
UNIT 15 NATURAL PHENOMENON

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15.1 INTRODUCTION

Nature affects us in many ways. Human beings since the early times have been curious to understand the natural world around them. The curiosity of human beings to understand nature has resulted in the development of the discipline of 'Science'. Apart from the knowledge of why things happen, knowledge of science is also important. We all live in a world influenced by Science and its applications. We all are impacted by the changes in the natural environment around us. At the same time, we affect nature through our various activities. Many of the so called natural calamities are said to be the result of un-thoughtful harnessing of nature. It is therefore important for all of us to appreciate this complex relationship of nature with our lives.

The present Unit discusses all these issues along with pedagogical inputs. This Unit attempts to facilitate you as a science teacher so that you can help your learners to understand the place of earth in the universe, the existence of resources and the relationship of man with the environment and the need to avert natural disasters and manage waste. These concepts are explained with the help of simple activities which may be conducted in the class while discussing the same.

15.2 OBJECTIVES

After going through this unit, you will be able to:

- explain various phenomenon related to light like reflection and refraction to learners in your class,
- demonstrate processes like evaporation and condensation,
- develop a sense of responsibility towards conservation of our natural resources among learners,
- develop a basic understanding of natural disasters among your learners, and
- help learners in appreciating the need to manage household and industrial waste.

15.3 LIGHT AS A NATURAL PHENOMENON

In elementary classes, learners get well acquainted with the fact that light makes us see things around us and the objects that emit or give out light are termed as sources of light. They are also aware of sources of light which can be divided into natural and artificial sources of light. Natural sources include the Sun, the Moon, fireflies and some deep sea organisms and on the other hand, artificial sources of light include candle, bulb, tube-light, etc.

At secondary level, focus is on exposing learners with some common phenomenon of light like how image formation takes place? How lenses help in improving vision? What are the scientific phenomenons which are associated with it? In coming subsections, we will discuss phenomenon like refraction and reflection. Discussion will also help you to deal with such topics in your classroom.

15.3.1 Reflection

Learners are well aware of the fact that mirrors are used for image formation. They must have experienced different type of image formation on a polished spoon, steel bowl, or on a polished floor.

Help them to recall laws of reflection, which are:

- i) The angle of incidence is equal to the angle of reflection, and
- ii) The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane.

You can use the following activity for this purpose:

Activity 1

- 1) Find a place in the school where there is a wall with plenty of space around it. Fix the mirror at the eye level of learners of your class on a wall with adhesive tape. Cover the mirror with a piece of paper.
- 2) Now, ask any two learners in your class to guess where they both need to stand to see each other's reflection in the mirror. When they both agree on the place, mark the place on the floor with the adhesive tape.
- 3) Remove the paper from the mirror. Ask the learners to stand at the place they have chosen to determine if they can see each other in the mirror.
- 4) If they cannot see each other, try different places until they can see each other. Mark the places where it is difficult to see each other with adhesive tape.

- 5) Next, place long pieces of masking tape on the floor from the place where the two children are standing to the wall straight under the center of the mirror. Make sure that these should be straight lines.
- 6) Look at the angles made by the taped lines on the floor and the wall to see if the angles are of the same size.

Ask learners to recall that according to law of reflection, “light bounces off a mirror at the same angle that it falls.” Therefore, when light from the face of one student travels to the mirror on the wall, it should bounce off the mirror at the same angle to the eyes of other learner.

Reflection of Light from Spherical mirrors (Convex and Concave Mirrors)

After performing the activity of reflection of light on smooth or plane mirror, you can acquaint the learners with the reflection of light from spherical mirror surfaces. However, before this, you should essentially make the learners understand about concave and convex surfaces (two types of curved surfaces).

A concave surface is such which is curved like a segment of the interior of the circle or hollow sphere and have at-least one interior angle greater than 180 degrees. On the other hand, a convex surface is curved or rounded outward and have all interior angles less than or equal to 180 degrees. Concave surfaced and convex surfaced mirrors / lenses are shown below:

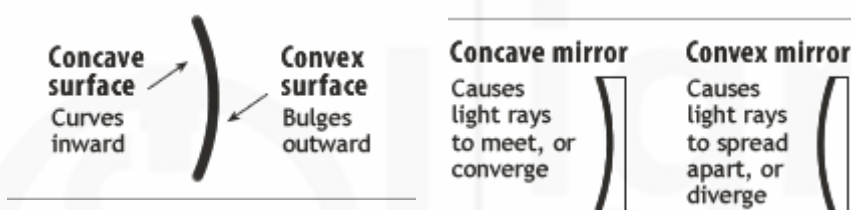


Fig. 15.1: Concave and Convex Surfaces

Give few concave and convex mirrors to learners and let them feel the reflecting surface and understand why one is convex and other is concave.

You should make it clear to the learners that light always reflects according to the law of reflection, regardless of whether the reflection occurs off a flat surface or a curved surface. Three simple rules of reflection of light from concave mirrors can be explained to learners with help of following ray diagram. These are:

- Any incident ray travelling parallel to the principal axis on the way to the mirror will pass through the focal point upon reflection.
- Any incident ray passing through the focal point on the way to the mirror will travel parallel to the principal axis upon reflection.
- Any ray incident parallel to principle axis is reflected passing through focus.

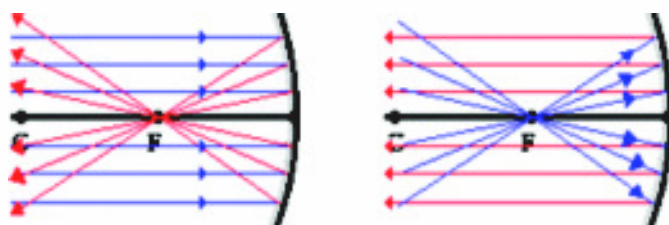


Fig. 15.2: Reflection of Light from Concave Mirrors

Further it can be explained that the image of any object placed in front of a concave mirror can be located easily by applying these rules. Concave mirrors can produce both real and virtual images, depending upon the location of object.

Learners should be given opportunity to do experiments of image formation by a concave mirror.

Learners can be asked to answer reflective questions like:

- Why concave mirrors are used in reflectors in torches, headlights of cars, scooters, etc.?
- What is the use of concave mirrors for dentists or for examining eyes, ears, nose and throat?

In a similar manner, the concept of reflection of light from convex mirrors can be illustrated. You can explain to the learners that a convex mirror is sometimes referred to as a diverging mirror due to the fact that the incident light will originate from the same point and will reflect off the mirror surface and diverge. The diagram given below shows four incident rays originating from a point and incident towards a convex mirror. These four rays will each reflect according to the law of reflection. After reflection, the light rays diverge; subsequently they will never intersect on the object side of the mirror. For this reason, convex mirrors produce virtual images that are located somewhere behind the mirror.

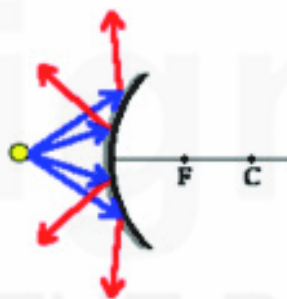


Fig. 15.3: Reflection of Light by Convex Mirrors

You can further elaborate uses of convex mirrors as side mirrors in cars, scooters etc. as they has a wider view to help drivers to see the traffic behind them.

While explaining the concept of reflection by convex and concave mirrors, you have to introduce the concepts like centre of curvature (C), radius of curvature of the mirror (R), principal axis, The principal focus (f), aperture, relationship between the radius of curvature R , and focal length f i.e. $R = 2f$ through various activities and experiments. Let learners themselves explore all such relationships while developing ray diagrams for different image formations.

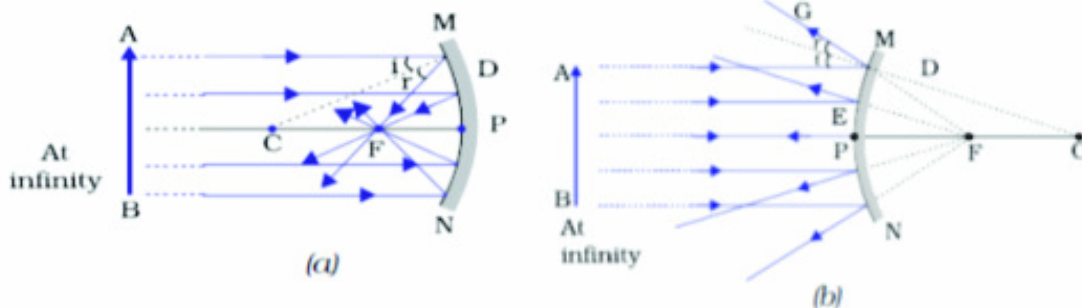


Fig. 15.4: Ray Diagrams of Image formation by (a) Concave Mirror (b) Convex Mirror

Activity 2

Ask learners in your class to perform following activity:

- Take a concave mirror. Find out its approximate focal length in the way described above. Note down the value of focal length. (You can also find it out by obtaining image of a distant object on a sheet of paper.)
- Mark a line on a Table with a chalk. Place the concave mirror on a stand. Place the stand over the line such that its pole lies over the line.
- Draw with a chalk two more lines parallel to the previous line such that the distance between any two successive lines is equal to the focal length of the mirror. These lines will now correspond to the positions of the points P, F and C, respectively. *Remember – For a spherical mirror of small aperture, the principal focus F lies mid-way between the pole P and the centre of curvature C.*
- Keep a bright object, say a burning candle, at a position far beyond C. Place a paper screen and move it in front of the mirror till you obtain a sharp bright image of the candle flame on it.
- Observe the image carefully. Note down its nature, position and relative size with respect to the object size.
- Repeat the activity by placing the candle – (a) just beyond C, (b) at C, (c) between F and C, (d) at F, and (e) between P and F.
- In one of the cases, you may not get the image on the screen. Identify the position of the object in such a case. Then, look for its virtual image in the mirror itself.
- Note down and tabulate your observations.

Activity taken from Chapter 10, Light and Reflection, Class X, NCERT, p. 163.

Facilitate learners in developing following table after various experiments on image formation:

Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At the focus F	Highly diminished, point-sized	Real and inverted
Beyond C	Between F and C	Diminished	Real and Inverted
At C	At C	Same size	Real and inverted
Between C and F	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect

15.3.2 Refraction

You can demonstrate that when light falls on a transparent object, it travels or passes through it and bends or changes its direction. This phenomenon is termed as refraction of light. Learners can be asked to demonstrate that light normally travels in a straight line (referred as rectilinear propagation of light) but when it passes from one medium to another, it bends. For example, the speed at which

light is traveling, changes when light moves from a medium of one density into a medium of a different density. For example, light slows when it moves from air into water, a denser medium. The slowing causes the light waves to change direction, or bend. The bending of light as it passes from one medium into another is known as refraction.

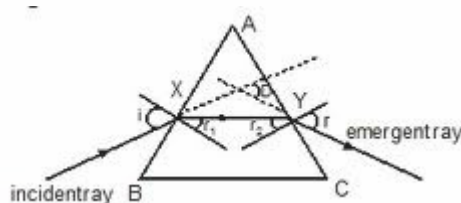


Fig. 15.5: Refraction: Bending of Light

You can undertake following activity to make learners understand about refraction of light.

Activity 3

Place one rectangular paper card on a table. Use the ruler and marker to draw a vertical line down the centre of the card parallel to the long edges of the card. The line should divide the card into two equal halves. Now, place the bottom of the drinking glass on top of the line. Looking down into the glass, adjust its position so the line appears to divide the bottom of the glass in half. Ask one learner of your class to look down continuously into the glass and simultaneously pour water into the glass. Now, ask the learners, what happens to the line in the bottom of the glass as water is added. What caused the change in the appearance of the line? After getting learners' responses summarize that the line appeared to move to one side as water is poured into the glass. Make the learners understand that speed of light slows down when it moves from air into water, a denser medium. The slowing of speed causes the light waves to change direction, or bend, causing a change in the appearance of the line. This phenomenon is called as refraction.

Refraction of Light from Concave and Convex Lenses

As you have explained reflection with help of image formation activities with mirrors, similarly you can familiarize your learners with the phenomenon of refraction of light through curved lenses.

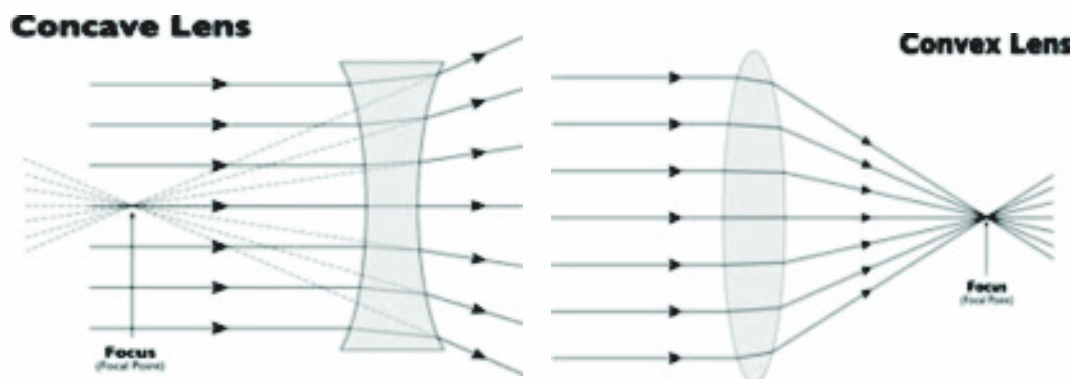


Fig. 15.6: Refraction of Light from Concave and Convex Lenses

You can help learners to understand that when light passes through a concave lens, it changes its direction in outward manner or diverges outside of the lens. On the other hand, when light passes through a convex lens, it bends inward or converges at focal point of the convex lens.

At secondary level, you have to expose your learners with certain concepts related to refraction. You have to give them opportunity to experience refraction of light from a rectangular glass slab as well as refraction through spherical lenses. You can use following activity:

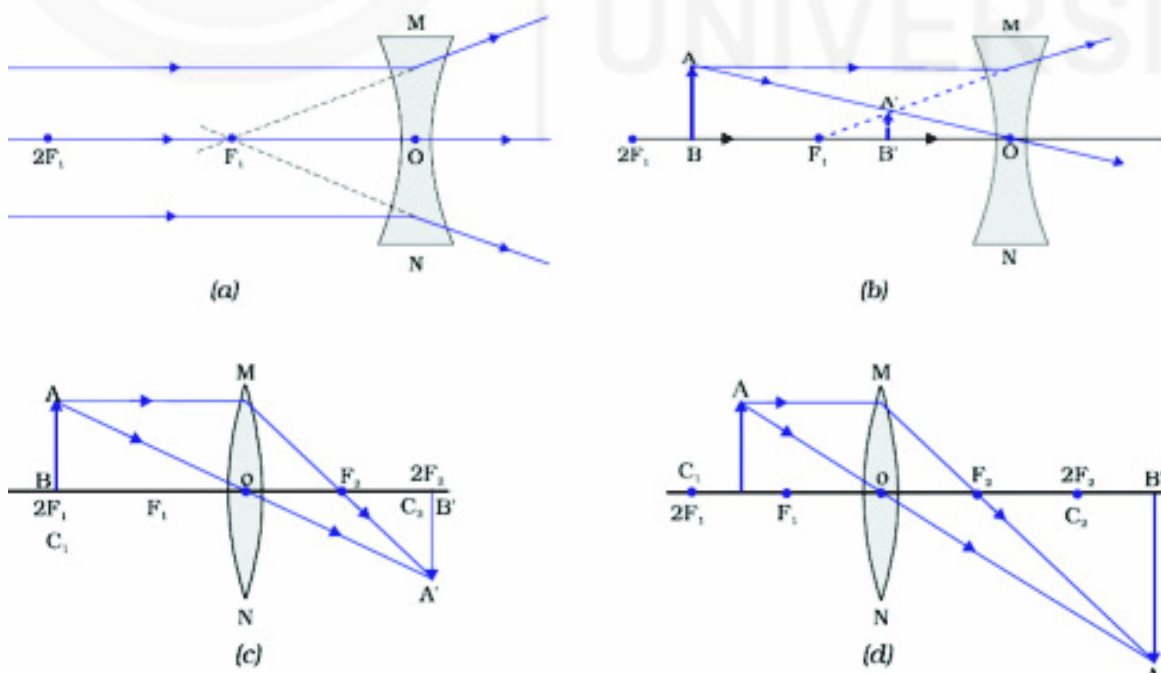
Activity 4

Ask your learners to perform following activity:

- Take a convex lens. Find its approximate focal length.
- Draw five parallel straight lines, using chalk, on a long Table such that the distance between the successive lines is equal to the focal length of the lens.
- Place the lens on a lens stand. Place it on the central line such that the optical centre of the lens lies just over the line.
- The two lines on either side of the lens correspond to F and $2F$ of the lens respectively. Mark them with appropriate letters such as $2F_1$, F_1 , F_2 and $2F_2$, respectively.
- Place a burning candle, far beyond $2F_1$ to the left. Obtain a clear sharp image on a screen on the opposite side of the lens.
- Note down the nature, position and relative size of the image.
- Repeat this Activity by placing object just behind $2F_1$, between F_1 and $2F_1$ at F_1 , between F_1 and O . Note down and tabulate your observations.

Activity taken from Chapter 10, Light and Reflection, Class X, NCERT, p. 178.

Ask learners to do image formation activities with different lenses and examine following ray diagrams:



Check Your Progress

Note: a) Space is given below to write your answer.

b) Compare your answer with the one given at the end of this Unit.

1) What are rules of reflection by spherical mirrors?

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2) What are the differences in image formed by a convex lens and a concave lens if the object is placed between F and 2F?

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15.4 WATER CYCLE

Water is one among most important natural resources for human life. Your learners are already aware of sources of water, forms of water, contamination of water, scarcity of drinking water, etc. at secondary level; you have to introduce some scientific phenomenon related with water like precipitation, evaporation, condensation, etc. which are the parts of natural water cycle.

When you will talk about water cycle, you can ask following questions to your learners:

Water comes from where?

How snow fall takes place?

How clouds are formed?

How water moves from mountains to rivers, from rivers to seas? etc.

You will get answers of many questions right as learners have experienced and discussed these questions in their previous classes. You have to introduce processes like precipitation, evaporation, condensation in connection with these questions.

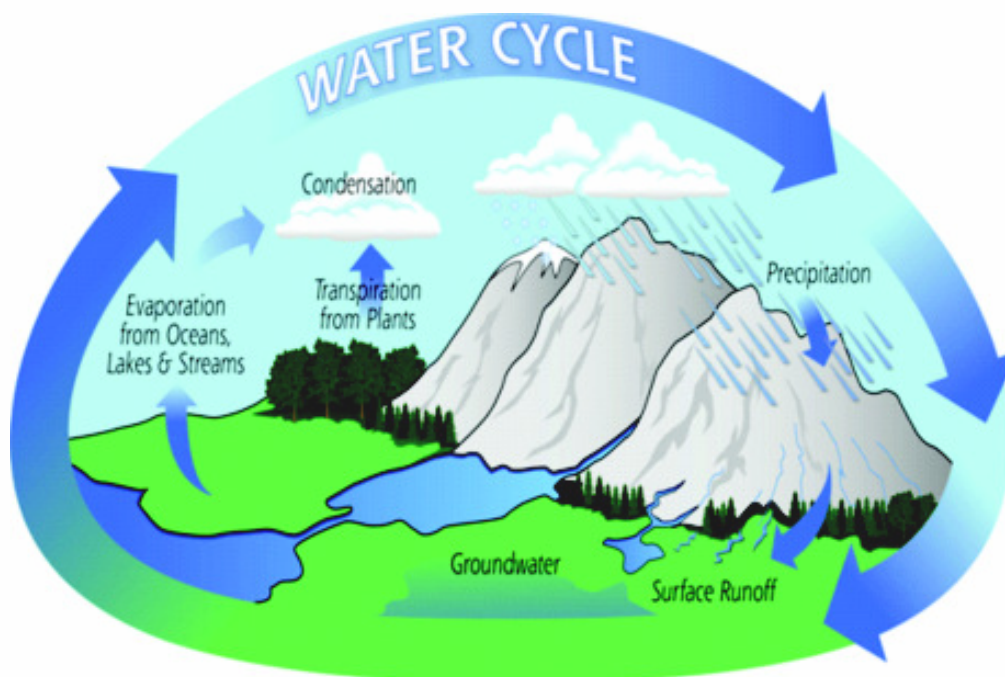


Fig. 15.7: The Water Cycle

Source: <https://www.flickr.com/photos/atmospheric-infrared-sounder/8265046380>

15.4.1 Evaporation

When you start discussion on water cycle with the help on figure 15.7, the first process which you need to discuss is the evaporation.

You can ask learners that what happens when water is boiled. They will respond that water converts into vapours. Here you can introduce the term “evaporation” as a process in which water is converted into water vapours.

Now you link this with vaporization of water from earth. Learners can thus understand that water from big reservoirs; sea, rivers, lakes, etc. get vaporized in presence of sunlight and enters in atmosphere in gaseous form. According to United States Geological Survey (the USGS), approximately 90% of the water vapour in the atmosphere comes from surface water, including oceans, lakes and rivers, with the rest coming from plants.

You can further explain that evaporation is also being used as a purifying process. You can explain it further when you introduce other related concepts.

15.4.2 Condensation

Learners must have seen clouds. They also know that clouds are essential for rainfall. At elementary level, they have learnt that sea water get vaporized and accumulate as clouds. The change of water vapours into liquid form is known as Condensation.

You can demonstrate in your classroom also. Boil some water in a transparent glass pan and cover it with lid. Learners can observe that vapours are going up and accumulating on lid. Slowly they will see that there are water droplets on lid, which is because of conversion of vapours into liquid again.

You have to differentiate between clouds and fog as they are both condensed vapours.

Activity 5

Plan a demonstration in your class to differentiate between cloud and fog. Ask learners to observe and take notes. Discuss the role of clouds and fog in your class.

15.4.3 Precipitation

Precipitation is the third process of water cycle. When water falls from atmosphere on earth in form of rain, snow, freezing rain, this is known as precipitation. You have to explain to your learners that when condensation continues in clouds and vapours condense to form water droplets, it falls. If the atmospheric temperature is very low, falling droplets freeze and precipitation is in the form of snow or freezing rain.

Check Your Progress

Note: a) Space is given below to write your answer.

b) Compare your answer with the one given at the end of this Unit.

3) How does rain occur?

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15.5 CONSERVATION OF WATER BODIES

We all know including your learners that in India, surface water and ground water is not enough for all. Many parts of the country face problems especially in summers. You can see it in news articles, TV reports and as well as in real in many urban and rural areas of Marathwada, Rajasthan, etc. Let's see a classroom discussion as an example:

“Sir, why *Ganga* is drying?” one morning when Science teacher Amit Kumar entered in his class, faced this question.

Amita sked the learners that why are they asking this question? Where have they heard about it? The learners told that they have seen a picture in morning newspaper in which some people are on hunger strike with a banner “*Ganga bachao*” and when they enquired about it from their parent; they came to know that these people are fighting for saving the *Ganga* from drying.

Amit Kumar replied in yes and said they are right. He told that our Holy River *Ganga* starts from Himalaya. Amit Kumar shows them a small documentary video named “*The Journey of Ganga*”. Learners noticed in the video that *Ganga* River starts from *Gangotri* and ends at Bay of Bengal. They also noticed that there are various big and small cities, holy places, Ghats and factories near *Ganga*. They observed that at some place *Ganga* is quite narrow and at some Ghats, there is ample of garbage.

Learners told that they have seen some Indian and foreigners working for cleaning of *Ganga* on television. They were collecting garbage there on the behalf of an NGO.

Such discussion you must be facing in your class when issues of water conservations are very common in news. It is the duty of every citizen along with governments to protect all natural water bodies like lakes, ponds, rivers, etc. There are many schemes on water conservation in India, about which learners should be made aware of.

Activity 6

You can give them a small group project to collect information on various schemes of water conservation in India. Few very common are as follows:

- National River Conservation Plan
- National Lake Conservation Plan
- National Wetland Conservation Programme

You can share many success stories of water bodies' conservation from India, which you can easily collect from newspaper articles or internet. This will make your learners aware of the issue and motivate them to participate and realize their role also.

15.6 NATURAL DISASTERS

Learners as secondary level are well aware of disasters. They understand the concept of natural and man made disasters also as they have studied these topics at elementary level.

Flood

To discuss about floods and their impact on geography as well as society, you can use video clips, newspaper clips, images of flood affected areas or some real life experience in the areas, where flood hits almost every year like areas near Ganga in Bihar and West Bengal or near Brahmaputra in Assam, etc.



Figure 15.8: Some Flooded Areas in India

Usually floods occur in areas below the sea level. The rivers usually flow slowly in these areas and the volume of water is large. Due to heavy rains, the volume suddenly increases, causing floods in the nearby areas. Coastal areas experience floods due to storms, hurricanes or tsunamis.

Children should be made aware about effects of flood as well as measures to be adopted during flood.

Draught

Draught is the other side of the coin as floods bring a lot of water all of a sudden and draught is a prolonged period of dry weather with very little or no rain over weeks, months and sometimes even years. In case of a drought, there is immense scarcity of water, the ponds and rivers dry up and the soil becomes so dry that no crops can grow. In our country, some parts of States of Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, eastern parts of Uttar Pradesh, etc. are more prone to droughts due to the lack of rains consistently.



Activity 7

Show a documentary video on flood and its impact or drought and its impact on human life. Organize a group discussion in your class and encourage learners to reflect on the causes of droughts and flood.

Earthquakes

Learners must have felt some sudden vibrations in the surface of the earth without any apparent reason on more than one occasion or heard stories of violent shaking of the earth surface resulting in damage to houses and buildings. This is called

an earthquake and sometimes when the intensity is high it may result into massive loss of life and infrastructure. Children often ask questions to us whenever they hear about earthquakes happening in any part of the world. A lot of misconceptions and fears about earthquakes prevail amongst learners. As a science teacher, it is your responsibility to explain the right causes of earth quake to children and make them aware about the precautions to be taken during any such incident.

Tell learners about the measuring instrument used for measuring the intensity of earthquakes, which is known as *seismograph*. The vibrations caused by an earthquake travel in the form of waves called seismic waves. These seismic waves are recorded with the help of seismograph. The intensity of an earthquake is measured with the help of Richter scale. An earthquake ranging from 2-4 on Richter scale is not very damaging, 4-7 is moderate but more than 7 is very severe.

Earthquake hazards

Some of the ways in which earthquakes can be a hazard are shaking of the earth resulting in collapse of infrastructures, buildings, landslides, avalanches and tsunamis, fires, Soil liquefaction and volcano eruption.

15.6.1 Disaster Management in India

India is among most vulnerable areas to natural disasters. Almost 85% of India's area is vulnerable to one or multiple hazard. Of the 28 states and 7 union territories, 22 are disaster-prone. Almost 57% of the land is vulnerable to earthquake (high seismic zones III-V), 68% to drought, 8% to cyclones and 12% to floods. India has also become much more vulnerable to tsunamis since the 2004 Indian Ocean tsunami in Chennai.

Government of India has taken up disaster management as a policy issue so that damage impact can be minimized due to any natural or manmade hazard. Learners must have idea about how Disaster Response teams work during flood, Landslide or Cyclone.

You have to explain the difference between the hazard and the disaster. You should clarify that *“a hazard is a natural or manmade damaging event which is beyond the effective control of human being, whereas the disaster is the sum total of consequences of natural hazard due to vulnerability of people or regions subject to hazard.”*

There are two major institutions set up by Government of India:

- National Institute of Disaster Management (NIDM)
- National Disaster Management Authority (NDMA)

National Disaster Management Act 2005

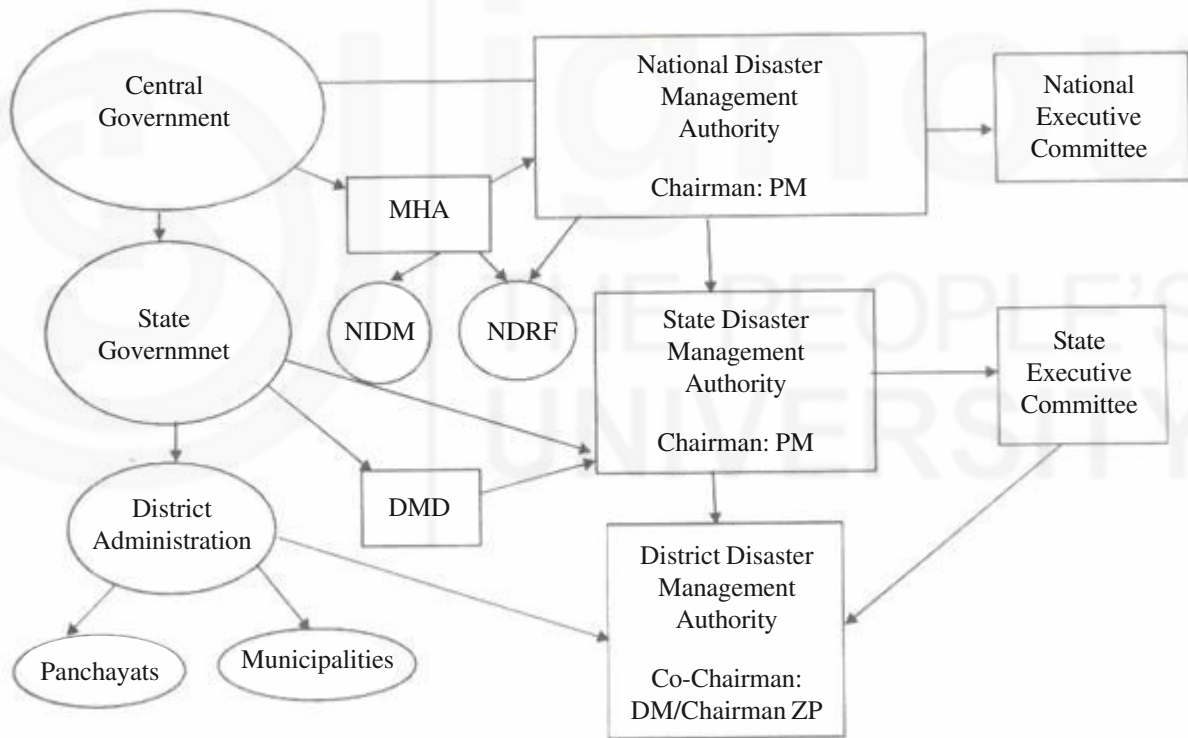
National Disaster Management Act, 2005 defines events that cause substantial loss of life, prosperity and environment. It reads, “Disaster means catastrophe, mishap, calamity or grave occurrence in any area, arising from nature or man-made causes, or by accident or negligence which result in substantial loss of life, of human suffering or damage to, and destruction of property, or damage to, or degradation of environment, and is of such nature or magnitude as to be beyond the coping capacity of the community of affected areas.”

Disaster management Act, 2005 defines Disaster Management as, a continuous cycle and integrated process of planning, organizing, coordinating and implementing, coordinating and implementing measures which are necessary or expedient for-

- Prevention of danger or threat of any disaster;
- Mitigation or reduction of risk of any disaster or its severity or consequences;
- Capacity-building;
- Preparedness to deal with any disaster;
- Prompt response to any threatening disaster situation or disaster;
- Assessing the severity or magnitude of effects of any disaster;
- Evacuation, rescue and relief;
- Rehabilitation and Reconstruction

The Act provides for three tier mechanism for Disaster Management that includes National Disaster Management Authority, State Disaster Management Authority and District Disaster Management Authority.

The Disaster Management Act, 2005 has created new institutions at the national, state, district and local levels. The new institutional framework for disaster management in the country is as under:



The National Disaster Management Authority (NDMA) under the Chairmanship of the Prime Minister is the apex body responsible for laying down policies, plans and guidelines for disaster management and for coordinating their enforcement and implementation throughout the country.

At the State Level the State Disaster Management Authority (SDMA), headed by the Chief Minister, lays down policies and plans for disaster management in the State. It is also responsible to coordinate the implementation of the State

Plan, recommend provision of funds for mitigation and preparedness measures and review the developmental plans of the different departments of the State to ensure integration of prevention, preparedness and mitigation measures.

DDMA is the planning, coordinating and implementing body for disaster management at district level. It monitors the implementation of the National and State Policies and the National, State and the District Plans.

Activity 8

Give your learners small group projects to collect information on role played by Disaster Management Institutions of India during the following event:

- Flood and Landslide in June 2013 in Uttarakhand
- Cyclone *HudHud*, September 2014 in Andhra Pradesh and Odisha
- Earthquake, April 2015, in Kathmandu

Check Your Progress

Note: a) Space is given below to write your answer.

b) Compare your answer with the one given at the end of this Unit.

4) Name the major agencies responsible for Disaster Management in India.

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15.7 WASTE MANAGEMENT

Commonly speaking, wastes are the substances that are no longer of use to us. For example children as well as adults often throw the vegetable and fruit peels, chocolate wrappers, packet of chips, soft drink cans and broken stuff in homes in garbage bins. What happens to this waste after the waste has been collected from the homes by the *safaikarmcharies*. Also, what about the dirty water that goes through your drains and flushes? Where does it go? Different agricultural and industrial activities also generate waste in solid, liquid or gaseous forms. If all this waste is not managed properly, we would face unhygienic and unhealthy living conditions and eventually our surrounding would not be fit for living.

It is also important for us to understand that all waste is not similar and hence we need to adopt different waste management techniques for different types of waste.

Let us first discuss the various types of wastes.

Solid Waste: Solid waste includes all wastes in the form of solid such as vegetable peels, discarded metal and plastic things, animal and plant feces etc. This waste is of two types: biodegradable and non-biodegradable. The substances which undergo decay easily by the action of tiny organisms (decomposers) come under

the category of biodegradable waste. Bio-degradable waste is easier to manage and does not harm the environment much. Some of the ways for managing solid waste are:

Open dumps: Open dumps are open pits where the waste is dumped but this practice is unhygienic and it may also contaminate the nearby water bodies.

Landfills- In this the solid waste is dumped into the pit and covered with soil.

Incineration- In incineration, the garbage that can be recycled is separated and the rest is burnt.

Vermicomposting- Vermicomposting involves use of earthworms for decomposing the waste. These worms eat biodegradable waste and convert it into compost that can be used as manure.

Liquid Waste: Waste water generated from the industries, construction of buildings, mining activities, drainage of pesticides and fertilizers and domestic sewage form the liquid waste. This kind of waste is often discharged into the water bodies and pollutes the water as already discussed.

The waste water released by the homes, industries, hospitals and offices contains lot of impurities called **contaminants**. This waste water is also called **Sewage**. The sewage consists of different types of contaminants. A few of these are:

- **Organic Impurities:** Human and animal faeces, urine, oil, pesticides, fertilizers etc.
- **Inorganic Impurities:** Nitrates, phosphates and metals
- **Nutrients:** Nitrogen and phosphorus
- **Bacteria and Microbes:** Such as those causing cholera, typhoid and dysentery.

If we dump all the waste generated from households or industries directly into the streams, this water will slowly become a threat to the animal and plant life there. The discharge of nutrient rich waste from the fields or industries increases the growth of algae and weeds in the water bodies. These consume the oxygen available to other plants and organisms leading to their death. This process is called **Eutrophication**.

When life forms in these water bodies die, bacteria and microbes begin to decompose them resulting in a foul smell. Mosquitoes and flies start breeding there. The place thus becomes a breeding ground for many diseases such as malaria and chikungunia.

15.7.1 Waste Water Treatment

The waste water is taken from its point of origin to the **treatment plant** through a network of pipes called **sewerage**. At the treatment plant, the waste water undergoes some physical, chemical and biological processes to remove the contaminants.

- 1) First, the waste water undergoes **primary treatment** in which the sewage is passed through rotating screens and huge sedimentary tanks. The heavy

waste that settles down at the bottom is called **sludge** whereas the lighter waste such as soap, oils, plastic etc. floats on the surface. This is called the **scum**. This waste is removed mechanically here.

- 2) After the primary treatment, the **secondary treatment** is done which is a biological process. The sludge generated above is transferred to a separate tank where it is decomposed by the anaerobic bacteria. The process generates biogas that can be used as fuel. The process can be speeded up by allowing water to pass through large aeration tanks where air is blown into sewage. The aerobic bacteria decompose the organic waste.
- 3) Water now undergoes the **tertiary treatment** which is a chemical process. This varies with the composition of water. This may involve treatment using filter beds, exposing the water to UV rays, addition of chlorine or addition of other chemicals like ozone. After this the water goes back to the distribution system.

15.7.2 Basic Principles of Waste Management

The basic principle of waste management is often referred as the **3Rs** of waste management:

Reduce: This means that you use less. You save electricity by switching off unnecessary lights and fans. You save water by repairing leaky taps. You do not waste food. Can you think of other things that you can reduce the usage of?

Recycle: This means that you collect plastic, paper, glass and metal items and recycle these materials to make required things instead of synthesising or extracting fresh plastic, paper, glass or metal. In order to recycle, we first need to segregate our wastes so that the material that can be recycled is not dumped along with other wastes. Does your village/town/city have a mechanism in place for recycling these materials?

Reuse: This is actually even better than recycling because the process of recycling uses some energy. In the 'reuse' strategy, you simply use things again and again. Instead of throwing away used envelopes, you can reverse it and use it again. The plastic bottles in which you buy various food-items like jam or pickle can be used for storing things in the kitchen. What other items can we reuse?

Source: Chapter 16, Management of Natural Resources, Class X, NCERT, p. 268.

Activity 9

- Arrange a visit to the nearby wastewater treatment plant to understand how sewage is treated there. Find out what happens to the sludge.
- Collect water from a puddle or a river. Observe its smell and colour. Put it under the microscope to observe the microorganism present in the water.

Check Your Progress

Note: a) Space is given below to write your answer.

b) Compare your answer with the one given at the end of this Unit.

- 5) Why is it harmful to release untreated sewage into rivers? Track the history of any river in your area to show how it has become polluted from being clean?

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15.8 LET US SUM UP

In this unit, discussion held on phenomenon of light like reflection and refraction of light from mirrors and lenses. The Unit discusses about water cycle and role of processes like evaporation, condensation and precipitation in water cycle. Unit suggested importance of conservation of bodies and recommends sharing some success stories from India on water conservation. Unit also discusses various natural disasters like flood, drought, earthquakes, and measures taken by India for Disaster Management. Unit ends with discussion on waste management and its importance. Unit has attempted to discuss various issues with a range of simple activities to make learners aware about the issues and sensitize them about their roles as responsible future citizens.

15.9 UNIT END EXERCISES

- 1) Differentiate between reflection and refraction with suitable examples.
- 2) Discuss the importance of process like evaporation, condensation and precipitation in nature.
- 3) Discuss major provisions of National Disaster Management Act, 2005.
- 4) What are the processes involves in disposal of liquid waste?
- 5) Prepare a report on waste management system in your village/city.

15.10 SUGGESTED READINGS AND REFERENCES

- <https://www.millcreekurbanfarm.org/sites/default/files/Water%20Cycle.pdf>
- <http://study.com/academy/lesson/the-water-cycle-precipitation-condensation-and-evaporation.html>
- NCERT (2015). Science Text Book (s) for IX and X, NCERT.
- IGNOU (2013). Natural Phenomenon and Natural Resources, Unit 13, BES-019: Teaching of Science, SOE.

- Mondal, P. (2016). Disaster Management in India: Classification, Policies and other Details, retrieved from <http://www.yourarticlelibrary.com/essay/disaster-management-in-india-classification-policies-and-other-details/25006/>.

15.11 ANSWERS TO CHECK YOUR PROGRESS

- 1) Three rules are:
 - Any incident ray travelling parallel to the principal axis on the way to the mirror will pass through the focal point upon reflection.
 - Any incident ray passing through the focal point on the way to the mirror will travel parallel to the principal axis upon reflection.
 - Any ray incident parallel to principle axis is reflected passing through focus.
- 2) Compare image (b) and (d) in point 15.3 and answer.
- 3) Rain occurs due to precipitation of condensed water vapours in clouds.
- 4) National Institute of Disaster Management (NIDM) and National Disaster Management Authority (NDMA).
- 5) Waste water generated from the industries, construction of buildings, mining activities, drainage of pesticides and fertilizers and domestic sewage form the liquid waste. The waste water released by the homes, industries, hospitals and offices contains lot of impurities called contaminants.