1 **(a** circuit with solenoid AND galvanometer or ammeter or voltmeter B1

magnet labelled OR poles shown, with any orientation, near solenoid OR inside solenoid B1

appropriate action described e.g. move magnet / solenoid B1

**(b) (i)** magnetic field (in core) M1
(magnetic field is) alternating / changing / reversing

**(ii)** same frequency a.c. ticked B1

**(iii)** $V_S/V_P = N_S/N_P$ in any form OR ($V_S$ =) 12 × 200 / 50 OR 48 (V) C1

$V_S I_S = V_P I_P$ in any form OR with numbers C1

($I_S$ =) 12 × 0.50/48 = 0.12 A OR 0.13 A A1

OR

$I_S/I_P = N_P/N_S$ in any form (C2)

($I_S$ =) 0.5 × 50/200 = 0.12 A OR 0.13 A (A1)

**[Total: 9]**

2 **(a** (alternating current causes alternating/changing) magnetic field (in core) B1

alternating/changing magnetic field in secondary coil B1

voltage/e.m.f. induced (in secondary coil) B1

more turns (on secondary) so greater output B1 [4]

**(b)** resistance increases (with/is proportional to length (of cable)) B1

(energy losses) due to resistance (of cables)/heating in cables/electrical working (in cables)/$I^2R$ B1 [2]

**(ii)** reduced resistance **or** less heat loss B1

more metal **or** cables heavier **or** more pylons **or** more costly to construct B1 [2]

**[Total: 8]**

3 **(a)** **(i)** Parallel lines perpendicular to pole faces with arrows N to S B1

**(ii)** Arrow pointing to the right B1

**(b)** **(i)** Geiger (counter) / Geiger (tube) (+ scaler / ratemeter) / photographic plate / scintillation counter / cloud chamber / luminescent or phosphorescent plate B1

**(ii)** Out of the plane of the paper B1

**(iii)** (Path is) a curve / circular / arc B1

**(iv)** (Air molecules are) ionised / lose electrons B1

**[Total: 6]**

4 **(a)** down
down OR anti-clockwise } both B1

**(ii)** BC is parallel to the field/doesn't cut field or vice-versa/not at angle to field
ignore BC not perpendicular to field B1

**(b)** continues moving/turning NOT reverse/other direction M1
idea of moving things continue moving OR reference to Newton's Laws
OR reference to momentum/KE/inertia NOT reference to force still acting A1

**(c)** more turns/several coils
iron core
increase current/voltage
stronger magnet
smaller air gap any 1 B1
curved poles
more efficient brushes
poles closer
use split-ring commutator [5]

5 **(a (i)** arrow pointing vertically downwards B1

**(ii)** magnetic fields due to current and magnet interact with each other
OR current produces magnetic field.
OR wire contains moving charges which experience a force in a magnetic field B1

**(iii)** direction of force unchanged B1

**(b)** arrow at P pointing down the page B1
curved path B1 [5]

6 **(a** any three from:
use a strong(er) magnet
increase the number of coils in the solenoid / turns of solenoid closer together
move the magnet fast(er).
place iron core in the solenoid
use thick(er) wire / low(er) resistance wire for solenoid max B3

**(b) (i)** $N_P/N_S = V_P/V_S$ OR $200/800 = V_P/24$ OR $V_P = N_P V_S/N_S$
OR $V_P = 200 \times 24/800$ C1
6.0 V A1

**(ii)** $I_p V_p = I_s V_s$ OR $I_p N_p = I_s N_s$ OR $I_P = I_S V_S/V_P$ OR $I_P = I_S N_S/N_P$
OR $I_P = (0.5 \times 24)/6$ OR $I_P = (0.5 \times 800)/200$ C1
2(.0) A
allow ecf from **(b)(i)** A1 [7]

7 **(a) (i)** current clockwise when viewed from top B1

**(ii)** anticlockwise (however expressed) allow ecf from **(a)(i)**
OR down on left and/or up on right B1

**(b) (i)** faster B1

**(ii)** faster OR the same B1

**(iii)** faster B1

**(c)** (increasing) back / opposing e.m.f. allow an opposing (induced) current B1 [6]