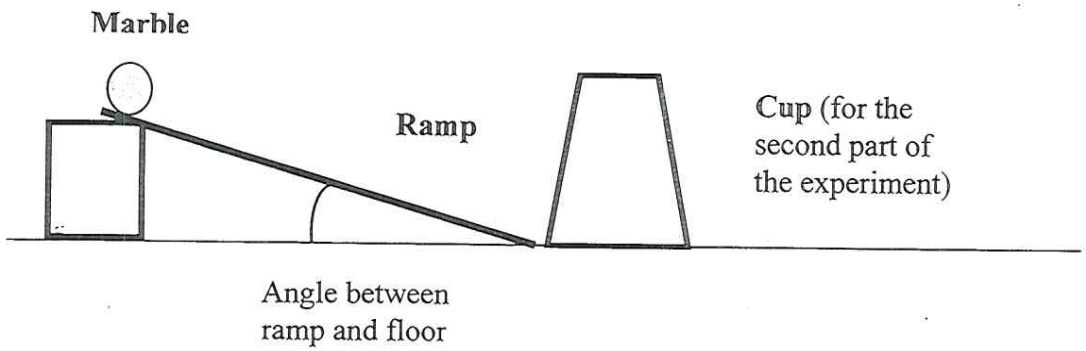
Activity 2.1: "Observing Motion - Bumper Cups"

In this set of experiments we will try to answer the following questions:

- Why is the marble going down the ramp?
- What is the main factor controlling how far the marble rolls?
- What happens during the collisions between marbles and plastic cups?
- What is the main factor controlling how far the plastic cups sliding after the collisions?

To investigate these questions we will set-up a "Bumper-Cup" track and observe the motion of marbles and cups. In the first experiment we will observe the motion of marbles only. In the second experiment we will observe what happens after a marble hits a cup.



Experiments:

(1) a. Place a marble on the table. Does it roll? _____

b. Push the marble. Why does it roll now?

_____

c. How can you control the speed of the marble?

_____

d. Set up a ramp on the table. Place the marble on the ramp and let it go.

What do you observe? What conclusions can you make from this observation?

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(7) Experimentally test your predictions.

A. **The Effect of Ramp Height on the Distance a Cup Moves**

Light Cup & Light Marble - ..... variables

Ramp Height, ...	Distance a cup moves, ...			Average Distance ...
	Trial 1	Trial 2	Trial 3	

B. **The Effect of Cup Mass on the Distance a Cup Moves**

Light Marble & Lowest Ramp - ..... variables

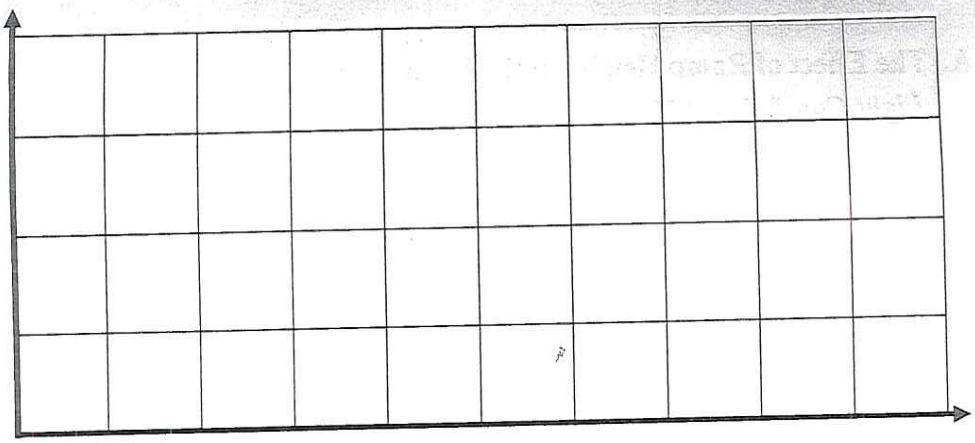
Mass of a Cup,...	Distance a cup moves, ...			Average Distance ...
	Trial 1	Trial 2	Trial 3	

C. **The Effect of Marble Mass on the Distance a Cup Moves**

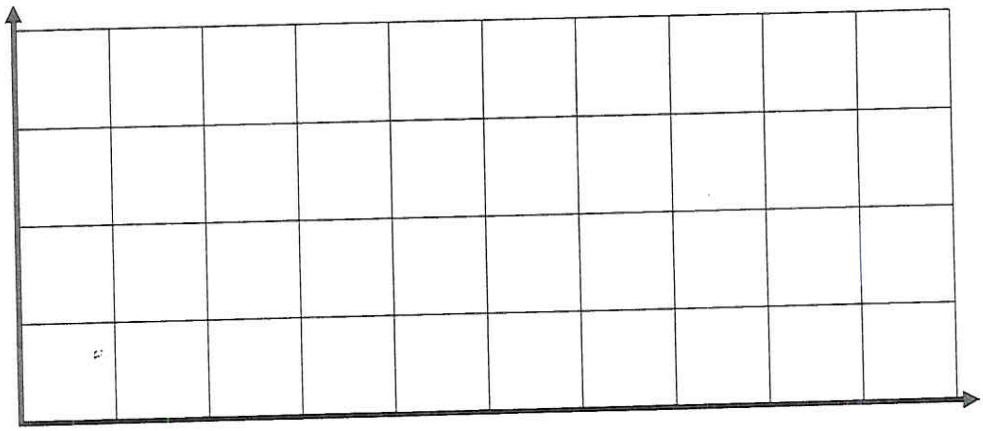
Light cup & Lowest Ramp - ..... variables

Mass of a Marble,...	Distance a cup moves, ...			Average Distance,...
	Trial 1	Trial 2	Trial 3	

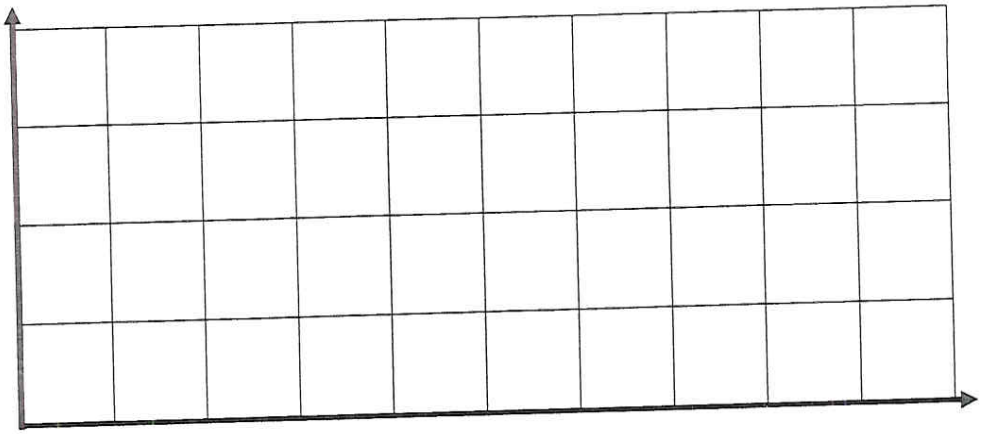
A. Bumper Cup Travel Distance vs. Ramp Height



B. Bumper Cup Travel Distance vs. Mass of Cup



C. Bumper Cup Travel Distance vs. Mass of Marble



(8) Highlight the correct part of the questions:

For a case where the masses of the cup and the marble is the same will the cup move further when the marble is released from a low or a high ramp?

Is it easier to move a light or a heavy cup?

At equal mass does a cup move more when hit by a light or a heavy marble?

State the important variables that will help you to move a cup farther.

_____

_____

_____

(9) a. What 2nd grade TEKS is addressed in this activity?

_____

_____

b. How is this activity addressing that TEKS?
(What concepts 2 grade students will learn/what skill will gain?)

_____

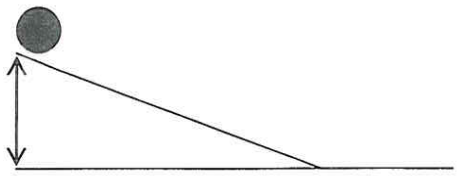
_____

c. Discuss why or why not this activity could be called "Inquiry based activity"

Chart 2.2 "Conservation of Energy"

Energy can neither be created nor destroyed, but can only converted from one form to another.

I. The marble is on the highest point of the ramp and not moving.



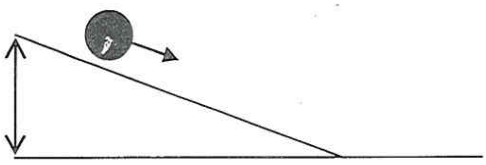
Has it Potential Energy? .....
Why would you say so? .....

Has it Kinetic Energy? .....
Why would you say so? .....

If the ramp height increases,
Potential Energy .....

If the ramp height decreases,
Potential Energy .....
Potential Energy is .....
proportional to the height of the ramp.

II. The marble is moving down the ramp.

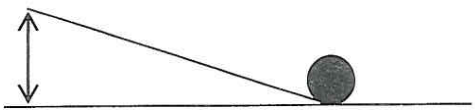


Has it Potential Energy? .....
Why would you say so? .....

Has it Kinetic Energy? .....
Why would you say so? .....

How the ratio of Potential to Kinetic energy will change as marble rolls down?
.....
.....
When and where this ratio equals one?
.....

III. The marble is on the lowest point.
The marble is still moving.

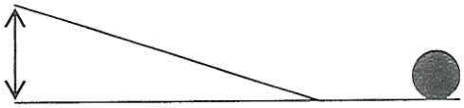


Has it Potential Energy? .....
Why would you say so? .....

Has it Kinetic Energy? .....
Why would you say so? .....

Is there a relationship between the Potential Energy at the highest point and the Kinetic Energy at the lowest? Explain.
.....
.....

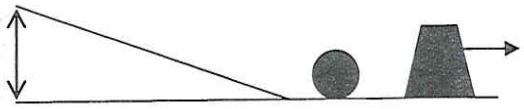
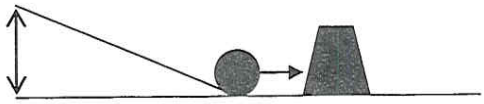
IV. The marble has stopped away from the ramp. The marble is not moving.



Has it Potential Energy? .....
Why would you say so? .....

Has it Kinetic Energy? .....
Why would you say so? .....

Where has energy gone?
.....
Why does the height of the ramp affect how far marble will go?
.....
.....

VI. The marble has hit the cup and is not moving any more. The cup is moving	V. The marble is on the lowest point and about to hit the bumper cup.
	
Has the marble Potential Energy? ..... Has the cup Potential Energy? ..... Has the marble Kinetic Energy? ..... Has the cup Kinetic Energy?	Has the marble Potential Energy? ..... Has the cup Potential Energy? ..... Has the marble Kinetic Energy? ..... Has the cup Kinetic Energy? .....

Newton's first law of motion states that:

"An object continues in a state of motion at a constant speed along a straight line, unless compelled to change that state by a net force".

Explain, based on that law, how far would the marble roll if there was no form of friction between the marble and the flat surface?

_____

_____

_____

The set of collisions between the marbles and the bumper cups illustrate another principle: ***inertia.***

"Inertia is the natural tendency of an object to remain at rest or in motion at a constant speed along a straight line. The mass of an object is a quantitative measure of inertia".

Explain, based on the concept of Inertia, how does the distance the cup moves will change if you replace a light marble with a heavy marble while keeping the same cup?

_____

_____

_____

Explain, based on the concept of Inertia, how the distance the cup moves will change if you replace a light cup with a heavy cup while keeping the same marble?

_____

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