Strand: **8.2**	Standard: **8.2.1-3**	Episode 2	**Big Idea**: Objects amount of kinetic energy is based on their mass and speed

Title: Mass Experiment: Losing your marbles.	**Time**: 45-90 minutes	CCCs: Quantity & proportion Cause and effect	Practices: **Use computational thinking** to **analyze data**

Episode Snapshot: Students will run an experiment that will help them determine how the quantity of mass affects the overall amount of kinetic energy of an object using marbles of different masses, ramps and and measuring the effect of the marbles on a stationary object.

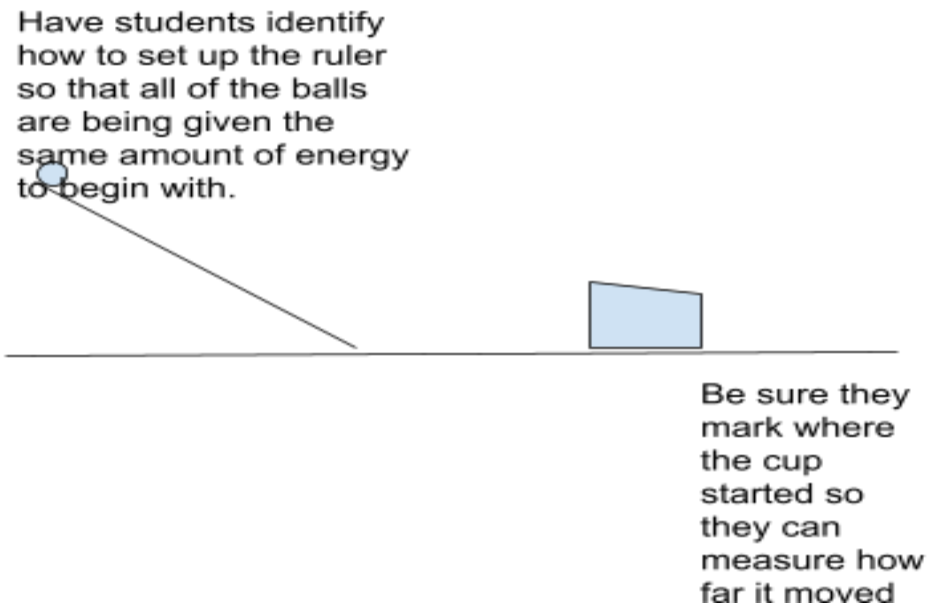
Gather:
Ask students to discuss in their groups how they would describe the energy caused by throwing the ball in episode 1. Let them discuss the energy and see if they can come up with something dealing with the energy of motion. Next explain that the energy they are talking about is what is known as kinetic energy (energy that a body possesses by virtue of being in motion) and that one way to determine the amount of kinetic energy an object has is to observe its effect on a stationary object as they saw in episode 1.

Today's experiment is going to explore the idea they came up with in the phenomenon that the mass of the ball had an affect on how hard (how much kinetic energy) the ball was able to hit the cans.

Present the research question to the students "How does the amount of mass affect the amount of kinetic energy in an object?" First ask students to help the class understand what mass is. Then ask the students to brainstorm ideas of what they would need to test this. Give them just a couple minutes in groups to discuss to some ideas and have them share. Based on the research question someone will most likely come up with the idea of using different masses of objects and hitting a stationary object to see how far it moves. If not as you are circulating for the few minutes and listening in you can always drop the seeds of the idea into their conversations.

Next pull out the supplies you have. There are lots of different materials you could use to do this 2 examples are are shown below

a) show them that you have different marbles of different masses (hopefully all the same size so as not to introduce another variable). Examples are 1 inch glass marbles, 1 inch steel ball bearings, and 1 inch acrylic balls, 1 inch wood balls, 1 inch smooth styrofoam balls. You can allow students to come up with an idea of what stationary object they will be measuring the distance it moves however an easy one is a paper or styrofoam cup cut in half and laid flat on the table. Most students came up with the idea of rolling the balls down a ruler with a grove in it or 2 rulers taped together in a v shape. They put them at the same height and angle and made sure they were putting it at the same place each time when it dropped to keep the amount of energy the same.



b) use a Hall's Carriage and different masses in the car you would need a wooden ramp to run the car down. You will need an object at the bottom of the ramp for the car to hit and record how much it moved. It could be a tissue box or another object that will move when hit.

Allow the students to design the experiment based on the supplies that you have. There are other ways they can test this if they would like to propose something different using the materials and you feel it will accomplish answering the research question. It is not required that they complete the experiment exactly as prescribed. This is just one way to accomplish it.

Have them run the experiment and collect their data. If the entire class designs the experiment together as a class you can compare your data directly using a google doc or other means. If not then they will just have to share their conclusions.

Reason:

After the students have collected the data remind them that the motion of the cup was our way of measuring the amount of kinetic energy that the balls had. Have the students **analyze their data** and make a graph to show their data.

Communicate:

Then have them write their conclusion of how the amount of mass affects the total amount of kinetic energy and give their evidence to support it. This is the day's assessment to determine if they are understanding that the amount of mass affects the amount of kinetic energy.

Have students discuss in groups how this explains the phenomenon. Either have them go back and add to their explanation or have them share with the class their ideas.

Assessment: Students conclusions should be used to determine if students understand that if an object has more mass that in turn means it has more kinetic energy.	**Materials, resources, handouts, etc:** ● Enough of each type of ball so that each group has one or each. 1 inch glass marbles, 1 inch steel ball bearings, and 1 inch acrylic balls, 1 inch wood balls, 1 inch smooth styrofoam balls. ● Plastic or styrofoam cups cut in half. ● Rulers to prop up and roll the marbles down as well as rulers to measure the movement of the cup. OR ● Halls cars, ● Variety of masses to put in cars ● Wood for ramps And ● Student sheet for recording data and writing a conclusion.