MARK SCHEME for the November 2005 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.

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1 **(a)** **(i)** force per unit area (ratio idea essential)   B1

     (ii) $kg\ m^{-1}\ s^{-2}$ B1   **[2]**

  (b) ρ has base unit $kg\ m^{-3}$ B1
       g has base unit $m\ s^{-2}$ B1
       $h\rho g$ has base unit $m \times kg\ m^{-3} \times m\ s^{-2}$ M1
       same as pressure QED   A0   **[3]**

2 **(a)** point where whole weight of body (allow mass)   M1
       may be <u>considered</u> to act (do not allow 'acts')   A1   **[2]**

  (b) when CG below pivot, weight acts through the pivot   B1
       (so) weight has no turning effect about pivot   B1   **[2]**

3 **(a)** <u>change</u> in velocity/time (taken)   B1   **[1]**

  (b) velocity is a vector/velocity has magnitude & direction   B1
       direction changing so must be accelerating   B1   **[2]**

  (c) *either* $6.1 \times \cos 35 = 4.99$ N   *or* scale shown   B1
       so no resultant vertical force   triangle of correct shape   B1
       $6.1 \sin 35 = 3.5$ N   resultant = 3.5 ± 0.2 N   B1
       horizontally   horizontal $\pm 3°$ B1   **[4]**

       allow answer based on centripetal force:
       resultant is centripetal force (which is horizontal)   (B1)
       resultant is horizontal component of tension   (B1)
       $6.1 \sin 35 = 3.5$ N   (B1)
       horizontally   (B1)

4 **(a)** **(i)** use of tangent at time $t = 0$ B1
       acceleration = 42 ± 4 cm s^{-2} A1   **[2]**

     (ii) use of area of loop   B1
       distance = 0.031 ± 0.001 m   B2   **[3]**
       allow 1 mark if 0.031 ± 0.002 m)

  (b) **(i)** $F = ma$ C1
       = 0.93×0.42 {allow e.c.f. from (a)(i)}
       = 0.39 N   A1   **[2]**

     (ii) force reduces to zero in first 0.3 s   B1
       then increases again in next 0.3 s   M1
       in the opposite direction   A1   **[3]**

5 **(a)** similarity: e.g. same wavelength/frequency/period, constant phase difference   B1

difference: e.g. different amplitude/phase   B1   **[2]**
(do not allow a reference to phase for both similarity and difference)

(b) constant phase difference so coherent   B1   **[1]**

(c) **(i)** *intensity $\propto$ amplitude^2*   C1

$I \propto 3^2$ and $I_B \propto 2^2$ leading to   M1

$I_B = \dfrac{4}{9}I$ A0   **[2]**

(ii) resultant amplitude = 1.0×10^{-4} cm   C1

resultant intensity = $\dfrac{1}{9}I$ A1   **[2]**

(d) **(i)** displacement = 0   B1   **[1]**

(ii) $x_A = -2.6 \times 10^{-4}$ cm and $x_B = +1.7 \times 10^{-4}$ cm   C1
allow $\pm 0.5 \times 10^{-4}$ cm)
resultant displacement = (-) 0.9×10^{-4} cm   A1   **[2]**

6 **(a)** force must be upwards (on positive charge)   M1
so plate Y is positive   A1   **[2]**

(b) **(i)** $E = V / d$ C1
= $630/(0.75 \times 10^{-2})$
= 8.4×10^4 N C^{-1} A1   **[2]**

(ii) $qE = mg$ C1
$q = (9.6 \times 10^{-15} \times 9.8) / (8.4 \times 10^4)$ C1
= 1.12×10^{-18} C   A1   **[3]**

7 **(a)** *either* $V = E R_1 / (R_1 + R_2)$ *or* $I = E / (R_1 + R_2)$ C1

= $\dfrac{1800}{3000} \times 4.50$ $V = \dfrac{1800}{3000} \times 4.50$ M1

= 2.70 V   = 2.70 V   A0   **[2]**

(b) **(i)** for a wire, $V = I \times (\rho L/A)$ M1
I, ρ and *A* are constant   A1
so $V \propto L$ A0   **[2]**

    (ii)   **1**   2.70 V   A1   **[1]**

            2 $\dfrac{L}{100} = \dfrac{2.70}{4.50}$ C1

            L = 60.0 cm   A1   **[2]**

    (iii)   thermistor resistance decreases as temperature rises   M1
            so QM is shorter   A1   **[2]**

8   **(a)**   product of force and distance   M1
                   moved in the direction of the force   A1   **[2]**

   (b)   **(i)**   falls from rest   B1
                   decreasing acceleration   B1
                   reaches a constant speed   B1   **[3]**

         (ii)   straight line with negative gradient   B1
                   y-axis intercept above maximum E_K B1
                   reasonable gradient (same magnitude as that for E_K initially)   B1   **[3]**