ASSESSMENT and QUALIFICATIONS ALLIANCE

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GCE

Physics A

Unit PHA3/W

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Unit 3

1

(a) between A and C: (each) series resistance = 100 Ω ✓

(parallel resistors give) $\frac{1}{100}+\frac{1}{100}=\frac{1}{50}$ gives R_{AC} = 50 Ω ✓ (*2*)

(allow C.E. for incorrect series resistance)

(b) between A and B: series resistance = 150 Ω ✓

parallel = $\frac{1}{50}+\frac{1}{150}$ ✓

(allow C.E. for series resistance)

R_{AB} = 37.5 Ω ✓ (38 Ω) (*3*)

(*5*)

2

(i) ($V = IR$ gives) $12 = (30 + 30 + 2)I$ ✓

$I = \left(\frac{12}{62}\right) = 0.19$ A ✓ (0.194 A)

(ii) $V_{PQ} = 12 - (0.19 \times 2)$ ✓

$= 11.6$ V ✓

(allow C.E. for incorrect I in (i))

[or $V_{PQ} = 0.19 \times 60 = 11.6$ V] (I = 0.194 A gives 11.6 V)

[or $V_{PQ} = 12 \times \frac{60}{62} = 11.6$ V

(iii) ($P_A = I^2R$ gives) $P_A = (0.19)^2 \times 30 = 1.08$ ✓ W ✓

[or $P_A = \frac{V^2}{R}$]

(allow C.E. for incorrect I in (i) or incorrect V in (ii))

(iv) ($E = P_At$ gives) $E = 1.08 \times 20$ ✓

$= 21.6$ J ✓

(allow C.E. for incorrect P_A in (iii)) (*8*)

(*8*)

3

(a)(i) for X: ($P = VI$ gives) $24 = 12I$ and $I = 2$ A ✓

for Y $18 = 6I$ and $I = 3$ A ✓ (*2*)

(b)(i) 12 V ✓

(b)(ii) voltage across R_2 (= 12 – 6) = 6 (V) ✓

$I = 3$ (A) ✓

($V = IR$ gives) $6 = 3R_2$ and $R_2 = 2$ Ω ✓

(allow C.E. for I and V from (a) and (b)(i))

[or $V = I(R_y + R_2)$ ✓ $12 = 3(2 + R_2)$ ✓ $R_2 = 2\ \Omega$ ✓]

(b)(iii) current = 2 (A) + 3 (A) = 5 A ✓
(allow C.E. for values of the currents)

(b)(iv) 27 (V)– 12 (V) = 15 V across R_1 ✓

(b)(v) for R_1, $15 = 5\ R_1$ and $R_1 = 3\ \Omega$ ✓
(allow C.E. for values of I and V from (iii) and (iv) (7)

(9)

4

(a)(i) battery, milliammeter, and wire in series ✓ ✓
voltmeter across the wire ✓
variable resistor/potential divider in series ✓

(a)(ii) alter variable resistor ✓
to obtain a series of values of I and V ✓

(a)(iii) plot a graph of V against I ✓
gradient = R ✓
[or calculate $R = V/I$ for each reading and take mean] (8)

(b)(i) ($P = \frac{V^2}{R}$ gives) $1200 = \frac{230^2}{R}$ ✓
$R = 44.1\ \Omega$ ✓

(b)(ii) $R = \frac{\rho l}{A}$ ✓
$l = \frac{44.1 \times 9.4 \times 10^{-8}}{1.1 \times 10^{-6}}$ ✓
= 3.8 m ✓
(allow C.E. for value of R in (i)) (5)

(13)

5(a)(i) X ✓
stress (force) ∝ strain (extension) for the whole length ✓

(ii) Y ✓
has lower breaking stress (or force/unit area is less) ✓

(iii) Y ✓
exhibits plastic behaviour ✓

(iv) Y ✓
for given stress, Y has greater extension
[or greater area under graph] ✓ (8)

(b)(i) (use of $E = \frac{F}{A} \times \frac{l}{e}$ gives)

$$F\left(=\frac{EAe}{l}\right)=\frac{2.0\times10^{7}\times0.64\times10^{-6}\times30\times10^{-3}}{160\times10^{-3}}$$

✓ for data into correct equation, ✓ for correct area

$= 2.4$ N ✓

(allow C.E. for incorrect area conversion)

(ii) (use of *energy stored* = ½*Fe* gives) energy = $\frac{2.4\times30\times10^{-3}}{2}$ ✓

$= 36\times10^{-3}$ J ✓

(allow C.E. for value of *F* from (i)) (5)

(13)

Quality of Written Communication (Q4(a)(ii), (iii) and Q5(a)) ✓✓ (2)

(2)