**4th Grade TSIN PBL**

**Standard 4.PS3.2**- observe and explain the relationship between potential energy and kinetic energy.

1. **Whole Group Hook**: Have students play red light, green light.
2. Students will fill out this or that **prediction sheet**- list of situations and students will mark if they think it is potential or kinetic energy.

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| --- | --- | --- |
| 1. Holding a marble at the top of a ramp: | Potential | Kinetic |
| 2. A slinky moving down a set of stairs: | Potential | Kinetic |
| 3. A boy standing on top of a slide: | Potential | Kinetic |
| 4. Dominos standing up on the floor: | Potential | Kinetic |
| 5. A girl sliding down a slide: | Potential | Kinetic |
| 6. A marble rolling down a ramp: | Potential | Kinetic |
| 7. Dominos falling in a line: | Potential | Kinetic |
| 8. A car parked in a garage: | Potential | Kinetic |
| 9. A ball being thrown on a playground: | Potential | Kinetic |
| 10. A school bus leaving the school: | Potential | Kinetic |

1. **Activity One**
	* 1. Students will watch videos before experimenting with the pendulum
			1. Potential, kinetic, and mechanical energy example lab <https://www.youtube.com/watch?v=XU_rMVd6DkU>
			2. Show video of acrobats on seesaw- <https://www.youtube.com/watch?v=A3z6mbx2Wwo>
			3. Show video of pendulum- <https://www.youtube.com/watch?v=09x_UZ-BtF8>
			4. Students will take turns experimenting with the pendulum
		2. Marbles with ruler station:
			1. You will need three or more marbles and a ruler with a groove.
			2. Students will make predictions on what will happen if you placed two marbles in the middle and one on the outside and flicked the outside marble towards to two in the middle.
			3. Students can revise their original prediction then,
			4. experiment and discover what happens when…
				1. Use a bigger marble on the outside
				2. Add more marbles in the middle and smaller marble on the outside
				3. Add more marble in the middle and larger marble on the outside
			5. Assessment question: What did you observe happening when the marbles touched each other?
		3. Marble roll
			1. Set up a demonstration of rolling three different sized marbles down an inclined plane. Place the bottom section of a milk carton at the bottom of the ramp to catch the marble and measure the distance that it moves the carton.
			2. Students will make predictions on which marble will make the carton move the farthest.
			3. Students will use the small marble on the incline plane/ramp, and let it go from the top of the ramp. The marble will roll into the milk carton, and the students will measure how far the milk carton was moved by the marble.
			4. Students will repeat the same steps using the medium and large marble.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Big | Medium | Small |
| Prediction |  |  |  |
| Observation |  |  |  |
|  |  |  |  |

* + - 1. Students will record their results.
1. **Activity Two**
	* 1. Chalk drop
			1. Take a piece of chalk and hold it 3 inches from the floor. Predict what will happen if you drop it. Record your prediction. Drop it, observe, and record the result.
			2. Hold the chalk up over your head while standing up. What will happen if the chalk is dropped? Make a prediction. Drop the chalk. Record the results. Why was the second time more damaging?
		2. Blow balloons
			1. Blow up the balloon and hold it still for ten seconds. Does the air-filled balloon have energy? Let it go. What happened? What type of energy was demonstrated when the balloon flew?
		3. Dominoes-
			1. Show video of dominos- <https://www.youtube.com/watch?v=ARM42-eorzE>
			2. On a flat surface, set up a domino so that it sits up on its end.
			3. Space the rest of the dominoes out so that each domino is just far enough apart so that they have the potential to knock down the next domino.
			4. Lightly push the first domino with your finger so it tips over. What happens to each of the dominos?
2. **Activity Three**
	* 1. Students can play this interactive resource and experience potential and kinetic energy through each step of a roller coaster. <https://unctv.pbslearningmedia.org/resource/hew06.sci.phys.maf.rollercoaster/energy-in-a-roller-coaster-ride/#.WzUuQqdKjIU>
		2. Rags to riches- millionaire game- <https://www.quia.com/rr/37397.html>
3. **Activity Four**
	* 1. Students will watch Currents of change DAM video- <http://www.currentsofchange.net/tennessee-history-videos/>
		2. Students will Read Hydro Energy Article- <http://www.kids.esdb.bg/hydro.html>
		3. Rivers to power video- <http://fwee.org/nw-hydro-tours/rivers-to-power-video/>
4. **Activity Five**
	* 1. Field Trip to Cheatham County DAM

**Formative assessment:**

1. You and your younger sibling wake up one winter morning and discover outside is covered in a blanket of white powdery snow. You quickly get your warm snow clothes on and grab your sled. You and your sibling decide to race down the hill in your backyard. Every time you say ‘GO’ your siblings sled doesn’t move. How can you explain the relationship between potential and kinetic energy to your sibling to help them understand why their sled won’t move?
2. Your dad comes outside to join the sledding fun. You race your dad, but he wins every time. Even though you both have the same sled, why does your dad beat you to the bottom of the hill? Can you and your brother figure out a way using your knowledge of potential and kinetic energy to win the race against your dad?

**Other possible comprehension questions that could be added:**

1. Explain how speed and weight affect an amount of kinetic energy.

2. Identify three examples of items that can store potential energy.

3. How can energy be transferred back forth between kinetic energy and potential energy?

4. What type of energy is created when a brick falls from the top of a wall?

5. Explain how kinetic energy can be changed into potential energy.

6. Identify two ways in which a spring has potential energy