UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*3428909673*

**PHYSICS** **0625/31**

Paper 3 Extended **October/November 2010**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

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

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

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

This document consists of **17** printed pages and **3** blank pages.

DC (NF/SW) 24990/4


UNIVERSITY *of* CAMBRIDGE International Examinations

**[Turn over**

**1** An object of weight *W* is suspended by two ropes from a beam, as shown in Fig. 1.1.

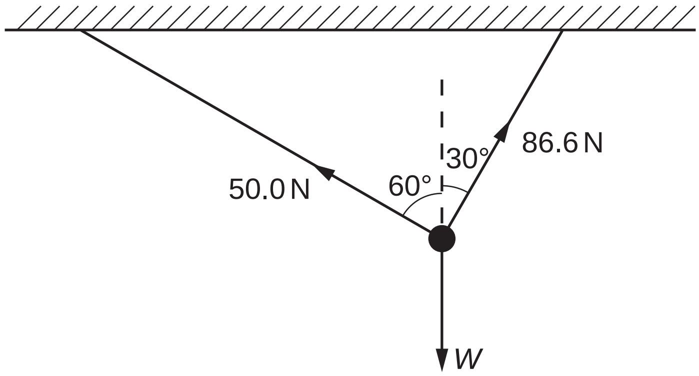


**Fig. 1.1**

The tensions in the ropes are 50.0 N and 86.6 N, as shown.

**(a)** In the space below, draw a scale diagram to find the resultant of the two tensions.

Use a scale of 1.0 cm = 10 N.

Clearly label the resultant. [3]

**(b)** From your diagram, find the value of the resultant.

resultant = ..........................................................

**(c)** State the direction in which the resultant is acting.

.......................................................................................................................... [1]

**(d)** State the value of *W*. *W* = .......................................................... [1]

[Total: 6]

**2** A car travels around a circular track at constant speed.

**(a)** Why is it incorrect to describe the circular motion as having constant velocity?

.......................................................................................................................... [1]

**(b)** A force is required to maintain the circular motion.

**(i)** Explain why a force is required.

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..........................................................................................................................

.......................................................................................................................... [2]

**(ii)** In which direction does this force act?

.......................................................................................................................... [1]

**(iii)** Suggest what provides this force.

.......................................................................................................................... [1]

[Total: 5]

**3** Fig. 3.1 shows a hydraulic lift in a car repair workshop.

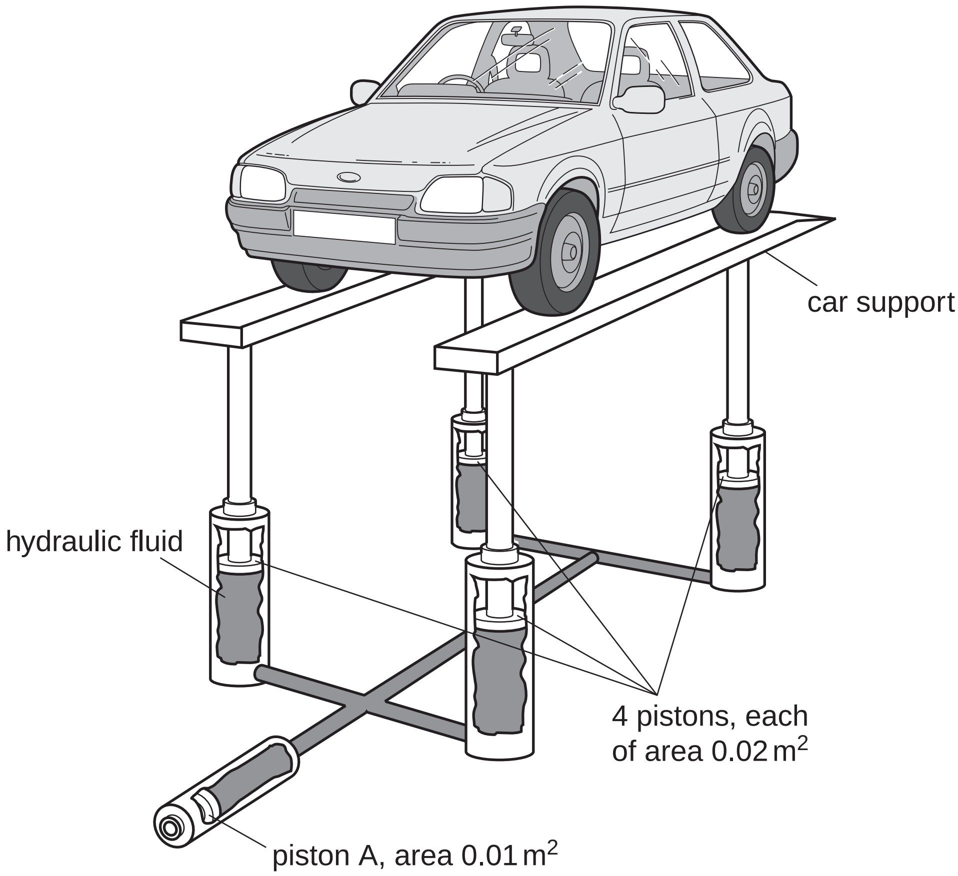


**Fig. 3.1**

The hydraulic fluid transmits the pressure, caused by piston A, equally to each of the four pistons holding up the car supports. The pressure throughout the fluid is the same.

A force of 1000 N on piston A is just enough to raise the car.

**(a)** Using values from Fig. 3.1, find

**(i)** the pressure caused by piston A on the fluid,

pressure = ........................................................ [2]

**(ii)** the total upward force caused by the fluid.

force = ........................................................ [2]

**(b)** The weight of each of the two car supports is 1000 N.

Calculate the mass of the car.

mass = .......................................................... [2]

[Total: 7]

**4** A student in a laboratory uses the apparatus shown in Fig. 4.1 to determine the specific heat capacity of aluminium.

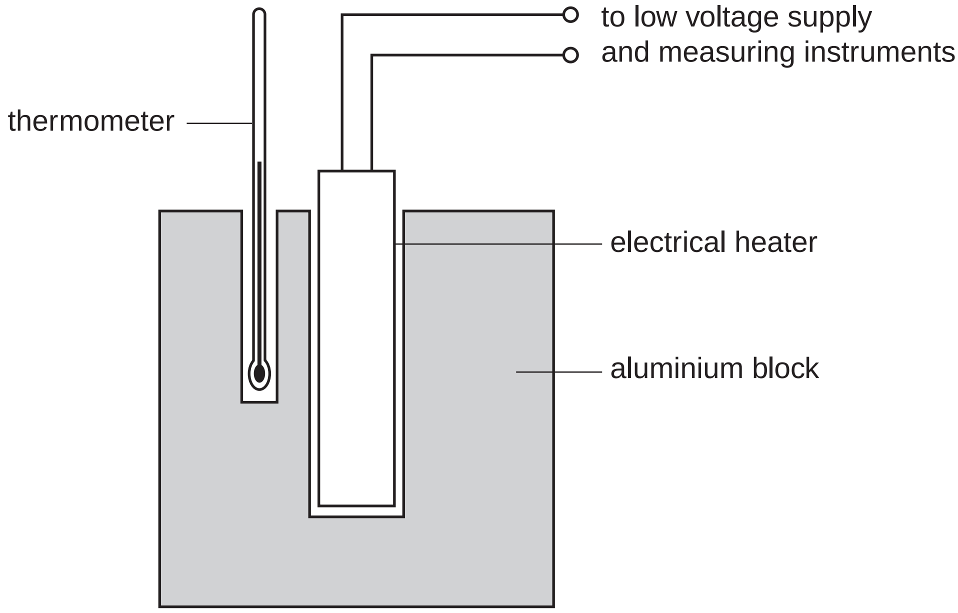


**Fig. 4.1**

The readings obtained in the experiment are given below.

mass of aluminium block = 0.930 kg

initial temperature of block = 13.1 °C

final temperature of block = 41.3 °C

electrical energy supplied = 23 800 J

**(a)** Define *specific heat capacity*.

..........................................................................................................................................

.................................................................................................................................... [2]

**(b)** Use the readings above to calculate the specific heat capacity of aluminium.

State the equation you use.

specific heat capacity = ........................................................ [3]

**(c)** Because the student knows it is good scientific practice to repeat readings, after e he carries out the experiment again, supplying the same quantity of electrical energ

This time the temperature readings are:

initial temperature of block = 41.0 °C

final temperature of block = 62.1 °C

**(i)** Use these figures to calculate a second value for the specific heat capacity of aluminium.

specific heat capacity = ......................................................... [1]

**(ii)** The student did not make any mistakes when taking the readings.

Suggest why the second value for the specific heat capacity of the aluminium is greater than the first.

..................................................................................................................................

.......................................................................................................................... [2]

**(d)** Suggest two ways of improving the experiment in order to give as accurate a result as possible.

1. ..............................................................................................................................

..................................................................................................................................

2. ..............................................................................................................................

.......................................................................................................................... [2]

[Total: 10]

**5** Fig. 5.1 shows a model cable-car system. It is driven by an electric motor couple[illegible]r system.

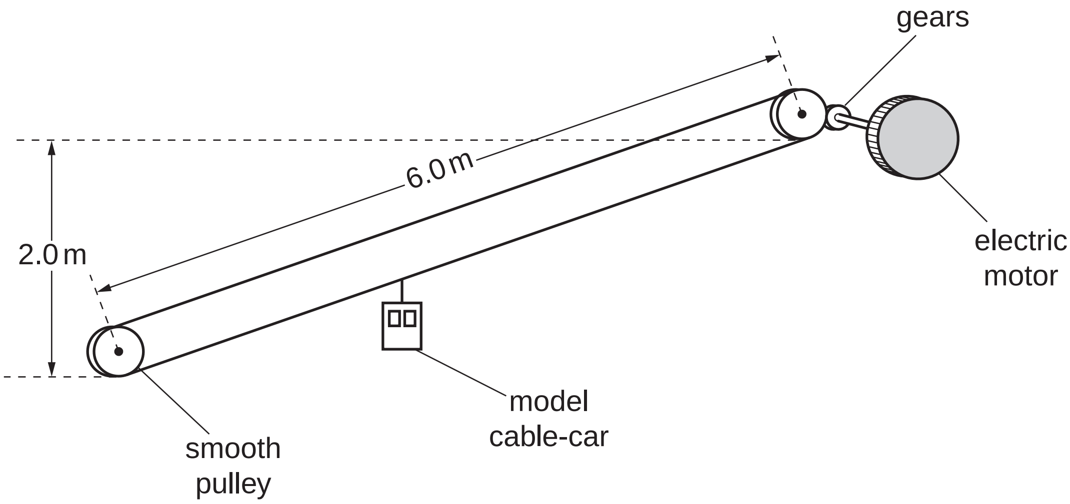


**Fig. 5.1**

The model cable-car has a mass of 5.0 kg and is lifted from the bottom pulley to the top pulley in 40 s. It stops automatically at the top.

**(a)** Calculate

**(i)** the average speed of the cable-car,

average speed = ........................................................... [2]

**(ii)** the gravitational potential energy gained by the cable-car,

gravitational potential energy gained = ........................................................... [2]

**(iii)** the useful output power of the driving mechanism.

power = .......................................................... [2]

**(b)** How would the electrical power input to the motor compare with your answer to **(a)(iii)**?

.......................................................................................................................................... [1]

[Total: 7]

**6** Fig. 6.1 shows part of the path of a ray of light PQ travelling in an optical fibre.

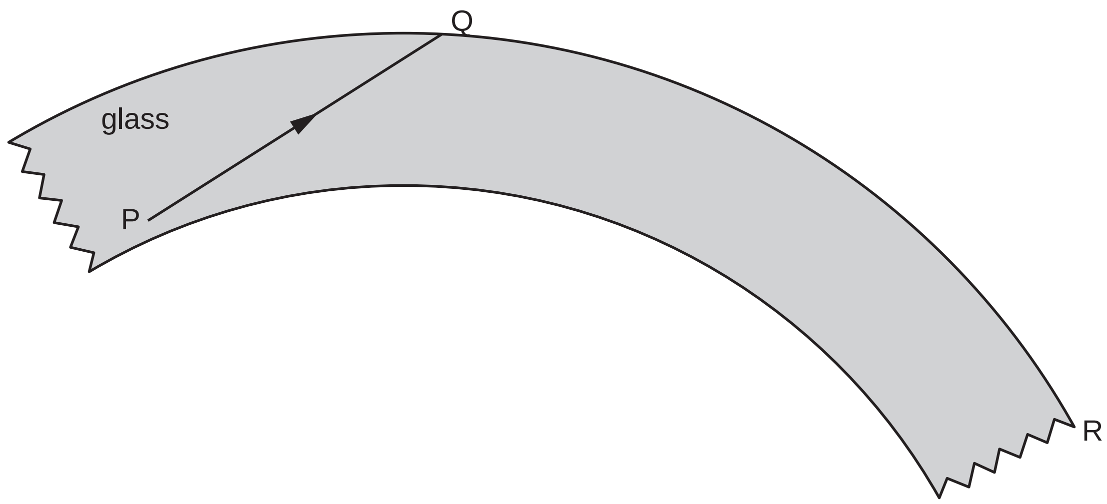


**Fig. 6.1**

PQ undergoes total internal reflection at Q.

**(a)** Explain what is meant by *total internal reflection*, and state the conditions under which it occurs.

..........................................................................................................................................

..........................................................................................................................................

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..........................................................................................................................................

...................................................................................................................................... [3]

**(b)** Carefully complete the path of the ray of light, until it reaches the end R of the optical fibre. [2]

[Total: 5]

7 **(a)** The following list contains the names of types of energy transfer by means of wa

$\gamma$-rays, infra-red, radio/TV/microwaves, sound, visible light, X-rays

**(i)** Which one of these is **not** a type of electromagnetic wave?

.......................................................................................................................... [1]

**(ii)** State the nature of the wave you have named in **(a)(i)**.

.......................................................................................................................... [1]

**(iii)** The remaining names in the list are all regions of the electromagnetic spectrum, but one region is missing.

Name the missing region.

.......................................................................................................................... [1]

**(b)** A television station emits waves with a frequency of $2.5 \times 10^8$ Hz. Electromagnetic waves travel at a speed of $3.0 \times 10^8$ m/s.

Calculate the wavelength of the waves emitted by this television station. State the equation you use.

wavelength = ........................................................ [3]

[Total: 6]

8 The circuit in Fig. 8.1 contains a 2.0V cell, whose resistance you should ignore. There are also three resistors, a 3-position switch, an ammeter and another component,

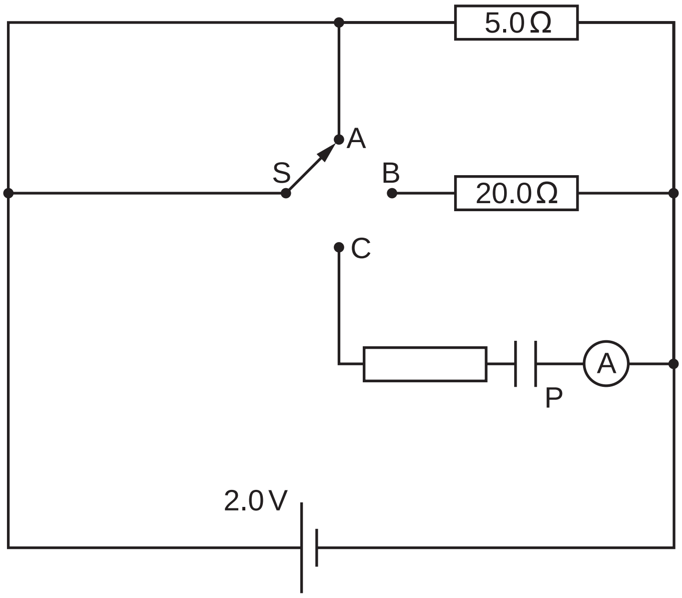


**Fig. 8.1**

**(a)** State the name of component P. ............................................................ [1]

**(b)** Deduce the resistance of the circuit when switch S is

**(i)** in position A,

resistance = ............................................................ [1]

**(ii)** in position B.

resistance = ............................................................ [3]

**(c)** Describe and explain what is seen on the ammeter when S is moved to position

..............................................................................................................................................

..............................................................................................................................................

..............................................................................................................................................

.......................................................................................................................................... [2]

**(d)** With S in position A, calculate how long it takes for the circuit to transfer 320 J of electrical energy to other forms.

time taken = ......................................................... [3]

[Total: 10]

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**9** In Fig. 9.1, A and B are two conductors on insulating stands. Both A and B [illegible] uncharged.

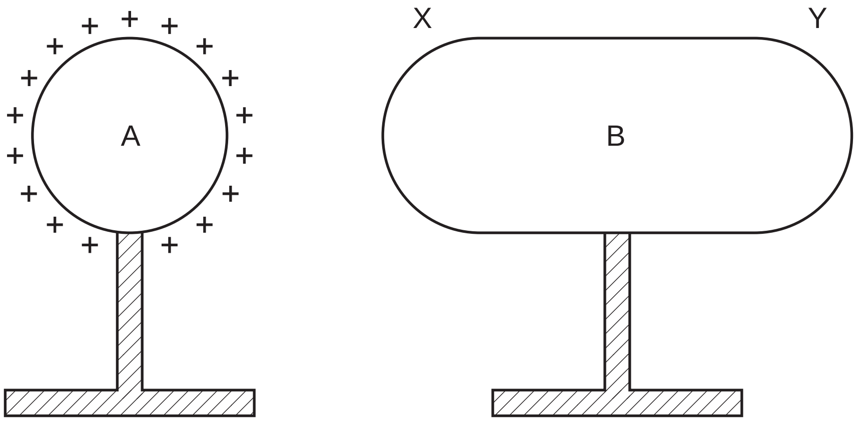



**Fig. 9.1**

**(a)** Conductor A is given the positive charge shown on Fig. 9.1.

**(i)** On Fig. 9.1, mark the signs of the charges induced at end X and at end Y of conductor B. [1]

**(ii)** Explain how these charges are induced.

..........................................................................................................................

..........................................................................................................................

.......................................................................................................................... [3]

**(iii)** Explain why the charges at X and at Y are equal in magnitude.

..........................................................................................................................

..........................................................................................................................

.......................................................................................................................... [1]

**(b)** B is now connected to earth by a length of wire.

Explain what happens, if anything, to

**(i)** the charge at X,

..........................................................................................................................

.......................................................................................................................... [1]

**(ii)** the charge at Y.

..........................................................................................................................

.......................................................................................................................... [2]

**10** Emissions from a radioactive source pass through a hole in a lead screen and into a magnetic field, as shown in Fig. 10.1.

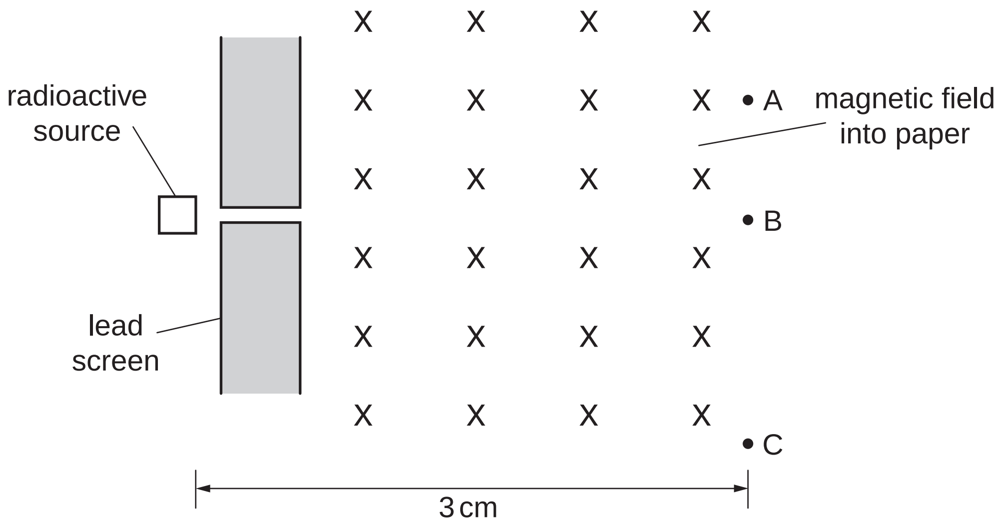



**Fig. 10.1**

Radiation detectors are placed at A, B and C. They give the following readings:

| A | B | C |
|---|---|---|
| 32 counts / min | 543 counts / min | 396 counts / min |

The radioactive source is then completely removed, and the readings become:

| A | B | C |
|---|---|---|
| 33 counts / min | 30 counts / min | 31 counts / min |

**(a)** Explain why there are still counts being recorded at A, B and C, even when the radioactive source has been removed, and give the reason for them being slightly different.

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

.................................................................................................................................... [2]

**(b)** From the data given, deduce the type of emission being detected, if any, at A, B and C when the radiation source is present.

State the reasons for your answers.

detector at A ..........................................................................................................................

..........................................................................................................................................

.................................................................................................................................... [2]

detector at B ..........................................................................................................................

..........................................................................................................................................

.................................................................................................................................... [3]

detector at C ..........................................................................................................................

..........................................................................................................................................

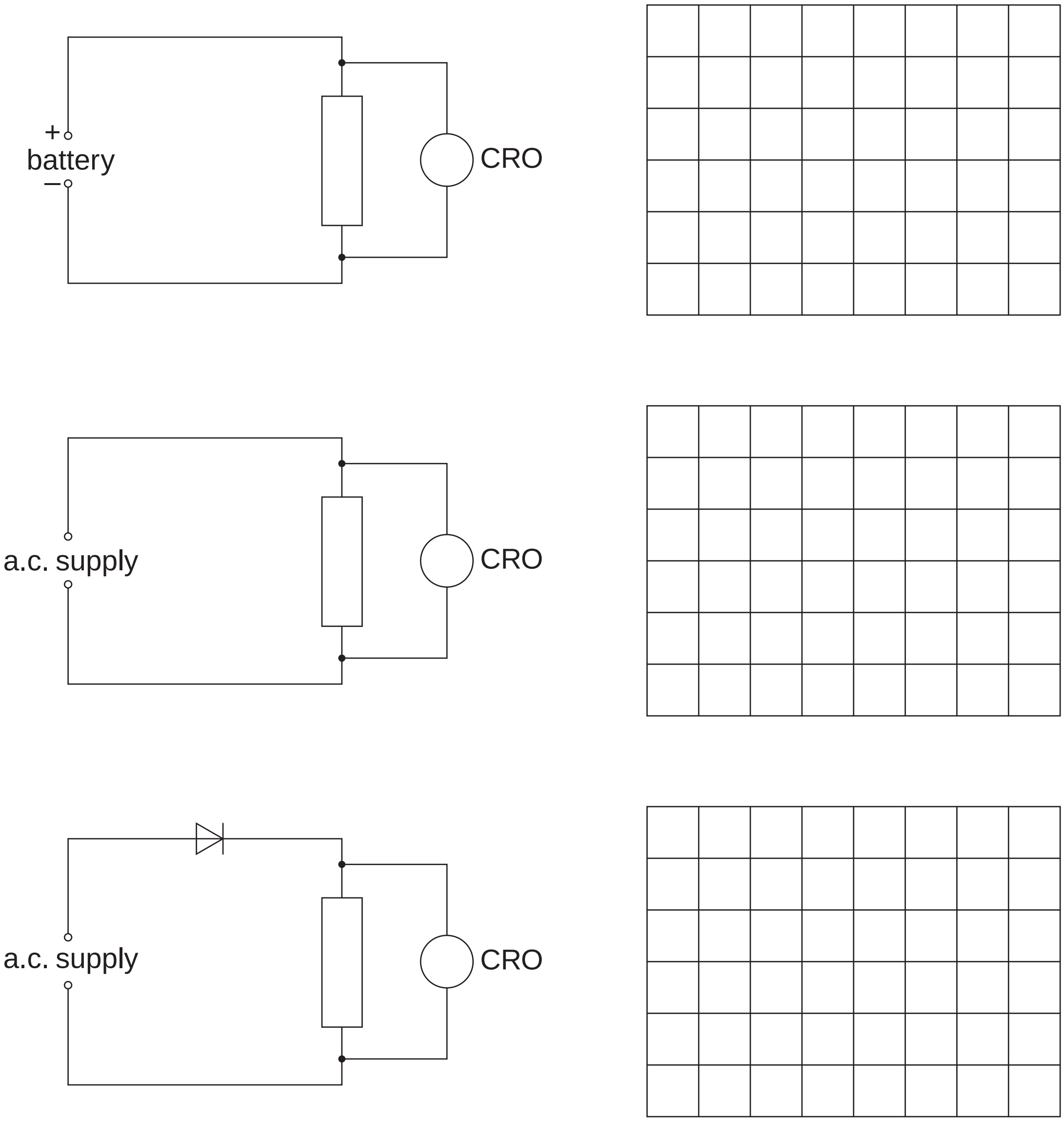
.................................................................................................................................... [3]

[Total: 10]

**11** When no circuit is connected to the input of a cathode-ray oscilloscope (CRO), there is a horizontal trace across the middle of the screen.

Fig. 11.1 shows three circuits, each connected to a CRO.

On the grid alongside each circuit, draw the trace that might be seen on the screen of the CRO.




[6]

**Fig. 11.1**

[Total: 6]

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