9.2 Impulse is Equivalent to a Change in Momentum pg 454

“It isn’t the fall that hurts, it’s the sudden stop at the end!”

Force and time affect momentum. The softer and more cushioned landing surface provided, the greater stopping distance for an object, therefore the less damage that can be done during a sudden stop, such as falling or in a car accident.

Impulse is equal to the *change* in momentum.

$\Delta p = F\Delta t$

$F\Delta t = m\Delta v$

On a Net Force - Time graph,the magnitude of impulse is equal to the area under the graph.

Safety devices are based on varying both the average net force acting on an object and the interaction time for a given impulse.

What happens if a snowmobile is going downhill towing a komatik using a rope suddenly puts on the brake? The komatik will slide into the snowmobile, a potentially dangerous situation.

A rigid tow bar with a spring attached to it can allow for the momentum to decrease over a shorter period of time.

***** List different safety devices in vehicles or sports equipment designed to provide extra distance and time in a crash. Explain in detail how they work using the principle of impulse. (one per student)*****

Extra Links for Impulse (One example, link and explanation per student)

Rogie - Mountain Bikes
Mountain bikes have front and rear suspension systems which helps the rider and bike absorb large shocks when landing jumps. These suspension systems consist of the spring and damper.The spring is in charge of absorbing the shock while the damper dissipates the energy that is stored in the spring. The spring is what decreases the momentum in a shorter period of time. http://adventure.howstuffworks.com/outdoor-activities/biking/mountain-bike4.htm

Rogie - What affect does decreasing momentum (as you described) have to do with Impulse? We will be discussing Energy (K & P) sooner than you think!

Quinten - Airbag (3rd gen)

Quinten? Information?

Lindsey - Crumple zones in a car
The Crumple zones in the car are normally found at the front of a vehicle and are a safety feature of the car that are made to absorb the impact of a head on crash. They work by absorbing the hit of the collision by absorbing it within the outer part of the vehicle instead of the inside where the passengers are. The crumple zones make more time for the car to absorb the hit and therefore have a less impact on the passengers.

How does this relate to impulse? Why are cars now designed with crumple zones instead of springs on the bumpers?

Lindsey: The crumple zone in the car changes the momentum of the collision to add more time for the momentum to change. Cars are now designed with crumple zones instead of springs on the bumpers because it is safer to have crumple zones in your car. If you had springs on the bumpers of your car and you crash you hit head on and then bounce back. This means that in the car your body moves forward with the crash and then backward once the car bounces. It is safer to have crumple zones because you would only have one forward motion and less stress on your body.

Jacinta - Springs in a car
There are some cars which have springs in the bumper of the car so if the car were to crash into something the springs would absorb most of the impact and lessens the about of momentum.

Like Rogie's the spring is in charge of absorbing the shock, they allow for the car to bounce back giving the car more time to 'control itself'. The car bouncing back changes the momentum which relates to changing the impulse.

How exactly does changing the momentum change impulse? How are they related? Are there different types of spring systems in cars? Which works better? What types of springs are used? Have they changed over time?

Changing momentum is impulse impulse is the change in momentum. Springs in the bumpers are not seen regularly anymore because of the crumble zones in cars.

But WHY do they use crumple zones and not springs any more?

Study Questions:

EVERYONE PLEASE ADD AN ANSWER TO COLLABORATE WITH EACH OTHER TO STUDY MAKE SURE THEY ALL GET ANSWERED BY MONDAY!

1. Compare and contrast momentum and impulse.

2. Explain the relationship between the units in which momentum and impulse are measured.

3. In your own words, restate Newton's second law in terms of momentum.

4. What difference does it make that momentum is a vector quantity and not a scalar quantity?
Lindsey: The difference of having momentum as a vector quantity and not a scalar quantity is that instead of just having a magnitude you also have a direction.

5. Stats show that less massive vehicles tend to have fewer accidents than more massive vehicles. However, the survival rate for accidents in more massive vehicles is much greater than for less massive ones. How could momentum be used to explain these findings?

6. Using the concept of impulse, explain how a hockey helmet works to reduce injury to a hockey player who falls on the ice and hits her head.

7. what instructions would you give a young gymnast so he avoids injury when landing on a hard surface?

8. will the magnitude of the momentum of an object always increase if a net force acts on it? Explain using an example.

9. What quantity will you get when Δp is divided by mass?

10. For a given impulse, what is the effect of A) increasing the time interval? B) decreasing the net force during interaction?

11. For each situation, explain how you would effectively provide the required impulse:
- to catch a water balloon tossed from some distance
- to design a hiking boot for back-country hiking on rough ground
- to shoot an arrow with maximum velocity using a bow
- for an athlete to win the gold medal in the javelin event with the longetst throw
- for a car to accelerate on an icy road

12. Why does a hunter always press the butt of a shotgun tight against the shoulder before firing?