Q1.

	Answer	Additional guidance	Mark
(ii)	12(.0) (cm)		**(1)** **AO1.1**

	Answer	Additional guidance	Mark
(iii)	a description to include time a wave (crest) over a measured/fixed/known/stated distance (1) use (speed =) $\frac{\text{distance}}{\text{time}}$ (1) ALTERNATIVE METHOD (determine frequency by measuring) the time taken for a set number of waves to pass a point (1) use (speed =) $f \times \lambda$ (1)	 measure how long it takes for a wave to travel a set distance measure distance travelled in a stated time (count) the number of waves in a specified time 'measure frequency' is not sufficient for this mark use (speed =) f x (0.)12	**(2)** **AO1.2**

Q2.

Question number	Answer	Additional guidance	Mark
	an explanation to include two from: waves cannot be seen (on arrival) (1) person will need another way of detecting the waves (1) (as) a person cannot count to 12 in one second / at a rate of 12 per second (1) <u>frequency</u> too high (1)	 idea of coming too fast to count / easy to lose count	**(2)**

Q3.

Question Number	Answer	Additional guidance	Mark
	an explanation linking: • measure across more than one (wavelength) (1) • divide by the number of wavelengths (1)	 use a more accurate device (finer divisions) use a camera / picture/strobe(light) (so the waves are not moving) count the number of wavelengths must be talking about **measuring**, NOT changing the wavelength etc.	**(2)** AO 3 3b

Q4.

	Answer	Additional guidance	Mark
(i)	12		**(1)** **AO1**

	Answer	Additional guidance	Mark
(ii)	$\frac{42}{12}$ (1) 3.5 (cm) (1)	 ecf from2ai allow 0.035 for 1 mark award full marks for the correct answer without working	**(2)** **AO1**

	Answer	Additional guidance	Mark
(iii)	A description to include: **either** time a crest/ripple/wavefront (1) (moving) between **P** and **Q** (1) use (wave speed =) $\frac{\text{distance}}{\text{time}}$ (1) **or** count number of crests /ripples /wavefronts passing (eg P) (1) in a given time (to find f) (1) use ($v = f\lambda$) (1)	 allow 'how long it takes' allow 'wave' for crest allow – over the 42 cm over a (set) distance allow waves if no other mark scored measure frequency for 1 mark	**(3)** **AO1**

Q5.

Question number	Answer	Additional guidance	Mark
(i)	a description to include count the number of waves(1) (arriving/passing a point) in a specific time(1) use frequency = $\frac{\text{number of waves}}{\text{time}}$ (1)	ignore in one second count the number of waves in one second scores 2 marks (MP1 and MP3) find the time between one wave and the next scores 2 marks (MP1 and MP2)	**(3)** **AO1**

Q6.

Question Number	Answer	Additional guidance	Mark
(i)	a description including count the number of waves/ripples (1) (that pass a point) in a certain time (1) OR measure the time for a certain number of waves/ripples (1) use of f = 1/T (1)	accept use of numerical values calculate the number of waves that pass the point in a second scores 2 marks	**(2)** **AO1**

Question Number	Answer	Additional guidance	Mark
(ii)	a description including any two from the waves/ripples are made to look stationary (1) measure the distance across a number of waves/wave fronts/ripples (1) calculate the wavelength from the measurements (1)	 using camera, video, strobe light, stroboscope, mobile, phone, photo(graph) accept measure the distance across a number of lines divide distance by the number of waves/ripples accept the idea of measuring the distance between one wave/ripple/line and another (successive) wave/ripple/line for 2 marks	(2) AO1