InkPhysics

QUESTION WORKBOOK

Electromagnetic induction: Faraday and Lenz

Magnetic fields · Year 13

AQA 3.7.5.4 · CIE 20.5 · OCR A 6.3.3

10 questions · 30 marks

PRINT EDITION

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SECTION A · Warm-up

A1 State Faraday's law of electromagnetic induction. [2]

A2 The flux linkage through a coil changes by 0.60 Wb-turns in 0.20 s. Calculate the magnitude of the induced emf. [2]

A3 State Lenz's law. [2]

SECTION B · Standard

B1 A straight rod of length 0.30 m moves at 4.0 m s^{-1} perpendicular to a 0.25 T field. Calculate the emf induced across it, using emf = Blv. [3]

B2 A coil of 200 turns and area 0.01 m^2 is in a field that falls from 0.50 T to 0.10 T in 0.40 s. Calculate the average induced emf. [4]

B3 The flux linkage of a coil collapses from 0.80 Wb-turns to zero in 0.010 s. Calculate the magnitude of the induced emf. [3]

B4 Explain how Lenz's law follows from the principle of conservation of energy. [3]

SECTION C · Stretch

C1 A coil of 100 turns and area 0.02 m^2 rotates in a 0.30 T field at a frequency of 50 Hz. Calculate the peak emf induced (peak emf = NBAω). [4]

C2 A rod of length 0.20 m slides at 3.0 m s^{-1} along rails in a 0.40 T field, connected to a 2.0 Ω resistor. Calculate (a) the induced emf, (b) the current and (c) the force needed to keep the rod moving at constant speed. [4]

C3 A bar magnet is dropped north-pole-first through a coil connected to a meter. Use Lenz's law to describe the induced current as the magnet enters the coil. [3]