I am currently working on the Physics 9 syllabus. I’m trying to decide between two possible grading schemes:

<table>
<thead>
<tr>
<th></th>
<th>Option A</th>
<th>Option B</th>
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</thead>
<tbody>
<tr>
<td>50%</td>
<td>weekly homework problems</td>
<td>40% weekly homework problems</td>
</tr>
<tr>
<td>25%</td>
<td>final exam</td>
<td>25% final exam</td>
</tr>
<tr>
<td>10%</td>
<td>take-home practice exam</td>
<td>15% midterm exam</td>
</tr>
<tr>
<td>10%</td>
<td>reading assignments</td>
<td>10% take-home practice exam</td>
</tr>
<tr>
<td>5%</td>
<td>lecture discussions</td>
<td>10% reading + clicker discussions</td>
</tr>
<tr>
<td>12</td>
<td>homework assignments</td>
<td>11 homework assignments</td>
</tr>
<tr>
<td>no</td>
<td>midterm exam</td>
<td>1 midterm exam</td>
</tr>
</tbody>
</table>

Which scheme do you think will be more helpful for your learning?
What are the expected shapes of $v_{1,x}(t)$ [blue] and $v_{2,x}(t)$ [red] when $m_2 = m_1$, and initially cart 1 is moving to the right and cart 2 is stationary? (We chose this one.)
What are the expected shapes of $v_{1,x}(t)$ [blue] and $v_{2,x}(t)$ [red] when $m_2 = m_1$, and initially cart 1 is moving to the right and cart 2 is moving to the left? (We chose this one.)
What are the expected shapes of $v_{1,x}(t)$ [blue] and $v_{2,x}(t)$ [red] when $m_2 = 2m_1$, and initially cart 1 is moving to the right and cart 2 is stationary? (We chose this one.)
What are the expected shapes of $v_{1,x}(t)$ [blue] and $v_{2,x}(t)$ [red] when $m_2 = 2m_1$, and initially cart 1 is stationary and cart 2 is moving to the left?
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“Collisions between pool balls are typically elastic collisions, as the relative speed of the two balls remains the same after the collision. Any sort of car crash is typically an inelastic collision, as the relative speed of the cars has lowered. If you have two magnetic balls rolling along, when one ball approaches the other and collides, they would connect and thus have a totally inelastic collision. Their relative speed becomes zero.”

“I think racquetball, the ball hitting the wall, is a nearly elastic collision, throwing a piece of ripe fruit at a wall is almost totally inelastic, and a normal inelastic collision could be shoving a rolling chair into a desk, it bounces back a little, but not much”

“Elastic - two bumper boats in water
Inelastic - dropping a pencil on the floor
Totally inelastic - a player catching a football (without fumbling)”
“Elastic” You are playing pool and hit the stationary 8 ball with the cue ball. After the collision, the cue ball is stationary and the 8 ball moves at a rate equal to the cue ball’s initial velocity.

“Inelastic” A soccer player kicks a ball against a wall during practice and it rebounds at a slower speed that it was initially traveling.

“Totally Inelastic” You throw a piece of cooked spaghetti against a wall to see if it’s done and it sticks to the wall.”

“Energy is extremely useful in physics because it is one of the few quantities that is conserved... like momentum. Though energy can be converted between forms (kinetic, thermal, chemical, mechanical, etc.) and transferred from one object to another, it is still conserved in a closed system. Because of this property of energy, many physics problems can be simplified and energy can be used to help solve many different kinds of physics problems as well as understand everyday phenomena.”
Today’s reading: *Energy!*

“Energy is important because it powers everything in our world. Energy cannot be created or destroyed, only transferred; our world is under a constant conservation of energy. In physics, energy is useful because it gives us a means of measuring the state or motion of an object (or system of objects).”

“I think energy is a very interesting topic, though harder to visualize than momentum. I found inelastic collisions and explosive separations to be a bit more difficult than elastic and totally inelastic collisions.”

Confusing:

- Internal energy
- Closed (or not); isolated (or not) system
- Explosive separation
- Coefficient of restitution
Conservation of energy

“‘Conservation’ (the conservation law) means this . . . that there is a number, which you can calculate, at one moment — and as nature undergoes its multitude of changes, this number doesn’t change. That is, if you calculate again, this quantity, it’ll be the same as it was before. An example is the conservation of energy: there’s a quantity that you can calculate according to a certain rule, and it comes out the same answer after, no matter what happens, happens.”

— Richard Feynman

http://www.youtube.com/watch?v=qMd4K0I6LF0

(There’s a much better, longer quote from Chapter 4 of The Feynman Lectures on Physics.)
Energy

- can be transferred or converted, but cannot be created or destroyed.
- is constant in a closed system.
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A closed system is one for which no energy flows in or out.
- Take *that*, philosophy buffs!
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The key point is that you need to be aware of the possible ways by which energy could go in or out, and make sure you choose your “system” boundary appropriately.
Energy

We’ll see energy in many forms in Physics 8, and even more in Physics 9.
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Kinetic energy, thermal energy (heat) [which we’ll see is really just the kinetic energy of many, many jiggling atoms, etc.], gravitational energy, electrostatic energy, elastic energy [which we’ll see is really just the electrostatic energy of the atoms in a metal spring, etc.], . . . , the energy carried by light, by sound, by a water wave, by the electric power grid. There’s the chemical energy of food and fuel (which again is electrostatic in origin).
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But to keep your head from exploding, let’s focus on kinetic energy today — the energy of motion.
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\[ K = \frac{1}{2}mv^2 \]
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**e.g.**

\[ \frac{1}{2} m_1 v_{1i}^2 + \frac{1}{2} m_2 v_{2i}^2 = \frac{1}{2} m_1 v_{1f}^2 + \frac{1}{2} m_2 v_{2f}^2 \]
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i.e. relative speed is the same before and after an elastic collision
We now know enough to be able to check the results on the 3rd graph, about which there was a question on Monday.

...when \( m_2 = 2m_1 \), and initially cart 1 is moving to the right and cart 2 is stationary?
Let’s look at momentum $p_x$ instead of velocity $v_x$: 

... when $m_2 = 2m_1$, and initially cart 1 is moving to the right and cart 2 is stationary?
Let’s look at kinetic energy $\frac{1}{2}mv^2$ instead of velocity $v_x$:

... when $m_2 = 2m_1$, and initially cart 1 is moving to the right and cart 2 is stationary?
Totally inelastic collisions

Now let’s repeat a couple of Monday’s collisions, but we’ll arrange for the two carts to stick together after the collision.

Thus, we will replace Monday’s elastic collisions with totally inelastic collisions.

\[ v_{1_{2f}} = 0 \iff \vec{v}_{1f} = \vec{v}_{2f} \]
What are the expected shapes of $v_{1,x}(t)$ [blue] and $v_{2,x}(t)$ [red] when $m_2 = m_1$, initially cart 1 is moving to the right, cart 2 is stationary, and the carts stick together in collision?