Physics Knowledge Map - Energy Transfer and Sound

Energy Transfer & Efficiency

Energy is never lost or made, it is just transferred by different processes to different places. The units of energy are Joules (J).

Energy can be transferred in many different ways. Examples of these are light, heat and sound.

A Sankey diagram is an energy transfer diagram . An example is shown below, for a light bulb.

This shows a light bulb receiving 100J of energy from electric current. It transfers 10J of energy as light and 90J of energy as heat energy to the surroundings. This heat energy is waste energy.

The efficiency of an object can be calculated using the formula:

(Useful energy/total input energy) x100

The energy efficiency of this light bulb would be 10/100 = 0.01 x 100 = 10%

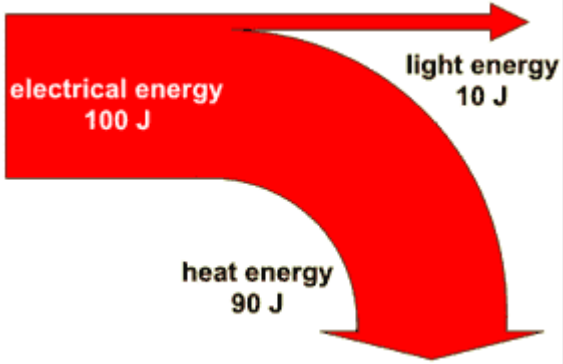
Fuels and Combustion

Fuels are chem icals that transfer energy to the surroundings by heat when they burn.

The most common fuels are coal, crude oil and methane (natural gas).

When fuels are burned, they combine chemically with oxygen from the air, which releases heat energy. This is called combustion.

Fuels derived from crude oil release crbon dioxide during combustion. This is a greenhouse gas and contributes to global warming.



Sound

Sounds are made by objects vibrating air particles. When these vibrating air particles reach your ears, sounds is made.

Energy is transferred by sounds in the form of waves. Sound waves are longitudinal waves.

Sounds can be made louder by increasing the energy in the vibration. Sounds can be made quieter by decreasing the energy in the vibration.

The loudness of a sound is measured in a unit called a decibel (dB).

Pitch and Waves

Very deep and low sounds are said to have 'low pitch'. High sounds such as sirens or whistles ane said to have 'high pitch'. The pitch of a note is also called its frequency.

The pitch of a sound can be changed by changing the frequency of the vibration.

Wavelength is the distance along a wave from one point to the next point where the wave repeats itself.

Amplitude refers to the volume of a wave.

Frequency refers to how many vibrations are produced per second.

Sound through Materials

Sounds can travel through solids, liquidsand gases, as they all contain particles.

Sounds cannot travel through a vacuum because their are no particles in a vacuum.

Sound travels fastest through materials that have particles very close together. For example, sound will travel faster through solids than they will gases because the particles are closer together so it is easier to pass on vibraitons.

Hearing Sounds

A labelled diagram of the ear is shown below.

The function of the ear is to transfer energy from sound into electrical impulses that are interpreted by the brain.

The outer ear captures sound waves. These waves pass along the ear canal to the ear drum. The middle ear containes bones called ossicles, which receives vibrations form the ear drum and makes them much bigger. The inner ear contains specialised cells that detect the vibrations and convert them into electrical impulses.

Ultrasound and Infrasound

Infrasound is sound below 20 Hz. Ultrasound is sound above 20000 Hz. Humans cannot detect these sounds as our ears are not sensitive enough.

We can use devices that generate ultrasound waves and detect the reflected ultrasound, which has led to many applications;

Safely scan body organs, scanning metals in aircraft parts and underground pipes for any cracks or damage.

The high energy transfer of ultrasound means it can also be used for breaking up kidney stones and cleaning surgical equipment, jewellery and teeth.

Infrasound waves transfer little energy, but can be detected by a microphone. Some large animals use infrasound to communicate, volcanoes that are about to erupt can be detected and the passage of meteors in space can also be tracked.

Keywords you should be confident with by the end of this topic

Energy, sound waves, pitch, amplitude, wavelength, frequency, ultrasound, infrasound, combustion, Sankey diagram, efficiency, heat, temperature, vacuum, ear canal, ear drum, ossicles, cochlea, auditory nerve