ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2001

GCE

Physics A

Unit PA02

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 Awardsmeeting 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 fail to reach the threshold for the award of one mark.

3 An arithmetical error in an answer should be marked 'AE' 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 'CE' (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 'SF' and, in addition, write 'SF' 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.

Unit 2

1(a) kinetic energy is not conserved ✓ (*1*)

(b)(i) ($p = mv$ gives) $p = 0.12 \times 18 = 2.2$ N s ✓ (2.16 N s)

(ii) $p = 0.12 \times (-15) = -1.8$ N s ✓

(iii) $\Delta p = 2.2 - (-1.8) = 4.0$ N s ✓ (3.96 N s)
(allow e.c.f. from (i) and (ii))

(iv) ($F = \dfrac{\Delta(mv)}{\Delta t}$ gives) $F = \dfrac{3.96}{0.14}$ ✓
$= 28$ N ✓ (28.3 N)
(allow e.c.f from (iii))

(v) ($E_k = \frac{1}{2}mv^2$ gives) $E_k = 0.5 \times 0.12 \times (18^2 - 15^2) = 5.9$ J ✓ *(6)*
(7)

2(a)(i) pressure ✓
(ii) (average) kinetic energy
[or rms speed] ✓ (*2*)

(b)(i) $pV = nRT$ ✓
$n = \dfrac{1.0 \times 10^{-2} \times 300 \times 10^3}{8.31 \times 290}$ ✓
$= 1.20$ (mol) ✓ (1.24 mol)

(ii) mass of air $= 1.24 \times 29 \times 10^{-3} = 0.036$ kg ✓
(allow e.c.f from (i))

(iii) $\rho = \dfrac{0.0360}{1 \times 10^{-2}} = 3.6$ kg m^{-3} ✓
(allow e.c.f. from (ii)) (*5*)

(c)(i) same ✓
because the temperature is the same ✓

(ii) different ✓
because the mass of the molecules are different ✓ *(4)*
(11)

3(a)(i) ($P = VIt$ gives) $P = 2500 \times 360$ ✓
$= 9.0 \times 10^5$ kJ ✓

(ii) ($Q = mc\Delta t$ gives) $Q = 3 \times 4200 \times 40$ ✓
$= 5\ 0 \times 10^5$ J ✓ (*4*)

(b) heat is lost to the surroundings
the dishwasher is heated any two ✓ ✓
evaporation of the water *(2)*
(6)

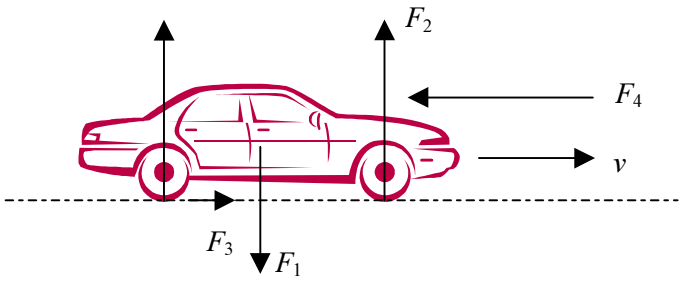
4(a) 360 N ✓ (*1*)

(b)(i) ($E_p = mgh$ gives) $E_p = 720 \times 0.6 = 4.3 \times 10^2$ J ✓

(ii) $T \cos 20^o$ ✓ $= 360$ (N)
$T = 380$ N ✓
(allow e.c.f from (a)) (*3*)

(c) (potential energy) changes ✓
centre of mass/gravity moves upwards ✓ (*2*)
(*6*)

5(a)(i)



F_1 weight / mg ✓
F_2 reaction or normal contact force ✓
F_3 driving force ✓
F_4 friction or air resistance ✓

(ii) zero acceleration ✓
zero resultant force ✓ $_{max}$(*5*)

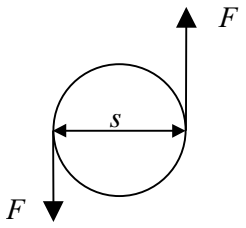
(b) ($P = Fv$ gives) $18 \times 10^3 = F \times 10$ ✓ (and $F = 1.8 \times 10^3$ N) (*1*)

(c)(i) $1800 - 250 = 1.6 \times 10^3$ N ✓ (1.55×10^3 N)

(ii) force $= 4 \times 1.55 \times 10^3 = 6.2 \times 10^3$ N ✓
(allow e.c.f. from (i))

(iii) total force $= 6200 + 250$ (N) ✓ ($= 6.45 \times 10^3$ (N))
($P = Fv$ gives) $P = 6.45 \times 10^3 \times 20 = 1.3 \times 10^5$ W ✓ (1.29×10^5 W)
(allow e.c.f. for value of total force) (*4*)
(*10*)

6(a)(i)



two forces opposing ✓
forces parallel ✓
s correct ✓

(ii) N m ✓ (*4*)

(b)(i) anticlockwise moments = clockwise moments ✓

(ii) weight of beam acts at centre ✓
this is through the pivot ✓ (*3*)

(c) (equating moments gives) $400 \times 1.0 = 200 \times 0.50 + 250 \times d$ ✓
$\therefore 400 - 100 = 250 \times d$ and $d = 1.2$ m ✓ (*2*)

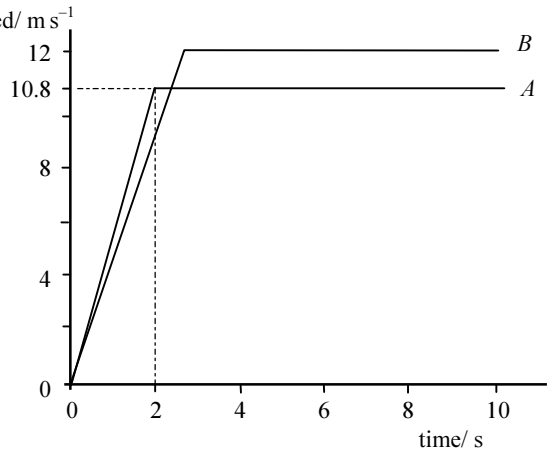
(*9*)

7(a)(i) ($v = \frac{s}{t}$ gives) $v = \frac{100}{10.2} = 9.8$ m s^{-1} ✓

(ii) ($v = at$ gives) $v = 5.4 \times 2 = 11$ m s^{-1} ✓ (10.8 m s^{-1})

(iii) ($s = ut + \frac{1}{2}at^2$ gives) $s = \frac{1}{2} \times 5.4 \times 2^2$ ✓
$= 11$ m ✓ (10.8 m) (*4*)

(b)



positive slope then horizontal ✓
initial slope correct ✓
horizontal line with correct

value from (a)(ii) ✓

(*3*)

(c)(i) $t = 2.8$ s ✓

(ii) (area under graph gives)
athlete B : 15 m ✓
athlete A : 11 ✓ + 8.6(4) = 20 m ✓ (10.8 + 8.64 = 19.4 m)

(iii) 20 – 15 = 5.0 m ✓ (19 – 15 = 4.0 m) max (*4*)
(allow e.c.f. from (c)(ii))

(*11*)

The Quality of Written Comunication marks are awarded primarily for the quality of answers to Q2(c)(i) and (ii), Q4(c) and Q5(a)(ii).