

1 A metal wheel consists of an axle A, eight spokes and a rim, as shown in Fig. 1.1.

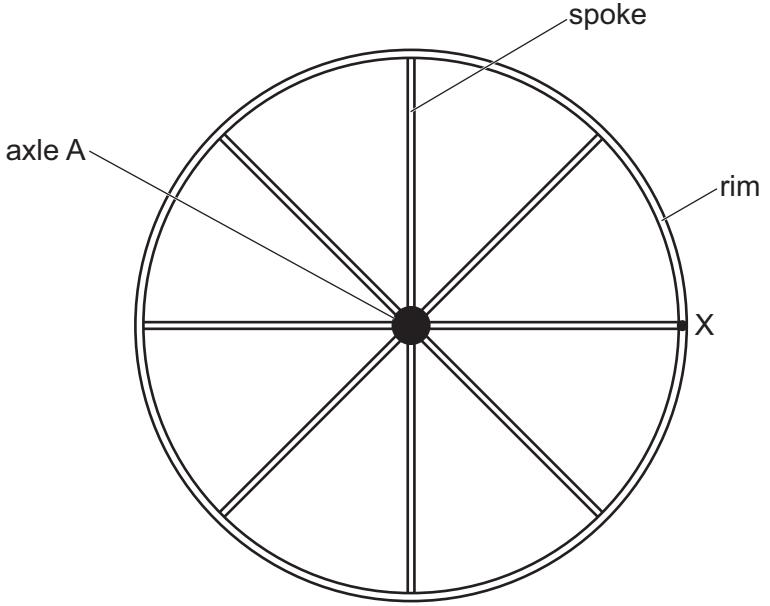


Fig. 1.1

Point X is on the rim at the end of one of the spokes.

The rim has a radius of 0.85 m.

The wheel is rotating clockwise with an angular speed of 140 rad s^{-1} .

(a) For point X, determine:

(i) the speed

$$\text{speed} = \dots \text{ ms}^{-1} [2]$$

(ii) the centripetal acceleration.

$$\text{acceleration} = \dots \text{ ms}^{-2} [2]$$





- (b) There is a uniform magnetic field of flux density 0.18 T into the plane of the page.

- (i) State Lenz's law of electromagnetic induction.

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[2]

- (ii) Show that the time taken for point X to complete one revolution is 45 ms.

[1]

- (iii) Calculate the magnetic flux cut by spoke AX during one revolution of the wheel.
Give a unit with your answer.

magnetic flux = unit [3]

- (iv) Determine the magnitude of the electromotive force (e.m.f.) induced across spoke AX.

induced e.m.f. = V [2]

- (v) Use Lenz's law to explain whether the potential is higher at end A or end X of the spoke.

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[1]