

8.2.2 SOUND

Features of a wave model can be used to account for the properties of sound

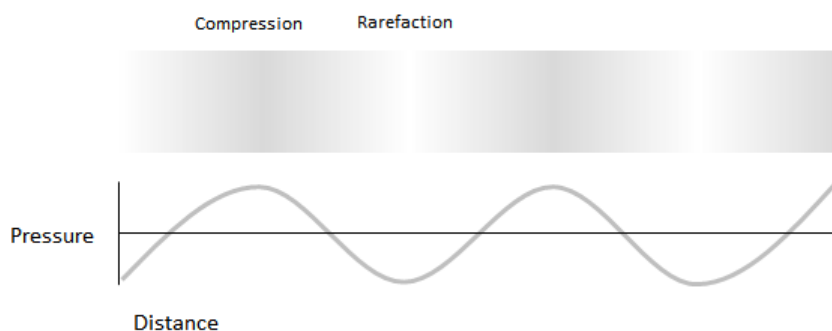
2.1 Identify that **sound waves** are **vibrations or oscillations** of particles in a medium

- Sound waves are **longitudinal waves in any medium** formed by **compressions and rarefactions** of particles
- A **drum** causes difference in **air pressure** (gas) due to **vibration of drum membrane**



2.2 Relate **compressions and rarefactions** of sound waves to the **crests and troughs** of **transverse waves** used to represent them

- Longitudinal waves can be represented as a transverse wave by **replacing displacement** (of transverse wave particles) **with pressure**



2.3 Explain qualitatively that **pitch is related to frequency** and **volume to amplitude** of sound waves

- Pitch is how **high or low** a note is, **directly related to frequency**:
 - The **higher the pitch**, the **higher the frequency** as there are more vibrations
 - Amplitude remains the same
- Volume is how **loud or soft** a note is, **directly related to amplitude**:
 - The **higher the volume**, the **higher the amplitude** as there is more energy emitted
 - Frequency remains the same

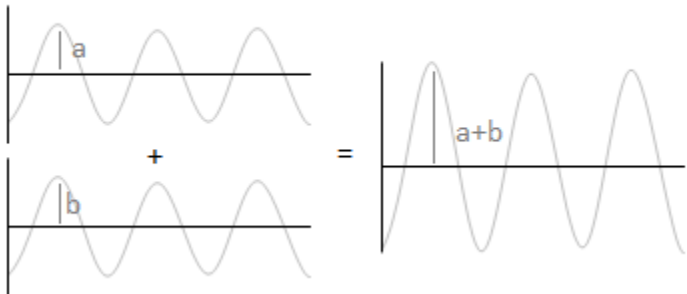
2.4 Explain an **echo** as a **reflection** of a sound wave

- Echo occurs as sound is **reflected from an object** back to the source
 - Source **does not absorb much energy**, therefore sound wave is heard again, softer
- Speed of sound is ≈ 340 m/s,
 - E.g. sound from a distance of 17 metres = echo in 0.1 seconds (0.05 to and back)

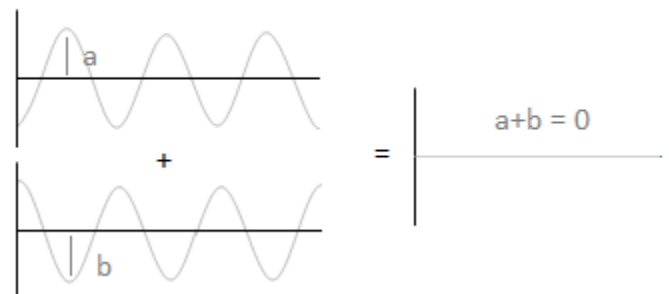
2.5 Describe the principle of **superposition** and compare the **resulting waves** to the **original waves** in sound

- Occurs when two or more sources of vibration **interfere** with each other
- Superposition: the **amplitude** of the **combined wave** is equal to **sum of amplitudes of component waves**
 - **Constructive interference** (reinforcement) and **destructive interference** (cancellation)

constructive interference



destructive interference



- Interference can occur in sound – **two loudspeakers** connected to same oscillator (so, same amplitude and wavelength)
 - Regions of **increased loudness** (constructive) – anti-nodes
 - Regions of **quietness** (destructive) – nodes
- Also occurs with light, with regions of light and dark

