5.7 – Elastic and Inelastic Collisions

Collisions can be analyzed by → Law of Conservation of Momentum (all collisions)
And… → Law of Conservation of Kinetic Energy (special situations)

**And of course – decide whether it is a 1D or 2D collision
→1D collision (solve using +/- integers)
→2D collision (solve 'x' and 'y' components separately)

Elastic Collisions – Total amount of kinetic energy is conserved.
ie: Ektotal before = Ektotal after.
- Momentum is conserved.
ie: Pto = Ptf

- This is less common – collisions where there is minimal deformation
ie: billiard ball collisions
- If it is a 2D question, Ek is conserved in 'x' plane and 'y' plane.

Inelastic Collisions – Total amount of kinetic energy is NOT conserved.
- Only Momentum is conserved.
ie: Pto = Ptf

- This is more common – collisions are those in which you see deformation (crumpling, squishing), or objects stick together.

- Well….if Ek is not conserved, the energy must go somewhere. Where does it go?
→ sound energy → heat energy → energy required to deform.
Remember energy cannot be destroyed! It just goes somewhere else.

Which way do I solve?? Follow the following steps

Q: Given the data below, what is the velocity of the 2nd object?

#1 – if it doesn't say it's an elastic collision, then assume it's not!
Therefore….you must use the Law of Conservation of Momentum ONLY!

#2 – Decide whether the question is 1D or 2D. Do you use +/- integers or 'x' and 'y' components.

#3 – Is this collision elastic or inelastic?
Find the final velocity as requested. Now calculate total Ek before And the total Ek after. Are they equal? If so….it is elastic. If not… it is inelastic.

1D Elastic Collisions – Short Cut Formulas!

There are some simplified formulas we can use ONLY IF the collision is 1D and ELASTIC and 2nd object is initially at rest!

IF
#1) Collision is 1D AND
#2) Collision is Elastic AND
#3) v_{2f} = 0 m/s

then you can use the following shortcuts:

** Please copy equation 4 and equation 5 from page 262 – look up at top left.

V_{1f} =

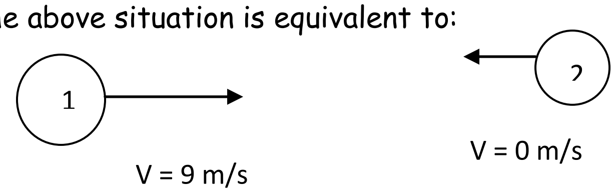
V_{2f} =

*** Make sure all 3 assumptions are met before you use these!
Otherwise your answer in incorrect.

What if V_{2f} does not equal 0 m/s?? (Example 15 – page 263) **You must an adjustment**!

#1 - Set one way as positive – in this case, the direction of #1.
#2 - Add an integer to #2 so that the result is v = 0 m/s.
ie: We need to add (+3). -3 + 3 = 0 m/s
#3 – Whatever you do to #2, you must do to #1.
ie: 6 + 3 = 9 m/s

So the above situation is equivalent to:



Now you can solve using the short cut formulas.

<u>Just remember to 'undo' your adjustment</u>.

ie: You added 3 m/s to each side. So before the end, you must subtract 3 m/s to each side!   Look at the example on page 15!