

Work Encyclopedia Article

Work

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Work

In the familiar sense, work refers to activities which require exertion. Within the scientific discipline of physics, however, the concept has a more precise definition. Here, work is the transfer of **energy** when a **force** acts on a body over some distance. For example, if a force causes something to move some distance in a straight line, then the work done by the force equals the magnitude of the force multiplied by the distance that the object traveled. When bowling, for instance, the work done by the bowler with a bowling ball is equal to the force of the swing times the distance that the ball travels along the bowling lane. Similarly, the work done by a snow plow is approximately equal to the force exerted by the plow against the snow multiplied by the length of road plowed. In another example, the work performed by the combustion of **space** shuttle fuel is about equal to the product of the force of the combustion against the gravitational pull on the shuttle and the distance the shuttle travels upward into the atmosphere.

When the work that is accomplished is in the same direction as the displacement, or movement, of the object, the work is said to be positive. If the force is in the opposite direction as the displacement, the work is negative. For example, pushing a door open involves positive work. The work done by the **gravitational force** on the space shuttle in the previous example is an example of negative work since the shuttle proceeds upward. The **time** component of doing work, or the rate of doing work, is called **power**. In order to calculate work, time is not essential, but displacement is. That is, an object must be moved from one location to another. Therefore, while it is a difficult task to hold a textbook stationary at arm's length for a period of time and energy is required, technically no work is done because there is no **motion**. Because the book does not gain or lose any energy from the force of the hand holding it, no energy is transferred from the hand to the book. While machines, like **levers** and pulleys, make tasks easier by reducing the amount of force necessary to move heavy objects, they do not change the amount of work done because the distance over which the force must be applied also changes.