ILD 5 Name: ____

The limits of reconciliation: Energy conservation

I. Blocks on ramps

Two identical blocks, A and B, are released from rest on frictionless ramps. They are released from the same height; but one ramp is steeper than the other.



- A. (Work together) Here's the issue: Which block has more speed at the bottom of the ramp?
 - 1. Why might a smart student say block A has more speed at the bottom?
 - 2. Why might a smart student say the two blocks have the same speed at the bottom?

🖈 Class discussion. POLLING. Experiment

- B. Energy conservation implies that both blocks reach the bottom with the same speed. And yet, in question A 1, many people express the intuition that "steeper means faster." Let's see if, by refining the raw intuition that "steeper means faster," we can reconcile it with what actually happens here. We'll lead you through some steps.
 - 1. Which block, if either, has greater acceleration? Why?
 - 2. Which block has less distance to cover to reach the bottom of its ramp?
 - 3. Which block reaches the bottom of its ramp *in less time*? Why? Be sure to check for coherence between your answer to this question and your answers regarding the accelerations and distances.
 - 4. Is there a sense in which "steeper means faster" is true about this scenario? In other words, can we refine that raw intuition into something that's more precise and also correct?

 \bigstar Class discussion.

The limits of reconciliation: Energy conservation

C. We just saw how to reconcile "steeper means faster" with the conclusion, based on energy conservation, that the blocks have the same speed at the bottom. But does the reconciliation really help you understand what's going on here? Here's how one scientist responded:

The reconciliation brings attention to the fact that what's going on with the *times* can be different from what's going on with the *speeds*. But there's no way the reconciliation can give you a deeper understanding of why the two blocks have the same speed at the bottom. That's something you need to accept, because energy conservation says it's true. My point is that reconciliation is worthwhile up to a point, but it's not the core of learning this stuff.

In what ways do you agree and/or disagree with the scientist? Explain.

POLLING: (i) agree, (ii) neutral, (iii) disagree

- D. Let's see if we can use the intuition-refinement reasoning of part B to gain deeper insight into why the two blocks have the same speed at the bottom of their ramps.
 - 1. Review from part B: Which block has more acceleration?
 - 2. Review from part B: Which block takes more time to the reach the bottom?
 - 3. Using what you just said about the accelerations and times, explain why the two blocks gain the same velocity.

E. Look over what the scientist said in part C. Above, you expressed to what extent you agree and/or disagree. Is your view on this issue the same as it was earlier, or has your view changed?



POLLING: (1) agree, (2) neutral, (3) disagree