

Work and Kinetic Energy

Starting with the 2nd Newton's Law:

$$F = ma$$

One can derive another important result:

“Change in **kinetic energy** is equal to the **mechanical work** done by all forces”

$$\Delta K = W$$

$$K = \frac{mv^2}{2},$$

is called Kinetic Energy of an object

$$W = F\Delta x,$$

is called Mechanical Work

(Work = Force x Displacement)

Homework

Problem 1.

Find Energy in Joules, for the following cases:

- Kinetic energy of yourself running as fast as you can.
- Minimal work you need to do to shoot an arrow of mass 50 g at speed 50 m/s, with a bow.
- Kinetic energy of all molecules in 1 cubic meter of air. Assume them to have a typical speed about 500m/s. Density of air is 1.2 kg/m^3 .

Problem 2.

The car of mass $m=2000 \text{ kg}$ moves at speed $v=30\text{m/s}$ when suddenly the driver applies breaks. Find the distance the car will travel before coming to complete stop, if friction coefficient is $\mu=0.5$.

Hint: use the Kinetic Energy theorem ($\Delta K=W$) to solve it. Remember that friction force is $F=\mu N$, where N is normal reaction.