2.4 WEATHER

Weather: the condition of the atmosphere at a given time and place.

Stevenson screen

- Used to measure shade temperature of air.
- Instruments kept inside it: maximum-minimum thermometer (Six's thermometer), and a wet- and dry-bulb thermometer (hygrometer), barometer.
- Instruments kept outside: rain gauge, wind vane (to determine wind direction), anemometer (to assess wind speed).

Features of stevenson screen (to ensure information collected is reliable)

- Slatted sides: to allow free entry of air; ventilation.
- Roof made of double boarding (insulated roof): to prevent sun's heat from reaching inside the screen.
- Made from wood: so it does not absorb/conduct heat.
- Outside painted white: to improve insulation by reflecting the sun's rays.
- Above ground level; on legs (1.25 - 2m): To not be affected by ground temperature.
- Placed on grass-covered surface: to reduce radiation of heat from the ground.
- Doors open away from the sun (to the north in the northern hemisphere and to the south in the southern hemisphere): to avoid sun's rays.
- Gently sloping / flat land

Ideal location of stevenson screen

- In the open, away from buildings; so it's not affected by heat from buildings.
- Away from trees; so that it is not sheltered / in the shade.
- On grass; to reduce radiation of heat from the ground. Grass does not absorb heat.
- Away from the general public OR security and fence around; to avoid tampering and vandalism.
- Doors open away from the sun; to reduce radiation.

Why are instruments used to collect information about temperature and humidity kept inside the Stevenson screen?

- Protects them from direct sunlight; the screen reflects sunlight.
- Screen does not conduct heat.
- Not affected by wind; but get enough ventilation.
- Conditions of air can be measured without being affected by ground radiation.
- They are a standard height above the ground, so are not affected by concrete.
- They are protected from tampering by animals and people.

Measuring temperature - Maximum-minimum thermometer (Six's thermometer)

Maximum temperature

- When the temperature rises, the alcohol in the left bulb expands, pushing the mercury along with the index, down, and upwards into the right bulb. (NOTE: bulb in RHS has vacuum, so the alcohol on this side expands and fills the vacuum).
- This index mark gives the maximum temperature.
- When the temperature falls, the mercury contracts but the index stays where it was pushed by the mercury (remains in the right bulb).

Minimum temperature

- When the temperature falls, the alcohol in the thermometer contracts, creating a vacuum space in the left bulb, which pulls the index upward in the left bulb.
- This index mark gives the minimum temperature.

The indices are brought back to the mercury by a magnet for measuring the next reading.

Measuring rainfall - rain gauge

Ideal location of rain gauge

- Open space; so that only raindrops enter the funnel.
- Away from buildings and not covered by trees; so that no runoff from trees, buildings, etc can get into the funnel.
- It is sunk into the ground so that the top of the funnel is about 30 cm above ground level; to prevent sun's heat from evaporating any water collected and to ensure no rain splashes up from the ground into the funnel.

How amount of rainfall is measured using a rain gauge

- Should be partially sunk into the ground.
- It has a collecting jar with a funnel.
- Rain falling over the funnel collects in the jar.
- Take measurements every 24 hours or at the same time everyday. (since small amounts of dew may accumulate in the gauge, leading to false readings when it actually rains).
- Pour water into a measuring cylinder (tapered), and read off in millimetres.
- Empty the water or replace the collecting jar.

Measuring relative humidity - Wet- and dry-bulb thermometer (hygrometer)

- **Dry-bulb:** glass thermometer that records actual air temperature.
- **Wet-bulb:** glass thermometer with bulb enclosed in muslin bag dipped in water

How relative humidity is measured

- Observe both wet- and dry-bulb temperatures, at set times each day.

- Work out the difference between these temperatures (dry-bulb - wet-bulb temperature). Wet-bulb temperature is generally lower than dry-bulb temperature (unless relative humidity is close to 100%).
  If humidity of surrounding air is high, evaporation rate is low, and temperature of thermometer is high. When rate of evaporation is high, it cools down thermometer.
- Use a relative humidity table.
- Read off the value where the difference between wet-bulb and dry-bulb temperatures intersects with the dry-bulb temperature.

Measuring air pressure - barometer

Measuring wind direction - wind vane

How it is used

- Consists of an arrow with compass points around.
- Observe the direction in which the arrow is pointing.
- Arrow points to the direction the wind is flowing from.
- Observe at regular intervals / set times.

Measuring wind speed - anemometer

How it is used

- Cups which catch wind rotate.
- Stronger the wind, faster the rotation.
- Observe figures on the electronic display.
- Number of rotations is recorded on a metre to give the wind speed in km per hour.
- Observe at regular intervals / set times.

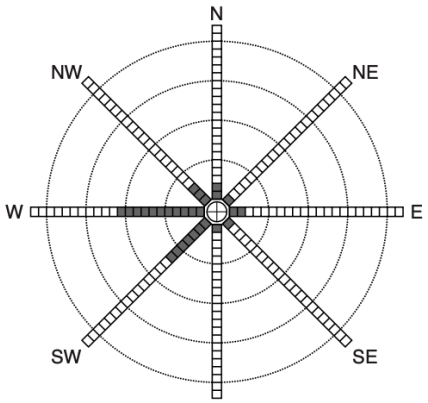
Ideal location of wind vane and anemometer

- On a roof/ on top of a pole
  - So it's higher than surrounding buildings/features.
  - So that wind will not be blocked.
  - So that it is not tampered with.
- Away from buildings or trees
  - They may interfere with free movement of air.
  - So that it is not sheltered by trees/buildings.

Recording results

- Winds are shown by arrows on a weather map.
- Shaft of the arrow shows wind direction; feathers on the shaft indicate wind velocity.
- Wind direction of a specific place can be shown on a wind rose
  - Direction of the rectangles represent compass points

- Length of the rectangles signify the number of days/times the wind blows from that direction.
- Number of days/times when there is no wind is recorded in the centre.



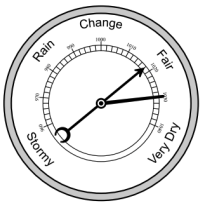
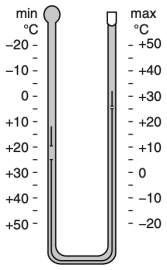
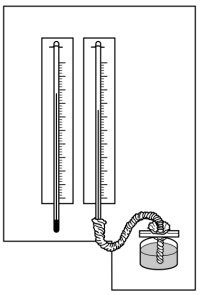
Wind rose

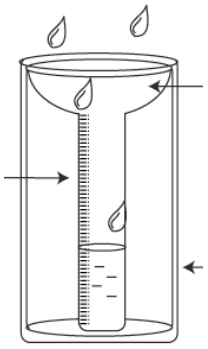
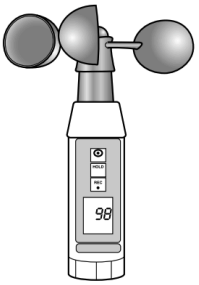
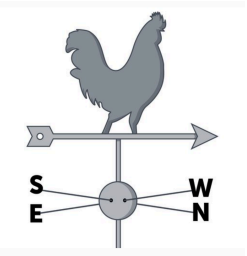
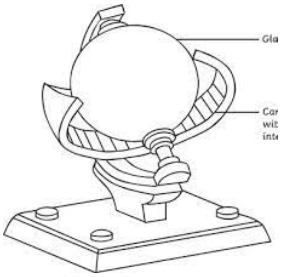
Measuring sunshine hours - Sunshine recorder

- Consists of a glass sphere partly surrounded by a metal frame.
- A strip of special card divided into hours and minutes is placed below the sphere.

How it is used

- Insert or replace the card.
- Leave for a set period of time (eg. 24 hours).
- When the sun shines, the sphere focuses the sun's rays on the card.
- As the sun moves, the rays burn a trace on the card.
- At the end of the day, the card is removed and replaced.
- Observe length of burn line on card; this represents the amount of sunlight the location receives.

			
Stevenson screen	**Barometer**	**Six's thermometer**	**Wet and dry bulb thermometer**

			
Rain gauge	Anemometer	Wind vane	Sunshine recorder

Advantages of using digital instruments rather than traditional ones

- Easy & quick to read
- More accurate
- Collects data automatically
- Collects data continuously
- Less chance of human error
- Provides immediate results

Clouds

Cumulus	**Stratus**	**Cirrus**
- Middle level - Puffy (like cotton wool) - White - Flat base - Broken up (discontinuous)	- Low level; not at high altitude. - Complete cover; fills most of the sky; sunlight can't get through. - Grey - Likely to bring rain.	- High level - Wispy/feathery - Long and thin - Formed of ice crystals

Cloud Cover

The amount of cloud covering the sky. It is measured in oktas (eighths).
Eg. the sky has 4/8 cloud cover.

How can cloud type and amount be recorded over a period of time

- Observe clouds in the sky or look at photographs, for set times of the day.
- Identify the type using diagrams, by considering vertical extent, shape, colour, etc.

- Estimate the number of eighths of sky which is covered by clouds; or use a transparent grid divided into sections.
- Repeat every day at the set times.
- Record the cloud type and cover results on a chart.
- Record cloud cover in oktas.

Why do places with equatorial climates have more clouds than deserts?

- Air is always rising near the equator (air is always descending in deserts).
- Low pressure at equator (high pressure in deserts).
- Large amounts of evaporation at equator (less in deserts).
- Large amounts of transpiration at equator (less in deserts).
- Deserts are more distant from water bodies.
- Winds to deserts are more likely to have blown over large areas of land.

What are the processes that result in large amounts of clouds forming in equatorial areas?

- Heating
- Evaporation
- Transpiration
- Water vapour rises
- Cooling
- Condensation
- Saturation
- Convection