GCE

Edexcel GCE

Physics (6732/01)

Summer 2005

advancing learning, changing lives

Mark Scheme (Results)

Edexcel GCE
Physics (6732/01)

Contents

Notes on the Mark Schemes

1. *Alternative responses:* There was often more than one correct response to a particular question and these published mark schemes do not give *all* possible alternatives. They generally show only the schemes for the most common responses given by candidates. They are **not** model answers but indicate what the Examiners accepted in this examination.

2. *Error carried forward:* In general, an error made in an early part of a question is penalised there but not subsequently, i.e. candidates are penalised once only, and can gain credit in later parts of a question by correct reasoning from an earlier incorrect answer.

3. *Quantity algebra:* The working for calculations is presented using quantity algebra in the mark schemes for Units PHY1, PHY2, PHY3 (Topics), PHY4, PHY5/01, and PHY6 but candidates are not required to do this in their answers.

4. *Significant figures:* Use of an inappropriate number of significant figures in the theory papers will normally be penalised only in "show that" questions where too few significant figures has resulted in the candidate not demonstrating the validity of the given answer. Use of an inappropriate number of significant figures will normally be penalised in the practical tests. In general candidates should nevertheless be guided by the numbers of significant figures in the data provided in the question.

5. *Unit penalties:* A wrong or missing unit in the answer to a calculation will generally lose one mark unless otherwise indicated.

6. *Quality of written communication:* Each theory paper will usually have 1 or 2 marks for the quality of written communication. The mark will sometimes be a separate mark and sometimes be an option in a list of marking points.

Within the schemes:

- / indicates alternative marking point
  ( ) brackets indicate words not essential to the answer
  [ ] brackets indicate additional guidance for markers

- The following standard abbreviations are used:

a.e.	arithmetic error (–1 mark)
e.c.f.	error carried forward (allow mark(s))
s.f.	significant figures (–1 mark only where specified)
no u.e.	no unit error

6732 Unit Test PHY2

1. <u>Circuits</u>

Base unit:	ampere OR amperes OR amp OR amps	✓	
Derived quantity:	charge OR resistance	✓	
Derived unit:	volt OR volts OR ohm OR ohms	✓	
Base quantity:	current	✓	**4**

[If two answers are given to any of the above, both must be correct to gain the mark]

2.(a) <u>Io and Jupiter: Time taken for electrons to reach Jupiter</u>

$t = s/\upsilon = (4.2 \times 10^8 \text{ m})/(2.9 \times 10^7 \text{ m s}^{-1}) = 14.48 \text{ s}$

Correct substitution in $\upsilon = s/t$ (ignore powers of ten) ✓

Answer: 14.48 s, 14.5 s [no ue] ✓ **2**

(b) <u>Estimate of number of electrons</u>

$Q = ne = It$

$n = It/e$

$n = (3.0 \times 10^6 \text{ A})(1\text{s})/(1.6 \times 10^{-19} \text{ C})$

Use of $ne = It$ ✓

$(1.8 – 2.0) \times 10^{25}$ ✓ **2**

(c) <u>Current direction</u>

From Jupiter (to Io) / to Io / to the moon ✓ **1**

5

3.(a) p.d. across 4 Ω resistor

1.5 (A) × 4 (Ω)

= 6 V ✓ **1**

(b) Resistance R_2

Current through R_2 = 0.5 A ✓

$R_2 = \dfrac{6\ (V)}{0.5\ (A)}$

R_2 = 12 Ω ✓ **2**
[allow ecf their pd across 4 Ω]

(c) Resistance R_1

p.d. across R_1 = 12 – 6 – 4

= 2 V ✓

Current through R_1 = 2 A ✓

$R_1 = \dfrac{2\ (V)}{2\ (A)} = 1\Omega$ ✓

[allow ecf of pd from (a) if less than 12 V]

Alternative method

Parallel combination = 3Ω ✓

Circuit resistance = 12(V)/2 (A) = 6Ω ✓

R_1 = 6 – (3 + 2) = 1 Ω ✓ **3**
[allow ecf of pd from (a) and R from (b)]

6

4.(a) Current in filament lamp

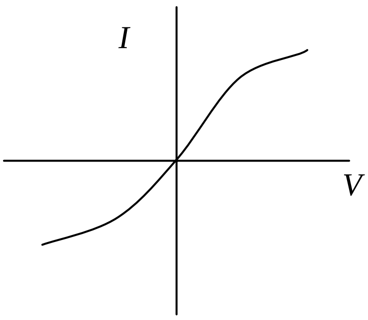
$P = VI$ or correct rearrangement ✓

2 A ✓ **2**

(b)(i) Sketch graph

Correct shape for their axes ✓

$-I$–V quadrant showing fair rotational symmetry ✓ **2**



(ii) Explanation of shape

(As the voltage/p.d. increases), current also increases ✓

(As the current increases), temperature of lamp increases ✓

(This leads to) an increase in resistance of lamp ✓

so equal increases in V lead to smaller increases in I OR rate of increase in current decreases OR correct reference to their correct gradient ✓ **4**

8

[If a straight line graph was drawn though the origin then ✓××✓ for the following:

V is proportional to R
therefore the graph has a constant gradient]

5.(a)(i)	Graph		
	Attempt to find gradient at start of graph ie over 11 ^{o}C rise or less	✓	
	Value calculated with units in K s^{-1} / K min^{-1} / ^{o}C s^{-1} / ^{o}C min^{-1} Range 0.07 – 0.18 K s^{-1} or 4.4 – 11.0 K min^{-1}	✓	**2**
(ii)	Power of heater		
	Formula $\Delta Q/\Delta t = mc\Delta T/\Delta t$ used	✓	
	Converts g to kg	✓	
	Value for rate within acceptable range 18 – 50 W or 1100 – 3000 J min^{-1}	✓	**3**
	[no ecf from gradient]		
(b)	Heating process		
	(rate of) energy lost to the surroundings OR due to evaporation[do not credit boiling] approaches (rate of) energy supply OR increases with temperature difference.	✓ ✓	**2**
(c)	Graph		
(i)	Curve of reducing gradient starting at 20 ^{o}C, 0 s	✓	
	initially below given graph (consequential mark)	✓	**2**
(ii)	Explanation		
	Reference of need to heat mug	✓	
	Hence reduced rate of temperature rise [consequential mark]	✓	
	Reference to insulating properties of mug	✓	**Max 2**
			11

6.(a)(i)	Definition of quantities		
	n number of moles	✓	
	R molar gas constant	✓	**2**
(ii)	Meaning of the temperature absolute zero		
	Temperature at which pressure [or volume] of a gas is zero		
	OR		
	temperature at which kinetic energy of molecules is zero	✓	**1**
(b)	Number of moles of gas		
	Use of $pV = nRT$	✓	
	$n = \dfrac{1.1 \times 10^5\,(\text{Pa}) \times 60\,(\text{m}^3)}{8.31(\text{J K}^{-1}\ \text{mol}^{-1})\,298\ (\text{K})}$		
	= 2665 moles		
	Conversion to kelvin	✓	
	Answer	✓	**3**
			6

7.(a)(i) Replacement

V_1 ✓ **1**

(ii) Explanation

[**ONE** pair of marks]

Resistance: resistance of $\underline{V_1}$ [not just the voltmeter]is much larger than 100 Ω OR combined resistance of parallel combination is approximately 100 Ω ✓

Voltage: p.d. across V_1 is much greater than p.d. across 100 Ω OR all 9 V is across V_1 ✓

OR

Current: no current is flowing in the circuit / <u>very</u> small current ✓

Resistance: because V_1 has infinite/<u>very</u> large resistance ✓

OR

(Correct current calculation 0.9 x 10 $^{-6}$ A and) correct pd calculation 90 x 10 $^{-6}$ A ✓

This is a very small/negligible pd ✓ **2**

(b) Circuit diagram

(i) V_1 or equivalent resistor symbol labelled 10 MΩ ✓

V_2 or equivalent resistor symbol labelled 10 MΩ ✓ **2**

[They must be shown in a correct arrangement with R]

(ii) Value of *R*

6 (V): 3 (V) = 10 (MΩ): 5 (MΩ) / R_{total} of parallel combination is 5 MΩ ✓

1/5 (MΩ) = 1/10 (MΩ) + 1/*R* OR some equivalent correct substitution to show working ✓

R = 10 MΩ ✓ **3**

8

8.(a) Terms in efficiency equation

T_1: temperature of hot reservoir/hot source ✓

T_2: temperature of cold reservoir/cold sink ✓

Reference to kelvins/absolute ✓ **Max 2**

(b)(i) Calculation of initial temperature

$$E = 1 - \frac{T_2}{T_1}$$

$$\frac{T_2}{T_1} = 1 - E = 1 - 0.53$$

$$T_1 = \frac{373\ (\text{K})}{0.47}$$

T_1 = 794 K/521 °C

Substitution into equation [no rearranging] E and T_1 ignore powers of 10 ✓

Use of 373 K ✓

Answer ✓ **3**

(ii) Improvement of efficiency of power station

Increase value of T_1 / reduce value of T_2 / increase temperature difference ✓ **1**
[ecf their terms for T_1 / T_2]

6

9.(a) Smoke particles

Smoke particles/bright specks moving randomly/irregularly ✓

[Ensure it is *not* air]

Motion is due to collisions with air molecules / gas molecules ✓

Any one further comment from:

- air molecules cannot be seen / invisible
- uneven collisions produce / resultant force produced
- air molecules have high speed (in order to be able to move heavier smoke particles)

✓

Quality of written communication ✓ **4**

(b) Diagram

Path that has

different length straight sections (min of 5) ✓

different directions ✓ **2**

6