



Objectives:

The students will demonstrate the ability to:

- Order programming commands and extend programming patterns to operate models. *(Science and Technology)*
- Design and produce a plot plan that optimizes the transport of park visitors from their cars to the park gateway. *(Science, Technology, Engineering, and Mathematics)*
- Experiment to find how fast the K'NEX Tramcar moves. *(Science and Mathematics)*
- Determine the time required to recoup the cost of materials for various park rides and systems using a mathematical simulation activity. *(Science, Technology, Engineering, and Mathematics)*

Have students open the K'NEX Tramcar. SCE.

Materials:

To complete the Learning Tasks and Challenge Activities below students will need the following:

- Large sheets of drawing paper (one per team).
- A collection of colored pencils, crayons, or markers.
- Rulers
- Meter sticks or tapes

Context:

A tramcar is a vehicle that transports amusement park visitors from the parking lot to the park entrance and then back again at the end of the day. Tramcar drivers make the trip from the parking lot easy and an onboard speaker system provides the visitors with important information that will make their park visit a success. At the end of the day, tram riders are very tired and they are happy to have an easy way to get to their car.

Requirements:

For this activity you are required to:

1. Make daily entries in your STEM Journal. *(Teacher Note: Help students to realize the importance of keeping records and journaling. Inform students of the materials they must include in their STEM Journals.)*
2. List the K'NEXions Chart for all Challenge Activities your team completes. *(Teacher Note: If you are using the simplified Program Presentation Sheet, the K'NEXions Chart will be at the top of that sheet. If not, a template page for K'NEXions Charts has been provided.)*
3. List and describe the steps in your programs. Keep a record of changes you made to programs as you improved them. *(Teacher Note: The simplified Program Presentation Sheet will help students with limited writing skills to describe their program in a graphic as well as a written form. Students with better writing skills can list and describe their programs directly in their STEM Journals.)*
4. Include all calculations, charts, and graphs you prepare in your STEM Journal.

Construction:

Use the instructions to build the K'NEX Tramcar model.

(Technology and Engineering)

Ensure that all of the electronic components have been plugged into the Control Box before you begin work.

(The K'NEXions Chart outlines the placement of the buzzer, motors, and LED for the Learning Tasks in this lesson. The students will find this information in graphic form in the building instructions.)

K'NEXions Chart

K'NEX Tramcar

Output	Device
1	
2	
3	LED
4	BUZZER
A	MOTOR
B	

Learning Tasks:

Complete these learning tasks using both the Tramcar SCE on the computer and the K'NEX Tramcar model and Control Box.

(Teacher Note: Encourage students to complete these learning tasks using the K'NEX Tramcar SCE on the computer before they program the Control Box to operate the model.)

Program the Tramcar to operate in a safe manner as it carries park visitors.

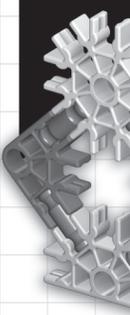
- * Write a program that uses the motor to move the Tramcar forward and backward to the extent that the wiring will allow. Allow the Control Box to loop the program several times.**
(Science and Technology)
- * Write a single program that uses the motor, LED, and buzzer in the following ways:**
 - When the Tramcar moves forward, the LED flashes,
 - When the Tramcar reverses, the LED stops and the buzzer sounds.
 - Allow the Control Box to loop your program several times.*(Science and Technology)*

Challenge Activities:

Keep daily notes in your STEM Journal and include all of the programs you write.

(Teacher Note: Remind students that the output devices may need to be plugged into different locations on the Control Box for Challenge Activities.)

- * Write a program that stops the Tramcar twice in the parking lot to safely load passengers before it moves to the park.**
 - Sound the buzzer briefly when the Tramcar is about to stop.
 - Flash the LED as the Tramcar stops and keep it flashing until the Tramcar begins moving again.
 - Allow the Control Box to loop your program several times.*(Science and Technology)*
- ** Design and create a diagram of the amusement park's parking lot and the tramcar roadway that leads up to the park's gateway. Draw the diagram as it would look from a helicopter high above the ground. Once your diagram has been accepted by the park owners, the contractors can begin work on the parking lot and roadway.**
 - Your group will take a large sheet of drawing paper to use for this activity.
 - Your diagram will show an aerial view of the parking lot, tramcar roadway, and the park gateway.



- Use colored pencils, crayons, or markers to color in the appropriate parts of the diagram.
 - Add landscaping to your diagram along with any other details that you would expect to see as you approach an amusement park.
 - Label your diagram.
 - List your team members on the plot plan and place it on the wall as directed by your teacher.
(Teacher Note: In advance of this activity, set aside wall or bulletin board space where teams can post their plot plans.)
(Science, Technology, Engineering, and Mathematics)
- 3. * Refer to the building instructions for the K'NEX Tramcar and the Cost per Piece Chart provided by your teacher. Determine the cost of the materials that are used to build the ride.**
- Make a data chart for this activity in your STEM Journal and include all of your calculations
 - Place your answer on the board in the spot indicated by your teacher.
(Teacher Note: Set aside space on the white board or chalk board for each team to list their cost of materials so that the costs are visible to the entire class.)
 - How do your results compare with other groups who have completed the challenge? If answers vary, devise and implement a plan to check your work.
(Teacher Note: Provide time for the teams to compare their answers and to correct any differences. The Cost Per Piece Chart has been provided in an editable format allowing you to assign costs to the K'NEX Pieces that are appropriate for the students you are working with.)
(Science and Mathematics)
- 4. ** Complete the activity above using a spreadsheet program to organize the data, compute the costs, and calculate the total cost of the materials used to build the K'NEX Tram.**
(Science, Technology, and Mathematics)
- 5. * Determine how far the Tramcar travels in five (5) seconds. Determine the materials you will need to complete the activity and request them from your teacher. Your design team must run three tests and find the average distance the Tramcar will travel in five (5) seconds. Prepare a data chart to show the results of each trial and show all of your calculations. Be prepared to explain the strategy you used to solve this challenge.**
(Science, Technology, and Mathematics)
- 6. ** Compare the cost of materials for the Swing Ride, Spinning Carpet Ride, Double Ferris Wheel Ride, and the Tramcar. Which of these was the most expensive to build? The costs of the Tramcar and Gateway are necessary expenses to keep visitors safe as they move back and forth from the parking lot and to welcome them to the park. The cost of these five items must be made up through the sale of tickets. Given the following information:**
- Four people can ride the Swing Ride at one time.
 - Four people can ride the Spinning Carpet Ride at one time.
 - Eight people can ride the Double Ferris Wheel at one time.
 - The cost to ride each ride is \$1.00.
 - The Swing Ride and the Spinning Carpet Ride run 50 times a day.
 - You found how many times a day the Double Ferris Wheel Ride runs in one of the Challenge Activities for that ride. Check your STEM Journal to find how many times the Double Ferris Wheel runs each day.
- How many days would it take to pay off the material costs of the different rides if the seats are completely full each time the rides are run?
- If each of the rides were to run for an additional 40 days, would they be able to make enough money to cover the cost of the K'NEX Tramcar and Gateway?
(Science, Technology, Engineering and Mathematics)