

Chapter 11

World Climate and Climate Change

Very Short Answer Type Questions

1. In how many categories can we classify type- A climate according to Koeppen?

Answer:

The tropical group i.e. group- A is divided into three types, namely

1. Af- Tropical wet climate;
2. Am – Tropical monsoon climate;
3. Aw- Tropical wet and dry climate.

2. In how many groups has Koeppen classified the climate?

Answer:

Koeppen has classified climate into five groups: four are based on temperature and one is based on humidity. The capital letters: A, C, D and E delineate humid climates and B dry climates.

3. In which areas is tropical climate found? What are its features?

Answer:

Tropical humid climates exist between Tropic of Cancer and Tropic of Capricorn. The sun being overhead throughout the year and the presence of Inter Tropical Convergence Zone (ITCZ) make the climate hot and humid. Annual range of temperature is very low and annual rainfall is high.

4. What is the astronomical theory of Millankovitch oscillations?

Answer:

It is an astronomical theory of Millankovitch oscillations, which infer cycles in the variations in the earth's orbital characteristics around the sun, the wobbling of the earth and the changes in the earth's axial tilt. All these alter the amount of

insolation received from the sun, which in turn, might have a bearing on the climate.

5.How does volcano affect the climate?

Answer:

Volcanic eruption throws up lots of aerosols into the atmosphere. These aerosols remain in the atmosphere for a considerable period of time reducing the sun's radiation reaching the Earth's surface. After the recent Pinatoba and El Cion volcanic eruptions, the average temperature of the earth fell to some extent for some years.

6.Explain about tundra climate.

Answer:

The tundra climate (ET) is so called after the types of vegetation, like low growing mosses, lichens and flowering plants. This is the region of permafrost where the sub soil is permanently frozen. The short growing season and water logging support only low growing plants. During summer, the tundra regions have very long duration of day light.

7.Explain about humid subtropical climate.

Answer:

Humid subtropical climate occurs poleward of Tropic of Cancer and Capricorn, mainly in North Indian plains and South China interior plains. The climate is similar to Aw climate except that the temperature in winter is warm.

8.What is Kyoto Protocol?

Answer:

International efforts have been initiated for reducing the emission of GHGs into the atmosphere. Kyoto protocol is the most important and was proclaimed in 1997. This protocol went into effect in 2005, ratified by 141 nations. Kyoto protocol bounds the 35 industrialised countries to reduce their emissions by the year 2012 to 5 per cent less than the levels prevalent in the year 1990.

9. In how many groups has warm temperate climates been divided?

Answer:

They are grouped into four types:

1. Humid subtropical, i.e. dry in winter and hot in summer (Cwa);
2. Mediterranean (Cs);
3. Humid subtropical, i.e. no dry season and mild winter (Cfa);
4. Marine west coast climate (Cfb).

Short Answer Type Questions

1. In which areas do we find tropical humid (Af) climate? What are its features?

Answer:

Tropical wet climate is found near the equator. The major areas are the Amazon Basin in South America, western equatorial Africa and the islands of East Indies.

Features:

- Significant amount of rainfall occurs in every month of the year as thunder showers in the afternoon.
- The temperature is uniformly high and the annual range of temperature is negligible.
- The maximum temperature on any day is around 30 C while the minimum temperature is around 20 C.
- Tropical evergreen forests with dense canopy cover and large biodiversity are found in this climate.

2. Explain about tropical wet and dry climate (Aw).

Answer:

Tropical Wet and Dry Climate (Aw): Tropical wet and dry climate occurs north and south of Af type climate regions. It borders with dry climate on the western

part of the continent and Cf or Cw on the eastern part. Extensive Aw climate is found to the north and south of the Amazon forest in Brazil and adjoining parts.

3.Explain about Mediterranean Climate

Answer:

Mediterranean climate occurs around Mediterranean sea, along the west coast of continents in subtropical latitudes between 30 – 40 latitudes. Central California, Central Chile, along the coast in south eastern and south western Australia are examples of this type of climate. These areas come under the influence of subtropical high in summer and westerly wind in winter.

Features:

- The climate is characterised by hot, dry summer and mild, rainy winter.
- Monthly average temperature in summer is around 25 C and in winter below 10 C.
- The annual precipitation ranges between 35 – 90 cm.

4.Explain about humid sub tropical climate (Cfa).

Answer:

Humid subtropical climate lies on the eastern parts of the continent in subtropical latitudes. In this region the air masses are generally unstable and cause rainfall throughout the year.

They occur in eastern United States of America, southern and eastern China, southern Japan, northeastern Argentina, coastal south Africa and eastern coast of Australia.

Features:

- The annual average of precipitation vary from 75-150 cm.
- Thunderstorms in summer and frontal precipitation in winter are common.
- Mean monthly temperature in summer is around 27 C, and in winter it varies from 5 -12 C.
- The daily range of temperature is small.

5. In which areas do we find Marine west coast climate? Explain about the features of this climate?

Answer:

Marine west coast climate (Cfb) is located poleward from the Mediterranean climate on the west coast of the continents. The main areas are: North western Europe, west coast of North America, north of California, southern Chile, Southeastern Australia and New Zealand.

Features:

- Due to marine influence, the temperature is moderate and in winter, it is warmer than for its latitude.
- The mean temperature in summer months ranges from 15 -20 C and in winter 4 -10 C.
- The annual and daily ranges of temperature are small.
- Precipitation occurs throughout the year. Precipitation varies greatly from 50-250cm.
- 2. Answer the following questions in about 30 words.

6. Which two climatic variables are used by Koeppen for classification of the climate?

Answer: It is an empirical classification based on the variables mean annual and mean monthly temperature and precipitation data. He introduced the use of capital and small letters to designate climatic groups and types. Although developed in 1918 and modified over a period of time, Koeppen's scheme is still popular and in use. Koeppen recognised five major climatic groups, four of them are based on temperature and one on precipitation. Koeppen identified a close relationship between the distribution of vegetation and climate. He selected certain values of temperature and precipitation and related them to the distribution of vegetation and used these values for classifying the climates.

7.How is the “genetic” system of classification different from the “empirical one”?

Answer:

Empirical classification is based on observed data, particularly on temperature and precipitation while genetic classification attempts to organise climates according to their causes.

8.Which types of climates have very low range of temperature?

Answer:

Tropical wet climate has very low range of temperature. It is found near the equator. The major areas are the Amazon Basin in South America, western equatorial Africa and the islands of East Indies. Significant amount of rainfall occurs in every month of the year as thunder showers in the afternoon. The temperature is uniformly high and the annual range of temperature is negligible. The maximum temperature on any day is around 30°C while the minimum temperature is around 20°C.

Tropical evergreen forests with dense canopy cover and large biodiversity are found in this climate.

9.What type of climatic conditions would prevail if the sun spots increase?

Answer:

Sunspots are dark and cooler patches on the sun which increase and decrease in a cyclical manner. According to some meteorologists, when the number of sunspots increase, cooler and wetter weather and greater storminess occur. A decrease in sunspot numbers is associated with warm and drier conditions.

Long Answer Type Questions

1.Explain the major climate categories by Koeppen.

Answer:

The first level recognises six major climatic types with each group being designated by a capital letter. These major climate categories have the following broad characteristics:

- Tropical moist climates: These are very warm climates found in the tropics that experience high quantities of precipitation. The primary distinguishing characteristic of these climates is that all months have average temperatures above 18 C (64 F).
- Dry climates: These are climates that experience little precipitation during most of the year. Further, potential losses of water from evaporation and transpiration greatly exceed atmospheric input.
- Moist mid-latitude climates with mild winters: In these climates, summer temperatures are warm to hot and winters are mild. The primary distinguishing characteristic of these climates is that the coldest month has an average temperature between 18 C (64 F) and -3 C (27 F).
- Moist mid-latitude climates with cold winters: In these climates, summer temperatures are warm and winters are cold. The primary distinguishing characteristic of these climates is the average temperature of warmest month exceeds 10 C (50 F), and average temperature of coldest is below -3 C (27 F).
- Polar climates: These climates have very cold winters and summers, with no real summer season. The primary distinguishing characteristic of these climates is the warmest month has an average temperature below 10 C (50 F).
- Highland climates: These are climates that are strongly influenced by the effects of altitude. As a result, the climate of such locations is rather different from places with low elevations at similar latitudes.

2.Explain the climatic changes that has taken place since ancient times. Also explain its causes.

Answer:

The type of climate we experience now might be prevailing over the last 10,000 years with minor and occasionally wide fluctuations. The planet earth has

witnessed many variations in climate since the beginning. Geological records show alteration of glacial and inter-glacial periods. The sediment deposits in glacial lakes also reveal the occurrence of warm and cold periods. The rings in the trees provide clues about wet and dry periods. Historical records describe the diversities in climate. All these evidences indicate that change in climate is a natural and continuous process. Archaeological findings show that the Rajasthan desert experienced wet and cool climate around 8,000 B.C. During the Pleistocene epoch, glacial and inter-glacial periods occurred, the last major peak glacial period was about 18,000 years ago. The present inter-glacial period started 10,000 years ago. Variability in climate occurs all the time. The nineties decade of the last century witnessed extreme weather events. The 1990s recorded the warmest temperature of the century and some of the worst floods around the world. Europe witnessed “Little Ice Age” from 1550 to about 1850. From about 1885–1940 world temperature showed an upward trend. After 1940, the rate of increase in temperature slowed down.

Causes of Climate Change: The causes for climate change can be grouped into astronomical and terrestrial causes.

1. **The astronomical causes:** These are the changes in solar output associated with sunspot activities. Sunspots are dark and cooler patches on the sun which increase and decrease in a cyclical manner. According to some meteorologists, when the number of sunspots increase, cooler and wetter weather and greater storminess occur. A decrease in sunspot numbers is associated with warm and drier conditions.

2. **Volcanism:** It is considered as another cause for climate change. Volcanic eruption throws up lots of aerosols into the atmosphere. These aerosols remain in the atmosphere for a considerable period of time reducing the sun’s radiation reaching the Earth’s surface. After the recent Pinatoba and El Cion volcanic eruptions, the average temperature of the earth fell to some extent for some years.

3. **Greenhouse gases:** The most important anthropogenic effect on the climate is the increasing trend in the concentration of greenhouse gases in the atmosphere which is likely to cause global warming.

3.Explain about Polar climate (E).

Answer:

Polar Climates (E) exist poleward beyond 70 latitude. Polar climates consist of two types:

1. Tundra (ET);
2. Ice Cap (EF).

1. Tundra Climate (ET): The tundra climate (ET) is so called after the types of vegetation, like low growing mosses, lichens and flowering plants. This is the region of permafrost where the sub soil is permanently frozen. The short growing season and water logging support only low growing plants. During summer, the tundra regions have very long duration of day light.

2. Ice Cap Climate (EF): The ice cap climate (EF) occurs over interior Greenland and Antarctica. Even in summer, the temperature is below freezing point. This area receives very little precipitation. The snow and ice get accumulated and the mounting pressure causes the deformation of the ice sheets and they break. They move as icebergs that float in the Arctic and Antarctic waters. Plateau Station, Antarctica ,79 S, portray this climate.

4.Explain about Cold snow forest climates (D).

Answer:

Cold Snow Forest Climates (D) occur in the large continental area in the northern hemisphere between 40 -70 north latitudes in Europe, Asia and North America. Cold snow forest climates are divided into two types:

1. Df- cold climate with humid winter;
2. Dw- cold climate with dry winter.

The severity of winter is more pronounced in higher latitudes.

1. Cold climate with humid winters (Df): Cold climate with humid winter occurs poleward of marine west coast climate and mid latitude steppe. The winters are cold and snowy. The frost free season is short. The annual ranges of temperature

are large. The weather changes are abrupt and short. Poleward, the winters are more severe.

2.Cold climate with dry winters (Dw): Cold climate with dry winter occurs mainly over Northeastern Asia. The development of pronounced winter anti cyclone and its weakening in summer sets in monsoon like reversal of wind in this region. Poleward summer temperatures are lower and winter temperatures are extremely low with many locations experiencing below freezing point temperatures for up to seven months in a year. Precipitation occurs in summer. The annual precipitation is low from 12-15 cm.

5.Write a detailed note on Tropical monsoon climate (Am).

Answer:

Tropical monsoon climate, occasionally also known as a tropical wet climate or tropical monsoon and trade-wind littoral climate in climate classification, is a relatively rare type of climate that corresponds to the Koppen climate classification category “Am”.

Tropical monsoon climates have monthly mean temperatures above 18 C in every month of the year and feature wet and dry seasons, as Tropical savanna climates do. Unlike tropical savanna climates however, a tropical monsoon climate's driest month sees less than 60 mm of precipitation but more than $(100 \text{ [total annual precipitation [mm]}/25])$. Also, a tropical monsoon climate tends to see less variance in temperatures during the course of the year than a tropical savanna climate. This climate has a driest month which nearly always occurs at or soon after the “winter” solstice for that side of the equator. Tropical monsoon climates are most commonly found in South and Central America. However, there are sections of South Asia, Southeast Asia, Africa (particularly West and Central Africa), the Caribbean, and North America that also features this climate.

6: Give the letter codes used by Koeppen for following types of climates.

- 1. Tropical Wet**
- 2. Sub tropical steppe**
- 3. Humid Subtropical**
- 4. Humid Continental**
- 5. Polar Ice cap**
- 6. Mid Latitude desert**
- 7. Subarctic**
- 8. Highlands with snow cover**

Answer:

1. Af
2. BSh
3. Cfa
4. Df
5. EF
6. BWk
7. Dw
8. H.

7: Which letter code did Koeppen use for following temperature ranges?

- 1. Average temperature of the coldest month is 18° or higher.**
- 2. Average temperature for all months is below 10° C.**
- 3. Average temperature of the coldest month is -3° or lower.**
- 4. Average temperature of the coldest month is higher than -3° but less than 18°.**

Answer:

1. A – Tropical climates
2. E – Cold Climates
3. D – Cold Snow Forest Climates

4. C – Warm Climates.

8.Explain about that region where there is no permanent settlements for human beings.

Ans:

Polar Climates (E) exist poleward beyond 70° latitude. There are no permanent human settlements. Only some scientists live there temporarily for their research and tasks related to manmade satellites.

Polar climates consist of two types:

1. Tundra (ET);
2. Ice Cap (EF).

1. Tundra Climate (ET): The tundra climate (ET) is so called after the types of vegetation, like low growing mosses, lichens and flowering plants. This is the region of permafrost where the sub soil is permanently frozen. The short growing season and water logging support only low growing plants. During summer, the tundra regions have very long duration of day light.

2. Ice Cap Climate (EF): The ice cap climate (EF) occurs over interior Greenland and Antarctica. Even in summer, the temperature is below freezing point. This area receives very little precipitation. The snow and ice get accumulated and the mounting pressure causes the deformation of the ice sheets and they break. They move as icebergs that float in the Arctic and Antarctic waters. Plateau Station, Antarctica, 79°S, portray this climate.

Multiple choice questions.

1.What kind of climate is expressed by the letter code- BSh?

- (a) Tropical Dry
- (b) Tropical Monsoon
- (c) Subtropical Dry Steppe
- (d) Mid Latitude Climate

Answer:

- (c) Subtropical Dry Steppe

2.What kind of climate is expressed by the letter code- ET?

- (a) Humid subtropical
- (b) Mediterranean
- (c) Marine west coast
- (d) Tundra

Answer:

- (d) Tundra

3.According to Koeppen, what is the average temperature of dry tropical climate?

- (a) More than 20°C
- (b) More than 18°C
- (c) More than 40°C
- (d) More than 10°C

Answer:

- (b) More than 18°C

4.Which of the following area come under tropical wet climate?

- (a) Amazon Basin in South America
- (b) Western equatorial Africa
- (c) Islands of East Indies.
- (d) All of the above

Answer:

- (d) All of the above

5. During the 1930s, severe drought occurred in southwestern Great Plains of the United States. What is it called?

- (a) Famine area
- (b) Barren area
- (c) Dust bowl
- (d) Dust flower

Answer:

- (c) Dust bowl

6. Which protocol was held for reducing the emission of GHGs into the atmosphere in 1997?

- (a) Reid Jenero Earth Summit
- (b) Johnsonburg meet
- (c) Kyoto Protocol
- (d) Copenhagen Meet

Answer:

- (c) Kyoto Protocol

7. In 8000 BC how was the climate of Rajasthan?

- (a) Humid and cold
- (b) Dry and warm
- (c) Dry and cold
- (d) Humid and warm

Answer:

- (a) Humid and cold

8. In the geological past, how was the earth's climate about 500-300 million years ago, through the Cambrian, Ordovician and Silurian periods?

- (a) Humid
- (b) Warm
- (c) Cold
- (d) Dry

Answer:

- (b) Warm

9. Which of the following is not a greenhouse gas?

- (a) Carbon dioxide
- (b) Chlorofluorocarbons
- (c) Methane
- (d) Oxygen

Answer:

- (d) Oxygen

10. What absorbs ultra-violet rays in stratosphere?

- (a) Ozone
- (b) Ions
- (c) Methane
- (d) Nitrogen

Answer:

- (a) Ozone

11. Europe witnessed what kind of experiences from 1550 to about 1850?

- (a) Excess summer season
- (b) Little Ice age
- (c) Long dry age
- (d) Long humid age

Answer:

- (b) Little ice age

12. What is thrown in atmosphere by volcanic eruptions?

- (a) Aerosols
- (b) Solid waste
- (c) Alcohol
- (d) Carbonmonoxide

Answer:

- (a) Aerosols

13. Which type of climate exist in Plateau Station , Antarctica ,79°S according to Koeppen?

- (a) Tundra climate
- (b) Ice cap climate
- (c) Taiga climate
- (d) Cold climate with roots

Answer:

- (b) Ice cap climate

14. At which place the highest shade temperature of 58° C was recorded in Libya on 13 September 1922?

- (a) Tripoli
- (b) Al Aziziyah
- (c) Taiwan
- (d) Tikari.

Answer:

- (b) Al Aziziyah

15. Which one of the following is suitable for Koeppen's "A" type of climate?

- (a) High rainfall in all the months
- (b) Mean monthly temperature of the coldest month more than freezing point
- (c) Mean monthly temperature of all the months more than 18°C
- (d) Average temperature for all the months below 10° C.

Answer:

- (a) High rainfall in all the months

16. Koeppen's system of classification of climates can be termed as:

- (a) Applied
- (b) Systematic
- (c) Genetic
- (d) Empirical.

Answer:

- (d) Empirical

17.The most important anthropogenic effect on the climate is the increasing trend in the concentration of greenhouse gases in the atmosphere. What can happen because of it?

- (a) Global warming
- (b) Air pollution
- (c) Water pollution
- (d) Land degradation

Answer:

- (a) Global warming

18.Most of the Indian Peninsula will be grouped according to Koeppen's system under:

- (a) "Af"
- (b) "BSh"
- (c) "Cfb"
- (d) "Am"

Answer:

- (d) "Am"

19.Which one of the following years is supposed to have recorded the warmest temperature the world over?

- (a) 1990
- (b) 1998
- (c) 1885
- (d) 1950.

Answer:

- (b) 1998

20. Which one of the following groups of four climates represents humid conditions?

- (a) A—B—C—E
- (b) A—C—D—E
- (c) B—C—D—E
- (d) A—C—D—F

Answer:

- (b) A—C—D—E