

Subject: Science

Topic: Potential and Kinetic Energy, Momentum, Friction and Gravity

Date: March 27, 2008

Grade Level: 3rd-6th

Teacher: Brittini Van Curen

Time frame: 30 minutes

Instructional Method: Inquiry

Rationale: Physics is important because it seeks understanding of the forces that act on us every day. Understanding things like energy, friction and momentum will help the students with anything from playing sports, to bike riding, to being safe drivers in a few years. It will also help them gain an insight into the laws that govern the world around them. It will also form a basis for further scientific exploration in the future including subjects such as engineering and astronomy, both of which rely heavily on basic concepts of Physics.

Goals: The children will gain practical experience seeing the basic laws of Physics (including potential and kinetic energy, friction, momentum, and gravity) in action and employing their knowledge of the laws in the building of a marble roller coaster.

Objective: The students will be able to verbally describe the concepts of potential and kinetic energy, momentum, friction, and gravity (not necessarily using the correct terms) using examples from their roller coaster.

The students will be able to take gravity, potential and kinetic energy, momentum and friction into account in the design of a marble roller coaster and fix problems presented by these forces in the course of their design.

SOLs: 3.1 The student will plan and conduct investigations in which

- a) predictions and observations are made;
- c) questions are developed to formulate hypotheses;
- j) inferences are made and conclusions are drawn

4.2 The student will investigate and understand characteristics and interaction of moving objects. Key concepts include

- a) motion is described by an object's direction and speed;
- b) forces cause changes in motion;
- c) friction is a force that opposes motion; and
- d) moving objects have kinetic energy.

6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include

- a) potential and kinetic energy

Materials: 2 Newton's Run Kits, masking tape, ladder, 2 yard sticks, candy or other prize, folding chairs, marble game, stop watch, marble roller coaster

Anticipatory Set: Ask the students if they like riding roller coasters. Ask them to close their eyes and imagine a ride on a roller coaster with all the speeding up and slowing down. Show the students the marble roller coaster and have them describe the changes in the motion of the marble throughout the journey. Explain that today they'll be competing a contest to design their own marble roller coasters.

Procedure: 1. Go over rules from the contest rules sheet (which will be posted both on the table and at each team's station)

2. Split students into 2 groups by picking chips, half of which are painted one color and the other half painted another color.
3. Send each group to their station with one adult to monitor and assist each group (but only with things like climbing the ladder, not with design).
4. Students will have 20 minutes to build their roller coaster trying for as many points as possible.
5. With 5 minutes left, each team will present their roller coaster and name one or two challenges they faced or adjustments they had to make and why they think changing what they did worked.
6. After each team presents, a “scoring run” will be performed where the marble is run down the track and the points are awarded.
7. All participants will get a small prize, with the winning group getting a little extra

Content: Potential Energy is the energy an object has when it has the potential to change its state. The marble has the most potential energy at the top of a hill because if let go the gravity will act on it and cause it to gain speed. The higher the marble is, the more potential energy it has, as it goes down a hill and speeds up it loses potential energy and gains kinetic energy.

Kinetic Energy is the energy a object has when it is moving. The more mass an object has and the faster it’s moving, the more kinetic energy it has. The marble has more kinetic energy the faster it moves, as it slows down going up it hill it loses kinetic energy and gains potential energy.

Friction is the force that acts against an object to slow it down. Without friction, all the potential energy would convert into kinetic energy and back without losing any energy, but friction takes away some of the energy as the marble goes through the track. This is especially true since the inside of the track is ribbed, which slows the marble down a lot.

Momentum is the tendency of a moving object to keep moving. Momentum is mass times speed, so the more massive a thing is and the faster it’s going, the more force that’s needed to slow it down or stop it.

Gravity is the force exerted on an object by another object. The force that gets the marble rolling and keeps it rolling is the Earth’s gravity pulling it down.

Assessment: Teacher questions, evaluation of design using points sheet

Additional assessment if done in classroom: The students will record their design in journals and write about the process and results of the activity.

Reflection: