CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the May/June 2015 series

9702 PHYSICS

9702/23 Paper 2 (AS Structured Questions), maximum raw mark 60

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1	**(a)** 150 or 1.5×10^2 Gm	A1	[1]
	(b) distance = $2 \times (42.3 - 6.38) \times 10^6$ (= 7.184×10^7 m)	C1	
	(time =) $7.184 \times 10^7 / (3.0 \times 10^8)$ = 0.24 (0.239) s	A1	[2]
	(c) units of pressure *P*: kg m s^{-2} / m^2 = kg m^{-1} s^{-2}	M1	
	units of density ρ: kg m^{-3} and speed *v*: m s^{-1}	M1	
	simplification for units of *C*: $C = v^2 \rho / P$ units: (m^2 s^{-2} kg m^{-3}) / kg m^{-1} s^{-2} and cancelling to give no units for *C*	A1	[3]
	(d) energy and power *(both underlined and no others)*	A1	[1]
	(e) **(i)** vector triangle of correct orientation	M1	
	three arrows for the velocities in the correct directions	A1	[2]
	(ii) length measured from scale diagram 5.2 ± 0.2 cm or components of boat speed determined parallel and perpendicular to river flow	C1	
	velocity = 2.6 m s^{-1} (allow ± 0.1 m s^{-1})	A1	[2]
2	**(a)** <u>constant</u> rate of increase in velocity/acceleration from *t* = 0 to *t* = 8 s	B1	
	<u>constant</u> deceleration from *t* = 8 s to *t* = 16 s or constant rate of increase in velocity in the opposite direction from *t* = 10 s to *t* = 16 s	B1	[2]
	(b) **(i)** area under lines to 10 s	C1	
	(displacement =) $(5.0 \times 8.0) / 2 + (5.0 \times 2.0) / 2$ = 25 m or ½ (10.0×5.0) = 25 m	A1	[2]
	(ii) $a = (v - u) / t$ or gradient of line	C1	
	$= (-15.0 - 5.0) / 8.0$		
	= (–) 2.5 m s^{-2}	A1	[2]
	(iii) KE $= \frac{1}{2} m v^2$	C1	
	$= 0.5 \times 0.4 \times (15.0)^2$ = 45 J	A1	[2]
	(c) (distance =) 25 (m) (= $ut + \frac{1}{2}at^2$) = $0 + \frac{1}{2} \times 2.5 \times t^2$	C1	
	(t = 4.5 (4.47) s therefore) time to return = 14.5 s	A1	[2]

3	**(a)**	(power =) work done / time (taken) or rate of work done	A1	[1]
	(b) (i)	$F - R = ma$	C1	
		$F = 1500 \times 0.82 + 1200$	C1	
		$= 2400\ (2430)$ N	A1	[3]
	(ii)	$P = Fv$	C1	
		$= (2430 \times 22) = 53\,000\ (53\,500)$ W	A1	[2]
	(c)	(there is maximum power from car and) resistive force = force produced by car hence no acceleration **or** suggestion in terms of power produced by car and power wasted to overcome resistive force	B1	[1]
4	**(a) (i)**	diameter and extension: micrometer (screw gauge) or digital calipers	B1	
		length: tape measure or metre rule	B1	
		load: spring balance or Newton meter	B1	[3]
	(ii)	to reduce the effect of random errors **or** to plot a graph to check for zero error in measurement of extension **or** to see if limit of proportionality is exceeded	B1	[1]
	(b)	plot a graph of F against e and determine the gradient	B1	
		$E = (\text{gradient} \times l)/[\pi d^2/4]$	B1	[2]
5	**(a)**	$R = \rho l / A$	C1	
		$= (5.1 \times 10^{-7} \times 0.50) / \pi(0.18 \times 10^{-3})^2 = 2.5\ (2.51)\,\Omega$	M1	[2]
	(b) (i)	resistance of CD = 8 × resistance of AB = 20 (Ω)	C1	
		circuit resistance = $[1/5.0 + 1/20]^{-1} = 4.0\ (\Omega)$	C1	
		current = V/R = 6.0/4.0	C1	
		= 1.5 A	A1	[4]
	(ii)	power in AB = I^2R or power = V^2/R	C1	
		$= (1.2)^2 \times 2.5 = 3.6$ W or $= (3.0)^2/2.5 = 3.6$ W	A1	[2]

		(iii)	potential drop A to M = 1.25 × 1.2 = 1.5 V	M1	
			potential drop C to N = 3.0 V p.d. MN = 1.5 V	A1	[2]
6	(a)	(i)	coherent: constant phase difference	B1	
			interference is the (overlapping of waves and the) sum of/addition of displacement of two waves	B1	[2]
		(ii)	wavelength = 3.2 m (allow ± 0.05 m)	M1	
			f (= v / λ = 240 / 3.2) = 75 Hz	A1	[2]
		(iii)	90° (allow ± 2°) or $\pi/2$ rad	A1	[1]
		(iv)	sketch has amplitude 3.0 ± 0.1 cm	M1	
			correct displacement values at previous peaks to produce correct shape	A1	[2]
	(b)	(i)	$\lambda = ax/D$	C1	
			$x = (546 \times 10^{-9} \times 0.85) / 0.13 \times 10^{-3}$ (= 3.57×10^{-3} m)	C1	
			AB = 8.9 (8.93) × 10^{-3} m	A1	[3]
		(ii)	shorter wavelength for blue light so separation is less	B1	[1]
7	(a)	(i)	(rate of decay) not affected by any external factors **or** changes in temperature and pressure etc.	B1	[1]
		(ii)	two protons and two neutrons	B1	[1]
	(b)	(i)	(total) mass before decay/on left-hand side is greater than (total) mass on right-hand side/after the decay	M1	
			the difference in mass is released as kinetic energy of the products	A1	[2]
			(may also be some γ radiation) (to conserve mass-energy)		
		(ii)	($6.2 \times 10^{6} \times 1.6 \times 10^{-19}$ =) $9.9(2) \times 10^{-13}$ J	A1	[1]