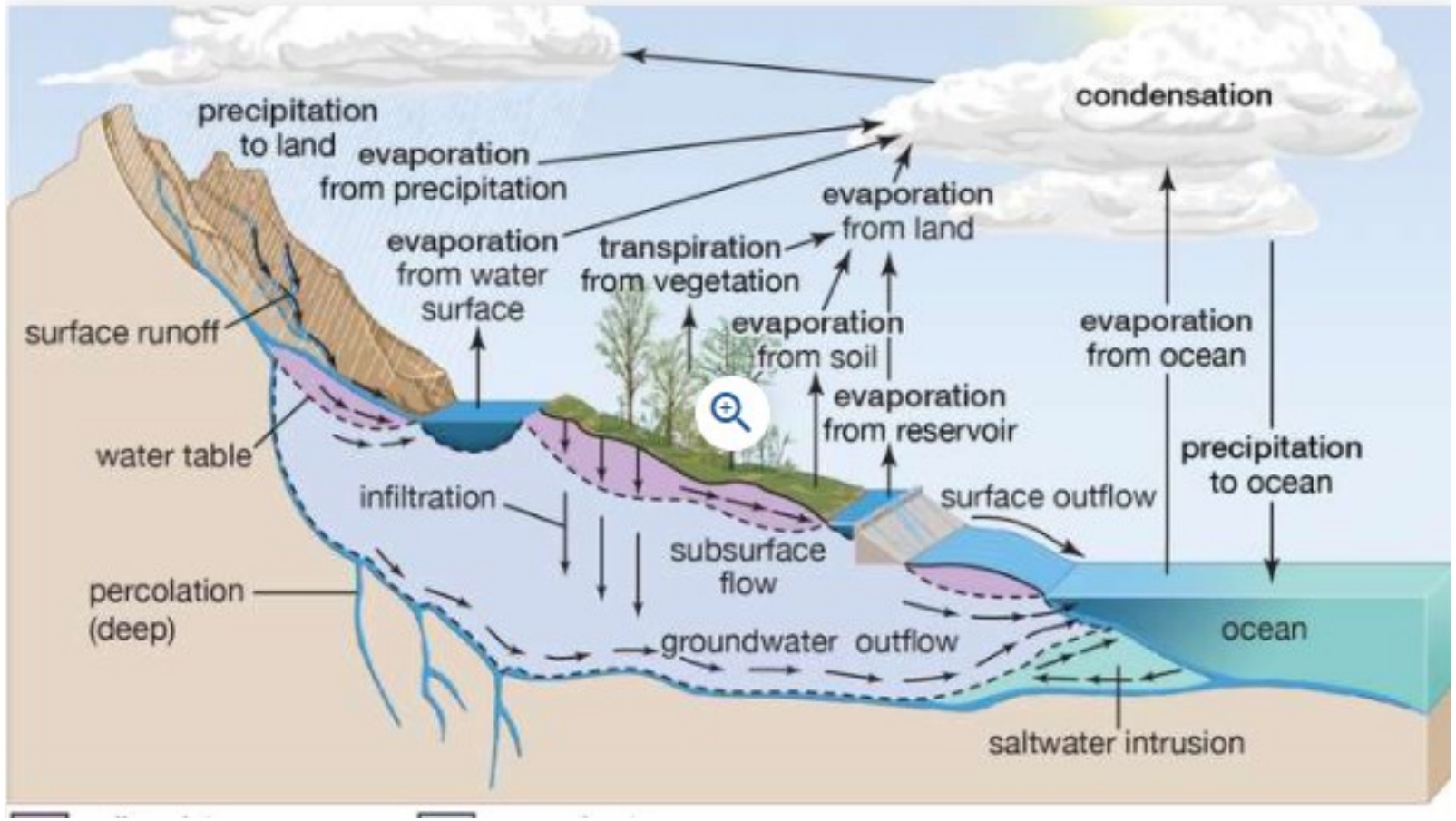
# Module:1 Introduction

# Hydrologic Cycle

- The hydrological cycle is the system which describes the continuous movement of all forms of water between earth and its atmosphere.



# Major process of hydrological cycle

- Evaporation
- Transpiration
- Condensation
- Precipitation
- Infiltration & Run-off

# Evaporation

- Evaporation is the change of state of a substance from a liquid to a gas.
- Water is continuously evaporating from the surface of the earth, literally pumping more and more water vapour into the atmosphere.
- Evaporation takes place in both sea and land surface where the sun is the most important factor determining the rate of evaporation.

# Transpiration

- Transpiration is the process where plants absorb water through the roots and then gives off water vapour through the pores called stomata.
- Of the transpired water passing through a plant, only 1% is used in the growth process of the plant. The remaining 99% is passed into the atmosphere.

# Condensation

- Condensation is the process whereby water vapour in the atmosphere is changed into a liquid state. In atmosphere condensation may appear as cloud or dew.
- In Hydrological Cycle, it refers to water being cooled at a high altitude where the temperature is low enough for the formation of cloud.

## Precipitation

- Precipitation is the result when the tiny condensation particles grow too large. Water released from clouds in the form of rain, freezing rain, snow, or hail.
- It is the primary connection in the water cycle that provides for the delivery of atmospheric water to the earth.

## Infiltration

- The flow of water from the ground surface into the ground. Once infiltration, the water becomes soil moisture or ground water.

# Runoff

- Runoff occurs when there is excessive precipitation and the ground is saturated.
- River and lakes are result of runoff. There is some evaporation from runoff into the atmosphere but for the most part water in rivers and lakes return to the ocean.

# Global Water Budget

- The global water budget takes into account all the water that is held in stores and flows of the global hydrological cycle
- This is the average time a molecule of water will spend in one of the stores. Residence times vary from 10 days in the atmosphere to 3,600 years in the oceans and 15,000 years in an ice cap.
- Water Budget means – the balance between the available water in the country and the water under use. Hence, it is balance between the accessible water and the water under utilization.

# Analysis of Water Budget

- Water budget analyses represent an environmental systems approach to the hydrological cycle, with emphasis on the transport, storage and utilization of water at the Earth's surface.
- The geographical scales of analyses range from global water budgets down to studies of the income, outflow and storage of water from small tanks set in the soil. known as lysimeters or evapotranspirometers.

# ANNUAL WATER BUDGET OF PLANET EARTH

| Sl. No. | No. of Particulars | Water in cubic kms |
|---|---|---|
| | | |
| 2 | Total evaporation from land surface | 72500 |
| | | |
| 4 | Total precipitation on land surface | 113500 |
| | | |
| 6 | Total evaporation from land and sea surface | 525100 |
| | | |

# History of Hydrology

- Hydrology has been a subject of investigation and engineering for millennia.
- During 3000 BC groundwater through wells was known to the people of the Indus Valley civilizations as revealed by the archeological excavations at **MOHENJODARO**.
- The first description of the rain gauge and its use is contained in **ARTHASHASTRA** by **CHANAKYA** .
- **VARAHAMIHIRA**'s **BRIHATSAMHITA** contains descriptions of the rain gauge , wind vane and prediction procedures for rainfall.
- The knowledge of the hydrologic cycle came to be known to Europe around AD 1500.

**CHOW** classified the history of Hydrology into eight periods as –

- Period of speculation – prior to AD 1400.
- Period of observation – 1400 – 1600.
- Period of measurement – 1600 – 1700.
- Period of experimentation – 1700 – 1800.
- Period of modernization – 1800 – 1900.
- Period of empiricism – 1900 – 1930.
- Period of rationalization – 1930 – 1950.
- Period of theorization – 1930 – to – date.

# Scope of Hydrology

Hydrology is the science that deals with all aspects of the water available on the earth. The study of Hydrology basically involves:

- The maximum probable flood that may occur at a given site and its frequency. This is required for the safe design of dams , culverts , drains , reservoirs , channels and other flood control structures.
- The water yield from a basin – its occurrence , quantity and frequency etc. this is required for the design of dams , municipal water supply , water power , river navigation etc.
- The maximum intensity of storm and its frequency for the design of a drainage project in the area.
- The ground water development for which a knowledge of the hydrology of the area i.e. of the formation soil , recharge facilities like streams and reservoirs , rainfall pattern , climate , cropping pattern etc. are required.