GCE 2005
January Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Physics Specification B

PHB6 Practical Examination

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

Set and published by the Assessment and Qualifications Alliance.

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 AQA, Devas Street, Manchester. M15 6EX. *Dr Michael Cresswell Director General*

Notes

Letters are used to distinguish between different types of marks in the scheme.

M indicates OBLIGATORY METHOD MARK
This is awarded for the physical principles involved, or for a particular point in the argument of definition. It is followed by one or more accuracy marks which cannot be scored unless the M mark has already been scored.

C indicates COMPENSATION METHOD MARK
This is awarded for the correct method or physical principle. In this case the method can be seen or implied by a correct answer or other correct subsequent steps. In this way an answer might score full marks even if *some* working has been omitted.

A indicates ACCURACY MARK.
These are awarded for correct calculations or further detail. They follow an M mark or a C mark.

B indicates INDEPENDENT MARK
This is a mark which is independent of M and C marks.

Where a correct answer only (cao) is required this means that the answer must be as in the marking scheme, including significant figures and unit. The correct answer may be specified or be required to be within a specified range.

Where an error carried forward (ecf) is allowed by the marking scheme for an incorrect answer ecf must be written on the script if an error has been carried forward.

Help given by supervisor

The amount of help given, if any, should be indicated in a note attached to the script by the supervisor.

If help has been given: each 'minor help' incurs a 2 mark penalty;
each 'major help' incurs a 4 mark penalty.

These penalties should be recorded on the front of the script and subtracted from the total mark previously awarded.

'Major help' might involve assistance without which the candidate would be unable to take the required readings (e.g. incorrect wiring in a circuit).

'Minor help' might involve the answering of an unnecessary question by the candidate.

Quality of Written Communication

Before accessing marks for the Quality of Written Communication (QWC) a candidate must first score a minimum of one mark for the physics that is being communicated – this will allow access to 1 mark for QWC. If the candidate scores more marks for physics (a minimum of two or three – depending upon the total mark for that part of the question) then this will allow access to 2 marks for QWC.

Good QWC: the answer is fluent/well argued with few errors in spelling, punctuation and grammar	**2**	
Poor QWC: the answer lacks coherence or spelling, punctuation and grammar are poor	**1**	
Very Poor QWC: the answer is disjointed, with significant errors in spelling, punctuation and grammar	**0**	**Max 2**

PHB6 Practical Examination

Exercise 1

(a)	(i)	L_0 given to nearest mm	**B1**	**1**
	(ii)	Time for n oscillations where $n \geq 10$	**M1**	
		Repeat and average	**A1**	
		Period determined correctly and given to 2 d.p. only+ unit	**A1**	**3**
(b)		Sketch graph shows correct curvature clearly not asymptotic	**B1**	**1**
(c)		Equation in ln form; $\ln A = \ln A_0 - kt$	**B1**	
		graph will be a straight line if the relationship is correct	**B1**	**2**
(d)	(i)	At least 5 sets of **scale readings** and n (allow for recording scale readings and n or vice versa)	**B2**	
		Repeats and average for each set	**B2**	
		At least 5 sets of values for A and n	**B2**	
		A values to nearest mm + unit	**B1**	
		Increments of n at least 5 oscillations (not necessarily equal increments)		
		Or		
		Increments of A at least 10 mm	**B1**	
		Evidence of taking readings at increasing n intervals as amplitude decreases (allow for use of increments of A at least 5 mm)	**B1**	
		Values of t calculated correctly (check 1)	**B1**	
		Values of t to 1 or 2 d.p.	**B1**	
		Values of ln A calculated correctly (check 1)	**B1**	
		Good tabulation of data	**B1**	**13**
	(ii)	Identifying correct scale reading/amplitude at maximum displacement	**M1**	
		Explanation of parallax problem and how it is overcome		
		Or		
		Explanation of use of repeat and average observations (if actually done)	**A1**	**2**
(e)	(i)	Graph axes labelled with correct units as in paper	**B1**	
		Suitable scale (lose for wrong quandrant)	**B1**	
		Correct plotting of ln(A/m) against t/s (check 5 points)	**B2**	
		Best line and well presented graph	**B1**	**5**
	(ii)	Correct conclusion from the correct graph (yes or no)	**M1**	
		Statement about plotted points lying close to line (line of best fit is a straight line) or deviation of points clearly not linear	**A1**	**2**

	(iii)	Appreciation that k is the gradient of the line		
		or correct method using graph point or point in table	**B1**	
		Suitable triangle or separation of coordinates, and		
		correct sides or use of point on graph line	**M1**	
		Correct calculation with unit (s^{-1})		
		Allow 2 max for k confused with spring constant		
		and correct calculation of k using $T = 2\pi\sqrt{\frac{m}{k}}$	**A1**	**3**
	(iv)	Appreciation that higher k is related to higher damping	**B1**	
		the mass of the oscillator or the radius/diameter/area of the card	**B1**	
		Correct conclusion for one factor:		
		increased diameter leads to heavier damping (higher k)		
		increasing mass leads to lighter damping (lower k)	**B1**	
		Correct second factor with correct conclusion	**B1**	**4**
		Allow 2 max for		
		k is spring constant and factor affecting spring constant		
(f)		Reads value from graph at a stated time	**M1**	
		Calculates A from this value	**M1**	
		halves A, calculates ln $A/2$, determines t and subtracts from original t	**A1**	
		Or		
		$0.5 = e^{-kT}$ (where T is the time to halve) or $T = 0.69/k$	**C1**	
		Correct substitution of their k value	**C1**	
		Correct calculation of time to halve		
		or other correct method	**A1**	**3**
				Total 39 Marks

Exercise 2

Question 1

(a)	(i)	Record of volume of air in syringe to nearest 0.5 scale division	**B1**	**1**
	(ii)	Record of V_1	**B1**	
		Record of V_2	**B1**	
		repeats and averages	**B1**	**3**
(b)	(i)	pressure =force/area	**C1**	
		9.8/their area	**A1**	
		Pa or N m^{-2}	**B1**	**3**
	(ii)	Correct substitution of data (allow ecf from (i))	**C1**	
		Value consistent with data (ecf)	**A1**	**2**
(c)	(i)	±1/2 or 1 cm^3 scale division	**B1**	**1**

	(ii)	percentage uncertainty in sum or differences determined correctly	**M1**	
		Evidence of adding percentage uncertainties for Δp	**M1**	
		Addition of all uncertainties correctly	**A1**	**3**
	(iii)	There is tendency of the piston to stick	**B1**	
		Clamp problems	**B1**	
		Use oil/some means of reducing the friction	**B1**	
		Movement of piston is small	**B1**	
		Make the syringe narrower and thinner	**B1**	
		Movement would increase so could be more accurately measured	**B1**	
		Increase the change in volume using a larger force	**B1**	
		Increase the number of repeat readings taken or use a syringe that contains more air	**B1**	**Max 5**
		At least 2 marks for physics + use of Physics is accurate, the answer is fluent/well argued with few errors in spelling, punctuation and grammar	**2**	
		At least 1 mark for physics + some incorrect work the use of Physics is accurate, but the answer lacks coherence or spelling, punctuation and grammar are poor	**1**	
		the use of Physics is inaccurate, the answer is disjointed, with significant errors in spelling, punctuation and grammar	**0**	**Max 2**
				Total 20 Marks

Question 2

(a)	(i)	otherwise danger of capacitor explosion/build up of gases/dielectric breakdown (not just capacitor destroyed)	**B1**	**1**
	(ii)	The working voltage	**B1**	
		Must be greater than that used in the experiment	**B1**	**2**
(b)	(i)	about 6 V and 5 V	**B1**	
		Given to consistent sf (2 or 3) with unit	**B1**	**2**
	(ii)	The ratio is the same i.e. $Q_c/Q_x = C/X$	**B1**	
		since $Q = VC$ and V is the same for both	**B1**	**2**
	(iii)	V_2 would be higher	**B1**	
		larger C would retain more charge	**B1**	**2**
	(iv)	Correct substitution and manipulation to 2 or more sf (about 220 μF)	**B1**	**1**
(c)		Repeat the procedure using a different (stated) starting voltage (e.g. 4.5 V)	**M1**	
		Calculate the ratio of the voltages using the 6 V initial voltage	**M1**	

	The ratio should be the same	**A1**	
	Or		
	Repeat the procedure using a different (stated) starting voltage (e.g. 4.5 V)	**M1**	
	Plot graph of starting voltage against final voltage	**M1**	
	Straight line through the origin	**A1**	
(d)	Appreciation that the voltage changes with time or mentions exponential decay	**B1**	
	Use a stop clock	**B1**	
	Record the voltage at regular time intervals	**B1**	
	Every 5 s – 10 s		
	Or use data capture because discharge is quick	**B1**	
	Plot a graph of voltage against time		
	Or appropriate alternative	**B1**	
	Sensible check for exponential decay	**B1**	**Max 4**
	At least 2 marks for physics + use of Physics is accurate, the answer is fluent/well argued with few errors in spelling, punctuation and grammar	**2**	
	At least 1 mark for physics + some incorrect work the use of Physics is accurate, but the answer lacks coherence or spelling, punctuation and grammar are poor	**1**	
	the use of Physics is inaccurate, the answer is disjointed, with significant errors in spelling, punctuation and grammar	**0**	**Max 2**
			Total 19 Marks
			Paper Total 39 Marks