4TH GRADE 4-H

MOTION AND ENERGY

Newton's Cradle and Clacker Balls

Materials Needed: Clacker Balls, Newton's Cradle, Book, Battery, Small Box (or other relatively light object)

Procedure:

Have a student predict, which has more energy, a car moving 10 mph or a car moving 100 mph? They should pick the 100 mph car; however, if they don't, have them think about car accidents. Which car is the most likely to have serious damage, a car that hits a wall at 10 mph or a car hitting a wall at 100 mph? Demonstrate (use student helpers) this concept by rolling a battery down a book held at a slight angle. Let the battery hit a small box (or any object that will move a little) at the bottom of the ramp. Do the same demonstration using the same items, except, raise the angle of the book, so the battery will roll faster. Observe how much further the object at the bottom moved. This shows that faster moving objects, of similar mass, have greater energy.

Have a student volunteer start moving the clacker balls slowly. Make sure that the students note the sound being made. Tell them that as the objects collide, some energy is being converted into sound. Have the volunteer speed up the clacker balls and ask students if the sound is getting louder or quieter. They should note that the sound is getting louder; thus, more energy is being released at a faster speed.

Have another volunteer start the clacker balls slowly. Now that students have been introduced to the concept, and they have observed that some energy from both balls has been turned into sound, ask them what is happening to the rest of the energy from each ball. Eventually, as you discuss, they should guess that most of energy from each ball was transferred to the other ball. This is the reason each ball changed direction after the collision. Have the volunteer speed up the balls. Ask the class, as the balls were sped up, did they gain or lose energy. Last, ask them why the volunteer needs to keep putting energy into the experiment? Shouldn't the balls go forever. This is a good place to touch on the fact that there is always some energy lost when transferring it between two objects (friction, heat, drag, etc.). That is why we can't get a car up to 60 mph, turn off the engine, and expect to coast very far.

Last, switch over to the Newton's Cradle. Have a volunteer start the balls by pulling one up at about 60-degrees and let it swing down to the next ball. Only the ball on the far end of the reaction should move much. If the students look at the balls in the middle, they should be able to see a train-reaction of force being transferred from one ball to the next. Continue for as long as it takes for students to get a good idea of what is happening with the balls. Now, ask the students to predict what would happen if you had a volunteer drop two balls instead of one? Answers will vary, however, lead the students to understand that the energy transferred from two balls will be more than one ball...this is because they have greater mass. Ask kids, "if you had a choice and you knew that after school today, you were going to be hit by a gnat moving at 30 mph or a bowling ball moving at 30 mph, which would you pick?" A little discussion should give kids a good idea that the energy released has to do with both speed and mass. Now, use a volunteer to test the student's theory of what will happen when two balls drop. (energy is transferred to the other side of the cradle and two balls fly up).

Now that the students have seen the result of two balls dropping, have them predict what three balls will do. Test the student's hypothesis. (Three balls "fly" on the far side of the cradle).

Indiana Standards:

4-PS3-1, Use evidence to construct an explanation relating the speed of an object to the energy of that object.
4-PS3-3, Ask questions and predict outcomes about the changes in energy that occur when objects collide.

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