GEOGRAPHY NOTES FORM 1

WEATHER

SPECIFIC OBJECTIVES

By the end of the topic, the learner should he able to:

a) define the term weather
b) state the elements of weather
c) explain the conditions necessary for siting a weather station
d) use instruments to measure elements of weather
e) analyse and interpret data on weather conditions
f) describe the structure and composition of the atmosphere
g) explain factors influencing weather
h) carry out field study on a weather station.

WEATHER

Definition

Daily atmospheric conditions of a place at a particular time.

Elements of Weather

1. Temperature
2. Humidity precipitation
3. Precipitation
4. Atmospheric pressure
5. Wind
6. Sunshine
7. Cloud cover

A Weather Station

A place where observation, measuring and recording of weather elements is done

Factors to Be Taken Into Account When Sitting a Weather Station

- An open place where there is little obstruction of weather elements.
- Accessible place so that recording can be done easily.
- A fairly level or gently sloping ground (5◦) so that it's easy to position weather instruments.
- The place should provide a wide view of the surrounding landscape and the sky.
- The site should be free from flooding.
- The place should have security.

Instruments for Measuring Elements of Weather

a) Thermometer-temperature
b) Hygrometer-humidity
c) Rain gauge-rainfall
d) Barometer-air pressure
e) Sunshine recorder-sunshine duration and intensity
f) Wind vane –wind direction
g) Anemometer-wind speed
h) Evaporimeter-rate and amount of evaporation.

Learner's Short Notes

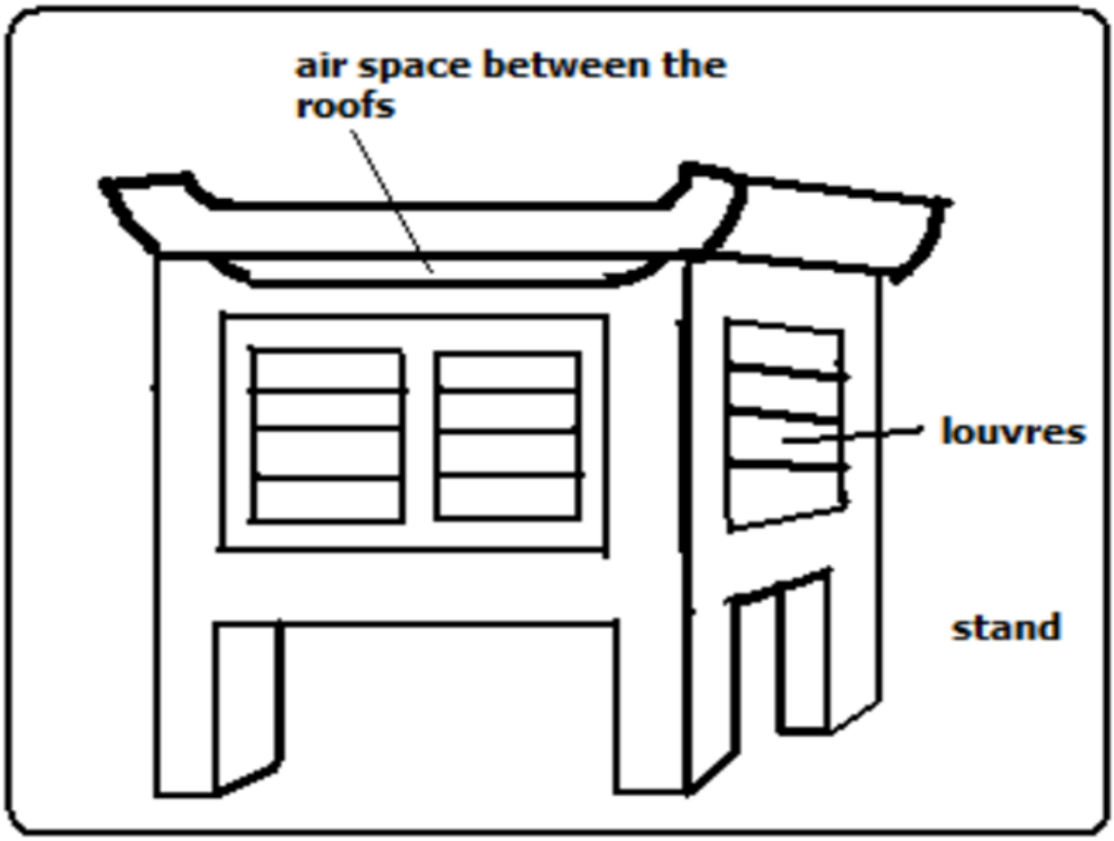


FIGURE 1: THE STEVENSON SCREEN

A white wooden box mounted on 4 legs used to house thermometers and hygrometers.

The instruments which are found in it are:

1. Maximum thermometer
2. minimum thermometer
3. Six's thermometer
4. hygrometer-wet bulb and dry bulb thermometer

Importance of the Stevenson Screen

1. Provide shade conditions for accurate temperature recording.
2. Ensure safety of thermometers because they are delicate.

Learner's Short Notes

Qualifications Which Make Stevenson Screen Suitable For Its Work

1) Painted white for little absorption of solar heat energy.
2) Made of wood which is a bad conductor of heat.
3) Well ventilated to allow easier flow of air inside it.
4) Raised to prevent contact with terrestrial radiation.
5) Has double roof which acts as an insulator to prevent direct heating from the sun.

Recording and Calculating Weather Conditions

Temperature

Degree of hotness of an object or a place.
It's measured using 3 types of thermometers namely:

a) Maximum thermometer
b) Minimum thermometer
c) Six's thermometer

Maximum Thermometer

It's used to measure the highest temperature reached in a day.

It uses mercury.

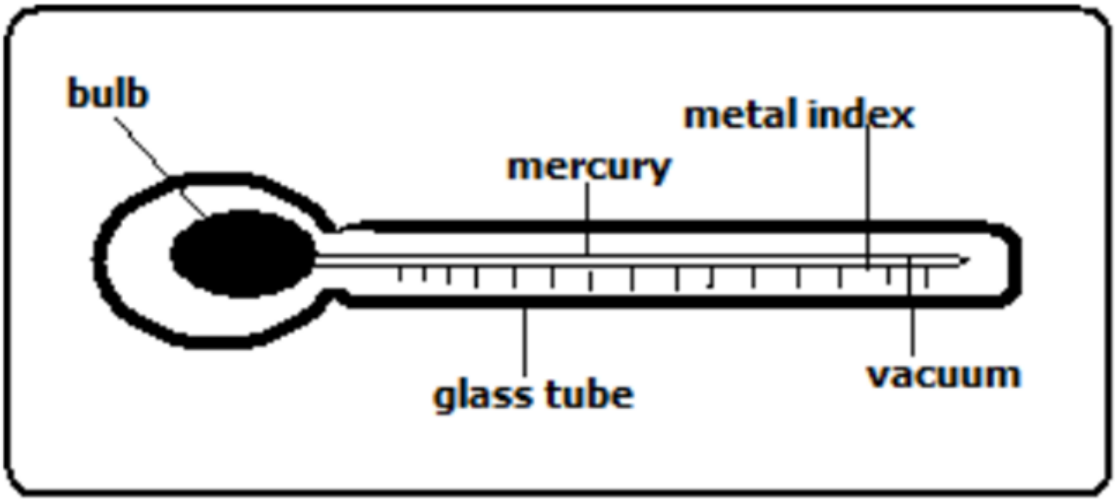


FIGURE 2: MAXIMUM THERMOMETER

Learner's Short Notes

How it's Used/Works

1) Temperature rises causing mercury to expand.
2) Mercury pushes the index up.
3) When temperature falls mercury contracts.
4) The maximum temperature is read from the scale at the lower end of the index.
5) Thermometer is reset by shaking it to force mercury back into the bulb.

Minimum Thermometer

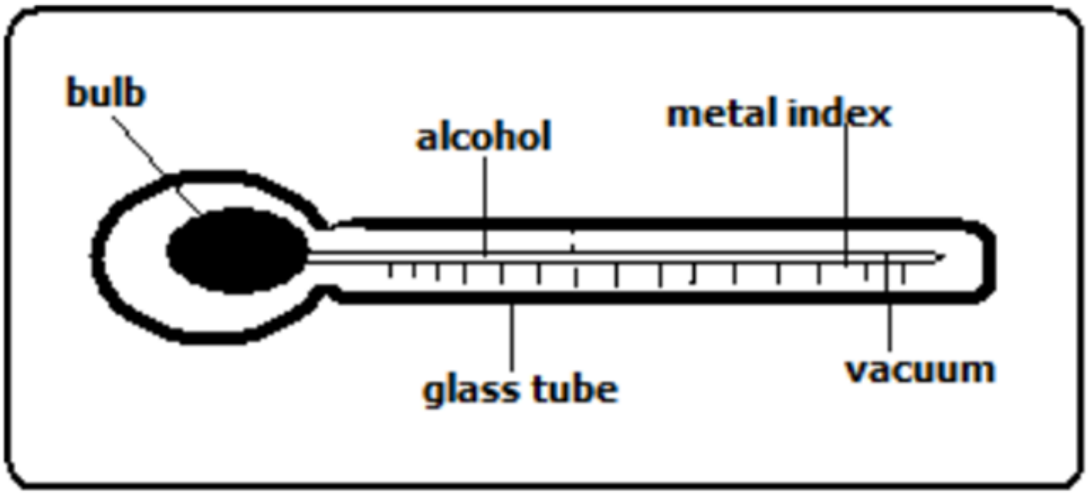


FIGURE 3: MINIMUM THERMOMETER

It's used to record the lowest temperature reached in a day.

It uses alcohol.

How it's Used/Works

i) Temperature falls causing alcohol to contract.
ii) Alcohol pulls the index down.
iii) When temperature rises alcohol expands and rises in the tube.
iv) The index remains where it was pulled.
v) Minimum temperature reading is obtained from the scale at the lower end of the index.

Learner's Short Notes

Calculating Temperature

1) Diurnal/daily Temperature range

Difference between the maximum and minimum temperature for any one day.

2) Mean Daily Temperature

Average of the maximum and the minimum daily temperatures.

3) Mean Monthly temperature

Sum of mean daily temperatures in a month divided by the number of days in that month.

4) Mean Monthly minimum Temperature

Sum of daily minimum temperatures divided by the number of days in that month.

5) Mean Monthly Maximum Temperature

Sum of daily maximum temperatures divided by the number of days in that month.

6) Mean Annual Temperature

Sum of mean monthly temperatures divided by 12.

7) Mean Annual Temperature Range

Difference between the highest and the lowest mean monthly temperatures in a year.

8) $^0K=^0c+273$

9) $^0F=(^0c\times1.8)+32$ derive the rest from the formulas.

Learner's Short Notes

Rainfall

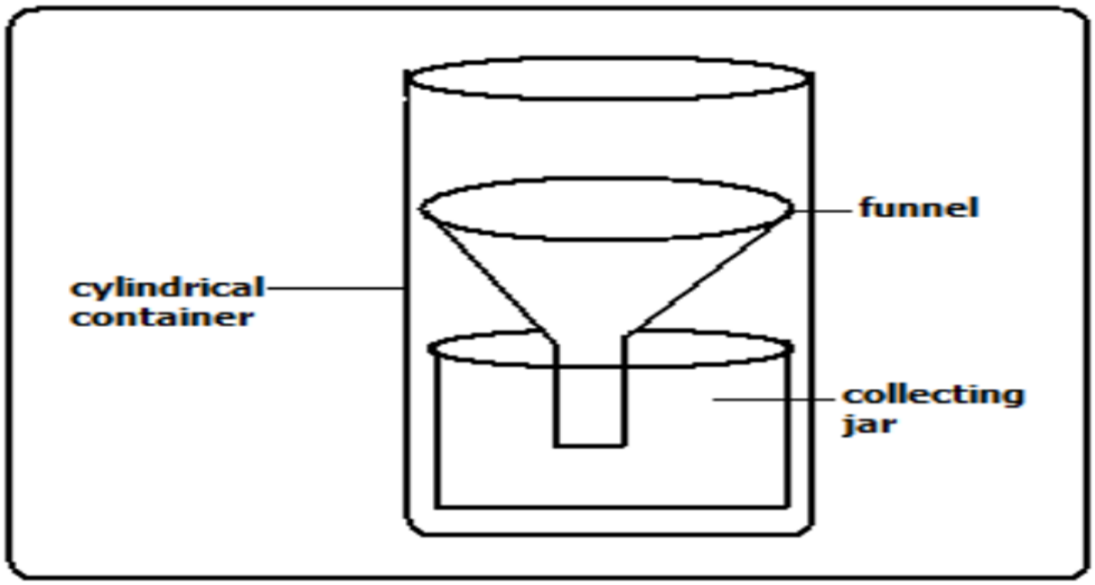


FIGURE 4: RAIN GAUGE

Rain gauge is the instrument used to measure the amount of rainfall in a day.

It should be made of impermeable material which can't absorb water.

How it's Used/Works

1. It's taken to an open space to prevent water from dropping into the funnel.
2. It's sunk into the ground to prevent evaporation
3. The funnel top is left 30cm above the ground to prevent splashes of water and run off.
4. After 24 hours water is emptied into the measuring cylinder.
5. The reading of the amount of rainfall is got from the measuring cylinder in millimeters.
6. The figure represents the millimeters of water falling on each square millimeter of the ground.
7. It could be used to measure snow fall by melting it before the readings are gotten.

Learner's Short Notes

Calculating Rainfall

1. **Monthly Rainfall Total**

   Sum of rainfall recorded in a month.

2. **Annual Rainfall Total**

   Sum of monthly rainfall totals for 12 months.

3. **Mean Monthly Rainfall**

   Sum of rainfall totals for a particular month over several years divided by the Number of the years of observation.

4. **Mean Annual Rainfall**

   Sum of mean monthly rainfall for 12 months of the year.

Sunshine

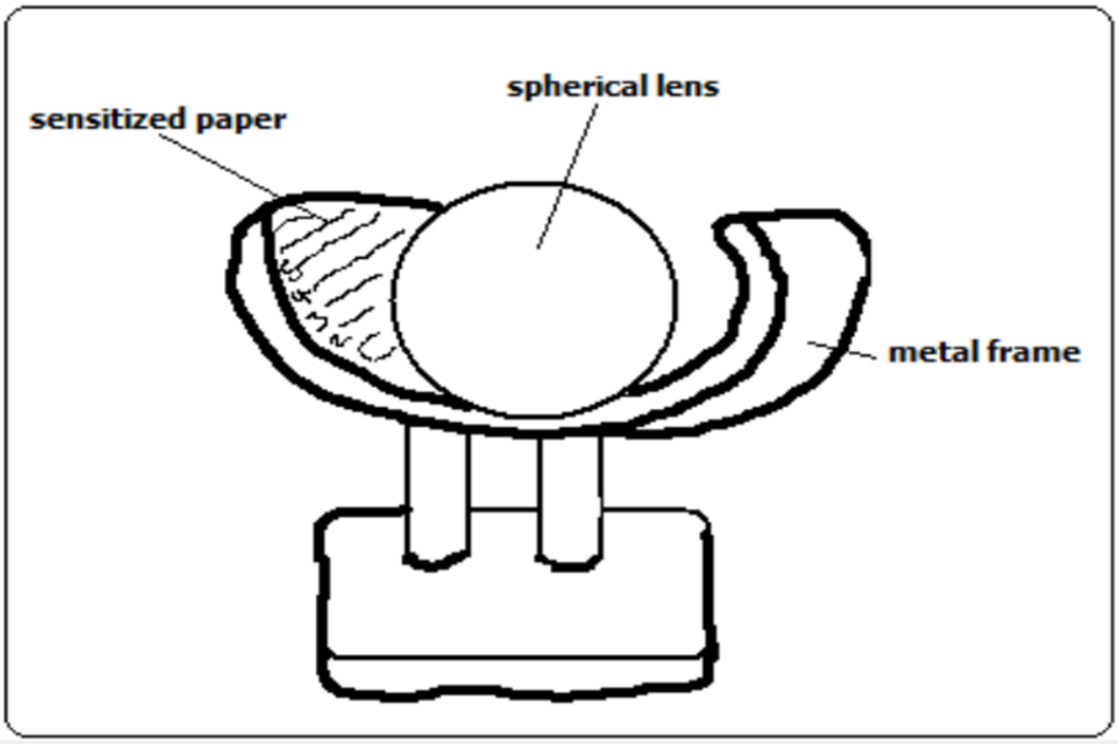


FIGURE 5: CAMPBELL STOKES SUNSHINE RECORDER

Learner's Short Notes

Duration of sunshine is measured using Campbell stokes sunshine recorder.

How It Works

- Spherical lens focuses light on sensitized paper.
- The paper burns when the sun is shining.
- The total hours of sunshine is got by adding all the burnt sections from calibrations on the side of sensitized paper.
- The sensitized paper is changed every day.

Humidity

- Humidity is the condition of atmosphere with reference to its water content.
- It's measured with hygrometer or psychrometer which consists of wet and dry bulb thermometers kept in Stevenson screen.
- Dry bulb thermometer is a thermometer covered with muslin bag immersed in water while dry bulb thermometer has no muslin.

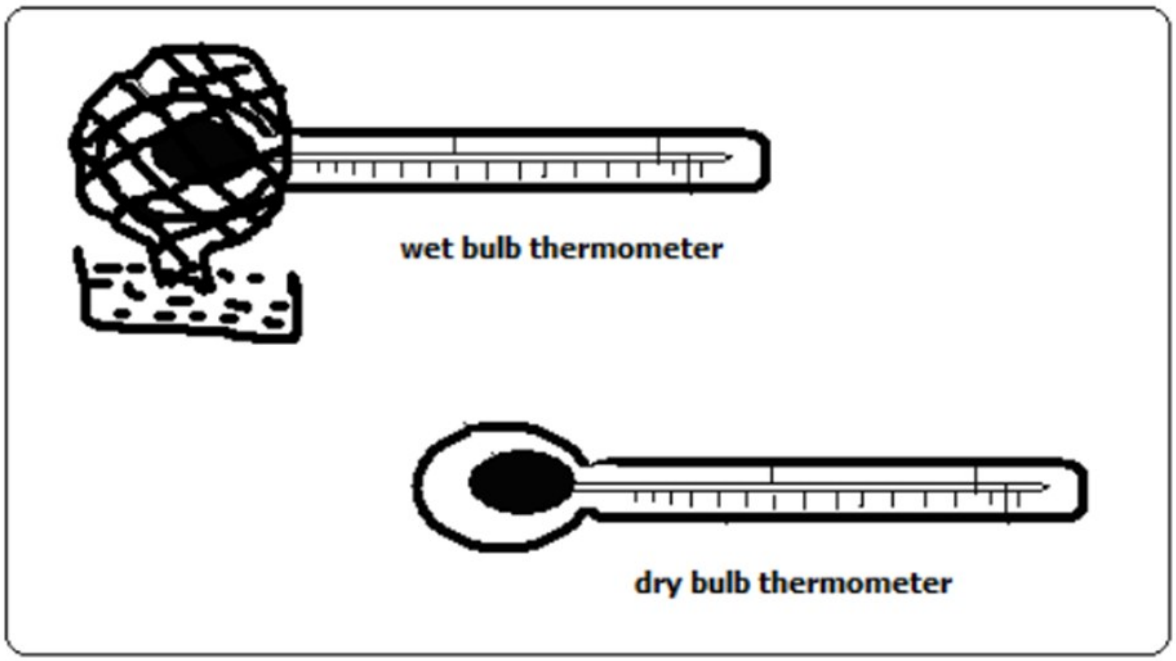


FIGURE 6: WET BULB AND DRY BULB THERMOMETER

Learner's Short Notes

How It Works

a. When air is dry there is a lot of evaporation from the muslin.
b. Evaporation cools the bulb of thermometer resulting in a low temperature reading.
c. When humidity is high there is little evaporation from the muslin.
d. The wet bulb thermometer is cooled at a slower rate and both thermometers show almost the same temperature reading.

The difference in readings between the two thermometers is used to determine relative humidity.

Interpretation of Hygrometer Readings

i) When the 2 readings are the same, relative humidity is 100% i.e. the air is saturated.
ii) If the difference is small, humidity is high.
iii) If the difference is big, humidity is very low.

Calculating Humidity

Absolute Humidity

Actual amount of water vapour a given volume of air can hold. It's expressed in g/m^3.

Specific Humidity

Mass of water vapour in a given mass of air. It's expressed in g/km.

Relative Humidity

Ratio between the absolute humidity and the maximum amount of water the air can hold expressed in a percentage.

$$R.H. = A.H/Maximum\ amount\ of\ water\ the\ air\ can\ hold\ at\ the\ same\ temperature.$$

Example

If the air at 20^0c contains $10g/m^3$ and given air can hold a maximum of $20g/m^3$.calculate the relative humidity.
10×100/20=50%

Learner's Short Notes

Wind Direction

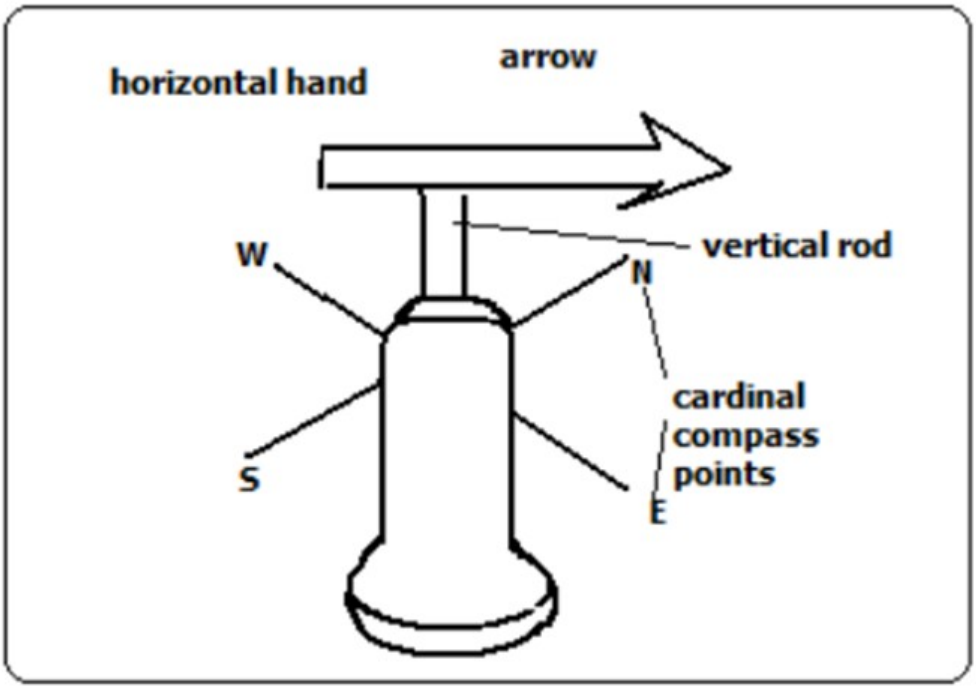


FIGURE 7: WIND VANE

Wind direction is determined using wind vane.

How It Works

a. As the wind blows the arrow swings.
b. The arrow points in the opposite direction of the wind flow.
c. The direction is read from the cardinal compass points.
d. The arrow will point in the direction from which the wind is blowing.
e. For instance if it points S the wind is blowing from S towards N.

Learner's Short Notes

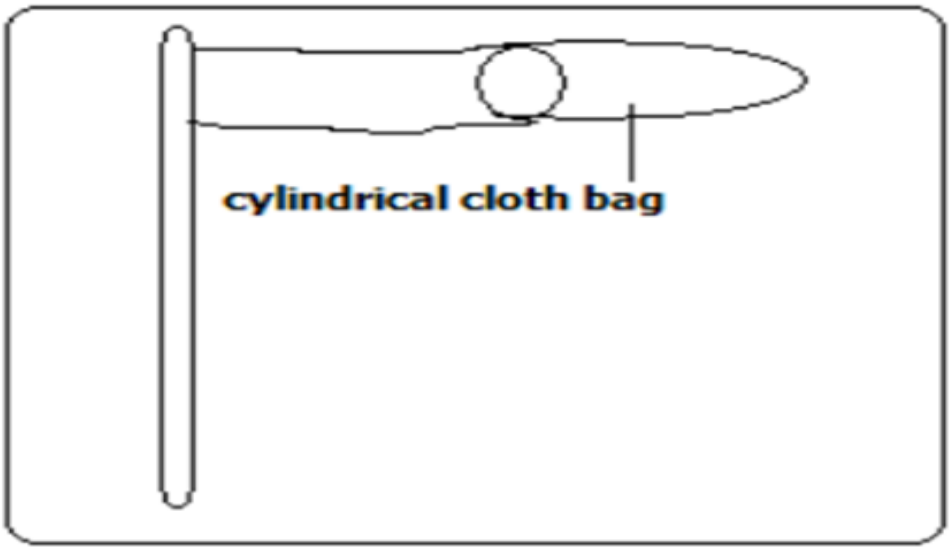


FIGURE 8: WIND SOCK

Used to indicate the general direction of wind flow. Not kept in a weather station because it doesn't give the accurate direction of wind flow.

Seen near airstrips for the benefit of pilots.

How it Works

When wind blows the bas stretches out in the direction that the wind is blowing.

Wind speed/Velocity

Measured using anemometer.

Learner's Short Notes

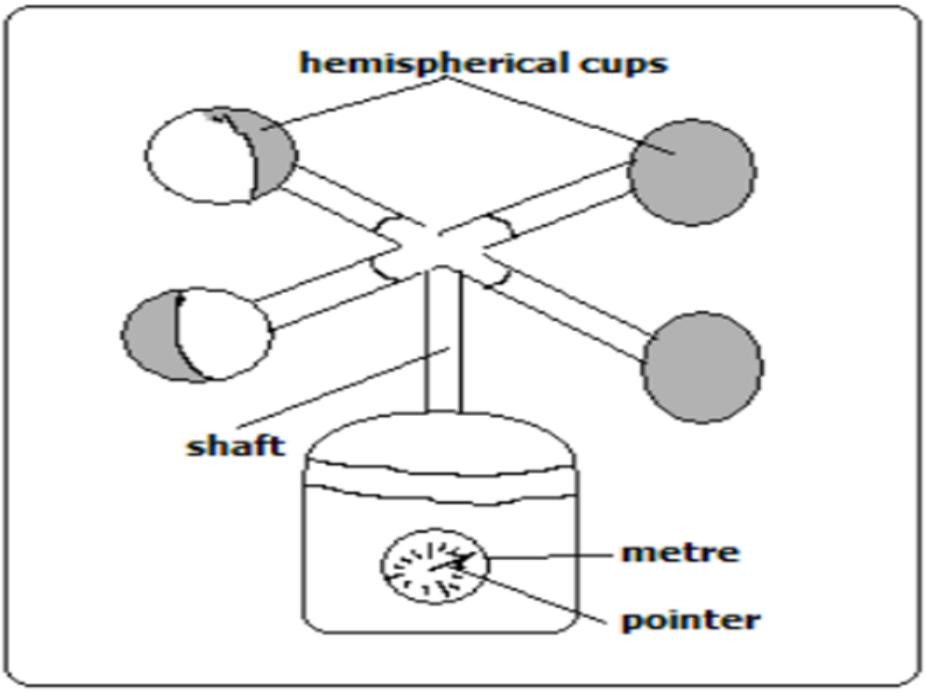


FIGURE 9: ANEMOMETER

How It Works

When wind blows hemispherical cups rotate.

The number of rotations is obtained from the metre on the lower part of the anemometer.

The units for measuring wind are called knots.

Atmospheric Pressure

The force exerted by gases in the atmosphere on some area or body on the earth's surface.

Measured using barometers of three types namely mercury, aneroid and Fortin Barometers.

Learner's Short Notes

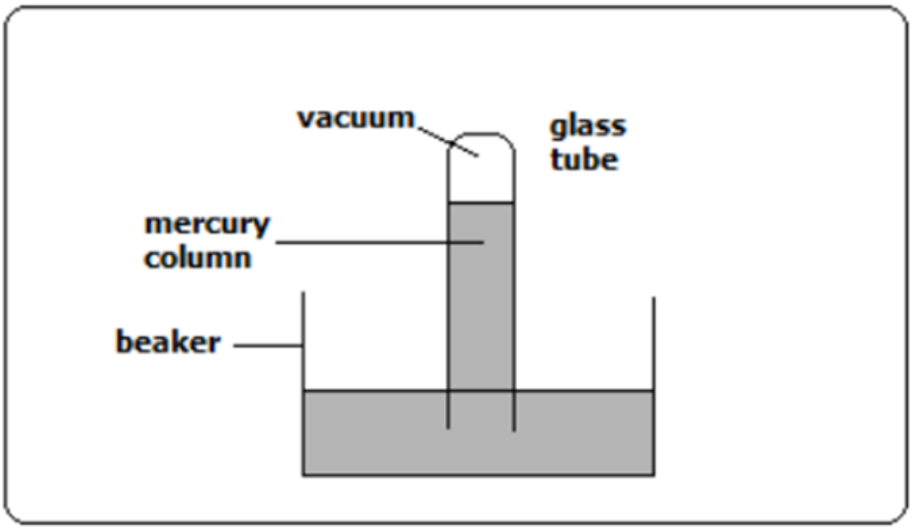


FIGURE 10: MERCURY BAROMETER

How It Works

- Air exerts pressure on the mercury in the beaker.
- The height of mercury in the tube is proportional to the atmospheric pressure.
- The readings are taken in mmHg.
- Its 760mmHg at sea level

Advantage

- Quite accurate

Disadvantage

- Cumbersome to carry around.
- Can be damaged quite easily while being carried around.

Aneroid Barometer

Measures changes in atmospheric pressure.

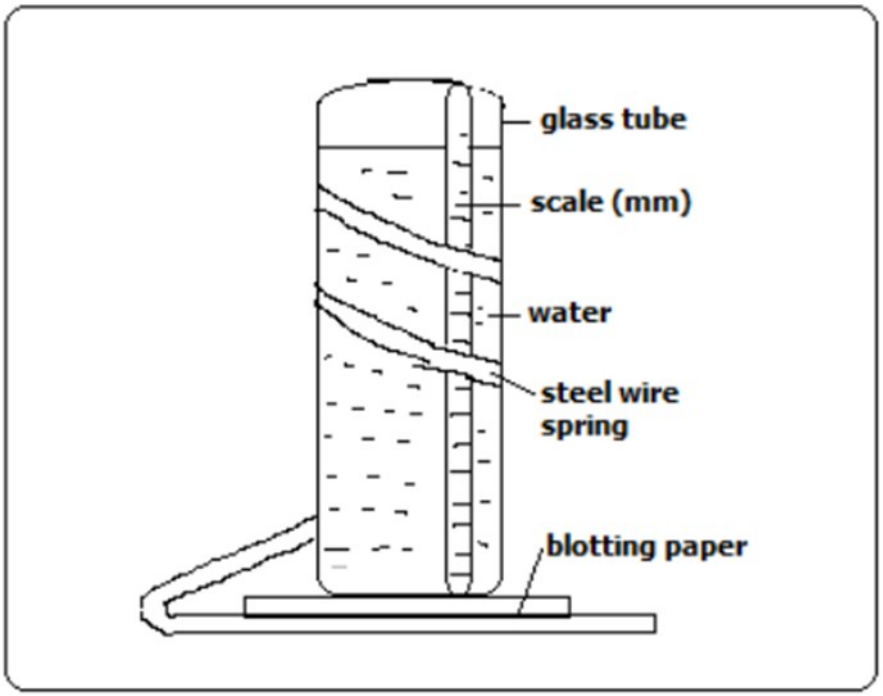
How It Works

- Has air tight compartment (vacuum).
- Compartment expands when pressure decreases.
- It collapses when pressure increases.
- The movement is transmitted by lever to a pointer on a dial.
- The readings are in kg/cm3.

Learner's Short Notes

Evaporation

The rate and amount of evaporation is measured using piche and tank evaporimeters.



When there is a lot of sunshine water evaporates from the blotting paper.

The level of water in the glass tube reduces.

The rate and amount of evaporation is got by looking at the scale on the outside of the glass tube.

The units are in mm.

Learner's Short Notes

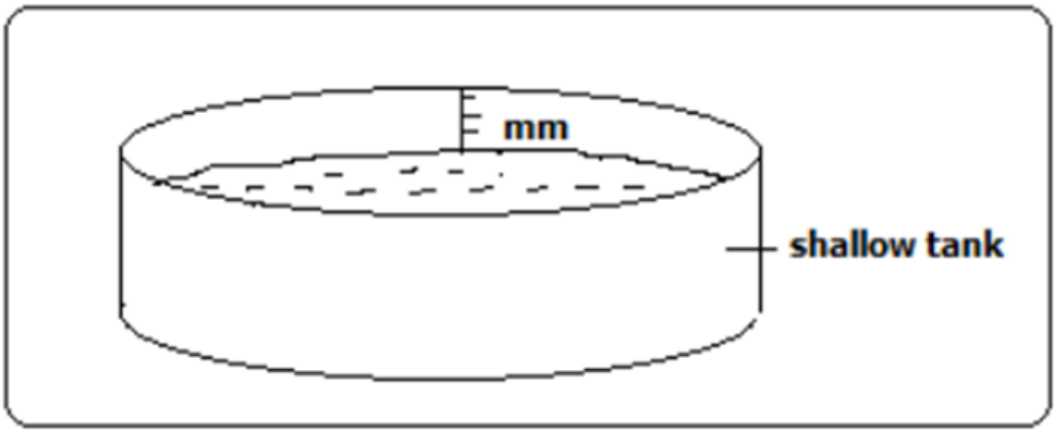


FIGURE 12: TANK EVAPORIMETER

How It Works

- The tank with water is put in the open.
- Water evaporates when there is a lot of sunshine.
- Water in the tank reduces.
- The rate and amount of evaporation is got from calibrations in the inner side of the tank in mm.

Cloud Cover

The amount of cloud cover is observed using eyes. It's given in oktas.

Okta = approximately 1/8 of sky is covered with clouds

Learner's Short Notes

Weather Forecasting

Prediction of the conditions of the atmosphere for a given place for a certain period.

Methods of Weather Forecasting

Traditional Methods

Prediction of weather based on traditional beliefs and facts.

- ◊ Plants shedding leaves indicates period of drought.
- ◊ Safari ants indicate it will rain.
- ◊ Migration of butterflies also indicates it will rain.
- ◊ Croaking of frogs during dry season indicate it's going to rain.
- ◊ Flowering of certain plants indicates the onset of rainfall.
- ◊ Changes in the intensity of sunshine indicate it's going to rain.

Modern Methods

Prediction of weather using modern instruments and new technology of collecting, transmitting, processing and analyzing weather data.

Instruments Used

1. **Satellites**-electronic devices which orbit the earth which collect and transmit weather data which is interpreted by computers.
2. **Radar**-an instrument used to see cloud formation.
3. **Sensors/radiosodes**-instrument fixed on a balloon used to measure atmospheric pressure, temperature and humidity.
4. **Computers**-electronic device used to store, analyse and display weather information.

Significance/Importance of Weather Forecasting

1) Helps us to be aware of natural calamities related to weather before they occur so as to take precautionary measures.
2) Guiding tourists on when to visit national parks.
3) Helps farmers to plan their activities such as planting, harvesting, etc.
4) Ensures air and water transport is carried out safely.
5) Helps sporting people to plan their training and competition schedules.
6) Helps people to plan many other activities such as mining, electricity generation, holiday events, etc.
7) Helps fishing communities to plan their activities.

Learner's Short Notes

Factors Hindering Weather Forecasting

1) Lack of skilled man power due to limited training facilities.
2) Lack of modern equipment leading to wrong forecasts.
3) Natural calamities such as storms and earthquakes.
4) Extreme weather conditions which may damage or displace instruments.
5) Use of faulty instruments.
6) Human error.
7) Poor sitting of instruments.

Factors Influencing Weather Temperature

Factors influencing temperature

1) Altitude

Height above sea level.

Temperature decreases with increase in height due to air at higher altitude being thinner and hence there is less particles e.g. gases, dust, smoke and water vapour to store heat so its rapidly lost to the outer space.

2) Latitude

Distance from the equator.

Temperature decreases with increase in latitude.

Places neat equator experience high temperature due to the rays of the sun travelling a shorter distance facing less interference from atmospheric conditions hence more solar energy reaches the earth's surface. Also the rays of the sun strike the earth at right angles hence solar energy is concentrated over a small area.

3) Aspect

Direction of slope.
At higher latitudes slopes facing the equator have higher temperature because they face the sun while those facing the poles have lower temperature have lower temperature because they face away from the sun.
At higher latitudes the rays of the sun travel a longer distance facing more interference from atmospheric conditions hence less solar energy reaches the earth's surface. Also the rays of the sun strike the earth at an acute angle hence solar energy is spread over a large area.

Learner's Short Notes

4) Winds

Transfer heat from one place to another.

When they blow from cool areas they take the cooling effect to the areas they blow over and when they blow from warm areas they take warming influence to the places they blow over.

5) Distance from a Large Water Body

Areas near a large water body experience lower temperature during the hot season and higher temperature during the cool season due to sea breezes, warm and cold ocean currents and wind blowing over water which could be either warmer or cooler than the adjacent land.

6) Cloud Cover

Clouds reduce the amount of solar energy reaching the surface by absorbing, scattering and reflecting solar radiation. When there are clear skies during the day the temperature is higher due to the earth receiving maximum solar insolation. During clear nights there are very low temperatures due to a lot of terrestrial radiation being lost to the outer space. Cloudy nights on the other hand are warmer due to clouds radiating to the earth heat absorbed during the day.

7) Length of Day

The longer the period of solar insolation the greater the quantity of radiation a place receives and hence the more the heat that will be generated by the earth and vice versa.

8) Solar Altitude

At equinox when the earth is farthest from the sun the temperature on the earth is lower due to less solar radiation reaching the earth's surface due to travelling a longer distance and hence facing great interference from atmospheric conditions. At solstices the earth receives more solar energy due to travelling a shorter distance and hence facing less interference from atmospheric Conditions.

9) Solar Input

Sometimes the sun gives out more heat due to reactions being violent causing temperature on the earth to be higher. When it gives out less heat the temperature on the earth is lower.

Learner's Short Notes

10)Surface Conditions

Light surfaces e.g. smooth surfaces reflect sunlight and hence less solar energy reaches the earth's surface.

Dark and irregular surfaces such as with vegetation absorb more heat leading to higher surface temperatures.

Humidity

Factors Influencing Humidity

1.Temperature

Places with high temperature experience high humidity due to high evaporation and air having high capacity to hold moisture.

Places with low temperature have low humidity due to low evaporation and air having low capacity to hold moisture.

2.Source of Moisture

- Areas near water bodies e.g. Kisumu and Mombasa experience high humidity due to evaporation of water from the water body.
- Places near thick vegetation also have high humidity due to evapotranspiration.
- Areas far away from water bodies such as the middle of deserts have low humidity.
- Areas receiving heavy rainfall also have high humidity.

3.Air Pressure

There is high humidity at low altitudes because high pressure compresses air warming it increasing its capacity to hold moisture and also causes high evaporation. There is low pressure at high altitudes because air expands and cools thus reducing its capacity to hold moisture.

4.Latitude

Low latitudes experience high humidity due to high temperatures resulting into high rates of evaporation and air having high capacity to hold moisture. High latitudes experience low humidity due to low temperatures resulting into low rates of evaporation and air having low capacity to hold moisture.

Learner's Short Notes

Significance of Humidity/Moisture

1. Affects rain formation in such a way that places with high humidity are likely to experience higher rainfall than those with low humidity.
2. Regulates the heat loss from the earth's surface by absorbing terrestrial radiation (process in which the earth gives off heat into the atmosphere).
3. It affects sensible temperature in that the higher the humidity the more we experience sensible temperature.

Precipitation

The forms in which the earth's surface receives moisture.

i. **Snow**

Solid precipitation formed when tiny water droplets freeze and form ice crystals. The crystals may fuse to form flakes.

ii. **Sleet**

Precipitation which is a mixture of rain and snow.

iii. **Hail**

Roughly spherical lumps of ice formed when super cooled cloud droplets mould themselves around ice crystals before cooling. It destroys crops life and house roofs.

iv. **Dew**

Precipitation consisting of water droplets formed on cold surfaces at night e.g. iron roofs and glass blades.

How it's formed

In a clear night there is a high ground radiation. Temperature of the earth's surface fall below dew point (temperature at which air being cooled becomes saturated). Excess water condenses on cold surfaces.

v. **Rain**

Precipitation consisting of water drops/droplets formed when tiny water droplets merge around particles of matter and become heavy and fall down to the earth.

Learner's Short Notes

Condensation

Turning of water vapour into tiny water droplets as cooling continues below dew point. The droplets join to form clouds.

Causes of Condensation

1. Adiabatic cooling-cooling of moist air as it rises vertically.
2. Orographic cooling-cooling of moist air as it climbs a hill or mountain.
3. Frontal cooling-cooling of warm air mass when it blows towards a cold air mass.
4. Advection cooling-cooling as a result of moist air moving over a cool land or sea.

How Condensation Takes Place/Cloud Formation

i) Moist air rises to the condensation level (altitude where temperature is below dew point.
ii) It's cooled below dew point.
iii) Tiny water droplets condense around tiny particles such as dust, smoke particles and pollen grains and salt particles (condensation nuclei).
iv) The droplets merge and eventually become bigger and fall as rain.
v) If moisture rises to an altitude where temperature is below 0◦c the condensed water droplets freeze forming ice particles or super cooled water (water which has remained in a liquid state at temperatures below freezing point due to lack of sufficient condensation nuclei.
vi) Super cooled cloud droplets may mould themselves around ice crystals before freezing to form hail.

Learner's Short Notes

Types of rainfall

1. Relief/Orographic/Mountain rainfall

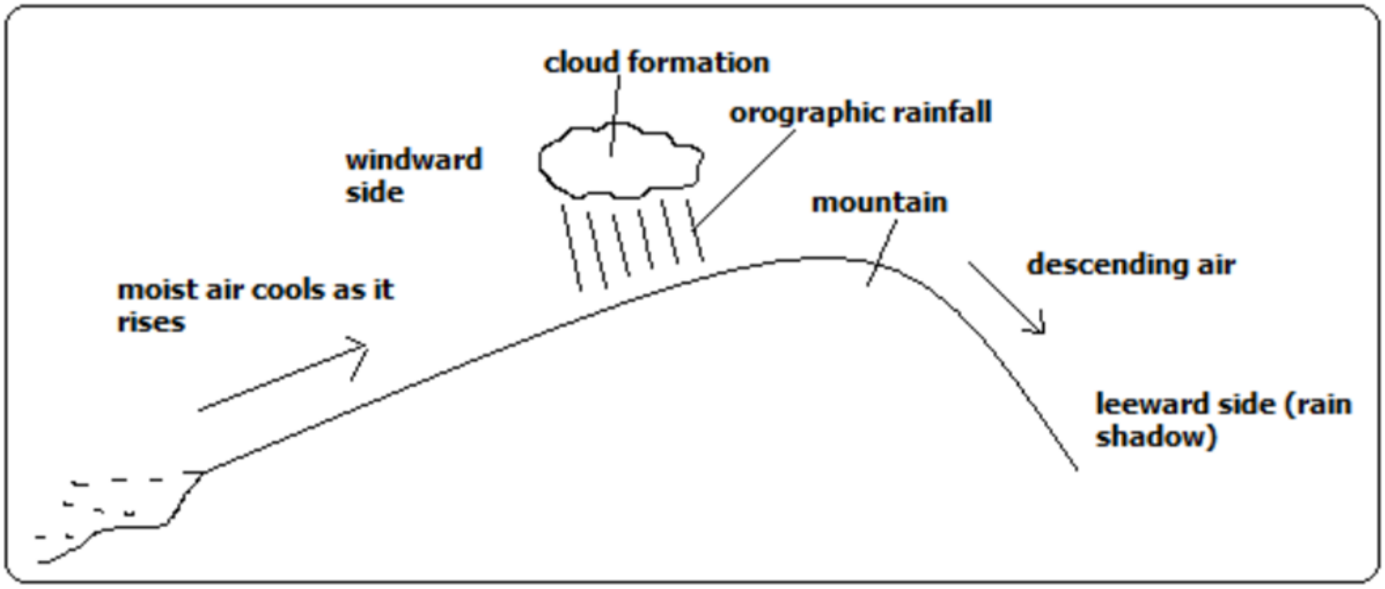


FIGURE 13: MOUNTAIN RAINFALL

Rain experienced on the windward slopes of mountains or hills formed when moist air is forced to rise over a mountain or a hill.

How it Forms

a. Moist air is forced to rise over a hill or mountain.
b. The temperature and air pressure decreases making it to expand.
c. Air cools due to decreased temperature and decreased pressure causing it to expand.
d. Moisture condenses forming tiny water droplets (clouds).
e. The tiny water droplets in clouds merge and become too heavy to be suspended in air and fall as rain.
f. Air proceeds to the leeward side with low moisture content.
g. Since its heavier due to being cool it descends over that side and gets warmed making it to hold onto the little moisture it had causing that side to receive low rainfall (rain shadow).

Learner's Short Notes

2. Convectional Rainfall

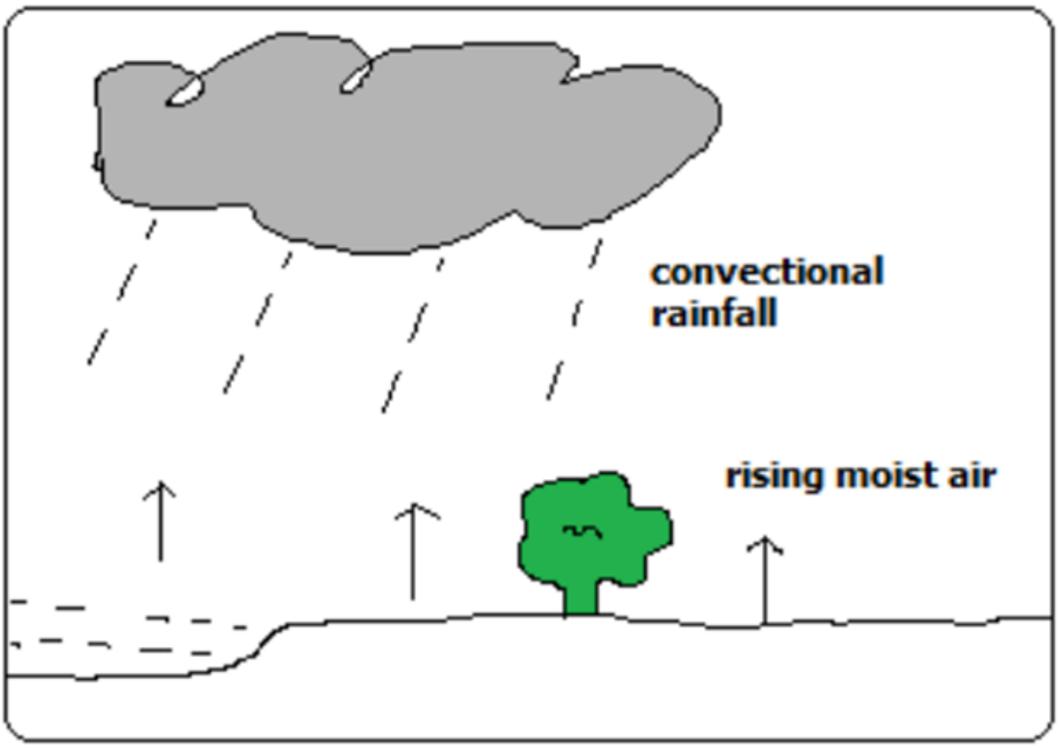


FIGURE 14: CONVECTIONAL RAINFALL

Type of rainfall common near large water bodies formed as a result of convective rising and cooling of moist air. It's accompanied by thunderstorms.

How it forms

a) Ground or water body is heated causing evaporation.
b) There is convective rising and cooling of moist air.
c) Condensation takes place forming tiny water droplets (clouds).
d) The droplets merge and fall as rain.
e) The cooled dry air descends to the surface where its heated and its capacity to hold moisture is increased.
f) The process is repeated.

Learner's Short Notes

3. Frontal/Cyclonic Rainfall

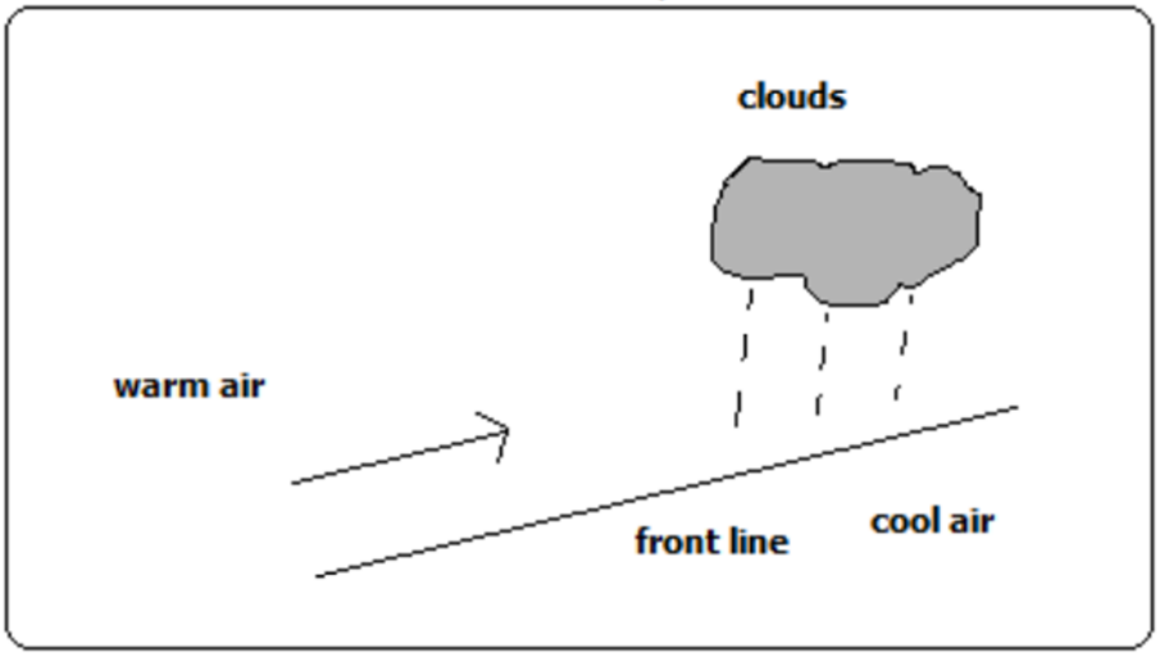


FIGURE 15: CYCLONIC RAINFALL

Type of rainfall common in mid-latitudes formed when warm air blows towards a cold area or when warm air mass meets with a cold air mass. It's accompanied by cyclones (violent winds).

How it Forms

- Warm moist air mass meets with a cold air mass.
- The warm air is forced to rise as it's less dense.
- It cools as it rises at the line of contact with cold air.
- The moisture condenses forming clouds resulting in frontal rain.

Learner's Short Notes

Factors Influencing Rainfall Types and Amounts

1. Relief/Topography

Relief features such as mountains and hills results in the rising and cooling of moist winds to form relief rainfall.

2. Aspect

Windward slopes which are on the path of rain bearing winds receive heavier rainfall than lee-ward slopes which face away.

3. Forests and Water Bodies

Areas near forests and large water bodies experience higher rainfall and more often due to high rate of evaporation.

4. Air pressure

High pressure areas receive low rainfall than low pressure areas due to pushing of air masses from high pressure to low pressure. The high pressure areas have descending dry air.

5. Air masses

When warm and cold air masses meet frontal rainfall is formed.

6. Ocean Currents

It influences rainfall whereby coasts washed by warm ocean currents experience heavy rainfall when moist onshore winds are warmed by the current and made to hold on to moisture which they release on reaching the land.

The coasts washed by cold ocean currents on the other hand experience low rainfall as a result of moist winds being cooled and moisture in them condensed resulting in rain falling over the ocean thereby bringing little or no rain to the coastal areas. This is the cause of western margin deserts e.g. Kalahari and Namib deserts.

Learner's Short Notes

Atmospheric pressure

Factors Influencing Atmospheric Pressure

1. Altitude

Pressure decreases with increase in altitude because the column of air becomes shorter hence it exerts less weight.

2. Temperature

When air is heated it expands and exerts pressure over a large area resulting in reduced pressure.

When it's cooled it contracts and exerts pressure over a small area resulting in increased pressure.

3. Rotation of the earth

Rotation pushes air masses from poles towards the equator causing air to spread out and occupy more space causing it to expand making pressure to decrease.

When air from the equator moves towards the poles it occupies less space causing it to contract resulting into high pressure.

Mist and Fog

Mist and fog are a mass of tiny water droplets suspended in the lower layers of the atmosphere.
Fog is denser than mist i.e. has more moisture.
Both hinder visibility although fog reduces visibility to less than a kilometre.
When fog mixes with smoke it is called smog.

How They Form

Moist air cools below dew point.
Condensation takes place.
The resultant water droplets remain suspended in the air.

Types of Fog

1. Radiation Fog

Type formed when moist air is cooled below dew point as a result of intense radiation on the ground at night.

2. Advection Fog

Type formed when moist air from the sea moves horizontally over a cold surface e.g. snow covered ground.

3. Orographic/Hill/Upslope Fog

Type formed when moist air is cooled after climbing a hill or mountain

Learner's Short Notes

4. Evaporation Fog

Type formed when water vapour is added to cold air that is already near saturation causing excess water vapour to condense and form fog.

5. Frontal Fog

Type formed when warm moist air is cooled from below as it rises over a cold air mass.

6. Steam Fog

Type formed when moist air passes over the surface of a much warmer fresh water body.

The warm water is cooled from above and condensing water vapour forms fog.

It appears to be steaming.

7. Ice Fog

Type formed when water vapour is converted directly into ice crystals when temperatures are below freezing point.

Clouds

Are a mass of tiny droplets or ice particles formed when water vapour condenses.

Three Cloud Forms

1. Cirroform

Thin and wispy clouds composed of ice crystals.

2. stratiform

Appear as greyish sheets covering most of the sky and are rarely broken into units.

3. Cumuliform

Are massive rounded with a flat base and limited horizontal extent and billow upwards to great heights.

Learner's Short Notes

Basic Cloud Types

1. Stratus Clouds

Are found in layers, are flat in shape and resemble fog.

2. Nimbus Clouds

Are dark at the base and sometimes white at the sides and cause rain and thunderstorms.

3. Cirro-cumulus

Are white clouds consisting of white ice crystals.

4. Nimbostratus

A rain cloud which is dark grey and spreads over the sky in low uniform layers.

5. Cumulus Clouds

Clouds with a flat horizontal base, massive, rounded and less horizontal extent.

6. Alto cumulus

High clouds composed of ice crystals which indicate fair weather.

World distribution of Pressure Zones and the Planetary wind System/World Prevailing Winds

The Equatorial Low pressure Zone (ITCZ-low)

- Found between 23 ½ ◦N and 23 ◦N
- Experiences high temperatures.
- A zone of low pressure and doldrums (light and intermediate winds).
- Zone where S.E and N.E Trade Winds converge.
- Associated with convectional rain and thunderstorms.
- Migrates to the N and with the apparent movement of the overhead sun.

Learner's Short Notes

The Sub-tropical High Pressure Zone

- Found within 30◦N and 30◦S.
- A zone of high pressure.
- A region of calm descending air.
- Source of Trade Winds and Westeries.
- Zone of divergence of T. Winds and Westeries.

The Temperate Low Pressure Zone

- Found within 60◦N and 60◦S.
- A low pressure zone.
- Zone of convergence of westeries and polar easteries

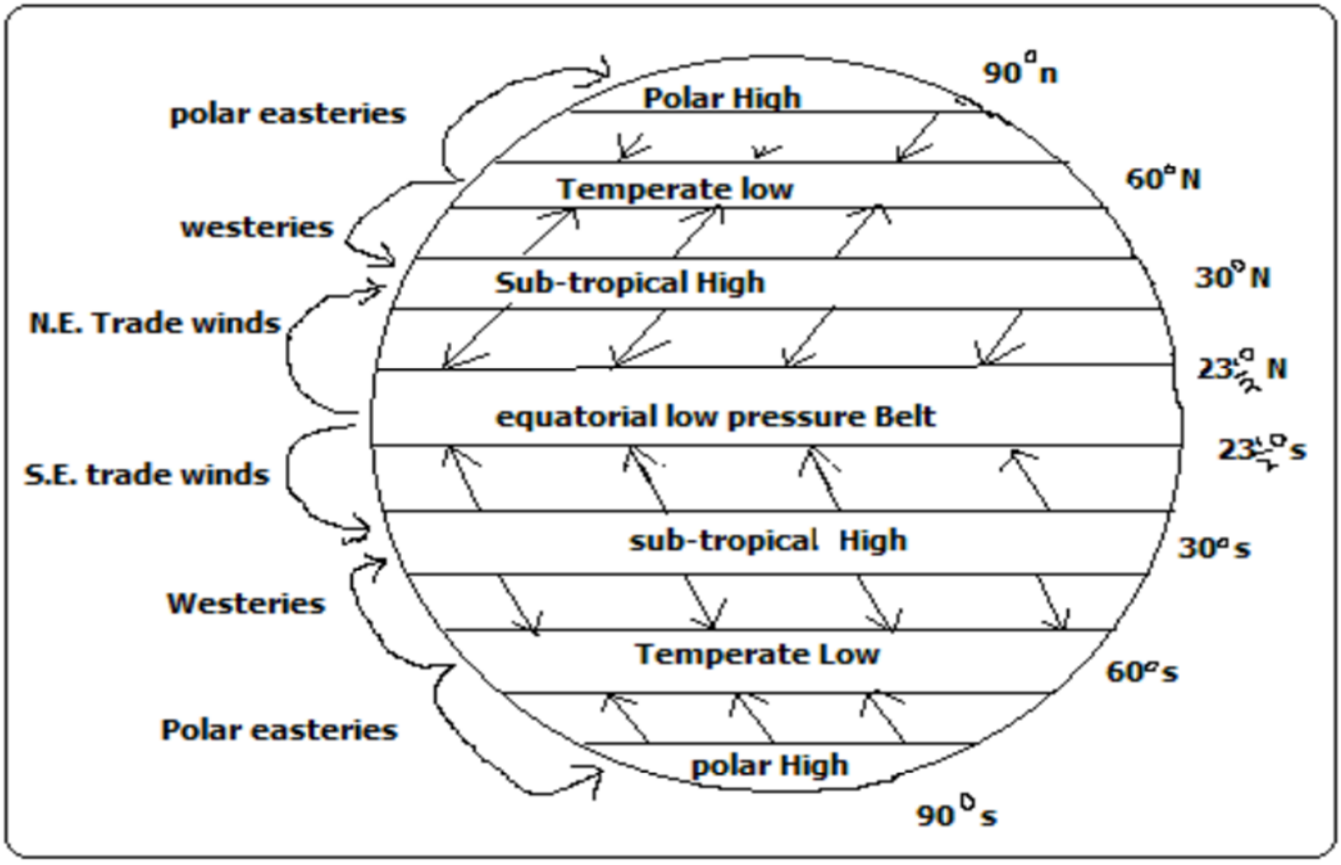


FIGURE 16: ZONE OF CONVERGENCE OF WESTERIES AND POLAR EASTERIES

Learner's Short Notes

The Polar High Pressure Zone

- Found over the poles 90◦N and 90◦S.
- A high pressure Zone.
- Zone of descending calm air of low temperature.
- Source of polar easteries.

The Worlds Prevailing Winds

These are the major winds blowing over the earth frequently and consistently and which influence the world weather.

1. Trade Winds

Blow from sub-tropical high pressure zone and blow to the equatorial low pressure belt.

2. Westeries

Originate from sub-tropical high pressure zone and blow to the temperate low pressure belt.

3. The Polar Easteries

Originate from polar high pressure zone and blow to temperate low pressure zone.

Monsoon Winds

Seasonal winds which reverse in the direction of flow.

They blow towards the land during summer (onshore) and from the land during winter (off shore).

Bring heavy rains when onshore which can cause severe flooding.

Well developed in the Indian Sun-continent, china, Japan and S.E Asia.

Air Masses

Distinct large parcels of air moving in one direction

Originate from areas of uniform weather and topography from where they derive their characteristics e.g. flat areas, forests, deserts, and snow covered areas.

Learner's Short Notes

Characteristics of Air Masses

A large volume of air.
Covers an extensive area.
Has uniform temperature and humidity.
Distinct from the surrounding air.
Retains its characteristics when it moves away.

Types of air Masses

1. Equatorial Air Mass

- Originate from equatorial oceans.
- It's hot and unstable.

2. Sub-tropical Air Mass

- Forms near sub-tropical high pressure belt.

3. Polar Air Mass

- Forms near the poles or temperate low pressure zone.
- It's cool.

4. Arctic and Antarctic air Masses

- Forms over the ice sheets of Greenland and Antarctica respectively.

5. Effect of air masses on Weather

- When warm moist air mass and cool air mass meet cyclonic rainfall is formed e.g. tropical maritime and polar maritime.
- Cool air masses take cooling effect to the areas they move to e.g. polar continental.
- If they are warm they take warming influence to the area they move to e.g. tropical continental.

Learner's Short Notes

Pressure Systems in the World

1. Cyclone

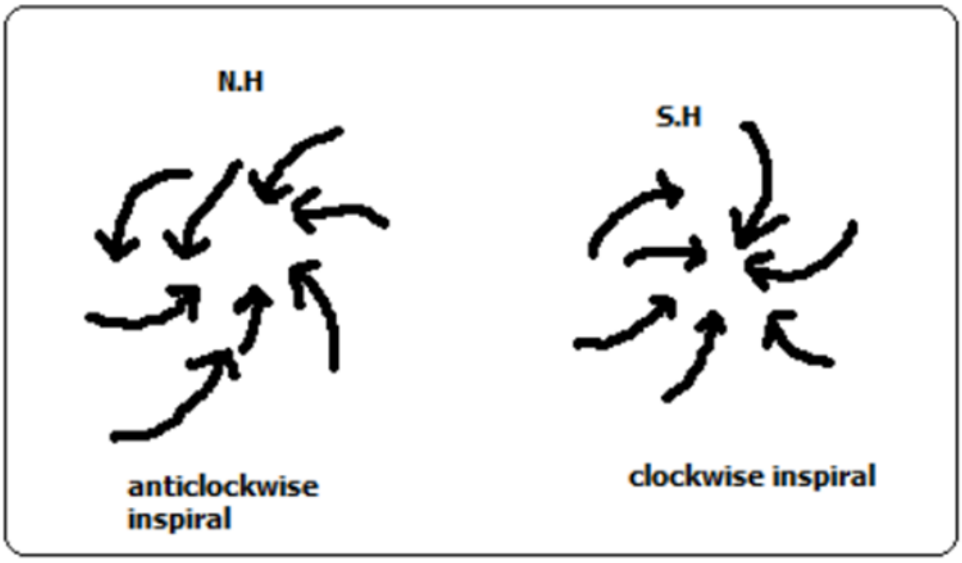


FIGURE 17: CYCLONE

a) It's a low pressure system characterized by low pressure at the centre and increases outwards.
b) Starts in areas where air ascends from the ground to the atmosphere and descends at high altitude.
c) It's of two types. Tropical cyclones e.g. hurricane, typhoon and Willy willies and depressions which are characterized by temperate latitudes.
d) The movement of wind is anticlockwise in the N. hemisphere and clockwise in the S. hemisphere.

2. Anticyclone

A high pressure system characterized by high pressure at the centre and decreases outwards.

Learner's Short Notes

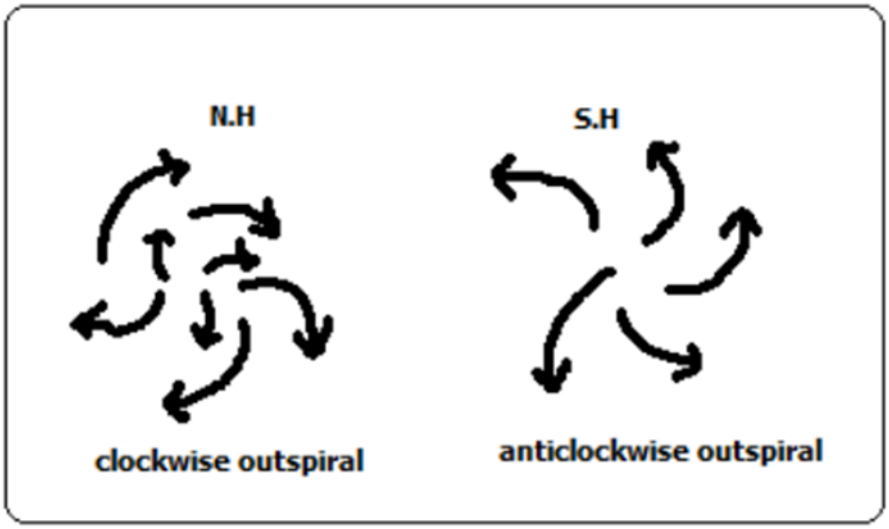


FIGURE 18: ANTICYCLONE

- It starts in areas where air is descending from the atmosphere onto the ground and then blows outwards on the ground.
- The movement of wind is clockwise in the N. hemisphere and anticlockwise in the S. hemisphere.

Local Winds

Which occur regularly for a short period of time affecting a limited area.

Modify the weather of the area they blow to.

1. Sea Breeze

A light and gentle wind which blows from the sea to the adjacent land.

How it Forms

- During the day land is heated faster than the sea.
- Air over the land is warmed and rises.
- Air from the sea moves to the land to replace the rising air.

Learner's Short Notes

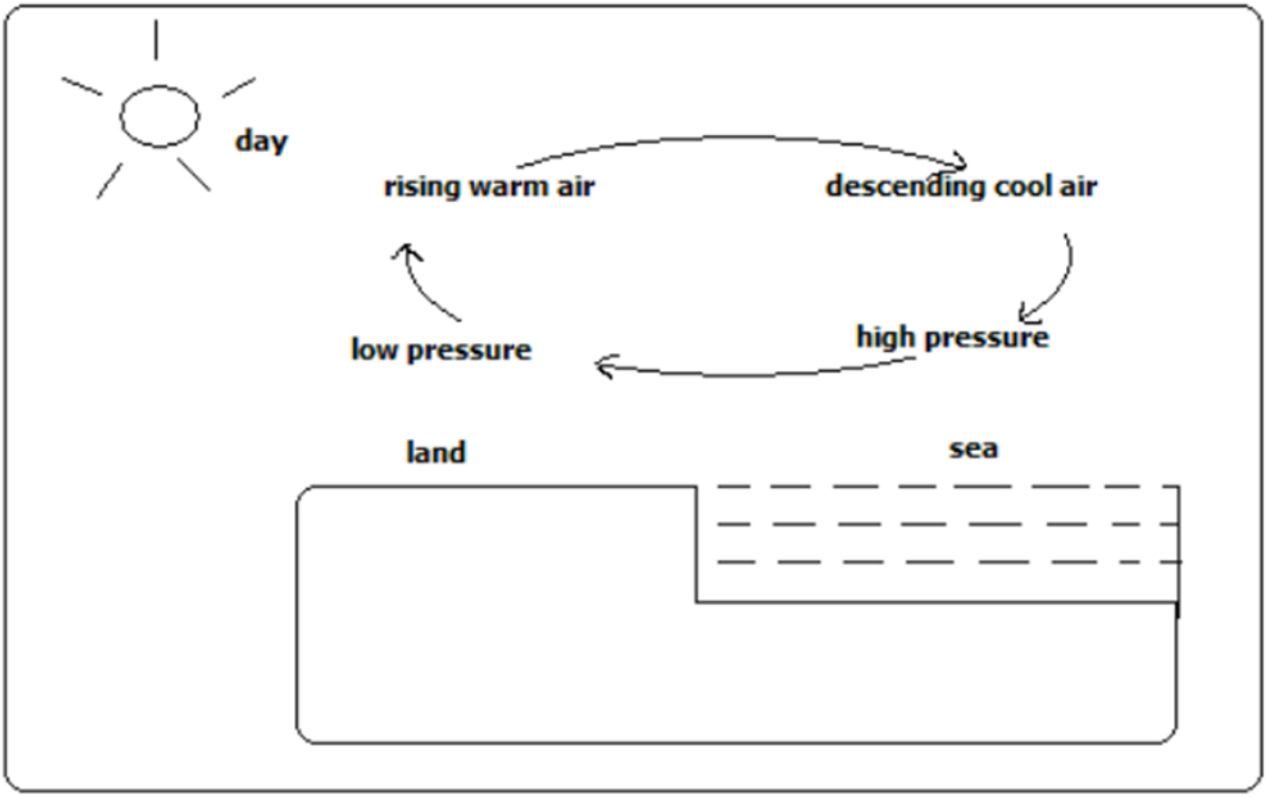


FIGURE 19: SEA BREEZE

- The rising air from the land cools and descends over the sea at high altitude.
- Circulation continues until the pressure difference is reversed at night.

Effects on weather

- It takes cooling effect on land on a hot afternoon

2. Land Breeze

A light and gentle wind which blows from land to the sea during the night.

How it forms

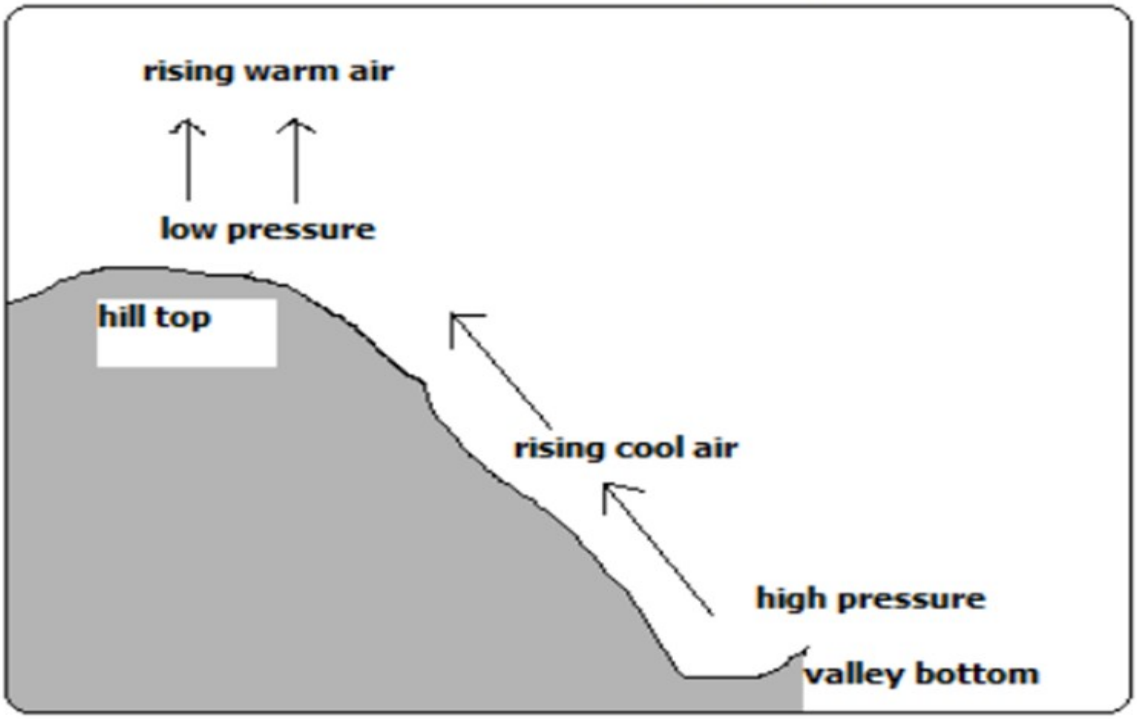
- At night land loses heat faster than the sea.
- Air over the sea is warmed and rises.
- Air from the land moves to the sea to replace the rising air.
- Rising air from the sea descends over land at high altitude.
- Circulation continues until pressure difference is reversed during the day.

Learner's Short Notes

Effects on weather

It causes early morning showers through moisture brought towards land at high altitude.

3. Anabatic winds (Valley Breeze).



Cool local winds which blow from the valley to the hill tops during summer afternoons.

How it Forms

- During the day hill tops are heated more than valley bottoms.
- Air over the hill tops is warmed and rises.

Cool air over the valley move up to the hill to replace the rising air.

Effect on weather

Cause afternoon showers on hilly grounds

Learner's Short Notes

4. Katabatic/Descending Winds

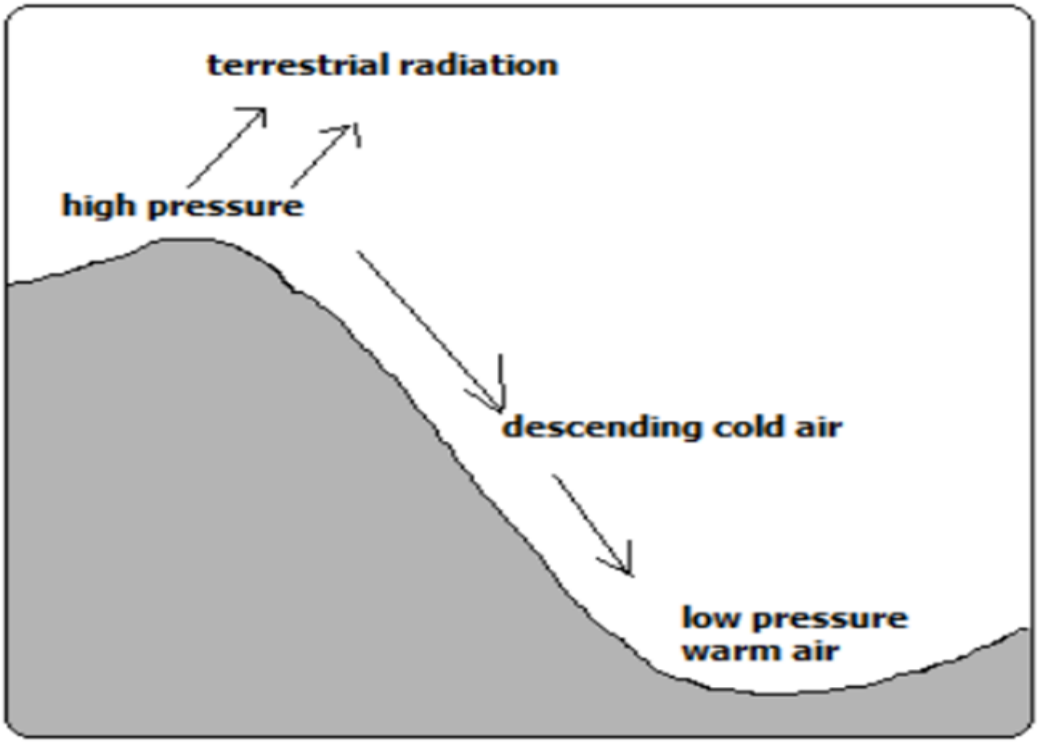


FIGURE 22: DESCENDING WINDS

Cold local winds which blow from hill tops to the valley during the night.

- During the night hill tops lose heat faster than the valley.
- Air over the valley is warmed and rises.
- Cool air over the hill tops move to the valley by gravity to replace the risingair.

Effect on Weather

Takes chilly conditions on valley bottoms.

Learner's Short Notes

5. Harmattan Winds

N.E winds which originate from Sahara and blow across W. Africa between November and March taking dry conditions there.

6. Fohn Winds (Alps)

Local cold winds which slide down the leeward side of the mountain at high speed and are warmed producing a temperature rise.

Due to the high speed and temperature they are associated with wild fires.

They are known as Chinook in Rocky Mountains, Santa Anas in California and Mistral in France.

Factors influencing Wind Flow (Speed and direction)

1. Pressure Gradient

If the pressure difference between high and low pressure areas is high the winds blow at high speed (strong) but if it's low they blow at high speed (are gentle). distance between Places of High and Low Pressure if the high and low pressure areas are near each other winds blow at high speed but if distant from each other winds blow at low speed.

2. Rotation of the earth

Rotation of the earth deflects winds to the right in the N. hemisphere and to the left in the S. hemisphere.

3. Frictional Force

If the surface of the earth is rugged or has obstacles such as hills, mountains, valleys or vegetation the wind is blocked causing speed reduction and its direction of flow is also changed.

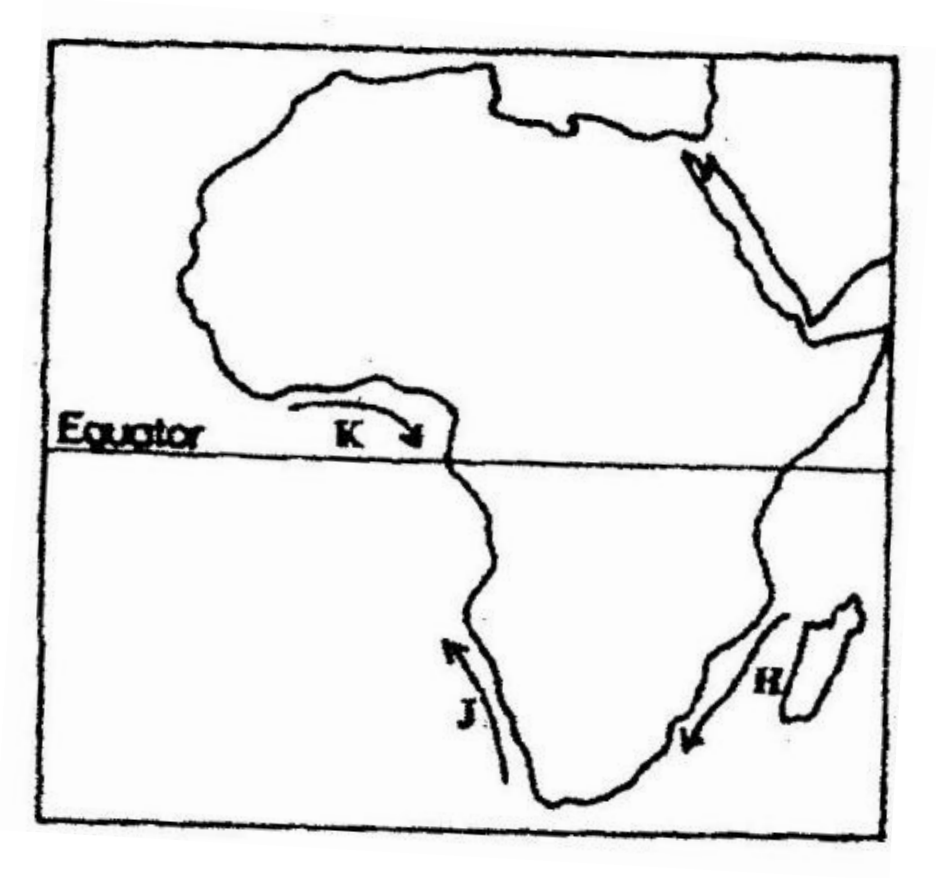
Learner's Short Notes

WEATHER

PAST KCSE QUESTIONS

1. (a) How does a sea breeze occur? (2 mks)

(b) Use the map of Africa below to answer questions (b) (i)



(i) Name the ocean currents marked H, J, and K (3 mks)

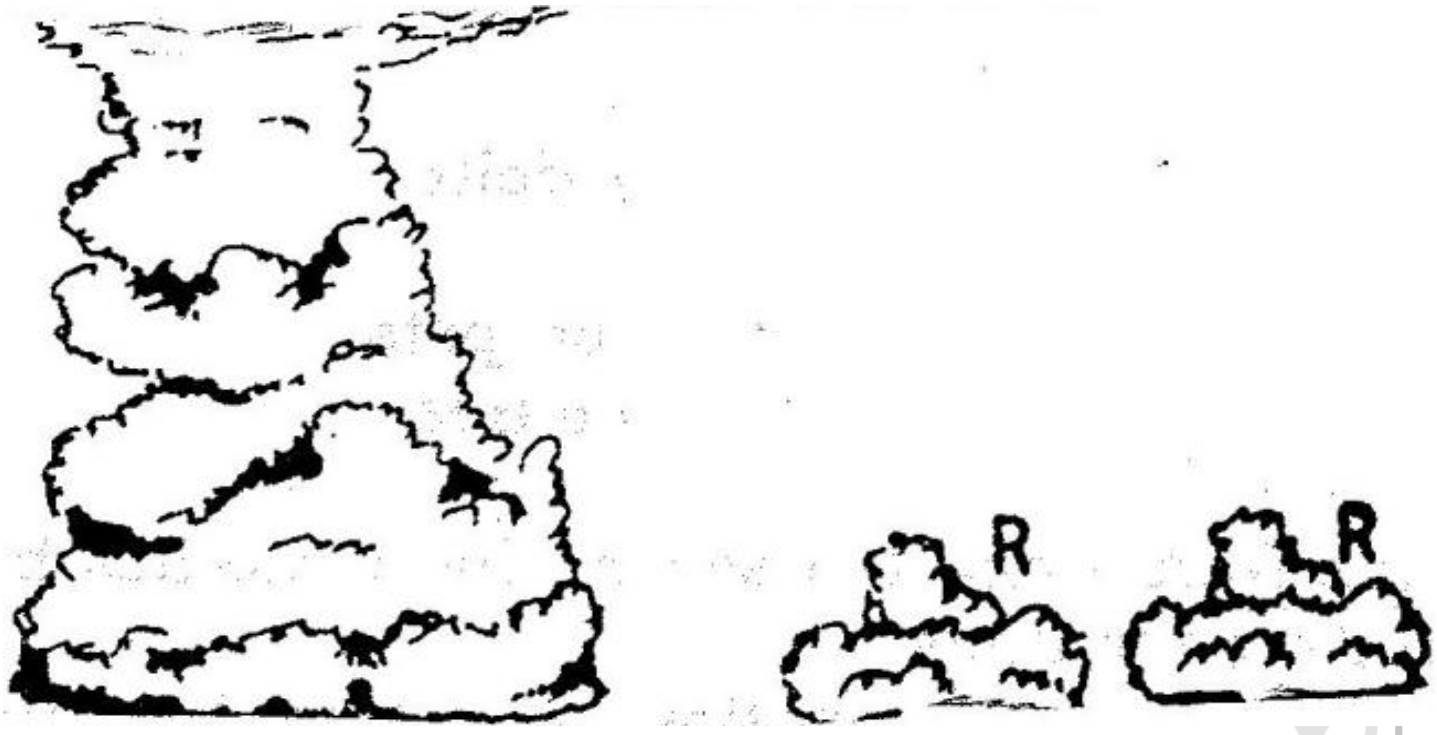
(ii) State two effects of a warm ocean current on the adjacent coastlands (2 mks)

2. (a) Name two theories of the origin of the earth (2 mks)

(b) Name four layers of the earth's atmosphere (4 mks)

3. (a) State two conditions that are necessary for the formation of fog.

(b) The diagram below shows some types of clouds. Use it to answer the questions that follow.



(i) Name the clouds marked R

(ii) Give two weather conditions associated with cumulonimbus clouds

4. a) the tables below represent rainfall and temperature of stations X and Y.

Use them to answer questions (a) and (b)

MONTHS	J	F	M	A	M	J	J	A	S	O	N	D
TEMPERA-TURE IN 0c	30	31	31	31	30	29	29	28	28	29	29	30
RAINFALL IN MM	250	250	325	300	213	25	25	25	100	275	380	200

MONTHS	J	F	M	A	M	J	J	A	S	O	N	O
TEMPERA-TURE IN 0C	21	20	20	17	15	13	12	13	15	16	18	20
RAINFALL IN MM	12	12	15	50	90	110	87	87	50	35	20	15

a) (i) For each of the two stations calculate the mean annual temperature.

X -

Y -

(ii) Calculate the annual rainfall for station Y

(iii) On the graph paper provided, draw a bar graph to represent rainfall for station x. Use vertical scale of 1cm to represent 50mm

b) Describe the climatic characteristics of station Y.

5. a) The table below shows climatic data of a station in Kenya.

Use it to answer question (a)

Month	Jan	Feb	Mar	April	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Temp in oC	28.9	29.7	30.3	29.9	29.7	29.2	28.4	28.7	29.6	30.1	29.2	28.7
Rainfall in mm	9.0	8.0	21.0	49.0	25.0	9.0	20.0	10.0	4.0	10.0	17.0	11.0

i) What is the annual range of temperature at the station?

ii) Calculate the total rainfall for the station.

b) State three factors that influence climate.

6. (a) Name two elements of weather that can be recorded at a school weather station

(b) Give three reasons why the recording of data at a school weather station may be inaccurate

7. (a) Describe a suitable site where you would locate a weather station in your School (2 mrks)

(b) Give reasons why a Stevenson's screen is:

(i) Painted White (2 mks)

(ii) Has louvers (2 mks)

8. Define relative humidity. (2 mks)

9. (a) Identify four characteristics of convectional rainfall. (4mks)

(b) State the difference between radiation fog and advection fog. (4mks)

10. (a) Briefly describe how the six thermometers operate. (5mks)

(b) Three ways in which clouds are classified. (3mks)

11. (a) Give three precautions to be taken when citing a weather station. (3mks)

(b) State three factors determining the amount of solar radiation reaching the earth's surface. (3mks)

12. Define the following terms:

(i) Climate

(ii) Relative humidity

(iii) Weather forecasting

(iv) Absolute humidity

(v) Weather lore (5mks)

13. State the advantages of studying weather through field work. (5mks)

14. (a) Describe how you would use the following apparatus during a field study.

Rainfall, maximum and minimum thermometers. (3mks)

(b) Identify and explain the formation of the type of rainfall found in the Lake Region or Kenya. (8mks)

(c) Briefly write down two problems associated with the type rainfall above. (4mks)

15. (a) What is weather forecasting? (2mks)

(b) List four problems of weather forecasting. (4mks)

(c) State four ways in which weather forecasting is important to the human activities. (4mks)

16. (a) Explain three ways in which clouds influence weather. (3mks)

(b) Use the data below to answer questions that follow.

Month of the year	J	F	M	*A*	M	J	J	A	*S*	O	N	D
Temp in *°C*	25	26	26	24	23	22	21	21	22	22	22	22
Rainfall in mm	42	40	73	171	90	89	163	160	71	68	64	42

(i) Calculate mean annual temperature

(ii) Calculate annual rainfall

(iii) Calculate annual range of temperature.

(iv) Calculate the mean annual rainfall

(v) Which is the wettest month? (10 mks)

17. (a) Define 3 air mass. (2mks)

(b) Name types of air masses. (3mks)

(c) A mass of air at 15°C can hold 20gm/cm3 of moisture. The same air at the same temperature has 6gm/cm3 of moisture. What is its relative humidity? (4mks)

18. Name two instruments placed in the Stevenson Screen. (2mks)

19. Why does sea breeze flow at night time? (3mks)

MARKING SCHEME TO PAST KCSE QUESTIONS ON WEATHER.

1. (a) During the day the land heats faster than the sea.

• The air over the land rises

• Cooler air from the sea blows towards the land to replace the rising air

• The cool air from the sea is called sea breeze

(b) (i) H- Mozambique, J - Benguera

(ii) Raising temperature Causes rainfall

2

- Troposphere
- Stratosphere
- Mesosphere
- Ionosphere

3. (a)

• Air must have abundant moisture.
• A cloudless night to facilitate terrestrial radiation.
• Air should be calm to remain in contact with the ground in order to be cooled.
• There should be gentle air currents to hold water droplets in suspension.
• The air must be cooled below dew point.

(b) (i) R - cumulus

4. (a)

(i) X - 3°C

Y - 9°C

(b)

(i) 583 mm

(ii)

• Sea make water is heated intensely by solar radiation.
• Heating is intense in the afternoon
• Warm moisture laden air rises and condenses at higher altitude.
• Condensed water vapour forms cumulonimbus clouds.
• Clouds eventually give rain accompanied by thunderstorm.

5. (a)

(i) 30.3 - 28.4 =1.9°C

(ii) 9.0 + 8.0 + 21.0 + 49.0 + 25.0 + 9.0 + 20.0+10.0 + 4.0+10.0+17.0+11.0 =1930 mm

(b)

• Altitude - High altitude areas have low temperature and low
pressure. Temperature varies with height because air is heated from below.
• Winds transfer heat from one place to another causing changes in temperature.
• Latitude influences climate such that areas near equator are warmer.
• Aspect influences climate as south facing slopes in the northern hemisphere are warmer than north facing slopes in the same.
• ITCZ- zone of low pressure which migrates North and South equator affects rainfall.

6. (a)

- Sunshine
- Rainfall
- Wind
- Cloud cover
- Air pressure
- Humidity

7. a)

- Open area free of shade by trees and buildings.
- Gentle land free of flooding
- Area with wide view of surroundings.
- Away from concrete surfaces.

b) Reasons why Stevenson screen is;

• Painted white - can reflect direct heat from the sun.
• Louvred on sides - To allow free flow of air and regulate temperature.

8. Relative humidity refers to the ratio between water vapour actually present in the air and its capacity to hold water vapour at a given temperature.

9. (a)

• It's heavy and torrential/falls in large drops.
• Usually accompanied by lighting and thunderstorms
• Falls mainly in the late afternoon
• It's highly localized and lasts for a short while (15-20 mins)

(b) Radiation fog forms when air in contact with the ground is cooled through terrestrial radiation while advection fog forms when warm moist air is cooled as it passes over cool surface e.g. land/sea.

10. (a)

• When the temperature rises, the alcohol in the left hand column expands and pushed the mercury column. The mercury in turn pushes the mercury in the right hand column and steel metal index up.

• The maximum temperature is shown by the end of the index pushed by the mercury.

• When the temperature falls, alcohol in the left hand column contracts and pulls the index along the tube. When the temperature rises, the alcohol expands leaving behind the index. Then the minimum temperature is read.

(b) • According to the altitude of their bases.

• Their appearance/structure
• Their formation

11. (a)

- It should be in an open place with free flow of air.
- Away from barrier e.g. trees
- Should be on a fairly level ground.
- The site should be free from flooding
- The site should provide a wide view of the surrounding landscape and the sky.

(b)

• Intensity of the sun's radiation in space the average distance from the sun.
• The transparency of the atmosphere
• Position of the earth in its orbit
• The area and nature of the surface on which the rays fall.

12. Climate It's the average weather condition of a given place over a period or time usually (30-35 years)

Relative humidity Refers to the ratio between water vapour actually present in the air and its maximum capacity to hold water vapour at a given temperature.

Weather forecasting it's the prediction of the weather situation for a given place within a given period of time e.g. hour, a day, a week.

Absolute humidity It is the total amount of water vapour that a given volume of air can -hold.

Weather lore Refers to a body of traditional facts and beliefs relating to weather e.g. a halo around the moon, croaking of frogs, a rainbow, migration of birds

13.

• The students are able to relate what they have learnt in class to the real environment hence making geography real and interesting.

• It breaks the class monotony.

• It enables learners to develop skills or observation measurement, recording and analyzing data.

• It improves the visual memory through observation.

14. (a) • Rain gauge

• The rain gauge is kept in an open space in the weather station from above. Its raised to avoid splashes from entering into the gauge.

• The water collected is emptied into the measuring cylinder every 24hrs.

• Take readings on the measuring cylinder.

• This cylinder is graduated in mm and the level the water emptied reaches gives us the reading amount of rainfall for the day.

• Record the readings and interpret.

• A maximum and minimum thermometer

• When the temperature rises, alcohol in the left hand column expands and pushes the mercury column and maximum temperature is read.

• When the temperature rises, alcohol in the left hand column contracts and pulls the index along the tube and the minimum temperature is read from the upper end of the index.

• After recording the reading, the thermometer is reset using a magnet.

• Interpret the readings.

(b) (i) Convectional rainfall

Its formation

• The intense heating from the sun results into warm air rising in form of convectional currents.

• The rising air reaches the high atmosphere and moisture in it condenses. Forms clouds and falls rain.

• It falls in the late afternoon accompanied lighting and thunderstorms.

(c) **Problems**

• Lightening and thunderstorms which are destructive to life and property.

• The torrential/large drops which are harmful to the crops and other vegetation.

• The hailstones also are destructive to the crop leaves.

15. (a) • Weather forecasting

• Weather forecasting is the prediction of weather conditions

(b) (i) Problems of weather forecasting

• Inaccurate data

• Defective instruments

• Personnel with limited skills

• Vagaries of nature such as earthquakes

(ii) • Determines times for sea and air travel.

• Determine time when sporting activities take place.

• Determines the fishing activities and habits in the area.

• Help determine suitable clothing for the day.

• Help plan farmers calendar of activities.

• Help plan suitable housing.

16. (a) How clouds influence weather.

• Clouds determine the amount of solar radiation reaching the earth's surface and the amount leaving the earth's surface. This determines temperature conditions.

• Day temperatures are moderated by clouds.

• Areas of thick rain clouds have high rainfall.

(b) (i) Mean temperature $^{-276}/_{12} = 23°c$

(ii) Annual rainfall 1073 mm

(iii) Annual range of temperature 5°C

(iv) Mean rainfall - 1073 mm

(v) Wettest month - April

NB. MUST SHOW WORKING!

17. (a) Large volume of air with uniform temperature and humidity and flow over considerable distance

(b) • Equatorial air mass

• Tropical air masses

• Polar air masses

• Arctic and Antarctic air masses

(c) 15° - $20g/cm^2$

$6g/cm^3$ =?

RH /Max= A.H x 100% = 6/20 x 100= 30%

18. (a) A thermometer/ maximum/ minimum/ six thermometer Hygrometer/wet and dry bulb thermometer.

19. • At night, land looses heat faster than sea.

• Air upon land becomes cooler and heavier than that upon the sea.

• The relatively warmer air upon the sea is lighter and therefore it rises while the cooler heavier air at the land flows towards the sea to replace the warm rising air.