

Solutions

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

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

3.1 (a) Convert: $l = 0.040 \text{ m}$ (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).

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.

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.