P11 Wave Properties Knowledge Organiser (Triple)

Mechanical wave	•A wave made up of vibrations travelling through a medium •E.g. Water, sound waves, waves on springs •Must have a medium to travel through
Electromagnetic wave	•An electrical and magnetic disturbance that transfers energy from a source to an absorber •All EM waves travel at 3 x 10^8 m/s (the speed of light!) •E.g. Visible light, X-rays, Infrared
Transverse wave	•A wave that oscillates perpendicular (90^o) to the direction of energy transfer •All EM waves are transverse.
Longitudinal wave	•A wave that oscillates parallel to the direction of energy transfer. •Sound waves are longitudinal
Peak/crest	•The maximum height above the zero line for a wave (maximum positive displacement)
Trough	•The maximum depth below the zero line for a wave (maximum negative displacement)
Amplitude	•The maximum positive or negative displacement of a point on a wave from the rest position •To measure, measure from the zero line to the highest part of a peak or lowest part of a trough
Wavelength, λ	•The distance from a point on one wave to the same point on the next wave, i.e. Peak to peak •Measured in m
Frequency, f	•The number of waves passing a particular point per second •Measured in Hertz, Hz •1 Hz = 1 wave per second
Period , T	•The time taken for one complete oscillation •Period T = 1 ÷ f •Measured in s

Wave speed , v	•The speed at which a wave moves through a medium •This can be calculated if we know the frequency and wavelength of a wave • v = f x λ •Measured in m/s •All EM waves travel at the speed of light, 3 x10^8 m/s
Incident wave	•The wave that comes from a source and interacts with a boundary/medium
Reflection	•Angle of incidence, i = angle of reflection, r
Refraction	•When waves move from one medium to another at a non-zero angle to the boundary between the two substances, the wavefronts change direction. •Caused because wavefronts travel at different velocities (and therefore wavelengths) in the different media. •Because part of the wavefront changes direction before the rest of it, it slows down first and is refracted towards the normal.
Transmission	•When waves aren't absorbed by the medium they travel through and pass through it. •This depends on the wavelength of the waves
Absorption	•When some of the energy from the waves travelling through a medium is transferred to the medium. •This depends on the wavelength of the waves.
Investigating waves	•To measure the speed of sound in air, time how long a sound wave takes to reach a wall and echo back. Use the formula s = 2d ÷ t to calculate the speed •A ripple tank can be used to measure wave speed of water waves.

Key Equations To Learn	
Wave Speed, v	Wave speed = frequency x wavelength v = f x λ

Sound waves	•Longitudinal waves that need a medium to travel through •The higher the frequency of the wave, the higher pitched the sound is •The greater the amplitude of a sound wave, the louder the sound will be. •Sound waves can travel through solids. This causes vibrations in the solid.
Hearing	•Sound waves cause the ear drum to vibrate. This causes other parts of the ear to vibrate, sending signals to the brain. This causes the sensation of sound. •Sound waves can only be converted into vibrations in solids over a particular range of frequencies. •This means that because the ear drum is a solid, the frequency range that a human ear detects is limited. •The frequency range a human ear can detect is 20 Hz to 20 kHz
Echo sounding	•When pulses of high frequency sound waves are used to detect objects in deep water and to measure depth. • A sound wave pulses are sent from a transmitter on a ship. They reflect off the object/seabed and travel back to a receiver. The time taken is measured and the distance between the ship and the object can be calculated. •Distance = 0.5 v x t, where v is the speed of sound in water and t is the time taken for the pulse to reach the receiver.
Seismic waves	•Waves that travel through the Earth caused by earthquakes. •The nearest point on the surface to the focus is the epicentre. •There are three kinds: P, S and L-waves.
P-waves	•P-waves are longitudinal and push and pull on material as they move through the Earth. •They travel at different speeds in liquids and solids.
S-waves	•S- waves are transverse waves •Cannot travel through liquids
L-waves	•Only happen in the Earth's crust
Earth's structure	•Seismic waves can be used to work out the Earth's structure. •There are shadow zones on the surface where no P or S waves are detected. •P-waves are refracted at the boundary between the mantle and the outer core and again when they leave. The second refraction is further around so is in the shadow zone. This shows that the Earth has a liquid outer core. •S-waves cannot travel through liquids. This also shows that the Earth has a liquid outer core.
Ultrasound	•Ultrasound waves are sound waves that have a frequency higher than 20kHz. Humans cannot hear them. •Used in medical imaging or in industrial imaging •Uses a transducer to send out and receive pulses of ultrasound waves. •The waves are partially reflected when they reach the boundary between two different substances e.g. Bone and muscle. •The time taken for the different reflections to reach the transducer is used to build an image. •If a boundary is further away, the reflected pulse will take longer to reach the transducer.