Friction on Different Planets Worksheet

Objectives: Students will

1. Explore coefficients of kinetic and static friction
2. Observe the relationship among applied force, total force and frictional force
3. Calculate force normal, force gravity (aka weight), acceleration and the coefficient of friction.
4. Investigate if a change in acceleration due to gravity will affect Force normal and gravity and the coefficient of friction.

Procedure:

1. Log onto the PhET website, http://phet.colorado.edu/web-pages/index.html
2. Click on Simulations, selection Motion and open *Force in 1 Dimension.*
3. Explore the simulation. After doing this answer question #1 on the chart page.
4. Select the **File Cabinet** and only have the Force Graph showing.
5. Click the More Controls button and select defaults, zoom the Force graph in so the scale is from 0 to 640. Make sure the small **Force Vectors Screen** is showing in the top right
6. Start pushing the object. Record the **Applied Force** (from the cell) at which the object just begins to move; this is approximately equal to the **Maximum Static Friction Force**. Continue pushing the object with the same force required to just get the object moving.
7. Record the **Friction Force** value when the object is sliding in motion. This frictional force is Kinetic Friction. If you continue pushing with the same force required to begin the object moving, your object may experience an acceleration.
8. To calculate Acceleration divide Net Force by the mass. Net Force is equal to the Applied Force (aka Static Friction Force) subtracted by the Kinetic Friction Force.
9. Calculate Force Gravity, Force Normal, and Coefficient of Friction. Force gravity is equal to 'g' multiplied by the mass of the object. The Coefficient of Friction is equal to the kinetic friction force divided by Force Normal.
10. **Discuss** your values with another group. Should they be the same or different?
11. Repeat steps 2-10 for the **Crate** and **Sleepy Dog.**
12. Fill in the table/chart and answer the questions.

Calculations must be shown on a separate sheet of paper.

Loca-tion	Object	$F_{applied}$	$F_{Static\ Friction}$	$F_{Kinetic\ Friction}$	$*F_{normal}$	$*F_{gravity}$	*Coef. Kinetic Frict.	*Accel.
Earth	File Cab.							
Jupit.	File Cab.							
Moon	File Cab.							
Earth	Crate							
Jupit.	Crate							
Moon	Crate							
Earth	Sleepy Dog							
Jupit.	Sleepy Dog							
Moon	Sleepy Dog							

1. How did you calculate Net Force?

2. Which variable(s) in chart did not change when moving the objects to Jupiter?

3. Which variable(s) in the chart did not change when moving the objects to the Moon?

4. What determines the coefficient of friction between two materials?

5. What happens to the Frictional Force as soon as the object begins moving?

6. What force(s) are affected by a change in gravity?

7. What happens to acceleration when the Net Force is reduced to zero?

8. Is the coefficient of kinetic friction affected when gravity changes? Why or why not?