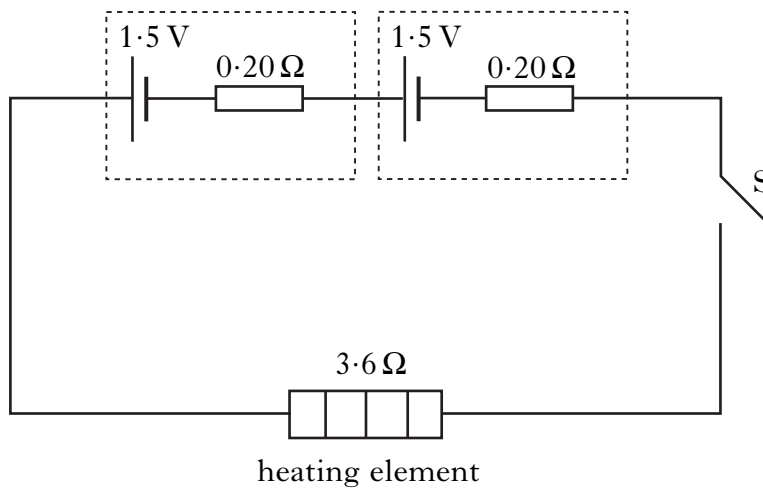*Marks*

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

   (*a*) Each glove has a heating element of resistance $3{\cdot}6\,\Omega$.

   Two cells, each of e.m.f. $1{\cdot}5\,V$ and internal resistance $0{\cdot}20\,\Omega$, are used to operate the heating element.
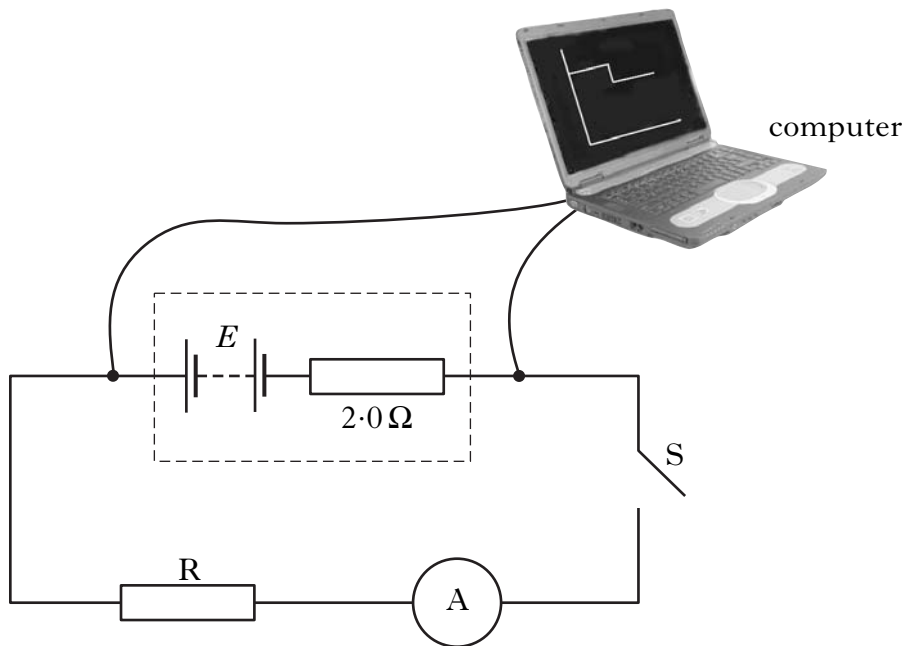

   Switch S is closed.

   (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?
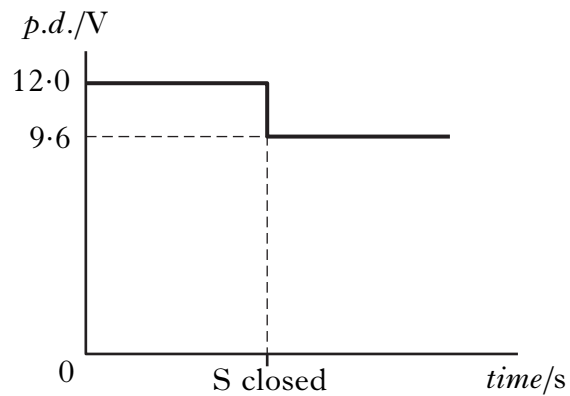
   Justify your answer.   **2**

   (7)

[Turn over

Marks

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

computer

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.
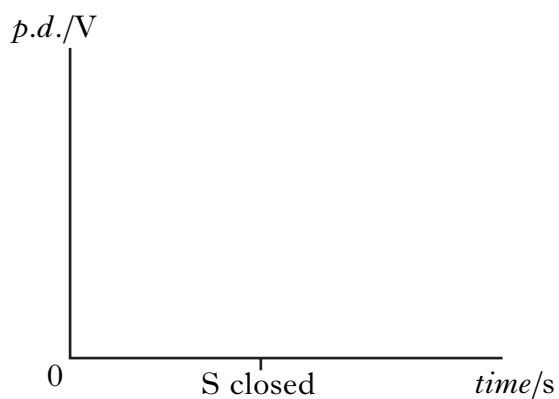

(*a*) State the e.m.f. of the power supply.   **1**

(*b*) Calculate:

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

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

25. (continued)

(*c*) Switch S is opened. A second identical resistor is now connected in parallel with R as shown.
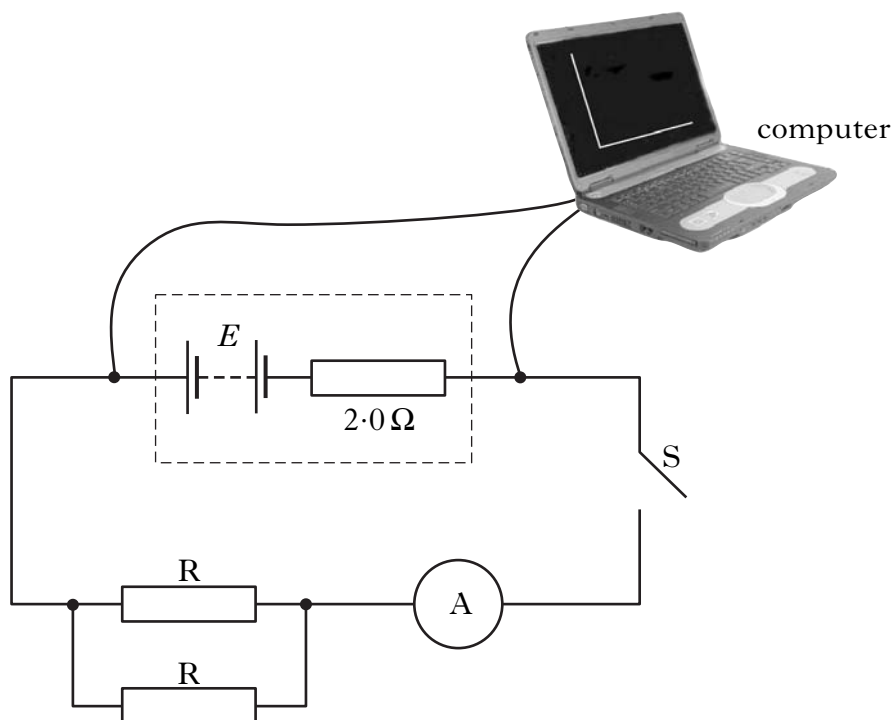
The computer is again connected in order to display a graph of potential difference against time.

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)

[Turn over