Review 3 – momentum & impulse – energy, power, & work

**momentum & impulse**

1. What is the magnitude of the impulse applied on a 25.0-kg cart to cause a velocity change of 12.0 m/s?

2. A 8-kg cart is rolling in the positive direction at 2.5 m/s. What is the magnitude and direction of the momentum of the cart?

3. The momentum of an object changes. Tell whether each statement is **correct**, **maybe correct**, or **incorrect** about the object while the object’s momentum changed.

(a) An impulse was applied to the object. (c) The velocity of the object changed.

(b) The net force on the object was NOT zero. (d) The object accelerated.

4. Ball P has a mass of 2 kg and is moving in the positive direction at 10 m/s. Ball Q has a mass of 4 kg and is moving in the negative direction at 6 m/s. What is the total momentum of the two balls?

5. Ball A strikes ball B. Ball A experiences an impulse of +4 N●s. What impulse does ball B experience?

6. A ball has a momentum of 1.0 kilogram meter per second. What is the mass of the ball if the ball has a velocity of 2.0 meters per second?

7. What is the impact force on a 0.40-kg flashlight if it falls 2.5 meters and hits a concrete floor at 7.0 m/s, stopping in 0.10 seconds?

8. A 1,000-kg cannon fires a 10-kg projectile horizontally at a velocity of 300 m/s. What is the recoil velocity of the cannon?

9. A train car with a mass of 3.00 x 104 kg traveling north at 1.5 m/s collides and couples with a 3.20 x 104 kg train car going south at 0.80 m/s. What is the velocity of the coupled cars

after the collision?

For questions 10-13: A force of 15 N acts on a 3-kg object changing the velocity of the object

from +10 m/s to -2 m/s.

10. What was the change in velocity of the object?

11. What was the change in momentum of the object?

12. What impulse was applied to the object?

13. For how much time did the force act on the object?

**energy, power, & work**

For questions 1-2: A 15-kg object is 10 meters above the ground and moving

horizontally at 8 m/s.

1. How much gravitational potential energy does the object have?

2. How much kinetic energy does the object have?

3. Where does a swinging pendulum bob have

(a) maximum kinetic energy?

(b) maximum gravitational potential energy?

(c) zero kinetic energy?

(d) minimum gravitational potential energy?

For questions 4-5: A spring that is stretched 15 cm gains 45 joules of elastic potential energy.

4. What is the spring constant of the spring?

5. What force was needed to stretch the spring?

6. A 100-kg man and a 50-kg boy are jogging at the same speed. The kinetic energy of the man is *KE*. What is the kinetic energy of the boy?

A  B  C  D  E 

7. A 50-kg woman and a 50-kg girl are jogging. The girl is running twice as fast as the woman. The kinetic energy of the woman is *KE*. What is the kinetic energy of the girl?

A  B  C  D  E 

8. A motor pulls an object across a level surface at a constant 4 m/s. The power output of the motor is 200 W. What magnitude force does the motor exert on the object and is the surface frictionless?

9. A block slides from rest down a frictionless ramp reaching a speed of 3 m/s at the bottom of

the ramp. How high is the ramp?

For questions 10-11: A pump lifts 100 kg of water to a height of 25 meters is 40 seconds.

10. How much work did the pump do in lifting the water?

11. What was the power output of the pump?

For questions 12-13: A 3.0-kg mass slides down a 5.0-m long, 3.0-m high frictionless plane.

12. How much kinetic energy does the mass have at the bottom of the incline?

13. How much work must be done to stop the mass when it reaches the bottom of the incline?

14. A block of mass 2.0 kg slides with a velocity of 10. m/s on a frictionless surface. It hits a horizontal massless spring (spring constant of 500 N/m). How much is the spring compressed when the block stops?

15. A person driving a 2.0 x 103-kg car at 15 m/s fully applies the brakes 50 m from a stoplight. If the car stops 5.0 m before the light, what is the magnitude of the average force applied by the brakes?

16. A box is sliding across a surface. The box has 10 joules of kinetic energy. Friction slows the box to a stop. What happened to the 10 joules of energy?