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: $kg\,m\,s^{-2}\,m^{-1}$ or $kg\,s^{-2}$ base units of time and mass: s and kg base units of *C*: $s\,(kg\,s^{-2}/kg)^{1/2}$ cancelling to show no units	B1 C1 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	
		$A = (\pi d^2/4) = \pi \times (9.4 \times 10^{-2})^2/4$ (= $0.00694\,m^2$)	C1	
		$P = 49.93/0.00694$ $= 7200\ (7195)\,Pa$ (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 or 2.3%)	C1	
		$\Delta P = 170\ (165\text{ to }167)\,Pa$	A1	[3]
	(iii)	$P = 7200 \pm 200\,Pa$	A1	[1]
3	(a)	<u>random</u> error (in the measurements) of the length OR resistance	B1	[1]
	(b)	gradient = (3.6 – 1.9) / (0.8 – 0.4) = 4.25	C1 A1	 [2]
	(c)	$R = \rho l/A$	C1	
		ρ = gradient × area = $4.25 \times 0.12 \times 10^{-6}$	C1	
		$= 5.1(0) \times 10^{-7}\,\Omega\,m$	A1	[3]
	(d)	resistance decreasing with increasing area correct shape with curve being asymptote to both axes	B1 B1	 [2]

4 **(a)** **(i)** acceleration = $(v - u) / t$ or $(12 - 0.5) / 4$ C1

= $(12 - 0.5) / 4$ = 2.9 (2.875) (= approximately 3 m s^{-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 = $2 \times 9.81 \times \sin 25°$ = 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

= 350×0.64 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]

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	
		$= 1.2 \times 6 = 7.2\,V$	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 (Ω)	C1	
		resistance of Y = 4 – 0.5 = 3.5 Ω	A1	[3]
		or		
		R_{total} = 12 / 1.2 = 10 (Ω)	(C1)	
		X + r = 6.5 (Ω)	(C1)	
		resistance of Y = 3.5 Ω	(A1)	
	(iii)	$P = I^2 r$	C1	
		$= (1.2)^2 \times 0.5 = 0.72\,W$	A1	[2]
	(c)	terminal p.d. increases as R is increased current decreases so there are less lost volts	B1	[1]
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 (ms)	C1	
		$f = 1 / (0.8 \times 10^{-3}) = 1250$ (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	
		$= 1250 \times 0.26$		
		$= 330\ (325)\ m\,s^{-1}$	A1	[2]