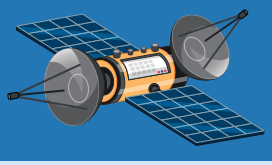
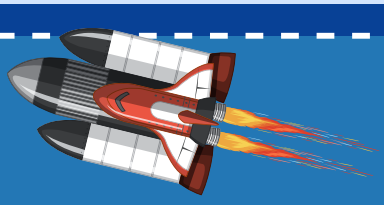
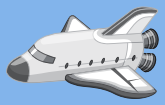
Geography Year 1

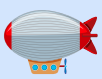
SECTION 8

STRUCTURE AND COMPOSITION OF THE ATMOSPHERE









THE EARTH AND ITS NEIGHBOURHOOD

The Earth's Atmosphere

Introduction

This section explores the atmosphere, covering its structure, composition, and importance. It discusses weather and climate, highlighting the roles of atmospheric gases in sustaining life. The section explains the difference between short-term weather and long-term climate patterns, and examines elements like temperature, humidity, air pressure, wind patterns, and rainfall. Understanding these topics helps us appreciate the atmosphere's contributions to human survival.

The section also explores the instruments used to record the elements of weather and calculate annual averages for rainfall and temperatures.

At the end of this section, you will be able to:

- Discuss the Physical Structure and Composition of the Earth's Atmosphere.
- Explain the differences between weather and climate and the factors that affect them.
- Calculate the annual and mean rainfall and temperature data of a station with appropriate instruments for measuring the various elements of weather.

Key Ideas

- The atmosphere is a mixture of gases surrounding the Earth.
- Some of the gases found in the atmosphere are oxygen, nitrogen, ozone, and water vapour.
- Based on temperature and nature of the gases, the atmosphere consists of layers, namely troposphere, stratosphere mesosphere and thermosphere.
- The atmosphere plays an important part in supporting life and protecting it from harmful radiation from the Sun.
- Weather is the condition experienced at specific place and time in terms of temperature, humidity, cloud cover, wind, and precipitation. It can vary greatly from day to day and even hour to hour, influencing our daily activities and plans.
- Climate is the long-term pattern of temperatures, humidity, wind, and precipitation over a region. Unlike weather which changes from day to day, it does not vary and uses the averages of data collected over an extended period, often more than 30 years.
- It is important to recognise the difference between the weather and climate for any place on the surface of the Earth.
- The factors that affect weather and climate include amount of solar radiation received at any latitude, altitude, rotation of the Earth, and aspect.

STRUCTURE, COMPOSITION AND IMPORTANCE OF THE ATMOSPHERE

The Atmosphere

The Earth's atmosphere is a thin layer of air made up of gases like oxygen, nitrogen, carbon dioxide, dust particles, and water vapor. Gravity holds these gases to the Earth. The atmosphere is crucial for life, providing warmth, oxygen, and weather conditions like rain and wind. It also protects us from the Sun's harmful rays. Without the atmosphere, life on Earth would not be possible.

Structure of the Atmosphere

The atmosphere is made up of different layers as you move up from the Earth's surface. Starting at the surface, the layers are the Troposphere, Stratosphere, Mesosphere, and Thermosphere. Above the Thermosphere, around 500 km up, is the Exosphere. Each layer has different constituents, conditions, and temperatures even though there are no visible boundaries.

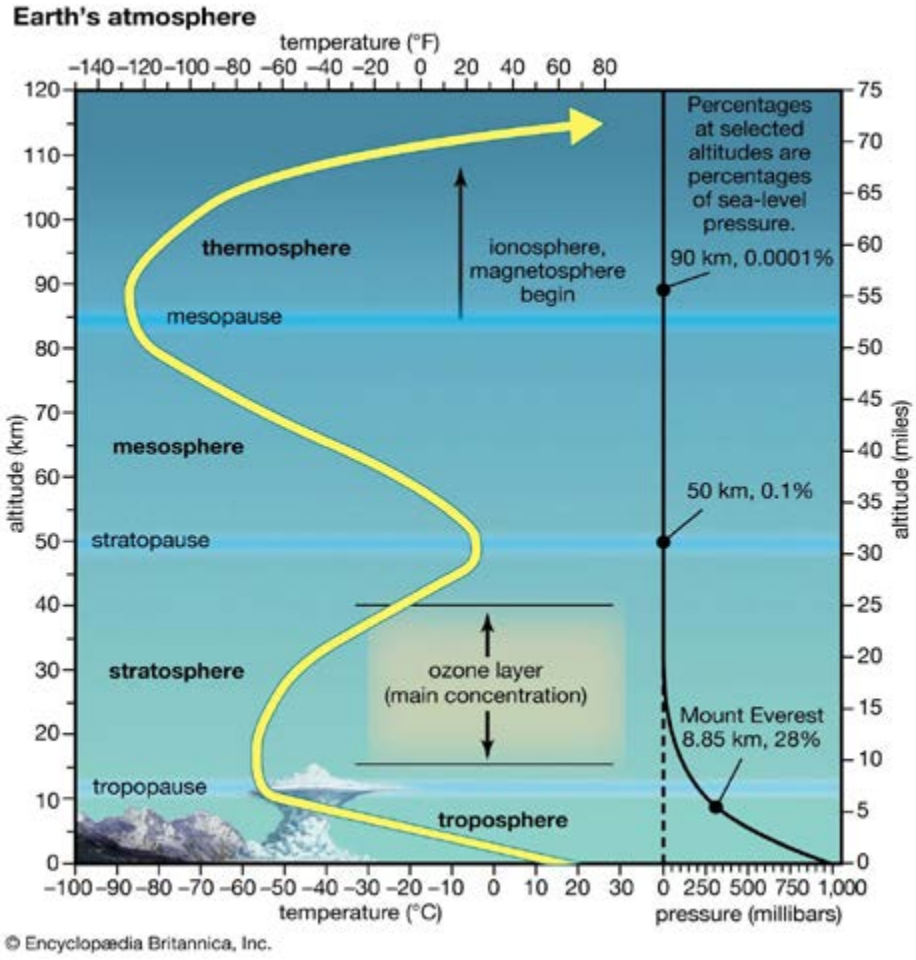


Fig. 8.1: Structure of the Atmosphere, shown in different layers.

Characteristics of each layer of the atmosphere

The Troposphere:

1. The troposphere extends 12-17 km high, containing all the tallest buildings, trees, and mountains.
2. It holds most gases like oxygen, nitrogen, water vapor, and dust, leading to weather activities such as rain, clouds, thunderstorms, wind, and fog.
3. The troposphere supports life due to its gas content.
4. Weather is confined to this layer.
5. Temperature decreases with altitude, explaining cooler conditions in higher areas like Kwahu and Amedzofe in Ghana.
6. Temperature drops by about 6.5°C for every 1000m increase in altitude, known as the Environmental Lapse Rate.
7. The troposphere is the densest layer, with convectional currents causing convectional rainfall.
8. The tropopause is the boundary between the troposphere and stratosphere.

The Stratosphere:

1. The stratosphere extends from the tropopause up to 50 km.
2. It contains ozone, which absorbs ultraviolet (UV) radiation from the Sun, protecting the Earth's surface.
3. In the lower stratosphere, temperature remains constant around -60°C.
4. In the upper stratosphere, temperature increases with height due to ozone absorbing UV rays.
5. The stratosphere is stable, free of clouds, but has high-speed jet streams.
6. Its stability makes it ideal for aircraft, avoiding weather disturbances.
7. The stratopause separates the stratosphere from the mesosphere above.

The Mesosphere:

1. The mesosphere extends up to 85 km from the Earth's surface, spanning about 30 km.
2. Temperature decreases with height, dropping to about -90°C, making it the coldest part of the atmosphere.
3. Noctilucent (shining at night) clouds, made of ice crystals, occur here and are visible during twilight in polar regions.
4. Meteors burn up in this layer, creating shooting stars.
5. The mesopause marks the boundary between the mesosphere and the thermosphere.

The Thermosphere:

1. The thermosphere lies above the mesosphere, extending up to 400 km.
2. It has an extremely low density of gas particles, resulting in high temperatures that may not feel hot due to the low density.

3. Temperatures can rise to about 2000°C during the day and drop significantly at night.
4. The lower thermosphere or ionosphere, contains electrically charged particles that interact with Earth's magnetic field, enabling radio broadcasting.
5. Charged particles in the thermosphere reflect radio, TV, satellite, and communication signals.
6. The thermopause marks the upper limit of the thermosphere.

The Exosphere:

1. The exosphere is the top layer of the atmosphere and is around 10,000km thick, extending halfway to the moon.
2. The density is so low here that any molecules that do exist rarely collide.
3. At the top of the exosphere is the vacuum of outer space.

Altitude and Temperature Calculation

One of the characteristics of the lowest layer of the atmosphere, the troposphere, is that there a reduction in temperature as height increases. This is called the Normal or Environmental Lapse Rate or ELR. It can be used to calculate temperatures at a given altitude.

How to calculate the temperature at a given altitude if you know the altitude and temperature at the base.

Step 1: Take the altitude of the base.

Step 2: Take the temperature at the base.

Step 3: Use the normal or environmental lapse rate to calculate the temperature difference due to the change in altitude. (6.5°C for every 1000m or 1km ascent)

Step 4: Given the altitude at the top subtract the base from this to find the height of the mountain in metres and divide this height by 1000 then multiply by 6.5 to find the temperature difference. The temperature at the top can be calculated by **subtracting** this difference from the base temperature.

Have a look at this worked example to make sure you understand.

Worked Example 1

Calculate the temperature at the top of a mountain 5000 metres high when the temperature at the base of the mountain is 29°C.

Fact 1 = Altitude or height of the mountain = 5000m
Fact 2 = The temperature at the base of the mountain = 29°C
Fact 3 = ELR = 6.5°C per 1000 metres

Thus, the difference in temperature between the base and top of the mountain

$\frac{5000}{1000} = 5$

$5 \times 6.5 = 32.5°C$

To get the temperature at the top of the mountain, you must subtract 32.5°C from 29°C. To remember this always remind yourself that the temperature at the top of a mountain is going to be colder than at the bottom.

Thus, temperature at the height of 5000m = 29°C –32.5°C = –3.5°C

So, the temperature at the top of the mountain is –3.5°C

Worked Example 2

The temperature at the base of Mt. Afadja is 30°C. If the height of the mountain is 1500m, what will be the temperature at the top?

Fact 1 = Altitude or height of the mountain = 1500m

Fact 2 = The temperature at the base of the mountain = 30°C

Fact 3 = ELR = 6.5°C per 1000 metres

Thus, the difference in temperature between the base and top of the mountain is found by;

$\frac{1500}{1000} = 1.5$

Multiply 1.5 by 6.5°C that is,

$1.5 \times 6.5 = 9.75°C$

To get the temperature at the top of the mountain subtract 9.75°C from 30°C

Thus, temperature at the height of 1.500m = 30°C – 9.75°C = 20.25°C

So, the temperature at the top of Mt. Afadja will be 20.25°C

How to calculate the temperature at lower altitude or base of mountains

Step 1: Determine the altitude difference between the base and the peak of the mountain.

Step 2: Use the normal or environmental lapse rate to calculate the temperature difference due to the change in altitude. (Thus, 6.5°C for every 1000m descent)

Step 3: Add the temperature difference to the temperature at the peak since temperature increases with decreasing altitude.

Worked Example 1

What is the temperature at sea level when the temperature at the summit, at 8000m, is -27.5°C?

Altitude or height of the mountain = 8000 metres

To calculate the difference in temperature if the ELR per 1000m = 6.5°C

8000 divided by 1000 = 8 (this means the temperature falls by 6.5°C eight times over the ascent)

Multiply 8 by 6.5°C

$8 \times 6.5°C = 52°C$ (this is the temperature difference between sea level and summit)

Add 52°C to the temperature at the summit of the mountain (because temperatures increase as altitude decreases).

Therefore 52°C + -27.5°C = 24.5°C

Therefore, the temperature at the base of the mountain will be = 24.5°C

Worked Example 2

The temperature at the summit of a mountain which is 4500m high is 15°C. what is the temperature at sea level, the base of the mountain?

The altitude height of the mountain is 4,500m.

The temperature at the summit is 15°C.

To calculate the difference in temperature if ELR per 1000m = 6.5°C

4,500 divided by 1000 = 4.5

Multiply 4.5 by 6.5°C. thus, $4.5 \times 6.5°C = 29.25°C$

To get the temperature at the base, add 29.25°C to the temperature at the top of the mountain, which is 29.25°C + 15°C = 44.25°C (because temperatures increase as altitude decreases).

Therefore, the temperature at the base of the mountain, at sea level will be 44.25°C

Composition of the atmosphere

The atmosphere is a mixture of gases. The main ones are nitrogen and oxygen which together, constitute over 99% of all the gases in the atmosphere. Figure below gives a comparative view of the proportion of the various gases in the atmosphere.

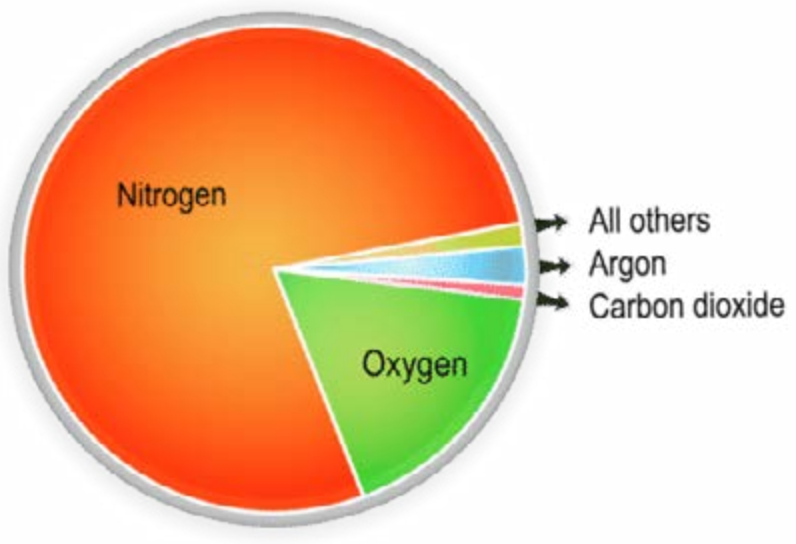


Fig 8.2: Proportions of gases in the atmosphere

Proportion and Role of Atmospheric Gases

It is important to know the proportion of gases in the Earth's atmosphere and the role each of these gases plays.

1. **Nitrogen (N_2):** Makes up about 78% of the atmosphere. Essential for life and biochemical processes.
2. **Oxygen (O_2):** Comprises around 21% of the atmosphere. Vital for respiration and combustion, mainly produced by plants.
3. **Argon (Ar):** Accounts for approximately 0.93% of the atmosphere. Chemically inert and does not react with other substances.
4. **Carbon Dioxide (CO_2):** Makes up about 0.04% of the atmosphere. Important for the greenhouse effect and temperature regulation, released through respiration, fossil fuel burning, and volcanic eruptions.
5. **Trace Gases (Ne, He, CH_4):** Exist in very small concentrations but can significantly impact climate and atmospheric interactions. Ozone, for example, absorbs UV radiation.
6. **Water Vapour (H_2O):** Ranges from nearly 0% to about 4% by volume. Crucial for weather patterns and temperature regulation, mostly found in the lower atmosphere.

Suspended particles like dust and pollutants from human activity that affect air quality, climate, and cloud formation are also found in the atmosphere

Click on this link to further read on the composition and structure of the atmosphere.

https://nios.ac.in/media/documents/316courseE/ch9.pdf.

In summary the atmosphere is important to humans for the following reasons:

- **Human Survival**: Provides oxygen for respiration.
- **Radiation Protection**: Ozone layer absorbs harmful UV radiation.
- **Temperature Regulation**: Greenhouse gases trap heat, maintaining Earth's temperature.
- **Weather and Climate**: Enables weather patterns and forecasting.
- **Aviation and Space**: Supports air travel and space exploration.
- **Communication**: Facilitates radio, TV, and telecommunications.
- **Recreation and Sports**: Enables activities like kite flying and skydiving.
- **Renewable Energy**: Source of solar and wind energy for electricity.

Activity 8.1

1. Observe the diagram below and also follow the link, watch the video, and undertake the following activities:
   https://youtu.be/Y0AOg_fPkog.

   i. Reproduce the diagram in your notebook. Identify each layer with distinct colours and add the depth of each layer.
   ii. Outline the importance of the Troposphere to humans.
   iii. Give one characteristic of the Stratosphere, Mesosphere and Thermosphere.
   iv. Write a letter to a friend which explains why it is important to study these layers of the atmosphere.
   v. Using your knowledge from the video and the content from this section explain the importance of the gases, nitrogen, oxygen and carbon dioxide found in the Earth's atmosphere.
   vi. Describe the variations in temperature between the atmospheric layers.
   vii. Draw a pie chart to visualise the gas composition of the atmosphere.
   viii. Calculate the temperature at the top of Mount Edouka the second highest mountain in Ghana with an elevation of 776m if the temperature at sea level is 25°C.

WEATHER AND CLIMATE

In your earlier discussion, you found out about the structure, composition, and importance of the atmosphere. You also calculated temperatures at different altitudes making use of the Environmental Lapse Rate. You will find that knowing the fact that temperatures decrease with altitude will help you to understand some of the topics in this section. This part of section 8 is about weather and climate.

Meaning of Weather and Climate

Weather refers to the state of the atmosphere at a given time and place. It describes conditions in the atmosphere, including temperature, precipitation, wind, humidity, and pressure. Weather is the day-to-day variations in atmospheric conditions at a given time and place. It varies from day to day and even from hour to hour. The study of weather is called **Meteorology** and the person who studies and forecasts weather is called a **Meteorologist**.

Climate refers to long-term, average weather conditions prevailing in a particular place, usually over 30 years. The study of climate is called **Climatology** and the person who studies climate is called **Climatologist**.

Difference between Weather and Climate

The following table provides the differences between Weather and Climate:

Theme	Weather	Climate
Definition	Weather is all about the current conditions of the air around us, right here and right now.	Climate is the average weather condition in a particular area over a long period.
Duration	The weather does not last long. One minute it might be sunny, then a few hours later it is raining.	Climate stays the same because it describes the average conditions observed over a much longer time, usually above 30 years.
Spatial (Area) Coverage	Weather conditions are localised and specific to a particular place or community.	Climate describes the conditions for regions or larger areas of the Earth.
Variability (Changeability)	Weather can change fast, sometimes even throughout the same day.	Climate does not change over the years as it is based on annual averages taken over many years.
Scope	Weather forecasts give short-term atmospheric conditions, typically up to a week in advance, using meteorological models and observations.	Climate projections focus on long-term trends and changes, aiming to provide insights into the general patterns and conditions that are expected to occur over decades or longer.

Theme	Weather	Climate
Impact	Weather changes can have a short-term effect on our daily lives.	Climate changes can have long-term effects on our environment and our way of life.

These are the similarities between weather and climate

1. **Study of Atmosphere**: Both weather and climate involve studying the Earth's atmosphere, including temperature, humidity, wind, and precipitation.
2. **Solar Influence**: Both are affected by the Sun's energy, which drives atmospheric processes and influences short-term weather and long-term climate.
3. **Data Sources**: Meteorologists and climatologists use similar tools like weather stations, satellites, and radar to study atmospheric conditions.
4. **Impact on Humans**: Weather affects daily activities like clothing and travel, while climate influences agriculture, water resources, and where people can live.
5. **Geographical Influence**: Both are influenced by the Earth's features like mountains, oceans, and deserts.

It is important to understand that several of the factors affecting weather also affect climate for example, altitude, latitude, and being near to large water bodies like oceans.

A. Factors Affecting Weather

1. **Temperature**: Influences the warmth or coldness of air, especially with altitude.
2. **Humidity**: The amount of moisture in the air, affecting precipitation and comfort levels.
3. **Precipitation**: Includes rain, snow, sleet, and hail, impacting visibility and ground conditions.
4. **Wind**: The movement of air, which can affect temperature and precipitation patterns.
5. **Air Pressure**: Variations in atmospheric pressure can lead to different weather conditions.
6. **Cloud Cover**: Influences temperature and precipitation by blocking sunlight and trapping heat.
7. **Geographical Location**: Proximity to oceans, mountains, and latitude can significantly impact weather patterns.

B. Factors Affecting Climate

1. **Latitude**: Determines the amount of solar energy received, influencing temperature and seasons.
2. **Altitude**: Higher altitudes have cooler temperatures. This is due to the lower air pressure and density at higher elevations, which reduces the ability to retain heat.
3. **Proximity to Water Bodies**: Oceans and seas moderate temperatures, leading to milder climates.
4. **Ocean Currents**: Warm and cold currents can significantly affect coastal climates.
5. **Topography**: Mountains can block air masses and create rain shadows, affecting local climates.
6. **Vegetation**: Forests and other vegetation can influence humidity and temperature.
7. **Human Activities**: Urbanisation, deforestation, and pollution can alter local and global climates.

In Ghana, the weather is primarily influenced by its tropical climate which is characterised by two main seasons: the wet season and the dry season. The interaction of two air masses with different characteristics creates the Intertropical Convergence Zone (ITCZ). This plays an important role, shifting north and south throughout the year, bringing rain in the wet season and dry conditions in the dry season. Additionally, the Harmattan winds from the Sahara Desert can cause dry and dusty conditions, particularly in the northern regions. Coastal areas experience more humidity and moderate temperatures due to the influence of the Atlantic Ocean, while inland areas can have more extreme temperature variations.

Visit this link to learn more about the ITCZ and to see how it influences the weather and climate of Ghana: https://www.youtube.com/watch?v=SGkvEk0-hoU

Fig. 8.3: Simple word cloud on factors affecting weather and climate

Activity 8.2

1. Click on the links below to watch videos and answer the questions that follows. They all explain the differences between weather and climate. You can also visit the library or use the information in this section.
    - https://youtu.be/lD6KsSjoNOY.
    - https://youtu.be/0geUS_j3gis.
    - https://youtu.be/vH298zSCQzY.
    - https://youtu.be/p9oOHFmg0cU.

    a. What is weather?
    b. Outline the main differences between weather and climate.
    c. Explain the similarities between weather and climate.
    d. Describe the factors influencing both weather and climate.

    If you cannot access the video, check your school or local library, or look for an internet café near your home.

5. Start a weather journal or notebook.
    a. Record daily observations of weather elements such as rainfall, over several weeks or months.
    b. Note any changes or patterns you observe in the weather data within the three months.
    c. At the end of the monitoring period, analyse your journal entries to identify trends and draw conclusions about the local weather and climate.
    d. Share your conclusions with your friends.

CALCULATION OF ANNUAL, MEAN RAINFALL AND TEMPERATURE DATA

In your earlier discussion, you learned about the atmosphere and the differences between weather and climate. In this part, you will explore the instruments used to record the elements of weather and calculate annual averages for rainfall and temperatures.

Some Elements of Weather, their Measuring Instruments and Units of Measurement

The following table shows the instruments which are used to record the elements of weather and their units of measurement:

Elements	Measuring Instruments	Unit of Measurement
Temperature: It is the measure of how hot or cold the air is.	Thermometer	Degrees Celsius (°C) or degree Fahrenheit(°F)
Rainfall: It is a form of water that falls from the atmosphere. Rain gauge/pluviometer Millimetres (mm) or inches (in).	Rain gauge/pluviometer	Millimetres (mm) or inches (in)
Wind speed: It measures the rate of fastness at which air moves.	Anemometer	Metres (m/s) per second or kilometres per hour(km/h) or knot
Wind direction: It measures the direction of movement of air.	Wind vane	Cardinal or compass directions or degrees
Air pressure: It is the force exerted on a given area of the earth's surface by the weight of air above it.	Barometer	Millibars (mb)
Humidity: It is the amount of moisture or water vapour present in the air.	Hygrometer (wet bulb thermometer and dry bulb thermometer)	Percentage (%)
Cloud cover: It is the amount and type of cloud present in the atmosphere.	Eyes observation Ceilometer	Oktas or Percentage (%) Metres or feet
Sunshine: It is the direct or indirect sunlight that reaches the surface of the earth.	Sunshine recorder	Hours or minutes
Solar radiation: It is the energy emitted by the sun in the form of magnetic waves.	Pyranometer	Watts per square metres
Visibility: It is the clarity at which objects can be seen in the atmosphere.	Visibility sensor/ transmissometer	Metres or kilometres

The following are examples of weather instruments:

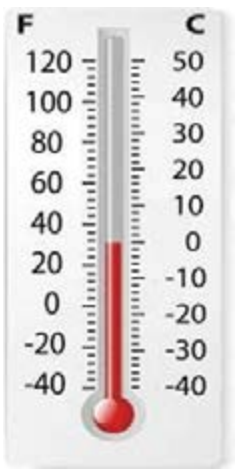


Fig. 8.4: Rain Gauge/pluviometer **Fig. 8.5:** Thermometer

Fig. 8.6: Anemometer (Left) and Wind Vane (Right)

Fig. 8.7: Barometer **Fig. 8.8:** Hygrometer (Dry and Wet Bulb)

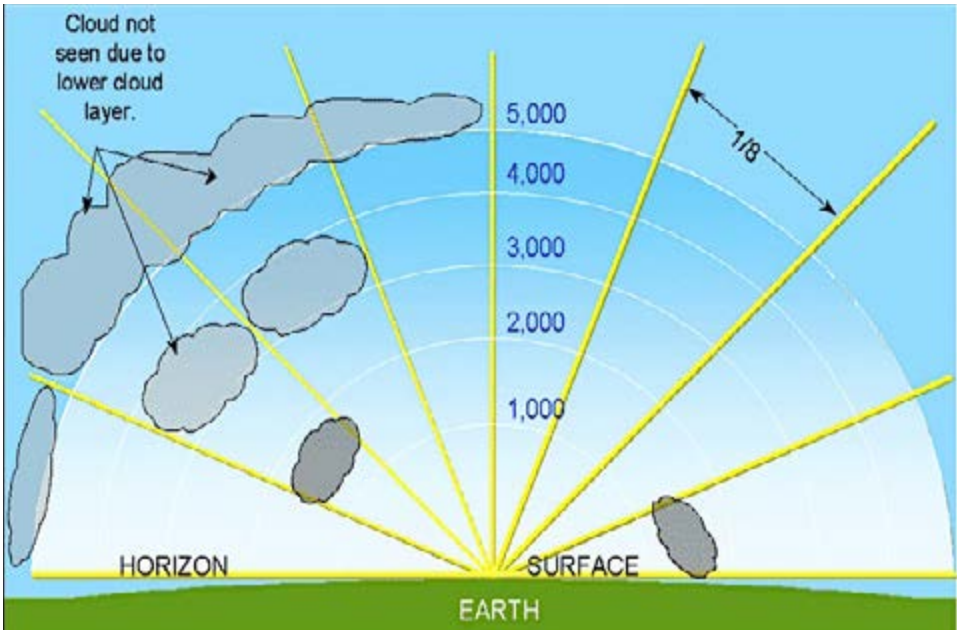


Fig. 8.9: Cloud observation in oktas

Fig. 8.10: Ceilometer

Fig. 8.11: Sunshine Recorder

Fig. 8.12: Pyranometer

Fig. 8.13: Transmissometer

Calculation of Annual, Mean Rainfall and Temperature Data

You are now familiar with the weather elements and the instruments used to measure them. After taking your measurements and recording the information, you can use the data to calculate the yearly average values for these elements. Below are examples for rainfall and temperature based on monthly figures. Average temperature and total rainfall for twelve months are used.

Calculate the Total Annual and Mean Rainfall and Mean Temperature and Temperature Range of a Station (a station is the name given to the place the data comes from)

The following is the procedure for calculating the annual and mean rainfall and temperature:

1. **Total Annual Rainfall (TAR)** is the sum of the amount of rainfall recorded in the year.

$$\text{Thus, TAR} = J + F + M + A + M + J + J + A + S + O + N + D$$

2. **Mean (Average) Annual Rainfall (MAR)** is the average amount of rainfall over the year.

$$\text{Thus, MAR} = J + F + M + A + M + J + J + A + S + O + N + D$$

$$= \frac{J + F + M + A + M + J + J + A + S + O + N + D}{12}$$

3. **Annual Range of Temperature (ART)** the difference between the highest and lowest temperatures recorded over a specific period of one year.

$$\text{Thus, ART} = \text{Tmax} - \text{Tmin}$$

4. **Mean Annual Temperature (MAT)** is the average temperature of the year

Thus, MAT

$$= \frac{J + F + M + A + M + J + J + A + S + O + N + D}{12}$$

Worked Example

This table gives an information on temperature and rainfall data recorded for a station

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rain (mm)	150	190	230	270	310	350	390	430	370	310	250	190
Temp (°C)	26	27	28	29	30	31	32	33	32	31	30	29

Calculate the:

a. Total annual rainfall
b. Mean annual rainfall
c. Annual temperature range
d. Mean annual temperature

Solution

a. Total annual rainfall:
150+190+230+270+310+350+390+430+370+310+250+190 = 3,440 mm

b. Mean annual rainfall:

$$= \frac{3{,}440\text{mm}}{12} = 287\text{mm}$$

c. Annual range of temperature = 33°C – 26°C = 7°C

d. Mean annual temperature $= \frac{(26+27+28+29+30+31+32+33+32+31+30+29)}{12}$

$$= \frac{358}{12}$$

$$= 29.83°C$$

Activity 8.3

Carefully study the table below which shows the monthly average rainfall and temperature for Accra in Ghana.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rain (mm)	110	150	200	250	300	350	400	450	390	340	290	240
Temp (°C)	23	24	25	26	27	28	29	30	29	28	27	26

Calculate:

a. Total annual rainfall
b. Mean annual rainfall
c. Annual range of temperature
d. Mean annual temperature
e. Draw a vertical bar graph to represent the rainfall for each month. On the same graph but above the bars draw a line graph to represent the temperature for each month. Make sure you place the line above the bars by starting the temperature scale above the rainfall scale. If you are not sure how to do this follow the link below which will explain.
   - https://www.youtube.com/watch?v=7qCDmm9Gkbo
f. Use your graph to describe any patterns you can see in the rainfall and temperature distribution over the year.

Activity 8.4

1. Visit the school library or search the internet for information on the instruments used to measure the elements of weather.
2. Name the instruments used to measure each of these elements.
3. Write an explanation of how each instrument works and the units used to record the data it collects.

What did I learn?

Review Questions

REVIEW QUESTIONS 8.1: THE EARTH'S ATMOSPHERE

1. Describe in a few sentences the Earth's atmosphere.
2. Identify the four most important gases in the Earth's atmosphere and explain their importance.
3. Identify and describe the four main layers of the Earth's atmosphere.
4. Why is the troposphere considered more important than the rest of the layers in the Earth's atmosphere.
5. What is the role of ozone layer in the atmosphere.
6. Why are mountainous areas quite colder than lowland areas in Ghana?
7. Calculate the temperature at the top of Aconcagua the highest peak in the Andes and the Western Hemisphere, with an elevation of 7000 metres if the temperature at sea level is 15°C
8. Calculate the temperature at South Base Camp in Nepal located at an altitude of 5,400 metres if the temperature at the top of Mount Everest at an altitude of 8850 metres is minus 20°C (-20°C).

REVIEW QUESTIONS 8.2: WEATHER AND CLIMATE

1. What is the meaning of weather?
2. What is the meaning of climate?
3. What are the main differences between weather and climate?
4. Describe the factors that influence weather.
5. Describe the factors that influence climate.
6. Explain how the movement of the Intertropical Convergence Zone (ICTZ) influences both the weather and climate of Ghana.

REVIEW QUESTIONS 8.3: THE ELEMENTS OF WEATHER AND CALCULATING ANNUAL AVERAGES FOR RAINFALL AND TEMPERATURES

1. What is the name given to a person who studies weather?
2. What is the name given to a person who studies climate?
3. Name the instruments used to measure rainfall, temperature, wind speed, solar radiation and humidity.
4. What are the units of measurement for rainfall, temperature, wind speed, solar radiation, and humidity?
5. Explain how cloud cover and sunshine are measured.

6. Study the following monthly averages for rainfall and temperature for Kumasi in Ghana

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rain (mm)	24	47	100	109	125	140	119	106	153	131	67	26
Temp (°C)	27	28	28	27	26	25	24	24	24	25	26	27

Using the data above calculate:

a. Total annual rainfall
b. Mean annual rainfall
c. Annual range of temperature
d. Mean annual temperature

Extended Reading

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