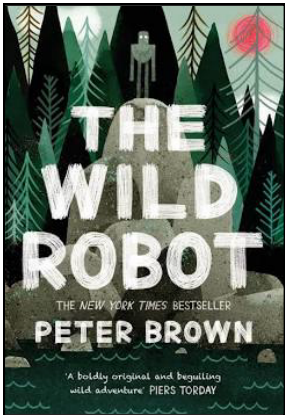


Engineering Adventure

Plan 4 4TH - 8TH GRADE

STEM STORY (30 min)



READ CHAPTERS 13 TO 16 OF 'THE WILD ROBOT'

Continue reading the story with your students. Try calling on student volunteers to read one paragraph each aloud. Discuss.

Discussion Questions:

Ask: **What is the main conflict in this part of the story?**

Example: Roz has been dented in the storm and is chased by bears.

Ask: **What do you learn about Roz's problem solving style?**

Example: She avoids conflict and has been programmed to not be violent.

Ask: **How is the storm a turning point in Roz's experience on the island?**

Example: She starts to see the animals are better skilled at surviving, and she is scared for the first time. .

Ask: **Which danger was more serious for Roz: the storm or the bears? Give examples from the story to support your choice.**

Example: Students' own answers.

Ask: **In what ways are Roz's choices showing her engineering thinking skills rather than instinct or emotion?**

Example: Roz shows engineering thinking by carefully observing the aftermath of the storm before moving, rather than rushing blindly into danger. She avoided the bears instead of fighting them. She figured out a safe escape route. She climbed the pine tree to protect herself and she has learned how to use the materials and environment around her (like the pine cones) strategically.

GAME TIME (20 minutes)

Materials:

- Printable cards
- Scissors
- Headlights from Plan 3

PINE CONE SCAVENGER HUNT

Say: **Let's play a fun game and gather pinecones, just like Roz!**

What you'll do:

- Cut out the pinecone cards. Students can help.
- The STEM Coach hides the cards all around the classroom.
- Students put on their headlamps.
- Turn off the lights and let students race to collect pinecones using only their head lamp! Say: **The student with the most pine cones at the end wins—but be careful, there are some trick cards.**

- Let them search for about 5 minutes.
- Students add up how many cards they got, including adding bonus points for bumper crops or pinecones that are the perfect shape to throw, and subtracting penalty points for crumbly, weathered pinecones and weevil infestations.
- The player with the most points wins!



ENGINEERING CHALLENGE

(60-90 min)

Materials:

- Scissors
- Tape
- Ruler or straight edge
- Magazine or catalog - used as a cushion to score the templates when tracing
- Ball-point pens
- Base for the roller coaster
- Concept design document

PAPER ROLLER COASTER: MAKE MORE COLUMNS AND ATTACH THEM TO THE BASE BOARD

Say: **Let's continue working on your amazing creations! Today, you will make more columns and learn how to attach them to the base.**

What you'll do:

1. Students refer to their Concept Design document. They start figuring out roughly how many columns they will need. (Remind students it is okay to come back to it and make more later, but they can begin with a rough idea or estimate.)
2. Student groups get a base board. They use pencil to mark out where their columns will go. It is important to let them collaborate and brainstorm together, based on their preliminary sketch and any changes they might have made. Say: **Now, you are defining the design opportunity in more detail and figuring out how to begin building the framework of your roller coaster.** Students mark the points they will place their columns with pencil on the board.
3. Students make the extra columns.
4. They cut along the four edges of a completed column only as far as the thin dotted line that goes around the column. **(Fig. 1)**
5. Fold back the four flaps along the thin dotted line. **(Fig. 2)**
6. Place the four flaps against the board in the desired location. Tape them to the board making sure that the tape is close to the column. **(Fig. 3)**
This will limit the amount of wobble that the column will have.

Tip: Use a ruler or the back of a pen to make sharp creases.

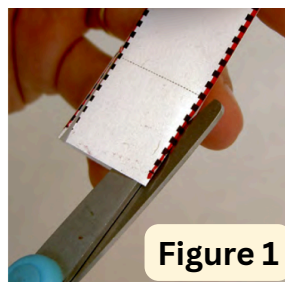


Figure 1

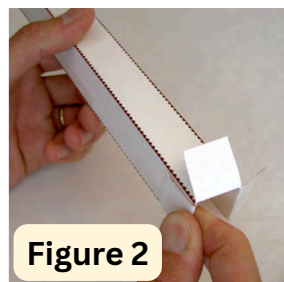


Figure 2

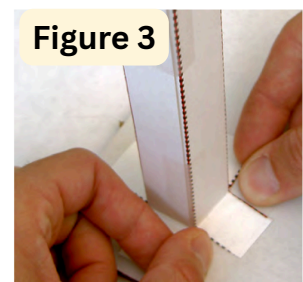


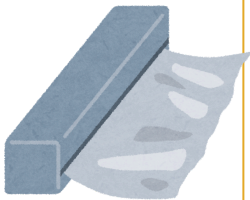
Figure 3

STEM ART

(30 min)

Materials:

- Tin foil
- Cardstock
- Scissors



MAKE TINFOIL IMPRESSION ART

Say: **Today we are going to make a special art project using a unique material! This material is soft enough that you can press your designs right into it—no pens, pencils, or paint needed. Can you imagine making a picture just by pressing lines and patterns into the surface? That's exactly what we're going to do**



Instructions:

1. Tell students to imagine what Roz looks like, based only on what they have read so far.
2. Students get a piece of cardstock paper and cover it with foil.
3. They take a chopstick as a stylus, they start etching a picture of Roz as they envision her directly into the foil. Since it is over the cardboard, they will be able to make clear impressions for their design.
4. Students can use a pencil (make sure it is not too pointy) to make indentations, add patterns and textures.

Ask: **What do we know so far about the materials that Roz is made of?**

Example: **We know Roz is a big gray robot made of metal, wires, and machine parts, but the author lets us imagine the exact materials ourselves. We know the material she is made of dents and scrapes.**

Say: **Different metals have their own special properties. In science, a property is a word we use to describe a material, and a material property is always true about that material.**

Give students a few examples (wood, cotton, glass, rubber) and ask them to use words to describe their properties. (Example: **Wood is hard and strong. Cotton is soft and absorbent. Glass is smooth and transparent. Rubber is stretchy and flexible.**) Explain: **Tin foil (aluminum foil) is a special material because it is easy to shape. It has the property of being malleable, which means you can press, scratch, or etch designs into it.**

STEM CRAFT

(60 min)

Materials:

- Yarn
- Tape + Scissors

MAKE A FINGER-KNIT PROJECT

Say: **Now that you have mastered the finger-knitting technique, we will learn to join our knit rope and create a fun project. YOU get to decide what you will design.**

STEM CRAFT

(Continued)



Fig. 1a



Fig. 1b

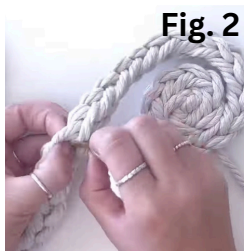


Fig. 2



Fig. 3

STEM TIME

(40-60 minutes)

Materials:

- Building barbs
- Straw
- Optional: brads, paperclips, scissors, tape, string/yarn

Instructions:

1. Students use the Two Finger Knitting technique they learned to create a long rope.
1. Leave a long tail on either side.
2. Tape the ends. This will create a point allowing students to use the yarn like a needle and thread it through their knitting.
3. Take one end of the long strand. Poke the taped edge of the yarn and pull taut. It will curve like the beginning of a coil. (Fig. 1a and 1b)
4. Continue to coil the knit rope, stitching through each time your coil reaches the tail. (Fig. 2)
5. Students can measure the circle to make sure it is even on all sides.
6. When you reach the end, take the opposite tail (also taped) and thread through to tie a knot. (Fig. 3)
7. You can also follow along with this video demonstration. Watch from the 15:00 minute mark to the 19:14.



<https://youtu.be/DRZutJNm2eg?si=8-RH6ZfFZbEF9H8D&t=901>

Optional: You can weave through in a straight line to make the coil more stable. For this, watch 6 more minutes until the 25:00 minute mark in the video.

Students can use this technique to make a rug for Roz, a coaster, a small doll blanket, or a placemat for their dinner table at home. They can also make several circles and join them together to make a flower, a circular bracelet or headband, or an animal!

8. Call on student volunteers to share their wonderful creations.

ENGINEER A SPINNING BARB INVENTION

What you'll do:

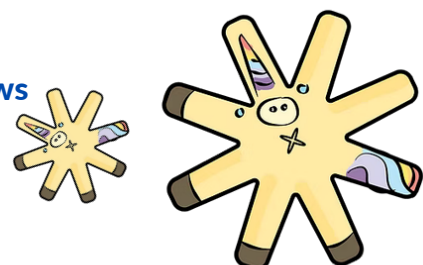
- Students use the barbs and straw to create their own invention. Say: **Use your barbs and straws to make a shape or structure that will spin, rotate or twirl.**
- They can use additional materials and sketch their design.
- They test out their creations and modify their design.

Ask: **What did you include in your design to help make it move?**

Example: **I made a hinge, I put straw in the middle and balanced both sides so it could move easily.**

Ask: **What do you think makes or allows something to spin?**

Explain: **Students' own answers.**

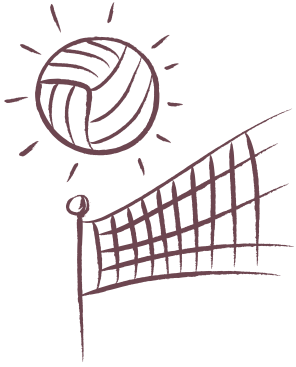


GAME TIME

(20 min)

Materials:

- Ball
- Cones or anything to mark zones



HUMAN NET VOLLEYBALL

How to play:

Organize students into three teams. Two teams will be the volleyball players, and the third team will be the human net. The human net will be lined up in the center of the court or play area.

The students will play volleyball and work in their teams to hit the ball over the net and try to score a point. The catch is that the human net can catch the ball and keep it from going over to the other team.

The net team will have a space marked either with cones or chalk that they cannot step out of. When one of the volleyball teams scores, they get a point. If the net catches the ball, they get a point. If the net steps outside of their space, they lose a point, and if either volleyball team steps into the net's space, they lose a point as well.

Play continues until the STEM Coach decides.



METRIC

ROLLER COASTER DESIGN + SPINNING INVENTION

4-PS3-1.

Use evidence to construct an explanation relating the speed of an object to the energy of that object.

3-5-ETS1-1.

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-3.

Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

TIN FOIL ART

2-PS1-2

Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

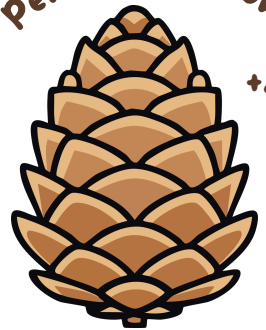


Too crumbly!
Put it back or -1



Perfect to throw!

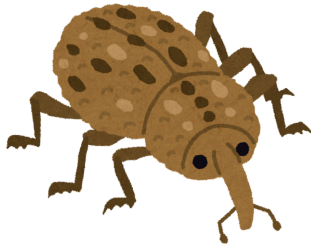
+2



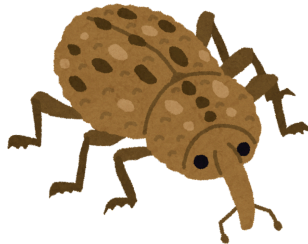
BUMPER CROP!
+3



Weevil Infestation!
-2



Weevil Infestation!
-2



BUMPER CROP!
+3



Too crumbly!
Put it back or -1



Perfect to throw!

+2

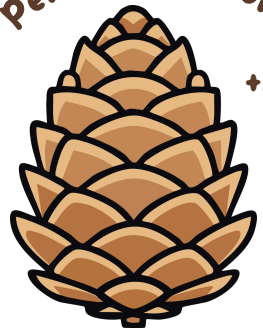


Too crumbly!
Put it back or -1



Perfect to throw!

+2



Too crumbly!
Put it back or -1



Perfect to throw!

+2

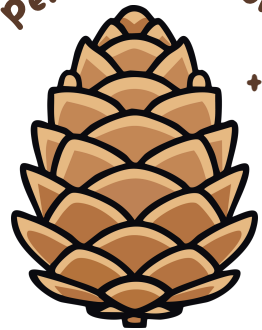


Too crumbly!
Put it back or -1



Perfect to throw!

+2



Weevil Infestation!
-1



BUMPER CROP!
+3



Too crumbly!
Put it back or -1



Perfect to throw!

+2

