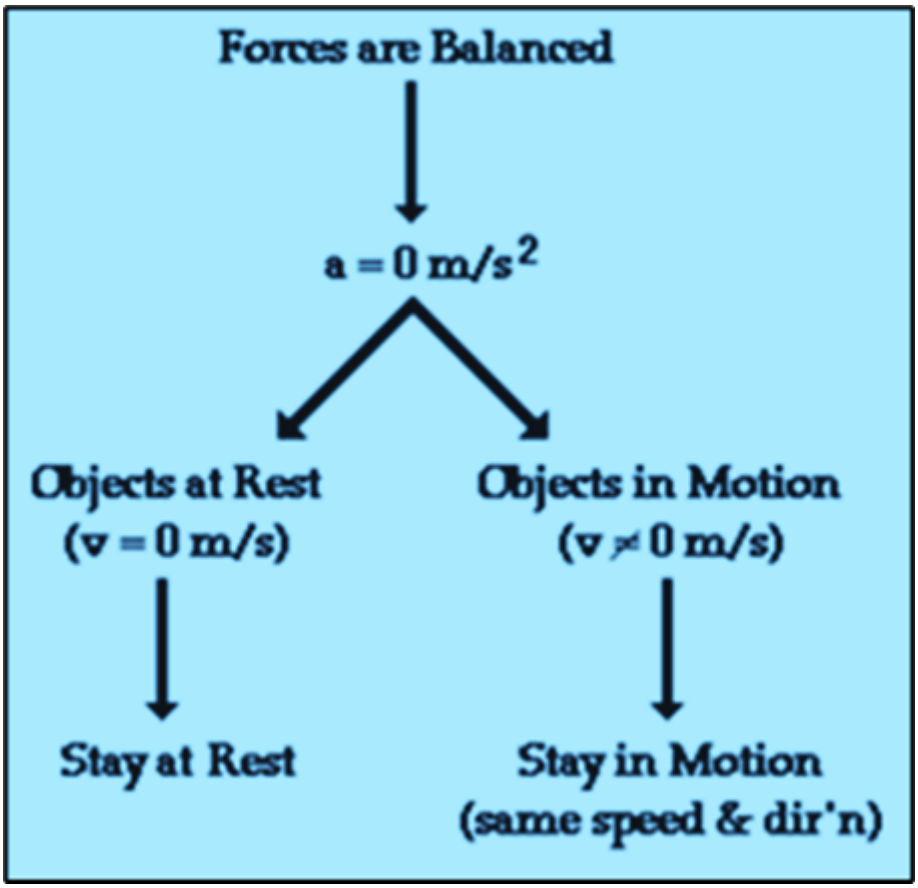
FlexiPrep

Newton's Second Law of Motion, Classification of Balanced Force, Application of Second Law (For CBSE, ICSE, IAS, NET, NRA 2022)

Newton's Second Law of Motion

- In the world of introductory physics, Newton's second law is one of the most important laws
- Newton's second law of motion pertains to the behaviour of objects for which all existing forces are not balanced.
- It's used in almost every chapter of every physics textbook, so it's important to master this law as soon as possible.
- The second law informs us that the acceleration of an object depends on two variables –
  - The **net force acting on the body**
  - The **mass of the body**
- The acceleration of the body is directly proportional to force and inversely proportional to the mass.
- According to Newton, an object will only accelerate if there is a net or unbalanced force acting upon it. The presence of an unbalanced force will accelerate an object - changing its speed, its direction, or both its speed and direction.

Classification of Balanced Force



- We know objects can only accelerate if there are forces on the object. Newton's second law tells us exactly how much an object will accelerate for a given net force.
- As a result, when the force acting on a body is increased, the acceleration increases. Likewise, when the mass of the body is increased, the acceleration decreases.
- A change in motion is equivalent to a change in velocity. A change in velocity means, by definition, that there is an *acceleration*.
- Newton's first law says that a net external force causes a change in motion; So, we see that a *net external force causes acceleration*.
- Newton's second law can be formally stated as,
- "The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object"
- This statement is expressed in equation form as,

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

- The above equation is often rearranged to a more familiar form as shown below. The net force is equated to the product of the mass times the acceleration
- This is often written in the more familiar form

$$F_{\text{net}} = \text{ma}$$

What Does Net Force Mean?

- A force is a push or a pull, and the net force ΣF, *where* F is the total force — or sum of the forces — exerted on an object.
- Adding vectors is a little different from adding regular numbers.
- When adding vectors, we must take their direction into account.
- The net force is the *vector sum* of all the forces exerted on an object.

Application of Second Law

- The application of the second law of motion can be seen in identifying the amount of force needed to make an object move or to make it stop.
- A few examples that we have listed to help you understand this point:

Kicking a Ball

- When we kick a ball, we exert force in a specific direction, which is the direction in which it will travel.
- In addition, the stronger the ball is kicked, the stronger the force we put on it and the further away it will travel.

Pushing a Cart

It is Easier to Push an Empty Cart in a Supermarket Than It is to Push a Loaded One. More Mass Requires More Force to Accelerate

Two People Walking

Among the two people walking, if one is heavier than the other then the one weighing heavier will walk slower because the acceleration of the person weighing lighter is greater.

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