

**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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- 1 (a) ampere  
kelvin  
(allow mole and candela) B1  
B1 [2]
- (b) (i) stress:  $\text{N m}^{-2}$   
 $\text{kg m s}^{-2} / \text{m}^2 = \text{kg m}^{-1} \text{s}^{-2}$  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 =  $\pm 0.2$  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  $\pm \frac{1}{2}$  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  $\theta = 23.6^\circ$  ( $24^\circ$ ) 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)

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- (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 ( $l$ ) =  $1.5 \text{ (V)}$  C1  
 $\text{BC} (l) = (1.5 / 1.6) \times 100 = 94 (93.75) \text{ cm}$  A1 [2]

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- (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)  $\lambda = 1.2 \times 10^{-2}$  (m) C1
- $v = f\lambda$   
 $= 15 \times 1.2 \times 10^{-2}$   
 $= 0.18 \text{ ms}^{-1}$  C1 A1 [3]
- (d) ratio =  $(1.4)^2 / (2.1)^2$   
 $= 0.44$  C1 A1 [2]