

CALCULATING WORK

Name _____

Work has a special meaning in science. It is the product of the force applied to an object and the distance the object moves. The unit of work is the joule (J).

$$W = \text{Force} \times \text{Distance}$$

$$W = F \times d$$

Force = newtons

Distance = meters

Solve the following problems.

1. A book weighing 1.0 newton is lifted 2 meters. How much work was done?

Answer: _____

2. A force of 15 newtons is used to push a box along the floor a distance of 3 meters. How much work was done?

Answer: _____

3. It took 50 joules to push a chair 5 meters across the floor. With what force was the chair pushed?

Answer: _____

4. A force of 100 newtons was necessary to lift a rock. A total of 150 joules of work was done. How far was the rock lifted?

Answer: _____

5. It took 500 newtons of force to push a car 4 meters. How much work was done?

Answer: _____

6. A young man exerted a force of 9,000 newtons on a stalled car but was unable to move it. How much work was done?

Answer: _____

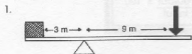
MECHANICAL ADVANTAGE

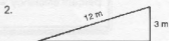
Name _____

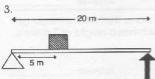
What is the mechanical advantage of the following simple machines?

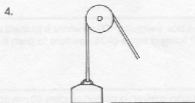
$$MA = \frac{F_R}{F_E} \quad \text{where } F_R = \text{resistance force}$$

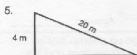
$$F_E = \text{effort force}$$

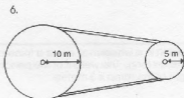


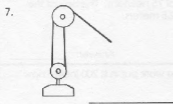


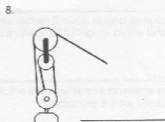












CALCULATING EFFICIENCY

BOAT Name _____

The amount of work obtained from a machine is always less than the amount of work put into it. This is because some of the work is lost due to friction. The efficiency of a machine can be calculated using the following formula.

$$\text{percent efficiency} = \frac{\text{work output}}{\text{work input}} \times 100$$

What is the efficiency of the following machines?

1. A man expends 100 J of work to move a box up an inclined plane. The amount of work produced is 80 J.

Answer: _____

2. A box weighing 100 newtons is pushed up an inclined plane that is 5 meters long. It takes a force of 75 newtons to push it to the top, which has a height of 3 meters.

Answer: _____

3. Using a lever, a person applies 60 newtons of force and moves the lever 1 meter. This moves a 200 newton rock at the other end by 0.2 meters.

Answer: _____

4. A person in a wheelchair exerts a force of 25 newtons to go up a ramp that is 10 meters long. The weight of the person and wheelchair is 60 newtons and the height of the ramp is 3 meters.

Answer: _____

5. A boy pushes a lever down 2 meters with a force of 75 newtons. The box at the other end with a weight of 50 newtons moves up 2.5 meters.

Answer: _____

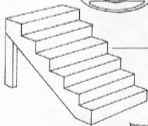
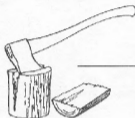
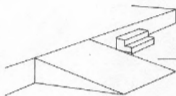
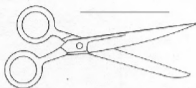
6. A pulley system operates with 40% efficiency. If the work put in is 200 joules, how much useful work is produced?

Answer: _____

SIMPLE MACHINES

Name _____

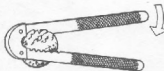
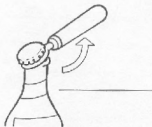
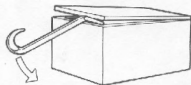
What types of simple machines are shown in the following pictures?



TYPES OF LEVERS

Name _____

Classify the following levers as first, second or third class.



CALCULATING POWER

Name _____

Power is the amount of work done per unit of time. The unit for power, joules/second, is the watt.

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

work = joules
time = seconds

Solve the following problems.

1. A set of pulleys is used to lift a piano weighing 1,000 newtons. The piano is lifted 3 meters in 60 seconds. How much power is used?

Answer: _____

2. How much power is used if a force of 35 newtons is used to push a box a distance of 10 meters in 5 seconds?

Answer: _____

3. What is the power of a kitchen blender if it can perform 3,750 joules of work in 15 seconds?

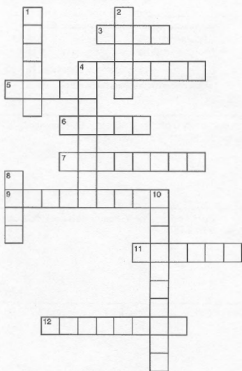
Answer: _____

4. How much work is done using a 500-watt microwave oven for 5 minutes?

Answer: _____

5. How much work is done using a 60-watt light bulb for 1 hour?

Answer: _____



Across

3. Force times distance
4. Point around which a lever rotates
5. Amount of work done per unit of time
6. Can be considered a type of inclined plane wrapped around a cylinder
7. A machine makes work easier by reducing force and increasing _____.
9. How many times a force is multiplied by a machine is the mechanical _____.
11. An inclined plane is an example of a _____ machine.

Down

1. Unit of force
2. Unit for work (newton-meter)
4. Force that reduces the efficiency of a machine
8. Joule per second
10. Work output divided by work input.
12. An automobile is an example of a _____ machine.