M1. B

[1]

M2. C

[1]

M3. B

[1]

M4. A

[1]

M5. A

[1]

M6. A

[1]

M7. A

[1]

M8. C

[1]

M9. C

[1]

M10.(a) (i) mass per sec (= density × vol per sec) = 1000 × 1.4 **(1)**

= 1400 kg (s^{-1})

(ii) loss of E_p per sec $\left(=\frac{mgh}{t}\right)$ = 1400 × 9.8 × 750 **(1)**

= 1.0 × 10^7 J (s^{-1}) **(1)** (1.03 × 10^7 J s^{-1})

(allow C.E. for value of mass per sec from (i))

(iii) efficiency $\left(=\frac{\text{power output}}{\text{loss of } E_p \text{ per second}}\right) = \frac{2.0\times10^6}{1.0\times10^7}$ (1)

= 0.2 **(1)**

(allow C.E. for value (ii))

6

(b) (i) (use of $P = IV$ gives) I_{rms} = $\frac{2.0\times01^6}{25\times10^3}$ **(1)**

= 80 A **(1)**

(ii) power output = (0.95 × power input) = 0.95 × 2.0 (MW) = 1.9 (MW) **(1)**

$I = \frac{1.9(MW)}{275(kV)}$ = 6.9 A **(1)**

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

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

4

[10]

M11. (a) $R = \rho L/A$

C1

$A = 2.0 \times 10^{-6}$ (m^2) or $\pi(0.8 \times 10^{-3})^2$ seen in equation
(condone $\pi(1.6 \times 10^{-3})^2$ or 8.04×10^{-6} seen)

C1

L = 2900 m, 2940 m, 2960 or 3000 m

A1

3

(b) resistance leads to loss of heat/energy/power
or I^2R loss or voltage drop (across cable)

B1

lower current lowers loss of heat/energy/power
or reduces voltage drop

B1

ac can be transformed (to lower transmission current)

B1

3

[6]

M12.(a) product of flux and number of turns **B1**

Wb or equivalent **C1**

(2)

(b) changing primary magnetic field due to alternating voltage **B1**

(applied to primary)
varying flux links with secondary **B1**

induced emf ∑ rate of change of flux linkage **B1**

N_S N_P so less voltage on secondary **C1**

(4)

(c) (i) equation or correct substitution **C1**

15.3 V **A1**

(2)

(ii) **not** just “heating” or “heat loss” **B2**

(2)

[10]