Backyard STEM

Ecosystem in a Bottle

Exploring the Water Cycle with a Terrarium

Goals:

⇒ Be able identify components and processes of the water cycle.

⇒ Describe the water cycle as it occurs in the terrarium.

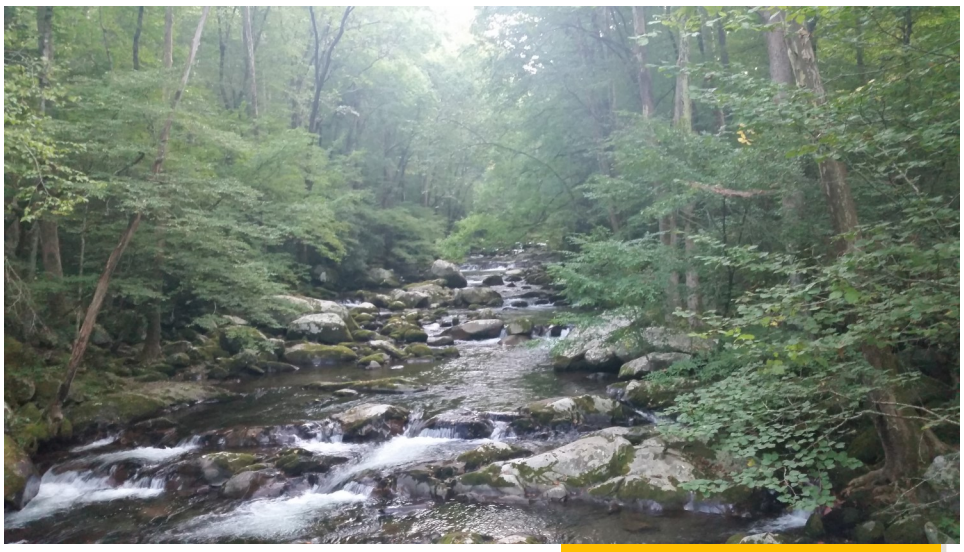
Words to Explore:

⇒ Water cycle
⇒ Watershed
⇒ Terrarium
⇒ Runoff
⇒ Infiltration
⇒ Interception
⇒ Sublimation

Add Tech:
Visit the link below for an interactive web application.

http://sciencelearn.org.nz/Contexts/H2O-On-the-Go/Sci-Media/Animations-and-Interactives/Dynamic-and-complex-the-global-water-cycle

Water is the most recyclable resource we have on planet earth.



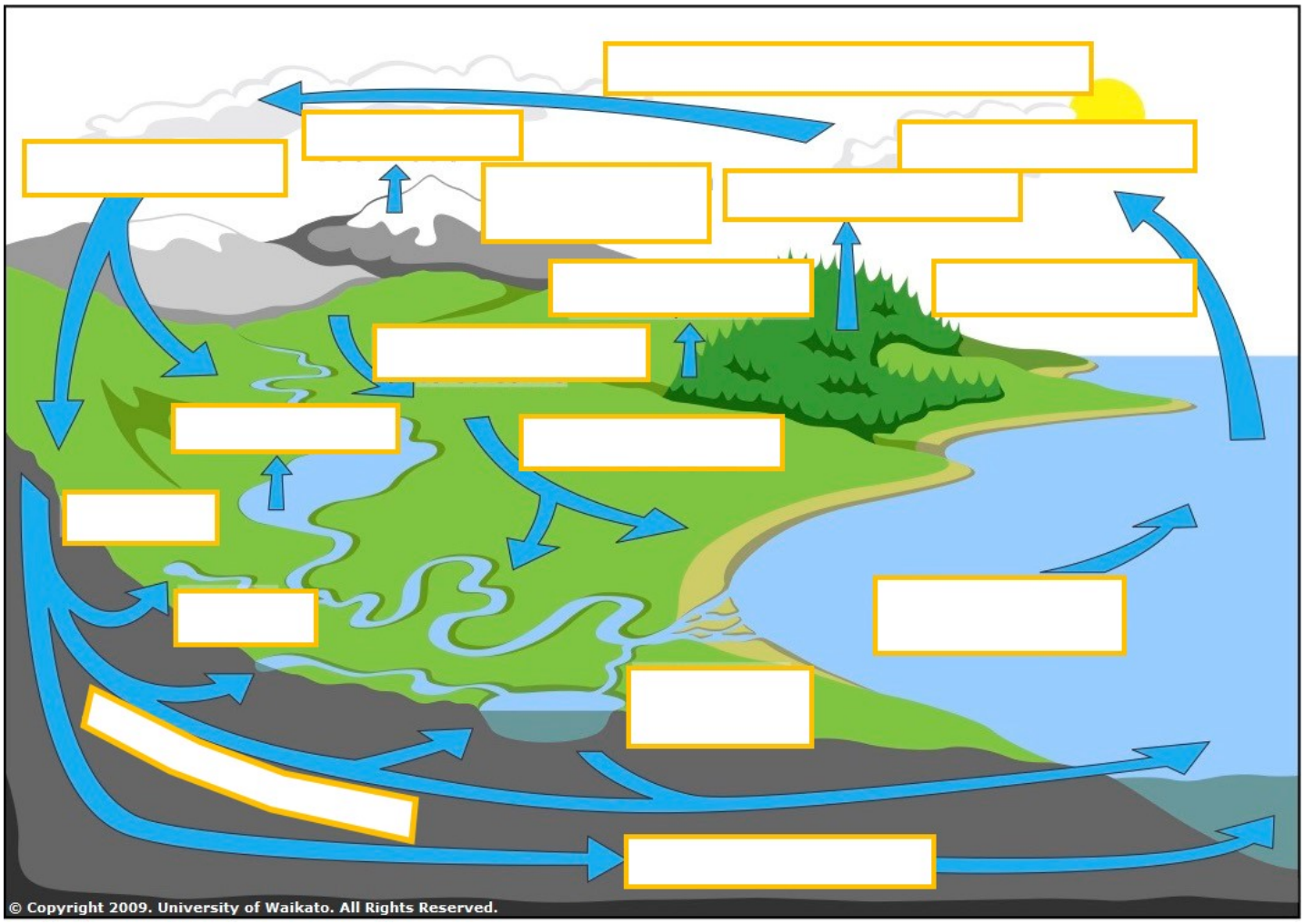
The water cycle describes the existence and movement of water on, in and above the earth. Water is always in movement, changing states from liquid to vapor to ice and back again. The water cycle has no starting point, but the sun drives the cycle as the external energy source. The sun heats up the water in oceans, which cover s over 70% of earth surface and make up over 97% of water volume on earth. Some of the water evaporates as vapor into the air; a smaller amount of vapor is created from snow and ice through sublimation—or the movement of water directly from a solid state into vapor. Rising air currents take vapor into the atmosphere to combine with water that has gone through transpiration, which means it was transpired from plants. Temperatures in the atmosphere vapor to condense into clouds.

Did you know?
The word "terrarium" comes from 19th century modern Latin, where "terra" means earth.

Air currents move clouds around, causing them to collide, grow and then fall as precipitation. Some precipitation falls as snow and can accumulate in ice caps or glaciers, which can store frozen water for thousands of years. Some precipitation in the form of rain is intercepted by plant leaves, a process called interception. Of the precipitation that makes it to the earth surface, some infiltrates into the ground and replenishes aquifers, which store large amounts of water for long periods of time. Some infiltrated water stays close to the land surface and can seep back into surface-water bodies as groundwater discharge. Groundwater is also absorbed by plant roots to end up as evapotranspiration from leaves. Over time, all of this water keeps moving, some to re-enter the ocean, where the water cycle begins again.

Credits: Andrea Ludwig and Jennifer DeBruyn

Fill in the orange boxes in the water cycle diagram below. Use the word bank to help identify the water cycle components and processes at work in the biosphere.



Word bank: Surface Runoff, Freshwater Storage, Ocean Storage, Atmospheric Storage, Spring, Groundwater discharge, Infiltration, Interception losses, Transpiration, Evaporation, Ice and Snow Storage, Condensation, Sublimation, Precipitation, Evaporation, Groundwater Storage, Snowmelt.

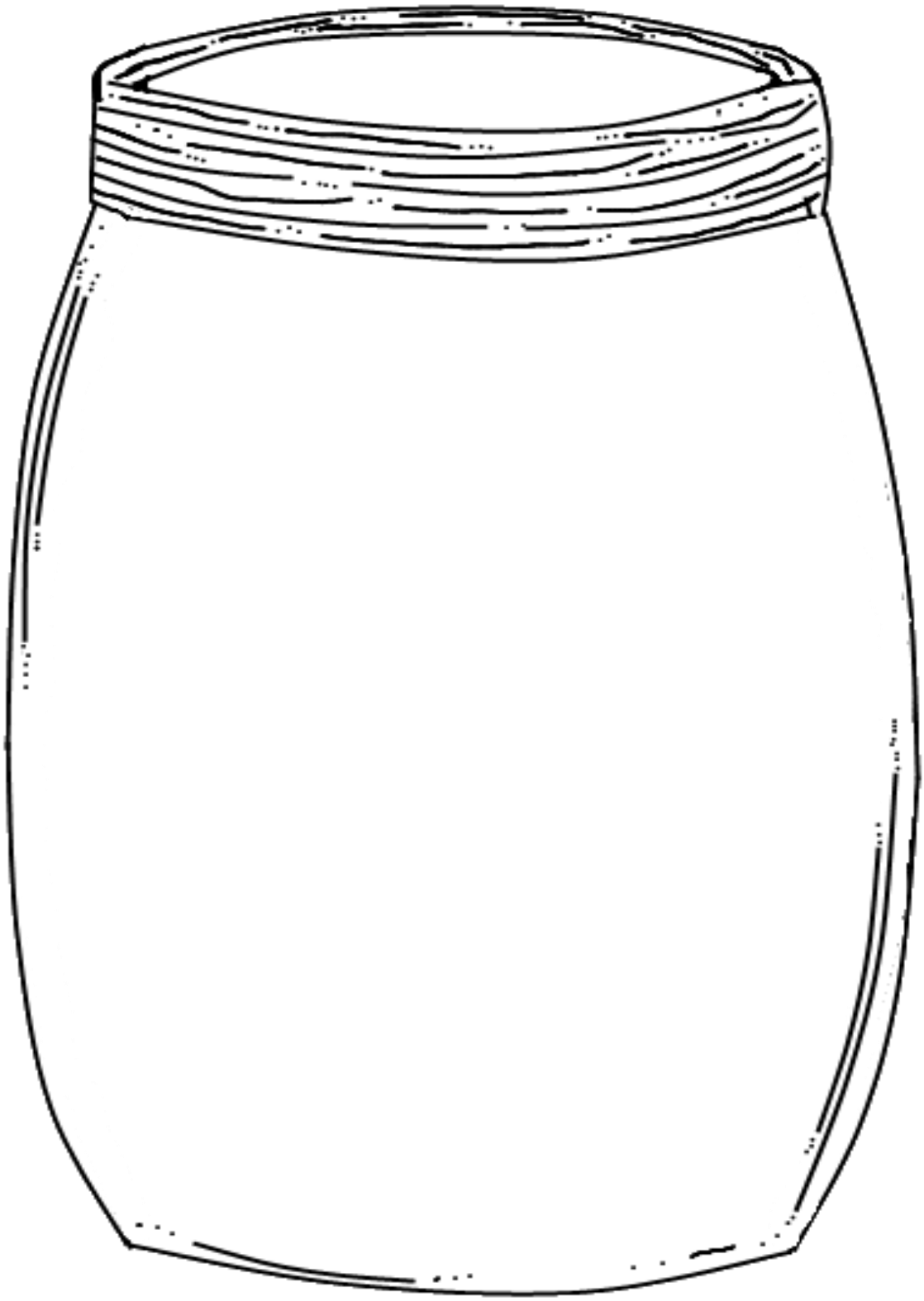
Observe: On your way home today, how many of the water cycle components or processes do you see? List them below.

Activity: Make a Terrarium!

Draw your terrarium below and label the parts of the water cycle that is happening in the ecosystem in a bottle. Be sure to use at least these components/processes: infiltration, precipitation, condensation, groundwater storage, transpiration, evaporation, interception.

Materials:

- ⇒ Clear glass jar with lid
- ⇒ Moss
- ⇒ Rocks/gravel
- ⇒ Sand
- ⇒ Topsoil/potting soil
- ⇒ Small plants
- ⇒ Calculator



Make a Water Cycle Bracelet

Take a piece of elastic cord and create the water cycle using the different colored beads to represent a component or process of the water cycle. Begin with the sun and complete the water cycle with enough beads to make a full bracelet.

Sun/Evaporation	Yellow/Orange
Condensation	Clear
Clouds	White
Precipitation	Light blue
Plants/Transpiration	Green
Soil	Brown
Rivers	Dark Blue
Ocean	Teal

Water Cycle Calculations:

1. **If it rained 5.5 cm over a 100 m^2 grass field and 0.5 cm of water was evapotranspirated by the grass, then how much water volume left the field as runoff assuming that 50% (or half) of the remaining water infiltrated into the soil?**
2. **If a glacier is retreating (e.g. melting) at a rate of 50 m/yr (in length and width) and thinning at a rate of 2 m/yr, how much water is being returned as liquid to the oceans assuming water expands by 10% when frozen?**
3. **If annual precipitation is 40 cm in a watershed of 2.5 km^2 and losses due to interception and evapotranspiration were a total of 0.01 cm/d, what is the total water volume that will either infiltrate or runoff?**
4. **If it rains at an intensity of 20 cm/min and the infiltration rate of the soil is 0.1 cm/s, will runoff occur?**

Reflection

Observe the terrarium over time. Take a photograph every day to help evaluate plant growth over time. Or use a rule to measure stalk height over time. How fast is the plant going?

Look at the top of the glass container. Is there condensation accumulating on the lid? What is driving the water cycle in the terrarium? What are the potential losses of water? How often do you think you will need to add water to the container?

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