

- 7 (a) Electromotive force (e.m.f.) and potential difference (p.d.) may both have the volt as a unit.

(i) Define the volt.

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

(ii) By reference to energy transfers, distinguish between e.m.f. and p.d.

e.m.f. ....  
.....  
p.d. ....  
..... [2]

- (b) A cell of e.m.f. 1.5V and internal resistance  $0.25\Omega$  is connected in series with a resistor R, as shown in Fig. 7.1.

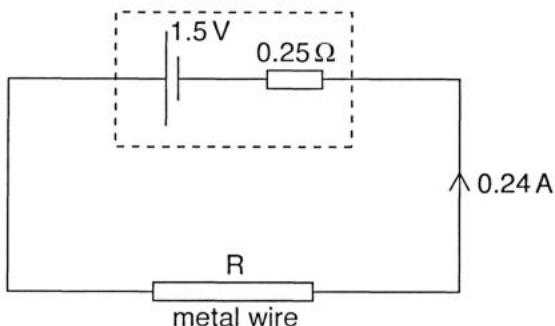


Fig. 7.1

The resistor R is made of metal wire.

A current of  $0.24\text{ A}$  passes through R for a time of 5.0 minutes.

Calculate

- (i) the charge that passes through the cell,

charge = ..... C [1]

- (ii) the total energy transferred by the cell,

For  
Examiner's  
Use

energy = ..... J [2]

- (iii) the energy transferred in the resistor R,

energy = ..... J [3]

- (iv) the resistance of R.

resistance = .....  $\Omega$  [2]

- (c) A second similar cell is now connected in series with the cell in (b) and the resistor R. The current in the circuit is 0.41 A and the resistance of R changes.
- (i) Calculate the new resistance of R.

$$\text{resistance} = \dots \Omega [2]$$

- (ii) Resistor R is made of metal wire. Suggest why the answers in (b)(iv) and (c)(i) are different.

..... [1]

- (d) The cells in (c) are now connected in series with a fixed resistor of resistance  $2000\Omega$  and a thermistor, as shown in Fig. 7.2.

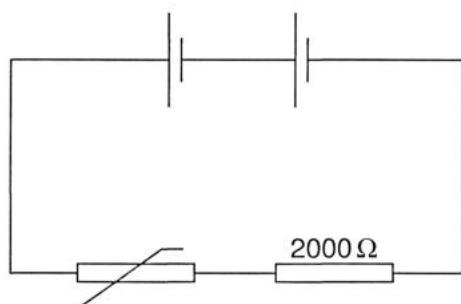


Fig. 7.2

The thermistor has resistance  $4000\Omega$  at  $0^\circ\text{C}$  and  $1800\Omega$  at  $20^\circ\text{C}$ .

- (i) Explain why, in this circuit, the internal resistance of the cells may be considered to be negligible.

..... [1]

- (ii) Determine the potential difference across the thermistor

1. at 0°C,

potential difference = ..... V [1]

2. at 20°C.

potential difference = ..... V [1]

- (iii) In one particular application of the circuit of Fig. 7.2, it is desired that the potential difference across the **fixed** resistor should range from 1.2V at 0°C to 2.4V at 20°C.

Determine whether, by substituting a different fixed resistor in the circuit of Fig. 7.2, it is possible to achieve this range of potential differences.

[3]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.