

**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 - ( $\pm$ ) 2.6 (V);  
 period - 0.024 (s); 2
- (iii) A calculation to include:  
 1.  $f = \frac{1}{T} = \frac{1}{0.024s}$ ;  
 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)  $\frac{N_p}{N_s} = \frac{V_p}{V_s}; = \frac{25000}{400000} = \frac{1}{16}$  ( or  $\frac{16}{1}$  if secondary to primary ); 3
    - (c) Advantage: less resistance; 2  
Disadvantage: heavier; 2
- [10]**
4. (a) (i) An explanation to include: 2
1. force produced;
  2. because of the magnetic fields of coil and permanent magnet;
- (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; 2  
to stop needle moving too far for (small) currents; 2
- [6]**
5. (a) (i) A continuation of the graph to show: 3
1. negative arc;
  2. completes cycle at 0.4 second;
  3. quality sine curve;
- (ii) A sketch to show: 2
1. smaller maximum voltage;
  2. longer time period;
- (b) (i) A calculation to include: 3
1.  $\frac{N_p}{N_s} = \frac{V_p}{V}$   
 $\frac{3200}{N_s} = \frac{240}{30}$ ;
  2.  $3200 = 8 \times N_s$ ;
  3.  $N_s = 400$ ;
- (ii) A calculation to include: 2
1.  $V \times I \times t = 30 \times 0.4 \times 1$ ;
  2. 12 (J);
- (iii) A calculation to include: 3
1. efficiency =  $\frac{\text{energy out}}{\text{energy in}}$   
 $= \frac{12}{15}$ ; [Allow ecf from part (ii)]  
 $= 80\% (0.8)$ ;

**[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 =  $\frac{E}{V_t} / 250 = 240 \times I$ ;  
 [ $E = V \times I \times t$  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]