Elastic Collision POGIL
(Process Oriented Guided Inquiry Learning)

Name:_____

A steel sphere of mass 4.0 kg moving at 3.0 m/s right collides with a stationary steel sphere of mass 2.0 kg. Let's assume the collision is completely elastic and we would like to find the after collision velocity of each sphere.

1. Since we have a more massive cart moving and striking a less massive cart, based on what you've seen in class and elsewhere, what do you think will happen to each cart's velocity?

2. Since we have a collision, if we let the system be the two carts together, we have an isolated system and can conserve momentum. Write an equation showing the conservation of momentum below. Use the symbols $v_4$ and $v_2$ for the unknown after collision velocities.

3. Next simplify this expression by dividing each term by the greatest common factor.


4. As you can see, we have an expression with two unknown quantities…we once again have two choices: either give up or find another equation! Since we were told this is an elastic collision, we can also conserve kinetic energy. Write another equation showing the conservation of kinetic energy below. As before, use the symbols $v_4$ and $v_2$ for the unknown after collision velocities.


5. Now you'll have to solve both equations at the same time. Perhaps you can solve the momentum equation (from #3) for one of the two unknowns, say $v_2$, and then substitute that into the kinetic energy equation (from #4). This may take a few mathematical steps, but you should end up with a quadratic equation ($2^{nd}$ order polynomial).

6. Simplify your expression by dividing each term by the greatest common factor.

7. Use your algebra skills to solve for the unknown $v_4$. If the expression is easily factorable, you can try doing that. Alternatively you can apply the quadratic formula (some simple calculator or phone apps can do this for you). Please show your work.

   You should get two answers…write them both below and identify the after collision velocity and circle it.

   What does the other one represent?


8. Finally, use the after collision velocity for $v_4$ found in #7 and an equation (like the one in #3 or #4) to calculate the after collision velocity $v_2$.

9. Review your original prediction made in question #1. Do your answers match your prediction?