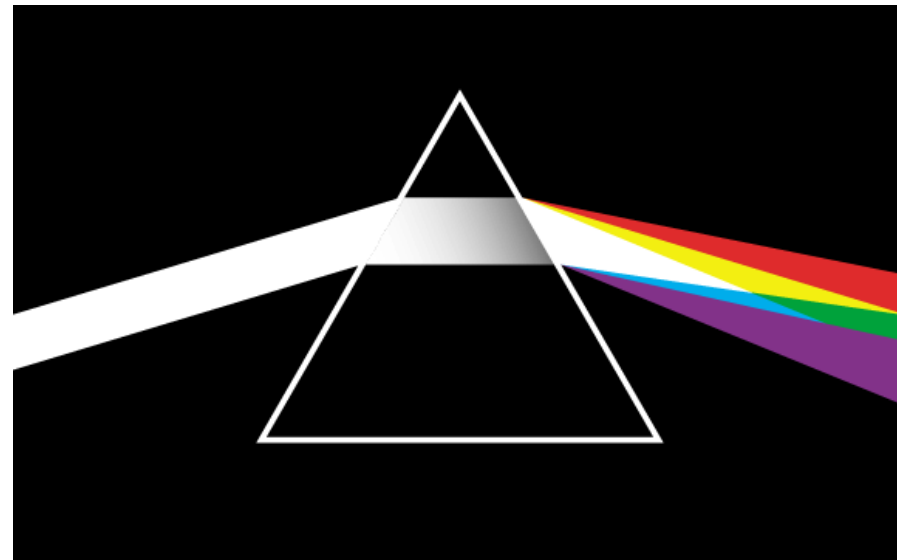
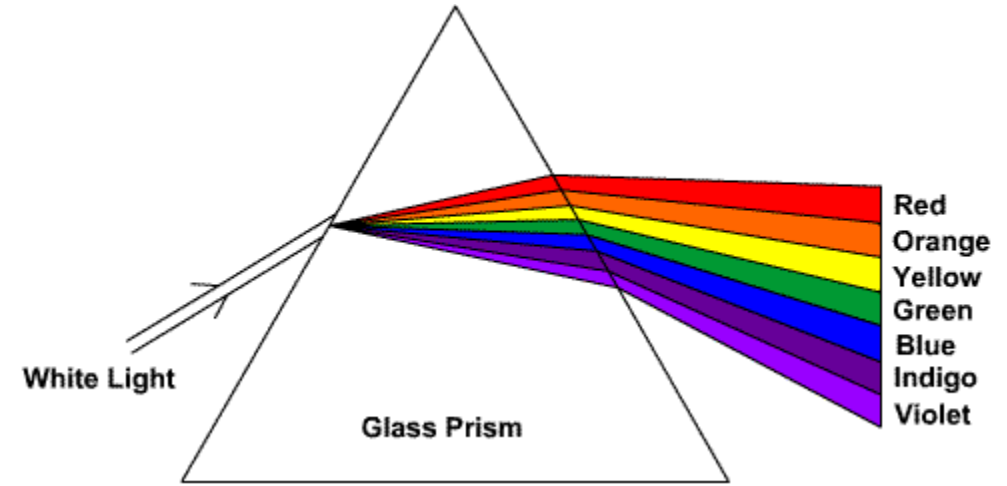


Properties of Visible Light

Lesson 20

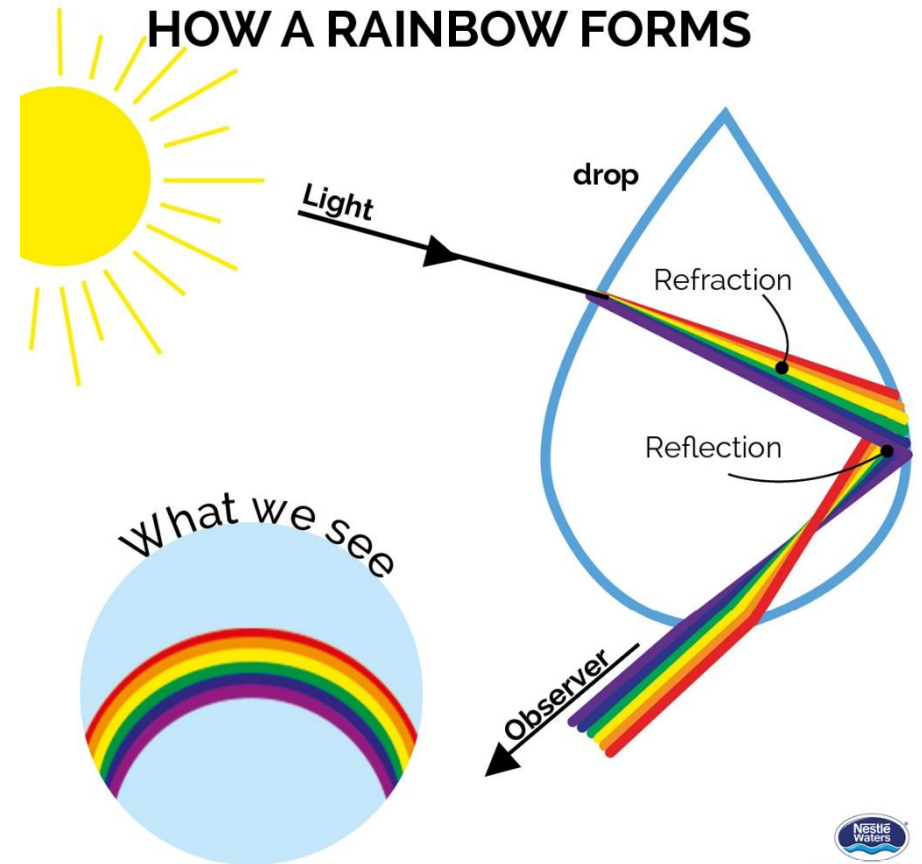
Properties of Visible Light

- Visible light is a mixture of all the colours of the rainbow
- A prism refracts light, separating the colours



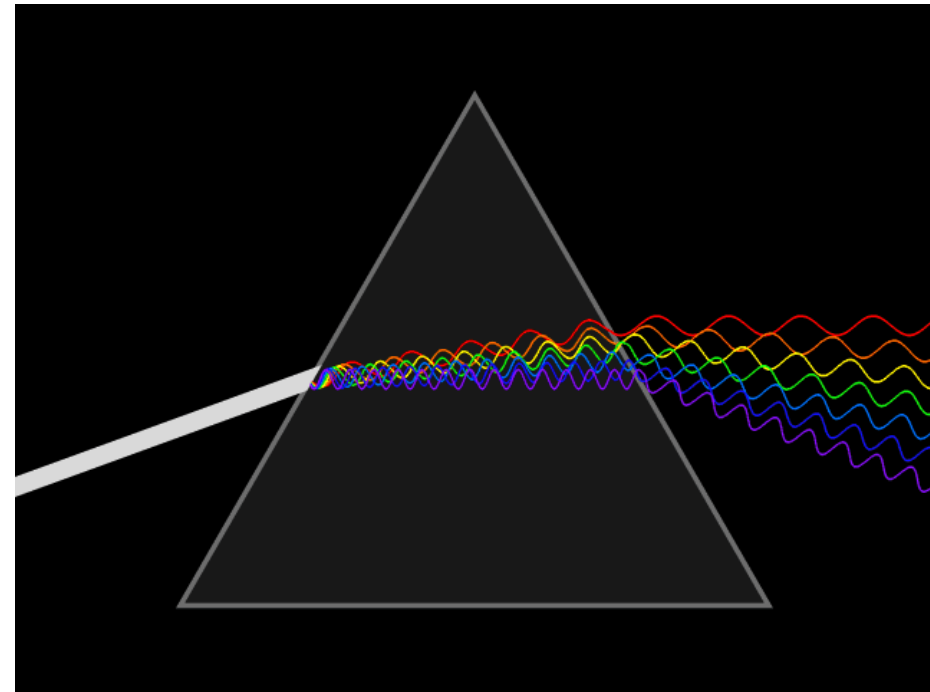
Properties of visible light

- After a rainstorm you might step outside and see a high arc of colours curving through the sky
- When the sunlight is behind you and the air is full of water droplets, you may be lucky enough to see a rainbow
 - The water droplets act like a prism and refracts the sunlight, separating the white light into the colours of the rainbow



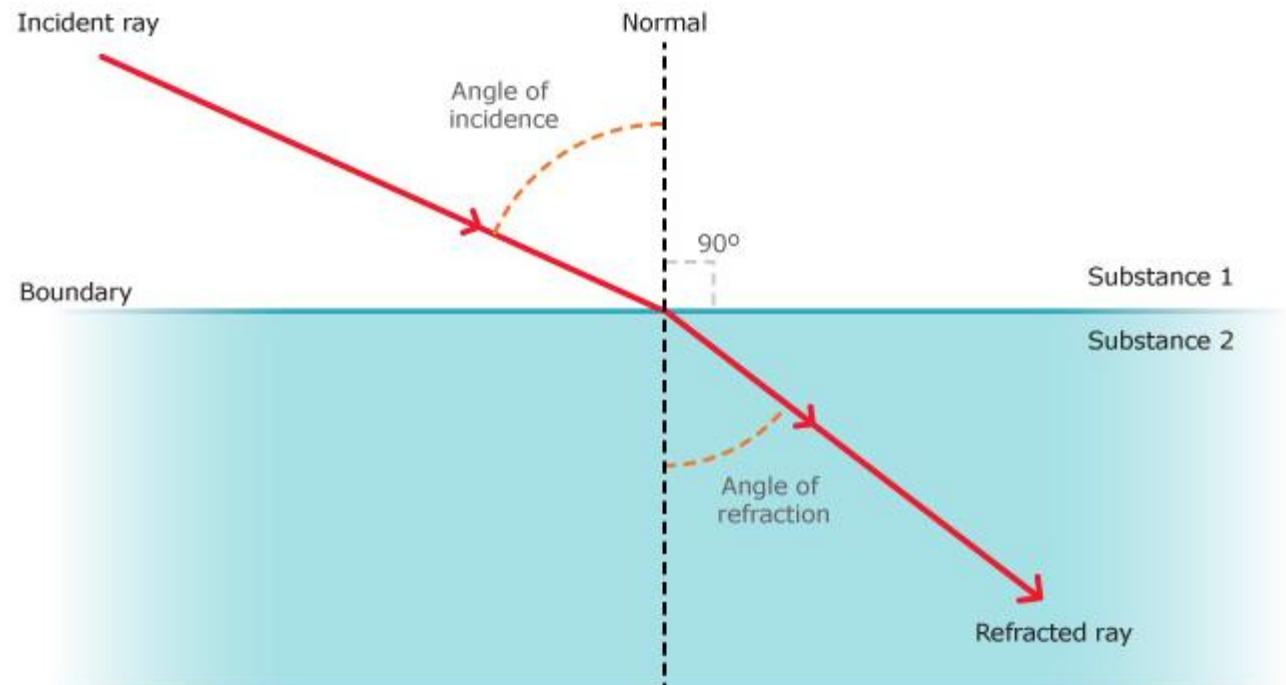
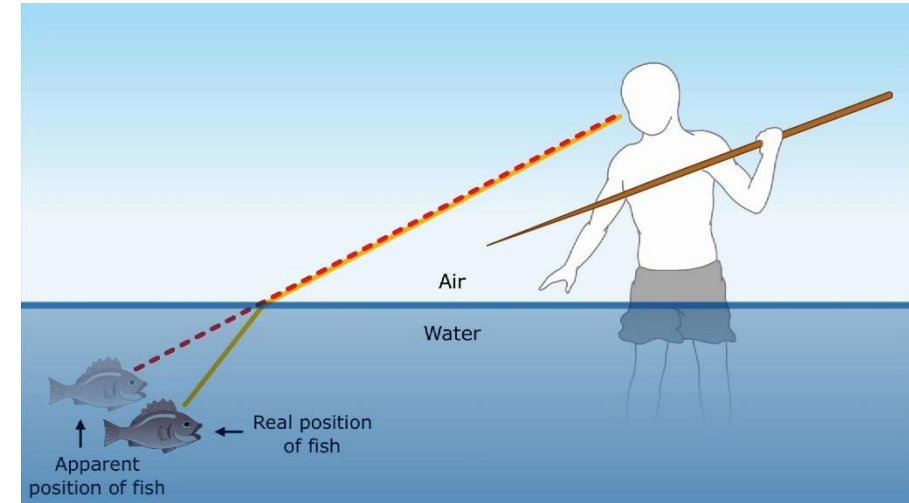
Wave Model of Light

- Scientists have developed a model of light by looking at how light behaves, and then trying to explain what they see
- A *model* is a way of representing something in order to understand it better and to make predictions
- One explanation of light behavior is the **wave model of light**, which pictures light travelling as a wave
 - **Light** is a type of wave that travels through empty space and transfers energy from one place to another, such as from the Sun to Earth
 - **Visible light** is a wave that we can see



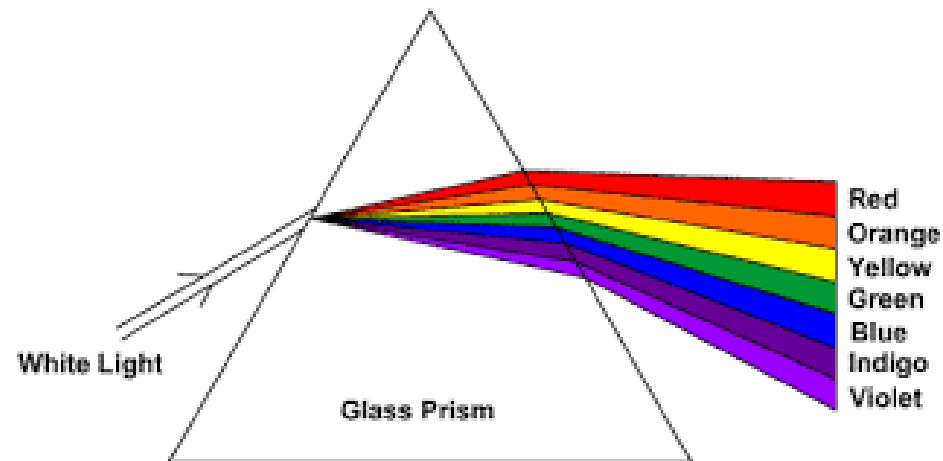
Refraction of Light

- What happens when a light wave passes from one material to another – from air into water for example?
 - If the light wave is travelling at an angle and the speed that light travels is different in the two materials, the wave will be bent, or refracted
- **Refraction** is the bending or changing direction of a wave as it passes from one material to another



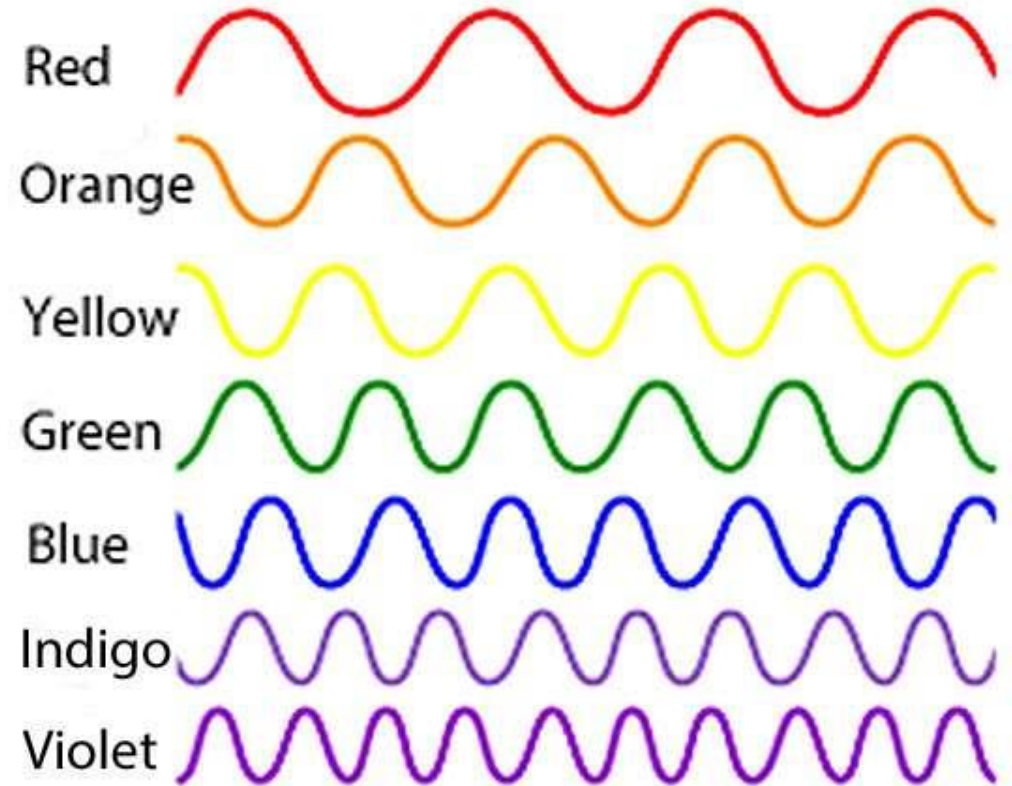
Refraction of Light

- White light, such as sunlight, is made up of waves having different wavelengths and frequencies
- If a light wave is refracted, such as by passing through a prism, the different wavelengths bend by different amounts
- Because the longer wavelengths are refracted (bent) less than the shorter wavelengths, different colours are separated when they emerge from the prism



Colours of the Rainbow

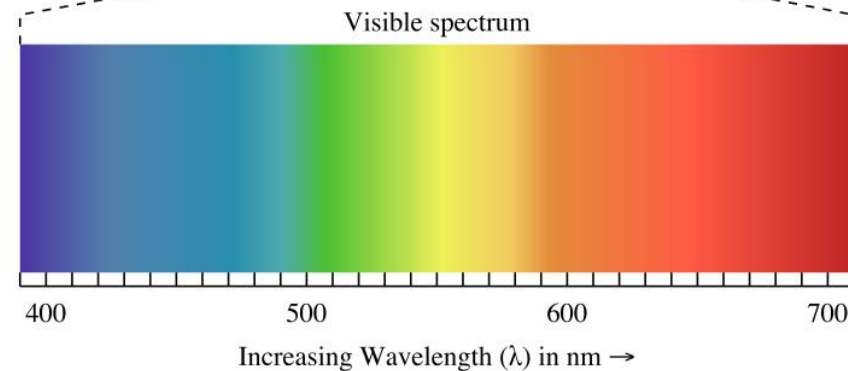
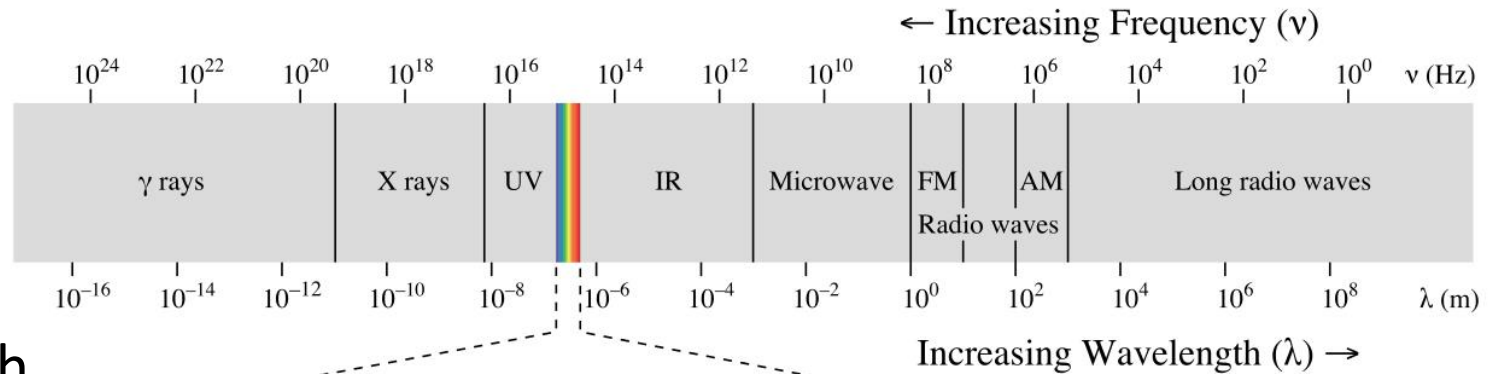
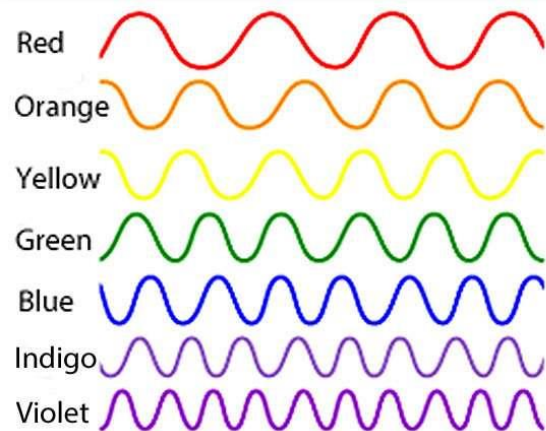
- Like prisms, water droplets also refract light
- In a rainbow, the human eye can distinguish a range of colours that are often described as falling into seven broad categories
- In order of decreasing wavelength, and increasing frequency:
 - Red, orange, yellow, green, blue, indigo, violet
- The range of colours (the rainbow) or frequencies of visible light is called the visible **spectrum**



Colours of the Rainbow

- The **visible light spectrum** is made up of different colours

- Each colour has its own wavelength
- Red has the longest wavelength
- Violet has the shortest wavelength



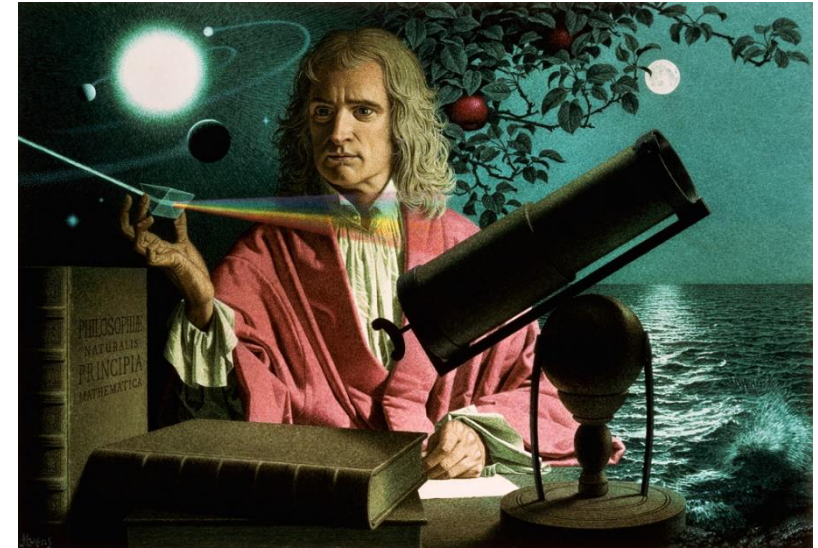
Producing the Visible Spectrum

- At one time, people believed that colour was something added to light
- When white light struck a green leaf, people believed that the leaf was adding green to the light
- Is colour picked up when light strikes a coloured object? Or does light itself contain colour?
- In the 17th century, English scientist Sir Isaac Newton conducted a famous experiment in search of the answer to these questions



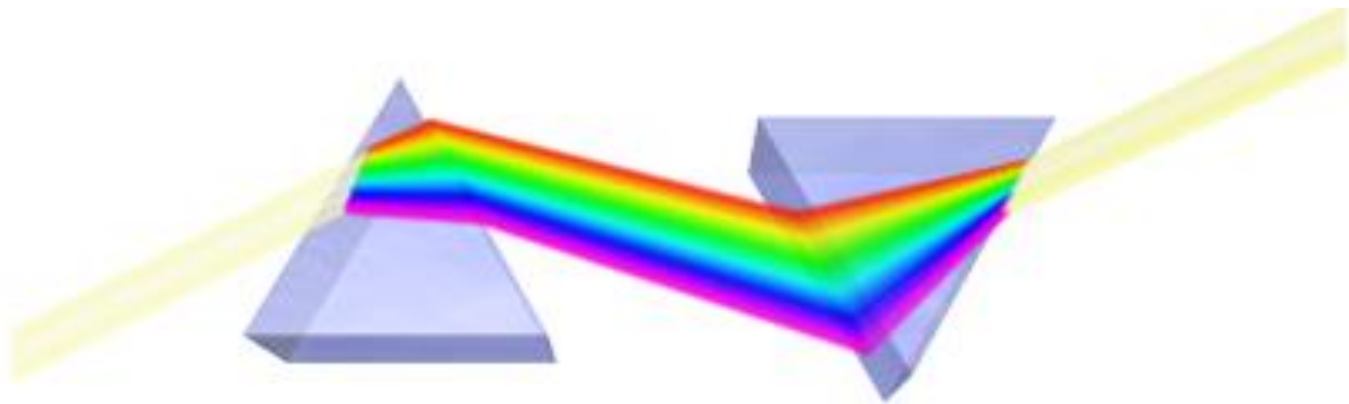
Producing the Visible Spectrum

- Newton placed a prism so that a thin beam of white light could pass through it
 - When the white light travelled through the prism, he saw bands of colour emerge
 - He observed that each band of colour was refracted at a different angle
 - Newton concluded that the prism was not the source of the colours
 - The different colours must have been present already in the white light



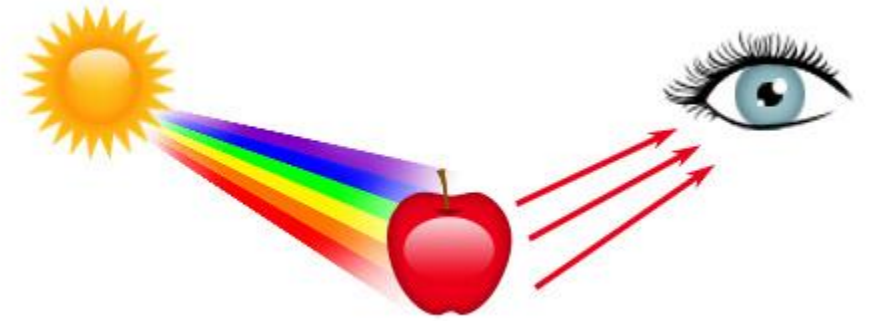
Producing the Visible Spectrum

- Next, Newton passed these colours through more prisms
 - This time, only white light emerged
 - Newton showed that colour was a property of visible light
 - He proposed that white light such as sunlight is the result of mixing together all the different colours of light

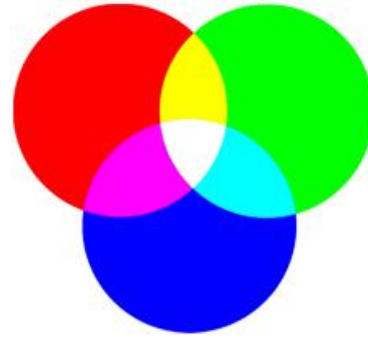


Colour and Reflection

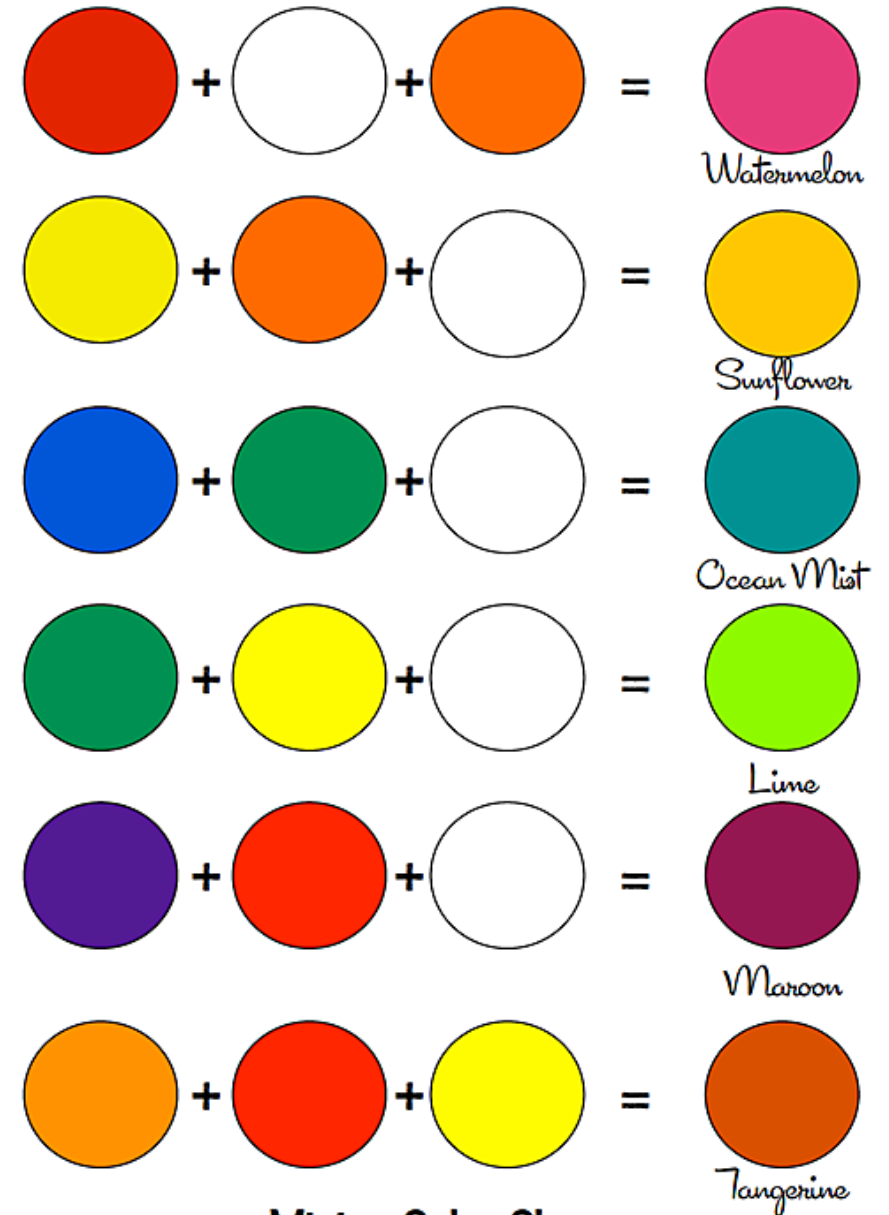
- **Reflection** occurs when a light wave strikes an object and bounces off
- When sunlight strikes coloured clothing, some colours are reflected while other colours are absorbed
 - ONLY the reflected colours can be seen
- **We** perceive only the reflected **colors**.
 - Thus, red is not "in" an apple. The surface of the apple is reflecting the wavelengths **we see** as red and absorbing all the rest.
 - An object appears white when it reflects all wavelengths and black when it absorbs them all.



Colour and Reflection



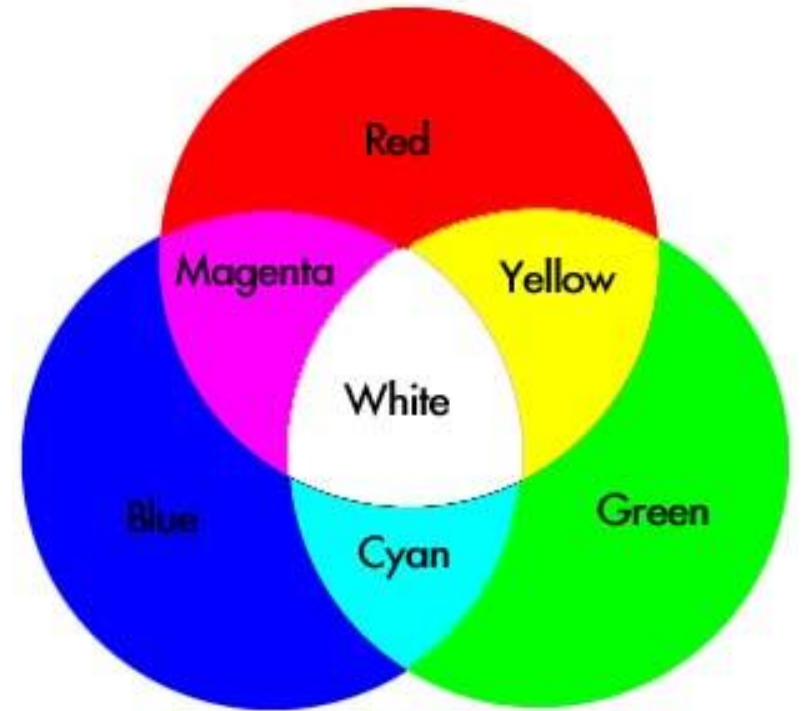
- Why does a bright red shirt look black when it is placed in a dark room?
 - Since a shirt does not produce its own light, but merely reflects the light in the room, the shirt appears to be black when there is no source light
- Only three colours of light, such as red, green, and blue, are needed to produce all the colours of the rainbow
 - Red, green, and blue are sometimes called the **additive primary colours**



Mixing Color Chart

Colour and Reflection

- Red, green, and blue are sometimes called the **additive primary colours**
 - They are called additive colours because adding all three together in the proper amounts will make white light
- The light of two **additive primary** colours will produce a **secondary** colour
 - The three secondary colours are: **yellow, cyan, and magenta**



Summary

- Visible light is a mixture of all the colours of the rainbow
- A prism refracts or bends light, separating the colours
- Different colours of light are carried by light waves that have different wavelengths
 - Red has the longest wavelength and violet has the shortest wavelength
- An object looks blue in sunlight because it reflects blue and absorbs colours other than blue from the sunlight
- Red, green, and blue are sometimes called the **additive primary colours**
- The light of two additive primary colours will produce a secondary colour