Educational Innovations®

ROB-340

Pair of Pull Back Cars

Force: A push or a pull. Weight is the force due to the acceleration of gravity. Objects have weight because their mass is being pulled downward toward the earth. The unit of force is a Newton (N). 1 kilogram is equal to about 9.8 Newtons.

Work: The transfer of energy through both force and motion. The force must be in the direction of the motion. The mathematical equation for work is force times distance (W = F x d). The unit of work is the Newton meter, more commonly referred to as a Joule (J).

Power: The rate at which energy is transferred, used or transformed. It can also be said that power is the rate at which work is done. The mathematical equation for power is work divided by time. (P = W / t). The unit of power is a Joule per second or a Watt (W).

Materials:
Low Gear Car
High Gear Car
Meter stick
Stop watch
Masking tape
Spring scale or balance

Activity

When you have two identical cars that travel the same distance, they do the same amount of work, but if one travels faster than the other, one will use more power than the other.

In order to calculate the power of each car for this activity, you must first determine the amount of work that will be done.

Using a meter stick and masking tape, mark off one meter on the floor or lab table. Using a spring scale or a balance find the weight of each car in Newtons. Calculate the amount of work each car will do by multiplying the force (weight of the car) times the distance (1m).

Now wind-up the first car by pulling it back while the wheels are pressed firmly on the ground. Position the car on the masking tape that marks the start of the meter. Release the car and time how long it takes for it to travel to the end of the meter. Calculate the amount of power it took for the car to travel that distance.

5 Francis J. Clarke Circle
Bethel, CT 06801
www.teachersource.com

Phone (888) 912-7474
Fax (203) 229-0740
info@teachersource.com

Repeat with the second car. Compare the amount of power used by each car. Which did more work? Which used more power?

Check for Understanding:

Q. If a big person and a small person run up the stairs in the same time, which person exerts the largest force on the stairs, the big person or the small person?

A. The big person exerts the largest force on the stairs because he weighs more.

Q. Which of them does the most work?

A. The big person does the most work because the big person exerts more force over the same distance.

Q. If a big person and a small person run up the stairs in the same time, which of them develops the most power?

A. The big person develops the most power because the big person does more work and the time is the same.

More Challenging Questions:

Q. Do you think a bicycle helps you to develop more power than you would develop walking the same distance? Do you do less work using a bicycle?

A. A bicycle helps you develop more power as long as you move at a faster rate than you would without the bicycle. The same amount of work is done with the bicycle as without; however, the bicycle gives the rider a greater mechanical advantage.

Q. Jack and Jill ran up a hill. Jack is twice as massive as Jill; yet Jill ascends the same distance in half the time. Who did the most work? Who delivered the most power?

A. Jack does more work than Jill. Jack must apply twice the force to lift his twice-as-massive body up the same hill. Yet, Jill is just as "power-full" as Jack. Jill does one-half the work yet does it in one-half the time. The reduction in work done is compensated for by the reduction in time.

