InkPhysics

ANSWER BOOK

Transformers

Magnetic fields · Year 13

AQA 3.7.5.6 · OCR A 6.3.3

10 questions · 30 marks

NAVY EDITION

© 2026 InkPhysics. All rights reserved.
inkphysics.co.uk

SECTION A · Warm-up

A1 An alternating current in the primary produces a continually changing magnetic flux in the iron core. This changing flux passes through the secondary coil and, by Faraday's law, induces an alternating emf in it, transferring energy without any electrical connection. [2]

A2 $V_s = V_p \times N_s/N_p = 230 \times 100/1000 = 23$ V. [2]

A3 Step-down (the secondary voltage is lower than the primary voltage). [2]

SECTION B · Standard

B1 $N_s = N_p \times V_s/V_p = 2000 \times 12/240 = 100$ turns. [3]

B2 Power $= V_pI_p = 230 \times 2.0 = 460$ W. For an ideal transformer $V_sI_s = V_pI_p$, so $I_s = 460/23 = 20$ A. [4]

B3 Efficiency = output/input = 450/500 = 0.90, i.e. 90%. [3]

B4 For an ideal transformer $V_pI_p = V_sI_s$, so $I_p = V_sI_s/V_p = (1150 \times 0.40)/230 = 2.0$ A. [3]

SECTION C · Stretch

C1 (a) $I = P/V = 100000/10000 = 10$ A, so loss $= I^2R = 10^2 \times 5.0 = 500$ W. (b) $I = 100000/100000 = 1$ A, so loss $= 1^2 \times 5.0 = 5$ W. Higher voltage means lower current and far smaller losses. [4]

C2 Input power $= 230 \times 5.0 = 1150$ W. Output power $= 0.96 \times 1150 = 1104$ W. Secondary current = output/V_s = 1104/46 = 24 A. [4]

C3 Transmitting a given power at a higher voltage means a smaller current ($P = VI$). Since the power wasted in the cables is I^2R, reducing the current greatly reduces these heating losses, making transmission far more efficient. [3]

© 2026 InkPhysics. All rights reserved.