Mark Scheme

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GCE

GCE 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 $g = 10\ \text{m s}^{-2}$ 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 × 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.

Question Number	Answer	Mark
1(a)	Ultrasound: High frequency sound / sound **above** human hearing range / sound above 20 kHz / sound too high for humans to hear (1)	**1**
(b)(i)	Pulses used: to prevent interference between transmitted and reflected signals / allow time for reflection before next pulse transmitted / to allow for wave to travel to be determined (1)	
(ii)	High pulse rate: Greater accuracy in detection of prey's motion / position / continuous monitoring / more frequent monitoring (1)	**2**
(c)	Size of object: Use of $\lambda = v/f$ (1) Correct answer (0.0049 m or 4.9 mm) (1) [accept 0.0048 m or 0.005 m] example: $\lambda = 340$ ms^{-1}/ 70000 Hz = 0.0049 m = 4.9 mm (accept 5 mm)	**2**
(d)	Time interval: Use of time = distance / speed (1) Correct answer (2.9×10^{-3} s) [allow 3×10^{-3} s] [allow 1 mark if answer is half the correct value ie. Distance = 0.5m used] (1) example: time = 1 m / 340 ms^{-1} = 2.9×10^{-3} s	**2**
(e)	Effect on frequency: Frequency decreases (1) Greater effect the faster the moth moves / the faster the moth moves the smaller the frequency (1)	**2**
	Total	**9**

Question Number	Answer	Mark
2 (a)	<u>Diffraction diagram:</u> Waves spread out when passing through a gap / past an obstacle(1) λ stays constant (1)	**2**
(b)	<u>Diagrams:</u> Diagram showing 2 waves in phase (1) Adding to give larger amplitude (1)	**2**
(c)	<u>Information from diffraction pattern:</u> Atomic spacing (similar to λ) Regular / ordered structure Symmetrical structure DNA is a double helix structure (2)	**Max 2**
(d)	<u>Electron behaviour:</u> (Behave) as waves (1)	**1**
	Total	**7**

Question Number	Answer	Mark
3 (a)	<u>Force arrow diagram:</u> Weight and upthrust correctly labelled (1) Tension in string shown downwards (1)	**2**
(b)	<u>Upthrust on balloon:</u> Knowledge of: upthrust = weight of displaced air (1) Use of upthrust = $\rho g V$ (1) Correct answer (0.18 N) [allow 0.2 N] (1) Example: Upthrust =1.30 kg m^{-3} x 9.81 ms^{-2} x 4/3π(0.15 m)^3 = 0.18 N	**3**
(c)(i)	<u>Airflow diagram:</u> Diagram showing at least three continuous lines around the balloon (1)	**1**
(ii)	<u>Type of airflow:</u> Streamline / laminar (1)	**1**
(d)(i)	<u>Word equation:</u> Weight + (viscous) drag = upthrust (1)	**1**
(ii)	<u>Terminal velocity:</u> $\frac{4}{3}\pi r^3 \rho g$ = upthrust = value obtained in (b) [or 0.2 N] (1) correct substitution into $mg + 6\pi r \eta v = \frac{4}{3}\pi r^3 \rho g$ (1) Correct answer (202 ms^{-1}) [196 – 202 ms^{-1} to allow for rounding errors] [if 0.2N is used v= 590 ms^{-1}] (1) Example: v = (0.18 – 0.17) / (6π x 1.8 x 10^{-5} x 0.15) = 202 ms^{-1}	**3**
(iii)	<u>Comment:</u> Any one of: Air pressure also acts on balloon / becomes less with height Air becomes less dense with height Upthrust becomes less with height Relationship only valid for small objects (1)	**Max 1**
	Total	**12**

Question Number	Answer	Mark
4(a) (i)	Diagram: i and r correctly labelled on diagram (1) $i = 25 \pm 2^{o}$ (1) $r = 38 \pm 2^{o}$ (1) [allow 1 mark if angles measured correctly from interface ie. $i = 65 \pm 2^{o}$, $r = 52 \pm 2^{o}$] (1)	**3**
(ii)	Refractive index: Use of ${}_g\mu_a = \sin i / \sin r$ [allow ecf] (1) Use of ${}_a\mu_g = 1/{}_g\mu_a$ (1) example: ${}_g\mu_a = \sin 25 / \sin 38 = 0.686$ ${}_a\mu_g = 1/{}_g\mu_a = 1.46$	**2**
(b)	Ray diagram: Ray added to diagram showing light reflecting at interface with angles equal (by eye) (1)	**1**
(c)	Observation: Incident angle > critical angle (1) T.I.R occurs (1)	**2**
(d)	largest angle: sin C = 1/1.46 (allow ecf) (1) $C = \sin^{-1}(1/1.46) = 43^{o}$ (1)	**2**
	Total	**10**

Question Number	Answer	Mark
5(a)(i)	<u>Gamma radiation:</u> Only gamma will penetrate the (outer layer of) flint / alpha and beta could not penetrate the outer layer of flint (1)	**1**
(ii)	<u>Background radiation:</u> Naturally occurring radiation / radiation present all around us (1)	**1**
(iii)	<u>Source of background:</u> Uranium / potassium / thorium deposits in the soil/ rocks / the soil / Granite / cosmic rays / the Sun (1)	**1**
(iv)	<u>Assumption:</u> Remains constant (1)	**1**
(b)	<u>To observe thermoluminescence:</u> Heat the sample (1)	**1**
(c)	<u>What must be measured:</u> Intensity of the light given off / amount of light / brightness of light / number of photons (1)	**1**
(d)	<u>Energy level diagram:</u> Showing defect levels and conduction and valence bands [only defect levels need to be labelled for mark] <u>Explanation:</u> (may take the form of a written explanation or correctly labelled and annotated diagram) Any 3 from – • **Electron** given **energy** from **radiation** • (Electron) moves to defect level • Stays at this level until heated • Drops back down releasing a photon (4)	**4**
	Total	**10**

Question Number	Answer	Mark
6(a)	Deformation of spring: As spring must return to original length when (compressive) force is removed (1) Elastic (conditional on 1st mark) (1)	**2**
(b)	Graph: 4 points plotted correctly (1) all points plotted correctly (to within +/- ½ square) (1) straight line of best fit through points and origin (1)	**3**
(c)	Stiffness: Use of stiffness = F/x taking any pair of values from the table or graph (1) = 0.53 N mm^{-1} (530 Nm^{-1}) [allow 0.52 – 0.54 N mm^{-1}] (1)	**2**
(d)	Force exerted: Correct reading from graph = 3.2 N [allow 3.1 – 3.3 N] (1) **OR** *F=kx* = 0.53 x 6 = 3.2 N [allow ecf] (1)	**1**
(e)	Elastic energy: Energy stored = area under graph **OR** Energy stored = ½ Fx **OR** Energy stored = ½ kx^2 (1) Correct values substituted [ignore powers of 10]` (1) Correct answer (9.6 x 10^{-3} J) [allow 9.3 - 9.9 x 10^{-3} J] (1)	**3**
	Example: Energy stored = ½ (3.2 x 6 x 10^{-3}) = 9.6 x 10^{-3} J **OR** Energy stored = ½ x 530 x (6 x 10^{-3})^2 = 9.6 x 10^{-3} J	
(f)	New force to compress: Half of the original force / 1.6 N [allow ecf] (1)	**1**
	Total	**12**
	Total marks for paper	**60**