MARKING SCHEME

1. (a) (i) to the left; 1
   (ii) current produces magnetic field/coil becomes magnetic;
        cause of movement in correct context;
        [Reject attraction/repulsion] 2

   (b) oscillates/vibrates/moves left then right/eq; 1

   (c) \[ v = f \times \lambda; \]
        [In any correct form]
        \[ = 800 \text{ (Hz)} \times 0.4 \text{ (m)}; \]
        \[ = 320 \text{ (m/s)}; \]
        [Bald correct answer scores 3 marks] 3

2. (a) (i) voltage has both + and – values/either direction; 1
   (ii) amplitude - (±) 2.6 (V);
        period - 0.024 (s); 2
   (iii) A calculation to include:
        \[ f = \frac{1}{T} = \frac{1}{0.024\text{s}}; \]
        \[ = 41.7 \text{ Hz}; \text{[Allow ecf from (ii)]} \]

   (b) (i) An explanation to include:
         1. appreciation that the coil is in the magnet’s field;
         2. field is changing/field lines cut; 2
   (ii) increases (the induced voltage and) the brightness;
        increased rate of change of field/cut lines more often/OWTTE;
        [Accept a reasoned energy argument] 2
   (c) A suggestion to include:
        1. to produce/create d.c./diode allows current/electricity to pass in one direction
           only/conducts only in one direction;
        2. prevents discharge of battery (through coil); 2

3. (a) (i) changing polarity, 1
   (ii) Any two from:
        • stronger magnet;
        • more turns;
        • increase speed rotation;
        • placing coil on soft iron core; 2

   (b) (i) An explanation to include:
        • higher V, less I; 1
• less I, lower heating effect; 2

(ii) \[
\frac{N_p}{N_s} = \frac{V_p}{V_s} = \frac{25000}{400000} = \frac{1}{16} \left( \frac{16}{1} \text{ if secondary to primary} \right); \]

(c) Advantage: less resistance; 2
Disadvantage: heavier; 2

4. (a) (i) An explanation to include:
1. force produced;
2. because of the magnetic fields of coil and permanent magnet; 2
(ii) moves to the left/backswards; 1
(iii) larger current/stronger magnet/more coils/weaker spring; 1
(b) to return the needle to zero when current stopped;
to stop needle moving too far for (small) currents; 2

5. (a) (i) A continuation of the graph to show:
1. negative arc;
2. completes cycle at 0.4 second;
3. quality sine curve; 3
(ii) A sketch to show:
1. smaller maximum voltage;
2. longer time period; 2
(b) (i) A calculation to include:
1. \[
\frac{N_p}{N_s} = \frac{V_p}{V_s} \]
\[
\frac{3200}{N_s} = \frac{240}{30}; \]
2. \[3200 = 8 \times N_s;\]
3. \[N_s = 400;\] 3
(ii) A calculation to include:
1. \[V \times I \times t = 30 \times 0.4 \times 1;\]
2. \[12 \text{ (J);}\] 2
(iii) A calculation to include:
1. \[
\text{efficiency} = \frac{\text{energy out}}{\text{energy in}} = \frac{12}{15}; \text{[Allow ecf from part (ii)]} \]
\[
= 80\% \ (0.8);\] 3

[10] [6] [13]
6. (a) (i) \[ \frac{V_P}{V_S} = \frac{N_P}{N_S}; \]
    [Must be in equation using symbols or words]  
    (ii) A calculation to include:
    1. \[ \frac{15000}{N_S} = \frac{240}{12}; \]
    2. \[ N_S = 750; \]
    [If 1500 used instead of 15000 to give 75 allow 1 mark]  
    [75 with no evidence scores 0 marks]

(b) A calculation to include:
    1. current = \[ \frac{E}{V t}; \]
    \[ [E = V \times I \times t \text{ scores 0 marks}] \]
    2. \[ \frac{250}{240 \times 10}; \]
    3. \[ = 0.104 / 0.1 \text{ A}; \]
    [Bald, correct answer scores 3 marks]  
    [0.1 with no units – 2 marks]  
    [1.04 / 1 \text{ A – 1 mark}]  
    [Using \( P = VI \) route is acceptable]

(c) (i) Calculation to include:
    1. \[ \frac{225}{250}; \]
    2. \[ = 0.9 / 90 \text{ %}; \]
    [Accept eddy currents in the core for 2 marks]  
    [Accept hysteresis losses in the core for 2 marks]  
    [Accept sound due to mains hum for 2 marks]  
    [Allow resistance in wires for 1 mark]  
    [heat / light / sound in the wires scores 0 marks]