UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9702 PHYSICS

9702/23 Paper 2 (AS Structured Questions), maximum raw mark 60

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1 **(a)** 2nd row random, 3rd row neither, 4th row systematic all correct B2
two correct scores 1 only [2]

(b) **(i)** **1.** systematic error: the average / peak is not the true value / the readings are not centred around the true value B1 [1]

2. random error: readings have positive and negative values around the peak value / values are scattered / wide range B1 [1]

(ii) **1.** accurate: peak / average value moves towards the true value B1 [1]

2. precise: lines are closer together / sharper peak B1 [1]

2 **(a)** resultant moment = zero / sum of clockwise moments = sum of anticlockwise moments B1
resultant force = 0 B1 [2]

(b) shape and orientation correct and forces labelled and arrows correct M1
angles correct / labelled A1 [2]

(c) **(i)** $T\cos 18° = W$ Scale diagram: C1
$T = 520 / \cos 18° = 547$ N ± 20 N A1 [2]

(ii) $R = T\sin 18°$
$= 169$ N ± 20 N A1 [1]

(d) θ is larger hence $\cos\theta$ is smaller, $T = W / \cos\theta$ M1
hence T is larger A0 [1]

3 **(a)** weight = $m \times g$
$= 130.5 \times 9.81 = 1280$ N A1 [1]

(b) **(i)** $F = ma$
$T - 1280 = 130.5 \times 0.57$ C1
$T = 1280 + 74.4 = 1350$ N A1 [2]

(ii) 1280 N A1 [1]

(c) $1240 - 1280 = 130.5 \times a$ C1
$a = (-)\ 0.31\,\text{m s}^{-2}$ A1 [2]

(d) **(i)** **1.** 3.5 s A1 [1]

2. 6.5 s A1 [1]

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(ii) basic shape M1
correct points A1 [2]

4 **(a)** force is proportional to extension B1 [1]

(b) **(i)** gradient of graph determined (e.g. 50 / 40 $\times 10^{-3}$) = 1250 N m^{-1} A1 [1]

(ii) $W = \frac{1}{2} k x^2$ or W = ½ final force × extension M1
$= 0.5 \times 1250 \times (36 \times 10^{-3})^2$ or $0.5 \times 45 \times 36 \times 10^{-3}$ M1
= 0.81 J A0 [2]

(c) **(i)** $0.81 = \frac{1}{2} mv^2$ C1
v = 8.0 (8.0498) m s^{-1} A1 [2]

(ii) 4 × KE / 4 × WD or 3.24 J C1
hence twice the compression = 72 mm A1 [2]

(iii) Max height is when all KE or WD
or elastic PE is converted to GPE C1
ratio = 1/4 or 0.25 A1 [2]

5 **(a)** **(i)** Start from (0,0) and smooth curve in correct direction B1
Curve correct for end section never horizontal B1 [2]

(ii) $R = V / I$ hence take co-ords of V and I from graph and calculate V / I B1 [1]

(b) **(i)** each lamp in parallel has a greater p.d. / greater current M1
lamp hotter M1
resistance of lamps in parallel greater A1 [3]

(ii) $P = V^2 / R$ or $P = VI$ and $V = IR$ C1
R = 144 / 50 = 2.88 for each lamp C1
total R = 1.44 Ω A1 [3]

6 **(a)** **(i)** amplitude = 7.6 mm allow 7.5 mm A1 [1]

(ii) 180° / π <u>rad</u> A1 [1]

(iii) $v = f \times \lambda$
$= 15 \times 0.8$ C1
= 12 m s^{-1} A1 [2]

(b) correct sketch with peak moved to the right B1
curve moved by the correct phase angle / time period of 0.25 T B1 [2]

(c) **(i)** zero (rad) A1 [1]

(ii) antinode maximum amplitude,
node zero amplitude / displacement A1 [1]

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(iii) 3 A1 [1]

(iv) horizontal line through central section of wave B1 [1]

7 **(a)** density in solids and liquids similar M1
spacing in solids and liquids about the same A1
density in gases much less as spacing in gases much greater B1 [3]

(b) density = mass / volume C1
mass = 1.67×10^{-27} kg and volume = $4/3\ \pi\ r^3$ C1
density = $(1.67 \times 10^{-27}) / 4/3 \times \pi \times (1.0 \times 10^{-15})^3$
= 3.99×10^{17} kg m^{-3} A1 [3]

(c) atoms / molecules composed of large amount of empty space / nucleus has very small volume compared to volume of atom / space between atoms in a gas is very large B1 [1]

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