

Name of the Student: \_\_\_\_\_

Max. Marks : 26 Marks

Time : 26 Minutes

Mark Schemes

**Q1.**

- (a) units:  $F$  - newton (N),  $B$  - tesla (T) or weber metre<sup>-2</sup> (Wb m<sup>-2</sup>),  
 $I$  - ampere (A),  $l$  - metre (m) **(1)**  
 condition:  $I$  must be perpendicular to  $B$  **(1)** 2
- (b) (i) mass of bar,  $m = (25 \times 10^{-3})^2 \times 8900 \times I$  **(1)**  
 (= 5.56 $l$ ) weight of bar (=  $mg$ ) = 54.6 $l$  **(1)**  
 $mg = BIl$  or weight = magnetic force **(1)**  
 54.6 $l = B \times 65 \times I$  gives  $B = 0.840$  T **(1)**
- (ii) arrow in correct direction (at right angles to  $I$ , in plane of bar) **(1)** 5

**[7]****Q2.**

- (a) (i) the emf (of the battery) **(1)**
- (ii) the voltage across the battery when current flows  
 [or terminal voltage or pd supplied to the circuit]
- (iii)  $V = (3 \times 0.5) = 1.5$  (V) **(1)**  
 current =  $(1.5/14) = 0.11$  A **(1)** (0.107 A)
- (iv) ( $\epsilon = V + Ir$  and emf =  $3.5 \times 0.5 = 1.75$  (V) gives)  
 $1.75 = 1.5 + 0.107r$  **(1)**  
 $r = 2.3 \Omega$   
 [or use of  $\epsilon = I(R + r)$  with  $I = 0.107$  gives  $r = 2.4 \Omega$   
 and  $I = 0.11$  gives  $r = 1.9 \Omega$   
 (allow C.E. for value of  $I$  from (iii)) 6
- (b) (i) peak value =  $3.5\sqrt{2} = 4.9$  V **(1)**
- (ii) oscilloscope screen to show  
 vertical line of height 2.5 divisions above central axis **(1)**  
 and below central axis **(1)** 3

**[9]**

**Q3.**

(a) (i) mass per sec (= density  $\times$  vol per sec) =  $1000 \times 1.4$  **(1)**  
 $= 1400 \text{ kg (s}^{-1}\text{)}$

(ii) loss of  $E_p$  per sec  $\left( = \frac{mgh}{t} \right) = 1400 \times 9.8 \times 750$  **(1)**  
 $= 1.0 \times 10^7 \text{ J (s}^{-1}\text{)}$  **(1)** ( $1.03 \times 10^7 \text{ J s}^{-1}$ )  
 (allow C.E. for value of mass per sec from (i))

(iii) efficiency  $\left( = \frac{\text{power output}}{\text{loss of } E_p \text{ per second}} \right) = \frac{2.0 \times 10^6}{1.0 \times 10^7}$  **(1)**  
 $= 0.2$  **(1)**  
 (allow C.E. for value (ii))

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(b) (i) (use of  $P = IV$  gives)  $I_{\text{rms}} = \frac{2.0 \times 10^6}{25 \times 10^3}$  **(1)**  
 $= 80 \text{ A}$  **(1)**

(ii) power output = (0.95  $\times$  power input) =  $0.95 \times 2.0 \text{ (MW)} = 1.9 \text{ (MW)}$  **(1)**  
 $I = \frac{1.9 \text{ (MW)}}{275 \text{ (kV)}} = 6.9 \text{ A}$  **(1)**

[or  $I$  for 100% efficiency  $\left( = \frac{2 \times 10^6}{275 \times 10^3} \right) = 7.3 \text{ (A)}$  **(1)**

$I$  for 95% efficiency = 95% of 7.3 = 6.9 A]

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**[10]**