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Mark Scheme (Results)
January 2011

GCE

GCE Physics (6PH08) Paper 01

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General Marking Guidance

- 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.
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.

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] ✓
[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 cm × 50 cm × 1.8 cm = 7200 cm^3

7200 cm^3 × 0.70 g cm^{-3} = 5040 g

5040 × 10^{-3} kg × 9.81 N/kg

= 49.4 N

5. Quality of Written Communication

5.1 Indicated by QoWC in mark scheme. QWC – Work must be clear and organised in a logical manner using technical wording where appropriate.

5.2 Usually it is part of a max mark.

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.

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

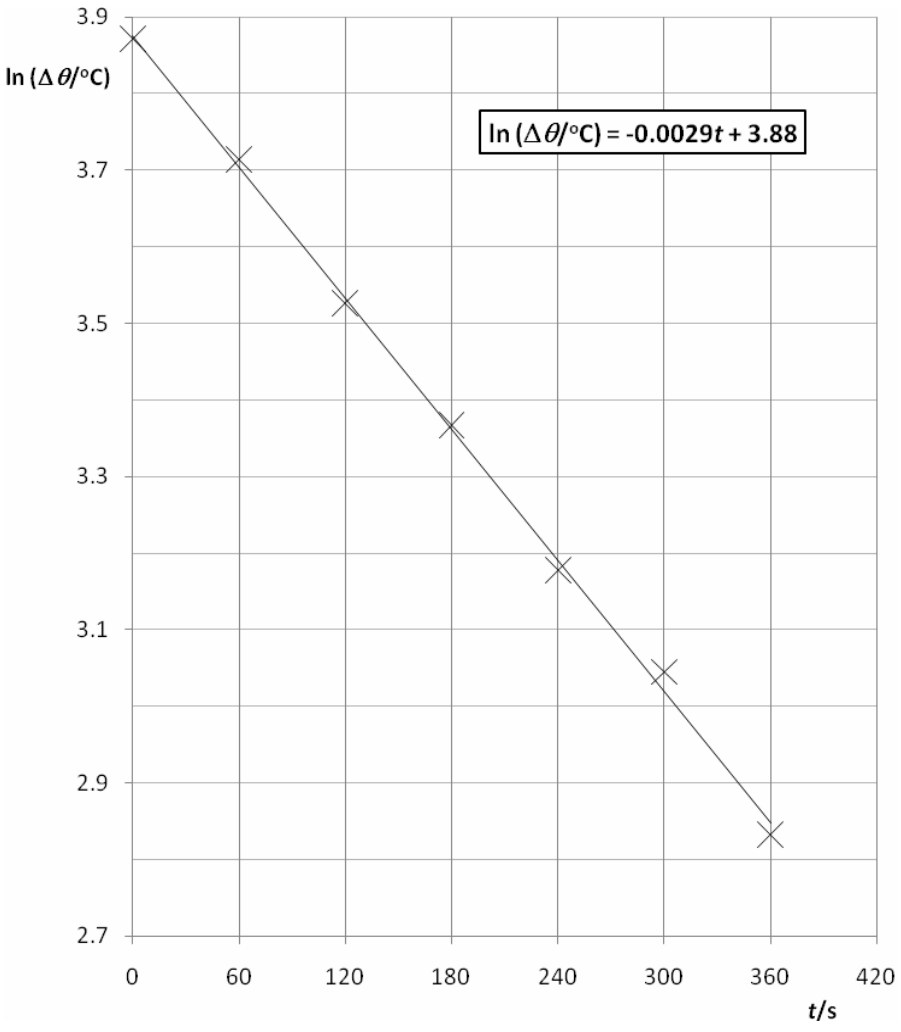
Question Number	Answer	Mark
1 (a) (i)	Weight of water = 1.91(03) N [to at least 3 sf] (1)	**1**
1 (a) (ii)	Divides their weight by g or a correct mass seen (1) [allow use of 9.81, 9.8 and 10] Correct density [using 9.8(1)] and stated to at least 3 sf (1) e.g. m = 1.9103/9.81 = 0.1947 kg ρ = 0.1947 / 191 x 10^{-6} = 1020 (kg m^{-3})	**2**
1 (b) (i)	Upthrust = 0.0263 N (c.a.o.) (1)	**1**
1 (b) (ii)	Divides their U by their value of density or 1000 and by g (1) [allow use of 9.81, 9.8 and 10] Correct V (allow ecf) stated to at least 3 sf and correct unit (1) e.g. V = 0.0263 / (1020x9.81) V = 2.63 x10^{-6} m^3 (or 2.63 cm^3 etc) (Using 1000 gives 2.68 x10^{-6})	**2**
1 (b) (iii)	Divides mass (9.38 or 0.00938) by their V (1) Correct density (allow ecf) with correct unit stated to 2 or 3 sf (1) e.g ρ = 0.00938 / 2.63 x10^{-6} ρ = 3.57 x 10^3 kg m^{-3} (or 3.57 g cm^{-3} etc) (Using 1000 and 2.68 gives 3500)	**2**
	Total for question 1	**8**

Question Number	Answer	Mark
2 (a)	Conservation of momentum only applies in there are no (resultant) external forces (1)	**1**
2 (b)	Truck A given a (gentle) push (1) The times shown on both timers are similar/calculated velocities are similar (1) OR Put truck on track, check if it remains stationary (1) Check in more than one position/use both trucks (1) OR Use spirit level (1) Check bubble in middle/check in more than one position (1) OR Check height of track above bench with rule and set square (1) At both ends (1) [in each case second mark is consequent on first]	**2**
2 (c)	Mass doubles (1) (So) velocity halves (1) time = $\frac{\text{(card) length}}{\text{velocity}}$ (so time is doubled) (1) allow mathematical proof which hides *v* ratio e.g. $mu = 2mv$ $m \times l / t_1 = 2m \times l / t_2$ hence $t_2 = 2t_1$	**3**
2 (d)	Mean ratio $t_2 / t_1 = 2.1$ (1) Uncertainty is $\pm$ 0.2 (1) Uncertainty range includes 2.0 (1) Alternatives for last 2 marks Calculates % difference as 5% (1) 5% is less than the experimental uncertainty of 9.5% (1) (Hence, yes, momentum is conserved)	**3**
	Total for question 2	**9**

Question Number	Answer	Mark
3 (a) (i)	Mean *W* values are 19.57 and 36.16 (1) Values for *C* are 1.9(3) and 2.0(1) to 2 or 3 sf (1)	**2**
3 (a) (ii)	Percentage difference between values calculated using mean *C* as denominator (1) e.g. (2.01 – 1.93)/1.97 = 4(.1)%	**1**
3 (b) (i)	Uses range or half range to estimate uncertainty (1) [must include unit] e.g uncertainty is 0.12 mJ or 0.06 mJ	**1**
3 (b) (ii)	Calculates percentage uncertainties in *V* and *W* (1) Combines percentages appropriately (1) e.g. using range (0.12 mJ) using half range (0.06 mJ) *W* = 0.6% & *V* = 2.2% *W* = 0.3% & *V* = 2.2% *C* = [0.6+(2×2.2)]%=5.0% *C* = [0.3+(2×2.2)]%=4.7%	**2**
3 (c)	Calculates % difference between their mean *C* and 2200 μF (1) Compares % difference (+ % uncertainty) with 20% (1) OR Calculates lower limit of range of 2200 μF as1760 (1) States that that mean *C*(– uncertainty) lies within range (1) e.g %difference from quoted value is (2.2 – 1.95)/2.2 = 11% %D + %U = 16 % which is within tolerance of 20%	**2**
	Total for question 3	**8**

Question Number	Answer	Mark
4 (a)	Control variable (1) e.g. room temperature, no draughts, exclude sunlight Measure temperature of oil as it cools (1) Good method e.g. specified time interval, starting temp at least 70 ºC (1) Measure room temperature (1) Sensible precaution (1) e.g. stir liquid as temperature falls, keep thermometer away from sides and base, eye level with thermometer reading	**5**
4 (b)(i)	$\ln \Delta\theta = -kt + \ln \Delta\theta_0$ and compare with $y = mx + c$ / states gradient is $-k$ (1)	**1**
4 (b)(ii)	$\Delta\theta$ & $\ln \Delta\theta$ correct and $\ln \Delta\theta$ to at least 3 SF (1) Sensible scale for graph (allow '60 s' here) (1) Axes labelled with quantities and units (1) Plots accurate (1) Best fit line (1)	**5**
4 (b) (iii)	Gradient found using large triangle (base > 5 cm) (1) 0.0027 > gradient > 0.0031 and negative (1) 0.0027 > k > 0.0031 with unit s^{-1} [seen anywhere] (1)	**3**
4 (c)	Takes simultaneous readings/plots graph automatically (1)	**1**
	Total for question	**15**

t/s	θ/°C	Δθ/°C	ln (Δθ/°C)
0	70	48	3.871
60	63	41	3.714
120	56	34	3.526
180	51	29	3.367
240	46	24	3.178
300	43	21	3.045
360	39	17	2.833



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