PH211-3 Explanation Assignment Instructions and Grading Rubric

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Always remember that a good assignment is clear and concise.

Overview

To help move towards a more professional submission of work, I have set requirements for the format of these explanation assignments. There are general formatting requirements that you are requested to follow for ease of reading/grading/commenting.

Something to keep in mind: Who is your intended audience for the work you are doing? For these explanation assignments, imagine you are writing it out for an "average" student in the class who has covered the material for the topic (and previous ones), but hasn't done the assignment yet. They should be able to read through and understand what you are doing at each point, with the need to ask minimal if any questions.

I have created a grading rubric that includes expectations for each assignment and each aspect will be marked on a scale from 0-1 and the final grade will be the sum of those values. The 5 sections for grading are:

- Formatting
- Physics Explanation
- Drawings and Other Images
- Solutions
- Answer and Reality Check

General Formatting

Here are some comments about general expectations for formatting:

- The assignment may be done by hand or digitally. You can also do things by hand to input into the digital document, such as images of drawings and equations.
- Make sure the first page has your name, the course number (PH211/PH212/PH213) and the assignment name and number.
  - Good to have on all pages, easily done digitally.
- Each page must be numbered.
- Pages must be in order and in the same standard vertical orientation.

- Each new problem must either start on a new page or be clearly distinguished from the previous problem with a solid horizontal line across the "entire" page.
    - Different parts of the same problem do **not** need to start on a new page, but it is suggested when nearing the end of a page. Please no lines in the same problem.
- At the start of each problem, the problem should be introduced. This is most commonly done by having the problem copied into the assignment.
- Text and equations should flow directly down the page, with text and equations being clearly displayed.
- Important equations should be numbered to easily reference them later on as needed.
    - You may number all equations if you want, but that can end up being a lot of numbers…
- If the term plot is used, you must use a plotting program, such as Excel or Desmos.
    - The term draw/sketch may be done by hand.
- Answers to each part of a problem should be clearly seen and easy to understand.
    - While I am not strict on format significant figure rules in lecture and for these assignments, answers should generally not have too many digits to lose sight of the meaning of the value. I recommend defaulting to 3 significant figures at the end of the problem.
    - I recommend boxing or highlighting your answers.
- At the end of the problem, acknowledge any persons and reference any materials who/that gave you significant assistance in completing the assignment.

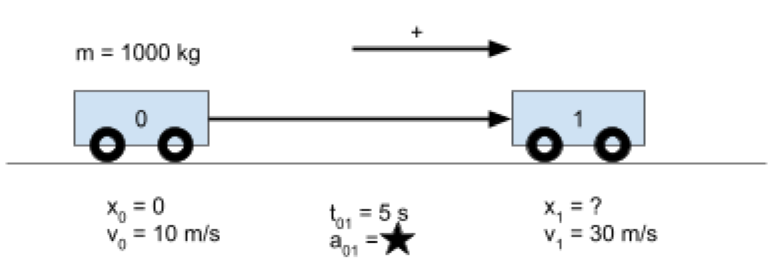
Problems

For all problems that are more than a text response, there will need to be an initial diagram that helps visualize the problem.

- If the problem already has a diagram, you can use it, but often might need to add details (to be described later).
- If there is no diagram (or if you want), you can draw your own diagram or find an appropriate diagram online (make sure to cite it as a reference).

The diagram should include

- A coordinate system!
- A labeling and relating of known values to symbolic variables on the diagram (don't forget units). Also good to label unknowns and what you are solving for in the end as well.
- Any important events (we will discuss in class/videos what is meant by an event) and a sketch of the path of the motion
- It is good to make sure that any lines are straight and round objects (such as a circle) are as close to the correct shape as possible.



Note that this diagram is used for the example that starts at the bottom of the next page.

A later section will discuss additional drawings/diagrams/images beyond that of the introductory diagram. But it is important to know that the introductory diagram counts as a drawing/image.

Explanation

I strongly believe that being able to write out the explanation is much more important than having the equations and answers. The explanation shows a better understanding of the material than just equations and numbers. These assignments need to have explanations and I reserve the right to give a zero for the entire assignment if there is no explanation.

A key thing to remember is that the explanation should be clear and concise. Really one or two sentences before each equation should be enough.

The general idea is that when you are writing down any equation, there should be some descriptor text before the equation saying what it is and why you can use it. Some equations should be coming from diagrams that should be included, such as vectors. Here are a few examples:

- As noted, the acceleration is constant, so we can use the constant acceleration kinematic equations:

  $$x(t) = x_0 + v_0\, t + \frac{1}{2}\, a\, t^2 \text{ and } v(t) = v_0 + a\, t.$$

  - For this specific problem the initial position (x_0) and initial velocity (v_0) are zero, we have:

    $$x(t) = \frac{1}{2}\, a\, t^2 \text{ and } v(t) = a\, t.$$

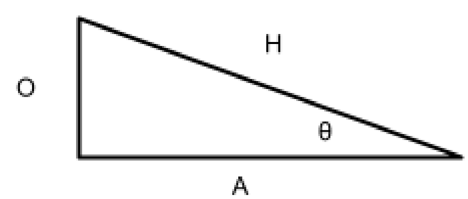
- Knowing Newton's 2nd law to be true, we have

  $$F_{net} = m\, a.$$

- From the right triangle shown to the right we can have the trigonometric identity,

  $$\cos(\theta)=A/H$$

  - More information to come about diagrams in the next section.



- As all work is only done by conservative forces, we will use conservation of energy,

  $$E_{initial} = E_{final}.$$

When it comes to algebra, I am not expecting every step to be explained in detail, though it might be a good habit to do so if you are struggling with algebra yourself. For calculus, it is important to note that you are using it (by taking the derivative), and note any rules of calculus used (using the rules for polynomials and the chain rule). You do not have to show the general equation for the rules, but again, if you are struggling with it, it helps reinforce it by writing it out.

Let's put a lot of that together to show one awesome example of some explanation (and solutions). The problem states: A cart going 10 m/s accelerated to 30 m/s over 5 seconds. Determine the acceleration of the car during that time. Additionally, plot the position as a function of time.

As noted, the acceleration is constant, so we can use the constant acceleration kinematic equation for position.

$$x(t) = x_0 + v_0\, t + \tfrac{1}{2}\, a\, t^2 \qquad [1]$$

We have a lot of information about velocities, so we get to an equation for velocity, we use its definition:

$$v(t) = dx/dt \qquad [2]$$

So plugging equation [1] into equation [2], we will take the derivative following the rules for a polynomial and get

$$v(t) = d(x_0 + v_0\, t + \tfrac{1}{2}\, a\, t^2)/dt$$

$$v(t) = v_0 + a\, t \qquad [3]$$

We want to know the acceleration, so we can do some quick algebra to solve for it

$$v(t) - v_0 = at$$

$$a = (v(t) - v_0)/t \qquad [4]$$

Knowing the initial velocity is 10 m/s and the velocity after 5 seconds is 30 m/s, we can calculate the acceleration:

$$a = (30\ \text{m/s} - 10\ \text{m/s})/(5\ \text{s})$$

$$\mathbf{a = 4\ m/s^2}$$

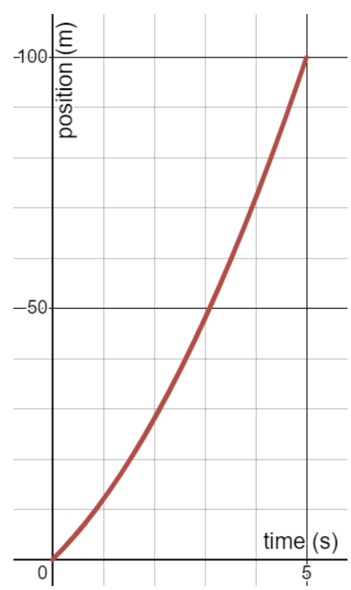
Considering a free falling object accelerates at 9.8 m/s^2, this value seems reasonable that the car is accelerating a little slower than an object would just fall.

Parting comments:

- We could have started with equation 3 when we have a constant acceleration.
- Some very important parts of the explanation will be diagrams, to be discussed in the next section.
- As shown, after your answer, you need a reality check.
- Not shown, after the reality check, there is a requirement for acknowledgements/references.

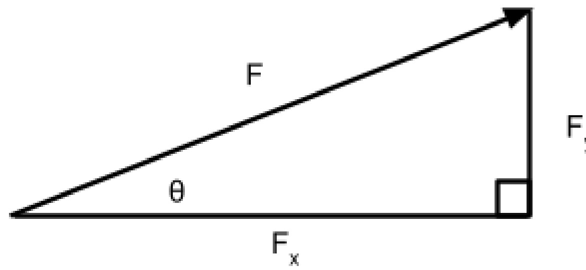
Drawings and other Images

There will often be the need to have additional diagrams beyond just the initial problem introduction diagram. The type of diagrams include, but are not limited to the following:

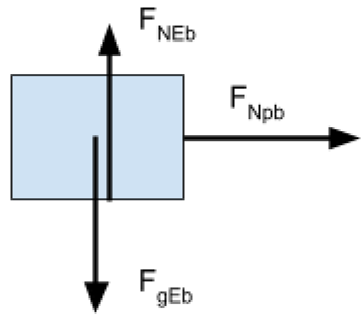


- Plots and graphs
  - Make sure that if you are asked to plot anything, that it has been done with a plotting program. If the phrase "sketch a plot" is used, it may be done "by hand".
  - Make sure to label your axis both with what it is with its units.
  - Show all relevant values on the graph and not any part of the plot outside the range where the equations are not valid.

- Vector diagrams
  - We will learn about vectors and how they can be split into components. This will always create a right triangle, and we will need to draw that triangle and then label any known sides with variables (or values). This will help clarify the trigonometry needed to be done.



- Free body diagrams (FBD)
  - When analyzing forces, we will draw free body diagrams to visualize how to add the forces together. The important things to include are a drawing of just the object being analyzed and all forces acting on the object (with proper labels), as well as the direction of the acceleration, if known.



- Redrawing of the introduction diagram to clarify any changes that have occurred, or to specify a different object being analyzed.

Make sure that each of the diagrams has the proper labeling of known and unknown terms. I know at the beginning of PH211 most students are more comfortable with using numbers, and I hope to show you the power and ease of using variables instead as we work throughout the year.

Solutions

This aspect comes down to more of "showing all your work" by making sure that each of the steps are included. I want you to be thinking about your explanation assignment as being solutions for other students in the class who are struggling to understand the material. If you find yourself having to explain multiple steps in one paragraph, chances are you are not breaking the solutions into small enough pieces for the best amount of clarity.

Let's talk about "showing work" for math. Considering this is a physics course, math is not the primary focus, but to be able to get to the right answer math will need to be done. Any math (numerical calculations, algebra, or calculus) can be done by a computer/calculator. When algebra or calculus is done in such a fashion, it is appropriate to state what program/calculator was used (as part of the explanation). You do not need to state that you used a calculator for plugging numbers into an equation.

Answer and Reality Check

The final answer, while important, is not the most important aspect of the assignment. In fact, there will often be supplied selected answers so you can check your work and make sure you are correct before you have turned it in. You can still get half of the credit in this section with an incorrect answer, as long as you are making statements about the realistic value you are getting.

Answer:
For your answer, it has to have units to be counted as correct. To make sure you are not having any formatting issues, make sure your answer is easy and clear to read, this often comes down to bolding/boxing the final answer and making sure it doesn't have too many digits. As noted earlier, I do not follow strict significant figure rules, but make sure to not give too many digits. 2 or 3 is fine with me. I'll take this moment to comment that you shouldn't round any numbers in your calculator until the end, to make sure you are getting the most accurate answer.

Reality check:
This is a check that should be done always and might often catch an incorrect answer before you know the actual answer and can save time for checking it. This is the moment where you look at your answer and think, is this realistic? Does this make sense? Can a kid throw a ball 1 meter? 10 meters? 100 meters? Is an average person running at 1 m/s, 5 m/s or 10 m/s realistic?

But most importantly, we want the reason this makes sense (or not). For the examples above, I know a kid can't throw the length of a football field, so 100 meters is not realistic. If that is an answer I got, I might want to look over my work or ask for help. I myself also did not know the running speed in m/s, so I searched [for it on the internet], and found that Usain Bolt's record time had a speed of about 10 m/s. So I can include a reference just for my reality check. Also, you might have to convert to imperial units, since you might be more familiar with feet/miles.

If you are running low on time (explanation assignment is due and it's time to move on) and do not have time to figure out the issue, you should state that you recognize that your answer does not pass your reality check.

Reality checks are only required for problems that have a numerical value. We will learn about reality checking equations throughout the year (and don't need to check any written answers).

Acknowledgements/References
You should always acknowledge those you discussed the assignment with. As such I am requiring you to acknowledge anyone you discussed this assignment with who had a significant impact on your work. It is normal that students will discuss the assignments with others. That may include other students in the class, previous students in the class, friends, family members, tutors, the instructor, an instructor for another course, some guy at the coffee shop, etc.

- Any person who has given non-trivial assistance to your assignment should be mentioned.
- Full names should be used when possible.
  - There might be more than 1 Herbert out there. I've had 4 Sams and 2 Gabes.
- When acknowledging someone outside of the course, you must give the relationship.
  - My sibling, from the tutoring center, random person at the bar/coffee shop, etc.

    - For tutors, please inform the type of tutor, examples below
        - Chemeketa tutoring center (either in person or online, specify)
        - Hired individualized tutor
        - Online tutor with website

References

I require you to share any specific materials that significantly helped you on the assignment.

- Examples of references include, but are not limited to: Any of my materials, class textbook, some other textbook, specific moment during class, websites, online videos, a great book you once read, tutoring center survival sheet.
- Referencing "your notes" is not a valid reference; where did your notes get the information from? So I am saying that your notes should also have references to them!
- I do not enforce any specific referencing scheme or bibliography, I just want a clear idea where the information came from.
- If doing your work digitally, including links is a great idea for yourself and for me to check.
- Be specific about websites and give a direct link when submitting electronically.
    - Good example: http://hyperphysics.phy-astr.gsu.edu/hbase/pflu.html, Hyperphysics website found via Google.
    - Bad example: Google
- Videos should have a website/link noted.

If you did not need to acknowledge and/or reference anything for the assignment, then state that you did not speak to anyone and/or did not reference anything. If assignments have no reference/acknowledgements and don't state that they didn't talk to anyone or use any references, then the assignment will receive a zero. The student will likely be asked to discuss this with the instructor as possible resources as being used without acknowledgement, be it unintentionally or not.

For assignments with multiple problems, it is best to include your references and acknowledgements for each problem after that problem has been solved. But I will accept getting all of them at the end of the assignment as long as each acknowledgement and reference states which problem they helped with.

Submission of assignments:

- Submissions occur through eLearn/Canvas.
    - Email submissions will not be accepted.
- The assignment must be submitted as a single document (.doc or .pdf).
    - Often scanned files might be 1 PDF per page, this is not acceptable.
    - Can input images into a google Doc and save that Doc as a pdf.
- Assignments turned in via eLearn must be no larger than 20 MB. Check your image sizes!

Getting feedback on the assignments:
Assignments submitted electronically will be given feedback with notes directly on the file submitted and/or written in the "assignment comments" on Canvas.

Grading Rubric:

Category	Accomplished (1)	Could be better (0.5)	Emergent (0)
Professionalism/Formatting	Formatting is done properly with little or no notable issues.	Several minor formatting issues are noticed.	Major formatting issues are noticed.
Physical Explanation	Every physics concept is explained directly before relevant equations with its name and why it can be used.	The physics concepts are stated by name and there is generally an explanation of what is going on.	Any relevant physics concepts are missing or incorrect. Or lacking overall explanation
Drawings and Other Images	All expected diagrams are included and complete.	All relevant drawings exist. Some with minor issues, but are still clear as to their usage.	Relevant diagrams are missing or not clear.
Solutions	There are no leaps in logic in the solutions, and the work is generally correct.	There are one or more smaller leaps in logic that require a bit of extra explanation or "reading between the lines" or mistakes in the work.	There are one or more significant jumps in logic/work. Or work is generally incorrect.
Answer and Reality Check	Correct with a correct reality check.	Correct with an incorrect or no/inaccurate reality check. Or Incorrect with a reality check.	Answer missing or answer missing units or answer is incorrect and not discussed.

Turning in a completed draft on time will award 1 point of EC, a partially completed draft will get 0.5 points.

If any categories are graded as a zero, the assignment itself may receive a zero and the student will be asked to resubmit fixing the noted issues with the assignment for credit. If assignments have no reference/acknowledgements and don't state that they didn't talk to anyone or use any references, then the assignment will receive a zero.

During class in the first topic, there will be an activity in which students are given three different solutions to a problem and asked to evaluate them on this grading rubric to gain familiarity with it.