Skateboard Physics

Introduction:
Skateboarding has seen a growth in popularity over the last several years. The sport that started as a way for surfers to kill time when waves were not high enough for surfing, has turned into an organized, competitive sport that boasts internationally known athletes.

This laboratory activity explores the physics of skateboards through a simulation called "Energy Skate Park." The simulation begins with a simple, frictionless half pipe type course but has a number of different skate courses that skaters can utilize. Using various controls, parameters can be set for the skaters including the shape of course, the skill of the skater, and some of the frictional forces that rob the skater of his/her mechanical energy.

This lab will take two class periods. In the first period, you will become familiar with the controls and features of the simulation as well as gain experience with the concept of conservation of energy. In the second period, you will continue to study the simulation features (including energy transformations) and then will design and save a skate track. You will provide energy calculations for that track.

Purposes of the Investigation:
1. To gain experience with the transformation between gravitational potential energy, kinetic energy, and thermal energy in an action situation.
2. To make energy calculations for a roller-coaster-like skate course.

Vocabulary:
Kinetic energy, gravitational potential energy, thermal energy, mechanical energy, conservation of energy

Procedure:
Part I. Learning How to Use the Simulation:
- Run the simulation at: http://phet.colorado.edu/new/simulations/sims.php?sim=Energy_Skate_Park.
- Follow the instructions, and answer the questions under Part I of the laboratory report.

Part II. Create a roller coaster and provide an energy analysis of the motion:
The purpose of this activity is to produce an exciting and fun roller coaster for the skater of your choice, save the roller coaster for show, and to provide an energy analysis report of the resulting motion. The analysis report should include an "Energy vs. Time" graph of a run and comments correlating the analysis to the motion of the skater. The track and analysis must have the features described below but may be more elaborate. The report will be in a Word or PowerPoint document.

Roller Coaster/Skateboard Project Rules

1. The roller coaster must contain at least one loop, and the skater must finish the run on the screen at a designated location. The stopping location must be on a piece of track, not on the ground.

2. The analysis report must contain a picture of the track and the Energy vs. Time graph for a run. (A common way to obtain images of the screen is to stop the motion, copy the screen using the ctrl-PrintScrn key sequence, and then paste the image to the report document.)

3. The analysis report must contain descriptions of energy transformations at various portions or locations on the track. These energy transformations should be referenced to the corresponding portions of the graph. (One way this can be done is to label portions of the track and the graph.)

4. Possible items to include in the analysis are:
   - Potential energy to kinetic energy transformations
   - Thermal energy generating sources (friction and jumps)
   - Purpose of design characteristics (such as roller coaster track, friction level, starting level, etc.)
   - Other significant events or features of interest