

3	A is the correct answer as frequency is unchanged when travelling into a different medium B is not the correct answer as some of the light intensity becomes the reflected light. C is not the correct answer as the speed decreases when travelling into a more optically-dense substance D is not the correct answer as the wavelength decreases when travelling into a more optically-dense substance	(1)
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3	B is the correct answer A is not the correct answer as this would reduce the detail C is not the correct answer as this would have no effect on detail D is not the correct answer as this would reduce the detail	(1)
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9	The only correct answer is B A is not correct because amplitude will decrease C is not correct because velocity will decrease D is not correct because wavelength will decrease	1
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2	The only correct answer is B A is not correct because it has an incorrect use of the factor of 2 C is not correct because it is an incorrect arrangement D is not correct because there is no factor of 2	1
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7	B is the correct answer A is not the correct answer as distance has not been doubled C is not the correct answer as time has been doubled, instead of halved D is not the correct answer as distance has been doubled and time halved	(1)
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6	The only correct answer is D $\left(\frac{340 \times 4 \times 10^{-3}}{2}\right)$ A is not correct because this doubles time or doubles distance B is not correct because this is an incorrect rearrangement C is not correct because this does not halve distance or time	1
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1	The only correct answer is B $(2.04 \times 10^8 \text{ m s}^{-1})$ A is not correct because this is 47% of the speed of light in a vacuum C is not correct because this is the speed of light in a vacuum D is not correct because this is greater than the speed of light in a vacuum	1
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8	The only correct answer is A $(20 \times 10^{-6}) v$ $= \left(\frac{10 \mu\text{s} \times 4}{2}\right) \times v$ <i>B is not correct because incorrect reading from graph</i> <i>C is not correct because no division by 2</i> <i>D is not correct because multiplication by 2 instead of dividing</i>	1
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Question Number	Answer	Mark
17(a)(i)	Higher percentage of sugar has a larger refractive index (1) So greater refraction or smaller angle of refraction (1) (accept converse)	2
17(a)(ii)	Use of $\mu_2 = \frac{\sin i}{\sin r}$ with $i = 40^\circ$ and $r = 26^\circ$. (1) $\mu = 1.47$ (1) reads correct percentage sugar for their value of μ (1) (MP3 is dependent on MP1 being awarded) 3 <u>Example of Calculation</u> $\mu = \frac{\sin 40}{\sin 26} = 1.47$ From graph percentage sugar = 72 %	
17(b)(i)	(The) single plane containing the oscillations/vibrations (of the polarised wave) (1) And the direction of the propagation (1) (MP2 is dependent on MP1 being awarded) 2 (accept energy transfer or wave travel for propagation) (do not accept wave motion for propagation)	
17(b)(ii)	(Plane of polarisation of) filter A is perpendicular to (the plane of polarisation) of filter B (1) Or the (polarised) light from filter A is perpendicular to (the plane of polarisation) of filter B (1) (So all) the polarised light (from A) is absorbed by filter B (1) Or light transmitted by A is not transmitted by filter B 2	
17(b)(iii)	The (plane of polarisation of the) light is rotated by a small angle (do not accept 90°) (1) only a <u>component</u> of the (polarised) light is transmitted by filter B (1) Or a <u>component</u> of the light is not absorbed by filter B 2	
17(b)(iv)	(one) filter is rotated (1) until no light is detected (1) measure/record the angle through which the filter is rotated (1) Or links the angle of rotation of the filter with the angle of the plane of polarisation 3	
Total for question 17		14

Question Number	Answer	Mark																																								
*17(a)	This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning. Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning. The following table shows how the marks should be awarded for structure and lines of reasoning. <table> <tr> <td></td> <td>Number of marks awarded for structure of answer and sustained line of reasoning</td> </tr> <tr> <td>Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout</td> <td>2</td> </tr> <tr> <td>Answer is partially structured with some linkages and lines of reasoning</td> <td>1</td> </tr> <tr> <td>Answer has no linkages between points and is unstructured</td> <td>0</td> </tr> </table> Total marks awarded is the sum of marks for indicative content and the marks for structure and lines of reasoning <table> <tr> <th>IC points</th> <th>IC mark</th> <th>Max linkage mark</th> <th>Max final mark</th> </tr> <tr> <td>6</td> <td>4</td> <td>2</td> <td>6</td> </tr> <tr> <td>5</td> <td>3</td> <td>2</td> <td>5</td> </tr> <tr> <td>4</td> <td>3</td> <td>1</td> <td>4</td> </tr> <tr> <td>3</td> <td>2</td> <td>1</td> <td>3</td> </tr> <tr> <td>2</td> <td>2</td> <td>0</td> <td>2</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> </table> Indicative content IC1 <u>Photons</u> (of ultraviolet light) IC2 cause (photo)electrons to be emitted IC3 from (the surface of) the magnesium / ribbon IC4 as the (photon) energy is greater than the work function of magnesium Or as the frequency of the ultraviolet light is greater than the threshold frequency of magnesium IC5 The electrons are attracted to the positively charged gauze (and create the current). IC6 When the polarity is reversed the current is zero because the electrons no longer have enough kinetic energy to move across the gap Or When the polarity is reversed the current is zero because the work function of copper is larger than the photon energy Or When the polarity is reversed the current is zero because the threshold frequency of copper is larger than the frequency of ultraviolet light		Number of marks awarded for structure of answer and sustained line of reasoning	Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout	2	Answer is partially structured with some linkages and lines of reasoning	1	Answer has no linkages between points and is unstructured	0	IC points	IC mark	Max linkage mark	Max final mark	6	4	2	6	5	3	2	5	4	3	1	4	3	2	1	3	2	2	0	2	1	1	0	1	0	0	0	0	
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1	1	0	1																																							
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6

Question Number	Answer	Mark
12(a)	Enable pulse to return before next is emitted Or To distinguish which reflected pulse corresponds to which emitted pulse (1)	1
12(b)	Use of $v = \frac{s}{t}$ (1) Correct factor of 2 (either s or their t multiplied by 2) (1) $t = 5.9 \times 10^{-4} \text{ s}$ (1) <u>Example of Calculation</u> $t = \frac{0.10 \text{ m} \times 2}{340 \text{ m s}^{-1}} = 5.88 \times 10^{-4} \text{ s}$	3
12(c)(i)	Ultrasound is reflected away from car/sensor Or Ultrasound does not reflect (straight) back (to car) (1)	1
12(c)(ii)	Little/no reflection (detected) Or Pulse does not hit the post Or Post is not wide enough to reflect (enough of the ultrasound) (1)	1
Total for question 12		6

Question Number	Answer	Mark
11	Waves <u>reflect</u> off surrounding objects / surfaces (1) Time to return is detected (1) This time can be used to determine the distance/position of an object (1)	3
Total for question 11		3