



ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Mark scheme

January 2002

GCE

Physics B

Unit PHB3

NOTES

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

M indicates OBLIGATORY METHOD MARK

This is usually awarded for the physical principles involved, or for a particular point in the argument or 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 marks are awarded for correct calculation 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.

e.c.f. is used to indicate that marks can be awarded if an error has been carried forward. This is also referred to as a ‘transferred error’ or ‘consequential marking’.

Where a correct answer only (c.a.o.) is required, this means that the answer must be as in the Marking Scheme, including significant figures and units.

c.n.a.o. is used to indicate that the answer must be numerically correct but the unit is only penalised if it is the first error or omission in the section (see below).

Where an error carried forward (e.c.f.) is allowed by the Marking Scheme for an incorrect answer, e.c.f. must be written on the script if an error has been carried forward.

Only **one** unit penalty (u.p.) in **Section A** and **one** unit penalty in **Section B** of this paper.

Only **one** significant figure penalty (s.f.) in **Section A** and **one** significant figure penalty in **Section B** of this paper. Allow 2 or 3 s.f. unless otherwise stated.

Significant figure penalties include recurring figures and fractions for answers

Question 1

(a)	(i)	value of T recorded – penalise if measurement is evidently not T eg $T/2$ or $5T$	B1	
		Value of n greater than or equal to 3. Allow if $n = 2$ and at least one repeat used or if $n = 1$ and at least two repeats are used	B1	
		Processing correct and T given to 2 or 3 s.f. and unit correct	B1	3
	(ii)	diameter recorded to nearest mm – unit stated	B1	1
	(iii)	amplitude recorded – must be at least $\frac{1}{2}$ diameter. Condone lack of unit if consistent with (ii)	B1	
		repeat and average seen	B1	2
	(iv)	graph showing damped harmonic motion approximately – curved not saw-tooth (accept linear decrease in amplitude)	B1	
		initial amplitude approximately $\frac{1}{2}$	B1	
		amp. after 5 complete oscillations agrees with their (iii)	B1	
		Amplitude after 5 oscillations agrees with their (iii)	B1	
		5 oscillations shown	B1	4
(b)	(i)	ball has to move further (when d or distance is greater)	B1	
		acceleration greater where sides are steeper /		
		average speed is greater	B1	
		conclusion consistent with their reasonable argument(s)	B1	3
	or	it appears to be SHM	M1	
		therefore period is constant	A1	
		(2 marks only for this argument)		
		“T is independent of d” with no argument gets no marks		
	(ii)	measure T for different values of d	B1	
		sensible range for d (minimum d between 1 and 3 cm for 10 cm watchglass but may be bigger for bigger glasses – max d should be approaching diameter of glass)	B1	
		sensible numbers of sets of readings 5 to 15	B1	
		way of measuring d any sensible method	B1	
		graph of T against d (condone T against displacement)	B1	
		suitable number of oscillations (greater than or equal to 3)	B1	
		number of oscillations same for each measurement	B1	5
		the use of physics terms 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 terms is accurate, the answer lacks coherence or the spelling, punctuation and grammar are poor		
		(must gain at least 1 for Physics)		1
		the use of physics terms is inaccurate, the answer is disjointed with significant errors in spelling, punctuation and grammar are poor		0

Total 20

Question 2

(a)	(i)	measures and records temperature - unit included – °C – not just °	B1	1
	(ii)	measures and records time time given to nearest second: unit given (tolerate time given to nearest 0.1 s)	B1 B1	2
	(iii)	measures and records temperature and time for the cooler oil – t should be greater than their (ii) units given and dps consistent with (ii) with t to nearest 1 s (tolerate time to nearest 0.1 s)	B1 B1	2
(b)	(i)	uncertainty given as between 0.1 and 0.5 s	B1	1
	(ii)	% uncertainty correctly calculated and given to 1 sf	B1	1
	(iii)	one error identified second error identified both errors correctly identified as systematic or random way of reducing any error fully explained	C1 C1 A1 C1 A1	5
		the use of physics terms 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 terms is accurate, the answer lacks coherence or the spelling, punctuation and grammar are poor (must gain at least 2 for Physics)	1	
		the use of physics terms is inaccurate, the answer is disjointed with significant errors in spelling, punctuation and grammar are poor	0	max 2
(c)	(i)	% uncertainty stated as same as measuring cylinder scale division stated on Supervisor's Report	B1	1
	(ii)	One rate calculated and stated Second rate calculated and stated 2 to 3 s.f. and unit correctly given for both addition of percentage uncertainties from (b)(ii) and (c)(i) ecf	B1 B1 B1 B1	4
(d)		viscosity is lower at higher temperatures	B1	1
				Total 20

Question 3

(a)	(i)	voltage recorded including unit	B1	2
		repeat and average seen	B1	
	(ii)	comment on precision or accuracy of meter / internal resistance of cell / varying reading on meter	B1	1
	(iii)	idea of maximum possible voltage	C1	2
		terminal p.d. with zero current / work done per unit charge in the whole circuit (including internal resistance)	A1	
	(iv)	(very) small current flowing / fewer lost volts	B1	1
(b)	(i)	$V = IR$ seen or used	C1	2
		$I = \frac{E}{wL + r}$	A1	
	(iii)	table with quantities and units – at least l , I & $1/I$	B1	1
	(iv)	5 sets of values	B5	11
		repeats and averages of all readings of l or I (-1 for each missed repeat)	B2	
		range of $L \geq 40$ cm	B1	
		L value given to nearest mm	B1	
		$1/I$ calculated correctly and seen	B1	
		d.p. for $1/I$ consistent with d.p. for I and self consistent	B1	
(c)		axes correct and labelled with quantity	B1	7
		units on axes ecf from table for wrong unit but not for missing unit	B1	
		scales non-awkward – scales cannot be drawn twice as long on either axis and l axis starts at zero	M1	
		five points correctly plotted (-1 for each error)	A2	
		best straight line (mark lost if fewer than 4 points)	B1	
		quality of graphical work	B1	
(d)	(i)	Suitable large triangle – at least $\frac{1}{2}$ the length of their line	B1	3
		Co-ordinates or steps correct	M1	
		Correct calculation to 2 or 3 sig figs – condone missing or incorrect units	A1	
	(ii)	Gradient = w/E seen or used	C1	3
		correct rearrangement and substitution of values	M1	
		their answer correct with unit – 2 or 3 sig figs	A1	
	(iii)	correct measurement of intercept	B1	2
		unit (A^{-1}) correct and 2 to 3 s.f. answer ecf for unit (from graph only)	B1	
	(iv)	intercept = r/E seen or used	C1	3
		correct rearrangement of equation and substitution of values	M1	
		correct value for r with unit correct - 2 or 3 sig figs - ecf from (ii) and (iii)	A1	

Total 38