

7 (a) State Faraday's law of electromagnetic induction.

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 [2]

(b) An aircraft is flying horizontally at constant speed v through the Earth's magnetic field, as shown in Fig. 7.1.

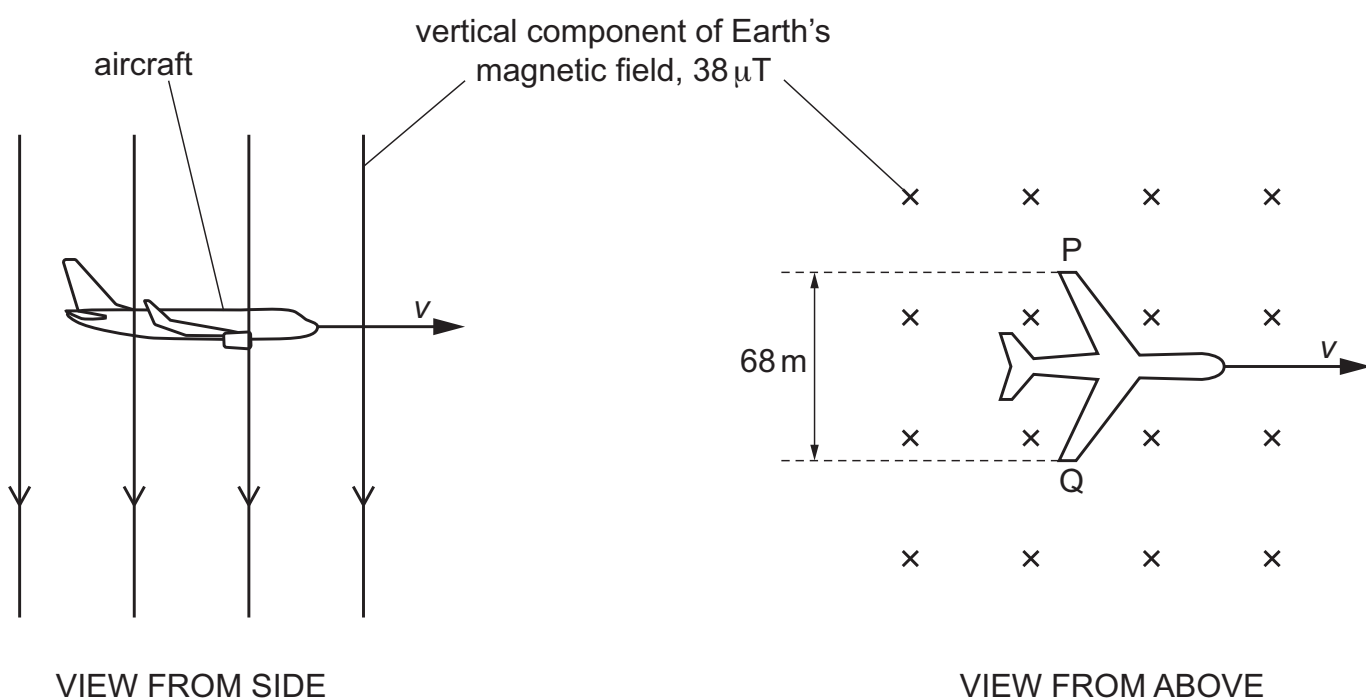


Fig. 7.1

At the location of the aircraft, the vertical component of the Earth's magnetic field is $38\mu\text{T}$ towards the ground.

The distance between the wingtips P and Q of the aircraft is 68 m.

As the aircraft moves through the magnetic field, an electromotive force (e.m.f.) of 0.54 V is induced between the wingtips P and Q.

(i) Calculate the magnetic flux cut by the wings of the aircraft in a time of 15 s. Give a unit with your answer.

magnetic flux = unit [2]

(ii) Determine the area of flux cut by the wings in a time of 15 s.

area = m^2 [2]

(iii) Use your answer in (b)(ii) to determine the speed v of the aircraft.

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

(iv) Use Lenz's law of electromagnetic induction to explain which of the wingtips P and Q is at the higher induced potential.

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 [3]