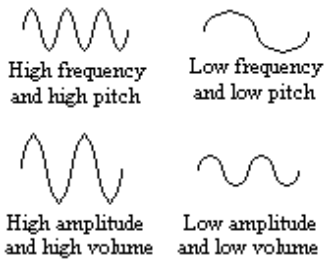
Physics Revision Notes – Waves

1. All waves carry energy from one place to another. There are two types of waves:
   - **Transverse waves** have vibrations perpendicular to the direction of travel (e.g. all electromagnetic waves).
   - **Longitudinal waves** have vibrations in the same direction as that in which they are travelling (e.g. sound waves).
2. The following words are used to describe waves:
   - **Amplitude** – the distance from the horizontal axis to the peak (in m).
   - **Wavelength (**λ**)** – the distance from peak to peak, or trough to trough (in m).
   - **Frequency** – the number of complete waves per second (in Hz).
   - **Period** – the time taken for one complete wavelength (in s).
3. All waves can be reflected, refracted and diffracted:
   - **Reflection** – a wave bouncing off a surface.
   - **Refraction** – a wave bending when it passes through a different medium.
   - **Diffraction** – a wave spreading out when it passes through a narrow gap.
4. The **wave formula**:

$$\text{Velocity (m/s)} = \text{Frequency (Hz)} \times \text{Wavelength (m)} \quad - \quad v = f \times \lambda$$

5. **Sound** is a longitudinal wave:
   - The amplitude is related to its **volume** (a higher amplitude means a higher volume).
   - The wavelength is related to its **pitch** (a shorter wavelength means a higher pitch).
6. Sound is produced by objects **vibrating**:
   - The **strings** on a violin.
   - The **surface** of a drum.
   - The **air** in a trumpet.
   - The **reeds** in an oboe.
7. A **cathode ray oscilloscope** shows sounds as transverse waves:



8. **Ultrasound** is a high frequency sound wave, and is used in industry, medicine, quality control and sonar by transmitting the waves, and observing the way in which they are reflected back.
9. The Earth consists of a **crust**, a **mantle**, a liquid **outer core**, and a solid **inner core**.
10. There are two types of **seismic waves**:
    - **P-waves** are longitudinal. They travel through solids and liquids and are fast.
    - **S-waves** are transverse. They will only travel through solids and are slower than p-waves.
11. Properties of **reflection**:
    - The **angle of incidence** is always equal to the **angle of reflection**.
    - An **image** is virtual, laterally inverted, and the same distance from the mirror as the **object**.
12. Properties of **refraction**:
    - If a wave enters a denser medium (e.g. a perspex block), it will be **bent towards the normal**. The emerging ray will come out at the same angle, but displaced.
    - A **prism** can be used to split white light into the **visible spectrum**.
    - When a wave passes into a different medium, it will either slow down or speed up.
13. Properties of **total internal reflection**:
    - **Total internal reflection** is when a wave reflects off the inside of a block, rather that refracting out of it.
    - The **critical angle** for perspex is about 43°.
    - This principle is used in **fibre optics** (e.g. with endoscopes in medicine).