AQA
ASSESSMENT and QUALIFICATIONS ALLIANCE

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GCE

Physics A

Unit PA04

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Section A

Key to Objective Test Questions

1-A; **2**-B; **3**-A; **4**-B; **5**-A; **6**-B; **7**-A; **8**-A; **9**-D; **10**-C; **11**-C; **12**-D; **13**-A; **14**-C; **15**-D.

Section B

1

(a) interference or superposition ✓
reflection from metal plate ✓
two waves of the same frequency/wavelength ✓
travelling in opposite directions (or forward/reflected waves) ✓
maxima where waves are in phase or interfere constructively ✓
minima where waves are out of phase/antiphase or interfere destructively ✓
nodes and antinodes or stationary waves identified ✓ $_{max}(4)$

(b)(i) (distance between minima = $\frac{\lambda}{2}$)

$\left(\frac{\lambda}{2} = \frac{144}{9}\text{gives}\right)$ $\lambda = 32.0$ mm ✓

(b)(ii) $c = f\lambda$ and $c = 3 \times 10^8$ (m s^{-1}) ✓

$f = \frac{3\times10^8}{32\times10^{-3}} = 9.38 \times 10^9$ Hz ✓

(allow C.E. for value of λ from (i)) (3)

(7)

2

(a) period = 24 hours or equals period of Earth's rotation ✓
remains in fixed position relative to surface of Earth ✓
equatorial orbit ✓
same angular speed as Earth or equatorial surface ✓ $_{max}(2)$

(b)(i) $\frac{GMm}{r^2} = m\omega^2 r$ ✓

$T = \frac{2\pi}{\omega}$ ✓

$r\left(=\frac{GMT^2}{4\pi^2}\right)^{1/3} = \left(\frac{6.67\times10^{-11}\times6\times10^{24}\times(24\times3600)^2}{4\pi^2}\right)^{1/3}$ ✓

(gives $r = 42.3 \times 10^3$ km)

(b)(ii) $\Delta V = GM\left(\frac{1}{R} - \frac{1}{r}\right)$ ✓

$= 6.67 \times 10^{-11} \times 6 \times 10^{24} \times \left(\frac{1}{6.4 \times 10^{6}} - \frac{1}{4.23 \times 10^{7}}\right) = 5.31 \times 10^{7}$ (J kg^{-1}) ✓

$\Delta E_p = m\Delta V$ (= 750 × 5.31 × 10^{7}) = 3.98 × 10^{10} J ✓

(allow C.E. for value of ΔV)

[alternatives:

calculation of $\frac{GM}{R}$ (6.25 × 10^{7}) or $\frac{GM}{r}$ (9.46 × 10^{6}) ✓

or calculation of $\frac{GMm}{R}$ (4.69 × 10^{10}) or $\frac{GMm}{r}$ (7.10× 10^{9})

calculation of both potential energy values ✓

subtraction of values or use of $m\Delta V$ with correct answer ✓] (6)

(8)

3

(a) units: F - newton (N), B - tesla (T) or weber metre^{-2} (Wb m^{-2}), I - ampere (A), l - metre (m) ✓

condition: I must be perpendicular to B ✓ (2)

(b)(i) mass of bar, $m = (25 \times 10^{-3})^2 \times 8900 \times l$ ✓ (= 5.56l)

weight of bar (= mg) = 54.6l ✓

` $mg = BIl$ or weight = magnetic force ✓

54.6l = $B \times 65 \times l$ gives B = 0.840 T ✓

(b)(ii) arrow in correct direction (at right angles to I, in plane of bar) ✓ (5)

(7)

4

(a) mass difference increases

or B.E. (per nucleon) or stability is greater for nucleus after fusion ✓

(greater) mass difference

or increase in B.E. (per nucleon) implies energy released ✓

both nuclei charged positively or have like charges ✓

electrostatic repulsion ✓ $_{max}$(3)

(b)(i) Δm (= 2 × (2.01355) – (3.01493 + 1.00867))

= 3.5 × 10^{-3} u ✓ (5.81 × 10^{-30} kg)

(b)(ii) ΔE = 3.5 × 10^{-3} × 931.3 (MeV) ✓ (= 3.26 MeV)

= 3.26 × 10^{6} × 1.6 × 10^{-19} = 5.22 × 10^{-13} (J) ✓ (3)

(6)

Quality of Written Communication (Q1(a) and Q4(a)) ✓✓ (2)