Vocabulary: Crumple Zones

Vocabulary

- Acceleration (*a*) – the change in velocity per unit of time.
  - Acceleration is equal to change in velocity divided by elapsed time: $a = \Delta v / \Delta t$.
  - If speeding up in the forward (or positive) direction, acceleration is positive; if slowing down acceleration is negative.
  - If speeding up in the reverse (or negative) direction, acceleration is negative; if slowing down acceleration is positive.
  - *Deceleration* occurs when acceleration decreases speed. When velocity is in the positive direction, deceleration is equivalent to a negative acceleration.

- Airbag – a safety device that inflates quickly during a crash and is designed to protect passengers from hitting hard parts of the vehicle such as the steering wheel, dashboard, or windshield.
  - An airbag will deflate when the passenger makes contact, causing the passenger to gradually decelerate. This increases the stopping time of the passenger.

- Collision avoidance system (CAS) – a system designed to prevent car crashes.
  - Collision avoidance systems may use radar, lasers, cameras, and/or GPS to locate possible obstacles in the path of the vehicle, such as oncoming cars, stopped cars, pedestrians, trees, or other barriers.
  - If an imminent crash is anticipated, the CAS will go into action.
    - In some systems an alarm sounds, warning the driver to slow down.
    - In other systems, the CAS will automatically apply the brakes when a collision is imminent.

- Crash test dummy – a model used to simulate a person in safety tests.
  - Crash test dummies are used to predict injuries that might result from a crash.
  - Crash test dummies have the same weight and dimensions as real people and contain sensors to record forces and accelerations that occur during the test.

- Crumple zone – a section of a vehicle that is designed to deform during a crash.
  - The crumple zone is designed to be weaker than other parts of the vehicle, allowing it to collapse during a crash.
  - Vehicles containing a crumple zone will come to a stop over a greater distance and time, reducing the force and acceleration on the car and passengers during a collision.

- Force (*F*) – an interaction that can cause a change in motion; a push or a pull.
    - An unbalanced force must be applied to accelerate an object.
    - For an object of constant mass, the greater the force the greater the acceleration.

- Kinetic energy (*KE*) – energy of motion.
    - The faster an object is moving, the greater its kinetic energy.
    - Given equal speeds, an object with more mass will have a greater kinetic energy.
    - Kinetic energy is equal to $\frac{1}{2} mv^2$, in which m is mass and v is velocity.
    - Kinetic energy is measured in joules (J).

- Newton's laws of motion – three fundamental laws that describe the relationship between force, mass, and acceleration.
    - Newton's first law states that a body in motion (or at rest) will continue in motion (or stay at rest) unless acted upon by an unbalanced force.
    - Newton's second law state that force is equal to mass times acceleration.
    - Newton's third law states that when one body exerts a force on a second body, the second body exerts an equal and opposite force on the first body.

- Safety cell – the passenger compartment of a vehicle.
    - Safety cells are designed to be very rigid in order to protect passengers from being crushed in an accident.

- Seat belt – a safety device designed to restrict the movement of a passenger during a crash.
    - Most cars are equipped with three-point seat belts that have a single strap across the waist and a diagonal strap that goes from the shoulder to the opposite hip.
    - Seat belts are designed to stretch a little during a collision but still prevent passengers from hitting the sides or front of the passenger compartment.

- Work (*W*) – the application of force across a distance.
    - Work is equal to force multiplied by distance, $W = Fd$.
    - In order to perform work, energy must be expended.
    - Like energy, work is measured in joules (J).

- Work-energy theorem – a law stating that the work applied to a system is equal to the change in kinetic energy of that system.
    - Mathematically, the work-energy theorem states that:

$$W = \Delta KE \quad \text{or} \quad Fd = \Delta \tfrac{1}{2} mv^2$$