

Name of the Student: _____

Max. Marks : 24 Marks

Time : 24 Minutes

Mark Schemes

Q1.

- (a) Substitution of data in $Y = \frac{FL}{A\epsilon}$
 $3.1 \times 10^{-3} \text{ (m)}$ ✓
2 marks can be awarded if 4mm used to show $T > 500 \text{ N}$ provided an explanation is provided, otherwise award zero.
 2
- (b) $(500 = T \cos 65)$
 $T = 1200 \text{ N}$ ✓
 1
- (c) Wind produces a wave / disturbance that travels along the wire ✓
 Wave is reflected at each end / waves travel in opposite directions ✓
 (Incident and reflected) waves interfere / superpose ✓
 Only certain frequencies since fixed ends have to be nodes. ✓
 4
- (d) Mass per m of the wire = $0.14(2) \text{ kg}$ ✓
 1
- (e) Use of $f = \frac{1}{2l} \sqrt{\frac{T}{\mu}} (= 2.47)$ to find fundamental
 (or $f = \frac{3}{2l} \sqrt{\frac{T}{\mu}}$)
 Third harmonic = 7.4 (Hz) ✓
The second mark is for multiplying the fundamental frequency by 3 – allow ecf
 2
- (f) Diagram showing three approximately equally spaced loops
 Condone single line
 1
- (g) Copper may be stretched beyond elastic limit / may deform plastically

✓

Permanent deformation / Does not return to original length ✓

Allow 'will remain longer than original' or 'will be permanently deformed'

2

[13]

Q2.

- (a) Period = 0.2×10^{-14} (s) read off

OR

Recognisable T substituted into $T = 1 / f$ ✓

An acceptable subject (period, time for one cycle, one cycle, T , etc.)

Allow non-standard symbol with unit seen on time.

Allow this subtraction of two times seen in $f = 1/T$

Use of $T = 1 / f$ and $c = f\lambda$ ✓

OR

Use of $\lambda = cT$

Use of here is:

Subject must be seen with substitutions or rearranged equations with $f = 1/T$ and $\lambda = c/f$

Condone power 10 error here

Condone lack of subject in vertical working where rearranged equation with appropriate subject seen at heading of column

$6(.0) \times 10^{-7}$ (m) ✓

Number must be expressed as 6×10^{-7} or 600×10^{-9} or equivalent not enough to see only nano prefix.

3

- (b) (Determines a fraction of cycle)

$$\frac{0.04}{0.2} \text{ or } \frac{2}{10} \text{ or } \frac{1}{5} \text{ or } 0.2 \text{ or } \frac{1.2(\times 10^{-7})}{6(\times 10^{-7})} \text{ or } 0.2 \lambda \text{ seen} \quad \checkmark$$

Condone their fraction $\times 2\pi$ or their decimal $\times 2\pi$

For 1st mark

$2\pi/5$ OR 0.4π

OR

1.26 or 1.3 ✓

Allow $8\pi/5$ OR 1.6π

OR

5.03 or 5.0

2

- (c) (Distance $\Rightarrow$) $3 \times 10^{-7} \times 2.37 \times 10^5$ seen

OR

(Distance =) 0.07(11) (m) seen ✓

Subs into $s = \frac{1}{2} at^2$ ✓

Condone error in sub for s where formula has been otherwise correctly manipulated with a (or g) as subject

9.88 (3 sf only) ✓

Alternative:

1 st mark	average speed = $\frac{3 \times 10 - 7 \times 2.37 \times 10^5}{0.12}$
2 nd mark	$a = \frac{2 \times \text{their average speed}}{0.12}$
3 rd mark	9.88

3

(d) Draws a tangent to the curve at approximately

$t = 120$ ms and attempts a gradient calculation ✓

Tangent must be a straight line that touches curve and divergent from curve before 90 ms and after 150 ms

(Gradient =) 1.2 (range 1.1 to 1.3) ✓

Allow 1.2×10^{-3} (range 1.1×10^{-3} to 1.3×10^{-3}) ✓

Ignore units on answer line

2nd mark is dependent on 1st mark

Max 1 mark for correct answer in range where tangent satisfies above conditions but doesn't quite touch curve (half-square tolerance)

First alternative:

1st mark

*Use of $v = u + at$ with sub for $a = 9.88$ or 9.875 **and** $t = 0.12$*

2nd mark

1.2 or 1.19 or 1.185 only

Second alternative:

1st mark

*Use of $s = \frac{1}{2}at^2$ and $ds/dt = at$ with sub for $a = 9.88$ or 9.875 **and** $t = 0.12$*

2nd mark

1.2 or 1.19 or 1.185 only

2

(e) (instantaneous) Velocity (of the mirror) or (instantaneous) speed (of the mirror) ✓

Ignore any units quoted

Do not allow:

Average speed / constant speed

1

[11]