

Magnets, motors, generators and transformers

Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Test answers (mark scheme)

Model answers show the working that earns method marks. Allow follow-through if a wrong value from an earlier part is used correctly in a later part, and accept equivalent wording for the explanations.

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

Question 1 Field lines (2 marks)

They run from the north pole to the south pole outside the magnet; they never cross; they are closest together where the field is strongest (any two).

Marking: 1 mark for each property.

Question 2 Force on a wire (3 marks)

$$F = B I L = 0.25 \times 3.0 \times 0.080 = \mathbf{0.060 \text{ N}}.$$

Marking: 1 mark equation, 1 mark substitution, 1 mark answer with unit.

Question 3 Increasing the force (2 marks)

Increase the current, use a stronger magnet (larger B), or use a longer length of wire in the field.

Marking: 1 mark for each correct way (any two).

Question 4 Transformer voltage (3 marks)

a. $V_s = V_p \times N_s \div N_p = 230 \times 50 \div 500 = \mathbf{23 \text{ V}}.$

b. **Step-down:** the secondary has fewer turns.

Marking: (a) 1 mark for the method, 1 mark for the answer; (b) 1 mark.

Question 5 Transformer power (3 marks)

Output power = $23 \times 2.0 = \mathbf{46 \text{ W}}$. Input power = 46 W, so $I_p = 46 \div 230 = \mathbf{0.20 \text{ A}}.$

Marking: 1 mark for the output power, 1 mark for equating input and output, 1 mark for the primary current.

Question 6 How a generator works (3 marks)

As the coil turns, its sides cut across the magnetic field lines, which induces a voltage in the wire. Each half turn the sides cut the field in the opposite direction, so the induced voltage reverses. The voltage rises and falls and changes sign, giving an alternating output.

Marking: 1 mark for cutting the field lines, 1 mark for voltage induced, 1 mark for the reversal each half turn.

Question 7 Direct current (2 marks)

A battery gives a steady current and a steady magnetic field in the core. A voltage is induced in the secondary only when the field changes, so the secondary voltage is zero.

Marking: 1 mark for the steady field, 1 mark for no change meaning no induced voltage.

Question 8 Electromagnet core (2 marks)

The current's field magnetises the soft iron, which becomes a magnet itself. Its field adds to the coil's field, giving a much stronger field.

Marking: 1 mark for the iron becoming magnetised, 1 mark for the combined field being stronger.