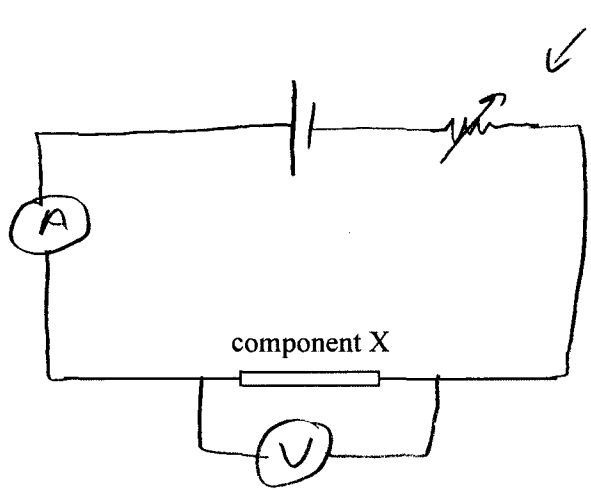
B3. This question is in **three** parts. **Part 1** is about electrical components. **Part 2** is about magnetic forces and **Part 3** is about electromagnetic induction.

Part 1 Electrical components

(a) In the space below, draw a circuit diagram that could be used to determine the current-voltage *(I-V)* characteristics of an electrical component X. *[2]*



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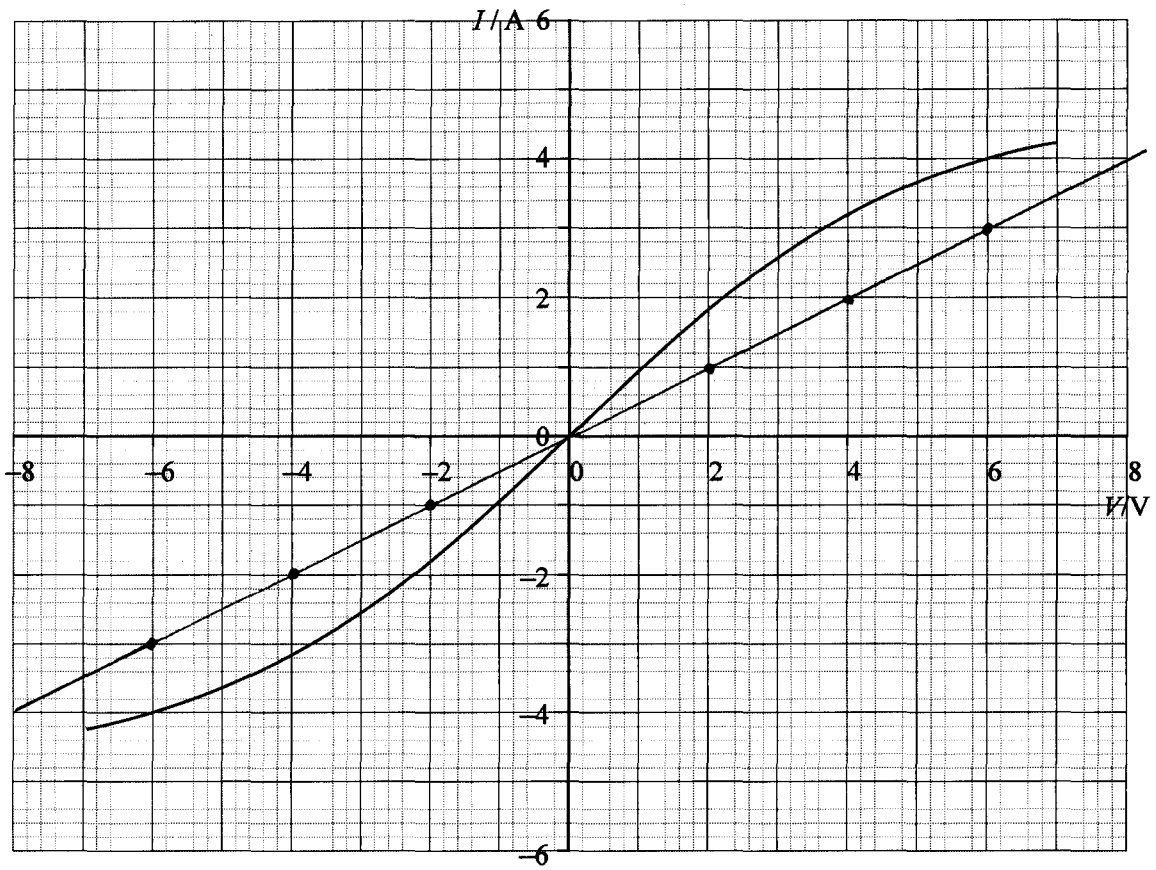
(Question B3, part 1 continued)

The graph below shows the *I-V* characteristics for the component X.



The component X is now connected across the terminals of a battery of e.m.f. 6.0 V and negligible internal resistance.

(b) Use the graph to determine

(i) the current in component X. *[1]*

4 A

(ii) the resistance of component X. *[2]*

$R = \frac{V}{I} = \frac{6}{4} = 1.5\ \Omega$

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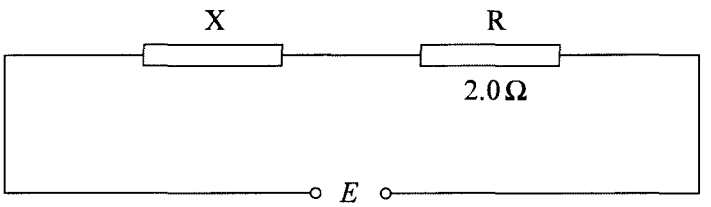
(Question B3, part 1 continued)

A resistor R of constant resistance 2.0 Ω is now connected in series with component X as shown below.



(c) (i) On the graph opposite, draw the *I-V* characteristics for the resistor R. *[2]*

(ii) Determine the total potential difference *E* that must be applied across component X and across resistor R such that the current through X and R is 3.0 A. *[2]*

R : 6V $V = IR = 3(2)$

X : 3.7V $V = 9.7\,V$

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