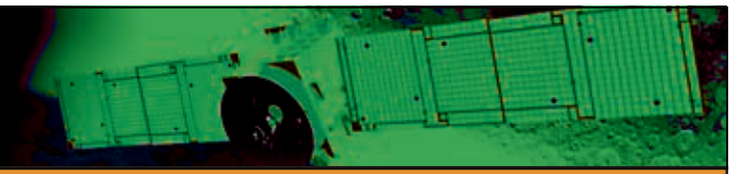

Particles, Waves and Quanta: Set 12

Set	Problem	Solution
9	1	340 m s^{-1} = 331 + 0.6 T_1 1 343 m s^{-1} = 331 + 0.6 T_2 2 2-1 3 m s^{-1} = 0.6 ($T_2 - T_1$) 3 / 0.6 = ($T_2 - T_1$) 5 °C = ($T_2 - T_1$)
	2	$\lambda = \frac{v}{f} = \frac{3 \times 10^8\ m\ s^{-1}}{720 \times 10^3\ Hz}$ λ = 420 m
	3	For sound travelling round the fence : 1310 m $s^{-1} = \frac{\pi r}{t}$ For sound travelling across the circle: 330 m $s^{-1} = \frac{2r}{t+0.3}$ Rearrange the first equation to give: $t = \frac{\pi r}{1310}$ Substitute for t into the second equation: 1037 r + 129690 = 2620 r r = 82 m
	4a	$\lambda = \frac{distance}{number\ of\ waves} = \frac{2\ m}{42}$ λ = 50 mm
	4b	$speed = \frac{distance}{time} = \frac{2\ m}{5\ s}$ = 0.4 m s^{-1}
	4c	$frequency = \frac{number\ of\ waves}{time} = \frac{42}{5\ s}$ 8.4 Hz
	5a	$frequency = \frac{number\ of\ waves}{time} = \frac{1}{2\ s}$ 0.5 Hz
	5b	Period = 1 / freq = 1 / 0.5 Hz 2 s
	6a	10 mm
	6b	8 µs
	6c	125 kHz
	7	The distance between athletes give athletes closer to the starting pistol a slight advantage.
	8	a) A sound increasing in pitch but keeping the same volume. b) A sound getting louder without changing pitch.
	9a	For all of Q9 use $\lambda = 3 \times 10^8$ m s^{-1} /f 1.3 m
	9b	17 mm
	9c	4.9 mm
	9d	3.4 km
	10	Initially there is no change in speed with depth as there is no change in temperature. As depth increases speed decreases, to a minimum and then begins to increase at greater depth.
	11	Sound travels faster in hotter gases: changes in temperature change the density of air (decreases) without changing its elasticity.
	12	Lower frequencies have larger wavelengths and are diffracted more, so more likely to be transmitted around barriers.
	13a	It takes time for her to hear the sound.
	13b	too short
	13c	Assume the speed of sound in air is 343 m s^{-1}. $time = \frac{distance}{speed} = \frac{100\ m}{343\ m\ s^{-1}}$ time = 0.29 s
	14a	George (larger amplitude)
	14b	Jane (greater distance between peaks)
	14c	George (more peaks in same time)