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Extension 8.2.2
The SINGLE Pringle Crunch
Engineering Challenge

Part 1

Purpose: To design, engineer, and build a container to protect a SINGLE PRINGLE potato chip from being crushed by a free-falling mass of 1 kg from 1.5 meters high.

Rules & Guidelines:
1. You will use a SINGLE PRINGLE potato chip provided by your teacher.
2. No substance may be applied to the chip, or the chip altered in any way and the chip has to be secured **inside the container** ready to be tested.
3. The maximum dimensions for the container are 8 cm wide and no taller than 12 cm.

Supplies: Your group may use any combination of the following supplies to build your house.
Straw, paper, cardstock, cotton balls, masking tape, duct tape.

Design: Draw a simple design of your container. ⟶

Purchase Order: Create a purchase order to be turned into the supply manager (teacher). Remember you must remain under budget. **Budget= $100**

Build: Once your purchase order has been approved by the teacher, collect the supplies. **Build** a container to protect the single Pringle.

Test: **Test** the container by placing it and the Pringle on the center of the piece of wood on the floor at your station. Then take the large pipe and set over your container. Make sure the nail is in the hole on the large pipe labeled 1.5 meters. Slide the 1 kg mass inside the top of the large pipe. (do NOT hold the nail… you may get pinched!) Pull out the nail and hold your breath, hopefully the single Pringle potato chip doesn't break. Pull the large pipe off the container and remove the mass and piece of wood. Carefully check your Pringle and clean up the mess (if the Pringle is crunched).

Item	Item Cost	Quantity	Total Cost
Straw	$10 each		
Paper	$30 each		
Cardstock	$60 each		
Cotton balls	$5 each		
Masking tape	$20/meter		
Duct tape	$50/.5 meters		
		Grand Total:	

Analysis: After observing how your container protected the chip, list 2 things that were successful and 2 things that were not.

Successful

1 –   2 –

Not successful

1 –   2 –

Redesign & Retest- If your container was not successful, you will need to redesign, rebuild and retest. You will have a new budget of $100 and may get new supplies.

1. After observing how your container or shield protected your chip, **explain** how the changes affected the damage to the single Pringle.

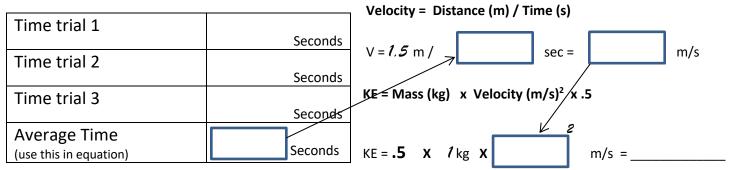| Item	Item Cost	Quantity	Total Cost
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		Grand Total:	

_____

_____

Part 2
Purpose:

To calculate the potential and kinetic energy of the 1 kg mass used in the Single Pringle Crunch experiment. (For all of the calculations mass is the 1 kg mass and height is the height is 1.5 m. These numbers are given to you at the top of the other side of this paper.)

Gravitational Potential Energy Formula:

GPE = mass (kg) **x** gravity x height (m)

GPE = _1_ kg **x** 10 m/s² x _1.5_ m = _____

Kinetic Energy Formula

KE = (.5) (Mass) (Velocity²)   v = distance (m) / time (s)
                                     distance = how far the mass fell
                                     time = how many seconds it takes to hit the wood on the floor.

First find velocity using the formula v = d/t. You will repeat the experiment by timing how long it takes the 1 kg mass to fall 1.5 meters down the large pipe. To measure the time it takes the 1 kg mass to fall 1.5 meters, repeat the experiment in part 1, **without the Pringle and container**. Start the timer when the nail is pulled and stop the time when the 1 kg mass hits the block of wood that is on the floor. Repeat 3 times and find the average time. Use the average time to solve the equation for kinetic energy.

Velocity = Distance (m) / Time (s)

Time trial 1	
	Seconds
Time trial 2	
	Seconds
Time trial 3	
	Seconds
Average Time (use this in equation)	
	Seconds

V = _1.5_ m / [ ] sec = [ ] m/s

KE = Mass (kg) x Velocity (m/s)² x .5

KE = **.5** **X** _1_ kg **X** [ ]² m/s = _____

Questions: Answer the following questions using complete sentences.

1. What modifications to the container do you think will need to be made if the 1 kg mass of was increased?

2. What modifications to the container do you think will need to be made if the height the 1 kg mass fell was increased?

3. How do you think potential energy will change if you dropped the 1 kg mass from 2 meters?

4. How do you think kinetic energy will change if you decreased the mass to 0.5 kg in this experiment?

5. Explain how energy is transferred from one object to another in this experiment.