Physics 120 **Winter 2026**

Lab 4: Flying Pigs

Name: _____

Lab Partner(s): _____

Honor Code Statement: I affirm that I have carried out my academic endeavors with full academic honesty. _____

Introduction

Procedure

1. Gather your equipment: one plastic pig with wings, a length of string, a spring scale, and a magnetic hook.

2. Measure out a known length of string and record its length, L.

   $L =$

3. Use the magnetic hook to stick the flying pig to the ceiling by tying one end of the string through the loop on the pig's back and place the loop at the other end over the hook. Open the pig's wings (so that they click into place) and turn on the switch on the pig's side, and watch it fly!

4. Note the pig's motion. What kind of motion is this and how do you know the motion is this type? Explain

5. What parameters of this motion are measurable? List the parameters and explain why they are measurable. For each of these parameters what are the measurements?

6. What parameters must be calculated from the measurable parameters? List the parameters and explain why they need to be calculated. For each of these parameters what are the calculations?

7. Using the available equipment, obtain values for the following quantities:
   - period of the motion,
   - frequency and angular frequency of the motion,
   - velocity of the pig,
   - acceleration of the pig,
   - tension of the string.

Theoretical Analysis:

1. Draw a free-body diagram of the pig at a moment during its motion and derive an expression for the net force in terms of the measurable parameters.

2. Considering the type of motion of the pig, what other expression must the net force equal? Setting these two expressions for net force equal to each other derive an expression for the period of the motion based on the measurable parameters.

3. What parameters should the period depend on? What do they depend on?

4. Test your theory by inserting your measured values into your expression for period and compare your "theoretical value" of the period to your measured value. If there is a significant disagreement, re-examine your theory. See if you can reconcile the results and your theoretical model. You may also confer with other lab groups and see if their data lead to a calculated period that agrees with their measured value.

   $T_{theo} =$

   $T_{expt} =$

5. Derive an expression for and then calculate a value for the tension force expected in the string.

   $F_{T,theo} =$

6. Hang the spring scale between the string and the magnetic hook. Start the pig flying and record the force that is seen on the spring scale. Is the value seen the tension force? Explain why or why not.

   $F_{T,expt} =$

7. Compare your “theoretical value” of the tension force to your measured value. If there is a significant disagreement, re-examine your theory. See if you can reconcile the results and your theoretical model. You may also confer with other lab groups and see if their data lead to a calculated tension force that agrees with their measured value.