

Science Journal

In your science journals answer the following questions.

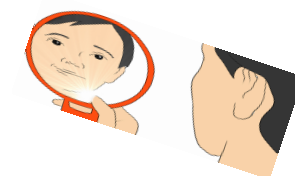
- 1) List some ways that you used light today. Include situations involving reflections.

- 2) How is light from a light bulb similar to the light from the sun?

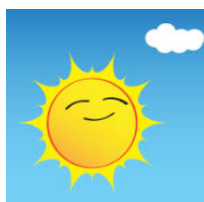
- 3) Why do objects look different when they are immersed in water?



Unit 3



Optics



Light - is the form of energy that you can see

Natural light sources are:

1) The Sun is a star with the most abundant and the least expensive in the world

2) Flames or Sparks from Fire

The sun and other stars emit light in all directions using waves or rays (similar to spokes on a bicycle). This is known as **radiation**. Energy such as light that travels by radiation, like the sun, is known as **radiant energy**.

Since we do not always have the light from the sun, we have developed **artificial light sources** Examples: light bulb, flashlight

Interesting fact - less than $1/10^7$ % of the sun's energy actually reaches the earth

All sources of light require energy. A light bulb uses electricity, flash light uses batteries and a match used chemicals. Light from the Sun is formed through a process called nuclear fusion.



The first basic property of light is that light is a form of energy.

When light is absorbed by a surface, it can be transformed into one of the following:

- 1) **Thermal Energy**- energy that comes from heat
ex) black sweater absorbing the sun

- 2) **Chemical Energy** - energy stored in the bonds of chemical compounds (atoms and molecules)
ex) trees absorbing sunlight to make sugars
ex) glow sticks

- 3) **Electrical Energy** - uses electrons and conductors to produce the electricity we use in our houses

- 4) **Solar Energy** - Solar cells change light to electricity

Intensity is the brightness of a light. This indicates how much energy a surface will receive.

Ex) Pavement on a bright sunny day will be hotter than pavement on a cloudy day.



Hot Clear day



Cloudy Day

Ex) Compare reading a book right next to a lamp at night time, to trying to read it 3 m away from it. How does increasing the distance from the lamp affect the intensity of the light striking the book's pages?

Sources of Light

There are many different sources of light:

1) **Incandescent sources** - is when an object can be heated to such a high temperature that it gives off visible light.

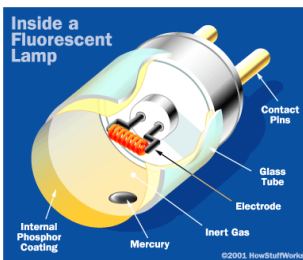
Pathway: Electrical → Thermal → visible

Ex) A regular Light bulb, candle flames

2) **Fluorescent Sources** - High energy, invisible ultraviolet (UV) is absorbing particles to produce visible light **immediately**.

Pathway: Ultraviolet → Energy absorbed by particles → visible

Ex) Black Light, Lights in classroom (long tubes)



Example) Fluorescent light in school. An electrical current from the lead in wires and electrodes cause the mercury vapor inside the tube to give off ultraviolet radiation. A phosphor coating on the inside of the tube absorbs the UV energy. This causes the coating to glow, thus producing light that you can see.

Fluorescent Advantage over Incandescent

- no thermal energy involved so less heat/ energy lost (Energy efficient)
- bulbs are cool to touch

Fluorescent Disadvantage over Incandescent

- expensive
- mercury & phosphorus are toxic thus making them harder to dispose of

Sources of Light continued

3) **Phosphorescent sources** - is when light particles are absorbed by certain particles **that can store energy for a while** then released later as light.



Pathway: Ultraviolet → Energy absorbed by particles → visible

Ex) glow in the dark stickers

4) **Chemiluminescent sources** - chemical reactions that release energy

Pathway: Chemical → visible

Ex) glow sticks



In a glow stick you have breakable barrier that separates two liquid. Bending the stick causes the barrier to break thus mixing the two liquids to cause a chemical reaction that relaes light.

5) **Bioluminescent sources** - unusual source but it is used by sea animals that usuall live deep in the ocean where the sunlight does not reach. Jelly fish use this source of light energy.

Pathway: Chemical → visible

Ex) Jelly Fish