Mark Scheme (Results)

January 2013

GCE Physics (6PH08) Paper 01
Experimental Physics (WA)

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information, please visit our website at www.edexcel.com.

Our website subject pages hold useful resources, support material and live feeds from our subject advisors giving you access to a portal of information. If you have any subject specific questions about this specification that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

www.edexcel.com/contactus

Pearson: helping people progress, everywhere
Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

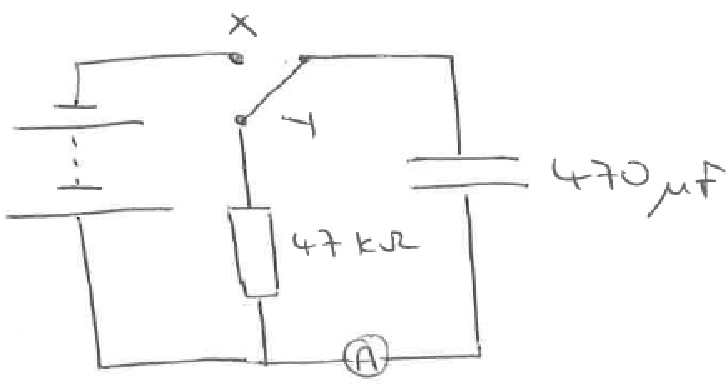
January 2013
Publications Code UA034790

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer		Mark
1(a)(i)	Precision is 1mm giving a small <u>%U</u> **Or** Precision is 1mm giving a <u>%U</u> of 0.3%	**(1)**	**1**
1(a)(ii)	Take repeat readings (for both dimensions) **and** average **Or** Appropriate use of set square	**(1)**	**1**
1(b)(i)	**Max 2** (By measuring 32) the mean value of thickness is obtained (Measuring a larger thickness) gives a smaller <u>%U</u> Since thickness is now greater **and** instrument precision is the same Enables at least 2 SF measurement since thickness is now greater than 0.1mm (Do not credit precision or accuracy alone or 3SF)	**(1)** **(1)** **(1)** **(1)**	**2**
1(b) (ii)	Micrometer (screw gauge) **Or** digital (vernier) callipers (not vernier callipers)	**(1)**	**1**

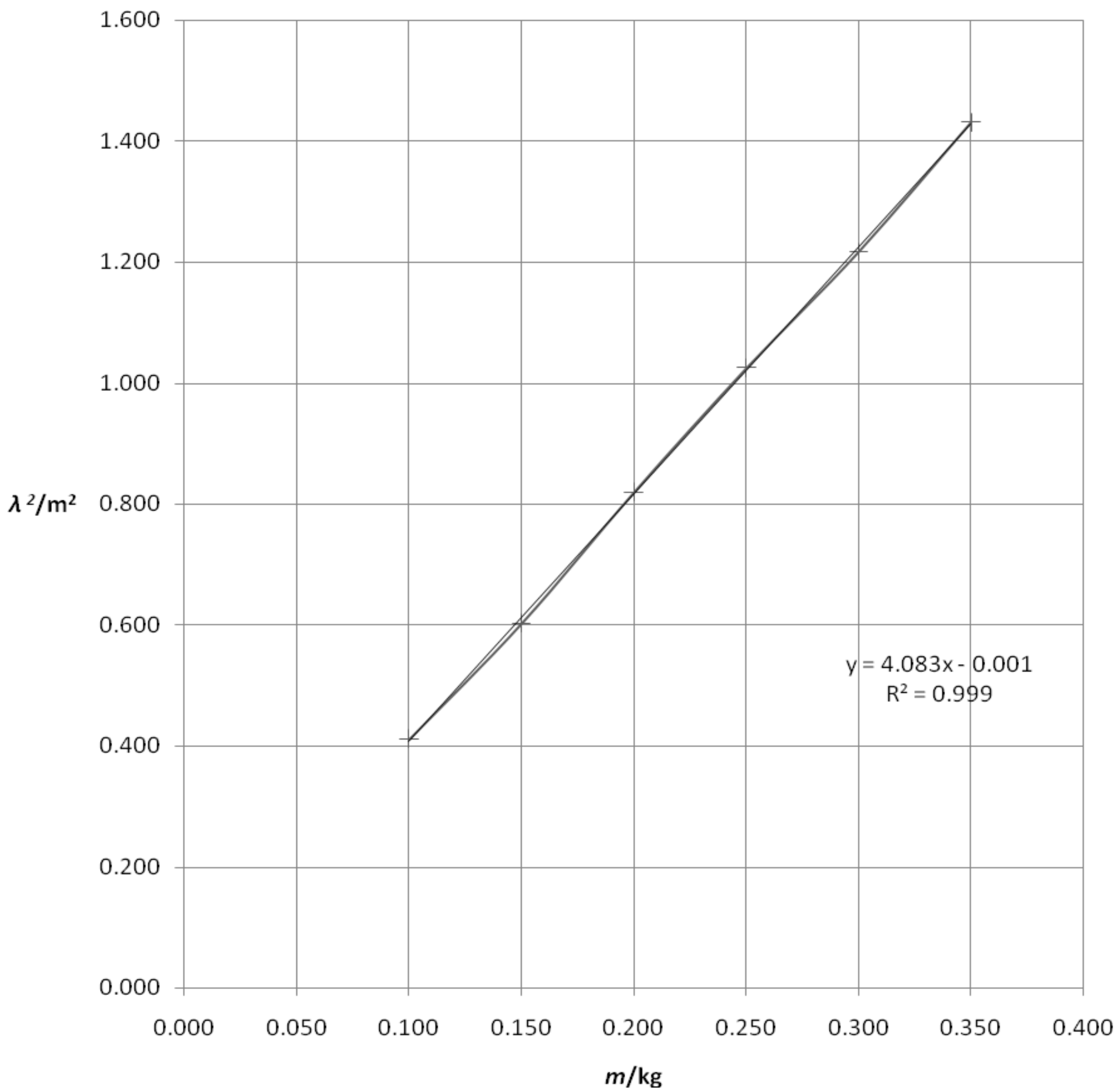
1(c)(i)	Divides by 32 once (not 25) **Or** calculates volume with correct unit conversion Volume = 1.04×10^{-6} (m^3) to at least 3SF <u>Example of calculation</u> 0.301 m × 0.300 m × (3.69×10^{-4} m)/32 = 1.04×10^{-6} m^3	**(1)** **(1)**	**2**
1(c)(ii)	Uses half ranges (or ranges) **Or** adds 3 % uncertainties To get between 5% - 6% (10% - 12%) <u>Example of calculation</u> [(4/301) + (3/300) + (12/369)] × 100% = 1.3% + 1.0% + 3.3% = 5.6%	**(1)** **(1)**	**2**
1(c)(iii)	Density = 2390 (kg m^{-3}) to 2/3 SF ecf their value for volume, Allow use of 1.0×10^{-6} m^3 <u>Example of calculation</u> Density = 2.49×10^{-3} kg / 1.04×10^{-6} m^3 = 2390 kg m^{-3}	**(1)**	**1**
1(c)(iv)	Calculates %D Comment based on comparison with %U **Or** Calculates maximum density value Compares this value with actual value <u>Example of calculation</u> [(2750 – 2390)/2750] × 100% = 13% %D (significantly) > %U so foil probably not pure aluminium	**(1)** **(1)** **(1)** **(1)**	**2**
	Total for question 1		**12**

Question Number	Answer		Mark
2(a)	Current = 130 μA Meter range plausible and greater than their value (e.g. 200 μA) <u>Example of calculation</u> I_0 = 6.0 V/47 kΩ = 128 μA	**(1)** **(1)**	**2**
2(b)	Calculates *RC* as 47 kΩ x 470 μF = 22 s [accept 22.1 s or 22.09 s] Record for a time equivalent to 3 - 5 times their time constant	**(1)** **(1)**	**2**
2(c)	Precision (0.01 s) < human reaction time (0.1 s)	**(1)**	**1**
2(d)	*Technique* Meter and stopwatch close together **Or** both in eye line at same time **Or** use of lap-timer (not repeat and average) *Safety* Capacitor connected correct way round **Or** capacitor rated voltage at least 6 V	**(1)** **(1)**	**2**
2(e)	$\ln I = -t/RC + \ln I_0$ is same form as $y = mx + c$ and since *RC* is constant (hence the line is straight) (equation need not be seen if other valid statement made) $T = -1/$<u>gradient</u> (must have negative sign)	**(1)** **(1)**	**2**
2(f)(i)	Capacitor will require time to charge up (through the resistor) **Or** capacitor will not be fully charged	**(1)**	**1**
2(f)(ii)	Suitable circuit drawn (values not needed) eg 	**(1)**	**1**
	Total for question 2		**11**

Question Number	Answer		Mark
3(a)(i)	$\sigma = 3.54 \times 10^{-8}$ (W m^{-2} K^{-4}) to 2/3 SF <u>Example of calculation</u> $\sigma = 23.5$ W / (2×10^{-5} m^2 × (2400 K)^4) = 3.54×10^{-8} (W m^{-2} K^{-4})	**(1)**	**1**
3(a)(ii)	Adds 3 percentage uncertainties % U = 23 (%) <u>Example of calculation</u> % U = 2% + 5% + 4×4% = 23%	**(1)** **(1)**	**2**
3(a)(iii)	Uses value in (i) to calculate % Difference = 38 (%) <u>Example of calculation</u> % D = (5.67 – 3.54) × 100% /5.67 = 38%	**(1)**	**1**
3(a)(iv)	%D > %U so the result is not reliable (Uses values from (ii) & (iii)) **Or** The % difference is not explained by the % uncertainty in the readings (so the result is not reliable)	**(1)**	**1**
3(b)(i)	Find value for intercept (on ln *L* axis) Divide anti-log of this value by *A*	**(1)** **(1)**	**2**
3(b)(ii)	The temperature of the bulb is (very) <u>much</u> greater than room temperature [accept reverse argument]	**(1)**	**1**
	Total for question 3		**8**

Question Number	Answer		Mark
4(a)	Table values correct **and** to 3dp Axes with suitable scales, labelled with quantities and units Plots Line of best fit	**(1)** **(1)** **(1)** **(1)**	**4**
4(b)	large triangle to include half the plotted length $4.00 \leq k \leq 4.15$ ($m^2\ kg^{-1}$) to 3 SF	**(1)** **(1)**	**2**
4(c)	Substitute into rearranged equation μ in range 9.46×10^{-4} to 9.81×10^{-4} ($kg\ m^{-1}$) (ecf on their value in (b)) to 3SF with unit, $kg\ m^{-1}$ or $N\ s^2\ m^{-2}$ <u>Example of calculation</u> $\mu = g/ f^2k$ so $\mu = 9.81\ N\ kg^{-1}/((50.0\ Hz)^2 \times 4.08\ m^2\ kg^{-1}) = 9.62 \times 10^{-4}\ kg\ m^{-1}$	**(1)** **(1)** **(1)**	**3**
	Total for question 4		**9**

m/kg	λ/m	λ^2/m^2
0.10	0.641	0.411
0.15	0.776	0.602
0.20	0.905	0.819
0.25	1.012	1.024
0.30	1.103	1.217
0.35	1.196	1.430


1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
λ^2/m^2
0.000
0.050
0.100
0.150
0.200
0.250
0.300
0.350
0.400
m/kg
y = 4.083x - 0.001
R^2 = 0.999

Further copies of this publication are available from
Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467
Fax 01623 450481
Email publication.orders@edexcel.com
Order Code UA034790 January 2012

For more information on Edexcel qualifications, please visit our website www.edexcel.com

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE

Ofqual

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

Rewarding Learning