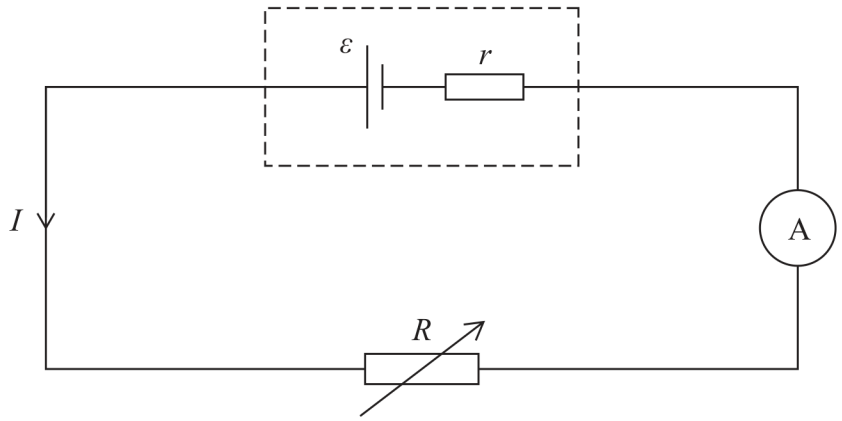
17 A student set up the circuit shown to determine the e.m.f. ε and internal resistance r of a cell.

I is the current in the circuit and R is the resistance of the variable resistor.

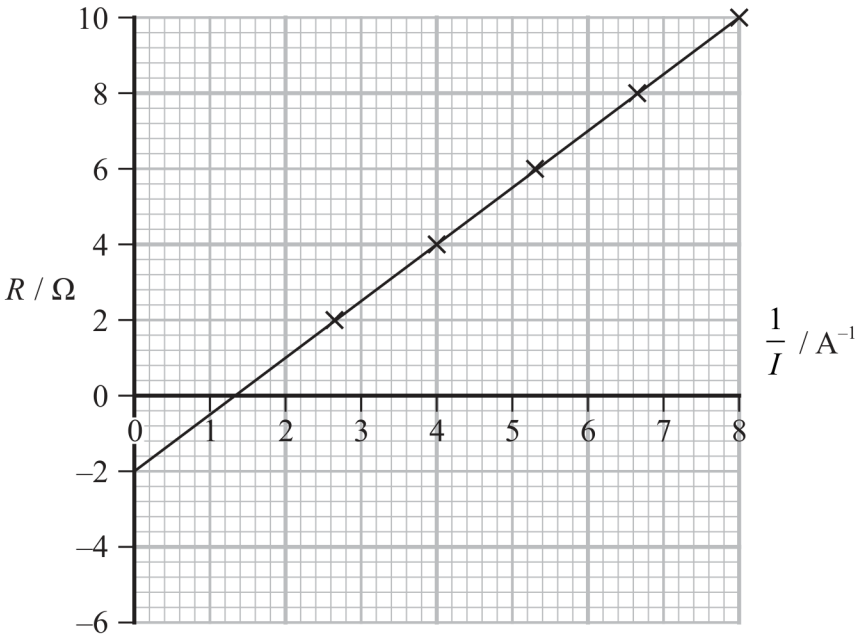


(a) Show that, for this circuit, $R = \frac{\varepsilon}{I} - r$

(2)

(b) The student varied R and measured corresponding values of I.

The student then plotted a graph of R against $\frac{1}{I}$, as shown.



Determine values of ε and r for the cell.

(3)

ε = ...

r = ...

(c) The student suggested that the power dissipated by the internal resistance r decreases as R increases.

Comment on the student's suggestion.

No further calculations are required.

(3)

(d) The student added a second, identical cell in series with the first cell and repeated the experiment.

Add a line to the graph to show the result of this experiment.

(3)

(Total for Question 17 = 11 marks)