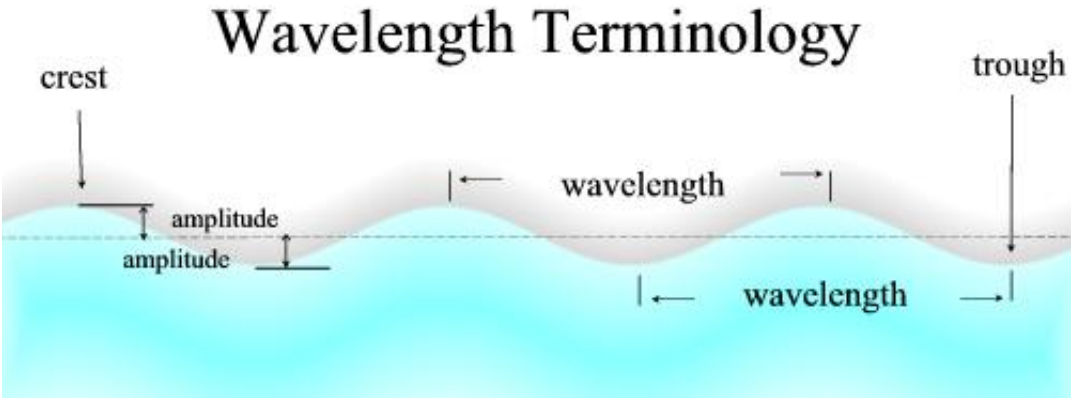
Topic 6 – The source of Colors is no longer covered in the Alberta Curriculum.

Topic 7 – The Wave Model of Light (pgs. 237-248)

Remember that ***light travels in straight lines***. Sir Isaac Newton tried to explain why. He proposed that light beams are made of streams of extremely tiny, fast-moving particles. These tiny particles of light, he suggested, could only travel in straight lines, not around objects.

Looking at Wavelength

After doing the **Find Out Activity** on p. 237, it appears that light is not made up of tiny particles that travel in straight lines as Newton suggests. When light passes through a small opening, it spreads out around each side of the opening. To explain this, Dutch scientist Christiaan Huygens (1629-1695) suggested that light travels in a wave, not as a stream of fast moving particles.



The high parts of the wave are called **crests**. The low parts of the wave are called **troughs**. The distance from crest to crest is called **wavelength** (the distance from one complete crest and one complete trough). The height of the crest or the depth of the trough from rest position is called the **amplitude**. The **Frequency** is the rate at which the crest and the trough move up and down. The number of cycles in a period of time - which is usually measured in **hertz**, or cycles per second.

The Wave Model of Light

The wave model of light pictures light traveling as a wave. It doesn't explain everything about how light behaves but it helps us visualize it. Thinking about light traveling in waves helps to explain unpredictable behavior, like when light curves around a opening. When light passes through a small opening, the waves spread out. If the wavelength is short, the waves spread out very little, whereas longer wavelengths spread out more. Wavelength is explored more in the labs for this topic.

Light Waves In Action

Sunsets can be explained using the wave model of light. As light waves from the sun travel through Earth's atmosphere, they strike particles of different sizes, including dust and other elements. The longer wavelengths of the reds and oranges tend to pass around these particles, whereas, the shorter wavelengths of blue and violet, strike the particles and reflect and scatter. At sunset, the light we see passes through about 700 kms of the Earth's atmosphere. There are many more particles in the atmosphere at this time of the day, due to the activity going on during the day - so many more blue and violet waves are reflected away. Red and orange are the vibrant colors we see at sunset.

See the diagram - Figure 3.59, p. 245 - to visualize this action.

Laser Light

In 1966, Theodore H. Maiman, a physicist at Hughes Aircraft Company in California became the first person to use a process called...

light
amplification by the
stimulated
emission of
radiation

or laser light

Incandescent lights give off many different colors and therefore have many different frequencies and wavelengths. The waves are jumbled and crests from one wavelength might overlap the trough of another, making the waves work against each other. This type of light is **incoherent**.

Laser light is quite different. It gives off a **single wavelength** (frequency) of **coherent** light.

Lasers have many useful applications:

- Scanners (bar codes in retail shops are scanned to give the price)
- Digitized data are read by a laser on a compact disk (CD)
- Lasers are use by law enforcement officers to detect the speed of vehicles.
- Laser light can be released in pulses or in a continuous beam. In either form, it is so powerful, that it can make precise cuts through metal and can also be used in surgery, as a scalpel - or, to instantly seal broken blood vessels, because it produces such intense heat.
- Eye surgeons use lasers to correct vision defects (shaving off areas of the cornea - to correct problems caused by irregularities in the shape of the eyeball)
- They can also 'spot weld' a detached retina
- One day dentists may use lasers to vaporize cavities, instead of drilling into them.

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