Name _____ Date _____

Physics Lab Activity #13 (30 pts)

Period _____ Mrs. Nadworny

Partners: Due Date: _____

Conservation of Energy

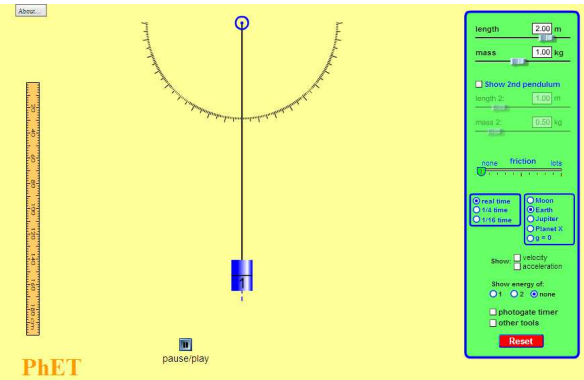
NO Lab Write-Up Required

Purpose

- To explore different types of energy and how energy is conserved.

PART 1: Pendulum Lab

1. Go to http://phet.colorado.edu. Click on **Play with Sims** or **How to Run Simulations/On Line** to get to the list of simulations. From the menu click on **Physics** and choose the **Pendulum Lab** simulation. Click on **Run Now!** to open the simulation. You should see the screen at right.



2. Be sure the length is set to 2.00 m, the mass is set to 1.00 kg, friction is set to "none," and *Real Time* and *Earth* are selected.

3. For *Show energy of:* click 1 so that we can see the energy of a single pendulum. A set of axes should appear on the screen.

4. Pull the pendulum back to an angle of 30^0 and let it go. Watch how the bar graphs for the energy of the pendulum change as the pendulum swings back and forth. You can click on *1/4 time* or *1/16 time* to slow it down.

5. For each position of the pendulum indicated below, sketch the bar graphs for the kinetic energy (KE), the potential energy (PE), and the total energy. Use a different color pen/pencil for KE and PE, or use solid/dashed bars to distinguish between the two types of energy. (5 pts)

Pendulum is at the upper right of its swing (30°)

Pendulum is partway through its swing (20°)

Pendulum is partway through its swing (10°)

Pendulum is at the lowest position of its swing (0°)

Pendulum is at the upper left of its swing (30°)

6. At which position(s) does the pendulum have the maximum amount of PE? _____ (1 pt)

7. Make a statement about the relationship between how high the pendulum is and the amount of PE it has. (1 pt)

8. At which position(s) does the pendulum have the maximum amount of KE? _____ (1 pt)

9. At which position(s) does the pendulum have the maximum speed? _____ (1 pt)

10. Make a statement about the relationship between the KE and the speed of the pendulum as it swings. (1 pt)

11. Make a statement about the relationship between the amount of PE and the amount of KE the pendulum has as it swings. (1 pt)

12. Make a statement about the amount of total energy the pendulum has as it swings. (1 pt)

13. Now, click RESET to begin again, but this time move the slider bar for *Friction* to halfway. Again pull the pendulum back to 30° and let it go. Watch the bar graphs for the KE, PE, thermal energy, and total energy. Notice what happens to the PE, KE, and total energy as the red bar for the thermal energy increases.

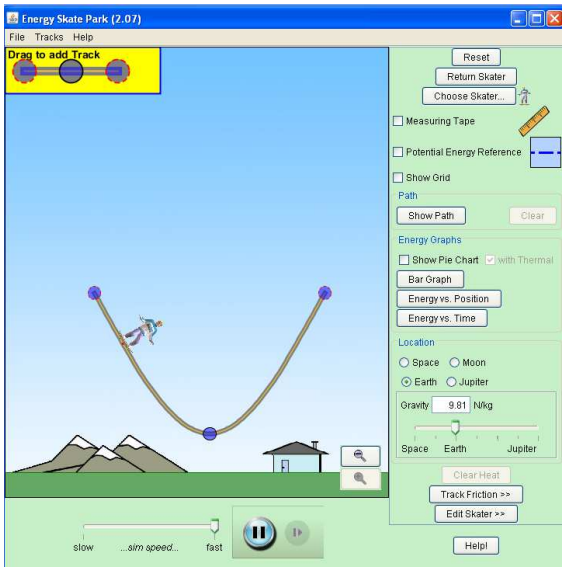
14. Describe what is happening to the height of the pendulum's swing as the thermal energy increases. (HINT: Does it go back to 30°?) (1 pt)

15. Describe what is happening to the speed of the pendulum as the thermal energy increases. (1 pt)

16. Describe what is happening to the amount of PE and the amount of KE as the thermal energy increases. (1 pt)

17. Describe what is happening to the amount of total energy as the thermal energy increases. (1 pt)

PART 2: Energy Skate Park



18. Close the window for the Pendulum Lab and again click on Physics from the simulation menu. This time, choose the **Energy Skate Park** simulation (avoid clicking on the "Basic" simulation). After you click **Run Now!,** you should see the screen at right which shows a skateboarder on a half-pipe. (You can change which skater you have from *Choose Skater...*)

19. Grab the dot at the top of the right hill and drag it up so that it is higher than the left hill. Grab the skater and start him at the top of the left hill. Watch as he goes back and forth along the half-pipe.

20. How high does the skater go on the right hill? (HINT: Compare the height where he stops to where he started on the left hill.) (1 pt)

21. Click RESET so that the hills are of equal height again. Grab the dot in the middle of the track and pull it down so that the center of the half-pipe is on the ground. Start the skater at the top of the left hill and again watch him roll back and forth along the half-pipe.

22. Select *Show Pie Chart*. You should now see a pie chart (a circle with changing colors) following the skater. Decide which color stands for PE and which color stands for KE. (HINT: See the key at the top of the screen.) Watch what happens to the PE and KE as the skater rolls back and forth. You can slow him down by the *Sim Speed* slider at the bottom.

23. At which position(s) does the skater have the maximum amount of PE? _____ (1 pt)

24. Make a statement about the relationship between how high the skater is and the amount of PE he has. (1 pt)

25. At which position(s) does the skater have the maximum amount of KE? _____ (1 pt)

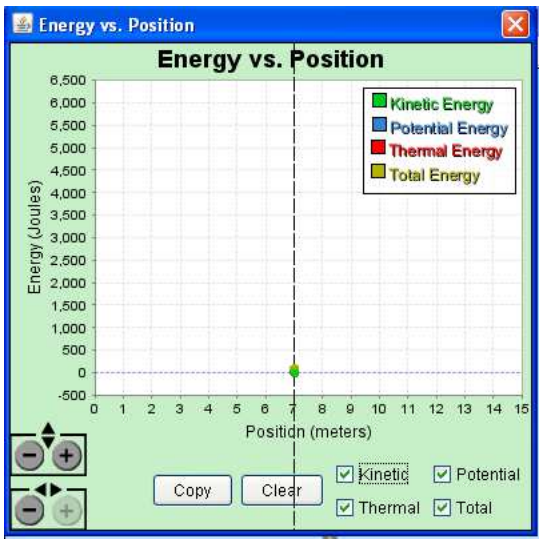
26. At which position(s) does the skater have the maximum speed? _____ (1 pt)

27. Make a statement about the relationship between the KE and the speed of the skater as he skates. (1 pt)

28. Make a statement about the relationship between the amount of PE and the amount of KE the skater has as he rolls back and forth. (1 pt)

29. How is the total energy of the skater represented by the pie chart? (1 pt)

30. Make a statement about the amount of total energy the skater has as he skates. (1 pt)



31. Click on the *Energy vs. Position* graph, as shown at right. This will show you how his energy varies as he rolls along the half-pipe as a graph. Watch how the colors on the graph correspond to where he is on the half-pipe.

32. Sketch the four curves/lines on the axes at right for one complete cycle of the skater. Label each curve/line as PE, KE, Thermal, or Total. (1 pt)

33. Close the graph window. Click on *Track Friction* and set the *Coefficient of Friction* slider to halfway. Watch the pie chart for the KE, PE, and thermal energy. Notice what happens to the PE and KE as the red slice for the thermal energy increases.

34. Describe what happens to the height of the skater's roll as the thermal energy increases. (1 pt)

35. Describe what is happening to the speed of the skater as the thermal energy increases. (1 pt)

36. Describe what is happening to the amount of PE and of KE as the thermal energy increases. (1 pt)

37. Describe what is happening to the amount of total energy as the thermal energy increases. (1 pt)