

6.2 The motor effect and electrical energy (P)

Name: _____ Class: _____ Date: _____

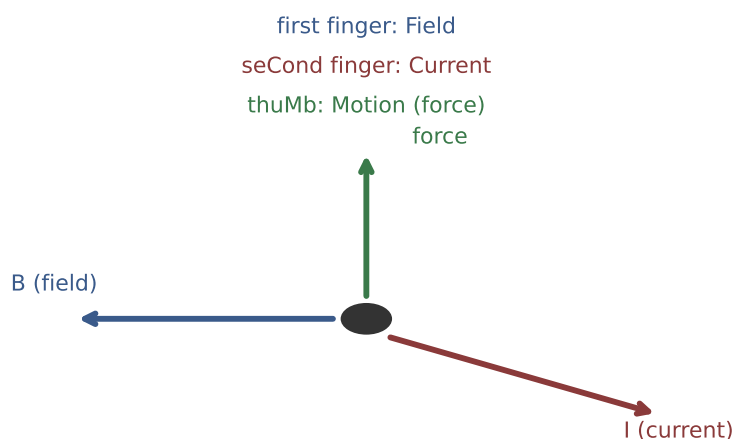
Total: 18 marks

Objective

Cover the motor effect and transferring electrical energy (3.6.4–3.6.5): force on a current-carrying conductor with Fleming's left-hand rule, the motor, appliance power $P = IV$, $E = VQ$, energy in kWh and electricity costs. All (P) Paper-2 content. Original OxfordAQA practice.

1 Key knowledge and worked examples

■ Motor force, direction and size



the three are mutually at right angles

Force grows with field, current and length of conductor in the field; no force when the wire is parallel to the field.

■ Paying for energy

$$P = IV \quad E = VQ \quad E \text{ (kWh)} = P \text{ (kW)} \times t \text{ (h)}$$

Worked check. A 230 V washing machine draws 10 A: $P = 2300 \text{ W} = 2.3 \text{ kW}$; a 1.5 h cycle uses 3.45 kWh; at 0.80 per kWh, cost ≈ 2.76 .

2 Practice

2.1 State Fleming's left-hand rule. [1]

2.2 When is there NO force on a current-carrying wire in a magnetic field? [1]

2.3 Name three ways to increase the motor force. [3]

2.4 Calculate the power of a 230 V, 5 A heater. [2]

2.5 Calculate the kWh used by a 3 kW tumble dryer running 2 hours. [2]

3 Exam-style questions

3.1 Explain why a current-carrying coil rotates in a magnetic field, and how this makes a motor. [3]

3.2 An electric shower is rated 9.2 kW at 230 V. Calculate its current and choose a fuse from 13 A, 30 A, 45 A. [3]

3.3 A meter reads 45 320 kWh; a month later it reads 45 610 kWh. Electricity costs 0.28 per kWh. Calculate the energy used and its cost. [3]

Solutions

2.1 First finger Field, seCond finger Current, thuMb Motion/force – held mutually at right angles.

2.2 When the wire is parallel to the magnetic field.

2.3 Stronger magnetic field; larger current; longer conductor (more turns) in the field.

2.4 $P = 230 \times 5 = 1150 \text{ W}$.

2.5 $E = 3 \times 2 = 6 \text{ kWh}$.

3.1 The two sides of the coil carry current in opposite directions across the field; each side feels a force – opposite directions by the left-hand rule; the pair of opposite forces turns the coil – continuous rotation with a commutator/alternating supply is the motor.

3.2 $I = 9200/230 = 40 \text{ A}$; choose the 45 A fuse – the next rating above the operating current.

3.3 $\text{Energy} = 45\,610 - 45\,320 = 290 \text{ kWh}$; $\text{cost} = 290 \times 0.28 = 81.20$.