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Mark Scheme (Results)
Summer 2008

GCE

GCE Salters Horners Physics (6752/01)

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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] [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.]	✓	**1**

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.

6752 Unit Test PSA2

Question Number	Answer	Mark
1 (a)	Blue light: Wavelength / frequency / (photon) energy	**1x1**
(b) i	Frequency: Conversion of either value of eV to Joules Use of f = E / h Correct frequency range [4.8×10^{14} – 8.2×10^{14} Hz **or** range = 3.4×10^{14} Hz] [no penalty for rounding errors] eg. 2 eV = $2 \times 1.6 \times 10^{-19} = 3.2 \times 10^{-19}$ J = $6.63 \times 10^{-34} \times f$ f = 4.8×10^{14} Hz 3.4 eV = $3.4 \times 1.6 \times 10^{-19} = 5.4 \times 10^{-19}$ J f = 8.2×10^{14} Hz	**3x1**
(b) ii	Diagrams: Downward arrow from top to bottom level On larger energy gap diagram	**2x1**
(c) i	Resistivity drop: Less heating / less energy lost / greater efficiency / lower voltage needed / less power lost	**1x1**
(c) ii	Resistance: Recall of $R = \rho L / A$ Use of $R = \rho L / A$ Correct answer [80(Ω)] [allow 80- 84 (Ω) for rounding errors] Eg. $R = (2 \times 10^{-2} \times 5.0 \times 10^{-3}) / (3.0 \times 10^{-3} \times 4.0 \times 10^{-4})$ = 83 Ω	**3x1**
		10

Question Number	Answer	Mark
2 (a) i	Type of behaviour: Plastic Correct definition of circled word: Ductile: can be pulled into a long thin shape Elastic: returns to original shape/size (once force removed) Plastic: does not return to original shape/size (once force removed) Tough: can withstand dynamic loads / shocks / impacts / absorbs a lot of energy before breaking	**2x1**
(a) ii	Brittle: Snaps / cracks / shatters / breaks without (plastic) deformation (when subjected to a force)	**1x1**
(a) iii	Strong: Large force / stress required to break it	**1x1**
(b) i	Breaking stress: Use of $\sigma = \varepsilon \times E$ Correct answer [2×10^8 Pa] Eg. $\sigma = 2 \times 10^{11} \times 0.001$ $= 2 \times 10^8$ Pa	**2x1**
(b) ii	Force to break wire: Use of $A = \pi r^2$ Use of $F = \sigma \times A$ Correct answer [157 (N)] [allow 156 – 157 (N) for rounding errors - no u.e] Eg. $A = \pi \times (1 \times 10^{-3} / 2)^2 = 7.9 \times 10^{-7} m^2$ $F = 2 \times 10^8 \times 7.9 \times 10^{-7} m^2$ Weight (= F) = 157 N	**3x1**
(b) iii	Force to break Biosteel fibre: 3.1×10^3 N [allow 3.1×10^3 N - 3.2×10^3 N] eg. 20 x 157 = 3140 N (3200 N if 160 N used)	**1x1**
(b) iv	Assumption: Elastic limit (of both materials) not reached / elastic behaviour / Hooke's law obeyed / Young modulus still holds at breaking point / Area remains constant / best Biosteel scenario / 20 × stronger	**1x1**
		11

Question Number	Answer	Mark
3 (a)	Type of radiation: Gamma Most penetrating / very penetrating / alpha and beta would not penetrate the food / can penetrate (the food)	**2x1**
(b) i	Tests on ancient artefacts: The age (of the artefact) / the amount of irradiation it has received (since it was last heated)	**1x1**
(b) ii	Light intensity measurement from food: Amount of exposure to radiation / whether food has been exposed to radiation or not	**1x1**
(c) i	Energy level diagram: At least three energy levels drawn with defect level labelled arrow showing electron moving from ground level to an intermediate / metastable energy level	**2x1**
(c) ii	What happens to electron: Electron knocked out of (defect) level and falls (back to the ground state) / drops / returns to valence band (difference in) energy given out as photon/light / reference to $E = hf$	**2x1**
(d)	False test result: Background radiation Higher (than average) in this area	**2x1**
		10

Question Number	Answer	Mark
4 (a)	Angles: Normal correctly added to raindrop (by eye) An angle of incidence correctly labelled between normal and incident ray and an angle of refraction correctly labelled between normal and refracted ray	**2x1**
(b)	Angle of refraction: Use of μ = sin *i* / sin *r* Correct answer [20°] [allow 20 ° – 21 ° to allow for rounding errors] eg. sin *r* = sin 27° / 1.3 *r* = 20°	**2x1**
(c) i	Critical angle: The angle beyond which total internal reflection (of the light) occurs [allow T.I.R] / r = 90 °	**1x1**
(c) ii	Critical angle calculation: Use of μ = 1 / sin *C* Correct answer [50.3°] [allow 50 ° – 51 °] Eg. Sin *C* = 1/1.3 *C* = 50.3°	**2x1**
(d)	Diagram: *i* = 35 ° [allow 33 ° -37 °] Ray of light shown refracting away from normal on leaving raindrop Some internal reflection of ray also shown with *i* = *r* [by eye] Reflected ray shown refracting away from the normal as it leaves the front of the raindrop / angle of refraction correctly calculated at back surface	**4x1**
(e)	Refractive index: (Red light has) lower refractive index (than violet light)	**1x1**
		12

Question Number	Answer	Mark
5(a)	Graph: Line of best fit drawn as straight line through origin	**3x1**
	Stiffness: Use of $k = F/x$ k = 22 Nm^{-1} (allow 21 -23 Nm^{-1}) [allow ecf from graph] eg. k = 110/5.0 = 22 Nm^{-1}	
(b)	Energy stored in rope: Use of E = area under graph = ½ Fx [also allow $E = ½ kx^2$ / $E = F^2/2k$] Correct answer [514 J (511J if k = 22 Nm^{-1} is used] [allow 505 – 522 J] E = ½ x 150 x 6.85 = 514 J	**2x1**
(c)	Less extension with child: Any one of: • Rope connected to sheet as (many) parallel sections (making it stiffer) • Each section of rope supporting (much) less than full weight • Work done / energy lost to friction with trampoline fram	**Max 1**
(d)	New rope dimensions: Rope needs to be thicker / shorter As stiffness would have to be increased / reference to $E = Fl/Ax$ / as it would have to withstand a greater stress / otherwise extension would be (much) greater	**2x1**
		8

Question Number	Answer	Mark
6(a) i	Focal length calculation: Use of $1/f = 1/u + 1/v$ Correct answer for f [0.30 cm] eg. $1/f = 1/0.31 + 1/15.5$ $1/f = 3.29$ f = 0.30 cm [accept 0.3 cm]	**2x1**
(a) ii	Image: It can be projected on to a screen / rays go through image / u > f / v is positive / image formed after lens	**1x1**
(b)	Ray diagram: Ray drawn from top of I_1 through the centre of the lens with no deviation Ray drawn from top of I_1 parallel with axis to lens then through focal point Rays extended to converge and form a virtual image	**3x1**
(c)	Image properties: Magnified Upside down / Inverted / Laterally inverted /same way up as I Virtual	**3x1**
		9
	Total for paper	**60**