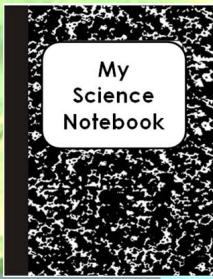


A vibrant illustration of a red apple hanging from a tree branch. The apple is the central focus, showing detailed texture and a bright red color. It is attached to a thin brown stem. Above the apple, several green leaves with prominent veins are shown, some appearing to be in motion or blowing in the wind. The background is a clear blue sky with soft, white clouds. The overall scene is bright and natural.

# The Force of Gravity

# Vocabulary Words



- **Mass – the amount of matter in an object.**
- **Gravity – the force of attraction between all matter.**
- **Newton – the scientific unit used to measure weight**
- **Weight – the measure of the force of gravity acting upon the mass of an object.**

# Mass, Gravity, & Weight

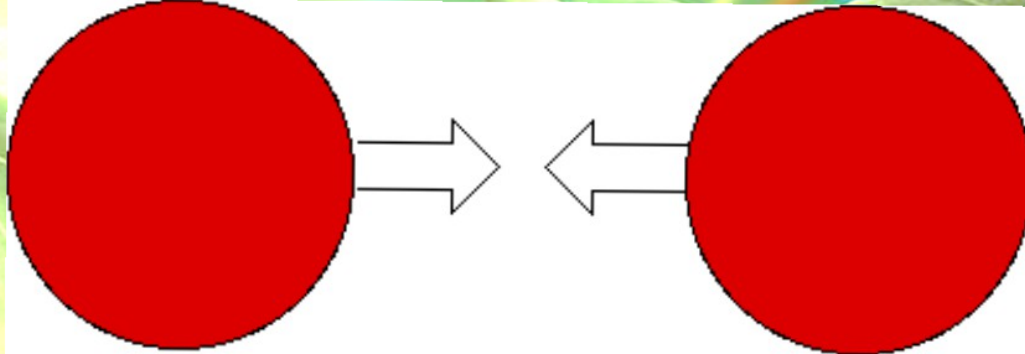
## Mass

- The mass of an object is the amount of matter or "stuff" it contains.
- The more matter an object contains, the greater its mass.
- Mass is measured in kilograms (kg), grams (g), or milligrams (mg) .
- An object's mass stays the same wherever it is.
- Mass is measured using a triple beam or a digital balance.

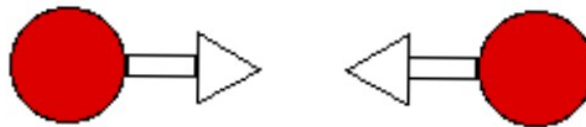
# Mass, Gravity, & Weight

## Gravity

- All objects, even you, have a force that attracts them towards each other. This is called gravity.
- Gravitational force increases as the mass increases, and / or the distance between objects decreases.
- Gravity only becomes noticeable around a really massive object like a moon, planet or star. Less massive objects are pulled down towards the ground because of gravity. The gravitational force pulls objects towards the center of the earth at a rate of 9.8 m/s.



Gravitational force between two objects depends on their masses, and the distance between them.



Even though the distance is the same the gravitational pull is less because the object's mass is less.



What would happen if we moved the balls farther apart?

The farther away you get from the center of the earth the less you weight up to the point of weightlessness in outer space.

# Mass, Gravity, & Weight

## Weight

- Weight is a force caused by gravity. The weight of an object is the gravitational force between the mass of the object and the Earth.
- Weight is calculated by multiplying the mass of an object times the gravity affecting it. Since Earth has a gravitational constant of  $9.8 \text{ m/s}^2$ , the weight of an object can be calculated by multiplying its mass in kg times  $9.8 \text{ m/s}^2$ . This is measured in Newtons (N)
- Weight is measured with various types of spring scales.

# Calculating Weight

**Mrs. Alvarenga's ferret, Slinky, has a mass of 2.2 kg. Calculate her weight in Newtons.**

**WDWK?**

$$\text{weight} = (\text{mass})(\text{gravity})$$

$$\text{Mass} = 2.2 \text{ kg}$$

$$\text{Earth's gravity} = 9.8 \text{ m/s}$$

$$N = (\text{mass})(\text{Gravity})$$

$$= (2.2 \text{ kg})(9.8 \text{ m/s})$$

$$= 21.56 \text{ kg}\cdot\text{m/s}$$

**Slinky weighs 21.56 N**

**Mrs. Alvarenga's other ferret, Volt, has a mass of 3.9 kg. Calculate his weight in Newtons.**

**WDWK?**

$$\text{weight} = (\text{mass})(\text{gravity})$$

$$\text{Mass} = 3.9 \text{ kg}$$

$$\text{Earth's gravity} = 9.8 \text{ m/s}$$

$$N = (\text{mass})(\text{Gravity})$$

$$= (3.9 \text{ kg})(9.8 \text{ m/s})$$

$$= 38.22 \text{ kg}\cdot\text{m/s}$$

**Volt weighs 38.22 N**

# Mass vs. weight

- The mass of an object stays the same wherever it is, but its weight changes depending on the gravity affecting the object.
- The Moon has less mass than the Earth, so its gravity is less than the Earth's gravity. The moon's gravitational constant is 1.6 m/s.



# Mass vs. weight

Calculate the weight in N of a girl who weighs 56 kg on Earth, and on the moon.

**weight = (mass)(gravity)**

**Mass = 56 kg**

**Earth's gravity = 9.8 m/s**

**moon's gravity = 1.6 m/s**

**N=(mass)(Gravity)**

**=(56 kg)(9.8 m/s)**

**= 548.8 kg•m/s**

**She weighs 548.8 N on Earth**

**N=(mass)(Gravity)**

**=(56 kg)(1.6 m/s)**

**= 89.6 kg•m/s**

**She weighs 89.6 N on the Moon**



My **WEIGHT** on  
Earth is around  
560N



My **WEIGHT**  
on the moon  
is around  
90N



My **MASS** is  
always 56kg!!

# Explore

- **Read, “The Difference Between Mass and Weight” (pg. 15).**
- **Fill in definitions and facts about mass and weight on the foldable provided.**
- **Describe how mass and weight are measured.**