MARK SCHEME for the May/June 2006 question paper

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.

CIE is publishing the mark schemes for the May/June 2006 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.
1 (a) \( \text{kg m s}^{-2} \)  
(b) \( \text{kg m}^{-1} \text{s}^{-1} \)  
(c) (i) \( v^2 = 2gs \)  
\[ = 2 \times 9.8 \times 4.5 \]  
\[ v = 9.4 \text{ m s}^{-1} \]  
(ii) \[ \text{either} \]
\[ F = 3.2 \times 10^{-4} \times 1.2 \times 10^{-2} \times 9.4 = 3.6 \times 10^{-5} \text{ N} \]  
\[ \text{weight of sphere} \ (= mg = 15 \times 10^{-3} \times 9.8) = 0.15 \text{ N} \]  
\[ 3.6 \times 10^{-5} \ll 0.15, \text{ so justified} \]  
\[ \text{or} \]
\[ mg = crv_T \]  
\[ \text{terminal speed} = 3.8 \times 10^4 \text{ m s}^{-1} \]  
\[ 9.4 \ll 3.8 \times 10^4, \text{ so justified} \]  
2 (a) (i) point at which whole weight of body may be considered to act  
(b) \[ \text{either:} \]
\[ T \text{ and } W \text{ have zero moment about } P \]
so \( F \) must have zero moment, i.e. pass through \( P \)  
\[ \text{or:} \]
if all pass through \( P \), distance from \( P \) is zero for all forces  
so sum of moments about \( P \) is zero  
(c) (i) \( F \cos \alpha = T \cos \beta \)  
(ii) \( W = F \sin \alpha + T \sin \beta \)  
(iii) \( 2W = 3T \sin \beta \)  
3 (a) sum of (random) kinetic and potential energies of the atoms/molecules of the substance  
(b) (i) potential energy unchanged as atoms remain in same positions  
allow ‘reduced because atoms slightly closer together’  
vibrational kinetic energy reduced because temperature lower  
so internal energy less  
(ii) potential energy increases because separation increases  
kINETIC ENERGY UNCHANGED because temperature unchanged  
so internal energy increases  
4 (a) mass per unit volume \( \text{(ratio idea must be clear, not units)} \)  
(b) (i) pressure is same at the surface of mercury because at same horizontal level  
(ii) \[ h \rho g \text{ is same for both} \]  
\[ 53 \times 10^{-2} \times 1.0 \times 10^3 \times g = 71 \times 10^{-2} \times \rho \times g \]  
\[ \rho = 7.5 \times 10^2 \text{ kg m}^{-3} \]
5 (a) no hysteresis loop/no permanent deformation
   (do not allow ‘force proportional to extension’)
   so elastic change
   A0 [1]

(b) work done = area under graph line OR average force × distance
   B1
   \[ \text{work done} = \frac{1}{2}F_2x - \frac{1}{2}F_1x \]
   A1
   \[ F = kx, \text{ so work done} = \frac{1}{2}kx^2 \]  
   A1
   \[ \text{work done} = \frac{1}{2}k(x_2^2 - x_1^2) \]
   A0 [3]

(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) \]
   C1
   = 0.36 J
   C1
   \[ \text{kinetic energy} = \frac{1}{2} \times 0.85 \times v^2 = 0.36 \]
   C1
   \[ v = 0.92 \text{ m s}^{-1} \]

6 (a) (i) correct shape drawn
   B1 [1]

   (ii) two nodes marked correctly
   B1 [1]

(b) \( \frac{1}{4} \lambda = 0.324 \text{ m} \)
   C1
   \[ \nu = f\lambda \]
   C1
   \[ = 512 \times 2 \times 0.324 \]
   \[ = 332 \text{ m s}^{-1} \]
   A1 [3]

(c) \( \frac{1}{4} \lambda = 16.2 \text{ cm} \)
   C1
   either antinode is 0.5 cm above top of tube
   or antinode is 16.2 cm above water surface
   A1 [2]

7 (a) lamp C
   lamp is shorted
   A1 [2]

(b) shorted lamp A would cause damage to the supply/lamps
   /blow fuse in supply
   B1 [1]

(c) 15 Ω
   B1 [1]

(d) (i) \[ V = I \times R \]
   \[ R = 30 \Omega \]
   C1
   A1 [2]

   (ii) \[ P = VI \quad \text{or} \quad V^2 / R \]
   \[ P = 1.2 \text{ W} \]
   C1
   A1 [2]

(e) filament is cold when measuring with ohm-meter in (b)
   resistance of filament rises as temperature rises
   B1 [2]

8 (a) nucleus emits
   \( \alpha \)- or \( \beta \)- particles and/or \( \gamma \)-rays
   M1
   A1 [2]

(b) decay unaffected by environmental changes
   such as temperature, pressure etc. (one e.g. is sufficient)
   M1
   A1 [2]

(c) constant probability of decay (per unit time) of a nucleus
   cannot predict which particular nucleus will decay next
   B1
   B1 [2]