NEWTON'S SECOND LAW OF MOTION

FORCE AND ACCELERATION

- ✔ Force is *a push or a pull*.
- ✔ Acceleration is when the *motion of an object changes*.

Examples:

Speed up

Slow down

Changes direction

- ✔ Mass is the *amount of matter in an object*.

FORCE AND ACCELERATION

Acceleration Equation

acceleration (in meters/second^2) = $\dfrac{\textbf{net force (in newtons)}}{\textbf{mass (in kilograms)}}$

$$a = \frac{F_{net}}{m}$$

FORCE AND ACCELERATION

- ✔ In this equation, a is the acceleration, m is the mass, and F_{net} is the net force.
- ✔ If both sides of the above equation are multiplied by the mass, the equation can be written this way:

$$F_{net} = ma$$

FORMULA PRACTICE

A book with a mass of 2.0kg is pushed along a table. If the net force on the book is 1.0N, what is the book's acceleration?

Acceleration Equation

$$\text{acceleration (in meters/second}^2) = \frac{\text{net force (in newtons)}}{\text{mass (in kilograms)}}$$

$$a = \frac{F_{net}}{m}$$

FORMULA PRACTICE

A book with a mass of 2.0kg is pushed along a table. If the net force on the book is 1.0N, what is the book's acceleration?

a= fnet/mass

a= 1.0 N /2.0 kg

a= 5 m/s^2

Final answer is ***5m/s^2***

FORCE AND ACCELERATION

Units of Force = Newtons (N)

SI units for mass is kg

SI units for acceleration is m/s^2

1 Newton (N) = 1kg * m/s^2

Gravity & Weight

- ✔ Gravity is the *force of attraction that exists between any two objects that have mass*.
- ✔ The force of gravity *depends on the mass of the objects and the distance between them*.

GRAVITY & WEIGHT

- Weight is a force, like the push of your hand is a force, and is measured in Newton's.
- The force of gravity causes all objects near Earth's surface to fall with an acceleration of 9.8 m/s^2.
- Your **weight** on Earth is the gravitational **force** between you and Earth.

GRAVITY & WEIGHT

- How are weight and mass different?
- Weight is a force, like the push of your hand is a force, and is measured in newton's.
- Mass is the amount of matter in an object, and doesn't depend on location.
- *Weight will vary with location, but mass will remain constant.*

Newton's 2nd Law

- ✔ Newton's Second Law states: *an object acted upon by an unbalanced force will accelerate in the direction of the force.*
- ✔ If you kick the ball, it starts moving.
- ✔ The ball accelerates only while your foot is in contact with the ball.

NEWTON'S 2ND LAW

- ✔ Newton's second law of motion can be used to calculate acceleration.
- ✔ For example, suppose you pull a 10-kg sled so that the net force on the sled is 5 N.

NEWTON'S 2ND LAW

- ✔ The acceleration can be found as follows:

$$a = \frac{F_{\text{net}}}{m} = \frac{5\ \text{N}}{10\ \text{kg}} = 0.5\ \text{m/s}^2$$

CIRCULAR MOTION

- ✔ A rider on a merry-go-round ride moves in a circle.
- ✔ This type of motion is called circular motion.
- ✔ If you are in circular motion, your *direction* of motion is constantly *changing*.
- ✔ This means you are constantly *accelerating*.

CIRCULAR MOTION

- ✔ If you are constantly *accelerating*, there must be a force acting on you the entire time.
- ✔ The force exerted is the ***centripetal force*** and always points toward the center of the circle.
- ✔ In circular motion the *centripetal* force is always perpendicular to the motion.

SECTION CHECK

Question 1.

Explain Newton’s second law of motion.

Answer:

An object acted upon by an unbalanced force will accelerate in the direction of that force. Newton's Second Law says that the acceleration of an object is equal to the net force on it divided by its mass.

Question 2

Your _____ on Earth is the gravitational force between you and Earth.

A. acceleration

B. inertia

C. mass

D. weight

Answer

The answer is D. Since weight is dependent on gravity, your weight would be different if you were standing on a planet other than Earth.

THANKS!

Reference

Newton`s Second Law of Motion. (2021). Retrieved 16 August 2021, from https://studylib.net/doc/5724088/newton-s-second-law-of-motion