Mark scheme January 2003

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

GCE

Physics B

Unit PHB1

Unit 1: Foundation Physics

Notes for guidance

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.

Note: 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.

        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.

Instructions to examiners

1 Give due credit to alternative treatments which are correct. Give marks for what is correct; do not deduct marks because the attempt falls short of some ideal answer. Where marks are to be deducted for particular errors specific instructions are given in the marking scheme.

2 Do not deduct marks for poor written communication. Refer the script to the Awards meeting if poor presentation forbids a proper assessment. In each paper candidates may be awarded up to two marks for the Quality of Written Communication in cases of required explanation or description. However, no candidate may be awarded more than the total mark for the paper. Use the following criteria to award marks:

   2 marks: Candidates write with almost faultless accuracy (including grammar, spelling and appropriate punctuation); specialist terms are used confidently, accurately and with precision.

   1 mark: Candidates write with reasonable and generally accurate expression (including grammar, spelling and appropriate punctuation); specialist terms are used with reasonable accuracy.

   0 marks: Candidates who fail to reach the threshold for the award of one mark.

3 An arithmetical error in an answer should be marked A.E. thus causing the candidate to lose one mark. The candidate's incorrect value should be carried through all subsequent calculations for the question and, if there are no subsequent errors, the candidate can score all remaining marks (indicated by ticks). These subsequent ticks should be marked C.E. (consequential error).

4 With regard to incorrect use of significant figures, normally a penalty is imposed if the number of significant figures used by the candidate is one less, or two more, than the number of significant figures used in the data given in the question. The maximum penalty for an error in significant figures is **one mark per paper**. When the penalty is imposed, indicate the error in the script by S.F. and, in addition, write S.F. opposite the mark for that question on the front cover of the paper to obviate imposing the penalty more than once per paper.

5 No penalties should be imposed for incorrect or omitted units at intermediate stages in a calculation or which are contained in brackets in the marking scheme. Penalties for unit errors (incorrect or omitted units) are imposed only at the stage when the final answer to a calculation is considered. The maximum penalty is **one mark per question**.

6 All other procedures, including the entering of marks, transferring marks to the front cover and referrals of scripts (other than those mentioned above) will be clarified at the standardising meeting of examiners.

Section A

Question 1

6A	M1
towards junction	A1
	2

Question 2

(a)	amplitude marked correctly	B1
(b)(i)	shows decrease of amplitude with time	B1
(ii)	use suitable instrument to measure amplitude	B1
	at known times with specified instrument	B1
	plot graph of amplitude vs time	B1
		5

Question 3

(a)	$12 \times 15/25$	C1
	$= 7.2$ V	A1
(b)	total R now 32.5	C1
	$12 \times 7.5/32.5 = 2.7[7]$ V **or** calculates $I = 0.369$ A	C1
	terminal p.d. $= 12 – 2.8 = 9.2$ V **or** V $= 0.369 \times (10+15) = 9.2$ V	A1
		5

Question 4

(a)	wt of person + load marked vertically downwards	B1
	wt of plank marked in centre downwards	B1
	upward force at pivot marked	B1
	inappropriate reaction forces loses one mark	
(b)	clear attempt to equate moments in both senses	C1
	$65g \times 0.5 = 25g \times 1.0 + L \times 2.5$	C1
	$L = 29.4$ [N]	A1
(c)	anticlockwise/student moment becomes smaller	B1
	clockwise moment now larger **or** plank rotates clockwise	B1
		8

Question 5

(a)	$^1/_2 \times (70 \times 9.8) \times 35$	M1
	$= 1.2 \times 10^4$ J	A1
(b)	use of $mg\Delta h$	C1
	$= 70 \times 9.8 \times 85$	C1
	$= 58.3 \times 10^3$ J	A1
		5

Section B

Question 6

(a)   *states* area under graph = distance **or** clear evidence of graph use   B1
       $^1/_2 \times 30 \times 25$ *seen*   B1

(b)   accel = grad of graph **or** uses a = $\Delta v/\Delta t$ M1
       = 30/20 = 1.5 m s^{-2} A1

(c)   300 + 375 = 675 m   B1

(d)   675/680 m (ecf) at 30m/s takes 22.5/22.7 s   C1
       but actually took 90 s   C1
       so loss of time = 67.5/67.3 s   A1
       8

Question 7

(a)(i)   construction correct, accurate and uses space sensibly   B1
       41° [correct calculation scores 2]   B1
    (ii)   work leading to 2.1 m s^{-1} B1

(b) $^1/_2\, mv^2$ C1
       $^1/_2 \times 4.5 \times 10^{-8} \times (2.13)^2$ C1
       = 1.02 × 10^{-7} J   A1

(c)   *work done = force × distance*   B1
       = (4.5 × 10^{-8} × 9.8) × 5   C1
       = 2.21 × 10^{-6} J   A1

(d)   air resistance increases with speed   B1
       eventually drag = weight   B1
       so overall force is zero   B1
       hence acceleration is zero   B1

       the use of physics terms is accurate, the answer is fluent/well
       argued with few errors in spelling, punctuation and grammar
       and scores **3+**   B2

       the use of physics terms is accurate, but the answer lacks
       coherence or the spelling, punctuation and grammar are poor
       and scores **1+**   B1

       the use of physics terms is inaccurate, the answer is disjointed
       with significant errors in spelling, punctuation and grammar   B0
       15

Question 8

cost comparison 1	B5
cost comparison 2	
[*e.g. capital/running/maintenance/transport/fuel*]	

+ maximum of three from
environment point 1
environment point 2
environment point 3
developed good point

[*e.g. air pollution/non –renewable nature/transport/fuel mass/volume/decommissioning/plant size/area/visual effect on landscape/safety during normal running/ safety with respect to catastrophe*]

the use of physics terms is accurate, the answer is fluent/well argued with few errors in spelling, punctuation and grammar **and** scores **3+**	B2
the use of physics terms is accurate, but the answer lacks coherence or the spelling, punctuation and grammar are poor **and** scores **2+**	B1
the use of physics terms is inaccurate, the answer is disjointed with significant errors in spelling, punctuation and grammar	B0
	7

Question 9

(a) $6800 \times \sin 20$ B1
           $= 2330$ N   B1

(b) $a = F/m$ B1
           $= 2300/690$ **or** $2300 = 690 \times a$ B1

(c) $v^2 = u^2 + 2as$ C1
           $s = [\,22 \times 22/2/3.33\,] = 72.7$ m [73.3 if using 3.3 m; 71.8 possible]   A1

(d) $F = 6900$ C1
           $a = F/m = [\,9.99/10\,]$ C1
           $t = 22/99.9$ or $22/10$ s $[\,= 2.2\,]$ A1
                                                    9

Question 10

(a) (i) charge carriers find it hard to move through/collide with lattice
      ions   B1

   (ii) temperature increase leads to increase in number of charge
       carriers   B1
       temperature increase leads to increase in lattice vibration   B1

   (iii) first effect in (ii) greater than second   B1
       resistance drops because of extra charge carriers   B1

(b) $V = IR$ B1
     R required = 10/0.009 = 1111 Ohm   B1
     so thermistor resistance = 1111 – 480 = 631 Ohm [ecf]   B1
     readoff [ecf] correct [70° C]   A1

(c)   Advantage 1   B1
     Advantage 2   B1
     [e.g. can operate 24 h per day/at any required time interval/ in any
     weather/more reliable/data processing easier/graphs plotted by
     computer/data storage eased/sampling rate quicker]   **11**
                                                           Total 75