

**NOVEMBER 2002**

**GCE Advanced Subsidiary Level**

**MARK SCHEME**

**MAXIMUM MARK : 60**

**SYLLABUS/COMPONENT :9702 /2**

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



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- 1 (a) (i) mass / volume ... (ratio must be clear) ..... B1  
(ii)  $\text{kg m}^{-3}$  OR  $\text{kg / m}^3$  ..... B1 [2]
- (b)  $v$  has unit of  $\text{m s}^{-1}$  ..... B1  
 $p / \rho$  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  $\text{m s}^{-1}$  ..... A1  
LHS = RHS so  $\gamma$  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  $0.80 \text{ m}$  ..... A1 [2]
- (b)  $\Delta p = m(v - u)$  OR  $p = mv$  ..... C1  
speeds are  $4.2 \text{ m s}^{-1}$  and  $3.6 \text{ m s}^{-1}$  ..... 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  $0.14 \text{ s}$  and  $0.17 \text{ s}$  ..... 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  $60^\circ$  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  
 $= (1.6 \times 10^5) / (1.8 \times 10^4)$   
 $= 8.9 \text{ V}$  ..... A1
- (ii) current =  $\Delta Q / \Delta t$  ..... C1  
 $= (1.80 \times 10^4) / (1.3 \times 10^5)$   
 $= 0.14 \text{ A}$  ..... A1 [4]
- (b) (i) energy  $\propto R$  (or formula) ..... C1  
energy =  $(15 / 45) \times 1.14 \times 10^5$  ..... C1  
 $= 3.7 \times 10^4 \text{ J}$  ..... 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  
 $= 25 / (1.7 \times 10^{-6})$   
 $= 1.47 \times 10^7 \text{ Pa}$  .....(do not allow 1 sig fig) ..... A1
- (ii) stress =  $E \times \text{strain}$  ..... C1  
 $1.47 \times 10^7 = 7.1 \times 10^{10} \times (\Delta l / 1.8)$   
 $\Delta l = 0.37 \text{ mm}$  ..... 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  $\Delta R$  - full credit possible

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