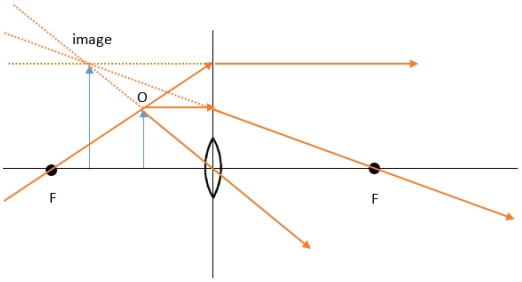
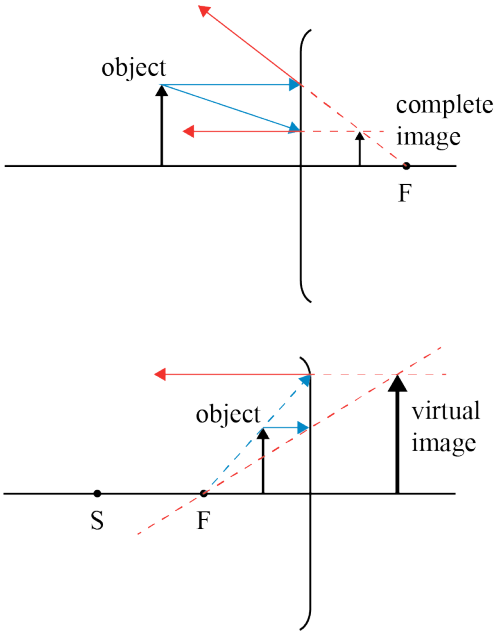
Assessment Schedule – 2018

Physics: Demonstrate understanding of waves (91170)

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	Completed ray diagram.  Accept rays that are not dotted.	TWO correct rays intersecting, showing size and position of image.		
(b)	$\frac{1}{d_o}+\frac{1}{d_i}=\frac{1}{f}$ $d_o = 5$ cm $f = 12$ cm $d_i=\left(\frac{1}{12}-\frac{1}{5}\right)^{-1}=(0.117)^{-1}$ $d_i = -8.6$ cm Properties: upright, magnified and **virtual.**	Correct calculation OR properties.	d_i correct (including negative) AND properties. OR evidence from diagram in (a)	
(c)	$\frac{h_i}{h_o}=\frac{d_i}{d_o}$ $m=\frac{d_i}{d_o}=-\frac{8.6}{5}=-1.71$ $\frac{h_i}{h_o}=m$ $h_i = m\times h_o = -1.71\times 2 = -3.43$ cm	ONE calculation correct.	BOTH calculations correct.	

(d)(i)	A concave mirror would be needed. A concave mirror produces an upright magnified image, compared to a diminished upright image for a convex mirror and a plane mirror has a m = 1.  	Concave mirror stated.	Concave mirror stated correctly. AND Statement why concave mirror is better. OR $d_o < f$ OR A ray diagram showing object within focal point on a concave mirror. OR Largest image when d_0 is as close to f as possible.	Concave mirror, since it is the ONLY mirror that can produce an enlarged image AND $d_o < f$ AND Largest image when d_0 is as close to f as possible AND attempt at reason. (If one point missing, then max of E7.)
(ii)	John's eye would need to be positioned within the focal length $d_o < f$.			
(iii)	John's eye would need to be positioned as close to the focal point (but not at it) as possible. AND At this position, the reflected rays are nearly parallel, causing a large d_i, h_i. OR As *do* gets closer to *f*, from $d_i = \left(\frac{1}{f} - \frac{1}{d_0}\right)^{-1}$, d_i gets very large, causing the height of the image to be much larger.			

Not Achieved			Achievement		Achievement with Merit		Achievement with Excellence	
NØ	**N1**	**N2**	**A3**	**A4**	**M5**	**M6**	**E7**	**E8**
No response; no relevant evidence. (e.g. 0A)	Very little Achievement evidence. (e.g. 1A)	Some evidence at the Achievement level, but most is at the Not Achieved level. (e.g. 2A OR 1M)	A majority of the evidence is at the Achievement level. (e.g. 3A OR 1M + 1A)	Most evidence is at the Achievement level. (e.g. 4A OR 2A + 1M)	Some evidence is at the Merit level. (e.g. 1A + 2M or 3A + 1M)	A majority of the evidence is at the Merit level. (e.g. 3M OR 2A + 2M)	Evidence is provided for most tasks. The evidence at the Excellence level may have minor errors, or the evidence is weak. (e.g. 1E + 2M OR 1E + 1M + 2A)	Evidence is provided for most tasks and the evidence at the Excellence level is accurate. (e.g. 1E + 2M + 1A)

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	Refraction is change of speed OR bending of the light as it goes from one medium to another,	Correct definition.		
(b)(i)	Completed ray diagram ($\theta_r < \theta_i$).	Correct diagram. OR Angle of 28° identified. OR Incorrect answer of 41.2°.	All correct.	
(ii)	$n_1\sin\theta_1 = n_2\sin\theta_2$ $1.00 \sin 28° = 1.34 \sin\theta_2$ $\theta_2 = 20.5°$			
(c)(i)	angle of incidence > critical angle for TIR	Part (i) correct. OR Part (ii) correct.	Both correct.	
(ii)	θ_c= 48.3, so has to be greater than that $n_1\sin\theta_1 = n_2\sin\theta_2$ $1.34 \sin\theta_c = 1\sin 90°$ $\theta_c = \sin^{-1}\left(\frac{1}{1.34}\right) = 48.3°$			
(d)(i)	$\lambda_{air} = \frac{v}{f} = \frac{3.0\times10^8}{5.6\times10^{14}}$ $\lambda_{air} = 5.36\times10^{-7}$ m $\frac{n_1}{n_2} = \frac{\lambda_2}{\lambda_1}$ $\frac{n_{juice}}{n_{air}} = \frac{\lambda_{air}}{\lambda_{juice}}$ $\lambda_{juice} = \frac{5.36\times10^{-7}}{1.34}$ $\lambda_{juice} = 4.00\times10^{-7}$ m	Correct wavelength in air.	AND Wavelength in juice calculated correctly. OR Correct explanation with frequency remaining the same.	Wavelengths calculated correctly, AND statement made that the frequency of the waves does not change during refraction, only the velocity and wavelength of the waves. For a non-fully linked answer max of E7 for question (ii).
(ii)	The frequency is constant, and because wave speed is slower in juice, from $v = f\lambda$, the wavelength must also be less in the juice.			

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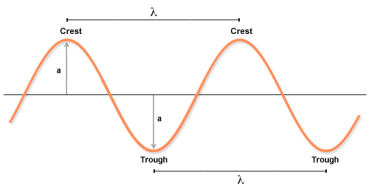
THREE (a)		Wavelength AND amplitude marked correctly.		
(b)	Named as diffraction, and the AM waves would diffract the most since they have the longer wavelength. So, the AM station is most likely to be detected at home.	Called diffraction.	Called diffraction AND AM bent more due to longer wavelength.	
(c)		A pulse 3 consecutive squares wide, with some combination of 2, 4, 2. OR 2,3,2 at 5th square0	Fully correct (up 2, up 4, up 2) starting on the 5th square from the left.	
(d)	A point X the waves are in phase, so the signal will be stronger due to constructive interference. Path difference = $n\lambda$. At point Y the waves are out of phase, so destructive interference occurs, so quiet. Path difference = $(n-\frac{1}{2})\lambda$.	X OR Y marked correctly. AND ONE explanation correct.	X AND Y marked correctly. AND TWO correct explanations.	Merit PLUS Path difference is explained. Path difference = $n\lambda$ for X and $(n-\frac{1}{2})\lambda$ for Y.

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Other combinations are also possible. (Using a=1; m=2; e=3) However, for M5 or M6, at least one Merit question needs to be correct. For E7 or E8, the Excellence needs to be correct.

Cut Scores

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