

Simulated Energy Conversion Lab

A person walking to the top of a burning building has to work to climb the stairs. The energy from the work is now stored in potential form because of gravity wanting to pull her down. If she were to jump from the burning building onto the fire fighter's trampoline, her potential energy would be converted into kinetic energy as she was falling. As she speeds up while falling, the potential energy decreases because she is closer to the ground and her kinetic energy increases as her speed increases. When she hits the trampoline she will slow down, and her energy will convert into vibrations, heat and noise.

More important than knowing what energy is, is knowing how it behaves. The law of energy conservation states that energy cannot be either created or destroyed. So the energy of a system must remain the same before and after things happen to it. Energy is always converting from one form to another and learning to examine what form energy may be in and to what it is converting is the subject of much scientific study. In this activity you will examine the simple scenario of a ball rolling on a ramp and track the energy conversions involved in the process of rolling up and down the ramp.

Procedure

1. Start Virtual Physics and select Energy Conversions from the list of assignments. The lab will open in the Mechanics laboratory.
2. The laboratory will be set up with a ramp, a ball on the ramp, and a plunger on the ball. Using the Force button to hit the plunger, you will push the ball up the ramp and then it will stop at some point and then come back down the ramp.
3. You will need to record and use the data from the experiment. Click the red Recording button to save data in the Lab Book. When the Force button is clicked the data selected with the check marks will be automatically recorded.
4. Click the Force button to hit the ball up the ramp and then watch it fall back down to the bottom.
5. Click the link in the Lab Book that contains your data. You may want to copy and paste it into a spread sheet program. From the data you should find five different locations of the ball and compare their potential and kinetic energies. First you will find and record the different velocities and heights and which the ball had that velocity. The beginning was when the ball first got hit, so it had no velocity and it was at the bottom. Find a middle height in the data and record it and the velocity of the ball at that height. Do the same for the top, the middle on the way down, and then bottom again. Record the information in the data table below.

Ball Position	Height (m)	Velocity (m/s)
Beginning Bottom	0.3088	5.8822
Middle Going Up	1.7316	2.5871
Top	2.0698	0.2470

Middle Going Down	1.7016	2.9686
End Bottom	0.0000	6.3762

Questions and Data Analysis

1. You can calculate the gravitational potential energy and the kinetic energy of the ball at the different positions. Recall that gravitational potential energy is due to the work of lifting the ball against gravity. So you only need to know the height of the ball off the ground. Record your calculations in the Data Table below. Use the equation: $PE = mgh$, where m is the mass of the ball, g is gravity, h is the height of ball from the ground.

2. Recall that kinetic energy is the determined when you know the speed or velocity of the object. Calculate the kinetic energy using the equation: $KE = \frac{1}{2}mv^2$, where m is mass, and v is velocity of the ball. Add your calculations to the table below.

Ball Position	Gravitational Potential Energy (J)	Kinetic Energy (J)
Beginning Bottom	3.0284	17.3001
Middle Going Up	16.9818	3.3465
Top	20.2985	0.0305
Middle Going Down	16.6876	3.6412
End Bottom	0.0000	20.3280

3. When did the ball have the most potential energy? Why?

At the top, this is because gravitational potential energy is proportional to height which is the highest at the top.

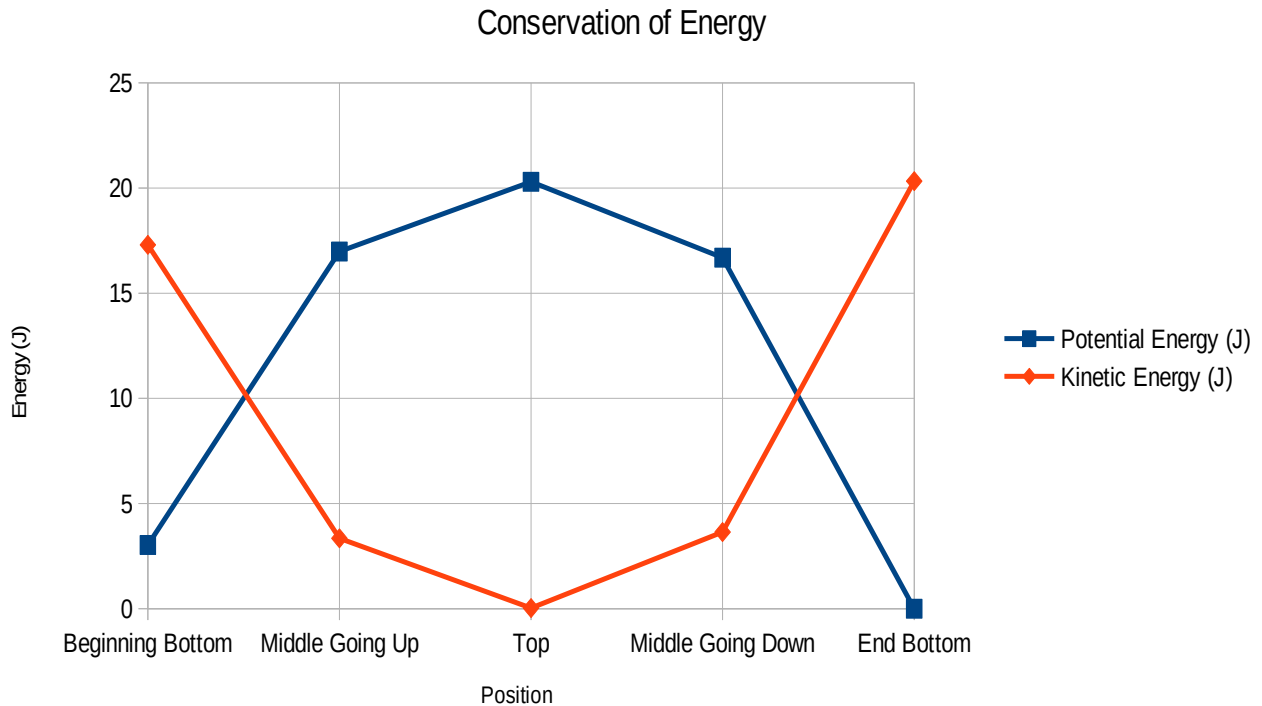
4. When did the ball have the most kinetic energy? Why?

End Bottom, all the energy of the ball was in the form of kinetic energy.

5. What are the relationships between the potential energy at the top of the ramp, and the kinetic energy at the bottom of the ramp?

They are almost equal.

6. Using the table with the energies at each location, graph the potential energy and kinetic energy versus position on the same graph. The x-axis can be labeled with the ball position given in the table. Make sure the graph has the proper units, titles, and a legend. Paste the graph below.



7. Is the total energy conserved? Can you determine this from the graph made above? How?

The total energy is conserved, we can conclude this from the above graph as it shows that when potential energy increases or decreases the kinetic energy decreases or increases by the same amount.