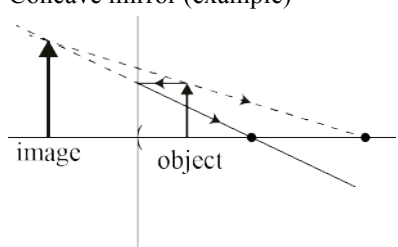


**Assessment Schedule – 2015****Physics: Demonstrate understanding of waves (91170)**

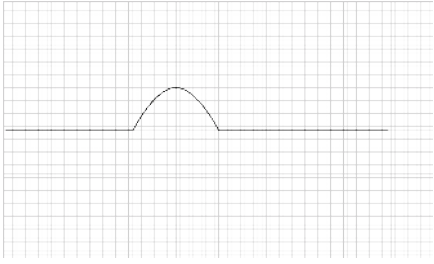
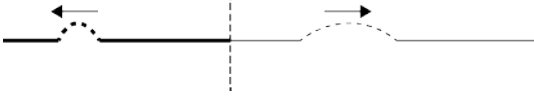
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No relevant evidence.	Very little Achievement evidence.	Some evidence at Achievement level; partial explanations.	Most evidence at Achievement level.	Nearly all evidence at Achievement level.	Some evidence at Merit level with remainder at Achievement level.	Most evidence at Merit level with some evidence at Achievement level.	Evidence provided for most tasks, but weak or incomplete at Excellence level.	Evidence provided for most tasks and Excellence level is accurate and full.
No response; no relevant evidence.	1a	2a	3a	4a	1m + 3a	2m + 2a	1e+ 2m	1e + 2m + 1a

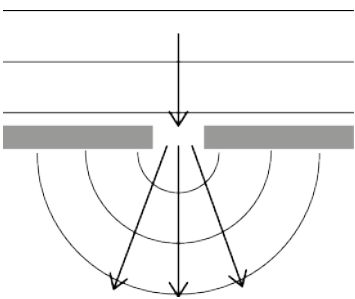
Other combinations are also possible. (Using a=1; m=2; e=3) However, for M5 or M6 at least one Merit question needs to be correct. For E7 or E8 at least one Excellence needs to be correct.

**Evidence Statement**

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	Real, inverted.	Both correct.		
(b)	$\frac{1}{d_o} = \frac{1}{f} - \frac{1}{d_i}$ $d_o = 44.4 \text{ cm}$ $\frac{d_i}{d_o} = m = \frac{25}{44.4} = 0.56$ $\frac{h_i}{h_o} = 0.56 \Rightarrow h_o = \frac{0.50}{0.56} = 0.89 \text{ cm}$	One mistake.	Correct answer.	
(c)	A convex mirror is a diverging mirror. So rays of light will not meet in front of the mirror to form an image. A convex mirror produces a virtual image where the rays appear to diverge from.	One correct idea. Recognises convex mirror diverges light rays OR virtual image formed.	Correct explanation that gives the reason why an image is not formed on the screen.	
(d)	Concave mirror (example)  Dentists use concave mirrors so that when the mirror is held close to the tooth, an enlarged upright image of the tooth is obtained. A plane mirror shows an image the same size as the object.	One correct idea / diagram.	Correct recognition of concave mirror AND Correct diagram.	Correct explanation showing clear links between concepts: the type of mirror preferred over the plane mirror, the ray diagram and the type of image obtained.

<p>TWO (a)</p>	$\frac{1}{d_i} + \frac{1}{d_o} = \frac{1}{f}$ $d_i = (5.0^{-1} - 2.0^{-1})^{-1}$ $d_i = -3.3 \text{ cm}$ <p>This is a virtual image.</p>	<p>One error.</p>	<p>Correct calculation. (Must have negative value OR state virtual image.)</p>	
<p>(b)</p>	<p>The colour of light depends on the frequency. The frequency does not change, so the colour stays the same.</p>	<p>Frequency does not change.</p>		
<p>(c)</p>	<p>Angle of incidence = <math>90 - 40 = 50^\circ</math>  <math>n_1 \sin \theta_1 = n_2 \sin \theta_2</math>  <math>\theta_2 = \sin^{-1} \frac{1.0 \sin 50^\circ}{1.33}</math>  <math>\theta_2 = 35^\circ</math></p>	<p>One error.</p>	<p>Correct answer.</p>	
<p>(d)</p>	<p>Rays of light from the bottom of the pool are bent before reaching Tom's eye.  The rays are bent away from the normal on entering air, as air has a lower refractive index than water (because light travels faster in air than in water).  Our brain makes us think that the rays are coming straight from where they are extended backwards, making the coin look nearer the surface than it really is.</p>	<p>One correct idea.</p>	<p>Two correct ideas.</p>	<p>Complete answer with links made between concepts regarding bending of light and speed of light in different media - from coin to eye - and what our brain makes us think.</p>

<p>THREE (a)</p>		<p>Correct answer.</p>		
<p>(b)</p>	 <p>(boundary shown)</p>	<p>Has one aspect of diagram correct.</p>	<p>Has both phase AND wavelength correct.</p>	
<p>(c)</p>	<p>The amplitude of the reflected pulse will be less, as not all the energy is reflected.</p>	<p>Amplitude is less.</p>	<p>Smaller amplitude AND due to decrease in energy.</p>	
<p>(d)</p>	<p>When rays of light at a very large angle of incidence hit the cold air – hot air interface, the angle of incidence is greater than critical angle. So all of it is reflected undergoing total internal reflection.</p>	<p>One correct idea.</p>	<p>Two correct ideas including total internal reflection (TIR).</p>	<p>Correct answer making links between concepts of total internal reflection and angle of incidence.</p>

FOUR (a)	(Semi-circular wave fronts. Wavelength remains the same after diffraction.) 	Correct shape AND wavelength for diffracted wave fronts.		
(b)	$\frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$ $\lambda_2 = \frac{1.75 \times 4.5}{12.0}$ $= 0.66 \text{ m}$ $v = f\lambda$ $f = \frac{12}{1.75} = 6.9 \text{ Hz (or s}^{-1}\text{)}$	One value correct.	Both values correct.	
(c)	<p>Tom will hear the loud and soft sounds at shorter distances as compared to Ellen, who walks further away.</p> <p>This is because the antinodal lines fan out from the speakers. (Accept diagram). So, the further away one is from the speakers, the further apart the loud and soft sounds are.</p>	Describes Tom hearing the loud and soft sounds along AB.	Correct reasoning why Ellen hears the loud and soft sounds at greater distances OR lower intensity	
(d)	<p>Bright bands 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.</p> <p>Dark bands 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 multiple of half wavelengths.</p>	Recognises bright bands are constructive interference AND dark bands are regions of destructive interference.	One error OR one aspect missing in the answer.	Complete answer.

### Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 8	9 – 16	17 – 24	25 – 32