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

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 October/November 2014 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

CAMBRIDGE
International Examinations

1 **(a)** ampere B1
kelvin B1 [2]
(allow mole and candela)

(b) **(i)** stress: N m^{-2} C1
$kg\,m\,s^{-2}/m^2 = kg\,m^{-1}\,s^{-2}$ A1 [2]

(ii) Young modulus = stress / strain and <u>strain has no units</u>
hence units: $kg\,m^{-1}\,s^{-2}$ B1 [1]

2 **(a)** **(i)** amplitude scale reading 2.2 (cm) C1
amplitude = $2.2 \times 2.5 = 5.5$ mV A1 [2]

(ii) time period scale reading = 3.8 (cm) C1
time period = $3.8 \times 0.5 \times 10^{-3} = 0.0019$ (s) C1

frequency f = 1 / 0.0019 = 530 (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 ± 30 Hz or 530 ± 10 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 N [allow 71 N as +½ small square on graph] A1 [1]

(ii) $\theta = 90°$ M1

(for equilibrium) the direction of Y must be <u>opposite</u> to Z

or using $Y \sin\theta = Z$, hence $\sin\theta = 70 / 70 = 1$, $\theta = 90°$ A1 [2]

(iii) **1.** $Y\cos\theta = 160$ and $Y\sin\theta = 70$ C1

$\tan\theta = 70/160$ hence $\theta = 23.6°$ (24°) A1 [2]

2. Y = 160 / cos 23.6° or 70 / sin 23.6° 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)

(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 <u>total</u> momentum remains constant M1
provided there is no <u>resultant</u> force acting (on the system) 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) 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 B1
time same for both forces <u>and</u> force is change in momentum / time B1 [2]

5 evaporation: molecules escape from the surface B1
at all temperatures B1

boiling: takes place throughout / in the liquid B1
at the boiling point / at specific temperatures B1 [4]

6 **(a)** $R = \rho l / A$ C1

$A = [\pi \times (0.38 \times 10^{-3})^2] / 4 \quad (= 0.113 \times 10^{-6}\ \text{m}^2)$ 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]

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

$v = f\lambda$
$= 15 \times 1.2 \times 10^{-2}$ — C1
$= 0.18\,\text{m s}^{-1}$ — A1 [3]

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