## Student Worksheet

This task is about Earth's water.

## Task

A new housing development is built to provide homes for new homeowners. After several months, the new homeowners discover that their toilets are often refilling between flushes. The toilets must be leaking!

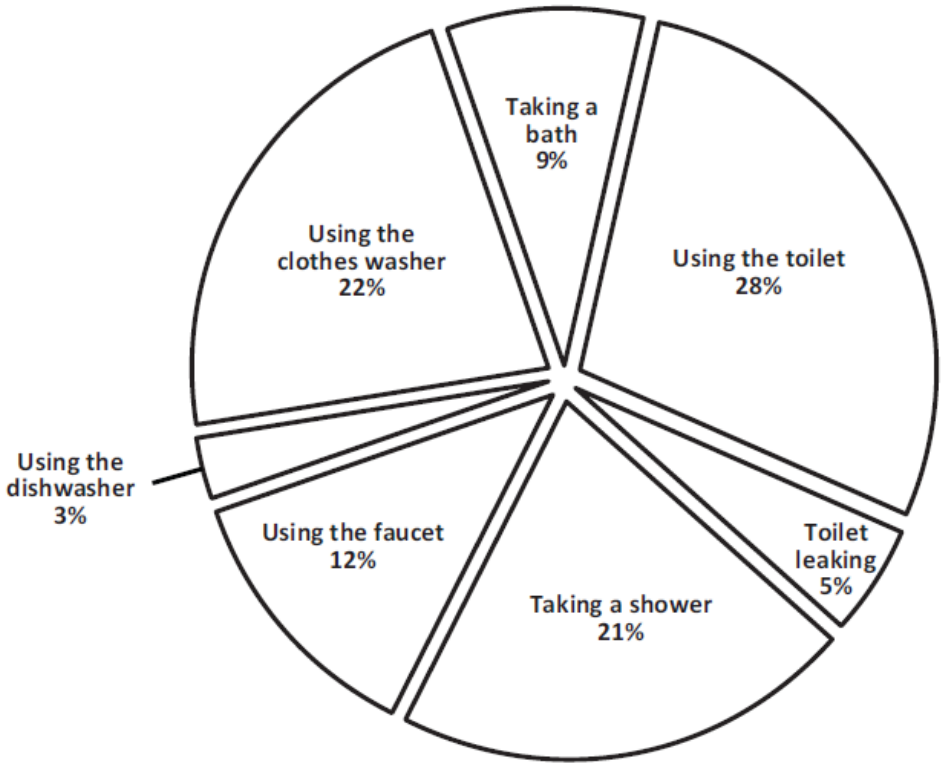
The water used by the housing development is stored in an underground water source called an aquifer. Over time, the amount of water in the aquifer may get low.

The homeowners are concerned about how much water is being wasted.

***Prompt 1***

Figure 1 shows the percentage of household water use for different activities. It shows how the average household uses fresh, clean water in one year.

**Figure 1. Household Water Uses**



A. Which activity uses the **most** water in **Figure 1**?

_____

B. Which activity uses the **least** water in **Figure 1**?

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The average American family uses more than 300 gallons of water per day! Based on Figure 1, leaking standard toilets account for **15 gallons of water loss per day,** or 5,475 gallons per year. That's a lot of water loss!

Table 1 compares the water usage of two types of toilets.

**Table 1. Toilet Water Usage**

| Type of Toilet | Gallons per Flush |
|---|---|
| Standard | 6.0 |
| Low-flow | 1.5 |

C. How much water would a homeowner save per flush by replacing a standard toilet with a low-flow toilet? _____ gallons

D. Per day, how many flushes of a low-flow toilet equal the amount of water lost by the leaking toilets in each household? _____flushes

E. Write an argument to convince the homeowners to replace their leaking standard toilets to conserve the water in the aquifer. Use information from **Figure 1** and **Table 1**.

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*Prompt 2*

Clean, fresh water is an important natural resource. Think about the ways you use fresh water each day. Of the water on Earth, only 3% is freshwater. Every drop counts because the rest of the water on Earth is saltwater. Table 2 shows four sources of fresh water and their approximate distribution on Earth.

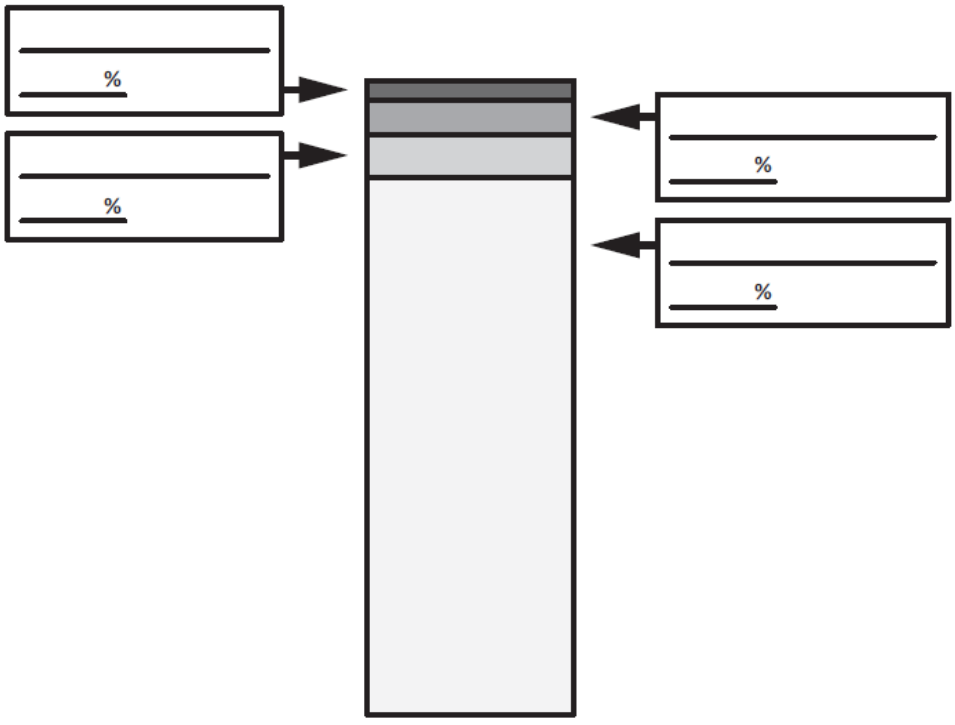
**Table 2. Distribution of Fresh Water Sources on Earth**

| Source | Percent (%) |
|---|---|
| Glaciers and ice caps | 76.0 |
| Shallow groundwater | 12.0 |
| Deep groundwater | 11.0 |
| Lakes and rivers | 0.3 |

**Part A.**

Complete **Figure 2** below using the information about Earth's water sources and the information in **Table 2**. Be sure to include the name of each water source and its percent distribution to fill in the blanks to complete the figure.

**Figure 2. Distribution of Freshwater on Earth**



Of the freshwater sources on Earth, only the water in lakes, rivers, and shallow groundwater is available for human use.

**Part B.**

What percent of the freshwater on Earth is available for human use? _____%

**Part C.**

Explain to the homeowners why it is important to protect the aquifer by fixing the leaking standard toilets and implementing other ways to reduce freshwater waste. Use the data in **Table 2** and **Figure 2** to support your explanation.

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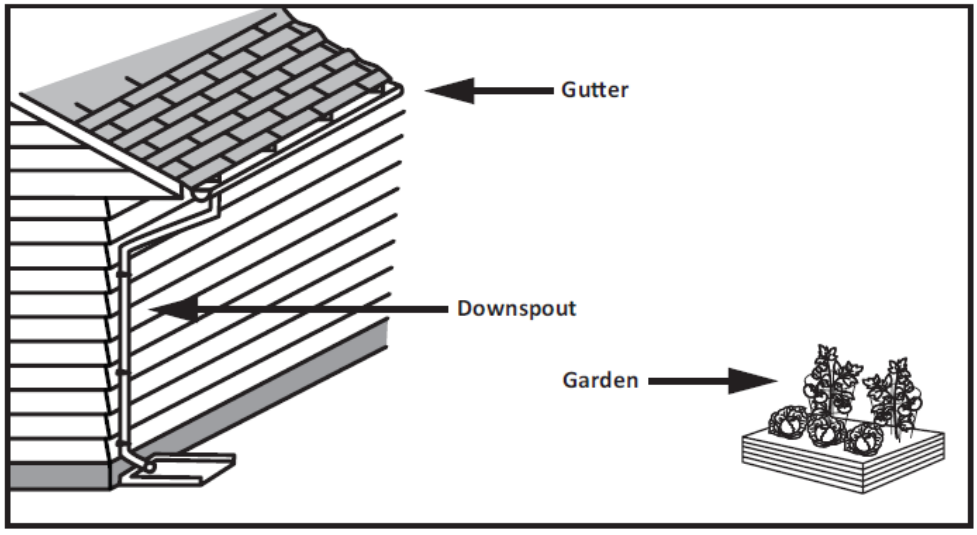
*Prompt 3*

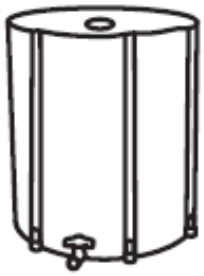
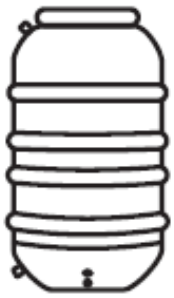
You want to show the homeowners how to design a solution to conserve water when using water to grow a vegetable garden. The garden is about 20 feet away from the house. To conserve water, a possible solution is to catch rainwater as it collects from the roof. The water runs through the gutter into the downspout.

**Figure 3. Homeowner's House and Garden**



You have **$75.00** to spend on a solution to conserve water, keep the plants in the garden alive, and provide the owners with a convenient way to reuse the rainwater. Table 3 shows garden supplies and their costs that could be used to solve the problem.

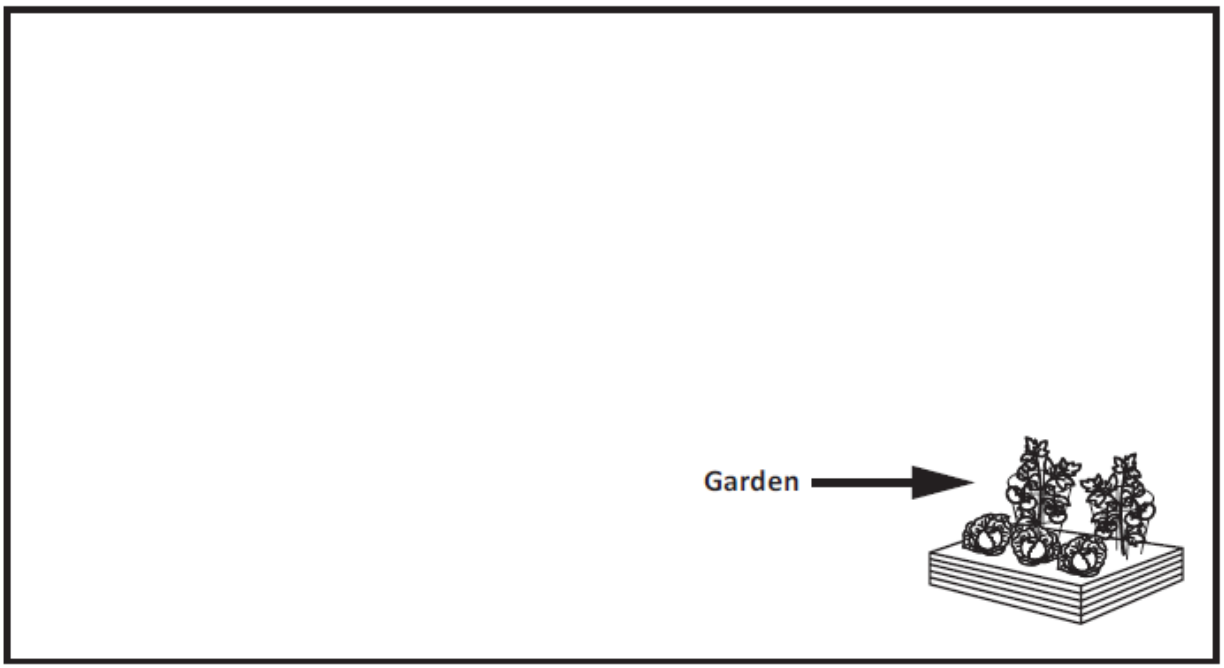
**Table 3. Costs of Garden Supplies**

| Garden Supply | Use | Cost ($) |
|---|---|---|
| **Shovel**  | • To dig a trench for the rainwater to travel from the downspout to the garden | 25.00 |
| **5-gallon Bucket**  | • To collect rainwater and carry the buckets of rainwater to the garden | 15.00 |
| **25-foot Hose**  | • To move water to the garden from the rain barrel | 15.00 |
| **50-gallon Vinyl Rain Barrel with screened lid and hose attachment**  | • To collect rainwater from the downspout | 40.00 |
| **60-gallon Plastic Rain Barrel with downspout adapter and hose attachment**  | • To collect rainwater from the downspout | 200.00 |

**Part A.**

Draw a solution for conserving water in **Figure 4**. In your drawing, be sure to label each garden supply you include and show how they work together to conserve water. Use information from **Table 3** and the homeowner's requirements to design your solution.

**Figure 4. Design Solution to Conserve Water**




**Part B.**

Explain your design solution to conserve water.

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**Part C.**

Compare how well your solution addresses the water conservation problem compared to other possible solutions. Consider the homeowner's requirements that you:

- have **$75.00** to spend on a solution to conserve water
- need to keep the plants in the garden alive
- need to provide the owners with a convenient way to reuse the rainwater

_____

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## Student Worksheet

This task is about how Earth's systems interact.

## Task

Josh and his friends are hiking in the mountains. After a few hours, they start to get thirsty. They notice a freshwater spring along the trail where the groundwater bubbles up and flows to the surface. The freshwater spring is a welcomed sight! But how do freshwater springs form?

The Earth's systems, or spheres, interact to produce the environments we observe. As you complete this task, consider how the Earth's spheres might interact to form a freshwater spring like Josh and his friends found.

***Prompt 1***

Picture 1 is a photograph taken by Josh. The photograph shows a mountain meadow's components (living and non-living things) and Earth's different spheres.

**Picture 1. Components of a Mountain Meadow**

**Part A.**

Complete **Table 1** by identifying the Earth's sphere that is represented by each component of the mountain meadow from **Picture 1**. Choose from the following list of Earth's spheres to complete the table.

Geosphere Biosphere Hydrosphere Atmosphere

**Table 1. Components of Earth's Spheres**

| Component | Earth's Sphere |
|---|---|
| Sheep | _____ |
| Mountain | _____ |
| Cloud | _____ |
| Grass | _____ |
| Air | _____ |
| Snow | _____ |

**Part B.**

Describe one way that two components of the biosphere interact in **Picture 1**.

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**Part C.**

Describe one way the biosphere and the atmosphere interact in **Picture 1**.

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*Prompt 2*

Josh and his friends leave the meadow and continue hiking. They hear fast-moving water before they see a stream. When they reach the stream, they see sand and pebbles tumbling along the bottom. As the water moves downstream, it carries twigs, leaves, and bits of soil. In sheltered water pools, insects hover in the air above the water. Toads are along the bank. A large fish is just under the water's surface.

Identify **three** interactions among the Earth's spheres that Josh and his friends observe.

For **each** interaction:

- Identify two spheres that interact
- Describe the interactions of the components of the two spheres

**Interaction 1.**

The _____ is interacting with the _____
(sphere) (sphere)

when _____

_____.

**Interaction 2.**

The _____ is interacting with the _____
(sphere) (sphere)

when _____

_____.

**Interaction 3.**

The_____ is interacting with the _____
(sphere) (sphere)

when _____

_____.

*Prompt 3*

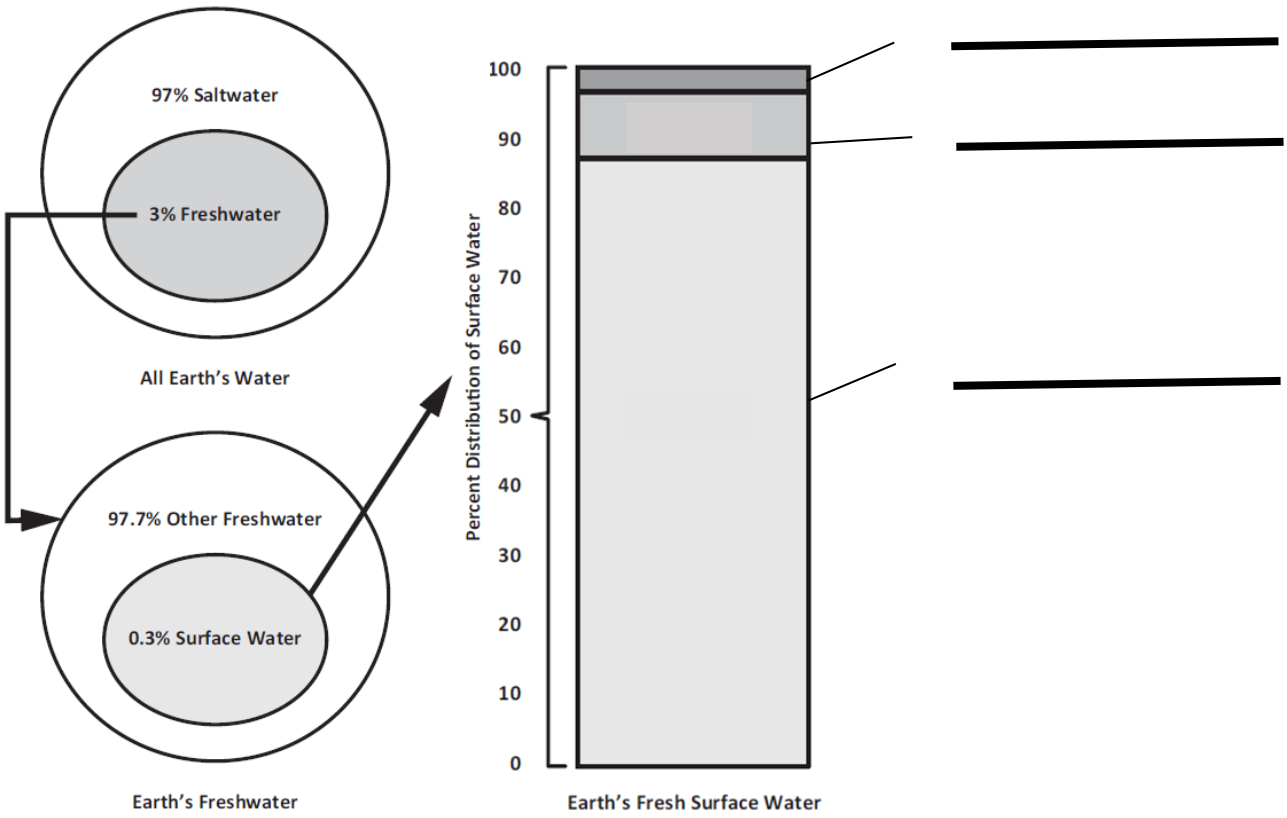
Table 3 shows the distribution of all water on Earth. The distribution ranges from the saltwater found in oceans to the flowing or liquid freshwater humans can see on Earth's surface, like lakes.

**Table 3. Percent Distribution of Earth's Water**

| All Earth's Water | Earth's Freshwater | Earth's Fresh Surface Water (liquid) |
|---|---|---|
| • 3% is freshwater<br>• 97% is saltwater | • 97.7% is other freshwater<br>• 0.3% is fresh surface water | • 87% is lakes<br>• 11% is swamps<br>• 2% is rivers |

**Part A.**

Write the percent **AND** type of surface water on each line of the Percent Distribution of Surface Water bar graph. Use the information from **Table 3**.



**Part B.**

Why could you argue that a freshwater spring is a rare and special resource? Use the data in **Table 3** and the percent distribution of **Earth's fresh surface water** in your bar graph to support your answer. Be sure to include what you know about the distribution of all of Earth's water.

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*Prompt 4*

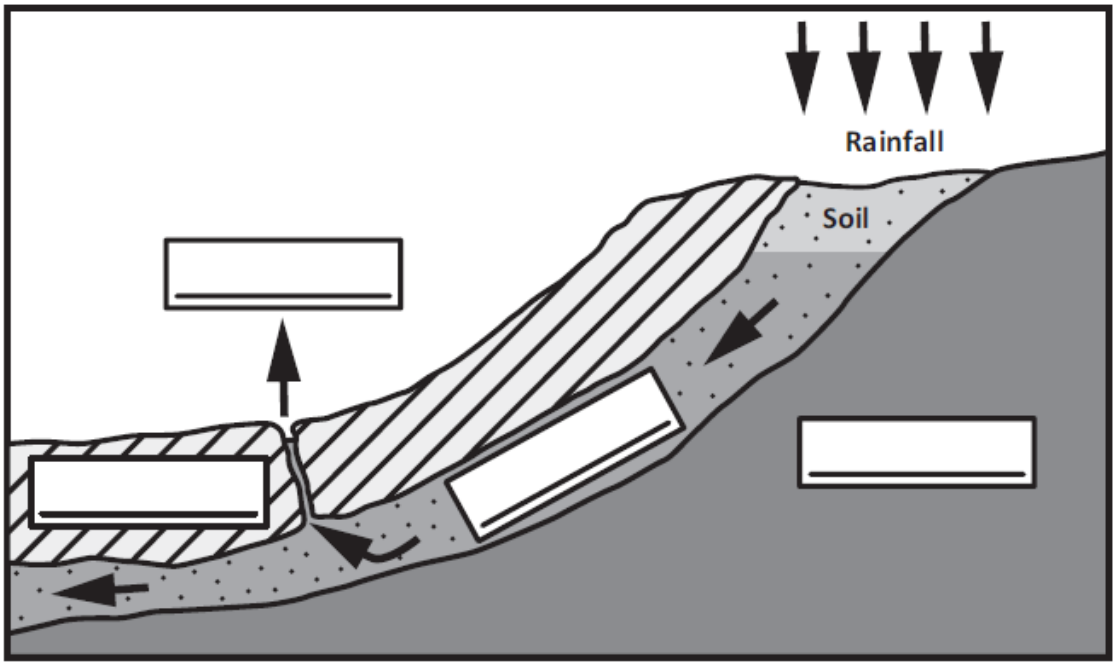
Figure 1 is an incomplete model showing the formation of the freshwater spring. The arrows in the incomplete model show the flow of rainfall that results in a freshwater spring.

**Part A.**

Use the following words to label **Figure 1:**

Freshwater spring  Rock and soil  Solid rock  Groundwater

**Figure 1. Model of the Formation of a Freshwater Spring**



**Part B.**

Which of Earth's spheres interact to form the freshwater spring in **Figure 1**?

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_____

**Part C.**

Describe how the Earth's spheres interact to form the freshwater spring. Use information from **Figure 1** to support your description.

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## Student Worksheet

This task is about protecting Earth's resources and environment.

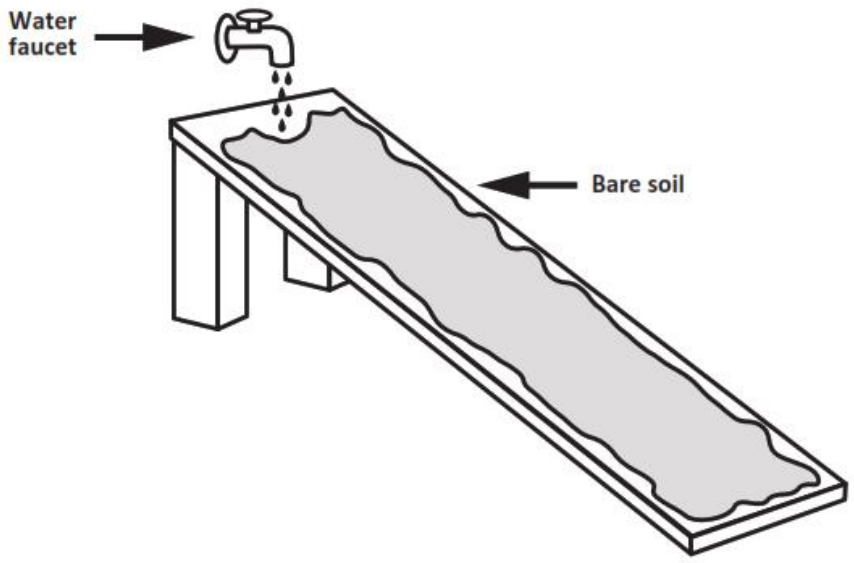
## Task

The Murdoch family owns a farm. They grow food crops for humans. The farm has experienced more severe weather during the last few years including heavy rainfalls and strong winds. This has caused soil erosion and the loss of fertile soil. Fertile soil has a thick top layer where plant roots can take hold. The plants' roots create pathways for the movement of water and soil nutrients. The problem the family needs to solve is to reduce the erosion of fertile soil.

*Prompt 1*

**Figure 1** is a stream table. It is set up for an experiment to observe the effect of moving water on soil. This stream table includes a propped-up or lifted board covered with bare soil. The board is placed under a water faucet. No water is flowing over the bare soil.

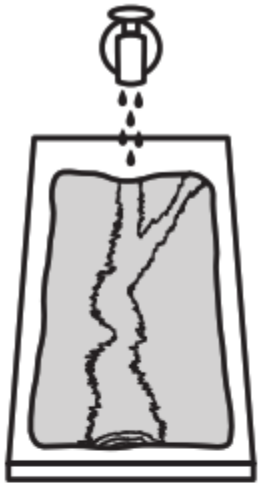
**Figure 1. Stream Table with Bare Soil**




During the experiment, the water faucet is turned on and water flows slowly over the bare soil in the stream table.

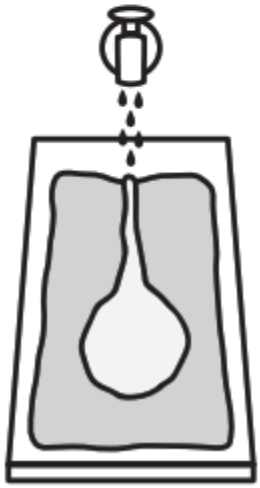
**Part A.**

Which shows the water's effect on the soil **after** flowing slowly down the stream table? Circle your answer.



A. Forms a long, narrow mound beneath the soil

B. Forms a tall hill in the middle of the soil



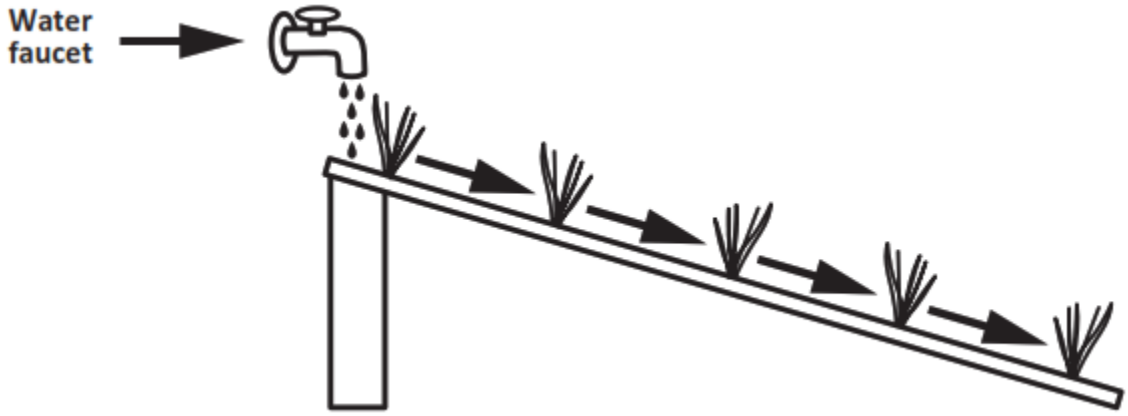
C. Forms a round pool of water in the middle of the soil

D. Forms a narrow channel in the middle of the soil

**Part B.**

**Figure 2** shows another experiment with a stream table. This time, plants are growing in the soil. The water faucet is turned on, and water flows slowly from the faucet over the soil with rooted plants.

**Figure 2. Stream Table with Soil and Plants**




Identify if the results from the two experiments, one with bare soil and one with plants rooted in the soil, will be the **SAME** OR **DIFFERENT.** Circle your answer below **AND** then compare the two experiments to explain your answer.

The results of the experiments will be the **SAME** **DIFFERENT**.

When I compare the two experiments, I know this because _____

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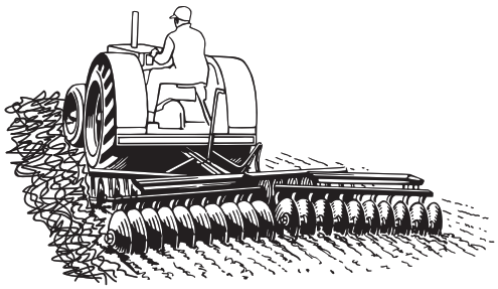
_____

***Prompt 2***

Each year, the Murdochs prepare the soil in their fields to be seeded. The soil is broken up and turned over to leave bare topsoil. This includes turning over the top layer of soil to remove weeds and native grasses. After the fields are prepared, there is nothing growing in the soil until the fields are planted.



Previous experiments showed the effects of water erosion on the Murdoch's fields. Figure 4 shows a model of another type of erosion that the Murdochs must consider.

**Figure 4. Model of Interaction Between Two of Earth's Spheres**

**Part A.**

Identify the type of erosion represented in **Figure 4** and explain the interaction between the two Earth spheres.

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**Part B.**

Explain how this type of erosion, shown in **Figure 4**, will **negatively** affect the Murdoch's crop production. Remember, fertile soil has a thick top layer where plant roots can take hold.

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***Prompt 3.***

During the last few years, stronger winds from the west have blown across the field. The wind is blowing the fertile soil away. One solution to the problem is to build a windbreak of trees. A windbreak may be a stand of trees growing along the edge of the field.

**Part A.**

On which side of the field should the farmer plant a windbreak? Circle your answer.

**North** **South** **East** **West**

**Part B.**

Explain why the farmer should be able to grow more food if a windbreak is planted and grows on the side of the field you circled in **Part A**.

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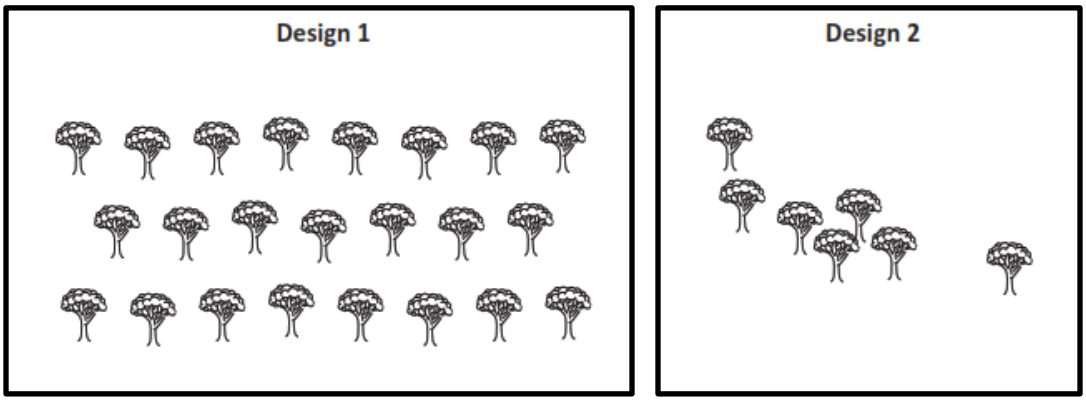
**Part C.**

Which design for a windbreak will provide the most effective solution to the farmer's problem? Circle your answer.




Explain the benefits of the design you chose.

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*Prompt 4*

Remember, the Murdoch's farm has experienced heavy rainfalls and strong winds during the last few years. This has caused soil erosion and the loss of fertile soil. The Murdochs want to be sure any solutions will reduce the water and wind erosion of their fertile soil from year to year**.**

The Murdoch family considers two solutions:

1. Wait until the fields are almost ready to be seeded before they prepare the soil for planting.
2. Plant a windbreak of trees.

**Part A.**

What measurements should the Murdochs collect to know if the solutions are working to prevent the erosion of the fertile topsoil?

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**Part B.**

If the solutions are working, what pattern would you expect to see in the data?

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