Water moves and changes state

Solar energy supplies heat for evaporation; gravity drives falling precipitation and downhill flow. Water cycles as liquid, ice and vapor between interconnected stores.

1. CONNECT THE SURFACE AND ATMOSPHERE

Liquid water at a surface	**Evaporation** →	Water vapor in air
Water taken up by plants	**Transpiration** →	Water vapor from leaves
Water vapor	**Condensation** →	Liquid water droplets
Water in clouds	**Precipitation** →	Rain, snow, sleet or hail at the surface

2. KEEP THE PHASE CHANGES CLEAR

Melting changes ice to liquid water; freezing reverses it. Sublimation changes ice directly to vapor. Water vapor is invisible: visible clouds contain tiny liquid droplets, ice crystals or both. Condensation means gas to liquid, not water falling to Earth.

Evapotranspiration combines evaporation and plant transpiration. Roots take up water, it moves through the plant, and leaves release vapor. Water does not have to travel through every process in one fixed sequence.

Processes and phase changes: USGS, Glossary of Water Cycle Terms.
Plant pathway: USGS, Evapotranspiration and the Water Cycle.

Scope: College Board AP Environmental Science CED (2025), Topic 1.7, p. 42.

Stores are not the same as transfers

A reservoir or pool is a place where water is held. A transfer moves water between pools. The amount stored and the rate of movement are different quantities.

1. COMPARE THE MAIN WATER STORES

Oceans	The dominant surface reservoir; water is saline.
Ice sheets and glaciers	Frozen stores, much smaller than oceans; melting releases liquid water.
Groundwater	Water in saturated pores and rock fractures; aquifers store and transmit it.
Soil, lakes and rivers	Land-based stores linked by runoff, infiltration and groundwater flow.
Atmosphere and life	Water vapor in air; water also occurs in clouds and within organisms.

2. DISTINGUISH TWO PATHS AFTER RAIN

Runoff	Water flows over land toward streams or other low areas.
Infiltration	Water enters soil from the surface. Some stays as soil moisture.
Recharge	Some infiltrated water percolates deeper and reaches the saturated zone, replenishing groundwater.

3. GROUNDWATER CAN RETURN TO THE SURFACE

Groundwater can discharge into streams, springs and oceans. A stream may continue flowing between rainstorms because groundwater supplies part of its flow.

Reservoirs and drivers: College Board, ERT-1.G; USGS, Water cycle.
Infiltration, recharge and stream supply: USGS, Infiltration and the Water Cycle.

Scope: College Board AP Environmental Science CED (2025), Topic 1.7, p. 42.

Land cover changes the water pathway

Application link: the same rainfall can follow different routes depending on soil, vegetation, slope and built surfaces. Water quantity, timing and quality all matter.

1. COMPARE TWO LAND SURFACES

Vegetated, permeable land

Water can enter the soil. Plant cover can slow runoff; some soil water returns to air through evapotranspiration.

Pavement and roofs

Less water enters the covered soil. More can reach drains and streams rapidly, increasing peak runoff and flood risk.

These are typical tendencies, not fixed percentages. Intense rain, saturated soil and compaction can also increase runoff.

2. PUMPING CAN LOWER GROUNDWATER STORAGE

Withdrawing groundwater persistently faster than it is replenished can lower the water table. This can reduce well yields and groundwater discharge to streams. Water is renewable through the cycle, but a particular aquifer may refill slowly.

3. TRACK INPUTS, OUTPUTS AND STORAGE

Change in stored water = inputs - outputs

Illustrative example: a lake receives 10 water units and loses 7 over a stated period. Storage rises by 3 units. Count inflows and rainfall as inputs; include outflow and evaporation as outputs. These invented numbers show the balance, not real measurements.

Land-cover effects: USGS, Infiltration and the Water Cycle.
Over-withdrawal: USGS, Groundwater Decline and Depletion.

Scope: College Board AP Environmental Science CED (2025), Topic 1.7, p. 42.