Ch. 11 Energy and Motion Review

_C_____ **1.** Which of the following has kinetic energy?

a. a rock poised for a fall
b. an archer's bow that is drawn back
c. a rolling bowling ball
d. a car waiting at a red light

_C_____ **2.** A car starts from a stopped position at a red light. At the end of 30 seconds, its speed is 20 meters per second. What is the acceleration of the car?

a. 1.5 m/s
b. 0.7 m/s
c. 0.7 m/s^2
d. 1.5 m/s^2

_D_____ **3.** When you know both the speed and direction of an object's motion, you know the

a. average speed of the object.
b. instantaneous speed of the object.
c. distance the object has traveled.
d. velocity of the object.

_A_____ **4.** How would you calculate an object's mechanical energy?

a. Add its kinetic and potential energies.
b. Multiply its kinetic and potential energies.
c. Subtract its kinetic energy from its potential energy.
d. Subtract its potential energy from its kinetic energy.

_C_____ **5.** If a bicyclist travels 30 kilometers in two hours, her average speed is

a. 30 km/h.
b. 60 km/h.
c. 15 km/h.
d. 2 km/h.

_C_____ **6.** The steepness of a line on a graph is called the

a. rise.
b. run.
c. slope.
d. vertical axis.

_B_____ **7.** Potential energy that depends on height is called

a. kinetic energy.
b. gravitational potential energy.
c. elastic potential energy.
d. mechanical energy.

8. The law of _Conservation of energy_____ states that energy cannot be created or destroyed.

9. A large truck and a small car are moving at the same speed. The truck has greater kinetic energy because its _mass_____ is greater.

True or False

If the statement is true, write true. *If it is false, change the underlined word or words to make the statement true.*

_True_____ **10.** Motion is measured relative to a <u>reference point</u>.

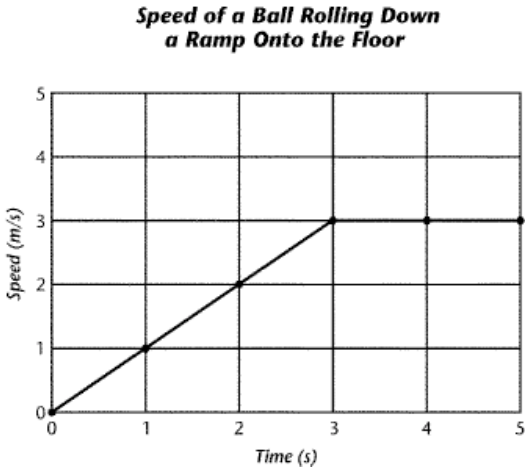
_True_____ **11.** A straight diagonal line on a <u>distance-versus-time</u> graph indicates constant speed.

_Direction___ **12.** A golf ball accelerates when either its speed or <u>distance</u> changes.

_Speed_____ **13.** If a toy car traveling at 10 cm/s passes a toy car moving at 10 cm/s in the opposite direction, both cars have the same <u>velocity</u>.

Using Science Skills

Use the figure below to answer the following questions in the spaces provided.



14. What is the acceleration of the ball between 0 and 3 seconds?

1 m/s^2 (3m/s + 0 m/s)/3 s = (3 m/s)/(3 s) = (1 m/s)/s = 1 m/s^2

OR Acceleration is position.

15. What happened to the speed of the ball during the final two seconds?

The ball's speed was constant; it did not change.

16. Does the graph indicate that the ball decelerated? Explain your answer.

No. Deceleration is a negative acceleration, which means an object slows down. According to the graph, the ball's velocity increased in the first three seconds and then remained the same for the next 2 seconds. It did not slow down. Deceleration would be indicated by a line that slopes downward.

Essay: *Write an answer for each of the following questions on a separate sheet of paper.*

17. Describe the energy of a bowling ball as it rolls toward and hits a bowling pin.

Answers may vary. As the ball rolls, it has some energy. In other words, it has the ability to do work and move the pin some distance. When it hits the bowling pin, it does work on the pin. During this process, some energy is transferred from the ball to the pin. After hitting the pin, the bowling ball has less energy than before, so it slows down.

18. Explain why a thrown football has both potential and kinetic energy. What is the combined energy called? Using Science Skills

The football has (gravitational) potential energy because of its position above the ground. It also has kinetic energy because it is moving. The combined energy is called mechanical energy.

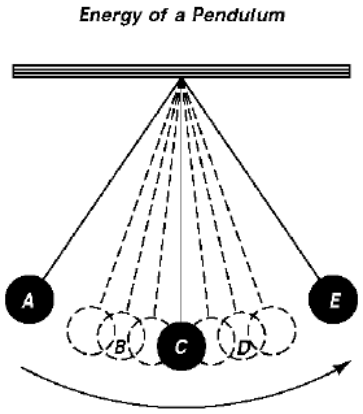
19. You are in a speedboat on a river moving in the same direction as the current. The speedometer on the boat shows that its speed is 20 km/h. However, a person on the shore measures the boat's speed as 23 km/h. How is this possible?

From the reference point of the river, the speed of the boat is 20 km/h. From the reference point of someone standing on the shore, the speed of the boat is the speed on the speedometer plus the downstream speed of the current.

20. Describe three ways you could change your velocity when riding a bicycle.

Answers will vary. Sample: Pedal faster to increase speed; apply brakes to slow down; turn handlebars to change direction.

Use the figure below to answer the following questions in the spaces provided.



21. Describe how the kinetic and potential energies of the pendulum are changing at position B. Is any energy being lost or gained?

The kinetic energy of the pendulum is increasing and the potential energy is decreasing. Potential energy is being converted to kinetic energy. No energy is lost or gained, only transformed.

22. Describe how the kinetic and potential energies of the pendulum are changing at position D. Is any energy being lost or gained?

The kinetic energy of the pendulum is decreasing and the potential energy is increasing. Kinetic energy is being converted to potential energy. No energy is lost or gained, only transformed.

23. If the pendulum is allowed to continue to swing, it will eventually come to a stop. Explain why.

As the pendulum swings back and forth, the pendulum encounters friction at the pivot of the string and from the air through which it moves. As a result of that friction, mechanical energy is converted to thermal energy. Eventually all the mechanical energy will be converted to thermal energy, so the pendulum will come to a stop.

Word Problems

KE= 1/2 m v^2

PE = mass x gravitational acceleration (9.8m/s^2) x height **OR** Weight X Height

Energy= joules
Weight= Newton
Mass= kilograms
Velocity= m/s
Gravitational acceleration= (9.8 m/s^2)

24. Determine the amount of potential energy of a 5.0-N book that is moved to three different shelves on a Bookcase. The height of each shelf is 1.0 m, 1.5 m, and 2.0 m.

PE = wt x ht
= (5N)(1m)
= 5J

PE = wt x ht
= (5N)(1.5m)
= 7.5J

PE = wt x ht
= (5N)(2m)
= 10J

25. You are on in-line skates at the top of a small hill. Your potential energy is equal to 1,000. J. The last time you checked, your mass was 60.0 kg.

a. What is your weight in newtons?

Mass x acceleration of gravity= wt in Newtons

(60kg)(9.8) = 588N

b. What is the height of the hill?

PE = wt x ht

$\frac{1000J}{588} = \frac{588N(h)}{588}$

1.7 meters = h

c. If you start rolling down this hill, your potential energy will be converted to kinetic energy. At the bottom of the hill, your kinetic energy will be equal to your potential energy at the top. Calculate your speed at the bottom of the hill. (Note: KE=PE)

$KE = 1/2mv^2$

$1000J = ½(60kg)\ v^2$

$\frac{1000}{30} = \frac{30v^2}{30}$

$\sqrt{33.33} = \sqrt{v^2}$

5.8 m/s = v

26. A 1.0-kg ball is thrown into the air with an initial velocity of 30. m/s.

a. How much kinetic energy does the ball have?

$KE = ½(1kg)(30m/s)^2$

KE = (.5)(900)

KE = 450J

b. How much potential energy does the ball have when it reaches the top of its ascent?

KE = PE, so 450J

c. How high into the air did the ball travel?

PE = mgh

$450J = (1kg)(9.8m/s^2)(h)$

$\frac{450}{9.8} = \frac{9.8h}{9.8}$

45.9 meters = h

27. What is the kinetic energy of a 2,000.-kg boat moving at 5.0 m/s?

$KE = ½mv^2$

$KE = ½(2000kg)(5m/s)^2$

KE = 1000(25)

KE = 25,000J

28. What is the velocity of a 500-kg elevator that has 4000 J of energy?

$KE = ½mv^2$

$4000J = ½(500kg)v^2$

$\frac{4000}{250} = \frac{250v^2}{250}$

$\sqrt{16} = \sqrt{v^2}$

4 m/s = v

29. What is the mass of an object traveling at 30 m/s if it has 33,750 J of energy?

$KE = \frac{1}{2}mv^2$

$33750J = \frac{1}{2}(m)(30\ m/s)^2$

$33750 = \frac{1}{2}(m)(900)$

$\frac{33750}{450} = \frac{450m}{450}$

$75kg = m$

30. A car is traveling with a velocity of 40 m/s and has a mass of 1120 kg. The car has _KINETIC_energy. Calculate it. $KE = \frac{1}{2}(m)v^2$

$KE = \frac{1}{2}(1120kg)(40m/s)^2$

$KE = (560)(1600)$

$KE = 896{,}000J$

31. A cinder block is sitting on a platform 20 m high. It weighs 79 N. The block has _POTENTIAL_ energy. Calculate it. PE = wt x ht

PE = (79N)(20m)

PE = 1580J

32. There is a bell at the top of a tower that is 45 m high. The bell weighs 190 N. The bell has _POTENTIAL_ energy. Calculate it. PE = wt x ht

PE = (190N)(45m)

PE = 8550J

33. What is the kinetic energy of a 3-kilogram ball that is rolling at 2 meters per second?

$KE = \frac{1}{2}(m)v^2$

$KE = \frac{1}{2}(3kg)(2m/s)^2$

$KE = 1.5(4)$

$KE = 6J$

34. The potential energy of an apple is 6.00 joules. The apple is 3.00-meters high. What is the mass of the apple? $PE = mgh$

$6J = (m)(9.8\ m/s^2)(3m)$

$\frac{6}{29.4} = \frac{29.4(m)}{29.4}$

$0.2kg = m$

35. Two objects were lifted by a machine. One object had a mass of 2 kilograms, and was lifted at a speed of 2 m/sec. The other had a mass of 4 kilograms and was lifted at a rate of 3 m/sec.

a. Which object had more kinetic energy while it was being lifted?

$KE = \frac{1}{2}(m)v^2$ $KE = \frac{1}{2}(m)v^2$

$KE = \frac{1}{2}(2kg)(2m/s)^2$ $KE = \frac{1}{2}(4kg)(3m/s)^2$

$KE = (1)(4)$ $KE = (2)(9)$

$KE = 4J$ $KE = 18J$

b. Which object had more potential energy when it was lifted to a distance of 10 meters? Show your calculation.

$PE = mgh$ $PE = mgh$

$PE = (2kg)(9.8m/s^2)(10m)$ $PE = (4kg)(9.8m/s^2)(10m)$

PE = 196J PE = 392J

36. What is the kinetic energy of a 1-kilogram ball is thrown into the air with an initial velocity of 30m/sec?
DUPLICATE W/ #26
a. How much potential energy does the ball have when it reaches the top of its ascent?
b. How high into the air did the ball travel? **KE=PE

37. What is the kinetic energy of a 2,000-kilogram boat moving at 5 m/sec?
DUPLICATE W/ #27

38. What is the velocity of a 500-kilogram elevator that has 4,000 joules of energy?
DUPLICATE W/ #28

39. What is the mass of an object that creates 33,750 joules of energy by traveling at 30 m/sec?
DUPLICATE W/ #29