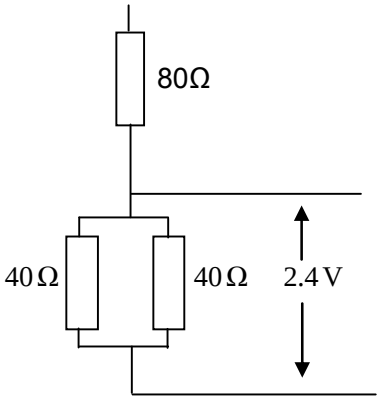
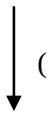
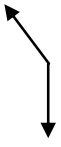
GCE Physics - PH1

Mark Scheme - January 2013

Question			Marking details	Marks Available
1	*(a)*	(i)	Decelerating (1) Gradient changes/decreases **or** correct use of values from the graph (1)	[2]
		(ii)	0.75m s^{-1} (**unit** mark)	[1]
		(iii)	Any tangent at 6 s (1) Speed: 0.55 – 0.75 [m s^{-1}] (1)	[2]
		(iv)		
		(I)	No- infinite speed (or equiv) don't accept very large speed	[1]
		(II)	Yes- stopped	[1]
	(b)		$Velocity = \frac{Displacement}{Time}$ (1); Displacement = 0 [over 1 complete lap] (1)	[2]
			Question 1 total	**[9]**
2	*(a)*	(i)	$Resistance = \frac{pd}{current}$ (accept: voltage / if V and I written must be qualified)	[1]
		(ii)	V = J C^{-1} (1); I = C s^{-1} (1); Convincing working (1) Don't accept use of t -award **ecf** for 3rd 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 [Ω] used correctly (1)	[2]
		(ii)	 Resistor combination shown (1) **ecf** from *(c)*(i) 2.4 [V] or V_{out} labelled correctly (1)	[2]
			Question 2 total	**[11]**

Question			Marking details	Marks Available
3	*(a)*	(i)	Straight line through origin. Accept $F \propto x$.	[1]
		(ii)	Area = ½ Fx (1); $F = kx$ and clear substitution/manipulation (1)	[2]
	(b)	(i)	F = 8.0 [N] (1) **or** k = 100 [N m^{-1}] (1) Use of ½ Fx Use of ½ kx^2 (i.e ½ x 8.0 x 80 x 10^{-3}) (1) (i.e ½ x 100 x (80 x 10^{-3})^2) (1) = 0.32 [J] (1) = 0.32 [J] (1) (**ecf** for derived value of k) **(ecf** for F)	[3]
		(ii)	0.32 = ½ mv^2 (**ecf**) (1); v = 4.0 [m s^{-1}] (1)	[2]
	(c)		$\Delta E_k = Fd$ understood (1) d =(0.8 + 0.4 + (2π(0.2))) **or** 2.46 [m] (1) ΔE_k = 0.03 [J] **or** (½ x 0.04 x (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]
			Question 3 Total	**[12]**
4	*(a)*	(i)	**Correct use** of $v^2 = u^2 + 2ax$ (i.e. 0 = 6^2 – 2 x 9.81 x x) (1) x = 1.8 [m] (1) Total height = 12.8 [m] (1) (**ecf** for x)	[3]
		(ii) (I)	v^2 = 2 x 9.81 x 12.8 (**ecf**) (1) or suitable alternative v = 15.9 [m s^{-1}] (1)	[2]
		(II)	$t_{up} = \left(\frac{0-6}{-9.81}\right)$ = 0.6 [s] (1) $t_{down} = \left(\frac{15.9(ecf)-0}{9.81}\right)$ = 1.6 [s] (1) Total time = 2.2 [s] (1) (other solutions possible)	[3]
	(b)	(i)	 (1) Ball only acted upon by **force due to gravity / weight** is the only force acting (1) Only award 2nd mark if 1st mark correct.	[2]
		(ii)	 (1) Marks are independent. If additional arrows present deduct 1 mark for each extra arrow. (1)	[2]
			Question 4 Total	**[12]**

Question			Marking details	Marks Available
5	*(a)*	(i)	Point where entire **<u>weight</u>** of object acts. Don't accept mass.	[1]
		(ii)	Tan θ = 40/60 (1); θ = 33.7° (1)	[2]
	(b)	(i)	V = 0.6.x 0.4 x 0.1 (1); $M = \rho$ x V used correctly (1)	[2]
		(ii)	T sinθ or equivalent (1) x 1.2 (1) = 9.6 x 9.81 x 1.8 (1) T = 220 [N] (1)	[4]
		(iii)	F = 220 (**ecf**) cos40° or equivalent (1) F = 169 [N] (1) Accept Pythagoras solution.	[2]
			Question 5 Total	**[11]**
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 **unit** mark	[1]
		(iii)	$v = \frac{I}{nAe}$ rearranged (or shown numerically) (1) n = 6.0 x 10^{28} x 3 (1) v = 1.55 x 10^{-5} [m s^{-1}] (**ecf** on I and n) (1)	[3]
	(b)	(i)	Same (or equivalent)	[1]
		(ii)	v increased (1) because…; A decreased, I,n,e unchanged by implicaton (1)	[2]
		(iii)	Increased frequency / more collisions **<u>between electrons and lattice</u>** / atoms / ions **or** electrons carry greater kinetic energy (1) leading to **<u>increased vibrational / kinetic energy of lattice atoms</u>** (1)	[2]
			Question 6 Total	**[10]**

Question			Marking details	Marks Available
7	*(a)*		*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)	[4]
	(b)	(i)	4 [Ω]	[1]
		(ii)	Gradient attempted e.g. 60/10 (1) (or use of equation **ecf** from *(b)* (i)) emf = 6 [V] (1)	[2]
		(iii)	$1/I = 4\,[A^{-1}]$ or by implication (1) $R = 20\,[\Omega]$ (1) Use of I^2R i.e. $(0.25)^2$ x 20 (**ecf**) (1) or correct substitution into both $V = IR$ and $P = IV$ or V^2/R $P = 1.25$[W] (1)	[4]
	(c)	(i)	emf = 12.0 [V] (**ecf**) **and** $r = 8.0\,[\Omega]$ (**ecf**)	[1]
		(ii)	$R = 52.0\,[\Omega]$ (**ecf**)	[1]
		(iii)	y intercept ($r \rightarrow 8.0\,\Omega$ (**ecf**)) (1) Precise gradient e.g. through (5,52) (**ecf**) (1)	[2]
			Question 7 Total	**[15]**