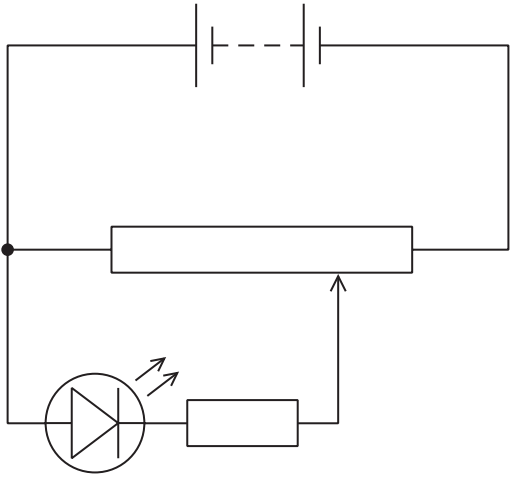


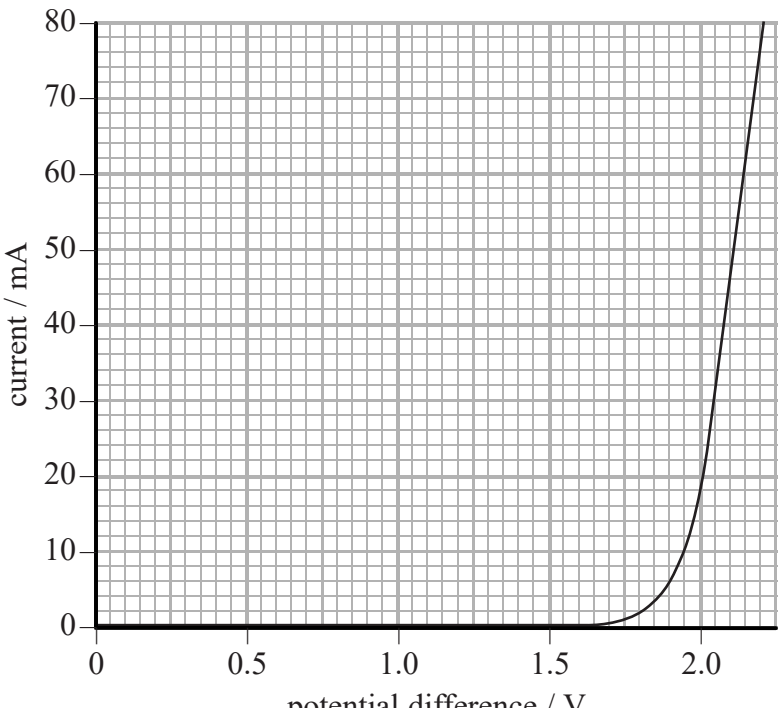
A student wanted to plot a graph of current against potential difference for a light emitting diode (LED). He used the circuit shown.



(a) Add an ammeter and a voltmeter to the circuit diagram that would enable the data to be collected.

(1)

(b) The graph of current against potential difference obtained by the student is shown.



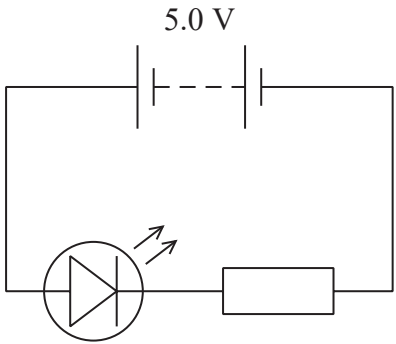
(i) The student wrote the following conclusion.

"The graph shows that in general the LED is not an ohmic conductor. However, for potential differences greater than +2 V, Ohm's law is obeyed since the graph is linear in this region."

Criticise the student's conclusion.

(2)

(ii) The student used the LED with a 5.0 V power supply as shown in the circuit.



To be lit to normal brightness the current through the LED must be 18 mA.
Calculate the resistance of the resistor needed in the circuit.

(4)

Resistance =

(Total for Question 8 = 7 marks)