1. What is the difference between weather and climate?

Answer: Weather refers to short-term atmospheric conditions (e.g., temperature, rain) at a place, while climate is the average weather condition over a long period (35–40 years) across a larger area.

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2. Name the primary elements of weather.

Answer: Temperature, pressure, wind, humidity, and precipitation.

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3. What is insolation?

Answer: Insolation is the solar energy reaching Earth's surface in the form of short waves.

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4. Define nuclear fusion and its role in weather.

Answer: Nuclear fusion is the process where atomic nuclei combine to form a larger nucleus, releasing energy. In the sun, it generates energy that drives Earth's weather through insolation.

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5. What is the greenhouse effect?

Answer: The greenhouse effect is the absorption of terrestrial radiation by atmospheric gases (e.g., carbon dioxide), which heats the atmosphere, maintaining Earth's temperature.

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6. How is the heat budget of Earth maintained?

Answer: The heat budget is maintained by balancing incoming insolation with outgoing terrestrial radiation, preventing extreme heating or cooling of Earth's surface.

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7. Why is the maximum temperature recorded at 2 PM?

Answer: The atmosphere takes longer to heat than Earth's surface, so the peak temperature occurs at 2 PM due to delayed heat transfer from insolation.

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8. What is a maximum-minimum thermometer?

Answer: A maximum-minimum thermometer is an instrument that records the highest and lowest temperatures of a day using two thermometers connected by a U-shaped glass tube.

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9. Calculate the diurnal range of temperature if the maximum and minimum temperatures are 40°C and 25°C.

Answer: Diurnal Range = Maximum temperature - Minimum temperature = 40°C - 25°C = 15°C.

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10. What are isotherms, and what do they indicate?

Answer: Isotherms are imaginary lines on a map connecting places with equal temperatures, indicating temperature distribution patterns.

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11. Why do coastal areas like Kerala have a low diurnal range of temperature?

Answer: Coastal areas have a low diurnal range due to the moderating influence of the sea, which heats and cools more slowly than land.

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12. How does altitude affect temperature?

Answer: Temperature decreases with increasing altitude because air density and insolation absorption decrease at higher elevations.

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13. What is the Coriolis force, and how does it affect winds?

Answer: The Coriolis force, caused by Earth's rotation, deflects winds to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

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14. Name the instrument used to measure wind speed.

Answer: Anemometer.

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15. What are trade winds, and where do they blow?

Answer: Trade winds are permanent winds blowing from subtropical high-pressure belts to the equatorial low-pressure belt, as northeast winds in the Northern Hemisphere and southeast winds in the Southern Hemisphere.

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16. Why are westerlies stronger in the Southern Hemisphere?

Answer: Westerlies are stronger in the Southern Hemisphere due to less landmass and fewer frictional obstacles compared to the Northern Hemisphere.

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17. What are monsoon winds, and how do they form in India?

Answer: Monsoon winds are periodic winds that reverse direction seasonally. In India, southwest monsoon winds form in summer due to low pressure over heated land, bringing rain, while northeast monsoon winds blow in winter from high-pressure land to the ocean, being mostly dry.

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18. Name two local winds and their regions.

Answer:

- Loo: North Indian Plains (hot, dry wind).
- Chinook: Rocky Mountains, North America (dry, warm wind).

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19. Differentiate between tropical and temperate cyclones.

Answer: Tropical cyclones are smaller, more destructive, and form over tropical oceans, dissipating over land. Temperate cyclones are larger, less destructive, form at fronts in temperate regions, and can move over land.

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20. What is relative humidity, and how is it calculated?

Answer: Relative humidity is the ratio of actual water vapor in the atmosphere to its total water-holding capacity at a given temperature, expressed as a percentage. Formula: Relative Humidity = (Absolute Humidity / Total Water-Holding Capacity) × 100.

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21. What is the saturation point, and what happens at this stage?

Answer: The saturation point is the temperature at which the atmosphere is fully saturated with water vapor (relative humidity = 100%), leading to condensation and formation of droplets.

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22. Name the instrument used to measure atmospheric humidity.

Answer: Hygrometer.

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23. What are cirrus clouds, and where are they found?

Answer: Cirrus clouds are thin, feather-like clouds formed at high altitudes, typically composed of ice crystals.

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24. Why is nimbus cloud dark in color?

Answer: Nimbus clouds are dark due to the thick concentration of water droplets, which block light penetration.

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25. What is orographic rainfall, and why does it cause rain shadow regions?

Answer: Orographic rainfall occurs when moisture-laden winds rise over mountains, cool, and condense to form rain on windward slopes. The leeward side receives dry air, creating rain shadow regions (e.g., Tamil Nadu during southwest monsoon).

Application-Level Questions

26. If the maximum temperature in a city is 35°C and the minimum is 20°C, calculate the daily mean temperature.

Answer: Daily Mean Temperature = (Maximum temperature + Minimum temperature) / 2 = (35°C + 20°C) / 2 = 27.5°C.

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27. Why do hill stations like Munnar experience lower temperatures than coastal areas like Kochi?

Answer: Munnar, at a higher altitude, experiences lower temperatures because air density and insolation absorption decrease with height, unlike Kochi, which is at sea level with moderated temperatures due to maritime influence.

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28. Predict the wind direction in Kerala during the southwest monsoon and explain why.

Answer: During the southwest monsoon, winds blow from the southwest in Kerala. This occurs due to low pressure over the heated Indian subcontinent, drawing moisture-laden winds from the Indian Ocean, deflected by the Coriolis force.

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29. If a place has a high pressure gradient, what can you infer about the wind speed, and why?

Answer: A high pressure gradient indicates a significant change in pressure over a short distance, leading to strong winds because air moves faster from high to low pressure areas to equalize pressure.

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30. Why do Western European countries experience milder winters compared to northeastern Canada at similar latitudes?

Answer: Western Europe benefits from the warm North Atlantic Current, which raises coastal temperatures, while northeastern Canada is cooled by the cold Labrador Current, causing severe winters.

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31. If you observe cumulus clouds in the sky at noon, what weather can you expect in the afternoon?

Answer: Cumulus clouds at noon, formed by convection, may develop into cumulonimbus clouds, leading to convectional rainfall (4 O'Clock rains) in the afternoon.

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32. Explain why the equatorial region is called the Doldrums.

Answer: The equatorial region, with high temperatures and rising air, forms a low-pressure belt with minimal horizontal winds, earning the name Doldrums due to its windless nature.

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33. If a place records 12 cm of rainfall in one hour, what type of event is this, and what are its potential impacts?

Answer: This is a cloud burst (rainfall >10 cm/hour), common in mountainous regions, which can cause flash floods and landslides, as seen in Kavalappara, Kerala (2019).

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34. Why do you feel ear discomfort while traveling to a hill station?

Answer: Ear discomfort occurs due to a rapid decrease in atmospheric pressure with increasing altitude, causing a pressure imbalance between the inner ear and the external environment.

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35. If you see isobars closely spaced on a weather map, what does this indicate, and how will it affect the weather?

Answer: Closely spaced isobars indicate a high pressure gradient, leading to strong winds and potentially stormy weather due to rapid air movement from high to low pressure areas.