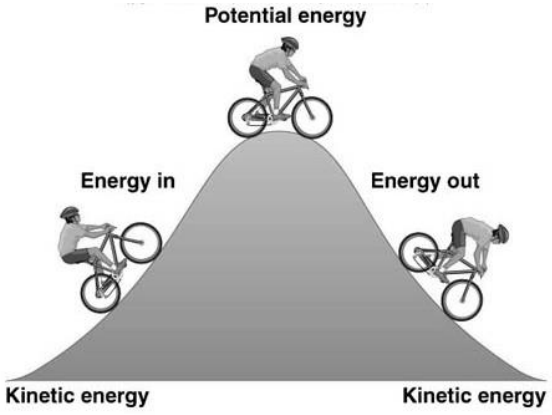
Name _____ **Date** _____

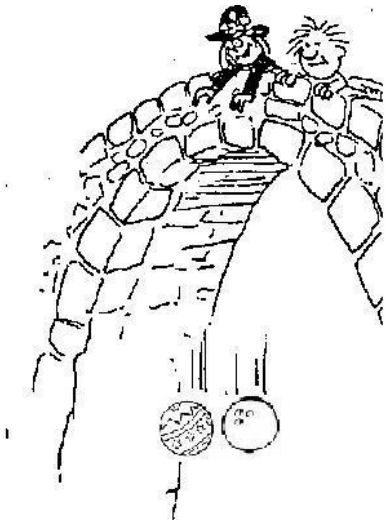
Move It!

Key Words		
acceleration	action	balanced forces
direction	distance	energy
friction	inertia	kinetic energy
motion	potential energy	reaction
speed	unbalanced forces	velocity

Energy is the ability to move matter or cause changes in matter. Suppose you lift a box off of the floor. Did the position of the box change? Yes, it did. You used energy stored in the muscles of your body to lift the box. Because energy never disappears, the energy you used to move it is now stored in the box. The box has **potential energy**—energy stored in an object due to its position.



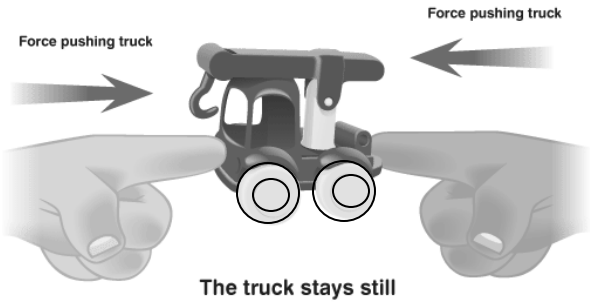
If you are holding the box above the floor and let it go, the box begins to move down towards the floor. The potential energy it possessed now changes to the energy of motion—**kinetic energy.** The total amount of energy in an object is the sum of its potential and kinetic energy. As the box falls, the potential energy decreases and the kinetic energy increases. The box moves faster. Just as the box hits the floor, the potential energy has completely changed to kinetic energy. Once the box stops moving on the floor, the energy changes back to potential energy.



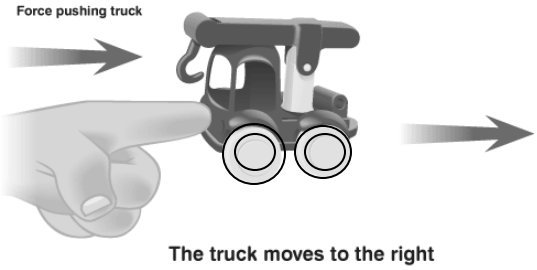
If you drop a beach ball and a bowling ball from the same height onto sand, which ball would make the biggest crater? If you said the bowling ball, you are right. The amount of potential energy an object has depends on its mass and the distance it is lifted. The more potential energy it has, the more kinetic energy it can produce. The amount of kinetic energy depends on the mass of the object and how fast it is moving. A large truck moving at 10 m/s has more kinetic energy than a car moving at the same speed.

You don't always have to lift or raise objects to increase their potential energy. As you stretch or compress a spring, you give it energy. The energy is stored in the spring as potential energy. When you release the spring, the potential energy quickly changes to kinetic energy.

Motion is a change in position. Forces cause motion. More than one force can act on an object at the same time. If the forces are equal and opposite, they are said to be **balanced forces**. Balanced forces cancel each other out, so motion does NOT change. If the forces on a moving object are balanced, the object continues to move at the same speed and in the same direction. If the forces acting on a still object are balanced, the object does not move.

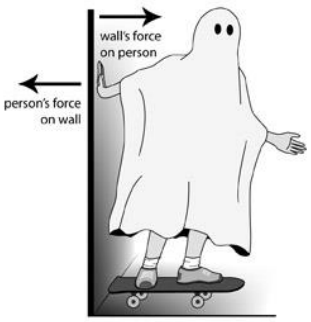


Forces that are not equal and/or opposite in direction are called **unbalanced forces.** Unbalanced forces don't cancel each other out. Unbalanced forces cause a change in motion. For example, imagine that you and a friend are pushing on a heavy box with equal force from opposite sides. The forces acting on the box are balanced. But, if a second friend helps you push the box from your side, the forces acting on the box become unbalanced. This causes a change in motion, and the box moves.



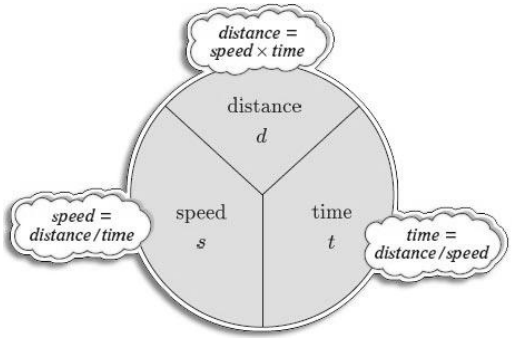
When you kick a soccer ball, you apply a force that makes the ball start to move. Does the ball keep moving forever? No, at some point, it will slow and stop. The ball stops moving because of **friction** caused by the ball rubbing against the ground or the air. If there were no friction to slow it down, the ball would keep moving until some other force stopped it. Forces such as gravity cause motion. Gravity can cause a book to fall off the table. **Gravity** is a force that pulls all objects towards each other. The greater its mass, the greater the force of gravity the object has.

Forces work in pairs. When one object pushes on a second object, the second object pushes back with equal force. For every **action**, there is an equal and opposite **reaction** (Newton's Third Law of Motion!!!) When you push on a wall, the wall pushes back with equal force, If it did not, the wall would collapse.



The tendency of an object to resist a change in motion is called **inertia.** Because of inertia, an object will not start or stop moving unless an outside force acts on it. An object's inertia is related to its mass. The more mass an object has, the more inertia it has. Just as a large truck has more potential energy than a car, the truck has more inertia than the car. It is harder to get the truck moving and harder to stop it.

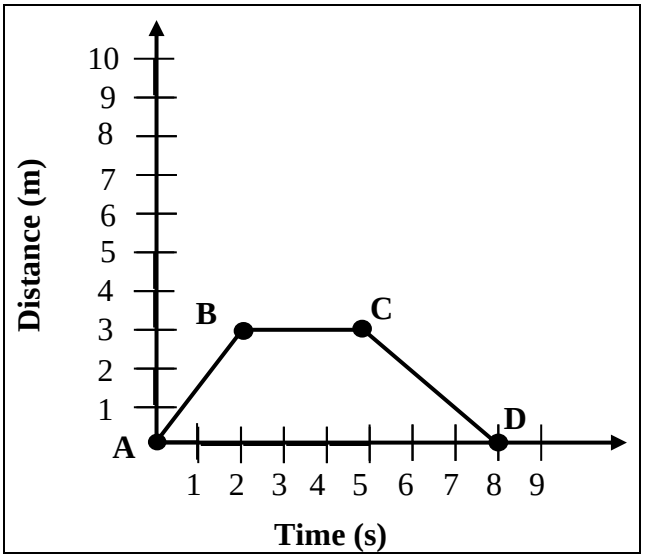
Motion can be described in terms of distance, direction, speed, velocity, and acceleration. **Distance** can be measured with a ruler or meter stick. It describes HOW FAR the object has moved. **Direction** is measured with a compass. It tells if the object is moving up or down, right or left, east or west. **Speed** is the distance an object travels in a certain amount of time. You can use a stopwatch and a meter stick to measure speed. **Velocity** is an object's speed in a particular direction. To describe an object's velocity, you must include both its speed and the direction in which it is moving. So, to measure an object's velocity, you use a stopwatch, a meter stick, and a compass. **Acceleration** occurs when the motion of an object changes—speeds up, slows down, or changes direction. That means that acceleration is a change in velocity. So, it is also measured with a stopwatch, a meter stick, and a compass.



Speed is calculated by dividing the distance that was traveled by the amount of time it took to travel that distance. For example, suppose the distance between school and your house is 12 kilometers and it takes you 2 hours to ride your bicycle home. What would your average speed be?

12 kilometers ÷ 2 hours = 6 kilometers per hour

Of course, you wouldn't travel exactly that speed for the entire 12 miles. You might slow down when going around a corner or speed up when going down a hill. An object's speed can increase, decrease, or stay the same as it moves.

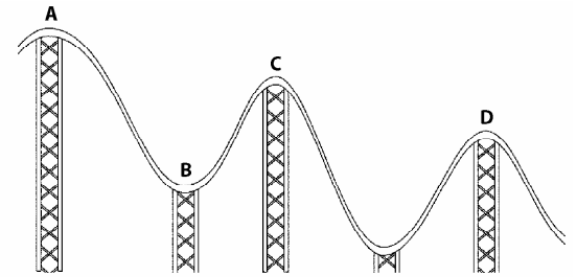


A good way to display acceleration and speed is by using a line graph. Look at the graph. It shows the motion of a student on a skateboard. From point A to point B, the student was moving forward. You can tell because the student moved 3 meters in 2 seconds. His speed would be 1.5 m/sec. (3 ÷ 2 = 1.5) From point B to point C, the student is NOT moving. Time is moving, but the distance stays the same. From point C to point D, the student is going back to where he started. His speed is slower, however. (3 ÷ 4 = .75 m/sec)

1. A student rolls the following four objects on the same surface with the same amount of force. Which object will have the greatest kinetic energy?

A A marble
B A basketball
C A beach ball
D A ping pong ball

Look at the section of roller coaster pictured below. Use the picture to answer questions 2-4.



2. At which point will a roller coaster car have the greatest amount of potential energy?

_____

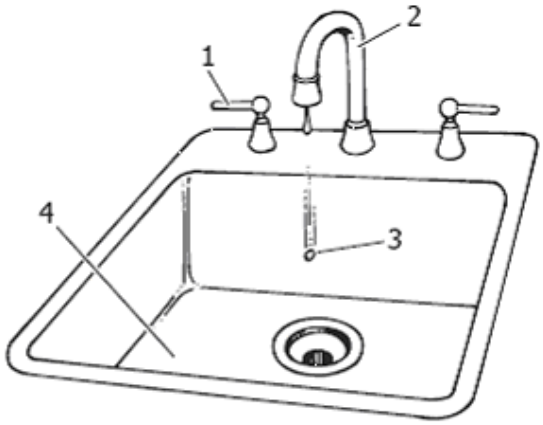
3. At which point will a roller coaster car have the greatest amount of kinetic energy?

_____

4. Why would the car have less potential energy at point D than point A?

_____

_____



5. Which labeled part in the drawing above shows evidence of kinetic energy?

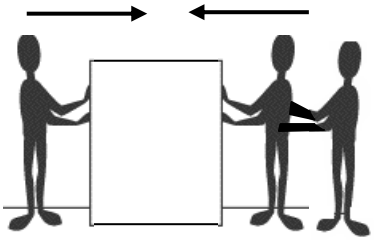
_____

6. Which labeled part in the drawing above shows evidence of potential energy?

_____

7. Which of the following BEST explains the difference between speed and velocity?

A Velocity has motion, and speed does not.
B Velocity has direction, and speed does not.
C Velocity involves time, and speed does not.
D Velocity involves acceleration, and speed does not.



8. In the picture above are the forces balanced or unbalanced? What will happen if each person begins pushing in the direction of the arrows with the same amount of force? Explain your answer.

_____

_____

_____

_____

_____

_____

9. Which of the following always causes change in speed, direction, or both?

A Balanced forces
B Unbalanced forces
C Either balanced or unbalanced forces
D Any combination of forces

10. Which of the following always causes an object to start moving?

A Balanced forces
B Unbalanced forces
C Either balanced or unbalanced forces
D Any combination of forces

11. What is a force that opposes motion between two surfaces that are in contact?

A Friction
B Motion
C Velocity
D Acceleration

Calculate the speed for each situation listed below.

12. A car drives 150 km in 2 hours

13. A marble rolls 24 cm in 8 seconds

14. A skateboarder moves 12 m in 6 seconds

15. The space shuttle travels 50,000 km in 25 seconds

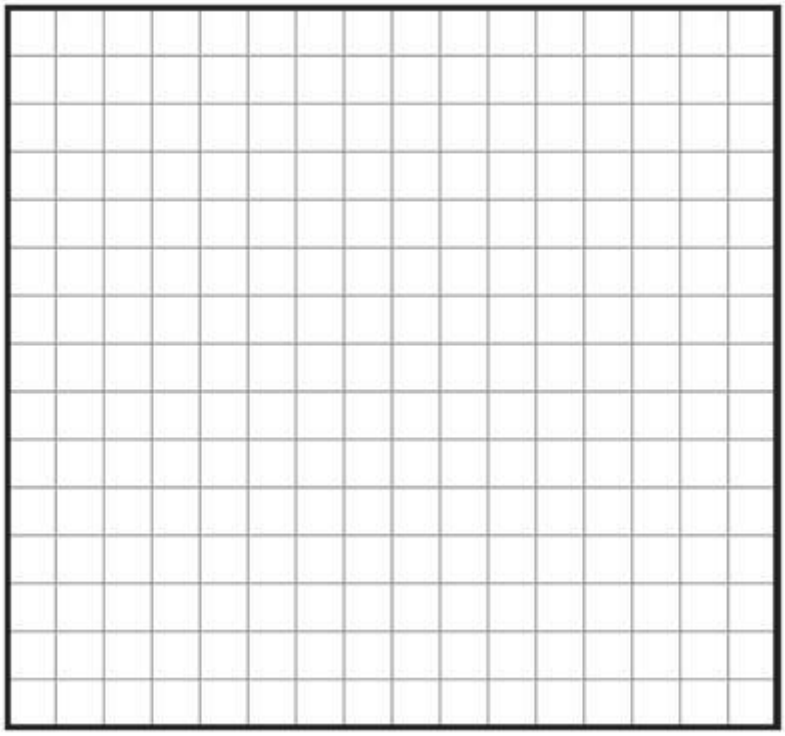
16. A sixth grade student reads 120 words in 60 seconds

Directions: Look at the information in the table. Construct a bar graph to illustrate the data given.

Students conducted an investigation using an inclined plane system. The data table below shows the information students collected.

Potential to Kinetic Energy

Trials (Height of Ramp)	Average Distance Car Traveled (in cm)
Trial 1 (6 cm)	78 cm
Trial 2 (8 cm)	116 cm
Trial 3 (10 cm)	133 cm
Trial 4 (12 cm)	145 cm



Science Words

Directions: Use the code in the boxes to write science words from "Move It!" Then write the words on the line with their definitions.

a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	r	s	t	u	y
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

17. 19 13 2 1 11 1 13 3 5 4 6 14 16 3 5 17

18. 2 1 11 1 13 3 5 4 6 14 16 3 5 17

19. 10 9 13 5 18 9 3 5 13 5 16 7 20

20. 5 13 5 16 7 20

21. 17 15 5 5 4

22. 15 14 18 5 13 18 9 1 11 5 13 5 16 7 20

23. 9 13 5 16 18 9 1

24. forces that are opposite and equal _____

25. the ability to do work or cause change in matter _____

26. the tendency of an object at rest to remain at rest _____

27. the energy of motion _____

28. energy due to an object's position _____

29. the distance an object travels in a certain amount of time_____

30. forces that are not equal or opposite _____

acceleration	action
balanced forces	direction
distance	energy
friction	inertia
kinetic energy	motion
potential energy	reaction
speed	unbalanced forces
velocity	