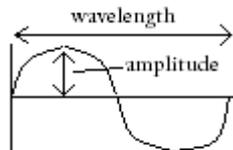


Topic 5 Light and the electromagnetic spectrum - Core Questions

You must learn the answers to each of these questions. **Bold indicates higher tier only.**

What do waves transfer?	Energy from the source to the observer. They can transfer information but not matter.
All of the electromagnetic waves including light are what type of wave?	Transverse waves
Which type of waves has the direction of the vibration is perpendicular to the direction of energy travel?	Transverse
What is the wavelength and what is it measured in?	The length of 1 complete wave cycle. It is measured in meters (m).  A diagram of a transverse wave on a horizontal axis. A horizontal double-headed arrow above the wave is labeled 'wavelength', spanning one full cycle from a crest to the next crest. A vertical double-headed arrow from the equilibrium line to a crest is labeled 'amplitude'.
What is the frequency of a wave and what is it measured in?	The number of waves in 1 second and the unit is Hertz (Hz)
What is wave velocity and how is it different to wave speed?	Wave velocity describes both how fast the wave is travelling (m/s) and in which direction. It is a vector quantity. Wave speed is only how fast the wave is going (still m/s). It is a scalar quantity.
What variable affects the speed of a light wave?	What the wave is moving through.
Which two equations can be used to find the velocity of a wave?	Distance / time and frequency x wavelength.
In calculation questions what must you remember to do?	Substitute in values in standard units, show working out clearly and show the units on the answer. Triangles are a tool to help us re-arrange equations.
Describe how to measure the velocity of sound in a solid like steel.	Suspend the steel rod and hit it with a hammer. Use a frequency app to record the peak frequency (or a microphone and oscilloscope). Measure the length of the steel rod. Wavelength = 2 x length and so divide the length by 2 to find wavelength. The speed (in m/s) will be frequency (Hz) x wavelength (m).
What happens to light as it passes from one material to another?	Some of it will be reflected (bounced off) and some will be refracted (bent through).
What is refraction and what causes it?	Refraction is the bending (change of direction) of a wave as it passes between different materials. It is caused by the slowing down or speeding up of the wave as it travels from one density to a different density.
As light travels from a more dense material to a less dense material, what direction will it bend in?	Away from the normal line.
If light is allowed the travel into a glass block and out of the other side again, what would you notice about the incident ray and the emergent ray?	They will be parallel to each other. You might also notice the incident ray is slightly brighter than the emergent ray as some energy may have been absorbed by the glass as the wave is transmitted through.

If a wave travels 90 °to the surface (along the normal line) of a material what will not change and what will change?	Direction will not change but speed still will. This means that the wavelength will change for a constant frequency but the direction of the wave will continue in a straight line and not bend.
What type of substances absorb waves?	Light waves are absorbed by black materials.
What type of substances reflect waves?	Mirror and shiny materials reflect light waves.
What type of substances transmit waves?	Clear materials like glass and plastic transmit light waves.
What property of the wave is the behaviour (absorption, transmission, reflect or refract) dependent on?	The wavelength of the wave.
How did Herschel and Ritter discover waves outside the limit of the visible spectrum?	Herschel noticed that if you split visible light up and measured the temperatures of the different colours the red light was hottest. He then moved the thermometer just outside the red colour where he could see no light and the thermometer recorded an even higher temperature. He called this wave energy Infrared. Ritter also split visible light up but looked for wave energy at the other end of the spectrum (the other side of the violet light). He tried to detect the presence of wave energy using silver chloride that he knew reacted with violet light faster than red light. He found that an unseen energy at this point in the spectrum made the silver chloride react even quicker. He called this energy Ultraviolet.
What are the colours of light in the visible spectrum? (Start with the longest wavelength)	Red, Orange, Yellow, Green, Blue, Indigo, Violet.
What is the order of waves in the electromagnetic spectrum? (Start with the longest wavelength)	Radio waves, Microwaves, Infrared waves, Visible light, Ultraviolet rays, X-rays, Gamma rays.
Which part or parts of the electromagnetic spectrum can we detect with our eyes?	Only visible light.
Which travels faster in a vacuum light or radio waves?	Neither, all electromagnetic waves travel at the same speed in a vacuum (3×10^8 m/s).
Which end of the electromagnetic spectrum has waves of the longest wavelength?	Radio waves
Which end of the electromagnetic spectrum has waves of the highest frequency?	Gamma rays
What are the harmful effects of excessive exposure to: 1. Microwaves 2. Infrared 3. Ultraviolet 4. X-rays and gamma rays?	1. Internal heating of body cells 2. Skin burns 3. Damage to surface cells and eyes, leading to skin cancer and eye conditions 4. Mutation or damage to cells in the body
What can happen to an atom if it is exposed to harmful electromagnetic waves?	The atom may gain enough energy to have an electron removed. This leaves it charged and so it becomes an ion.
As the frequency of a wave increases, what happens to the potential danger?	It increases too because of the increased energy.

What can be used to produce radio waves in a transmitter?	Oscillations in electrical circuits in the transmitter. These oscillations can induce radio waves.
Name some of the uses of: <ol style="list-style-type: none"> 1. Radio waves 2. Microwaves 3. Infrared 4. Visible light 5. Ultraviolet 6. X-rays 7. Gamma rays 	<ol style="list-style-type: none"> 1. Broadcasting, communications and satellite transmissions. 2. Cooking, communications and satellite transmissions 3. Cooking, thermal imaging, short range communications, optical fibres, TV remote controls and security systems. 4. Vision, photography and illumination. 5. Security marking, fluorescent lamps, detecting forged bank notes, disinfecting water. 6. Observing the internal structure of objects, airport security scanners and medical X-rays. 7. Sterilising food and medical equipment and the detection of cancer and its treatment.
Name 3 types of ionising electromagnetic radiation that transfer energy?	Short frequency UV rays, X-rays and gamma rays
What is a spectrometer?	A device that can split up the different wavelengths of light. (It splits light into its different colours).
Name a common object that could be used as a spectrometer.	A CD or DVD or a prism (a triangular shaped piece of glass).
What is the advantage of the Hubble space telescope?	As it is situated above the atmosphere so that light from distant objects enters it without being refracted or reflected which creates clearer images.