

Objective 5 Energy

Describe the law of conservation of energy

Energy -- the ability to do work, which involves a change in movement. If an object or organism does work (exerting a force over a distance to move an object) it uses energy. Also if an object has work done on it, it gains energy.

One unit of energy is the Joule (J), the same as the unit of work. Because of the direct connection between work and energy both use the same units.

Five main forms of energy

mechanical, heat, chemical, electromagnetic, nuclear

- Mechanical energy -- energy associated with motion
- Heat energy -- the internal motion of particles of matter
- Chemical energy -- the energy that bonds atoms or ions together.
- Electromagnetic energy – moving electrical charges
- Examples: electricity, light, X-rays, radiowaves, laser light
- Nuclear energy – energy in the nucleus of the atom. Released during nuclear fission (splitting) or nuclear fusion (combining). Example: sun's energy

The five types of energy can exist in two states: kinetic or potential.

1. Kinetic energy -- energy that moving objects have due to their motion. Example – release a stretched rubber band

Kinetic energy depends on both mass and velocity. An increase in either will increase kinetic energy but velocity has a greater effect than mass.

Formula: for kinetic energy

$$\mathbf{K.E. = m \times v^2 / 2}$$

2. Potential energy – energy stored in an object due to its position. Examples – a stretched rubber band, a spring, a stretched bow string, a brick held above the ground
3. Gravitational Potential Energy -- energy that is dependent on height above the earth's surface.

Weight also determines the amount of G.P.E. that an object has. The greater the height or weight, the greater the G.P.E.

Formula for G.P.E. **G.P.E. = Weight x Height**

Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

____ 1. The kinetic energy of an object depends on which of the following?

- a mass and height
- b velocity and height
- c mass and acceleration
- d mass and velocity

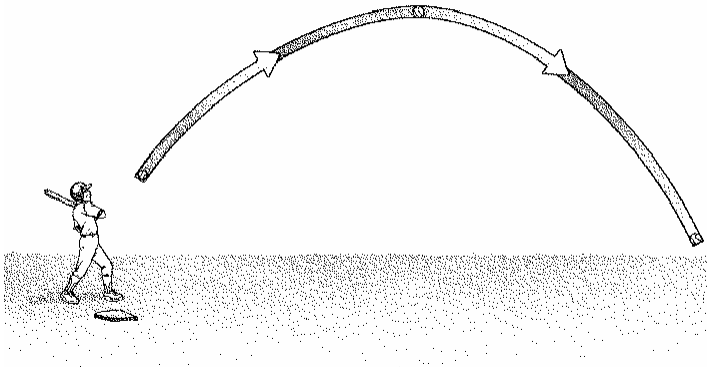
____ 2. A baseball is dropped from a height of 5 m. As the ball falls toward Earth, there is a decrease in its ____.

- a gravitational potential energy
- b mechanical energy
- c chemical potential energy
- d kinetic energy

____ 3. While at a picnic, you place a banana on the ground next to you. The banana has stored ____.

- a elastic potential energy
- b gravitational potential energy
- c chemical potential energy
- d mechanical energy

____ 4. A baseball batter hits a pop fly as shown in the illustration. Which of the following energy changes does NOT happen to the ball as it flies through the air?



- a its mechanical energy increases
- b its kinetic energy increases
- c its kinetic energy decreases
- d its gravitational potential energy increases

____ 5. A hockey puck gradually slows to a stop as it slides across an ice rink. Which of the following energy transformations occurs?

- a $KE \rightarrow$ chemical PE
- b $KE \rightarrow GPE$
- c $KE \rightarrow$ elastic PE
- d $KE \rightarrow$ thermal energy

_____ 6. A small amount of mass is transformed into energy when _____.

- a gasoline burns in a car engine
- .
- b a nuclear power plant produces electricity
- .
- c your body digests a candy bar
- .
- d an electric heater warms a room
- .

Table 1 Calories Used in 1 h			
Type of Activity	Body Frames		
	Small	Medium	Large
Sleeping	48	56	64
Sitting	72	84	96
Eating	84	98	112
Standing	96	112	123
Walking	180	210	240
Playing Tennis	380	420	460
Bicycling (fast)	500	600	700
Running	700	850	1,000

_____ 7. Luis has a medium body frame, and he walks for 30 minutes. How many Calories does he use during this time? Use the table above.

- a 47
- .
- b 105
- .
- c 210
- .
- d 630
- .

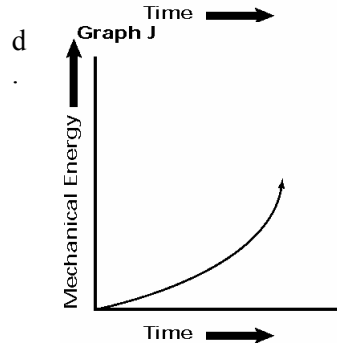
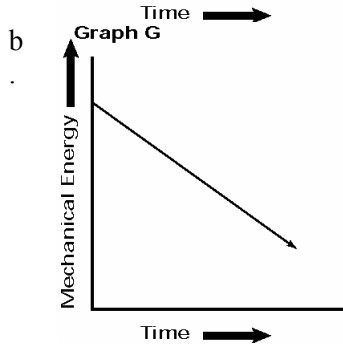
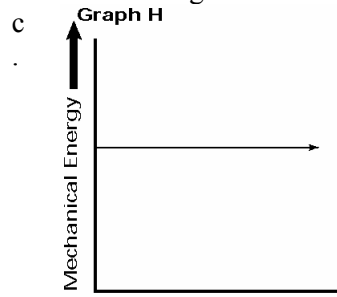
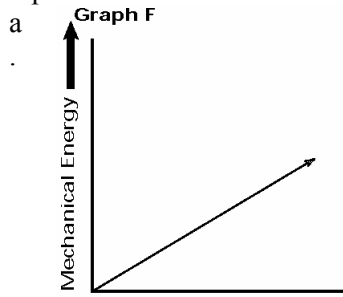
_____ 8. Chantal eats a burrito that contains 300 Calories. If Chantal has a small body frame, for how long would she have to bicycle at a fast pace to use up the Calories in the burrito? Use the table above.

- a 12 minutes
- .
- b 26 minutes
- .
- c 36 minutes
- .
- d 100 minutes
- .

_____ 9. A bowling ball rolls at a speed of 2.0 m/s and has kinetic energy of 12.0 J. What is the kinetic energy of the bowling ball when its speed is 1.0 m/s?

- a 3.0 J
- .
- b 6.0 J
- .
- c 12.0 J
- .
- d 24.0 J
- .

10. A stone is dropped from a bridge 10 m above a river. Which of the following graphs best represents the mechanical energy of the stone as it falls to a height of 5 m above the river?



11. What is the height of a 2.5-kg mass that has gravitational potential energy of 196 J?

a 4.6 m

c 9.8 m

b 8.0 m

d 78.4 m

12. As Joan slides down the slide at the local park, all of the following energy changes occur EXCEPT _____.

a $GPE \rightarrow$ thermal energy

c mechanical energy \rightarrow thermal energy

b $GPE \rightarrow KE$

d $GPE \rightarrow$ chemical PE

IPC6A
Answer Section

MULTIPLE CHOICE

- | | |
|-----|---|
| 1. | D |
| 2. | A |
| 3. | C |
| 4. | A |
| 5. | D |
| 6. | B |
| 7. | B |
| 8. | C |
| 9. | A |
| 10. | C |
| 11. | B |
| 12. | D |