Momentum Notes Momentum Notes Momentum Notes Momentum Notes

Big

Idea #1

How is momentum similar to inertia? They both describe things about an object. Momentum begins to hint at more useful characteristics.

How is momentum different from inertia? It is possible for an object to have zero momentum, but no thing that has mass can have zero inertia.

Momentum is calculated as *p=mv*. The units are ugly (kg\*m/s).

Big Idea #2

Momentum and Impulse

For an object to speed up or slow down, an unbalanced force must be applied (Newton’s 2nd law). If the object speeds up quickly, the force must be larger than if the object speeds up slowly. F = ma vs. F=ma

Abrupt, fast changes in velocity are harmful to living things. Non-living things must be strong and resilient to withstand the large forces that bring about changes to their motion quickly. It’s the accelerations that kill ya, not the force. ;)

If those same changes to motion are achieved over a longer period of time, then less force is needed. This can help increase safety. It can also make a previously not possible task become possible.

 F=ma F=m(Δv/t) F= m\*Δv/t $F=\frac{m\*∆v}{t}$ F = (change in momentum) / time [note: Δp = mΔv]

What are some materials, or methods, which help things slow down slowly? Speed up slowly?

 Foam, trampoline, air bag, mattress, pad in helmets, pads in shoes moving with a catch, follow-through on a kick or bball shot

Big Idea #3

Conservation of Momentum

Momentum is conserved in a closed system. Using Newton’s 3rd of “equal and opposite”, we can look at collisions (or two things interacting) with a new perspective. As discussed in our previous unit, the force one object exerts on another is equal to the amount of force exerted on itself. If a large mass interacts with a small mass, then the large mass with have a smaller acceleration that the small mass.

 mA = F = Ma

Similarly, this is true for momentum. When two objects collide, the total momentum before the collision is equal to the total momentum after the collision. Momentum can be transferred from object to another, or the momentum of one object can cancel out the momentum of the other object.

 M1V1 + M2V2 = M1V3 + M2V4 🡨 This is for two objects. The combined momentum of both objects before a collision

is equal to the total value after, too.