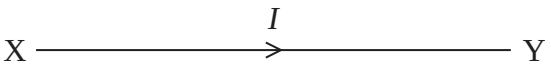
12 An electrical conductor XY carries a current I as shown.



The current density j is defined as $j = \frac{I}{A}$ where A is the cross-sectional area of the conductor.

(a) Current density is a vector quantity.

State what is meant by a vector quantity.

(1)

(b) I is constant but A decreases towards end Y.

Explain how this affects the drift velocity of the free electrons in the conductor.

(2)

(c) The resistivity ρ of the conducting material is given by $\rho = \frac{E}{j}$

where E is the electric field strength.

Show that the units are the same on both sides of this equation.

(4)

(Total for Question 12 = 7 marks)