

Magnets, motors, generators and transformers

Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab answers

Model answers use the sample table. Your own values may differ by a few per cent, but the straight line through the origin and a gradient slightly below the ideal ratio of 2.0 are what a good set of results should show.

Level: Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS2-5, GCSE P7

Question 1 Planning the readings

Changed: **the primary voltage V_p** . Measured: **the secondary voltage V_s** . Constant: the numbers of turns (200 and 400), the same iron core and the supply frequency.

Question 2 Predicted value

$V_s = V_p \times N_s \div N_p = 6.0 \times 400 \div 200 = 12.0$ V. Measured 11.5 V. Difference = $(12.0 - 11.5) \div 12.0 \times 100 = 4.2$ % below the prediction.

Question 3 Graph of V_s against V_p

The points lie on a straight line through the origin: V_s is proportional to V_p . Gradient = $(19.0 - 3.8) \div (10.0 - 2.0) = 15.2 \div 8.0 = 1.90$.

Question 4 Ratio for each row

$V_s \div V_p = 1.90, 1.93, 1.92, 1.91$ and 1.90 . The mean is **1.91**. The ideal value is $400 \div 200 = 2.00$, so the difference is $(2.00 - 1.91) \div 2.00 \times 100 = 4.5$ %.

Question 5 Why is V_s low?

Some energy is lost as heat in the resistance of the copper coils. Some field leaks out of the core so it does not pass through the secondary, and changing field in the iron induces eddy currents that warm the core. **These losses lower V_s .**

Question 6 Efficiency

Input power = $10.0 \times 0.65 = 6.5$ W. Output power = $19.0 \times 0.30 = 5.7$ W. Efficiency = $5.7 \div 6.5 \times 100 = 88$ %.

Question 7 Making it more reliable

Clamp the core tightly and use a laminated core so there is less leakage and fewer eddy currents; repeat each reading and take a mean, and use a thicker wire. **These reduce energy losses and random error.**