

- 5 A long straight horizontal wire is held in place by two clamps. The wire carries a current, as shown in Fig. 5.1.

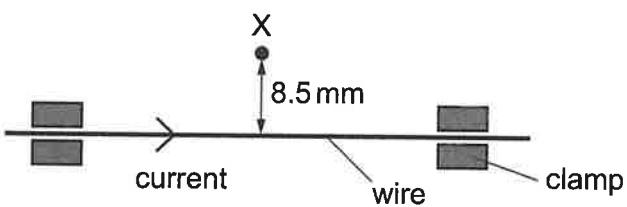


Fig. 5.1

Point X is at a distance of 8.5 mm from the wire.

The magnetic flux density at X due to current in the wire is  $2.8 \times 10^{-4} \text{ T}$ .

- (a) Calculate the current in the wire.

current = ..... A [1]





- (b) A long straight horizontal rod is placed parallel to and above the wire. The rod rests on supports that are uniformly spaced along its length.

The rod and the wire are in the same vertical plane and are separated by a distance of 8.5 mm, as shown in Fig. 5.2.

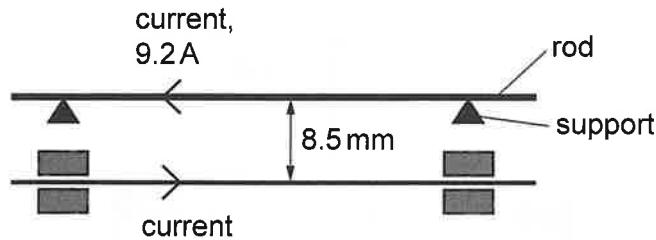


Fig. 5.2

A current of 9.2A in the rod is switched on in the direction shown.

- (i) Calculate the magnetic force per unit length acting on the rod after the current is switched on. Include the unit with your answer.

$$\text{force per unit length} = \dots \text{unit} \dots [2]$$

- (ii) The mass per unit length of the rod is  $63\text{ g m}^{-1}$ .

Determine the percentage change in the force exerted by each support on the rod when the current is switched on. Show your working.

$$\text{percentage change} = \dots \% [2]$$

- (iii) Explain whether the change in (b)(ii) is an increase or a decrease.

.....  
.....  
..... [1]





- (iv) The rod is now rotated so that it remains above the wire and is perpendicular to the wire, as shown in Fig. 5.3.

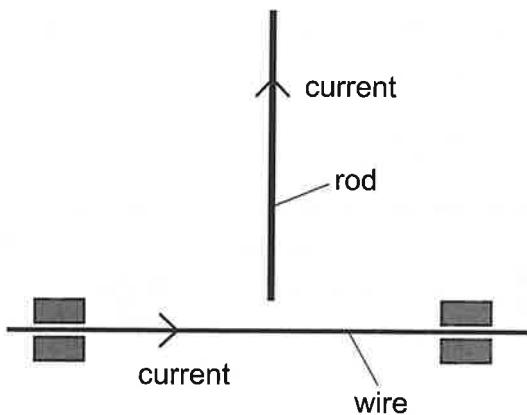


Fig. 5.3

The rod and the wire remain in the same vertical plane.

- 1 State and explain the direction of the force acting on the rod due to the current in the wire.

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.....  
.....  
.....  
.....

[2]

- 2 Describe how the magnetic force per unit length acting on the rod varies with distance from the wire.

.....  
.....  
.....

[1]

[Total: 9]

