II. Laws of Motion in the Solar System

All the celestial bodies are suspended in space. However, they do not collide. There are two forces in the universe: attraction and repulsion. It is these forces which maintain equilibrium in the universe.

Experiment 2: Centrifugal and Centripetal Force

Materials: small bucket with handle, rope, water.
Procedure: Take the small bucket, fill it about 3/4 full of water. Attach the rope to its handle, and swing the bucket over your head. Repeat the experiment, slowing down the movement. Repeat the experiment with the bucket empty, and let go.
Observations: Record your observations.
Statement: If we put an object in circular motion, two forces result: one that attracts the object towards the center (centripetal force) and the other that pulls it from the center (centrifugal force).

The arm exercises centripetal force. When one lets go, the bucket will not continue to go in a circle. It is centrifugal force which causes it to fly off on the tangent.
Centripetal force is a center-seeking force that causes an object to move in a circular path. **Centrifugal force** is experienced by the object moving in the circular path. Centrifugal force pulls away from the center of the circle..

In the universe, there are two forces which prevent collision of the celestial bodies.

Force of Attraction: Centripetal Force
Force of Repulsion: Centrifugal Force

The whole matter of motion is summarized by Sir Isaac Newton, in the form of three generalizations known as laws of motion. They may be expressed as follows:

1. Every body continues at rest or in a state of uniform motion unless a force acts upon it. A body at rest remains at rest.
2. If a force acts upon a body, the body experiences an acceleration in the direction of the force and proportional in amount to it, as well as inversely proportional to the mass of the body.
3. Associated with every force there is an equal and oppositely directed reaction force. For every action there is an equal and opposite reaction.

Experiments 3A, 3B, 3C: Laws of Inertia

Experiment 3A: Law of Inertia

Materials: A cylindrical glass with a smooth, flat base, a quarter, and a file card are needed.

Procedure: Turn the glass upside down on the table. Place the file card on top of the glass. On top of the file card, place the coin. Pull the file card away with a sharp movement.

Observations: Record your observations.

Statement: The coin remains in its position through the 'law of inertia'. Because the card is no longer in position, the coin sits on the glass. A body in a state of rest remains at rest unless a force acts upon it. The coin did not move because there was no force acted upon it, only on the card.

Experiment 4A: Force of Gravity

This experiment shows not only the speed with which objects fall, but also that objects fall in a vertical line.

Materials: A piece of iron, a sheet of paper, a piece of cork, a feather, a plumbline, and a chair are needed. ('Plumb' comes from the Latin 'plumbum' for lead.)

Procedure: With the plumbline, show that there is a force that pulls the plumbline straight down in a vertical line. Discuss.
Hold, in one hand, the first four materials. Stand on a chair and let the articles fall all at once. Repeat the experiment twice. (The experiment may also be done with a Newton's tube. With the objects in the Newton's tube, take the tube, holding it vertically, and then turn it over rapidly.)

Observations: Record your observations.

A. Gravity is the force that attracts all bodies towards the earth. The force of gravity is the same for equal weights of different materials. The direction of gravity is that indicated by the plumbline.

B. Weight is the result of the action of gravity on a body. It may be said that the force of gravity increases gradually as the bodies draw near the surface of the earth. Weight is defined as a measure of the pull of gravity on a body.

Statement: The force of gravity increases as the body nears the earth. Since weight and gravity are linked together, the weight of a body increases gradually as the body nears the earth. The weight of a body decreases gradually as the body moves away from the earth.

Experiment 4B: Force of Gravity

The experiment shows that the distribution of weight affects the speed at which an object will fall.

Materials: Two equal sheets of paper and a chair are needed. Note that the two papers are identical in size and in weight.

Procedure: Crumple one of the sheets of paper into a hard ball. Stand on a chair. Holding the flat sheet of paper vertically and the ball of paper, drop both at the same time.

Observations: Record your observations.

Statement: The weight of the two bodies (the sheets of paper) is equal. The sheet crumpled into a ball falls more rapidly because it has a smaller surface area than the flat sheet; that is, there is less air underneath it to exert pressure on it. The air resistance met by the sheet of crumpled-up paper is less than that met by the flat sheet of paper.