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]
$= 800$ (Hz) $\times 0.4$ (m);
$= 320$ (m/s); [Bald correct answer scores 3 marks] 3

[7]

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:

1. $f = \frac{1}{T} = \frac{1}{0.024\text{s}}$;
2. = 41.7 Hz;[Allow ecf from (ii)] 2

(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

[11]

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;

- less I, lower heating effect; 2

(ii) $\frac{N_p}{N_s} = \frac{V_p}{V_s}$; $= \frac{25000}{400000} = \frac{1}{16} \left(\text{or } \frac{16}{1} \text{ if secondary to primary} \right)$;; 3

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

[10]

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/ –3/backwards; 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

[6]

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. $\frac{N_P}{N_S} = \frac{V_P}{V}$

$\frac{3200}{N_S} = \frac{240}{30}$;

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
2. 12 (J);

(iii) A calculation to include:

1. efficiency $= \frac{\text{energy out}}{\text{energy in}}$

$= \frac{12}{15}$; [Allow ecf from part (ii)]

= 80% (0.8); 3

[13]

6. (a) (i) $\frac{V_P}{V_S} = \frac{N_P}{N_S}$;

[Must be in equation using symbols or words] 1

(ii) A calculation to include:

1. $\frac{15000}{N_S} = \frac{240}{12}$;
2. $N_s = 750$; 2

[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 = $\frac{E}{Vt}$ / 250 = 240 × I;

[$E = V \times I \times t$ scores 0 marks]

2. $\frac{250}{240 \times 10}$;;
3. = 0.104 / 0.1 A; 3

[Bald, correct answer scores 3 marks]
[0.1 with no units – 2 marks]
[1.04 / 1 A – 1 mark]
[Using $P = VI$ route is acceptable]

(c) (i) Calculation to include:

1. $\frac{225}{250}$ / OUTPUT / INPUT;
2. = 0.9 / 90 %; 2

(ii) An explanation to include:

1. sound / energy still lost as heat / eddy currents / hysteresis;
2. in wires / core / coil; 2

[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]

[10]