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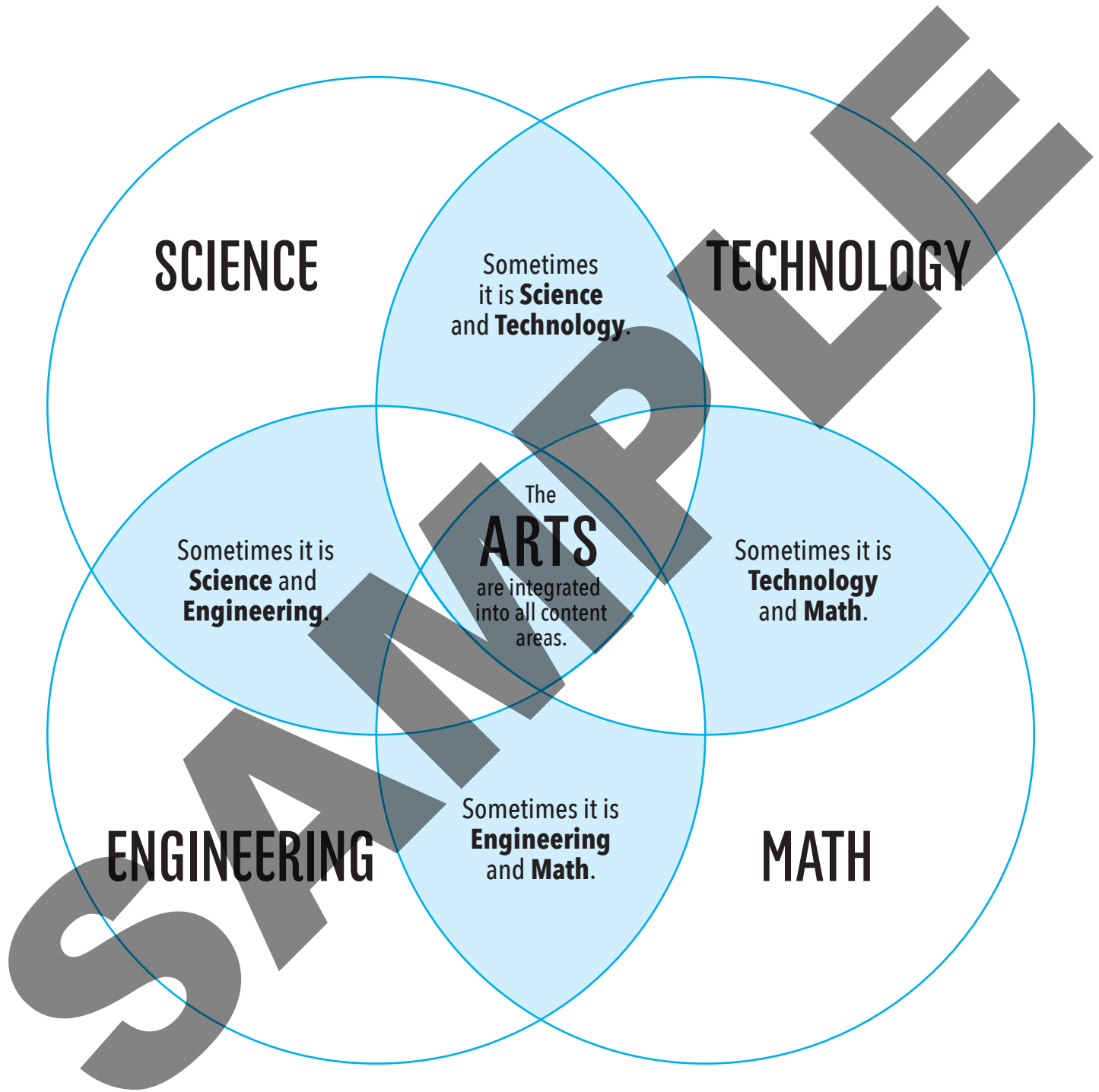
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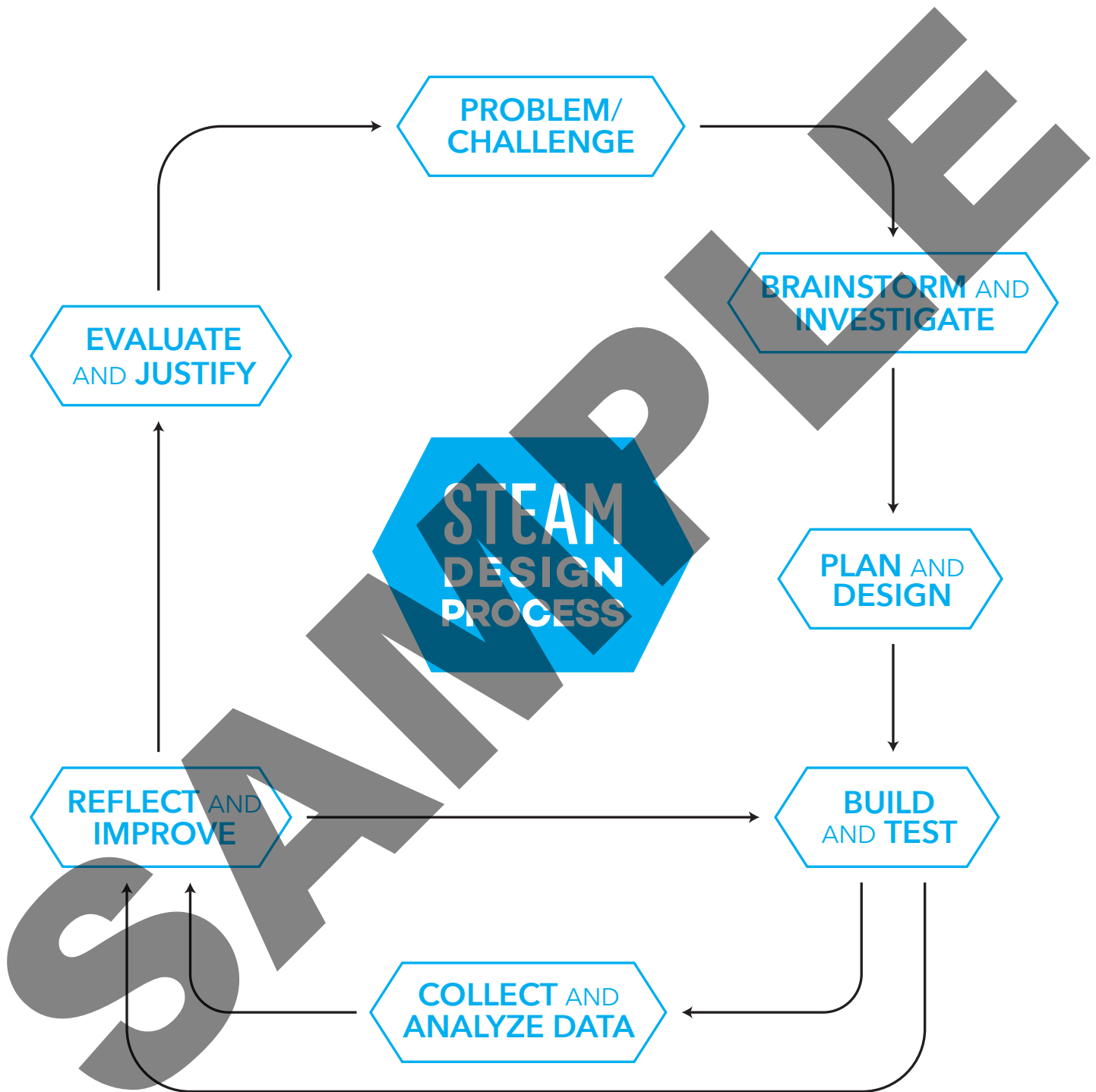
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INTEGRATION IN THE ENGINEERING DESIGN CHALLENGE



Sometimes it is all five!

STEAM DESIGN PROCESS



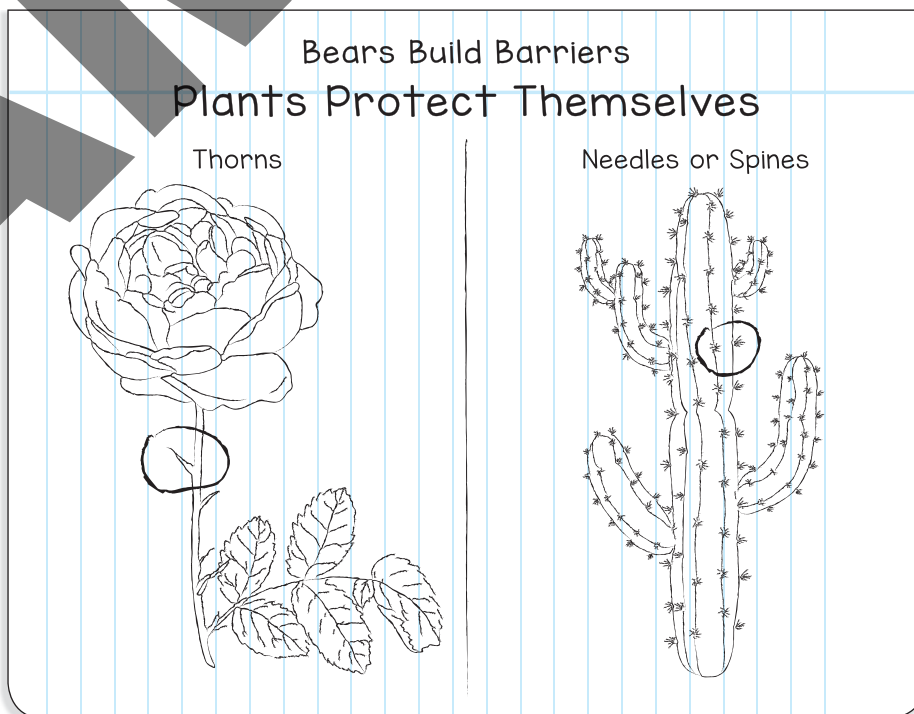
RECORDING INFORMATION IN A SCIENCE NOTEBOOK

Students will record their thinking, answer questions, make observations, and sketch ideas as they work through each design challenge. It is recommended that teachers have students designate a section of their regular science notebooks to these STEAM challenges or have students create a separate STEAM science notebook using a spiral notebook, a composition book, or lined pages stapled together. A generic science notebook cover sheet has been provided in the Appendix.




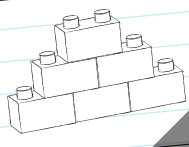
Have students set up their notebooks based upon the natural breaks in the lesson. Remind students to write the name of the design challenge at the top of the page in their notebooks each time they prepare their notebooks for a new challenge

Pages 1-3 Background Information

- Students record notes from any information provided by the teacher during whole-group instruction (e.g., teacher's notes written on the board or a reproducible that has been cut apart and glued into the notebook).
- Students record student-friendly related vocabulary words and their definitions. Teachers may wish to have students cut out the words and their definitions to match up by gluing the pieces into their notebooks. Teachers can also provide a sheet of definitions



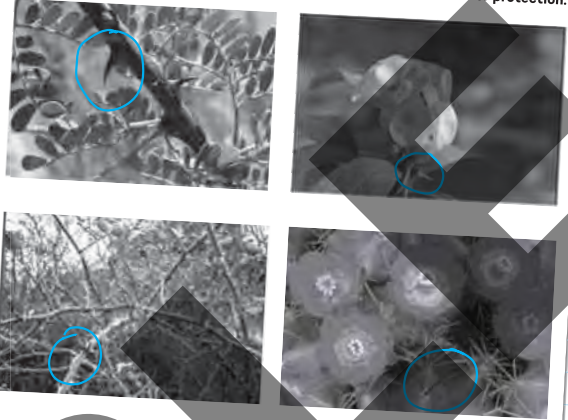
Bears Build Barriers VOCABULARY

external	outside parts	
intruders	people who go where they are not invited	
mimic	to copy someone or something	
structure	the way something is put together	

Page 2

Bears Build Barriers NOTES

Directions: Circle the external structure of each plant that is used for protection.



Page 3

for students to cut out and glue into their notebooks and then write the word for each definition. Or make copies of the vocabulary sheet (page 145) and have students complete it and glue it into their notebooks.

- Students record notes from research, including information from science books, diagrams, and worksheets or activities provided by the teacher. These worksheets can be completed by the students and then glued into their notebooks.

Page 4 Dilemma and Mission

- Display the dilemma and mission for students to record.
- Or make copies of the dilemma and mission for students to glue into their notebooks to use as a reference.

Bears Build Barriers



DILEMMA ENGAGE

Baby bear is sad. A girl broke into his house and ate all his porridge, broke his favorite chair, and messed up his bed. Papa bear promised to build a barrier around the house to protect it from intruders, but Mama bear is worried that the barrier will look ugly and unfriendly to their visiting friends. Papa bear needs you to help him build a barrier that will protect their house and also look nice.

MISSION

Create a barrier that will protect the Bears' house. It must be decorated with at least five flowers and must mimic a plant part used for protection.

Page 4

INDIVIDUAL BLUEPRINT DESIGN SHEET

TEAM MEMBER NAMES	PROS OF DESIGN	CONS OF DESIGN
Julio (me)	<ul style="list-style-type: none"> Has all the flowers Toothpicks on all sides 	<ul style="list-style-type: none"> Didn't use rubber bands so making changes will be hard
Adam	<ul style="list-style-type: none"> Toothpicks stick outward Has all flowers 	<ul style="list-style-type: none"> Toothpicks spaced out too much Flowers not pretty
Zoie	<ul style="list-style-type: none"> Toothpicks stick outward Has all flowers 	<ul style="list-style-type: none"> Toothpicks only on two sides Lopsided flowers
Charles	<ul style="list-style-type: none"> Toothpicks spaced well Pretty flowers 	<ul style="list-style-type: none"> Toothpicks point straight up Missing flowers

Page 5

Page 5 Blueprint Design

- Students draw their own suggested design. Then students write the pros and cons of both their and their teammates' designs.
- Or make copies of the Individual Blueprint Design Sheet for students to complete and glue into their notebooks.

Bears Build Barriers

REFLECTIONS		EXPLAIN & ELABORATE
AFTER TEST TRIAL 1	Did your barrier prototype keep out the "intruder"? Explain. What materials did successful teams use to create their barriers?	
ANALYSIS	How will you change your barrier prototype to make it more effective at keeping out the intruder?	
AFTER TEST TRIAL 2	Did your barrier prototype keep out the "intruder"? Explain. What were the similarities and differences between the different teams' prototypes?	
ANALYSIS	How will you change your barrier prototype to make it more effective at keeping out the "intruder"?	
AFTER TEST TRIAL 3	Was your barrier successful at stopping the "intruder"? Explain. Discuss how your barrier is similar to real-world barriers that are used around homes.	

Page 6

Bears Build Barriers

SUMMARY

Today we learned that plants have external structures that protect them. An example of this type of structure is a thorn on a rose bush. We tried to mimic a plant with thorns by building a barrier with sharp sticks to protect a house.

Page 7

Pages 6-7 Engineering Task, Test Trial, Analyze, Redesign

- The teacher can use the reflection questions provided for each challenge to facilitate discussion with teams during each test trial.
- Students can respond verbally to the reflection questions and to more general questions about which parts of the prototype were successful and which parts were not.
- Students can summarize what they learned during the challenge either verbally during a discussion with the teacher or in writing in their science notebooks.

STEAM FOR THE FALL



4-5 HOURS
TIME FOR COMPLETION

S>t>e>A>m



DESIGN CHALLENGE PURPOSE

Design an informative book describing autumn.

TEACHER DEVELOPMENT

This lesson focuses on science, art, and literacy standards. Making observations is a critical piece of scientific inquiry and discovery-based learning. It is important for students to realize that as the days get shorter, the temperature outside gets cooler, and as the days get longer, the temperature gets warmer. Animals respond to changes in

the environment caused by the changes in the seasons. Many animals **migrate** or **hibernate** in winter because of lack of food sources in cold weather. Animals that hibernate spend the autumn, or fall, months before winter eating lots of food in preparation for surviving the cold winter months.

STUDENT DEVELOPMENT

Before beginning the lesson, provide time to explore websites, videos, and literacy connections with students. Lead a discussion with students, prompting them with questions such as *What time of day do you feel the most heat outside? During the day or at night? What happens when the sun is not visible? What would*

happen if the sun didn't rise one day? Why do seasons occur and what happens to plants and animals when seasons change?

Note: Visit the website listed on the inside front cover for videos and additional resources about the seasons.

STANDARDS

SCIENCE	TECHNOLOGY	ENGINEERING	ARTS	MATH	ELA
1-ESS1-2			Creating #1 Creating #2 Creating #3 Performing/ Presenting/ Producing #4, #5, #6		CCSS.ELA-LITERACY.SL.1.1 CCSS.ELA-LITERACY.W.1.1 CCSS.ELA-LITERACY.W.1.2 CCSS.ELA-LITERACY.W.1.8

SCIENCE & ENGINEERING PRACTICES

Planning and Carrying Out Investigations: Make observations (firsthand or from media) to collect data that can be used to make comparisons.

CROSSCUTTING CONCEPTS

Patterns: Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.



TARGET VOCABULARY

- autumn
- daylight
- heat
- hibernate
- migrate



MATERIALS

- crayons
- colored pencils
- construction paper
- empty cereal boxes
- magazines
- glue
- tape
- fall book map (page 129)



LITERACY CONNECTIONS

Time to Sleep
by Denise Fleming

The Reasons for Seasons
by Gail Gibbons

Four Seasons Make a Year
by Anne Rockwell

NOTES

SAFARI