Name ______________________________ Class ______________ Date ____________

Assessment

Work and Energy

Section Quiz: Work

Write the letter of the correct answer in the space provided.

______ **1.** Which of the following sentences uses *work* in the scientific sense.
a. Stan goes to work on the bus.
b. Anne did work on the project for 5 hours.
c. Joseph found that holding the banner in place was hard work.
d. An engine does work on a car when the car is moving.

______ **2.** Work is done on an object
a. whenever a force acts on the object.
b. whenever a force is perpendicular to the displacement of the object.
c. whenever a force causes a displacement of the object.
d. whenever a net force acts on the object.

______ **3.** In which of the following cases is *no* work done?
a. A weightlifter lifts a barbell.
b. A weightlifter holds a barbell overhead.
c. A weightlifter slowly lowers a barbell.
d. A weightlifter drops a barbell and the barbell falls to the ground.

______ **4.** If the sign of work is negative,
a. the force is in the same direction as the displacement.
b. the force is perpendicular to the displacement.
c. the component of the force that does work is in the direction opposite the displacement.
d. the component of the force that does work is perpendicular to the displacement.

______ **5.** A painter lifts a bucket of paint, carries it 5 m horizontally, then sets it back down. Which of the following is true?
a. The force of gravity does negative work when the worker lifts the bucket.
b. The painter does positive work on the bucket when carrying it horizontally at constant speed.
c. The painter does positive work on the bucket when setting it down.
d. No net work is done on the bucket.

______ **6.** Which equation is used to calculate the work done on an object by a force at an angle, θ, to the displacement?
a. $W = Fd$
b. $W = Fd\cos\theta$
c. $W = Fd\sin\theta$
d. $W = mg\sin\theta$

Name ______________________ Class ______________ Date ______________

______ **7.** A joule is equivalent to a
a. N.
b. N•m.
c. N/m.
d. kg•m/s^2.

______ **8.** A parachutist falls at a constant speed for 200 m. Which of the following is true?
a. The force of gravity is the only force doing work on the parachutist.
b. Air resistance is the only force doing work on the parachutist.
c. No forces are doing work on the parachutist.
d. No net work is done on the parachutist.

9. A construction worker lifts a heavy cinder block 1 m off the ground, holds it in place for 3 s, then sets it back down in the same place. Describe the forces doing work on the block and the net work on the block throughout this action.

____

____

____

____

____

____

10. A child pulls a wagon 3.0 m using a force of 55 N at an angle 35° above horizontal. The force of friction on the wagon is 12 N. Calculate the net work done on the wagon.

5 Work and Energy

WORK

1. d
2. c
3. b
4. c
5. a
6. b
7. b
8. d
9. While lifting the block, the worker does positive work on the block while gravity does negative work on the block. The net work while lifting the block is positive. When the worker is holding the block, no forces do work on the block and no net work is done on the block. While lowering the block, the worker does positive work while gravity does negative work on the block. The net work on the block while it is lowered is negative. The total net work on the block is zero because the net displacement is zero.
10. 99 J

Given

$d = 3.0$ m

$F_{child} = 55$ N

$\theta = 35°$

$F_k = -12$ N

Solution

$W_{net} = F_{net}d = (F_{child}\cos\theta + F_k)d =$
$[(55 \text{ N})(\cos 35°) + (-12 \text{ N})](3.0 \text{ m})$
$= \boxed{99 \text{ J}}$

5 Work and Energy

ENERGY

1. a
2. c
3. d
4. c
5. b
6. b
7. d
8. c
9. The bocce ball has more kinetic energy. Kinetic energy depends on both mass and velocity. However, kinetic energy is more strongly dependent on velocity because the velocity term is squared in the equation for kinetic energy: $KE = (1/2)mv^2$.
10. $KE_i = 1.1 \times 10^5$ J; $KE_f = 8.5 \times 10^4$ J

Given

$m = 1.0 \times 10^3$ kg

$v_i = 15 \text{ m/s}^2$

$W_{net} = -25 \text{ kJ} = -2.5 \times 10^4$ J

Solution

$KE_i = \left(\frac{1}{2}\right)mv_i^2 = \left(\frac{1}{2}\right)(1.0 \times 10^3 \text{ kg})$
$(15 \text{ m/s})^2 = 1.1 \times 10^5 \text{ J}$

$W_{net} = \Delta KE = KE_f - KE_i$

$KE_f = KE_i + W_{net} = (1.1 \times 10^5 \text{ J}) +$
$(-2.5 \times 10^4 \text{ J}) = \boxed{8.5 \times 10^4 \text{ J}}$

5 Work and Energy

CONSERVATION OF ENERGY

1. d
2. c
3. d
4. a
5. d
6. b
7. d
8. c
9. When the ball is first thrown, the ball has some kinetic energy and some gravitational potential energy. As the ball rises, the kinetic energy is transferred to gravitational potential energy. At the peak, all the energy is potential energy. As the ball falls, the potential energy is transferred to kinetic energy. When the ball hits the ground, all the energy is kinetic energy. Mechanical energy is conserved throughout the flight of the ball.
10. 5.8 m/s

Given

$m = 5.7 \times 10^{-2}$ kg

$v_i = 2.0$ m/s

$h_i = 1.5$ m

$h_f = 0$ m

$g = 9.81 \text{ m/s}^2$

Solution

$ME_i = ME_f$

$\frac{1}{2}mv_i^2 + mgh_i = \frac{1}{2}mv_f^2 + mgh_f$

$$v_f^2 = \frac{2\left(\frac{1}{2}mv_i^2 + mgh_i - mgh_f\right)}{\text{m}}$$

$$v_f = \sqrt{2\left(\frac{1}{2}v_i^2 + gh_i - gh_f\right)}$$

$$v_f = \sqrt{2\left[\left(\frac{1}{2}\right)(2.0 \text{ m/s})^2 + (9.81 \text{ m/s}^2)(1.5 \text{ m}) - (9.81 \text{ m/s}^2)(0 \text{ m})\right]}$$

$v_f = \boxed{5.8 \text{ m/s}}$