Name: _____ Period: _____

When Pigs Fly… Lab

$$v = \frac{2\pi\ r}{T} \qquad a_c = \frac{v^2}{r}$$

$$F_c = ma_c \qquad cir = 2\pi\ r$$

$$soh - cah - toa$$

Purpose:
1. To measure the tangential velocity of an object in circular motion.
2. To determine the centripetal force of an object in circular motion.
3. To compare the theoretical velocity to the experimental velocity.

Materials: Flying pig, magnetic hook, stopwatch, meter stick, scale.

Introduction:

If no net force acts upon a moving object, it will travel in a straight line with no change in speed. To cause an object to travel in a circular path, a force constantly perpendicular to the direction of motion must act upon the object. This force is called the *centripetal* force, will always be directed toward the center of the circle.

Lab Procedure:

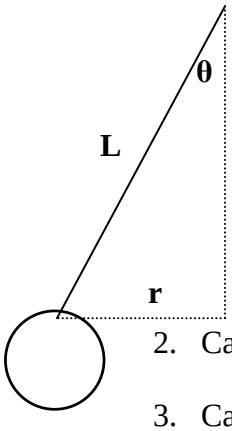
1. Place magnetic hook above lab table.
2. Attach the pig to the magnetic hook making sure the pig is able to rotate.
3. Measure the length, L, of the string from the magnetic hook to the top of the pig. Record in Data Table 1.
4. Hold on to the pig by its body so that the string is about 30° from vertical.
5. Turn on the motor.
6. Give the pig a slight shove in a direction that is tangent to the circle where it will fly.
7. If the pig does not fly in a circle for 10 seconds, carefully catch it and try the launch again.
8. When the pig is flying in a consistent circle, measure the radius of the circle, r. Record in Data Table 1.
9. Using the stopwatch determine how long it takes the pig to make ten revolutions. Record in Data Table 1.
10. Unhook the pig and measure its mass on the scale. Record in Data Table 1.

Data Table 1

Length of string (m)	Radius of circle (m)	Time for 10 revolutions (sec)	Mass of pig (kg)

Targeted Questions:

1. Determine the **angle**, θ, that the string makes from vertical.



2. Calculate the experimental **period**, T, of the pig. No equation needed.

3. Calculate the **circumference,** cir, of the circle that the pig travels along.

4. Calculate the experimental tangential **velocity**, v, of the pig.

5. Calculate the experimental centripetal **acceleration**, a_c, of the pig.

6. Calculate the experimental centripetal **force**, F_c, of the pig.

7. Draw a free body diagram of the pig flying in a circle, showing only the forces that on it. Ignore air resistance.

8. On your FBD, draw the vertical and horizontal components of the Tension in the string. Label the angle, θ, and the two components, T_y and T_x.

9. In what direction does the pig accelerate?

10. What is the relationship between T_y and F_G?

11. Which force in the diagram in the centripetal force, F_c?

12. What is an equation that shows the relationship between T_y, T_x and θ?

13. What is an equation that shows the relationship between centripetal force, F_c, and tangential velocity, v?

14. Using answers in 10, 11, 12, and 13 to show the relationship between tangential velocity, v, the acceleration due to gravity, g, and the angle, θ.

15. Rearrange the equation found in 14 for v =

16. Calculate the theoretical tangential velocity, v, of the pig using the equation in 14.
    Use values found in Data Table 1 and g = - 9.8 m/s^2.

17. Look at your the percent error between the theoretical tangential velocity to the experimental tangential velocity of the pig. Was your experimental value higher or lower than the theoretical value? What can account for this?