Assessment Schedule – 2007

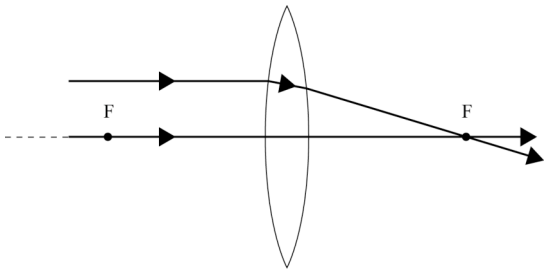
Physics: Demonstrate understanding of waves (90254)

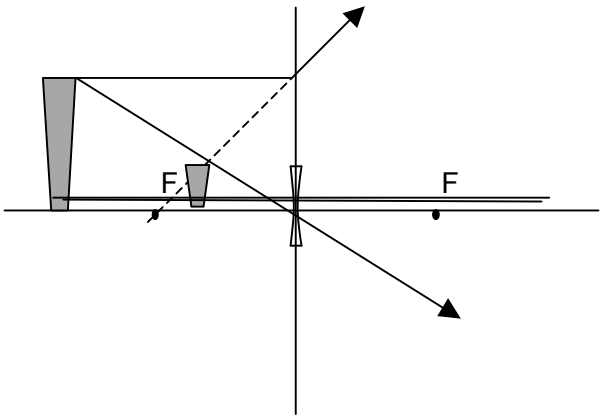
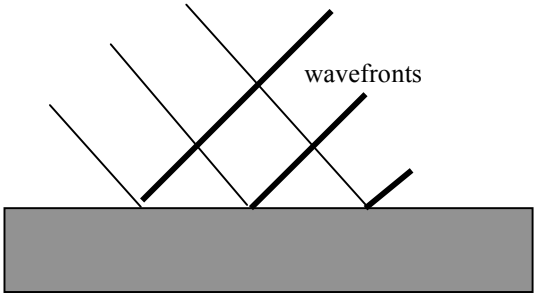
Evidence Statement

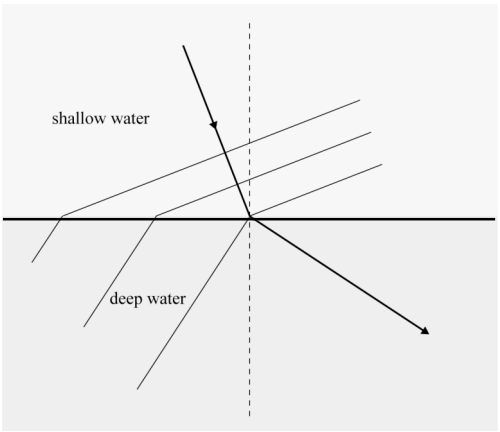
Note: Minor computational errors will not be penalised. A wrong answer will be accepted as correct provided there is sufficient evidence that the mistake is not due to a lack of understanding. Such evidence includes:

- the last written step before the answer is given has no unexpanded brackets or terms and does not require rearranging
- the power of any number that is multiplied by a power of 10 is correct.

Correct units and significant figures are required only in the questions that specifically ask for them.

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
ONE (a)	The refractive index is a measure of how much a material slows light down. **OR** a measure of how much a material bends (refracts) light as it enters. **OR** A measure of the optical density of a material.	[1] Correct answer.		
(b)	$r = 90° - 65° = 25°$	[2] Correct answer.		
(c)	$n_1 \sin\theta_1 = n_2 \sin\theta_2$ $\sin\theta_2 = \frac{n_1 \sin\theta_1}{n_2}$ $\theta_2 = \sin^{-1}\left(\frac{1 \times \sin 25°}{1.60}\right)$ $\theta_2 = 15°$	[2] Correct formula **AND** substitution. Or substitution consistent with 1(b).	[2] Correct working **AND** answer. Or answer consistent with 1(b).	
(d)	$n_1 \sin\theta_1 = n_2 \sin\theta_2$ $1.6 \times \sin c = 1$ $c = \sin^{-1}\left(\frac{1}{1.6}\right)$ $c = 39°$	[2] Correct formula **AND** substitution.	[2] Correct working **AND** answer.	
(e)		[1] One correct ray **OR** light bending at axis.	[1] Both rays correct. Must show refraction at both lens surfaces.	
(f)	The glass has a lower refractive index, therefore it will bend the rays less, so the top ray will converge less so the ray will cut the axis further from the lens. The glass lens has a longer focal length.	[1] Glass has a lower refractive index and will bend rays less **OR** Glass lens has a longer focal length.	[1] Glass has a lower refractive index and will bend rays less **AND** Glass lens has a longer focal length.	

(g)		[1] Two rays correct.	[1] Two rays **AND** image correct. Must show arrows on both rays.	
(h)	Virtual, erect and diminished.	[1] 2 out of 3 descriptions correct **OR** answer consistent with 1(g).		
(i)	$m = \frac{H_i}{H_o} = \frac{9}{22} = 0.41\ (\pm 0.03)$	[2] Correct answer. **OR** answer consistent with candidates diagram.		
(j)	$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{-f}$ $\frac{1}{1} + \frac{1}{d_i} = \frac{1}{-0.30}$ $d_i = 23\text{cm}$ $\frac{h_i}{h_o} = \frac{d_i}{d_o}$ $h_i = \frac{h_o d_i}{d_o}$ $h_i = \frac{.35 \times .23}{1}$ $h_i = 8.1\text{cm}$ **OR** M = f/S_o= 0.3/1.3 = 0.23 and $h_i = Mh_o$ = 0.23x0.35 = 8.1 cm	[2] Correct image distance (Descartes) or correct magnification (Newtons). Incorrect sign allowed.	[2] substitution into formula for h_i. (linking of two formulae).	[2] Correct working **AND** answer.
TWO (a)		[1] Wavefronts at correct angles.		

(b)		[1] Wavefronts at correct angles **OR** wave direction away from normal and at right angles to wavefront.	[1] Wavefronts at correct angles **AND** wave direction away from normal and at right angles to wavefront.	
(c)	$n_1 \sin\theta_1 = n_2 \sin\theta_2$ $\sin\theta_2 = \frac{n_1 \sin\theta_1}{n_2}$ $\frac{n_1}{n_2} = \frac{v_2}{v_1}$ $\sin\theta_2 = \frac{v_2 \sin\theta_1}{v_1}$ $\sin\theta_2 = \frac{0.35 \times \sin 35}{0.25}$ $\theta_2 = 53°$	[2] Correct use of Snell's Law **OR** speed ratio.	[2] Correct linking of formulae (symbols or values).	[2] Correct working **AND** answer.
(d)	First diagram shows small diffraction Second diagram shows large diffraction. Wavelength is constant.	[1] Second diagram shows diffraction.	[1] Both diagrams correct including more diffraction in diagram 2 **AND** consistent wavelength **OR** straight section approximately width of gap.	[1] Both diagrams correct including: more diffraction in diagram 2 **AND** consistent wavelength **AND** straight section approximately width of gap.
(e)	Diffraction.	[1] Correct answer.		
(f)	On the central antinode, the boat is equidistant from both sources. Path difference equals zero, waves arrive in phase and add constructively producing a large amplitude. Off to one side, waves travel further from one aerial, path difference equals half wavelength, they arrive out of phase, add destructively, small amplitude.	[1] Links observations to interference.	[1] Correctly explains node (destructive, out of phase) **OR** antinode (constructive, in phase) behaviour.	[1] Correctly explains node (destructive, out of phase) **AND** antinode (constructive, in phase) behaviour.
(g)	$f = \frac{1}{T} = \frac{1}{0.035 \times 10^{-3}}$ $f = 2.9 \times 10^4$ Hz	[2] Correct except for conversion	[2] Correct working **AND** answer.	

(h)	$\lambda = \frac{v}{f} = \frac{3.00 \times 10^8}{2.9 \times 10^4} = 1.0 \times 10^4 \text{ m}$ or d = v x T = 3.00 x 10^8 x 0.035 x 10^{-3} = 1.1 x 10^4 m	[2] Correct answer **OR** answer consistent with 2(g). In approach 2 allow lack of conversion.		
		[1] Correct sig figs.		

Judgement Statement

	Achievement	Achievement with Merit	Achievement with Excellence
Criterion One	5 × A1	2 × A1 + 3 × M1	2 × A1 + 3 × M1 + 1 × E1
Criterion Two	3 × A2	2 × A2 + 3 × M2	2 × A2 + 3 × M2 + 1 × E2