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Lesson one

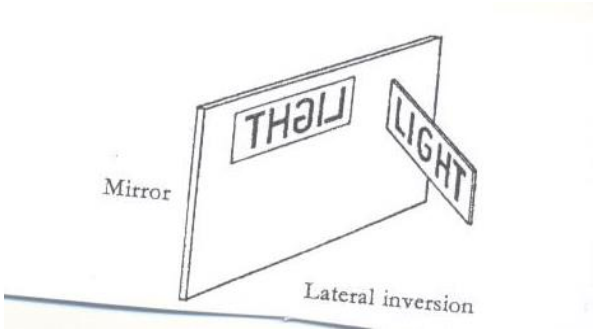
Simple optical instruments.

Optical instruments are instruments which use light for their functioning.
Examples of simple optical instruments are **plane mirrors** and **lenses.**

Plane mirrors.

Characteristics of images formed in a plane mirror.

- They are erect/upright.
- They have the same size as the object.
- The image is laterally inverted. (the right appears to be left in the mirror).
- Image distance is equal to the object distance from the mirror
- The image is virtual. (not formed on the screen)



Uses of plane mirrors

- They are used in periscopes
- They are used as dressing mirrors.
- They are used by dentists.
- They are also used in saloons

Lesson two

Curved Mirrors

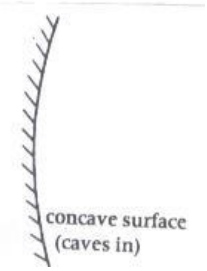
These have their reflecting surfaces form a hollow sphere.

Types of curved mirrors

Concave mirrors: It is coated on the outside of the spherical surface.

- ✓ They are used as reflectors in head light of cars and torches.
- ✓ Used by dentists.

- ✓ They are used in solar cookers to focus light on one spot.
- ✓ Used as shaving mirror



CHARACTERISTICS OF IMAGES IN CONCAVE MIRRORS.

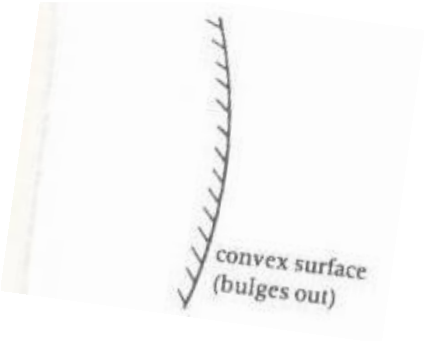
- ➢ They are real.
- ➢ They are upright.

Convex mirror: It is coated on the inside of the spherical surface.

- ✓ They are used as driving mirrors because they a clear view of the traffic behind.

Characteristics of images formed in convex mirrors.

- ✓ The images are upright
- ✓ The images are virtual.
- ✓ The images are smaller than the objects.



Real and virtual images

Virtual images are not formed on screen.

Virtual images are cast by plane mirrors, concave lens, and convex lens.

1. **How is reflection important to us?**
2. **How are periscopes useful to sub mariners?**
3. **State the way one can correct the following eye defects:**
   a) Myopia **b) Hypermetropia.**

Lesson three

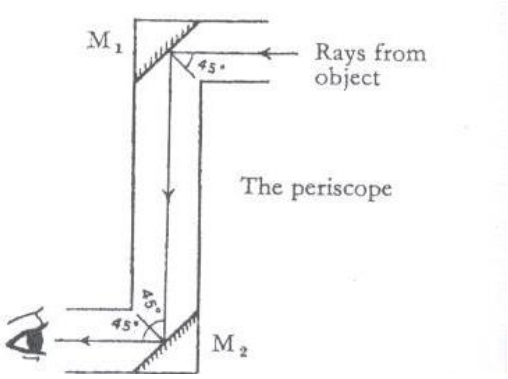
Periscope

They are instruments used to see objects overhead.

It is used by soldiers, sub mariners etc.

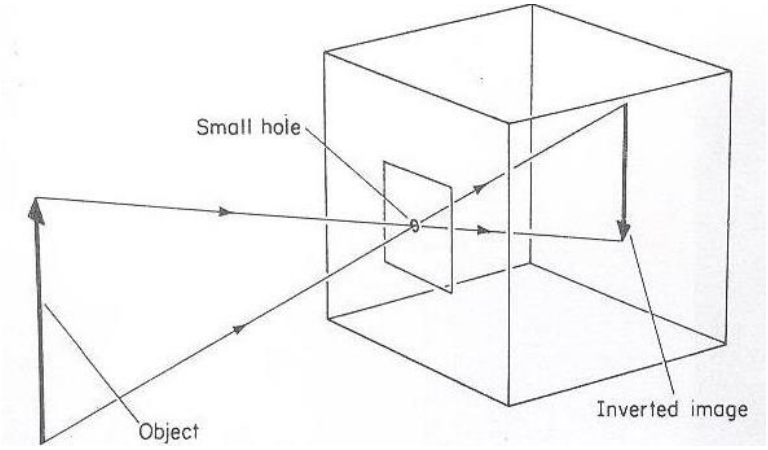
A ray of light from the object strikes mirror one at 45 degrees and then turned through 90 degrees to strike mirror two until the object is seen by the observer.

Illustration of a periscope.



Pinhole camera

It works on the principle that light travels in a straight line.



Characteristics of images formed with a pin hole camera

- The image is smaller than the object/diminished.
- The image is upside down./inverted
- The image formed is real.

  NB:- If the distance between the object and camera is increased, the image becomes smaller and blurred.

- If the distance between the object and the camera is decreased, the image becomes larger and blighter.
- When the hole is too big, the image is blurred.

Lesson 4 and 5

Refraction of light

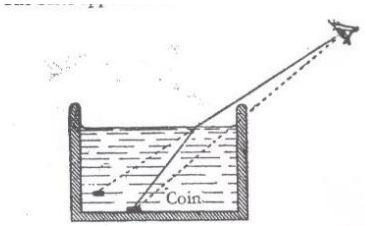
Refraction means the bending of a light ray as it moves from one transparent medium to another.

Principle/law of refraction.

i.The incident ray, the refracted ray and the normal all lie on the same plane.
ii.A ray of light travelling along the normal will not get refracted and will pass unchanged.

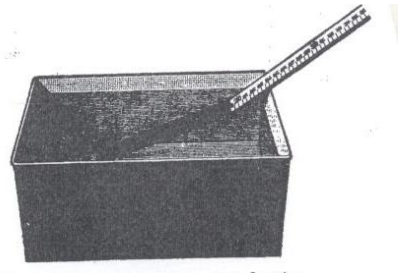
Effects of refraction

i. Fish in water appears shallower than they are.



ii. A pool appears shallower than it really is.
iii. Refraction produces colors e.g. spectrum

IV. An object put in water appears bent.



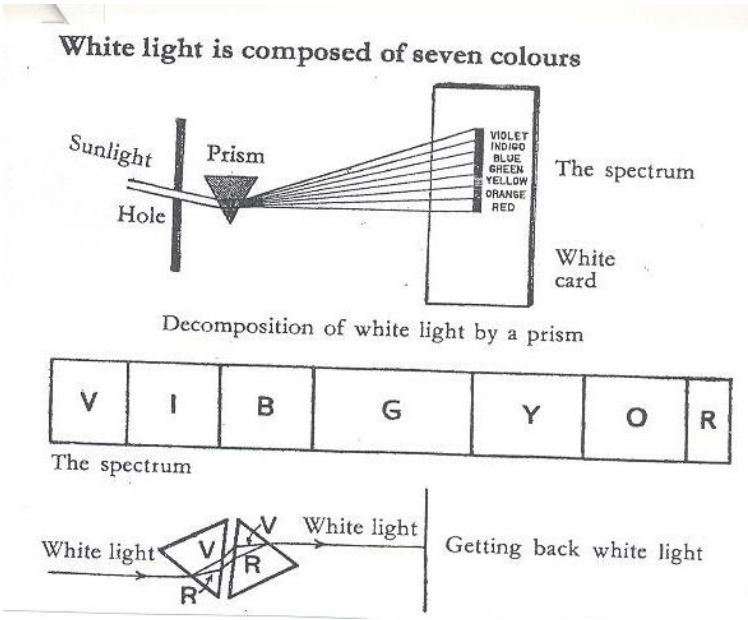
Prisms and Light spectrum.

Spectrum

Is a band of seven colours.

Dispersion of light.

- Is the splitting of light into different colours.
- Dispersion is caused by refraction of light rays at different angles in glass prism. **Dispersion/ Refraction of white light by glass prism**. (ROYGIBIV)
- Light rays in a glass prism bend at different angles because they move at a different speed.
- The fastest ray bends most (violet) and it has a short wave length.

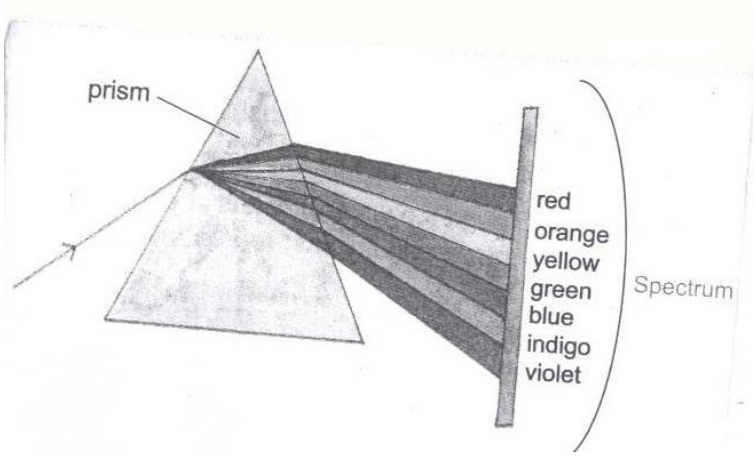


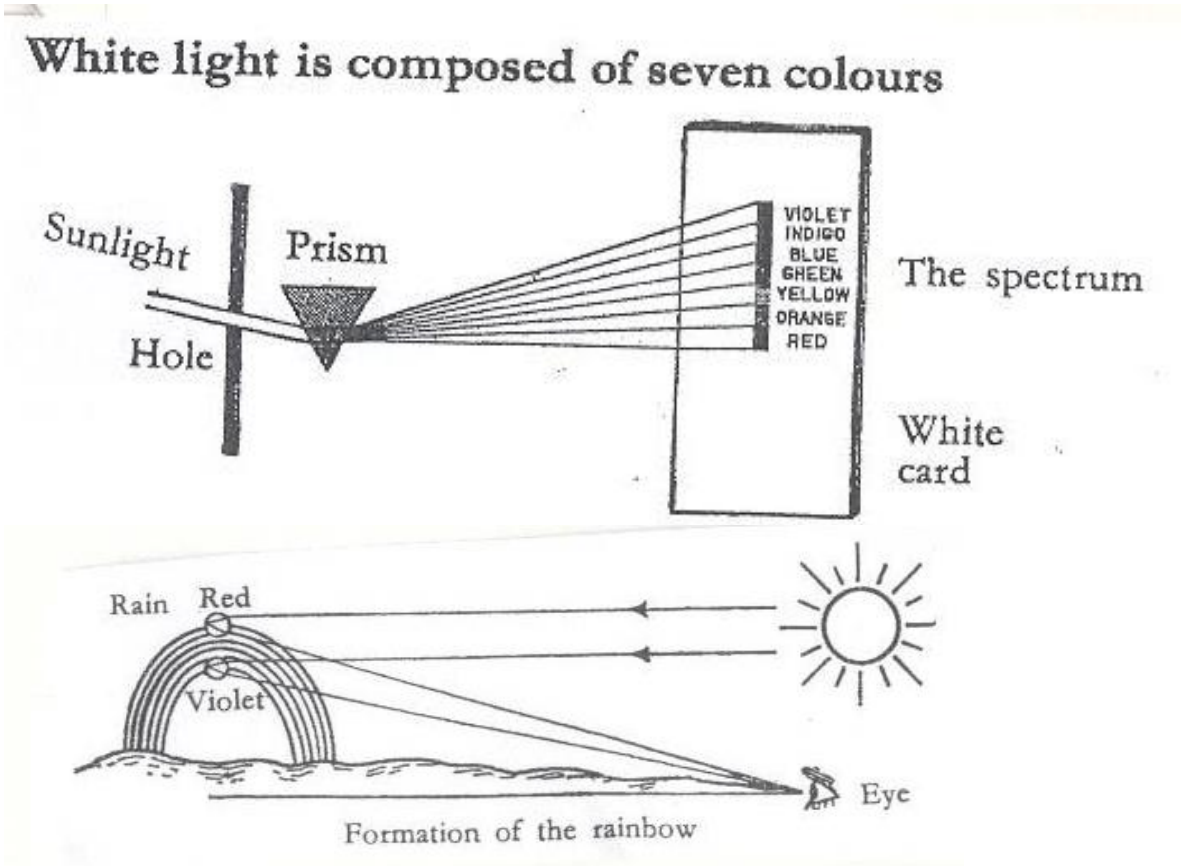
- The slowest ray bends least.(red) and it has a long wave length.
- The order of the colours of the spectrum from top to bottom is Red, Orange, yellow, Green, Blue, Indigo, Violet.
- It can be memorized in the sentence Richard Okello Your Girl Benita Is Vomiting.

Lesson 6 and 7

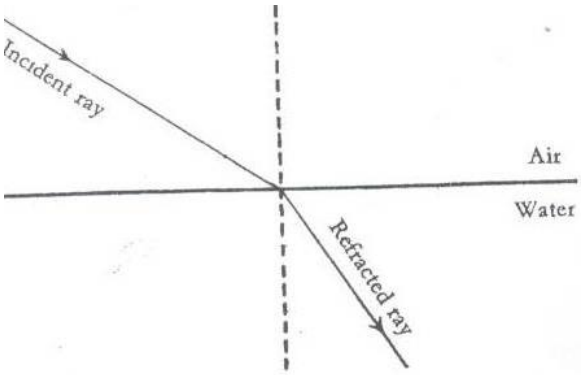
THE RAINBOW

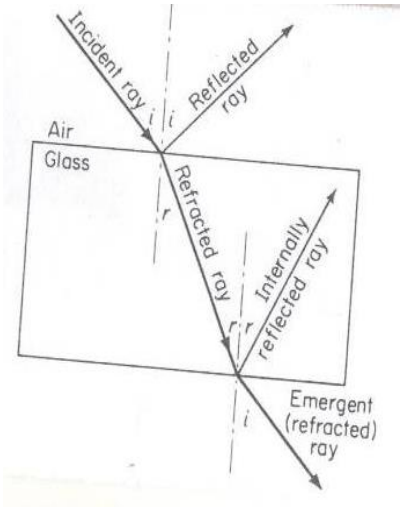
- It is a natural spectrum in the sky.
- It is formed when light rays from the sun pass through rain drops.
- The inner colour of the rainbow is violet.
- The outer colour of the rainbow is red.





Refraction through a rectangular glass prism.





- **I** - Angle of incidence
- **R** - Angle of refraction
- Angle **i** is greater than angle **r.**

Qn. What happens to the ray of light when it moves from one medium with fewer molecules to another one with more molecules?

-Its speed slows down.

-It bends towards the normal

Qn. What happens to the ray of light when it moves from one medium with molecules to another with fewer molecules?

-Its speed increases.

-The light ray bends away from the normal.

COLOURS OF LIGHT

TYPES OF COLOURS.

- Primary colours
- Secondary colours.
- Complementary colours.

Primary colors of light are the colours got without mixing any other colour.

Examples of primary colours.Red, Blue and Green

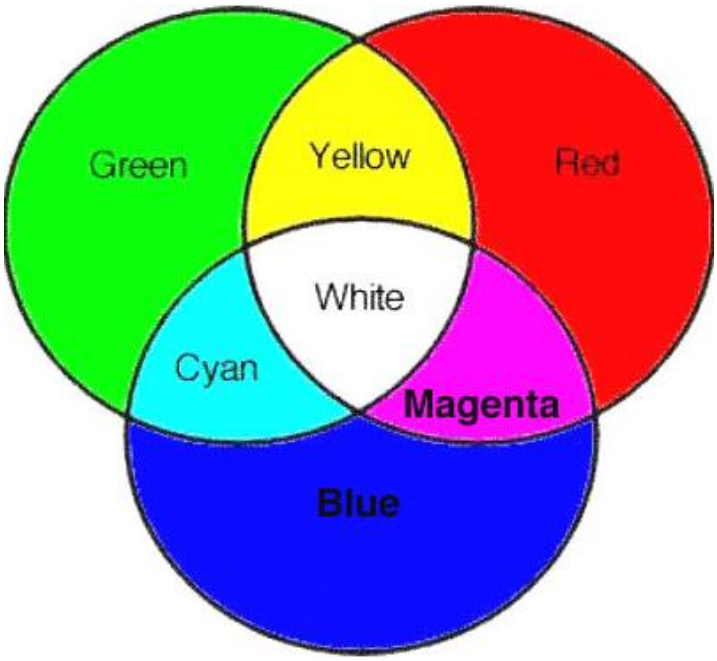
Secondary colours are the colours formed by mixing two primary colours.

Examples of secondary colours are Yellow, Magenta and cyan.

i.e. Red + Green = White

- Red + Blue = Magenta
- Blue + Green =Cyan

Complementary colours. Are the two colours of light which when mixed give white light
Examples of complementary colours are
Blue + Yellow = White
Red + Cyan = White
Green + Magenta = White
Red + Green + Black = White light.



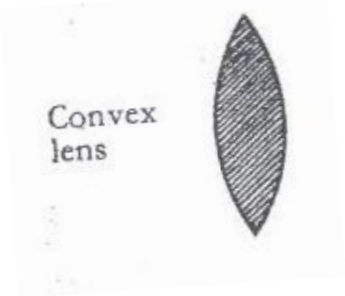
Lesson 8 and 9

LENSES

- Lenses are optical instruments used to focus or defocus.
- The surface of the lens may be convex, concave, plane or a combination of these.
- Lenses are used in materials like; cameras, microscopes, binoculars.

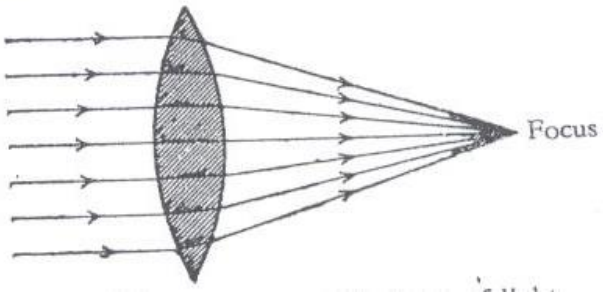
Types of lenses

Convex (converging) lens



Concave (diverging) lens.

- **The effect of lenses on beams of light.**
  Convex (converging) lens.
  It refracts light to meet at one point (focal point)

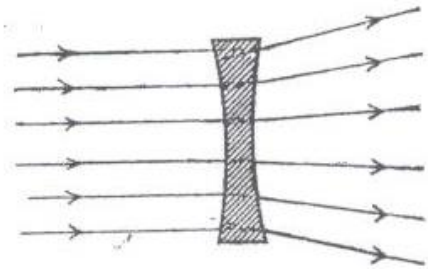


Characteristics of images by convex lenses

- It is inverted.
- It is magnified.
- It is real
- It is formed in infinity.

Concave (diverging) Lens

It refracts light and spread it out in different directions.



- **Characteristics of images formed by concave lens.**
- Are erect/upright
- Are virtual.
- Image is diminished/reduced in size.

  Uses of lenses
- Lenses are used in optical instruments like telescopes, camera, and microscopes etc

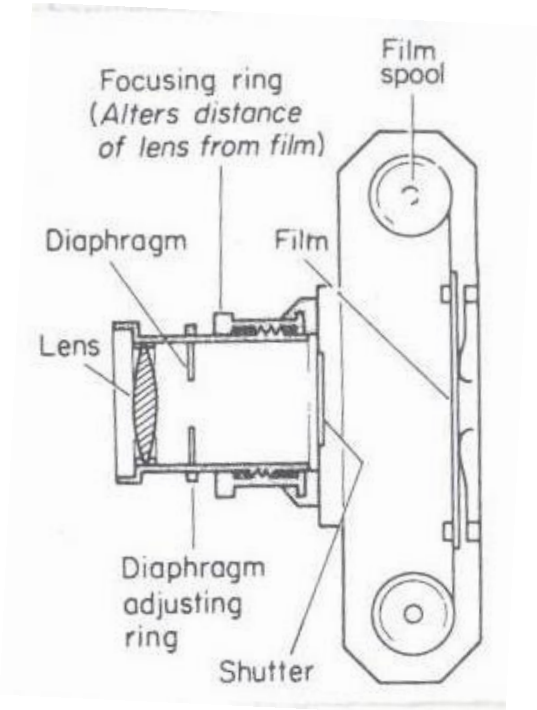
- Lenses are used in spectacles.
- Lenses are used in magnifying glasses.

The magnifying glass

WEEK 4

Lesson one and two

The lens camera



<u>Parts of the camera and their functions.</u>

- **Lens**: It focuses light to the film.
- **Film:** The image is formed there.
- **Diaphragm**: Controls the amount of light entering the camera.
- **Shutter**: It uncovers the diaphragm to allow light into the camera.
  It blocks light entering the camera.

- **Bellows(screw mounting):** Adjusts the distance of the lens from te film to obtain the sharp image.
  When the film is developed in a chemical a **negative** is got.
  On the negative the **bright** part appears **dark** and vice versa.
  That is the reason why it is called **negative**.
    - **Aperture:** It allows light into the camera.

Characteristics of images formed by the lens camera

- They are real (they are formed on the film.)
- They are smaller than the object.
- They are inverted

Telescope:
It is used to look at distant objects.

Microscope:
It is used to look at very small objects e.g. bacteria, amoeba, cells etc.
Spectacles
Projectors.
It casts images from films and slides to the screen.
It consists of a source of light, a concave reflector and a condenser.
The condenser focuses the rays through the film or side.

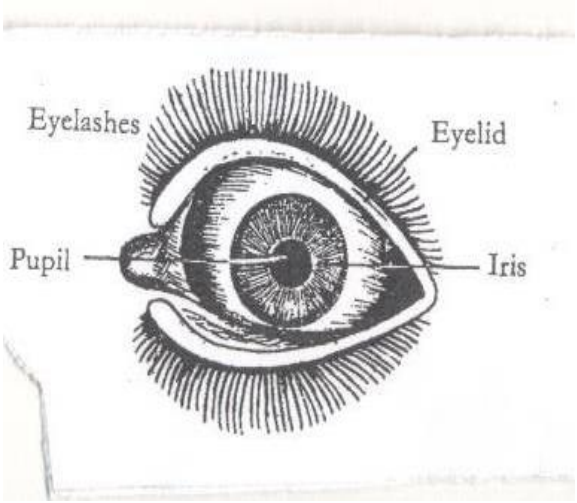
Epivisors.

Lesson three and four

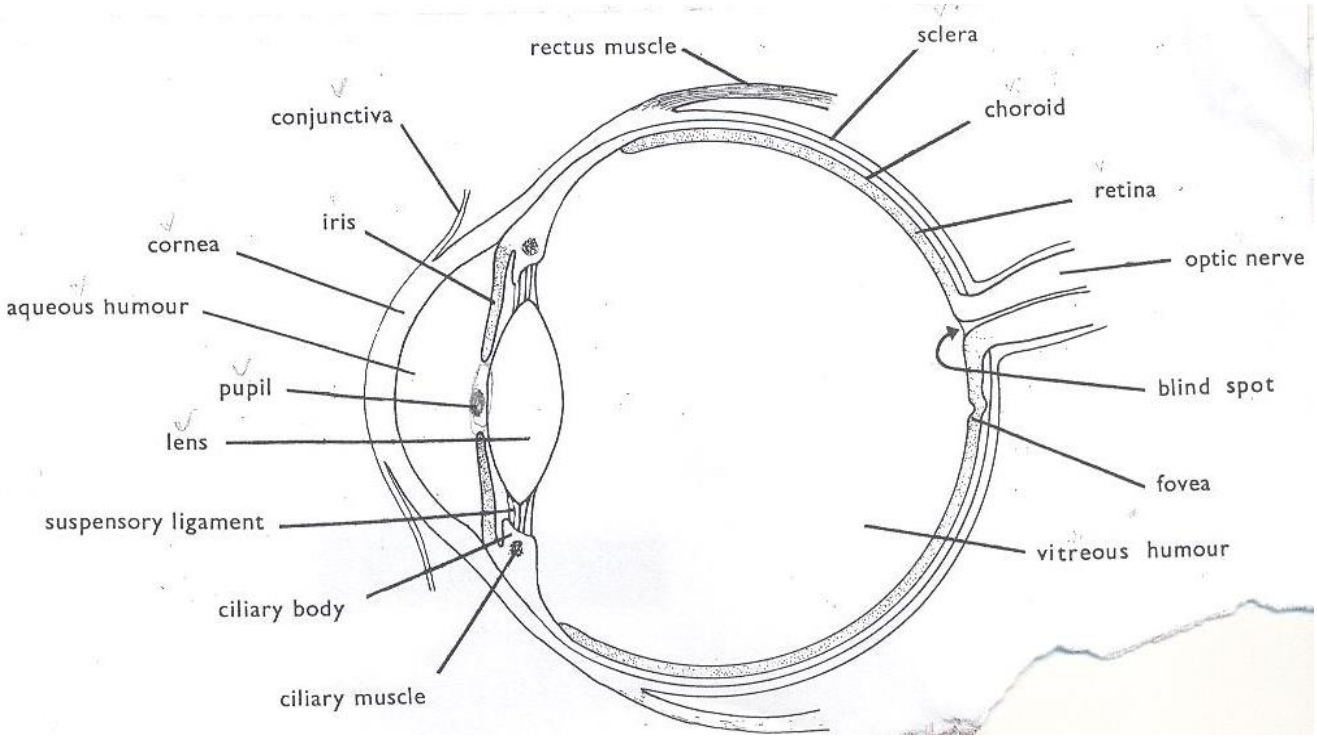
The human eye

The eye is the sense organ for sight.
The complete eye is called the **eyeball**.
The eye ball is protected by the socket of the skull.

A structure of a mammalian eye
Front view



Cross section view



<u>Uses of the parts of the eye</u>

i. Cornea: It aids refraction of light rays to begin converging as it passes through it.

ii. Conjunctiva: It covers the front part of the eye.

iii. Aqueous humour: It maintains the shape of the eye.

It helps to refract light and form an image on the retina.

iv. Iris: It controls/regulates the amount of light entering the eye.
It expands and contracts to reduce the size of the pupil.
v. Pupil: It lets enough light into the eye.
vi. Convex Lens: It focuses light on to the retina (accommodation)
vii. Ciliary muscles: These change the shape of the lens for accommodation.
viii. Vitreous humour: It maintains the shape of the eye.

It helps to refract light and form an image on the retina.

ix. Retina: It is where the image is formed.

It has the rods (light sensitive cells that are responsible for dim light) and the

cones (light sensitive cells that are responsible for bright light)
x. Optic nerve: It transmits light messages to the brain.
xi. The eye lids: Prevent foreign bodies from entering the eye

xii. Eye rashes: Prevents water and other particles from entering the eye.
xiii. Fovea: It gives the most accurate interpretation of an image.
xiv. Blind spot: Has no light sensitive cells. If part of an image falls on it no impression is recorded in brain.

xv. **Ciliary body**: It contains blood vessels which supply blood to the eye.

xviii. **Choroid:** a black pigment under the sclera that prevents **internal reflection** in the eye.

xv. **Tear glands:** produces a solution that keeps the eye moist and washes dust fro m them.

xvi. Sclera: It is a tough, non elastic and fibrous coat round the eyeball

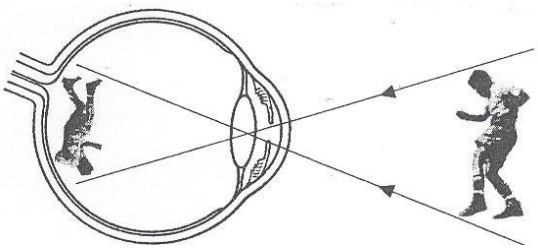
How is regular blinking important to the eye?

It distributes the fluid over the surface of the eye and prevents it from drying up.

Characteristics of images formed by the eye.

i. It is upside down/inverted.
ii.Smaller than the object/dimished.
iii.The image is real.

Normal vision.
In normal vision, the image of the object seen is formed on the retina.



COMPARE A MAMMALIAN EYE AND A LENS CAMERA.

DIFFERENCES

Eye	**Camera**
Lens focuses light on the retina	Lens focuses light on the film
Iris controls light intensity.	Diaphragm controls light intensity
Eyelids block light from entering the eye	The shutter blocks light into the camera
The images are formed on the retina	The images are formed on the film
The pupil allows light into the eye	The aperture allows light into the eye.
The choroid prevents internal reflection	The black inside parts prevents internal reflection

Lesson five and six

SIMILARITIES BETWEEN IMAGES FORMED IN A CAMERA AND EYE.

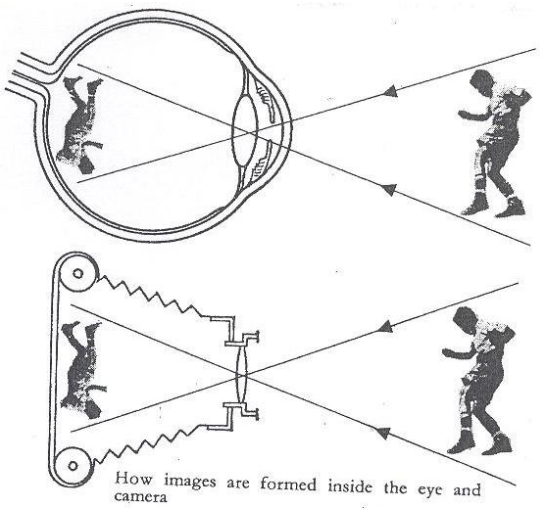
The images are real, diminished and upside down

Compare a mammalian eye and a pinhole camera.

Eye	**Pin hole camera**
Focusing is done by changing the shape of the lens.	Focusing is done by moving the camera forwards or backwards
Image is formed on the retina.	Image is formed on the screen
Iris controls light entering the eye	No control of light.
The eye can be covered by eyelids.	The pinhole is always exposed to light.

Similariries.

The image formed is upside down
The image is diminished
The images formed are real



How images are formed inside the eye and camera

The parts of the eye and Camera with similar functions.

Eye	**Camera**
1. convex Lens	convex Lens
2. Iris	Diaphragm
3. Eye lid	Shutter
4. Retina	Film
5. Pupil	Aperture
6. Choroid	The black inside part of the camera.

Diseases and disorders of the human eye.

Eye diseases

1. Conjuctivitis (Red eyes/pink eyes)

Cause

It is caused by **bacteria or viruses**.

Spread

It is spread by finger and face towels.

Signs and symptoms

- Red eye/pink eye.

- Mild burning in the eyes.
- Eyelids stick together during sleep.
- Watery fluid discharge.

Control

- Isolation of the sick.
- Avoid sharing towels, handkerchiefs and bathing containers.
- Always wash hands with clean water.
- Treat pregnant mothers with gonorrhea.

2. Trachoma

Cause; It is caused by a bacterium called **Chlamydia.**

Spread; It is spread by houseflies, hands and face towels.

Signs and symptoms

- The eye turns red.
- The eyes produce watery fluids.
- Irritation in the eyes.
- Small lamps under the upper eyelids.
- The white part swells.

Control

- Wash hands and eyes regularly.
- Do not shake hands during the outbreak.
- Do not share hankies and face towels.
- Treat the infected ones.

3. **River Blindness**

It is caused by **onchocerca**

It is spread by black flies/simulids /Jinja fly.

Signs and symptoms.

- The eyes turn red
- Tears flow.
- Inflammation of the iris.
- The skin gets rough.
- Enlargement of lymph nodes.
- Itching on the trunk.
- Lumps from under the skin.

Control

- Clear vegetation on banks of rivers.
- Spray the larva of Jinja fly.

Other eye diseases.

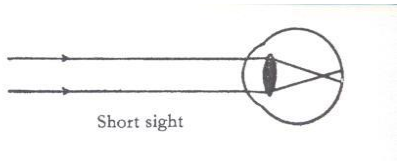
- Blepharitis.
- Cataracts-clouded lenses

- Glaucoma- damage to the optic nerve from too much pressure in the eye Sty.

Eye defects/disorders, cause and correction.

- **i.Short sight (myopia)**

  It is where a person is able to see nearby objects clearly but not far off objects.



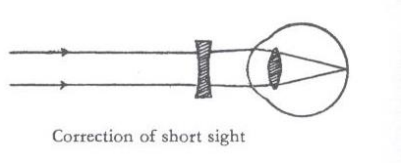
Causes of short sight.

-Large/elongated eyeballs.

-Eye diseases

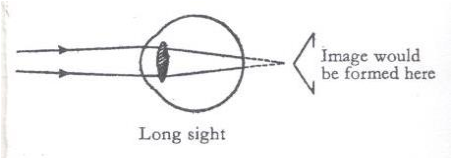
Correction.

Wear spectacles with concave lens



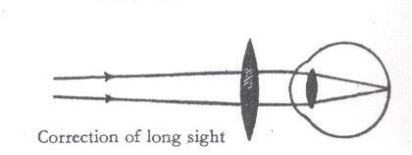
ii.Long sightedness. (Hypermetropia

Is where a person can see distant objects clearly but not nearby objects.



Correction.

Wear spectacles with convex lens.



iii.Astigmatism. (distorted vision at all distances)

It is a condition in which one is unable to see both vertical and horizontal objects clearly at the same time.

Astigimation is common during old age.

Causes of astigmation.

Having irregular cornea.

Correction

Wearing glasses with cylindrical lenses.

Care of the human eye

1. Wash eyes with soap every day.
2. Don’t look directly at very bright light e.g. sun.
3. Don’t share face towels.
4. See the optician in case of a problem.
5. Avoid reading on dim light.
6. While reading, let the light come from over the shoulders**.**
7. Avoid rubbing your eyes.

While reading don’t be too close to the source of light