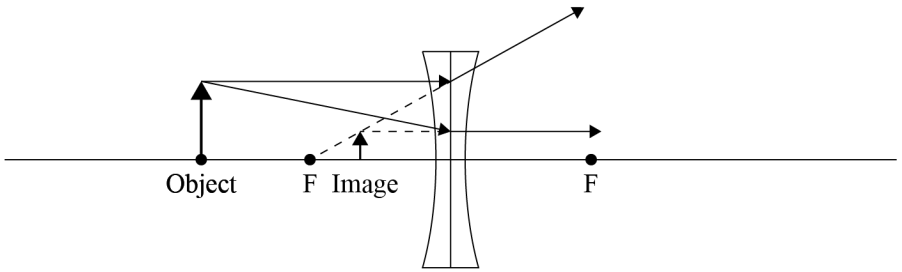
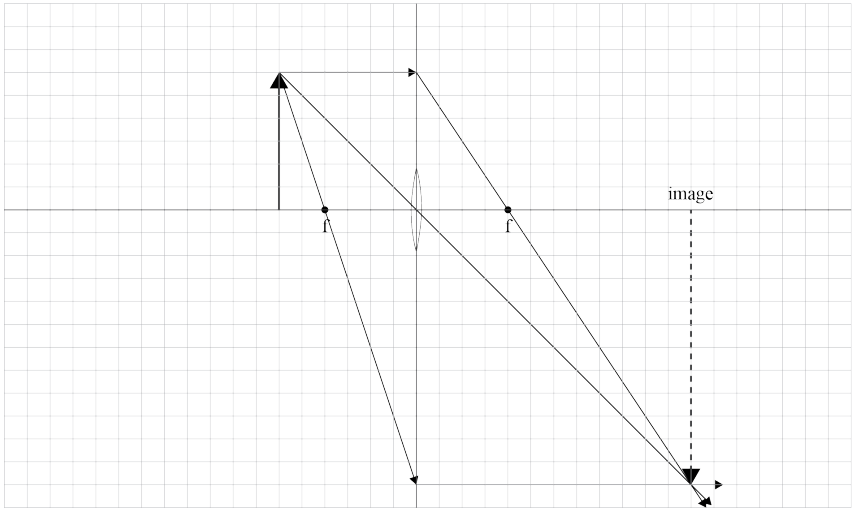
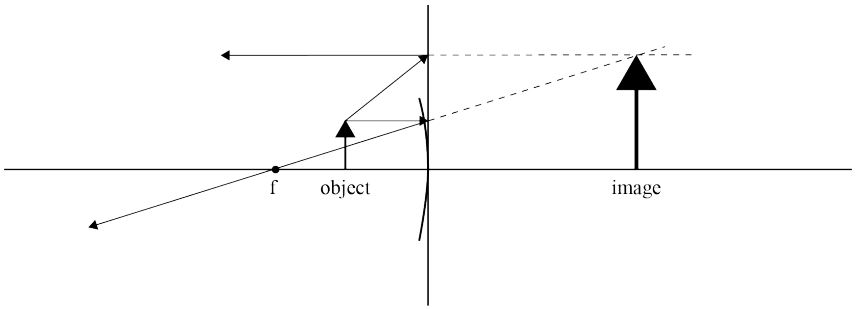
Assessment Schedule – 2025

Physics: Demonstrate understanding of waves (91170)

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	*Diagram is NOT to scale*  	• Image found.		
(b)(i)	$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$ $\quad \frac{1}{-10} = \frac{1}{d_i} + \frac{1}{15}$ $\frac{1}{d_i} = -\frac{1}{10} - \frac{1}{15}$ $\quad d_i = -6$ cm Magnification $= \frac{d_i}{d_o} = \frac{6}{15} = 0.4$ times	• Uses $f = 10$ to get $d_i = 30$. OR Correctly identifies $f = -10$. OR Correct description.	• Correct magnification. OR Made one error overall and has correct description.	• Correct magnification and description.
(ii)	Image will be virtual, upright, and diminished.			

(c)	$\frac{d_i}{d_o} = 2 \Rightarrow d_i = 2d_o$ and $h_i = 2h_o$ $\frac{1}{f} = \frac{1}{2d_o} + \frac{1}{d_o} \Rightarrow d_o = 1.5f$ OR $\frac{1}{4} = \frac{1}{2d_o} + \frac{1}{d_o} \Rightarrow d_o = 6$ (squares) 	• States that: $d_i = 2d_o$ OR $h_i = 2h_o$ OR $h_i = 12$ (squares)	• Places object and image so that $d_i = 2d_o$ and $h_i = 12$. AND Draws at least one correct ray from object.	• Object and image placed correctly, of the correct size with two correct rays drawn and some evidence of a calculation. E.g. $d_i = 2d_o$ etc.
(d)(i)		• Correct diagram (2 rays). OR Correct description.	• Correct diagram (2 rays). AND Correct description.	
(ii)	Image is virtual, upright, and enlarged.			

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Very little Achievement evidence. 1a	Some evidence at Achievement level, but most is at the Not Achieved level. 2a or 1m	A majority of the evidence is at Achievement level. 3a or 1a, 1m or 1e	Most evidence is at Achievement level. 4a or 1m, 2a or 1e, a	Some evidence is at Merit level. 2m	A majority of the evidence is at Merit level. 3m or 2e	Evidence is provided for most tasks. The evidence at Excellence level may have minor errors, or the evidence is weak. 1e, 2m or 2e, 1a	Evidence is provided for most tasks and the evidence at Excellence level is accurate. 2e, 1m

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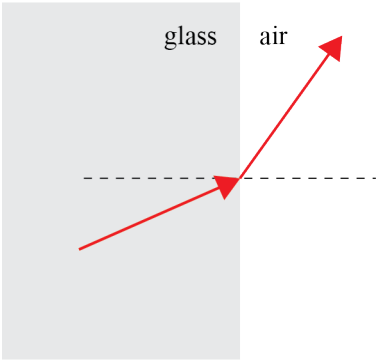
TWO (a)		• Draws arrow in the correct direction (away from the normal) with arrow head.		
(b)	$\frac{v_{glass}}{v_{air}} = \frac{1}{1.5}$ so $v_{glass} = \frac{2}{3} v_{air}$ or inverse.	• The speed of light is slower in glass. OR The speed of light is faster in air than glass.	• ($v_{air} = 1.5\ v_{glass}$) $v_{glass} = \frac{2}{3} v_{air}$ (accept $v_{glass} = \frac{1}{1.5} v_{air}$ or $v_{glass} = 2 \times 10^8$ m s^{-1}) Quantitative answer.	
(c)	$n_{air} \sin\theta_{air} = n_{glass} \sin\theta_{glass}$ $\frac{n_{air}}{n_{glass}} \sin\theta_{air} = \sin\theta_{glass}$ $\frac{n_{air}}{n_{glass}} = \frac{\lambda_{glass}}{\lambda_{air}} = \frac{464 \times 10^{-9}}{650 \times 10^{-9}} = 0.7138$ $0.7138 \sin 30^\circ = \sin\theta_{glass}$ $\theta_{glass} = 20.9 = 21^\circ$	• Correct formula identified. OR $n_{glass} = 1.4$ OR Correct $\frac{n_{air}}{n_{glass}}$ ratio.	• Calculation with ONE error (e.g. = $\theta_{glass} = 44.4$	• Full calculation with correct angle.
(d)(i) (ii)	Total internal reflection. • The phenomenon which occurs when the light rays travel from a medium of higher refractive index to one of a lower refractive index. • The angle of incidence must be greater than the critical angle. • Critical angle is the angle of incidence when the angle of refraction is 90°.	• Identifies TIR. OR ONE of the bullet points about the conditions of TIR.	• Identifies TIR. AND Partial explanation.	• Full explanation.

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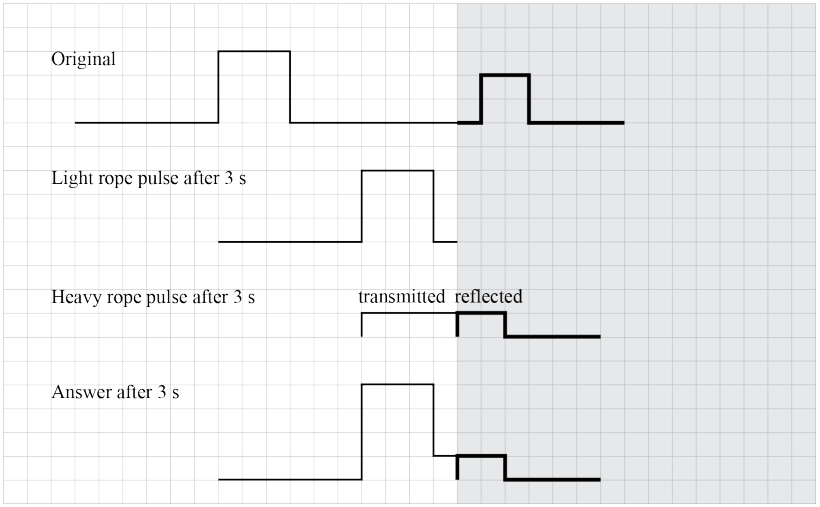
THREE (a)	Transverse wave.	• Correct answer.		
(b)	When two waves of the same frequency are in the same place, they interfere. If the waves are in phase, they constructively interfere, causing spots of strong Wi-Fi signal. If the waves are out of phase, they destructively interfere, and cause spots of weak (no) Wi-Fi signal. To arrive in phase, the path difference from each access point needs to be a whole number of wavelengths ($n\lambda$). To arrive out of phase, the path difference from each access point needs to be $(n - 0.5)\lambda$ (an odd number of half wavelengths).	• Recognises interference.	• Partial answer.	• Full explanation in the context of signal strength, with p.d. in terms of λ (could be correctly labelled diagram.).
(c)	$f = \frac{3 \times 10^8}{0.025} = 1.2 \times 10^{10}$ Hz Two hours = $2 \times 60 \times 60 = 7200$ s The number of radio waves = $1.2 \times 10^{10} \times 7200 = 8.64 \times 10^{13} = 8.6 \times 10^{13}$	• Correct frequency. OR Calculated $t = 7200$ s.	• Correct answer.	
(d)(i) (ii)	The frequency of the Wi-Fi signal does not change as it enters / leaves the wall from / to the air. 	• The frequency is unchanged. OR The correct position of one of the pulses after 3 s.	• Same frequency. AND One resulting pulse form in the correct place.	• Correct diagram showing pulses and frequency is unchanged. (allow for a minor error).

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Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 12	13 – 18	19 – 24