Force Meters / Gauges

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There are different forces that can act upon objects to create movement, some of the forces measured include tension, and gravitational and friction forces. Force acts upon an object causing it to be pushed, pulled, accelerated, rotated or deformed. Force meters measure forces upon objects in the scientific measurements of Newtons. Basic meters use elastic materials such as springs and rubber bands to measure forces. A good example of a force meter is a bathroom scale that measures the amount of force exerted upon it showing this force in the form of units of weight.

A force is a vector quantity. A vector quantity is a quantity which has both magnitude and direction. To fully describe the force acting upon an object, you must describe both its magnitude and direction. Thus, 10 Newtons of force is not a complete description of the force acting on an object. 10 Newtons, downwards is a complete description of the force acting upon an object.

In 1678, English scientist Robert Hooke created a force meter by showing the distance a spring will stretch is proportional to the amount of force applied to it. His theory of force became known as Hooke's Law. Springs are often used in force meter's because of Hooke's experiments.

For simplicity sake, all forces (interactions) between objects can be placed into two broad categories: contact forces, and forces resulting from action-at-a-distance. Contact Forces include: frictional forces, buoyant forces, normal forces, and air resistance forces. Action-at-a-distance forces include: gravitation, electrostatic and magnetic forces.

Every force has a size and a direction, the combination of size and direction is calculated as a force vector. The common unit for measuring force is a Newton (N) which is named after Sir Isaac Newton. The first law of motion put forward by Newton expresses the idea that an object will not move or remain in a straight line motion unless affected by an external force. Newton's second law explains how the velocity and direction of an object are affected by an external object. Force meters are also known as Newton meters, as the forces exerted in an experiment can be measured in Newtons.

Force gauge are often made using rubber bands, as they also obey Hooke's law by stretching due to the amount of force exerted on them. However, a rubber band is not always accurate, as the elasticity of rubber bands changes with each use.

Basic experiments using force meters can measure the gravitational force on small objects dropped while attached to the force meter. Force meters also measure the force needed to drag an object up an incline and the force applied to the throwing arm of a catapult.

Simple force meters can be made using two pieces of PVC tubing, two small washers, a length of wire and a thick rubber band.

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