ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCE

Physics B

Unit PHB3

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PHB3

Question 1

(a)	12 readings recorded *times should be sensible and increase with distance*	B1	
	at least one *t* calculated correctly	B1	
	all value(s) of t (final column) given to 1 or 2 dps	B1	**3**
(b)(i)	an absolute uncertainty (max +-0.2; 1 or 2 sf; unit)	B1	
	calculated from the range (*e.g. $^1/_3$ or ½ range, or mean deviation from t*)	B1	**2**
(ii)	uncertainty given as +-1mm or +-2mm	B1	
	appropriate justification given *referring to mm scale* (e.g. +-0.5mm uncertainty at both ends of measurement)	A1	**2**
(iii)	average speed correctly calculated (2 or 3 sf with unit) *using d in the range 0.145..0.0.155 m*	B1	**1**
(iv)	% uncertainty correctly calculated for *d*	C1	
	% uncertainty correctly calculated for *t*	C1	
	% uncertainties added	M1	
	consistent answer (1 or 2 sf)	A1	
	OR		
	upper bound found correctly	C1	
	lower bound found correctly	C1	
	valid method for % uncertainty used	M1	
	consistent answer (1 or 2 sf)	A1	**4**
(c)	t^2/d calculated or *implied by alternate method*	C1	
	for all three sets of readings	M1	
	consistent conclusion considering experimental uncertainty	A1	
	OR		
	graph plotted with suitable axes	M1	
	three points plotted with best fit line	M1	
	consistent conclusion considering experimental uncertainty	A1	**3**
(ii)	initially velocity zero and acceleration constant	B1	
	as velocity increases so does air resistance/drag/resistive forces (*but* **not** *Friction alone*)	M1	
	so acceleration decreases	A1	
	eventually air resistance = accelerating force	M1	
	so acceleration is zero	A1	
	the cylinder reaches terminal/constant velocity	B1	**Max 3**
	Note *a good graphical answer could achieve the two* **B** *marks but no QWC*		

Accurate use of physics terminology + fluent and well argued description + good spelling, punctuation and grammar + **at least two marks for the physics**		**2**
Good physics but poor spelling and/or grammar		**1**
Good QWC with **one physics mark**		**1**
No marks for the physics and/or disjointed answer with poor spelling and grammar		**0**
	Total 20	

Question 2

(a)(i)	sensible value of *E* recorded; with unit	M1, A1	**2**
(ii)	value of *V* recorded; value less than *E*	M1, A1	**2**
(b)	correct substitution in formula consistent value for r with unit and 2 or 3 sf	M1 A1	**2**
(c)	value of *V* recorded *must be less than in (a)(ii)*	B1	**1**
(ii)	graph showing: -line starting from origin -correct curvature -approaching *E* (candidate's value) for large R	 B1 B1 B1	**3**
(d)(i)	*Any* **one** *of the following, but <u>no other alternatives</u>* -concentration of solution -size of <u>rods</u> -separation of rods/wires -depth of solution/immersion of rods	 M1	**1**
(ii)	*corresponding answer to that given in (i)* -<u>more charge carriers</u> would mean <u>lower resistance</u> -<u>larger surface area</u> would mean <u>lower resistance</u> -<u>larger separation</u> would mean <u>higher resistance</u> -<u>larger effective surface area</u> would mean <u>lower resistance</u>	 A2	**2**

(e)	*any **five** of the following* -<u>calculate r</u> for different temperatures -sensible range of temperatures suggested (*e.g. room temperature to 70 ℃,* max 90°C) -at least **five** sets of readings specified -method of <u>measuring and controlling</u> temperature given (*e.g. water bath + thermometer or electric heater + thermostat*) -method of changing temperature described *accept Bunsen burner* -consideration of a fair test (*e.g. same rod separation each time*) -<u>clear statement</u> of how results will be presented (*e.g. what to plot*) -any <u>reasonable</u> improvement on the basic method (*e.g. for each temperature use more than one load resistor and find an average, **not** just repeats and averages*)	B5	**5**
	Accurate use of physics terminology + fluent and well argued description + good spelling, punctuation and grammar + **at least three marks for the physics**		**2**
	Accurate use of physics terminology + comprehensible description but poor spelling and/or grammar		**1**
	Less than two marks for physics and/or disjointed answer with poor spelling and grammar		**0**
			Total 20

Question 3

(a)(i)	T_o recorded with unit *must be in the range 2..3 s*	B1	
	at least 10 oscillations recorded	B1	**2**
(ii)	*any **two** from:* reaction time/judging end of period effect of draughts on the motion difficulty establishing correct mode of oscillation amplitude too large	B2	**2**
(b)(c)	table, neatly drawn with column for repeats and averages (*including d^2 and T^2*)	B1	
	labels and units all columns (*including T^2/s^2, d^2/m^2 and d/m*)	B1	
	5 sets of values: - *1 for each set missing and/or if d = 0.480 m not included and/or d<0.160 m shown*	B4	
	minimum of 5T recorded for each timing	B1	
	minimum of 10T recorded for each timing	B1	
	repeats of all timings (-1 for each one missing)	B2	
	range of *d* >= 25cm	B1	
	d values given to nearest mm	B1	

	all times showing consistent dps	B1	
	sensible T^2 calculated correctly (*check value in first row*)	B1	
	d^2 calculated correctly (*check value in last row*)	B1	
	T^2 1 or 2 dp and d^2 3dp consistently	B1	**16**
(d)	axes correct way round and labelled with quantity	B1	
	units given both *axes allow ecf from table but not missing*	B1	
	sensible scales: *zero origin and neither axis could be doubled*	M1	
	five points correctly plotted (-1 each error or missing point)	A2	
	good best fit line (at least 4 points must be used)	B1	
	general quality of graph *see separate notes*	B1	**7**
(e)(i)	triangle sufficiently large *at least half length of drawn line*	B1	
	coordinates correctly taken from best fit line	M1	
	correct calculation (2 or 3 sf)	A1	**3**
(ii)	gradient equated to $0.10K$	M1	
	correct calculation of K *allow ecf from (e)(i)*	A1	**2**
(iii)	correct measurement of intercept	M1	
	expressed with unit 2 or 3 sf *allow unit ecf from graph*	A1	
	actual intercept in range 1.1..1.8	B1	**3**
(iv)	intercept equated to $0.042Km$	C1	
	correct rearrangement and substitution	M1	
	OR		
	point accurately read from line	C1	
	correct substitution into equation of line	M1	
	correct calculation of m with unit and 2 or 3 sf *provided K between 400 and 600*	A1	**3**
			Total 38