Practice Question Set For A-Level
Subject : Physics
Paper-3 Topic: Section A(Practical Skills Set-1)

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Name of the Student:_____
Max. Marks : 27 Marks **Time : 27 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

[9]

Q2.

(a) 180 degrees

accept ° for degrees

OR

π radians ✔

condone ^{c} or 'rad' for radian

reject 'half a cycle'

treat 'π radians in phase' as talk out

1

(b) (idea that) sets of combining waves do not have the same amplitude ✔

condone 'waves do not have same intensity' or 'same energy' or 'some energy is absorbed on reflection' or 'same power' or 'same strength' or idea that non point source or non point receiver would lead to imperfect cancellation

condone the idea that the waves may not be monochromatic

ignore 'some waves travel further' or 'waves do not perfectly cancel out'

reject 'waves may not be 180° out of phase'

1

(c) valid use of a set square or protractor against TR (to ensure perpendicular) $_{1}$ ✔

measure *x* at two <u>different</u> points [at each end of M] **<u>and</u>** adjust until [make sure] both <u>distances are the same</u> $_{2}$ ✔

OR

use of set square to align M with the perpendicular line earns $_{2}$ ✔

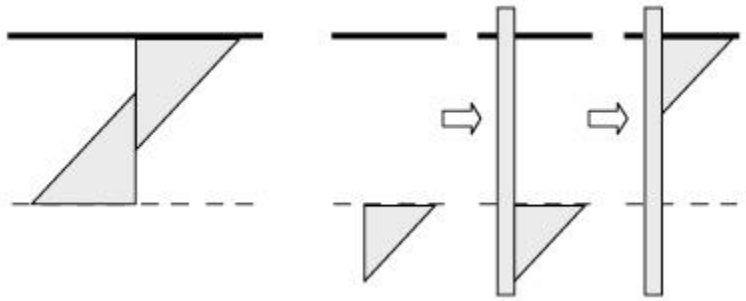
if method used does not allow <u>continuous</u> variation in *x* then award maximum 1 mark

OR

align <u>graph paper</u> with TR $_{1}$ ✔

align M with grid lines on graph paper $_{2}$ ✔

both marks can be earned for suitable sketch showing a viable procedure involving one or more recognisable set squares or protractors; the sketch may also show a recognisable ruler, eg



allow use of scale on set square to measure the perpendicular distances don't penalise incorrect reference to the set square, eg as 'triangular ruler', as long as the sketch shows a recognisable set square

2

(d) G_{max} line <u>ruled</u> through bottom of *n* = 3 error bar and through top of *n* = 11 error bar 1✔

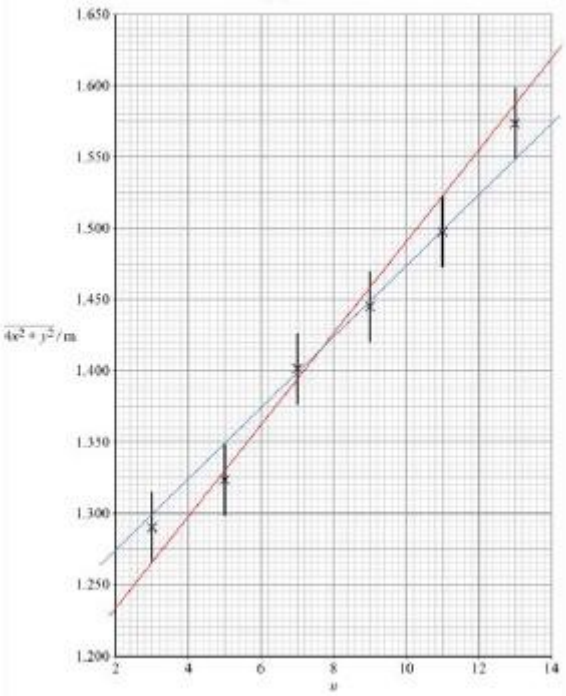
G_{min} line <u>ruled</u> through top of *n* = 5 error bar and through bottom of *n* =

13 error bar $_2$ ✔

G_{max} and G_{min} calculated from valid *y* step divided by valid *x* step; both *n* steps ≥ 6 $_3$ ✔

allow 1 mm tolerance when judging intersection of gradient lines with error bars

ignore any unit given with G_{max} or G_{min}; penalise power of ten error in 01.5



$_{12}$ ✔*= 1 MAX if (either) line is thicker than half a grid square or of variable width or not continuous;*

expect G_{max} = 3.2(1) × 10^{-2} and G_{min} = 2.5 (2.49) × 10^{-2}

3

(e) $\lambda (\text{from} \frac{G_{max} + G_{min}}{2})$

AND

result in range 2.8(0) to 2.9(0) × 10^{-2} (m) $_1$ ✔ $_2$ ✔

OR

award one mark for

2.7(0) to 3.0(0) × 10^{-2} (m) $_{12}$ ✔

penalise 1 mark for a power of ten error

reject 1 sf 3 × 10^{-2} (m)

if a best fit line is drawn between the G_{max} and G_{min} lines and the gradient of this is calculated award 1 mark for λ in range 2.8(0) to 3.0(0) × 10^{-2}(m)

2

(f) uncertainty in λ = G_{max} – λ

OR

$\lambda - G_{min}$

OR

$\left(\frac{G_{max} - G_{min}}{2}\right)_1$ ✔

percentage uncertainty = (uncertainty/λ)×100 $_2$ ✔

result in range 11(.0) % to 14(.0) % $_3$ ✔

$_1$✔ can be earned by showing a valid uncertainty then dividing by λ

ecf their λ, G_{max} and G_{min} for $_1$ ✔ and $_2$ ✔

allow λ found from best fit line

accept $\left(\frac{G_{max} - \lambda}{\lambda}\right) \times 100$ or $\left(\frac{G_{max} - G_{min}}{G_{max} + G_{min}}\right) \times 100$ etc for $_{12}$ ✔

allow $\left(\frac{\Delta\lambda}{\lambda}\right) \times 100$ *where $\Delta\lambda$ is any plausible uncertainty for $_2$* ✔

numerical answer without valid working can only earn $_3$ ✔

3

(g) (states) calculate the (vertical) intercept $_1$ ✔

OR

outlines a valid calculation method to calculate y $_1$ ✔

determine the intercept for both lines and calculate average value $_2$ ✔

OR

determine the (vertical) intercept of the line of best fit (between G_{max} and G_{min}) $_2$ ✔

draw the line of best fit (between G_{max} and G_{min}); perform calculation to find intercept earns $_{12}$ ✔

2

(h)

result	reduced	not affected	increased
G_{max}		✔	
G_{min}	✔		
λ	✔		
y			✔

general marker question

allow any distinguishing mark as long as only one per row

for ✔ and X in same row ignore X

for ✔ and ✔ in same row give no mark

ignore any crossed-out response

4

alternative approach: single best fit line drawn on **Figure 4**

(d) G calculated from y step divided by x step;

n step ≥ 6 $_3$ ✔

MAX 1

(e) λ in range 2.8(0) to 2.9(0) × 10_{-2} ✔

MAX 1

(f) percentage uncertainty in λ = $\left(\frac{\Delta\lambda}{\lambda}\right)$ × 100

AND

result in range 11(.0) % to 14(.0) % ✔

MAX 1

(g) calculate intercept

OR

outlines a valid calculation method to find *y* ✔

MAX 1

(h) as main scheme

no ecf possible

4

alternative approach: non-crossing lines for G_{max} and G_{min} on **Figure 4**:
includes lines that meet but do not cross

(d) G_{max} and G_{min} calculated from *y* step divided by *x* step; both *n* steps ≥ 6 $_3$ ✔

MAX 1

(e) to (h) as main scheme

1

[18]