

Question 23 (Answer: B)

- Loudness is set by the amplitude and pitch by the frequency.
- The loudness does not change, so the amplitude is constant.
- The pitch varies, so it is the frequency that is changing.

Question 23 (Answer: C)

- Sound is longitudinal, so the particles bunch up and spread out along the direction of travel.
- In a compression the particles are closer together, so the pressure is higher.
- In a rarefaction they are further apart, so the pressure is lower – the wavelength is the same throughout.

Question 23 (Answer: D)

- Amplitude controls loudness, so a smaller amplitude makes the sound quieter.
- Frequency controls pitch, so a lower frequency makes the pitch lower.
- Both decrease here, so the sound is quieter *and* lower.

5(a)	(speed of sound in air =) 330 m/s $\leq$ value $\leq$ 350 m/s AND (speed of sound in water) is faster			
5(b)	Yes AND (normal) human hearing range is 20 Hz to 20 kHz (and all dolphin sounds lie in this range)			
	Yes AND all the dolphin sounds are in the range of human hearing			
5(c)	Frequency kHz	amplitude	loudness	pitch
	14	Large	loud	high
	8	small	soft / quiet	low
	one mark for each column correct			
5(d)	Particles			
5(d)	high pressure AND low pressure			
	Parallel			

Question 23 (Answer: D)

- The frequency is fixed by the source, so it does not change when the wave enters the steel.
- Sound travels much faster in a solid than in air.
- Since $v = f\lambda$ with f unchanged, a higher speed means a longer wavelength.

Question 22 (Answer: C)

- A compression and the nearest rarefaction are *half* a wavelength apart.
- So $\lambda = 2 \times 2.5 = 5.0 \text{ cm} = 0.050 \text{ m}$.
- $f = v/\lambda = 330/0.050 = 6600 \text{ Hz}$.

Question 23 (Answer: D)

- Medical scanning of soft tissue uses ultrasound.
- It reflects at boundaries between tissues, and unlike X-rays it does not ionise.
- That makes it safe for scanning a fetus.

Question 22 (Answer: A)

- Light reaches Y effectively instantly, so the delay is entirely the sound's travel time.
- $t = d/v = 100/340$.
- $= 0.29 \text{ s}$.