

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 B1
current B1 [2]
(allow amount of substance and luminous intensity)
- (b) base units of force constant: $\text{kg m s}^{-2} \text{m}^{-1}$ or 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 ms^{-2}) M1 [2]
- (ii) $x = (u + v)t / 2$
 $= [(12 + 0.5) \times 4] / 2$ C1
 $= 25 \text{ m}$ 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
 $= 0.5 \times 25 \times (0.64)^2 = 5.1(2) \text{ J}$ A1 [2]
- (ii) zero A1 [1]
- (iii) $(-)5.1(2) \text{ J}$ A1 [1]
- (b) (i) $PE = mgh$ C1
 $= 350 \times 0.64 \times 25$ C1
 $= 5600 \text{ J}$ 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
 $= 1.2 \times 6 = 7.2 \text{ V}$ A1 [2]
- (ii) p.d. across Y and internal resistance $r = 4.8 \text{ (V)}$ [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 = 3.5Ω (A1)
- (iii) $P = I^2 r$ C1
 $= (1.2)^2 \times 0.5 = 0.72 \text{ W}$ 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
 $= 1250 \times 0.26$
 $= 330 \text{ (325) ms}^{-1}$ A1 [2]