Post-Lab 6

A GENERAL EXPLANATION which contains within THE SPECIFIC QUESTIONS FOR Physics 204, LAB 6

PHYSICS 204: LAB
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Updated 7-2-15

The ***Post-Lab***

All responses to all four parts of every ***Post-Lab*** must be submitted on clean, separate sheets of paper. The ***Post-Lab*** must be headed with the names of all Lab Group members and each response must somehow make clear precisely what question it is intended to address. No other document or reading should be necessary in order for a reader to follow the meaning and sense of a properly completed ***Post-Lab***.

Post-Labs in Physics 203 have a very specific four-part format. Each part is graded out of 2.5, for a total possible score of 10.0.

The ***Post-Lab*** is designed to help you write your ***Formal Report.*** Therefore, you should always complete the post-lab ***first***, AS A GROUP, *then* work on the ***Formal Report***. If you don't have time to work as a group on the post lab, then we STRONGLY RECOMMEND that each group member attempt all questions SEPARATELY on his/her own; that way, the group can compare answers remotely. If the group is not in agreement on the ***Post-Lab***, it will be unable to write a good ***Formal Report***, and any group member who has not worked on the ***Post-Lab*** is not prepared to work on the ***Formal Report***.

For this first Physics ***Post-Lab***, we will now walk through each of the four different parts and explain how it works. At the end of each explanation, the specific Post-Lab question for THIS LAB (Lab #1) is presented in a different typeface and introduced by the phrase WHAT TO DO FOR THIS PARTICULAR (Lab #1) POST-LAB.

ON SEPARATE SHEETS OF PAPER, PLEASE ANSWER THE FOUR QUESTIONS FOUND IN THE FOLLOWING PAGES. THIS IS YOUR POST-LAB for LAB 1.

In future labs, you will simply be given the four particular questions and expected to know how to approach them. They will be of the same four types for every lab.

I. ***Epistemological Table***

BACKGROUND EXPLANATION

If you make a ***claim***, someone might as you "How do you know?" and, if you consider yourself a scientist, you'd be obliged to ***justify*** your claim. How you justify your claim—how you know what you know—is called epistemology. From now on in this lab course, there are ***six*** basic ways that a claim can be justified.

(Note! A claim is a <u>full statement</u>; a claim is expressible as a complete sentence of English, and must therefore contain both a subject *and* a predicate. But note also: a mathematical equation is a sentence: the part before the equals sign is the subject; the rest is the predicate.)
Any claim that we make in a physics lab must have been:

- **Observed / Measured,**
- **Defined,**
- **Derived,**
- **Calculated,**
- **Postulated, or**
- **DISCOVERED through YOUR Research.**
  …
- And once in a while, we will make a claim that *seems* or maybe even is
  Not Justified

Each Physics Post-Lab will contain an EPISTEMOLOGICAL TABLE like the one shown below. Every Epistemological Table will have two columns: CLAIMS on the left, JUSTIFICATIONS on the right. The claims will be filled in for you. Your job is to fill in the justifications, from the seven categories listed above. In some cases, you'll need to provide a little extra information.

1. OBSERVED/MEASURED (using). Measurement and observation are the two basic types of ***data collection***. Measurement is ***quantitative*** data collection: it produces something you would describe with ***numbers***. Observation is qualitative data collection: it produces something that you would describe with ***words***.

When using this category in the Epistemological Table, you should specify either "Observed (qualitative data collection)" or "Measured (quantitative data collection)." In addition, if a claim is the result of measurement, you must specify the measurement device: "Measured using protractor (quantitative data collection)" or "Measured using stopwatch (quantitative data collection)."

2. DEFINED (definition of). This category includes anything that is defined either by the researchers themselves in the course of the lab or by physicists in the past. A definition is ***not*** a discovery. If you define the top of the window to be x=0 or you define average velocity to be displacement over time, you're not figuring anything out about the world; you're simply ***naming*** things. When using this category you must state what is being defined: e.g. "Definition of Mass" or "Definition of Distance." Etc.

3. CALCULATED (from): any ***numerical value*** that is calculated, through ***mathematical operations*** on other (measured or assumed) quantities. When using this category you must state what equation(s) were used to calculate the value: e.g. “Calculated from the definition of average velocity” or “Calculated from Netwon’s Second Law.”

4. DERIVED (from). Derived knowledge is anything (equation or verbal statement) that is derived (i.e. figured out) through ***logic and/or mathematical proof***. When using this category, you must specify which laws, definitions, observations, etc. you used to derived this statement: “Derived from the definition of acceleration and the midpoint velocity formula” or “derived from Newton’s first law.”

5. POSTULATED. Postulates are statements that form ***the basic assumptions of an area of study (in this case, physics)***. A postulate is not directly provable, but it is accepted because it makes all the rest of physics possible. Only a VERY small number of claims fall into this category. When using this category, state the name of the postulate: e.g. “Postulated: Galileo’s Principle of Relativity” or “Postulated: Newton’s Second Law.”

6. DISCOVERED THROUGH OUR RESEARCH. This category is reserved for things that you learned not by ***pure*** observation, measurement, derivation, calculation, or postulation, but through ***the strategic combination of these various forms of knowledge***, which we call ***scientific research***. This could be something that you discovered in a previous lab in this course or something that you discovered in this lab, after doing a bunch of data collection AND analysis. If a claim was proved in a previous lab, you should specify which lab: e.g. “Discovered through our research, in the ‘Free Fall’ experiment.”

7.NOT JUSTIFIED. You should use this category VERY rarely. It is reserved for statements that you are taking as true basically just because someone told you they were true and you believed them—i.e. statements that you have no way to verify.

WHAT TO DO FOR THIS PARTICULAR (Lab #5) POST-LAB:

Reproduce this table in a SEPARATE document or sheet of paper and choose among the ***seven*** categories listed above in order to complete it.

NOTE: the Justification **MUST INCLUDE**
some sort of prepositional phrase that narrows the type
(and makes it easier for instructors to award credit for valid justifications they did not anticipate),
e.g.: "derived ***from…***," "measured ***with*** (using)…" "definition ***of…***," etc.

* NOTE! The epistemological categories apply to ***all*** claims (statements, propositions) whether the claims seem true or false! (The categories do not, however, apply to anything that is not a claim: "the number 7" cannot derived nor measured; "the table's length is 7 meters" can be.)

Claim	Type of Justification
a) A thin piece of metal was seen to touch another thin piece of metal and, suddenly, there was light.	
b) We looked at the needle fluctuating on a power supply and noticed that the potential difference between the two terminals of the supply was 4.5 Volts.	
c) In order to find the amount of current flowing past the resistor on the right side of the light bulb, we attached an ammeter to the left side of the light bulb and trusted the reading.	
d) The potential difference between two locations in a circuit is the amount of electric potential energy 1 coulomb of positive charge would gain if it moved from one location to the other.	
e) As a charge makes one complete trip around an electric circuit, the total amount of electric potential energy it loses passing through devices will equal the amount of electric potential energy it gains moving through the battery.	
f) If a wire branches into two parallel paths that then reunite at the battery, the current measured near the battery will equal the sum of the two branch currents.	
g) $I = \frac{\Delta V}{R}$.	

II. *Research Design Chart.*

BACKGROUND EXPLANATION.

The chart begins with your ***Research Question*** and shows how you proceeded from data collection FOR at least ONE MEASUREMENT all the way toward an answer for that ***Research Question*** (***RQ***).

Note: For this and all future ***Post-Labs***, you need only select ONE particular ***RQ*** and one particular data thread for depiction in a ***Chart***.

Always write your ***RQ*** right above your ***Research Design Chart***

The chart has 3 sections:

DATA COLLECTION: Measurement(s) you took or observation(s) you made in the lab.	→	ANALYSIS: Some mathematical or logical analysis you did on those measured quantities or observations.	→	CONCLUSION: How that analysis helped you answer your Research Question

<u>Example</u>

RQ: how does changing the volume of a chamber affect the temperature of a the gas inside the chamber?

We measured the initial length, width & height of the chamber and got 7 cm, 5 cm, and 8cm, respectively.	→	We substituted these values into the equation for the volume of a rectangular prism: $V=W \times L \times H$. We concluded that the initial volume of the chamber was $5cm \times 7cm \times 8cm = 280\ cm^3$	→	Knowing the initial volume of the chamber allowed us to compare that to the volume after the chamber was compressed, which allowed us to see the change in volume, which helped us determine the relationship between change in volume to change in pressure.

<u>WHAT TO DO FOR THIS PARTICULAR (Lab #6) POST-LAB</u>:

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 #6.

III. The Counter-Factual.

BACKGROUND EXPLANATION.

At this point in the semester, we let this portion of the ***Post-Lab*** speak for itself. It is simply a question or small set of questions that asks you to consider the implications of something that most probably did NOT happen in your laboratory experience. Though it might seem as though we are asking you to waste thought or time on a non-sequitur (to something entirely unrelated to the issues at hand), we are not.

In fact, we are asking you to identify, scrutinize, test or possibly challenge some kind of reasoning that is central to the lab—and therefore to the ***Formal*** Lab ***Report***.

<u>WHAT TO DO FOR THIS PARTICULAR (Lab #6) POST-LAB</u>:

In complete sentences of English, answer the following question:

Imagine that in the hypothetical counter-factual world, you do and thought about everything in this experiment precisely as you did in your actual John Jay experience, EXCEPT a couple of things (consider each independently):

1) Here, protons move through wires while electrons sit still.

Which procedures, measurements or findings from this lab would come out differently? Why?

2) Here, no one has ever heard of a resistor. Circuits are constructed enthusiastically, but no one ever seems to include objects for solely for their ability to reduce current.

Which procedures, measurements or findings from this lab would come out differently? Why?

IV. The Wild Card.

BACKGROUND EXPLANATION.

There is no 'Background Explanation' for something called a ***Wild Card***. We claim that you know that. Our justification is "by definition of ***Wild Card***". In other words, each week the ***Wild Card*** is one final piece of written reflection for which you are responsible – but which can appear in any form — whether familiar or unfamiliar.

The ***Wild Card*** might require another simple diagram or another 'counter-factual' paragraph of writing (things already done) or it might ask you to communicate your understanding in a manner you have not previously considered – such as "knit a sock puppet who can perform a one-act pantomime play about the particle's acceleration". The reason for a ***Wild Card*** is that each particular experiment raises its own particular issues and concerns. Often, particular issues are best expressed by means of their own particular modes of expression. (Usually, there are more effective and precise ways to convey physics findings than by means of a sock puppet.)

WHAT TO DO FOR THIS PARTICULAR (Lab #6) POST-LAB:

You are given one 9 Volt battery, two 30 ohm resistors, two 100 ohm resistors, and two 500 ohm resistors.

Your goal is to create a circuit loop through which precisely 25 milliAmperes of current flows.

In a complete and coherent page, explain what you would do and why.

a) Include a clear circuit diagram.

b) Include all relevant quantities and calculations.

c) Determine and explain the amount of current going through every single resistor you use.

d) You may label your diagram with letters at relevant points if helpful.

e) Provide a minimum of three - five (3 - 5) complete sentences explaining the reasoning behind your circuit design.

f) Imagine that each of your resistors is, in fact, a light bulb. Provide a minimum of two (2) complete sentences explaining what advantages and disadvantages your circuit would have--as compared to all six light bulbs being connected in series.