AS Physics Name_____
Enrichment – 2D Forces

You have two options for this enrichment opportunity. You may do either one or both. Both of the following options are enrichment opportunities written by Mr. Ruiz for AS Mechanics. You may receive credit in physics and math for completing the activities. However they are for different units in Mr. Ruiz's class so you may want to check his website before you decide which option to do.

Option #1

Introduction

Static equilibrium occurs when a system of interrelated forces has a vector sum of zero. In class, we have discussed a number of scenarios where equilibrium applies in two dimensions. In this enrichment assignment, you will be analyzing static equilibrium in three dimensions in a more complex case. Consider the structure on the bottom of this page. This sculpture, by Michael Craig-Martin, is described as a table supported by buckets which are resting on top of the table.

Questions – Please provide answers on separate sheets of paper.

1. Is the description given by the creator of this work accurate? Justify your answer using physics and mechanics concepts.

2. Provide free body force diagrams for each of the following members of the sculpture, assuming that the buckets contain enough water to hold the arrangement in equilibrium. Explain how each of your forces compares to one other by showing equations and inequalities to show their relative magnitudes.
    a. One of the buckets
    b. The table
    c. One of the eye bolts on the top of the table
    d. One of the pulleys attached to the surface of the ceiling.

3. Repeat your force diagrams assuming that each of the buckets is in empty and that equilibrium no longer applies.

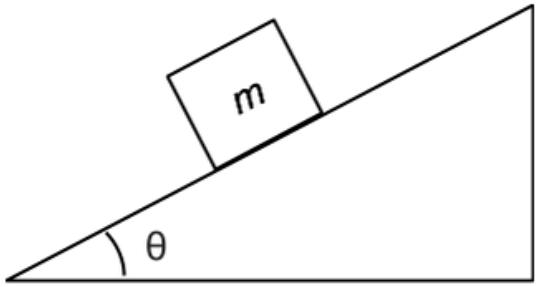
Option #2

Introduction

In this enrichment assignment, you will conduct experiments to determine the coefficient of friction for a number of different materials and their interactions.

Pre-Analysis

1. Consider an object resting on an inclined plane in limiting equilibrium. Draw a force diagram for this arrangement.



2. Create a force table to support your force diagram, using the directions of parallel to the incline and perpendicular to it.

3. Use your table to generate two simultaneous equations. Solve this system of equations to find a general expression for the coefficient of friction.

Experiment

1. Choose a surface that can support objects placed on it and which you can easily incline and measure the angle of incline. Record the material that makes up this surface.

2. Choose five different objects whose coefficients of friction you can measure by inclining your chosen surface to the point of sliding. Use a protractor to measure the angle as accurately as possible. Use the results of your preliminary analysis to determine appropriate values for the coefficient of friction. In each case, record what the object is as well as the substance that it is made of.

3. Construct a data table to show all of the data that you collected in the previous steps.

4. Submit all of your raw calculations and preliminary analysis with your report.