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

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 May/June 2015 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

® IGCSE is the registered trademark of Cambridge International Examinations.

CAMBRIDGE
International Examinations

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: $\text{kg m s}^{-2} / \text{m}^2 = \text{kg m}^{-1} \text{s}^{-2}$ — 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: $(\text{m}^2 \text{s}^{-2} \text{kg m}^{-3}) / \text{kg m}^{-1} \text{s}^{-2}$ 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 $(10.0 \times 5.0) = 25$ m — A1 [2]

(ii) $a = (v - u) / t$ or gradient of line — C1

$= (-15.0 - 5.0) / 8.0$

$= (-) 2.5 \text{ m s}^{-2}$ — 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]

© Cambridge International Examinations 2015

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

$= 2400\ (2430)\,\text{N}$ — A1 [3]

(ii) $P = Fv$ — C1

$= (2430 \times 22) = 53\,000\ (53\,500)\ \text{W}$ — 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 = (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 $\times$ resistance of AB = $20\,(\Omega)$ — C1

circuit resistance = $[1/5.0 + 1/20]^{-1} = 4.0\,(\Omega)$ — C1

current = V/R = $6.0/4.0$ — C1

$= 1.5\,\text{A}$ — A1 [4]

(ii) power in AB = I^2R or power = V^2/R — C1

$= (1.2)^2 \times 2.5 = 3.6\,\text{W}$ or $= (3.0)^2/2.5 = 3.6\,\text{W}$ — A1 [2]

© Cambridge International Examinations 2015

		(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 π/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 × 10^{-9} × 0.85) / 0.13 × 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 × 10^{6} × 1.6 × 10^{-19} =) 9.9(2) × 10^{-13} J	A1	[1]

© Cambridge International Examinations 2015