Assessment Schedule – 2006

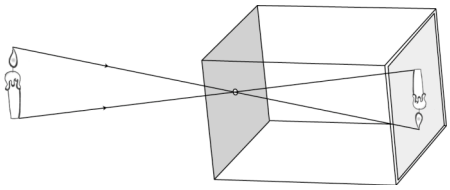
Physics: Demonstrate understanding of wave and light behaviour (90182)

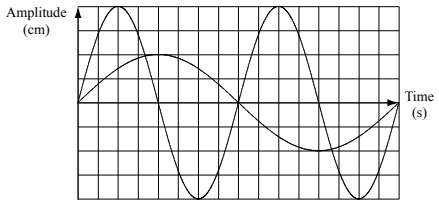
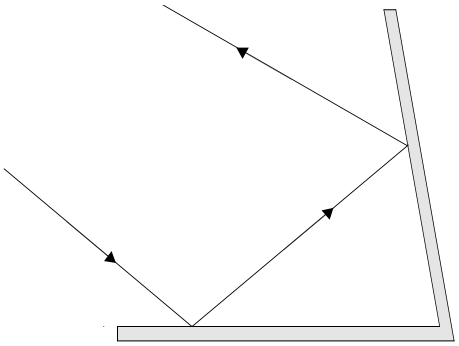
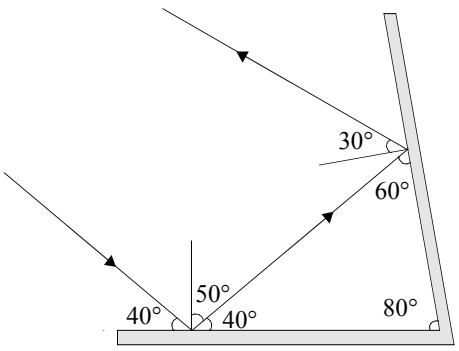
Evidence Statement

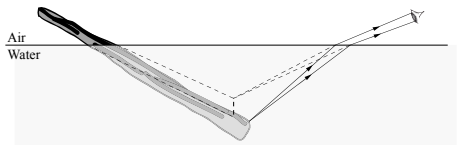
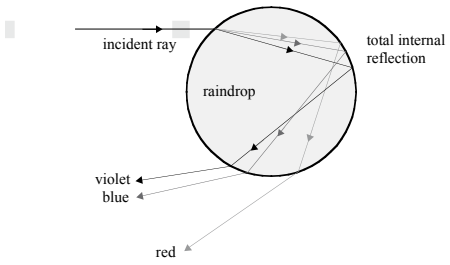
Note: Minor computational errors will not be penalised. A wrong answer will be accepted as correct provided there is sufficient evidence that the mistake is not due to a lack of understanding. Such evidence includes:

- 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.

Question	Evidence	Achievement	Merit	Excellence
ONE (a)		[1] Both rays are drawn correctly but no arrows : straight lines : cross at pinhole precisely	[1] Correct diagram as shown.	
(b)	See above diagram.	[1] Correct image.		
(c)	Inverted / upside down, real, diminished / smaller.	[1] Any two correct answers.		
(d)	Light travels in straight line / rectilinear propagation	[1] Correct answer.		
(e)	1. The image becomes **brighter**. Because **more** light is let in by a bigger hole. 2. The image becomes **blurred**. Because a larger hole acts like many pinholes creating multiple images next to each other, thus creating a blurred image/ Light from a point on the candle passes through pinhole at various angles	[1] Mentions either brighter or blurred.	[1] Mentions either brighter or blurred, with explanation.	[1] Mentions both descriptions with explanations.
TWO (a)	$v = \frac{d}{t} = \frac{6.3}{1.8} = 3.5 \text{ m s}^{-1}$	[2] Correct working and answer.		
(b)	$\lambda = \frac{5.75}{3} = 1.92$	[2] Correct working.		
(c)	$f = \frac{v}{\lambda} = \frac{3.5}{1.92} = 1.82 = 1.8 \text{ Hz}$ COE possible from (a).	[2] Correct working and answer.		

(d)	$T = \frac{1}{f} = \frac{1}{1.82} = 0.55$ s COE possible from (c).	[2] Correct working and answer.		
(e)	$\lambda = \frac{v}{f} = \frac{330}{550} = 0.60$ m Number of waves = $\frac{d}{\lambda} = \frac{13.2}{0.60} = 22$ **Or** t = 13.2 ÷ 330 = 0.04 s Number of waves = 550 x 0.04 = 22	[2] Correct working and answer for λ.	[2] Correct methods but wrong answer.	[2] Correct working and answer.
(f)	 Accept any phase relationship with a wave pattern showing 2:1 wavelength ratio.	[1] Amplitude or frequency is correctly drawn.	[1] Both amplitude and frequency are correctly drawn.	
THREE (a)	$2d = 1500 \times 0.018 = 27$ m Depth = $\frac{27}{2} = 13.5$ m	[2] Correct working and answer for $2d$.	[2] Correct working and answer.	
(b)	$f = 22 \times 1000 = 22\ 000$ Hz $\lambda = \frac{v}{f} = \frac{1500}{22\ 000} = 0.068$ m	[2] Correct working and answer using 22Hz/220Hz/2200 Hz	[2] Correct working and answer.	
(c)			[1] Correct diagram with correct angles.	
(d)	30° 		[2] Correct working and answer.	

(e)	$f = \frac{1}{T} = \frac{1}{2.9\times10^{-7}} = 3.45\times10^{6}$ Hz $\lambda = \frac{v}{f} = \frac{3.0\times10^{8}}{3.45\times10^{6}} = 87$ m Length = $\frac{\lambda}{2} = \frac{87}{2} = 43.5 = 44$ m		[2] Correct methods but wrong answer.	[2] Correct working and answer for aerial length.
(f)		[1] 1 error	[1] Both **correct image** and correct rays : **rays must diverge to pupils** **correct construction lines shown** **ray direction shown**	
FOUR (a)		[1] Correct position for blue light.		
(b)	Dispersion.	[1] Correct answer.		
(c)	$\frac{n_1}{n_2} = \frac{v_2}{v_1} \Rightarrow \frac{1.00}{1.34} = \frac{v_2}{3.00\times10^{8}}$ $v_2 = \frac{3.00\times10^{8}\times1.00}{1.34} = 2.24\times10^{8}$ $v_2 = 2.2\times10^{8}$ m s^{-1}	[2] Correct substitution of data.	[2] Correct working and answer.	.
(d)	Sunlight contains different colours. Different colours have different frequencies (wavelengths). Each frequency / wavelength (colour) is travelling at a different speed in the raindrop so each is bent by a slightly different angle which causes the separation of colours.	[1] Different colours/ wavelengths / frequencies refract at different angles.	[1] Different colours have different speed in the raindrop OR refractive index for each colour is different in the raindrop, which causes the bending.	[1] Clearly relates colour to wavelength or frequency as the cause of different speed change and hence varying refraction.
(e)	$d = v \times t = 8900 \times (5 \times 60) = 2670\,000$	[2] Correct working and answer.		

(f)	Time lapsed between the longitudinal and transverse wave = $4 \times 60 = 240$ s Total time = 240 + 300 = 540 s $v = \frac{d}{t} = \frac{2\ 670\ 000}{540} = 4\ 944\ \text{m s}^{-1}$ $= 4\ 900\ \text{m s}^{-1}$	[2] Correct working and answer for 540 s.	[2] Correct methods but wrong answer.	[2] Correct working and answer.
	Total opportunities	**criterion 1: 10** **criterion 2: 10**	**criterion 1: 6** **criterion 2: 7**	**criterion 1: 2** **criterion 2: 3**

Judgement Statement

Physics: Demonstrate understanding of wave and light behaviour (90182)

The grade awarded is the highest one that has been demonstrated in all achievement criteria up to and including that grade.

The following is a guide to the standard required for each grade in the two criteria.

Criterion One

Achievement	Achievement with Merit	Achievement with Excellence
Total of FIVE opportunities answered at Achievement level or higher. 5 × A1	Total of SIX opportunities answered with TWO at Merit level or higher. 2 × M1 + 4 × A1	Total of SIX opportunities answered with at least ONE at Excellence level. 1 *or* 2 × E1 + 2 × M1 + 3 × A1 (Note: A total of 3 × E with at least ONE from each criterion.)

Criterion Two

Achievement	Achievement with Merit	Achievement with Excellence
Total of FIVE opportunities answered at Achievement level or higher. 5 × A2	Total of SEVEN opportunities answered with THREE at Merit level or higher. 3 × M2 + 4 × A2	Total of EIGHT opportunities answered with at least ONE at Excellence level. 1 *or* 2 × E2 + 3 × M2 + 4 × A2 (Note: A total of 3 × E with at least ONE from each criterion.)