Physics You Learned

Physics Concepts	Is There an Equation?
When an object is moving, it will continue to move at constant speed in a straight line unless there is an unbalanced force to change its motion. If the object is at rest, it stays at rest unless there is an unbalanced force. This is known as **Newton's first law.**	
Active Physics Plus Pressure (P) is equal to the force applied (F) divided by the area to which it is applied (A). A large force over a small area will exert a very large amount of pressure.	$P = \frac{F}{A}$
Kinetic energy (KE) is the energy of motion. An object's kinetic energy is proportional to the object's mass multiplied by its velocity squared.	$KE = \frac{1}{2}mv^2$
Work (W) done is the product of the force exerted by an object (F) and the displacement in the direction of the force (d). Work may change an object's kinetic energy.	$W = Fd$ $W = \Delta KE$
A small force acting over a large distance can produce the same change in kinetic energy as a large force acting over a small distance.	
An air bag increases the stopping distance available for passengers in the event of a collision, thus decreasing the required stopping force.	
Active Physics Plus Work (W) on an object can increase its kinetic energy (ΔKE).	$W = \Delta KE$ $= \left(\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2\right)$
The **acceleration** of an object (a) is directly proportional to the net force applied (F_{net}), and inversely proportional to the object's mass (m). This is known as **Newton's second law.**	$a = \frac{F_{net}}{m}$
The net force on an object is the sum of all the forces acting on it at the same time.	
Whiplash is a neck injury often sustained in rear-end collisions, due to the **inertia** of the human head when the torso is accelerated forward.	
Momentum (p) is the product of an object's mass (m) multiplied by its **velocity** (v). Momentum has direction as well as size (a vector quantity), and may be transferred between objects during a collision.	$p = mv$
The **law of conservation of momentum** states that if there are no external forces acting on the system, the total momentum of a system before a collision (mv_b) is equal to the total momentum after the collision (mv_a). During a collision, the objects may gain or lose speed, but the total momentum remains the same.	$m_1v_{1b} + m_2v_{2b} =$ $m_1v_{1a} + m_2v_{2a}$

Active Physics Plus In an elastic collision, both momentum and kinetic energy are conserved. The sum of the kinetic energies after the collision must equal the sum of the kinetic energies before the collision. When two particles of equal mass collide and one is initially at rest, they must travel off at right angles after the collision for this condition to be met.	$p_{before} = p_{after}$ $KE_{before} = KE_{after}$
Impulse equals the product of a force acting on an object, and the time period during which the force acts.	Impulse = $F\Delta t$
When an impulse acts on an object, the momentum of the object changes by an amount equal to the applied impulse.	$F\Delta t = m\Delta v$
Active Physics Plus The area under a force vs. time graph is the impulse and therefore, equal to the change in momentum of the object.	
Crumple zones are built into automobiles as cushioning devices. A crumple zone increases the time a force may act to bring an automobile to rest, which allows a smaller force to be exerted during the stopping process. The net impulse required to stop an automobile does not change if the automobile has a crumple zone, but the net force applied is decreased as the time it acts is increased.