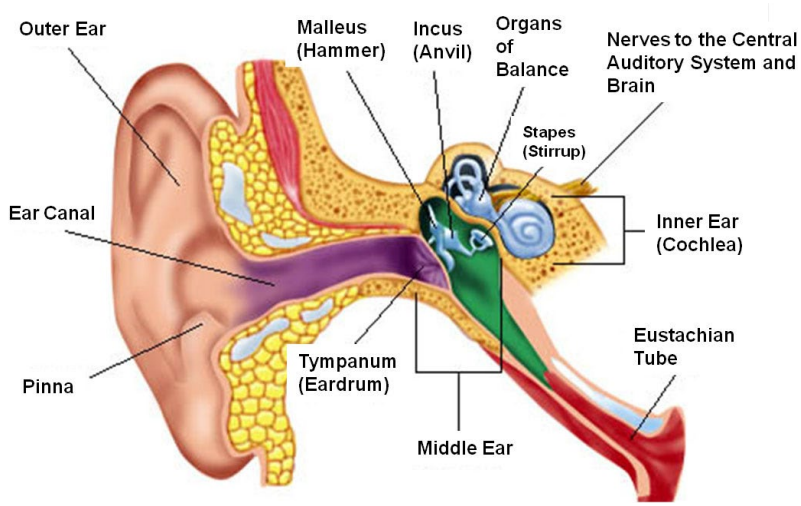
Structure and Function of the human ear



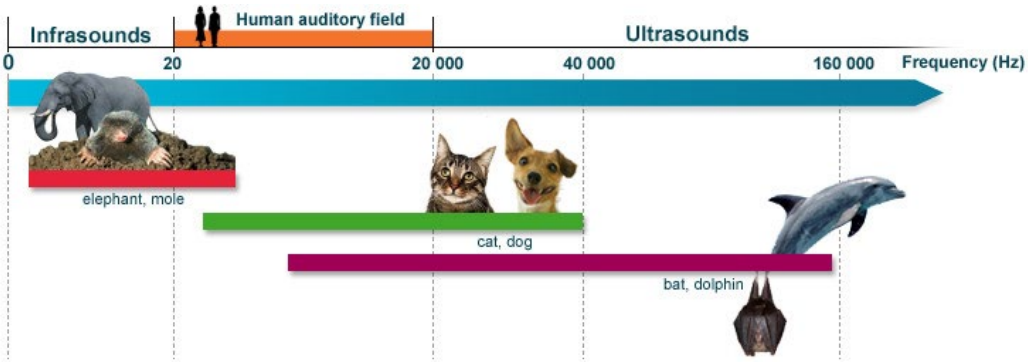
Sound waves travel through the **ear canal** and cause the **eardrum** to vibrate. The small bones of the inner ear transfer this vibration to the inner ear **cochlea**.

The cochlea is fluid filled and lined with many hair-like **nerve cells**. Different length nerve cells detect different wave frequencies and transmit this information to the **brain** using electrical impulses that move along the nerves.

Audible range of humans and other animals

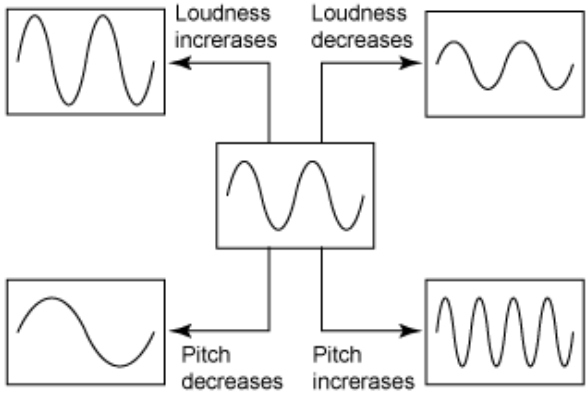
Humans can hear between 20 – 20,000 **Hertz,** a measure of freq
the number of waves that pass by a fixed point in a given amount of time.

In comparison to many other animals, humans have a very limited audible range. Bats and dolphins can hear and produce sound at an exceedingly high frequency – and use it to bounce back off objects as sonar to "see" without light. Low rumbling noises of elephants and moles are below our auditory range but can travel long distances.



extra info

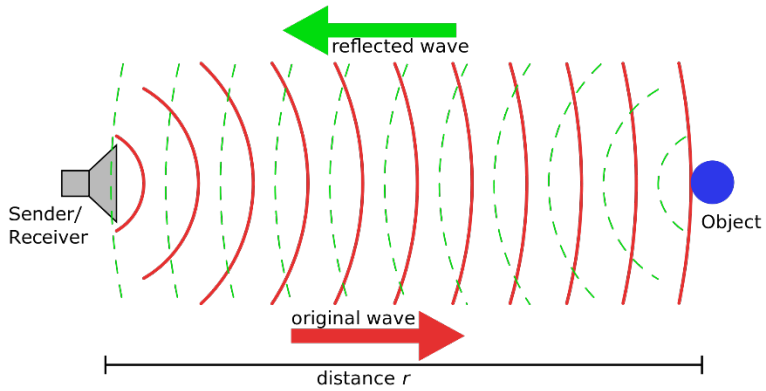
Pitch and Loudness of sound



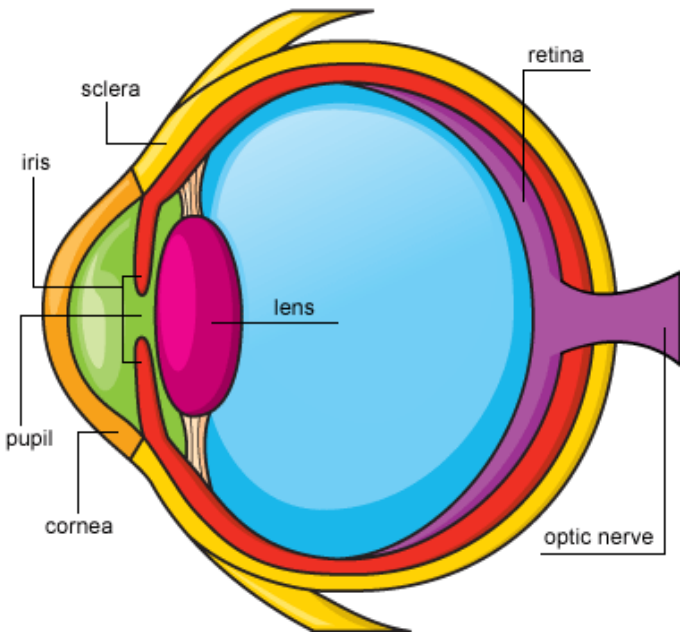
Sound can be described by "characteristics" called pitch and loudness. **Pitch** is related to **frequency** – the higher the frequency then the higher the pitch of the note (a single sound at a particular level). **Loudness** is related to **amplitude** – the higher the amplitude the louder the sound.

Reflecting sound waves

Sonar (originally an acronym for **SO**und **N**avigation **A**nd **R**anging) is simply making use of an echo. When an animal or machine makes a noise, it sends sound waves into the environment around it. Those waves bounce off nearby objects, and some of them reflect to the object that made the noise. Whales and specialised machines can use reflected waves to locate distant objects and sense their shape and movement.



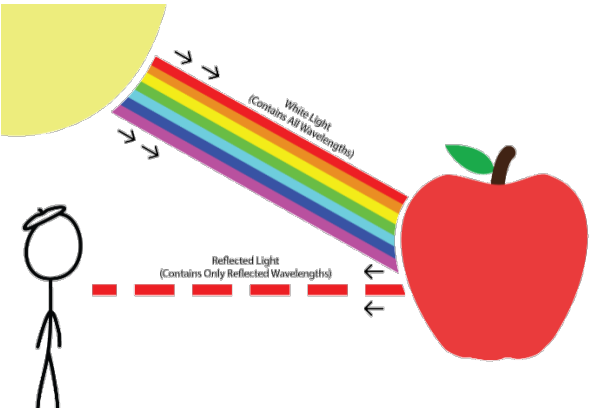
Structure of the Human eye



The human eye is a "collecting" organ that allows light to reach sensory nerves which then transmit electrical signals to the brain. The **convex lens** focuses the images seen onto the **retina** of the eye. Various sensory cells in the retina called rods and cones detect both amount of light and colour of light. The **iris** opens to let more light into the eye when it is dimmer. The **muscles** around the lens change the shape of the lens. The **blind spot** is the point of entry of the optic nerve on the retina and has no light receptors. The **cornea** is the tough transparent layer at the front of the eye.

Messages from the retina travel through the optic nerve to the brain. The brain further processes the images in various parts of the brain responsible for language, speech and thinking.

White light is made from colours mixed together



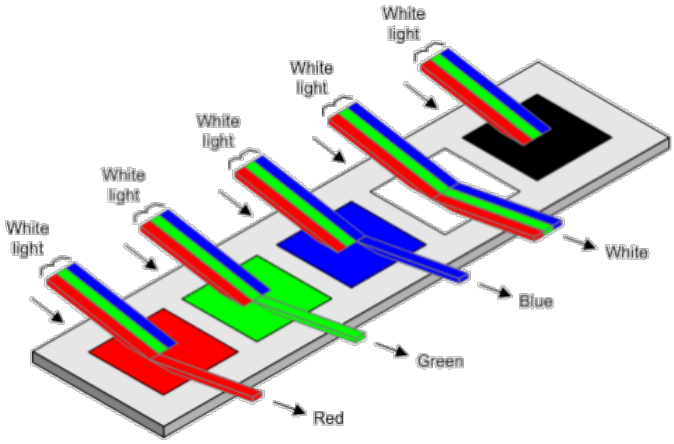
White light is a combination of all the other colours of light mixed together. The main colours that make up white light can be seen in a rainbow. They are red, orange, red, green, blue, indigo (a dark inky blue) and violet. They can be remembered by the acronym ROY G BIV.

The sun releases visible light of all wavelengths, when combined becomes **white light**. When this white light hits the surface of a red apple **all the other colours** of light except red are **absorbed**. The **red light** is instead **reflected**, and when hitting our eyes, we see the apple as red because that is the only wavelength detected.

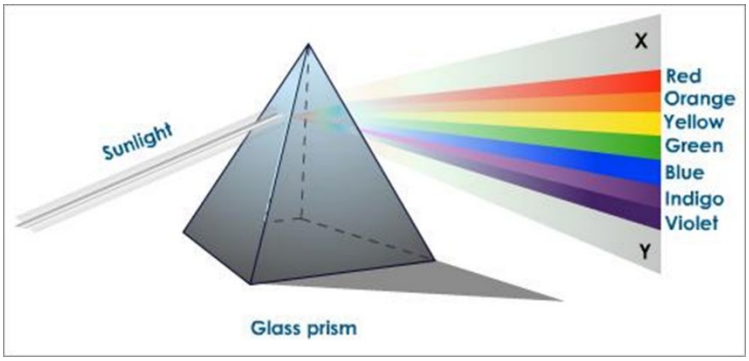
We see colours because of what wavelengths are reflected

A colour is a property processed by an object as a result of the way it reflects, absorbs or emits light of a specific wave length.

We see a tree as green because the leaves absorb the red and blue light waves, and only the green light is reflected into our eyes.



Prisms work by diffracting colours of different wavelengths



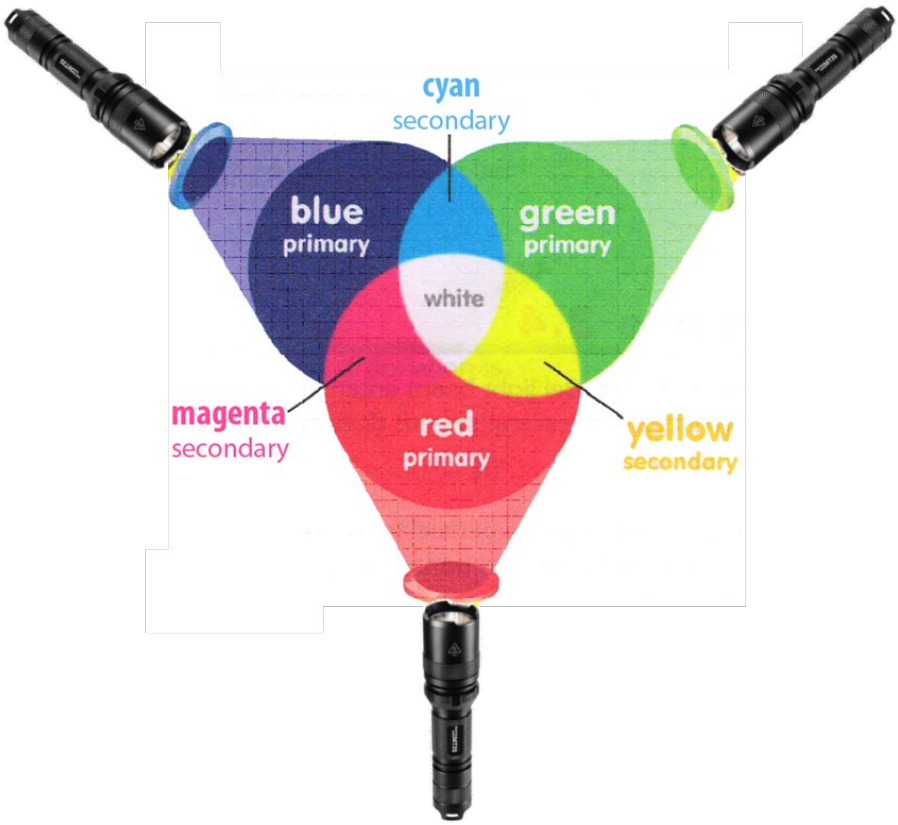
A prism is a triangular block used to disperse white light. This causes light of different colours to be refracted differently and to leave the prism at different angles, creating an effect like a rainbow. The degree of bending of the light's path varies with the wavelength or colour of the light used, called dispersion. This can be used to separate a beam of white light into its spectrum of colours.

Primary and Secondary colours

Combining light colours is said to be **additive**. Each wavelength of light adds to another.

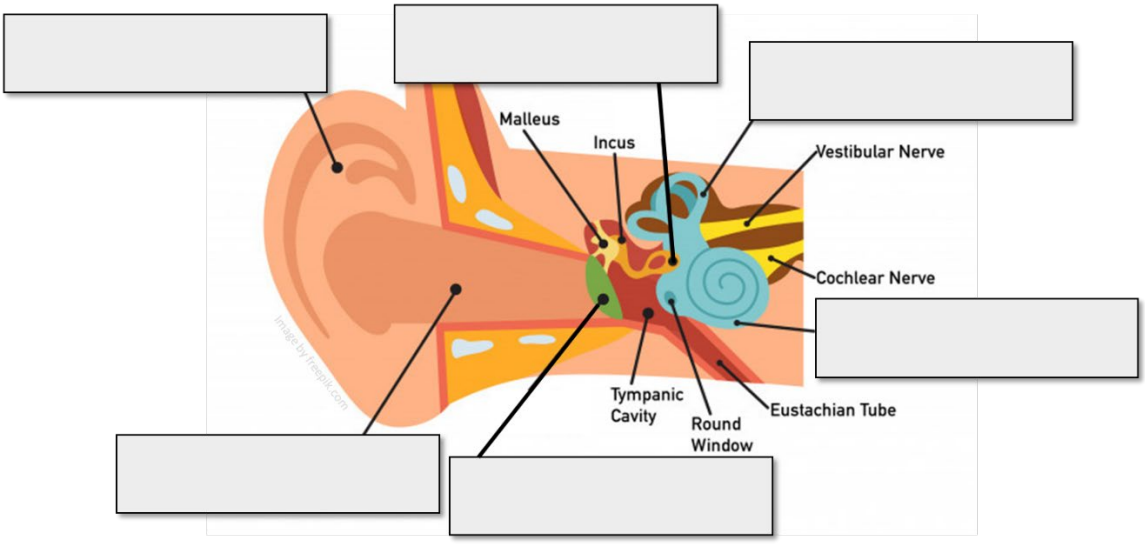
The three main colours of light are called **primary**. Two primary colours together make a **secondary** colour and all three primary colours together make up **white light**.

NOTE: Paint absorbs light waves. The paint is called **subtractive** because with each addition of colour more of the wave lengths are absorbed. The three primary colours of paint are cyan, yellow and magenta. When these three are added together the resulting colour is **black**: all the different wavelengths of coloured light are absorbed.

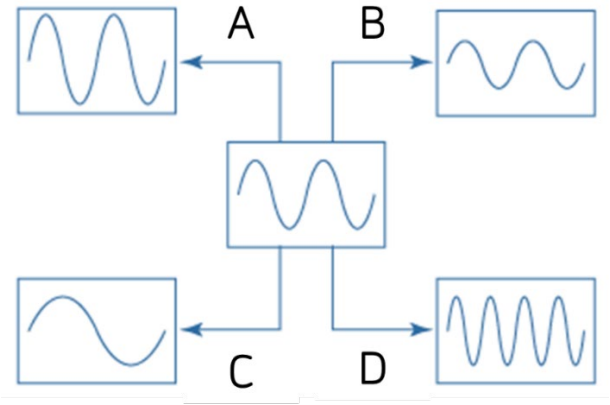


1. Label the structure of the human ear

cochlea	ear drum	stirrup (stapes)	outer ear	semi-circular canals	outer ear canal



2. The diagrams below shows oscilloscope readings of **sound** where the **pitch and loudness** has been altered (A-D) from the central reading. Match the letter to the changes.

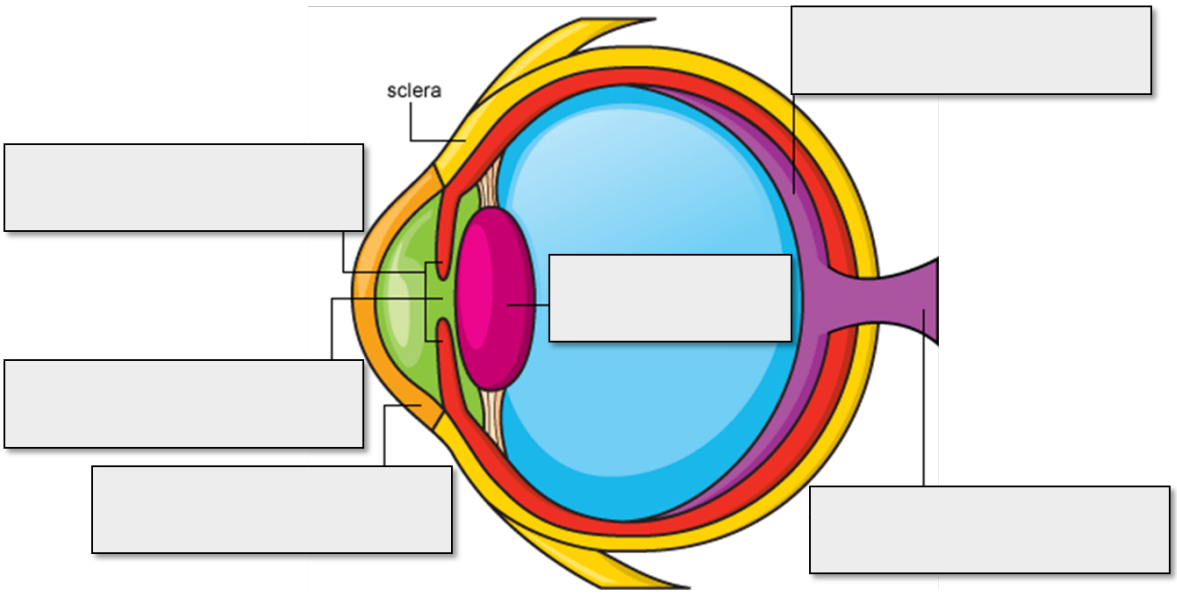


Change	Letter
Decreasing loudness	
Increasing pitch	
Increasing loudness	
Decreasing pitch	

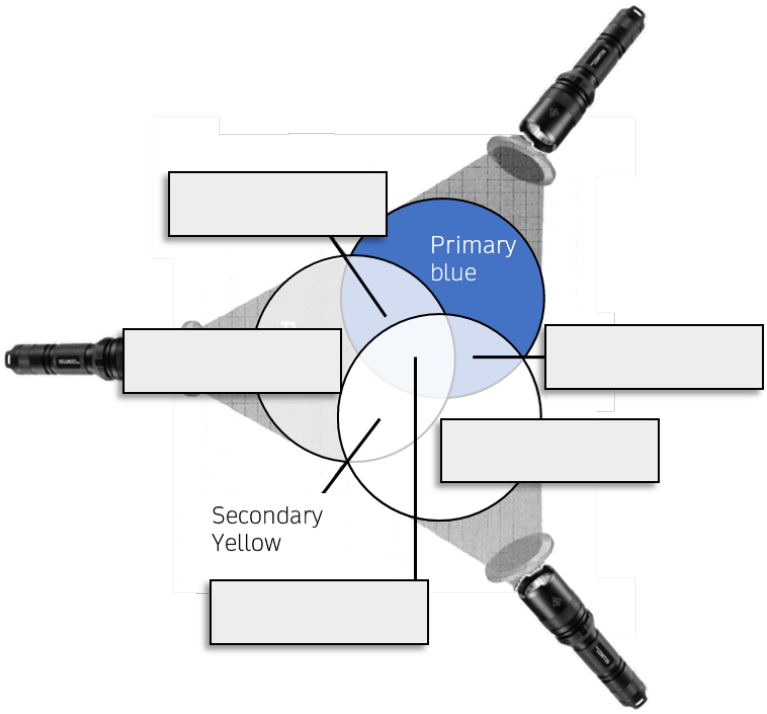
3. SONAR was used in World War II by allied forces (Such as Britain and the United States) to locate enemy submarines. Research and summarize information on how the SONAR worked, and why it was the preferred method.

4. Label the structure of the human eye

retina	lens	pupil	iris	optic nerve	cornea



5a. Use the clues given to complete the remaining labels for **primary and secondary light colours**



5b. Summarize information in table

	Coloured light		
	Red	Blue	Green
Red			
Blue			
Green			

5c. Complete the table below to show which colours are absorbed and which are reflected by an object when we see a colour

colour	colour(s) absorbed	colour(s) reflected	colour	colour(s) absorbed	colour(s) reflected
red			yellow		
blue			cyan		
green			magenta		