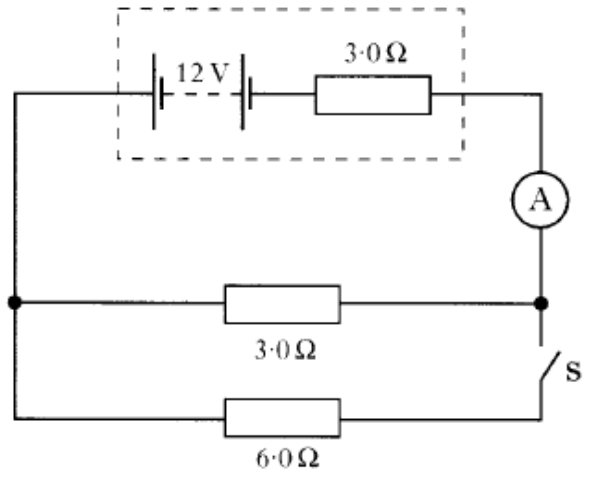
Exercise 12 - Emf and Internal Resistance

Past Paper Homework Questions

1. A battery of e.m.f. 12 V and internal resistance 3·0 Ω is connected in a circuit as shown.



When switch **S** is closed the ammeter reading changes from

A 2·0 A to 1·0 A

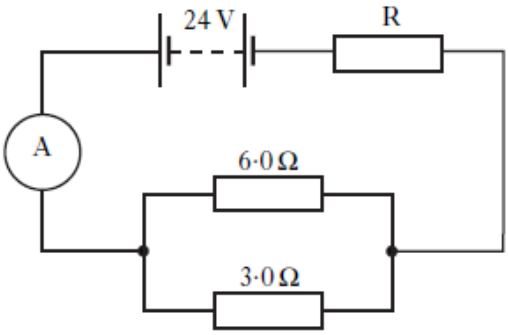
B 2·0 A to 2·4 A

C 2·0 A to 10 A

D 4·0 A to 1·3 A

E 4·0 A to 6·0 A.

2. A battery of e.m.f. 24 V and negligible internal resistance is connected as shown.



The reading on the ammeter is 2·0 A.

The resistance of R is

A 3·0 Ω

B 4·0 Ω

C 10 Ω

D 12 Ω

E 18 Ω.

3. The e.m.f. of a battery is

A the total energy supplied by the battery

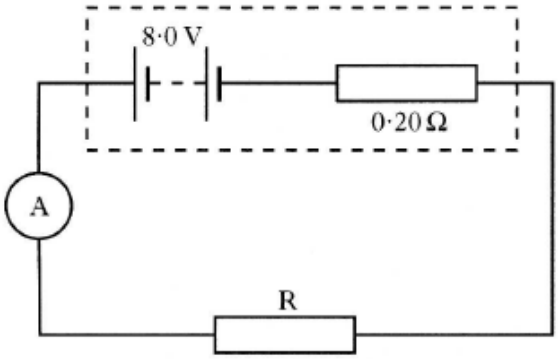
B the voltage lost due to the internal resistance of the battery

C the total charge which passes through the battery

D the number of coulombs of charge passing through the battery per second

E the energy supplied to each coulomb of charge passing through the battery.

4. In the following circuit, the battery has an e.m.f. of 8·0 V and an internal resistance of 0·20 Ω.



The reading on the ammeter is 4·0 A.

The resistance of R is

A 0·5 Ω

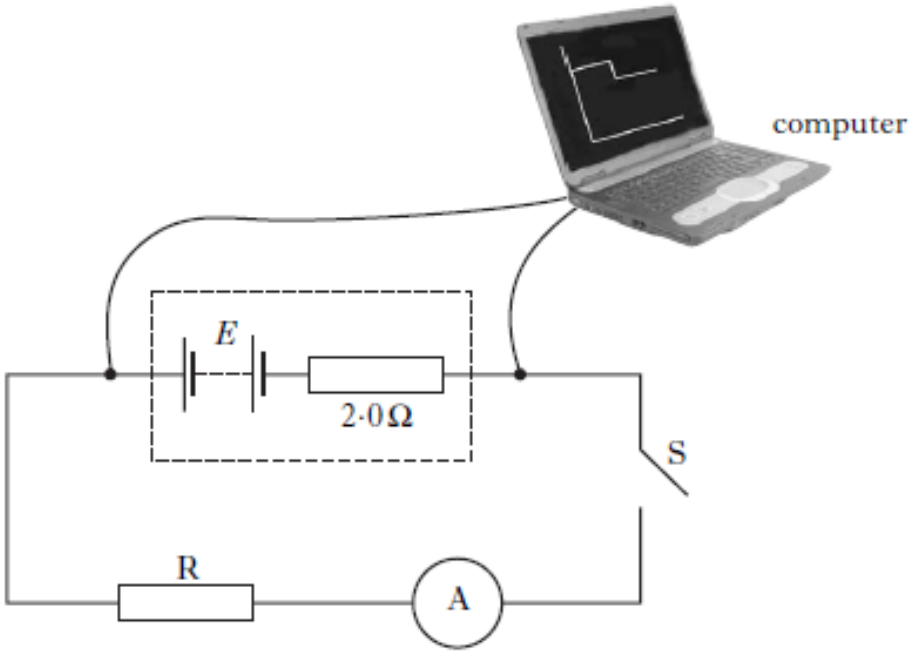
B 1·8 Ω

C 2·0 Ω

D 2·2 Ω

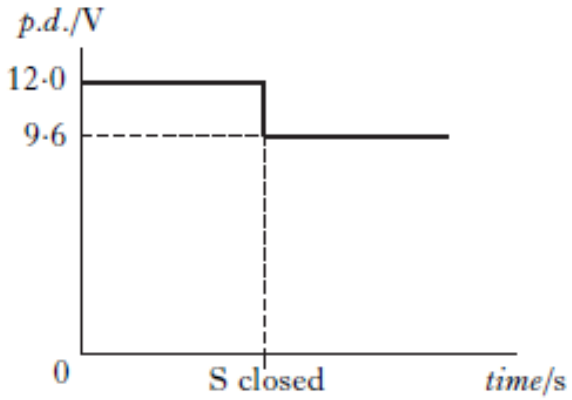
E 6·4 Ω.

5. A power supply of e.m.f. E and internal resistance $2{\cdot}0\,\Omega$ is connected as shown.



The computer connected to the apparatus displays a graph of potential difference against time.

The graph shows the potential difference across the terminals of the power supply for a short time before and after switch S is closed.



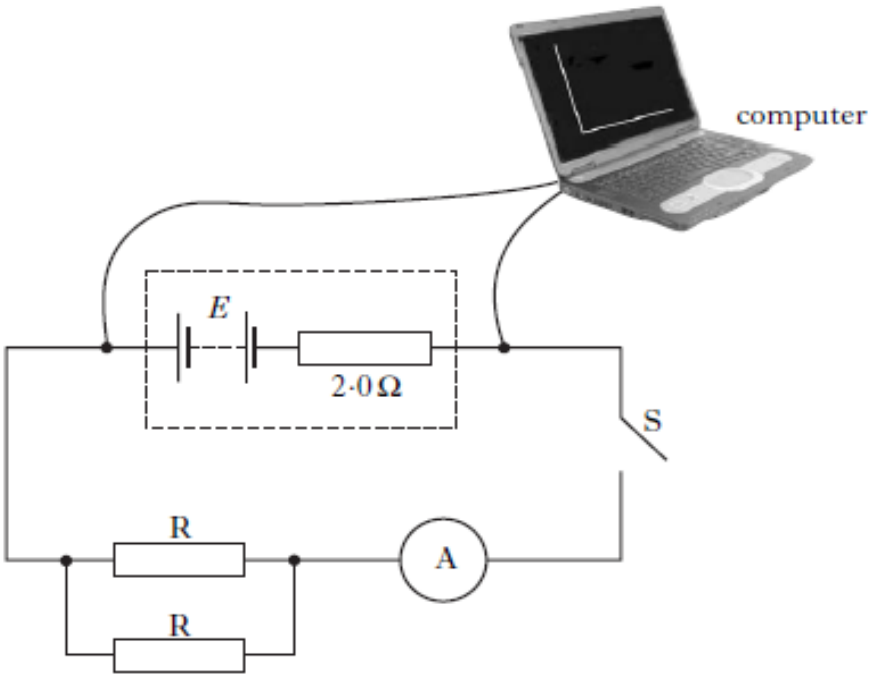
(*a*) State the e.m.f. of the power supply. **1**

(*b*) Calculate:

(i) the reading on the ammeter after switch S is closed; **2**

(ii) the resistance of resistor R. **1**

(*c*) Switch S is opened. A second identical resistor is now connected in parallel with R as shown.



The computer is again connected in order to display a graph of potential difference against time.

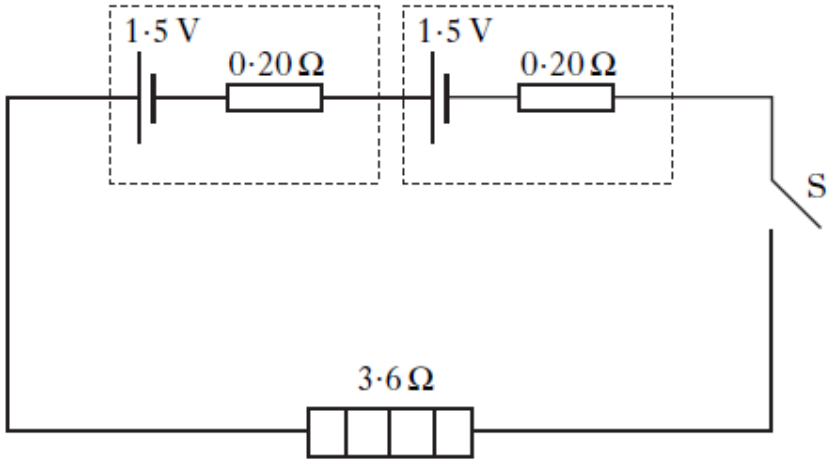
Copy and complete the new graph of potential difference against time showing the values of potential difference before and after switch S is closed. **2**

(6)

6. Electrically heated gloves are used by skiers and climbers to provide extra warmth.

(*a*) Each glove has a heating element of resistance 3·6 Ω.

Two cells, each of e.m.f. 1·5 V and internal resistance 0·20 Ω, are used to operate the heating element.



heating element

Switch S is closed.

(i) Determine the value of the total circuit resistance. **1**

(ii) Calculate the current in the heating element. **2**

(iii) Calculate the power output of the heating element. **2**

(*b*) When in use, the internal resistance of each cell gradually increases.

What effect, if any, does this have on the power output of the heating element?

Justify your answer. **2**

(7)

7. (*a*) A supply of e.m.f. 10·0 V and internal resistance *r* is connected in a circuit as shown in Figure 1.

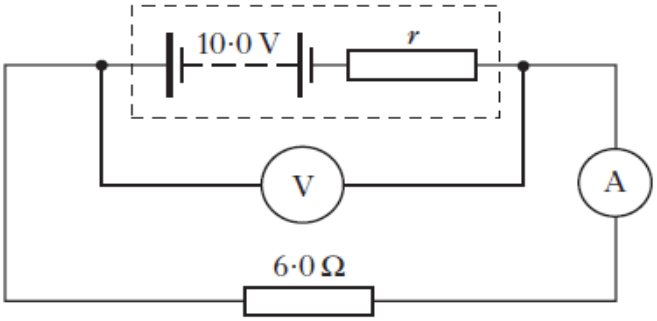


Figure 1

The meters display the following readings.

Reading on ammeter = 1·25 A

Reading on voltmeter = 7·50 V

(i) What is meant by an *e.m.f. of 10·0 V*? **1**

(ii) Show that the internal resistance, *r*, of the supply is 2·0 Ω. **1**

(*b*) A resistor R is connected to the circuit as shown in Figure 2.

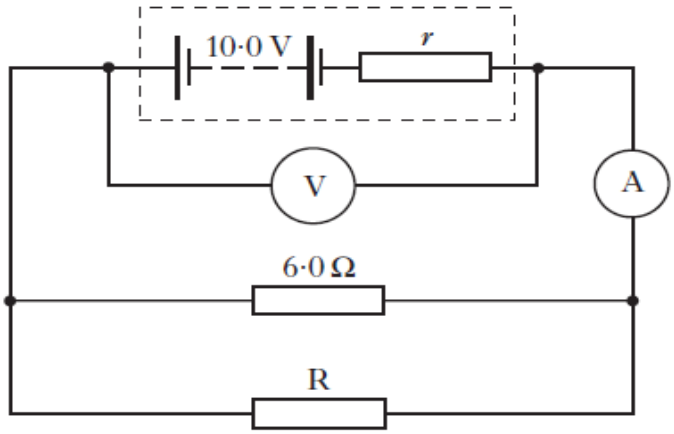


Figure 2

The meters now display the following readings.

Reading on ammeter = 2·0 A

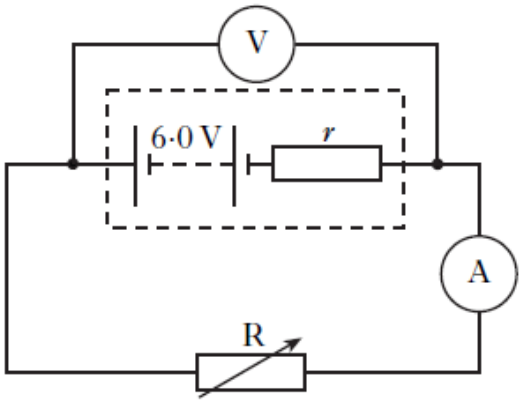
Reading on voltmeter = 6·0 V

(i) Explain why the reading on the voltmeter has decreased. **2**

(ii) Calculate the resistance of resistor R. **3**

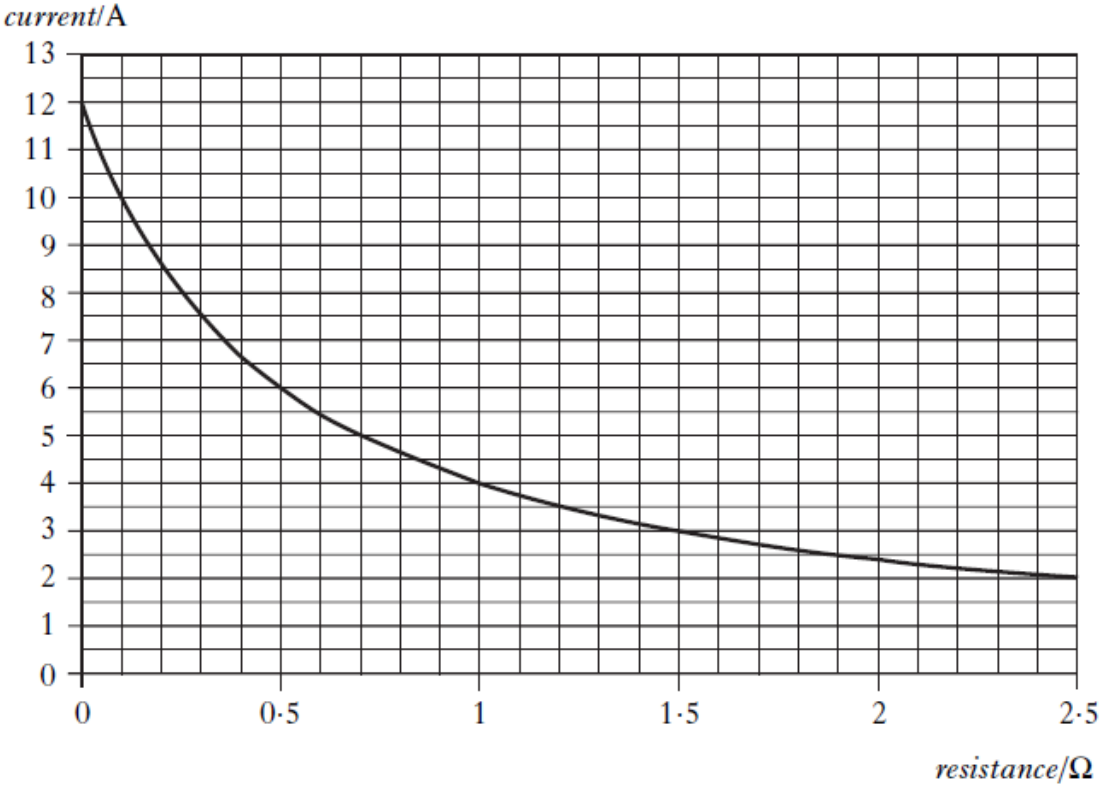
(7)

8. A battery of e.m.f. 6·0 V and internal resistance, r, is connected to a variable resistor R as shown.



The graph shows how the current in the circuit changes as the resistance of R increases.

The graph shows how the current in the circuit changes as the resistance of R increases.



(*a*) Use information from the graph to calculate:

(i) the lost volts in the circuit when the resistance of R is 1·5 Ω; **2**

(ii) the internal resistance, r, of the battery. **2**

(*b*) The resistance of R is now increased.

What effect, if any, does this have on the lost volts?

You must justify your answer. **2**

30 marks