STEM Design Challenge Cards

STEM design challenges are prompts that ask learners to build something new for a specific reason or purpose. Each card includes questions to support you as you plan, design, and reflect.

**Directions:** Print and assemble these cards. Then choose a design challenge to complete.

1. Cut along the solid lines. 2. Fold along the dotted line. 3. Paste or tape the sides together. You will have 16 cards total.

**BOAT CHALLENGE QUESTIONS**
- What is the size of the boat? What things would fit in the boat?
- What is the size of the boat? What things would fit in the boat?
- How much weight can the boat maintain?
- Can you think of other materials you could use to make a new boat?

**CEREAL BOX CHALLENGE QUESTIONS**
- What is the purpose of your design?
- How does the size of your chosen cereal box limit what you can create?
- How does your design help someone?
- What materials did you use in addition to the cereal box?
- What materials would you like to add and why?

**MUSICAL SCULPTURE CHALLENGE QUESTIONS**
- What materials did you use?
- Does the sculpture stand up on its own?
- How tall is the sculpture?
- How does it play music? When or how long does the music play?
- Can the sculpture withstand outside weather?

**HELPFUL TOOL CHALLENGE QUESTIONS**
- What does your tool help you do?
- How does the size affect its usefulness?
- Why create this tool instead of using something that already exists?
- Can you use this tool in more than one way?
- Is this tool child-friendly?
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### NEW SPORT CHALLENGE

How can I invent a new sport with kitchen tools?

- What is the purpose of the game?
- How would someone win?
- Justify why you would have certain rules?
- Can you think of another way to make the game more challenging?

### FURNITURE CHALLENGE

How can I build a piece of furniture with up to 5 pieces?

- What is the purpose of the furniture?
- Can the new piece of furniture support your weight?
- What is the maximum amount of weight this piece of furniture can hold? How might you test this?
- Can you use a different material to make the furniture stronger?

### SHOE DESIGN CHALLENGE

How can I design shoes inspired by nature?

- What is the purpose of the shoes?
- When would someone use these shoes?
- How could you use these shoes in various environments?
- Are the shoes appropriate for exercise or the beach?

### PROBLEM-SOLVING CHALLENGE

How can I solve a problem using just the materials I have on hand at home?

(Choose 5–8 materials.)

- What problem do you want to solve?
- What’s your plan to solve the problem?
- Can this tool solve more than one problem?
- What materials do you wish you had to make your invention better?

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Apple Slice Science!

When apples are set out in the air, they turn brown. But when they're coated with lemon juice, the acid in the juice keeps the apples looking fresh.

In this activity, your child will design a happy face snack and experiment with using lemon juice to keep the apples fresh. In the end, your child will have learned about the effects of lemon juice on apple slices, and have a healthy snack to go along with the lesson!

What You Need:

- Apple
- Apple peeler
- Lemon juice
- Raisins
- Grapes
- Plates

What You Do:

1. Peel the skin off the apples and cut apple slices.
2. Give your child one of the slices, two grapes, and two raisins. Have your child use the ingredients to create a happy face on the plate with the raisins for the eyes, the grapes for the nose, and the apple slice as the mouth. Talk about how a mouth looks when smiling to help your child turn the apple slice the correct way.
3. Have your child show you what a sad face looks like. Give your child one of the slices, two grapes, and two raisins. Have your child use the ingredients to create a sad face on a second plate.
4. Show your child how to sprinkle the lemon juice on the apples. Do not put any lemon juice on the sad face.
5. After 15 minutes, come back and check on the snack. Ask your child what is the difference between the two snacks. Ask your child why one is brown and the other one is not. Have your child tell you which one they would like to eat.
6. Have your child eat a slice of the apple that you did not use to make the faces. Then have your child eat the apple that you put lemon juice on. Ask if the apple with lemon juice on it tastes any different than the apple without lemon juice.
7. When you are finished, enjoy a snack of apples, grapes, and raisins with your child!
Word Scramble

Take a letter from every test tube and make a word!
Every letter can be used only once.

**Answer:**
Trees, maple, birch, aspen, beech.
2) Fruit, apple, lemon, peach, mango.
CROSSWORD PUZZLE
Science Experiment Vocabulary

Complete the crossword puzzle using what you know about the subject. Refer to the word bank if you need help.

Word Bank
scientific method
meter
liter
kilogram
law
typeh
hypothesis
Fahrenheit
Celsius

Across
2 A known truth in mathematics and science that is not subject to change
4 The temperature scale where water freezes at 32 degrees
5 A series of techniques to ask and answer scientific questions by making observations and doing experiments

Down
1 An educated guess at the outcome of an experiment
2 The metric unit of measurement for volume
3 The temperature scale where 100 degrees is the boiling point of water
6 An explanation about the results of many experiments that is developing and can be changed
7 The metric unit of measurement for length
8 The metric unit of measurement for mass

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“No Sprites” Animation

Game Lab Project Guide - No Sprites

Description: Test your understanding of variables and the draw loop by creating an animated scene without any sprites!

Ideas:
- A car driving across the screen
- Clouds floating by

Background knowledge
- Drawing with rectangles, ellipses, other shapes, and text
- Variables
- The draw loop
- The counter pattern

Where To Learn
- Self-Paced Introduction to Game Lab
- CS Discoveries - Interactive Games and Animation Unit

Tips:
Using Variables
Since we aren’t using sprites, you’ll need to create a variable for each aspect of your animation that will change. For example, create a variable to track the x position of an object that will move across the screen. Inside the draw loop, draw the shape and be sure to update the value of the variable using the counter pattern.

Moving Shapes Together
If you want to make two shapes move together, you can actually use the same variable. For example, two shapes drawn at the x positions shapeX and shapeX+50 can end up side by side. See the demo animations below for examples of this.

Demo Animations:
- Clouds
- Car and Trees Scene
Astronomy

Word Search

C M A R S P B Q I O L P S L
O C R L R L G W S N I U A O
M O O U X A I T O H A F T A
E N C Z W N H O S N S O E C
T S K U E E M E G N T R L H
F T E P D T C N U L R G L I
Q E T F E A M E T E O R I W
B L C M P T L L G I N Z T V
Y L F S A L K M A U O I E D
Z A S S L V X D L Q M U Y E
K T T U I F I S A M E V Z H
B I A N E Z Z L X E R I F Y
B O R K N M H V Y Y R C H Z
Z N W A S T R O N A U T W Q

SATellite  UFO  MOON  PLANet
ROCKET    COMET  MARS  MEteor
ASTRONAUT  ALIEN  SUN   CONstellation
STAR      ASTRONOMER  SPACESHIP  GALAXY
Toys on the Grid

Many of the skills needed in computer programming are practiced when students must figure out how to navigate a grid. When they move a toy from one position to another on a surface with a grid pattern, they will gain experience moving in measured patterns that are similar to the way computer code controls the movements of a robot. In this activity, children will be challenged to describe and count the ways a toy moves from one position on a grid to another.

What You Need:

- Square sticky notes
- Small toy figures (students can bring a small toy from home)

What You Do:

1. Have students work in pairs for this activity. First, have them create a grid on the surface of the table using nine sticky notes—three across and three down.
2. Invite one student in each pair to place a toy on one of the squares.
3. Then invite the other student to place a second toy on a different square.
4. Ask the first, “Suppose your toy wants to go visit your partner’s toy. How would you get there?”
5. Challenge them to describe the path of travel using their own words or by drawing arrows on a piece of paper. For example, a student might say, “My toy has to move two squares down and one square over.”
6. Before students can move their toy, their partner has to say whether or not they agree with the plan. Once both students in the pair agree that they have a good plan, the first child may move their toy to visit their partner’s toy, following the step-by-step plan they already verbalized or wrote down.
7. Next, have all children place their toys in new positions. Let the other child in each pair have a turn determining the path to the other toy.
8. Ask students to count how many steps it took to get from one position to another. Challenge them to find new positions for the toys that will require a greater number of steps.

Ann Gadzikowski is an author and educator with a passion for challenging children to think creatively and critically. Her recent book Robotics for Young Children won the 2018 Midwest Book Award for best educational book. Ann developed her expertise in robotics, computer science, and engineering through her work as early childhood coordinator for Northwestern University’s Center for Talent Development. She has over 25 years of experience as a teacher and director of early childhood programs, and currently serves as the Executive Director of Preschool of the Arts, a Reggio-Emilia inspired school in Madison, Wisconsin.
Follow the Dots

Draw a line from dot number 1 to dot number 2, then from dot number 2 to dot number 3, 3 to 4, and so on. Continue to join the dots until you have connected all the numbered dots. Then, color the picture!