

NOVEMBER 2002

GCE Advanced Subsidiary Level

MARK SCHEME

MAXIMUM MARK : 60

SYLLABUS/COMPONENT :9702 /2

**PHYSICS
(STRUCTURED QUESTIONS (AS))**



UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

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- 1 (a) (i) mass / volume ... (ratio must be clear)..... B1
(ii) kg m^{-3} OR kg / m^3 B1 [2]
- (b) v has unit of m s^{-1} B1
 p / ρ has unit of $\text{kg m}^{-1} \text{s}^{-2} / \text{kg m}^{-3}$ (no e.c.f. from (a)) M1
 $\sqrt{(p / \rho)}$ has unit of m s^{-1} A1
LHS = RHS so γ has no unit A0 [3]
- 2 (a) $1.6 \pm 0.2 \text{ cm}$ B1 [1]
- (b) $1.6 / 50 = 0.032$... (ignore any uncertainties)..... B1 [1]
- (c) idea of adding fractional uncertainties C1
 $(0.2 / 1.6) + (0.1 / 50)$
 $= 0.127$ OR 12.7% ... (-2 marks if uncertainties not added) A1
actual uncertainty = $(\pm) 0.004$ A1 [3]
(do not allow more than 2 sig. fig)
- 3 (a) $v^2 = u^2 + 2as$ OR use of triangle etc C1
 $4.0^2 = 2 \times 9.8 \times s$ OR $s = \frac{1}{2} \times 4.0 \times 0.4$
 $s = 0.82 \text{ m}$ OR 0.80 m A1 [2]
- (b) $\Delta p = m(v - u)$ OR $p = mv$ C1
speeds are 4.2 m s^{-1} and 3.6 m s^{-1} C1
 $\Delta p = 0.045 (4.2 + 3.6)$ (2/4 only if speeds not added) C1
 $= 0.35 \text{ N s}$ A1 [4]
(1 mark only if only one speed used)
- (c) any time between 0.14 s and 0.17 s C1
force = $\Delta p / \Delta t = 0.35 / 0.14$ (allow e.c.f.)
 $= 2.5 \text{ N}$ A1 [2]
- 4 (a) force \times distance moved M1
in the direction of the force A1 [2]
- (b) weight / force = mg M1
 $\Delta E_p = mg \times \Delta h$ A1 [2]
(no marks for quote of $mg\Delta h$)

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- 5 (a) displacement & direction of energy travel normal to one another ... B1 [1]
- (b) (i) phase angle of 60° correct .. (need to see $1\frac{1}{2}$ wavelengths) B1
lags behind T_1 B1 [2]
- (ii) waves must be in same place (at same time) B1
resultant displacement = sum of individual displacements B1 [2]
- (iii) 1. $-\frac{1}{2}A$ B1
2. $\frac{1}{2}A$ (allow e.c.f.) B1
3. zero (allow e.c.f.) B1 [3]
- 6 (a) (i) arrow in upward direction, foot near P B1
(ii) curved path consistent with (i) between plates B1
then straight (with no kink at change-over) B1 [3]
- (b) $E = V/d$ C1
 $= 400 / (0.8 \times 10^{-2})$
 $= 5.0 \times 10^4 \text{ V m}^{-1}$ (allow 1 sig fig) A1 [2]
- (c) (i) $F = Eq$ C1
 $= 5.0 \times 10^4 \times 1.6 \times 10^{-19}$
 $= 8.0 \times 10^{-15} \text{ N}$ (allow 1 sig fig and e.c.f.) A1
- (ii) $a = F/m$ C1
 $= (8.0 \times 10^{-15}) / (9.1 \times 10^{-31})$
 $= 8.8 \times 10^{15} \text{ m s}^{-2}$ (allow 1 sig fig and e.c.f.) A1 [4]
- (d) because F_E is normal to horizontal motion M1
no effect A1 [2]

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- 7 (a) (i) e.m.f. = energy / charge C1
= $(1.6 \times 10^5) / (1.8 \times 10^4)$
= 8.9 V A1
- (ii) current = $\Delta Q / \Delta t$ C1
= $(1.80 \times 10^4) / (1.3 \times 10^5)$
= 0.14 A A1 [4]
- (b) (i) energy $\propto R$ (or formula) C1
energy = $(15 / 45) \times 1.14 \times 10^5$ C1
= 3.7×10^4 J A1
- (ii) energy dissipated in internal resistance (of battery) B1 [4]
OR in extra resistance in circuit
- 8 (a) shows nucleon number as 220 B1
shows proton number as 87 B1 [2]
- (b) shows products as ${}^4_2\text{He}$ OR ${}^4_2\alpha$ B1
and ${}^{216}_{83}\text{At}$ (allow e.c.f. from (a)) B1 [2]
- 9 (a) (i) stress = F / A C1
= $25 / (1.7 \times 10^{-6})$
= 1.47×10^7 Pa(do not allow 1 sig fig) A1
- (ii) stress = $E \times \text{strain}$ C1
 $1.47 \times 10^7 = 7.1 \times 10^{10} \times (\Delta l / 1.8)$
 $\Delta l = 0.37$ mm A1 [4]
- (b) $R = \rho l / A$ OR $R \propto L$ C1
so, $\Delta R / R = \Delta l / l$ C1
 $\Delta R = (3.7 \times 10^{-4} / 1.8) \times 0.03 = 6.2 \times 10^{-6} \Omega$ A1 [3]

May calculate $\rho = 2.833... \times 10^{-8} \Omega \text{ m}$
giving new R as $3.0006167 \times 10^{-2} \Omega$
hence ΔR - full credit possible

However, if rounds off ρ as $2.83 \times 10^{-8} \Omega \text{ m}$,
then $R_{\text{new}} < R_{\text{old}}$!
Allow 1 mark only for $R \propto L$