~ Thing on a String: Post Lab ~

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I. *Epistemological Table*

FIRST: A quick reminder of how the ET works.

There are a few basic ways you can know something:

- You might have learned it from examining the physical world, either
  - by ***observing*** directly with your senses, or
  - by ***measuring***, with the help of a tool, like a meter stick, or a clock, or a protractor.
- On the other hand, you might have figured it out, using your mind, maybe with the help of thinking tools, like pencil, paper, or computer software. For example, you might have
  - ***calculated*** a number, using an equation, or
  - ***derived*** an equation, using algebra, or
  - made some other kind of ***inference***.
- There are also some things you believe because they were discovered by other scientists and are widely accepted (e.g. that the speed of light is 186,000 miles/second). This is called
  - ***canonical knowledge***
- But some claims are not discovered or figured out. Some claims are just things that some committee of scientists decided—or that we got to decide ourselves. In other words, they're
  - ***definitions***.
- Other claims are things that we can't justify but which we assume. They might be
  - ***fundamental beliefs*** that make all other inquiries possible; or
  - ***convenient assumptions*** that we make under particular circumstances.

So we have nine categories of knowledge:

- ***Observations*** ← What did you observe?
- ***Measurements*** ← What measuring tool did you use?
- ***Calculations*** ← What equation did you use?
- ***Derivations*** ← What equations was it derived from? When does it apply?
- ***Inferences*** ← How did you draw this inference? Explain your reasoning.
- ***Canonical knowledge*** ← What is the name of the relevant law/principle?
- ***Definitions*** ← What is it the definition of?
- ***Fundamental beliefs*** ← Name or describe the belief (most of them have names).
- ***Convenient Assumptions*** ← Why is this assumption reasonable in this situation?

And for each claim in the epistemological table, you just pick the appropriate category from the eight listed above and then answer the question that appears next to that category.

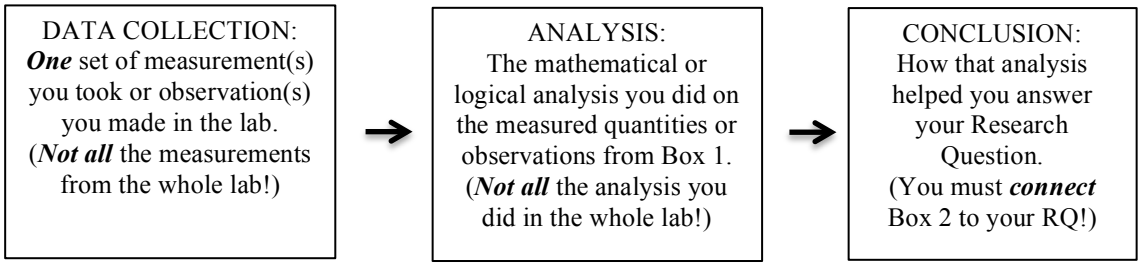
Sometimes, though, it may be unclear what category a claim goes in. A claim might seem to be a combination of multiple categories. Or it might seem like none of them quite fit. Feel free to combine two categories of knowledge in your justification—or even make up a new category

For Lab 2, "Thing on a String," fill out the Epistemological Table below:

Claim	Justification (Category + extra info, including any necessary explanation)
a) A mass suspended from a long vertical string started to swing back and forth if released from anywhere other than the lowest possible position.	
b) Released at an angle of 10.0 degrees from the vertical, a mass on a 9.80 cm string took approximately 3.1 seconds to complete five cycles.	
c) The amount of time taken for this mass to complete one cycle was approximately 0.62 seconds.	
d) The amount of time taken to complete one cycle is referred to as the pendulum's '***period***'.	
e) Released at angles of 5.00, 12.0, 15.0 and 18.0 degrees from the vertical, a mass on a 9.80 cm string continued to take approximately 3.1 seconds to complete five cycles.	
f) If the pendulum described in parts (a) through (c), above were released at 7 degrees from the vertical, it should take approximately 3.1 seconds to complete five cycles.	
g) The period of a simple pendulum varies if the length of the pendulum string is varied.	
h) The period of a simple pendulum varies in direct proportion to the square root of the string length.	
i) The angular position of the pendulum at any point in time can be described by a function which satisfies $\frac{d^2\theta}{d\theta^2} = -(\omega^2)\theta$.	

II. *Research Design Chart*.

FIRST: A quick reminder of how the RDC works.



Using the model provided by two figures above, make a ***Research Design Chart*** that applies specifically to at least ONE MEASUREMENT you made in Lab #2.

III. *The Counter-Factual*.

FIRST: A quick reminder of how the CF works.

The Counter-Factual questions are always about a hypothetical (imaginary) world in which something about the lab is ***different*** from how it actually was when you did the lab in class.

WHAT TO DO FOR THIS PARTICULAR (Lab #2) POST-LAB:

In complete sentences of English, answer question a, parts i & ii, and question b (next page):

a. Imagine that you did this lab precisely as you did in your actual John Jay experience, EXCEPT one thing: the angles from which you released the pendulum were much larger—they ranged from 40 degrees to 70 degrees as measured from the vertical. It is too late to go back to the lab, so you go ahead and draft a full formal report anyway.

    i. In what specific ways (if any) would this accidental choice of angles change your final answer to a Research Question concerning the variable(s) on which pendulum period depends? That is, would you suppose differing large angles to produce differing periods? If not, why not? If so, in which direction (larger angles → larger ***or*** smaller periods)?

    ii. In what specific ways (if any) would this would this accidental choice of angles change your final answer to a Research Question concerning the type of oscillation characteristic of a planar pendulum? That is, would you suppose a large-angle planar pendulum to demonstrate simple ***harmonic*** oscillation? Why or why not?

b. Now imagine that you used small angles like you did in the real lab and followed all the other lab procedures perfectly. During the lab, your lab partner says, "Thank goodness we're finally dealing with something traveling in a curve. Now 'angular frequency' makes sense. Since the pendulum mass is also swinging through angles that are measured from the vertical, the radians/second indicated by omega now simply refers to how fast the pendulum is traveling. When it's close to equilibrium, it's zooming through angles at close to its maximum speed, so its omega is very large; up near the turning points, the omega is practically zero."

   In at least two complete sentences of your own words, how would you respond to your partner? Do you think she's saying something correct but unhelpful? Correct and helpful? Incorrect yet helpful? Etc.

IV. *The Wild Card.*

No reminder: just answer the questions below:

In at least ***two*** clear and careful pictures for each and in at least ***three*** complete sentences of your own words for ***each***, please respond to the following:

A) Why does the period of a simple planar pendulum seem to be independent of the mass at the end of the pendulum string?

B) If a simple planar pendulum seems to be a simple harmonic oscillator, and if a simple harmonic oscillator is a system that ***acts like a mass on a spring***, then why is the period of a mass on a spring ***in***dependent of ***spring length***?

C) Describe an entirely different scenario in which
the time-rate of change of some variable is a function of that variable itself.

Ideally, you might come up with a situation in which it is the rate of change of the rate of change (i.e.: the second derivative) that is relevant and in which the function at hand is a linear function, but neither of these two features is mandatory. Somehow or another in words and pictures, capture a situation in which some quantity changes as time passes – in a manner that is directly determined by that quantity itself (as opposed to being directly determined by time).

You can draw this situation from your imagination, from familiar scientific phenomena or from daily life – from anywhere as long as the scenario is clearly described and convincingly fits with the required relationship.