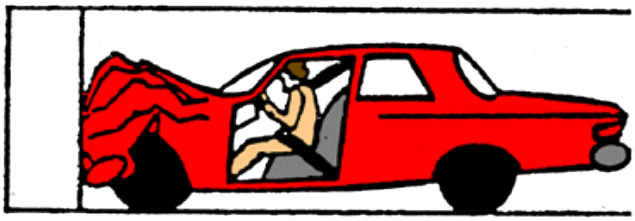
MOMENTUM, ENERGY & IMPULSE PROBLEMS

***Instructions**: Show all of your work completely in your journal, including the equations used in variable form. Pay attention to sig figs and units; use complete sentences if applicable.*

1. A 1200 kg car is crash-tested against a rigid wall. The car is accelerated by a cable underneath it, which provides a constant force of 500. N for a distance of 15.0 m.
   a. What is the velocity just before it hits the wall?
   b. The car's "crumple zone" crumples 2.30 m upon impact. What is the force the car experiences upon impact?



2. Glenn remembers when he was in spring training! His favorite memory is about his first homerun! The ball was pitched at 45 $^{m}/_{s}$ and he swung his bat with an initial speed of 31 $^{m}/_{s}$. After the bat and the ball collided, the ball left the bat at homerun velocity, 67 $^{m}/_{s}$. The time of contact was 0.0015 sec. The mass of the bat was 1.0 kg and the mass of the ball was 0.14 kg.
   a. What was the change in momentum of the baseball?
   b. What was the force of impact of the bat against the ball?
   c. By how much was the bat slowed down by the impact?

3. Maggie is looking to play a trick on Beth by dropping a water balloon on her head. Her plan is to climb a tree, sit on a branch and drop the water balloon as Beth walks underneath. Sounds good, huh? ☺
   a. If she carries this 0.75 kg balloon up a tree 15 m vertically, how much work has she done to the balloon?
   b. When Maggie drops the balloon on Beth's head (approximately 2.0 m above the ground), how fast will the balloon be traveling? *(Hint: Use energy equations!)*
   c. If Beth thinks quick, dodges and catches the balloon with a downward motion of her hands, such that she exerts a constant force on the balloon for 0.30 seconds, what is the magnitude of this force? *(Hint: think impulse!)*
   d. Why would the balloon break if it hit Beth's head, but probably not if she caught it with a downward motion? Use appropriate physics terminology in your answer.