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| **Name:**  | **Date:**  |
| **Natural and Urban “Stormwater” Water Cycles Handout Answer Key****Instructions:** Before the teacher’s presentation begins, complete the left column by writing in your known answers or best guesses. During the presentation, complete the right column. After the presentation, compare the answers in your two columns. |
| **Slide #** | **Your Predictions** | **From the Presentation** |
| Slide 1Slide 2Slide 3Slide 4Slide 5Slide 6Slide 7Slide 8Slide 9Slide 10Slide 11Slide 12Slide 13Slide 14 | * Our planet is covered by water, an astonishing \_71\_\_ percent!
* If the world was uniform all the way around, water would cover the planet to a depth of \_\_2.6\_\_ km, (\_\_1.6\_\_ miles).
* It would take \_\_15.5 billion\_\_\_ years for that volume of water to go over the Niagara Falls. Our planet is \_\_\_4.54 billion\_\_ years old.
* It takes the average American\_\_7.5\_\_ years to use the amount of water that flows over Niagara Falls every second.
* \_\_\_2.5\_\_ % of the water on our planet is considered fresh water.
* \_\_\_1.7\_\_ % trapped as polar ice, \_\_0.76\_\_\_ % fresh groundwater, and \_\_0.1\_\_ % in the planet’s surface and atmosphere.
* That means ~\_\_131\_\_ gallons are available per person per day.
* Civil and environmental engineers design systems to pump water from \_\_surface\_\_ and \_\_groundwater\_\_ sources to water treatment facilities and then to our homes. It is their job to provide \_\_quality\_\_ drinking water and a sufficient \_\_quantity\_\_ of water.
* Civil and environmental engineers use the \_\_rates\_\_ of \_\_reaction\_\_ to design treatment systems and must understand the \_\_phase transformation\_\_ occurring as a result of the reaction, in order to provide water that is safe to drink and release back into nature.
* These engineers must have an -depth knowledge of the water cycle. List the different components of the water cycle:

\_\_\_\_\_\_evaporation\_\_\_\_\_\_\_\_\_\_\_\_ stormwater runoff\_\_\_\_\_\_\_\_\_\_\_\_condensation\_\_\_\_\_\_\_\_\_\_\_ groundwater flow\_\_\_\_\_\_\_\_\_\_\_\_precipitation\_\_\_\_\_\_\_\_\_\_\_\_ plant uptake\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_infiltration\_\_\_\_\_\_\_\_\_\_\_\_\_\_ transpiration\_\_\_\_\_\_\_\_\_\_* \_\_\_\_\_\_Evaporation\_\_\_\_\_\_\_\_\_\_\_\_\_: When water changes from a liquid to gas or vapor.
* Phase change: Heat from the sun creates energy that \_\_\_breaks\_\_\_\_ the bonds holding water molecules together.
* \_\_\_\_\_\_\_Condensation\_\_\_\_\_\_\_\_\_\_: When water vapor changes from gaseous state (vapor) to the liquid phase.
* Phase change: Evaporated water vapor condenses in the atmosphere due to \_\_\_\_lower\_\_\_\_\_ temperatures resulting from \_\_less\_\_\_\_ atmospheric pressure.
* Rate: On average, the residence time for moisture in the atmosphere is \_\_\_8.2\_\_\_\_\_ days
* A large cumulonimbus cloud can weigh as much as a 747 jumbo jet. So why does it not come crashing down to the ground? Answer: The rising air responsible for the cloud formation keeps the cloud \_\_floating\_\_ in the air because the air below the cloud is \_\_denser\_\_ than the cloud.
* \_\_\_\_\_Precipitation\_\_\_\_\_\_\_\_\_\_\_\_\_\_: Condensed water vapor that falls to Earth as rain, snow or hail.
* Phase change: Water molecules combine with tiny \_\_dust\_\_ particles that act as a nucleus to form cloud droplets. \_\_\_\_Millions\_\_\_\_\_ of collisions occur with other droplets until the mass of the droplet creates a fall velocity that is \_\_\_\_greater\_\_\_\_\_\_ than the cloud updraft speed, resulting in rain, snow or hail.
* \_\_\_\_Infiltration\_\_\_\_\_\_\_: Movement of water into the media layer.
* \_\_\_\_Percolation\_\_\_\_\_: Movement of water within the media layer.
* \_\_\_\_Media layer\_\_\_\_\_: The combination of inorganic and/or organic earth materials (for example, sand, soil, mulch, compost, limestone, granite, gravel).
* \_\_\_\_Stormwater runoff\_\_\_\_\_: The flow of rainwater that occurs as a result of the precipitation rate exceeding the soil infiltration and percolation rate or as a result of impervious surfaces.
* Also generated from \_\_impervious surfaces\_\_\_ such as roofs, roads, and sidewalks.
* Collects \_\_\_particulates\_\_\_, \_\_\_nutrients\_\_\_\_, and \_\_\_heavy metals\_\_\_\_ as it travels down the street and into the storm sewer.
* \_\_\_\_Groundwater flow\_\_\_\_\_\_\_: The lateral or horizontal flow of water beneath the ground surface.
* Groundwater levels are typically the surface level at which you can see water in a \_\_\_lake\_\_\_ or the level of a \_\_\_well\_\_.
* Storm water replenishes the groundwater table and underground aquifer through \_\_\_infiltration\_\_\_\_ and \_\_\_\_\_percolation\_\_\_\_\_ of water, which then flows to streams, lakes and wells.
* \_\_\_\_Plant uptake\_\_\_\_\_\_: The process of plants absorbing water and nutrients from roots in order to grow.
* Phase change: Plants use the energy from the sun (\_\_photosynthesis\_\_) and \_\_capillary action\_\_ to draw up water and nutrients andtransform inorganic nutrients into organic above-ground and below-ground biomass.
* \_\_\_\_\_Transpiration\_\_\_\_\_\_\_\_\_: The process by which plants release water into the air.
* In the fall, trees typically drop their leaves in order to \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_ conserve water by stopping the pathway for transpiration\_\_\_* As a result of transpiration, an acre of corn can give off\_\_\_\_3,000-4,000\_\_\_ gallons of water per day.
* As a result of transpiration, a large oak tree can give off \_\_\_\_\_40,000\_\_\_\_\_\_ gallons of water per year.
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| **Additional notes and questions:** |

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| Slide 15 | **Urban “Stormwater” Water Cycle — Vocabulary and Definitions** |
| surface water | Water that is contained by stormwater ponds, rivers, lakes, estuaries, bays, dams, wetlands, oceans or Gulf Coast areas |
| impervious surface | A surface that water will NOT pass through. |
| pervious surface | A surface that water will pass through. |
| wastewater | Water that exits your home through a drain. |
| storm sewer | A series of pipes that collects and transports only stormwater. |
| sanitary sewer | A series of pipes that collects and transports only wastewater and does not include stormwater. |
| combined sewer | A series of pipes that collects and transports stormwater and wastewater. |
| urban infrastructure | A structure or system that supports the urban environment. Examples: Roads, bridges, buildings, water distribution, sanitary and storm sewers, stormwater pond, electricity transmission lines, cable and internet. |
| Slide 16 | **Your RAFT Assignment:** Take on the role of a journalist to describe the journey through the urban water cycle—from a water droplet’s point of view. * + You are a travel magazine journalist for *Urban Environment Weekly*.
	+ Your assignment this week is to follow the life of a drop of water as it makes its way through the urban environment.
	+ In your article, include all the descriptive details about whom the drop met and what it encountered along the way.
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