

Name of the Student: _____

Max. Marks : 18 Marks

Time : 18 Minutes

Mark Schemes

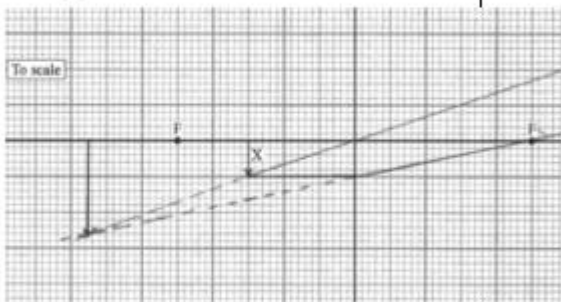
Q1.

| Question Number | Acceptable answers | Additional guidance | Mark |
|-----------------|--|--|------|
| | EITHER <ul style="list-style-type: none"> Waves are produced by the toothbrush and reflected (at the mass) (1) Waves meet and superpose (1) Constructive interference takes place where the waves are in phase Or Destructive interference takes place where the waves are in antiphase (1) The string vibrates at the centre with maximum amplitude, forming an antinode in the centre Or The string here has zero/minimum amplitude, forming nodes at the ends (1) Creating a standing/stationary wave (1) OR <ul style="list-style-type: none"> The toothbrush causes the string to vibrate at its natural frequency (1) There is a maximum/efficient transfer of energy from the toothbrush to the string (1) Resonance occurs (1) The string vibrates at the centre with maximum amplitude, forming an antinode in the centre (1) Creating a standing/stationary wave (1) | Accept answer in terms of multiple 'loops' Accept reference to phase difference in terms of 2π , or 0 (radians) Accept reference to phase difference in terms of π (radians) Do not credit out of phase | 5 |

Q2.

| Question Number | Acceptable answers | Additional guidance | Mark |
|-----------------|---|--|------|
| | <ul style="list-style-type: none"> Use of $W = mg$ Use of $v = \sqrt{T/\mu}$ Determination of wavelength Use of $v = f\lambda$ $f = 30 \text{ Hz}$ | <p>(1) <u>Example of calculation</u> $T = 0.010 \text{ kg} \times 9.81 \text{ N kg}^{-1} = 0.0981 \text{ N}$ $v = \sqrt{(0.0981 \text{ N} / 9.1 \times 10^{-4} \text{ kg m}^{-1})} = 10.4 \text{ m s}^{-1}$ $\lambda = 0.69 \text{ m} / 2 = 0.345 \text{ m}$ $f = 10.4 \text{ m s}^{-1} / 0.345 \text{ m} = 30 \text{ Hz}$</p> | 5 |

Q3.

| Question Number | Acceptable answers | Additional guidance | Mark |
|-----------------|--|--|------|
| | <ul style="list-style-type: none"> 2 rays drawn: Extended line joining centre of lens to tip of object and Horizontal line from tip of object to the lens, then an extended line joining the point on the lens where this line intercepts to the focal point on the right of the lens Image drawn where their two rays cross Use of $m = \frac{v}{u}$ or $m = \frac{\text{image height}}{\text{object height}}$ $m = (-) 2.3 - 2.7$ | <p>Accept: line from focal point on the left hand side of lens through the tip of object to the lens, and then a parallel line joining the line from the lens through the left hand side of lens.</p> <p>(1) </p> <p>(1) <u>Example of calculation</u> $m = \frac{v}{u}$ $m = \frac{7.5 \text{ (cm)}}{3.0 \text{ (cm)}} = (-) 2.5$</p> | 4 |

Q4.

| Question Number | Acceptable answers | Additional guidance | Mark |
|-----------------|--|--|----------|
| | <p>EITHER</p> <ul style="list-style-type: none"> • Use of $n = \frac{c}{v}$ (1) • Use of $\sin C = \frac{1}{n}$ (1) • $C = 25^\circ$ (1) • comparison of their calculated value of C with 40° and conclusion consistent with their comparison (1) <p>OR</p> <ul style="list-style-type: none"> • Use of $n = \frac{c}{v}$ (1) • Use of $n_1 \sin \theta_1 = n_2 \sin \theta_2$ (1) • $\sin \theta_2 > 1$ (1) • There cannot be a refracted ray and so the ray must follow the path shown (1) | <p><u>Example of calculation</u></p> $n = \frac{3.0 \times 10^8 \text{ m s}^{-1}}{1.25 \times 10^8 \text{ m s}^{-1}} = 2.4$ $C = \sin^{-1} \frac{1}{2.4} = 24.6^\circ$ | 4 |