Unit #5: Momentum and Energy Study Guide

1. Know your science vocabulary words: Momentum, law of conservation of momentum, elastic, inelastic, impulse, kinetic energy, potential energy, joule, power, work, watt, mechanical energy, and the law of conservation of energy.

2. Understand how to use each of the equations listed below:

$p = mv$ $\quad m = \frac{p}{v}$ $\quad v = \frac{p}{m}$ $\quad W = fd$ $\quad P = \frac{W}{t}$ $\quad KE = \frac{1}{2}mv^2$ $\quad PE = mgh$

$$(m_1v_1) + (m_2v_2) = (m_1v_1) + (m_2v_2)$$

3. What is the work done when 50 N is applied to move a box 10 m?

$W = F \cdot d \quad 50N \cdot 10m = \boxed{500J}$

4. What is the power in the problem above if it took 4s to move the box?

$P = \frac{W}{t} \quad \frac{500J}{4s} = \boxed{125W}$

5. What is the momentum of a 10 kg block of steel that falls from a truck at 5 m/s?

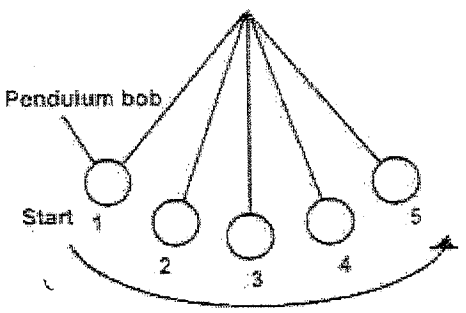
$p = mv \quad 10Kg \cdot 5m/s = \boxed{50Kg \cdot m/s}$

6. If a 1 kg vase is sitting on a shelf 1.5 m high, what is the potential energy of the vase? Assume the vase falls, what is the potential energy just as it strikes the ground? → $\boxed{0J}$

$PE = mgh \quad 1Kg \cdot 10m/s^2 \cdot 1.5m = \boxed{15J}$

7. A roller coaster has a mass of 400 kg and moves at a velocity of 20 m/s. What is the kinetic energy of the roller coaster? Where would the coaster have the greatest kinetic energy on a section of track, the top of a hill, the middle of its descent, or at the bottom of the hill?

$KE = \frac{1}{2}mv^2 \quad \frac{1}{2}(400Kg)(20m/s)^2 = \boxed{80,000J}$



8. In the swinging pendulum picture above, which number(s) represent where potential energy is greatest? Kinetic energy greatest? Where are potential and kinetic energy equal?

↓ 1+5 $\quad$ ↓ 3 $\quad$ ↓ 2+4

9. A 1 kg ball moving at 3 m/s hits a stationary ball with a mass of 2 kg. What speed does the more massive ball move away with?

THE 2kg BALL HAS TWICE THE MASS OF THE 1kg BALL. IT WILL MOVE AWAY AT A SPEED OF 1.5m/s OR HALF AS MUCH AS THE 1ST BALL.

10. A 2 kg object moving at 2 m/s hits a 2 kg object moving at 1 m/s in the same direction. Assuming both objects stick together after the collision, what speed do they move away at?

$m_1v_1 + m_2v_2 = (m_1+m_2)V$

$(2\cdot2) + (2\cdot1) = (2+2)V$

$4 + 2 = 4V$

$6 = 4V$

$\frac{6}{4} = \frac{4V}{4}$

$V = 1.5\,m/s$

11. What does the law of conservation of momentum state? What about the law of conservation of energy?

MOMENTUM: THE TOTAL MOMENTUM OF 2 OBJECTS BEFORE A COLLISION EQUALS THE TOTAL MOMENTUM OF THE 2 OBJECTS AFTER A COLLISION.

12. Are you doing work on an object if you lift it over your head? What about if you hold it stationary? What if you hold it level and walk down a hallway?

YES, NO, NO

ENERGY: ENERGY CAN'T BE CREATED OR DESTROYED ONLY CONVERTED TO OTHER FORMS.

13. D A moving train car runs into an identical train car at rest on the track. The cars couple together. Compared to the velocity of the first car before the collision, the velocity of the combined cars after the collision is

A. Twice as large
B. The same
C. Zero
D. Half as much

14. Rank the following objects in order from greatest momentum to least momentum: A fast moving car, a school, a person walking, a ping pong ball rolling slowly across the floor

FAST MOVING CAR → PERSON WALKING → PING PONG BALL MOVING SLOWLY → SCHOOL

15. A An object that has kinetic energy must have

A. Momentum
B. Acceleration
C. A force applied to maintain it
D. None of the above