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

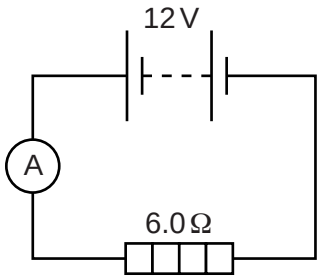

Fig. 8.1

(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.

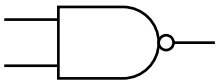

Fig. 9.1

(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.

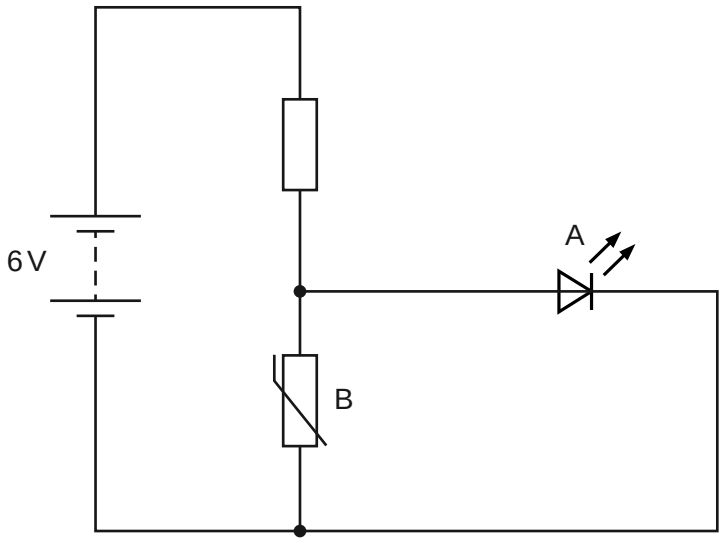

Fig. 9.2

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

(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 Ω.

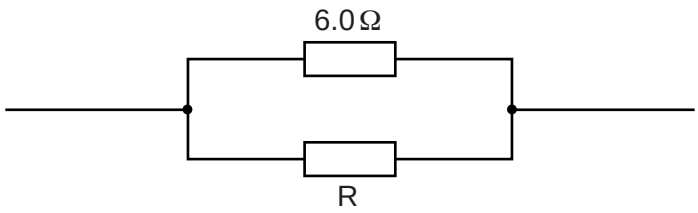

Fig. 9.3

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

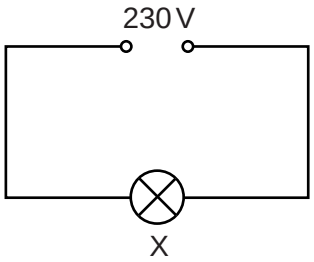

Fig. 9.1

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 230 V supply.

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

ratio = ... [4]

[Total: 7]

5 **(a)** A piece of wire has a resistance of 0.45 Ω.

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.

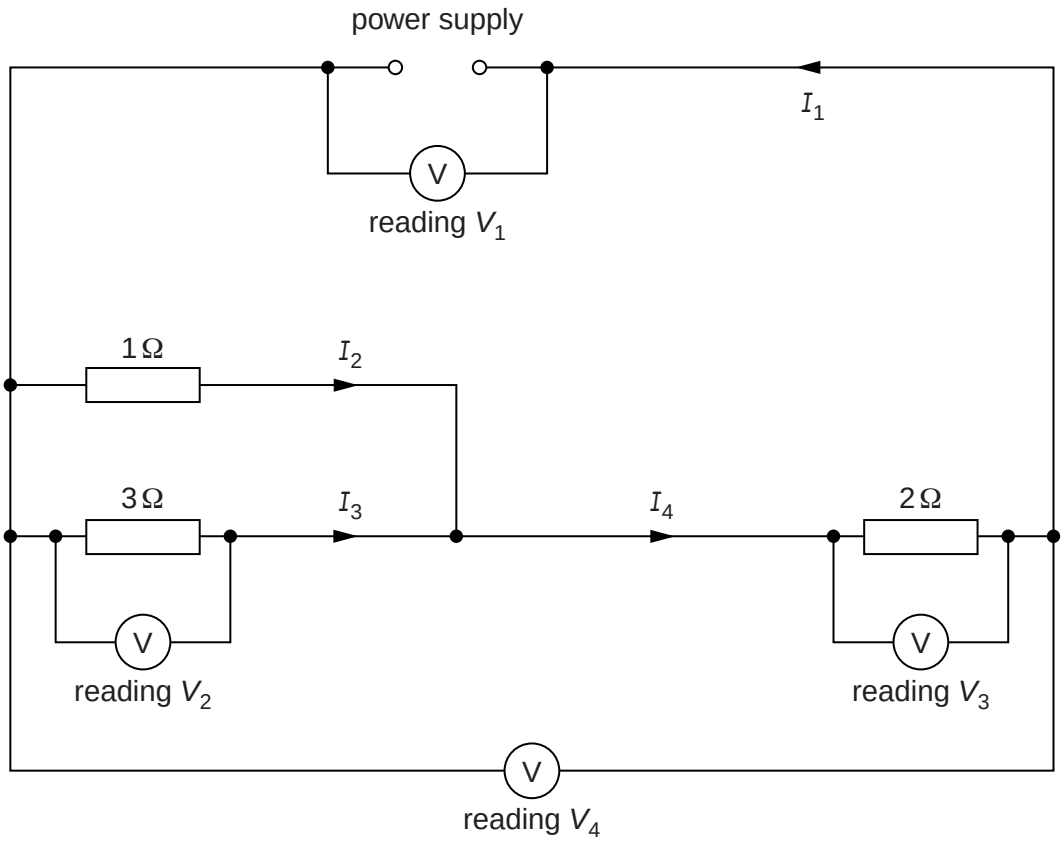

Fig. 8.1

(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.

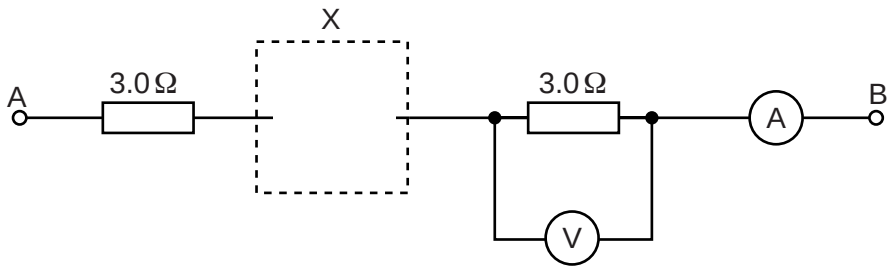

Fig. 11.1

(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.

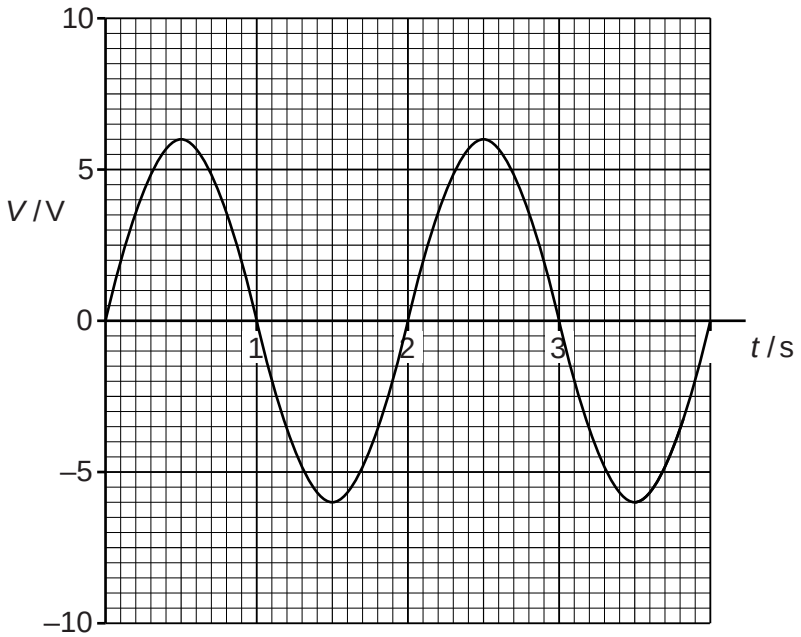

Fig. 11.2

[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.

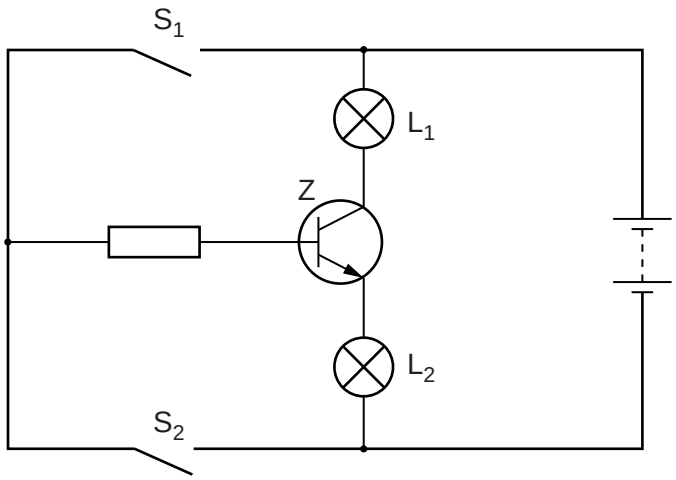

Fig. 11.3

(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.

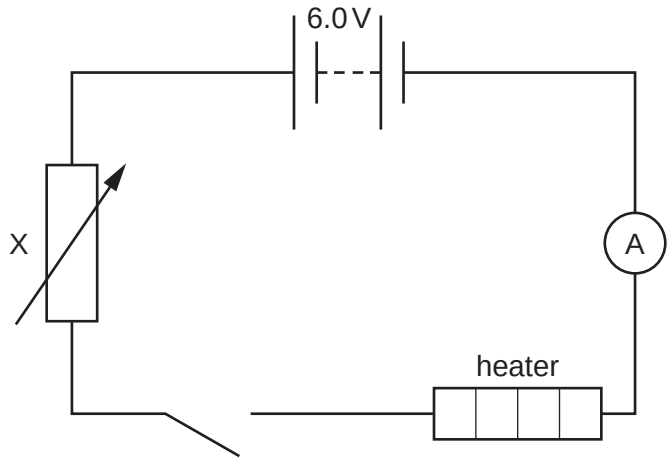

Fig. 4.1

(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.

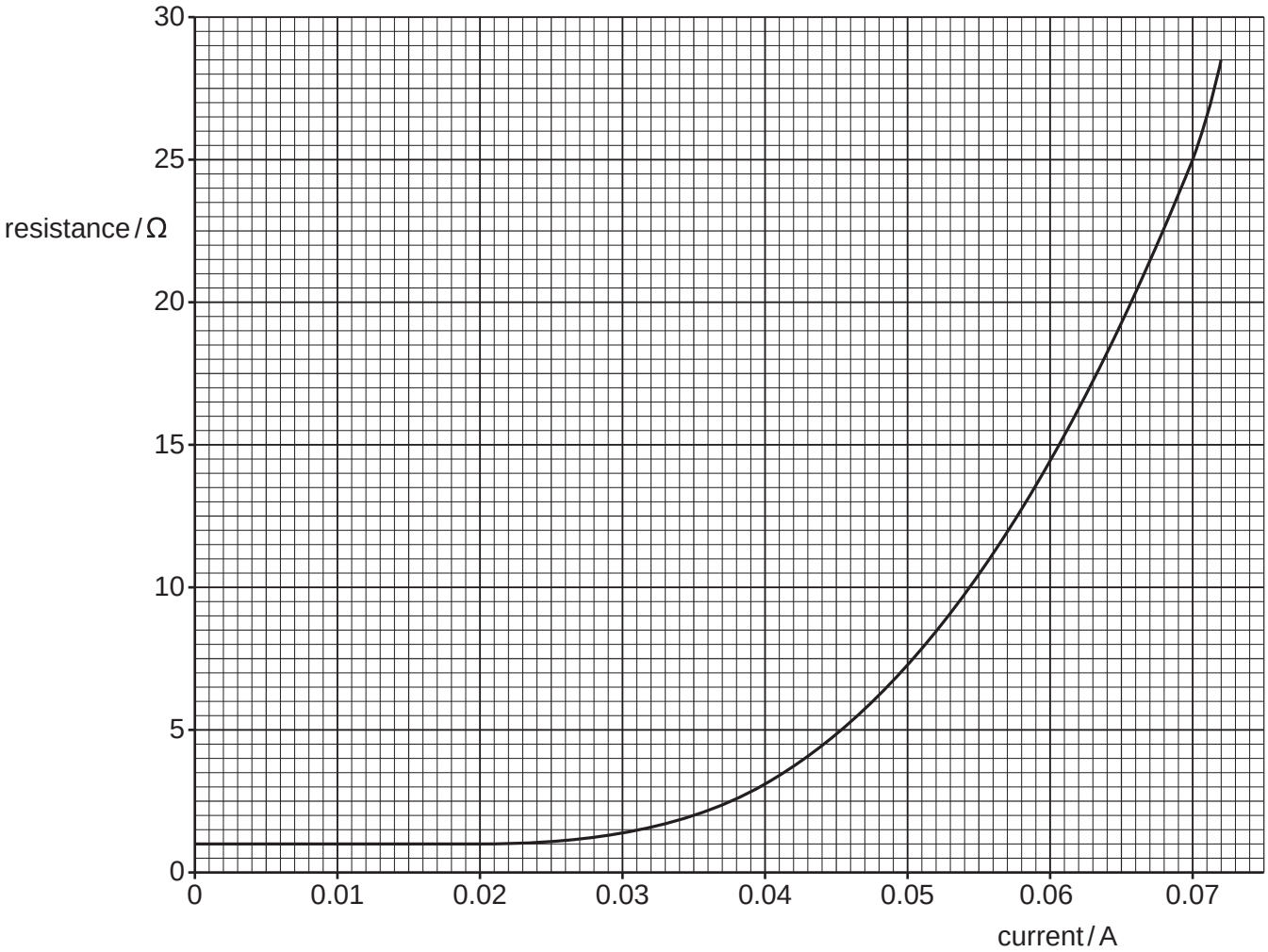

Fig. 7.1

(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.

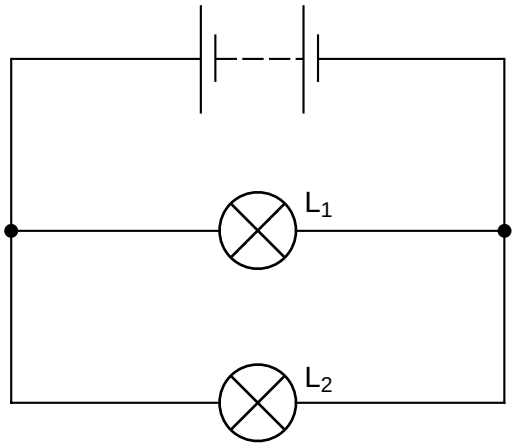

Fig. 10.1

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

current = ... [2]

(b) The current in lamp L_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]

[Total : 8]