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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International Examinations

1	**(a)** temperature	B1	
	current	B1	[2]
	(allow amount of substance and luminous intensity)		
	(b) base units of force constant: $kg\,m\,s^{-2}\,m^{-1}$ or $kg\,s^{-2}$	B1	
	base units of time and mass: s and kg	C1	
	base units of C: $s\,(kg\,s^{-2}/kg)^{1/2}$ 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	
	$A = (\pi d^2 / 4) = \pi \times (9.4 \times 10^{-2})^2 / 4$ (= $0.00694\,m^2$)	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 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)	C1	
	= 4.25	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	B1	
	correct shape with curve being asymptote to both axes	B1	[2]

4 **(a)** **(i)**	acceleration = $(v - u) / t$ or $(12 - 0.5) / 4$	C1	
	= $(12 - 0.5) / 4$ = 2.9 (2.875) (= approximately $3\,\mathrm{m\,s^{-2}}$)	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	
			$= 1.2 \times 6 = 7.2\,\text{V}$	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 (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	
			$= (1.2)^2 \times 0.5 = 0.72\,\text{W}$	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)	$T = 0.8\,(\text{ms})$	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	
			$= 1250 \times 0.26$		
			$= 330\ (325)\,\text{m}\,\text{s}^{-1}$	A1	[2]