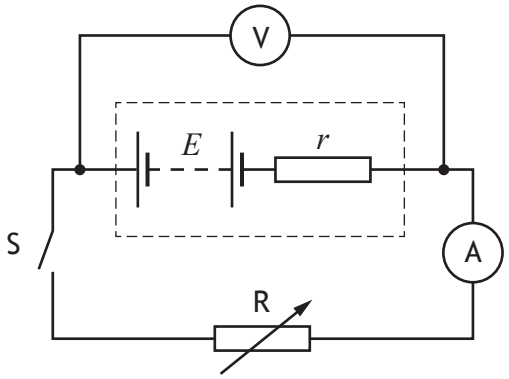
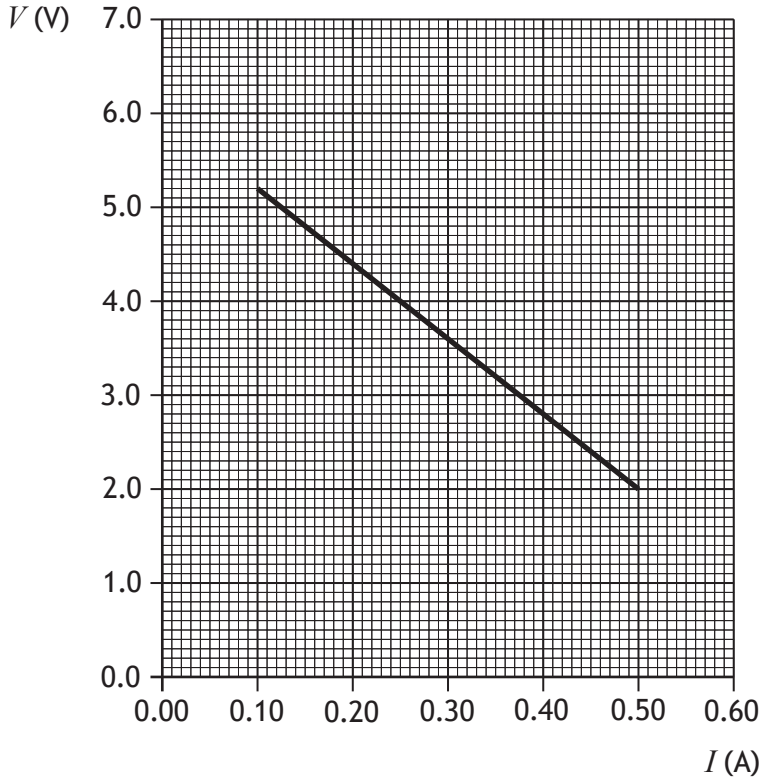
12. A student uses the following circuit to investigate the internal resistance r and EMF E of a battery.



Switch S is closed.

The student uses readings of current I and terminal potential difference V from this circuit to produce the graph shown.



(a) State what is meant by the term *electromotive force* (*EMF*). **1**

12. (continued)

(b) Using information from the graph, determine:

(i) the EMF E of the battery **1**

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

Space for working and answer

(c) Using the circuit shown, describe how the student could **measure** the value of the EMF. **1**

(d) Explain why the terminal potential difference of the battery decreases as the resistance of the variable resistor R is decreased. **2**

12. (continued)

(e) The student now repeats the experiment with a different battery that has a smaller EMF and the same internal resistance.

On the graph below, add a line to show how the results of this experiment compare with the original experiment. **2**

(An additional graph, if required, can be found on *page 49*.)