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Mark Scheme Final Version
January 2008

GCE

GCE Physics (6735/01)

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General Marking Guidance

These instructions should be the first page of all mark schemes

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Mark scheme notes

Underlying principle

The mark scheme will clearly indicate the concept that is being rewarded, backed up by examples. It is not a set of model answers.
For example:

(iii) Horizontal force of hinge on table top

66.3 (N) or 66 (N) **and** correct indication of direction [no ue] ✓ **1**
[Some examples of direction: acting from right (to left) / to the left / West / opposite direction to horizontal. May show direction by arrow. Do not accept a minus sign in front of number as direction.]

This has a clear statement of the principle for awarding the mark, supported by some examples illustrating acceptable boundaries.

1. **Mark scheme format**
   - 1.1 You will not see 'wtte' (words to that effect). Alternative correct wording should be credited in every answer unless the ms has specified specific words that must be present. Such words will be indicated by underlining e.g. 'resonance'
   - 1.2 Bold lower case will be used for emphasis.
   - 1.3 Round brackets ( ) indicate words that are not essential e.g. "(hence) distance is increased".
   - 1.4 Square brackets [ ] indicate advice to examiners or examples e.g. [Do not accept gravity] [ecf].

2. **Unit error penalties**
   - 2.1 A separate mark is not usually given for a unit but a missing or incorrect unit will normally cause the final calculation mark to be lost.
   - 2.2 Incorrect use of case e.g. 'Watt' or 'w' will **not** be penalised.
   - 2.3 There will be no unit penalty applied in 'show that' questions or in any other question where the units to be used have been given.
   - 2.4 The same missing or incorrect unit will not be penalised more than once within one question but may be penalised again in another question.
   - 2.5 Occasionally, it may be decided not to penalise a missing or incorrect unit e.g. the candidate may be calculating the gradient of a graph, resulting in a unit that is not one that should be known and is complex.
   - 2.6 The mark scheme will indicate if no unit error penalty is to be applied by means of [no ue].

3. **Significant figures**
   - 3.1 Use of an inappropriate number of significant figures in the theory papers will normally only be penalised in 'show that' questions where use of too few significant figures has resulted in the candidate not demonstrating the validity of the given answer.
   - 3.2 Use of an inappropriate number of significant figures will normally be penalised in the practical examinations or coursework.
   - 3.3 Using $g = 10\ m\ s^{-2}$ will **not** be penalised.

4. Calculations

4.1 Bald (i.e. no working shown) correct answers score full marks unless in a 'show that' question.

4.2 If a 'show that' question is worth 2 marks then both marks will be available for a reverse working; if it is worth 3 marks then only 2 will be available.

4.3 **use** of the formula means that the candidate demonstrates substitution of physically correct values, although there may be conversion errors e.g. power of 10 error.

4.4 **recall** of the correct formula will be awarded when the formula is seen or implied by substitution.

4.5 The mark scheme will show a correctly worked answer for illustration only.

4.6 Example of mark scheme for a calculation:

'Show that' calculation of weight

Use of L × W × H	✓	
Substitution into density equation with a volume and density	✓	
Correct answer [49.4 (N)] to at least 3 sig fig. [No ue] [Allow 50.4(N) for answer if 10 N/kg used for g.] [If 5040 g rounded to 5000 g or 5 kg, do not give 3rd mark; if conversion to kg is omitted and then answer fudged, do not give 3rd mark] [Bald answer scores 0, reverse calculation 2/3]	✓	**3**

Example of answer:

$80 \text{ cm} \times 50 \text{ cm} \times 1.8 \text{ cm} = 7200 \text{ cm}^3$

$7200 \text{ cm}^3 \times 0.70 \text{ g cm}^{-3} = 5040 \text{ g}$

$5040 \times 10^{-3} \text{ kg} \times 9.81 \text{ N/kg}$

$= 49.4 \text{ N}$

5. Quality of Written Communication

5.1 Indicated by QoWC in mark scheme, placed as first mark.

5.2 Usually it is part of a max mark.

5.3 In SHAP marks for this are allocated in coursework only but this does not negate the need for candidates to express themselves clearly, using appropriate physics terms. Likewise in the Edexcel A papers.

6. Graphs

6.1 A mark given for axes requires both axes to be labelled with quantities and units, and drawn the correct way round.

6.2 Sometimes a separate mark will be given for units or for each axis if the units are complex. This will be indicated on the mark scheme.

6.3 A mark given for choosing a scale requires that the chosen scale allows all points to be plotted, spreads plotted points over more than half of each axis and is not an awkward scale e.g. multiples of 3, 7 etc.

6.4 Points should be plotted to within 1 mm.

- Check the two points furthest from the best line. If both OK award mark.
- If either is 2 mm out do not award mark.
- If both are 1 mm out do not award mark.
- If either is 1 mm out then check another two and award mark if both of these OK, otherwise no mark.

6.5 For a line mark there must be a thin continuous line which is the best-fit line for the candidate's results.

6735 Unit Test PHY5

Question Number	Answer	Mark
1(a)	(i) P.d. across capacitor Use of VR = I × R (1) [allow one error of 10^3 in individual substitutions; disallow if V_R value is 6V] VC = 6.0 V - 4.0 V (= 2.0 V) (1) [No ecf] Example of answer: $V_R = 20 \times 10^{-6}A \times 2.0 \times 10^5$ Hence V_C = 6.0 V - 4.0 V = 2.0 V	2
(b)	Calculation of charge Use of Q = C × V with 560 μF & 2.0 V (1) [Check correct equation is being used; allow power of 10 error in capacitance value. If capacitance value mis-transcribed, allow this first mark only] Answer 1.1(2)mC (1120μC) [no ecf] (1)	2
(c)	Calculation of energy stored Use of $W = \frac{1}{2}CV^2$ with given values, or $W = \frac{1}{2}QV$ with their Q, to get 1.1(2) mJ (1120μJ) or their correct answer . (1) [same numerical value as in (b)]	1
(d)	Calculation of energy transferred Use of $E = QV$, with their Q and V = 6.0 V, to get 6.7(2) mJ (6720μJ) or their answer [6 x value at part c] correctly found. (1)	1
(e)	Main reason for energy difference Energy is transferred to thermal / heat energy in / work is done against, the resistance of the **resistor** in the circuit [NOT just 'the resistance of the **wires**', nor the 'components'] (1) [Do not credit vague reference to energy dissipation, nor 'energy is lost to the surroundings']	1
	Total	7

Question Number	Answer	Mark
2(a)	Calculation of potential difference Use of $\frac{1}{2}m_p v^2$ with v = 2.77 × 105 ms-1 and mp = 1.67 × 10-27 kg (1) Use of eV with e = 1.60 × 10-19 C (1) [beware confusion of *v* and *V*] Answer = 400(.4) / 401 V (1) [If data used to 2 sf, →380V, 384V or 364V, allow 2/3] Example of answer: $eV = \frac{1}{2}m_p v^2$ $V = \frac{m_p v^2}{2e} = \frac{1.67\times10^{-27}\ \text{kg}\times(2.77\times10^{5}\ \text{ms}^{-1})^2}{2\times1.6\times10^{-19}\ \text{C}}$ $= 400\ \text{V}$ [beware unit error of eV here]	3
(b)	Add second path to diagram Path at B stays equidistant from that at A [gauge by eye] (1)	1
(c) (i)	Added path at A [allow through letter A] also curves upwards (1) But is less curved than the original, straight beyond plates and continues to diverge from it (1)	2
(c) (ii)	Explanation (1) Mass of proton. (1) [hence acceleration is approximately halved]. [Ignore reference to F = Bqv; do not credit reference to ^4_2He unless implication of numbers 4 and 2 is made clear].	2
	Total	**8**

Question Number	Answer	Mark
3(a)	Two deductions [not simply word descriptions of features of the diagram] The gravitational potential is increasing with height / when moving away from the Earth / Work must be done to move away from the Earth (1) [Ignore idea that $V \propto \frac{1}{r}$; in words or symbols] The field is non-uniform / radial / Field strength decreases with height / when moving away from the Earth (1)	2
(b)	Entry speed at Earth's atmosphere $\|\Delta V\|$ = -1MJkg-1 – (- 61MJkg-1) = 60MJkg-1 [accept ± 60MJkg-1] (1) Loss of GPE/ Gain in KE of spacecraft = mΔV (1) Statement / use of $\frac{1}{2}mv^2 = m\Delta V$ OR $\frac{1}{2}v^2 = \Delta V$ / (= 60 MJ kg-1) (1) [either of these statements also earns the second mark, if not already awarded] [See $v^2 = 1.2 \times 10^8 \rightarrow$ 3 / 4 at this stage] Answer 1.095 × 103 m s-1 / 10950 ms-1 / 11.0 kms-1 [more than 2 sf] (1)	4
(c)	Showing relative distance Use of Newton's Law; FE = $\frac{GM_E m}{r_E^2}$ or FM = $\frac{GM_M m}{r_M^2}$ (1) $\frac{r_E^2}{r_M^2} = \frac{M_E}{M_M}$ (or) $\frac{r_E}{r_M} = \frac{\sqrt{M}_E}{\sqrt{M}_M}$ (1) [or equivalent re-arrangement] $\frac{r_E^2}{r_M^2} = \frac{6.0\times10^{24}\text{ kg}}{7.4\times10^{22}\text{ kg}} =$ 81(.1) [or equivalent] (1) [correct relationship, expressed in terms of numerical values] [If inverted, then MM:ME = 0.0123] $\frac{r_E}{r_M} = \sqrt{81} = 9$ [or $\frac{r_M}{r_E} = 0.11$] (independent mark) (1)	

	[Stating 81 mark] [Beware ambiguity or transposition of r values at steps 2 or 3]	4
	Total	**10**

Question Number	Answer	Mark
4(a)(i)	Extent of the uniform magnetic field 60cm to 64cm (1) [Allow statements such as '18cm to 82cm']	1
(ii)	Magnitude of the current Use of B = $\frac{\mu_0 NI}{L}$ or = $\mu_o nI$ with B = 6.0 x 10-4T (1) N = 300 and L = 0.80m (→ n = 375 m-1) (1) Answer = 1.27 A (1.3 A to 2 s.f.) (1) [Use of L = 100cm {→1.6A} or = 60cm/their value {→ ~0.95A}, scores1/3]	3
(b)	One factor Direction in which turns are wound / Direction of current (in the solenoid) (1) [Beware suggestions of the direction of current in the **circuit**, the idea that e.g. current enters at north pole, or any correlation of cell polarity with magnetic polarity]	1
	Total	**5**

Question Number	Answer	Mark
5(a)(i)	Direction of current Position 1 = Q to P / anticlockwise / to the left, Position 3 = P to Q / clockwise / to the right } (1) [both needed; arrows added to diagram may give current directions at 1 & 3] Position 2 = no current (1)	2
(ii)	Current calculation Use of $\frac{\Delta\phi}{\Delta t} = \frac{\Delta(BA)}{\Delta t}$, or $\varepsilon = Blv$, = 2 × 10-2 T × 0.12 m × 0.05 ms-1 (1) [ignore power of 10 errors in dimension and velocity values] (Emf =) 1.2 × 10-4 V (1) $I = \frac{V}{R}$ or $I = \frac{E}{R}$ seen or used (1) Answer = 6.0 x 10-5A or 60μA [ecf their emf] (1)	4
(b)	Uniform acceleration? QoWC (1) Magnitude of current would be increasing as frame moves through position 1 (or position 3) (1) Magnitude of current would be greater for position 3 than 1 (1) [Beware comparison of position 3 with position 2 here] Reference to increased rate of flux cutting / increased rate of flux change / increased area swept out per second (Beware suggestion that B or flux density is changing) } (1) So induced emf is greater (1) Current for position 2 is zero [Do not credit equal and opposite currents cancelling] Since flux linkage is constant / (net) rate of flux cutting is zero / Emfs in PS and QR are equal and opposite } Both needed (1)	Max 4
	Total	10
	Total for paper	40