ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCE

Physics B

Unit PHB1

PHB1

Section A

Question 1

	Resistance decreasing with decreasing temperature above transition temperature	B1	
	Abrupt discontinuous vertical change to zero resistance at –120 °C	B1	**2**
(a)	Use of moment formula	C1	
	$0.5 \times 550 + 1.2 \times 650 = \text{Weight C} \times 2.1$	C1	
	Weight C = 502 N	A1	
(b)	Weight of see-saw = $9.8 \times 35 = 343$ N **or** total people wt = 1200+C ecf	B1	
	Total weight = 2.05 kN	B1	**5**

Question 3

(a) (i)	22-10 = 12 V	B1	
(ii)	use of $V=IR$	C1	
	$R_{total} = 12/0.25 = 48$	C1	
	So $R = 48 - 0.9 = 47.1\ \Omega$	A1	
(b)	Charge $= It = 0.25 \times 8 \times 3600 = 7200$ C [cnao]	B1	**5**

Question 4

(a)	Time for one cycle	M1	
	One cycle defined correctly in terms of diagram, can be on diagram	A1	
(b)	B	B1	
	Mention of air resistance, allow *drag* OR bob faster in centre of motion	B1	
	Links two ideas	B1	**5**

Question 5

(a)	$[V_1 = V \times R_1/(R_1 + R_2)]$	C1	
	$= 16 \times 1200/2000$		
	= 9.6 V	A1	
(b)	LDR resistance drops	B1	
	voltmeter reading decreases	B1	
	because more conduction electrons/charge carriers released	B1	**5**

Question 6

(a)	Electrons	B1	
(b)	n: number of charge carriers **per unit volume** OWTTE	B1	
	v: **drift** speed/velocity or **average** speed/velocity	B1	**3**

Section B

Question 7

(a)	$V \propto I$ [allow proportional]	M1	
	physical condition constant	A1	
(b)(i)	Line goes through (12, 2) [within one square]	B1	
	Straight line at origin aimed at (1,0.5) and smooth curve (correct shape) beyond (1,0.5)	B1	
	Calculation clearly supporting second mark [$V=IR$, $I = 0.5$, so $V = 1$]	B1	
(ii)	Correct shape for V +ve	M1	
	Non-zero, positive breakaway from V-axis, $V <= 1$V; line not > 1V]	A1	
	Zero current for reverse bias explicit	B1	**8**

Question 8

(a)(i)	$\frac{1}{2} mv^2 = \frac{1}{2} \times 2.8 \times 10^4 \times 71^2$	C1	
	$= 7.1 \times 10^7$ J	A1	
(ii)	decel = gradient of graph or $a = (v-u)/t$ or $\Delta v/\Delta t$ or evidence on graph	B1	
	$= (71-0)/(3.5 - 0)$	B1	
	$= 20.3$ [m s^{-2}]	B1	
(iii)	[$F=ma$]		
	$= 2.8 \times 10^4 \times 20.3$	C1	
	$=568$ kN	A1	
(b)(i)	[$F = 2T\cos\theta$] some use of resolved vector	C1	
	$T = F/2 \cos\theta = 568\ 000/2 \times \cos 12.5°$ (ecf)	C1	
	$= 291\ 000$ [N]	A1	
(ii)	[$\frac{1}{2} F \Delta l$]		
	$= \frac{1}{2} \times 290\ 000 \times 0.15$	C1	
	$= 22$ kJ [21.8]	A1	
(c)	$v^2 = u^2 + 2as$		
	$a = v^2/2s = 71^2/124$ or alt process	C1	
	$= 41$ m s^{-2} [40.6]	A1	

(d)	drawing correct, scale clearly stated, wind speed line>+ 2 cm **or** one correct calculation	B1	
	speed 82/83/82.5 m s^{-1} [80 – 84 if drawn]	B1	
	course 14° [12 – 16] west of north [346°]	B1	**17**

Question 9

Sensible method for timing	B1	
Sensible method for distance/speed measurement	B1	
max 2 for totally inappropriate method		
Analysis description	B1	
Further good detail (e.g. averaging or graphing *if analysis mark scored*/ignore air resistance with indication of effect on calculated *g*/in vacuum with good detail/electromagnetic release, must indicate logic of circuit/measure size of falling object if appropriate to expt/suitable described falling object/light gate used, show internal machine computation/datalogging with good detail/etc)	B1	
[any mark can be scored for detail shown on diagram]		
Use of physics terms is accurate, the answer is fluent/well argued with few errors in spelling, punctuation and grammar **and gains at least 3 marks for physics**	**6**	**2**
Use of physics terms is accurate but the answer lacks coherence or the spelling, punctuation and grammar are poor **and gains at least 1 mark for physics**		**1**
Use of physics terms is inaccurate, the answer is disjointed with significant errors in spelling, punctuation and grammar		**0**
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Question 10

(a)(i)	Use of $R = \rho l/A$	C1
	$= 1.3 \times 10^5 \times 12 \times 10^{-3}/2.5 \times 10^{-3} \times 1.5 \times 10^{-3}$	C1
	$= 4.2 \times 10^8\ \Omega$	A1
(ii)	$P = V^2/R$	
	$= 25/4.2 \times 10^8$	C1
	$= 6.0 \times 10^{-8}$ W	A1
(iii)	total power $= 12 \times 10^{-8}$ W	B1
(iv)	area $= (7.5 \times 10^{-3}) \times 12 \times 10^{-3}$ [$= 90 \times 10^{-6}$ m^2]	C1
	p/area $= 12 \times 10^{-8}/90 \times 10^{-6}$	
	$= 1.3$ mW m^{-2}	A1

(b)(i)	area goes down 100 times, or quotes area 3.75×10^{-8} m^2	B1	
	$R = \rho(l \times 10)/(A \times 100)$, or quotes length 12×10^{-4} m [so resistance goes up 10 times]	B1	
(ii)	power dissipated is reduced [power down 10 times]	B1	**12**
	through area that is smaller by bigger factor than power	B1	

Question 11

Energy extracted from internal energy of rocks	B1	
origin: original formation of Earth (e.g. volcanic activity) **or** present radioactive decays	B1	
heat used to produce steam	B1	
for conventional turbine-generator system	B1	
advantage no fuel cost/no pollution/etc [*not* no running costs]	B1	
disadvantage sites limited by geology/expensive set-up only if comparison with other energy source/steam/water often very corrosive ∴high maintenance	B1	
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