Unit 1 (Materials):
Green Music Makers

Concept

We can manufacture things so that they are easier on the environment by making it easy for people to recycle them. “Green design” takes into account the entire life cycle of the product.

Content Objective

Investigate properties of materials and create a musical instrument that fits specifications, then rate its green design.

Language Objective

Evaluate the sustainability of the project using comparative adjectives: e.g., *better, stronger, friendlier*, and *safer*.
Express and support an opinion about the role of sustainability in future engineering projects in school and beyond using modal verbs: e.g., *should, could, might, will.*
Write an explanation about sustainability in engineering.

Standards

- **NGSS:**
  - **5-ESS3-1:** Obtain and combine information about ways that communities use science ideas to protect the Earth’s resources and environment.
  - **3-5-ETS1-1:** Define a simple design problem, including criteria for success and constraints on materials, time, or cost.
  - **3-5-ETS1-2:** Generate and compare multiple solutions based on criteria and constraints of the problem.

- **TEKS:**
  - **1B** Students will make informed choices in the conservation, disposal, and recycling of materials.
  - **2F** Students will communicate valid conclusions in both written and verbal forms.
  - **3D** Students will connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists.

- **ELPS:**
    - **2C** Students will learn new language structures, expressions, and basic and academic vocabulary heard during classroom instruction and interactions.
    - **3G** Students will express opinions, ideas, and feelings ranging from communicating single words and short phrases to participating in extended discussions on a variety of social and grade-appropriate academic topics.
    - **3H** Students will narrate, describe, and explain with increasing specificity and detail.
    - **5G** Students will narrate, describe, and explain with increasing specificity and detail to fulfill content area writing needs.

Materials

Design Materials:

- Chart paper & pens, one per team of two students, handouts 5.1.1-5.1.4.

Construction Materials:

- Cereal boxes, margarine tubs, other containers; connectors (e.g., string, brads, staples, glue) construction materials (e.g. rubber bands, paper plates, straws, cardboard tubes)

Literature Connection:

- Awesome Dawson by Chris Gall

Day 1: Engage/Explore *Materials- Green Music Makers*

Teacher Says/Does	Student Says/Does	Language requirements
1. Preparation: Make an anchor chart of the Materials Cycle (Handout **5.1.1**). 2. Recycling: Pair students up and pose the following questions: What is recycling? How is recycling done? Why do people recycle? 3. Discuss recycling and the Materials Cycle referring to the anchor chart. Review how recycling saves energy. Say one of the most important activities in recycling is sorting into materials types. 4. Materials: Have the children select an object from the classroom and tell what materials they think are combined to make it.. Ask student pairs to consider the questions below about their selected objects: • Would you have to take it apart? • Would it be easy or hard to take apart? How would you do it? • When you take it apart, how many different materials do you have? *5.* Ask one or two of the children to describe or act out how they would recycle the object they are showing. Ask the children to tell why it is easier on the environment to make things that are easy to recycle (refer to the Materials Cycle). *If we use less energy, it is better for the environment.* 6. Green Design: Explain that some engineers specialize in designing for the environment. They use "green design," earth-friendly strategies and materials. 7. Ask students to discuss how engineers might plan a new toy so it would be earth-friendly. Write down some of their ideas. They might include: a. Use recycled/used materials b. Make the designs easy to take apart and sort c. Use natural materials that break down in the earth	After students have time to think, they share their answer with their partner then share out to the class. Children talk about how they might recycle in their home. Students discuss questions in pairs. Students share responses in whole group.	Recycling is _____. Recycling is done by _____. It would be (easy/simple/hard/difficult/challenging) to take apart because _____.

d. Use materials that are easy to re-make into new products, like aluminum 8. Consider showing one example of green design called biomimicry: https://www.youtube.com/watch?v=FBUpnG1G4yQ 9. Give students the exit slip on green design (Handout **5.1.2**).	Students complete exit slip.	

Day 2: Explore: *Materials- Green Music Makers*

Teacher Says/Does	Student Says/Does	Language requirements
1. Display the Materials Cycle anchor chart. Ask students to describe the cycle to a partner. Remind students that we use recycling and green design to save energy and review the design problem. 2. Tell students that they will be working as engineers *using green design to make a musical instrument.* Explain that they will be working in teams and should use their listening and speaking skills to work together to make their instruments. Show children the Design Brief (handout **5.1.3**) and the rating scale for green design so they know how their project will be judged. 3. Construction: While the students are working, use the **Collaborative Dialogue Template** (p. 32 in Teacher Handbook) to guide conversations and take a running record of students' progress on content and language objectives.	Students discuss the materials cycle in pairs. The teams work independently to make a Design Brief with several preliminary sketches, select one they like, and add any necessary details.	

Day 3: Explain/Elaborate *Materials- How Green Is Your Musical Instrument?*

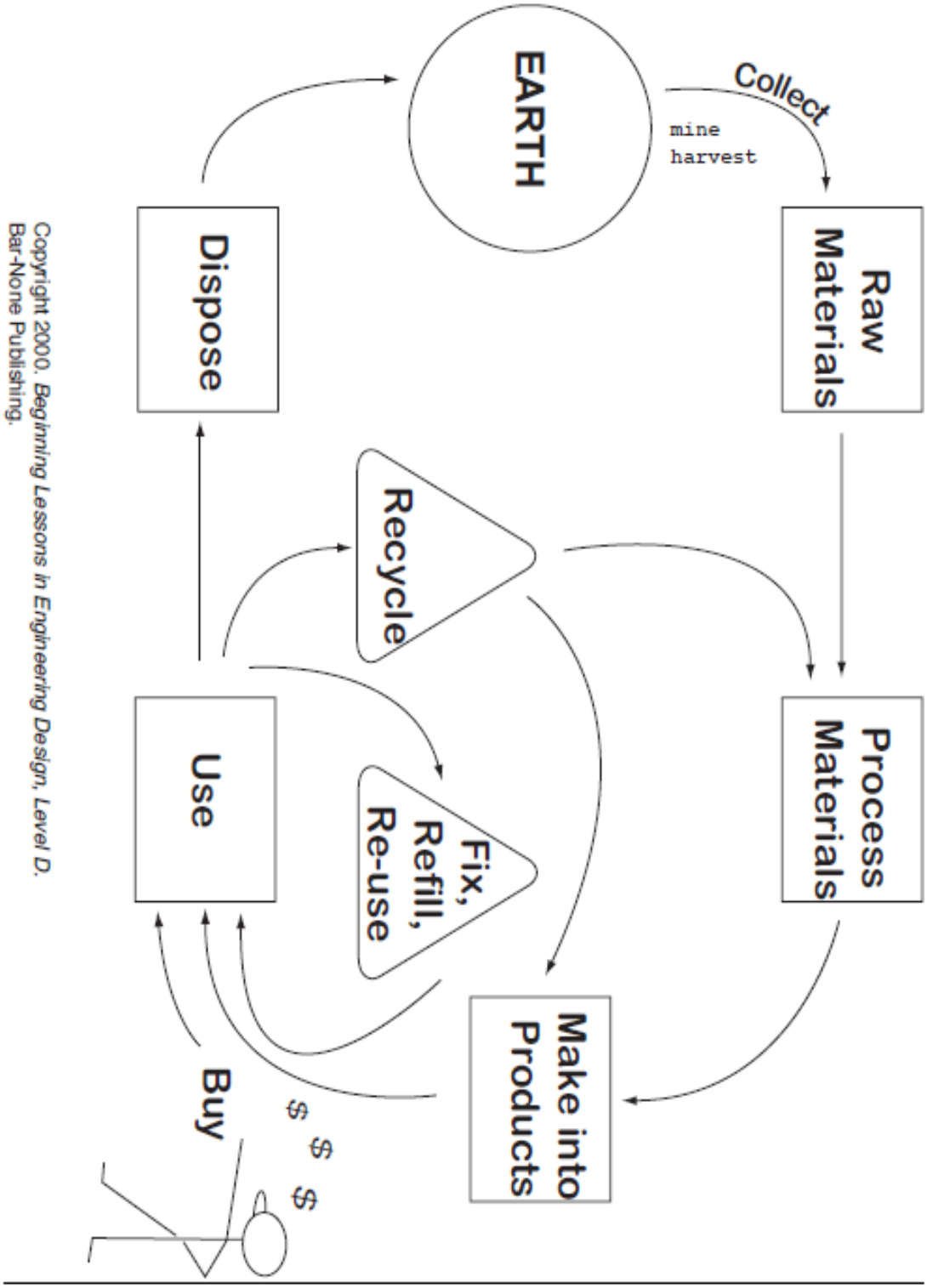
Teacher Says/Does	Student Says/Does	Language requirements
1. Tell students that they will share their instruments during a design review. Explain that a "design review" is a discussion in which teams present their plans and models-in-progress for friendly review and collaborative problem solving. 2. As the other teams ask questions of the presenters, think about what they know and are using in their design. Facilitate a conversation among the students and give suggestions. 3. Explain that the teams will have the remainder of class to make adjustments to their instruments based on feedback from the design review.	Student teams take turns sharing their progress on the design challenge. Other teams ask questions of the presenters. Teams revise and extend their green design instruments. Upon completion, the team should score their product using "How 'green' is your musical instrument" handout. They should prepare to present their instrument explaining how they met the specifications of the design problem.	We were wondering _____. One thing your team might try is _____. We thought that your _____ was creative because _____. Comparative adjectives: *better, stronger, friendlier*, and *safer*.

Day 4: Elaborate/Evaluate *Materials- Green Music Makers*

Teacher Says/Does	Student Says/Does	Language requirements
1. Explain that each team will present their completed musical instrument and explain how they met the specifications of the design problem. 2. Ask the students to organize themselves into one or more bands and play a simple tune using their instruments. After you enjoy the music, use handout **5.1.4** to discuss and score their instruments: a. Would it be hard to make a real musical instrument using the Green Design rules? b. Would it be hard to make a car using the Green Design rules? How might it be done? c. How might you have changed your musical instrument to get a higher score? d. Did you have to "de-bug" or "trouble-shoot" in your design (find and correct problems). 3. Write the following quote on the board: "*The world sends us garbage…we send back music."* Favio Chávez, Orchestra Director Explain that they will watch a short video of a group of students from Paraguay who are using green design in very creative ways. Landfill Harmonic video: https://www.youtube.com/watch?v=wCjbd21fYV8 Lead a discussion on the director's quote and how it relates to social and environmental justice. Possible questions include: • What do you think the director meant? • Why do you think he said that the world sent them trash? • Is it fair that some countries produce much more trash and pay other countries to store it in landfills? • What do you think the video didn't show? 4. Consider reading the book, *Funny Bones* by Duncan Tonatiuh, to emphasize how the artist José Guadalupe Posada always included messages in his artwork. Ask the students how they think this could relate to their drawing and designing in their engineering work.	Students should play an active role in rating each instrument, holding up number cards for each category. Everyone should understand the reasons underlying the ratings, and the team can share their self-rating. Students practice playing their instruments and create a simple tune. They share their responses to the whole group discussion questions. Students discuss the questions in pairs and then whole group.	Comparative adjectives: *better, stronger, friendlier*, and *safer*.

5. Tell students that they will write a “Makers’ Philosophy” describing their vision for engineering that they would like to follow throughout the school year. 6. Analyze the structure and language of the school mission statement or district philosophy. Model the process of drafting a philosophy statement, highlighting specific features of the language and structure of the example text. 7. Answer individual student questions as they write their “Makers Philosophy.”	Students write their “Makers Philosophy” about principles of engineering that they feel are important in their future classes.	In our future engineering projects, sustainability _____. Prepositions: because, since, as a result, moreover, furthermore, in addition, etc.

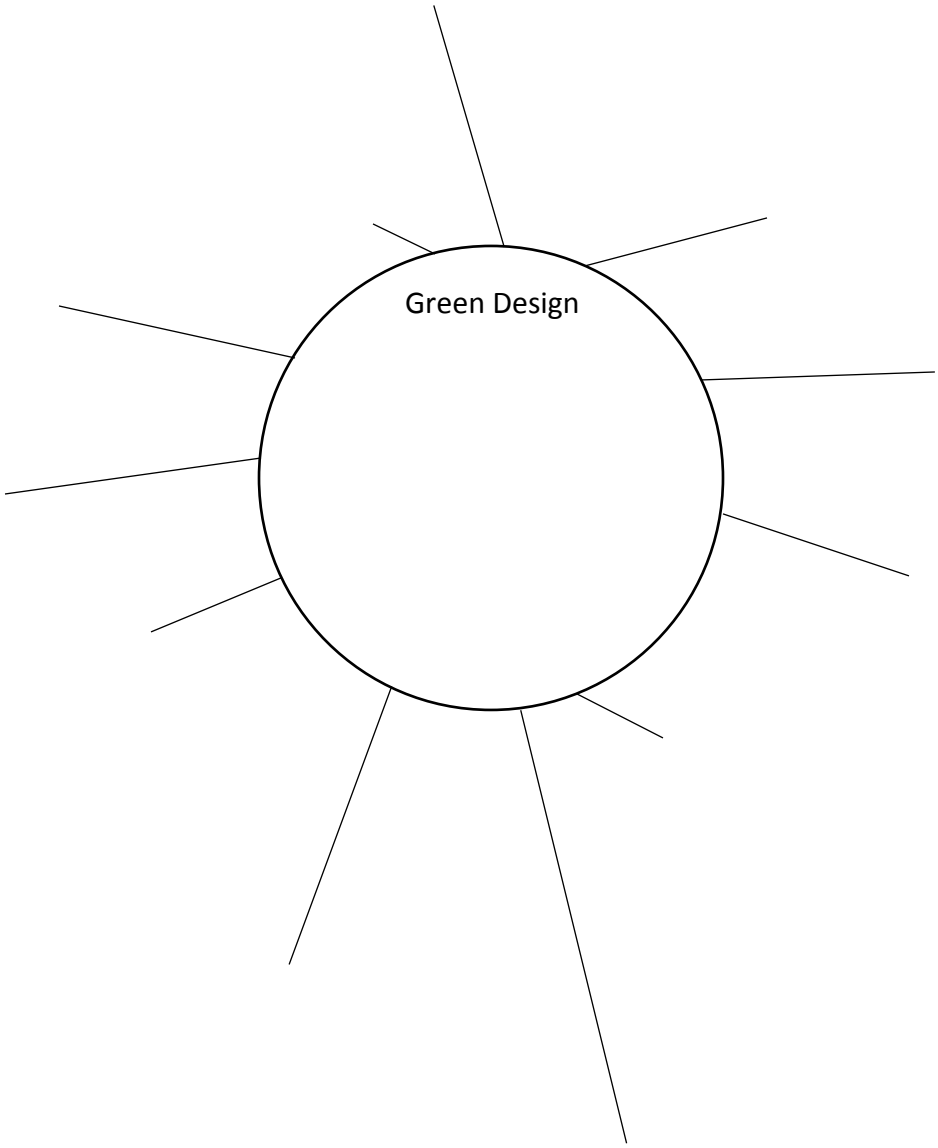
Total Materials Cycle



Exit Slip: Green Design Word Web

Name _____ **Date** _____

Draw an example of green design in the circle and **write** important ideas about green design in the lines to make a word web.



Design Brief: Green Music Makers

Design Problem	**Words to Remember/** **Palabras para recordar**
Design and make a musical instrument from at least three (3) different recycled, natural, or processed materials. It should be made of recycled or reused materials and be easy to recycle. <u>Specifications and constraints:</u> 1. The musical instrument should work, and it should be fun (to find out if it is fun, test it on a friend). 2. Use recycled materials wherever possible in your design. 3. Draw the design first and label with materials to be used. 4. Your design will be scored according to the green design rating scale. 5. Provide copies of Resource Page E.	

Drawing or Model of Our Plan (You can use the back of the page, too!):

Steps

Task	**Person Responsible**

How "Green" is Your Musical Instrument?

Name _____ **Date** _____

You have learned that in order to save energy and money, engineers use "green design." They:

- Use recycled materials whenever possible
- Design so products are easy to sort by materials, and
- Make things that are easy to take apart

Find out how well your musical instrument meets these "green design" ideas.

Read through the rating score system below, then take your musical instrument apart, keeping count of materials, steps, tools, and time. Circle your score on the chart.

Green Design Scores for Your Musical Instrument

	POINTS				
	1	2	3	4	5
Goal: Use recycled materials					
How much material in your musical instrument is recycled or re-used?	None	Almost none	About half	Almost all	All
Goal: Make sorting easy					
How many different materials did you use in making your musical instrument?	Over 7	6	5	4	3
How many steps did it take for you to separate your musical instrument into its parts?	Over 5	4	3	2	1
Goal: Make it easy to take apart					
How many tools did you need to use to take your musical instrument apart?	Over 4	3	2	1	None
How many seconds did it take for you to take your musical instrument apart?	Over 80	60	40	20	Less than 20 seconds

YOUR MUSICAL INSTRUMENT'S TOTAL SCORE: _____