6 **(a)** Define the *tesla*.

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.....

[2]

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(b) Fig. 6.1 shows a uniform metal rod resting on a smooth metal circular rail guide of negligible resistance and the rod is able to move freely along the rail guide. A uniform magnetic field of flux density 0.56 T is applied into the paper. A light carbon brush is placed in contact with the centre of the metal rod. The carbon brush and rail guide are connected to a d.c. supply as shown in Fig. 6.2.

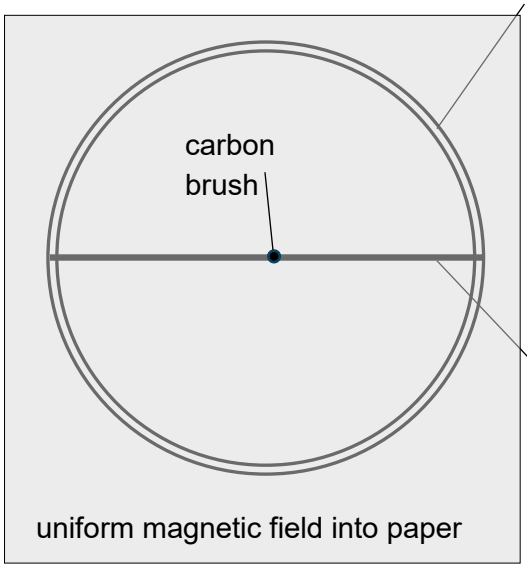

Fig. 6.1 (Top view)

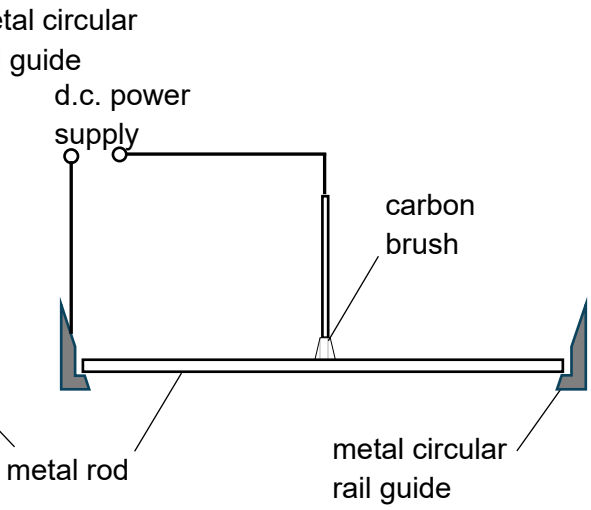

Fig. 6.2 (cross-sectional view)

(i) A current is passed through the circular rail guide and carbon brush such that the rod rotates in a clockwise direction as viewed from the top. On Fig. 6.2, draw arrows to show the direction of the current flow in the carbon brush and metal rod.

[1]

(ii) With reference to Fig. 6.1, explain why the rod rotates in a clockwise direction.

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[3]

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(iii) The current flowing through the brush is 3.0 A. Calculate the force per unit length that is acting on the rod.

force per unit length = ... N m^{-1} [2]

(iv) Explain why when the magnetic field is gradually rotated about the horizontal axis beyond a certain angle, the rod stops rotating.

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[1]

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