Faculty Showcase
for
Innovative Teaching
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One Question Assignment

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ONE QUESTION ASSIGNMENT USING CANVAS DISCUSSION

Learning outcomes: interrogating one's own understanding; prioritizing in context; formulating coherent questions to gain and/or improve understanding – critical thinking.

This simple assignment was developed with the intention of engaging students in critical thinking as they prepare for an assessment.

We developed and have been using the One Question Assignment for a number of years and first implemented it using Canvas Discussions in 2020.

The graded assignment requires each student to reflect on the material that will be assessed in an upcoming assessment and submit a single **well-composed** question that they consider it essential to get answered in preparation for the assessment.

Questions are used as the framework for class review session(s) (face-to-face) or instructor online response (asynchronous online).

EXAMPLE ONE QUESTION ASSIGNMENT

This assignment is to post in this discussion one ***well-composed content question**** on the ***content of Chapters 6 and 7*** that you would most like to have answered. (If you don't have questions, you know what I think, or at least should, by now.)

*What is a ***content question***? It is a question that is about the content of the chapters and any associated questions, problems, videos, or other materials that have been assigned on the content in the chapters. It is ***not*** about class policies, homework policies, deadlines, grades, what material to plan to study for exams, etc., (you are always welcome to ask these questions at office hours).

What is ***well-composed***? A question that includes all the relevant information and context so that it can be understood and considered without having to refer to other material.

BEFORE you ask a question about a specific homework problem that was assigned, CHECK THE POSTED KEYS. If your question is answered by the keys, you need to compose a different question. If your question is simply how to do one of the assigned homework problems for which there is a problem key, it is not well-composed. Of course, the homework problems can be interesting, puzzling and complex, so questions about assigned homework problems and/or aspects of the solutions given in the problem keys are fine so long as the question is more substantial than just "how do I do it?" and so long as the answer to the question isn't straightforwardly answered in the problem key.

Examples (for an intro physics class) that are either not content question, or not well-composed, or are neither DO NOT DO THESE:
- Do we need to memorize the uniform acceleration motion equations for the quiz? ***Not a content question.***
- Will the quiz cover Chapter 4.15? ***Not a content question.***
- Is there a way to get extra credit points on the Module questions? ***Not a content question.***
- How do you do problem 3-92? ***Not well-composed.***
- Can you explain equation 3.49? ***Not well-composed.***
- I followed the example in the textbook but I couldn't get the answer in the back of the book for the cannon-ball problem. Why? ***Not well-composed.***

Examples (for an intro physics class) that are well-composed content questions:
- In problem 3-92 the mass of the parakeet isn't given, but the equation for gravitational force requires mass. How do you use equation 3-31 for that problem when you don't know the mass of the parakeet? (***better*** would be to include the equation for gravitational force)
- Equation 3-49 has two different speeds in it, v and v_0. I get confused about when to call the speed in a problem v and when to call it v_0. Can you explain how to determine which speed is which when using that equation? (***better*** would be to include Eq. 1-49 in the question)
- When I followed the example for solving projectile motion on page 91 of the text book to solve for the distance a cannon-ball in projectile motion travels in problem 4-17, I obtain a negative number inside the radical (Eq. 4-22) and my calculator gives 'undefined' for the result. Why doesn't that example work for this problem?

After you've posted your question, you can see the questions your classmates have posted and you are welcome and encouraged to engage in discussion with them about their questions and your own. I may give a small amount of extra credit for correct, insightful responses.

CONCLUSIONS

- Clear and detailed elaboration of the expectations for a well-composed question is essential
- Majority of students submit substantive, well-composed questions
- Scope of questions typically touches on much of the relevant material for an upcoming assessment
- Common themes of questions or difficulties often emerge
- *Instructor response can be time-consuming*
- *Students only infrequently interact in the Canvas Discussion*
- *There is a tendency for questions to be weighted toward more recent assignments*

SAMPLE QUESTIONS AND RESPONSES

In class we learned that the kinetic energy of a non rolling object is $\frac{1}{2}mv^2$. Then we learned that for an object that is rolling without slipping the kinetic energy is $\frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$. My question is does a non rolling object that travels at the same speed as an object that is rolling without slipping have a smaller amount of kinetic energy? Given that both have an equal translational motion but the rolling object has an additional amount of energy from its rotational motion.

For my answer to question 1 of this week's general problems, I got a value for A that had a ± symbol. Assuming I was correct, of course, what does it physically mean for there to be two values of A? Does it mean that $\psi_S(x)$ can be interpreted as a superposition of either the sum with the positive version, the negative version, or both?

If I was totally wrong and just asked about something inconsequential because the answer doesn't have ±, could you give me a physical interpretation of a superposition wave function in an ISWP? Does this adding of two wave functions mean that we are looking at two quantum particles in this square well?

Michael Braunstein (*He/Him*)
Jan 31, 2023

Oh[redacted] it's worse than that. In fact what you found is that the normalization constant could be $Ae^{i\phi}$; if $\phi = 0$, this is +A, if $\phi = \pi$, this is -A, but ϕ could be any value at all based on the information you were given because $|Ae^{i\phi}|^2 = Ae^{i\phi}Ae^{-i\phi} = A^2e^0 = A^2$. We call the term $e^{i\phi}$ of the normalization constant its ***phase.*** Since you weren't given any more information to determine the phase, you could arbitrarily pick it - so $+A$ would be correct, as would $-A$, as would also $Ae^{i\frac{17\pi}{209}}$. You'll notice that the superposition wavefunction in ⋯

In our MLM 14, question 2, part c confused me. This part asked us to sum the forces in the y direction. I originally had put Tsin(theta)-m1g-m2g. It told me to think about my signs, and I figured out the correct answer, which was -Tsin(theta)+m1g+m2g. I had a tutor help me with this and he told me that we have to think about it in a weird way, that the Tsin(theta) is a negative force and that the m1g and m2g are adding to this, but it didn't really click as to why we look at the forces in this way. Can you explain why our Tsin(theta) is negative?

[redacted]
Jan 28, 2023

Sometimes I forget when to use sin or cos when determining an angle θ in a problem, like in Problem 10.54 of Module 4 MLM. What is the best way to remember which one is right for these problems requiring getting an angle in order to solve the problem?

[redacted]
Jan 28, 2023

Hi[redacted]

When I'm dealing with angles in a problem it helps me to always write down the definitions of sine (opposite/hypotenuse) and cosine (adjacent/hypotenuse) somewhere on the corner of my paper. That way, when I'm trying to decide which to apply, I can easily see which of the functions gives me the side that I want using the side that I have. If you're dealing with a problem that wants you to find an angle, however, then you would be using the inverse of your trigonometric function. :)

Edited [redacted] on Jan 28 at 7:36pm

Michael Braunstein (He/Him)
Feb 1, 2023

also discussed in class, 2/1/2023

Michael Braunstein (He/Him)
Feb 1, 2023

Thanks for the suggestion[redacted]

1. In general, I'm still unsure when to use the classical physics equations and when to use Lorentz transformations. Would there be any dead giveaways or keywords that would help determine when to use classical vs. Lorentz?

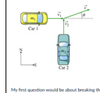
We've been working with the hydrogen atom all of chapter 7, including the schrodinger wave equation, electron states and transitions etc. Why do we only work with the hydrogen atom? Are the other atoms more complicated, or are they just not applicable to what we're learning? Maybe because it's the most abundant atom, or just the simplest? Fun stuff.

[redacted]
Jan 28, 2023

My question is in regards to Module 6 MLM question #4 about the colliding Cars (MLM question below:)

In this problem we will consider the collision of two cars initially moving at right angles. We assume that after the collision the cars stick together and travel off as a single unit. The collision is therefore completely inelastic.

Two cars of masses m1 and m2 collide at an intersection. Before the collision, car 1 was traveling eastward at a speed of v_1 and car 2 was traveling northward at a speed of v_2. (Figure 1)After the collision, the two cars stick together and travel off in the direction shown.



My first question would be about breaking them into their x and y components, would this only pertain to objects colliding perpendicular to each other? What would change if one of the cars are colliding with the other at a 45 degree angle rather than 90? Would it be best practice to annotate them as i and j components or is x and y acceptable? (I know it is pretty much the same but still a little shaky on where we use i and j hat.)

My second question would be finding the angle after the collision. Since we already did the homework, we know it is tan (opp/adj) however, I couldn't grasp on why we would use tangent instead of the others? Why wouldn't we use sin (opp/hyp)?

[redacted]
Feb 1, 2023

You can use sin or Cos or Tan on this problem. Since we found that the two sides (besides the hypotenuse) were the same value, and the hypotenuse was a little higher, using sin, cos, or tan all yield the same result. (The inverse of these identities)*

$\sin^{-1}\left(\frac{\frac{1}{\sqrt{2}}}{1}\right) = 45 \quad \cos^{-1}\left(\frac{\frac{1}{\sqrt{2}}}{1}\right) = 45 \quad \tan^{-1}\left(\frac{\frac{1}{\sqrt{2}}}{\frac{1}{\sqrt{2}}}\right) = 45$

They all yield the same result, so as long as you set it up right, it works out.

Michael Braunstein (He/Him)
Feb 1, 2023

Answered in class on 2/1/2023

Michael Braunstein (He/Him)
Feb 1, 2023

[redacted] that's right! In this problem, we sort of automatically get the opposite and adjacent sides of a right triangle for the final momentum vector, so tangent is probably the first trig relationship most folks will grab for, but, yes, with a little extra work you could use any of them as you showed.