NAME ______________________________ DATE ____________________

WHAT IS WORK? Chapter 4.1 Review

The concept of work is dependent upon two factors: the unbalanced force applied and the distance moved as a result of that force. The quantity of work done may be measured as the product of these two factors, or:

$$\text{work} = \text{force} \times \text{distance}$$

Analyze each of the following situations:

A. A force of 300 Newtons is needed to lift a bag of grain from the floor to the top of a 1-meter platform.

B. You weigh 500 Newtons and climb a ladder to a point that is 5 meters off the ground.

C. A car that won't start is pushed 50 meters using a force of 400 Newtons.

D. You attempt to lift a 1200-Newton barbell for 10 minutes, but it won't budge.

E. You drop a 10-Newton book a distance of 2 meters to the floor.

PART A

Fill in the following table with the requested information for each situation, then answer the questions under the table:

	Force applied	Distance moved	Work accomplished
A			
B			
C			
D			
E			

PART B

1. In which situation was the greatest amount of work accomplished? ____

2. In which was the least amount of work accomplished? ____ Explain:

____.

3. In situation E, how much work did *you* do? ____ Explain:

____.

4. For all situations listed in which work was done, what are the units for measuring the work?

____

Energy and Work

1. Work changes either the ______________________ or ______________________ energy of an object.

2. Work is done when a(n)__________________________ changes the energy of an object.

3. Throwing a dart changes its speed. Lifting a book changes its position. Statement ________ below is true.

   a. Both of these energy changes involve work.
   b. Neither of these energy changes involves work.
   c. Only one of these energy changes involves work.

4. Using *W* for work, *F* for force, and *d* for the distance moved, you can write the equation for work in this form:

   ____

5. Robin used a force of 17 newtons to push a bookcase 7 meters across the floor.

   b. To find the work done, you need a value for force and distance. List the data for Robin's work.

   ____

   c. Substitute the data from the problem in the formula for work.

   W = (N)(meters) ______________________

   d. The work done by Robin was ________newton-meters.

Decide whether work is being done in the following situations. If you think work is being done, write W in the space provided. If you think work is not being done, write N

______ 8. You move a shovelful of snow from the driveway to the lawn.

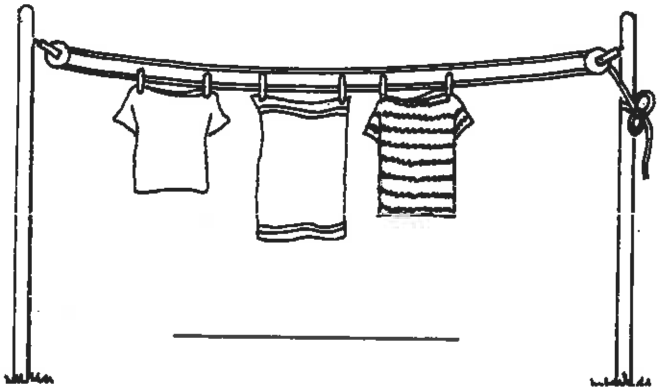
______ 9. You and a friend push a heavy piano, causing it to move about 10 centimeters.

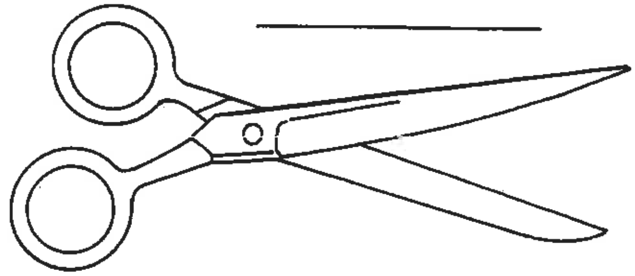
______ 10. You stand for half an hour in the freezing cold waiting for the bus to come.

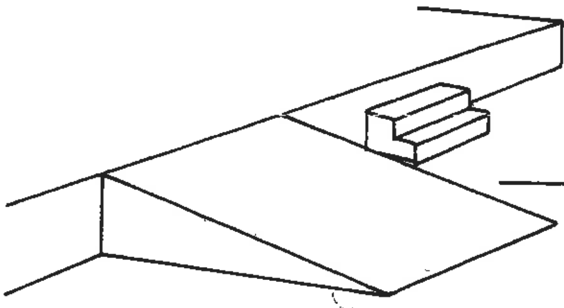
SIMPLE MACHINES

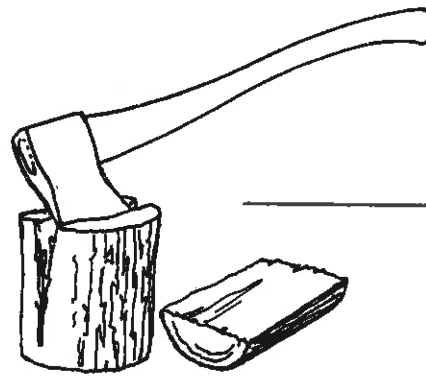
Name ____________________

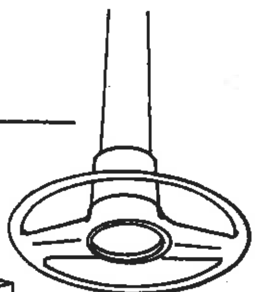
What types of simple machines are shown in the following pictures?

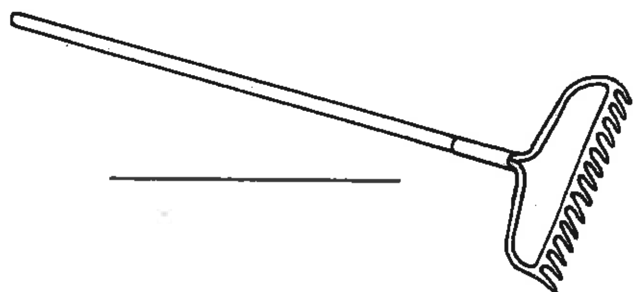


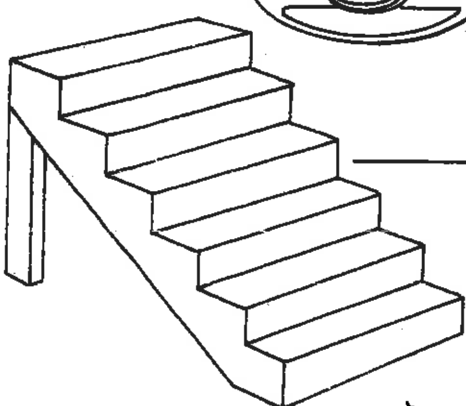


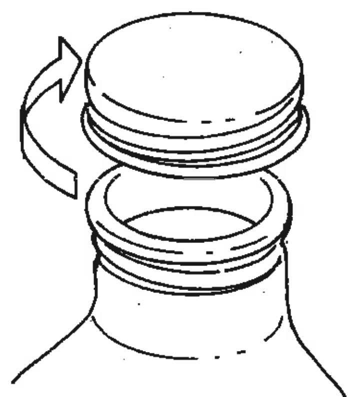


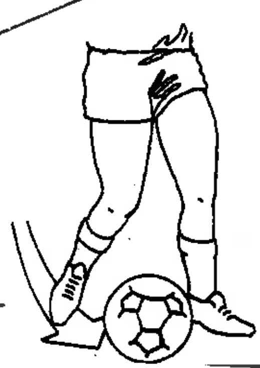


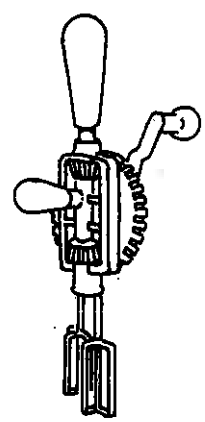




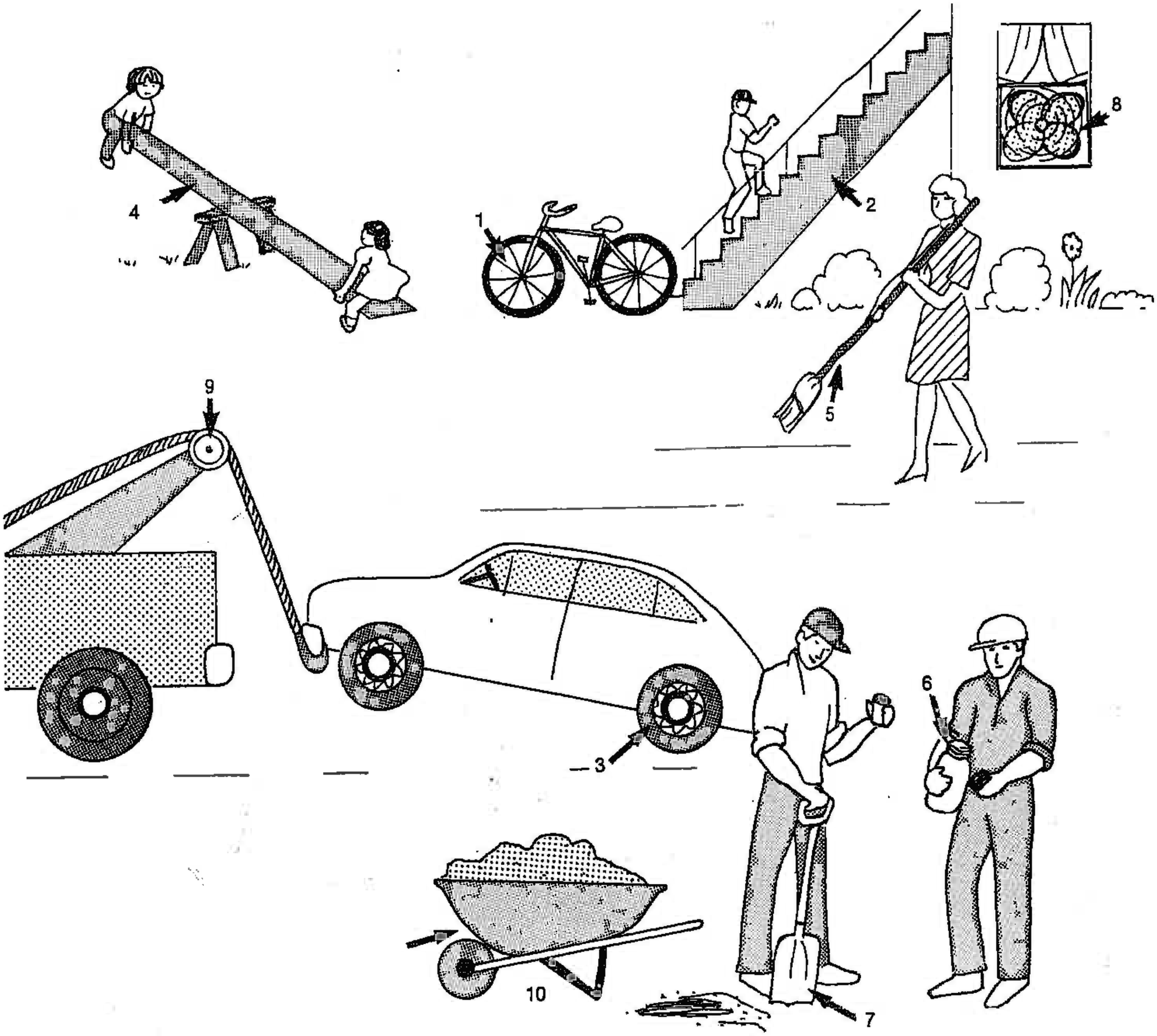








REVIEW



Identify the simple machines numbered in the drawing.

1. ______________________ 6. ______________________

2. ______________________ 7. ______________________

3. ______________________ 8. ______________________

4. ______________________ 9. ______________________

5. ______________________ 10. ______________________

Machines and Mechanical Advantage

Use this worksheet to study Lesson 5.2. Cover the answers on the right. Read each statement or question and write your answer in the space provided. Then uncover the correct answers to see if they match your answers. If any of your answers are incorrect, reread the part of the lesson covered by that question.

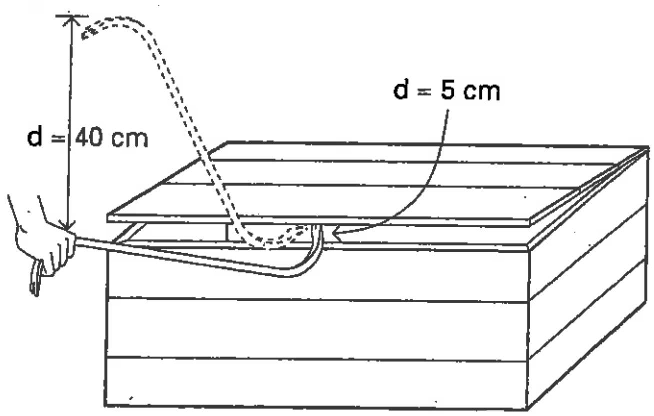
1. Most machines make jobs easier because they produce ______________ forces that are larger than ______________ forces. Some machines, such as pulleys, make work easier by changing the ______________ of the applied force.

2. Machines make a job easier by changing ________.

a. work

b. forces and distances

c. total energy needed



3. To help open a crate, you use a crowbar. You have to push down the crowbar handle 40 centimeters to move up the crate lid 5 centimeters. The mechanical advantage of the crowbar can be found by using this formula.

$$M.A. = \frac{d_{effort}}{d_{load}} \quad \frac{(\text{Output Force})\ N}{(\text{Input Force})\ N}$$

In the formula:

d_{effort} = ____________ cm

d_{load} = ____________ cm

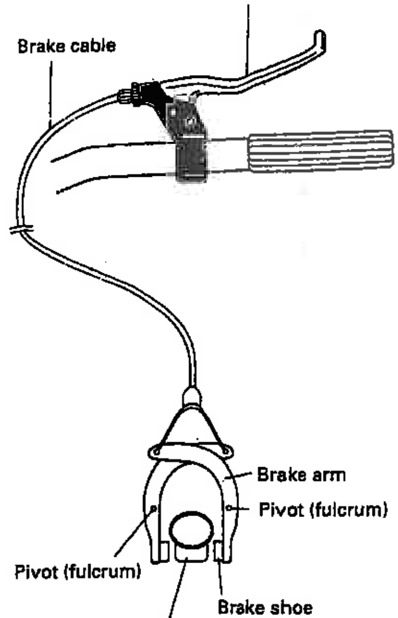
$M.A.$ = ____________

NAME ______________________________

CLASS ____________________ DATE ____________

Machines and Mechanical Advantage

The diagram shows the brake on a bicycle. You see that it is actually a system of two levers. The first lever in the system is the brake lever itself.



The second lever in the system shown in the diagram is the brake arm. The load force of the brake arm is exerted on the rim of the wheel. This force combines with a matching force from the other brake arm to pinch the rim, slowing the wheel. Use the diagram to help you solve the following problems.

1. To stop the bike, a rider does 0.5 joule of work by squeezing a single brake lever a distance of 5 centimeters. The cable is pulled 2 centimeters.

a. The effort distance is ________.

b. The load distance is ________.

c. Calculate the effort force of the brake lever.

____

2. The brake cable pulls the brake arm a distance of 2 centimeters, moving the brake shoe 0.2 centimeter.

a. The effort distance is ________.

b. The load distance is ________.

c. Calculate the effort force of the brake arm.

____

3. The mechanical advantage of the entire brake system can be calculated by two different methods. One method is to compare the force of the brake arm (load force) to the force put into the system by the brake lever (effort force).

a. The load force of the system is ________.

b. The effort force of the system is ________.

c. Calculate the mechanical advantage of the system.

____

4. Calculate the mechanical advantage using the effort distance and the load distance.

____