

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the October/November 2014 series

9702 PHYSICS

9702/23

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

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – October/November 2014	9702	23

- 1 (a) ampere
kelvin
(allow mole and candela) B1
B1 [2]
- (b) (i) stress: N m^{-2}
 $\text{kg m s}^{-2} / \text{m}^2 = \text{kg m}^{-1} \text{s}^{-2}$ C1
A1 [2]
- (ii) Young modulus = stress/strain and strain has no units
hence units: $\text{kg m}^{-1} \text{s}^{-2}$ B1 [1]
- 2 (a) (i) amplitude scale reading 2.2 (cm)
amplitude = $2.2 \times 2.5 = 5.5 \text{ mV}$ C1
A1 [2]
- (ii) time period scale reading = 3.8 (cm) C1
time period = $3.8 \times 0.5 \times 10^{-3} = 0.0019 \text{ (s)}$ C1
frequency $f = 1 / 0.0019 = 530 \text{ (526) Hz}$ A1 [3]
- (iii) uncertainty in reading = ± 0.2 in 3.8 (cm) or 5.3% or 0.2 in 7.6 (cm)
or 2.6% [allow other variations of the distance on the x-axis] M1
actual uncertainty = 5.3% of 526 = 27.7 or 28 Hz
or 2.6% of 526 = 13 or 14 A1 [2]
- (b) frequency = $530 \pm 30 \text{ Hz}$ or $530 \pm 10 \text{ Hz}$ A1 [1]
- 3 (a) displacement/velocity/acceleration/momentum/etc.
three correct (none wrong) 2, two correct (none or one wrong) 1 A2 [2]
- (b) (i) $Y = 70 \text{ N}$ [allow 71 N as $+1/2$ small square on graph] A1 [1]
- (ii) $\theta = 90^\circ$ M1
(for equilibrium) the direction of Y must be opposite to Z
or using $Y \sin \theta = Z$, hence $\sin \theta = 70 / 70 = 1$, $\theta = 90^\circ$ A1 [2]
- (iii) 1. $Y \cos \theta = 160$ and $Y \sin \theta = 70$ C1
 $\tan \theta = 70 / 160$ hence $\theta = 23.6^\circ$ (24°) A1 [2]
2. $Y = 160 / \cos 23.6^\circ$ or $70 / \sin 23.6^\circ$ C1
 $= 174.6$ or 175 or 170 N A1 [2]
- or:
 $160^2 + 70^2 = Y^2$ (C1)
 $Y = 174.6$ or 175 or 170 N (A1)

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – October/November 2014	9702	23

- (c) (equilibrium not possible as) there is no vertical component from Y to balance Z B1 [1]
- 4 (a) for a system (of interacting bodies) the total momentum remains constant provided there is no resultant force acting (on the system) M1 A1 [2]
- (b) (i) total momentum = $m_1v_1 + m_2v_2$ C1
 $= 0.4 \times 0.65 + 0.6 \times 0.45$ C1
 $= 0.26 + 0.27 = 0.53 \text{ N s}$ A1 [3]
- (ii) $0.53 = 0.4 \times 0.41 + 0.6 \times v$ C1
 $v = 0.366 / 0.6 = 0.61 \text{ m s}^{-1}$ A1 [2]
- (iii) $\text{KE} = \frac{1}{2}mv^2$ C1
total initial KE = $\frac{1}{2} \times 0.4 \times (0.65)^2 + \frac{1}{2} \times 0.6 \times (0.45)^2$ C1
 $= 0.0845 + 0.06075 = 0.15 (0.145) \text{ J}$ A1 [3]
- (c) check relative speed of approach equals relative speed of separation
or:
total final kinetic energy equals the total initial kinetic energy B1 [1]
- (d) the forces on the two bodies (or on X and Y) are equal and opposite
time same for both forces and force is change in momentum/time B1 B1 [2]
- 5 evaporation: molecules escape from the surface at all temperatures B1 B1
- boiling: takes place throughout/in the liquid at the boiling point/at specific temperatures B1 B1 [4]
- 6 (a) $R = \rho l / A$ C1
 $A = [\pi \times (0.38 \times 10^{-3})^2] / 4 (= 0.113 \times 10^{-6} \text{ m}^2)$ C1
 $R = (4.5 \times 10^{-7} \times 1.00) / ([\pi \times (0.38 \times 10^{-3})^2] / 4) = 4.0 (3.97) \Omega$ M1 [3]
- (b) (i) $I = V/R$ C1
 $= 2.0 / 5.0 = 0.4(0) \text{ A}$ A1 [2]
- (ii) p.d. across BD = $4 \times 0.4 = 1.6 \text{ V}$ A1 [1]
- (iii) p.d. across BC (l) = $1.5 (V)$ C1
 $BC (l) = (1.5 / 1.6) \times 100 = 94 (93.75) \text{ cm}$ A1 [2]

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – October/November 2014	9702	23

- (c) p.d. across wire not balancing e.m.f. of cell OR cell Y has current energy lost or lost volts due to internal resistance B1 B1 [2]

- 7 (a) (i) progressive: energy is moved / transferred / propagated from one place to another (without the bulk movement of the medium) B1
- transverse: (particles) oscillate / vibrate at right angles to the direction of travel of the energy / wavefront B1 [2]

- (ii) number of oscillations per unit time / number of wavefronts passing a point per unit time B1 [1]

- (b) (i) P and T B1 [1]

- (ii) P and S or Q and T B1 [1]

- (c) $\lambda = 1.2 \times 10^{-2} \text{ (m)}$ C1

$$\begin{aligned}
 v &= f\lambda \\
 &= 15 \times 1.2 \times 10^{-2} \\
 &= 0.18 \text{ ms}^{-1}
 \end{aligned}$$

C1 A1 [3]

- (d) ratio = $(1.4)^2 / (2.1)^2$ C1
= 0.44 A1 [2]