1   **(a**   **(i)** $N_1/N_2 = V_1/V_2$ in any form, symbols, words or numbers   C1
         12 (turns) [possible unit penalty]   A1

     (ii)   mention of magnetic / electromagnetic field   )
)
              <u>change</u> of flux linkage / magnetism   )
              OR   field lines being cut   )
) any 3   B1 x 3
              Induced current / emf / voltage   )
)
              Fewer coils in secondary so smaller emf / voltage
              OR larger current   )

     (iii)   heat in either coil / wires   )
              eddy currents in core / heat in core   ) any 1   B1
              magnetic leakage from core   )
              sound from core/coil   )

     (b)   **(i)**   12 V <u>d.c</u>. OR low <u>d.c.</u>voltage

         (ii)   diode OR rectifier [Ignore extras unless wrong]   B1

     (c) $V_1I_1 = V_2I_2$ in any form, or words or numbers
         OR power in = power out or equivalent   C1

         8 A   A1   [10

2   **(a**   a.c./changing current (in primary)   )
         <u>magnetic</u> flux/field/force in <u>core</u>   )
         alternating/changing <u>magnetic</u> field   )   any 3   B1 × 3
         accept without magnetic if used in previous line
         field cuts <u>secondary</u>   )
         changing flux linkage in (secondary)   )
         <u>induces</u> emf/current in (secondary)   )

     (b)   more/increasing turns on secondary OR less/decreasing turns on primary
         OR step up   B1

     (c) $V_1I_1 = V_2I_2$ in any form OR 24 000 × 12 000 = 400 000 × I_2 C1
         720 A   A1

     (d)   less heat/energy/power loss OR more efficient <u>energy transfer</u>   )
            thinner/smaller cables   )
            less metal used   )   any 2   B1+B1
            less massive pylons   )
            ignore less electricity loss

3 **(a** Fig.8.1   nothing seen/no current/no deflection/no voltage   B1
         Fig. 8.2   deflection (of needle)/current in mV/voltage induced   B1
         Fig. 8.3   deflection (of needle)/current in mV/voltage induced
                      (**ignore** size of deflection)   M1
                      same direction as Fig. 8.2   A1

(b) increase speed   B1
     increase turns (of wire)/more coils   (**ignore** longer wire)   B1
     increase magnet strength   (**ignore** larger magnet)   B1

[Total: 7]

4 **(a) (i)** <u>step-up</u> transformer   B1

       (ii) less heat/energy/power loss (from lines) / thinner wires (possible)   B1
            OR   lower current   NOT more efficient

(b) P = V × I   in any form, figures or symbols / (P =) VI   C1
     2.5 A   A1

(c) P = I^2R in any form, figures or symbols / (P =) I^2R C
     18.75 W   e.c.f. from **(b)**   A1

(d) V = IR   in any form, figures or symbols   OR   (V =) IR   OR
     P = V^2 / R in any form, figures or symbols   OR   (P =) V^2 / R   OR   V = $(PR)^{1/2}$ C1

     7.5 V   e.c.f. from **(b)** or **(c)**   A1

(e) 22,000 – 7.5 – 7.5   OR   22,000 – 7.5   ecf   C1
     21,985 V   e.c.f. (minimum 4 s.f.in this case)   A1
     OR
     55,000 – 37.5 = 54962.5   (C1)
     54962.5 / 2.5 = 21985 V (minimum 4 s.f. in this case)   (A1)

[10]

5   **(a)** 3 complete circles about thick wire, roughly concentric on wire   B1
        clockwise or anticlockwise arrows on any 2 correct circles, and no contradictions   B1

    (b) (i)   reduced

         (ii)   same OR none   B1

    (c) (i)   thin wire is a current-carrying conductor in a magnetic field   B1
              field produced by current in thick wire   B1
              OR alternative approach:
              (both wires produce a magnetic field   B1)
              (fields interact   B1)

         (ii)   inwards/towards thick wire/to right/towards T_1T_2 B1

        (iii)   smaller force   B1
                                                                                                          [8]