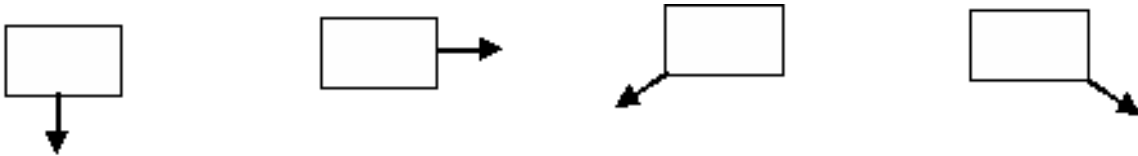


# ENERGY CONCEPTUAL/PRE-TEST QUESTIONS

1.) The gravitational force exerted by the earth on the moon holds the moon in an orbit around the earth. Let us assume that the orbit is perfectly circular. The work done by this gravitational force during a one week interval in which the moon moves through a displacement in its orbital path is

- a. negative.
- b. zero.
- c. positive.
- d. impossible to determine with the information given.

2.) The figure below shows four situations in which a force is applied to an object. In all four cases, the force has the same magnitude, and the displacement of the object is to the right and of the same magnitude. Rank the situations in order of the work done by the force on the object, from most positive to most negative.



- a. (iv) (ii) (iii) (i)
- b. (ii) (iv) (iii) (i)
- c. (i) (ii) (iv) (iii)
- d. (ii) (iv) (i) (iii)

3.) A dart is loaded into a spring-loaded toy dart gun by pushing the spring in by a distance  $d$ . For the next loading, the spring is compressed a distance  $2d$ . How much work is required to load the second dart compared to that required to load the first?

- a. two times as much
- b. the same
- c. four times as much
- d. one-fourth as much

4.) A dart is loaded into a spring-loaded toy dart gun by pushing the spring in by a distance  $d$ . For the next loading, the spring is compressed a distance  $2d$ . How

much faster does the second dart leave the gun compared with the first?

- a. two times as fast
- b. the same
- c. half as fast
- d. one fourth as fast

5.) You are traveling quickly along a freeway. Your car has kinetic energy. You suddenly skid to a stop because of congestion in traffic. Where is the kinetic energy that your car once had? (DON'T DO THIS PROBLEM!)

- a. All of it goes into internal energy in the road.
- b. All of it goes into internal energy in the tires.
- c. Some of it goes into internal energy of the road and some goes into internal energy of the tires.
- d. Some of it goes into internal energy of the road, some of it goes to internal energy of the tires, some of it goes to other internal energy, and some of it is transferred away by mechanical waves.

6.) An older model car accelerates from rest to speed  $v$  in 10 seconds. A newer, more powerful sports car accelerates from rest to speed  $2v$  in half the time (5 seconds). What is the ratio of the power of the newer car to that of the older car?

- a. 0.125
- b. 1.0
- c. 4.0
- d. 8.0

7.) You go out for a burger with some friends. At the restaurant the waiter serves you your burger on a plate. You pick up the burger with your hand and lift it to your mouth. This action requires about \_\_\_\_\_ of work.

- a. 0.1 joules
- b. 1 joule
- c. 10 joules
- d. 100 joules

8.) You go out for a burger with some friends, as in Problem 7. At the restaurant the waiter serves you your burger on a plate. You pick up the burger with your hand and lift it to your mouth. About how much power did you expend when you

lifted the burger to your mouth from the plate? (DON'T DO THIS PROBLEM!)

- a. 0.1 watts
- b. 1 watt
- c. 10 watts
- d. 100 watts

9.) Discuss whether any work is being done by each of the following agents and, if so, whether the work is positive or negative. (i) a chicken scratching on the ground (ii) a person studying physics (iii) a crane lifting a bucket of concrete (iv) the gravitational force on the bucket in (iii) (v) the leg muscles of a person in the act of sitting down. (DON'T DO THIS PROBLEM!)

- a. All of them do work. Positive work is done in cases (i), (ii), and (iii) and negative work is done in cases (iv) and (v).
- b. No work is done in case (ii). Positive work is done in cases (i) and (iii) and negative work is done in cases (iv) and (v).
- c. No work is done in cases (i) and (ii). Positive work is done in case (iii) and negative work is done in cases (iv) and (v).
- d. No work is done in cases (i) and (ii). Positive work is done in cases (iii) and (v) and negative work is done in case (iv).

10.) A certain uniform spring has a spring constant  $k$ . Now the spring is cut in half. What is the relationship between  $k$  and the spring constant  $k_{new}$  of each resulting smaller spring? (DON'T DO THIS PROBLEM!)

- a. Each half has  $k_{new} = k/2$ .
- b. Each half has  $k_{new} = 2k$ .
- c. Each half has the same  $k$  as the whole.
- d. Each half's new  $k$  is indeterminable.

11.) The gravitational potential energy of a system

- a. depends on the reference configuration for zero potential energy.
- b. is always positive.
- c. is always negative.
- d. is none of these.

12.) When we analyze situations that involve the kinetic and potential energies of falling objects, we identify the system as (DON'T DO THIS PROBLEM!)

- a. only the earth.
- b. only the falling object.
- c. both the earth and the falling object.
- d. none of these.

13.) Which of the following is (are) conserved in an isolated system? (DON'T DO THIS PROBLEM!)

- a. the kinetic energy alone
- b. the potential energy alone
- c. both the potential energy and the kinetic energy
- d. the sum of the kinetic energy and the potential energy

14.) A rock of mass  $m$  is dropped to the ground from a height  $h$ . A second rock, with mass  $3m$ , is dropped from the same height. When the second rock strikes the ground, its kinetic energy is:

- a. the same as that of the first rock.
- b. three times that of the first rock.
- c. six times that of the first rock.
- d. nine times that of the first rock.

15.) Three identical balls are thrown from the top of a building, all with the same initial speed. The first is thrown  $30^\circ$  above horizontal, the second horizontally, and the third  $45^\circ$  below horizontal. Rank their speeds from fastest to slowest when they hit the ground (and ignore air resistance).

- a. 1 3 2
- b. 1 2 3
- c. 3 2 1
- d. none of these

16.) A block of mass  $m$  is projected across a horizontal surface with an initial speed,  $v$ . It slides until it stops due to the friction force between the block and the surface. The same block is now projected across the horizontal surface with an initial speed  $2v$ . When the block has come to rest, how does the distance from the projection point compare to that in the first case?

- a. It is the same.
- b. It is twice as large.
- c. It is four times as large.
- d. It is none of these.

17.) A block of mass  $m$  is projected across a horizontal surface with an initial speed  $v$ . It slides until it stops due to the friction force between the block and the surface. The surface is now tilted at  $20^\circ$  and the block is projected up the surface with the same initial speed,  $v$ . Assume that the friction force remains the same as when the block was sliding on the horizontal surface. When the block comes to rest momentarily, how does its total mechanical energy compare to the case where the block slid horizontally comes to rest?

- a. It is the same.
- b. It is less in the case where the block went up the slope.
- c. It is more in the case where the block went up the slope.
- d. We cannot tell from the information given.

18.) Consider two slides, both of the same height. One is long and the other is short. From which slide will a child have a greater final speed when sliding off? Assume that there is no friction acting.

- a. The child on the longer slide will have a greater final speed.
- b. The child on the shorter slide will have a greater final speed.
- c. The final speed will be the same for the child on the longer slide as it is for the children on the shorter slide.
- d. We cannot tell from the information given.

19.) If 3 different conservative forces and one non-conservative force act within a system, how many potential energy terms appear in the energy equation that describes the system?

- a. 0
- b. 1
- c. 3
- d. 4

20.) You are working in a library, re-shelving books. You lift a book from the floor to the top shelf. The kinetic energy of the book on the floor was zero, and the kinetic energy of the book on the top shelf is zero, so there is no change in kinetic energy. Yet you did some work in lifting the book. Is the work-kinetic energy theorem violated?

- a. Yes, it is violated because a force acting on the book should change the book's kinetic energy.
- b. No, it is not violated because the book really does have a final velocity, but

so does the entire system, so it is impossible to detect the book's motion.

c. Yes, it is violated because a force that acts on the book should change the book's velocity.

d. No, it is not violated because there are two forces that act on the book. One is the downward force that the earth exerts on the book, which is counterbalanced by the upward force that you exert on the book. The total work done on the book, therefore, is zero, and is equal to its overall change in kinetic energy.

21.) A ball is thrown straight up in the air. At what position is its kinetic energy a maximum? At what position is the gravitational potential energy of the ball-earth system a maximum? Consider only the trip up.

a. The maximum kinetic energy occurs at the top of the ball's trajectory and the maximum gravitational potential energy occurs at the top of the ball's trajectory.

b. The maximum kinetic energy occurs at the point of release and the maximum gravitational potential energy occurs at the point of release.

c. The maximum kinetic energy occurs at the point of release and the maximum gravitational potential energy occurs at the top of the ball's trajectory.

d. The maximum kinetic energy occurs at the top of the ball's trajectory and the maximum gravitational potential energy occurs at the point of release.

22.) In the case of a force varying with position, what feature of the graph of force vs. position represents the work done during a displacement?

a. the maximum force times the maximum position

b. the beginning force times the total displacement

c. the area under the curve

d. nothing

Solutions: b, d, c, a, d, d, b, b, b, b, a, c, d, b, d, c, c, c, c, d, c, c