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Newton's Laws of Motion

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NEWTON'S LAWS OF MOTION

Physics

In the study of Newton's Laws of Motion, it is more important to understand the concepts they embody than to be able to repeat them verbatim. Too frequently, in the teaching of high school physics, memory work is allowed to take the place of concrete information. This is particularly true with reference to these basic mechanical concepts of the physical universe known as Newton's Laws of Motion.

Newton's first law of motion is a statement of the most basic physical property of matter in nature. Molecular mass has the habit that when at rest it wants to remain so and when in motion it insists on remaining so as long as there is not opposition. Furthermore, from inertia we learn that translatory motion in a straight line is the simplest and most natural for a moving mass.

Inertia in its purest aspect could only be illustrated at some locality in space far away from the earth where the gravitational pull on a mass would be exactly balanced in all directions. In such a locality a mass at rest would remain at rest for all time. Furthermore, it would not need to be upheld by any support since it would have no weight. Again in such a region out in space, any motion possessed by a mass would be exactly uniform and in a straight line. Of course, no one can predicate that there are such regions out in space but we can imagine it for the sake of an illustration of pure inertia.

On the earth's surface inertia is manifested to us in numerous ways but only as a temporary phenomenon since every mass or object is continually under the action of a gravitational field or force. This is clear when we consider the trite illustration so frequently given in texts on physics wherein it is called to our attention that a person sitting still in a passenger car is suddenly thrown backward when the car is accelerated from rest, and also, that he is thrown forward when the car is suddenly brought to rest. The inertia of motion is also well illustrated in the use of a bicycle when a boy driving such a wheel on a level stretch of paving stops pedaling, the machine continues for quite a distance by virtue of its inertia without any additional effort on his part. If there were no friction on its revolving tires, he would continue to move on indefinitely in a uniform straight line direction.

The practical value of inertia is illustrated in numerous every day experiences; as for instance, in the case of a man shoveling coal into the fire-pot of a furnace. As he throws his shovel forward into the opening of the furnace he suddenly stops the shovel letting inertia carry the coal into the furnace. In a similar manner every man engaged in a shoveling task of any kind is continually using inertia to finish the process started by his muscular action. When we kick the mud off of our shoes we take advantage of inertia to accomplish our end. In shaking the dust out of a rug or any dusty garment, it is inertia that renders the act effective.

The fact of the persistence of a straight line direction inherent or natural to translatory motion should be emphasized particularly in the discussion of inertia. For it is the directional inertia of a moving mass that has led to numerous practical inventions. It is this idea which is practically utilized in many revolving devices; such as, cream separators, drying machines used in laundries, and the centrifugal machines used in sugar refineries. An interesting application is also found in the familiar Babcock testing device used to determine the percentage of cream in milk. In all machines of this kind, so useful in our present day civilization, we take advantage of the fact that a mass will react to any force that pulls it out of a straight line path. This reaction, of course, is commonly called centrifugal force but might more properly be designated directional inertia. Centrifugal force is the measure of the directional inertia possessed by a revolving mass. It is this persistence of direction that make it so dangerous to steer an automobile around a curve at high speed. The front of the car may make the curve by virtue of the steering gear, but the rear of the car, true to inertia, may continue in a straight line causing an "upset". It does not take much

sense or skill to drive a car in a straight line at high speed, but it does require good judgment to steer it safely around a curve.

The value of inertia in nature is best illustrated in our solar system and in other systems like it which abound in the universe. What is it that keeps the earth moving in its orbit? All we can say is "inertia". What keeps the earth rotating on its axis? "Inertia". The gravitational attraction of the sun balances the directional inertia of the planets, otherwise they would pass off into space following a straight line path. The very existence of the solar system depends upon the proper balance of gravitational force and inertia.

Finally it is evident that inertia presents itself to us in nature in three ways; first, that of masses at rest; second, that of masses in motion; and third, that due to the direction of a moving mass. Finally we should call attention to the underlying relationship of mass and inertia. Inertia is the measure of the quantity of mass in a body. In fact in the discussions of modern physics inertia and mass are often used interchangeably. It is more difficult for a teacher to shake a fat heavy boy than it is to shake a lean thin one of the same height because the former possesses more inertia or mass. For the same reason, omitting consideration of the frictional resistance of the air and road-bed, it would take more power to start a heavy automobile than it would a light one.

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(To be continued.)

A CLASSIFIED BIBLIOGRAPHY OF REFERENCES FOR GENERAL AGRICULTURE

(continued from January)

IV. BEEF CATTLE

A. Breeds and History.

1. Breeds of Beef Cattle. U. S. Dept. Agric. Farmer's Bul. 612.
2. For further information write to the following:
   a. American Aberdeen Angus Breeders Association, Union Stock Yards, Chicago, Ill.
   b. American Galloway Breeders Association, Carrollton, Mo.
   c. American Hereford Cattle Breeders Association, Kansas City, Mo.
   d. American Short Horn Breeders Association, Union Stock Yards, Chicago, Ill.
   e. Red Polled Cattle Club of America. Richland Center, Wis.
   f. Polled Shorthorn Breeders Association, Greenville, Ohio.
   g. American Polled Hereford Breeders Association, Des Moines, Iowa.

B. Feeding.

1. An Economic Study of Cattle Feeding Enterprise in Iowa. Ia. Bul. 242.
2. Baby Beef Production. Ia. Bul. 181.
3. Limitation of Grain Ration for Fattening Cattle. Ia. Bul. 182.
4. Beef Production. Neb. Bul. 174.
5. Winter Steer Feeding. Ind. Bul. 206.
6. Mineral Deficiency in Rations of Cattle. Minn. Bul. 229.
7. Corn Silage and Alfalfa for Beef Production. Neb. Bul. 151.
8. Rations for Fattening Baby Beeves. Minn. Bul. 237.
9. Roughages for Fattening Two-Year Old Steers. Ia. Bul. 253.
10. Economical Beef Production. Neb. Bul. 116 and 132.

C. Improvement of the Herd.

1. Judging Beef Cattle. U. S. Dept. Agric. Farmers' Bul. 1068.
2. County Livestock Breeders Association. Ia. Ext. Circ. 100.
3. Proof that Pure Bred Sires Pay. Ia. Ext. Circ. 107.

D. Management.

1. Beef Cattle Barns. U. S. Dept. Agric. Farmers' Bul. 1350.