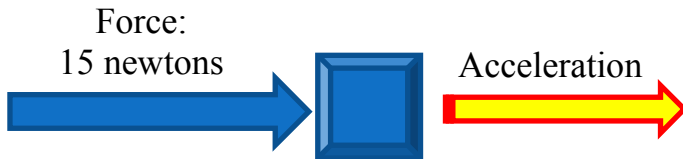


## Force & Motion / Simple Machines (Unit 4) Test Review Answers

1. **Describe an unbalanced force.**

2. **Draw an example.**

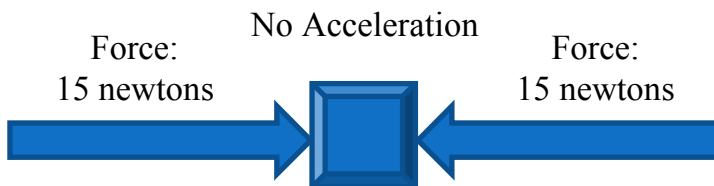
An unbalanced force is either a single force acting on an object, or two or more forces acting on an object that do not cancel each other out, resulting in a change in movement (acceleration) in the object, and a net force greater than zero.



3. **Describe a balanced force.**

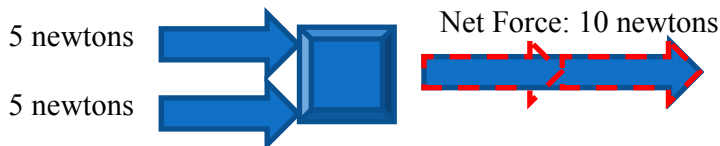
4. **Draw an example.**

A balanced force is one or more pairs of forces acting on an object that cancel each other out, so that no change in movement (acceleration) occurs in that object. The net force is zero.



5. **What is net force?**

The net force acting on an object is the sum of all the different forces acting on that object. Both the strength and direction of each force must be considered to find the net force. One way of finding the net force is to draw scaled arrows (vectors) for each force, connected end to end, and then drawing one arrow from the starting to the ending point. This last arrow is the net force vector.



6. **What is inertia?**

7. **Give an example of inertia in the real world.**

Inertia is the tendency of an object to resist a change in motion. Inertia is the reason that you must wear seat belts in a car. Without a seat belt, if a car that you were riding in stopped suddenly, inertia could send you through the windshield of the car. Inertia is also the reason that you fell forward when the hovercraft stopped suddenly.

8. **State Newton's First Law of Motion.**

9. **What is Newton's First Law known as?**

Newton's First Law of Motion states that "An object at rest will remain at rest, and an object that is moving at constant velocity will continue moving at constant velocity, unless acted upon by an unbalanced force." Newton's First Law of Motion is also known as the Law of Inertia.

**10. What increases inertia as it increases?**

As the mass of an object increases, the inertia that the object has also increases. Mass is the amount of matter that an object contains. Mass can also be defined as a measure of the inertia of an object.

**11. What is friction?**

**12. What would happen if machines didn't have friction?**

Friction is a force acting in the opposite direction of an object's motion that opposes that motion. It is caused by the rubbing surfaces of two different objects. It can either be sliding friction, rolling friction or fluid friction (like air resistance).

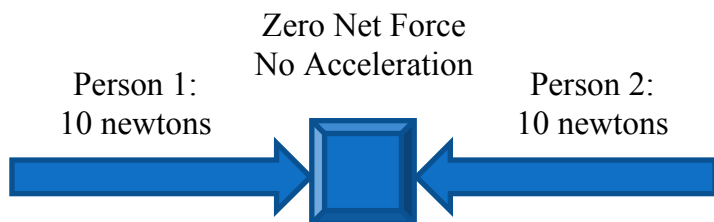
Some machines such as gasoline engines would be more efficient without friction. But many machines need friction to work. Cars could not transfer the power from the tires to the road without friction.

**13. What is gravity?**

Gravity is the force that pulls objects towards one another. All objects with mass exert a gravitational force on all other objects with mass. The closer that objects are to one another, and the more mass they have, the greater the force of gravity they will exert. Gravity is the force that causes objects to fall towards Earth.

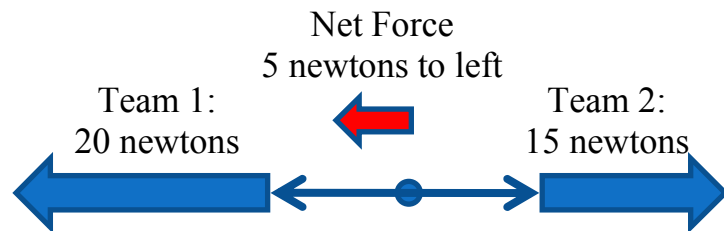
**14. Two people are pushing on a box. Person 1 is pushing the box to the right with a force of 10N. Person 2 is pushing the box to the left with a force of 10N. Will the box move? What is the net force acting on the box? Explain.**

The two forces, because they are equal in strength and point in 180° opposite directions, will cancel each other out, resulting in a net force of zero. Because these forces are balanced, they cause no change in motion.



**15. Two teams of 7th graders are playing a game of tug-of-war. Team 1 (4 kids) pulls with a force of 20N to the left. Team 2 (5 kids) pulls with a force of 15N to the right. Which team will win? Why? What is the net force?**

Team 1 will win because it has a stronger force of 20 newtons, which is 5 newtons more than Team 2's force. The net force is 5 newtons to the left. (The number of kids on each team does not matter, only the total force of each team.)



**16. What is a machine?**

A machine is a device with which you can do work in a way that is easier or more effective. Machines can either be simple or complex. A simple machine only uses one of the six basic kinds of machines, while a complex machine uses more than one kind of simple machine. For example, Rube Goldberg made cartoons of crazy complex machines built from levers and pulleys to do simple tasks.

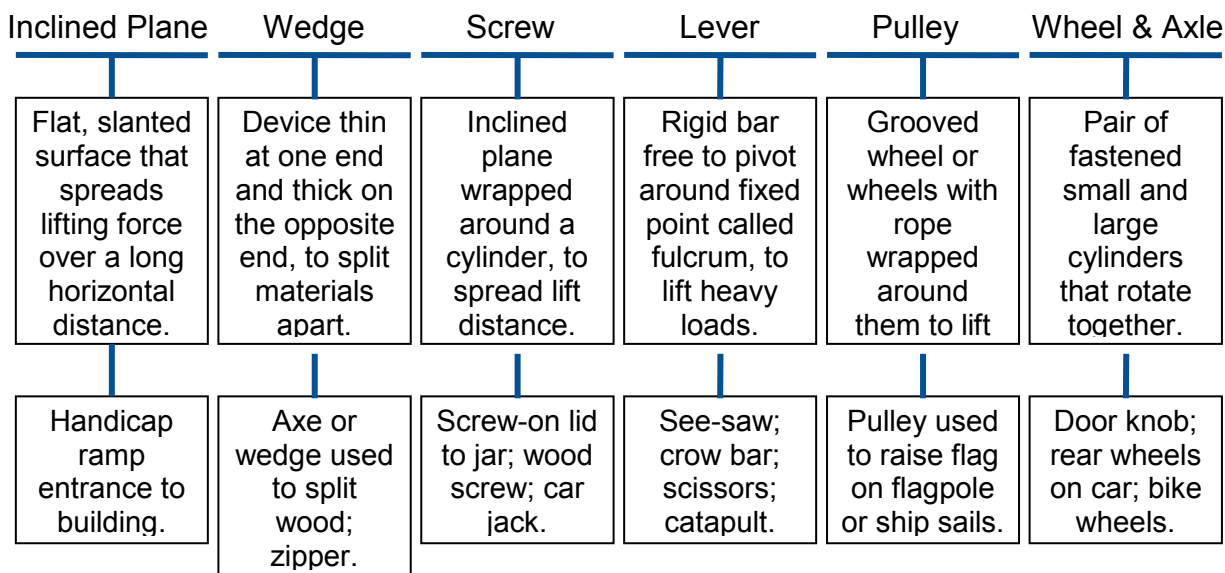
**17. What are the three ways that machines make work easier?**

A machine makes work easier by changing the amount of force you exert, changing the distance over which you exert the force, or changing the direction in which you exert the force. You do not get more work from the machine, however. If the machine creates more force output, the trade-off is that the lesser force input must be applied for more distance. In fact, because no machine is 100% efficient, some of the input work is lost due to friction.

**18. As related to a machine, what is input and output force?**

In a machine, the input force is the effort that is put into the machine, either from the person operating the machine or some other source. The output force is the resistance or weight being moved. For example, in a pulley, the input or effort is the person pulling on the pulley rope. The output or resistance is the weight being lifted.

**19. Draw a tree map that classifies the six types of simple machines. Describe each machine's function and give an example of each.**

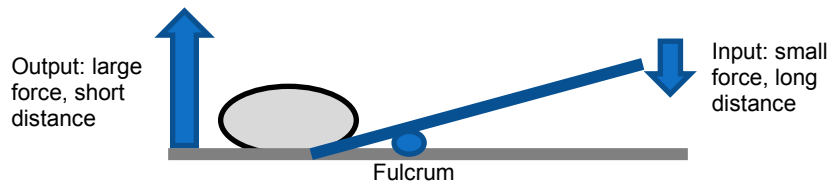


**20. What is a fulcrum?**

A fulcrum is the fixed point around which a lever pivots. For example, in a see-saw, the fulcrum is the support at the center of the see-saw that allows it to rock up and down. In scissors, the fulcrum is the pivot at the center of the scissors.

**21. How does a fulcrum's position affect a first class lever?**

As the fulcrum is moved closer to the output (resistance) side of the lever, the input force gets lower, but the distance over which that force must be applied get greater. For example, to lift a large boulder with a first class lever, the fulcrum should be placed as close to the boulder as possible.



22. **Describe how a catapult works.**

A catapult is a device that can throw objects long distances. It is a first class lever with a short input arm and a very long output arm. A large weight is attached to the input arm, and the object to be thrown is placed in an open cradle at the end of the output arm. To use the catapult, the lever is rotated so that the input, weight side of the lever is almost straight up, and the output, throwing arm is almost straight down. When the lever is released, gravity pulls the weight down, causing the output arm to move in a very fast arc.

