**Middle School STEM Science Lab/Activity Planner**

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| Name of Lab/Activity: Law of Conservation of Energy- Coaster Cruising | Grade: 8 |
| California Science Standard(s): (please copy and paste standards taught during this lesson)8PC.1C *Students know* how to solve problems involving distance, time, and average speed.8PC.2D *Students know* how to identify separately the two or more forces that are acting on a single static object, including gravity, elastic forces due to tension or compression in matter, and friction.8PC.2D *Students know* that when the forces on an object are unbalanced, the object will change its velocity (that is, it will speed up, slow down, or change direction). |
| Learning Objective/Goal:SWBAT demonstrate how the application and removal of energy impacts the motion of objects. |
| Language Objective/Goal: (based on California Common Core Standards)Speaking & Listening- Comprehension and Collaboration 1a-1d |
| Materials & Resources: Steel Balls, Foam insulation, tape, meter sticks (posts), Protractors, Timer, Calculator, meter-stick, rope, plastic tube (marbles) |
| Procedure:Introduce concepts of momentum and Law of Conservation via two demonstrations and then present (to the class) the challenge lab (Coaster Cruising).**Demo 1:** Newton’s Cradle- Demonstrate Newton’s Cradle using document camera. Provide class with the following prompts to engage in conversation:* What do you think will happen when a ball is dropped? 2 balls, 3 balls, balls dropped together? Opposing balls dropped from same height at the same time? What ultimately causes the balls to stop moving? Where does the energy go? Introduce the Law of Conservation of Energy.

**Demo 2:**Tie a bowling ball or shot put to a rope that is hanging from the ceiling. Clear students and desks/tables from path of (soon to be falling object). Pick object up to level of chin and drop. Stand still. The ball will swing to other end of the room and back towards the instructor. The instructor will not be hit by the ball. * Why not? Demonstrate again. Review, conceptually, The Law of Conservation of Energy.

**Activity Coaster Cruising Lab:** Groups will be given the Coaster Cruising Lab(see supplemental documents) | Teaching Notes: (include timing)These activities can be used to transition from a momentum to the law of conservation of energy, or used to introduce the two topics, together. The demonstrations can be spaced out through the 2 days of activities, listed here. Less harmful objects such as tennis balls can be used in place of bowling ball, depending upon the weight bearing load of the classroom used.  |
| Math Connection:Re-visting Average Speed- Distance/Time | Teaching Notes:A basic application for determining average speed. |
| Technology Extension of Learning: Document Camera for demonstrationsPHET- <http://phet.colorado.edu/en/simulation/energy-skate-park> (using smart board)http://phet.colorado.edu/en/contributions/view/3548 | Teaching Notes:The document camera does an effective job of demonstrating the collisions, ripple effect, and transfer of energy via momentum.The PHET animation, here, can be used in a variety of ways: To introduce topic, review the fundamentals of PE and KE via the skateboarder, as a pendulum. The animation captures data and displays the energy various bar graph formats, that may be effectively used to dissect the ideas of PE, KE, and Total Energy. (\*\* Incorporating this animation with a SmartBoard may increase some student engagement.\*\*We have 2 documents to support the lesson. 1. Basic Energy Skate Park PHET
2. CoasterCruiserFinal
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| Formative Assessment: (please attach a copy)Lab Sheet and PHET support document (see supplemental documents .pdf) | Teaching Notes:N/A |
| Strategies for EL and Special Needs Students:* Materials Board
* Demo Roller Coaster
* Modified Assignment, (complete components of design challenge that correspond to level of students, tier 1 tier 2, etc)
* Vocabulary worksheet/word wall- involving main terminology
 | Vocabulary:FrictionSpeedAccelerationGravityMotionVelocityMomentumLaw of Conservation of Energy |
| Alignment in science unit: (Brief description of lessons taught **prior to & after** this lab/activity)Physics- Motion (including speed, velocity, acceleration, friction, gravity and Newton’s Laws of Motion) |
| Brief description of lessons taught **after** this lab/activity:* **After**- Physics (Summation Lab) Blast Off Lab/Egg-launcher Lab
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| Lab/Activity adapted from: (website, textbook, etc.)Reference Hope Oliver<http://www.teachengineering.org/> (search build roller coasters) | Formative Assessment adapted from:Our Brains |
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