Motion at constant acceleration

- **For motion at constant acceleration *a* , with no initial speed, the displacement after time *t* is:**

$$\Delta x = v_{average} t = \left(\frac{0 + at}{2} \right) \times t = \frac{at^2}{2}$$

For braking (motion with negative acceleration *a*) , if it takes time *t* to stop, the initial speed is *–at = |a|t* (note that since we take absolute value, initial speed is positive), the displacement after time *t* is:

$$\Delta x = v_{average} t = \left(\frac{|a|t + 0}{2} \right) t = \frac{|a|t^2}{2}$$

Homework 8

Problem 1.
How long would it take a rock to fall from the top of mount Everest to the ground at sea level? The height of mount Everest is about 8850 m. Take free fall acceleration to be 10 m/s^2.

Problem 2.
A car manufacturing company is testing all its new cars in extreme driving conditions according to the same procedure. First, the car accelerates with acceleration 5 m/s^2 until it reaches speed 40 m/s. Then is goes one minute with that speed. Finally, the driver brakes with acceleration -8 m/s^2 coming to a full stop. How long should the testing track be?

Problem 3.
When driving a car at night with low beam headlights on, the driver can see the road up to 30 meters ahead. The driver suddenly sees a deer crossing the road ahead within the headlight reach. He immediately slams the brakes and the car starts braking with acceleration -5 m/s^2. At what maximal initial speed the car can still avoid hitting the deer? Convert your answer to miles per hour.