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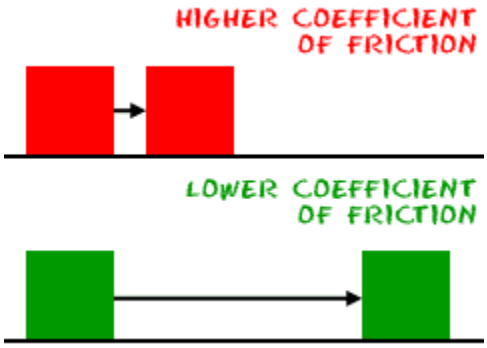
Friction is defined as the force that is exerted by an object as it moves across a surface. For that, there is two ways one can measure friction: with the kinetic frictional coefficient (μk) and the static frictional coefficient (μs).

- For the static frictional coefficient, it is the friction of an object as it begins to move.
- As for the kinetic frictional coefficient, it is depicted as the friction of an object when it is continuously in motion as it moves across a surface.

- To measure the frictional coefficients, you need the following equations:
  - Kinetic Frictional Coefficient (μk) = Kinetic Force ($F_K$) ÷ Normal Force ($F_N$)
  - Static Frictional Coefficient (μs) = Static Force ($F_S$) ÷ Normal Force ($F_N$)
    - To find normal force, use the equation: F=M*A

- As a side note, the static frictional coefficient is bigger than the kinetic frictional coefficient because it takes more force to move an object than it is to keep it in motion.
- Also, frictional coefficients do not have an unit, where as Forces are denoted in Newton (N)
- In addition to this, the Fr in a Free Body Diagram is equal to the $F_k$: $F_r = F_k$.




EXAMPLES

1. "A 110kg box has a μs of 0.47, μk of 0.35, and a normal force of 1078N. How much force would be required to make the box move and to keep it moving?"
   - $\mu k = F_K \div F_N$
   - $0.35 = F_K \div 1078N$
   - **$[F_K = 377.3]$**

   - $\mu s = F_S \div F_N$
   - $0.47 = F_S \div 1078N$
   - **$[F_S = 506.66]$**

2. "A skateboarder (75 kg) is moving with an acceleration of 0.8 $m/s^2$. $M_k$ = 0.03N."
   - F=MA
   - $F_N = (75) * (9.8)$
   - $F_N = 735$

   - $\mu k = F_K \div F_N$
   - $0.03 = F_K \div (735)$
   - **$[F_K = 22.05]$**

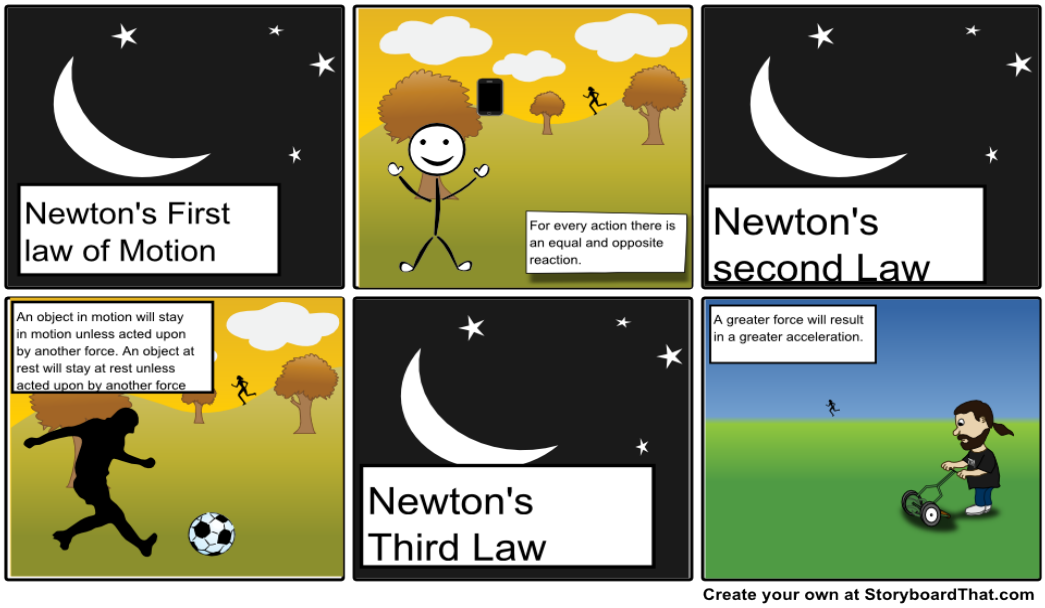
PRACTICE

"A 2kg, rolling chair was pushed and has a μs of 1.47. If it continued to roll across the floor and had a μk of 1.02, what is force that kept it moving?"

Newton created three laws to define motion.

- The first law is the law of inertia, it illustrates than "An object at rest will remain at rest, and an object in motion will stay in motion unless an outside force acts upon it."
- The second law represents the equation F=MA, it states that, "Acceleration is proportional to F, but inversely proportional to mass."
- The third law explains that "For every action, there is an equal and opposite reaction", for that, "forces come in pairs."

- Typically, because an object is pulled towards the Earth, the acceleration in F=MA will be 9.8m/s as it represents gravity.




EXAMPLES

1. "A rider, whose mass is 52 kg, experienced a net force of 1800 N when on a roller coaster ride. Determine their acceleration."
   - F=MA
   - 1800N = 52kg * A
   - A=1800/52
   - **[A=34.6 m/s$^2$]**

2. "An elephant can reach heights of 13 feet and possess a mass of as much as 6000 kg. What is the force exerted from the elephant while it is standing still?"
   - F=MA
   - F = (6000kg) * (9.8m/s)
   - **[F = 58800N]**

PRACTICE

"A rope is used to pull a 2.89-kg bucket of water out of a deep well.

a. What is the acceleration of the bucket when the tension in the rope is 30.2 N?

b. If starting from rest, what speed will the bucket have after experiencing this force for 2.16 seconds?"