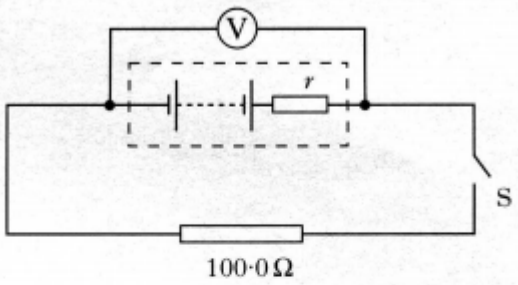
Exercise 12 - Emf and Internal Resistance

Past Paper Homework Questions

1. A pupil sets up the following circuit to measure the internal resistance r of a battery.



The reading on the voltmeter is 12·0 V when switch S is open. The reading drops to 10·0 V when switch S is closed.

The internal resistance of the battery is

A 0·00 Ω

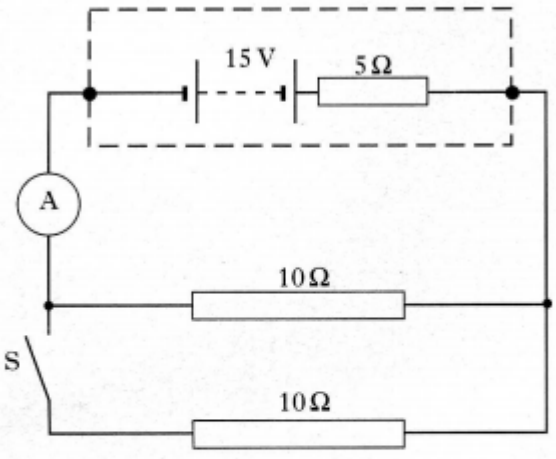
B 0·05 Ω

C 16·7 Ω

D 20·0 Ω

E 100·0 Ω.

2. A battery, of e.m.f. 15 V and internal resistance 5 Ω, is connected to two 10 Ω resistors as shown. Switch S is initially open.



When switch S is closed, the reading on the ammeter changes

A from 1 A to 2 A

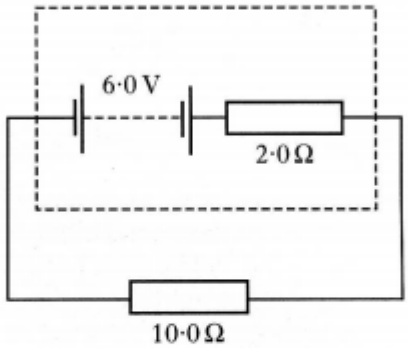
B from 1·5 A to 3 A

C from 1 A to 1·5 A

D from 1·5 A to 0·75 A

E from 1 A to 0·6 A.

3. A battery has an e.m.f. of 6·0 V and an internal resistance of 2·0 Ω. It is connected to a 10·0 Ω resistor, as shown below.



The p.d. across the 10·0 Ω resistor is

A 1·0 V

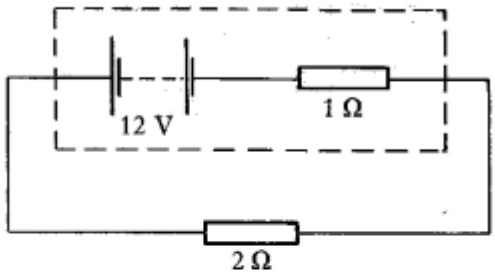
B 1·2 V

C 4·8 V

D 5·0 V

E 6·0 V.

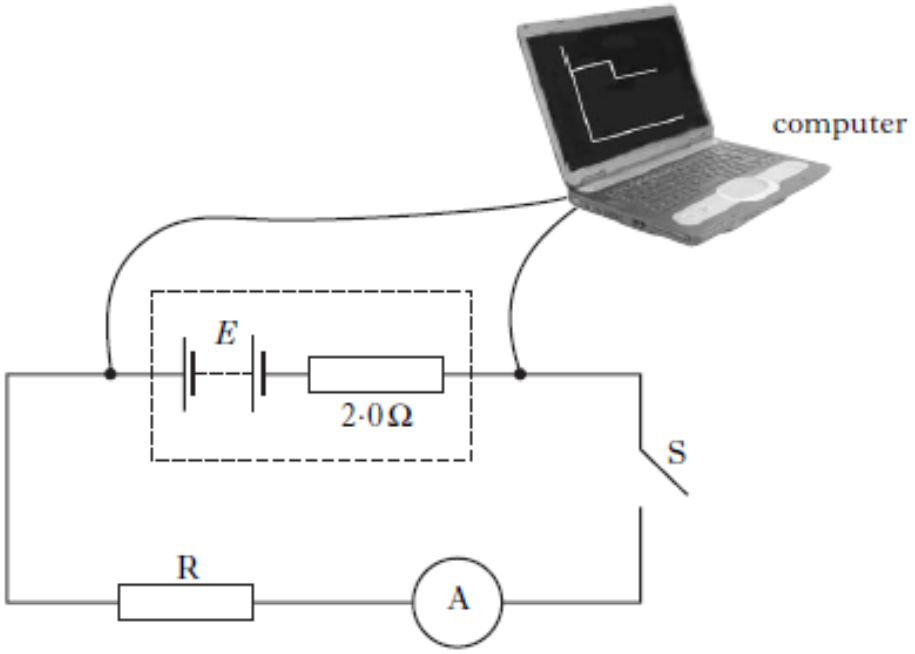
4. A battery of e.m.f. 12 V and internal resistance 1 Ω is connected across a 2 Ω resistor, as shown in the circuit below.



Which row in the following table shows the correct values for current, terminal potential difference and lost volts in this circuit?

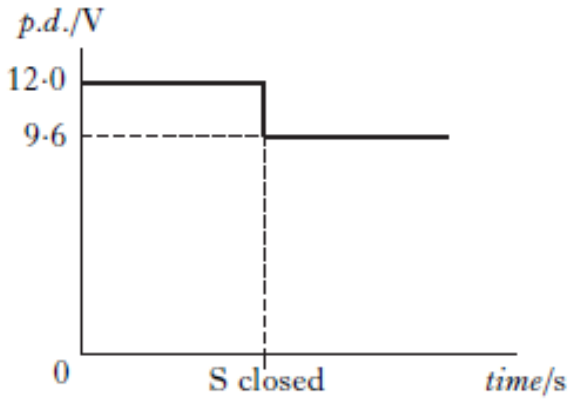
	Current/A	*t.p.d./V*	*lost volts/V*
A	4	4	8
B	4	8	4
C	6	4	8
D	6	8	4
E	12	8	4

5. A power supply of e.m.f. E and internal resistance 2·0 Ω 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**

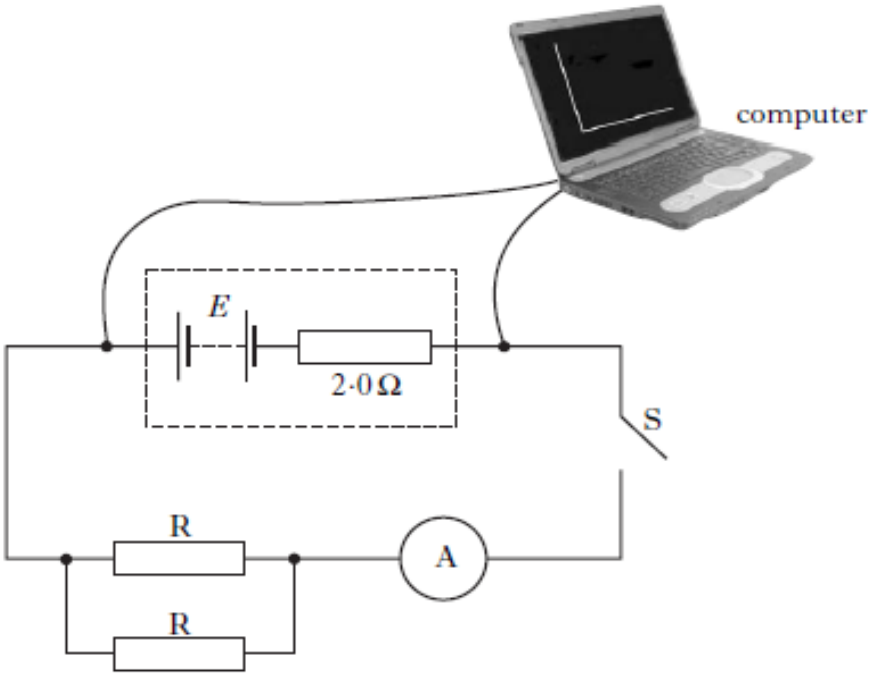
(*b*) Calculate:

(i) the reading on the ammeter after switch S is closed; **3**

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

5. (cont.)

(*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.

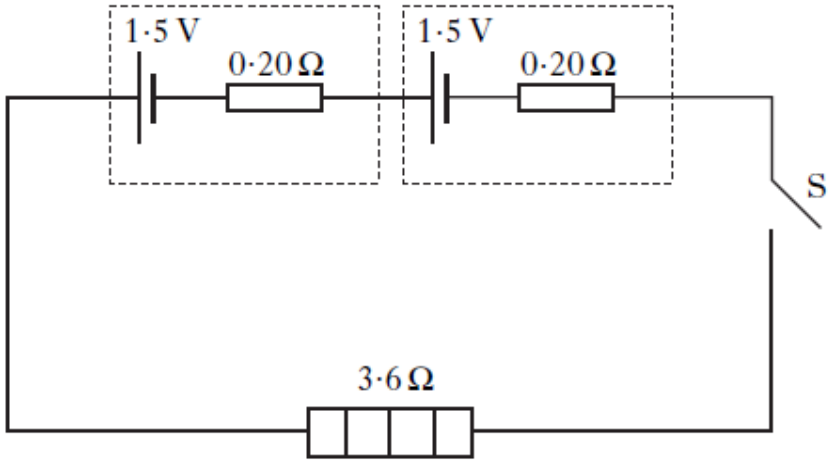
3

(8)

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. **3**

(iii) Calculate the power output of the heating element. **3**

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

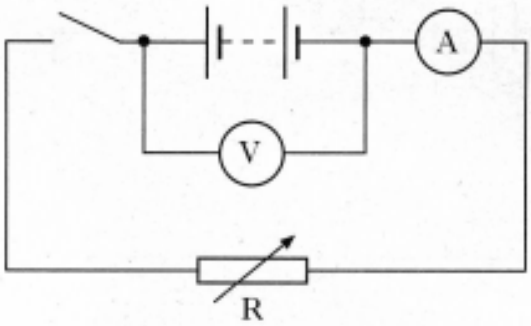
What effect, if any, does this have on the power output of the heating element?

Justify your answer. **4**

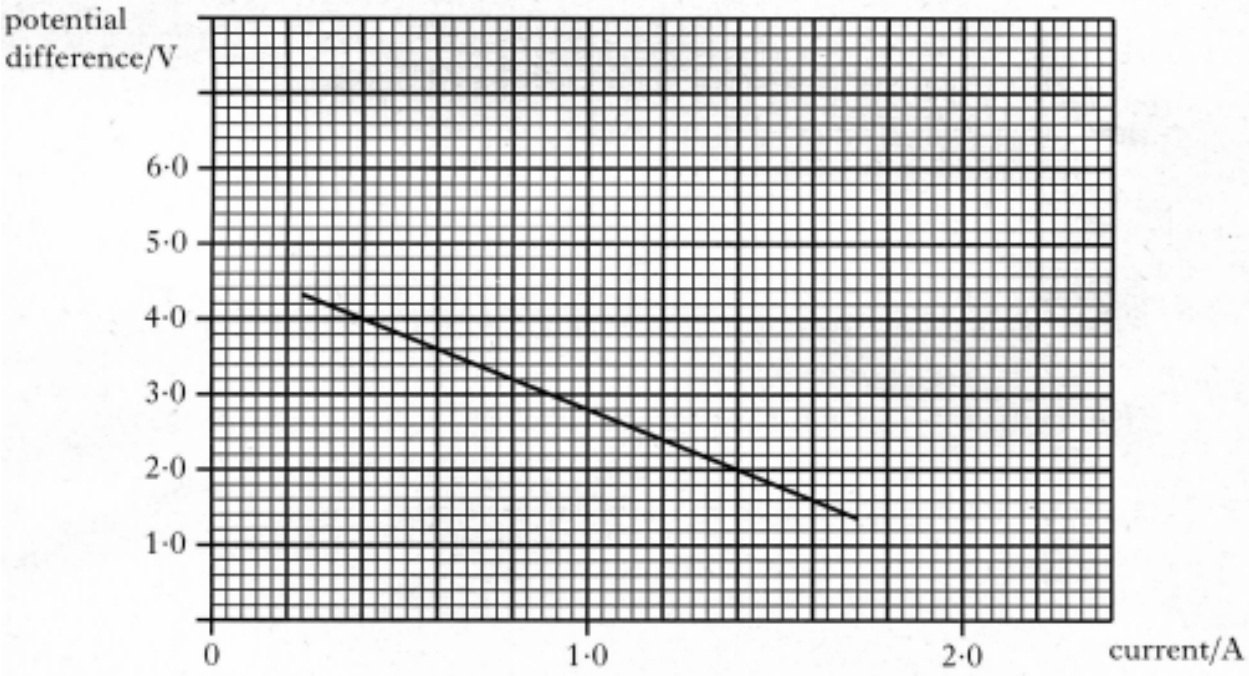
(11)

Marks

7. (*a*) The following circuit is used to measure the e.m.f. and the internal resistance of a battery.



Readings of current and potential difference from this circuit are used to produce the following graph.



Use information from the graph to find:

(i) the e.m.f. of the battery, in volts; **1**

(ii) the internal resistance of the battery. **3**

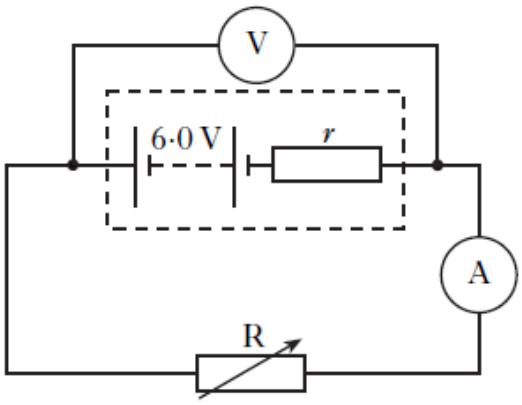
(*b*) A car battery has an e.m.f. of 12 V and an internal resistance of 0·050 Ω.

(i) Calculate the short circuit current for this battery. **3**

(ii) The battery is now connected in series with a lamp. The resistance of the lamp is 2·5 Ω. Calculate the power dissipated in the lamp. **4**

(11)

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.

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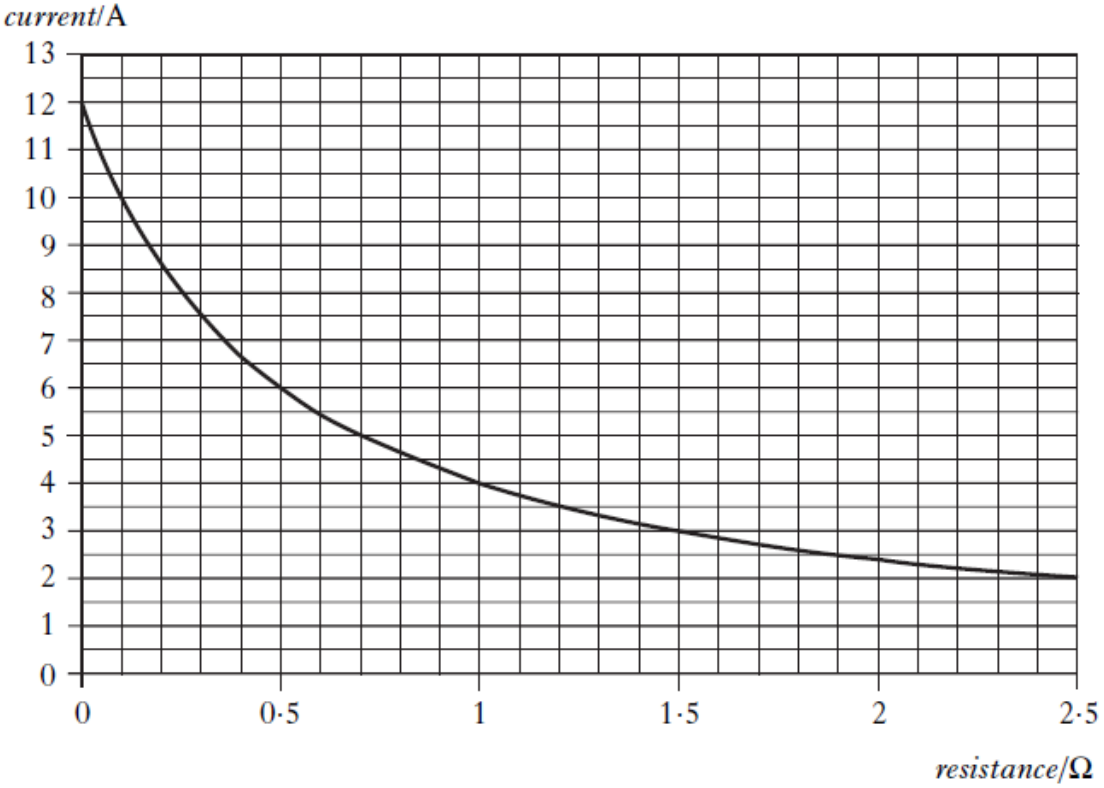

(*a*) Use information from the graph to calculate:

the lost volts in the circuit when the resistance of R is 1·5 Ω; **4**

(*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**

40 marks