1 Fig. 8.1 shows a car battery being charged from a 200 V a.c. mains supply.

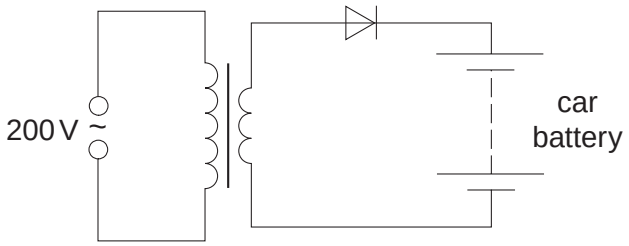


Fig. 8.1

(a) State the function of the diode.

.....

..... [1]

(b) The average charging current is 2.0 A and the battery takes 12 hours to charge fully.

Calculate the charge that the battery stores when fully charged.

charge stored ..... [2]

(c) The battery has an electromotive force (e.m.f.) of 12 V and, when connected to a circuit, supplies energy to the circuit components.

State what is meant by an *electromotive force of 12 V*.

.....

.....

..... [2]

(d) **(i)** In the space below, draw a circuit diagram to show how two 6.0V lamps should be connected to a 12V battery so that both lamps glow with normal brightness. [1]

(ii) The power of each lamp is 8.0W. Calculate the current in the circuit.

current = ... [2]

(iii) Calculate the energy used by the two lamps when both are lit for one hour.

energy = ... [2]

[Total: 10]

2 Fig. 8.1 shows part of a low-voltage lighting circuit containing five identical lamps.

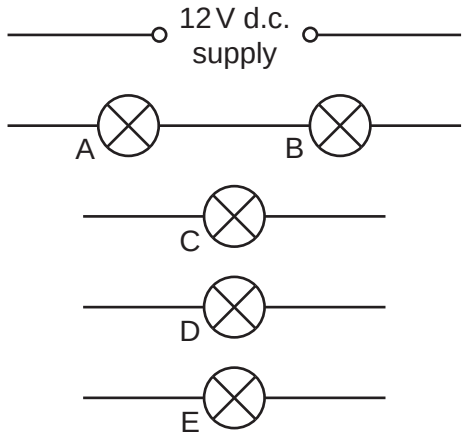


Fig. 8.1

(a) Complete the circuit, by the addition of components as necessary, so that

(i) the total current from the supply can be measured,

(ii) the brightness of lamp E only can be varied,

(iii) lamps C and D may be switched on and off together whilst lamps A, B and E remain on. [4]

(b) All five lamps are marked 12 V, 36 W. Assume that the resistance of each lamp is the same fixed value regardless of how it is connected in the circuit.

Calculate

(i) the current in one lamp when operating at normal brightness,

current = ... [1]

(ii) the resistance of one lamp when operating at normal brightness,

resistance = ... [1]

(iii) the combined resistance of two lamps connected in parallel with the 12 V supply,

resistance = ... [1]

(iv) the energy used by one lamp in 30 s when operating at normal brightness.

energy = ... [1]

(c) The whole circuit is switched on. Explain why the brightness of lamps A and B is much less than that of one lamp operating at normal brightness.

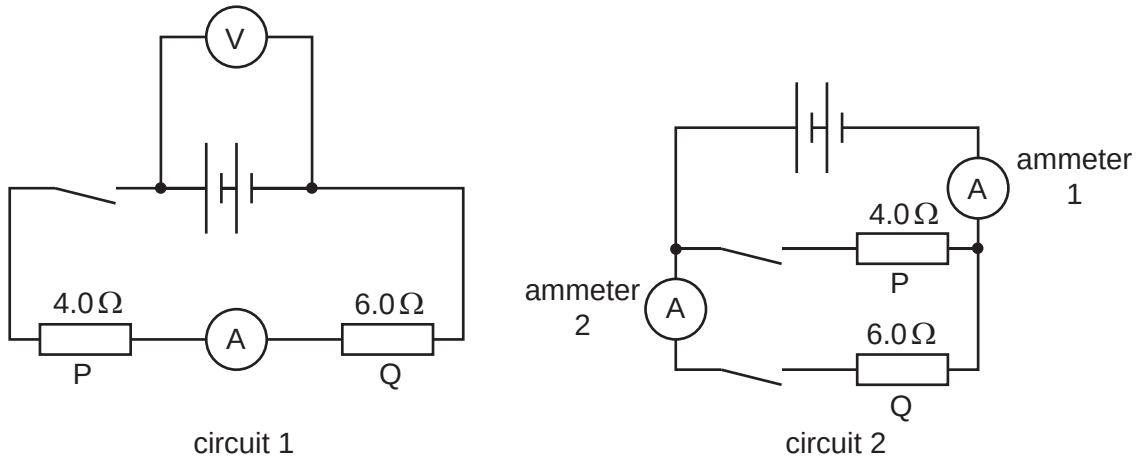
.....

.....

..... [2]

[Total: 10]

3 Fig. 8.1 shows two electrical circuits.



The batteries in circuit 1 and circuit 2 are identical.

Fig. 8.1

(a) Put ticks in the table below to describe the connections of the two resistors P and Q.

	series	parallel
circuit 1		
circuit 2		

[1]

(b) The resistors P and Q are used as small electrical heaters.

State two advantages of connecting them as shown in circuit 2.

advantage 1 .....

advantage 2 ..... [2]

(c) In circuit 1, the ammeter reads 1.2 A when the switch is closed.

Calculate the reading of the voltmeter in this circuit.

voltmeter reading = ... [2]

(d) The two switches in circuit 2 are closed. Calculate the combined resistance of the two resistors in this circuit.

combined resistance = ... [2]

(e) When the switches are closed in circuit 2, ammeter 1 reads 5 A and ammeter 2 reads 2 A.

Calculate

(i) the current in resistor P,

current = ... [1]

(ii) the power supplied to resistor Q,

power = ... [1]

(iii) the energy transformed in resistor Q in 300 s.

energy = ... [1]

[Total: 10]

4 Fig. 8.1 shows an electrical circuit.

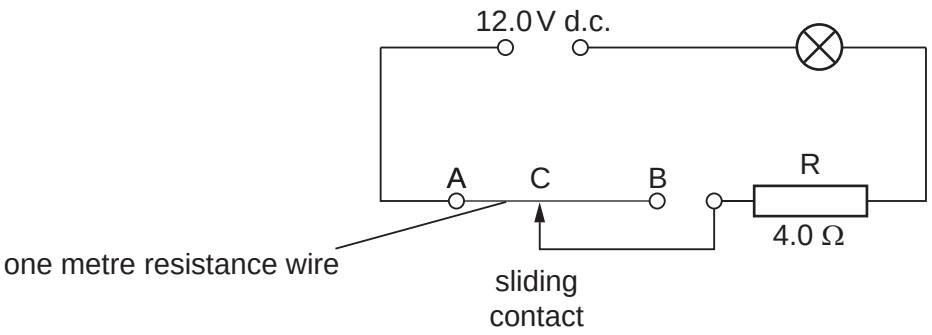


Fig. 8.1

The resistance of the lamp is 4.0 Ω when it is at its normal brightness.

(a) The lamp is rated at 6.0 V, 9.0 W.
Calculate the current in the lamp when it is at its normal brightness.

current = ...[2]

(b) The sliding contact C is moved to A. The lamp lights at its normal brightness.
Calculate

(i) the total circuit resistance,

resistance = ...[1]

(ii) the potential difference across the 4.0 Ω resistor R.

potential difference = ...[1]

(c) The sliding contact C is moved from A to B.

(i) Describe any change that occurs in the brightness of the lamp.

.....[1]

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

.....

.....[2]

(d) The 1 m wire between A and B, as shown in Fig. 8.1, has a resistance of 2.0 Ω. Calculate the resistance between A and B when

(i) the 1 m length is replaced by a 2 m length of the same wire,

resistance = ...[1]

(ii) the 1 m length is replaced by a 1 m length of a wire of the same material but of only half the cross-sectional area.

resistance = ...[1]

[Total : 9]