

Q1. (2018)

05.2		an answer of 0.063 (m) scores 3 marks		AO2 6.6.1.2
	$3.0 \times 10^8 = 4.8 \times 10^9 \times \lambda$	allow $\lambda = \frac{3.0 \times 10^8}{4.8 \times 10^9}$ this mark may be awarded if the standard form values are incorrectly converted	1	
	$\lambda = 0.0625 \text{ (m)}$		1	
	$\lambda = 0.063 \text{ (m)}$ or $\lambda = 6.3 \times 10^{-2} \text{ (m)}$	allow an answer to 2 sig figs that is consistent with their calculated value of λ and has required rounding	1	

Q2. (2019)

a)

02.1	Level 3: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 6.6.1.2	E
	Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4		
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2		
	No relevant content.	0		
	Indicative content <ul style="list-style-type: none">• If two quantities have been determined, $v = f \lambda$ can be used to find the third. Frequency <ul style="list-style-type: none">• use a stopclock• count the number of waves passing a point in a fixed time period• divide the time by the number of waves to determine the time for one wave, T• $f = 1/T$• read the frequency off the oscillator Wavelength <ul style="list-style-type: none">• use a camera to freeze the image• use a metre rule to measure the distance between two wavefronts• count the number of waves between the wavefronts• divide distance by the number of waves to determine λ Velocity <ul style="list-style-type: none">• determine a mean value of frequency• determine a mean value of wavelength• measure the time it takes one wavefront to travel the length of the screen• measure the length of the screen• speed = distance / time <p>to access Level 3 there must be a description of how frequency, wavelength and velocity can be determined</p>			

b)

02.2	(the duck) moves perpendicular to the direction of wave travel	duck moves up and down is insufficient	1	AO2 6.6.1.1	E
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c)

02.3	mean maximum height = 511 and mean minimum height = 500 $511 - 500 = 11$ $11 / 2 = 5.5 \text{ (mm)}$	an answer of 5.5 gains 3 (mm) marks allow a calculated difference from incorrect means allow their difference divided by 2 any correct method of determining the mean amplitude can score 3 marks	1 1 1	AO2 6.6.1.2	E
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Q3. (2021)

a)

03.1	Level 2: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4	AO1 6.6.1.2
	Level 1: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	1–2	
	No relevant content	0	
	Indicative content Wavelength <ul style="list-style-type: none"> place a metre rule at the side of the screen perpendicular to the wave fronts use the metre rule to measure the length of the screen take a photograph of the shadow on the screen count the number of complete waves on the screen determine the wavelength by dividing the length of the by the number of complete waves or <ul style="list-style-type: none"> place a metre rule at the side of the screen perpendicular to the wave fronts take a photograph of the shadow on the screen use the metre rule to measure the distance between two wave front Frequency <ul style="list-style-type: none"> count the number of waves that pass a given point time how long it takes for the waves to pass that point using a stop clock frequency is number of waves divided by time taken or <ul style="list-style-type: none"> put a stop clock on the screen use a digital video camera to record the waves passing a point replay in slow motion and count the number of waves passing a point in 1 second <p>There must be a description of both frequency and wavelength measurement to access level 2</p>		

b)

03.2	mean $f = 9.5 \text{ Hz}$		1	AO2 6.6.1.2
	mean $\lambda = 0.020 \text{ m}$		1	
	$v = 9.5 \times 0.020$	allow a correct substitution of an incorrect value of mean frequency and/or wavelength	1	
	$v = 0.19 \text{ (m/s)}$	allow a correct calculation using an incorrect value of mean frequency and/or wavelength	1	
	or			
	$v = 9.8 \times 0.017$ and $v = 9.4 \times 0.022$ and $v = 9.3 \times 0.021 \text{ (2)}$ $v = \frac{(1.67 + 2.07 + 1.95)}{3} \text{ (1)}$ $v = 0.19 \text{ (m/s) (1)}$	allow a maximum of 2 marks if a single pair of values is used		

c)

03.3	reduces the effect of random errors	allow anomalous readings can be discarded before calculating a mean	1	AO1 6.6.1.2
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d)

03.4	deeper water means longer wavelength		1	AO3 6.6.1.2
	because			
	v increases and f is constant	allow for a fixed frequency period is constant	1	

Q5. (2022)

01.2	$f = 4000 \text{ Hz}$		1	AO2
	$T = \frac{1}{4000}$	allow a correct substitution using an incorrectly / not converted value of f	1	AO2
	$T = 0.00025$	allow a correct calculation using an incorrectly / not converted value of f	1	AO2
	seconds or s		1	AO1 6.6.1.2

Q6. (2022)

01.3	wave speed = frequency $\times$ wavelength or $v = f \lambda$		1	AO1 6.6.1.2
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Q7. (2023)

a)

01.4	wave speed = frequency $\times$ wavelength or $v = f \lambda$		1	AO1 6.6.1.2
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b)

01.5	$3.0 \times 10^8 = f \times 5.0 \times 10^{-7}$ $f = \frac{3.0 \times 10^8}{5.0 \times 10^{-7}}$ $f = 6 \times 10^{14} \text{ (Hz)}$	allow a correct rearrangement using incorrect powers of 10 allow a correct calculation of f using incorrect powers of 10 allow $6.0 \times 10^{14} \text{ (Hz)}$	1 1 1	AO2 6.6.1.2
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Q8. (2023)

a)

03.1	distance across all 8 wavelengths = 113 (mm) their distance $\times 5.0$ wavelength = 70 (mm)	allow a range from 108 (mm) to 118 (mm) allow a range from 68 mm to 72 mm	1 1 1	AO2 6.6.1.2 RPA20
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b)

03.2	$97 \times 5 = (96 + 99 + 97 + X + 97)$ $X = 96$	allow $X = (97 \times 5) - (96 + 99 + 97 + 97)$	1 1	AO2 6.6.1.2 RPA20
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c)

03.3	the spread of values about the mean is very small		1	AO3 6.6.1.2 RPA20
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Q9. (2024)

a)

01.1	Level 2: The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.		3–4	AO1 6.6.1.2 RPA20
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.		1–2	
	No relevant content		0	
	Indicative content <ul style="list-style-type: none">• use the signal generator to adjust the frequency• keep the number of masses the same• move the wooden bridge• observe a steady / stationary wave pattern• use the metre rule to measure the wavelength• repeat using different values of frequency• repeat for different stationary wave patterns			

b)

01.2	$v = f \times \lambda$		1	AO1 6.6.1.2
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c)

01.3	$35.1 = 45.0 \times \lambda$		1	AO2 6.6.1.2
	$\lambda = \frac{35.1}{45.0}$		1	
	$\lambda = 0.78$	allow 0.780	1	