Lesson Plan

Subjects: Algebra/Geometry/Physical Science (8th-12th grades)

Lesson Focus: Half-Pipe Loop System **Time:** Activity variations and extensions could require as few as 1 and as much as 8 class periods

Course Level Expectations (Algebra I and II):

CLE 3102.1.7, CLE 3102.3.7, CLE 3102.3.9, CLE 3103.1.7, CLE 3103.3.4, CLE 3103.3.5

Course Level Expectations (Geometry): CLE 3108.1.7, CLE 3108.2.3, CLE 3108.4.4, CLE 3108.4.7, CLE 3108.4.8

Course Level Expectations (Physical Science): CLE 3202. Inq.2, 3,4,5,6; CLE 3202.T/E.2; CLE 3202.Math.2; CLE 3202.3.1; CLE 3202.3.2; CLE 3202.3.3; CLE 3202.4.1; CLE 3202.4.2; CLE 3202.4.3

Materials (per group):

1 K'NEX Education Roller Coaster Physics Set Computer
Building instructions CD-ROM –File: 8 ½ X 11 Half-Pipe II
Ruler
3 Balls – Golf, Almost Golf, Ping-Pong
Science/Mathematics Journal
Cardboard Boxes for testing areas
Clothespins for marking locations on track

Preparing the lesson:

1. Set up Testing Area, as shown.
2. Divide students into small groups. (4-5 students)

3. Provide 1 K'NEX set and other materials for each group.

CHALLENGE #1: BUILD!!

Teaching the Lesson:
1. Students will open the "8 ½ X 11 Half-Pipe II" on the CD-ROM and follow the schematics to build the half-pipe with the following modification: The end of the structure cannot be higher than the box. (Note: The colors on the CD-ROM do not match the colors in the set. Students will have to determine which parts correspond with the parts shown in the diagram.)
2. Allow students to discover the forces required to successfully launch each ball into the box.

CHALLENGE #2: EXPLORE!!

Determine the maximum distance that the box can be placed from the end of the ramp in order for each ball to go into the box (See testing set up.)

One thing that is different about engineering than other types of problem solving is that there a many ways to do things, some better than others. Which leads us to …

CHALLENGE #3: INVENT/CREATE!!

Modify your half-pipe so that it will deliver a golf ball to the box, located 12 inches away from the end of the track. (You may use clothespins to secure parts or mark lengths, if different from what the K'Nex parts allow. For the competition, you will attempt to successfully deliver up to 12 golf balls to the box.

Teaching the Lesson (Follow up questions):

Why was it harder to launch the ping-pong ball than the golf ball?

Describe and demonstrate potential and kinetic energy.

How does this relate to the differences in the masses of the balls?

CHALLENGE #4: BUILD!!

Teaching the Lesson
1. Students will open the "8 ½ X 11 Incline Circular Loop" on the CD-ROM and follow the schematics to convert their half-pipe design to the loop design.

2. Allow students to discover the forces required for each ball to successfully complete the

loop.

CHALLENGE #5

For this challenge, students will use their loop structure. Without moving the loop, keeping it close to the ground, the goal is to launch the ball over the 1st box, into the 2nd box, which is placed 12" behind the 1st box, as shown. Teams will have 3 minutes to deliver as many balls, as possible to the 2nd box. Golf balls will be awarded 5 pts each, Almost Golf balls, 10 pts, and Ping-pong ball are worth 20 pts each.

CHALLENGE #6 (THE FINAL CHALLENGE!!)

The goal is to get the 3 balls into a box with 3 partitions. The box is placed 2 feet from the "blue line." Every piece of the loop structure must be behind the blue line. Golf ball that lands in the box is awarded 5 points. If it lands in the yellow (farthest section) it will be awarded 10 points. Almost golf ball that lands in the box is awarded 10 points. If it lands in the red (center section) it will be awarded 20 points. Ping-pong ball that lands in the box is awarded 20 points. If it lands in the blue (closest section) it will be awarded 40 points.

Assessment:

For Challenges #1 and #4 Award team points based on fastest successful completion. 1st place - 10 points 2nd place – 8 points, 3rd place – 6 points, all other – 4 points

For Challenge #3 Award team points based on the number of balls successfully delivered to the box, 1 point per ball, up to 12 points maximum.

For Challenge #5 Award team points based on the number of balls successfully delivered to the 2nd box within 3 minutes. Golf balls will be awarded 5 pts each, Almost Golf balls are 10 pts each, and Ping-pong balls are worth 20 pts each.

For Challenge #6 Award team points based on the number of balls successfully delivered to the partitioned box within 3 minutes. Golf ball that lands in the box is awarded 5 points. If it lands in the yellow (farthest section) it will be awarded 10 points. Almost golf ball that lands in the box is awarded 10 points. If it lands in the red (center section) it will be awarded 20 points. Ping-pong ball that lands in the box is awarded 20 points. If it lands in the blue (closest section) it will be awarded 40 points.

Closing Activity: Journal writing- Have students reflect on their method(s) of problem solving and communicating. What could they have done differently to improve accuracy and efficiency?

Extension: Provide a "Parts List" to each group with prices for K'NEX pieces. Have students determine the cost of their structure and make changes to lower the cost, but still

maintain accuracy of functions.