Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Waves

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Name of the Student:_____
Max. Marks : 18 Marks   **Time : 18 Minutes**

Mark Schemes

Q1.

(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 different points [at each end of M] **and** adjust until [make sure] both distances are the same $_2$ ✔

OR

use of set square to align M with the perpendicular line earns $_2$ ✔

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

OR

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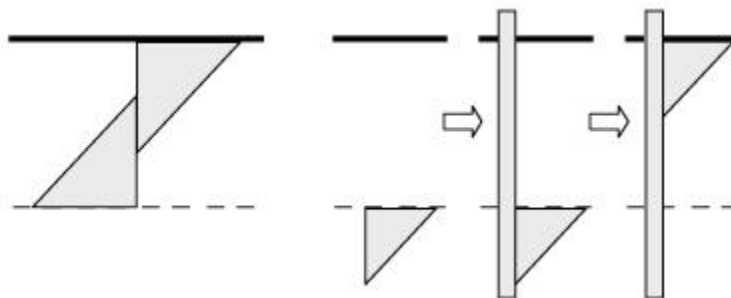
allow use of scale on set square to measure the perpendicular distances don't penalise incorrect reference to the set square, eg as 'triangular ruler', as long as the sketch shows a recognisable set square

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; <u>both</u> 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
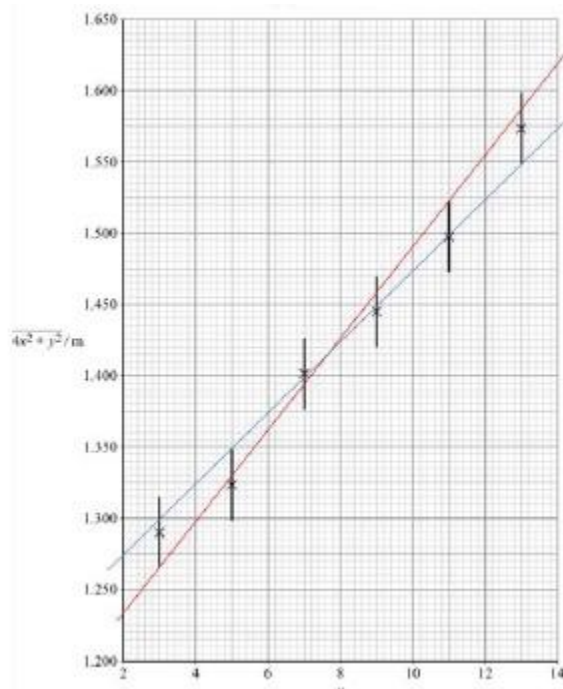
₁₂ ✔= 1 MAX if (either) line is thicker than half a grid square or of variable width or not continuous;

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

3

(e) $\lambda \left(\text{from} \dfrac{G_{max} + G_{min}}{} \right)$

AND

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

OR

award one mark for

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

         penalise 1 mark for a power of ten error
         reject 1 sf 3 $\times 10^{-2}$ (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)
         $\times 10^{-2}$(m)

                                                               2

(f)   uncertainty in $\lambda = G_{max} - \lambda$

OR

$\lambda - G_{min}$

OR

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

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 $\left(\dfrac{G_{max} - \lambda}{\lambda} \right) \times 100$ or $\left(\dfrac{G_{max} - G_{min}}{G_{max} + G_{min}} \right) \times 100$ etc for
         $_{12}$ ✔
         allow $\left(\dfrac{\Delta\lambda}{\lambda} \right) \times 100$ 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 <u>both lines</u> 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 $\lambda = \left(\dfrac{\Delta\lambda}{\lambda}\right) \times 100$

   AND

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

                             MAX 1

(g) <u>calculate</u> 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]