ANS KEY

Momentum:

1. What is the change in momentum for a 50kg mass that goes from 8m/s to 2m/s?

$\Delta P = M\Delta V = M(V_2 - V_1) = 50kg(2m/s - 8m/s) = 50kg(-6m/s)$
$= -300 N \cdot s$ (means loss in momentum)

2. What is the impulse acting on the 50kg mass in question #1?

Impulse = $-300 N \cdot s$ because Δ in P is brought about by applying a force for a given time.

3. What is the impulse on a bullet fired from a gun compared to the impulse on the gun?

The impulse is the same for both, according to Newton's 3rd law

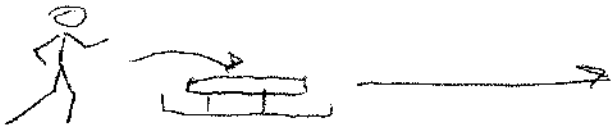
4. Two toy cars collide and stick together; what kind of collision is this? Explain.

This is an inelastic collision, meaning two units become a single entity.

5. Which will travel a greater distance, a bullet fired from a rifle or a bullet fired from a handgun? Why? (think about the barrels of each of these devices).

The rifle's bullet will travel farther because there is a greater impulse on the rifle's bullet, because the longer barrel increases the time over which the force acts.

6. You have a mass of 65kg and are running at 2.5 m/s. You jump onto a stationary sled that has a mass of 3.0kg. What is the velocity of you and the sled after you jump on it? (Assume you and the sled are on a flat, snowy, frictionless sidewalk.)



$x = 2.38 m/s$

$M_1V_1 + M_2V_2 = M_{1+2}V_3$

$65kg(2.5m/s) + (3kg)(0m/s) = 68kg(x\ m/s)$

$162.5 kgm/s = 68kg(x\ m/s)$

Energy, Work & Power

W=F x d **P=W/t** **$PE_g = ma_gh$** **$KE = ½ mv^2$** **$F_g = ma_g$** **746 Watts = 1 HP**

7. If you can carry one load of laundry up one flight of 3 stairs, then how much work do you do if you carry that same load up 9 flights of stairs?

a) nine times as much
b) three times as much
c) The same amount
d) One-third as much
e) One-sixth as much

8. How many joules of work are done on an object when a force of 10 N pushes it 5 m?

a) 500 J b) 100 J c) 50 J d) 2 J e) 0.5 J

9. In which of the following situations is no work done on a 500-gram beach ball?

a) Picking it up
b) Carrying it down the beach while not moving it up or down
c) Pushing it upwards onto a shelf
d) All of these are examples where no work is done
e) All of these are examples where work is done

10. How much work is done when you lift a 6.0 N weight 1.5-m above the ground?

a) 0 J b) 4.0 J c) 7.5 J d) 9.0 J e) none of these

11. What is your power when you do 100 J of work on an object in 2.0 seconds?

a) 200 W b) 100 W c) 50 W d) 2 W e) 0 W

12. Potential energy is the energy of an object due to its

a) Velocity
b) Location
c) Volume
d) Temperature
e) Density

13. The amount of potential energy possessed by an elevated object is equal to

a) The force needed to lift it
b) The distance it is lifted
c) The power used to lift it
d) The work done in lifting it
e) The value of the acceleration due to gravity

14. What is the kinetic energy of a 5.0 kg boulder pushed off a cliff 25.0 m high (on earth), right before it hits the ground? (Hint: Think about how potential energy relates to kinetic energy.)

a) 5 J b) 125 J c) 1225 J d) 49 J

15. As a pendulum swings back and forth, which of the following is true

a) Potential energy is transformed into kinetic energy
b) Kinetic energy is transformed into potential energy
c) At the lowest part of its swing, its energy is all kinetic
d) At the end points of its swing, its energy is all potential
e) All of the above are true

16. An arrow in a bow has 70 J of potential energy. Assuming no loss of energy due to heat, how much kinetic energy will the arrow have after it has been shot?

a) 0 J b) 35 J c) 50 J d) 70 J e) 140 J

17. A 10kg object moves at 3 m/s. Its kinetic energy is

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

$\frac{1}{2}(10kg)(3m/s)^2$

a) 45 J b)15 J c) 90 J d) 30 J e) 300 J

18. If it requires 3000J of work to lift Mr. D. up stairs that are 6m high, what is Mr. D's mass in kg?

a) 60 kg b) 500 kg c) 0.2 kg d) 50 kg e) 110 kg

$W = F \cdot d$

$3000J = F(6m)$

$F =$

19. Which of these is described as "the rate at which work is done"?

a) Potential Energy
b) Kinetic Energy
c) Power
d) Momentum
e) Work

$KE = \frac{1}{2}mv^2 = 250J = 2.5kg \times$

20. A 5kg ball is thrown so that it has a kinetic energy of 250J. What is the ball's speed?

a) 7.07 m/s b) 5 m/s c) 100 m/s d) 22 m/s e) 10 m/s

21. An object has a potential energy of 600J. If it is 30cm above the ground, what is its mass?

a) 200 kg b) 100 kg c) 2 kg d) 10 kg e) 2000 kg

0.3m

22. How much work is done when you lift a 15.0 kg weight 3.5 m above the ground?

$W = F \cdot d = 15kg(9.8m/s^2)(3.5m) = 514.5J$

23. What is your power when you do 300 J of work on an object in 3.0 seconds?

$P = \frac{W}{t} = \frac{300J}{3s} = 100W$

24. What is the kinetic energy of a 12 kg boulder pushed off a cliff 25.0 m high (on earth), right before it hits the ground? (Hint: Think about how potential energy relates to kinetic energy.)

$KE = PE = mgh = 12kg(9.8m/s^2)(25m) = 2,940J$

25. If a 2.5 kg ball is thrown so that it has a kinetic energy of 280 J, then what is the ball's speed?

$KE = \frac{1}{2}mv^2 = 280J = \frac{1}{2}(2.5kg)(v)^2$

$= \frac{280J}{1.25kg} = 224 = v^2$

$\frac{kg \cdot m^2/s^2}{kg}$

$v = \sqrt{224\ m^2/s^2} = 14.9\ m/s$

26. What is the highest a skateboarder can go if a 55 kg skateboarder is moving at 4.0 m/s before she starts up a ramp?

$PE = m(g)h$

$440J = 55kg(9.8\ m/s^2)(h)$

$440J = 539\ kg\ m/s^2(h)$

$= 81\ cm$

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

$= \frac{1}{2}(55kg)(4\ m/s)^2$

$= 27.5kg(16\ m^2/s^2)$

$= 440\ J$

27. Stacey Leigh raises 45 kg a distance of 220 centimeters in 2.5 seconds. How much *horsepower* does she display in this lift? (Recall, 1 HP=746 W and 100 cm = 1m).

$W = F \cdot d = 45kg(9.8\ m/s^2)(2.2m) = 970.2J$

$P = \frac{W}{t} = \frac{970.2J}{2.5s} = 388W$

$\left(\frac{388W}{1}\right)\left(\frac{1HP}{746W}\right) = 0.52HP$

28. The fourth floor of a house is ~~120 m~~ 8m above street level.

a. How much *work* is needed to move (lift) a 120 kg trunk to the fourth floor that is 8.0 meters above street level?

$W = F \cdot d = 120kg(9.8\ m/s^2)(8m) = 9,408J$

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b. How much *power* is necessary to move that same trunk to the fourth floor in 6.0 minutes? (Recall that one minute is equal to 60 seconds)

$P = \frac{W}{t} = \frac{9408J}{360s} = 26W$