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WEATHER, CLIMATE AND ADAPTATION

WEATHER

- Weather plays an important role in our lives. In cold weather we protect ourselves by wearing woolen clothes while in hot weather we use certain cooling devices like fan, cooler or air conditioner to keep ourselves cool.
- We wear raincoats or use umbrellas to escape from the rain. We plan many of our day-to-day activities on the basis of prevailing weather conditions. We plan a picnic on a cool, pleasant and cheerful day and not on a hot and sultry day. We even plan a trip to a hill station or any other place after taking into account the weather conditions of that place.
- Weather is defined as the state or condition of the atmosphere of a particular place, at a particular time in terms of **humidity, cloudiness, temperature, windspeed**, etc.
- People who study and record weather are called **meteorologists**.
- The study of weather is called **meteorology**.
- **Rainfall** is measured by an instrument called the **rain gauge**. It is basically a measuring cylinder with a funnel on top to collect rain water.
- The **hygrometer** is used for humidity measurement. The amount of water **vapour** present in the air is called humidity.
- The maximum and minimum temperature are recorded every day by special **thermometers** called **maximum and minimum** thermometers.
- The **maximum temperature** of the day occurs generally in the afternoon while the **minimum temperature** occurs generally in the early morning.
- All kinds of changes in the weather are caused by the sun. There are variations in time of sunrise and sunset. Due to which days are longer in summer than winters. Sun is a huge sphere of hot gases having high temperature although distance of sun from earth is very large but energy sent by sun is the main source of all heat and light on the earth. Thus sun is the primary source of energy that causes changes in the weather. Earth surface, oceans & atmosphere absorb and reflect the solar energy, which play important roles in determining the weather at any place. Due to this property changes in weather occur near oceans, mountains and in desert etc.

Weather Forecasting

Weatherman to a certain extent can predict or estimate what the weather will be like in the near future.

This is called **weather forecasting**. It gives the following information :

- (i) Maximum and minimum temperature of the past 24 hours
- (ii) Humidity/ relative humidity
- (iii) Rainfall
- (iv) Time of sunrise and sunset
- (v) Time of moonrise and moonset
- (vi) Prediction of weather for the present day

CLIMATE

- The average weather pattern taken over a long time say 25 years is called as the **climate** of the place.
- It is the average weather conditions of a particular region of earth or area with regard to temperature, rain fall, air pressure, seasonal variations etc.
- Temperature, rainfall, solar radiations and air pressure determine the climate of an area. The variations in climates develop due to different duration, angle and intensity of solar radiations in different areas of the world, resulting in movement of winds and ocean currents.
- Climate determines the flora and fauna of a place. Local variations of a climate that occurs in an area of limited size is called **micro-climate**.
- If the temperature and rainfall at a place is high most of the time then the climate of that place is hot and wet.
- By taking information about climate of two places in India, we can compare climate of these regions. For eg. Jammu & Kashmir and Kerala. We find that Kerala is very hot & wet in comparison to Jammu and Kashmir.
- Similarly data of western region of India i.e. Rajasthan, shows that the temperature is very high during most of the year. Winter lasts for a few months and temperature is quite low. This region receives very little rainfall, thus this is a typical desert climate and it is hot and dry.
- The north-eastern part of India receives rain in most of the year. Thus, the climate is wet.

DIFFERENCE BETWEEN WEATHER AND CLIMATE

WEATHER	CLIMATE
Weather is the current condition or the state of atmosphere of a particular place in terms of humidity cloudiness, temperature wind etc.	Climate is a long term (usually 25 – 30 years) average weather conditions at a particular place.

GLOBAL WARMING AND GREEN HOUSE EFFECT

Many countries seem to be experiencing warmer conditions than normal. This is due to **global warming**. Gases like **carbondioxide** and **methane** trap the heat radiated by the earth and prevent it from escaping the earth's surface. The more carbon dioxide (CO₂) is present in the earth's atmosphere, the less heat can escape. This makes the earth and its atmosphere **hotter**. This increase in the earth's temperature is called **green house effect** which leads to global warming.

MAXIMUM AND MINIMUM TEMPERATURE

In the weather report of a day, maximum and minimum temperature represents the maximum and minimum level of mercury recorded by a **maximum-minimum thermometer**. When the rays of the sun fall on the earth's surface during the daytime, they heat up the surface. Generally the temperature is the maximum in the afternoon. When the heat escapes during night, the temperature falls. So, the minimum temperature is recorded generally in the morning.

HUMIDITY

When a certain amount of water is present in the air, it is said to be **saturated**. Therefore, **humidity** can be defined as the capacity of the air to hold water vapour in it at a particular temperature. The capacity of holding water vapour increases with rise in temperature.

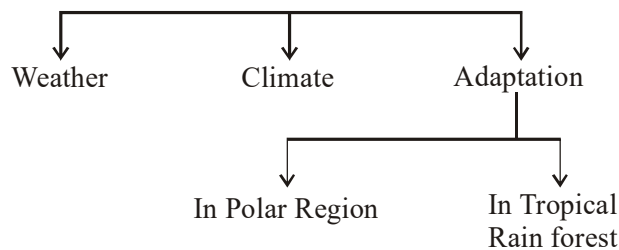
Humidity is sometimes recorded in terms of relative humidity in the weather reports. **Relative humidity** is a measure of the amount of water vapour present in the air at a specific temperature compared to the

maximum amount of water vapour air can hold at that temperature. It is expressed as a **percentage value**. Relative humidity depends on the temperature and keeps on changing throughout the day, so it is also represented as maximum and minimum relative humidity in the weather.

Relative humidity is measured by a **hygrometer**. A simple hygrometer, also called **psychrometer**, has two thermometers. The bulb of one of them is wet and the other is dry. Evaporation from the wet bulb lowers the temperature relatively. As a result, the wet bulb thermometer shows a lower temperature than than the dry bulb thermometer. The difference of the two reading is used to calculate relative humidity.

ADAPTATION

Adaptation are special characteristics developed by organisms to live comfortably and successfully under a prevailing set of environmental conditions. Adaptations may be morphological, physiological or behavioural or a combination of them. Adaptation develop through the process of natural selection. The ultimate aim of all adaptations is to make the individual fit to obtain food & space for its survival, opportunities for its reproduction & rearing of young ones.



ADAPTATION OF ANIMALS TO CLIMATE

Climate of an area greatly affect the flora, fauna and soil of the region. Animals are well adapted to their surrounding conditions, so that they can easily survive. Animals special features and habits helps them to adapt themselves to surroundings that result in evolution.

1. ANIMALS LIVING IN THE POLAR REGION :

Animals found in the polar region are polar bears, penguins, birds, fishes, reindeers, foxes, seals and whales.

Adaptations in a Polar Bear :

- The body has a white fur. This blends with the snowy white background. This adaptation protects the polar bear from predators. It also helps in catching the prey.
- The fur has two layers. The two thick layers of fur protect the polar bear from the extremely cold surroundings.
- In addition to fur, a thick layer of fat is present under the skin. This layer of fat also helps to keep the body warm (insulates the body from cold).
- It can close its nostrils. This feature helps the animal during swimming. By closing its nostrils, it can remain under water for long periods.
- It has a strong sense of smell that helps in locating the prey from a distance.
- Its paws are flat and broad which help it to walk on ice.
- It has long curved and sharp claws. This provides good grip and helps it to walk on ice.
- It has small ears that help it to retain as much heat as possible.

Adaptations in a Penguin :

Penguin is another well-known animal living in the polar region and shows the following adaptations:

- Its body is white coloured from the underside and merges well with the white background of snow.
- It has thick skin and a thick layer of fat under the skin. These features protect it from cold.

- The body is streamlined and the feet have webs. Both these features help in swimming. Penguins are good swimmers.
- Like polar bears, penguins also have very small ears which help the animal to retain as much heat as possible.

Adaptations in Birds

Birds are covered with feathers to protect their bodies from the cold. For survival, birds must remain warm. They migrate to warmer regions when winter sets in. They come back after the winter is over.

2. ANIMALS LIVING IN DESERTS

- It has a brown-coloured body which matches well with the surroundings.
- It has long eyelashes which protect the eyes during sand storms.
- It can close its nostrils to prevent sand from entering the nasal cavity.
- The hump of a camel stores fats and helps the animal to survive without food for several months.
- The animal can drink over 40 litres of water at a time and this water is stored for later use.
- It has thick lips which help it to eat prickly desert plants like cacti without hurting itself.
- It has well-padded wide feet which enable it to walk on hot sand.

3. ANIMALS LIVING IN TROPICAL

The climatic conditions in rainforests are highly suitable for supporting a rich variety of plants and animals. The animals include apes, gorillas, monkeys, lions, tigers, elephants, leopards, lizards, snakes, birds and insects.

Adaptations for food: As there is competition for food, some animals have developed adaptations to obtain food which is not easily available to all animals. For example, the bird **toucan** possesses a long, large beak. This helps the bird to reach the fruit on branches which are too weak to support the weight of the bird. The birds with small beaks are not able to reach the fruit on such branches.

Adaptations for shelter: As the living area is quite less in comparison to the large number of animals, many animals are adapted to living on trees. For example, the red-eyed frog has developed sticky pads on its feet. These pads help to climb trees on which it lives. Generally, monkeys have long tails for grasping branches.

Other Adaptations

Other adaptations include sensitive hearing, sharp eyesight, thick skin and a skin colour that matches or blends with the surroundings (**camouflage**). Camouflaging provides protection from predators. For example, big cats (lions and tigers) have sensitive hearing and thick skins. The beard ape (also called lion-tailed macaque) found in the rainforests of Western Ghats in India lives on trees. It has a silvery-white mane which surrounds the head from the cheeks down to its chin. As it lives on trees, it is a good climber. It feeds on fruit, seeds, young leaves, stems and flowers. It also looks for insects under the bark of trees. Since it is able to get sufficient food on the trees, it rarely comes down to the ground.

Elephant is commonly found in the Indian tropical rainforests. It has developed a number of adaptations to live in the rainforests.

- It has a big trunk which is used for two purposes-as a nose and for picking up food.
- Its tusk can tear the bark of trees and eat them. The elephant thus does not face problems as far as availability of food is concerned.
- It has large ears which can hear even very small sounds. The large ears also help the elephant to remain cool in the hot and humid climate of the rainforest.

CONCEPT APPLICATION LEVEL - I [NCERT Questions]

Q.1 When do you find maximum & minimum temperature?

Ans. The maximum temperature of the day generally occurs in the afternoon while the minimum temperature occurs generally in the early morning.

Q.2 Name the elements that determine the weather of a place.

Ans. The elements that determine the weather of a place are :

(i) temperature (ii) humidity (iii) rainfall, and (iv) wind-speed

Q.3 Which of the two changes frequently in weather or climate?

Ans. It is weather that changes frequently, because it is such a complex phenomenon that it can vary over very short period of time.

Q.4 The tropical rain forest has a large population of animals. Explain why it is so.

Ans. Because of continuous warmth and rain, tropical rainforest region supports a wide variety of plants and animals. The climate conditions in rainforests are highly supportive and suitable for an enormous number and variety of animals.

Q.5 Explain with example why we find animals of certain kind living in particular climatic conditions.

Ans. Animals are adapted to survive in the conditions in which they live. Features and habits that help animals to adapt to their surroundings are a result of the process of evolution. Since to survive in a particular type of climate all the animals must have certain adaptive features, therefore we find animals in the polar region are adapted to the extremely cold climate by having some special characteristics as in polar bear such as white fur, strong sense of smell, a layer of fat under the skin, wide and large paws for swimming and walking etc.

Q.6 How do elephant living in the tropical rainforest adapt itself.

Ans. The elephant is well adapted to living in rainforests. It uses its trunk as a nose because it has a strong sense of smell. Trunk is also used for picking up food. Adult elephant has modified teeth, called tusks. They use them to tear the bark of trees, which is their favourite food. They have large ears with a keen sense of hearing which also help them to lose heat from the body to keep cool.

Q.7 A carnivore with stripes on its body moves very fast while catching its prey. It is likely to be found in

(A) Polar regions (B) Deserts (C) Oceans (D) Tropical rainforests

Ans. (D)

Q.8 Which features adapt polar bears to live in extremely cold climate

(A) A white fur, fat below skin, keen sense of smell
(B) Thin skin, large eyes, a white fur
(C) A long tail, strong claws, white large paws
(D) White body, paws for swimming, gills for respiration.

Ans. (A)

Q.9 Which option best describes a tropical region.

(A) Hot and Humid (B) Moderate temperature, heavy rainfall
(C) Cold and humid (D) Hot and dry

Ans. (A)

CONCEPT APPLICATION LEVEL - II

Section–A

Q.1 What is climate?

Ans. The average weather pattern taken over a long time, say 25 years, is called the climate.

Q.2 How do we determine the weather pattern at a place?

Ans. Meteorologists record the weather every day. These records of the weather are preserved over the long time period. These preserved records help us to determine the weather pattern at a place.

Q.3 How do we find mean temperature for a given month?

Ans. The mean temperature for a given month is found in two ways. First, we find the average of the temperatures recorded during the month. Second, we calculate the average of such average temperature over many years that gives the mean temperature.

Q.4 Which factor makes climate to a particular place wet?

Ans. Rainfall is an important determining factor for climate. If rainfall is heavy on most of the days in the same given place, then climate of that place is called wet climate.

Q.5 Describe various adaptations in polar bear. How do these adaptations help them to survive in extreme cold climate?

Ans. Polar bears are adapted to cold climate in the following ways:

- (i) Polar bears have white fur so that they are not easily visible in the snowy white background. It protects them from their predators. It also helps them in catching the prey.
- (ii) To protect them from extreme cold, they have two thick layers of fur.
- (iii) They also have a layer of fat under their skin. In fact, they are so well insulated that they have to move slowly and rest often to avoid getting overheated.
- (iv) Physical activities on warm days necessitate cooling. So, the polar bear goes for swimming. It is a good swimmer. Its paws are wide and large, which help it not only to swim well but also walk with ease on snow. While swimming under water it can close its nostrils and can remain under water for long duration.
- (v) It has a strong sense of smell so that it can catch its prey for food.

Q.6 Why do the birds in cold climate migrate to warmer regions in winters?

Ans. Birds must remain warm to survive. They migrate to warmer regions when winter sets in. They come back after the winter is over. For example, the herds of Siberian crane come from Siberia to the places like Bharatpur in Rajasthan and Sultanpur in Haryana in India.

Q.7 Give the names of some countries where the tropical rainforests are found.

Ans. India, Malaysia, Indonesia, Brazil, Republic of Congo, Kenya, Uganda and Nigeria.

Q.8 Name the major types of animals living in the rainforests.

Ans. Monkeys, apes, gorillas, lions, tigers, elephants, leopards, lizards, snakes, birds and insects.

Q.9 How are the animals in tropical rainforests adapted? Explain giving some examples.

Ans. The climatic conditions in rainforests are highly suitable for supporting an enormous number and variety of animals. Since the number is large, there is intense competition for food and shelter.

Many animals are adapted to live on trees. **Red-eyed frog** has developed sticky pads on its feet which help it to climb trees on which it lives. To survive, flourish and live happily on trees, **monkeys** have long tails for grasping branches. Their hands and feet are such that they can easily hold on to branches.

As there is competition for food, some animals are adapted to get food which are at heights of the trees and not easily reachable. For example, **Toucan** bird possesses a long and large beak.

Many tropical animals have sensitive hearing, sharp eye sight, thick skin and different skin colours which helps them to camouflage by blending with the surroundings. This is to protect them from predators as well as help them to catch prey. For example, big cats (lions and tigers) have thick skins and sensitive hearing.

Q.10 Explain various adaptive features in lion-tailed macaque.

Ans. The lion-tailed macaque is found in the canopy layer of evergreen tropical rainforest. It is a good climber and lives on trees. It feeds on fruits, seeds, flowers, leaves and some insect. Lion-tailed macaque has a characteristic silver-white mane, which surrounds the head from the cheeks down to its chin.

Section-B

PREVIOUS YEAR'S NSO QUESTIONS

Q.1 The plants living in deserts need to reduce the loss of water because water is very scarce in deserts. Which of the following is an adaptation developed by the desert plants to manage the above situation?

[NSO-2010]

- (A) They have lots of branches and leaves.
- (B) They do not shed leaves in the summer.
- (C) They develop roots which come above the ground.
- (D) Their leaves are modified into spines.

Q.2 Match **column I** with **column II** and select the correct option from the codes given below:

Column I

- (a) Red eyed frog
- (b) New world monkey
- (c) Polar bear
- (d) Siberian cranes
- (A) a-(i), b-(ii), c-(iii), d-(iv)
- (C) a-(iv), b-(iii), c-(ii), d-(i)

Column II

- (i) Long and strong claws
- (ii) Migrate to warmer regions
- (iii) Sticky pads on its feet
- (iv) Long tail
- (B) a-(iii), b-(iv), c-(i), d-(ii)
- (D) a-(ii), b-(iii), c-(i), d-(iv)

[NSO-2010]

Q.3 Bactrian camels found in the Gobi desert of Mongolia have thick fur as compared to the camels found in the Thar desert of Rajasthan. Identify the reason for this from the following given options.

[NSO-2010]

- (A) Bactrian camels drink more water than camels of Thar desert.
- (B) Bactrian camels have developed thick fur to protect themselves from low temperature.
- (C) Bactrian camels have developed thick fur to protect themselves from high temperature.
- (D) Bactrian camels have thick fat in their hump.

Q.4 Read the given statements and select the correct option.

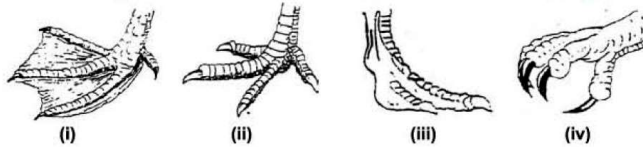
[NSO-2011]

Statement 1 : The bodies of birds are streamlined.

Statement 2 : Birds have hollow and light bones.

- (A) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
- (B) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
- (C) Statement 1 is true but statement 2 is false.
- (D) Both statements 1 and 2 are false.

Q.5 Which of the following types of feet are adapted to run on flat ground and to grip prey respectively? [NSO-2011]



- (A) (iii) & (iv) (B) (i) & (iii) (C) (ii) & (i) (D) (iv) & (ii)

Q.6 Rainwater harvesting is an important method for _____. [NSO-2011]

- (A) Treating sewage water (B) Recycling water from factories
(C) Raising ground water level (D) Industrial purposes.

Q.7 Which among the following is an odd one? [NSO-2012]

- (A) Desert : Stems store water
(B) Pond : Animals with streamlined bodies
(C) High altitude : Increase in RBC
(D) Rainforests : Camouflage to escape from enemies

Q.8 A fertile agricultural soil appears dark coloured down. The reason for dark colour of top soil is [NSO-2012]

- (A) More moisture at the surface as compared to soil one metre
(B) Rich inorganic matter and abundance of minerals
(C) Rich organic matter
(D) Recent soil formation

Q.9 Which of the following is not the correct example of structural adaptation in animals? [NSO-2012]

- (A) A desert fox losing excess heat through its large ear.
(B) A monkey using its strong, long limbs and tail for grasping branches.
(C) A polar bear balancing itself on its paws with stiff hair.
(D) Toucan has developed sticky pads on its feet to help it to reach the fruits on branches which are otherwise too weak to support its weight.

Q.10 Read the given statements and select the correct option.

Statement 1 : Climate is the current condition or the state of atmosphere of a particular place in terms of humidity, cloudiness, temperature, wind, etc.

Statement 2 : Weather refers to the long term (usually 25-30 years) average environmental conditions of a particular place. [NSO-2012]

- (A) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
(B) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
(C) Statement 1 is true and statement 2 is false.
(D) Both statements 1 and 2 are false.

Q.11 Which of the following is the probable method these migratory birds use to travel to the same place year after year? [NSO-2014]

- (A) They have built-in sense of direction and probably use land-marks to guide themselves.
(B) They are guided by the position of the sun during the day and by the position of stars at night.
(C) They use the magnetic field of earth to find the direction so as to reach the same place.
(D) All of these

CONCEPT APPLICATION LEVEL - III

SECTION - A

• **Fill in the blanks with suitable words.**

1. The average weather taken over a long time is called _____.
2. A place receives very little rainfall and the temperature is high throughout the year, the climate of that place will be _____ and _____.
3. The two regions of the earth with extreme climatic conditions are _____ and _____.

SECTION - B

• **Match the following (one to one)**

1. **Column I**

- (i) Temperature
- (ii) Rain gauge
- (iii) Hygrometer
- (iv) Weather report

Column II

- (a) Meteorological department
- (b) Humidity
- (c) Thermometer
- (d) Rainfall

SECTION - C

1. **Mark 'T' if the statement is true and 'F' if it is false:**

- (i) The weather reports are prepared by the various news papers.
- (ii) Rainfall in any area is measured by rain gauge.
- (iii) Humidity is amount of water vapours present in air.
- (iv) Hot & Wet climate is found in desert.
- (v) Over earth major source of light and heat is sun.

ANSWER KEY

CONCEPT APPLICATION LEVEL - II

SECTION - B

Q.1	D	Q.2	B	Q.3	B	Q.4	B	Q.5	A	Q.6	C	Q.7	C
Q.8	C	Q.9	D	Q.10	D	Q.11	D						

CONCEPT APPLICATION LEVEL - III

SECTION - A

1. climate 2. hot, humid 3. south pole, north pole

SECTION - B

1. (i)-c, (ii)-d, (iii)-b,

(iv)-a

SECTION - C

1. (i) F, (ii) T, (iii) T, (iv) T, (v) T