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Mark Scheme (Results)

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GCE

GCE Salters Horners Physics (6751/01)

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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] ✓ **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:

<u>'Show that' calculation of weight</u>

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] **3**
[Bald answer scores 0, reverse calculation 2/3]

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.

6751 Unit Test PSA1

1.(a) Comment on assumption

Yes – air resistance negligible OR still close to Earth (ignore upthrust) ✓
or No – air resistance becomes significant **1**

(b) Explanation of why formula for cell B6 is appropriate

Recall of $v = u + at$ (accept $\Delta v = a\,\Delta t$ or $\Delta v = at$ for 1st mark) ✓
(v is B6), u is zero, a is 9.81 [m s^{-2}] and t is A6 ✓ **2**

(c)(i) Explanation of $\frac{(B6 + B7)}{2}$

it is average speed (for that interval)

or $\frac{(u + v)}{2}$ ✓ **1**

(c)(ii) Why $\frac{(B6 + B7)}{2}$ is multiplied by 0.20

because dist = ave speed x time [accept $s = vt$]
and 0.20 is the time ✓ **1**

(d) Formula for D10

= D9 + C10 ✓ **1**

(e) Calculation to check D11

Use of appropriate equation of motion ✓

Correct answer [12.557 m] [no ue] ✓ **2**

Example of calculation:

$s = ut + {}^{1}/_{2}\, at^2$

$= 0 + {}^{1}/_{2} \times 9.81 \text{ m s}^{-2} \times (1.6 \text{ s})^2$

= 12.557 m
N.B. use of $\upsilon^2 = u^2 + 2as$ gives answer s = 12.563 m **8**

2.(a) <u>Circuit diagram and explanation</u>

ammeter and voltmeter shown in series and parallel respectively ✓

current measured with ammeter and voltage / p.d. with voltmeter ✓ **2**

(b) <u>Calculation of resistance</u>

Recall of $R = V/I$ ✓

Correct answer [25.0 Ω] ✓ **2**

Example of calculation:

$R = V/I$

$R = 3.00\text{ V} \div 0.12\text{ A}$

$= 25.0\ \Omega$

(c) <u>Calculation of resistance</u>

Recall of $P = V^2/R$ ✓

Correct answer [29.4 Ω] ✓ **2**

Example of calculation:

$P = V^2/R$

$R = (230\text{ V})^2 \div 1800\text{ W}$

$R = 29.4\ \Omega$

[Accept calculation of $I = 7.8$ A ✓, calculation of $R = 29.4$ Ω ✓]

(d) <u>Explanation of difference in values of resistance</u>

At higher voltage value element is at a higher temperature ✓

(resistance higher because) increased lattice ion vibrations impede charge flow (more) ✓ **2**

8

3.(a)	Explain how vapour emits light		
	electrons excited to higher energy levels	✓	
	as they fall they emit photons/electromagnetic radiation/waves/energy	✓	**2**
(b)(i)	Meaning of spectral line		
	(when the light is split up) each frequency/wavelength/photon energy is seen as a separate/discrete line (of a different colour)	✓	**1**
(b)(ii)	Calculation of frequency		
	Recall of $v = f\lambda$	✓	
	Correct answer [$f = 5.1 \times 10^{14}$ Hz]	✓	**2**
	Example of calculation: $v = f\lambda$ 3.0×10^{8} m s^{-1} $= f \times 589 \times 10^{-9}$ m $f = 5.1 \times 10^{14}$ Hz		
(c)	Explanation of different colours		
	different colours = different freq/wavelengths / photons of different energies	✓	
	photon energy/frequency/wavelength depends on difference between energy levels	✓	
	diff atoms have diff energy levels/diff differences in levels	✓	**3**
(d)	Explanation of transverse waves		
	variation in E or B-field /oscillations/vibrations/displacement at right angles/perpendicular to direction of travel/propagation [not just motion or movement for both 1st and 3rd part]	✓	**1**
			9

4.(a)	<u>Mark and label *W* and *T*</u>		
	W marked and labelled	✓	
	T marked and labelled	✓	**2**
(b)	<u>Calculation of horizontal component of *P*</u>		
	Recall of trigonometrical function	✓	
	Correct answer [9974 N]	✓	**2**
	Example of calculation:		
	horizontal component = $P \cos \theta$		
	= 23600 N × cos 65°		
	= 9974 N		
(c)(i)	<u>State magnitude of horizontal component of *T*</u>		
	T = 9974 N [ecf]	✓	**1**
(c)(ii)	<u>Calculate magnitude of *T*</u>		
	Use of trigonometrical function	✓	
	Correct answer [13 420 N] [ecf]	✓	**2**
	Example of calculation:		
	horizontal component of $T = T \cos 42° = 9974$ N		
	$T = 9974$ N ÷ cos 42°		
	= 13 420 N		
(d)	<u>Scale drawing</u>		
	P added	✓	
	resultant correctly drawn	✓	
	magnitude of resultant = 13 400 N (± 400 N)	✓	
	angle = 42° (± 3°)	✓	**4**
(e)	<u>Describe one other force</u>		
	E.g., push from wind	✓	<u>**1**</u> **12**

5.(a) Show that electrical energy supplied is about 39 000 J

Recall of: energy = IVt ✓

Correct answer [39 300 [J]] [no ue] ✓ **2**

Example of calculation:

energy = IVt

= 1.85 A × 11.8 V × 30 × 60 s

= 39 300 J

(b) Show that heat energy gained is about 31 000 J

Use of $\Delta Q = mc\Delta\theta$ ✓

Correct answer [30 700 [J]] [no ue] ✓ **2**

Example of calculation:

$\Delta Q = mc\Delta\theta$

= 0.15 kg × 4180 J kg^{-1} $°C^{-1}$ × (69.5°C – 20.5°C)

= 30 700 J

(c) Calculation of efficiency of bulb

Calculation of light energy [ecf] ✓

Use of efficiency equation ✓

Correct answer [22%] [ecf] ✓ **3**

Example of calculation:
light energy = total energy – heat energy = 39300 J – 30700 J
= 8600 J [i.e light or useful output as total – heat]

efficiency = (8600 J / 39300 J) × 100% [efficiency substitution]

= 21.9 % [0.22]

(d)(i) Explanation of shape of graph

Heat / energy lost by water ✓

at increasing rate ✓

(so) temperature rises at decreasing rate/
rate of heat loss eventually = rate of heat gain ✓ **3**

(ii) Explanation of A or B correct

[B correct]

proportion/rate of heat loss increases/steady rise over 1st 10 minutes but decreases/rate at which heat gained by water decreasing / temperature stops increasing after 3000 s	✓	
over longer time light energy value overcalculated / calculated efficiency over longer time too high / over time value less accurate / student A's value of efficiency for light would be greater	✓	**2**
		12

6.(a)	<u>Meaning of digital</u>		
	Sequence of numbers/discrete values/on or off/0 or 1	✓	**1**
(b)	<u>Explanation of maximum or minimum</u>		
	path difference = $2 \times 125 \times 10^{-9}$ m = 250×10^{-9} m	✓	
	= half wavelength /antiphase	✓	
	→ destructive interference / superposition	✓	**3**
	(→ minimum intensity)		
(c)	<u>Meaning of coherent</u>		
	remains in phase / constant phase relationship	✓	**1**
(d)	<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 diagram allowed)	✓	**2**
(e)(i)	<u>Calculation of number of bits</u>		
	Use of ratios of areas × total bits	✓	
	Correct answer as whole number	✓	**2**
	Example of calculation:		
	$= (1.7 \times 10^{-11}\ m^2 / 9.0 \times 10^{-3}\ m^2) \times 8.1 \times 10^9$		
	= 15.3		
	= 15 bits		
(e)(ii)	<u>Confirmation of answer</u>		
	3 tracks	✓	
	5 bits per track	✓	**2**
			11