Lesson Plan **Subject: Math and Science** (9th-12th grades)

Lesson Focus: K'Nex Car Competition with Economic Consideration (Phase 3)
Time: 40 min for build and testing

40 min for competition (Multiple testing areas can expedite this process.)

Guiding Question, Course/Grade Level Expectations, and SPI's are included for 6th, 7th, and 8th grade Math and Science, Physical Science, Biology, Physics, Algebra 1, Algebra 2, and Geometry. (**See the Standards Spreadsheet**.)

Materials: K'Nex Forces, Energy, and Motion Set with schematics.
Washers, BB's, coins
Measuring Tape
Stopwatch or Timer
Tape
Pencils (speed bumps)

Preparing the lesson:
1. Divide students into small groups. (4-5 students)
2. Provide K'Nex Set to each group.
3. Set up Testing Area(s), as shown.
(You will need 25 feet for racetrack, perhaps in a hallway. Use masking tape to mark a starting location and delivery locations. For an added challenge, add "speed bumps" by taping pencils to the track, as shown in attachments.

Teaching the Lesson:
1. This is an extension of K'Nex Car Competition (Phases 1-2.)

2. Present the competition rules, as follows:
- Build a vehicle having your own design. It does not have to be like any of the vehicles in the K'Nex book.
- It must be powered by spring motor(s) only. You may use up to four of the spring motors, but understand that there is additional cost based on the number of motors you use.
- It must have only parts from the kit you were given, excluding the rubber bands, the friction motor, and the battery powered motor.
- Vehicles must make a complete run from the base block to the target block and back to get credit for the run.
- If any part of the vehicle is touching or passed through either the base block or the target block then the vehicle is considered to have reached the block.
- At no time may the vehicle be moved using any motive power other than the spring motors. Any infraction of this rule will result in a refueling cost of five times the normal refueling cost.
- Should a vehicle stop before it reaches the target or base block, it must be restarted from the point where it stopped. Failure to abide by this rule will

result in a refueling cost of 3 times the normal fueling cost.
- Some of the locations may have obstacles between the base and their position.

Describe the following scene. Your vehicle will be carrying cargo to three different locations, which are 12ft, 18ft, and 24ft away from the base block.

- You will have 3 minutes to deliver as many pieces of cargo, as possible.
- Cargo delivered to Station #1 will receive $2/gram, Station #2 will receive $3/gram, and Station #3 will receive $4/gram.
- Refueling costs will be based on the mass of the vehicle (unloaded) and the number of motors the vehicle uses. Cost per refueling will be calculated as $1 per gram of vehicle mass times the number of motors the vehicle uses.
- Any cargo dropped must be replaced on the vehicle at the point where it was dropped.
- The ultimate goal is to make the MOST PROFIT in the 10-minute time limit.
- Experiment with your vehicle and collect data to determine the best way to maximize profit.

Assessment: Use the following formulas:
Let x = Weight of cargo in grams
Score = 2*X delivered to station #1 + 3*X delivered to station #2 +4*X delivered to station #3 – Costs - Penalties.

Refueling Costs = ($1* weight of vehicle (in grams) * number of motors) * # of restarts

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Penalty for pushing the car = 5* normal Refueling cost * # of incidents
Penalty for restarting at the wrong location = 3* normal Refueling cost * # of incidents

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Award points for 1st place through last place, based on profit.

Journal Writing: Have students reflect on their method(s) of problem solving and

communicating. How could they have improved their methods, communication, and accuracy?

Extension: Have students plan and present a technical presentation. (See Technical Presentation Lesson Plan for criteria and grading rubric.)
