

Name: _____

Skill Sheet 10.2

Work

In science, "work" is defined with an equation. Work is defined as force times distance. By measuring how much force you have used to move something over a certain distance, you can calculate how much work you have accomplished. This skill sheet reviews the work equation and provides problems for you to practice using this equation.

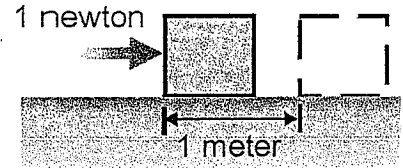
1. What is work?

As you recall, in science work is defined as force acting over a distance. That is, a force acts upon an object to move it a certain distance. However, to do work according to this definition, the force must be applied in the same direction as the movement. For example, if you lift a box off a table, the force applied is upward and the distance is also upward. This means that you have done work. However, if you lift the box off the table and then carry it to a shelf, only the lifting is work. Carrying the box is not work because the force on the box is upward but the distance is horizontal. However, you would be doing work if you pushed the box across the floor. Why?



is the amount of work done by pushing with a force of 1 newton for a distance of 1 meter.

Remember, the only time that work is done is when the force and the distance are in the same direction. So, in scientific terms, work is the force that is applied to an object in the same direction as the motion. The formula for work is:



$$\text{Work (joules)} = \text{Force (newtons)} \times \text{distance (meters)}$$

$$W = F \times d$$

You should note and remember that a *joule* of work is a *newton-meter*; both units represent the same thing: WORK. In fact, one joule of work is defined as a force of one newton exerted on an object to move it a distance of one meter.

$$1.0 \text{ joule} = 1.0 \text{ N} \times 1.0 \text{ meter} = 1.0 \text{ newton-meter}$$

2. Applying your knowledge

1. In your own words, define work in scientific terms. Be complete in your definition.

2. How are work, force, and distance related?

3. What are two different units that represent work?

3. Solving work problems

Solve the following problems using the formula for work. The first problem is done for you. Write your answers in joules.

1. How much work is done on a 10-newton block that is lifted 5 meters off the ground by a pulley?

$$\text{work} = F \times d = 10 \text{ N} \times 5 \text{ meters} = 50 \text{ newton-meters} = 50 \text{ joules}$$

2. A woman lifts her 100-newton daughter up 1 meter and carries her a distance of 50 meters to her bedroom. How much work does the woman do?

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3. You pulled your sled through the snow a distance of 500 meters with a force of 200 newtons. How much work did you do?

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4. An ant sits on the back of a mouse. The mouse carries the ant a distance of 10 meters across the floor. Was there any work done by the mouse? Explain.

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5. You did 170 joules of work lifting your 140-newton backpack. How high did you lift your backpack?

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6. In problem 5, how much did the backpack weigh in pounds? (HINT: There are 4.448 newtons in one pound)
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