

# Electric circuits

## Question Paper 8

|            |                           |
|------------|---------------------------|
| Level      | IGCSE                     |
| Subject    | Physics                   |
| ExamBoard  | CIE                       |
| Topic      | Electricity and Magnetism |
| Sub-Topic  | Electric circuits         |
| Paper Type | (Extended) Theory Paper   |
| Booklet    | Question Paper 8          |

**Time Allowed:** 90 minutes

**Score:** /75

**Percentage:** /100

- 1 Fig. 8.1 shows a circuit containing a battery of electromotive force (e.m.f.) 12V and a heater of resistance  $6.0\Omega$ .

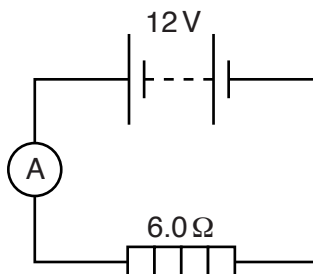


Fig. 8.1

- (a) State what is meant by electromotive force (e.m.f.).

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

- (b) (i) Calculate the current in the heater.

current = ..... [2]

- (ii) State the name of the particles that flow through the heater.

..... [1]

- (iii) On Fig. 8.1, draw an arrow next to the heater symbol to show the direction of flow of these particles through the heater. [1]

- (c) Calculate the thermal energy produced in the heater in 10 minutes.

thermal energy = ..... [2]

[Total: 7]

2 (a) Fig. 9.1 shows the symbol for a logic gate.

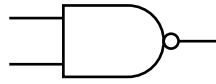


Fig. 9.1

(i) State the name of this gate.

.....

(ii) On Fig. 9.1, clearly label an input and an output.

[2]

(b) In the space below, draw the symbol for a fuse.

[1]

(c) Fig. 9.2 shows a circuit.

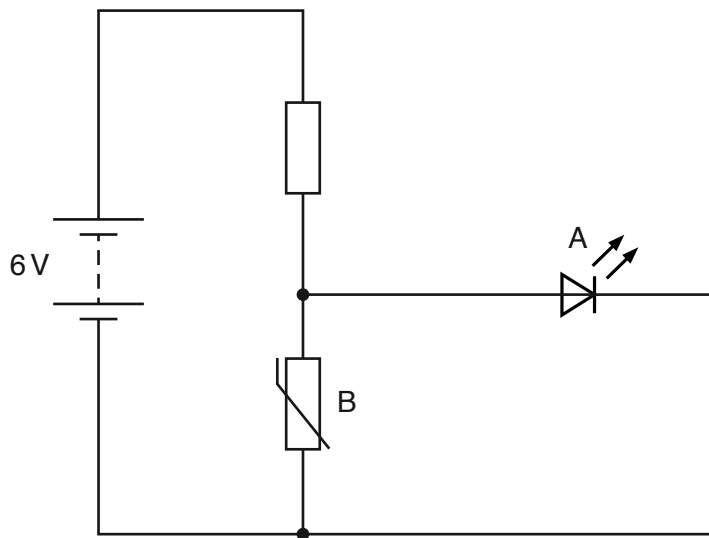


Fig. 9.2

Component A is not emitting light. It only emits light when the p.d. across it is greater than 1V.

(i) A change to the environment around component B causes component A to emit light.

State the environmental change.

.....[1]

(ii) Explain your answer to (i).

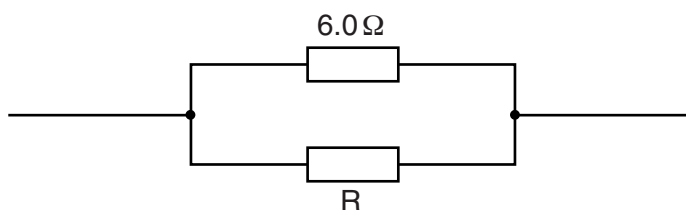
.....

.....

.....

.....[3]

(d) The combined resistance of the two resistors shown in Fig. 9.3 is  $4.0\Omega$ .



**Fig. 9.3**

Calculate the resistance of resistor R.

resistance of R = .....[2]

[Total: 9]

3 A charger for a cellphone (mobile phone) is marked:

input: a.c. 240V, 50 Hz, 80 mA.  
output: d.c. 5.3V, 500 mA.

(a) State

(i) the component in the charger that converts a.c. to d.c.,

.....

(ii) the quantity that has the value 50 Hz.

.....

[2]

(b) Calculate

(i) the output power of the charger,

output power = .....[2]

(ii) the energy transferred in the output circuit when the cellphone is charged for 1.5 hours.

energy = .....[2]

(c) In the following list, underline the quantity that is stored in the battery of the cellphone.

voltage      Current      Power      energy      [1]

[Total: 7]

4 (a) State the relationship between

(i) the resistance  $R$  and the length  $L$  of a wire of constant cross-sectional area,

.....

(ii) the resistance  $R$  and the cross-sectional area  $A$  of a wire of constant length.

.....

[1]

(b) A 60W filament lamp X is connected to a 230V supply, as shown in Fig. 9.1.

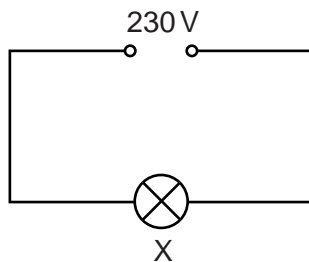


Fig. 9.1

Calculate the current in the filament.

current = ..... [2]

**(c)** Lamp Y has a filament made of the same metal as the filament of lamp X in **(b)**.

This filament has half the length and one-third of the cross-sectional area of the filament of X.

Lamp Y is also connected to a 230V supply.

Calculate the ratio  $\frac{\text{current in filament of Y}}{\text{current in filament of X}}$ . Show your working.

ratio = ..... [4]

[Total: 7]

- ) (a) A piece of wire has a resistance of  $0.45 \Omega$ .

Calculate the resistance of another piece of wire of the same material with a third of the length and half the cross-sectional area.

resistance = ..... [3]

- (b) Fig. 8.1 shows a circuit with three resistors, a power supply and four voltmeters.

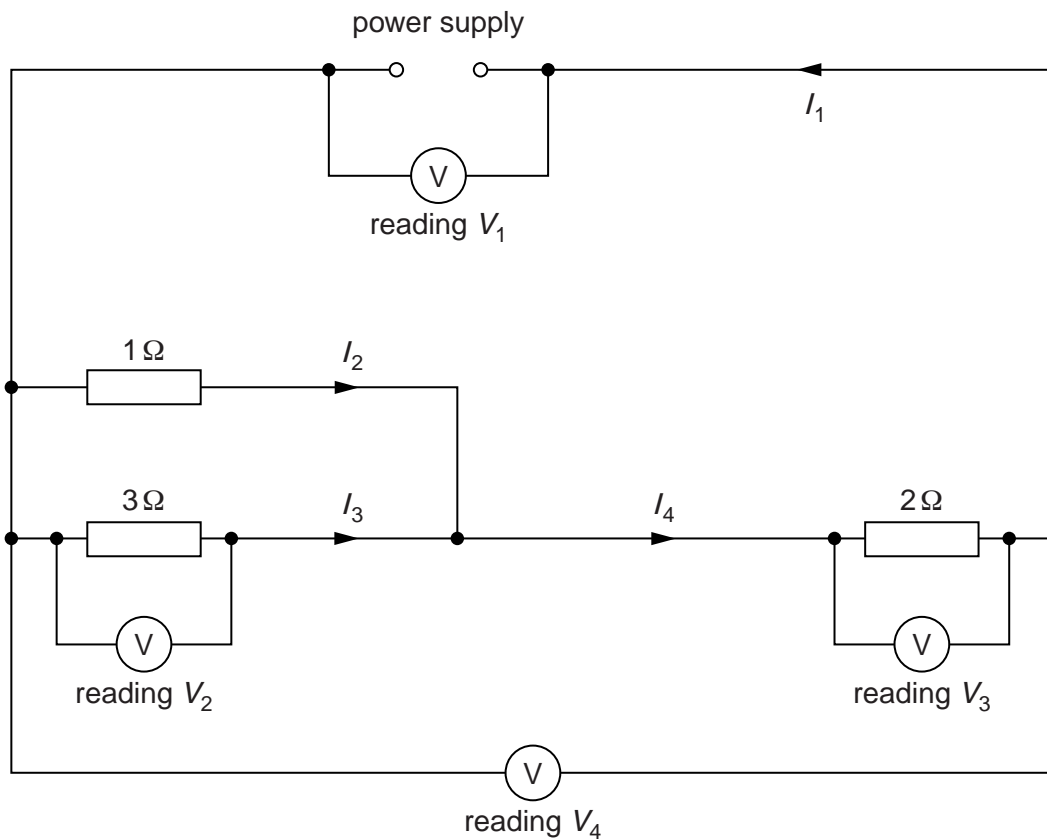


Fig. 8.1



- (i) Calculate the combined resistance of the three resistors.

resistance = ..... [3]

- (ii) Write down **two** relationships for the currents in the circuit.

[2]

- (iii) Write down **two** relationships for the voltmeter readings in the circuit.

[2]

[Total: 10]

- 6 A student carries out an experiment with the circuit shown in Fig. 11.1. The component in the dashed box labelled X is a diode.

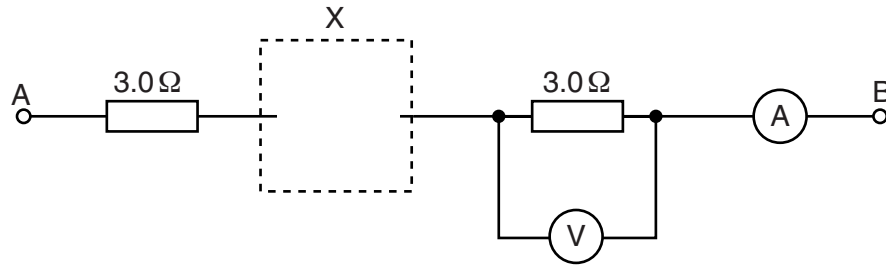


Fig. 11.1

- (a) On Fig. 11.1, draw the correct symbol for a diode, connected either way round, in the dashed box labelled X. [1]

- (b) (i) +6.0V is applied to point A, 0V to point B.

State what the student observes on the ammeter.

.....

- (ii) –6.0V is applied to point A, 0V to point B.

State what the student observes on the ammeter.

.....

[2]

- (c) The voltage shown in Fig. 11.2 is applied to the point A of the circuit in Fig. 11.1. Point B is kept at 0V.

On Fig. 11.2, draw a graph of the readings indicated by the voltmeter.

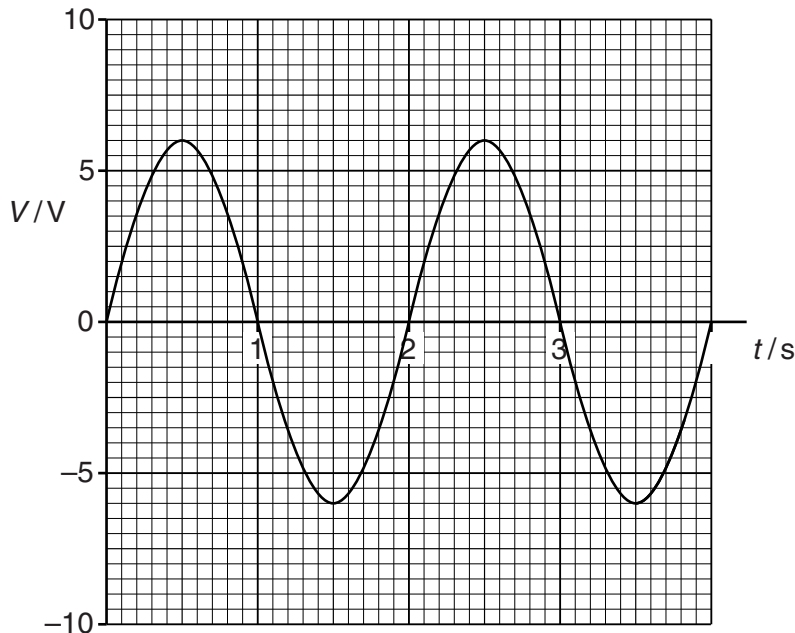


Fig. 11.2

[2]

- (d) The circuit shown in Fig. 11.3 contains two switches  $S_1$  and  $S_2$  and two indicator lamps  $L_1$  and  $L_2$ .

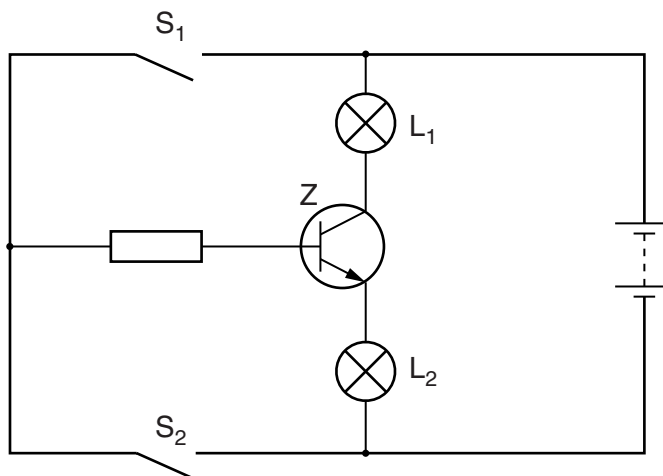


Fig. 11.3

- (i) Name component Z. .... [1]
- (ii) Complete the table to state whether the lamps are on or off with the switches in the positions stated.

| switch $S_1$ | switch $S_2$ | lamp $L_1$ | lamp $L_2$ |
|--------------|--------------|------------|------------|
| open         | closed       |            |            |
| closed       | open         |            |            |

[2]

[Total: 8]

7 The circuit of Fig. 4.1 is set up to run a small immersion heater from a 6.0V battery.

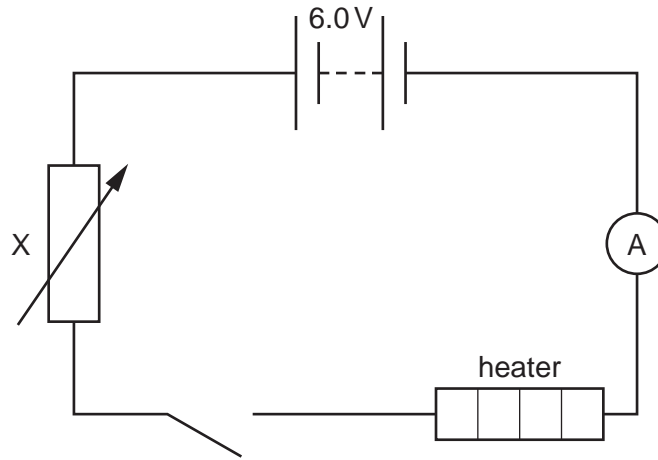


Fig. 4.1

(a) State the name and purpose of component X.

name .....

purpose .....[1]

(b) The heater is designed to work from a 3.6V supply. It has a power rating of 4.5W at this voltage.

(i) Calculate the current in the heater when it has the correct potential difference across it.

current = .....[2]

(ii) Calculate the resistance of component X if there is to be the correct potential difference across the heater. The battery and the ammeter both have zero resistance.

resistance = .....[3]

- (c) Some time after the heater is switched on, the ammeter reading is seen to have decreased.

Suggest why this happens.

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

- (d) As an alternative to running the heater from a battery, it is decided to construct a circuit to enable it to be operated from the a.c. mains supply.

Name the electrical component needed to

- (i) reduce the potential difference from that of the mains supply down to a potential difference suitable for the heater,

.....[1]

- (ii) change the current from a.c. to a current which has only one direction.

.....[1]

[Total: 9]

- 8 Fig. 7.1 shows how the resistance of the filament of a lamp changes as the current through the lamp changes.

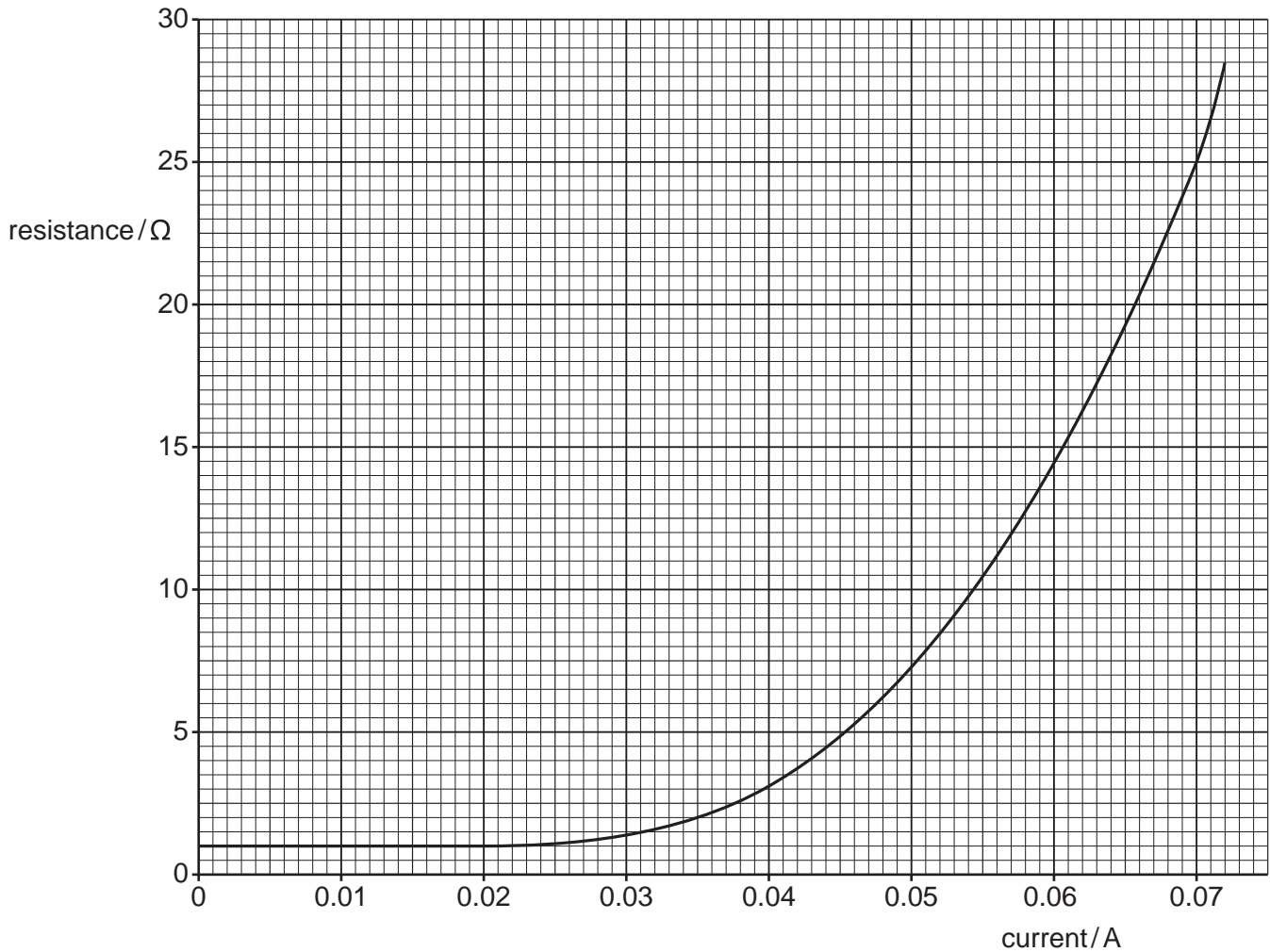


Fig. 7.1

- (a) Describe how the resistance of the lamp changes.

.....

.....

..... [2]

**(b)** For a current of 0.070 A, find

**(i)** the resistance of the lamp,

resistance = ..... [1]

**(ii)** the potential difference across the lamp,

potential difference = ..... [2]

**(iii)** the power being dissipated by the lamp.

power = ..... [2]

**(c)** Two of these lamps are connected in parallel to a cell. The current in each lamp is 0.070 A.

**(i)** State the value of the e.m.f. of the cell.

e.m.f. = ..... [1]

**(ii)** Calculate the resistance of the circuit, assuming the cell has no resistance.

resistance = ..... [2]

[Total: 10]

9 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.

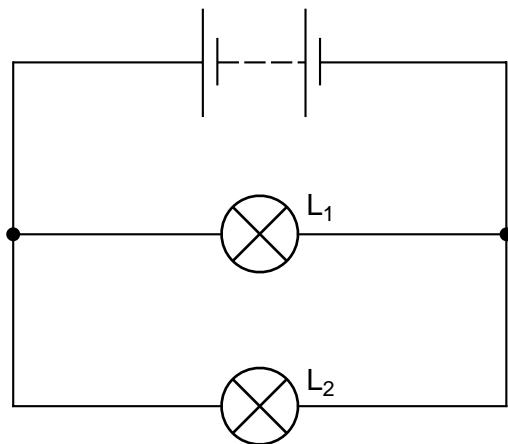


Fig. 10.1

(a) Calculate the current supplied by the battery when both lamps are on.

current = ..... [2]

(b) The current in lamp L<sub>2</sub> is 5.0 A.

Calculate

(i) the current in lamp L<sub>1</sub>,

current = .....



**(ii)** the power of lamp  $L_1$ ,

power = .....

**(iii)** the resistance of lamp  $L_1$ .

resistance = .....

[6]

[Total : 8 ]