CIE Physics GCSE

Topic 3.1 - General Wave Properties

Flashcards

What is a wave?

What is a wave?

A regular disturbance transferring energy in the direction of the wave's propagation **without transferring matter**.

What is a transverse wave?

What is a transverse wave?

A wave in which oscillations are at right angles (perpendicular) to the direction of motion.

Give examples of transverse waves

Give examples of transverse waves

Waves on a string, all electromagnetic waves (eg. visible light), ripples on water, vibrations on guitar strings

What is a longitudinal wave?

What is a longitudinal wave?

A wave where the oscillations are parallel to (in the same direction as) the direction of motion.

Give examples of longitudinal waves

Give examples of longitudinal waves

Pulses along a spring, sound waves, ultrasound

Transverse waveforms have...

Transverse waveforms have...

Peaks and troughs

Longitudinal waveforms have...

Longitudinal waveforms have…

Compressions and rarefactions

Wavelength is...

Wavelength is...

The shortest distance between the same point on two consecutive waves (e.g. the distance between two consecutive peaks)

Displacement is...

Displacement is...

- The distance from equilibrium position
- At maximum distance (peaks or troughs), this is the **amplitude** (the maximum displacement of the wave)

Frequency is...

Frequency is...

The number of complete waves passing a given point per second, or the number of waves per second produced by the source.

State the wave equation (supplement)

State the wave equation (supplement)

$$v = \lambda \times f$$

- v = velocity (m/s)
- λ = wavelength (m)
- f = frequency (Hz)

What is refraction?

What is refraction?

Refraction is the change in **speed** of a wave when crossing a boundary between two media, resulting in a change in direction.

What property of a wave is **not** changed by refraction?

Which property of a wave is **not** changed by refraction?

The frequency.

What happens when waves are incident on a flat surface?

What happens when waves are incident on a flat surface?

Reflection.

A stronger reflected wave is produced when...

A stronger reflected wave is produced when...

The surface is smoother.

Why do rough surfaces appear matt when illuminated?

Why do rough surfaces appear matt when illuminated?

The reflected rays light are scattered in all directions.

When entering a denser material, light waves…

When entering a denser material, light waves...

...slow down and bend towards the **normal.**

When entering a less dense material, light waves…

When entering a less dense material, light waves...

...speed up and bend away from the **normal.**

What is diffraction?

What is diffraction?

The spreading out of waves passing through a narrow gap or across an edge.

What size of gap produces the largest diffraction?

What size of gap produces the largest diffraction?

A gap of the same width as the wavelength of the wave passing through it.

What is a ripple tank?

What is a ripple tank?

A shallow glass tank with an oscillating paddle/needle to create waves. It is illuminated from above so waves can be seen on the surface below the tank.

Describe how to demonstrate reflection using a ripple tank.

Describe how to demonstrate reflection using a ripple tank.

Waves will reflect off the glass sides of the tank.

Describe how to demonstrate refraction using a ripple tank.

Describe how to demonstrate refraction using a ripple tank.

Place a glass box across half of the floor of the ripple tank. The waves will change speed when travelling through the less dense area.

Describe how to demonstrate diffraction using a ripple tank.

Describe how to demonstrate diffraction using a ripple tank.

Place two glass blocks in the middle of the tank, leaving a small gap, and observe the wave patterns.

CIE Physics GCSE

Topic 3.2 - Light

Flashcards

What happens when rays of light hit a plane mirror?

What happens when rays of light hit a plane mirror?

They are reflected.

What are the characteristics of an image formed from a plane mirror?

What are the characteristics of an image formed from a plane mirror?

- The same size as the object
- On the the same side of the mirror as the object
- An **inverted** (upside down) version of the object

When light is reflected, how do angles i and r compare?

When light is reflected how do angles i and r compare?

angle of incidence = angle of reflection

How are the angles of incidence and reflection measured?

How are the angles of incidence and reflection measured?

Relative to the normal.

What is a virtual image? (supplement)

What is a virtual image? (supplement)

An image produced on the same side of the lens as the object.

What is a real image? (supplement)

What is a real image? (supplement)

- An image produced on the opposite side of the lens from the object.
- A real image can be formed on a screen as the light rays cross after the lens.

What kind of image is produced by a plane mirror? (supplement)

What kind of image is produced by a plane mirror? (supplement)

A virtual image.

What is refraction?

What is refraction?

Refraction is the change in **speed** of a wave crossing a boundary between two media, resulting in a change in direction.

What property of a wave is **not** changed by refraction?

Which property of a wave is **not** changed by refraction?

The frequency

What is the critical angle?

What is the critical angle?

The angle of incidence which produces an angle of refraction of 90°.

What is internal reflection?

What is internal reflection?

When light reaches a boundary and is reflected back into the medium which it came from.

What is total internal reflection?

What is total internal reflection?

When a ray of light is fully reflected back into the medium it came from, when reaching a boundary between media.

When does total internal reflection occur?

When does total internal reflection occur?

When the angle of incidence is greater than the critical angle.

Define refractive index (supplement)

Define refractive index (supplement)

The ratio of the speed of light in a vacuum to the speed of light in any given medium.

Give the equations for refractive index (supplement)

Give the equations for refractive index (supplement)

$$\text{refractive index} = \frac{\sin(i)}{\sin(r)}$$

$$\text{refractive index} = \frac{1}{\sin(i)}$$

When light passes through a converging lens...

When light passes through a converging lens...

The light rays bend towards the normal, and meet at a **focal point**.

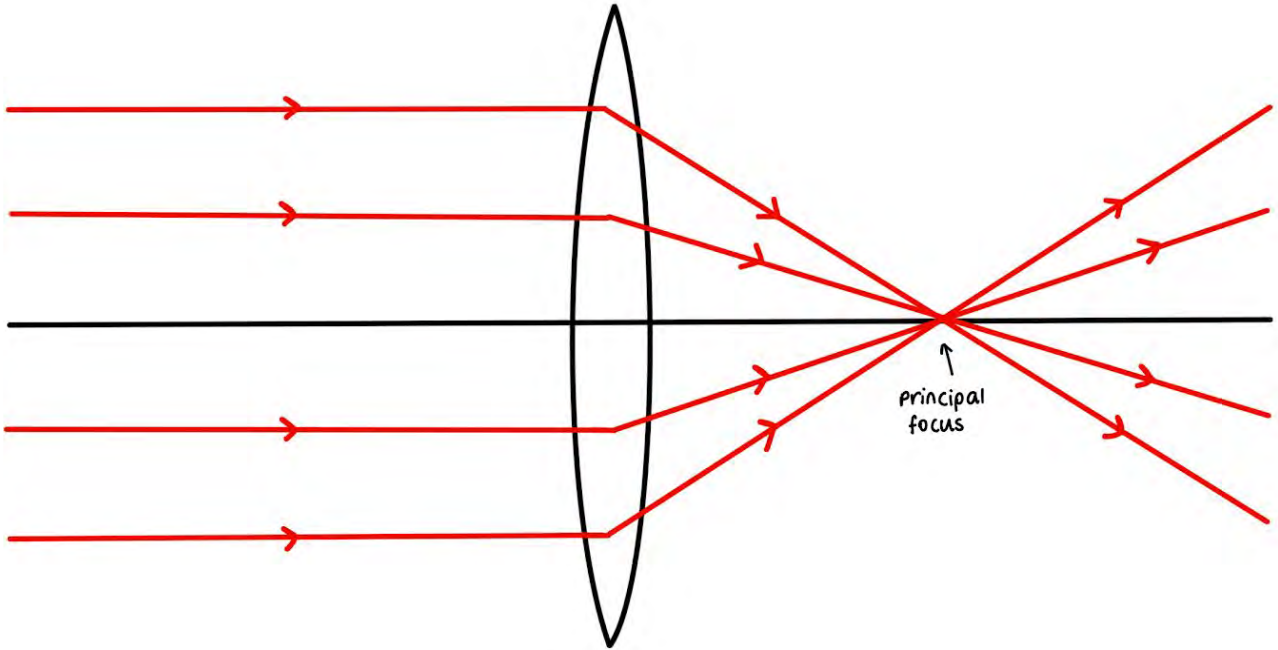
What is the principal focus of a lens?

What is the principal focus of a lens?

A focal point before a convex lens, from which the light rays appear to come from, or the focal point after a concave lens where all the rays meet.

Draw a diagram of light rays through a converging lens

Draw a diagram of light rays through a converging lens



How can lenses act as magnifying glasses?

How can lenses act as magnifying glasses?

By producing an enlarged, virtual image.

How does wavelength affect refraction?

How does wavelength affect refraction?

Shorter wavelength waves refract **more.**

What happens when white light is shone through a prism?

What happens when white light is shone through a prism?

It separates into a spectrum of all its coloured light components.

Why is white light separated by a prism?

Why is white light separated by a prism?

Each different coloured light wave has a different wavelength. The shortest wavelength light (blue) refracts the most while longer wavelengths (red) refract more, producing a spectrum.

List, in the correct order, the colour spectrum produced by the dispersion of white light

List, in the correct order, the spectrum of colours produced by the dispersion of white light

Red, orange, yellow, green, blue, indigo and violet.

What is monochromatic light?
(supplement)

What is monochromatic light? (supplement)

Light of a single frequency.

CIE Physics GCSE

Topic 3.3 - Electromagnetic Spectrum

Flashcards

State the 7 electromagnetic waves found in the electromagnetic spectrum in order of increasing wavelength.

State the 7 electromagnetic waves found in the electromagnetic spectrum in order of increasing wavelength.

Gamma, X Ray, UV, Visible, Infrared, Microwaves, Radio

What is the highest frequency electromagnetic wave?

What is the highest frequency electromagnetic wave?

Gamma waves

What is the highest energy electromagnetic wave?

What is the highest energy electromagnetic wave?

Gamma waves

What is the speed of EM waves in a vacuum? (supplement)

What is the speed of EM waves in a vacuum? (supplement)

$3x10^8$ m/s

A wave transmits energy from...

A wave transmits energy from...

...source to absorber.

e.g. from a light source to the eye

What range of frequencies of electromagnetic waves can be detected by the human eye?

What range of frequencies of electromagnetic waves can be detected by the human eye?

400-700 nanometres

What properties are shared by all electromagnetic waves?

What properties are shared by all electromagnetic waves?

- They are all transverse waves
- They all travel at the same speed (10^8 m/s)
- They can travel through a vacuum

State and explain a use of radio waves.

State and explain a use of radio waves.

Communications, because radio waves are long wavelength and can travel long distances without losing quality.

State and explain a use of microwaves.

State and explain a use of microwaves.

Cooking, as microwaves are absorbed and heat fat/water in foods.

State uses of infrared radiation.

State uses of infrared radiation.

Cooking food (as it transfers thermal energy), infrared cameras and short range communication.

State and explain uses of visible radiation.

State and explain uses of infrared radiation.

Illuminating (i.e. seeing) and fibre optics, as they reflect best in glass (other waves have wavelengths that are too long/short).

State and explain uses of UV radiation.

State and explain uses of UV radiation.

Sterilisation, as it kills bacteria, energy efficient lamps, as it radiates low heat but high energy, and sun tanning etc.

State and explain uses of X rays.

State and explain uses of X rays.

Medical imaging and treatment, because they are very high energy and can easily penetrate body tissues.

State and explain uses of gamma rays.

State and explain uses of gamma rays.

Gamma rays are used in medical treatments, such as radiotherapy in the treatment of cancer.

How does UV radiation affect body tissue?

How does UV radiation affect body tissue?

- UV radiation can cause cancer when skin is exposed to it.
- It can cause blindness if eyes are overexposed to UV radiation.

How do X-rays affect body tissue?

How do X-rays affect body tissue?

X-rays are ionising so they can damage or kill cells and cause mutations that could lead to cancer.

How do gamma rays affect body tissue?

How do gamma rays affect body tissue?

Gamma rays are even more ionising than X-rays, so they can cause cell mutations (which can lead to cancer) and cell death.

CIE Physics GCSE

Topic 3.4 - Sound

Flashcards

How does sound travel through solids?

How does sound travel through solids?

Sound waves cause vibrations through the solid.

What type of wave are sound waves?

What type of waves are sound waves?

Longitudinal waves.

Can sound travel through a vacuum?

Can sound travel through a vacuum?

No, sound requires a medium to be transmitted.

What is an echo?

What is an echo?

A reflected sound wave.

How can the speed of sound be measured?

How can the speed of sound be measured?

Make a noise (eg. clap, fire a starter pistol) at a known distance from a solid wall. Record the time taken for the echo to be heard. Then half the time and use speed = distance/time to calculate speed.

What is the speed of sound in air? (supplement)

What is the speed of sound in air? (supplement)

343 m/s

What is the speed of sound in steel? (supplement)

What is the speed of sound in steel? (supplement)

5130 m/s

How does the speed of sound compare in solids, liquids and gases?

How does the speed of sound compare in solids, liquids and gases?

It is fastest in solids and slowest in gases.

What is the range of frequencies audible to the human ear?

What is the range of frequencies audible to the human ear?

20 Hz - 20kHz

(20-20000Hz)

What is ultrasound?

What is ultrasound?

Sound with a frequency higher than 20kHz.

Describe the features of a longitudinal wave.

Describe the features of a longitudinal wave.

Longitudinal waves have **compressions** and **rarefactions**.

What wave property affects the volume of sound?

What wave property affects the volume of sound?

The amplitude (greater amplitude = louder sound).

What wave property affects the pitch of sound?

What wave property affects the pitch of sound?

The frequency (higher frequency = higher pitch).

How can ultrasound be used to measure distances? (supplement)

How can ultrasound be used to measure distances? (supplement)

- When waves reach a boundary between two media, they are partially reflected
- The speed of the waves is constant
- The time between emission and detection can be used to calculate distance (from distance = speed x time)

  (remember to halve the time; the recorded time is for the distance there **and** back)

Describe applications of ultrasound (supplement)

Describe applications of ultrasound (supplement)

Ultrasound is used largely in medical imaging, specifically pregnancy scanning, as it is non-ionising so it does not increase the risk of cancer.

What is SONAR imaging? (supplement)

What is SONAR imaging? (supplement)

SONAR (Sound Navigation and Ranging) uses both low and high frequency sound waves for imaging eg. underwater.