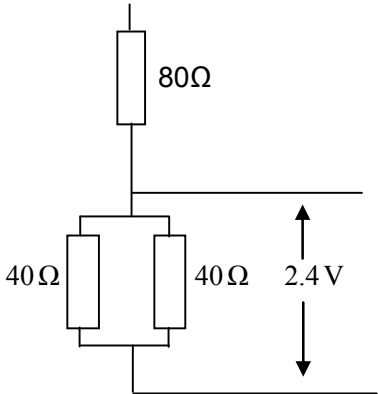

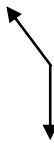


GCE Physics - PH1

Mark Scheme - January 2013

Question		Marking details	Marks Available
1	(a)	(i) Decelerating (1) Gradient changes/decreases <b>or</b> correct use of values from the graph (1) (ii) $0.75 \text{ m s}^{-1}$ ( <b>unit</b> mark) (iii) Any tangent at 6 s (1) Speed: $0.55 - 0.75 \text{ [m s}^{-1}]$ (1) (iv) (I) No- infinite speed (or equiv) don't accept very large speed (II) Yes- stopped	[2] [1] [2] [1] [1]
	(b)	$Velocity = \frac{Displacement}{Time}$ (1); Displacement = 0 [over 1 complete lap] (1)  <b>Question 1 total</b>	[2]  <b>[9]</b>
2	(a)	(i) $Resistance = \frac{pd}{current}$ (accept: voltage / if $V$ and $I$ written must be qualified)	[1]
		(ii) $V = JC^{-1}$ (1); $I = C s^{-1}$ (1); Convincing working (1) Don't accept use of t -award <b>ecf</b> for 3 <sup>rd</sup> mark. Alternative route using power formulae is acceptable.	[3]
	(b)	(i) $I = \frac{V_{in}}{R_1 + R_2}$	[1]
		(ii) $V_{out} = IR_2$ (1); $I$ (from (i)) used correctly (1)	[2]
(c)	(i) Any parallel combination shown (1); $40 \text{ [}\Omega\text{]}$ used correctly (1)	[2]	
	(ii) <div style="display: flex; align-items: center; justify-content: center;">  <div style="margin-left: 20px;">                         Resistor combination shown (1) <b>ecf</b> from (c)(i)                           2.4 [V] or <math>V_{out}</math> labelled correctly (1)                     </div> </div>	[2]	
		<b>Question 2 total</b>	<b>[11]</b>

Question		Marking details	Marks Available	
3	(a)	(i) Straight line through origin. Accept $F \propto x$ .	[1]	
		(ii) Area = $\frac{1}{2}Fx$ (1); $F = kx$ and clear substitution/manipulation (1)	[2]	
	(b)	(i) $F = 8.0$ [N] (1) <b>or</b> $k = 100$ [N m <sup>-1</sup> ] (1) Use of $\frac{1}{2}Fx$ (i.e. $\frac{1}{2} \times 8.0 \times 80 \times 10^{-3}$ ) (1) <b>or</b> Use of $\frac{1}{2}kx^2$ (i.e. $\frac{1}{2} \times 100 \times (80 \times 10^{-3})^2$ ) (1) = 0.32[J] (1) (ecf for $F$ ) = 0.32[J] (1) (ecf for derived value of $k$ )	[3]	
		(ii) $0.32 = \frac{1}{2}mv^2$ (ecf) (1); $v = 4.0$ [m s <sup>-1</sup> ] (1)	[2]	
(c)	$\Delta E_k = Fd$ understood (1) $d = (0.8 + 0.4 + (2\pi(0.2)))$ <b>or</b> 2.46 [m] (1) $\Delta E_k = 0.03$ [J] <b>or</b> ( $\frac{1}{2} \times 0.04 \times (4^2 - 3.8^2)$ ) (1) (ecf from (b) (ii)) $F = 0.013$ [N] (1) (ecf for $d$ ) Alternative method using equations of motion and $F = ma$ acceptable.	[4]		
		<b>Question 3 Total</b>	[12]	
4	(a)	(i) <b>Correct use</b> of $v^2 = u^2 + 2ax$ (i.e. $0 = 6^2 - 2 \times 9.81 \times x$ ) (1) $x = 1.8$ [m] (1) Total height = 12.8 [m] (1) (ecf for $x$ )	[3]	
		(ii) (I) $v^2 = 2 \times 9.81 \times 12.8$ (ecf) (1) or suitable alternative $v = 15.9$ [m s <sup>-1</sup> ] (1)	[2]	
		(II) $t_{\text{up}} = \left( \frac{0 - 6}{-9.81} \right) = 0.6$ [s] (1)	[3]	
			$t_{\text{down}} = \left( \frac{15.9(\text{ecf}) - 0}{9.81} \right) = 1.6$ [s] (1)	[3]
			Total time = 2.2 [s] (1) (other solutions possible)	
	(b)	(i)	 (1) Ball only acted upon by <b>force due to gravity / weight</b> is the only force acting (1) Only award 2 <sup>nd</sup> mark if 1 <sup>st</sup> mark correct.	[2]
(ii)		 (1) Marks are independent. If additional arrows present deduct 1 mark for each extra arrow. (1)	[2]	
		<b>Question 4 Total</b>	[12]	

Question		Marking details	Marks Available
5	(a)	(i) Point where entire <b>weight</b> of object acts. Don't accept mass. (ii) $\tan \theta = 40/60$ (1); $\theta = 33.7^\circ$ (1)	[1] [2]
	(b)	(i) $V = 0.6 \times 0.4 \times 0.1$ (1); $M = \rho \times V$ used correctly (1) (ii) $T \sin \theta$ or equivalent (1) $\times 1.2$ (1) = $9.6 \times 9.81 \times 1.8$ (1) $T = 220$ [N] (1) (iii) $F = 220$ ( <b>ecf</b> ) $\cos 40^\circ$ or equivalent (1) $F = 169$ [N] (1) Accept Pythagoras solution.  <b>Question 5 Total</b>	[2] [4] [2]  <b>[11]</b>
6	(a)	(i) Correct and convincing use of $\rho = \frac{RA}{l}$ (including unit conversion)	[1]
		(ii) $\left(\frac{2000}{11.2}\right) = 179$ A <b>unit</b> mark	[1]
		(iii) $v = \frac{I}{nAe}$ rearranged (or shown numerically) (1) $n = 6.0 \times 10^{28} \times 3$ (1) $v = 1.55 \times 10^{-5}$ [m s <sup>-1</sup> ] ( <b>ecf</b> on $I$ and $n$ ) (1)	[3]
	(b)	(i) Same (or equivalent)	[1]
		(ii) $v$ increased (1) because...; $A$ decreased, $I, n, e$ unchanged by implication (1)	[2]
		(iii) Increased frequency / more collisions <b>between electrons and lattice</b> / atoms / ions <b>or</b> electrons carry greater kinetic energy (1) leading to <b>increased vibrational / kinetic energy of lattice atoms</b> (1)  <b>Question 6 Total</b>	[2]  <b>[10]</b>

Question		Marking details	Marks Available
7	(a)	<p>V- energy (per coulomb) used in [external] resistor / circuit. (1)  E- energy (per coulomb) transferred / supplied by source / in the whole circuit (1)  Ir- energy (per coulomb) wasted / lost in source / cell / internal resistance (1)  Use of 'per coulomb / unit charge' once. (1)</p>	[4]
	(b)	(i) 4[Ω]	[1]
		(ii) Gradient attempted e.g. 60/10 (1) (or use of equation <b>ecf</b> from (b) (i)) emf = 6[V] (1)	[2]
		(iii) 1/I = 4[A <sup>-1</sup> ] or by implication (1) R = 20[Ω] (1) Use of I <sup>2</sup> R i.e. (0.25) <sup>2</sup> x 20 ( <b>ecf</b> ) (1) or correct substitution into both V = IR and P = IV or V <sup>2</sup> /R P = 1.25[W] (1)	[4]
	(c)	(i) emf = 12.0[V] ( <b>ecf</b> ) <b>and</b> r = 8.0[Ω] ( <b>ecf</b> )	[1]
		(ii) R = 52.0[Ω] ( <b>ecf</b> )	[1]
		(iii) y intercept (r → 8.0Ω ( <b>ecf</b> )) (1) Precise gradient e.g. through (5,52) ( <b>ecf</b> ) (1)	[2]
<b>Question 7 Total</b>			<b>[15]</b>