ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme January 2002

GCE

Physics A

Unit PA04

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.

Section A: Objective test keys

1-D; 2-C; 3-B; 4-C; 5-B; 6-D; 7-B; 8-A; 9-D; 10-C; 11-B; 12-B; 13-A; 14-D; 15-B.

Section B: Waves , Fields and Nuclear Energy

1(a) graph to show:
maxima of successively smaller intensity ✓
subsidiary maxima/minima equally spaced ✓
(at least two each side of central axis)
width of subsidiary sections half width of central section ✓
symmetrical pattern each side of central axis ✓ (*4*)

(b)(i) broader maxima or pattern ✓ [or fringes wider apart]
dimmer pattern ✓

(ii) maxima are closer ✓ [or narrower fringes]
green and dark regions ✓ max (*3*)

(*7*)

2(a) use of $mg = ke$ gives $k = \dfrac{0.20 \times 9.81}{3.5 \times 10^{-2}}$ ✓
$= 56\ \text{N m}^{-1}$ ✓ [or kg s^{-2}] (*2*)

(b)(i) 28 (N m^{-1}) ✓ (unit to be given in either (a) or (b))
(allow C.E. from (a))

(ii) (use of $T = 2\pi\sqrt{\dfrac{m}{k}}$ gives) $T = 2\pi\sqrt{\dfrac{0.50}{28}} = 0.84$ (s) ✓
(allow C.E. for value of k from (b)(i))
number of oscillations per minute = $\dfrac{60}{0.84} = 71$ ✓
(allow C.E. from (b)(ii)) (*3*)

(*5*)

3(a) graph to show:
straight line from origin ✓
<u>end point</u> at 4.5 (V), 9.0 (μF) ✓ (*2*)

(b)(i) $\Delta W = V\Delta Q$ explained ✓
energy stored or total work done in charging = area under graph or
charge × average voltage ✓
energy stored = work done (= ½QV) ✓

(ii) $Q = 2.0 \times 1.5 = 3.0$ (μC) ✓
E (=½ QV) = ½ × 3.0 × 10^{-6} × 1.5 = 2.25 × 10^{-6} J ✓
[or E = (½CV^2 = ½ × 2.0 × 10^{-6} × 1.5^2 = 2.25 × 10^{-6} J] (*5*)

<u>(*7*)</u>

4(a)(i) (force) to the right ✓

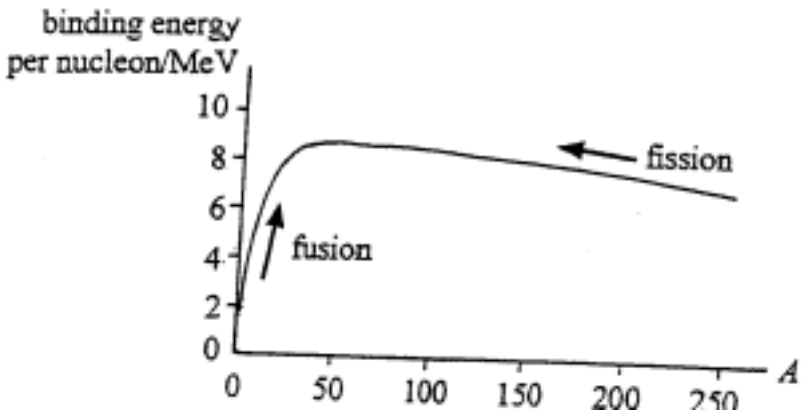
(ii) electrons accelerate or speed increases ✓ (*2*)

(b)(i) sketch to show path <u>curving</u> upwards in the field
(must not become vertical) ✓

(ii) horizontal component of velocity is unchanged ✓
vertical or upwards acceleration (or force) ✓
parabolic path described (or named) ✓ <u>max (*3*)</u>

<u>(*5*)</u>

5(a)



graph to show:
steep rise, maximum and gradual fall,
with maximum between 6 MeV and 10 MeV ✓
suitable values of A (up to 200 – 250) ✓
maximum shown at $A \approx 60$, with fall < 20% of rise ✓ (*3*)

(b)(i) *fission* when nucleus splits into two nuclei
and
fusion when two nuclei join to form one nucleus ✓

(ii) energy released when B.E./nucleon increases
or when B.E. increases
or when greater stability results
[or by movement towards peak of graph] ✓

how fission achieves this ✓
how fusion achieves this ✓
[if not explained, award ✓ (one only) if fusion and fission
arrows shown correctly on graph] max (*3*)

(*6*)

The Quality of Written Communication marks are awarded primarily for the quality of answers to Q4(b)(ii) and Q5(b).