

PHYSICS 534

EXERCISE-09

Newton's Laws of Motion



Joseph Thomson received the Nobel prize for physics in 1906 for his work on the conduction of electricity by gases.

THOMSON

Continuing the work of Galileo, Isaac Newton combined the ideas of forces and motion and came up with a single consistent picture of nature. This view of nature is called the "**Newtonian synthesis**" as it unifies many apparently different phenomena under a single set of principles. The motion of the solar system, the motion of a satellite, the tides, falling objects, as well as many other natural occurrences, become clear and understandable under this system.

Newton published his work in a book he called Mathematical Principles of Natural Philosophy. The book is one of the classics of science and is often referred to as the "Principia" from its Latin title. In it, Newton states three fundamental laws of motion:

▪ **1ST LAW** *The Law of Inertia*

"An object continues in its state of rest, or in **uniform** motion in a straight line, unless acted upon by an external applied force."

▪ **2ND LAW** *The Law of Acceleration*

"The acceleration of an object is directly proportional to its resultant force and inversely proportional to its mass."

▪ **3RD LAW** *The Law of Interaction*

"For every action there is an equal but opposite reaction."

• **INERTIA**

The first law of motion gives all objects the property of resisting changes to their state of "rest". The word "at rest" means either motionless or moving at constant velocity in a "straight line" (both are identical). Thus, inertia is the property of matter to resist change. The more mass an object has, the greater its inertia (i.e., the greater its resistance to change).

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1. Describe briefly what is meant by "Newtonian synthesis".

The whole universe can be understood using a single set of laws.

2. Why did Newton call his book "Mathematical Principles of **Natural Philosophy**" instead of Mathematical Principles of Science.

Because in Newton's time, science was called "natural philosophy".



3. State Newton's three laws of motion:

1st Law: Law of Inertia

2nd Law: Law of Acceleration

3rd Law: Law of Interaction

4. Define *inertia*.

The property of matter which makes it resist change.

5. What determines the amount of inertia an object has?

The mass of an object determines its inertia.

