CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2012 series

9702 PHYSICS

9702/21 Paper 2 (AS Structured Questions), maximum raw mark 60

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

1 (a) (i)		acceleration = change in velocity / time (taken) or acceleration = rate of change of velocity	B1	[1]
(ii)		a body continues at constant velocity unless acted on by a resultant force	B1	[1]
(b) (i)		distance is represented by the area under graph distance = ½ × 29.5 × 3 = 44.3 m (accept 43.5 m for 29 to 45 m for 30)	C1 A1	[2]
(ii)		resultant force = weight – frictional force frictional force increases with speed at start frictional force = 0 / at end weight = frictional force	B1 B1 B1	[3]
(iii)	1.	frictional force increases	B1	[1]
	2.	frictional force (constant) and then decreases	B1	[1]
(iv)	1.	acceleration = $(v_2 – v_1) / t$ = (20 – 50) / (17 – 15) = (–) 15 m s^{-2}	C1 A1	[2]
	2.	$W – F = ma$ W = 95 × 9.81 (= 932) F = (95 × 15) + 932 = 2400 (2360) (2357) N	C1 C1 A1	[3]
2 (a)		resistance = potential difference / current	B1	[1]
(b) (i)		metal wire in series with power supply and ammeter voltmeter in parallel with metal wire rheostat in series with power supply or potential divider arrangement or variable power supply	B1 B1 B1	[3]
(ii)	1.	intercept on graph	B1	[1]
	2.	scatter of readings about the best fit line	B1	[1]
(iii)		correction for zero error explained use of V and corrected I values from graph resistance = V / I = 22.(2) Ω [e.g. 4.0 / 0.18]	B1 C1 A1	[3]
(c)		R = 6.8 / 0.64 = 10.625	C1	
		%R = %V + %I = (0.1 / 6.8) × 100 + (0.01 / 0.64) × 100 = 1.47% + 1.56% ΔR = 0.0303 × 10.625 = 0.32 Ω R = 10.6 ± 0.3 Ω	 C1 A1	 [3]

3	**(a)**	pressure = force / area	B1	[1]
	(b)	molecules collide with object / surface and rebound	B1	
		molecules have change in momentum hence force acts	B1	
		fewer molecules per unit volume on top of mountain / temperature is less hence lower speed of molecules	B1	
		hence less pressure	A0	[3]
	(c) (i)	$\rho = m / V$	C1	
		$W = V\rho g = 0.25 \times 0.45 \times 9.81 \times 13600$	C1	
		$= 15000\ (15009)$ N	A1	[3]
	(ii)	$p = W / A$ (or using $p = \rho gh$) $= 15009 / 0.45$		
		$= 3.3 \times 10^4$ Pa	A1	[1]
	(iii)	pressure will be greater due to the air pressure (acting on the surface of the liquid)	B1	[1]
4	**(a)**	waves pass through the elements / gaps / slits in the grating	M1	
		spread into geometric shadow	A1	[2]
	(b) (i) 1.	displacements add to give resultant displacement	B1	
		each wavelength travels the same path difference or are in phase	B1	
		hence produce a maximum	A0	[2]
	2.	to obtain a maximum the path difference must be λ or phase difference 360° / 2π rad	B1	
		λ of red and blue are different	B1	
		hence maxima at different angles / positions	A0	[2]
	(ii)	$n\lambda = d \sin\theta$	C1	
		$N = \sin 61° / (2 \times 625 \times 10^{-9}) = 7.0 \times 10^5$	A1	[2]
	(iii)	$n\lambda = 2 \times 625$ is a constant (1250)	C1	
		$n = 1 \rightarrow \lambda = 1250$ outside visible		
		$n = 3 \rightarrow \lambda = 417$ in visible		
		$n = 4 \rightarrow \lambda = 312.5$ outside visible		
		$\lambda = 420$ nm	A1	[2]
5	**(a)**	when the load is removed then the wire / body object does not return to its original shape / length	B1	[1]
	(b) (i)	stress = force / area	C1	
		$F = 220 \times 10^6 \times 1.54 \times 10^{-6} = 340\ (338.8)$ N	A1	[2]
	(ii)	$E = (F \times l) / (A \times e)$	C1	
		$e = (90 \times 10^6) \times 1.75 / (1.2 \times 10^{11}) = 1.31 \times 10^{-3}$ m	A1	[2]
	(c)	the stress is no longer proportional to the extension	B1	[1]

6 **(a)** 92 protons in the nucleus and 92 electrons around nucleus B1
143 neutrons (in the nucleus) B1 [2]

(b) **(i)** α-particle travels short distance in air B1 [1]

(ii) very small proportion in backwards direction / large angles B1
majority pass through with no /small deflections B1
either most of mass is in very small volume (nucleus) and is charged or most of atom is empty space B1 [3]

(c) $I = Q / t$ C1
$n / t = (1.5 \times 10^{-12}) / (2 \times 1.6 \times 10^{-19})$ C1
$n / t = 4.7 \times 10^{6}\ s^{-1}$ A1 [3]