FLINN SCIENTIFIC

Name____

Investigating Pendulums Worksheet

Data

Test 1

Plumb bob size	Release Angle	Number of complete swings in 30 seconds			
		Trial 1	Trial 2	Trial 3	Average
Small	5°				
Small	15°				
Large	15°				

Test 2

Pendulum length (m)	Release Angle	Number of complete swings in 30 seconds			
		Trial 1	Trial 2	Trial 3	Average
0.20	15°				
0.70	15°				

Post-Lab Calculation and Questions *(Answer on a separate sheet of paper.)*

1. Calculate the average number of swings in 30 seconds for each test in Tests 1 and 2. Record the average value in the data tables.
2. Calculate the swing period by dividing 30 seconds by the average number of complete swings in 30 seconds for each test in Tests 1 and 2.
3. Compare the swing periods in Test 1. How does the release angle affect the swing period? How does the mass of the plumb bob affect the swing period?
4. Compare the swing periods in Tests 1 and 2. How does the length of the pendulum affect the swing period?
5. Based upon the data from this experiment, are the following statements true or false? (Circle one.)

T F The period of a pendulum is not affected by the mass of the plumb bob on the end of the pendulum.

T F The period of a pendulum is affected by how high the pendulum is raised before it is released.

T F The period of a pendulum increases as the pendulum length decreases.

T F A grandfather clock will "tick-tock" faster when the pendulum is released with a large swing arc compared to a small swing arc.

Archimedes' Principle Worksheet

Data

Trial	Weight of clay in air (g)	Weight of clay submerged in water (g)	Initial volume (mL)	Final volume (mL)	Volume of water displaced by the submerged clay	Volume of water displaced by the floating boat
1						
2						

Post-Lab Questions *(Answer on a separate sheet of paper.)*

1. Calculate the difference between the weight (mass) of the clay in air and when it is submerged.
2. Subtract the initial volume from the final volume and record the difference in the data table as the volume of the water displaced by the submerged clay.
3. Assume the density of water is 1 g/mL. Explain the similarity between the weight (mass) difference and the volume of water displaced by the clay (Questions 1 and 2). The similarity of the weight difference and the volume of water displaced represents Archimedes' principle. Write the principle in your own words.
4. Calculate the density of clay. Should the clay sink or float? Explain.
5. Calculate the density of the clay boat. Should the boat sink or float? Explain.
6. The mass of the ball of clay and the mass of the boat-shaped clay are the same. In terms of Archimedes' principle, why does the boat shape float while the ball shape sink? (*Hint:* What does the waterline on a floating object indicate?)
7. Predict what will happen to the water level of a lake if a cannonball is fired from a floating ship into a lake. Why?

   a. Water level will go up.

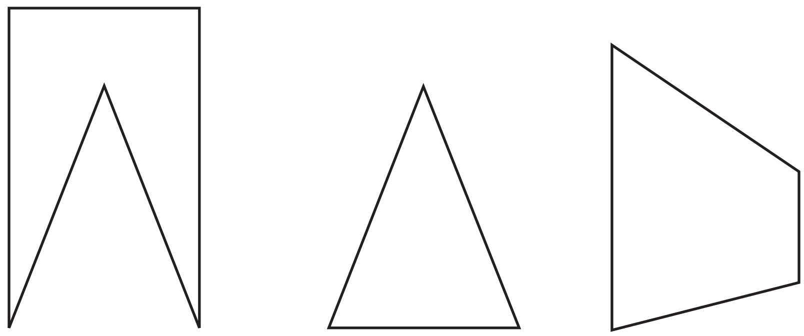
   b. Water level will go down.

   *c.*Water level will stay the same.

Center of Gravity Worksheet

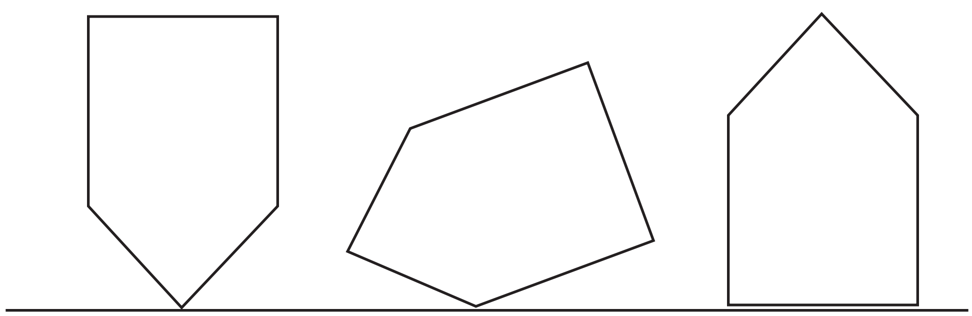
Observations

Sketch the position of the lines drawn on each polygon shape.



Post-Lab Questions *(Answer on a separate sheet of paper.)*

1. Define the center of gravity of an object.
2. Describe a test that could be used to verify whether a point on an object was indeed the center of gravity.
3. Assuming that the objects shown below all have the same uniform density throughout, rank the following objects from most stable to least stable, and explain your reasoning.



Atwood's Machine Worksheet

Data Table

Height of the released mass: ___________

Friction "mass": ___________

Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10

Post-Lab Questions *(Answer on a separate sheet of paper.)*

1. Review the timing data for all the trials and determine the best average time of descent. (Sample methods for determining the best average time include: calculate the average value for all the time measurements; ignore data points such as the high and low values and then calculate the average; draw a graph and determine a line of best fit, etc.)
2. Use the following equation to calculate the acceleration of the masses.

$$a = 2h/t^2 \qquad \textit{Equation 1}$$

a = acceleration of the masses
h = height the released mass
t = average time of decent

3. Use the following equation to calculate the acceleration due to gravity (g).

$$g = a\,(m_1 + m_2 + m_s)/(m_2 - m_1 - m_f) \qquad \textit{Equation 2}$$

g = acceleration due to gravity
a = acceleration of masses (calculated in Question 2)
m_1 = 200 g
m_2 = 220 g
m_s = pulley sheave mass (5.3 g)
m_f = friction "mass"

4. Calculate the percent error compared to the literature value of g, 9.81 m/s^2 (at sea level).
5. List possible sources of error in this experiment and their effects on measuring the acceleration due to gravity. How would friction in the pulley affect the outcome of this experiment—would the calculated value of g be too high or too low as a result of this error?