

Mark Scheme (Results) Summer 2008

GCE

GCE Salters Horners Physics (6751/01)

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 $g = 10 \text{ m s}^{-2}$ 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 $L \times W \times H$	✓
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 3 rd mark; if conversion to kg is omitted and then answer fudged, do not give 3 rd mark] [Bald answer scores 0, reverse calculation 2/3]	✓
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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.

6751 Unit Test PSA1

Question Number	Answer		Mark
1 (a)	<p><u>Comment on use of weighing</u></p> <p>Clear statement correctly identifying weight or mass (or their units) e.g. kg a unit of mass, not weight</p>	✓	1x1
(b)	<p><u>Calculation to check statement</u></p> <p>Use of equation of motion to show time or distance Answer to 2 sig figs [120 m or 4.5 s] [no ue]</p> <p>Example of calculation:</p> $s = ut + \frac{1}{2} at^2$ $s = 0 + \frac{1}{2} \times 9.81 \text{ m s}^{-2} \times (5\text{s})^2 \quad \text{OR} \quad 100 = 0 + \frac{1}{2} \times 9.81 \text{ m s}^{-2} \times t^2$ $s = 123 \text{ m} \quad \quad \quad \text{OR} \quad t = 4.5 \text{ s}$	✓ ✓	2x1
(c)	<p><u>Calculation of kinetic energy</u></p> <p>Either</p> <p>Use of equation(s) of motion which allow(s) v^2 or v to be found Recall of $ke = \frac{1}{2} mv^2$ Answer [69 000 J]</p> <p>OR</p> <p>Recall of $E_p = mgh$ Substitution Answer [69 000 J]</p> <p>Example of calculation:</p> $v^2 = u^2 + 2as$ $v^2 = 0 + 2 \times 9.81 \text{ m s}^{-2} \times 100 \text{ m}$ $v^2 = 1962 \text{ m}^2 \text{ s}^{-2}$ $ke = \frac{1}{2} mv^2$ $= 69\,000 \text{ J (68 670 J)}$ <p>OR</p> $gpe = mgh$ $gpe \text{ lost} = 70 \text{ kg} \times 9.81 \text{ N kg}^{-1} \times 100 \text{ m}$ $gpe \text{ lost} = 69\,000 \text{ J (68 670 J)}$ <p>[so $ke = 69\,000 \text{ J}$ because $ke \text{ gained} = gpe \text{ lost}$]</p>	✓ ✓ ✓ ✓ ✓ ✓	3x1
			6

Question Number	Answer		Mark
2 (a)	<u>Meaning of focal length</u> distance between focal point and (centre of) lens where focal point is point to which incident parallel rays are focused (marks from labelled diagram for illustrating these marking points)	✓ ✓	2x1
(b) i	<u>Condition for reflection</u> Angle of incidence greater than critical angle [accept $i > c$]	✓	1x1
(b) ii	<u>Description of path of ray</u> Any two from: <ul style="list-style-type: none"> • Ray <u>refracted</u> at A and C • Description of direction changes at A and C • <u>Total internal reflection</u> at B 	✓✓	2x1
(c) i	<u>Things wrong with the diagram</u> Angle of refraction can't be 0 / refracted too much No refraction on emergence from prism [Allow 1 mark for correct reference to partial reflection]	✓ ✓	2x1
(c) ii	<u>Corrected diagram</u> <ul style="list-style-type: none"> • emergent ray roughly parallel to the rest of the emergent rays • direction of refraction first surface correct • direction of refraction second surface correct 	✓ ✓ ✓	3x1
(d)	<u>Calculation of power</u> Correct answer [5.3 D or 5.3 m^{-1}] Example of calculation: power = $1/f$ power = $1/0.19 \text{ m}$ power = 5.3 D	✓	1x1
			11

Question Number	Answer		Mark
3 (a)	<u>Formula for C6</u> $v = u + at$ OR $v = 10.7 - (9.81 \times 0.2)$ [units need not be given] OR $C6 = C5 - 9.81 \times A6$	✓	1x1
(b)	<u>Explain B5 to B16 constant</u> g affects vertical motion only / no horizontal force	✓	1x1
(c)	<u>Significance of negative values</u> The ball moving downwards	✓	1x1
(d) i	<u>Completion of diagram</u> Vertical arrow has 6.8 added, horizontal arrow has 10.7 added	✓	1x1
(d) ii	<u>Calculation of velocity at time $t = 0.4$ s</u> Use of Pythagoras Answer for magnitude of v [12.7 m s^{-1}] [ecf from diagram] Use of trigonometrical function [ecf from magnitude] Answer for direction [32.4°] [ecf from diagram] Example of answer: $v^2 = (6.8 \text{ m s}^{-1})^2 + (10.7 \text{ m s}^{-1})^2$ $v = 12.7 \text{ m s}^{-1}$ $\tan \theta = 6.8 \text{ m s}^{-1} \div 10.7 \text{ m s}^{-1}$ $\theta = 32.4^\circ$ [For scale drawing- components drawn correctly to scale✓, resultant shown correctly✓, answer for v $\pm 0.5 \text{ m s}^{-1}$ ✓, angle to $\pm 2^\circ$ ✓]	✓ ✓ ✓ ✓	4x1
(e) i	<u>Calculation of components for new angle</u> Answer for vertical component [8.7 m s^{-1}] Answer for horizontal component [12.5 m s^{-1}] [1 mark only if answers reversed] Example of answer: vertical component = $v \sin \theta = 15.2 \text{ m s}^{-1} \times \sin 35^\circ = 8.7 \text{ m s}^{-1}$ horizontal component = $v \cos \theta = 15.2 \text{ m s}^{-1} \times \cos 35^\circ = 12.5 \text{ m s}^{-1}$	✓ ✓	2x1
(e) ii	<u>Suggest reason for greater distance</u> Examples - greater horizontal component of velocity; easier to throw at higher speed closer to the horizontal; launching from above ground level affects the range; force applied for longer; more force can be applied	✓	1x1
			11

Question Number	Answer		Mark
4 (a)	<p><u>Show that heat energy supplied at about 500 W</u></p> <p>Recall of power = energy/time</p> <p>Answer to 2 sig figs [470 [W]] [no ue]</p> <p>Example of calculation:</p> <p>power = energy/time = $1.63 \times 10^5 \text{ J} / 347 \text{ s}$ = 470 W</p>	<p>✓</p> <p>✓</p>	2x1
(b) i	<p><u>Show that heat energy gained is about $1 \times 10^5 \text{ J}$</u></p> <p>Use of $\Delta Q = mc\Delta\theta$</p> <p>Correct answer [$1.4 \times 10^5 \text{ [J]}$] [no ue]</p> <p>Example of calculation:</p> <p>$\Delta Q = mc\Delta\theta$ = $0.44 \text{ kg} \times 3800 \text{ J kg}^{-1} \text{ }^\circ\text{C}^{-1} \times (96^\circ\text{C} - 12^\circ\text{C})$ = $1.4 \times 10^5 \text{ J}$</p>	<p>✓</p> <p>✓</p>	2x1
(b) ii	<p><u>Calculate the time taken to reach 96°C</u></p> <p>Use of time = energy/power</p> <p>Correct answer [300 s]</p> <p>Example of calculation:</p> <p>time = energy/power = $1.4 \times 10^5 \text{ J} / 470 \text{ W}$ = 299 s</p>	<p>✓</p> <p>✓</p>	2x1
(c) i	<p><u>Explain why it might take longer</u></p> <p>Heat supplied to milk at a lower rate / expansion on mechanism of heat loss /destination of heat lost</p>	<p>✓</p>	1x1
(c) ii	<p><u>Suggest why time the same</u></p> <p>Power calculation includes a heat loss factor / rate of heat gain the same as for water / appropriate mechanism to reduce heat loss (Allow 1 for heat losses already taken into account when warming the water)</p>	<p>✓</p>	1x1
			8

Question Number	Answer		Mark
5(a)	<u>Calculation of adaptor's input</u> Recall of: power = IV Correct answer [0.01 A] Example of calculation: $\text{power} = IV$ $I = P/V = 25 \text{ W} / 230 \text{ V}$ $= 0.01 \text{ A}$	 ✓ ✓	2x1
(b) i	<u>Explain why VA is a unit of power</u> Power = voltage x current so unit = volt x amp	✓	1x1
(b) ii	<u>Calculation of efficiency of adaptor</u> Use of efficiency equation Correct answer [24%] Example of calculation: $\text{efficiency} = (0.6 \text{ VA} / 2.5 \text{ W}) \times 100\%$ $= 24 \% [0.24]$	 ✓ ✓	2x1
(b) iii	<u>Reason for efficiency less than 100%</u> Resistance (accept explanations beyond spec, e.g. eddy currents) <u>hence</u> heat loss to surroundings	 ✓ ✓	2x1

(c) i	<u>Calculation of charge</u> Recall of: $Q = It$ Correct answer [4000 C] Example of calculation: $Q = It$ $= 0.2 \text{ A} \times 6 \text{ h}$ $= 0.2 \text{ A} \times (6 \times 60 \times 60) \text{ s}$ $= 4000 \text{ C} \text{ (4320 C)}$	✓ ✓	2x1
(c) ii	<u>Calculation of work done</u> Recall of: $W = QV$ OR Recall of $W = Pt$ Correct substitution Correct answer [13 000 J] Example of calculation: $W = QV$ $W = 4320 \text{ C} \times 3 \text{ V}$ [ecf] $= 13\,000 \text{ J} \text{ (12\,960 J)}$ OR $W = Pt$ $W = 0.6 \text{ W} \times 6 \text{ h}$ $W = 0.6 \text{ W} \times (6 \times 60 \times 60) \text{ s}$ $= 13\,000 \text{ J}$	✓ ✓ ✓	3x1 12

Question Number	Answer		Mark
6(a) i	<u>Add standing waves to diagrams</u> Mark for each correct diagram	✓✓	2x1
(a) ii	<u>Mark place with largest amplitude of oscillation</u> antinode marked [allow clear indication near centre of wave other than an X, allow correct antinode shown on diagrams B or C]	✓	1x1
(a) iii	<u>Name of place marked</u> (Displacement) Antinode [allow ecf from (a) ii]	✓	1x1
(b) i	<u>Calculation of wavelength</u> Correct answer [5.6 m] Example of calculation: = 2 x 2.8 m = 5.6 m	✓	1x1
(b) ii	<u>Calculation of frequency</u> Recall of $v = f\lambda$ Correct answer [59 Hz] [ecf] Example of calculation: $v = f\lambda$ $f = 330 \text{ m s}^{-1} / 5.6 \text{ m}$ = 58.9 Hz	✓ ✓	2x1
(c) i	<u>Explanation of difference in sound</u> as the room has a standing wave for this frequency / wavelength / it is the fundamental frequency (allow relevant references to resonance)	✓	1x1
(c) ii	<u>Suggest another frequency with explanation</u> Appropriate frequency [a multiple of 59 Hz] [ecf] Wavelength 1/2, 1/3 etc (stated or used)	✓ ✓	2x1
(d)	<u>Explain change in frequencies</u> wavelengths (of standing waves) bigger / $f = v/2l$ hence frequencies smaller/lower	✓ ✓	2x1
			12
	Total for paper		60