Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Measurement And Their Errors

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Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Mark Schemes

Q1.

(a) To detect anomalies so these can be rejected

Reason for calculating a mean must be qualified.

Ignore:

To decrease the percentage uncertainty

OR

Determine a mean thus producing a more accurate / repeatable / reproducible value

Ignore:

To make it more accurate (without reason why)

OR

To reduce the effect of random error / variations in width of pencil

Ignore:

To make the reading more reliable

OR

Readings from micrometer are more accurate / have a smaller (percentage) uncertainty (than using a ruler) because the micrometer has a greater resolution

Ignore:

To make it more precise

Condone 'sensitivity' for resolution

1

(b) $\%\ \text{uncertainty} = \frac{\frac{1}{2}\text{range}}{\text{mean}} \times 100) = 1.19\%$ ✔ ✔

1.19 % awarded 2 marks without supporting working

1 % or 1.2 % are permissible answers but must be supported by convincing working

Maximum of 3 sf permissible for answer

1 mark can be awarded for:

(Evidence for a calculated mean =) 7.15 (mm)

Reject 7.2 for calculated mean

OR

$(\frac{1}{2}\text{range} =) 0.085\,(\text{mm})$

Reject $\frac{1}{2}\text{range} = 0.09\,(\text{mm})$

OR

Use of % uncertainty = $\frac{uncertainty}{mean} \times 100$

OR

Use of % uncertainty = $\frac{\frac{1}{2}\text{range}}{\text{mean}} \times 100$

Allow their "½ range", their "uncertainty" and their "calculated mean" in use of...

But will need to see formula quoted on page and numbers or correct subject and equals sign and numbers for awarding use of...

2

(c) d = 2.2(1) mm ✔ ✔

Correct answer worth 2 marks

Condone 3rd sf rounding error if process correct

ECF from (b)

1 mark can be awarded for:

(Area of core = 0.09 × 42.43 or =) 3.8(2) seen

Penalise Talk Out on same line by use of a subject that is not an area

Allow $\frac{\pi d^2}{4}$ *as area of core or* πr^2

Allow any value of w from this list (7.06, 7.10, 7.15, 7.16, 7.20, 7.23, 7.1, 7.2, 7) or ECF from (b)

Allow any value of 0.83 w^2 from this list (41.37, 41.84, 42.43, 42.55, 43.02, 43.39, 40.67) or ECF from (b)

Allow any value of core from this list (3.72, 3.77, 3.82, 3.83, 3.87, 3.90, 3.66) or ECF from (b)

Condone power 10 error for 1 mark

OR

$d = \sqrt{\frac{4 \times 0.09 \times 0.83 w^2}{\pi}}$

Accept their area (as a numerical value) for (0.09 × 0.83 w^2)

Do not allow *area of core = 0.83 d^2*

OR

$r = \sqrt{0.09 \times 0.83 w^2}$

Accept their area (as a numerical value) for (0.09 × 0.83 w^2)

Answers must be on answer line or clearly identified as answer by using correct subject and equals sign

2

(d) 85.3 **or** 85.4 (mm) ✔

General Marker

Must be 3 sf

1

(e) 83.8 **or** 83.9 (mm) ✔

General Marker

Mark together with (d)

*Where <u>both</u> (d) and (e) are incorrectly quoted as the **cm** value then award a compensatory 1 mark. Otherwise mark independently*

e.g: (8.53 <u>and</u> 8.39) or (8.53 <u>and</u> 8.38) or (8.54 <u>and</u> 8.39) or (8.54 <u>and</u> 8.38): award 1 mark

Must be 3 sf

1

(f) Answers 133.43, 142.33, 152.32, 142.16 ✔ ✔

(Allow 2 sf or more)

Allow **ECF**

One of these correct answers without working obtains two marks.

ECF must be supported by appropriate working

1 mark can be awarded for:

(Decrease in length per cm drawn found =)

$$\frac{\text{change in length (ans to (e) } - \text{ ans to (d))}}{20 \times 25} = 2.8 \times 10^{-3}$$

OR

$$\frac{\text{half pencil length (ans to (d)} \div 2)}{\Delta\text{length (ans to (e) - ans to (d))}}$$

Allow ecf from answers to (d) and (e),

condone any power of 10 errors on intermediate working seen

2

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Q2.

(a) 2.9% ✓

Allow 3%

1

(b) $\frac{1}{3.5 \times 10^3}$ seen ✓

1

0.29 mm or 2.9 x 10^{-4} m✓ must see 2 sf **only**

1

(c) ± 0.01 mm ✓

1

(d) Clear indication that at least 10 spaces have been measured to give a spacing = 5.24 mm✓

spacing from at least 10 spaces
Allow answer within range ±0.05

1

(e) Substitution in $d\ sin\theta = n\lambda$✓

The 25 spaces could appear here as n with sin θ as 0.135 / 2.5

1

d = 0.300 x 10^{-3} m so
number of lines = 3.34 x10^{3}✓

Condone error in powers of 10 in substitution
Allow ecf from 1-4 value of spacing

1

(f) Calculates % difference (4.6%) ✓

1

and makes judgement concerning agreement ✓

Allow ecf from 1-5 value

1

(g) care not to look directly into the laser beam✓
OR
care to avoid possibility of reflected laser beam ✓
OR
warning signs that laser is in use outside the laboratory✓
ANY ONE

1

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