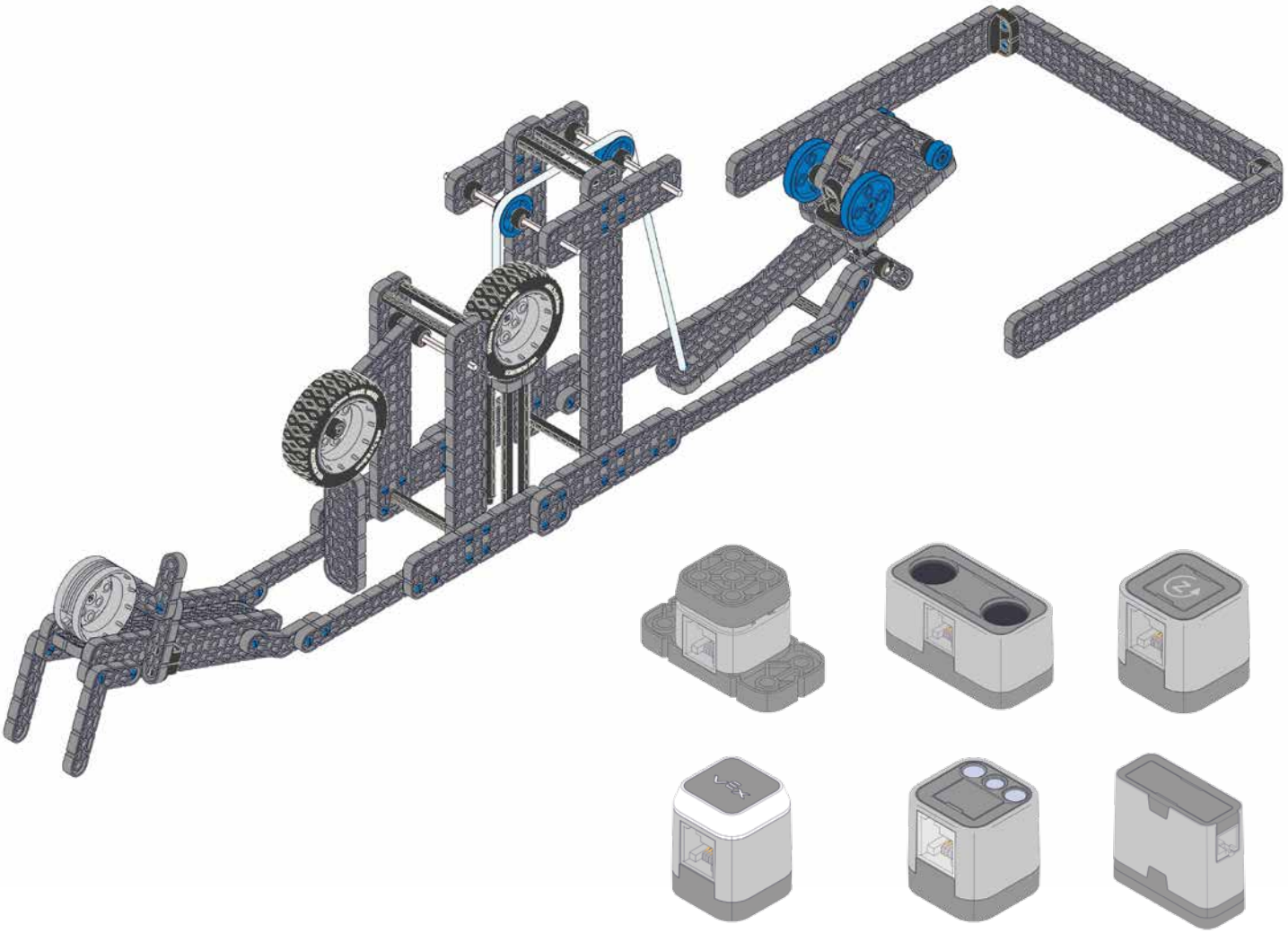
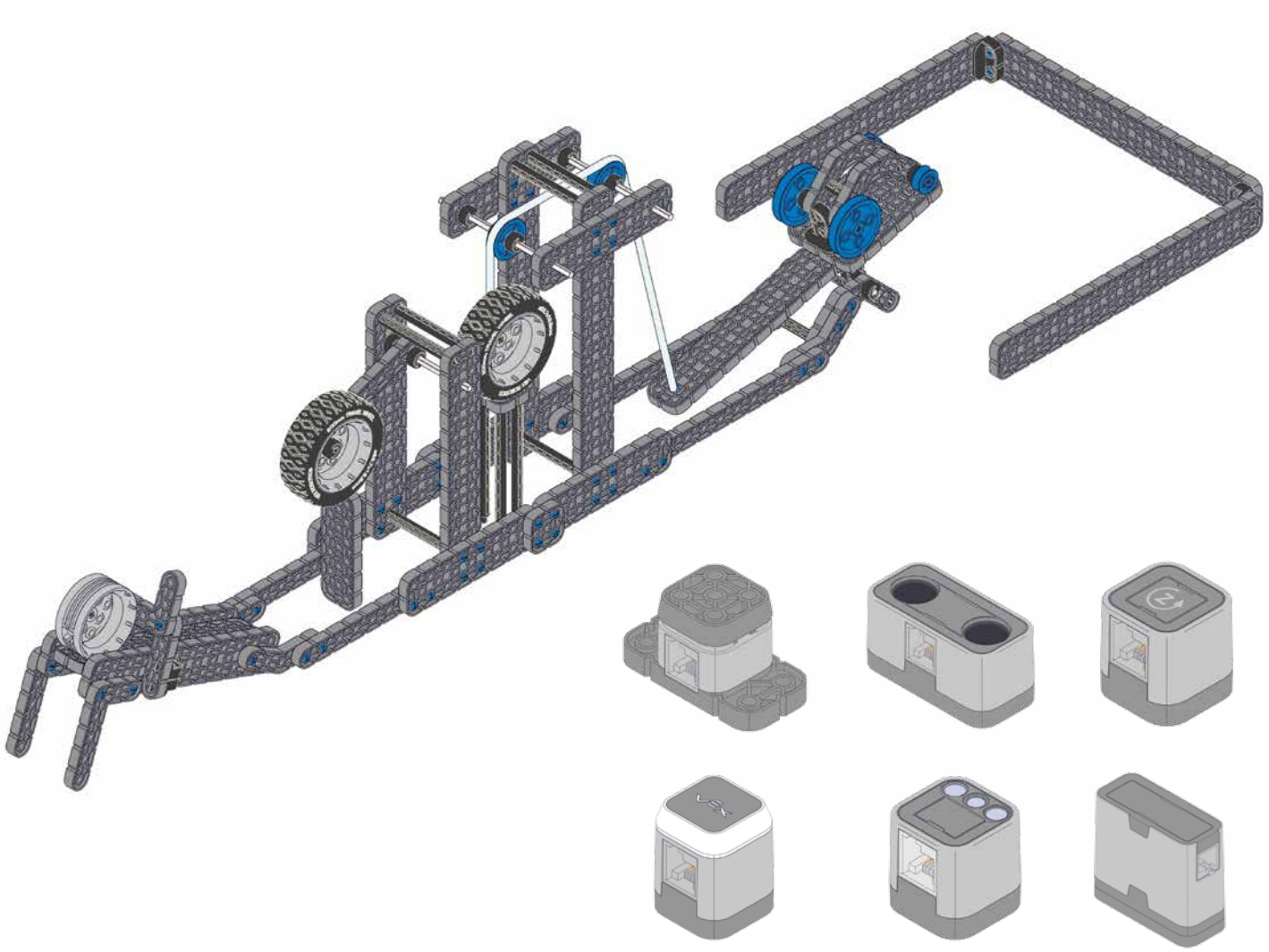
J

Chain Reaction Programming Challenge





J.1

Chain Reaction Programming Challenge

Unit Overview:

In this unit you will use your knowledge of simple machines, sensors and programming to build and test autonomous Chain Reaction Devices.

Unit Content:

- Chain Reaction Programming Challenge Rules

Unit Activities:

- Chain Reaction Challenge Device Build using Autonomous Chain Reaction Device Rubric
- Completion of Idea Book Pages with device build and testing

Note: You may be asked to use your Chain Reaction Device from Unit 5 and add sensors, then program them rather than build a new Device. See your teacher for instructions.

Note: Separate copies and/or printouts of activities may be used for student work. Please see your teacher BEFORE writing in this guide. Visit www.vexiq.com/curriculum to download and print PDFs of all exercises!

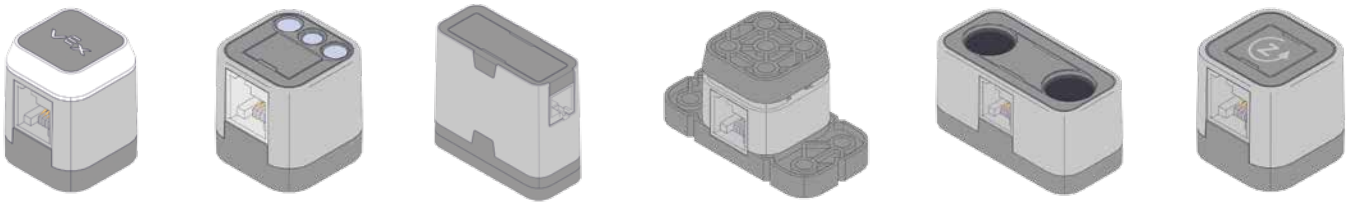
J.2

Chain Reaction Programming Challenge:

The Chain Reaction Programming Challenge Rules: Parking the Car Autonomously

Challenge Goal & Overview: The goal is to successfully build and program a fully autonomous Chain Reaction Device that successfully parks the car in the garage. Your teacher will provide you with (or ask you to build) the car and garage models to be used in this challenge. In most cases you will be asked to work together in teams, but you may be asked to work alone.

Note: Depending on time and your teacher's plans, you may be asked to use and modify your Chain Reaction Devices previously built for the Chain Reaction Challenge in an earlier unit (adding additional motor(s), sensors, and programming). Otherwise, you may be asked to design, build, and program this challenge from scratch. Please see your teacher for details.



Challenge Rules for Autonomous Chain Reaction Device (grades 4-8):

1. Build a four-stage Chain Reaction Device that parks the car in the garage.
2. Your Chain Reaction Device will be autonomous – using four or more Smart Motors, four or more sensors, a Robot Brain, and programming techniques to customize control. Smart Motors ARE considered a sensor in this challenge IF control is customized through the use of programming techniques.
3. Use three or more of the following to construct your stages: Wheel & Axle, Inclined Plane, Wedge, Lever, Pulley, Screw, or Pendulum. You may use a type of simple machine or pendulum more than once if you wish.
4. Please see the **Rubric to Evaluate Autonomous Chain Reaction Device** for all of the details on how you will be evaluated.
5. Idea Book Pages can be used for planning and troubleshooting. Your teacher will provide further instructions on using the Idea Book Pages.

J.3

Rubric to Evaluate Autonomous Chain Reaction Device (grades 4-8)

Evaluation Criteria	Expert = 4	Proficient = 3	Emerging = 2	Novice = 1	Assessment	Comments
Design & Process Criteria						
Creating viable solutions to the given challenge: mechanism use	Four or more, well developed stages exist meeting all challenge rules	Three well developed stages exist meeting majority of challenge rules	Two or more partially developed stages are evident	A single stage that may or may not be developed is evident		
Simple machines and pendulum usage	Device uses three or more efficient simple machines/ pendulum	Device uses two functioning simple machines/ pendulum	One simple machine/ pendulum exists that functions	Attempt using one simple machine/ pendulum		
Design Process (defined by the teacher, could be Idea Book use)	Design process utilized, documented & enhances product	Design process utilized and fully documented	Design process utilized consistently	Some evidence that design process was utilized		
Utilization of Resources (materials and parts, information and instructions, people, and time)	Resources used fully within challenge rules and efficiency maximized	Resources utilized to maximize efficiency	Evidence that some resources utilized meeting challenge purpose	A few resources (e.g., tools & materials) partially utilized		
Technical Criteria						
Autonomous Programming	Efficiency and consistency of program execution	Consistency evident in program execution	Functional, but inconsistent control system	Program incomplete or rarely functional		
Control System (Sensor & Motor use)	Completely functional control system with four or more motors & four or more sensors used	Consistently functional control system three or more motors & three or more sensors used	Functional, but inconsistent control system (regardless of # of motors & sensors)	Non-functional or incomplete control system (regardless of # of motors & sensors)		
Electrical Systems	Battery charged. Wire routing safe, efficient, & completely functional	Battery charged. Wire routing safe & consistently functional	Functional, but inconsistent (battery or wiring issues)	Non-functional or incomplete (battery and wiring issues)		
Mechanical Systems (mechanisms & triggers)	Completely functional and consistent mechanical systems	Consistently functional mechanical systems	Functional, but inconsistent mechanical systems	Non-functional or incomplete/ unsafe mechanical systems		
Unifying Themes (This area emphasizes the Interaction of Science, Technology, & Human Endeavor)						
Communication (written, electronic and/or oral as defined by the teacher)	Sophisticated and highly efficient communication for stated audiences	Purposeful, consistent, effective communication	Purposeful, partially consistent communication	Communication very inconsistent and lacks purpose		
Teamwork	Integrated teamwork that maximizes outcomes is evident	Teammates fully define roles, goals, & work together	Teammates partially define roles, goals, & work together	Participants function separately within a group		
Creativity	Device is unique, imaginative, and functional	Device is unique and/or imaginative in multiple ways	Device clearly shows a unique and/ or imaginative element	Unique and/ or imaginative element(s) unclear		

Rubric Adapted from Rubric and Evaluation Criteria for Standards-Based Robotics Competitions & Related Learning Experiences – TSA, 2005

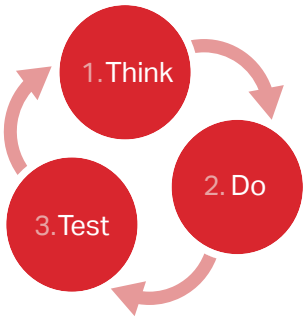
J.4

Chain Reaction Programming Challenge Idea Book Page: Design Plan

Student Name(s): _____

Teacher/Class: _____ Date: _____ Page #: _____

Plan and design a Four-Stage Chain Reaction Device that meets challenge and rubric criteria on pages 1 and 2 below.



Sketch/Describe Stage 1 of your Device, including Trigger Mechanism Here:

Machine Type (One of the Simple Machines or Pendulum): _____

Sensor(s) to be used in this stage (if any) and function of each sensor:

_____

Sketch/Describe Stage 2 of your Device Here:

Machine Type (One of the Simple Machines or Pendulum): _____

Sensor(s) to be used in this stage (if any) and function of each sensor:

_____

Sketch/Describe Stage 3 of your Device Here:

Machine Type (One of the Simple Machines or Pendulum): _____

Sensor(s) to be used in this stage (if any) and function of each sensor:

_____

Remember: Problems ARE NOT failures, they are an expected part of the design process!

J.4 cont.

Sketch/Describe Stage 4 of your Device Here:

Machine Type (One of the Simple Machines or Pendulum): _____

Sensor(s) to be used in this stage (if any) and function of each sensor:

_____

Plans for Connecting Each Device Stage:

Follow through with your design plan and BUILD/PROGRAM your device, then TEST and OBSERVE.

Testing Observations:

_____

_____

_____

_____

_____

Does your Device function like you expected? YES NO

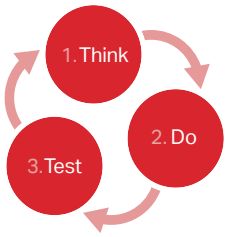
If you answered "YES" - Congratulations! You will score well on the Challenge Rubric. You may now move on to other lessons.

If you answered "NO" - Use your observations above and the Rubric to determine what problem needs troubleshooting, then use a copy of the Troubleshooting Idea Book Page to help solve that problem. Keep repeating this "THINK - DO - TEST" process with the troubleshooting pages, until your device functions correctly.

Remember: Problems ARE NOT failures, they are an expected part of the design process!

J.4 cont.

Chain Reaction Programming Challenge Idea Book Page: Troubleshooting



Student Name(s): _____

Teacher/Class: _____ Date: _____ Page #: _____

Use a copy of this Idea Book Page for each device problem you have to troubleshoot.

Sketch/Describe Your Device Problem Here:

Sketch/Describe Your Solution to the Problem Here:

Follow through with your solution and MAKE PLANNED CHANGES to your device, then TEST and OBSERVE.

Testing Observations:

_____

_____

_____

_____

_____

Does your Device function like you expected? YES NO

If you answered "YES" - Congratulations! You will score well on the Challenge Rubric. You may now move on to other lessons.

If you answered "NO" - Use your observations above and the Rubric to determine what problem needs troubleshooting next, then use another copy of this Idea Book Page to help solve that problem. Keep repeating this "THINK - DO - TEST" process with troubleshooting pages, until your device functions correctly.

Remember: Problems ARE NOT failures, they are an expected part of the design process!