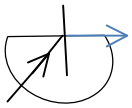
Assessment Schedule – 2012

Physics: Demonstrate understanding of waves (91170)

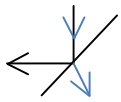
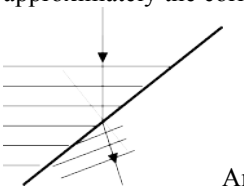
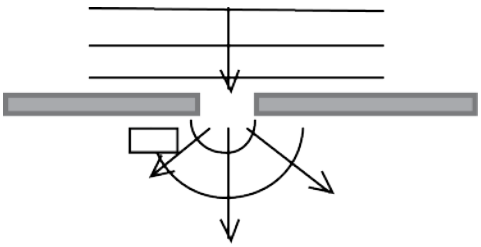
Assessment Criteria

Question	Achievement	Merit	Excellence
ONE (a)(i)	Object positioned between mirror and F for concave mirror.	Rays drawn correctly to obtain enlarged virtual image for concave mirror.	
(ii)	Rays drawn correctly to obtain diminished upright virtual image.		
(b)	Any ONE of: Rays only appear to intersect to form image. OR Image is always upright. OR Image cannot be formed on a screen. OR Image is always behind the mirror.	Any TWO of: Rays only appear to intersect to form image. OR Image is always upright. OR Image cannot be formed on a screen. OR Image is always behind the mirror.	
(c)	$d_i = \left(-\frac{1}{6.0} - \frac{1}{4.5} \right)^{-1}$ OR Using $S_o = 10.5$ cm OR Using $f = +6$ giving $h_i = 8$ cm	$d_i = -2.57$ Correct substitution in Newton's formula, but incorrect answer	$h_i = \frac{2 \times 2.57}{4.5}$ $h_i = 1.14$ cm
(d)	Diagram for lens with higher refractive index shows a shorter focal length. OR WRITTEN A greater refractive index means rays will bend more. OR A greater refractive index will mean a shorter focal length.	Diagram for lens with higher refractive index shows a shorter focal length and hence the image is formed further away. OR A greater refractive index will mean a shorter focal length ,resulting in light rays crossing the principal axis closer to the lens.	Since rays through F bend more, they will appear to meet further away from the lens and hence a larger image will be formed. OR evidence from diagram OR Since magnification is $\frac{d_i}{d_o}$ the size of the image will be greater, when using a convex lens with a higher refractive index.

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

TWO (a)	 Correct angle marked for critical angle OR Outgoing ray at 90°	Correct angle marked for critical angle. AND Refracted ray at 90°. OR Total Internal Reflection.	
(b)	The angle of incidence has to be greater than critical angle. OR This is true for a ray going from a medium of higher refractive index(optical density) to one of lower refractive index.	The angle of incidence has to be greater than critical angle. AND This is true for a ray going from a medium of higher refractive index(optical density) to one of lower refractive index.	
(c)	$n_1 \sin\theta_c = n_2 \sin\theta_2$ $n_1 \sin 42° = 1.0 \sin 90°$	$n_1 = \dfrac{1.0 \sin 90°}{\sin 42°}$ $n_1 = 1.49 = 1.5$	
(d)	$\theta_{air} = 90 - 56 = 34°$ (Using 56° = 9.6 cm)	$n_{air} \sin\theta_{air} = n_{glass} \sin\theta_{glass}$ $1.0 \sin 34° = 1.5 \sin\theta_{glass}$ $\theta_{glass} = 21.8°$	$\theta_{glass} = 21.8°$ AND Distance in glass = 8.0 / cos21.8° = 8.6 cm

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

THREE	Holistic: mark (a) and (b) together		
(a)	 Shows 2 correct directions (Diagram shows: angle of incidence = angle of reflection OR Angle of incidence greater than angle of refraction.)	Shows THREE correct rays (Diagram shows: Angle of incidence = angle of reflection AND Angle of incidence greater than angle of refraction.)	
(b)	Diagram showing refracted wavefronts closer OR Refracted wavefronts travelling in approximately the correct direction.  Arrows not needed	Diagram showing refracted wavefronts closer. AND Refracted wavefronts travelling in approximately the correct direction.	
(c)	 Fig (Used for A/M/E) Diagram shows circular waves. Alt: Diagram shows plane waves = to gap.	Diagram shows waves. PLUS TWO of three: Arrow(s) OR The waves would diffract around the gap in the barrier. OR The boat would move up and down as the waves pass under it. PLUS No / little diffraction.	Diagram shows waves including direction of waves. AND The waves would diffract around the gap in the barrier. AND The boat would then move up and down as the waves pass under it. PLUS No movement.
(d)	Words OR diagram. Circular wavefronts are produced as the waves go through each gap. OR Boat will remain calm due to destructive interference.	Answer linked to Path difference. OR Phase difference.	Waves from gap B will have to travel an extra 2.0 m to reach the boat. AND This means the path difference is half a wavelength. So the waves will interfere destructively. AND Hence the boat will remain calm.

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

Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 6	7 – 14	15 – 19	20 – 24