

Ray Model of Light

- Used to explain why and how we are able to see things
- Luminous objects emit light in all directions
- The light rays travel in straight lines from the objects to our eyes, allowing us to see the object
- Light from a light source can bounce off an object and enter our eyes

Reflection

- The bouncing of light is called reflection
- Light travels in straight lines even when bouncing off objects (no matter what)
- Incident ray: Ray that hits the reflecting surface
- Angle of incidence (i) is the angle between the normal and incident ray
- Normal: The line perpendicular to the surface at the point of incidence
- Point of incidence: Point where the incident ray, normal and angle of reflection meet
- Angle of reflection (r): Angle between the reflected ray and normal
- Reflected ray: Light ray travelling away from the reflecting surface after bouncing off the surface
- Angle of incidence (i) and the angle of reflection (r) are and will always be equal
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- Mirrors:
 - o Plane mirrors (Flat mirror):
 - o Properties
 - § Virtual
 - § Upright
 - § laterally inverted
 - § image is same distance from the mirror as the object is from the mirror
 - o Applications:
 - § Bathroom mirror
 - § periscope
 - o Convex mirror (Curved outwards):
 - o Properties
 - § Shows more things
 - § decreases the size of objects reflected in them

- o Applications:
 - § Funhouse mirror
 - § road corners
 - § rear-view mirrors
 - § side-view mirrors
- o Concave mirror (Curved inwards):
 - o Properties
 - § Shows less things
 - § increases the size of objects
 - o Applications:
 - § Vanity mirror
 - §
 - § dentist mirror
 - § car headlights (reflect light to form strong beams of light)
 - § microscope

Refraction

- A clear image can only be formed if the reflecting surface is smooth
- When parallel rays of light on a rough surface, each ray is reflected in a different direction
- Reflection is the bending of light at the boundary as it passes from one medium to the other => due to change of speed as it passes through 1 medium to another
- Optical mediums have a property called optical density that affects the speed that light travels at through the medium
- Light travels faster in air than in glass
 - o when a ray of light travels from air (optically less dense substance) into the glass block (optically less dense substance) => it slows down and bends towards the normal
 - o When the ray of light is exiting the glass block => gains speed and bends away from the normal
- Refraction also makes things appear shallower than they actually are (like in a swimming pool)
- White light is made up of a spectrum of the 7 primary colours => namely:
 - o Red
 - o Orange
 - o Yellow
 - o Green

- o Blue
 - o Violet
 - o ROYGBIV
- Light bend when it travels from air to water due to its decrease in speed, after rain => moisture in the air => sunlight crosses the air-water boundary to enter each raindrop => light of each colour bends at different angles, violet rays bending the most and red rays bending the least => sunlight get separated into the seven colours of the spectrum => this is known as dispersion
- Dispersion also occurs when white light passes through a glass prism

Impact of Radiation Applications

- We can only see electromagnetic (EM) radiation
- We cannot see some electromagnetic (EM) radiation such as: infrared and ultraviolet (UV) radiation
- Infrared light:
 - o Applications
 - § Infrared technology can be used in healthcare
 - In airports, public spaces to screen people for fever
 - Detects infrared radiation emitted by a person to form an image of their body temperature
 - o Harmful effects:
 - § Overexposure can harm us
 - § Commonly used in welding, cutting and brazing operations as well as in furnaces and molten metal production in industries
 - § Workers exposed to prolonged exposure to infrared radiation have to wear goggles to protect their eyes
 - § Infrared radiation also contributes to climate change, temperatures on earth have also increased and weather patterns have changed in ways that could harm living things
- Ultraviolet (UV) radiation:
 - o Applications
 - § Exposure to a small amount => increases the production of vitamin D in the body
 - § Used in medical treatments for skin diseases like psoriasis
 - § Reproduces action of sunlight in a scientific and controlled manner

- § UV light sterilisation is an environmentally friendlier method of disinfecting medical equipment, food and water without using harmful chemicals or releasing harmful by-products
- Harmful effects:
 - § Overexposure can harm eyes and cause skin cancer
 - § Encouraged to put on sunscreen => helps filter out UV radiation
- Visible light:
 - Applications
 - § During the day, plants need the energy provided by visible light to make sugars using carbon dioxide and water using photosynthesis
 - § Allows us to carry out our daily activities
 - Harmful effects:
 - § Causes chemical changes in some materials => deterioration of their quality
 - § In museums, care is taken to protect very old documents, photographs and paintings => photography is not allowed, some objects are stored in the dark to prevent discolouration by light
 - § Too much light => light pollution => negatively impacts animals that depend on the cycle of night and day to survive (migration, reproduction, searching for food, sleeping, escaping from predators)
 - § Also uses a lot of electricity (wasteful)
 - § Can avoid this with prudent use of energy-efficient lighting technology such as LEDs and compact fluorescents (CFLs), can reduce light pollution and energy usage