Name _____ Date _____

Motion

Use the text to answer each question below.

1. Work occurs whenever something is moved and an object is put into motion. The motion of an object is described with three things: position, direction and speed. Forces come into play with work because they push and pull objects. All forces have size and direction. Some, like the pull of gravity toward a black hole, are immense, while others, like the push of an ant on a breadcrumb, are very small.

Work is possible because all objects have mechanical energy, including potential (energy based on position) and kinetic (energy of motion) energy. Mechanical energy is transferred from one object to another by pushing or pulling it. How fast these objects move depends on the position they began in and how much force was applied to them.

Which of the following is an example of a situation where work occurs?

A. a glass of water sitting on the counter
B. a leaf resting on a rock
C. a student sitting at a desk
D. a baseball soaring through the air

2. The position of an object is its location relative to a second or background object, which becomes the reference point. We describe positions using terms like on top of, next to, to the right of or just north of.

An object's motion is measured by its speed and direction from the reference point. Since no objects are truly "still" or completely motionless, motion is always relative to some other, usually larger, object or reference point.

Which of the following is an example of an object’s position?

A. over there
B. on the table
C. right here
D. somewhere

3. Speed is the rate at which an object moves relative to its reference point. Average speed is the total distance divided by the total time. We use average speed because the speed of an object may vary over time. Common measures of speed include miles per hour, meters per second or kilometers per minute. If you drive at a speed limit of 65 miles per hour, it means that in one hour you will have traveled 65 miles from the reference point of where you began.

Because the speed at which an object travels varies over time,

A. it is impossible to calculate any type of speed measurement.

B. distance is considered the more important measurement.

C. average speed is used, which is total distance divided by total time.

D. time is considered the more important measurement.

4. Velocity is the speed at which an object moves in a specific direction. It's measured in meters per second, minute or hour in a particular direction—like miles per hour going north, kilometers per minute west or meters per second up. Velocity tells us both the speed and direction we are traveling.

Acceleration is a change in velocity. It's measured by subtracting the object's starting velocity from the final velocity, divided by the time this change in velocity took. We usually think of acceleration as speeding up, but it can also mean slowing down. We call this negative acceleration or deceleration.

If a car was driving 45 miles per hour northeast, and is now driving 30 miles per hour north,

A. the car’s velocity decelerated.

B. the car’s velocity accelerated.

C. the car’s velocity remained unchanged.

D. the car’s acceleration is 30 miles per hour.

5. Friction is a force that works against motion between two surfaces that are touching. Sometimes this is because two surfaces are rough and don't slide easily. If a surface isn’t smooth, there’s sliding friction, which is influenced by the mass of the moving object and the smoothness of the surface it’s moving on.

Rolling friction is usually less than sliding friction, which is why it's easier to move heavy furniture on a hand truck. Rolling friction happens when we use wheels.

Fluid friction makes it difficult to move through liquids like water. It's also the friction caused by air on the outside of a moving vehicle. You can feel fluid friction on your face when you run against the wind.

Which of the following best describes how friction affects motion?

A. Friction makes motion between two touching surfaces much easier.

B. Sliding friction makes running on a windy day much harder on your body.

C. Rolling friction makes moving through liquids feel like very hard work.

D. Friction makes motion between two touching surfaces more difficult.

6. A machine is a device that helps make our work easier. Machines don't change the amount of work needed to do a job, but they can change the size, direction or amount of the force doing the work. They can also change the kind of friction two objects are creating. This change, called mechanical advantage, redirects the force in a way to make the work easier for us. Simple machines include levers, inclined planes, wedges, screws and wheels and axles—all of them help us out by changing the direction, amount or speed of force or the distance needed to do work.

According to the passage, which of the following is an example of a simple machine that makes our work easier?

A. a lawnmower used to cut the grass

B. a laptop computer that fits easily in a backpack

C. a pulley that lifts an elevator off the ground

D. a remote control for the television

7. Sir Isaac Newton's laws govern force and motion. The First Law of Motion says that an object at rest stays at rest unless acted upon by an outside force. In addition, an object in motion remains in motion at a constant speed, in a straight line, unless acted upon by an outside force.

Newton's Second Law of Motion says that the acceleration of an object depends on the object's mass and the amount of force applied. The greater the force, the more it will change the object's motion.

Newton's Third Law of Motion says that whenever you exert a force on an object, that object exerts an equal and opposite force on you. Or, for every action there is an equal and opposite reaction. For example, when you jump off the ground, there is a downward push of your legs into the ground as well as the upward push of your body into the air.

Which of these provides the best evidence for Newton's First Law of Motion?

A. While sitting in a chair, you exert force on the chair, and the chair exerts the same amount of force back on you.

B. A basketball sitting on the basketball court doesn't move until something pushes it.

C. You push a full shopping cart and an empty shopping cart. The empty shopping cart goes much faster than the full one.

D. You push your little brother on the swings, and he goes higher the harder you push him.