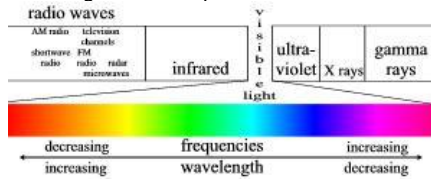


ELECTROMAGNETIC SPECTRUM

The sun is the most abundant source of electromagnetic energy. Each part of the electromagnetic spectrum has different wavelengths and frequencies.



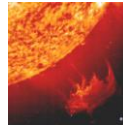
The higher the frequency the more damaging the electromagnetic rays are. **Gamma rays** are the most dangerous, and **Radio waves** are the least dangerous.

Many practical applications utilize different types of electromagnetic energy on a daily basis. Each form of energy is unique because of its distinct properties and wavelength.

NATURAL LIGHT

Light is often called **radiant energy**. Light from the sun is formed by nuclear fusion.

NATURAL Light Sources



Sun



Candles

Oil Lamps



Wood (fire)



Bioluminescence
(light produced by living organisms)

ARTIFICIAL LIGHT



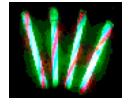
Incandescent
(heat causing a filament of metal to glow - visible light)

Florescent
(ultraviolet light is absorbed by fabric particles, which in turn emit some of the energy as light - glowing)



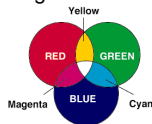
Phosphorescent
(light energy is stored and released later as visible light) paint

Chemiluminescent
(light energy released by chemical reactions)
glow sticks

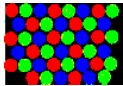


COLOR OF LIGHT

The primary colors of the visible light spectrum are red green and blue.

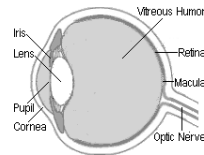


By mixing the correct intensities of the primary colors, you will observe white light. Secondary colors are cyan, magenta and **yellow**. The mixing of three colors of light to produce many different colors of light is called the **theory of color addition**.

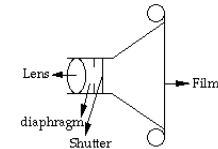


Television puts this theory of color addition into practice. By changing the brightness of the dots that make up the screen many different colors can be produced.

EYES AND CAMERAS



In the eye, the device (or part of the eye) that controls the amount of light entering is called the **iris** (the colored part of the eye), which changes the size of the **pupil** - in much the same way as the **diaphragm** controls the **aperture** (opening) of the camera lens.



The natural adjustment in the size of the pupils is called the **iris reflex**, which is extremely rapid.

CAMERA EYES

Eyes that have a cornea, a lens and a retina are called **camera eyes**. Vertebrates (animals with backbones) for the most part have camera eyes.

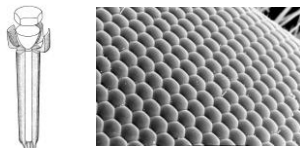
Fish have camera eyes with a perfectly round lens, which bulges out from the pupil, allowing it to see in practically every direction.

Birds have sharper vision than humans because they have five types of cones (humans have only 3), each sensitive to different wavelengths of light.

Nocturnal animals have eyes that collect as much light as possible because of their very large pupils. They also have a layer, called *tapetum lucidum*, inside their eye which acts as a mirror. They also have many more rods than cones in their retina making their eyes more sensitive to low levels of light.

COMPOUND EYES

Insects and crustaceans have **compound eyes**. Each eye is made up of many smaller units called **ommatidium**.



An ommatidium looks like a long tube with a lens on the outer surface, a focusing cone below it, and then a light sensitive cell below that.

The compound eye is great for spotting movement, but with so many lenses it is difficult to form a single **coherent** image. Instead it forms a **mosaic image** (much like a television screen).

DIGITAL IMAGES

Stadium Images

The stadium image is made up of people holding different colored cards. Each card is assigned a seat based on the graphic representation of where the colors need to be to produce the correct effect.

Digital Images

Just as in the stadium image, a big picture made out of small colored squares, a digital image is a picture made up of smaller colored pieces called **pixels** (picture elements). Each small pixel is assigned a place and is represented by a number. A series of numbers represents a color. These series of numbers can then be stored in the memory of a computer to be accessed at a later time. The quality of the image is represented by its **resolution**. The more pixels there are in the image, the higher the resolution.

DIGITAL TECHNOLOGIES

Capturing Digital Images

Scanners, digital video recorders, and digital cameras use a **charge-coupled device** (CCD) to capture the light. The CCD is a grid similar to graph paper. As the light enters each grid square it creates a small electrical charge, which is then converted into digital information and stored on a hard drive, compact disk or digital tape.

Transmitting Digital Images

Digital images can be sent over vast distances, without having to be processed. A powerful computer can convert the digital information very quickly. Digital imaging can also collect different parts of the electromagnetic spectrum, allowing infrared as well as visible images to be captured.