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GETTING STARTED

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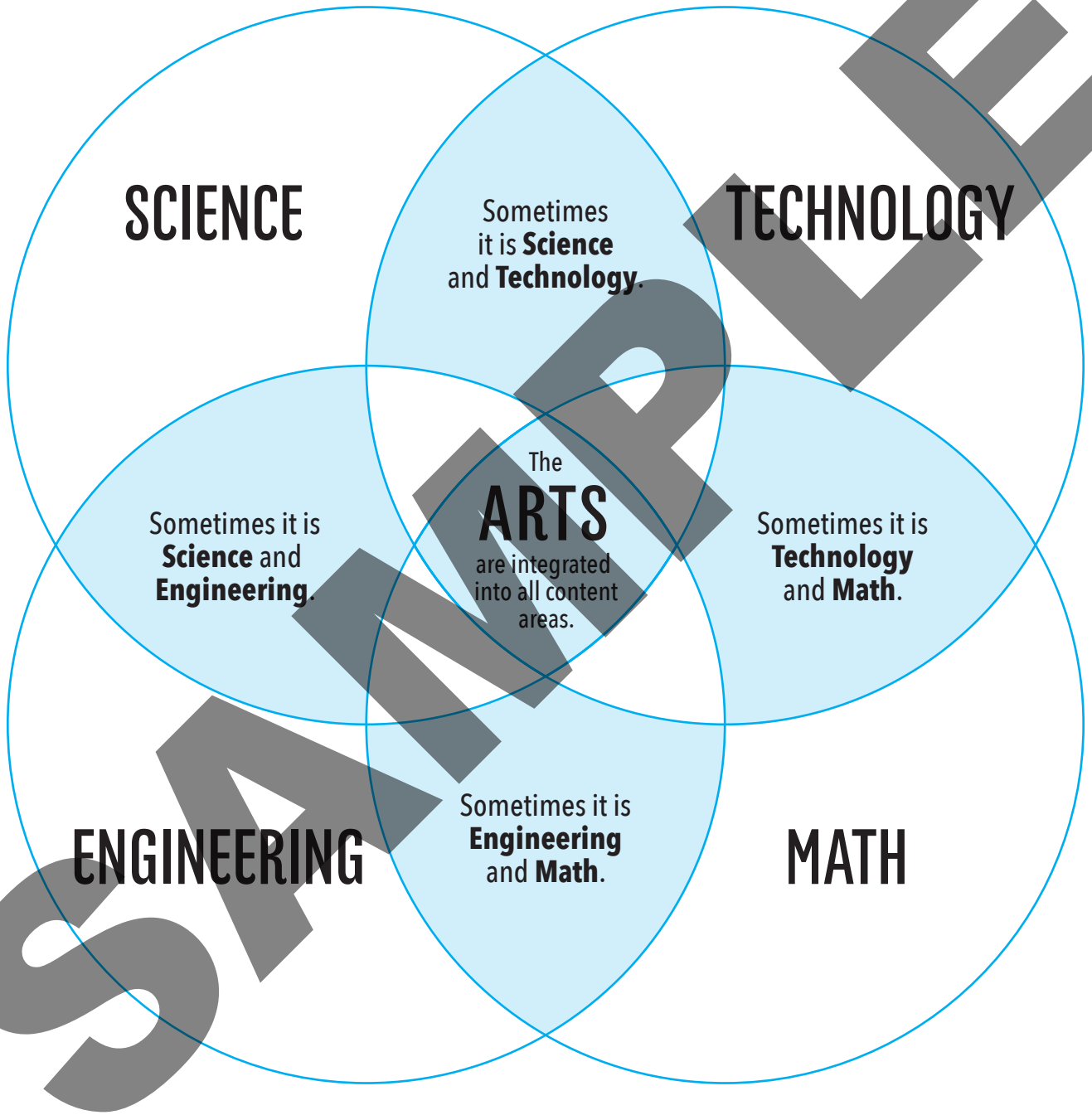
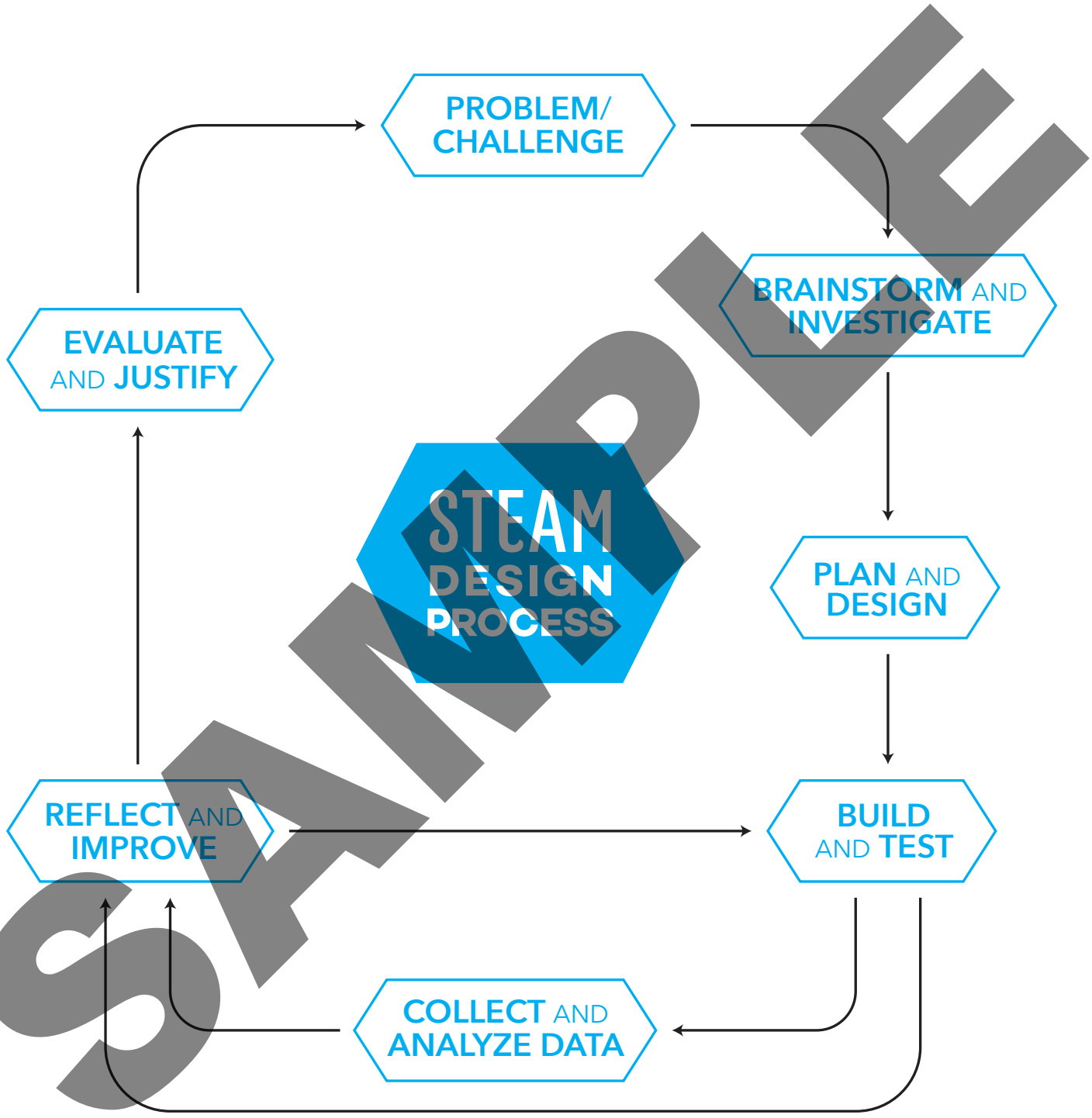
APPENDIX

INTEGRATION IN THE ENGINEERING DESIGN CHALLENGE



Sometimes it is all five!

STEAM DESIGN PROCESS



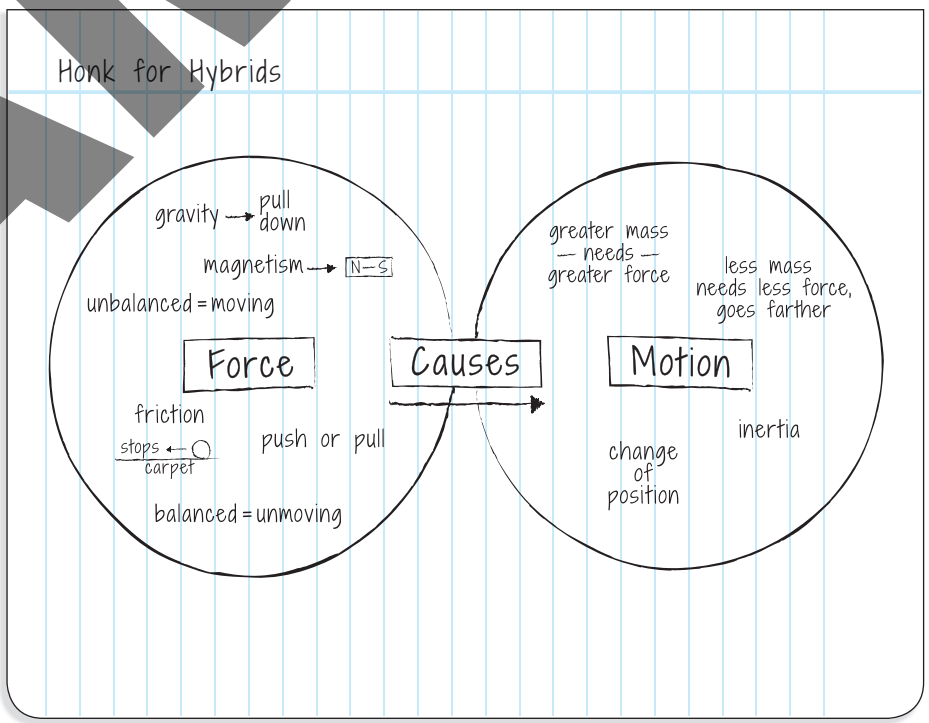
RECORDING INFORMATION IN A SCIENCE NOTEBOOK

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.
- Students record related vocabulary words and their definitions.
- Students record notes from their own independent research, including information gathered through literacy connections and existing background knowledge.



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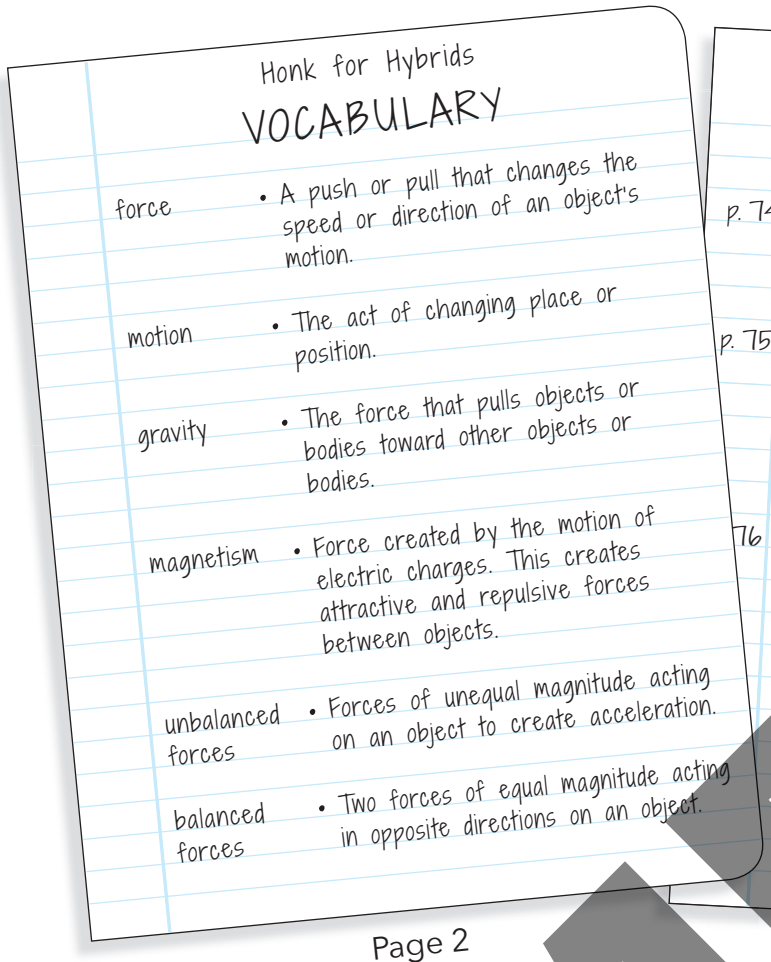

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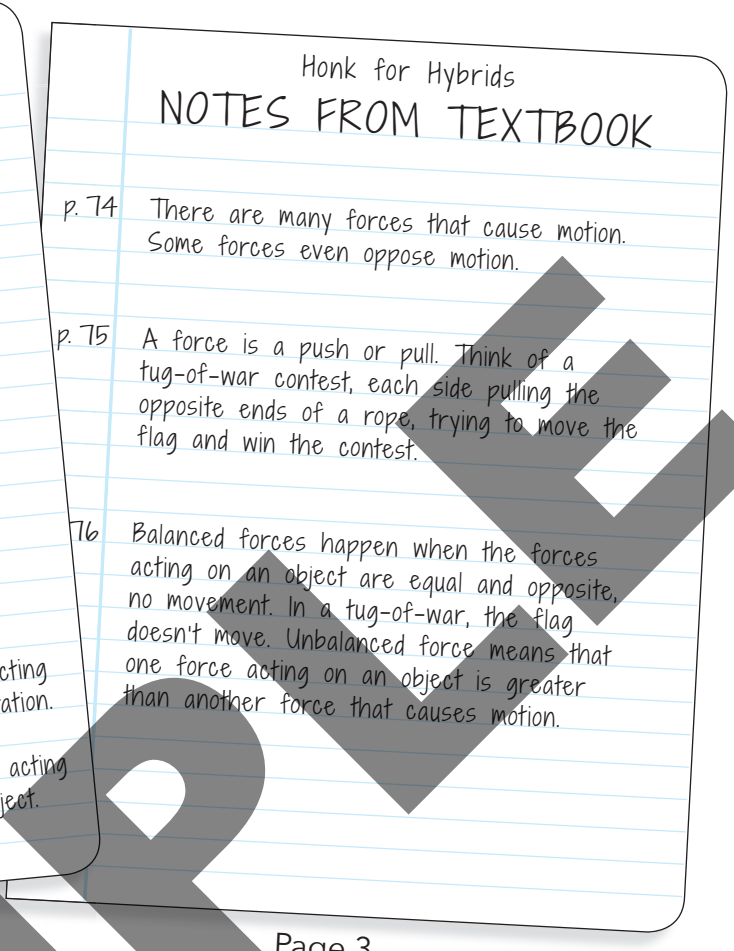
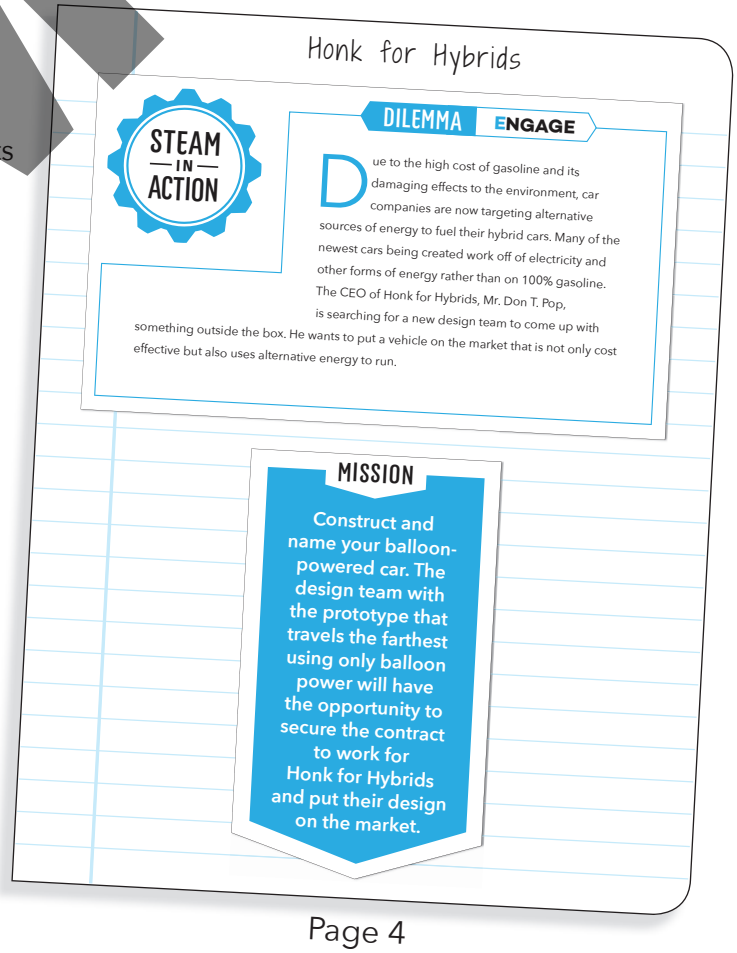


Page 3

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.



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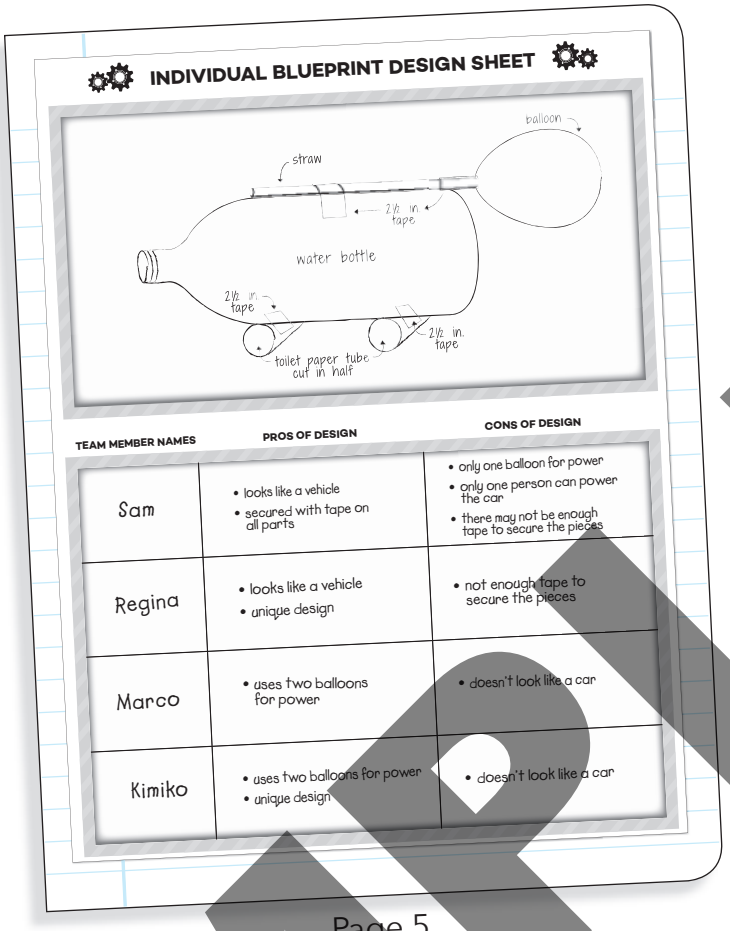
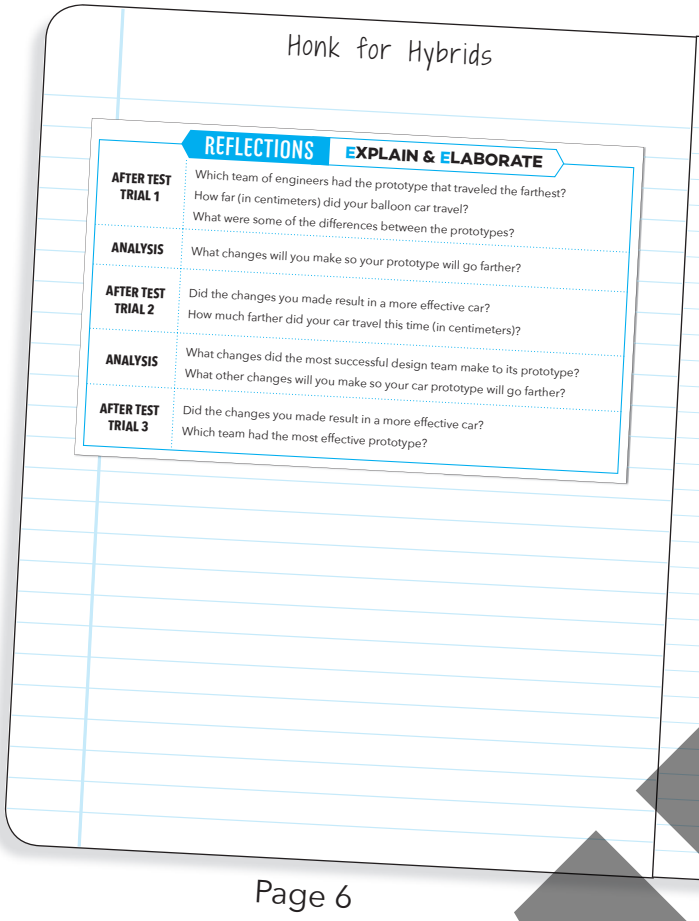


Page 5

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.



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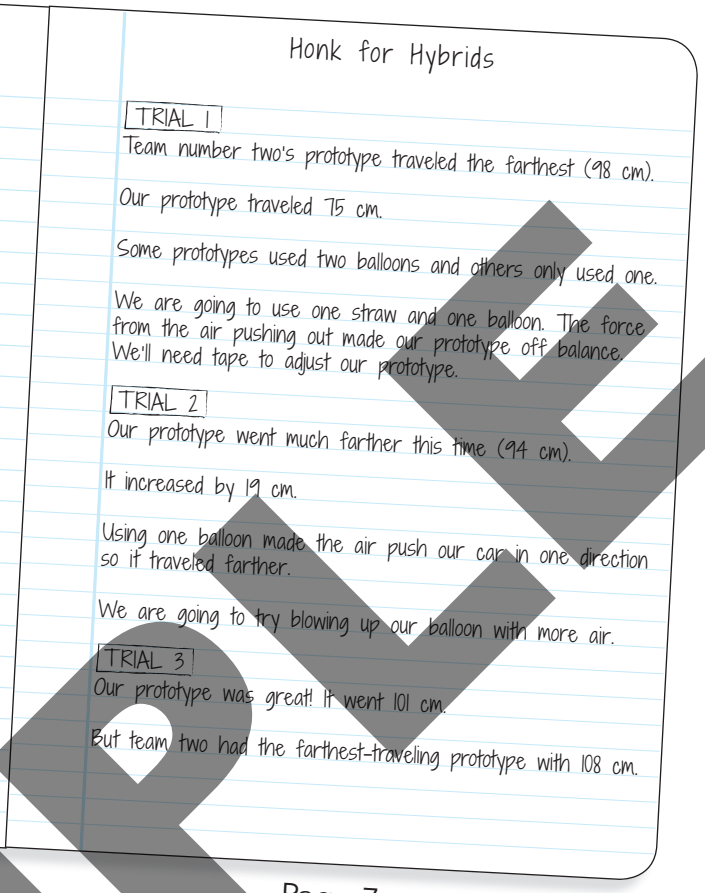

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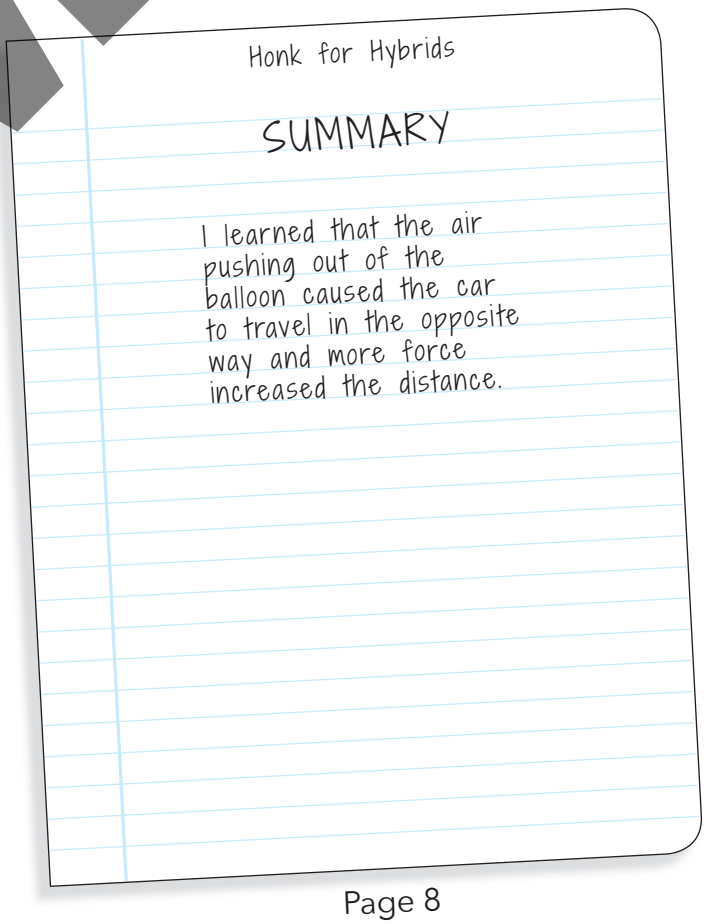
Pages 6–8 Engineering Task, Test Trial, Analyze, Redesign

- Students record analysis questions from the teacher and then record their answers. Or provide copies of the questions for students to glue into their notebooks.
- Record their reflections on the components of the prototypes that were successful and those that were not.
- Include additional pages as needed to allow students to record any notes, observations, and ideas as they construct and test their team prototype.



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BLOCK THAT BLIZZARD

STEAM

1-2 HOURS

TIME FOR COMPLETION

TEST TRIALS CAN BE TESTED OVER SEVERAL DAYS

DESIGN CHALLENGE PURPOSE

Design a gingerbread house made from graham crackers, following the specifications provided, that will withstand simulated blustery Arctic winds.

TEACHER DEVELOPMENT

Earth has four major systems. They are the **atmosphere** (air), the **geosphere** (land), the **biosphere** (life), and the **hydrosphere** (water). The geosphere, also referred to as the **lithosphere**, consists of soil, sediments, molten rock, and solid rock. The atmosphere contains all of the earth's air. The hydrosphere includes both water and ice. The biosphere is made up of all living things. These systems interact with each other in a multitude of ways that shape and affect the earth's surface and processes. This design challenge focuses on both the atmosphere and the biosphere.

STUDENT DEVELOPMENT

Introduce the earth's four major systems outlined in the teacher development section. Have students share what they already know about these systems. Tell them that by talking and listening, they have been interacting with each other in order to deepen their understanding of the earth's systems. Explain that the earth's systems interact with each other as well, which results in changes that affect the earth's surface and its processes. For example, the atmosphere and the hydrosphere interact as part of the water cycle. As water is evaporated from the hydrosphere, it becomes a gas and then becomes part of the atmosphere, where it eventually condenses into clouds, becoming part of the hydrosphere again.

Lesson Idea: Write down the earth's four major systems. Assign students to work together in groups of four.

Give each team of students a large piece of construction paper folded into four sections. Assign each student on the team one of the four systems. Give each student on a team a different colored marker representing a different system. Using different colored markers will help you assess individual understanding. Have students discuss the different ways the systems could interact with each other. Next have student use their markers to write the name of their system in one of the sections on the construction paper. Students will take turns drawing arrows from their system to other systems, labeling the arrows with the type of interaction. For example, a student might draw an arrow from the biosphere to the hydrosphere and label it, "Land mammals need fresh water to survive." Collect the papers and check for understanding.

STANDARDS

SCIENCE	TECHNOLOGY	ENGINEERING	ARTS	MATH	ELA
5-ESS2-1	ISTE.1	3-5-ETS1-1	Creating	CCSS.MATH.CONTENT.3.MD.A.2	CCSS.ELA-LITERACY.W.5.3.A
	ISTE.4	3-5-ETS1-2	Anchor Standard #1	CCSS.MATH.PRACTICE.MP2	CCSS.ELA-LITERACY.SL.5.1.C
		3-5-ETS1-3		CCSS.MATH.PRACTICE.MP5	

SCIENCE & ENGINEERING PRACTICES

Developing and Using Models: Develop a model using an example to describe a scientific principle.

Using Mathematics and Computational Thinking: Describe and graph quantities such as area and volume to address scientific questions.

CROSSCUTTING CONCEPTS

Scale, Proportion, and Quantity: Standard units are used to measure and describe physical quantities such as weight and volume.

Systems and System Models: A system can be described in terms of its components and their interactions.

TARGET VOCABULARY

Arctic
atmosphere
biosphere
environmentalist
geosphere
hydrosphere
shelter

MATERIALS

- graham crackers
- various small candies
- icing
- plastic spoon or knife
- butcher paper or newspaper to cover the workspace
- straws
- tape
- 5 index cards
- ruler
- Testing Materials: fan or hair dryer for the whole classroom

LITERACY CONNECTIONS

Extreme Weather: Surviving Tornadoes, Sandstorms, Hailstorms, Blizzards, Hurricanes, and More! by Thomas M. Kostigen

NOTES