

# Physics Review

**DIRECTIONS:** Read the passage and question, and choose the **best** answer.

Work is directly proportional to both force and distance, so decreasing force while increasing distance—or vice versa—results in the same amount of work. This is the idea behind simple machines. The amount of work needed to lift an object, for example, would be the same whether it is lifted straight upward or carried up a ramp. Using the ramp requires more distance, but less force. A ramp is a type of simple machine.

Simple machines allow a smaller force to overcome a larger force. That difference in force is called mechanical advantage, or MA. The equation for calculating mechanical advantage is:

$$MA = \frac{\text{output force}}{\text{input force}}$$

3. A pulley is a simple machine. A system of pulleys is installed in a factory to allow a worker to lift heavy crates. If the worker exerts a force of 600 newtons (N) on the pulley system to lift a crate that weighs 1,800 N, what is the mechanical advantage of the pulley system?
- A. 18  
B. 6  
C. 3  
D. 0.3

**DIRECTIONS:** Read the passage and question. Then use the drag-and-drop options to complete the table.

Heat, or thermal energy, is a form of kinetic energy that results from events that happen at a scale we cannot see. As heat is transferred from system to system or from object to object, the motion of the particles that make up the object or system speed up or slow down, depending on whether heat is being transferred in or out. The average kinetic energy of all the particles in a substance can be measured as temperature by using a thermometer. The total kinetic energy of an object or system is greater if more particles are present. That is, at the same temperature, a 100 ml sample of water has more kinetic energy than a 50 ml sample of water.

25. Determine whether each drag-and-drop option describes a condition that relates to an increase or a decrease in the kinetic energy of an object or a system. Then record each description in the correct column of the table.

Increase in Kinetic Energy	Decrease in Kinetic Energy

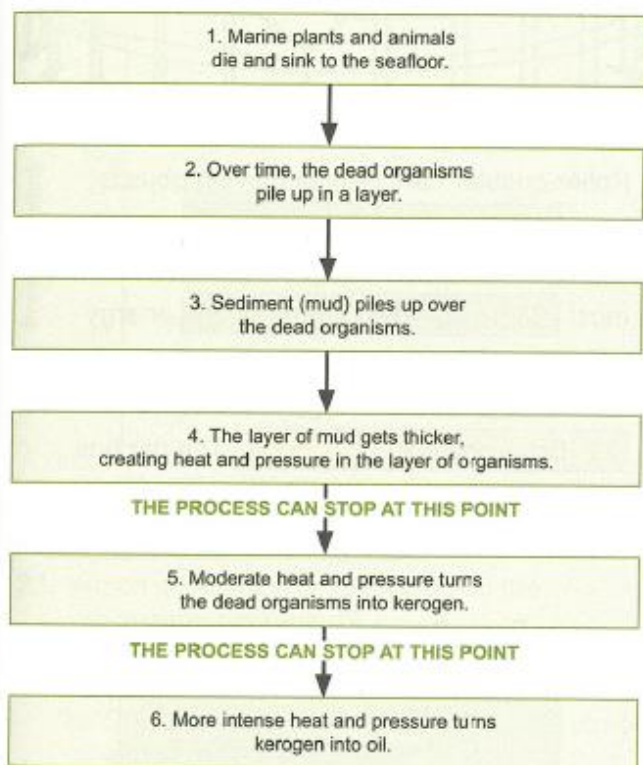
### Drag-and-Drop Options

Particles speed up.
Temperature drops.
Heat is transferred in.
Volume is increased.
Particles slow down.
Heat is transferred out.
Volume is reduced.
Temperature is raised.

**DIRECTIONS:** Study the information and diagram, read each question, and choose the **best** answer.

Oil shale is sedimentary rock, or shale, that contains a substance called kerogen. Like oil, kerogen is a hydrocarbon, a substance made of carbon and hydrogen. However, kerogen is not as fully cooked in Earth as oil is. Oil shale can be mined and subjected to a process called retorting, which liquifies the kerogen and transforms it into an oil that can be refined into products such as jet fuel and diesel fuel.

### FORMATION OF OIL



14. The passage says that kerogen is "not as fully cooked" as oil. What does this mean?
- A. Kerogen does not have all the ingredients needed to be oil.
  - B. Kerogen has not been in Earth long enough to be ready for use in a practical application.
  - C. Kerogen is still in solid form when it is mined.
  - D. Kerogen has not been subjected to enough heat and pressure to become oil.

15. At what point in the process represented by the flowchart does oil shale form?
- A. step 2
  - B. step 3
  - C. step 5
  - D. step 6
16. What does the process of retorting **most likely** involve?
- A. heat and pressure
  - B. additional dead organisms
  - C. liquifying and refining
  - D. oil shale and oil

**DIRECTIONS:** Read the passage. Then read each question, and fill in your answer in the box.

If the velocity of an object is increasing, its acceleration is positive. If its velocity is decreasing, its acceleration is negative. Negative acceleration is also called deceleration. For example, when a car's brakes are applied, the car decelerates. The calculation for deceleration is the same as that for acceleration: Subtract the initial velocity from the final velocity and divide that number by time. If the object's velocity is constant, its acceleration is zero.

17. The velocity of a car changes from 5 meters per second (m/s) to 35 m/s in 5 seconds (s). What is the car's acceleration?

18. A car going 20 m/s takes 10 s to come to a complete stop. What is the car's deceleration?

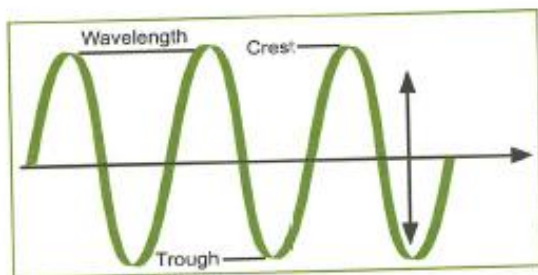
19. A car is moving at a constant velocity of 20 m/s for 60 s. What is its acceleration over that period of time?



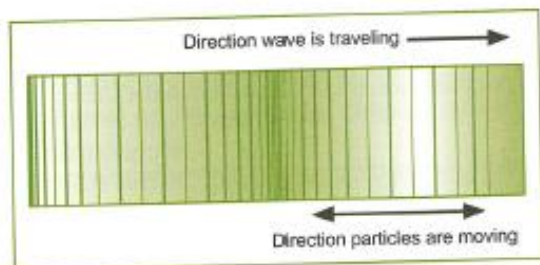
**DIRECTIONS:** Read the passage. Then read each item, and respond by marking the appropriate hot spot or hot spots.

Waves transfer energy from place to place without transferring matter. A mechanical wave needs a medium, such as air or water, through which to travel. Electromagnetic waves, such as radio waves, do not require a medium. They can travel through empty space. Waves can be further classified into either transverse or longitudinal waves. A transverse wave can be either mechanical, as in ocean waves, or electromagnetic, as in radio waves. When a transverse wave passes through matter, it moves the matter up and down or side to side. The matter moves in a direction perpendicular to the direction in which the wave is traveling. Longitudinal waves are always mechanical waves; that is, they need a medium through which to travel. When a longitudinal wave passes through matter, it causes the matter to expand (at rarefactions) and contract (at compressions). The matter moves in a direction parallel to the direction in which the wave is traveling.

20. Identify movement of matter in a transverse wave. In the diagram, mark X on each arrow that shows how particles move in a transverse wave.



21. Identify movement of matter in a longitudinal wave. In the diagram, mark X at each rarefaction.



**DIRECTIONS:** Study the diagram. Then read the incomplete passage that follows. Use the information from the diagram to complete the passage. For each drop-down item, choose the option that **best** completes the sentence.



22. Roller-coaster cars, like all moving objects, have **22. Drop-down 1** energy. The roller-coaster car has the most **22. Drop-down 2** energy when it is at Point A. As it descends toward Point B, the energy of the car is **22. Drop-down 3**. The car has the least potential energy and the most kinetic energy at Point **22. Drop-down 4**.

#### Drop-Down Answer Options

- 22.1 A. kinetic  
B. chemical  
C. thermal  
D. electrical

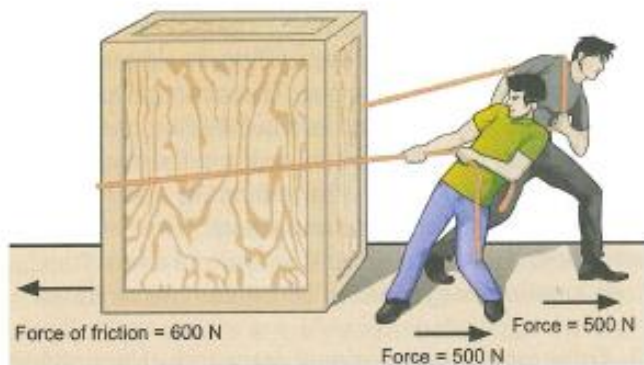
- 22.2 A. chemical  
B. mechanical  
C. potential  
D. kinetic

- 22.3 A. being lost to momentum  
B. changing from kinetic to potential  
C. being changed to gravitational energy  
D. changing from potential to kinetic

- 22.4 A. A  
B. B  
C. C  
D. D

**DIRECTIONS:** Study the information and diagram, read the question, and choose the **best** answer.

Two people pulling on ropes are moving a crate across the floor. The force of friction is opposing the motion of the crate. The diagram shows the three forces acting on the crate.



26. What is the magnitude of the net force acting on the crate?

- A. 400 N
- B. 800 N
- C. 1,600 N
- D. 2,000 N

**DIRECTIONS:** Read the passage. Then read each question, and choose the **best** answer.

A student learning about Newton's laws of motion sets up an investigation to test the relationship between the length of a pendulum's string and the pendulum's frequency of oscillation. Oscillation is back-and-forth motion. She constructs pendulums by tying a metal washer to one end of pieces of string of different lengths. Her hypothesis is that a shorter string will result in a higher frequency of oscillation.

27. What is the dependent variable in the investigation?

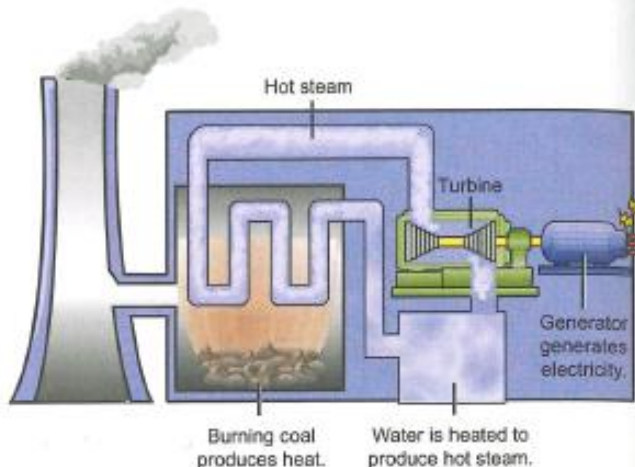
- A. length of string
- B. mass of pendulum
- C. frequency of oscillation
- D. angle of oscillation

28. What is the independent variable in the investigation?

- A. length of string
- B. mass of pendulum
- C. frequency of oscillation
- D. angle of oscillation

**DIRECTIONS:** Study the information and diagram, read each question, and choose the **best** answer.

Energy cannot be created or destroyed; it can only be converted from one kind to another. Electrical energy is generated at a power plant through a series of energy conversions. In a coal-fired plant, the process begins with chemical energy stored in the coal. The coal is burned in a boiler to produce steam. The steam turns the blades of a turbine. The turbine turns the generator that produces electricity.



29. Which type of energy does the action of the turbine represent?

- A. chemical
- B. heat
- C. kinetic
- D. electrical

30. Which sequence describes the chain of energy conversions in a coal-fired power plant?

- A. chemical → heat → mechanical → electrical
- B. heat → chemical → mechanical → electrical
- C. mechanical → chemical → heat → electrical
- D. heat → mechanical → chemical → electrical



**DIRECTIONS:** Read the passage. Then read each question, and fill in your answer in the box.

The law of momentum conservation states that the total momentum of a closed system is constant if no external force acts on the system. This means that momentum is neither lost nor gained when two bodies collide with each other. Momentum is calculated by using the equation  $p = mv$ , where  $p$  is momentum,  $m$  is mass, and  $v$  is velocity. Momentum is expressed in units of mass times velocity—such as kilograms (kg) times meters per second—and direction. For example, "10 kg • m/s downward" is an expression of momentum.

31. What is the momentum of a 100 kg object moving at 25 m/s toward the east?

32. The same object catches up with a 20 kg stationary object and collides with it. The collision stops the first object and sets the second object in motion. What is the velocity of the second object after the collision?

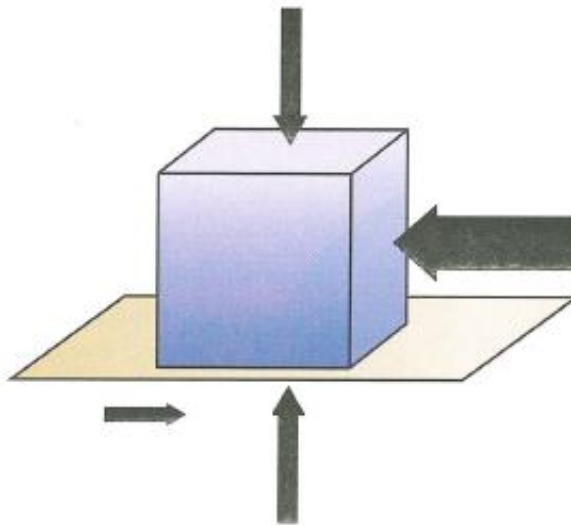
**DIRECTIONS:** Read the passage. Then read each question, and choose the **best** answer.

Average speed is found by dividing total distance by time. Average velocity is found by dividing total displacement by time. If a person walks 300 meters (m) to the east and then returns to the starting point by the same route, the total distance equals 600 m. Total displacement equals 0 m.

33. If the entire trip took 10 minutes, what was the average speed in m/s?
- A. 0 m/s  
B. 1 m/s  
C. 6 m/s  
D. 60 m/s
34. If the entire trip took 10 minutes, what was the average velocity?
- A. 0 m/s  
B. 1 m/s east  
C. 6 m/s west  
D. 60 m/s

**DIRECTIONS:** Study the information and diagram, read the question, and choose the **best** answer.

According to Newton's first law of motion, an object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless it is acted on by an unbalanced force.



35. Which statement describes the motion of the box when the forces represented in the diagram act on it?
- A. The box will move down.  
B. The box will move to the left.  
C. The box will move to the right.  
D. The box will move up.

**DIRECTIONS:** Read the passage and question, and choose the **best** answer.

Environmental scientists investigating radiation levels in streams and ponds within a kilometer of a site where nuclear power materials are being stored collected seven water samples. They used equipment to count the number of radioactive particles emitted by each sample in microroentgens per hour ( $\mu\text{R/h}$ ). They recorded the following measurements for the seven samples: 500.0  $\mu\text{R/h}$ , 520.0  $\mu\text{R/h}$ , 420.0  $\mu\text{R/h}$ , 475.0  $\mu\text{R/h}$ , 410.0  $\mu\text{R/h}$ , 510.0  $\mu\text{R/h}$ , and 445.0  $\mu\text{R/h}$ .

36. What is the mean value of the scientists' data set, rounded to the nearest whole number?
- A. 3,280  $\mu\text{R/h}$   
B. 520  $\mu\text{R/h}$   
C. 475  $\mu\text{R/h}$   
D. 469  $\mu\text{R/h}$