

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International Advanced Subsidiary and Advanced Level

**MARK SCHEME for the October/November 2014 series**

**9702 PHYSICS**

**9702/21**

Paper 2 (AS Structured Questions), maximum raw mark 60

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- 1 (a) temperature  
current  
(allow amount of substance and luminous intensity) B1  
B1 [2]
- (b) base units of force constant:  $\text{kg m s}^{-2} \text{m}^{-1}$  or  $\text{kg s}^{-2}$  B1  
base units of time and mass: s and kg C1  
base units of C:  $\text{s (kg s}^{-2} / \text{kg)}^{1/2}$  cancelling to show no units B1 [3]
- 2 (a) pressure = force / area (normal to the force) [clear ratio essential] B1 [1]
- (b) (i)  $P = mg / A = (5.09 \times 9.81) / A$  C1  
 $A = (\pi d^2 / 4) = \pi \times (9.4 \times 10^{-2})^2 / 4 (= 0.00694 \text{ m}^2)$  C1  
 $P = 49.93 / 0.00694$   
 $= 7200 (7195) \text{ Pa}$  (minimum of 2 s.f. required) A1 [3]
- (ii)  $\Delta P / P = \Delta m / m + 2\Delta d / d$  C1  
 $= 0.01 / 5.09 + (2 \times 0.1) / 9.4 (= 0.0020 + 0.021 \text{ or } 2.3\%)$  C1  
 $\Delta P = 170 (165 \text{ to } 167) \text{ Pa}$  A1 [3]
- (iii)  $P = 7200 \pm 200 \text{ Pa}$  A1 [1]
- 3 (a) random error (in the measurements) of the length OR resistance B1 [1]
- (b) gradient =  $(3.6 - 1.9) / (0.8 - 0.4)$  C1  
 $= 4.25$  A1 [2]
- (c)  $R = \rho l / A$  C1  
 $\rho = \text{gradient} \times \text{area} = 4.25 \times 0.12 \times 10^{-6}$  C1  
 $= 5.1(0) \times 10^{-7} \Omega \text{ m}$  A1 [3]
- (d) resistance decreasing with increasing area B1  
correct shape with curve being asymptote to both axes B1 [2]

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- 4 (a) (i) acceleration =  $(v - u) / t$  or  $(12 - 0.5) / 4$  C1  
=  $(12 - 0.5) / 4 = 2.9$  (2.875) (= approximately  $3 \text{ ms}^{-2}$ ) M1 [2]
- (ii)  $x = (u + v)t / 2$   
=  $[(12 + 0.5) \times 4] / 2$  C1  
= 25 m A1 [2]
- (iii) line with increasing gradient M1  
non-zero gradient at origin A1 [2]
- (b) (i) weight down slope =  $2 \times 9.81 \times \sin 25^\circ = 8.29 / 8.3$  M1 [1]
- (ii) ( $F = ma$ ) 8.3 –  $F_R = 2 \times 2.9$  C1  
 $F_R = 2.5$  (2.3 if 3 used for a) N A1 [2]
- 5 (a) (i) change in kinetic energy =  $\frac{1}{2}mv^2$  C1  
=  $0.5 \times 25 \times (0.64)^2 = 5.1(2)$  J A1 [2]
- (ii) zero A1 [1]
- (iii)  $(-)$ 5.1(2) J A1 [1]
- (b) (i) PE =  $mgh$  C1  
=  $350 \times 0.64 \times 25$  C1  
= 5600 J A1 [3]
- (If full length used allow 1/3)
- (ii)  $P = Fv$  or gain in PE /  $t$ ,  $E_p / t$  or work done /  $t$ ,  $W / t$  C1  
=  $350 \times 0.64$  or  $5600 / 25$   
= 220 (224) W A1 [2]
- 6 melting: solid to liquid B1  
at a specific/one temperature/at the melting point B1
- evaporation: liquid to vapour/gas OR molecules escape from surface of liquid B1  
at all temperatures B1 [4]

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- 7 (a) due to the lost volts in internal resistance / cell or energy losses in the internal resistance / cell B1 [1]
- (b) (i)  $V = IR$  C1  
 $= 1.2 \times 6 = 7.2V$  A1 [2]
- (ii) p.d. across Y and internal resistance  $r = 4.8(V) [12 - 7.2]$  C1  
resistance of Y +  $r = 4.8 / 1.2 = 4(\Omega)$  C1  
resistance of Y =  $4 - 0.5 = 3.5 \Omega$  A1 [3]
- or
- $R_{\text{total}} = 12 / 1.2 = 10 (\Omega)$  (C1)  
 $X + r = 6.5 (\Omega)$  (C1)  
resistance of Y =  $3.5 \Omega$  (A1)
- (iii)  $P = I^2 r$  C1  
 $= (1.2)^2 \times 0.5 = 0.72W$  A1 [2]
- (c) terminal p.d. increases as  $R$  is increased B1 [1]  
current decreases so there are less lost volts
- 8 (a) two waves (of the same kind) travelling in opposite directions overlap B1  
waves have same frequency / wavelength and speed B1 [2]
- (b) (i)  $T = 0.8(\text{ms})$  C1  
 $f = 1 / (0.8 \times 10^{-3}) = 1250(\text{Hz})$  A1 [2]
- (ii) microphone is moved from plate to loudspeaker or vice versa B1  
wavelength is the twice the distance between adjacent maxima or minima (seen on c.r.o.) B1 [2]
- (iii)  $v = f\lambda$  C1  
 $= 1250 \times 0.26$   
 $= 330 (325)\text{ms}^{-1}$  A1 [2]