Sc8.2 : Optics

Name: Key

Chapter 4 Review

Nature of Science – History of Light

1. Describe what these scientists did regarding theories and experiments on light.
   a. Pythagoras – Believed beams of light were made of tiny particles
   b. Galileo - Tried to measure the speed of light using 2 lanterns on the top of hills. He was not very successful. He did build the first telescope though.
   c. Michelson - First person to measure the speed of light. 3×10^8 m/s or 300,000,000 m/s or 1,000,000,000 Km/hr
2. Define light.
   A form of energy that can be detected by the human eye.
3. What is the speed of light? 1,000,000,000 Km/hr

   How does it compare with the speed of sound? Speed of sound is much slower. 1200 km/hr
4. Give examples of technologies based on light. (There are 10 in your notes.)

   microscope, telescope, periscope, binoculars, fibre optics, Camera, prescription contact lenses, lasers, movie projectors, Overhead projectors

Properties of visible light

5. Identify and describe the following properties of light
   a. rectilinear propagation
      Light travels in a straight line. ex Shadows.
   b. a vacuum
   c. What is the difference between these terms and give an example of each:

      transparent -

      translucent -

      opaque-

   d. What are:

      specular reflection - light reflecting off a smooth surface ex. mirror

      diffuse reflection - light reflecting off a rough surface ex. clothing, paper, asphalt, dust

   e. What is refraction? - light bends ex. prism or "the bent stick effect"
   f. What is dispersion? - light bends into its constituent colours. ex. white light through a prism will bend and turn into a rainbow.

The electromagnetic spectrum

6. List the colours of white light, in order of degree of refraction from red (least refracted) to violet (most refracted) ROY G BIV

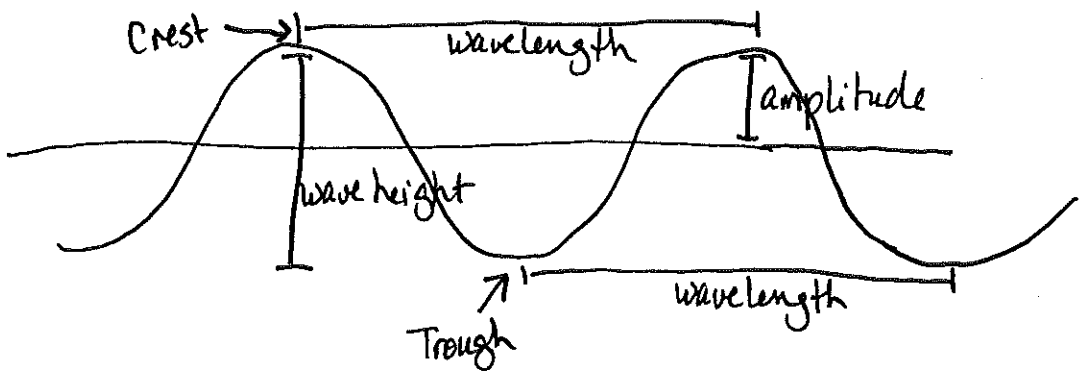
Red Orange Yellow Green Blue Indigo Violet

Bends least → Bends most

Least refracted → most refracted

Longest wavelength → Shortest wavelength

7. Draw and label a transverse wave. Be sure to label wavelength, wave height, amplitude, crest and trough.



What is frequency? The number of repetitive waves that occur during a given time!
The number of wavelengths that pass a point in one second is measured as Hertz.

What is the relationship between frequency and wavelength, and why is it called an inverse relationship?

Inverse means opposite.
As frequency ↑ wavelength ↓
as frequency ↓ wavelength ↑

8. Which colour of visible light:

Has the longest wavelength? - Red

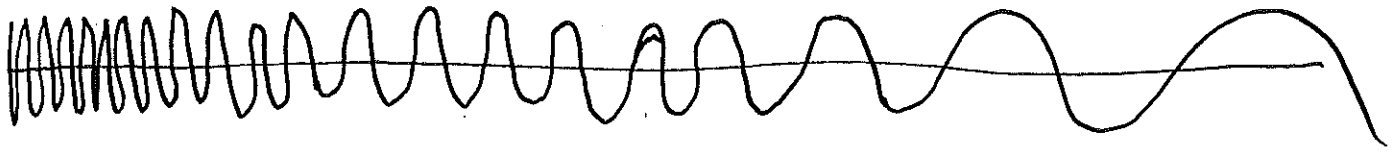
Has the shortest wavelength? - Violet

Refracts the most? - Violet

Refracts the least? - Red

9. Write the names of the different types of waves of the in order of longest wavelength to shortest wavelength. Draw a representation of the wave under it.

Gamma X-Ray Ultraviolet Visible Infrared Microwave Radio



Which has the longest wavelength? Radio

Which has the shortest wavelength? Gamma

Which has the lowest frequency? Radio

Which has the highest frequency? Gamma

Which has the highest energy? Gamma

Which has the lowest energy? Radio

10. Provide examples of uses and possible dangers of each type of electromagnetic radiation:

Type of radiation	Uses	Possible dangers
Radio waves	AM FM Radio - Communication diagnose illness - MRI	Possibly causes cancer in large doses Uncertain effect of long-term exposure
Microwaves	Cooking food	direct exposure can damage human tissue
Infra-red	Remote controls, Heat lamps, motion sensors	felt as heat. Could cause skin burns
Visible light	So you can see	bright lights can kill gremlins
Ultraviolet treats jaundice in babies	Can kill bacteria in food + water + medical supplies. Makes Vitamin D in humans	Overexposure → sunburns or long term exposure can lead to skin cancer
X-Rays	medical - detects broken bones	overexposure → cancer
Gamma rays	Radiation therapy for cancer patients.	Overexposure → Radiation sickness