Electromagnetic Induction and Alternating Currents

Fields · 4 questions · step-by-step answers at the end

Name: Date: Score: / 4

USEFUL EQUATIONS

$\Phi = BA\cos\theta$ $\varepsilon = -\Delta(N\Phi)/\Delta t$ $\varepsilon = BLv$ $V_{rms} = V_0/\sqrt{2}$ $N_s/N_p = V_s/V_p$

Questions

Show your working in the space under each question.

1. Mains electricity has an r.m.s. voltage of 230 V. What is the peak voltage?

2. A 200-turn coil of area 4.0×10^{-4} m² lies at right angles to a field that falls from 0.50 T to zero in 0.10 s. Find the induced e.m.f.

3. An aircraft with a 30 m wingspan flies at 250 m s^{-1} through a vertical field component of 4.0×10^{-5} T. Find the e.m.f. between the wing tips.

4. Why is a transformer core made of thin insulated sheets?

Step-by-step answers

Electromagnetic Induction and Alternating Currents

1. $V_0 = 230 \times \sqrt{2} =$ **325 V**.

2. 1. Initial flux linkage = NBA = $200 \times 0.50 \times 4.0 \times 10^{-4} = 0.040$ Wb.
2. $\varepsilon = \Delta(N\Phi)/\Delta t = 0.040/0.10$.
3. $\varepsilon =$ **0.40 V**.
Answer: 0.40 V

3. $\varepsilon = BLv = 4.0 \times 10^{-5} \times 30 \times 250 =$ **0.30 V**.

4. Laminations **reduce eddy currents**, and so the energy wasted heating the core.