Force Interactive
Situations Involving Friction

Purpose:
The purpose of this activity is to explore some relationships between variables for the situation of a block being accelerated across a horizontal surface by an applied force.

Background:
When forces are unbalanced, objects accelerate. But what exactly affects the acceleration of the object? What affect does the amount of force that is applied, or the mass of the object, or the amount of friction experienced by the object have upon the acceleration the object experiences? In this activity you will conduct several controlled or simulated studies in order to determine the answer to these questions.

Challenge 1:

Conduct a controlled study in which you determine the effect of a varying applied force upon the acceleration in the presence of friction. Think hard about what variables you change and what quantities you will keep constant over the course of the study. Run several trials in which you collect data to determine this cause-effect relationship. Plot the data and perform linear regression in order to generate an acceleration equation, expressing acceleration as a function of the applied force.

Note: the friction variable that is indicated in the simulation refers to the coefficient of friction. It is represented by the symbol μ (pronounced "mu"). It is a unit-less number ranging from 0 up to 0.9. (Values of μ can exceed 0.9; that just happens to be the upper limit in this Interactive.)

Trial	Applied Force (N)	Mass (kg)	Mu --	Net Force (N)	Velocity-time Information	Accel'n (m/s/s)
1						
2						
3						
4						
5						
6						
7						
8						

Challenge 1 Conclusion:
In the space below, make a **claim** in which you state the equation relating the acceleration to the applied force. Show a sketch of the graph and the linear regression statistics (slope, y-intercept, and regression constant). Write a paragraph of **reasoning** in which you explain how the data and associated graph support the claim that you have made.

A Challenging Follow-up:
Look at the slope value from your graph and inspect the Data table. What quantity do you suppose the slope represents? Make a claim and support it with evidence and reasoning.

Challenge 2:

Conduct a study in which you determine the effect of a varying coefficient of friction (mu) upon the acceleration. Run several trials in which you collect data to determine this cause-effect relationship. Before you begin, think hard about what variables you will change and what quantities you will keep constant. If your original plan fails, then adjust your values and start over until you have a sufficient quantity of data. Plot the data and perform linear regression in order to generate an acceleration equation, expressing acceleration as a function of mu.

Note: the friction variable that is indicated in the simulation refers to the coefficient of friction. It is represented by the symbol μ (pronounced "mu"). It is a unit-less number ranging from 0 up to 0.9. (Values of μ can exceed 0.9; that just happens to be the upper limit in this Interactive.)

Trial	Applied Force (N)	Mass (kg)	Mu --	Net Force (N)	Velocity-time Information	Accel'n (m/s/s)
1						
2						
3						
4						
5						
6						
7						
8						

Challenge 2 Conclusion:
In the space below, make a **claim** in which you state the equation relating the acceleration to the coefficient of friction (mu). Show a sketch of the graph and the linear regression statistics (slope, y-intercept, and regression constant). Write a paragraph of **reasoning** in which you explain how the data and associated graph support the claim that you have made.

A Challenging Follow-up:
Look at the slope value from your graph. What quantity do you suppose the slope represents? Make a claim and support it with evidence and reasoning.