GOVERNMENT OF TAMIL NADU

STANDARD SEVEN

TERM - III

VOLUME - 3

SCIENCE
SOCIAL SCIENCE

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Department of School Education

Untouchability is Inhuman and a Crime

Government of Tamil Nadu

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NOT FOR SALE

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PREFACE

The Science textbook for standard Seven has been prepared following the guidelines given in the National Curriculum Framework 2005. The book enables the reader to read the text, comprehend and perform the learning experiences with the help of teacher. The Students explore the concepts through activities and by the teacher demonstration. Thus the book is learner centric with simple activities that can be performed by the students under the supervision of teachers.

HOW TO USE THE BOOK?

- The Third term VII Science book has Six units.
- Units planned as per the index given including computer science.
- Each unit comprises of simple activities and experiments that can be done by the teacher through demonstration if necessary student's can perform them.
- Colorful info-graphics and info-bits enhance the visual learning.
- Glossary has been introduced to learn scientific terms.
- The "Do you know?" box can be used to enrich the knowledge of general science around the world.
- ICT Corner and QR code has been introduced in each unit for the first time to enhance digital science skills.

Lets use the QR code in the text books ! How ?

- Download the QR code scanner from the Google play store/ Apple App Store into your Smart phone.
- Open the QR code scanner application
- Once the scanner button in the application is clicked, camera opens and then bring it closer to the QR code in the text book.
- Once the camera detects the QR code, a URL appears in the screen.
- Click the URL and go to the content page.

Q9R2V2
E - book

Z1Z1F1
Assessment

B351_7_SCIENCE_EM
DIGI links

QR GUIDE

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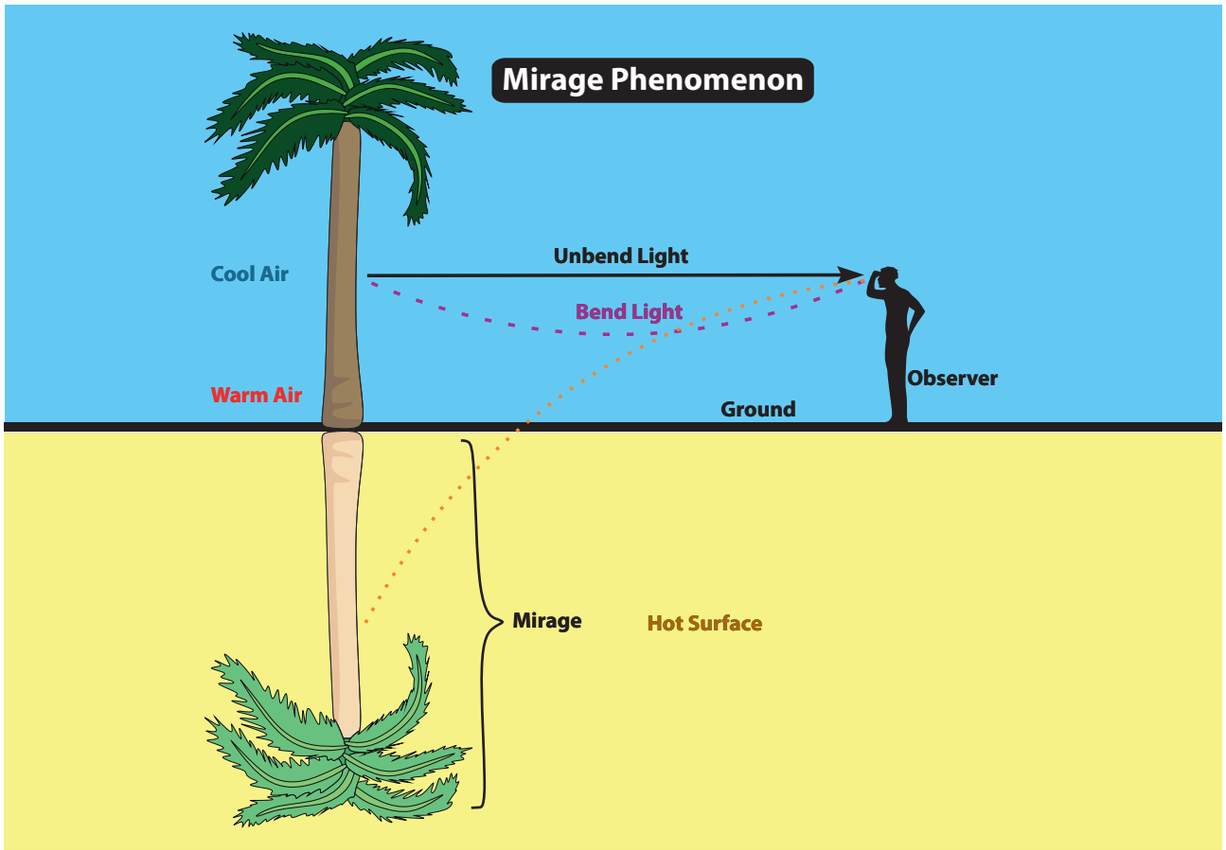
Unit 1

Light



Learning Objectives

The students will be able to

- understand that light is an energy
- differentiate natural and artificial light sources
- understand rectilinear propagation of light
- understand formation of shadows
- know reflection of light and its types
- know the laws of reflection
- understand the properties of the images formed in a plane mirror
- understand dispersion and spectrum
- understand synthesis of colors

G3I1D2

Introduction

When you enter into a dark room, nothing is visible. The moment you switch on the light, everything in the room becomes visible. How do we see things with our eyes? When you look at this book, the light falling on the book is reflected and enters your eyes. Light is a type of energy that helps us to see all the things around us. Light can be detected by the human eye. We all know that light is essential for vision. Let us see more about light in this chapter

DO YOU KNOW?

Light is the only source of energy for plants. So, they entirely depend on light. People and animals derive energy from carbohydrates, protein and fat through their food. Plants produce food using the energy from Sun light, carbon-di-oxide and water by the process called as Photosynthesis. Sun light acts a vital role in the process of photosynthesis.

Sources of Light.

Objects which are able to emit light are known as light sources. Light rays can come from different sources. There are two types of sources of light.

1. Natural sources of light
2. Artificial sources of light

G5L3R8

Natural Sources of light

Sources which emit light naturally are known as natural sources of light. The Sun is the primary and the major source of natural light. Stars also produce light, in the same way as the Sun do. However, as they are much farther away than the Sun, the light from them are too weak. The moon provides light, particularly in the night. Some living organisms have the ability to produce light named by bioluminescence. It is the effect of certain chemical reactions occurring in the organism. Fireflies, jellyfish, glow worm, certain deep sea plants and some microorganisms can emit light naturally.

Artificial Sources of light

Apart from the natural sources, light can also be produced artificially. The different light sources that are able to produce light artificially can be put under three broad categories.

DO YOU KNOW?

Is the moon a luminous object?

The moon provides light as well, but it cannot produce light by its own. The light emitted by the Moon is the light of the Sun reflected towards the Earth. When we see the Moon, we see only the Moon's lighted part. Thus, half of the moon is always facing the Sun and receiving light from it. Hence, we receive light from the moon.

Artificial sources are man – made light sources such as flame of candle, incandescent lamp, neon lamp, Sodium lamp etc.

1. Incandescent Sources: When certain objects are heated to a high temperature, they begin to emit light. The glowing of hot iron rod is a kind of Incandescent light.

Example: Candle, incandescent lamp.

2. Gas Discharge Sources: Passing electricity through certain gases at a very low pressure (discharging) can produce light .

Example: Neon lamp, Sodium lamp

DO YOU KNOW?

We often use a kind of gas-discharge lamp that uses fluorescence to produce visible light. The electric current in the gas excites mercury vapour, which produces short-wave ultraviolet light that then causes a phosphor coating on the inside of the lamp to glow in visible light.

Properties of light

In this section, we shall examine some properties of light. Light has some fundamental properties as mentioned below

- ❖ Rectilinear propagation of light
- ❖ Reflection
- ❖ Speed
- ❖ Interaction of light with matter
  - Types of material according to permeability
  - Formation of shadows
  - Plane mirror and images
- ❖ Spectrum

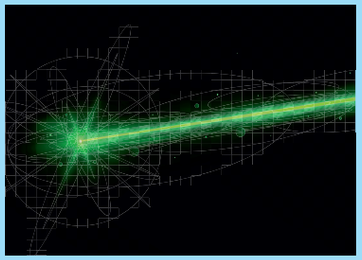
The path of light

How does light travel?

- Have you ever seen the scene of light penetrating through the branches of trees in denser forest?
- Have you ever seen the path of sun light entering through the hole of a cement grill building?
- Have you ever seen the path of a laser light?

Light penetration through trees

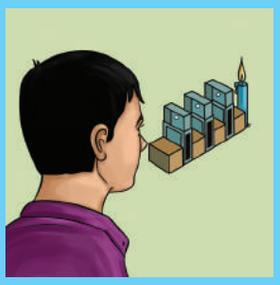
Light travels through the holes in cement grill

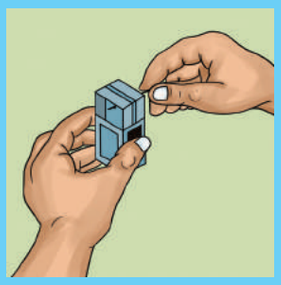


Laser beam

ACTIVITY 1

Requirement: Three empty match boxes, pin, candle and wooden blocks.





Procedure: Arrange empty match boxes and wooden blocks as shown in the figure. First, you make a hole in the inner tray of each match box such that all three holes are in the same spot. Arrange the match boxes as shown in figure. Now, adjust the three inner trays in such a way that the three holes are in a straight line. Place a lighted candle at one end of this arrangement and try to see the flame of candle from a hole at the other end. Is the flame visible?

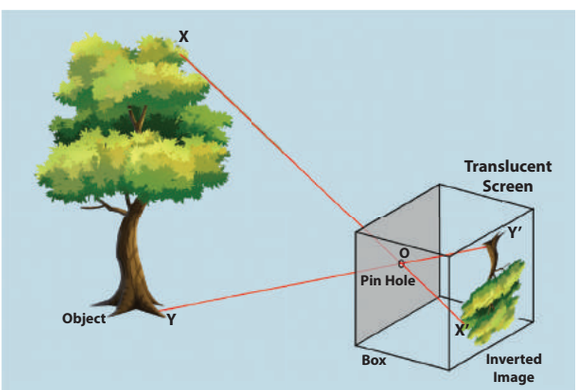
Now, arrange the trays such a way that they are not at the same height. Try to see the flame. Is it visible? What does this activity tell you about the path of light?

Light travels in straight line, it cannot bend the path itself. This is called as the *rectilinear propagation of light*. This is one of the most important property of light.

Al-hasan -Haytham was a scientific thinker who made important contribution to the understanding of vision, optics and light. He observed that light coming through a tiny hole travelled in straight lines and projected an image onto the opposite wall. Based on such experimentation, he concluded that vision is accomplished by rays coming from external luminous sources and entering the eye, rather than through rays emitted from the eye as was then commonly believed. He is the first one to experiment with light and found important properties like the rectilinear propagation of light.

Pinhole Camera

Pin hole camera is a simple device which helps us to understand about the rectilinear propagation of light

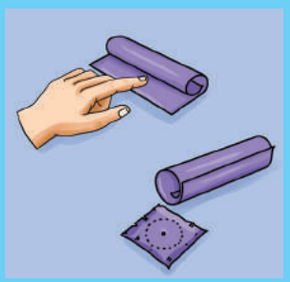


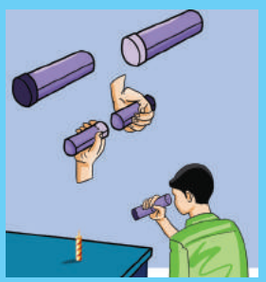
The above picture shows a model of a pin – hole camera. O is small hole by a pin. XY is the object and Y'X' is the image of XY. As light travels in straight line, one light ray from X travels along the XO strikes the screen X'.

ACTIVITY 2

Make your pin-hole camera

Requirement : Two rectangular pieces of thick paper, carbon paper, a semi-transparent paper, adhesive





Procedure : Make two tubes using thick paper as shown in figure. One tube should be slightly smaller in diameter so that it can slide into the other tube without leaving much gap between the tubes. Fix a carbon paper to one side of the tube of greater diameter. Make a hole with a pin at the center of the carbon. Close one end of the second tube with the butter paper. Slide the smaller tube into the bigger one such a way that the butter paper is inside. Keep a lighted candle on a table and look through the hole with black side towards the candle. If you go closer to the candle, you will see a smaller, but brighter image. You can also change the image size by adjusting the tubes.

Use the pin-hole camera to see things in sun light outside the window and see how good an image you get. What are your observations about the image? Is it straight, inverted, bright and sharp?

In similar way, another light ray staring from Y and travels along YO strikes the screen Y'. Similarly, all the rays in between X and Y fall on the screen between Y' and X'. Thus Y'X' becomes the image of XY. The image produced is temporary, if a simple paper is used. The image can be made permanent if the paper is replaced by a photographic plate.

Reflection

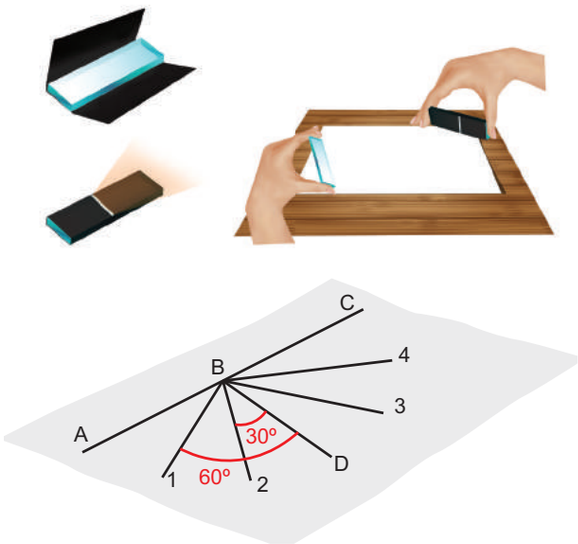
L8C1X8

A mirror reflects our face. A still water body like a pond reflects the scenery around it. When we see our face in the mirror, we see the light rays from our face bouncing off the surface of the mirror. How the rays of the light are reflected?

Take a plane mirror. Cover it with black paper. Cut a small slit as shown in the figure. If

Before the advancement of camera, Pinhole camera was used to photograph movement of the sun over a long period of time. This type of photography is known as ***solography*** and also be used for observing and recording solar eclipses. And it was also used to take photograph of stationary objects.

you shine light on the mirror from a torch light or sunlight, you will get a small ray of light. We can use this to study the properties of light.



Place a blank white sheet on a level ground out in the open. Choose a place where partly the sheet gets sunlight and partly it is in shadow. Hold the mirror with the slit facing the sun. You can see a straight ray of light reflected from the slit on the paper. Hold another mirror to reflect this ray. Observe well.

The light falling on the mirror is called as incident ray and the light reflected is called reflected ray..

Is there any relationship between the incident ray and reflected ray?

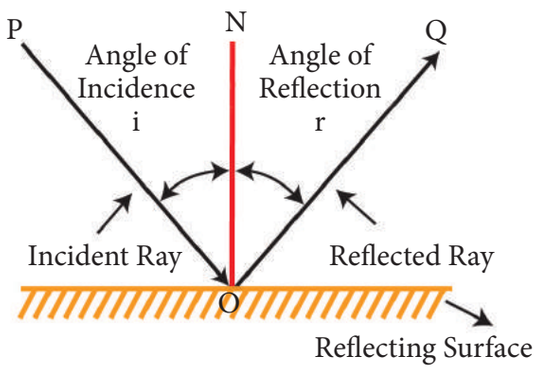
Draw a straight line ABC and angles as shown in the figure above. The line 1 is at 60^{O} from BD, 2 at 30^{O} from BD. Now , the line 4 at 60^{O} from BD and line 3 at 30^{O} from BD. The line BD is perpendicular, to ABC. Hold the mirror along the line ABC. Use the mirror with slit and make a ray go along the line 1 and reach the mirror at point B. Observe where the reflected ray is? Is the reflected ray go along 4?

Now, try keeping the mirror with slit and make the incident ray go along line 2. Now do we see that the reflected ray is along line 3?

Line BD, which is perpendicular the mirror surface is called as normal. The angle between the incident ray and the line BD is called angle of incident. Similarly, the angle between reflected ray and the normal is called as angle of reflection.

Can you make out relationship between the angle of incident ray and the angle of reflected ray? Yes. Is it not obvious that the angle of incident is same as the angle of reflection?

Terms used in reflection of light.



Incident ray: The ray of light that falls on the surface of the reflection materials. In figure, PO is the incident ray.

Reflected ray: The ray of light that comes from the point when the incident ray falls on the reflection material. In the figure, OQ is the reflected ray.

Point of incidence : The point of which are incident ray strikes the reflecting surface is the point of incidence. In the figure 'O' point of incidence.

Normal : The perpendicular line drawn from the point of incidence to the plane of reflecting surface is called normal. In figure, ON is the normal.

Angle of incidence: The angle formed between the incident ray PO and the normal 'ON' is angle of incidence. It is denoted by ∠i

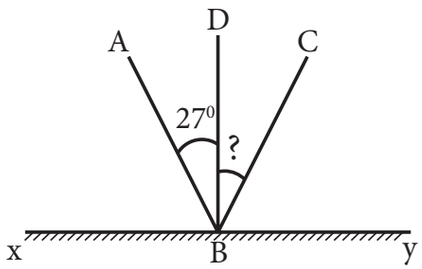
Angle of reflection: The angle formed between the reflected ray OQ and the normal ON is angle of reflection. It is denoted by ∠i

Laws of reflection:

1. The angle of incidence is always equal to the angle of reflection. ∠i = ∠r
2. The incident ray, the reflected ray and the normal at the point of incidence lie on the same plane.

Example 1

In the figure, the incident ray makes 27° with the normal, then find the angle of reflection.



Solution:

Angle of incidence = 27°

∴ According to the laws of refelection, the angle of refelection = Angle of incidence = 27°

Example 2:

A light ray strikes a reflective plane surface at an angle of 43° with the plane surface.

i. Find the angle of incidence.

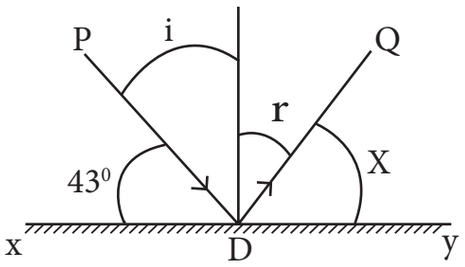
ii. Find the angle of reflection.

iii. Find the angle between the incident and the reflected ray

iv. Find the angle between the reflected ray and the plane surface.

Solution:

We use the diagram shown below to answer the questions.



a) Angle of incidence: i = 90 -43 = 47 °

b) angle of reflection r = i = 47°

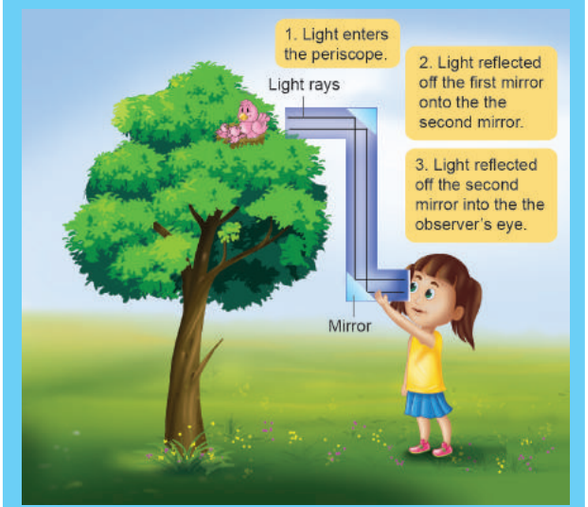
c) i + r = 47 + 47 = 94 °

d) x = 90 - r = 90 - 47 = 43 °

ACTIVITY 3

Make your own periscope : You can use an empty agarbathi box and two plane mirrors to make a periscope.

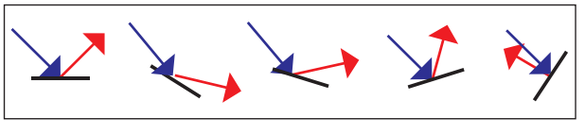
As shown in the figure below, two plane mirrors are kept 45 degrees to horizontal.



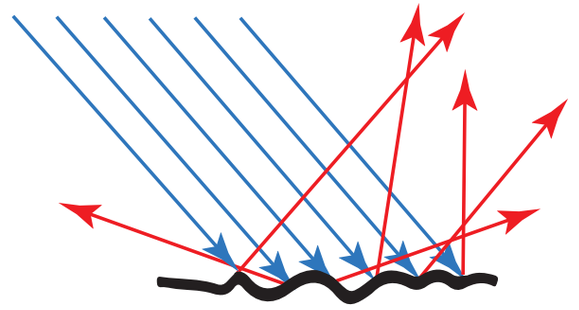
As shown the figure above, the light rays from the distant object enter through the tube at 1, and hit the mirror at 2. As the angle of incident must be equal to angle of reflection, the reflected rays flow through the tube downwards. As the light rays hit the mirror at 3 once again they are reflected. This reflected rays then travel out of the box to our eye. As you can see, periscope uses the laws of reflection.

Types of reflection

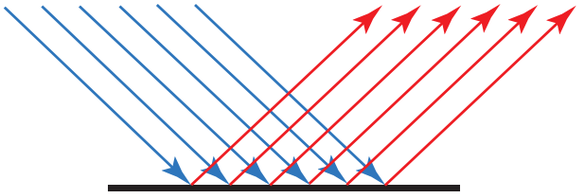
On a mirror we can see our image, but not on the wall. Why? Both the surface reflects light. Only because the reflected light comes to our eyes, we are able to see it. If the wall was not reflecting light, then we cannot see it.



We saw earlier that the light reflects off surfaces in a very predictable manner, in accordance with the law of reflection. The laws of reflection holds good for all surfaces irrespective of the shape. Vertical surfaces, angled surfaces, and even over the curved surfaces, the laws of reflection holds good. As long as we can draw the normal, perpendicular to the surface at the point can be drawn, the angle of incidence at that point will be equal to angle of reflection.



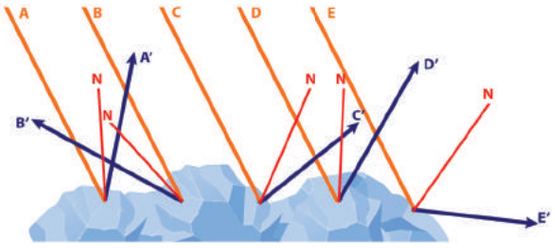
Diffuse Reflection
(Rough surface)



Specular Reflection
(Smooth surface)

The law of reflection is always observed regardless of the orientation of the surface. If the surface is smooth, and flat, all points on it have the normal in the same direction. Therefore a set of parallel rays striking the surface will be reflected at an angle, but the rays themselves will still remain parallel to each other.

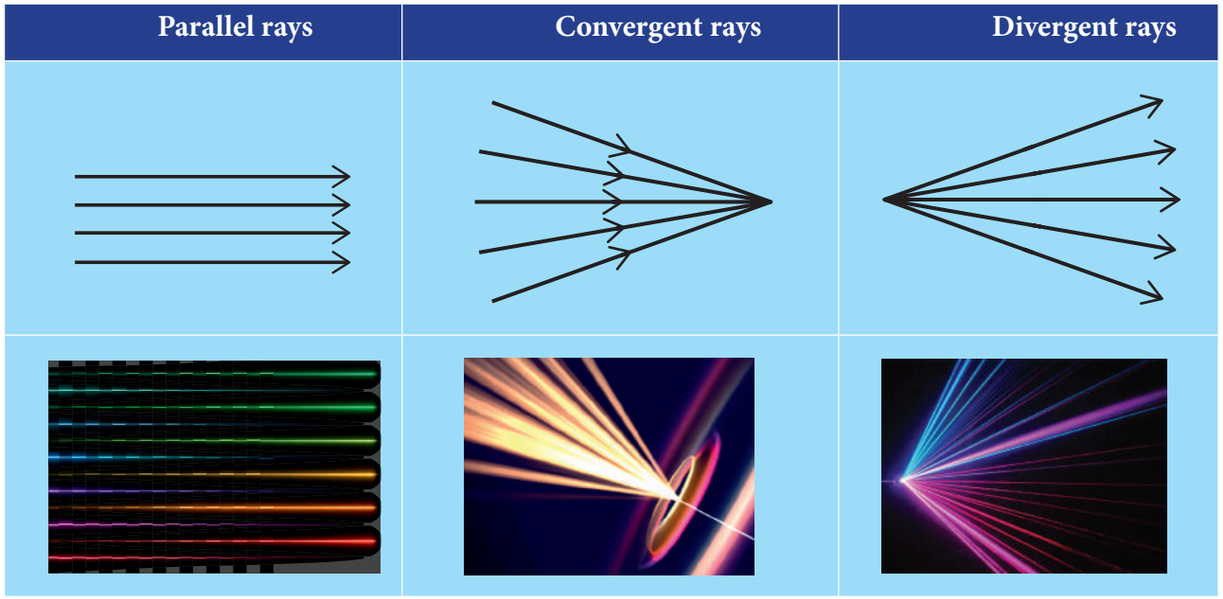
However ,consider a surface which is not smooth. Such as the surface of a wall. What happen when the light ray hits the rough surface? Roughness of the wall means that each individual ray meets a surface which has a different orientation. The diagram below depicts the case. Five incident rays labelled as A, B, C, D and E approach a surface. The normal line at each point of incidence is shown in black and labelled with an N. In each case, the law of reflection is followed, resulting in five reflected rays labelled A', B', C', D', and E'. While the incident rays were parallel to each other, the reflected rays are going in different directions. The result is that the rays of light are incident upon the surface in a concentrated bundle and are diffused upon reflection.



Broadly, we can say that there are two types of reflection. If the surface is smooth then we have specular reflection. The parallel light rays striking the surface gets reflected, yet individual reflected rays remain parallel.

If the surface is rough, then we have diffused reflection. Light rays, after reflection go in many directions.

In fact during the day, our class room is illuminated by sunlight . Walls and floors are exposed to diffused reflection. Suppose walls



were smooth mirror like. Then sunlight entering through the window will get bounced by the floor at an angle above towards the roof. And it will never get reflected to left or right. That is left and right walls will remain dark. However walls and floors are not smooth surfaces. Therefore, incident light from the window get bounced in all directions that the whole room is illuminated with diffused light.

Types of beam of light

Generally light is not a single ray, but a bundle of rays which are called as a beam of light.

A light beam can be a bundle of parallel rays, convergent rays or divergent rays. Let us look at the light coming from the Sun. The rays of sunlight are parallel. Often the headlight of car gives parallel rays. However look at the rays of light coming out of a candle. Light rays go in all directions, from the candle fire. These rays are divergent. Light rays from a flash light is also divergent. Using lenses we can converge light rays. Using a lens, you can focus sunlight at a point. That is what we are making the light rays to converge.

Speed of light:

When lighting a bulb in a dark room, light spreads the whole room quickly. This is because the light travels very fast. Light travels three lakh kilometers per second in air or vacuum. In theory , nothing can travel faster than light

Interaction of light with matter

Take a piece of clear glass, a paper and a metal sheet. Shine a light from one side of each object and see if the light penetrate on the other side. Readily, we can see light enters and comes out of the other end of clear glass, whereas the light is bit dim through a paper. Light does not pass through metal sheet. Depending upon permeability, materials can be classified into three categories.

Transparent Material:

Materials that allow light to pass through completely are known as transparent material.

Example: Eye glasses, clear drinking glass, clear water, face glasses used in buses.

Translucent Material:

Objects that allow light to pass through partially are called translucent material. For

example, we cannot see the image of someone who stands behind a rough window glass, because it allows only a part of light from the person.

Opaque Material:

Materials that are not able to allow light to pass through, are called opaque material. **Example**: Wall, thick card board, stone, etc.

ACTIVITY 4

Let's categorize transparent material, translucent material and opaque material among the given materials

(Clear plastic ruler, cellophane paper , some water in a glass jar, tissue paper, drinking glass, beaker, tap water, kerosene, coconut oil, note paper, card board, milk, diluted milk, aluminum foil, thick colored plastic lid, rough glass piece, measuring glass with water, wooden piece)

Place all the materials given above in the dark room. Focus a torch light on one side of each material. Inspect the light coming out at the other side of each material and then classify the materials in the table.

S. No	Transparent Material	Translucent Material	Opaque Material

Shadows

How are shadows formed?

I1V3E5

As we saw earlier, light is obstructed by certain materials. Light travels in a straight line. Hence it cannot go around such objects. That is why we see shadow. Shadow is always against, opposite side of light source. It is caused by opaque objects that stop light from propagating.

Parts of shadow

When an opaque object is placed in the path of light from a point source, a uniform dark shadow will appear on the screen. This is shadow is called as umbra. When an opaque object is placed in the path of light coming from a broad source of light, a small umbra will appear on the screen and an illuminated shadow area appears around umbra. This illuminated shadow area is called as penumbra. The penumbra always surrounds the umbra. The umbra is the darkest part of a shadow. In this part, light rays are completely prevented by the opaque object. The lighter shade of shadow is the penumbra.

Properties of shadow

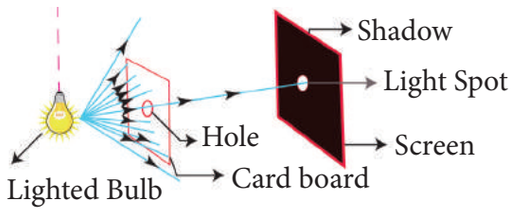
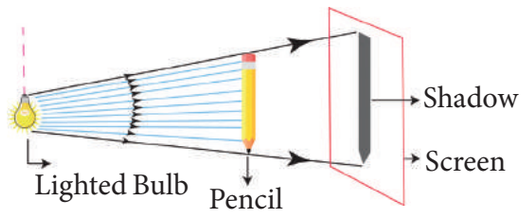
1. All objects do not form shadows. Only opaque objects form shadows
2. Shadows will be formed in the opposite side of light source

3. It cannot be determined the characteristics of an object by its shadow.

4. The shadow will be always darker, whatever may be the color of light rays

5. Light source, opaque object are shadow all are in a straight line.

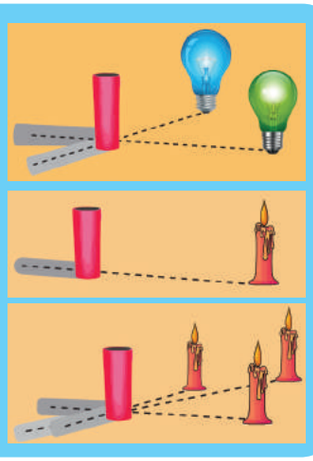
6. The size of shadow depends upon the distance between light source and object and the distance between object and the screen.

Arrangement	Activity	Observation	You Learn
	Place a lighted bulb in front of a rectangular card board with a hole at the center	A shadow with a spot light appears in the screen.	Light rays are passing only through the hole and are not allowed by the remaining part of card board
	Place a pencil in the path of light ray coming from a bulb	A shadow of pencil appears in the screen	The size of the shadow is proportional to the size of the opaque objects.

ACTIVITY 5

Requirement : A white screen, a cylindrical opaque object and three bulbs in different sizes.

Use the three different size lamps and examine the umbra and penumbra formed. Keep the distance between the lamp and the cylinder, cylinder and the screen same. As the size of the lamps grow smaller, the umbra region begins to enlarge. If the size of the lamp is a point, then there will be no penumbra. There would be only umbra shadow. Can you tell what the reason is for that?



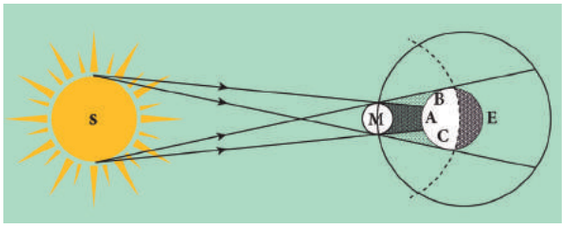
Eclipses

An eclipse is an incident, when any astronomical object is partially or fully obscured due to the placement of another astronomical object in the presence of light. Thus, solar and lunar eclipses are occurring that are due to the property of light known as the rectilinear propagation of light.

Solar eclipse

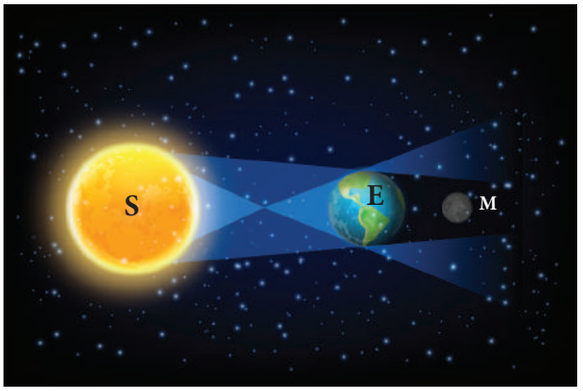
Solar eclipse occurs, when the moon arrives between the sun (S) and the earth(E). The shadow of the moon appears on the earth at A as shown in picture. Hence, those who are at the region A are unable to see the Sun instantly. This is solar eclipse. But, those who are at the region B and C are able to see the sun partially.

Solar eclipse

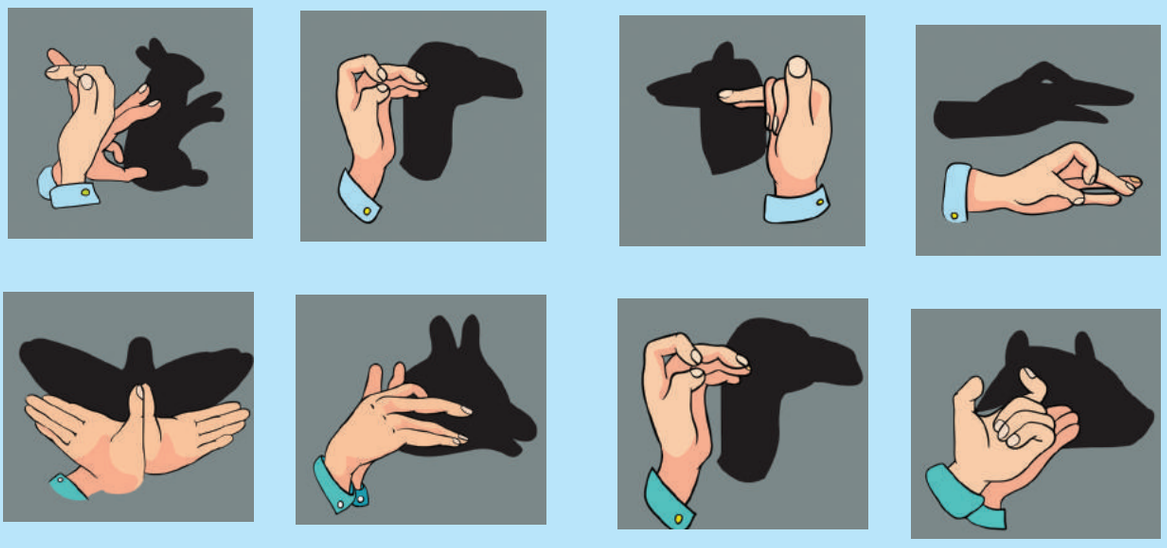


Lunar eclipse

Lunar eclipse: Lunar eclipse occurs, when the earth (E) comes between the sun (S) and the moon (M). The earth prevents light coming from the sun and makes shadow on the moon. This is lunar eclipse



TRY THIS

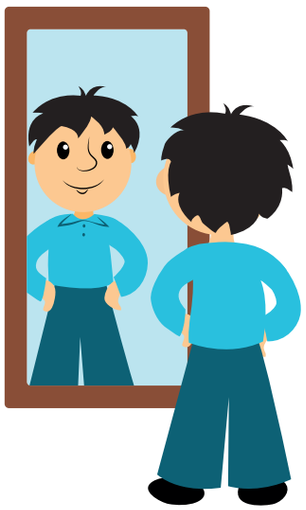


ACTIVITY 6

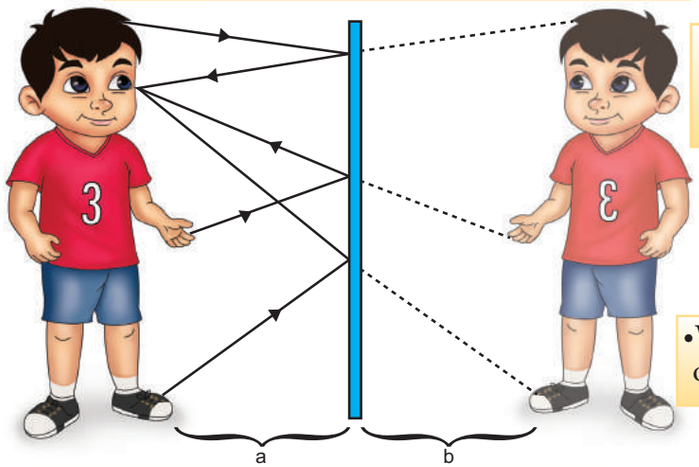
Surfaces	Property of Image (Clearer / blurred)
Glass	
Metal Sheet	
Aluminum foil	
White paper	

Plane Mirror and Reflection

A polished (or) smooth surface (like glass) which forms image by reflection is known as mirror. A plane mirror is a mirror with a flat reflective surface. A plane mirror makes an Image of objects in front of it.



- The image is upright.
- The image and the object are the same size.
- The image is virtual.



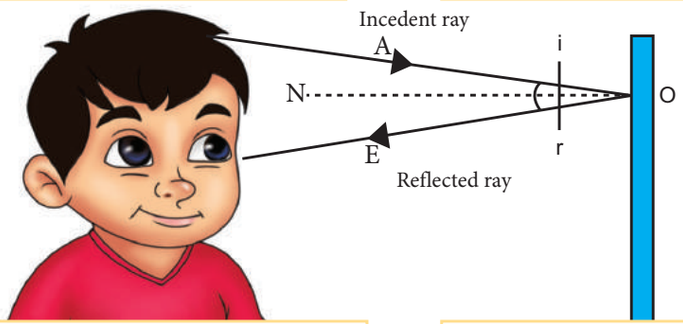
- The image is laterally inverted. The boy's left hand is his image's right hand.

- We can determine the position of an object's image by drawing light rays.

- The distance of the object from the mirror is equal to the distance of the image from the mirror (a=b).

The ray of light AO from the boy head strikes the mirror at point O. AO is called the incident ray.

The incident ray makes an angle of incidence. i. with the perpendicular line ON.

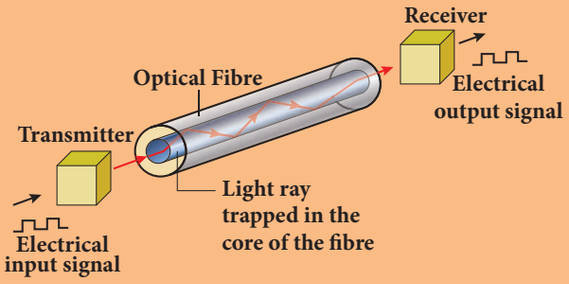


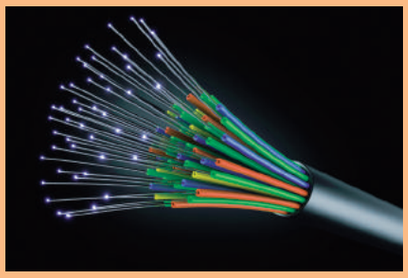
The light ray OA strikes the surface and is reflected as OE. OE is called the refelected ray. This ray makes an angle of reflection r with normal.

The lline, ON, perpendicular to the surface is known as the normal.

DO YOU KNOW?

Optical fibre is a device that works on the principle of ***total internal reflection*** by which light signals (huge data) can be transmitted from one place to another place with a negligible loss of energy in a very short time. It consists of a cable having one or more thin flexible fibers with a glass core through which light signals can be sent. Optical fiber can be twisted and bent easily. When a light a ray of light is incident at one end of the core of optical fiber, it suffers total internal reflection at the many places inside the fiber and emerges at the other end with negligible loss of energy. The data or information in the form of pulses of light, can be sent through bundles of optical fibers. Optical fibers have become very important in high-speed communications, such as cable TV and high-speed broadband services. Fiber optic cables are able to carry more signals than traditional **copper** cable telephone lines.





Real and virtual images

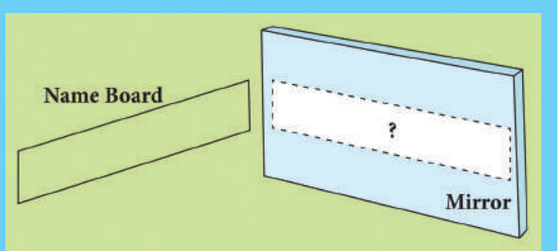
We have seen images being formed in a pinhole camera and a mirror. Can we see what is different in both of these images? Firstly, the image of the pinhole camera was formed on a screen. While the image made by the mirror is not obtained on a screen. The images that are obtained on a screen are called 'real image' and that which cannot be obtained on a screen 'virtual image'. Also notice that the image on pinhole camera was upside down. While the mirror image was upright.

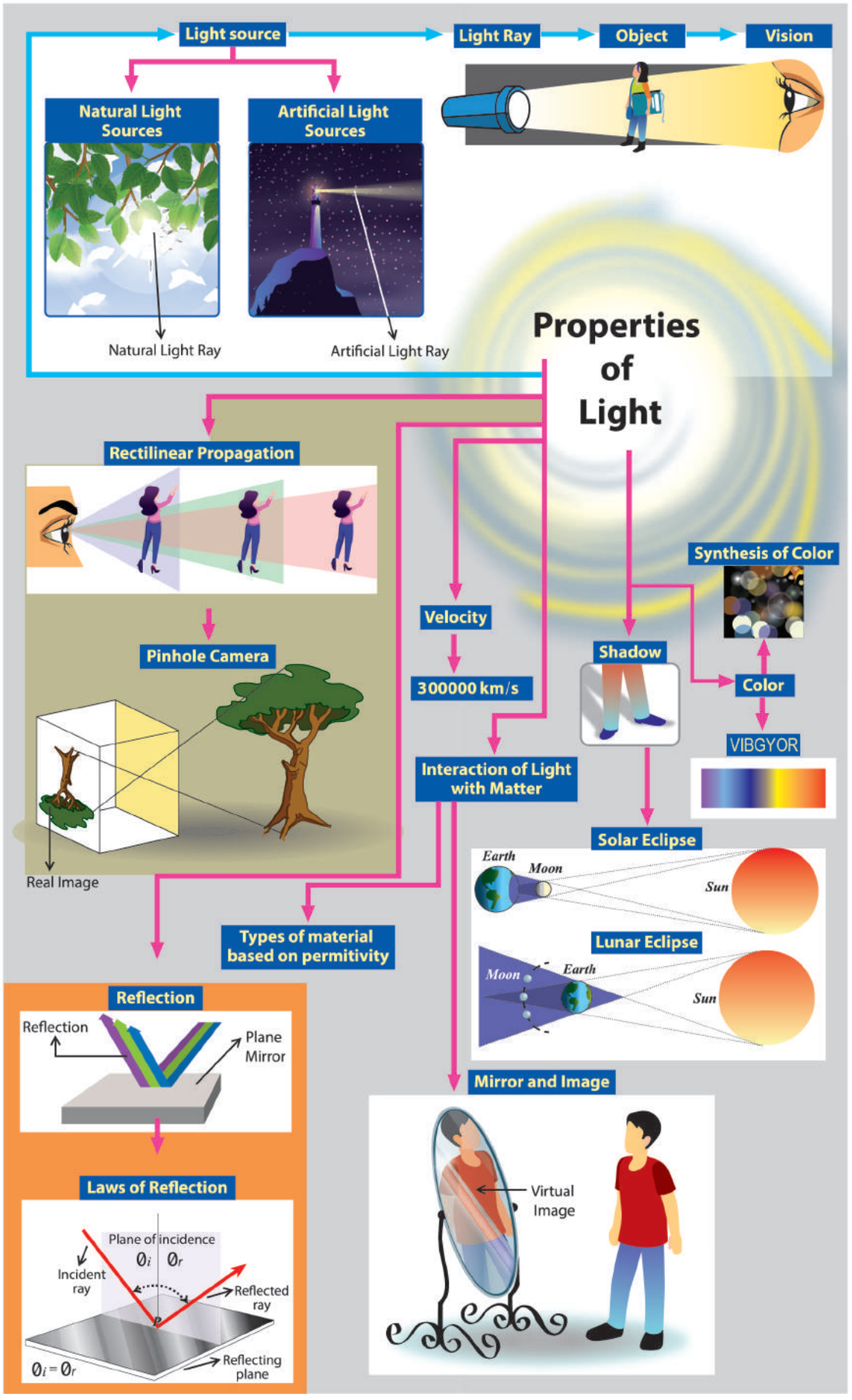
Properties of Image formed in a plane mirror
Image formed in a plane mirror is upright
Image formed in a plane mirror is virtual
The image is of the same size as the object
The distance of the image from the plane mirror is equal to the distance of the object from the mirror
Image is laterally inverted.

ACTIVITY 7

There are eight letters in the word **EINSTEIN**

1. Write the word in front of a plane mirror shown in diagram
2. Write down how these letters appear in the mirror
3. How many of these letters appear to be different, when the word is reflected?
4. Write down the letters that appear to be the same.





Colour

Colour of sunlight : Light is a form of energy in the form of a wave that simulates that retina of our eyes. Visible light is a spectrum of a number of waves with different wavelength range from 400nm to 700nm (1nm = 10^{-9} metre) each wave has a definite wavelength represents a particular color. The band of visible light is VIBGYOR.

V – Violet

I – Indigo

B – Blue

G – Green

Y – Yellow

O – Orange

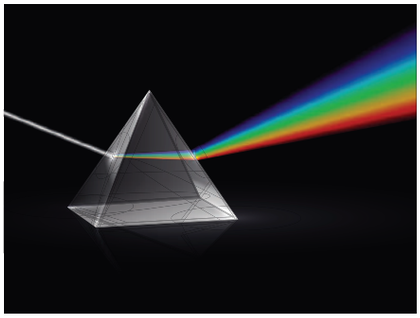
R – Red

Violet colour has shorter wavelength and red color has longer wavelength.

When light ray of particular wavelength (Colour) strikes the retina of our eye, our brain perceives that specific colour. When all colors of visible light strikes the retina of our eye at the same time, our brain perceives white. This shows, white is not a colour at all. But, it is the combination of all the colors of the visible light spectrum. If all the wavelength (colours) of visible light spectrum give appearance of white similarly, the observe of all there wavelength of visible light, will lead appearance of black

What is prism?

A prism is an object made up of a transparent material, like glass or plastic that has at least two flat surfaces that from an acute angle (less than 90^{O} degrees).



ACTIVITY 8

We have seen that white light is made of different colors and we can split white light. Is it possible to do the reverse? That is, can you get white color by mixing colors? Try this activity.

You need oil pastel and white paper. Take different oil pastel colors. Choose colors which are exactly seen on the rainbow. Apply colors over each other on a white paper. Did you get white color?

DO YOU KNOW?

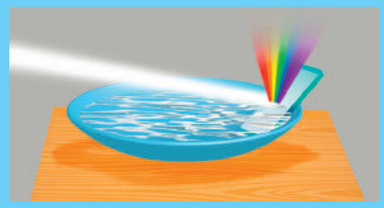
Why is the word "**AMBULANCE**" written backwards in ambulance vehicle? This is due to lateral inversion .The phenomenon due to which the left side of an object appears to be right side of the object in its image in a reflecting medium (mirror). so that drivers see the word the right way around in their rear-view mirror

Difference between the images formed in Pinhole camera and Plane mirror	
Images formed by Pin hole camera	**Images formed in Plane mirror**
The image is real	The image is virtual
The image may not be equal to the size of the object	The image is equal to the size of the object
The image is inverted	The image is erect

ACTIVITY 9

Let's make a rainbow

You must surely have seen a rainbow in the sky. Why don't you try making one at your class room?



Place a flat but deep pan. Place this pan where there is direct sunlight. Place a plain mirror in the pan as shown in the diagram, so that you see sunlight reflected on you ceiling or on a white wall. Next slowly pour water in to the pan. At particular level of water, you will get a beautiful rainbow colors on the wall. If the colors are not clear adjust the position of the mirror to bring it into focus. This arrangement of colors in sunlight is called spectrum.

DO YOU KNOW?

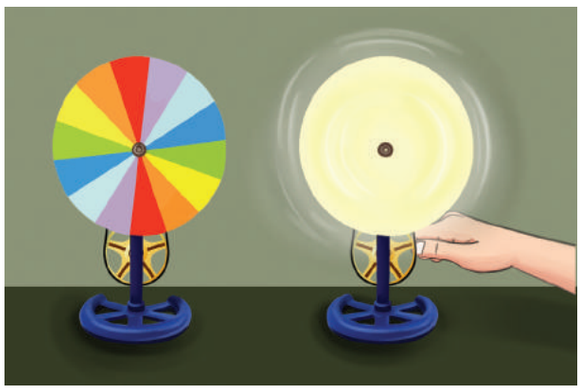
Why danger lights in vehicles are red in colour?

1. Red color is scattered the least by air molecules.
2. Red color has the highest wavelength of all the other colors. So red color is able to travel the longest distance through air, fog.

When white light is passed through a prism as shown in the figure, the colors of the rainbow emerge from the prism.

Newton Disc:

Newton suggested a process of mixing different colors to make white color by setting an arrangement as shown figure below. Newton Disc is a card board disc with seven equal sectorscolored red, yellow,orange, green, blue, indigo and violet. When the disc turned quickly, the retina receives the sensation of the spectrum simultaneously and disc appears white. Using this disc, one can explain that white is a combination of VIBGYOR



ACTIVITY 10

You need Gelatin papers of Red, Blue and Yellow. Fold each gelatin paper three times and look different color objects listed below through each folded paper. Observe what color each object has. Write your observations in the table.

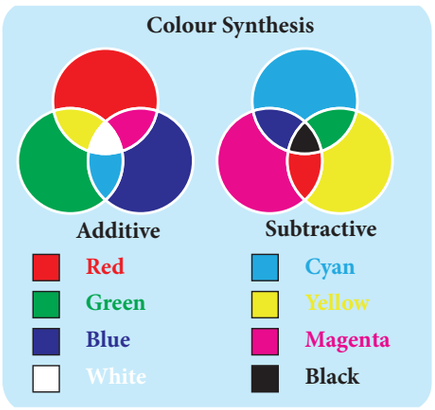
Object	Original color of object	Color through Red gelatin paper	Color through Blue gelatin paper	Color through Yellow gelatin paper
Blue sky				
Orange flower				
Yellow banana				
leaves				
Brown trouser				
White shirt				
Black board				

We know that white shirt will reflect white light and we have seen that white light consists of different colours. When we look at the white shirt through the yellow gelatin paper, we see it as yellow in color. From this, we can say that the yellow gelatin paper did not allow any other color except yellow to pass through. Similarly, we conclude that red gelatin paper allows only red light and blue gelatin paper allows only the blue light.

Synthesis of colour

Synthesis of colour is the method of creating colour by mixing various proportion of two (or) three distinct colours of light. These distinct colours are Red, Green and Blue called as primary colours.

- Equal proportions of two primary colour create a secondary color.
- Magenta, Cyan and yellow are called secondary colour.



1 Red	+	1 Blue	=	Magenta
1 Blue	+	1 Green	=	Cyan
1 Green	+	1 Red	=	Yellow

- Equal proportions of all three primary colour create white.

1 Red	+	1 Blue	+	1 Green	=	White

EVALUATION

K2K3V2

I. Choose the correct option

1. Light travels only in a _____. It is because of this property that _____ are formed
   a. curved line, shadows
   b. straight line, shadows
   c. straight line, reflection
   d. curved line and then straight line, shadows

2. Light that hits a mirror gets _____
   a. Transmitted
   b. Reflected
   c. Absorbed
   d. Refracted

3. _____ Surface reflects the light well.
   a. water
   b. compact disc
   c. mirror
   d. stone

4. Light is a form of _____
   a. matter
   b. energy
   c. medium
   d. particle

5. You can see your image in polished floors, but not in wooden table because _____
   a. regular reflection takes place in wooden table and irregular reflection in polished floor
   b. regular reflection takes place in polished floor and irregular reflection in wooden table
   c. regular reflection takes place in both polished floor and wooden table
   d. irregular reflection takes place in both polished floor and wooden table

6. Choose the translucent substance from the following
   a. glass b. wood
   c. water d. Clouds

7. Reflection occurs , when the light
   a. about to reach a surface
   b. approaches a surface
   c. passes through a surface
   d. None of these

8. Which of the following is the best reflector of light?
   a. plastic plate
   b. plane mirror
   c. wall
   d. paper

9. Sivarajan placed a meter stick in the playground at 7.00 am in the morning. How will the shadow of the stick at noon look in comparison to the one in the morning
   a. There will be no shadow
   b. The shadow will be longer and on the opposite side as the sun
   c. The shadow will be shorter and on the same side as the sun
   d. The shadow will be shorter

10. The image formed by a pinhole camera is inverted because,
    a. light travels in straight lines
    b. light rays become laterally inverted as they pass through a pinhole camera
    c. light rays pass through the pinhole

d. light rays get reflected

11. Which of the following facts explain how shadows are formed?

a. Light travels in straight lines

b. Opaque bodies do not allow light to pass through them

c. Reflection occurs at a smooth surfaces like mirrors

d. Lateral inversion happens

a. both A and B

b. both A and D

c. both B and C

d. only A

II. Fill in the blanks

1. A plane mirror produces a _____ image
2. A _____ reflection helps us to see the objects
3. The light ray gets _____ when it falls on any polished surface.
4. Sunlight is a blend of _____ colors
5. The splitting of white light in to seven colors is called _____
6. The moon _____ sun light
7. The sunlight can be split into its constituent colors using _____
8. Reflection of light from rough surface is called _____ reflection

III. Say TRUE or FALSE

1. The image of right hand in a plane mirror looks like a left hand
2. Rainbow is formed by dispersion of which light by water drops
3. The image formed by the plane mirror is laterally inverted, hence the image seen through the periscope is also laterally inverted
4. We see planets because they reflect light from the sun
5. We see a book because it reflects the light that falls on its surface
6. The image formed in a pinhole camera is always inverted
7. The image formed in a pinhole camera is always the same size as the object
8. The image formed in a plane mirror is upside down
9. A plane mirror is opaque
10. A shadow is formed on the same side of the object as the source of light.
11. we are able to see things around us with the help of regular reflection
12. After passing through a prism, white light splits into a band of seven colours

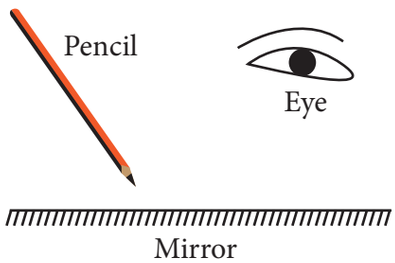
IV. Match the following

1. Rectilinear propagation	-	Primary source of light
2. Plane Mirror	-	Non-luminous object
3. Fire fly	-	Periscope
4. The Moon	-	Pinhole camera
5. Wide light source	-	Spectrum of light
6. Regular reflection	-	luminous object
7. The sun	-	Penumbra
8. Band of seven colors	-	Glossy surface

V. Answer the following questions in short

1. With the help of a diagram, state the laws of reflection

2. Figure shows a pencil placed above a mirror



   a. Draw its image formed by the mirror

   b. Show how light rays from the object are reflected at the mirror to form the image for the eye.

3. A person is looking at the image of a tree in a mirror placed 3.5 m in front of him. Given that the tree is at 0.5 m behind his eyes. Find the distance between the image of the tree and his eyes. What are needed to see an object?

4. What are luminous objects?

5. Is the moon a luminous object?

6. What are the three types of materials based on the absorption of light?

7. What are the parts of shadow?

8. What are the properties of shadow?

9. What is plane mirror?

10. What is prism?

11. What do you mean by visible light?

12. Write the items given here in the correct column **(Stars, brick walls, plants, mirror, planets, electric light bulb,candle)**

Sources of Light	Objects that reflect light

13. A boy of height 1m 45 cm is standing in front of a long mirror at a distance of 2 m. From this information, fill up the following sentences:

   a. The distance between the boy and his image is _____

   b. The height of the image is _____

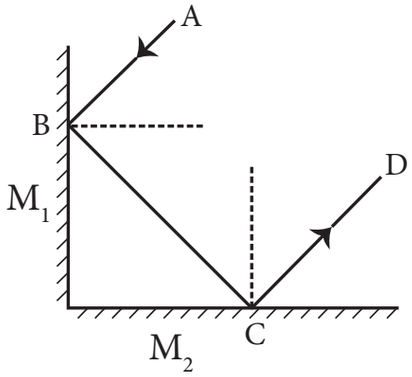
   c. When the boy moves 1m forward, the distance between her and her image is _____

14. Draw a diagram of a pin hole camera showing the rays of light passing between the Object and its image

15. Why is the writing on the front of an ambulance back to front as shown in the picture?

16. Explain with examples, why some capital letters look the same in a mirror but others are reversed.

17. Two plane mirrors M1 and M2 are placed perpendicular with each other, as shown in figure. The ray AB makes an angle 39 ° with the plane mirror M1, then



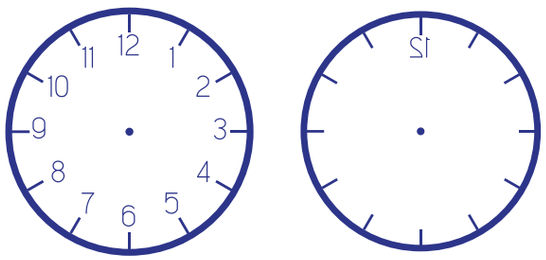
1. The reflected rays are _____, _____

2. The incident rays are _____, _____

3. What is the angle of incident corresponding to the ray BC?

4. What is the angle of reflection corresponding to the ray CD

18. Rajan was playing with the mirror images of a clock. He looked at the clock in his room. It was showing 1:40. Draw the position of the hands on the real clock and on its mirror reflection. Write below the picture what time each picture is showing.



19. What is reflection of light?

20. If a ray of light is falling on a plane mirror at an angle of 500 is formed, what will be the angle of reflection?

21. What do you mean by lateral inversion?

22. How do you obtain a spectrum of light?

23. Why do we see white color in Newton's disc, when we rotate it very fast?

24. What is a shadow? What things are necessary for the formation of a shadow?

VI. Answer the following questions in detail

1. What are regular and irregular reflection? Explain with the help of diagrams

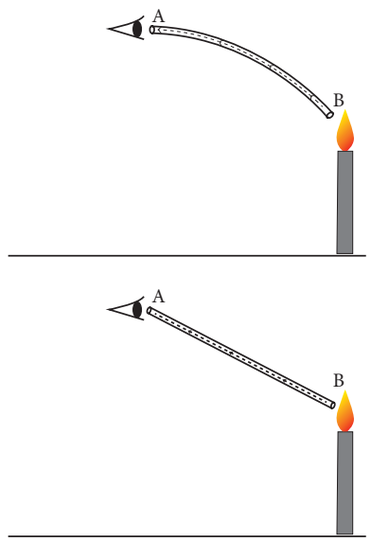
2. What are the difference between luminous and non-luminous objects? Give two examples of each.

3. Write about two everyday situations that tell you that light travels in a straight line.

4. Differentiate between a reflection and a shadow

5. What are the characteristics of an image formed in a plane mirror?

6. Describe the pictures.



7. Define the following terms
   a. Incident ray
   b. Reflected ray
   c. Normal
   d. Angle of incidence

8. Compare the images formed by plane mirror with that by pinhole camera

ICT CORNER

LIGHT

Explore the activity to know about law of reflection.

PROCEDURE :

Step 1: Type the following URL in the browser or scan the QR code from your mobile to open the activity page.

Step 2: Click the torch to see how the light ray reflects off the mirror and drag the torch to different angles. You can learn the angle of incidence at that point will be equal to angle of reflection.

Step 3: Next Scroll down and select the prism. Click the torch how the prism changes the path of the light ray.

Step 1

Step 2

Step 3

Step 4

Light URL:

https://simpop.org/reflection/reflection.htm

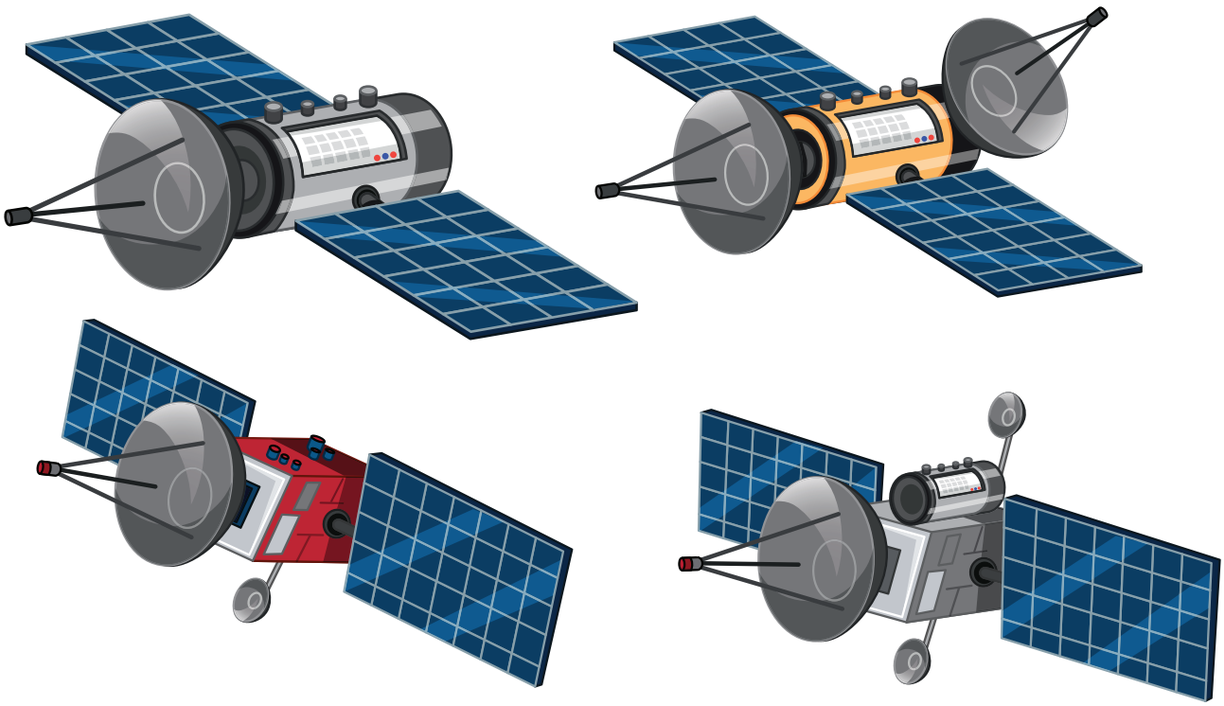
*Pictures are indicative only

*If browser requires, allow Flash Player or Java Script to load the page.

B351_7_SCIENCE_EM

Unit 2

Universe and Space



Learning Objectives

The students are able to

- Explain the beginning of universe
- Know about galaxies and its types
- Recognise different constellations in the night sky
- Get information about the stars
- Distinguish between natural and artificial satellites.
- Understand the functions of ISRO

Z3E3C6

Introduction

"My goal is simple. It is a complete understanding of the universe, why it is as it is and why it exists at all."

—Stephen Hawking

Starry night sky is a wonder which has fascinated humans from time immemorial. Our ancestors have observed and documented the objects seen in the night sky. The field of study of the universe is called astronomy. We know that there are billions and billions of stars in the universe, although only about 2000 or so are visible to naked eye. Have you ever think of the size of our universe? The universe is unimaginably and infinitely big. Universe is commonly defined as the totality of everything that exists or is known to exist. Even though the spatial size of the entire universe is still unknown, it is possible to measure the observable universe.

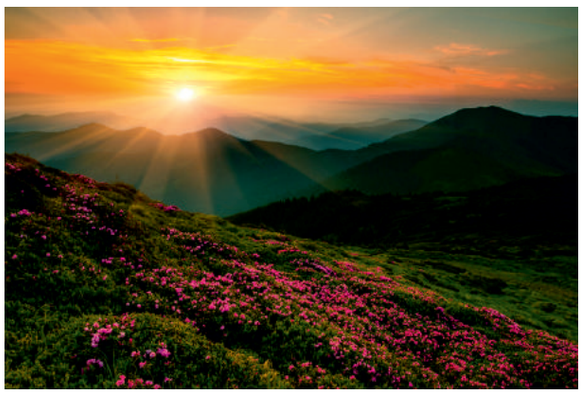
The universe consists of galaxies, planets, stars, meteorites, satellites and all other forms of matter and energy. And it is a world of wonder. Let us move into this world of wonder to know more interesting facts about the place of residence of our solar system.

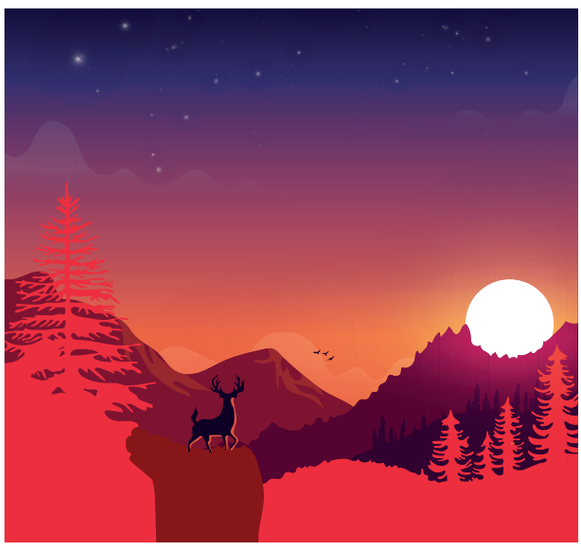
GEO Centric Theory

Sky is a wonder. Sun, Moon, stars all appear to rise in the East and move towards the west, giving us an impression that all these objects are going around the Earth. Just as in a moving bus the distant mountains and trees appear to move backwards, perhaps really Earth is spinning and that is why Sun, Moon and stars appear to go around the Earth. Does the Earth revolve around the Sun, or the Sun revolves around the Earth? How do you know about it?

When you look at the night sky you can see lot of twinkling objects. But a few of them differ from the others. They don't twinkle and while the other stars hold a fixed pattern from night to night, these drift. They wander across the sky, moving against the backdrop of stars. These are called planets. Our ancestors observed this and they imagined a universe with the Earth at the center, the stars in the distant background, and Sun, Moon and the planets orbiting around us.

Two observations supported the idea that Earth was the center of the Universe. First, from anywhere on the Earth, the Sun appears to revolve around the Earth once in a day. While the Moon and the planets have their own motions, they also appear to revolve around the Earth about once per day. Even the celestial sphere studded with stars appears to rise and set in the evening, and make one complete rotation in a year. Second, the Earth seems to be unmoving from the perspective of an earthbound observer; it feels stationary.





As civilization progressed the early astronomers found two types of motion of celestial objects. Let us take the case of Moon. On a daily basis Moon appears to rise in the east and set in the west. Thus, one can say that Moon is going around the Earth with a period of one day. But for a careful observer, it was clear that the Moon was also exhibiting another motion. Suppose, the Moon is appearing in the sky today near the star Asvini, tomorrow we will observe that the Moon is near the star Bharani, a star east of Asvini. And the next day it will be near the star Kartikai, east of Bharani. After 27 days, moving little by little eastwards, the Moon again stations itself near asvini. Thus, everyday Moon appears to move from east to west in one day where as it appears to go in a circle from west to east in the background of stars in about 27 days.

These two motions were puzzling. Very soon astronomers like Aryabhata said that Earth is spinning in its axis, that is the cause of apparent daily motion from East to West. Whereas the eastward motion of Moon in the celestial sphere with a period of about 27 days, was seen as the 'actual' motion of the celestial objects.

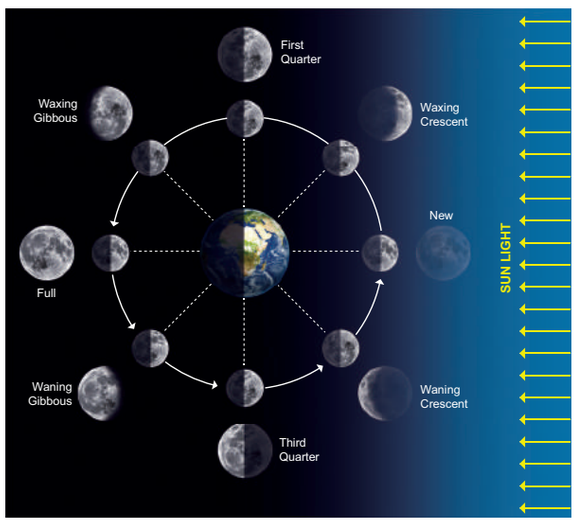
Thus, the geocentric model (also known as geocentrism), that is a description of the Universe with spherical and spinning Earth at the center and the Sun, Moon, stars, and planets all orbits the Earth emerged in various cultures. In Greece, this model was put forth by the Greek philosopher Plato and his disciple Aristotle in 6th century B.C. It was standardized by a Greeco Roman mathematician Ptolemy in the 2nd Century A.D. A similar model is seen in the Siddhanthic astronomy in India like Aryabhateeyam of Aryabhata.

How moon exhibit phases

Astronomers in ancient times also observed certain facts. The Purananuru (65) of Sangam literature, the poet Poet Kalathalaiyar singing in appreciation of Cheraman Peruncheralathan says"

On the day when the full moon appears, the sunand moon look at each other with their bright light. In the evening time, one sphere hides behind the mountains."

On the full moon day, when the Sun is setting in the west, precisely at the same time, Moon rises at the East. That is both Sun and Moon are in the opposite side. Likewise when it is waning half moon, the Moon is rises when it is midnight and the waxing half moon rises during noon. From such observations and modelling ancient astronomers could explain why we have waxing and waning of moon.



It is probably easier to understand the waxing and waning of Moon in the order of new moon & full moon and then how the first and third quarter moon (half moon) appear and then the phases in between.

Sun is the source of light. Sun light falls on the spherical earth, but only on the side facing

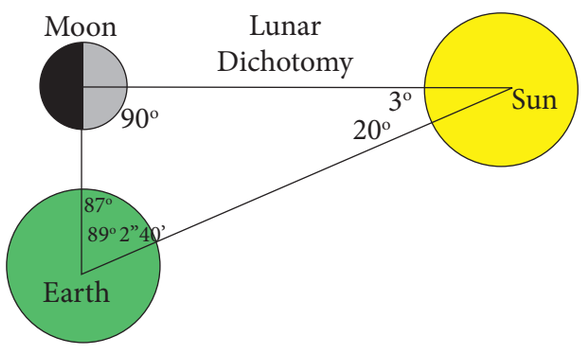
Sun. The opposite side of Earth is without sunlight. As the Earth spins day and night follows as different parts of Earth appear before the Sun. That is at all times one half of Earth is illuminated by Sun and one half is in darkness.

Like wise at all times one half of Moon is illuminated by Sun and the opposite side is shroud in darkness.

As shown in the above diagram, when the moon is positioned between the earth and sun, notice all the illuminated part of Moon is away from Earth. Hence we cannot see any part of the illuminated side of the Moon. Only the dark side of Moon is towards Earth. When the moon is in this position, we have new moon.

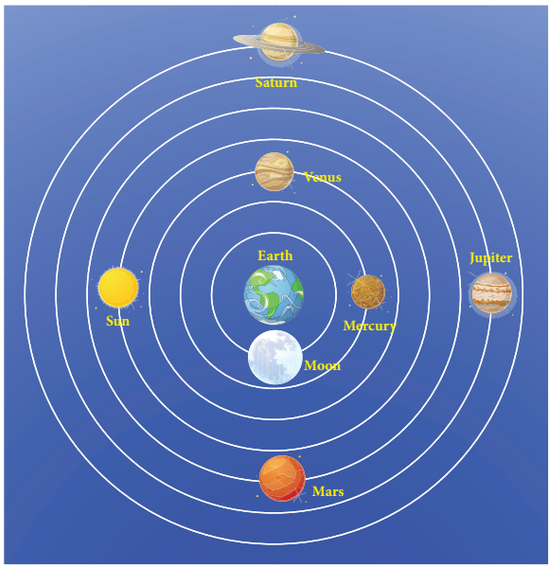
Now look at the moon when it is behind the Earth. Now the portion of the moon illuminated by sun is totally towards Earth. The dark side is away from the Earth. This means the moon will appear to be round in the sky. This is full moon.

When the Sun, Earth and Moon are in 90 degree angle how will the moon appear to a person on the surface of the Earth? Now if you look at the portion of moon facing Earth, we will see half if it illuminated and half is dark side. Thus, the moon will appear as half moon. The half moon during the waxing period is called as first quarter and the half moon during the waning period is called as third quarter. (figure sun moon and earth are at right angles)



Once we understand those four key moon phases, the phases between them should be fairly easy to visualize.

The word crescent refers to the phases where the moon is less than half illuminated. The word gibbous refers to phases where the moon is more than half illuminated. Waxing essentially means "growing" or expanding in illumination, and waning means "shrinking" or decreasing in illumination. Note all so that these discoveries could be made with naked eye. You do not need telescope or any modern equipment.



Epicycles

Moon going around Earth with 27 day period nicely explained its motion. However astronomers in ancient times faced problem in explaining the motion of the then known five planets- Mercury, Venus, Mars, Jupiter and Saturn.

Moon in the background of stars moved everyday eastwards nicely. However for example, if we were observing the motion of Mars from January , it would appear to move eastward in

the background stars. That is the position of mars today will be near a star which is east of the star near which it was yesterday. However on June 28 , we will see a change. From that date the Mars would appear to move west rather than its normal eastward motion. This reversal of direction of planets is called as 'retrograde motion'. If we continue to observe, on August 28 once again the Mars would appear to reverse the direction and again on its usual eastward motion in the celestial sphere. Usually Jupiter is brighter than Mars, however, around the period of retrograde motion the Mars was much bright than other times; even brighter than Jupiter.

Other planets also exhibited number of puzzling behaviours. Venus and Mercury always appeared very close to Sun, and hence never appeared in the midnight sky. The brightness of Jupiter also varied again when it exhibited retrograde motion. For example in 2018, Jupiter reversed its direction of motion on March 9, 2018 and again resumed its normal eastward motion on July 11, 2018.

The simple geocentric model, where planets go around the Earth could not explain why the brightness of the planets changed, and why they reversed their directions. Change in brightness and retrograde motion would be impossible if we assumed that the planets were at the same distance at all times from Earth.

To explain the puzzling phenomena astronomers in early times proposed a change in the simple geocentric model. This is called as epicycle model.

Ptolemy (2nd cent) in Greece, Aryabhatta in India and others used the epicycle model to explain the motion of the celestial objects. Their models were improved by generation of astronomers like Tycho Brahe and Neelakanta Somayaji.

Although, the model explained many phenomena there were number of mismatches. The model was becoming messy.

Arrival of telescope.

Telescope was invented by Hans Lippershey but Galilio used it for studying the sky for the first time. The telescope showed more universe was than visible to naked eye. With his simple telescope matching toy telescopes of today, Galilio was able to see mountains on the Moon, small dim stars invisible to naked eye, sunspots on the face of Sun. He was able to demonstrate that the milky way, an hazy bright patch in the sky is nothing but thousands of stars huddled together, Jupiter had moons going around it and Saturn had mysterious appendage which we now know as rings.

One of the most startling observations he made was related to telescopic observation of Venus. This convinced him to accept the theory of the Polish Astronomer Nicolus Copernicus, that it is not Sun, planets and Stars that go around Earth, but it is Earth and other planets that go around the Sun- heliocentric theory.

Heliocentric model.

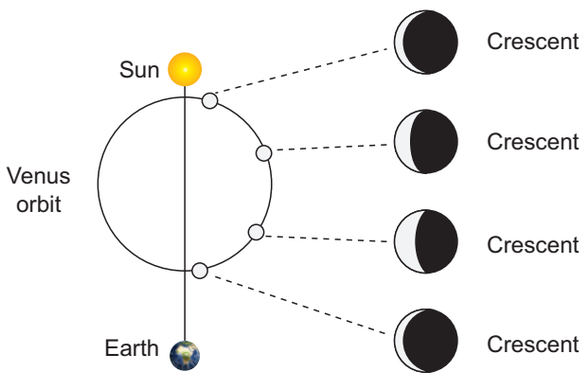
Dissatisfied with the messy epicycle model Nicolus Copernicus, radically proposed that the model will become simple if we assume Sun is at the center and all planets, including Earth, go around it.

Suppose, Earth and Mars are on the two sides of the Sun, then Mars would be far and appear dim, compared to when they are on the same side. Earth orbit around Sun in 365 days, whereas Mars takes 687 days. This implies at

times Earth will overtake Mars. When the Earth is approaching and overtaking Mars, the Mars would appear to exhibit retrograde motion. In short all the observed phenomena could be explained in a simple way.

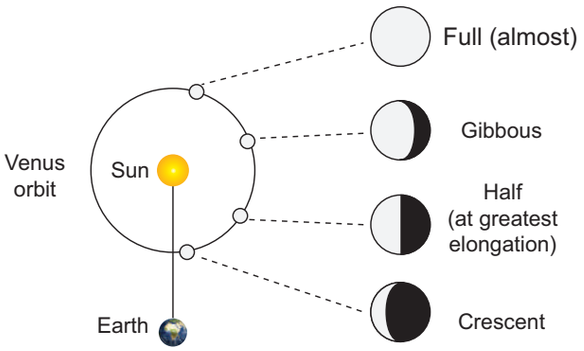
However how do we know that actually Sun is at the center or not?

Galileo found that his observation of Venus gave the observational evidence to support the heliocentric theory. Galileo observed Venus in 1610-1611 with a telescope. To naked eye, Venus is just a gleaming bright spot. However, through a telescope, the shape of the planet can be seen. Galilio was startled to find like Moon Venus too exhibited phases. The shape varied from crescent to gibbous. Also, the size of the planet varied. When the planet was in gibbous phase the size was small, and when it was thin crescent the size was many folds higher.



As the Venus went around the epicycle, as shown in the diagram Venus would exhibit phases. Also at times the planet would be nearer, making the apparent size grow bigger and at times far making the apparent size smaller. Thus, the variation in the brightness can also be explained.

It became clear to Galilio that the geo-centric epicycle model will not help in accounting for the observed phases of the Venus.



Look at the above diagram. If the Venus was going around the Sun, and its orbit is inside that of Earth, Venus would appear always near the Sun in the sky. It can never be seen in the midnight sky. Two when it is near the Earth, it would be brighter and bigger compared to when it is on the other side of the Sun. Thirdly only if the Venus is revolving around the Sun, it can exhibit gibbous phase, and the size of the gibbous phase smaller than the crescent phase. If the Venus was revolving around the Earth, we can never see the gibbous phase of the Venus and it would be seen only if it is orbiting tthe he Sun. This clinching observational evidence proved that at the least Venus orbited around the Sun. Further evidences collected by astronomers using telescope and other advanced modern instruments gave enough evidence that all planets revolve around the Sun.

If Galileo were around today, he would surely be amazed at exploration of our solar system and beyond by ISRO, NASA, Russian space agency and others.

Now we can observe planets orbiting around other stars (called exoplanets), proving that not only planets orbit around the Sun in

solar system, but all around the universe such planetary systems exist. Who knows, in some of there could be life and in rare cases intelligent life, like humans wondering and exploring universe. Imagine a future time when such life meet us; how exciting and momentous it would be!

Origin of the Universe

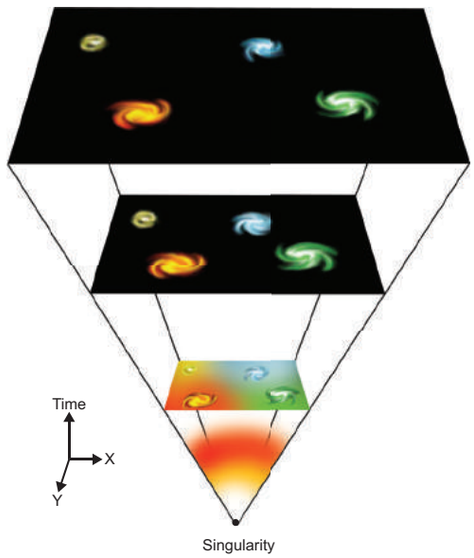
P5E6Q1

You are a student who belong to a particular class studying in VII std. In your school, there might me many section for VII std. Likewise, there are VI std class, VIII std class and so on. All of them together make the school. Likewise, our Sun is a star with a planetary system. Billions of such stars consitute a system called as galaxy. The name of our galaxy is, Milky Way. Like Milky Way, there are at least hundreds of billions of galaxies in the Universe.

How did all these come about? Where they in existence always or was there a beginning?

When we observed other galaxies we found a strange behavior. All the galaxies were appearing to move away from us. Further, farther they are faster they appear to move. Cosmologists , scientists who study the structure and evolution of universe that is cosmos, reason that this imply at one point of time in the past all matter was confined in a single point and since then it has started to expand.

The event when the matter confined in a single point and began to expand is called 'big bang'. This is considered as the origin of our universe as we know it.



The Big Bang Theory is the prevailing model of the evolution of the Universe. Under this theory, space and time emerged together about 14 billions of years ago. At that time, the entire Universe was inside a bubble that was thousands of times smaller than a pinhead. It was hotter and denser than anything we can imagine. Then it suddenly expanded. The present Universe emerged .Time, space and matter all began with the Big Bang.

In a fraction of a second, the Universe grew from smaller than a single atom to bigger than a galaxy. And it kept on growing at a fantastic rate. It is still expanding today. Over the next three minutes, the temperature dropped below 1 billion degrees Celsius. After 300 000 years, the Universe had cooled to about 3000 degrees. Atomic nuclei could finally capture electrons to form atoms. At that stage of the evolution of the Universe, it was filled with clouds of hydrogen and helium gas. Giant clouds of hydrogen and

helium were gradually drawn to the places where dark matter was most dense, forming the first galaxies, stars, and everything else seen today.

We cannot see anything that happened during the first 300000 years of the Universe. Scientists try to work it out from their knowledge of atomic particles and from computer models. The only direct evidence of the Big Bang itself is a faint glow in space, called cosmic microwave background.

As millions of years passed, the dense areas pulled in material because they had more gravity. Finally, about 100 million years after the Big Bang, the gas became hot and dense enough for the first stars to form. New stars were being born at a rate 10 times higher than in the present-day Universe. Large clusters of stars soon became the first galaxies.

The Hubble Space Telescope and powerful ground-based telescopes are now beginning to find galaxies that were created about one billion years after the Big Bang. These small galaxies were much closer together than galaxies are today. Collisions were common. Like two flames moving towards each other, they merged into bigger galaxies. Our Milky Way galaxy came together in this way.

Building Blocks Of Universe.

As stated above universe is constituted of galaxies, just as lot of houses in our locality constitute a village or a city. We have lot of things such as rooms, furniture etc. in our homes. Likewise lot of stellar objects such as stars, planets, asteroids and meteors are the building blocks of our universe.

More to know

Astronomical unit : The average distance between the Earth and the Sun is called an astronomical unit. It is denoted by 'au'.

1 au = 1.496×10^8 km

Light year : The distance travelled by light in one year is called a light year. It is denoted by 'ly'.

1 ly = 9.4607×10^{12} km

Parsec: A parsec is defined as the distance at which one astronomical unit subtends an angle of one arc second. It is denoted by 'pc'

1 pc = 3.2615 ly = 3.09×10^{13} km

Galaxies.

Q7E4F8

A galaxy is a large collection of stars or cluster of stars and celestial bodies held together by gravitational attraction. There are about billions of galaxies in the universe. Most galaxies range from thousand to ten thousand parsec in diameter. As we have different types of houses in a locality, the galaxies are also of different types.

Types of galaxies

There are various types of galaxies such as spiral, elliptical, barred spiral and irregular

Spiral Galaxy

Spiral galaxies consist of a flat, rotating

disk containing stars, gas and dust, and a central concentration of stars known as the bulge. These are often surrounded by a much fainter halo of stars. Spiral galaxies are named by their spiral structures that extend from the center into the galactic disc. The spiral arms are sites of ongoing star formation and are brighter than the surrounding disc because of the young, hot stars that inhabit them.

Elliptical Galaxy

An elliptical galaxy is a type of galaxy having an approximately ellipsoidal shape and a smooth image. Unlike flat spiral galaxies with organization and structure, elliptical galaxies are three-dimensional, without much structure, and their stars are in somewhat random orbits around the center. Interestingly Stars found inside of elliptical galaxies are on an average much older than stars found in spiral galaxies. Elliptical galaxies tend to be surrounded by large numbers of globular clusters.

Irregular Galaxy

An irregular galaxy is a galaxy that does not have a distinct regular shape, unlike a spiral or an elliptical galaxy, they are often chaotic in appearance, with neither a nuclear bulge nor any trace of spiral arm structure. About one forth of the galaxies found so far are of this type.

Cosmologists say that some irregular galaxies were once spiral or elliptical galaxies but were deformed by an uneven external gravitational force. Irregular galaxies may contain abundant amounts of gas and dust.

Barred Spiral

A barred spiral galaxy is a spiral galaxy with a central bar-shaped structure composed of Stars. Bars are found in approximately in two-thirds to one third of all spiral galaxies.The Milky Way Galaxy, where our own Solar System is located, is classified as a barred spiral galaxy.

Milky Way

K1W3E1

The Milky Way is the galaxy in which our solar system is located. The diameter of Milky Way is over 100,000 light years. The Milky Way includes stars smaller than our Sun as well as many other stars that are thousands of times bigger than the Sun. It includes many other celestial bodies of gases, clouds of dust, dead stars, newly born stars, etc. It is also thought to contain at least 100 billion stars. The galaxy that is closest to our Milky Way is Andromeda. The descriptive "milky" is derived from the appearance from Earth of the galaxy – a band of light seen in the night sky formed from stars that cannot be individually distinguished by the naked eye. In Indian mythology, this patch called as Akasha Ganga. From the Earth, the Milky Way appears as a band because its disk-shaped structure is viewed from within. Galileo Galili first resolved the band of light into individual stars with his telescope in 1610. Until the early 1920s, most astronomers thought that the Milky Way contained all the stars in the Universe. Observations by Edwin Hubble showed that the Milky Way is just one of many galaxies.

The Milky Way does not sit still, but is constantly rotating. Our solar system is located within the disk of the galaxy, about 27,000 light years away from the centre of the galaxy. The solar system travels at an average speed of 828,000 km/h. Even at this rapid speed, the solar system would take about 230 million years to travel all the way around the Milky Way. When the solar system was in the same spot as it is now, there were no humans, no Himalayan mountain on Earth and the dinosaurs were roaming around the Earth.

Tucked inside the very center of the galaxy is a monstrous black hole, billions of times as massive as the sun. Although, black holes cannot be directly viewed, scientists can see their gravitational effects as they change and distort the paths of the material around it, most galaxies, like our milkyway, are thought to have a black hole in their heart.

Constellation

A constellation is a recognizable pattern of stars in the night sky when viewed from the Earth. International Astronomical Union has classified 88 constellations to cover the entire celestial sphere. Many of the old constellations have Greek or Latin names and are often named after mythological characters.

Ursa Major (Saptha Rishi Mandalam) is a large constellation and it covers a large part of the sky. The most striking feature of this constellation is a group of seven bright stars known as big dipper (seven Sages in Indian astronomy).

Ursa Minor in Lattin means 'the little bear' it lies in the northern sky. The Pole star – Polaris (Dhrua) lies within this constellation. The main group, 'little dipper', consists of seven stars and is quite similar to that found in Ursa Major.

Orion was a hunter in Greek mythology. The constellation comprises around 81 stars out of which all but 10 are too faint to be seen with naked eye.

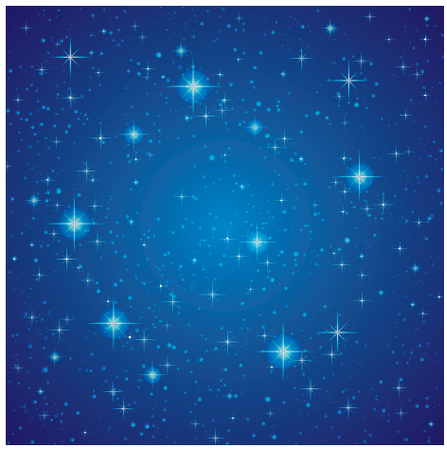
Different constellations become visible in the sky at different times in the year. This happens due to the revolution of the Earth around the Sun.

Unlike galaxy, constellations are mere optical appearance and not real objects. In galaxy stars are bound by gravity and constitute a system. In a constellation, one star may be near and another very very far, but because they are in the same direction appear to be near to each other in the sky.

Name of Constellations	
Indian Name	**English Name**
Mesham	Aeries
Rishabham	Taurus
Midhunam	Gemini
Kadakam	Cancer
Simmam	Leo
Kanni	Virgo
Thulam	Libra
Vrischikam	Scorpio
Dhanusu	Sagittarius
Makaram	Capricorn
Kumbam	Aquarius
Meenam	Pisces

Stars

A Star is a luminous heavenly body that radiate energy. With naked eyes, we can see nearly 3000 stars in the night sky and many more with the help of a telescope. The stars are remotely located and appear as tiny dots of light. Their light travels long distances to reach us. The atmosphere disturbances do not allow light to reach us in a straight line path. Because of this the stars appear to twinkle. The Sun is the nearest star to the Earth. The next nearest star is Alpha Centauri



Satellites

An object that revolves around a planet in a stable and consistent orbit is called a satellite. Satellites can be classified into two categories – natural and artificial.

Natural satellites

All natural objects revolving around a planet are natural satellites. They are also called moons. Most moons are spherical, the ones that are not usually asteroids or meteors that were captured by the strong gravity of a planet. All planets except mercury and Venus in our solar system have moons. Earth has only one moon- whereas planets like Jupiter and Saturn have more than 60 moons.

Artificial satellites

Artificial satellites are man-made objects placed in an obit to rotate around a planet – usually the Earth. The world's first artificial

Spiral galaxies

Flat rotating disc containing Stars.

Elliptical galaxies

Three dimensional without structure

Irregular galaxies

Irregular in shape

UNIVERSE

Galaxy: Collection of Stars

Launching Satellites figure ISRO

Satellites

Objects revolving around the planets

Planets

Objects revolving around the stars

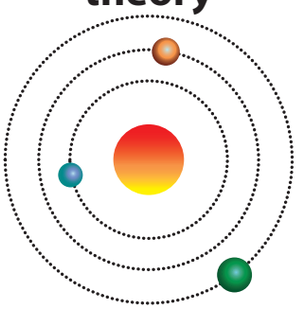
Stars

Luminous heavenly bodies radiating light

Milky way

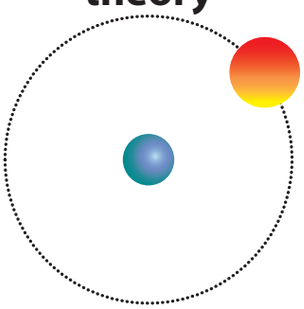
The galaxy in which our solar system is located.

Heliocentric theory



Sun is supposed to be at the centre

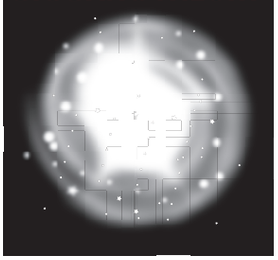
Geocentric theory



Earth is supposed to be at the centre

Origin of Universe

BIG BANG THEORY



Space and time emerge together about billions of years ago

satellite launched was Sputnik-1 by Russia, Aryabhatta was the first satellite launched by India. These satellites are used in television and radio transmission, studying agriculture yield, locating mineral resources, weather forecasting, locate different places on earth.

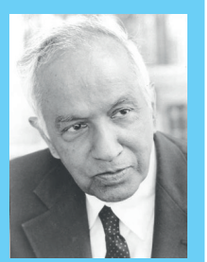
ISRO

The Indian Space Research Organisation (ISRO) is the space agency of the Government of India headquartered in the city of Bangalore. Its vision is to "harness space technology for national development while pursuing space science research and planetary exploration."

F8Q7C2

Know your Scientist

Subrahmanyan Chandrasekhar (19 October 1910 – 21 August 1995) was an Indian Americanastrophysicist who spent his professional life in the United States. He was awarded the 1983 Nobel Prize for Physics with William A Fowler. His mathematical treatment of stellar evolution yielded many of the best current theoretical models of the later evolutionary stages of massive stars and black holes. The Chandrasekhar limit is named after him. Chandrasekhar worked on a wide variety of physical problems in his lifetime.



Formed in 1969, ISRO superseded the erstwhile Indian National Committee for Space Research (INCOSPAR) established in 1962 by the Scientist Vikram Sarabhai. The establishment of ISRO thus institutionalized space activities in India. It is managed by the Department of Space, which reports to the Prime Minister of India.

ISRO built India's first satellite, Aryabhatta, which was launched by the Soviet Union on 19 April 1975. It was named after the Indian astronomer Aryabhata. In 1980, Rohini became the first satellite to be placed in orbit by an Indian-made launch vehicle, SLV-3. ISRO subsequently developed two other rockets: the Polar Satellite Launch Vehicle (PSLV) for launching satellites into polar orbits and the Geosynchronous Satellite Launch Vehicle (GSLV) for placing satellites into geostationary orbits. These rockets have launched numerous communication satellites and earth observation satellites. Satellite navigation systems like GAGAN and IRNSS have been deployed. In January 2014, ISRO used an indigenous cryogenic engine in a GSLV-D5 launch of the GSAT-14.

ISRO sent a lunar orbiter, Chandrayan -1, on 22 October 2008 and a Mars orbiter, Mars Orbiter Mission, on 5 November 2013, which

entered Mars orbit on 24 September 2014, making India the first nation to succeed on its first attempt to Mars, and ISRO the fourth space agency in the world as well as the first space agency in Asia to reach Mars orbit. On 18 June 2016 ISRO set a record with a launch of 20 satellites in a single payload. On 15 February 2017, ISRO launched 104 satellites in a single rocket (PSLV-C37) and created a world record. ISRO launched its heaviest rocket, Geosynchronous Satellite Launch Vehicle-Mark III (GSLV-Mk III), on 5 June 2017 and placed a communications satellite GSAT-19 in orbit. With this launch, ISRO became capable of launching 4 ton heavy satellites.

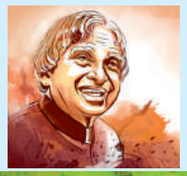
ISRO launched Chandran 2 on July 22, 2019, Geosynchronous Satellite Launch Vehicle (GSLV-Mk III). It entered the Moon's orbit on August 20, 2019 and its lander landed on the Moon on September 7.

In 1989, Galileo Galilei was memorialized with the launch of a Jupiter-bound space probe bearing his name. During its 14-year voyage, the Galileo space probe and its detachable mini-probe, visited Venus, the asteroid Gaspra, observed the impact of Comet Shoemaker-Levy 9 on Jupiter, Europa, Callisto, IO, and Amalthea.

In order to avoid the possible contamination of one of Jupiter's moons, the Galileo space probe was purposely crashed into Jupiter at the end of its mission in September 2003.

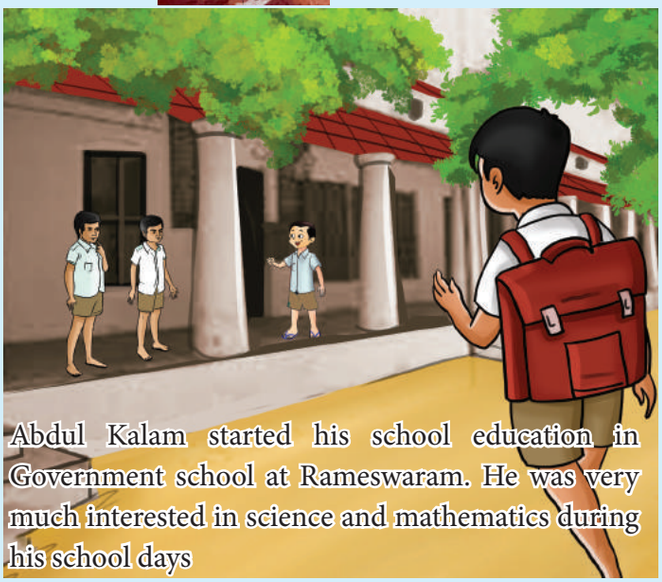
Points to Remember

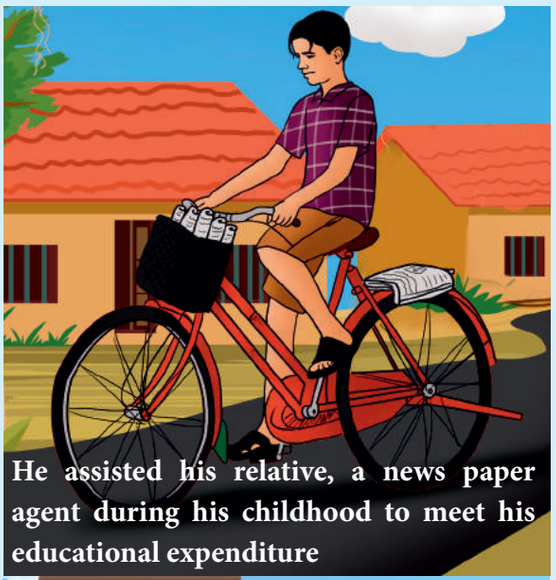
- The field of study of the universe is called astronomy.
- The universe consists of galaxies, planets, stars, meteorites, satellites and all other forms of matter and energy.
- The half moon during the waxing period is called as first quarter and the half moon during the waning period is called as third quarter.
- The word crescent refers to the phases where the moon is less than half illuminated. The word gibbous refers to phases where the moon is more than half illuminated..
- The reversal of direction of planets is called as 'retrograde motion'.
- The geocentric theory followed by the ancient people proposed that the Earth is at the centre and the sun and other planets revolve around it.
- The helio-centric theory states that the sun I at the centre and the planets revolve around it
- Galilio gave the observational evidence to support the heliocentric theory
- There are at least hundreds of billions of galaxies in the Universe.
- A galaxy is a large collection of stars or cluster of stars and celestial bodies held together by gravitational attraction.
- A constellation is a recognizable pattern of stars in the night sky when viewed from the Earth.
- An object that revolves around a planet in a stable and consistent orbit is called a satellite.
- The Indian Space Research Organization (ISRO) is the space agency of the Government of India headquartered in the city of Bangalore.

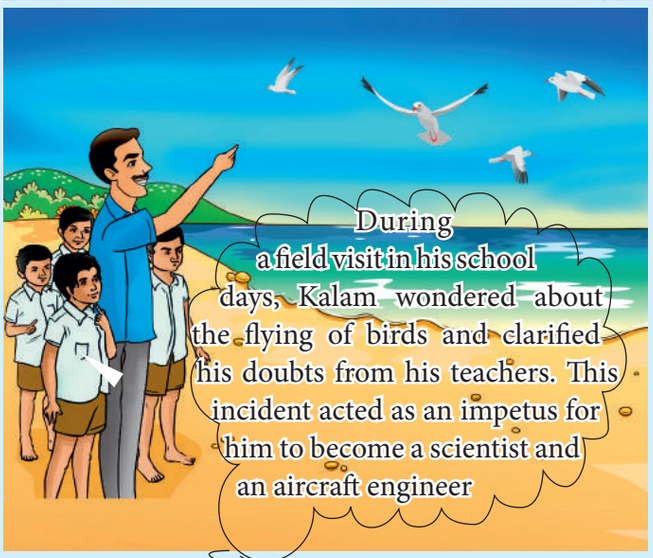


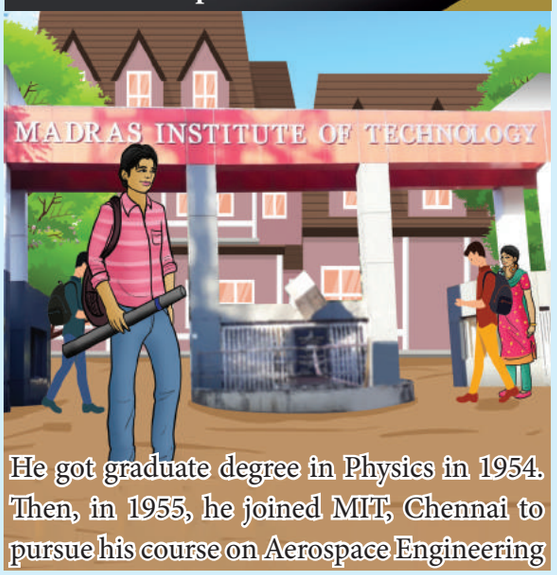
The Missile Man Of India

A.P.J. Abdul Kalam (1931-2015)









Kalam successfully launched the 'Rohini-1' satellite using the India's first satellite launch vehicle SLV-3 in 1980. He acted as the Project Director when the missiles Thrishul, Agni,Prithvi, Nag and Akash were designed in the Indian Defence

India for the first time experimented nuclear explosion test named 'Smiling Buddha' in 1974. Kalam was one among the sixty Aeronautical Engineers in this project

Abdul Kalam played a vital role in the nuclear explosion test project in Pokran named "Operation Sakthi" in 1999. The credit that the India has become a nuclear power goes to him

Kalam worked in five missile projects of India. He was the most important behind the designing defence rocket of India

The Government of India awarded him the Bharatha Ratna. He was the President of India during the period from 2002-2007

The missile man who quoted "Man needs difficulties because to enjoy the success they are needed to and you have to dream before your dreams can come true" lives among us even after his death. Let's also sacrifice for the country like him

EVALUATION

B5W4H3

I Choose the correct answers

1. The moon takes _____ days to complete one revolution around the Earth

   a. 25 b. 26 c. 27 d. 28

2. If the Moon is appeaing in the sky today near the star Karthikai , the position of the Mon after 27 days is near the star

   a. Bharani b. Karthikai
   c. Rohini d. Asvini

3. Telescope was invented by

   a. Han Lippershey b. Galilio
   c. Nicolus Coppernicus d. Ptolomy

4. The galaxy containing young and hot stars is

   a. elliptical galaxy b. irregular galaxy
   c. cluster d. spiral galaxy

5. With the launch of this satellite, ISRO became capable of launching 4 ton heavy satellites.

   a. GSAT- 13 b. GSAT- 14
   c. GSAT- 17 c. Way par GSAT- 19

II. Fill in the blanks.

1. Waxing of moon means _____
2. Heliocentric model is proposed by _____
3. _____ is the prevailing model of Evolution of the Universe
4. _____ is a large constellation which covers a large part of the sky.
5. _____ is the first satellite launched by India

III True or False – If False give the correct answer

1. On a full moon day, when the Sun is setting in the west, moon rises in the West.
2. The word crescent refers to the phases where the moon is less than half illuminated.
3. Galilio accepted the Geo-centric model.
4. Our Milky Way galaxy is identified as an elliptical galaxy.
5. The planet Venus in our solar system doesn't have a moon.

IV Match the following

1.	Rohini	-	GSLV-Mark III
2.	GSAT-14	-	GSLV Mark III M1
3.	GSAT-19	-	SLV-3
4.	Chandrayaan-2	-	PSLV-XL C25
5.	Mangalyaan	-	GSLV-D5

V Analogy

1. Older stars : elliptical galaxies :: younger stars :----------
2. Nearest galaxy : Andromeda :: Nearest star :-------- -------.

VI Very short answer

1. The word ---------- refers to the phases where the moon is less than half illuminated (cresent / gibbous)
2. ---------- and ---------- planets never appear in the mid-night sky.
3. Number of days taken by the Mars to orbit around the Sun.
4. In which phase does the size of the planet Venus is small?
5. The only evidence of the big bang theory is
6. The galaxy which contains abundant amount of gas and dust is _____

7. Which country launched the world's first artificial launch vehicle?

VII Short Answer Questions

1. What is epicyclic model?
2. Name the four different types of galaxies.
3. What is constellation?
4. Give the expansions of PSLV and GSLV

VIII Answer in Detail

1. Explain the waxing and waning phases in Venus
2. Write short notes on constellations.

IX. HOT Question

Neelan and Mala are having a conversation about our Universe. Neelan is telling our earth will be the only planet in the entire Universe to have a life with. But, Mala is opposing his view by citing certain points. What would be the argument of Mala. Do you support Mala? Justify your stand.

ICT CORNER

UNIVERSE AND SPACE

Let us know about Universe and space

PROCEDURE :

Step 1: Use the URL or scan the QR code to open the activity page.

Step 2: Click the start button and then Click anywhere to open side bar.

Step 3: Click the top most icon in the side bar then Click the RUN INTRO button to see the various views of the solar system and universe

Step 4: Click the bottom most search icon in the side bar to search a particular planet, constellation, stars and Spacecraft.

Step 5: By dragging the mouse left ,right, up and down you can see the various views and scroll the Mouse to zoom in and zoom out .

Step 6: Click the play button to see the solar system in year wise.

Step 1

Step 2

Step 3

Step 4

Universe and Space URL:

https://www.solarsystemscope.com/

https://play.google.com/store/apps/details?id=air.com.eu.inove.sss2

*Pictures are indicative only

*If browser requires, allow Flash Player or Java Script to load the page.

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Unit 3

Polymer Chemistry

Learning Objectives

- Recognize various types of fibres
- Conduct activities to learn the characteristics of synthetic fibres
- List the advantages and disadvantages of synthetic fibres
- Differentiate between thermoplastics and thermo-setting plastics
- Identify various types of plastics based on the resin codes
- Realize the impacts of plastics on humans, animals and the environment.
- Recall the different methods and hierarchy of disposing waste based on the 5R principle
- Explore the complexities of bio-plastics
- Gather information about plastic eating bacteria
- Learn about glass and its types and uses

B7Z6V9

Introduction

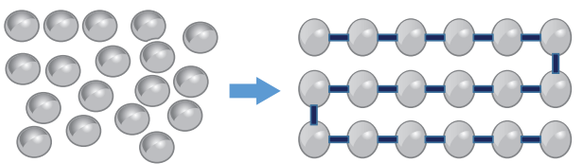
Polymer chemistry has a positive impact on your everyday life. Many of the materials you use are linked to polymer chemistry. When you get ready for school, you wear clothes, shoes, brush your teeth and take a school bag. Did you ever ask yourself what these items are made of? They are created from fibres. Fibres are made up of long chains of natural or synthetic polymers.

As a society, we are consuming more and more. The more things we buy the more things we throw away. 30 years ago, most of the waste in Tamil Nadu was biodegradable or easily recyclable. Today it is more complex. Many of the materials we use are non-biodegradable and difficult to recycle. For example, in the past people used many natural materials such as cotton, silk and jute fibres. Today we use a lot of synthetic materials such as plastics. In this lesson you will learn about polymers, different types of fibres, plastics and the waste we produce and how we should manage it.

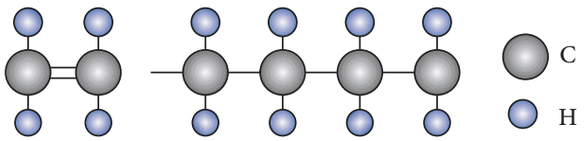
3.2 What Are Polymers?

Q4M1K1

The word 'Polymer' is of Greek origin. 'Poly' means many and 'mer' means basic smaller unit. Polymers are very long chains made of repeating smaller molecules called 'monomers' that are joined together by covalent bonds and the process is called polymerization. The diagram below shows how repeating monomers join to form a polymer:

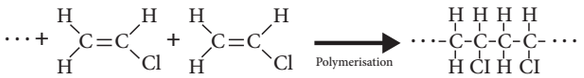


Monomers Polymer



Monomer Polymer

Polyvinyl Chloride (PVC) is a common plastic used for water pipes. The monomer and polymers of PVC is shown below.



monomer monomer polymer

ACTIVITY 1

Compare the following things. Ice cubes and a polythene bag. In both the materials, there are large number molecules combined together. Are both polymers?

3.2.1 Polymer

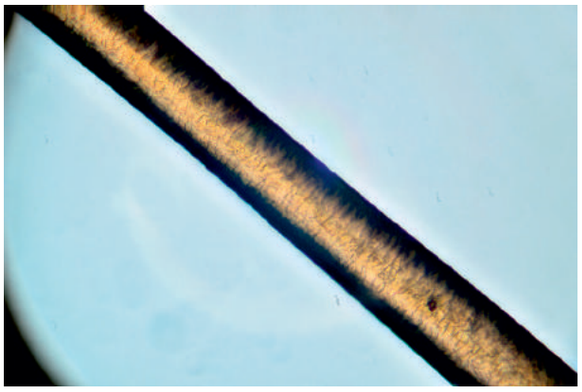
Polymers can be classified into natural and synthetic polymers. Can you imagine that your body produces and you are made up of natural polymers? The most familiar polymers that we use in our daily life are man-made and synthetic.

3.2.2 Natural Polymers

Natural polymers are found in living systems that include proteins and carbohydrates

in our bodies and cellulose in wood and paper. They play a very important role in living things to provide structural materials and molecules needed for life processes.

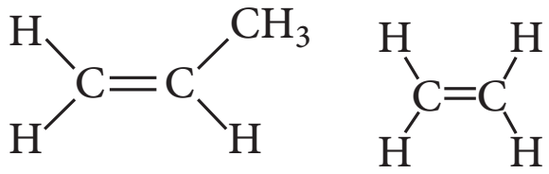
Protein polymers are made from amino acid monomers (20 different kinds of amino acids). Different combinations of the amino acid monomers create many different protein polymers. Examples of protein polymers include DNA, enzymes, silk, skin, hair, fingernails, feathers and fur.



Examples of carbohydrate polymers include cellulose, chitin and lignin found in plants. Cellulose is made of sugar molecules and is the main component of cotton used in clothing. Chitin is found in the cell walls of fungi such as mushrooms and exoskeletons of insects such as crabs and spiders. Lignin consists of a network of polymers and is important in giving structure to plants.

3.2.3 Synthetic Polymers

Synthetic polymers are man-made polymers produced by using raw materials from petroleum oil and gas. Plastics are synthetic polymers. When oils and gases are processed to make petrol, ethylene and propylene monomers are removed as by-products. We have already seen that polymer such as the Poly Vinyl Chloride (PVC) is made up of many monomers joined together. Ethylene and propylene are the building block monomers that make up many different types of plastics.



Propylene and Ethylene

Based on the nature of the monomers, the way they are arranged in the polymer and the characteristics of final polymer.

There are grouped into different categories such as fibres, plastics, proteins. Let us study about few of them in the following sections.

3.3 Fibres

We wear clothes, use bags, rope, blankets, etc. in our daily life. They are made of fibres. Once upon a time, people used natural fibres such as cotton and wool. Nowadays, we use a lot of synthetic fibres. All natural and synthetic fibres are polymers.

Observe the difference between the natural and synthetic fibres:

Natural Coconut Rope vs. Nylon Fishing rope

3.3.1 Natural and Synthetic Fibres

Fibres are long strands of polymers interwoven to form linear, string-like structures. Fibres that are obtained from plant or animal sources are called natural fibres. Examples include cotton, coconut fibre, hair, wool and silk. Fibres that are made using raw materials from petroleum are synthetic fibres. Examples include polyester, acrylic and nylon. Historically, humans used natural plant fibres and animal fur for shelter, clothing and protection from the weather. Today, a large variety of natural fibres are still grown and processed such as cotton, silk, and wool. Natural fibres can be spun into filament, thread or rope. Then they can be woven, knitted, matted or bondedand are used to make clothing, containers, insulation materialand many other products we use in our daily life. Three main sources of natural fibres are : (i) Animal (e.g.) wool and silk.

Q6Q3Y7

Natural wool



Silk


Plants


Cotton


Jute


Flax

Minerals


Glass fibre

The discovery of making synthetic fibres out of petrochemicals has replaced the use of many natural fibres. Synthetic fibres such as nylon, polyester and acrylic are used to make many different plastic items you use in your daily life such as clothing, blankets, tooth brushes and stuffing in cushions.

3.3.2 Types and Uses

Silk: Natural Fibre

Natural silk fibres are obtained from boiling the cocoons of silk worms from specific species of moths. There are four types of natural silk: Mulberry silk, Tasar silk, Muga silk and Eri silk. Most of the mulberry silk worldwide is produced in India. Silk is one of the strongest natural fibres and has many uses such as clothing, carpets and parachutes.

Rayon: A Semi-synthetic Fibre

In the 19th century scientists were successful in producing the first artificial silk known as rayon. The first rayon factory in India was established in Kerala in 1946. Rayon is a man-made fibre, but it is not considered fully synthetic as it is made out of natural cellulose collected from wood pulp. The cellulose that is collected from wood or bamboo pulp is treated with several chemicals. First sodium hydroxide is added followed by carbon disulphide. The cellulose dissolves in the chemicals added to it and produces syrup called Viscose. Viscose is forced through a spinneret (a device made of metal plates with very tiny holes) into a solution of dilute sulphuric acid. This produces silk-like threads that are cleaned with soap and dried. This new fibre is called rayon.

Some types of rayon are made from the short cotton fibres left on cottonseeds after ginning. Rayon is cheaper than silk, can be woven like natural silk fibre and can be dyed in a wide variety of colours. It can be mixed with cotton to make bed sheets or with wool in the production of carpets and home furnishing products. Rayon is also found in sanitary products, diapers, bandages and gauze for dressing wounds.

Nylon: Synthetic Fibre

Nylon is the first fully processed synthetic fibre. It was popular during the Second World War for the use of parachutes and rope materials for climbing. Nowadays, nylon has replaced natural silk in many textiles, and has become one of the most commonly used synthetic fibres.

Nylon fibre is strong, elastic and light. It islustrous and easy to wash, which has made it popular for the clothing industry.We use many products made from nylon such as socks, ropes, tents, toothbrushes, car seatbelts, sleeping bags, curtains, etc. Nylon thread is actually stronger than a steel wire.