

CURRENT ELECTRICITY

1. D
2. C
3. C
4. D

5. both measure (energy / work) / charge B1
 for e.m.f., transfer of chemical energy to electrical energy B1
 for p.d., transfer of electrical energy to thermal energy / other forms B1 [3]

6. Solution

a. Find the current in the circuit.

For R_1 and R_2 combined,

$$R_{12} = R_1 + R_2 = 170 \Omega + 190 \Omega = 360 \Omega$$

$$V_{12} = V_{\text{source}} - V_3 = 75 \text{ V} - 21 \text{ V} = 54 \text{ V}$$

$$I = \frac{V_{12}}{R_{12}} = \frac{54 \text{ V}}{360 \Omega} = 0.15 \text{ A}$$

b. Find the resistance of R_3 .

$$R_3 = \frac{V_3}{I} = \frac{21 \text{ V}}{0.15 \text{ A}} = 140 \Omega$$

7. (a) energy transferred from source / changed from some form to electricalM1
 per unit charge (to drive charge round a complete circuit) A1 [2]
 (b) and power in $R = I^2 X$ M1
 $E = I(X + r)$ M1
 power in cell = EI and algebra clear leading to ratio = $X / (X + r)$ A1 [3]

(c) (i) 1.4 W A1
 0.40 J(allow 0.4)

8.

(a) (i) 1 total resistance = 0.16 Ω A1
 2 e.m.f. = either (14 - E) or (E - 14) A1 [2]
 (ii) either $14 - E = 42 \times 0.16$ or $(E - 14) = -42 \times 0.16$ C1
 $E = 7.3 \text{ V}$ A1 [2]

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(b) (i) charge = It C1

$$= 12.5 \times 4 \times 60 \times 60$$

$$= 1.8 \times 10^5 \text{ C A1 [2]}$$

(ii) either energy = EQ or energy = Eit C1

$$\text{either energy} = 14 \times 1.8 \times 10^5 \text{ or energy} = 14 \times 12.5 \times 4 \times 3600$$

$$= 2.52 \times 10^6 \text{ J A1 [2]}$$

(iii) energy = I

$$2Rt \text{ or } Vit \text{ and } V = IR \text{ C1}$$

$$= 12.52 \times 0.16 \times 4 \times 3600$$

$$= 3.6 \times 10^5 \text{ J A1 [2]}$$

$$\text{(c) efficiency} = (2.52 \times 10^6 - 3.6 \times 10^5) / (2.52 \times 10^6) \text{ C1}$$

$$= 86\% \text{ A1 [2]}$$