Simple and Compound Machines

A machine is a device that does work. In science, the word *work* is used to describe a force that acts on an object to move it. For example, carpenters do work when they pull nails out of wood. Movers do work when they load boxes onto a truck. They use simple machines to do these tasks.

Machines make it easier to do work because a person using them needs to use less force to move an object. Using the claw end of a hammer to pull nails out of wood requires less force than pulling the nails out with fingers. Pushing a heavy box up a ramp onto a truck requires less force than lifting the heavy box onto the truck.

The hammer and the ramp are examples of two types of simple machines. The hammer is an example of a lever, a bar that transfers force from one point to another while turning on a third point. A ramp is an example of a type of simple machine called an inclined plane. Besides levers and inclined planes, other types of simple machines include wedges, screws, wheels and axles, and pulleys.

When two or more simple machines are combined, they form a compound machine. For example, an ax is made up of two simple machines, the wedge and the lever. The blade of the ax is the wedge. It has a wide end and a thin, sharpened edge. The handle is a lever.

A wheelbarrow is a compound machine made up of a lever and a wheel and axle. The handles of the wheelbarrow act as levers to lift materials. Force applied to the wheel turns a shaft at the center of the wheel called an axle. This causes the wheelbarrow to move.

A bicycle is a compound machine that uses a variety of simple machines. Brake handles on a bicycle are levers. A screw connects the handlebars with the front wheel for steering. The wheels, pedals, and gears are all separate wheel and axle systems. These systems work together so that little force is required to make the bike move.

Imagine trying to chop wood without the wedge or lever of the ax. Imagine pushing a heavy load in a wheelbarrow without a wheel and axle. Using simple machines makes work easier to do. Combining simple machines to form compound machines, however, makes work easier still.
Recalling Facts
1. When two or more simple machines are combined, they form a
   □ a. compound machine.
   □ b. lever.
   □ c. screw.

2. Levers, inclined planes, wedges, screws, wheels and axles, and pulleys are types of
   □ a. ramps.
   □ b. tools.
   □ c. simple machines.

3. A compound machine made up of a lever and a wheel and axle is
   □ a. a hammer.
   □ b. a wheelbarrow.
   □ c. an ax.

4. When a person uses a machine,
   □ a. more concentration is needed.
   □ b. doing work is more difficult.
   □ c. doing work is easier.

5. There are ______ types of simple machines.
   □ a. twelve
   □ b. one
   □ c. six

Understanding Ideas
6. A seesaw on a playground is an example of a
   □ a. wheel and axle.
   □ b. wedge.
   □ c. lever.

7. The platform that leads from a pier to the deck of a ship is an example of a
   □ a. complex machine.
   □ b. simple machine.
   □ c. compound machine.

8. It is possible to conclude that using a compound machine instead of a simple machine to complete a task makes the work ______ to do.
   □ a. easier
   □ b. harder
   □ c. equally difficult

9. Machines make work easier to do because they
   □ a. allow people to use less force.
   □ b. can do work without any involvement from people.
   □ c. are more skillful than people.

10. A compound machine that uses a screw, levers, and several wheel and axle systems is
    □ a. a wheelbarrow.
    □ b. an ax.
    □ c. a bicycle.
Bicycles on the Move

The ancestor of the modern bicycle was the velocipede, invented in 1860s by Pierre Lallement, a French carriage maker. It had pedals and cranks attached to its front wheel, and it was the first human-powered vehicle to have lasting popularity. A few years later James Starley of England changed the design so that the front wheel was much larger than the rear wheel. Thomas Stevens rode one of these “high wheelers” across the United States, Europe, and Asia. The front wheel of his bike was 1.2 meters (4 feet) tall. High wheelers were faster than their predecessors, but they were dangerous because the rider sat above the high front wheel. In 1885 Starley’s nephew created the rover, a safer bicycle with a smaller front wheel. Like bikes today, the rover had tires of equal size, pedals, a chain, and brakes. Despite this new design, cars soon became the most popular form of transportation.

Today, using a bicycle instead of a car to get around has its benefits. Riding a bike cuts down on traffic and pollution. It is less expensive than driving a car or taking a bus. In China and India, there are more bicycles than cars on the road. But elsewhere, there is still work to be done to promote the bicycle as a beneficial form of transportation.

1. Recognizing Words in Context
   Find the word predecessors in the passage. One definition below is closest to the meaning of that word. One definition has the opposite or nearly opposite meaning. The remaining definition has a completely different meaning. Label the definitions C for closest, O for opposite or nearly opposite, and D for different.

   ___ a. things that come after
   ___ b. things that come before
   ___ c. things that go

2. Distinguishing Fact from Opinion
   Two of the statements below present facts, which can be proved correct. The other statement is an opinion, which expresses someone’s thoughts or beliefs. Label the statements F for fact and O for opinion.

   ___ a. In China and India, there are more bicycles on the streets than cars.
   ___ b. Riding a bike is the best way to get around a city.
   ___ c. The front wheel of the high wheeler was taller than the wheels of a modern bike.
3. Keeping Events in Order
Label the statements below 1, 2, and 3 to show the order in which the events happened.
   — a. The high wheeler was invented.
   — b. The rover was invented.
   — c. The velocipede was invented.

4. Making Correct Inferences
Two of the statements below are correct inferences, or reasonable guesses. They are based on information in the passage. The other statement is an incorrect, or faulty, inference. Label the statements C for correct inference and F for faulty inference.
   — a. Soon there will be more bicycles than cars on the road everywhere.
   — b. The design of the bicycle has improved over time.
   — c. Bicycles have some advantages over cars.

5. Understanding Main Ideas
One of the statements below expresses the main idea of the passage. One statement is too general, or too broad. The other explains only part of the passage; it is too narrow. Label the statements M for main idea, B for too broad, and N for too narrow.
   — a. The rover was similar to modern bicycles.
   — b. The design of the bicycle has improved over time.
   — c. The bicycle is a common means of transportation.

Correct Answers, Part A ______
Correct Answers, Part B ______
Total Correct Answers ______