P3.3 Knowledge Organiser

Science Mastery

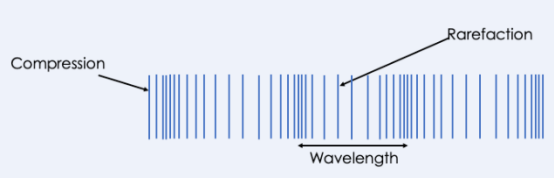
Types of wave

1. Waves transfer **energy**
2. There are two types of wave;

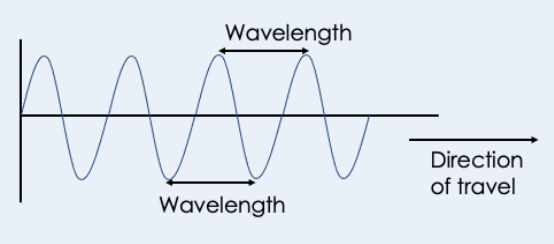
Longitudinal:

And **Transverse**:

3. Longitudinal waves have **oscillations parallel** to the direction of energy transfer



4. Longitudinal waves show areas of **compression** and **rarefaction**
5. A sound wave is an example of a longitudinal wave
6. Transverse waves have **oscillations perpendicular** to the direction of energy transfer
7. A light wave is an example of a transverse wave



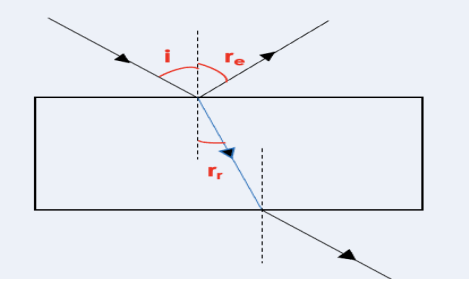
Properties of waves

8. Waves can be **reflected** or **refracted**
9. Reflection is when light bounces back the direction it came from at a boundary between materials
10. Refraction is when light changes speed as it moves from one medium to another, so light bends towards or away from the normal
11. **Frequency –** The number of waves that pass a point each second. The unit is Hertz (Hz)
12. **Period –** The length of time it takes one wave to pass a given point. The unit is seconds (s)
13. **Wavelength** - the distance from one point on one wave to the identical point on the next wave. The unit is metres (m)
14. **Amplitude -** the maximum distance of a point on the wave from its rest position
15. The **peak** is the highest point of the wave and the trough is the lowest point
16. Humans can only hear frequencies between 20 and 20000Hz. Anything above this is called **ultrasound**.

Investigating reflection and refraction

17. The method for investigating reflection and refraction is;

- Use the ruler to draw a straight line near the middle of the A3 paper.
- Use the protractor to draw the normal at right angles to the first line
- Place the first transparent block against the ruler line and draw around it.
- Place the slit (and lens if required) into the ray box and switch on the power.
- Direct the ray of light at an angle at the point where the normal line meets the block.
- You should observe incoming and outgoing rays. Mark these with crosses.
- Switch off the ray box and join up the crosses to make three straight lines. Then label these.
- Measure the angles of incidence, reflection, and refraction with the protractor and record these.



Velocity of waves

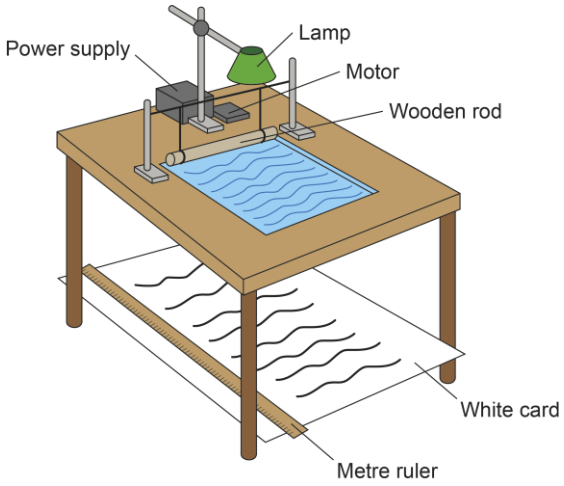
18. The velocity of a wave is the **speed** in the **direction** the wave is travelling
19. The equation that links velocity of a wave, displacement of a wave and time is;
    Velocity = displacement/time
20. The equation that links velocity of a wave, frequency and wavelength is:
    Velocity = frequency x wavelength
21. The unit of velocity is metres per second (m/s)

22. The unit of displacement is metres (m)
23. The unit of time is seconds (s)
24. Sound waves can travel through solids, causing vibrations in the solid
25. Sound waves can travel through air
26. People hear sound due to the sound wave vibrating the **ear drum**

Investigating waves

27. To investigate waves we can use a **ripple tank** or a **string** and frequency generator.
28. The method for finding the velocity of a wave in a **ripple tank** is;

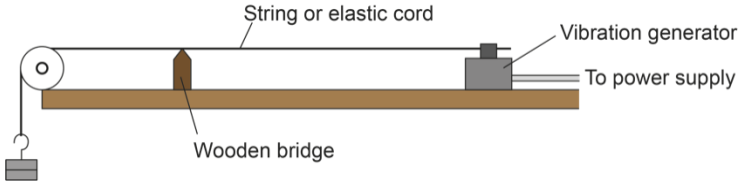
- Set up the equipment as per the diagram.



- Pour approximately 5mm depth of water into the tank.
- Adjust the wave generator so it is contact with the surface of the water (not submerged).
- Switch off the room lights and switch on the lamp and motor.
- Set the motor speed so as to produce low frequency waves.
- Set the lamp height so that the wave pattern is clearly visible.
- Using the ruler, measure the length across as many waves as possible, then divide by the number of waves. Record this as the 'wavelength'.
- Count the number of waves passing a fixed point in a given number of seconds (for instance, twenty seconds). Then divide by the number of seconds. Record this as the 'frequency'.
- Wave speed can be calculated with the equation:
  Wave speed = frequency x wavelength

29. The method for finding the velocity for a **wave on a string** is;

- Set up the equipment as per the diagram.



- Start the vibration generator and adjust the tension of the string, the position of the wooden bridge, and/or the vibration frequency until you see a clear stationary wave.
- Measure across as many half wavelengths as possible, then divide this length by the number of half waves. Double this number and record it as the 'wavelength'.
- Record the frequency of the signal generator as the 'frequency'.
- Repeat the experiment for different frequencies.
- Wave speed can be calculated with the equation:
  Wave speed = frequency x wavelength

Using waves

30. Waves can be **absorbed**, **reflected** or **transmitted** at the boundary between materials
31. Ultrasound waves are **partially reflected** at the boundary between two materials. The **time taken** to reach a detector can determine **how far away** an object is
32. Ultrasound can be used for **seeing unborn babies**, finding cracks in pipes and finding how far away underwater objects are.
33. **Seismic waves** have helped us understand the **structure** of the **earth**
34. There are two types of seismic waves. **S-waves** and **P-waves**
35. S-waves cannot travel through a liquid. P-waves and S-waves provide evidence for the structure and size of the Earth's core.