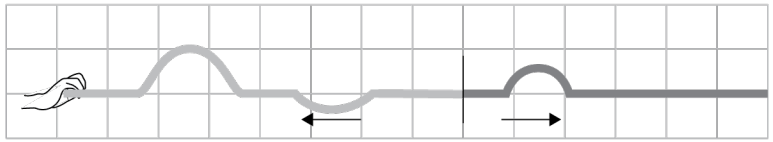
Assessment Schedule – 2024

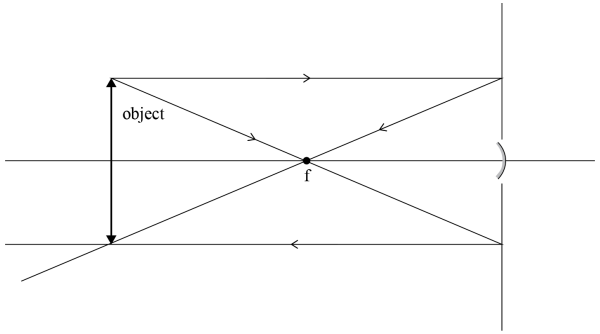
Physics: Demonstrate understanding of waves (91170)

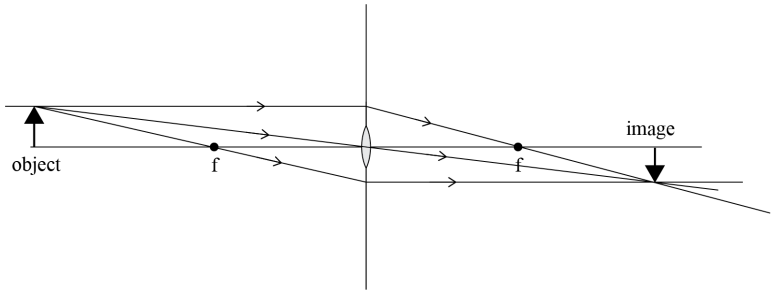
Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	Refraction.	• Correct answer.		
(b)	$f = \frac{6}{8} = 0.75$ Hz $\lambda = 0.04$ m speed in deep $= v = f\lambda = 0.75 \times 0.04 = 0.03$ m s^{-1} $\frac{v_2}{v_1} = \frac{\lambda_2}{\lambda_1} \Rightarrow \frac{v_2}{0.03} = \frac{0.02}{0.04}$ speed in shallow $= v_2 = 0.015$ m s^{-1}	• Correct frequency.	• Correct answer.	
(c)	• The wave slows down as it enters shallow water. • Frequency remains unchanged. • Because $v = f\lambda$, the wavelength shortens. • The amplitude of the wave will increase.	• Any TWO correct points.	• THREE correct points clearly linked.	• Explanation including all FOUR bullet points.

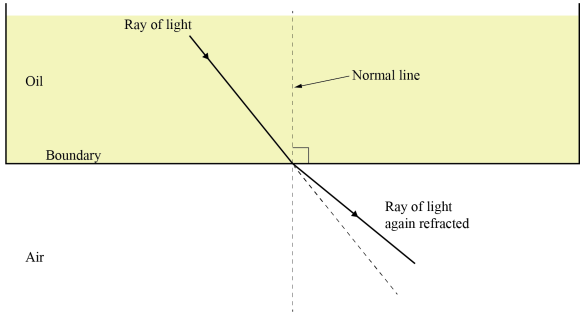
(d)(i)	Less dense More dense  Reflected pulse Transmitted pulse • Reflected pulse has opposite phase. • Transmitted pulse same phase. • Both amplitudes smaller than incident pulse. • The reflected pulse further from the boundary than the transmitted pulse. (ii) The reflected pulse is faster than the transmitted pulse.	• Any of the bullet points shown on the diagram. OR Stated that the reflected pulse is faster than the transmitted pulse.	• THREE bullet points shown on diagram AND States that the reflected pulse is faster than the transmitted pulse.	• Correct, fully labelled diagram with arrows AND Correct comparison of velocities.

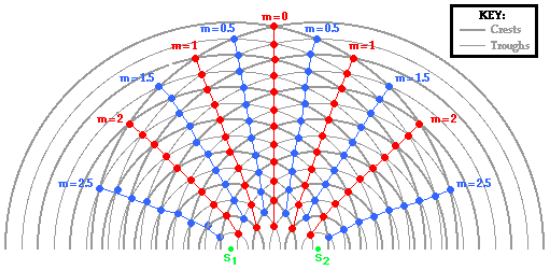
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No evidence	1a	2a or 1m	3a or 1a+1m or 1e	4a or 2a+1m or 2m or 1a+1e	2m+1a or 1m+1e or 1m+3a or 1e+2a	3m or 2m+2a or 1m+1e+1a or 1e+3a	1e+1m+2a or 1e +2m or 2e+1a	2e+m or 2e+2a

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	Virtual image.	• Correct answer.		
(b)	$\frac{1}{f}=\frac{1}{d_i}+\frac{1}{d_o}$ $\frac{1}{2}=\frac{1}{d_i}+\frac{1}{0.9}$ $d_i=-1.636\ m$ $\frac{d_i}{d_o}=\frac{h_i}{h_o}\Rightarrow\frac{-1.636}{0.9}=\frac{h_i}{1.5}\Rightarrow h_o=-2.7$ m Accept without the negative.	• Correct d_i.	• Correct answer.	
(c)(i)	 $d_o=4$ $d_i=4$ $h_i=2$ $h_i=-2$	• Correct nature of image: real, same size, and inverted. OR ONE correct ray drawn.	• Correct ray diagram (with arrows).	• Correct ray diagram (with arrows) correctly locating image. AND Image described.
(ii)	Image properties: inverted, real image, $h_i = h_o$, $d_i = 2f$.			

(d)(i) (ii) (iii)	Image is real.  Bring object closer to the lens.	• Real image is produced. OR One correct ray drawn from an object. OR Move the candle closer to the lens to enlarge the object (not within f).	• TWO of: - image is real - needs two rays with arrows - bring object closer to the lens (not within f).	• All THREE of: - image is real - needs two rays with arrows and labels - bring object closer to the lens (not within f).

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No evidence	1a	2a or 1m	3a or 1a+1m or 1e	4a or 2a+1m or 2m or 1a+1e	2m+1a or 1m+1e or 1m+3a or 1e+2a	3m or 2m+2a or 1m+1e+1a or 1e+3a	1e+1m+2a or 1e +2m or 2e+1a	2e+m or 2e+2a

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	• Refractive indices (of the mediums).	• Correct answer.		
(b)(i) (ii)	Total internal reflection. • The angle of incidence on the glass cladding boundary has to be greater than the critical angle. • The cladding must have a lower refractive index than the glass.	• (i) OR Either of the points from part (ii).	• Correct answer. (ii) must be in the context of glass and cladding.	
(c)(i)		• Ray bending away from normal in air. OR $n_1 = 1.17$. OR Finds angle from incorrect n.	• TWO of: - Correct ray - Correct angle. - Correct n.	• Correct answer including refracted ray with label and arrow.
(ii)	$\frac{n_1}{n_2} = \frac{v_2}{v_1} \Rightarrow \frac{n_1}{1} = \frac{3.00\times10^8}{2.56\times10^8}$ Therefore $n_1 = 1.17$ $n_1 \sin\theta_1 = n_2 \sin\theta_2$ $1.17 \sin 30 = 1 \sin\theta_2$ $\theta_2 = 35.8°$			

(d)	Visitors will hear loud and soft sounds as they walk past the speakers system. Loud sounds are due to constructive interference. These are regions where the crest of one wave combines with the crest of another. The path difference is either zero (central band) or a whole number of wavelengths. Quiet spaces are due to destructive interference, where the crest of one wave combines with the trough of another wave. The path difference is either half a wavelength or an odd mulitiple of half wavelengths. 	• ONE of: - loud sounds linked to constructive interference - soft sounds linked to destructive interference - description of constructive interference - description of destructive interference - interference linked correctly to path difference - diagram drawn showing a nodal line or anti-nodal line.	• An explanation including at least THREE of: - loud sounds linked to constructive interference - soft sounds linked to destructive interference - description of constructive interference - description of destructive interference - interference linked correctly to path difference - diagram showing a nodal line and an anti-nodal line OR diagram showing a labelled nodal line and an anti-nodal line linked to path difference.	• Comprehensive explanation of interference, linked to path difference.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No evidence	1a	2a or 1m	3a or 1a+1m or 1e	4a or 2a+1m or 2m or 1a+1e	2m+1a or 1m+1e or 1m+3a or 1e+2a	3m or 2m+2a or 1m+1e+1a or 1e+3a	1e+1m+2a or 1e +2m or 2e+1a	2e+m or 2e+2a

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 07	08 – 13	14 – 18	19 – 24