PhyzGuide: Power

Quick! Which requires more work: lifting a one-kilogram mass two meters in one **second** or lifting a one-kilogram mass two meters in one **minute?**

Don't be tricked! Both tasks require the *same* amount of work. Go ahead, calculate it—work has *no* dependence on time!

"But how can this be?" you ask. "It's harder to lift an object quickly than it is to raise it slowly!"

What is different about the aforementioned tasks is the *power* developed in each.

Power is the *rate* at which work is done, or the rate at which energy is *dissipated* (used or consumed). Power is a scalar quantity (not a vector quantity).

$$P = W/t$$

Power can also be expressed in terms of the force applied to an object and the speed at which that object is traveling.

Since	$P = W/t$
and	$W = \mathbf{F}\cdot\mathbf{d}$
it follows that	$P = \mathbf{F}\cdot\mathbf{d}/t$
but	$\mathbf{d}/t = \mathbf{v}$
so	$P = \mathbf{F}\cdot\mathbf{v}$

Which means that the power developed by a moving object can be calculated as the scalar product of the force acting on it and the speed at which it is being propelled.

*Think about this one: if a 1 N (~0.1 kg) object were propelled along a frictionless surface at a speed of 1 m/s, how much power would be required?**

UNITS

The SI unit of power is J/s, which is abbreviated as W (watt). In terms of SI base units,

1 watt = 1 $kg\cdot m^2/s^3$. In British units, power is measured in units of horsepower, abbreviated hp. 1 hp = 746 W. So a "muscle car" might have a 186,000 W engine, and a good reading light might use a one-third horsepower bulb.