

Since the beginning of the earth changes have been taking place on its surface. This process is very slow at some places and is very rapid at other. Sometimes, these changes become destructive while sometimes it is constructive as well. Natural phenomena such as volcano, earthquake, drought, floods, cyclone, landslides etc. are responsible for such changes. Mostly such phenomena bring destruction only, hence these are called **Natural Hazards** also.

In earlier time it was believed that natural hazard is the result of mans interference in the natural process. Some hazards come abruptly and create devastation in short time. This does not leave any time for any relief work. Impact of some hazards is felt over a longer time. Here, there is enough time for relief work to save human life and property. Natural hazards and disasters are phenomena which cause damage to human life and economy.

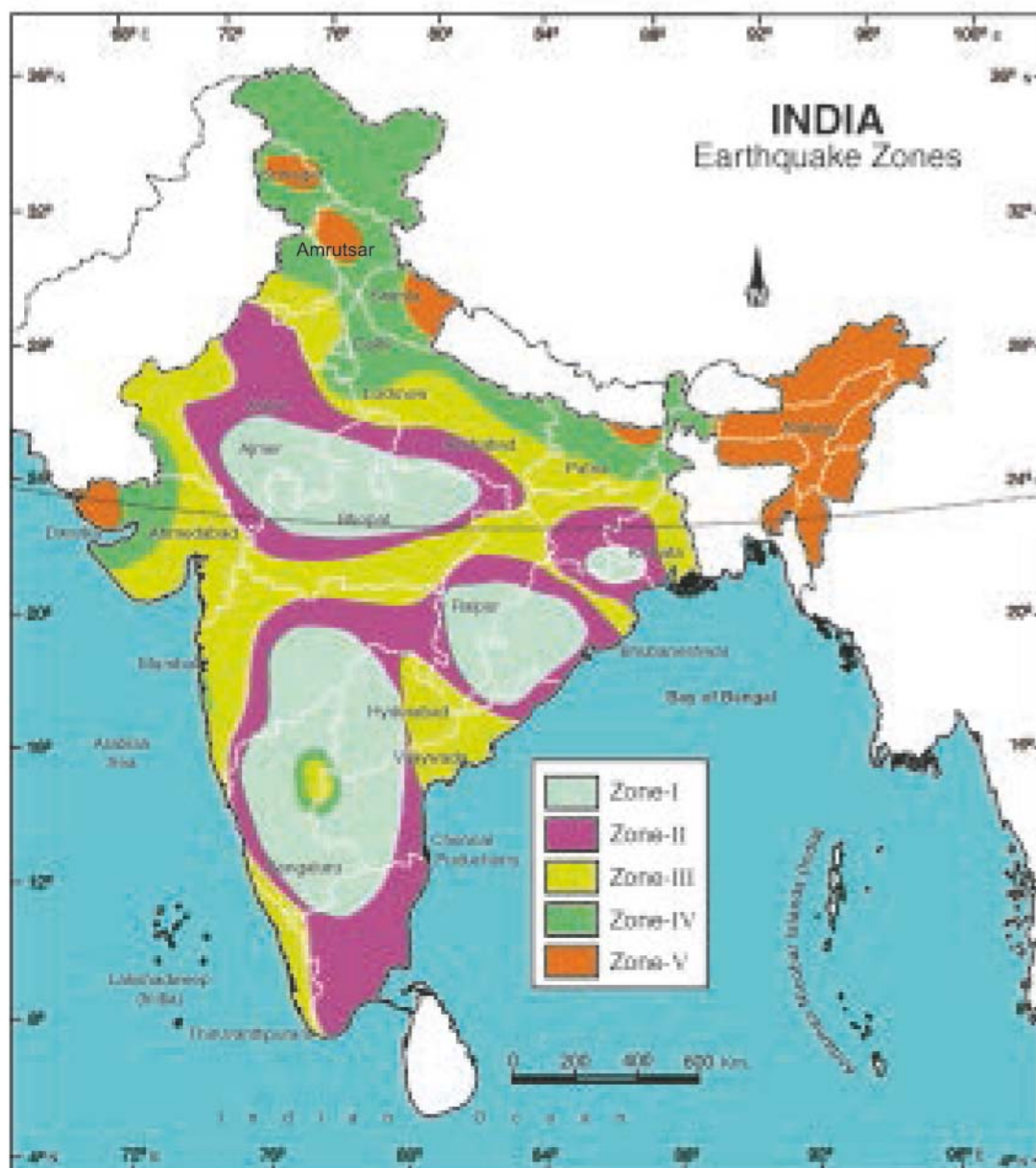
Technically advanced countries are successful in preventing the effects of hazards. In this scientific age, there is a total change in transportation and telecommunication. As a result, the relief work during hazards and disasters can be carried out in time. Advanced forecast can be had about some phenomena. This helps to reduce the damage to human life, animals and other property. For this, **Disaster Management** has become necessary.

#### Classification of Hazards

Hazards	Phenomena
1. Geophysical	Earthquake, landslide, volcanic eruption
2. Meteorological	Cyclone, storms
3. Climatological	Heavy rain, drought, heat wave, cold wave, hailstones, cloud burst
4. Biological	Grasshoppers attack, plague, sars disease, ebola
5. Hydrological	Flood, snowfall
6. Man-induced	Atomic disaster, industrial disaster, war, atomic explosions

#### Earthquake

Detailed information about earthquake is given in 4<sup>th</sup> chapter. Himalayas in the north of India is a young folded mountain of the world. Her interior part is still very active and experience crustal movements periodically. On the basis of possibilities and intensity, India is divided into five earthquake zones which are called '**Seismic Zones**'. The area where earthquakes are most likely and more intense are placed in Zone V. Himalayan mountain system, North Eastern States and the Kachchh region of Gujarat are placed in Zone V.



### 14.1 Probable earthquake zones of India

A vast area of peninsular plateaus falls in Zone III and IV. Delhi, Mumbai and their surrounding areas are also included in Zone IV. The rest of the regions are included in Zone I & II.

#### Impact of Earthquake on human life

An earthquake has manifold effects. Mostly it is destructive, but somewhere its constructive effects are also experienced. Fissures develop at some places and hot gases and water are ejected out. Sometimes sand is also thrown out. Courses of small rivers and streams change. Sea waves and tides become more devastating. Tidal waters gain momentum and erode the shore rapidly. Somewhere an island is also formed. Due to an earthquake, the subsurface strata change and that changes the saline water into fresh water and vice versa.

There is a large scale devastation in urban areas. Trees are uprooted, Electric poles overturn and are broken. This exposes the electric current. So many people and animals are electrocuted. Buildings develop cracks. Multi storeyed buildings collapse and weak structures fall. Damage is also caused to railways and roads, so the routine is disrupted. Walls of dams and reservoirs develop cracks and may cause devastating floods. In Gujarat, the earthquake of 26<sup>th</sup> January, 2001 did much devastation.

The earthquakes which occur at night are more destructive. India has experienced earthquakes many times in past. Following is the information of some earthquakes experienced during last 10 years.

Date	Place	Intensity on Richter Scale
20 <sup>th</sup> October, 1991	Uttar kashi (Uttarakhand)	6.6
30 <sup>th</sup> September, 1993	Latur (Maharashtra)	6.3
22 <sup>nd</sup> May, 1997	Jabalpur (Madhya Pradesh)	6.3
29 <sup>th</sup> March, 1999	Chamoli (Uttarakhand)	6.8
26 <sup>th</sup> January, 2001	Bhuj (Gujarat)	7.9

About 8000 people lost their lives in the earthquake of 7.8 intensity which occurred in Nepal on 25<sup>th</sup> April, 2015. There was some damage in Bihar also. Its effects were felt all over India.

On 26<sup>th</sup> December 2004, a tsunami occurred in the Indian Ocean near Sumatra-Indonesia marine region, and its impact was felt on the eastern sea coast of India. During this tsunami, about 9000 people died and a heavy damage was done to property on eastern coast and in Andaman-Nicobar Islands.

An earthquake is an unexpected disaster. In India, some areas feel the earthquake tremors at a specific interval. In Gujarat, especially in Kachchh, about 500 tremors are felt every year due to which heavy damage is done. In this area, all buildings should have similar set up of construction. Sufficient knowledge about earthquake and awareness is necessary. After gathering information about an earthquake, it is necessary to know as to what precautions should be taken at the time of the earthquake. Our first target should be to save the life.

#### **Precautions to be taken when an earthquake takes place :**

- Lie down on your stomach if you are in open ground.
- If you are inside a school/ college building, sit below a strong table or a bench.
- When tremor starts, stay away from the heavy furniture and glass.
- Stay under a strong cover till the tremors stop. When the tremor stops, leave immediately considering the safety.
- If you are coming out of a multi-storey building, do not attempt to push others while coming out. Stand very near the wall. Do not use lift to get down.
- Stay as much away from electric poles, trees, multi-storeyed buildings as possible.
- If you are in a stadium, theatre, school or an auditorium at the time of earthquake do not rush to come out. More deaths can occur due to pushing than earthquake. Do not leave the safe place till the tremors stop. Give priority to children, old people, handicapped person and women to come out safely.
- In case the services of T.V., internet are discontinued, contact can be made through Hem radio.

#### **Steps to be taken after the tremors stop :**

- Be comfortable mentally and help others.
- If family members get separated during the earthquake, try to get them together.



- If somebody is severely injured and if there is no danger, leave him/her there. When the situation sets right, do the needful remedy.
- If you get information about persons buried below the debris, inform the relief party.
- Use internet. Communicate proper and true information.
- Implement the instructions, official announcement or a Government advertisement given on radio, television or other media.
- Instead of joining a crowd to know what has happened, avoid the crowd.
- Get first aid service in casual injuries.
- Do not re-enter in the damaged building.
- Make sure that the house is safe for entry. If gas leakage is suspected then do not switch on the electric light, and avoid use of other electric gadgets.
- In case of fire, dial 101 for fire brigade and 100 for police control room.

## Volcano

The process in which the magma from below the surface of the earth, hot gases, rock material, soil, mud, ash vapour etc., come out towards the surface of the earth with great thrust or gradually, is known as volcanic eruption. Serious impact is felt during as well as after a volcanic eruption. Disaster management is necessary in areas of active and dormant volcanoes. As soon as the signs of an eruption are sensed, the administration becomes alert. It is not easy to inform people who live scattered or in a group in mountainous area near a volcano.

Estimate of the damage is made after the eruption stops. Sometimes, the volcano becomes active again.

### Safety measures to be taken during volcanic eruption :

- Follow the orders of the Administration at the time of eruption.
- Stay as much away as possible from the site of eruption.
- Avoid watching the eruption very closely with naked eyes.

## Landslide

Landslide means the sliding of a large portion of land or a cliff or a part of it from the mountain downwards. Landslides generally occur in mountainous regions. Various settlements in such area become their victim. When such places are in remote areas, their contact is lost and help cannot reach them immediately. It is also difficult to reach inaccessible areas.

### Reasons for landslide :

(1) Geographical (2) Structural (3) Physical (4) Human induced

Landslides generally take place in Himalayas in India. About 200 people died in the landslide at Maalpa - Pithoragadh on 18<sup>th</sup> August, 1998. Such phenomena also occur in South India. About 150 people died in the landslide which occurred in Malin village of Pune district on 30<sup>th</sup> July, 2014. In June 2013, a heavy cloud burst and the resultant floods at Kedarnath in Uttarakhand caused heavy devastation to human life, roads, bridges and other property.

### **Precautions at the time of landslide :**

- Keep life saving commodities while passing through a probable landslide area.
- Follow the instructions given on the Notice Board while passing through a landslide area.
- Avoid visiting the landslide area during rainy season.
- Do not make haste to cross the area while the landslide is in progress.

### **Snowfall**

Many a times, a snowfall causes much damage in Himalayas. In Himalayas, which are snow-clad and lofty in the world, such phenomena are felt occasionally. Landslide is caused generally by tectonic movements, ice skating, (skiing), adventure sports like snow skating, mountaineering, excessive pressure due to heavy snowfall etc. Sometimes, mountaineers become victims of such phenomena. Human life is lost due to this natural as well as man induced phenomena over limited area.

### **Precautions at the time of snowfall :**

- Implement the instructions given by the authorities while going through snowfall hit area.
- Avoid going to areas where stormy winds blow and rains heavily in snowfall region.
- Keep your life saving things with you while going through snowfall hit areas.

### **Cyclone**

This is a meteorological hazard and it has its own geographical area. Here, the air moves towards centre where atmospheric pressure is very low and a high pressure exists around all sides. The winds in centrifugal direction rise high in circular movements due to the coriolis force. This phenomena is called Cyclone. The cyclone originates mostly over the oceans and after the contact with the coast, they gradually get extinct.

### **What happens during a cyclone ?**

Powerful waves in the vast oceans rise very high. Coastal area submerges into the water. If the cyclone develops during spring tide, then its combined effect becomes very devastating. Coastal area gets heavy showers which result into floods. Cyclones uproot the trees and demolish buildings. Electric poles are also uprooted. Mangrove forests near the sea coast protect the region from the devastating and powerful waves.

Entire eastern coast (Coromandel and Circar) of India is a cycloneprone area. West Bengal, Andhra Pradesh, Odisha and Tamil Nadu experience frequent cyclones. On Arabian Sea coast, Gujarat and Maharashtra states are frequent victims of cyclones.

Advanced information about cyclones can be obtained through satellites. Its intensity, velocity and direction can be known through the satellites. On this basis, action can be taken for the protection of people of any area. Evacuation of all people was possible due to the advanced information from cyclone named as Failin. Indian Weather Office remains active for such occasions. Cyclonic Detection Radar are placed at 10 places in the country. Insat satellite and these detection centres provide information constantly.

### **Steps to be taken before a cyclone :**

- Do not spread rumours. Do not get panicky.
- Attend to the authentic news and warnings.
- Fishermen should not leave for sea. Boats should be anchored at safe place.
- Coastal inhabitants should shift to a safer place.

- Keep in mind the places at a height where refuge can be taken.
- Keep dry breakfast, water, clothes and a first aid kit with you.

#### **During the cyclone :**

- Do not take shelter below an old worn out building or a tree.
- If possible, use mobile internet and get latest information.
- Keep on listening radio and follow instructions.
- Do not stand near sea, below a tree or an electric pole or the power line.
- Disconnect the electricity and gas connections.

#### **After the cyclone :**

- Do not attempt to enter a damaged house.
- Stay in the house only if it is totally safe.
- Before leaving the house, confirm that the cyclone has passed by.
- Wait for the all clear message on radio or television in your home.
- Stay away from the debris of buildings, glass pieces etc.
- Check whether there is any leakage in the gas connection. If the leakage is traced, Open all windows and doors and go out of your house.
- If evacuated, return only when the instructions are received and by the route suggested.
- To save the electric gadgets from damage, turn off the main switch of the house.
- For safety measures, contact Fire Brigade, Police, NGOs etc.
- Use safe food only.

### **Flood**

Flood is a natural hazard. When the river flow increases abruptly and heavily, river water spreads over large area along both banks and the deep impact of that water remains for a short time, then such a situation is called Flood. When cracks develop or if there is a break in the dams, the water stored in the reservoir gushes out very rapidly and causes flood. On 11<sup>th</sup> August, 1979 Morbi flood disaster took place due to the bursting of the Machchhu Dam<sup>2</sup>. Due to tectonic movements, when the slope of the relief features changes, river changes its course and that also may result into unexpected flood.

In the North-Eastern states, every year, flood problem becomes very grave. There are frequent floods in Brahmaputra, Ganga and Kosi rivers. Due to heavy rainfall in the upper valley, flood problem exists in rivers Narmada, Godavari, Tapi, Krishna and Kaveri. Punjab, Haryana and Himachal Pradesh also get frequent floods. When there is a sudden heavy rainfall in the catchment area of a river, the water level in the dams rises, so the gates of the dams have to be opened. Under the circumstance, flood like situation is created in the lower valley regions.

#### **Flood Management :**

Flood is a natural hazard but we can prevent it from becoming a local disaster. A **Disaster Management Team (DMT)** is formed by the states concerned. This team is trained to carry out relief work at the time of flood. A common man needs to know some primary information from it. This is as follows :

### **Precautionary measures before the floods :**

Floods can now be forecast easily. The work has expedited by satellites. Sometimes, floods can be forecast even before a week. When a confirmed information about the flood is received, following steps can be taken :

- Gather information about higher places and know about the short route to reach there.
- All valuable luggage of the house should be shifted to a safe place so that the flood waters do not reach there. Moreover, Disconnect water, gutter and gas connections.
- In case of shifting to a safer place, park your vehicles at a safer higher place. A special arrangement is made over the roofs of the buildings in Surat.
- If you are travelling, avoid to cross the flooded area or a low bridge on a river.
- If your vehicle fails, then leave the vehicle and reach a safer place without any delay.
- Keep the First Aid kit ready with you. Medicine for snake bite and diarrhoea should be kept in ample quantity.
- Keep ready thick ropes to tie up various goods and to carry them.
- Keep an umbrella ready and use strong plastic bags to save goods from getting wet in the flood. Keep extra plastic bags with you.
- A small torch and a radio should be kept handy.
- Keep long bamboos or batons to keep away the snakes and other animals which are drifted in the flood water.
- Manage for woollen clothes, drinking water and durable snacks.

### **What to do during and after the flood :**

- Keep in constant touch with radio, TV, internet and newspapers.
- If you have to evacuate collect your important documents and life saving drugs with you.
- Leave the address of the place where you are going to the DMT.
- Do not plunge into unknown water.
- Drink only boiled water during flood.
- Keep the food covered. Do not eat stale or wet food.
- Be helpful to Government administration and NGOs.

### **What to do after the floods :**

- Do not enter into deep and unknown water.
- Sprinkle insecticide / pesticide over small water pools of dirty water.
- Know about your house. If it is not habitable, do not take the risk to stay.
- If flood waters have entered your house, then it is not advisable to stay in the house.
- Sometimes, there is a break in the gutter and water pipelines. So the polluted sewage water merges with drinkable water. Do not drink such water.
- Get your gutter, electricity, water lines checked by authentic persons.
- Drink boiled chlorinated water.
- There is a possibility for spread of contagious disease, so seek doctors advice.



## **Drought**

On hearing the word drought, words like dry land, failure of crops, inadequate rainfall, starvation etc. come to our mind. Collective characteristics like inadequate rainfall, acute water shortage, no possibility of farming, shortage of fodder for animals is called drought.

Inadequate rainfall is the main reason for drought. If a region gets much less rain and if this happens continuously for two-three years, the severe effects of drought is felt. Such a condition creates many problems. Decrease in rainfall is a gradual process. So a drought can be considered to be a hazard which develops very gradually and leaves a long term impact.

Many places in India experience drought periodically. Every year, there is at least one region in India facing a drought. Due to weak monsoon season, many places in Gujarat and Rajasthan face drought frequently. Drought is a common phenomenon in many places in Western Odisha, Rayalsima and Telangana regions of Andhra Pradesh, Chhattisgarh, Jharkhand, Central Maharashtra, interior Karnataka, West Bengal and Tamil Nadu. Besides, few places of Haryana, Punjab, Bihar and Uttar Pradesh which have abundant water, experience drought occasionally. In India, there are 191 drought prone districts.

### **Environmental Degradation :**

Quality of the environment reduces during a drought. This is called Environmental degradation.

- Deforestation increases.
- Soil is eroded.
- Surface water and ground water are used excessively. Biodiversity is lost.
- Global warming increases.
- Drought occurs due to excessive rainfall also. Due to excessive rain, crop is destroyed, epidemic spreads. Excessive rain is also called wet drought (Lilo dukaal).

### **Effects of Drought :**

Drought has a long term effects and it affects all fields in the society. Due to crop failure, a shortage of food grains, fodder for animals, water shortage in rural and urban areas are created. Agricultural labourers loose their income, so they have to divert to other sources of income. Children suffer from under nourishment.

### **Drought Management :**

Ultimate reason for a drought is water shortage. If the water sources are utilised reasonably and if modern technology is used then the drought impact can be reduced to some extent. Israel gets about 53.7 mm rainfall only, but it implements modern technology in farming. So even with inadequate rainfall, they are prosperous in agriculture. Trees control the rain. Due to more forested area, South Gujarat does not experience drought.

### **Infestic Diseases**

Some insects, virus, bacteria etc. spread diseases. Diseases like anthrax, bird flue, swineflue, chikungunia, aids etc. are spreading fast. Of these most of the diseases are the result of human actions. In Gujarat, swine flue creates some problem for some years during winter.

Information about the diseases, cleanliness, proper disposal of litter, disposal of '**medical waste**' through proper way etc. are remedies to control the infestic diseases.

Human acts like industrial pollution, dropping of litter in the ocean, chemicals used to get more production may prove dangerous for human life in long term.



## **Industrial disasters and Atomic Explosions**

In industrial plants, accidental disasters take place during any chemical process. Gas Tragedy in Bhopal (1984) is a well known phenomena, where many people died due to leakage of poisonous gas due to human negligence. Chernobyl Atomic Disaster of Russia (1986) has become famous world over.

A war also can be called a man-induced disaster. It starts abruptly. Many lives are lost. In recent times, a domestic warlike situation among Arab countries is a painful man-induced disaster .

### **Atomic Explosions**

Atomic explosion is perhaps the most terrible and long lasting disaster which causes loss of human lives. In 1945, more than two lakh people died when America dropped two atomic bombs over two Japanese cities Hiroshima and Nagasaki. It is in the hands of man to be safe from the man-induced atomic, biological and chemical disasters.

### **Remedies of Safety Against Industrial Disasters**

Accidents are associated with the establishment of an industrial unit. Let us understand how safety can be assured under extra ordinary circumstances.

- Avoid as much as possible residing near the industrial units producing poisonous chemicals.
- Know about the general characteristics of the dangerous chemicals through different media.
- Citizens should know about the dangerous and poisonous chemicals. Enthusiastic youths should take training for safety measures in case of emergency, so that it could be used timely.
- Participate in the training programmes organised by Government / NGOs / industrial units,
- Try to create awareness in the society.
- Know beforehand about the direction of evacuation and safe refuge.
- Plan a disaster management scheme for the affected people and inform all of them.
- If the disaster information is not reachable from the industrial unit concerned, as a citizen, inform immediately to fire brigade, police and Government authorities.
- Observe the direction of the chimney smoke and go in the opposite direction.
- Keep wet piece of cloth or a handkerchief on your mouth at the time of industrial accident.
- If gas is found to be excessive, take a vehicle and reach a safer place.
- Do not try to go near the place of disaster; avoid unnecessary crowding.
- Life is more precious than goods. Do not worry about the goods but save yourself.
- Listen the siren, necessary instructions on TV and follow them.
- Cooperate fully to the persons who help you.
- If the proportion of poisonous gas is less in your area, keep the windows and doors tightly closed, and stay inside.
- Provide protection to those patients who are unable to leave and to weak, helpless and handicapped persons. Close the windows and doors and confirm about their safety.

### **Precautions**

- Get health related and life insurance beforehand.
- Keep the first aid box handy and keep the material inside updated. Get trained for first aid.
- Keep important phone numbers handy.

## EXERCISE

### 1. Write a detailed answer to the following questions :

- (1) Write a detailed explanation about natural hazards and disasters.
- (2) Explain the effects of earthquake on people.
- (3) Discuss the effects of drought.
- (4) Discuss the industrial disasters.

### 2. Write short notes :

- (1) Flood
- (2) Rescue operations during an earthquake
- (3) Cyclone
- (4) Natural Hazards
- (5) Remedy for safety against industrial disasters
- (6) Disaster Management
- (7) Atomic explosion

### 3. Answer the following questions in one-two sentences :

- (1) By which other name a disaster is known as ?
- (2) Which factors are responsible for the changes on the earth ?
- (3) How many countries have been successful in controlling the effects caused by disaster (hazards) ?
- (4) Into how many parts can the hazards be classified ?
- (5) Write two examples of biological disasters.
- (6) Write two examples of geo-physical hazards.
- (7) On the basis of probabilities and intensity or risks, into how many seismic zones is India divided ?

### 4. Select the correct option for the questions given below and write :

- (1) Which of the following is a man-induced hazard ?  
(a) Storm                      (b) Drought                      (c) Atomic explosion                      (d) Earthquake
- (2) In which seismic zone does Kachchh fall ?  
(a) V                      (b) IV                      (c) III                      (d) II
- (3) If you are in a building and the earthquake tremors start, what is to be done ?  
(a) Come out immediately.                      (b) Stand in a safe corner of the house.  
(c) Disconnect the electric connections.                      (d) Ask others for help.
- (4) In which year, did the Morbi disaster take place ?  
(a) 1980                      (b) 1989                      (c) 1979                      (d) 1981
- (5) Advance and live information about a cyclone can be gathered through  
(a) Satellite                      (b) Radio                      (c) Newspapers                      (d) TV

