

Objectives

After reading this lesson, you should be able to

- ◆ define and explain power.
- ◆ measure and calculate power.

Power

The amount of work a person does within a given period of time

Watt

The unit used to measure power

The watt was named for James Watt who developed the steam engine. Since a watt is a small amount of power, the kilowatt (1,000 watts) is often more convenient to use.

Imagine pushing a box 3 meters across a floor using 50 newtons of force. You would do 150 joules of work on the box. Notice that work does not take into account the amount of time it takes for you to move the box. The amount of work you do within a given period of time is called **power**. Power is the rate at which you do work. To calculate power, take the amount of work done and divide it by the amount of time it took to do the work.

$$\text{power} = \frac{\text{work}}{\text{time}}$$

Suppose you did 150 joules of work in 5 seconds. The power would be equal to 30 joules per second.

EXAMPLE

$$\text{power} = \frac{150 \text{ joules}}{5 \text{ seconds}}$$

$$\text{power} = 30 \text{ joules per second}$$

The unit for measuring power is the **watt**. A watt is 1 joule of work done in 1 second. In the example above, 30 joules of work were done in one second, so 30 watts of power were used. You will learn more about the watt in Chapter 11.

Imagine someone else pushing the box with the same force but taking 10 seconds to move it. In that case, the work that was done would still be the same—150 joules. But, the power would be different.

EXAMPLE

$$\text{power} = \frac{\text{work}}{\text{time}}$$

$$\text{power} = \frac{150 \text{ joules}}{10 \text{ seconds}}$$

$$\text{power} = 15 \text{ joules per second or 15 watts}$$

Here is another way to look at this example. If you do the same amount of work as someone else, but do it in half the time, then you have used twice as much power.

Understanding Power

Directions Choose the word or words from the box that best complete each sentence.

force

joules

kilowatts

power

rate

second

watt

watts

1. Power is a measure of the _____ at which you do work.
2. Work measures the amount of _____ used to move an object a certain distance.
3. Work divided by time equals _____.
4. The units of measure for power are _____ per _____, or _____.
5. A _____ is 1 joule of work done in 1 second.
6. Usually, power is measured in _____, or 1,000-watt units.

Directions Use the formula to find each answer.

$$\text{power} = \frac{\text{work}}{\text{time}}$$

7. Alex pushed a stroller 2 blocks in 3 minutes. Then he pushed it 2 more blocks in 2 minutes. When did he use more power?
- _____

8. How much power would it take to move a chair 5 meters in 15 seconds using a force of 51 newtons?
- _____

9. A man can use a snowblower to move snow in 5 minutes. If he moves it with a shovel, it will take 20 minutes. He will use more power with which process?
- _____

10. A 600-newton diver dives off a 10-meter platform. If it takes 2 seconds to hit the water, what is the diver's power?
- _____