

# Mark Scheme (Results) Summer 2008

GCE

## GCE Salters Horners Physics (6754/01)



## 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 <sup>rd</sup> mark; if conversion to kg is omitted and then answer fudged, do not give 3 <sup>rd</sup> 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.

## 6754 Unit Test PSA4

Question Number	Answer	Mark
1(a)	Show sum of quark charges in proton = +1 $+2/3 + 2/3 - 1/3 = (+) 1$  Show sum of quark charges in neutron = 0 $+2/3 - 1/3 - 1/3 = 0$  [ignore references to e]	1   1
1(b)i	<ul style="list-style-type: none"> <li>• baryon</li> <li>• meson</li> </ul>	1 1
1(b)ii	baryon: 3 quarks meson: quark/antiquark [1 for answers reversed or baryon/meson not specified]	1 1
1(c)	any 4 marks from the following examples: high speed means high energy/momentum may need to overcome (electrostatic) repulsion more energy available for creating particles higher energy/momentum/speed means shorter wavelength reference to $\lambda = h/mv$ or $\lambda = h/p$ for diffraction/scattering need $\lambda$ approx equal to particle spacing/internal structure	1 1 1 1 1 1 1 max 4
1(d)	Speeds near the speed of light	1
	Total for question	11

Question Number	Answer	Mark
2	<p>Recall speed = <math>s/t</math>            Use of <math>s = \pi D</math>            Answer for speed            Conclusion</p> <p>OR</p> <p>Use of <math>v = r\omega</math>            Use of <math>\omega = 2\pi \times 20\,000</math>            Answer for speed            Conclusion</p> <p><math>v = s/t</math>  <math>s = \pi \times 8000</math> (m)  <math>v = \pi \times 8000 \times 20\,000</math> (m/s)  <math>v = 5 \times 10^8</math> m/s</p> <p>inaccurate/not possible <u>since speed &gt; c</u></p>	<p>1 1 1 1</p>
	Total for question	4

Question Number	Answer	Mark
3(a)	Lines [not crossing; minimum 2 lines starting from S pole of magnet ] Correct arrow(s) [minimum 1 arrow pointing towards S pole, any incorrect arrow scores 0]	1 1
3(b)i	Use of $F = BIl$ rearranged to $B = F/Il$ OR with two correct subs Leading to correct answer  $B = F/Il = 0.008 / (5.8 \times 0.012)$ (T) $B = 0.11$ (T)	1 1
3(b)ii	Assumption: parallel field/uniform field/constant field for 12 mm then falls to zero / assume wire perpendicular to field (at all points)/ $\theta=90^\circ$ (where $F=Bil \sin\theta$ given earlier)/force same at all points on the wire	1
3(c)	Experimental value less because field diverges OR field strength decreases with distance OR field could be 0.3 T at magnet surface and only 0.1 T at wire	1
3(d)	Wire would levitate (again) Two reversals cancel/applying FLHR [wire moves downwards due to current OR field reversed scores 1]	1 1
	Total for question	8

Question Number	Answer	Mark
4(a)	capacitors need d.c. OR Mains is a.c. / mains current changes direction constantly	1
	Charge given in one half of cycle is removed the next half OR C charged then discharges	1
4(b)i	Voltage value for initial voltage $\times 1/e$ [or use of 37%] OR use 2 values where 2 <sup>nd</sup> is $1/e$ th of first OR draw tangent at time = 0 s OR $V = V_0 e^{-t/RC}$ with correct substitution of (t,V) from graph	1
	$T = 0.07$ s [allow 0.065 s - 0.075 s]	1
4(b)ii	Recall time constant = $CR$ Answer for $R$ [allow ecf for T]	1
	$R = T/C = 0.07 \text{ s}/(100 \times 10^{-9} \text{ F})$ $R = 7 \times 10^5 \Omega$	1
4(c)i	Recall $Q = CV$ [equation or substitution] Answer for Q	1
	$Q = CV = 100 \times 10^{-6} \times 300$ $Q = 0.03 \text{ C}$	1
4(c)ii	Recall $W = 1/2 CV^2$ OR $W = 1/2 Q^2/C$ OR 2 correct subs into $W = 1/2 QV$ [allow ecf] Answer	1
	Eg: $W = 1/2 QV = 0.5 \times 0.03 \times 300 \text{ (J)} = 4.5 \text{ J}$ OR $W = 1/2 CV^2 = 0.5 \times 100 \times 10^{-9} \times 300 \times 300 \text{ (J)} = 4.5 \text{ J}$ OR $W = 1/2 Q^2/C = 0.5 \times 0.03 \times 0.03/(100 \times 10^{-9}) \text{ (J)} = 4.5 \text{ J}$	1
Total for question		10

Question Number	Answer	Mark
5(a)	Recall that attenuation = gradient of ln(intensity) vs distance graph Gradient = 0.0059 - 0.0060  Eg gradient = $6.1/1030 \text{ (m)} = 0.0059 \text{ (m}^{-1}\text{)}$ [substitute values from graph into equation to correct answer = 1]	1 1
5(b)i	Recall of $I = P/A$ Use of a percentage to find power output Answer  Example: Initial $I = 1000/17.5 \text{ (W m}^{-2}\text{)}$ So final $I = (1000/17.5) \times 0.12 \times 0.83 \text{ (W m}^{-2}\text{)}$ $I = 5.7 \text{ (W m}^{-2}\text{)}$	1 1 1
5(b)ii	Use of $I = I_0 e^{-\mu x}$ with two correct subs Taking logs: $\ln(I) = \ln(I_0) - \mu x$ Answer  Example $1 \times 10^{-7} = 5.7 \times e^{-0.006 x}$ $\ln(1 \times 10^{-7}) = \ln 5.7 - 0.006 x$ $x = 2980 \text{ m to } 3036 \text{ m}$	1 1 1
5(b)iii	This is less than calculated [ecf] Sensible reason for difference  E.g. beam not really parallel (so intensity decreases faster) background light, so becomes indistinguishable at higher intensity diffraction/dispersion effects due to fog source more of a point source/quote $1/4\pi r^2$ $\mu$ may vary different wavelengths/frequencies have different attenuation	1 1
5(c)	Less attenuation for low frequencies (so use low frequencies)	1
	Total for question	11

Question Number	Answer	Mark
6(a)	<p>Any 5 marks from</p> <p>[going down columns]</p> <p>doubling pixels = halving photos</p> <p>Example of a calculation</p> <p>Number photos <math>\propto</math> 1/pixels</p> <p>OR pixels x number photos = constant</p> <p>[going along rows]</p> <p>doubling capacity = doubling photos</p> <p>Example of a calculation</p> <p>Number photos <math>\propto</math> capacity</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>max 5</p>
6(b)	<p>Selection of an appropriate set of three values</p> <p>Substitution leading to number of bits OR number of pixels</p> <p>Answer</p> <p>Example 1 GB card, 8 M pixels, 256 photos</p> <p><math>1 \times 10^9 \times 8</math> bits (= <math>8 \times 10^9</math> bits)</p> <p>OR <math>8 \times 10^6 \times 256</math> pixels (= <math>2.048 \times 10^9</math> pixels)</p> <p>So approx 4 bits/pixel</p> <p>[allow 1 kB = <math>2^{10}</math> B or 1 MB = <math>2^{20}</math> B or 1 MB = <math>10^3 \times 2^{10}</math> B, may lead to 4.5 ~ 5 bits/pixel]</p>	<p>1</p> <p>1</p> <p>1</p>
<b>Total for question</b>		<b>8</b>

