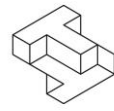


Down the Drain

Teacher Resource Guide



The Tech
Museum of Innovation

201 S. Market St.
San Jose CA. 95113
1-408-294-8324
thetech.org

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How to use this Document

The resources provided in this document are not required to be used in preparation for your lab. They are simply resources that we thought might be helpful to you and engaging for your students in preparation for your lab. It is your choice to use them, you may pick as few or as many to implement as you like.

**If you are receiving a Title 1 scholarship for your lab, you are required to implement a vocabulary or journal activity prior to your lab visit.*

Lab Summary

Design and construct different types of storm drain grates to keep trash out of the Bay's watershed from San Jose to the Pacific Ocean. Students discover how water systems function and how to use science and their own ideas to protect Earth's natural resources.

Grade Levels: 3-8

Student Outcomes:

- Students will be able to describe a watershed.
- Students can explain why keeping trash out of the watershed is important.
- Students will be able to work as a team using the materials provided to create a storm drain to combat pollution from a specific source.

State and National Standards Connections:

Next Generation Science Standards

**The Earth and human activity standards relate to the weather-related hazard of flooding.*

- Grade 3: *Earth and Human Activity* 3-ESS3-1
- Grade 4: *Earth and Human Activity* 4-ESS3-2
- Grade 5: *Earth and Human Activity* 5-ESS3-1
- Grades 6-8: *Earth and Human Activity* MS-ESS3-3, MS-ESS3-4
- Grades 3-5: *Engineering Design* 3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3
- Grades 6-8: *Engineering Design* MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4
- Grades 3-8: Science and Engineering Practices: 1, 2, 3, 6, 7, 8
- Grade 3 & 4: Disciplinary Core Idea: ETS1.A, ETS1.B, and ETS1.C
- Grade 5: Disciplinary Core Idea: ESS2.A, ESS2.B, ESS3.C
- Grades 6-8: Disciplinary Core Idea: ESS3.C, ESS3.D, ETS1.A, ETS1.B, ETS1.C
- Grade 3 – 5: Crosscutting Concept: Influence of Engineering, Technology, and Science on Society and the Natural World
- Grade 5: Crosscutting Concept: Systems and System Models
- Grade 6-8 Crosscutting Concept: Structure and Function, Science is a Human Endeavor

Common Core Language Arts-*Speaking and Listening*

- Grade 3: SL.3.1b-d, SL.3.3, SL.3.4a
- Grade 4: SL.4.1b-d, SL.4.4a
- Grade 5: SL.5.1b-d, SL.5.4
- Grade 6: SL.6.1b-d
- Grade 7: SL.7.1b-d
- Grade 8: SL.8.1b-d



Related Links and Games

The following links and games provide additional information regarding water and environmental sustainability. We are not endorsing the following organizations, but feel that the information provided by said organizations may be of benefit to your students and may help enhance the learning experience of the lab.

- What Is a Watershed? PBS Video explaining what a watershed is and giving a few facts about watersheds in the United States.
<https://ca.pbslearningmedia.org/resource/ket09.sci.ess.water.wshed/what-is-a-watershed>
- The Water Cycle Activity and the California Drought: Demonstration of how the water cycle works.
<http://www.pbs.org/parents/adventures-in-learning/2015/07/water-cycle-activity/>
- Water Use it Wisely - Tip Tank Game: Match water saving tips to win.
<https://wateruseitwisely.com/tip-tank-game/>
- California Watersheds - Our Vital Link: Background information on watersheds and more specific information about hydrologic regions in California.
<http://www.conservation.ca.gov/dlrp/wp/Documents/California%20Watersheds.pdf>
- San Francisco Bay Area Creek & Watershed Finder: If you live in the San Francisco Bay Area this resource can help you learn more about your watershed. <http://explore.museumca.org/creeks/resc.html>
- Great Pacific Garbage Patch curated educational videos on WatchKnowLearn.org: Different videos that can be used in the classroom to explain what happens when trash enters our oceans.
<http://www.watchknowlearn.org/Category.aspx?CategoryID=5138>



Related Texts

The following titles may provide students with a greater contextual understanding of the physics of roller coasters. Included in the list are narratives (fiction/nonfiction), and referential texts. We are not endorsing the following authors, but feel that the information provided by said authors may be of benefit to your students and may help enhance the learning experience of the lab.

Reference

- One Well: The Story of Water on Earth (CitizenKid). By Rochelle Strauss.
 - Recommended for ages 8-12
 - Recommended for Grades: 3-7
 - Explains where water comes from, how it is a finite resource, and how students can help conserve water.
- Plastic, Ahoy!: Investigating the Great Pacific Garbage Patch. By Patricia Newman.
 - Recommended for Grades: 4-8
 - A nonfiction book that details a research scientists work in studying the impact of the Great Pacific Garbage Patch on sea life.
- Going Blue: A Teen Guide to Saving Our Oceans, Lakes, Rivers, & Wetlands. By Cathryn Berger Kaye M.A.
 - Recommended for Grades: 7 and up
 - This book provides information on waterways with concepts of service learning to help students be informed and take action to protect this natural resource.

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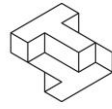
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Gallery and Exhibit Connections

Outside the group entrance (Ground Level)

- *Science on a Roll (Ball Machine on Park Ave)*: Witness an elaborate demonstration of the transfer of energy in motion with the assistance of gravity.
 - Connection to the lab:
 - Explore the concept gravity.
 - Activities to complete at the exhibit:
 - Pick a ball and follow it throughout its journey through the ball machine contraption.
 - Questions to guide student learning:
 - What force helps the ball travel from the top of the machine to the bottom?
 - *Gravity*



Writing Prompts

The following writing prompts and questions are just a few examples of journal topics to incorporate writing into your students' lab experience. If you feel that one of the below prompts does not meet your needs, you are welcome to use your own, but please make sure it is related to the chosen lab experience. If you have a related writing prompt you would like to share with The Tech and other teachers, please let us know on our teacher survey that will be available in the lab.

Most of the writing topics could be used as either pre-lab or post-lab writing. You may choose the prompts that work best for your class and schedule.

Pre-Visit Writing Topics/Prompts

Generic

- We will be attending ___lab name___ at The Tech Museum of Innovation; what do you think we will learn about in the lab? What do you want to know about this topic? What do you already know about this topic?
- We will be attending ___lab name___ at The Tech Museum of Innovation; what are you looking most forward to in this lab? Why?

Specific to Down the Drain

- A new student at your school has never heard the word "watershed" before. Explain to your classmate what a watershed is and why protecting water in them is important.
- Imagine an animal that lives near your home. Which one is it and where is it? How do you think pollution would impact their life?

Post-Visit Writing Topics/Prompts

Generic

- We learned a lot in our ___lab name___ lab. What were your two favorite things you learned in the lab? Why?
- The principal is excited to hear all about your lab experience. Explain what you did and learned about in the lab since she or he was unable to attend the lab.

Specific to Physics of Roller Coasters

- You and your team created an amazing storm drain. If your storm drain prototype was made, what materials would it be made out of? Why?
- Write a story describing the adventure of a raindrop traveling from a hilltop and out to the Pacific Ocean through your storm drain.



Pre-Visit Vocabulary and Activities

These are words and concepts that we will discuss in the lab. Your students' experience will be enhanced if they are familiar with these terms prior to your visit. Below you will find several graphic organizers and games to aid in your vocabulary review.

Terms and Definitions

- **Pollution:** A substance or thing that when it enters an environment its presence has a harmful effect.
- **Gravity:** A force that attracts a body toward the center of the Earth.
- **Watershed:** The highest point that water can start to the lowest point where it collects. For example, from a mountain top to a lake or ocean.
- **Storm Drain:** A device that allows water to flow away from human developments and back into the watershed to prevent flooding of human communities.
- **Sustainability:** To keep something at a certain level. Minimize the use of a natural resource, so it can be kept or conserved to be used in the future.
- **Natural Resources:** Something that is not created by humans that is usually a finite material like clean water or forests.

Advanced Vocabulary

- **Biological accumulation:** The build-up of toxic substances within living organisms, from the environment.
- **Interdependence:** Two things or organisms that are reliant on one another. Often seen in larger systems like the carbon or nitrogen cycles.
- **Harmful Algal Bloom:** Rapid increase of algae in freshwater that can lead to the death of fish or water becoming dangerous to humans in the area.

Vocabulary Activities:

Graphic Organizers

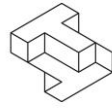
- **Frayer Graphic Organizer:** The Frayer Graphic Organizer is a great tool for vocabulary development. This graphic organizer allows students to write their own definitions, define characteristics, and provide examples and non-examples. This tool will lead your students to a deeper understanding of the vocabulary and how it relates to their lives. On page 9 you will find a blank Frayer Graphic Organizer for your use in the classroom.
 - For more information on the Frayer Model and how to implement it, please visit the following link: <http://www.theteachertoolkit.com/index.php/tool/frayer-model>
- **Vocabulary Graphic Organizer:** This graphic organizer is a great tool for younger students as well as English Language Learners. Although very similar to the Frayer Model, this graphic organizer includes a drawing of the vocabulary term and the use in a sentence. On page 10 you will find a blank Vocabulary Graphic Organizer for your use in the classroom.
- **Circle Map:** This graphic organizer is a great tool for helping all students develop an overall sense of a topic. It is also very helpful for beginning and early intermediate English Language Learners. This graphic organizer lets students brainstorm what a term or concept means to them and provides a frame of reference for the term. On page 11 you will find a blank Circle Map for your use in the classroom.
 - For more information on the Circle Map and other Thinking Maps, please visit the following link: <http://thinkingmaps.com/why-thinking-maps-2/>



Review Strategies

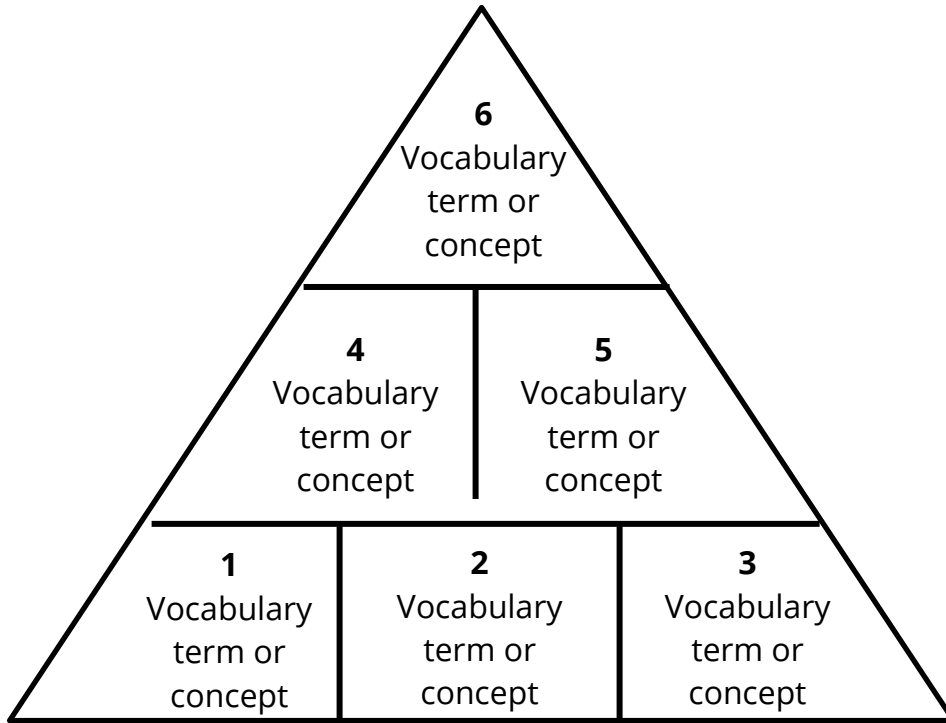
Vocabulary Review Games

- **Quiz, Quiz, Trade:** This is a fun cooperative game for students to review vocabulary terms. For more details and to see an example of Quiz Quiz Trade in action, please visit the following link:
<http://www.theteachertoolkit.com/index.php/tool/quiz-quiz-trade>
 1. Create questions or vocabulary cards. On one side of an index card, write the question or vocabulary term; on the other, the answer or definition. Pass out the cards to students. If there are not enough terms for everyone to have a different card, try using different “back” sides to the same cards (e.g. instead of the definition again, have a drawing, a question about the term, characteristics of the term, or an example of the term).
 2. Pair up. When all cards have been passed out, students find a partner to quiz with their card.
 3. Hands up. When both partners have completed the quizzes correctly, they put their hand up to show other students that they are ready for a new partner to quiz.
- **Back-words:** This game is part Charades part 20 Questions. In this review game, students have to guess the vocabulary term that is on their back by asking questions of a partner or having the partner act out the term.
 1. Write your vocabulary terms on index cards. If there aren't enough terms for each student to have a different one, you can make two sets and divide the class into two groups. You may also add in other related vocabulary terms that you have been studying in class.
 2. Tape one term onto the back of each student so that he or she cannot see the word.
 3. Have students pair up. Each partner should look at the word on their partner's back. Partners take turns asking questions or acting out or gesturing about the term that is on their back.
 4. (e.g. “Am I an element? Am I part of an atom? Do I make up all matter? Etc.) Partners must ask at least 2 questions before guessing their word.
 5. When both partners have correctly guessed their word, they put a hand up to signal that they are in need of a new partner. Continue game play until everyone has guessed their word.
- **\$10,000 Pyramid:** This review game is exactly like the classic game show. Students will work in pairs, taking turns to describe the words and to guess the words.
 1. Break up the terms into two groups. Each partner will take on one group of words.
 2. Have each partner fill out the worksheet on the next page with their group of words.
 3. For the first round, Partner A will be the one describing the term and Partner B will be the one guessing the term. Partner A will describe the term (starting with 1) using the words he or she wrote down on the worksheet. From the description, Partner B will guess what the term is.
 4. When Partner B guesses the word correctly, Partner A moves on to the next word.
 5. When Partner B correctly guesses all the words in Partner A's pyramid, they switch places and Partner B will describe the terms on his or her pyramid while Partner A guesses the terms.
 6. You can time this activity like on the quiz show, but it may intimidate some students.



Student Name: _____

\$10,000 Pyramid



Write descriptive clues about each vocabulary term or concept

1. _____

2. _____

3. _____

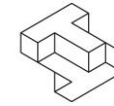
4. _____

5. _____

6. _____

Physics of Roller Coasters

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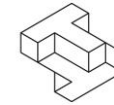
Frayer Graphic Organizer

Definition	Characteristics
Examples	Non-Examples

Vocabulary Word

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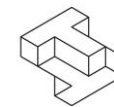
Vocabulary Graphic Organizer

Definition	Characteristics
Sentence	Drawing

Vocabulary Word

Physics of Roller Coasters

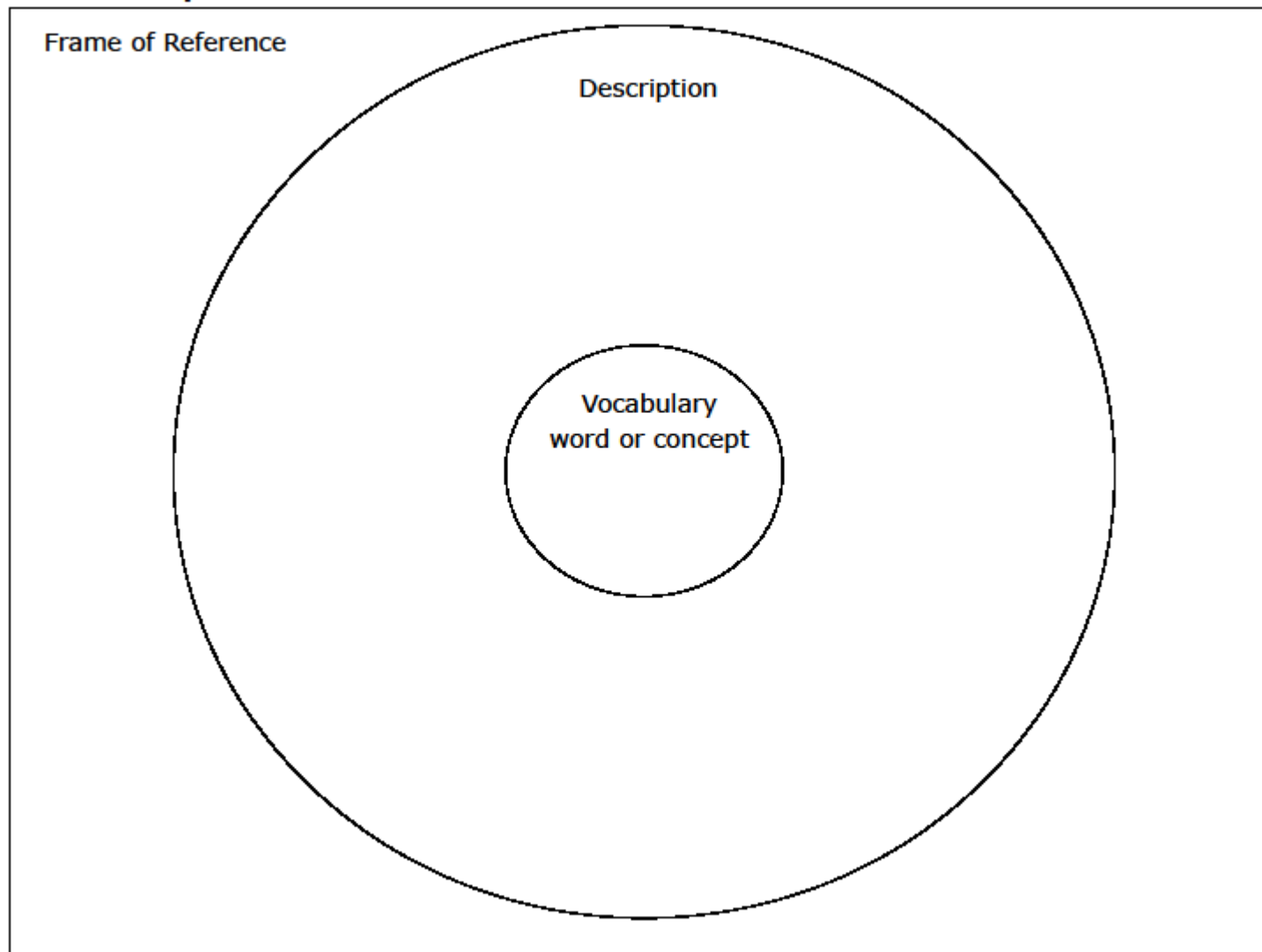
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Circle Map



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