

MARK SCHEME for the May/June 2006 question paper

9702 PHYSICS

9702/02

Paper 2

Maximum raw mark 60

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

The minimum marks in these components needed for various grades were previously published with these mark schemes, but are now instead included in the Report on the Examination for this session.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

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Page 1	Mark Scheme	Syllabus	Paper
	GCE A Level – May/June 2006	9702	02

1	(a) kg m s ⁻²	B1	[1]
	(b) kg m ⁻¹ s ⁻¹	B1	[1]
	(c) (i) $v^2 = 2gs$ $= 2 \times 9.8 \times 4.5$ $v = 9.4 \text{ m s}^{-1}$	C1 A1	[2]
	(ii) <i>either</i> $F (= 3.2 \times 10^{-4} \times 1.2 \times 10^{-2} \times 9.4) = 3.6 \times 10^{-5} \text{ N}$ weight of sphere ($= mg = 15 \times 10^{-3} \times 9.8) = 0.15 \text{ N}$ $3.6 \times 10^{-5} \ll 0.15$, so justified <i>or</i> $mg = crv_T$ (M1) terminal speed $= 3.8 \times 10^4 \text{ m s}^{-1}$ (M1) $9.4 \ll 3.8 \times 10^4$, so justified (A1)	M1 M1 A1	[3]
2	(a) (i) point at which whole weight of body may be considered to act	M1 A1	[2]
	(ii) sum of forces in any direction is zero sum of moments about any point is zero	B1 B1	[2]
	(b) <i>either</i> : T and W have zero moment about P so F must have zero moment, i.e. pass through P <i>or</i> : if all pass through P, distance from P is zero for all forces (M1) so sum of moments about P is zero (A1)	M1 A1	[2]
	(c) (i) $F \cos \alpha = T \cos \beta$	B1	[1]
	(ii) $W = F \sin \alpha + T \sin \beta$	B1	[1]
	(iii) $2W = 3T \sin \beta$	B1	[1]
3	(a) sum of (random) kinetic and potential energies of the atoms/molecules of the substance	M1 A1	[2]
	(b) (i) potential energy unchanged as atoms remain in same positions <i>allow 'reduced because atoms slightly closer together'</i> vibrational kinetic energy reduced because temperature lower so internal energy less	M1 M1 A1	[3]
	(ii) potential energy increases because separation increases kinetic energy unchanged because temperature unchanged so internal energy increases	M1 M1 A1	[3]
4	(a) mass per unit volume (<i>ratio idea must be clear, not units</i>)	B1	[1]
	(b) (i) pressure is same at the surface of <u>mercury</u> because at same horizontal level	B1	[1]
	(ii) $h\rho g$ is same for both $53 \times 10^{-2} \times 1.0 \times 10^3 \times g = 71 \times 10^{-2} \times \rho \times g$ $\rho = 7.5 \times 10^2 \text{ kg m}^{-3}$	B1 C1 A1	[3]

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- 5 (a) no hysteresis loop/no permanent deformation
(do not allow 'force proportional to extension')
so elastic change
- (b) work done = area under graph line OR average force \times distance
 $= \frac{1}{2}Fx$
 $F = kx$, so work done = $= \frac{1}{2}kx^2$
 work done = $\frac{1}{2}k(x_2^2 - x_1^2)$
- (c) gain in energy of trolley = $\frac{1}{2}k(0.060^2 - 0.045^2) + \frac{1}{2}k(0.030^2 - 0.045^2)$
 $= 0.36 \text{ J}$
 kinetic energy = $\frac{1}{2} \times 0.85 \times v^2 = 0.36$
 $v = 0.92 \text{ m s}^{-1}$
- 6 (a) (i) correct shape drawn
- (ii) two nodes marked correctly
- (b) $\frac{1}{2}\lambda = 0.324 \text{ m}$
 $v = f\lambda$
 $= 512 \times 2 \times 0.324$
 $= 332 \text{ m s}^{-1}$
- (c) $\frac{1}{4}\lambda = 16.2 \text{ cm}$
 either antinode is 0.5 cm above top of tube
 or antinode is 16.2 cm above water surface
- 7 (a) lamp C
lamp is shorted
- (b) shorted lamp A would cause damage to the supply/lamps
/blow fuse in supply
- (c) 15Ω
- (d) (i) $V = IR$
 $R = 30 \Omega$
- (ii) $P = VI$ or I^2R or V^2/R
 $P = 1.2 \text{ W}$
- (e) filament is cold when measuring with ohm-meter in (b)
resistance of filament rises as temperature rises
- 8 (a) nucleus emits
 α - or β - particles and/or γ -rays
- (b) decay unaffected by environmental changes
such as temperature, pressure etc. (one e.g. is sufficient)
- (c) constant probability of decay (per unit time) of a nucleus
cannot predict which particular nucleus will decay next