Learning target: I can explain and demonstrate the relationship between gravity, potential energy, and kinetic energy.

Marble Roller Coaster Lab

Fastest	**Lowest**	**potential**	**bottom**
maximum	**kinetic**	**speed**	**slowest**
taller	**highest**	**highest**	**top**
gravitational	**kinetic**	**kinetic**	

Lab Introduction - The first hill of a roller coaster is always the _____ point of the roller coaster because it requires the _____ potential energy to be converted into _____ energy to get through the rest of the ride. At the top of the first hill, a car's energy is almost entirely gravitational _____ _____ energy and almost zero _____ energy (because its velocity is zero or almost zero). This is the _____ energy that the car will ever have during the ride. That energy can become _____ energy, which it does at the bottom of this hill when the car is moving fast, or a combination of potential and kinetic energy, like at the tops of smaller hills, but the total energy of the car cannot be more than it was at the top of the first hill. If a _____ hill were placed in the middle of the roller coaster, it would represent more gravitational potential energy than the first hill, so a car would not be able to ascend to the top of the taller hill. This would leave the roller coaster stuck on the tracks. Cars on roller coasters always move the _____ at the bottom of hills. This is related to the first concept in that at the _____ of hills all the potential energy has been converted to kinetic energy, which means more _____. Likewise, cars always move the _____ at their highest point, which is the ___ of the first hill. Basically, gravitational potential energy is at its _____ at this point and kinetic energy is at its _____ at this point.

Claim: If given the proper materials, students will be able to setup and conduct a lab that demonstrates the relationship between gravity, potential energy and kinetic energy.

Materials list:

- 1.5" diameter pipe insulation - Scissors - Marble - Chair or wall
- Meter stick - Painter's tape

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Procedure – Make sure to check off each step as you complete it!

1. Use the scissors to cut the pipe insulation in half lengthwise.

2. Use the painters' tape one end of the insulation to a chair or wall. Tape the insulation approximately 18 inches high.

3. Use the painters' tape to tape the other end to the ground, forming a hill.

4. Bend the insulation into a loop and tape it down.

5. Place the marble on the hill at four inches in height and let it go. Did the marble make it through the loop? Provide your rationale for why or why not. Record your results on the data table.

6. Place the marble on the hill at eight inches in height and let it go. Did the marble make it through the loop? Provide your rationale for why or why not. Record your results on the data table.

7. Place the marble on the hill at twelve inches in height and let it go. Did the marble make it through the loop? Provide your rationale for why or why not. Record your results on the data table.

8. Place the marble on the hill at sixteen inches in height and let it go. Did the marble make it through the loop? Provide your rationale for why or why not. Record your results on the data table.

9. Calculate gravitational potential energy and answer the post-lab questions.

Marble height	**Did marble make it through the loop?**	**Provide your rationale. Explain why it did or did not make it through the loop.**	**Gravitational Potential Energy (*Gravity = 10 m/s²*) (Mass x Gravity x Height)**
4 inches			
8 inches			
12 inches			
16 inches			

Post-Lab Questions:

1. Which height resulted in the most potential and kinetic energy? _____ Explain why. _____
_____
_____

2. Which height resulted in the least potential and kinetic energy? _____ Explain why. _____
_____
_____

3. What is the relationship between gravity, potential and kinetic energy? _____
_____
_____

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