

Weight and Friction

Weight!!!

- The force due to gravity
- Gravity pulls everything down, towards the center of the earth
- gravity = $g = -9.8 \text{ m/s}^2$
- $F_w = \text{mass} \cdot \text{gravity}$
- $F_w = mg$

Weight examples

- Mr. Cutler has a mass of 155 Kg, what is his weight in Newtons?
- If the desk is pushing on the book (that is not moving) with a force of 78.4N, what is the mass of the book?

What is gravity really?

- Gravity is a result of the size of the objects involved and the distances between them
- The gravity of earth is created by its mass and its radius (how far we are from the center)

- $$g = \frac{G \cdot M_E}{R_E^2} = \frac{(6.67 \times 10^{-11})(5.97 \times 10^{24})}{(6.37 \times 10^3)^2}$$

- $$g = 9.81 \text{ m/s}^2$$

- What if the mass was reduced? What happens to g on the moon?

Gravity on the moon

- The moon has a mass roughly $1/4$ that of the earth and its radius is $1/82$ of the earth
- That causes the acceleration due to gravity on the moon to be $1/6$ that of the earth

- $$g_{moon} = \frac{g_{earth}}{6} = \frac{9.81 m/s^2}{6} = 1.63 m/s^2$$

Examples

- What is Mr. Cutlers weight on the moon? (remember his mass is 155Kg)
- How much does a 2000Kg car weight on the moon?

FRICTION

- Friction - a force that resists motion. It involves objects that are in contact with each other.
- Causes of friction:
 - 1) uneven surfaces rubbing together.
 - 2) forces of attraction between two molecules of a substance. (polished surfaces still have friction.)

Benefits of friction:

- walking
- stopping a car
- moving a car
- nailing a board
- writing a letter
- sitting on a hill

Disadvantages of friction:

- motors become overheated
- moving heavy furniture
- slows down motion -- reduces efficiency
- ex. skiing, skating, car moving

Measuring friction - of Solid Objects

Static friction - the maximum frictional force between stationary objects.

Kinetic (sliding) friction - the frictional force between objects that are sliding in respect to one another.

Descriptions of friction

1) Friction acts parallel to the surfaces that are in contact and in a direction opposite to the motion of the object or to the net force tending to produce such motion.

2) Friction depends on the nature of the materials in contact and the smoothness of their surfaces.

3) Sliding friction is less than or equal to starting friction. Starting friction prevents motion until the surfaces begin to slide. When the object begins to slide, less force is required to keep it sliding than was required to start it sliding.

4) Starting or sliding friction is directly proportional to the force pressing the two surfaces together.