ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCE

Physics B

Unit PHB6

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales 3644723 and a registered charity number 1073334
Registered address: Addleshaw Booth & Co., Sovereign House, PO Box 8, Sovereign Street, Leeds LS1 1HQ
Kathleen Tattersall: *Director General*

PHB6

Exercise 1

Question 1

(a)(i)	value ≈ 5 (mm) allow 1 or 2 s.f..	B1	
	repeated and averaged appropriate unit	B1	**2**
(ii)	correct substitution into πr^2	M1	
	correct calculation in cm^2 only (*0.20/0.28 most likely*)	A1	**2**
(b)	measurement of length in cm	B1	
	multiplication by area and addition of 5.0 cm^3 (2/3 s.f.) (*5 cm^3 scores 1 and 5.0 cm^3 scores 2*)	B1	**2**
(c)(i)	mention of bottom of *meniscus* allow clear diagram	B1	**1**
(ii)	start at same level one up and one down, two up and two down etc. or other sensible clear statements	B1	**1**
(d)(i)	minimum of 3 positive values of *h* (not including 0)	B3	
	minimum of 3 negative value of *h*	B3	
	minimum of six readings showing *h* to be the sum of distances from neutral position on each side/ repeats and averages of *l* or *h* shown	B1	
	minimum of six *l* values consistent with h's recorded	B1	
	neat table with consistent significant figures	B1	**9**
(ii)	table containing corresponding values of *h*, *V* and 1/*V* with correct units	B1	
	V correctly calculated/or simply read from syringe scale	B1	
	all *V* values to 1 d.p. in cm^3	B1	
	1/*V* correctly calculated (*check first value*)	B1	**4**
(e)	axes correct way round and quantities and units correctly labelled	B1	
	scales non-awkward and at least half length of paper in each direction	M1	
	min of five points correctly plotted (allow 1 error of 1mm) **check and tick two extreme (from table) points**	A1	
	best straight line (0 if less than four points plotted)	B1	
	overall quality of the graph	B1	**5**
(f)(i)	candidate relates *k* to gradient	M1	
	use of large gradient triangle (at least half plotted line in each direction) with correct side lengths/coordinates	M1	
	consistent value for *k* 2/3 s.f.*	A1	**3**
(ii)	cm^4 etc.	B1	**1**
	use of point on line	B1	
	substitute coordinates and *k* value	B1	

	consistent calculation of P (in same units as h) 2/3 s.f.* *compensation of 1 for correctly read intercept on poor scale* (in same units as h) *only one penalty	B1	**3**
	number of moles or mass of gas relevant comparison of equation with ideal gas temperature relevant comparison of equation with ideal gas	M1 A1 M1 A1	
	density of liquid in tube clear link with $p = h\rho g$	M1 A1	**Max 4**
	the use of physics is accurate, the answer is fluent/well argued with few errors in spelling, punctuation and grammar (**must gain at least 2 for Physics**)		**2**
	the use of physics is accurate but the answer lacks coherence or the spelling, punctuation and grammar are poor (**must gain at least 1 for Physics**)		**1**
	the use of the physics is inaccurate, the answer is disjointed with significant errors in spelling punctuation and grammar.		**0**
			Max 2
			6
			Total 39

Exercise 2

Question 1

(a)	**swing**: reference **to total** of 10 or more oscillations calculated T/s ≈ 1s* **bounce:** reference **to total** 5 or more oscillations calculated T/s ≈ 0.5 s* **twist:** reference **to total** 2 or more oscillations calculated T/s ≈ 10 s* *penalise any oscillations that are clearly ½ oscillations either by descriptions or inconsistent times *penalise unit once only	B1 B1 B1 B1 B1 B1	**6**
(b)(i)	greatest damping of bouncing oscillations + least damping twisting	B1	**1**
(ii)	top gpe; bottom epe (+ gpe); middle ke (+ gpe) temp rise of rubber/w.d. on rubber/ rubber "heats up"	B1 B1	**2**

(iii)	air resistance internal energy of rubber ***not*** *heating* **further detail relating to either air resistance or increased internal energy of rubber**: large surface area at right angles to motion means high air resistance – energy transferred to surroundings /increased kinetic energy of air molecules/ on falling work is done by gravity in separating molecules /energy is not recovered when rubber contracts so loss of possible energy / hysteresis etc.	M1 M1 A1	**3**
(c)	minimum of 5 steps of 100g constant twist applied time 10 oscillations repeat and average times graph of lg$T$ vs lg m (or reversed) gradient n (or 1/n) lg$T$ intercept lg$c$ (or consistent with graph) *max 3 for method	B1 B1 B1 B1 B1 B1 B1	**Max 6**
	the use of physics is accurate, the answer is fluent/well argued with few errors in spelling, punctuation and grammar (**must gain at least 3 for Physics**)		**2**
	the use of physics is accurate but the answer lacks coherence or the spelling, punctuation and grammar are poor (**must gain at least 1 for Physics**)		**1**
	the use of the physics is inaccurate, the answer is disjointed with significant errors in spelling punctuation and grammar.		**0**
			Max 2
			8
			Total 20

Question 2

(a)(i)	R = 120.0 Ω (4 s.f.)	B1	**1**
(b)	value of R_{max} approximately 2 Ω larger any second reading to ¾ s.f. value of R_{min} taken with gauge clearly on underside	B1 B1 B1 B1	**4**
(c)(i)	larger value on the top – extension or wire thinner smaller value on the bottom – compression or wire fatter	B1 B1	**2**
(i)	min of 1 value of ΔR divided by R (allow fraction)	B1	**1**

(d)(i)	8 – 10 mm	M1	
	multiplied by number of strips (10 or 12) (u.p.)	A1	**2**
(ii)	calculation of extension [2.1 x ©(ii) x (d)(i)]	B1	
	estimate of δl (either 1 or 2 mm) OR $\delta l / l$	B1	
	clear idea that % extension = $\%l + \%\Delta R + \%R$	M1	
	% x extension	A1	**4**
(e)(i)	resistor in series with strain gauge and power supply	B1	
	resistor ≈ 60 – 120 Ω **and** power supply (1 – 12 V)	B1	**2**
(ii)	correct use of potential divider formula OR calculation of relevant current	M1	
	calculation of unstretched and stretched voltages to give change in voltage OR of change in resistance (ΔR) multiplied by current to give change in voltage	M1	
	sensible comment regarding likelihood of being resolved base on precision of typical voltmeter	A1	**3**
			Total 19