 6.2
name of the effect shown		
wavelength change, if any		
frequency change, if any		

[4]

For Examiner's Use

(b) Fig. 6.3 is drawn to full scale. The distance **CF** is the focal length of the lens.

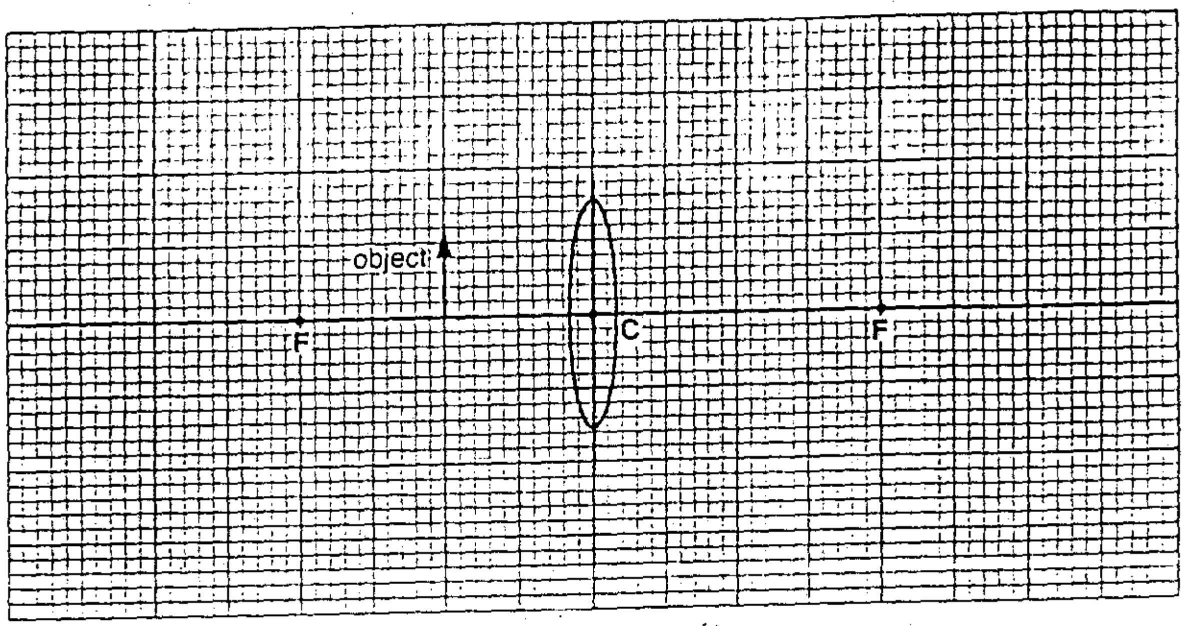

Fig. 6.3

(i) By drawing rays from the tip of the object, locate the position of the image. Hence work out how many times bigger the image is than the object.

number of times bigger = ...

(ii) 1. Draw an eye on Fig. 6.3 to show a suitable place to view the image.
2. Suggest a use for this lens arrangement.

.... [6]

248

[Turn over

7 (a) Fig. 7.1 shows a current-carrying solenoid and the position of a plotting compass.

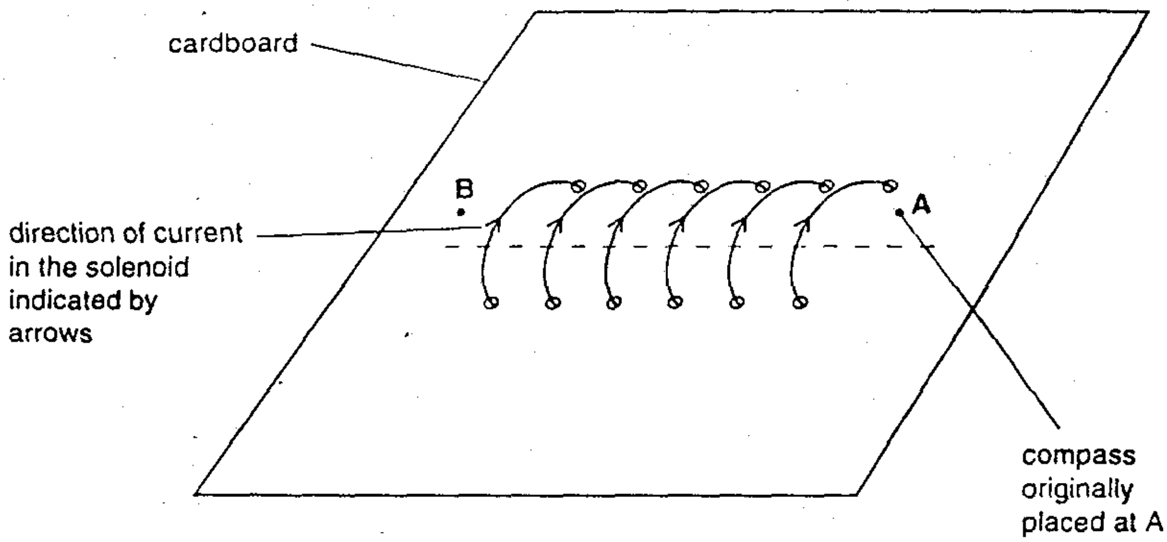

Fig. 7.1

The plotting compass is used to follow magnetic field lines.
On Fig. 7.1 draw in one magnetic field line which links A and B, both through the inside of the solenoid and round the outside of the solenoid.
Mark the direction of each part of the field line with an arrow. [3]

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For Examiner's Use

(b) Fig. 7.2 shows the result of a similar experiment with a current-carrying, straight wire.

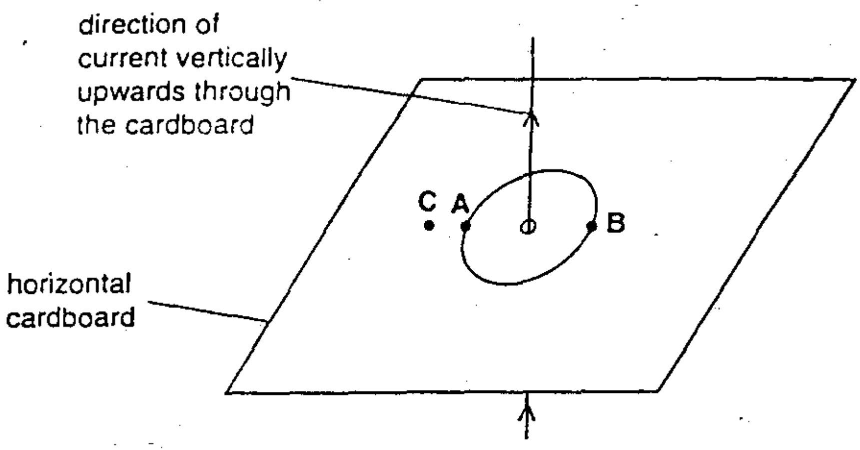

Fig. 7.2

(i) On Fig. 7.2, draw another magnetic field line starting at **C**. Mark its direction with an arrow.

(ii) Explain why the line from **C** could never pass through **B**.

....

....

(iii) What would be the effect on the strength and on the direction of the magnetic field of

1. reversing the current without changing its value,

strength.................................... direction..

2. increasing the value of the current without changing its direction?

strength.................................... direction..

[5]

8 Fig. 8.1 shows how two security lamps are connected to a mains supply.

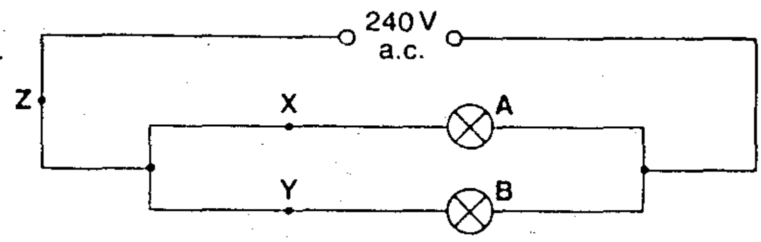

Fig. 8.1

Lamp **A** is labelled 240 V, 600 W and lamp **B** is labelled 240 V, 300 W.

(a) Calculate the currents at points **X**, **Y** and **Z** in Fig. 8.1.

current at **X** = ...

current at **Y** = ...

current at **Z** = ... [2]

(b) The resistance of lamp **A** is 96 Ω and the resistance of lamp **B** 192 Ω. Using these values, or by an alternative method, calculate the total circuit resistance. (Ignore the resistance of the circuit wiring.)

resistance = ... [3]

(c) Fig. 8.2 shows the same lamps connected differently.

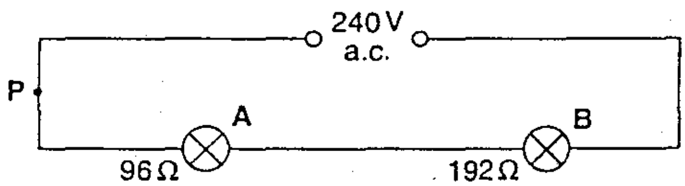

Fig. 8.2

(i) Calculate the current at P.

current at **P** = ...

(ii) Calculate the potential difference across **A** and across **B**.

potential difference across **A** = ...

potential difference across **B** = ...

[3]

For Examiner's Use

(d) (i) With reference to values already worked out, explain why the lamps should be connected as in Fig. 8.1 and not as in Fig. 8.2.

....

....

....

(ii) The two lamps are to be switched on and off independently. State and explain which circuit is better for this purpose when suitably placed switches are included.

....

....

....

....

[4]

252

For Examiner's Use

9 Fig. 9.1 shows a circuit and a cathode-ray oscilloscope (c.r.o.).

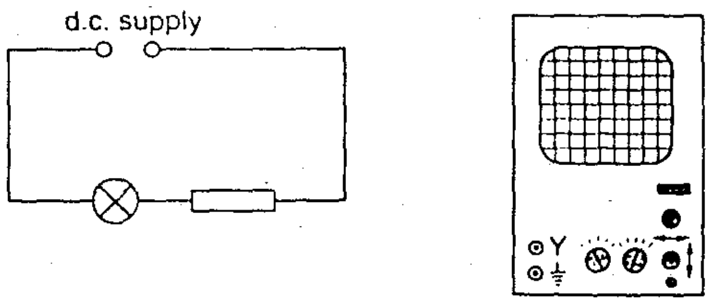

Fig. 9.1

(a) Complete the connections to show how you would use the c.r.o. to measure the potential difference across the lamp. [1]

(b) Fig. 9.2 shows the screen of the c.r.o. when measuring this potential difference.

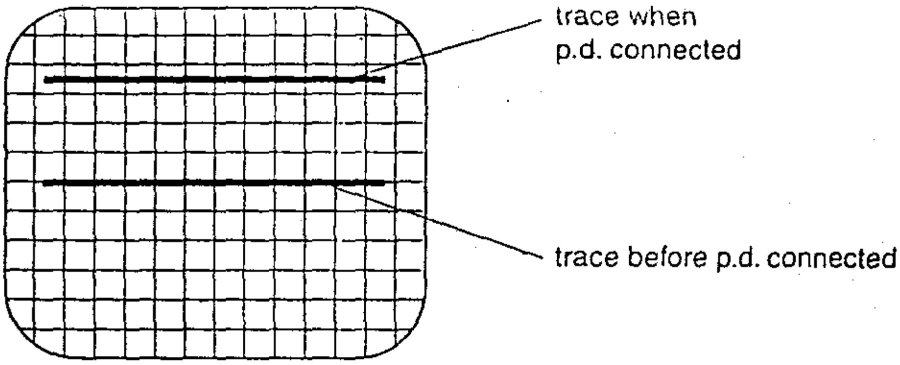

Fig. 9.2

When calibrated, each vertical division corresponds to a potential difference of 0.4 V. What is the potential difference across the lamp?

potential difference = ... [2]

(c) Suggest one advantage of using this method of measuring potential difference rather than using a standard voltmeter.

....

....[1]

For Examiner's Use

10 (a) Radioactive sodium has a nuclide represented by the symbol ${}^{24}_{11}Na$.
Complete the equation below to show how this nuclide decays with the emission of a β-particle.

$${}^{24}_{11}Na \longrightarrow \quad Mg \; + \; e$$ [2]

(b) Fig. 10.1 shows a narrow beam of β-particles entering an electric field created by two charged plates.

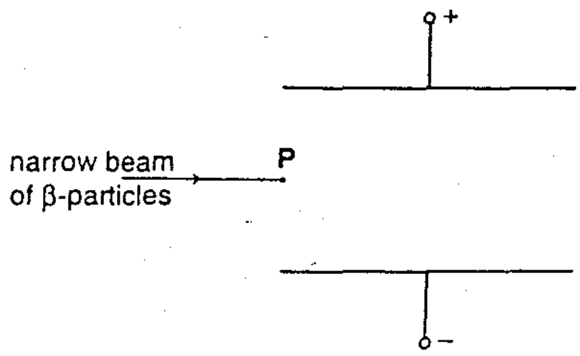

Fig 10.1

(i) Complete the path of the β-particles, starting from the point **P**.

(ii) Explain any change of direction which you have shown.

....

....

.... [3]

254

1562

For Examiner's Use

(c) (i) In the space below, draw a labelled diagram of an arrangement, using a radioactive source which emits β-particles, for finding the variation in thickness of a sheet of paper.

(ii) State the readings which need to be taken and how they would be used to decide whether or not the thickness of the paper varies.

....

....

....

....

....[4]

255

Centre Number	Candidate Number

Candidate Name ____________________

International General Certificate of Secondary Education

CAMBRIDGE INTERNATIONAL EXAMINATIONS

PHYSICS **0625/3**

PAPER 3

MAY/JUNE SESSION 2002

1 hour 15 minutes

Candidates answer on the question paper.
No additional materials required.

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

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	
TOTAL	

This question paper consists of 12 printed pages.

SP (AT/JB) S22941/2

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

1 A group of students attempts to find out how much power each student can generate. The students work in pairs in order to find the time taken for each student to run up a flight of stairs.
The stairs used are shown in Fig. 1.1.

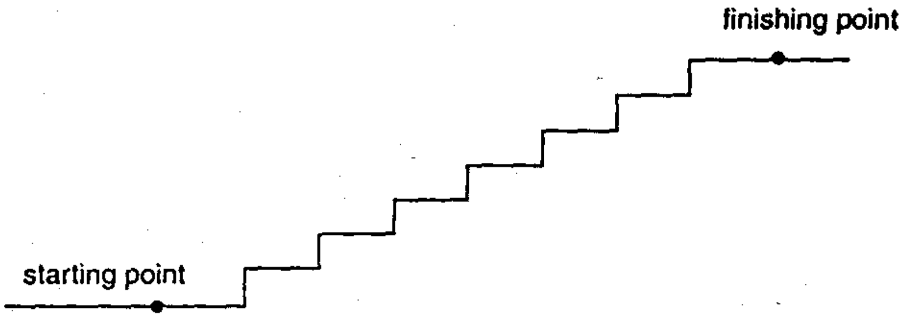

Fig. 1.1

(a) Make a list of all the readings that would be needed. Where possible, indicate how the accuracy of the readings could be improved.

....

....

....

....

....

.... [4]

(b) Using words, not symbols, write down all equations that would be needed to work out the power of a student.

....

....

.... [2]

(c) (i) When the student has reached the finishing point and is standing at the top of the stairs, what form of energy has increased to its maximum?

....

(ii) Suggest why the total power of the student is greater than the power calculated by this method.

....

....

[3]

For Examiner's Use

2 A small rubber ball falls vertically, hits the ground and rebounds vertically upwards. Fig. 2.1 is the speed-time graph for the ball.

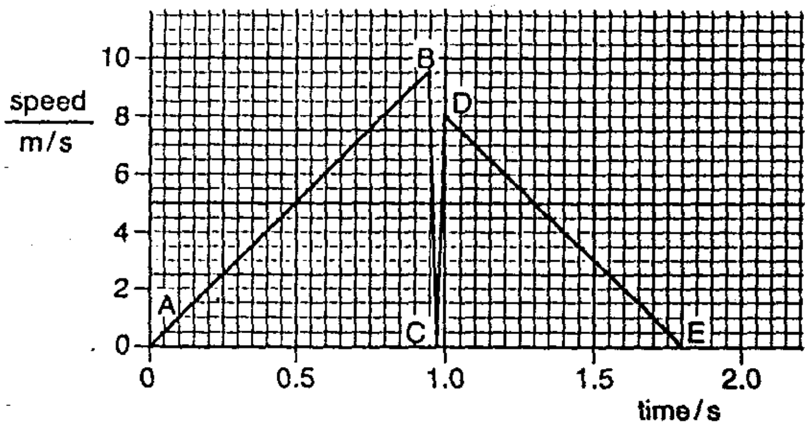

Fig. 2.1

(a) Using information from the graph, describe the following parts of the motion of the ball.

(i) part AB

....

....

....

(ii) part DE

....

....

.... [3]

(b) Explain what is happening to the ball along the part of the graph from B through C to D.

....

....

.... [2]

(c) Whilst the ball is in contact with the ground, what is the

(i) overall change in speed,

change in speed = ...

(ii) overall change in velocity?

change in velocity = ...

[2]

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[Turn over

For Examiner's Use

(d) Use your answer to (c) to explain the difference between speed and velocity.

....

....

.... [2]

(e) Use the graph to calculate the distance travelled by the ball between D and E.

distance travelled = ...[2]

(f) Use the graph to calculate the deceleration of the ball between D and E.

deceleration = ...[2]

259

For Examiner's Use

3 Fig. 3.1 is an attempt to show the molecules in water and the water vapour molecules over the water surface.

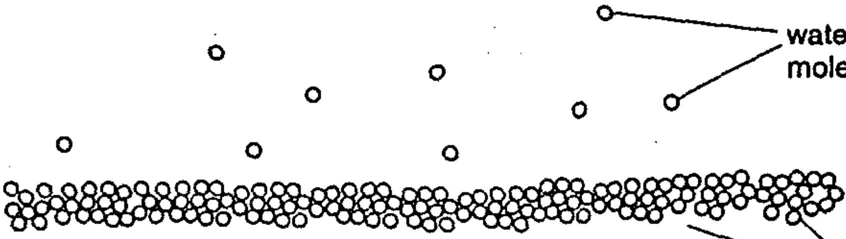

Fig. 3.1

(a) Explain, in terms of the energies of the molecules, why only a few water molecules have escaped from the water surface.

....

....

.... [2]

(b) State two ways of increasing the number of water molecules escaping from the surface.

1 ....

2 .... [2]

(c) Energy is required to evaporate water.

Explain, in molecular terms, why this energy is needed.

....

....

.... [2]

For Examiner's Use

4 (a) Fig. 4.1 shows a cylinder containing air at a pressure of 1.0×10^5 Pa. The length of the air column in the cylinder is 80 mm.

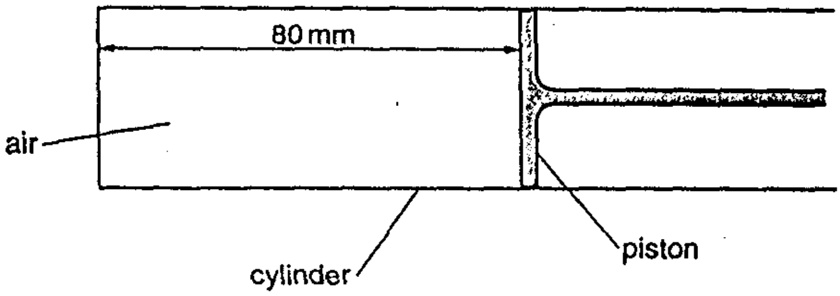

Fig. 4.1

The piston is pushed in until the pressure in the cylinder rises to 3.8×10^5 Pa.

Calculate the new length of the air column in the cylinder, assuming that the temperature of the air has not changed.

new length = ... [3]

(b) Fig. 4.2 shows the same cylinder containing air.

Fig. 4.2

The volume of the air in the cylinder changes as the temperature of the air changes.

(i) The apparatus is to be used as a thermometer. Describe how two fixed points, 0 °C and 100 °C, and a temperature scale could be marked on the apparatus.

....

....

....

....

(ii) Describe how this apparatus could be used to indicate the temperature of a large beaker of water.

....

....

....

261

....

[5]

For Examiner's Use

5 Fig. 5.1 shows an arrangement where a plane mirror is used in a shop to watch a display counter. The arrangement is drawn to a scale of 1 cm : 1 m.

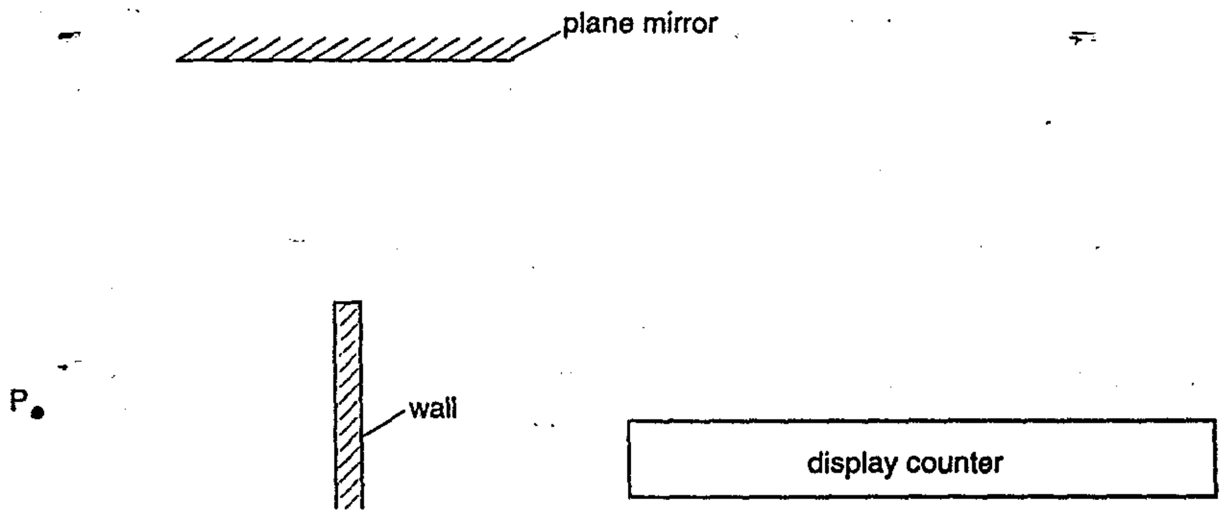

Fig. 5.1

(a) **(i)** State the law of reflection.

....

(ii) On Fig. 5.1, draw rays to show how much of the display cannot be seen from P. Indicate this by shading in the part that cannot be seen.

[3]

(b) By construction on Fig. 5.1 and by using the scale, calculate how far the mirror must be moved so that all of the display counter can be seen from P.

distance moved = ... [2]

(c) State the characteristics of an image seen in a plane mirror.

....

....

.... [2]

262

6 Observations of a distant thunderstorm are made.

(a) During a lightning flash, the average wavelength of the light emitted is 5×10^{-7} m. This light travels at 3×10^{8} m/s.

Calculate the average frequency of this light.

frequency = ... [2]

(b) The interval between the lightning flash being seen and the thunder being heard is 3.6 s. The speed of sound in air is 340 m/s.

(i) Calculate the distance between the thunderstorm and the observer.

distance = ...

(ii) Explain why the speed of light is not taken into account in this calculation.

....

....
[3]

(c) A single ray of white light from the lightning is incident on a prism as shown in Fig. 6.1.

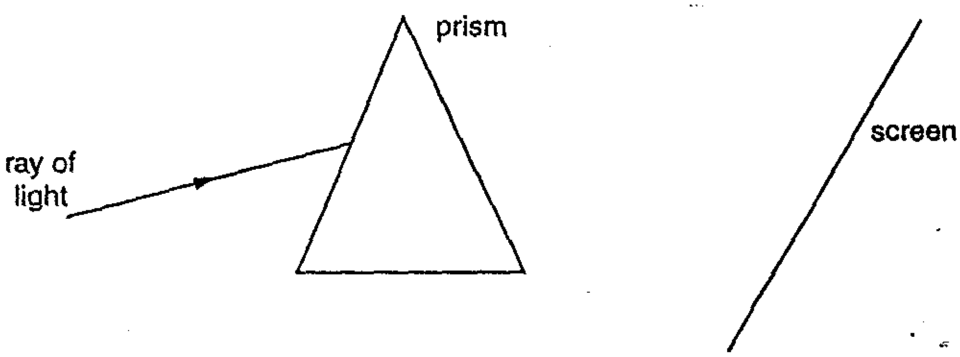

Fig. 6.1

Complete the path of the ray to show how a spectrum is formed on the screen. Label the colours. [2]

7 (a) Two non-conducting spheres, made of different materials, are initially uncharged. They are rubbed together. This causes one of the spheres to become positively charged and one negatively charged.

Describe, in terms of electron movement, why the spheres become charged.

....

....

.... [2]

(b) Once charged, the two spheres are separated, as shown in Fig. 7.1.

Fig. 7.1

On Fig. 7.1, draw the electric field between the two spheres. Indicate by arrows the direction of the electric field lines. [2]

(c) A conducting wire attached to a negatively charged metal object is connected to earth. This allows 2.0×10^{10} electrons, each carrying a charge of 1.6×10^{-19} C, to flow to earth in 1.0×10^{-3} s.

Calculate

(i) the total charge that flows,

charge ....

(ii) the average current in the wire.

current ....
[3]

264

[Turn over

8 Fig. 8.1 shows a transformer and a rectifier used in a battery charging circuit for a 12 V battery.

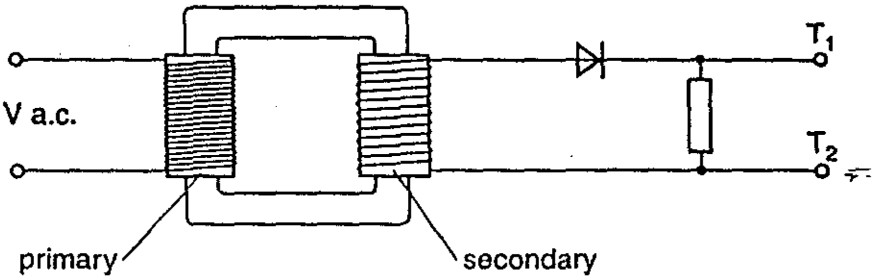

Fig. 8.1

(a) The transformer produces an output of 15 V across the secondary coil.

Calculate a suitable turns ratio for the transformer.

turns ratio = ... [2]

(b) Fig. 8.2 shows the 15 V output across the secondary coil.

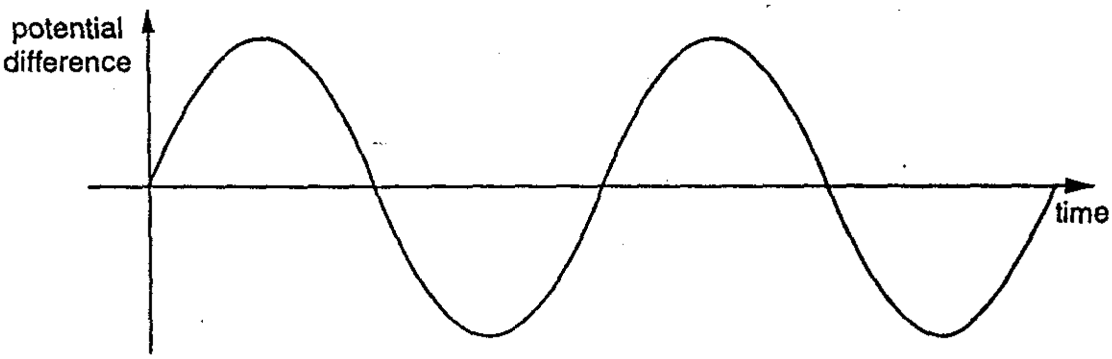

Fig. 8.2

On the same axes, sketch the graph of the potential difference across the terminals T_1 and T_2 before the battery is connected. [2]

(c) Explain how the circuit converts an a.c. supply into a d.c. output.

....

....

.... [2]

(d) On Fig. 8.1, draw in a battery connected so that it may be charged. [1]

265

(e) When fully charged, the 12V battery can supply a current of 2.0 A for 30 hours (1.08×10^5 s).

Calculate

(i) the battery power when supplying a current of 2.0 A,

power = ...

(ii) the total energy that the battery will supply during the 30 hours.

energy = ...

[4]

9 Fig. 9.1 shows three resistors connected across a low voltage d.c. supply, and a c.r.o.

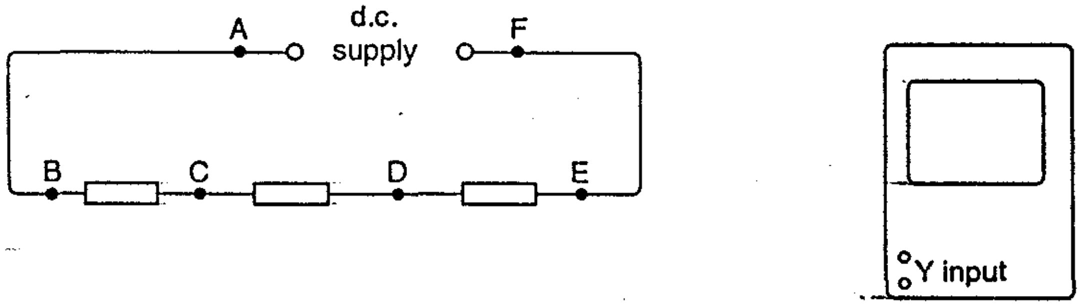

Fig. 9.1

(a) Explain how you would use a 1 V d.c. supply to calibrate the c.r.o.

....

....

.... [2]

(b) On Fig. 9.1, draw in the connections between the c.r.o. and the circuit so that the potential difference between points C and D may be measured. [2]

(c) The potential differences between A and F, B and C, C and D, and D and E are measured.

State the relationship between them.

....

....[2]

266

[Turn over

10 Some liquid from an atomic power station is known to be radioactive. A sample of this liquid is tested in a laboratory.

(a) In the space below, draw a labelled diagram of the test apparatus used to verify that α-particles are emitted from the liquid. [2]

(b) Explain how the apparatus may be used to estimate the quantity of α-radiation being emitted from the sample.

....

....

....

....

.... [2]

(c) State any two safety precautions that the technician might take whilst making the test.

precaution 1 ....

....

precaution 2 ....

.... [2]

	Centre Number	Candidate Number
Candidate Name ______________________		

International General Certificate of Secondary Education
CAMBRIDGE INTERNATIONAL EXAMINATIONS

PHYSICS 0625/3

PAPER 3

OCTOBER/NOVEMBER SESSION 2002

1 hour 15 minutes

Candidates answer on the question paper.
No additional materials are required.

TIME 1 hour 15 minutes

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 on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
1	
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10	
TOTAL	

This question paper consists of 14 printed pages and 2 blank pages.

SP (NF/KS) S23400/3

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

[Turn over

For Examiner's Use

1 Fig. 1.1 shows a smooth metal block about to slide down BD, along DE and up EF. BD and DE are friction-free surfaces, but EF is rough. The block stops at F.

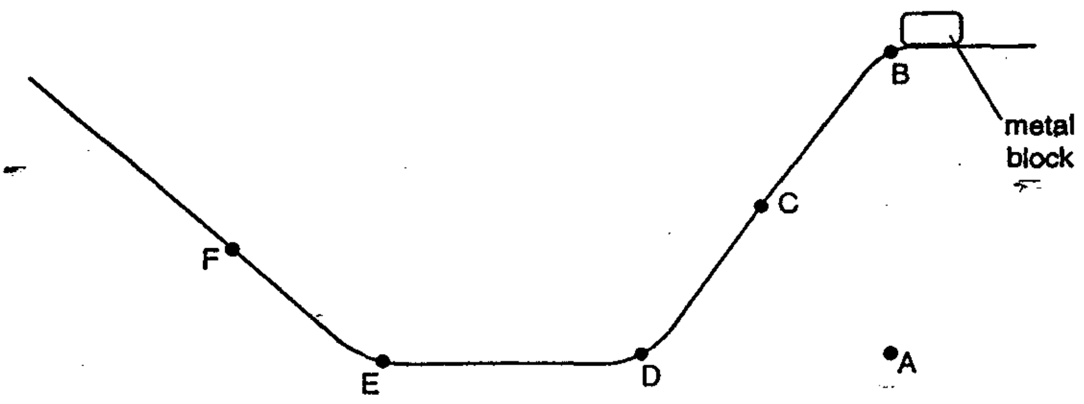

Fig. 1.1

(a) On Fig. 1.2, sketch the speed-time graph for the journey from B to F. Label D, E and F on your graph. [3]

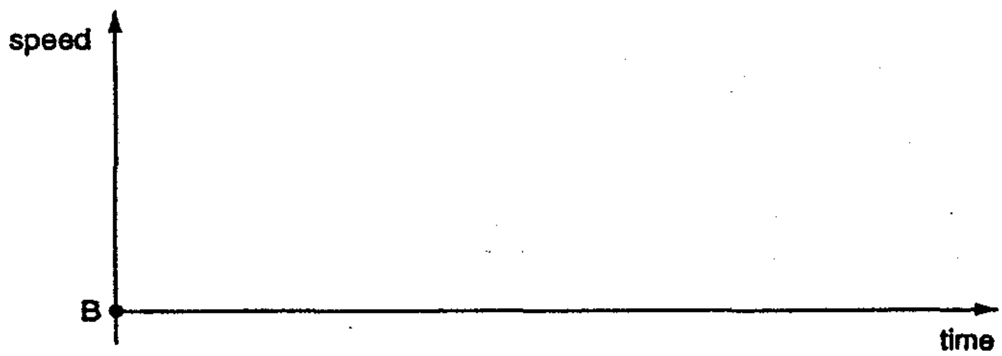

Fig. 1.2

(b) The mass of the block is 0.2 kg. The vertical height of B above A is 0.6 m. The acceleration due to gravity is 10 m/s^2.

(i) Calculate the work done in lifting the block from A to B.

work done = ...

(ii) At C, the block is moving at a speed of 2.5 m/s. Calculate its kinetic energy at C.

kinetic energy = ...

[5]

269

For Examiner's Use

(c) As it passes D, the speed of the block remains almost constant but the velocity changes. Using the terms *vector* and *scalar*, explain this statement.

....

....

....[2]

(d) F is the point where the kinetic energy of the block is zero. In terms of energy changes, explain why F is lower than B.

....

....

....

....[3]

For Examiner's Use

2 A student is given the following apparatus in order to find the density of a piece of rock.

100 g mass
metre rule
suitable pivot on which the rule will balance
measuring cylinder that is big enough for the piece of rock to fit inside
cotton
water

The rock has a mass of approximately 90 g.

(a) (i) In the space below, draw a labelled diagram of apparatus from this list set up so that the student is able to find the mass of the piece of rock.

(ii) State the readings the student should take and how these would be used to find the mass of the rock.

....

....

....
[5]

(b) Describe how the volume of the rock could be found.

....

....

....[2]

(c) The mass of the rock is 88 g and its volume is 24 cm^3.
Calculate the density of the rock.

density of rock = ... [2]

271

3 A thermocouple is used to measure the temperature of the inner wall of a pottery kiln.

(a) In the space below, draw a labelled diagram of a thermocouple that could be used for this purpose. [2]

(b) Describe

(i) how you would read the temperature of the wall from the thermocouple,

....

....

(ii) how the thermocouple works.

....

....

....

[2]

(c) State two conditions in which a thermocouple is very suitable for temperature measurement.

....

....[2]

For Examiner's Use

4 (a) In an experiment to find the specific latent heat of water, the following readings were taken.

m_1	mass of water at 100 °C, before boiling starts	120 g
m_2	mass of water at 100 °C, after boiling finishes	80 g
V	voltage across the heater	12 V
I	current through the heater	2.0 A
t	time that the heater was supplying energy	3750 s

(i) Using the symbols above, write down the equation that must be used to find the value of the specific latent heat L of water.

(ii) Use the equation to calculate the specific latent heat of water from the readings above.

specific latent heat = ...

[4]

(b) Explain, in terms of the energy of molecules, why the specific latent heat of water has a high value.

....

....

....[2]

5 (a) Fig. 5.1 shows the air pressure variation along a sound wave.

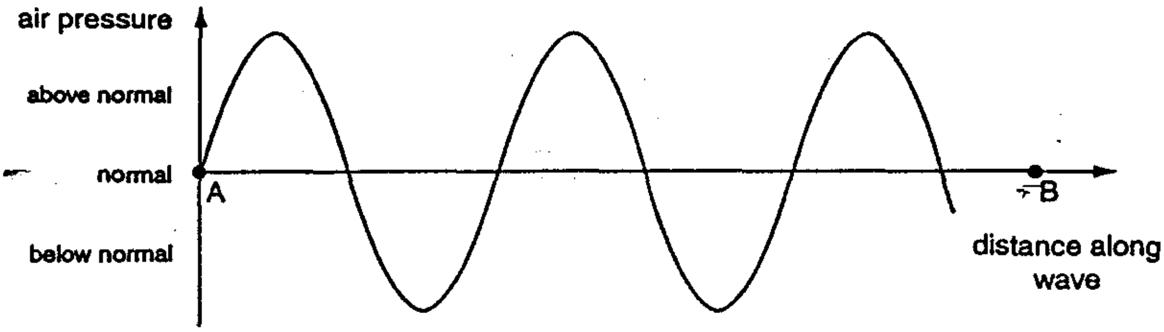

Fig. 5.1

(i) On AB in Fig. 5.1, mark one point of compression with a dot and the letter C and the next point of rarefaction with a dot and the letter R.

(ii) In terms of the wavelength, what is the distance along the wave between a compression and the next rarefaction?

....

[3]

(b) A sound wave travels through air at a speed of 340 m/s. Calculate the frequency of a sound wave of wavelength 1.3 m.

frequency = ... [2]

274

[Turn over

For Examiner's Use

6 **(a)** Fig. 6.1 shows the results of an experiment to find the critical angle for light in a semi-circular glass block.

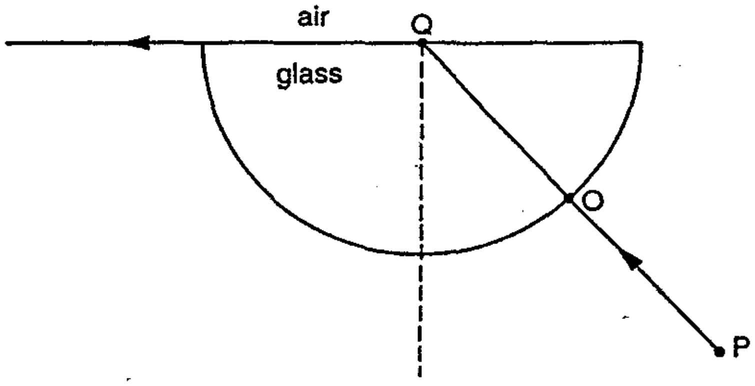

Fig. 6.1

The ray of light PO hits the glass at O at an angle of incidence of 0°.
Q is the centre of the straight side of the block.

(i) Measure the critical angle of the glass from Fig. 6.1.

critical angle = ...

(ii) Explain what is meant by the *critical angle* of the light in the glass.

....

....

....
[3]

275

For Examiner's Use

(b) Fig. 6.2 shows another ray passing through the same block.

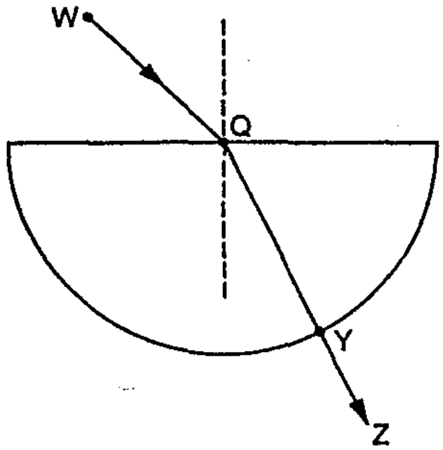

Fig. 6.2

The speed of the light between W and Q is 3.0×10^8 m/s. The speed of the light between Q and Y is 2.0×10^8 m/s.

(i) State the speed of the light between Y and Z.

speed = ...

(ii) Write down an expression, in terms of the speeds of the light, that may be used to find the refractive index of the glass. Determine the value of the refractive index.

refractive index = ...

(iii) Explain why there is no change of direction of ray QY as it passes out of the glass.

....

(iv) What happens to the wavelength of the light as it passes out of the glass?

....

[5]

276

For Examiner's Use

7 Fig. 7.1 shows an arrangement that could be used for making an electromagnet or a permanent magnet.

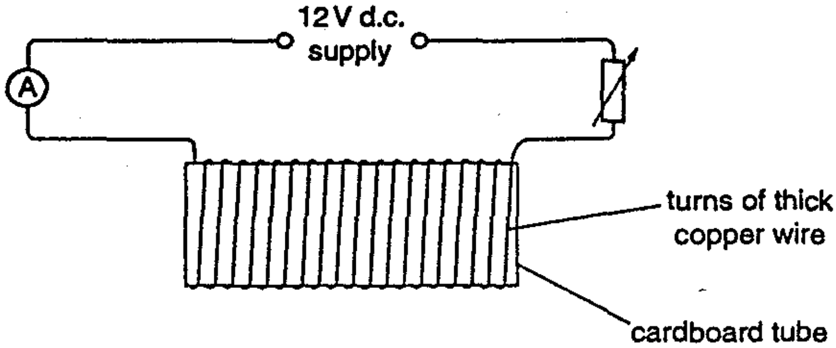

Fig. 7.1

Two bars of the same size are also available, one made of iron and the other of steel.

(a) (i) State which bar should be used to make a permanent magnet.

....

(ii) Describe how the apparatus would be used to make a permanent magnet.

....

....

....

(iii) Suggest one reason why the circuit contains an ammeter and a variable resistor.

....

....
[3]

277

For Examiner's Use

(b) During the making of a permanent magnet, the ammeter reads a steady current of 4.0 A throughout the 5.0 s that the current is switched on. The voltage of the supply is 12 V.

Calculate

(i) the total circuit resistance,

resistance = ...

(ii) the power of the supply,

power = ...

(iii) the energy supplied during the 5.0 s.

energy = ...

[6]

(c) The potential difference across the variable resistor is 7.0 V and that across the ammeter is zero.

(i) Calculate the potential difference across the magnetising coil.

potential difference = ...

(ii) State the general principle used in making this calculation.

....

....

[3]

8 Fig. 8.1 shows a long straight wire between the poles of a permanent magnet.
It is connected through a switch to a battery so that, when the switch is closed, there is a steady current in the wire.

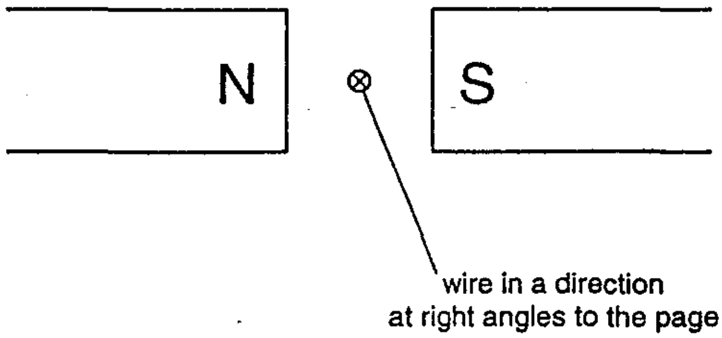

Fig. 8.1

(a) State the direction of the magnetic field between the poles of the magnet.

....[1]

(b) The wire is free to move. The current is switched on so that its direction is into the page.

(i) State the direction of movement of the wire.

....

....

(ii) Explain how you reached your answer to (b)(i).

....

....

....

[4]

(c) This experiment is the basis of an electric motor.
Describe two changes to the arrangement shown in Fig. 8.1 that would enable continuous rotation to take place.

change 1 ....

....

change 2 ....

....[2]

9 Fig. 9.1 shows a beam of electrons, two charged plates and a screen. These components are inside an electron tube, the outline of which is not shown.

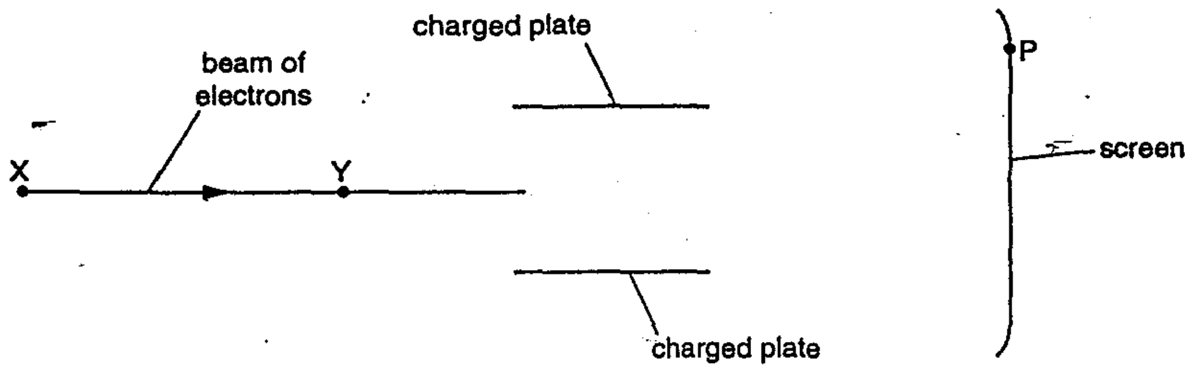

Fig. 9.1

The beam of electrons hits the screen at the point P.

(a) On Fig. 9.1,

(i) complete the path of the electron beam,

(ii) mark the charges on both plates,

(iii) mark with an arrow and the letter C the direction of the conventional current in the electron beam.

[4]

(b) In this electron tube, the electrons are produced at X and are accelerated towards Y. In the space below, draw a labelled diagram of the components needed to produce and accelerate the electrons. [4]

280

[Turn over

For Examiner Use

10 Fig. 10.1 is part of the decay curve for a sample of a β-emitting isotope.

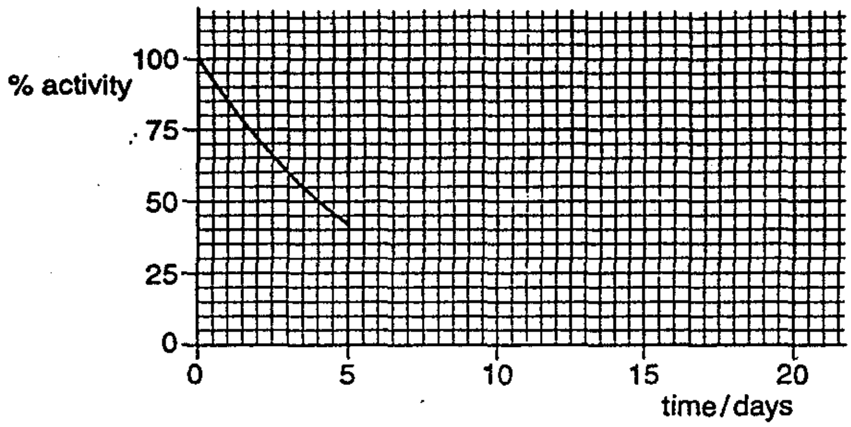

Fig. 10.1

(a) Use Fig. 10.1 to find the half-life of the isotope.

half-life = ... [1]

(b) Complete Fig. 10.1 as far as time = 20 days, by working out the values of a number of points and plotting them. Show your working. [2]

(c) The decay product of the β-emitting isotope is not radioactive.
Explain why the sample of the radioactive isotope will be safer after 20 days than after 1 day. Support your answer by reference to the graph.

....

....[1]

(d) The isotope used for this decay curve may be represented by the symbol $^{A}_{Z}X$.
Write down an equation, by filling in the gaps below, to show the β-decay of this isotope to a decay product that has the symbol Y.

$$^{A}_{Z}X \rightarrow \quad\quad + \quad\quad Y$$ [2]

Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

PHYSICS **0625/03**

Paper 3

May/June 2003

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 in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
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Total	

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

This document consists of **12** printed pages.

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SP (AT/KN) S46413/2

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

[Turn over

For Examiner's Use

1 Fig. 1.1 shows apparatus that may be used to compare the strengths of two springs of the same size, but made from different materials.

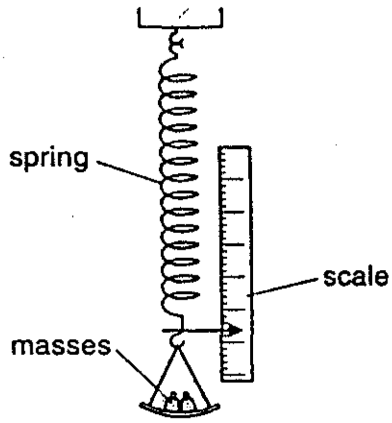

Fig. 1.1

(a) (i) Explain how the masses produce a force to stretch the spring.

....

(ii) Explain why this force, like all forces, is a vector quantity.

....

....
[2]

(b) Fig. 1.2 shows the graphs obtained when the two springs are stretched.

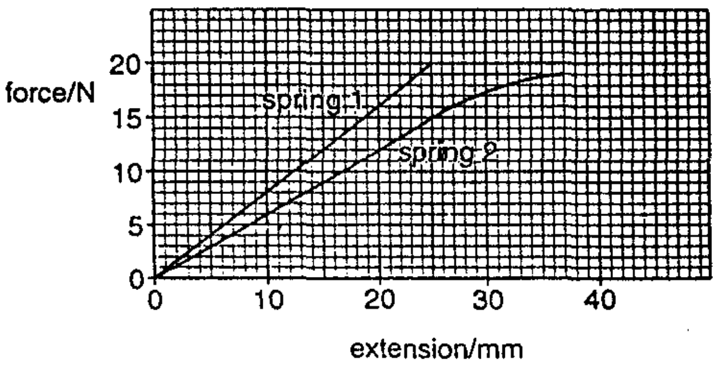

Fig. 1.2

(i) State which spring is more difficult to extend. Quote values from the graphs to support your answer.

....

....

....

....

(ii) On the graph of spring 2, mark a point P at the limit of proportionality. Explain your choice of point P.

....

....

....

(iii) Use the graphs to find the difference in the extensions of the two springs when a force of 15 N is applied to each one.

difference in extensions = ...

[6]

2 The speed of a cyclist reduces uniformly from 2.5 m/s to 1.0 m/s in 12 s.

(a) Calculate the deceleration of the cyclist.

deceleration = ...[3]

(b) Calculate the distance travelled by the cyclist in this time.

distance = ...[2]

284

3 Fig. 3.1 shows the arm of a crane when it is lifting a heavy box.

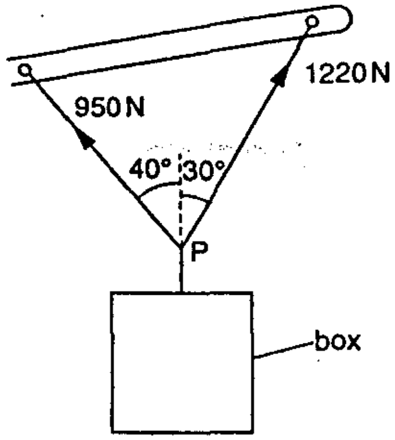

Fig. 3.1

(a) By the use of a scale diagram (**not** calculation) of the forces acting at P, find the weight of the box. [5]

For Examiner's Use

(c) Another box of weight 1500 N is raised vertically by 3.0 m.

(i) Calculate the work done on the box.

work done = ...

(ii) The crane takes 2.5 s to raise this box 3.0 m. Calculate the power output of the crane.

power = ...
[4]

4 Fig. 4.1 shows a sealed glass syringe that contains air and many very tiny suspended dust particles.

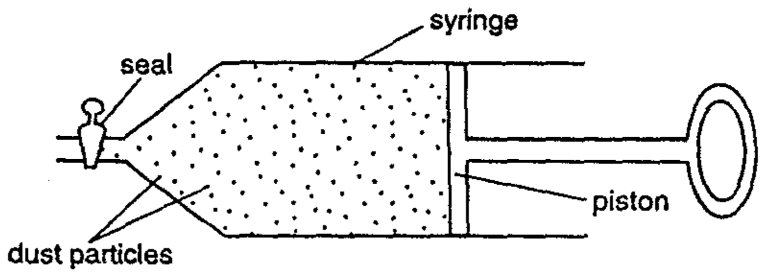

Fig. 4.1

(a) Explain why the dust particles are suspended in the air and do not settle to the bottom.

....

....

....

....[3]

(b) The air in the syringe is at a pressure of 2.0×10^5 Pa. The piston is slowly moved into the syringe, keeping the temperature constant, until the volume of the air is reduced from 80 cm^3 to 25 cm^3. Calculate the final pressure of the air.

pressure = ...[3]

For Examiner's Use

5 Fig. 5.1 shows a thermocouple set up to measure the temperature at a point on a solar panel.

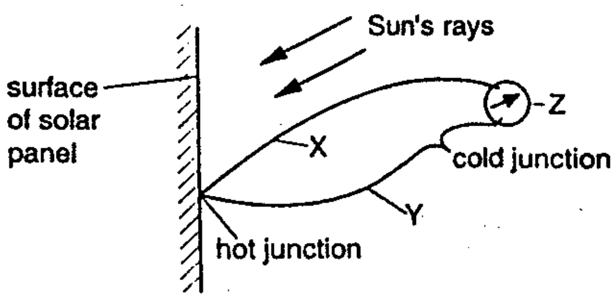

Fig. 5.1

(a) X is a copper wire.

(i) Suggest a material for Y.

....

(ii) Name the component Z.

....
[2]

(b) Explain how a thermocouple is used to measure temperature.

....

....

....[3]

(c) Experiment shows that the temperature of the surface depends upon the type of surface used.

Describe the nature of the surface that will cause the temperature to rise most.

....

....[1]

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For Examiner's Use

6 Fig. 6.1 shows wavefronts of light crossing the edge of a glass block from air into glass.

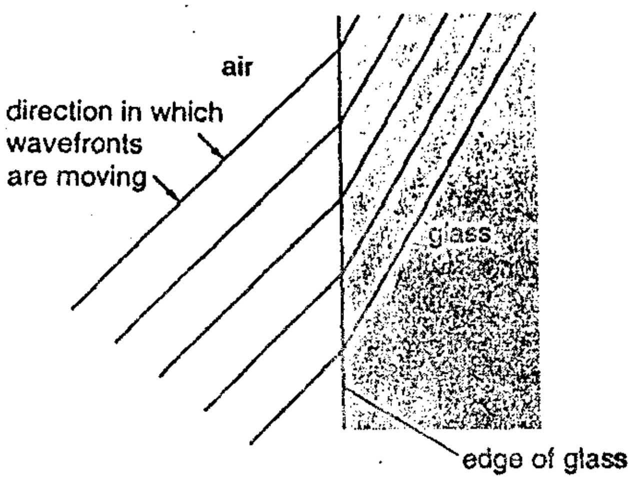


Fig. 6.1

(a) On Fig. 6.1

(i) draw in an incident ray, a normal and a refracted ray that meet at the same point on the edge of the glass block,

(ii) label the angle of incidence and the angle of refraction,

(iii) measure the two angles and record their values.

angle of incidence = ...

angle of refraction = ...

[4]

(b) Calculate the refractive index of the glass.

refractive index = ...[3]

288

[Turn over

For Examiner's Use

7 In a thunderstorm, both light and sound waves are generated at the same time.

(a) How fast does the light travel towards an observer?

speed = ... [1]

(b) Explain why the sound waves always reach the observer after the light waves.

....[1]

(c) The speed of sound waves in air may be determined by experiment using a source that generates light waves and sound waves at the same time.

(i) Draw a labelled diagram of the arrangement of suitable apparatus for the experiment.

(ii) State the readings you would take.

....

....

....

(iii) Explain how you would calculate the speed of sound in air from your readings.

....

....

[4]

For Examiner's Use

8 Fig. 8.1 shows a battery with a resistor connected across its terminals. The e.m.f. of the battery is 6.0 V.

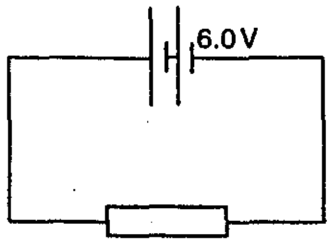


Fig. 8.1

The battery causes 90 C of charge to flow through the circuit in 45 s.

(a) Calculate

(i) the current in the circuit,

current = ...

(ii) the resistance of the circuit,

resistance = ...

(iii) the electrical energy transformed in the circuit in 45 s.

energy = ...
[6]

(b) Explain what is meant by the term *e.m.f. of the battery.*

....

....

....[2]

290

[Turn over

For Examiner's Use

9 A transformer has an output of 24 V when supplying a current of 2.0 A. The current in the primary coil is 0.40 A and the transformer is 100% efficient.

(a) Calculate

(i) the power output of the transformer,

power = ...

(ii) the voltage applied across the primary coil.

voltage = ...
[4]

(b) Explain

(i) what is meant by the statement that the transformer is 100% efficient,

....

....

....

(ii) how the transformer changes an input voltage into a different output voltage.

....

....

....

....
[4]

For Examiner's Use

10 Fig. 10.1 and Fig. 10.2 show two views of a vertical wire carrying a current up through a horizontal card. Points P and Q are marked on the card.

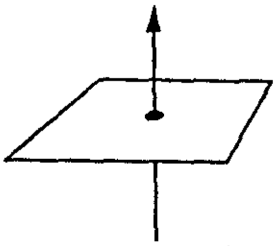
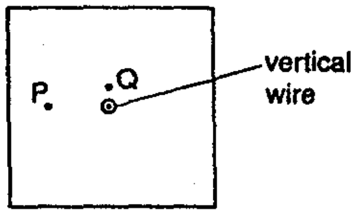


Fig. 10.1



view from above the card

Fig. 10.2

(a) On Fig. 10.2,

(i) draw a complete magnetic field line (line of force) through P and indicate its direction with an arrow,

(ii) draw an arrow through Q to indicate the direction in which a compass placed at Q would point.

[3]

(b) State the effect on the direction in which compass Q points of

(i) increasing the current in the wire,

....

(ii) reversing the direction of the current in the wire.

....

[2]

(c) Fig. 10.3 shows the view from above of another vertical wire carrying a current up through a horizontal card. A cm grid is marked on the card. Point W is 1 cm vertically above the top surface of the card.

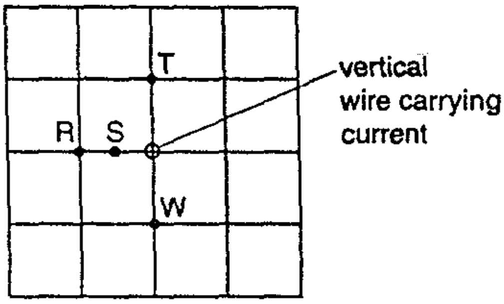


Fig. 10.3

State the magnetic field strength at S, T and W in terms of the magnetic field strength at R. Use one of the alternatives, **weaker, same strength** or **stronger for each answer.**

at S ....

at T ....

at W..

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For Examiner's Use

11 (a) A radioactive isotope emits only α-particles.

(i) In the space below, draw a labelled diagram of the apparatus you would use to prove that no β-particles or γ-radiation are emitted from the isotope.

(ii) Describe the test you would carry out.

....

....

....

....

(iii) Explain how your results would show that only α-particles are emitted.

....

....

.... [6]

(b) Fig. 11.1 shows a stream of α-particles about to enter the space between the poles of a very strong magnet.

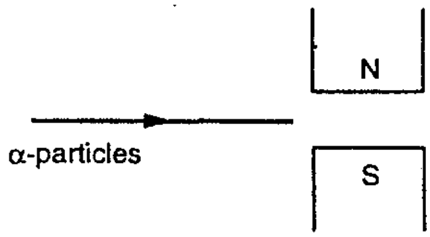

Fig. 11.1

Describe the path of the α-particles in the space between the magnetic poles.

....

....

....[3]

Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

PHYSICS **0625/03**

Paper 3

October/November 2003

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 in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
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.
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 = $10\,m/s^2$).

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

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MML 4504 11/02 S53411/2

UNIVERSITY *of* CAMBRIDGE
Local Examinations Syndicate

[Turn over

1 Fig. 1.1 shows the speed-time graph for a bus during tests.

At time $t = 0$, the driver starts to brake.

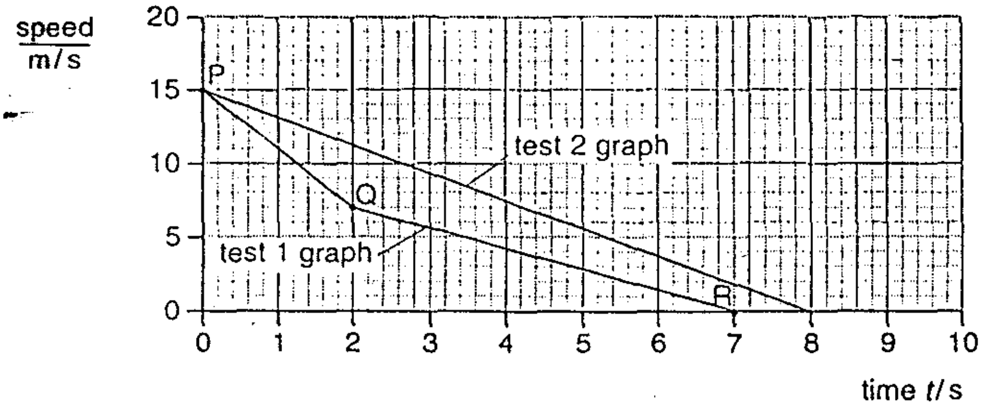

Fig. 1.1

(a) For test 1,

(i) determine how long the bus takes to stop,

....

(ii) state which part of the graph shows the greatest deceleration,

....

(iii) use the graph to determine how far the bus travels in the first 2 seconds.

distance = ...

[4]

(b) For test 2, a device was fitted to the bus. The device changed the deceleration.

(i) State two ways in which the deceleration during test 2 is different from that during test 1.

1 ....

2 ....

(ii) Calculate the value of the deceleration in test 2.

deceleration = ...

[4]

(c) Fig. 1.2 shows a sketch graph of the magnitude of the acceleration for the bus when it is travelling around a circular track at constant speed.

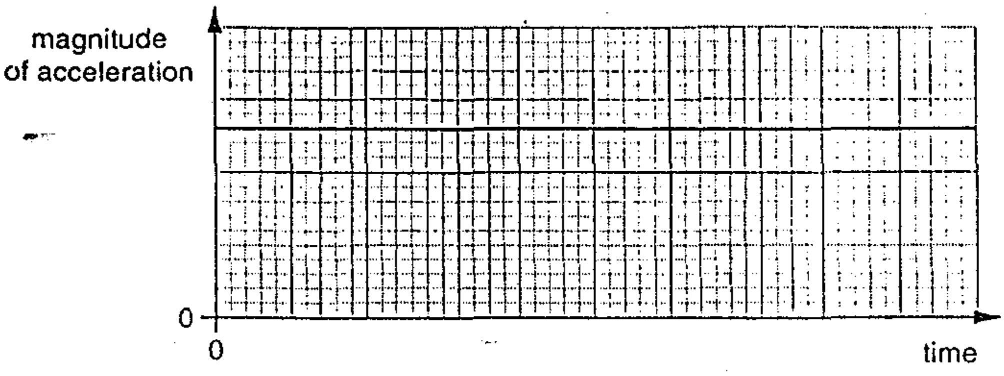

Fig. 1.2

(i) Use the graph to show that there is a force of constant magnitude acting on the bus.

....

....

(ii) State the direction of this force.

.... [3]

2 Fig. 2.1 shows a diver 50 m below the surface of the water.

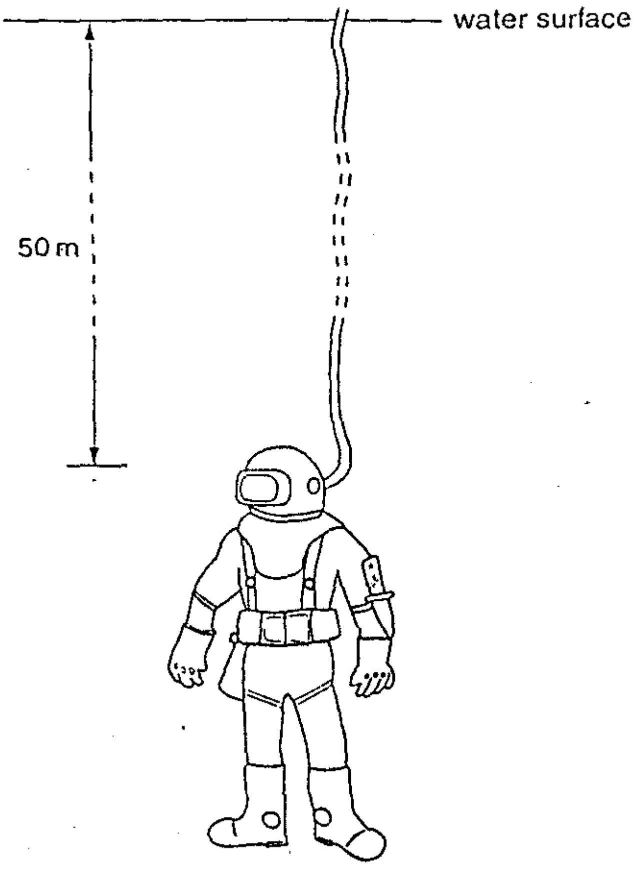

Fig. 2.1

(a) The density of water is 1000 kg/m^3 and the acceleration of free fall is 10 m/s^2. Calculate the pressure that the water exerts on the diver.

pressure = ... [3]

(b) The window in the diver's helmet is 150 mm wide and 70 mm from top to bottom.

Calculate the force that the water exerts on this window.

force = ... [3]

3 Fig. 3.1 shows a simple see-saw. One child A sits near to end X and another child B sits near to end Y. The feet of the children do not touch the ground when the see-saw is balanced.

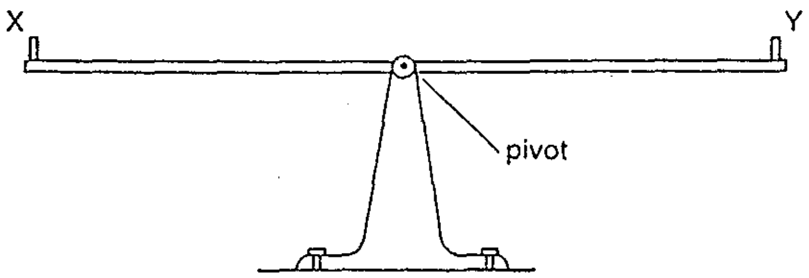

Fig. 3.1

(a) Child A has a mass of 18.0 kg and child B has a mass of 20.0 kg.

Without calculation, indicate where the children could sit so that the see-saw balances horizontally. You may draw on Fig. 3.1 if you wish.

....

....

.... [2]

(b) State the relationship between the moment caused by child A and that caused by child B.

....

.... [1]

(c) Child A is 2.50 m from the pivot. Calculate the distance of child B from the pivot.

distance = ... [2]

4 Fig. 4.1 shows water being heated by an electrical heater. The water in the can is not boiling, but some is evaporating.

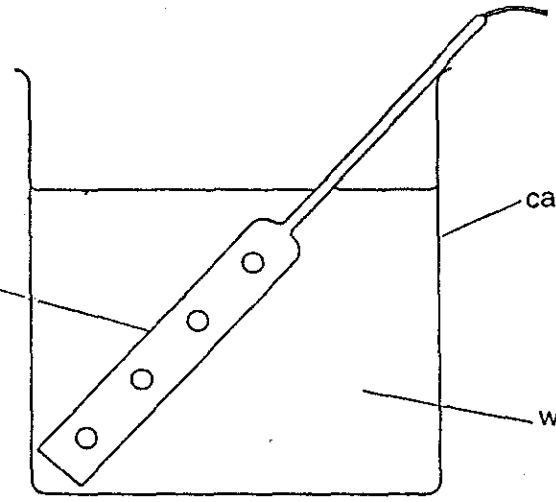

Fig. 4.1

(a) Describe, in terms of the movement and energies of the water molecules, how evaporation takes place.

....

....

....

.... [2]

(b) State two differences between evaporation and boiling.

1 ....

....

2 ....

.... [2]

(c) After the water has reached its boiling point, the mass of water in the can is reduced by 3.2 g in 120 s. The heater supplies energy to the water at a rate of 60 W. Use this information to calculate the specific latent heat of vaporisation of water.

specific latent heat = ... [3]

5 (a) Equal volumes of nitrogen, water and copper at 20 °C are heated to 50 °C.

(i) Which one of the three will have a much greater expansion than the other two?

....

(ii) Explain your answer in terms of the way the molecules are arranged in the three substances.

....

....

.... [3]

(b) Fig. 5.1 shows a thermometer with a range of −10 °C to 50 °C.

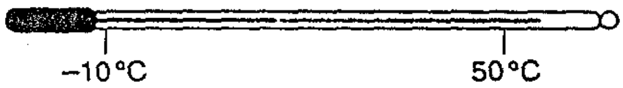

Fig. 5.1

Explain what is meant by

(i) the *sensitivity* of a thermometer,

....

....

(ii) the *linearity* of a thermometer.

....

.... [2]

6 Fig. 6.1 shows the diffraction of waves by a narrow gap.

P is a wavefront that has passed through the gap.

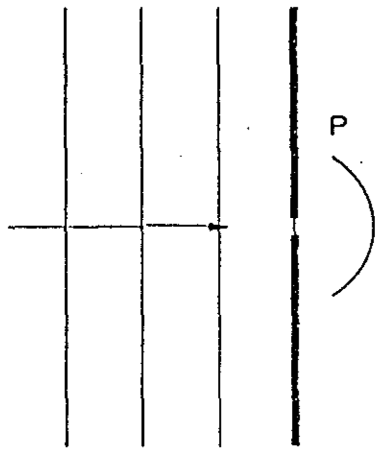

Fig. 6.1

(a) On Fig. 6.1, draw three more wavefronts to the right of the gap. [3]

(b) The waves travel towards the gap at a speed of 3×10^8 m/s and have a frequency of 5×10^{14} Hz. Calculate the wavelength of these waves.

wavelength = ... [3]

7 Fig. 7.1 is drawn to full scale. The focal length of the lens is 5.0 cm.

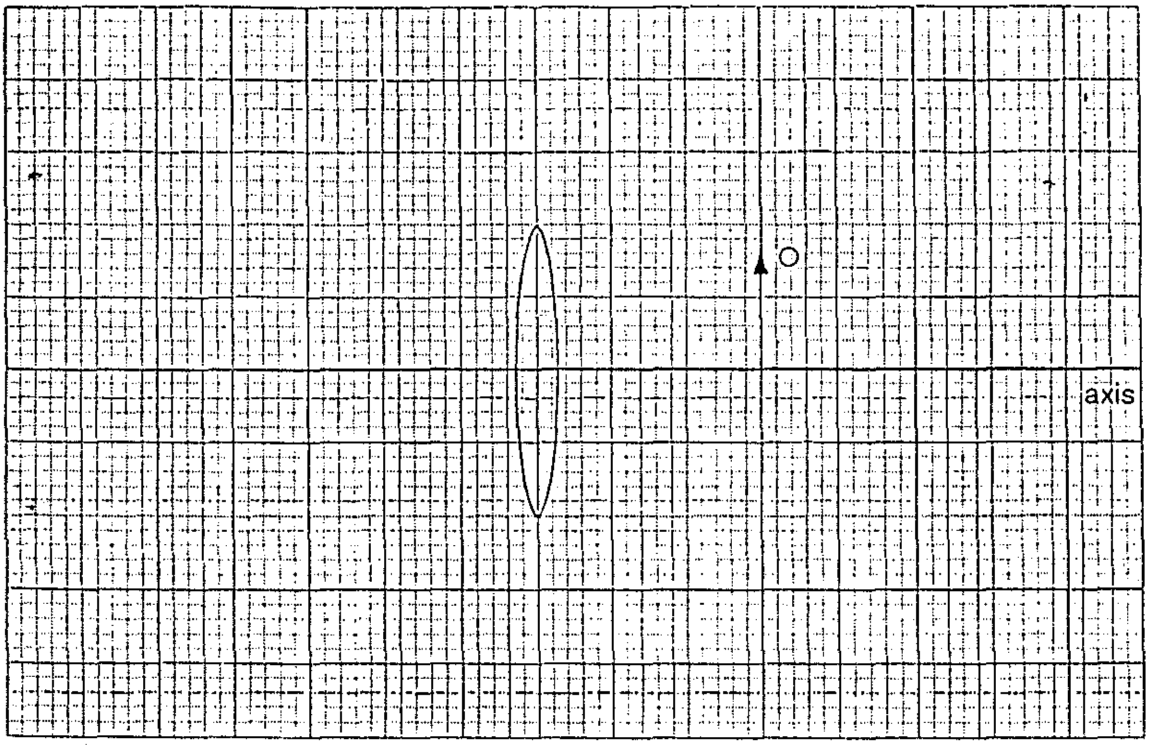

Fig. 7.1

(a) On Fig. 7.1, mark each principal focus of the lens with a dot and the letter F. [2]

(b) On Fig. 7.1, draw two rays from the tip of the object O that appear to pass through the tip of the image. [2]

(c) On Fig. 7.1, draw the image and label it with the letter I. [1]

(d) Explain why the base of the image lies on the axis.

....

.... [1]

(e) State a practical use of a convex lens when used as shown in Fig. 7.1.

.... [1]

8 Fig. 8.1 shows the outline of an a.c. generator. The peak output voltage of the generator is 6.0 V and the output has a frequency of 10 Hz.

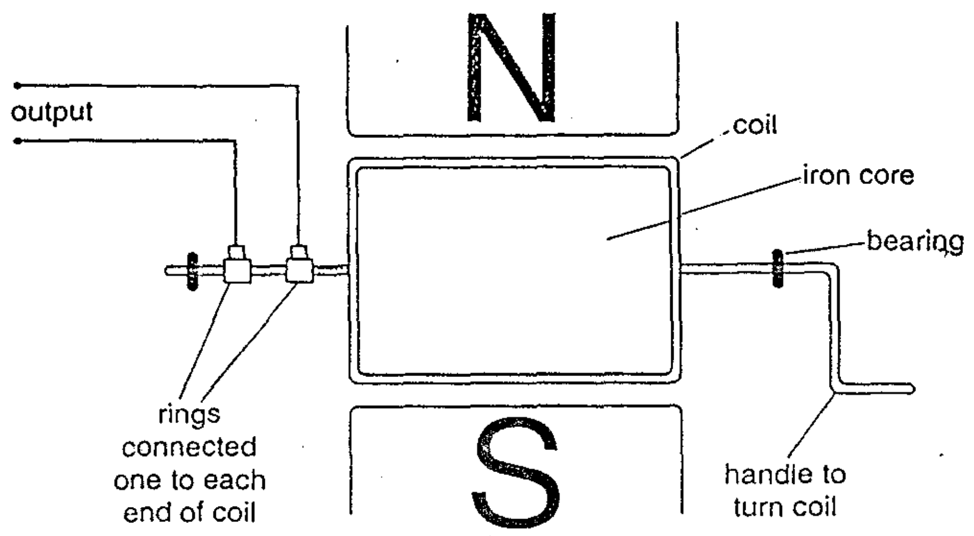

Fig. 8.1

(a) Fig. 8.2 shows the axes of a voltage-time graph for the generator output.

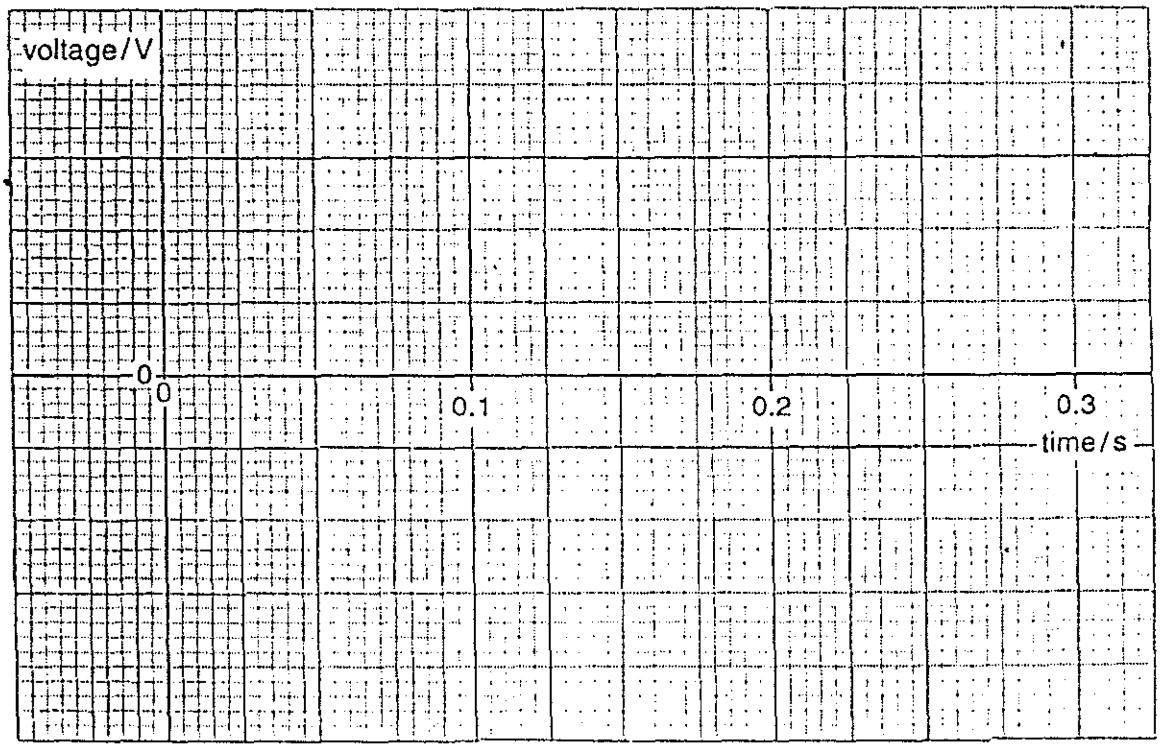

Fig. 8.2

On Fig. 8.2,

(i) mark suitable voltage values on the voltage axis,

(ii) draw a graph of the generator output.

[3]

(b) The generator shown in Fig. 8.1 works by electromagnetic induction.

Explain how this effect produces the output voltage.

....

....

....

.... [3]

(c) State the energy changes that occur in the generator when it is producing output.

.... [2]

9 (a) Fig. 9.1 shows the screen of a c.r.o. (cathode-ray oscilloscope).

The c.r.o. is being used to display the output from a microphone.

The vertical scale on the screen is in volts.

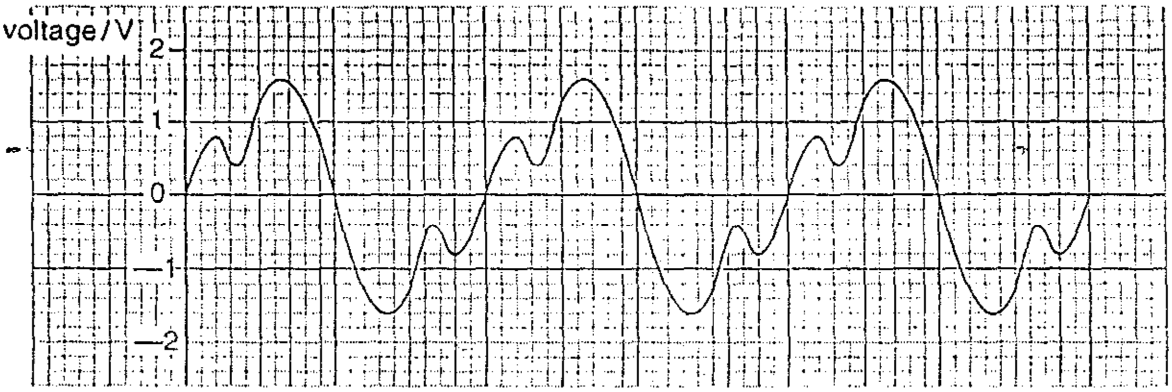

Fig. 9.1

(i) Describe the output from the microphone.

....

....

(ii) Use the graph to determine the peak voltage of the output.

....

(iii) Describe how you could check that the voltage calibration on the screen is correct.

....

....

[4]

(b) Fig. 9.2 shows the screen of the c.r.o. when it is being used to measure a small time interval between two voltage pulses.

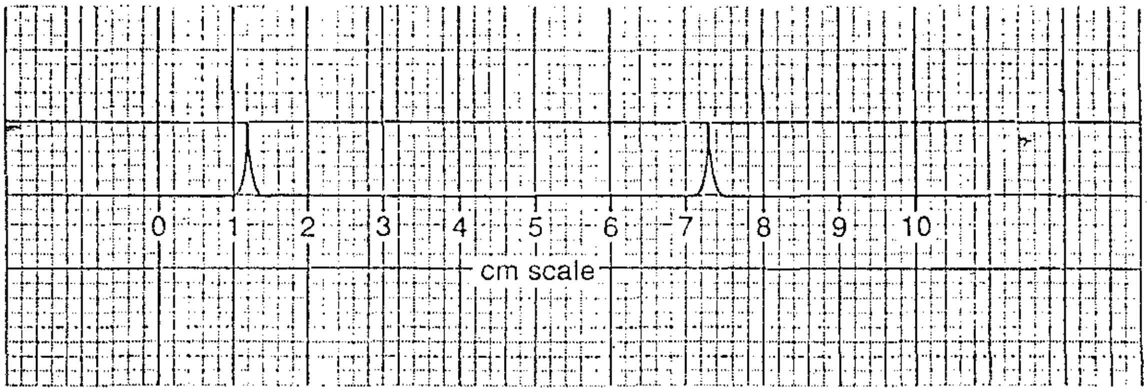

Fig. 9.2

(i) What is the distance on the screen between the two voltage pulses?

....

(ii) The time-base control of the c.r.o. is set at 5.0 ms / cm.

Calculate the time interval between the voltage pulses.

time = ...

(iii) Suggest **one** example where a c.r.o. can be used to measure a small time interval.

....

[4]

10 Fig. 10.1 shows a battery with an e.m.f of 12 V supplying power to two lamps.

The total power supplied is 150 W when both lamps are on.

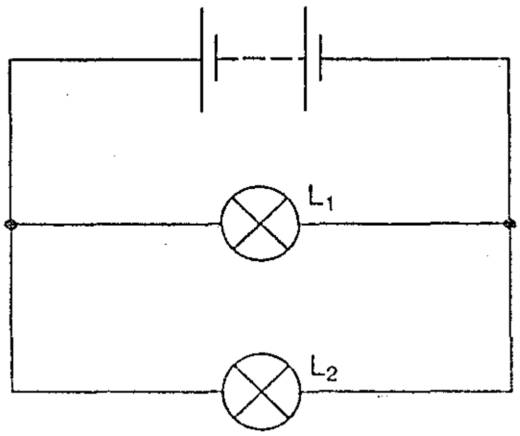

Fig. 10.1

(a) Calculate the current supplied by the battery when both lamps are on.

current = ... [2]

(b) The current in lamp L_2 is 5.0 A.

Calculate

(i) the current in lamp L_1,

current = ...

(ii) the power of lamp L_1,

power = ...

(iii) the resistance of lamp L_1.

resistance = ...

[6]