

**MARK SCHEME for the October/November 2010 question paper
for the guidance of teachers**

9702 PHYSICS

9702/22

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

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- 1 (a) (i) scalar quantity has magnitude (allow size) B1
vector quantity has magnitude and direction B1 [2]
- (ii) 1. temperature: scalar B1 [1]
2. acceleration: vector B1 [1]
3. resistance: scalar B1 [1]
- (b) *either* triangle / parallelogram with correct shape C1
tension = 14.3 N (allow ± 0.5 N) A2 [3]
- (if $> \pm 0.5$ N but $\leq \pm 1$ N, allow 1 mark)
- or $R = 25 \cos 35^\circ$ (C1)
 $T = R \tan 35^\circ$ (C1)
 $T = 14.3$ N (A1)
- or $T = 25 \sin 35^\circ$ (C2)
 $T = 14.3$ N (A1)
- or R and T resolved vertically and horizontally (C2)
leading to $T = 14.3$ N (A1)
- 2 (a) (i) $V_H = 12.4 \cos 36^\circ (= 10.0 \text{ m s}^{-1})$ C1
distance = 10.0×0.17
 $= 1.7$ m A1 [2]
- (ii) $V_V = 12.4 \sin 36^\circ (= 7.29 \text{ m s}^{-1})$ C1
 $h = 7.29 \times 0.17 - \frac{1}{2} \times 9.81 \times 0.17^2$ C1
 $= 1.1$ m A1 [3]
- (b) smooth curve with ball hitting wall below original B1
smooth curve showing rebound to ground with correct reflection at wall B1 [2]
- 3 (a) point at which (whole) weight (of body) (allow mass for weight) M1
appears / seems to act ... (for mass need 'appears to be concentrated') A1 [2]
- (b) (i) point C shown at centre of rectangle ± 5 mm B1 [1]
- (ii) arrow vertically downwards, from C with arrow starting from the same margin of error as in (b)(i) B1 [1]
- (c) (i) reaction / upwards / supporting / normal reaction force M1
friction M1
force(s) at the rod A1 [3]
- (ii) comes to rest with (line of action of) weight acting through rod B1
allow C vertically below the rod B1
so that weight does not have a moment about the pivot / rod [2]

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- 4 (a) energy = average force \times extension
 $= \frac{1}{2} \times F \times x$
(Hooke's law) extension proportional to (applied) force
hence $F = kx$
so $E = \frac{1}{2}kx^2$ B1
B1
B1
B1
A0 [4]
- (b) (i) correct area shaded B1 [1]
- (ii) 1.0 cm² represents 1.0 mJ or correct units used in calculation C1
 $E_s = 6.4 \pm 0.2 \text{ mJ}$ A2 [3]
(for answer $> \pm 0.2 \text{ mJ}$ but $\leq \pm 0.4 \text{ mJ}$, then allow 2/3 marks)
- (iii) arrangement of atoms / molecules is changed B1 [1]
- 5 (a) (i) distance (of point on wave) from rest / equilibrium position B1 [1]
- (ii) distance moved by wave energy / wavefront during one cycle of the source
or minimum distance between two points with the same phase or between adjacent crests or troughs B1 [1]
- (b) (i) $T = 0.60 \text{ s}$ B1 [1]
- (ii) $\lambda = 4.0 \text{ cm}$ B1 [1]
- (iii) either $v = \lambda/T$ or $v = f\lambda$ and $f = 1/T$ C1
 $v = 6.7 \text{ cm s}^{-1}$ A1 [2]
- (c) (i) amplitude is decreasing
so, it is losing power M1
A1 [2]
- (ii) intensity $\sim (\text{amplitude})^2$ C1
ratio = $2.0^2 / 1.1^2$ C1
= 3.3 A1 [3]
- 6 (a) (i) at 22.5 °C, $R_T = 1600 \Omega$ or 1.6 k Ω C1
total resistance = 800 Ω A1 [2]
- (ii) either use of potential divider formula or current = 9 / 2000 (4.5 mA) C1
 $V = (0.8/2.0) \times 9$ $V = (9/2000) \times 800$
= 3.6V = 3.6V A1 [2]
- (b) (i) total resistance = $4/5 \times 1200$ C1
= 960 Ω A1 [2]
- (ii) for parallel combination, $1/960 = 1/1600 + 1/R_T$
 $R_T = 2400 \Omega$ / 2.4 k Ω C1
temperature = 11 °C A1 [2]

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(c) e.g. only small part of scale used / small sensitivity
 non-linear
(any two sensible suggestions, 1 each, max 2) B1 B1 [2]

7 (a) (i) most α -particles were deviated through small angles
(allow 1 mark for 'straight through' / undeviated) B2 [2]

(ii) small fraction of α -particles deviated through large angles
 greater than 90° (allow rebound back) M1 A1 [2]

(b) e.g. β -particles have a range of energies
 β -particles deviated by (orbital) electrons
 β -particle has (very) small mass
(any two sensible suggestions, 1 each, max 2) B2 [2]

Do not allow β -particles have negative charge or β -particles have high speed