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Mark Scheme (Results)
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GCE

GCE Physics (6732/01)

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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:

'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.

6732 Unit Test PHY2

1 Word equations

[Must be in words for credit.]

Force / Area ✓

Resistance x ✓
Cross sectional area /length ✓

absolute temperature x number of mole(s) x (molar) gas constant
Product of any two ✓
Multiplied by the third ✓

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Accept temperature in Kelvin or temperature/K
Accept mass/molar mass
Do not accept just "moles"

2 Tungsten filament bulb

a Resistance

Use of $P=V^2/R$ or $P=VI$ with $V=IR$	✓	
answer 960 Ω	✓	**2**

Example of answer
R = (240 V × 240 V) ÷ 60 W
R = 960 Ω

b Drift speed

rearrangement of $I = nAvQ$	✓	
Use of Q = 1.6 x 10^{-19} (C)	✓	
answer 0.15/0.148 m s^{-1}	✓	**3**

Example of answer
v = 0.25 A ÷ (3.4 × 10^{28} m^{-3} × 1.6 × 10^{-19} C × 3.1 × 10^{-10} m^2)

c Explanation

Qowc	✓	

Any THREE

- Resistance due to collisions between electrons & ions/atoms/particles
- (as T increases) ions/atoms/particles have more energy
- (as T increases) ions/atoms/particles vibrate through larger amplitude /vibrate faster OR amplitude if lattice vibration increases.
- more chance/increased frequency of collision/interaction OR impedes the flow of electrons

✓✓✓ **4**

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3 Emf and Internal resistance

a Derivation

$E = I(R + r)$ OR $E = IR + Ir$	✓	**1**

bi Correct working (allow even if evidence of working backwards) ✓ **1**

Example of answer
$E/I = R + r$
Rearranging $R = E/I - r$

ii Emf

Attempt to use gradient	✓	
answer 1.5 V (bald answer 1.5 V scores 0/2)	✓	**2**

iii Power

From graph find value of $1/I$ when R = 5 Ω	✓	
Use of $P = I^2R$	✓	
answer 0.31 (W)	✓	
		3

Example of answer

$1/I = 4\ A^{-1} \rightarrow I = 0.25\ A$

$P = 0.25\ A \times 0.25\ A \times 5\ \Omega = 0.3125\ W$

c Graph

Intercept at –2 (ohms)	✓	
Graph steeper than original	✓	
Gradient is 3.0 V i.e. line passes through [10, 27-29] [no ecf]	✓	**3**

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4 Potential divider

a First circuit

Middle terminal M		
Outer terminals L and K (any order)	✓	**1**

bi P.d across lamp.

External resistance in circuit is 25 or (20+5) ohms	✓	
See ratio of resistances (denominator larger) x 6.0 V	✓	
OR current = 6/25 A		
answer 4.8 V	✓	**3**

ii Assumption

The resistance of the ammeter is zero/negligible.	✓	**1**

c Second circuit

See 2 resistors in parallel with supply	✓	
Supply across ends of variable resistor (10 Ω)	✓	
Fixed resistor across one end and slider (consequent mark)	✓	**3**

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5 Latent heat

ai Apparatus and circuit.

- Supply connected to immersion heater/heating coil in water or kettle
- Clock / balance under beaker/ beaker under apparatus
- Power rating of immersion heater given
  or A & V correctly connected
  or joulemeter connected to supply
- Start clock when boiling is established
- Read Joulemeter when boiling starts
- After measured time obtain change of mass (condensed or evaporated) OR 2nd Joulemeter reading
- VIt or Pt or reading from Joulemeter = ΔmL

✓✓✓✓ **4**

LH fusion of ice max 3
Experiments recording temp rise max 2

ii Precaution

Any sensible suggestion for their arrangement, for example

- Water covers heating coil
- Tall beaker to avoid spillage
- Use of lagging
- Partial lid to avoid spillage

✓ **1**

bi Energy

Conversion of g to kg ✓
$168000 / 1.68 \times 10^5$ (J) / 0.17 (MJ) ✓ **2**

Example of answer
$E = 0.4\ kg \times 4200\ J\ kg^{-1}K^{-1} \times 100\ K = 168000\ J$

ii Energy

$920000 / 9.2 \times 10^5$ J / 0.92 MJ ✓ **1**

Example of answer
Energy = $0.4\ kg \times 2.3 \times 10^6\ J\ kg^{-1}$

iii Graph

Straight line graph from (0,0) to (100, 1.7 or 2.0) ✓
Vertical line at 100 °C of length 9 / their value ✓ **2**

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6 Heat engine

a Symbols

T_1 Temperature of the hot source/reservoir/body	✓	
T_2 Temperature of the cold sink/reservoir/body	✓	
(T_1 initial temperature AND T_2 final temperature 1 mark only)		
W Work done by engine OR mechanical work done OR useful work done	✓	
Q_2 Wasted energy OR remaining energy that flows to sink ecf wording from T_2	✓	**4**

bi Temperature calculation

Uses Efficiency = $(T_1 - T_2)/T_1$ (K or ^{0}C)	✓	
Conversion to Kelvin ie see 500 K	✓	
answer 380 K (107 °C)	✓	**3**

Example of answer

$E = 1 - T_2/T_1$ $T_2/T_1 = 1 - 0.24$

$T_2 = 0.76 \times 500$ K = 380 K

bii Efficiency

By increasing T_1 /temperature of the hot steam Or by decreasing T_2 / temperature of the cold sink Or by increasing the temperature difference.	✓	**1**

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7 Gas laws

a Boyle's law

Uses pV = constant	✓	
See V_2 = 15 or (20 – 5) cm^3	✓	
Pressure = 267/270 x 10^3 Pa /Nm^{-2}	✓	
		3

Example of answer
$p_1V_1 = p_2V_2$
$p_2 = 200 \times 10^3$ Pa $\times$ 20 $cm^3 \div 15$ cm^3
$p_2 = 266667$ Pa

b Force

Uses $F = pA$	✓	
15.8/16.0 N	✓	**2**

Example of answer
F = 200×10^3 Pa $\times$ 7.9×10^{-5} m^2
F = 15.8 N

ci Pressure law

Uses p/T = constant Kelvin or Celsius.	✓	
At least one conversion to Kelvin (295K or 308K)	✓	
209 x 10^3 Nm^{-2}/Pa	✓	**3**

Example of answer
$p_1/ T_1 = p_2 / T_2$
$p_2 = 200 \times 10^3$ Pa $\times$ 308 K $\div$ 295 K
$p_2 = 208813$ Pa

ii Graph

Curve reasonably similar to one given	✓	
Curve above first. (no ecf for their p_2 less than p_1)	✓	**2**

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