Name: ___________________________________Tutorial section _______

What if something just doesn't make sense: Acceleration at the peak

Today's lesson, a continuation of this week's tutorial, focuses on strategies you can use to deal with counterintuitive ideas.

I. Up & down the ramp: Acceleration at the peak

Consider a cart rolling up and down the ramp, like you saw in tutorial. The detector is at the bottom.

A. (*Work individually)* Intuitively, at the peak (highest point), is the cart's acceleration positive, negative, or zero? Why?

B. (*Work with a neighbor*) If you didn't do so in part A, give an intuitive argument that the cart has no (zero) acceleration at the peak.

✯ *Experiment: Acceleration at the peak*

C. (*Work individually*) Consider the common-sense argument that the cart has no acceleration at its peak. Which of the following choices best expresses your view about how you should treat that common sense argument as you keep learning about acceleration.

(1) In general, it's helpful to relate physics concepts to common sense. Bt when a concept seems counterintuitive, the key is to learn exactly when the counterintuitive concept applies, so that you'll know in which specific cases you can't "trust" your common sense.

(2) If physics were common sense, we wouldn't need your instructor! When learning physics, it's best to learn the concepts on their own terms instead of mixing them up with your own common-sense ideas.

(3) Neither of the above. *POLLING*

If you chose (1) or (2), explain why. If you chose (c), explain your view.

D. Discuss your answer with a neighbor.

✯ *Class discussion*

II. Does checking for coherence help us understand?

A. (*Work with a neighbor*) Assume your velocity graph prediction for this experiment was correct. Even before doing the experiment, how could you have predicted with confidence that the acceleration at the peak is negative? Explain.

B. (*Work with a neighbor*) Is there some way to use your reasoning from part A to give an explanation for why the acceleration is negative at the peak, an explanation that's at least partly intuitive? How? Hint: Based on the velocity graph, is the cart's velocity at the peak staying the same?

✯ *Class discussion*

✯ *Mini-lecture: The velocitometer*

III. The velocitometer: Another way of picturing acceleration

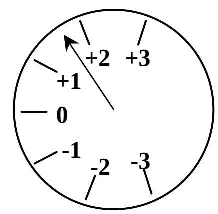
A. Understanding the velocitometer

1. (*Work together*) By looking at a velocitometer, how can you tell whether the cart is accelerating?

2. (*Work together*) By looking at a velocitometer, how can you tell whether the acceleration is + or **-**?

✯ *Class discussion*

B. Using the velocitometer to visualize the acceleration at the peak



1. (*Work with a partner*) Suppose, when you push the cart up the ramp, it leaves your hand traveling at 3 m/s. When you catch it on the way down, it's traveling at –3 m/s. Describe the motion of the velocitometer needle as the cart rolls up and down the ramp.

2. (*Work together*) How much time does the needle spend pointing at 2 m/s? Does the needle *stop* at 2 m/s for some finite time, or does it sweep through 2 m/s, spending just an infinitesimal instant at that point?

3. (*Work together*) How much time does the needle spend pointing at 0 m/s. Does that needle *stop* at 0 m/s for some finite time, or does it sweep through 0 m/s, spending just an infinitesimal instant at that point?

✯ *Class discussion*

4. (*Work together*) Using your above answers, can you come up with an intuitive, common-sense explanation for why the cart's acceleration is *not* zero at the peak, even though the cart has zero velocity at that moment?

✯ *Class discussion: Looking at it another way*