

## 5. Precipitation



Can you tell?



- ✿ The blades of grass look like this on winter mornings.

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**From where does the water on the blades of grass come?**

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- ✿ Snow is found everywhere in the winters in Kashmir.



**Why isn't snow found in our surroundings?**

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- ✿ Generally, it rains between June and September in our region.

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**How do the rain droplets form?**



- In London, there is fog like this till the afternoons in the winters.

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**Why don't we have fog like this till afternoons in the winters in our region?**



- Sometimes hailstones destroy the standing crops in the fields.

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**Why don't we get hailstones frequently ?**

### Geographical explanation

70.8% part of the earth's surface is full of water. The distribution of this water is very uneven. At some places, the water storage is limited while it is ample at other places. We see/experience the different forms of condensation as shown in the pictures above and in fig 5.1. These forms of condensation occur due to the water vapour in the atmosphere.

As the atmospheric conditions change, we see changes in the forms of condensation. On winter mornings, we find dew. In areas located at higher altitudes, snowfall occurs; while it rains in other places. Some places experience dense fog while some experience hailstones suddenly and face crop destruction.

#### Precipitation:

Water falls in the solid or liquid state from the clouds to the ground. Snow, hailstones, rainfall are the major forms of precipitation. See the images in fig.5.1.



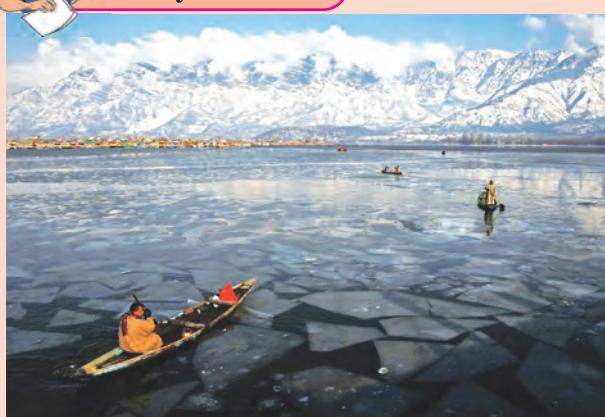
**Figure 5.1 : Forms of precipitation / Condensation**

## Snow:

When the temperature in the atmosphere falls below the freezing point, water vapour directly turns into snowflakes. This is called sublimation. Here, the vapour in the form of gas transforms into solid snow. Precipitation in the form of solid particles of snow is known as snowfall. In high latitudinal and temperate regions, snowfall occurs at the mean sea level while in tropical areas, snowfall occurs at places located higher than the snowline altitude.

As snow is in the solid form, it does not flow like water. Layers of snow get deposited. When the snow accumulates on a large-scale, then the transport and communication system of that area collapses. People living in those regions have to protect themselves from frostbite. When the snow melts, the region gets water.

### Do you know?



**Snow-capped mountains and frozen lake**

There is a difference between ice and snow. In areas located at higher altitudes and high-latitudes, where the temperatures are below  $0^{\circ}\text{C}$  precipitation occurs in the form of snow. Snow is friable and opaque. This snow accumulates in the form of layers on top of each other. Because of the pressure from the upper layers, the lower layers of the snow become homogeneous, massive and transparent. Massive transparent snow formed in such a way is called ice.

When temperature drops below

freezing point, a layer of ice forms on the lake's surface and this layer floats on the surface of reservoir. This ice is not related to snowfall directly.



**Figure 5.2 : Snowfall**

## Hail:

When there is lot of heat on the earth's surface, the upward air flow blows at a greater speed. Because of this upward flow, the temperature of the air reduces and the condensation of the water vapour takes place. Dark clouds are formed. Because of the upward movement of air, these water droplets go to a higher altitude. Here, solidification of these droplets occur and hailstones are formed.

As hailstones are heavy, they fall towards the ground, but because of the frequent upward flow of air, they are repeatedly taken upwards. Here, a new layer of snow encapsulates the hail. This happens quite a few times. Hence, concentric layers are formed while the hail grows in size. These big heavy hailstones fall rapidly to the ground because of gravity. We call the precipitation of this type as hail showers. Because of hail, crops may get destroyed and loss of life and property may also occur.



### Think about it.

We use a raincoat or umbrella to protect ourselves from rainfall. What will you use to protect yourself from severe hailstorms?

Hails occur in summers in India, Africa and in some parts of South East Asia. Hails do not occur in equatorial areas because of the heat in the atmosphere. Hails do not occur in cold zones because of lack of upward flow.



### Try this.

#### Let us make rain !

Gather the following materials : a vertical glass container with metal lid, nail, hammer, hot water, ice cubes and handful of salt.

- ⇒ Take the container with the metal lid.
- ⇒ Remove the lid.
- ⇒ Hit the lid on the upper side at a number of points with a nail and the hammer (take care that the lid does not get any holes because of this).
- ⇒ Fill 1/3rd of the container with steamed water. ( Not boiled)
- ⇒ Now put the lid on the container and close it tightly. Take care that the steam in the container should not go out.
- ⇒ On the lid, put ice cubes, handful of rocksalt and little water.

#### Observe the container. Experience rain!

( Note: It may take 10-15 minutes for rain to occur)



Figure 5.3 : Students carrying out the rainfall experiment

### Geographical explanation

As the vapour in the container is light, it travels upwards. As the lid is tightly closed, the vapour cannot escape. Because of the ice cubes above the lid, condensation of the vapour occurs. Consequently, water droplets formed from the vapor accumulate on the inner side of the lid. Because of the punches on the lid, these droplets gather together and fall down as drops. During rainfall, similar process happens in the atmosphere on a large scale.

#### Rainfall:

We generally get water in the form of rainfall. The temperature of the air with water vapour reduces when it goes higher. Condensation of the vapour occurs. Clouds form when the condensed water droplets and dust particles accumulate. The water droplets increase in size. When they cannot float in the air anymore because of their weight, they come down as rainfall.

#### Convectional rainfall :

In equatorial areas, the surface gets heated because of the sun's heat and the air near it also gets heated. As it gets heated, it spreads and becomes lighter and moves upwards. The air cools down when it goes upward. The moisture-holding capacity of cold air is less. Consequently, condensation of the water

vapor occurs and rainfall occurs. In equatorial areas, such a type of rainfall occurs almost daily in the afternoons. Rainfall is accompanied by lightning and thunder. The Congo basin of the Africa and the Amazon basin in the S. America experience convectional rainfall. Such a rainfall occurs in a very limited area in the world.

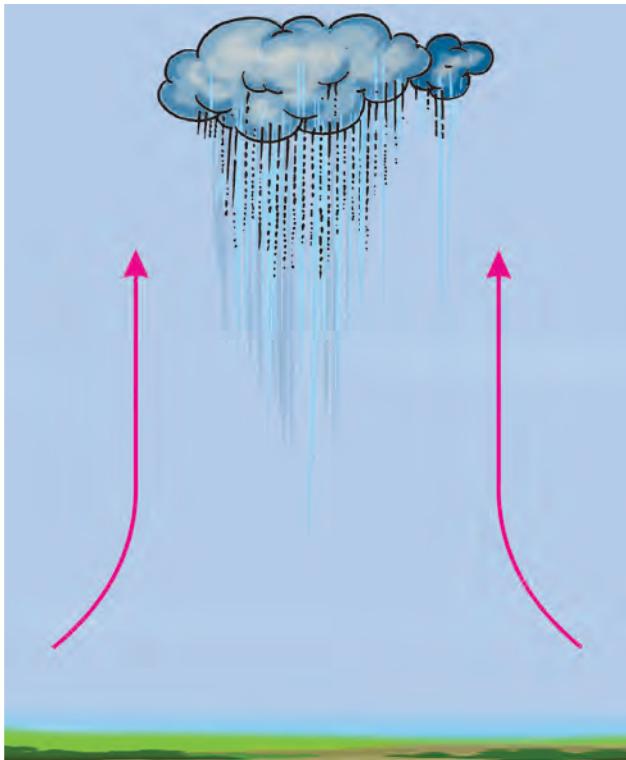
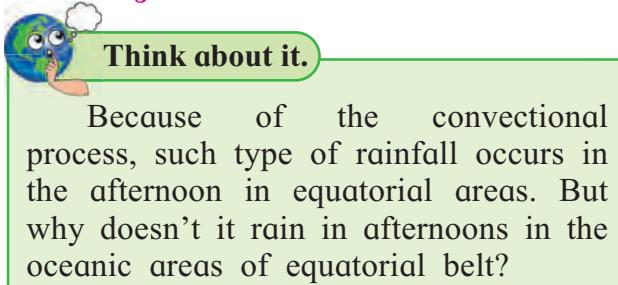


Figure 5.4 : Convectional rainfall



#### Think about it.

Because of the convectional process, such type of rainfall occurs in the afternoon in equatorial areas. But why doesn't it rain in afternoons in the oceanic areas of equatorial belt?

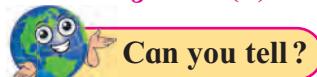
**Orographic rainfall :** Winds coming from lakes or seas are moisture-laden. They are obstructed by the high mountain ranges coming in their way. They start going upwards along the slope of the mountains. The temperature of these winds drop and condensation occurs and rainfall takes

place. Thus because of the obstruction of the mountains, this type of rainfall occurs. The windward side of the mountains gets more rain; amount of vapour in the air reduces after crossing the mountain and the moisture holding capacity of the air increases. The leeward side of the mountain gets lesser rainfall and hence this area is identified as rain-shadow area. See fig 5.5(A) and (B)

The effect of Monsoon rainfall is important when we think of the Indian subcontinent. We have studied this in the previous standard. The rainfall occurring in India because of these winds is orographic type rainfall.



Figure 5.5 (A) : Orographic rainfall



Observe the horizontal profile of Maharashtra in fig 5.5 ( B ) and answer the following questions:

- ❖ What type of rainfall occurs in Maharashtra?
- ❖ Where will the rain shadow area lie in Maharashtra?
- ❖ Considering the figure estimate the rainfall of your district. Discuss.

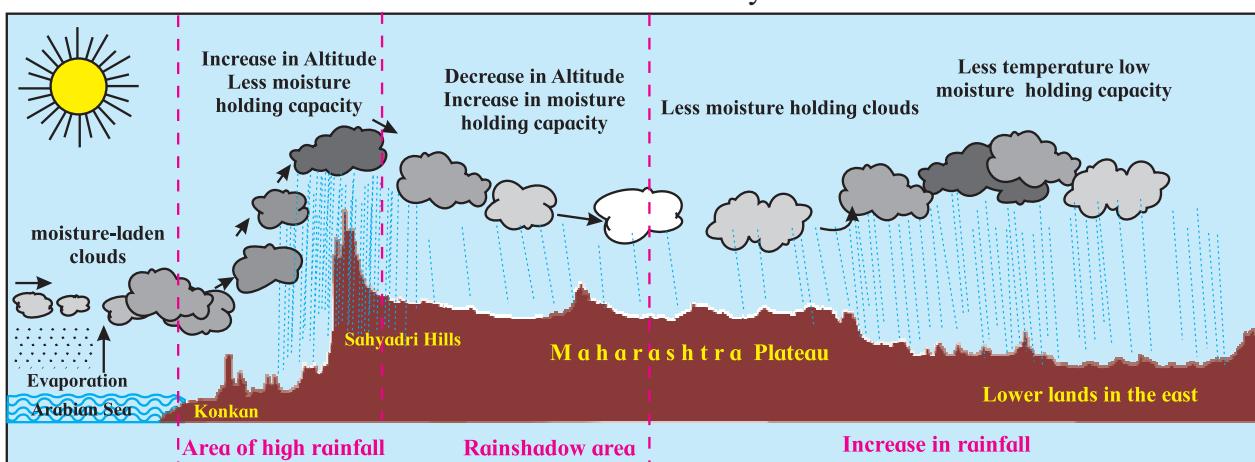


Figure 5.5 (B) : Cross profile of Maharashtra and rainfall

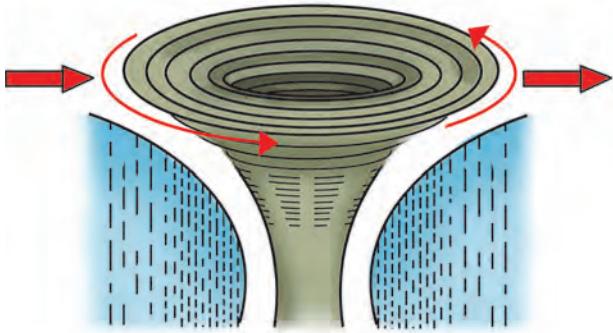


Figure 5.6 : Cyclonic rainfall

**Cyclonic rainfall :** Cyclone is the specific air formation when the pressure at an area is less than the surrounding regions. This is called cyclone. Air from the surrounding region comes toward the center of the cyclone and starts moving upwards. As it rises, the temperature of the air reduces, condensation occurs and rainfall takes place.

It rains in areas over which the cyclone passes. Cyclonic rainfall occurs more in temperate zones and cyclone's area is also

quite extensive. Comparatively, cyclonic rainfall occurring in tropical regions is limited in extent and it is stormy in nature.

Orographic rainfall occurs in most of the parts in the world. Convectional rainfall is regional in nature. There is a certainty in the convectional rainfall occurring in the equatorial areas. Comparatively, the orographic and cyclonic rainfalls are less certain. And therefore, such areas are prone to very heavy rainfall, floods or droughts frequently.

Study the rainfall map of the world given in Fig 5.7 carefully and answer the following questions:

- Which region experiences more rainfall?
- What is the reason for low rainfall in the central Peninsular India?
- Why does the eastern part of central African Continent gets less rainfall than the western part despite its location close to the equator.

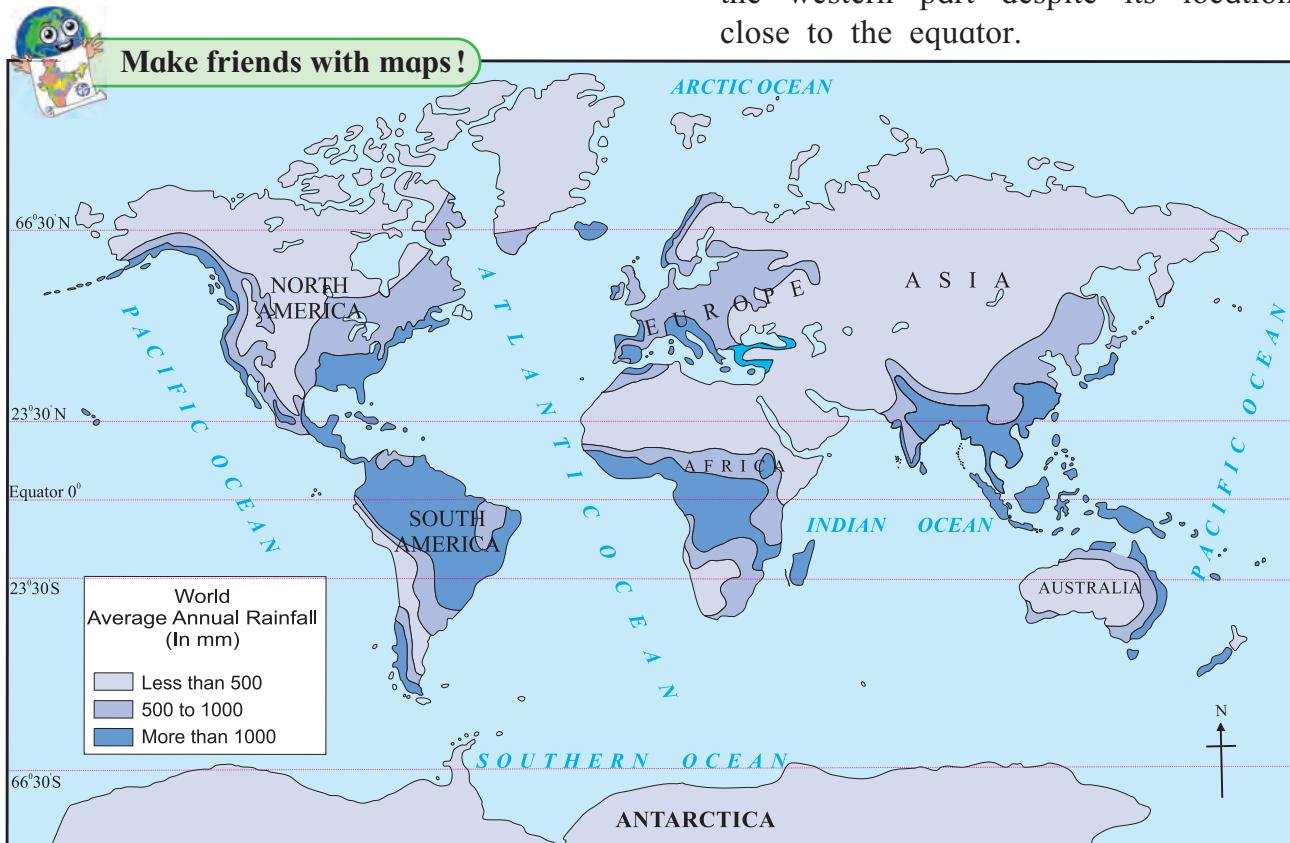


Figure 5.7 : World : Distribution of rainfall

- Why does the amount of high rainfall in the western part of the European continent reduces in the eastern part?
- Why is the rainfall more only in the eastern coast of Australia?



### Think about it.

Why are the areas of high rainfall situated in tropical areas?



### Always remember –

The factors which affect the amount of rainfall in a region are the amount of water vapour in the atmosphere, air pressure and temperature. The topography and latitudinal position of a place also affects its rainfall.

### Rain gauge :

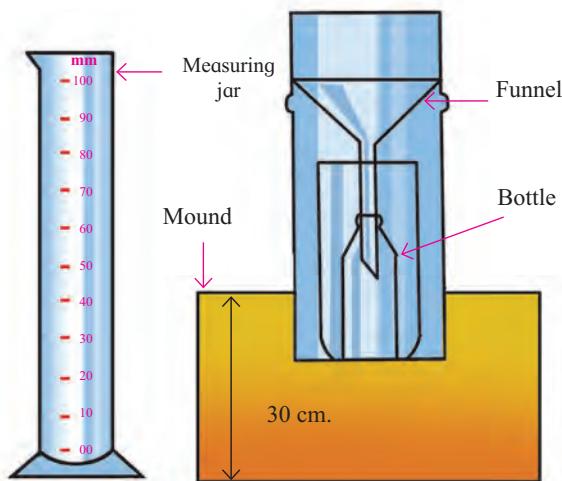


Figure 5.8 : Rain gauge

The instrument that is used to measure rainfall is called rain gauge. See fig. 5.8. The funnel that is used in the rain gauge has a specific diameter. The rain falling in this funnel is collected in a bottle fitted in the gauge. The collected water is then measured with the help of measuring jar. In areas of heavy rainfall, the reading of the rain is taken every three hours. The measuring jar reads in millimeters. The gauge is kept in open ground on a 30cm

high flat mount. Hence, the rainwater is collected without any obstruction. See fig. 5.8.



### Do you know ?

#### (a) How much of water does 1 mm of rain mean?

If we do not let 1 mm of rainwater move as run off, penetrate in the ground or evaporate, then how much water can be accumulated? Let's understand this by an example. If 1mm rainfall occurs over 1 sq.km area then we get 10 lakh litres of water from it.

#### (b) How is snowfall measured?

Snowfall can also be measured with the help of rain gauge. For this, the container full of snow particles is heated carefully to melt the snow. Then the water obtained is measured. A layer of 120 mm of ice is equivalent to 10mm of rainfall.

**Fog, dew and frost :** When the condensation or solidification of the water vapour in the atmosphere occurs near the earth's surface, then we can see fog, dew or frost.

The temperature of the layers of the air near the surface of the earth reduces. As temperature reduces, water vapour condenses. In this process, vapour turns into microscopic water particles and float in the air. When the density of these droplets in the air increases, fog occurs.

When moisture-laden air near the earth's surface comes into contact with very cold objects, condensation of the vapour takes place. They turn into very small water droplets. These water droplets stick to the surface of the cold objects. This is called dew.

If the temperature of the air is less than 0°C, the water droplets stuck to the surfaces of cold objects freeze. This frozen water droplet is called frost. Dew and frost occur on a large scale in winters.

**Effects of precipitation :** The main source of potable water available on the earth is precipitation. As excessive rainfall is destructive so is the absence of rain. Floods may occur because of heavy rainfall causing loss of life and property. If precipitation does not take place, then conditions of drought arise. There is a shortfall of food and food may have to be imported. Farmers' condition becomes grave. A country's economy gets affected.

Economy of an agrarian country like India is dependent on agriculture. Agriculture in India to a large extent is dependent on the Monsoons. Hence, the rainfall in India is important to the whole country. A good rainfall at the right time increases crop production while untimely rain can cause damage to the crops. The rainfall in India is quite erratic.

Visibility reduces because of highly dense fog. It affects the means of transportation like roads, railways, waterways and the airways. Accidents

may take place in such conditions. Trains, flights and other transport services may have to be cancelled. Frost is harmful to crops and causes accident if spread on the road. Fog and dew damage some crops by spreading diseases while it may be beneficial to some crops.

**Acid rain :** Because of air pollution in industrial areas, various gases get mixed in the air. Different acids are created when the water vapour in the air reacts chemically with these gases. Such as nitric acid, sulphuric acid, etc.

Precipitation of water with dissolved acids reach the ground. Such rainfall is called 'acid rain'. These rain are harmful to living organisms as well as the non-living objects



Obtain information regarding ill-effects of acid rain.

### Exercise

**Q1 Identify the precipitation type with the help of the description given:**

(a) It is the main source of the water that you use. Sometimes it is torrential and sometimes continuous. Most of the agriculture in India is dependent on it.

(b) It seems as if water droplets are floating in the atmosphere. In London, one cannot see the Sun till the afternoon during winters because of this phenomenon.

(c) It never precipitates like this in equatorial areas. Precipitation in the solid form sometimes causes damage to the crops.

(d) A white cotton like layer spreads on the earth's surface. Because of this form of precipitation, the State of Jammu and Kashmir has to change its capital in winters. In Maharashtra, it does not precipitate like this.

**Q2 Look at the following pictures and identify the correct rainfall type.**

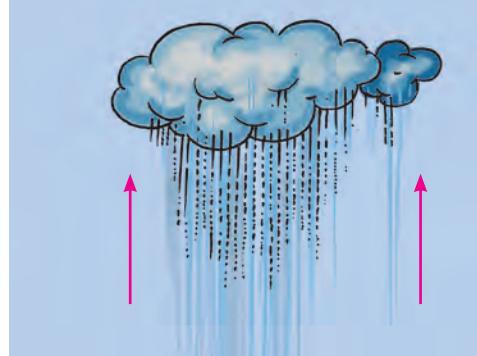


Figure (A)

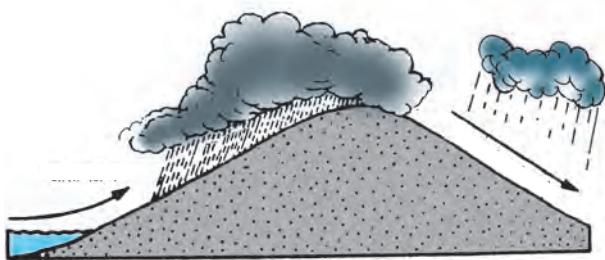


Figure (B)

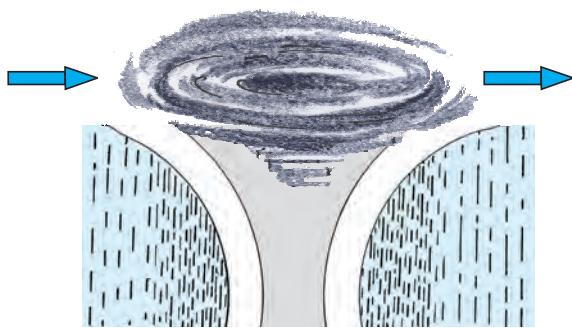


Figure (C)

Q 3. Look at the figures above and answer the following questions:

- (1) In fig B, on which side of the mountain is it raining more?
- (2) Shade the rain shadow region in fig B and name it.
- (3) What is the difference between A and C?
- (4) Stormy winds and floods are associated with which rainfall type?
- (5) What type of rainfall occurs in Singapore?

Q 4. Identify the odd man out :

- (1) Orographic rainfall, acid rain, cyclonic rainfall, convectional rainfall
- (2) Snowfall, rainfall, hailstones, dew
- (3) Thermometer, rain gauge, anemometer, measuring jar

Q 5. Answer in brief:

- (1) In what ways does precipitation occur on the earth?
- (2) Comment on the rainfall occurring in the rain shadow area.
- (3) Which type of rainfall occurs in most of the world? Why?
- (4) If condensation occurs closer to the earth's surface, what types of forms become visible?
- (5) What precautions should be taken while measuring rainfall?

Q 6. Distinguish between –

- (1) Dew and frost
- (2) Snow and hail

### Activity :

Using the rain gauge in your school, measure the rainfall continuously for one week occurring in your surroundings. Make a bar graph using computers to show the amount of rainfall on the basis of the data obtained.

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Photograph of wettest place on earth with rain gauge

