

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 : $\text{kg m s}^{-2} / \text{m}^2 = \text{kg m}^{-1} \text{s}^{-2}$ 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 $\pm 0.1 \text{ m s}^{-1}$) A1 [2]
- 2 (a) constant rate of increase in velocity/acceleration from $t = 0$ to $t = 8$ s B1
constant 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 $\frac{1}{2} (10.0 \times 5.0) = 25$ 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) $\text{KE} = \frac{1}{2} m v^2$ 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]

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- 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) Ω M1 [2]
- (b) (i) resistance of CD = 8 \times resistance of AB = 20 (Ω) C1
- circuit resistance = $[1/5.0 + 1/20]^{-1} = 4.0$ (Ω) C1
- current = $V/R = 6.0/4.0$ C1
- $= 1.5$ A A1 [4]
- (ii) power in AB = $I^2 R$ or power = V^2 / R C1
- $= (1.2)^2 \times 2.5 = 3.6$ W $= (3.0)^2 / 2.5 = 3.6$ W A1 [2]

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- (iii) potential drop A to M = $1.25 \times 1.2 = 1.5\text{ V}$ 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 $\pm 0.05\text{ m}$) M1
- $f (= v/\lambda = 240 / 3.2) = 75\text{ Hz}$ A1 [2]
- (iii) 90° (allow $\pm 2^\circ$) or $\pi/2$ rad A1 [1]
- (iv) sketch has amplitude $3.0 \pm 0.1\text{ cm}$ M1
- correct displacement values at previous peaks to produce correct shape A1 [2]
- (b) (i) $\lambda = ax/D$ C1
- $x = (546 \times 10^{-9} \times 0.85) / 0.13 \times 10^{-3} (= 3.57 \times 10^{-3}\text{ m})$ C1
- $AB = 8.9 (8.93) \times 10^{-3}\text{ m}$ 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) $(6.2 \times 10^6 \times 1.6 \times 10^{-19} =) 9.9(2) \times 10^{-13}\text{ J}$ A1 [1]