

Exercise walk-through

7.2

Electromagnetism and the motor effect (4.7.2)

AQA · GCSE · Physics

Exercises 2.1·2.3

2.1 State two ways to strengthen the field of a solenoid. [2]

2.2 A 0.15 m wire carries 2.0 A perpendicular to a 0.50 T field. Calculate the force. [2]

2.3 State the three factors that increase the motor-effect force. [3]

Exercises 2.1·2.3

2.1 State two ways to strengthen the field of a solenoid. [2]

2.1 Larger current through the solenoid; add an iron core inside it.

2.2 A 0.15 m wire carries 2.0 A perpendicular to a 0.50 T field. Calculate the force. [2]

2.2 Known: $B = 0.50 \text{ T}$, $I = 2.0 \text{ A}$, $l = 0.15 \text{ m}$, all perpendicular.

$$F = BIl = 0.50 \times 2.0 \times 0.15 = \mathbf{0.15 \text{ N}}$$

(equation C1, answer with unit A1)

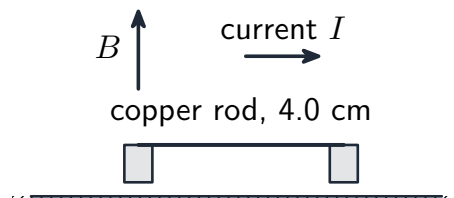
2.3 State the three factors that increase the motor-effect force. [3]

2.3 Stronger magnetic flux density; larger current; longer conductor in the field.

Exercise 3.1

3.1 A copper rod rests on rails in a 0.15 T field.

- (a) The rod is 4.0 cm long and carries 2.5 A. Calculate the force on it. [3]
- (b) State two changes that would double the force. [2]
- (c) The current's direction is reversed. State the change in the force. [1]



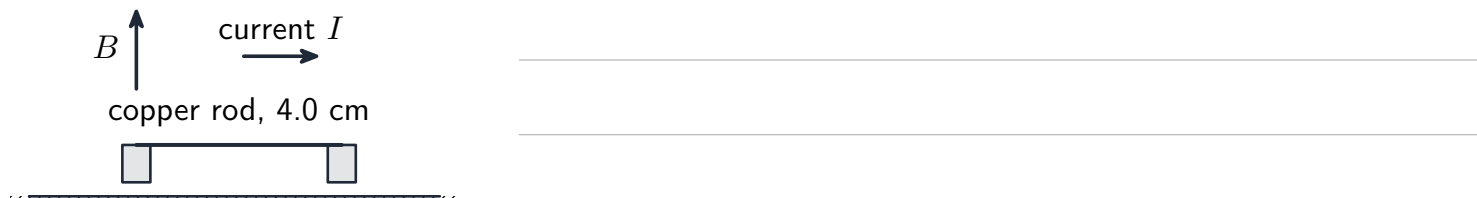
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3.1 (a) Convert: $l = 0.040$ m (C1).

$$F = BIl = 0.15 \times 2.5 \times 0.040 = \mathbf{1.5 \times 10^{-2} \text{ N}}$$

(C1, A1) **3.1** (b) Any two of: double the current; double the flux density; double the length in the field. **3.1** (c) The force reverses direction (same size).

Exercise 3.2

3.2 Explain how a moving-coil loudspeaker turns an electrical signal into sound. [4]

Exercise 3.2

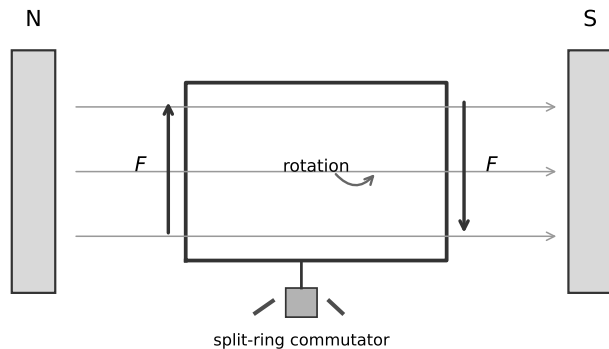
3.2 Explain how a moving-coil loudspeaker turns an electrical signal into sound. [4]

3.2 The signal is an alternating current in the coil, sitting in a permanent magnetic field; by the motor effect the coil experiences a force whose direction reverses with the current, making the coil move in and out; the coil is attached to the cone, which pushes and pulls the air; creating pressure variations – sound waves at the same frequency as the signal.

Exercise 3.3

3.3 A motor coil spins between poles.

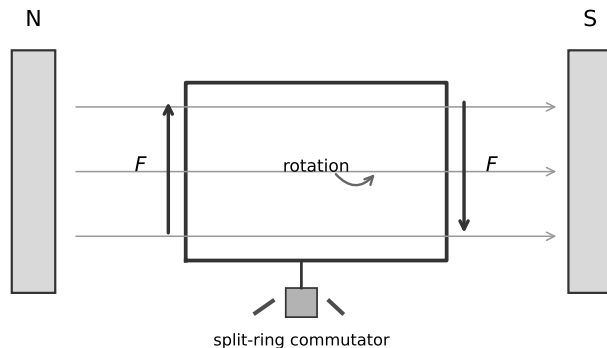
- (a) Explain why the coil rotates, using Fleming's left-hand rule. [3]
- (b) Explain the role of the split-ring commutator. [2]
- (c) The motor is made to spin faster. Give two design changes that achieve this. [2]



Exercise 3.3

3.3 A motor coil spins between poles.

- (a) Explain why the coil rotates, using Fleming's left-hand rule. [3]
- (b) Explain the role of the split-ring commutator. [2]
- (c) The motor is made to spin faster. Give two design changes that achieve this. [2]



3.3 (a) Each side of the coil carries a current at right angles to the field; by Fleming's left-hand rule each side feels a force perpendicular to the coil face – one up, one down, because the currents in the two sides flow opposite ways; the equal and opposite forces form a couple that rotates the coil. **3.3** (b) The current in the coil would otherwise reverse

Full solution 3.3

3.3 (a) Each side of the coil carries a current at right angles to the field; by Fleming's left-hand rule each side feels a force perpendicular to the coil face – one up, one down, because the currents in the two sides flow opposite ways; the equal and opposite forces form a couple that rotates the coil. **3.3** (b) The current in the coil would otherwise reverse relative to the fixed brushes every half-turn and stall the rotation; the commutator swaps the connections each half-turn so the force on each side stays in the same rotational sense. **3.3** (c) Any two: stronger magnets (larger B); larger current; more turns on the coil.