Ch #11 – "Forces: Newtons's 3 Laws of Motion" Test

Vocabulary: Select the term that <u>best</u> matches each of the definitions below. Place the correct letter in the blank on your answer sheet. (1pt each)

1. Forces occur in pairs….for every action force there is an equal and opposite reaction force.
2. The S.I. unit representing any force acting on an object.
3. Inertia in motion!... This is a quantity representing the product of mass and velocity of an object.
4. The tendency of an object to resist being moved, changing speed of both.
5. The total amount of momentum in an isolated system is conserved – the momentum before an event equals total momentum after an event.
6. A push or pull
7. An object at rest <u>or</u> in motion will maintain that state unless acted on by an outside force.
8. A change in momentum – usually involving a change in time to increase or decrease the force of impact.
9. An object acted on by unbalanced forces will accelerate in the direction of the net force.
10. A property that dictates the amount of inertia an object has
11. The change in position over time.
12. The overall force acting on an object when all forces are combined.
13. Any force keeping an object moving in a circle.

A. Centripetal Force
B. Conservation of Momentum
C. Force
D. Impulse
E. Inertia
F. Mass
G. Momentum
H. Motion
I. Net Force
J. Newton
K. Newton's 1st Law
L. Newton's 2nd Law
M. Newton's 3rd Law

Multiple Choice: Select the ONE <u>best</u> answer for each statement below and write the letter in the blank on your answer sheet. (1pt each)

1. Which statement illustrates Newton's 1st Law?
    a. A stone will not move unless something pushes or pulls it.
    b. A ball rolling across the floor eventually slows down.
    c. As a car comes to a stop, the passengers continue to move forward.
    d. All of the above.
2. Which object has the <u>greater</u> **inertia?**
    a. A tennis ball
    b. A bowling ball
    c. A beach ball
    d. A volleyball

3. What force causes a skater sliding on the ice to gradually slow down?
    a. A balanced force
    b. Inertia
    c. Friction
    d. Acceleration
4. One **Newton** is a unit that measures _____and is equivalent to _____.
    a. Acceleration; m/s^2
    b. Density; kg/L
    c. Force; $kg \bullet m/s^2$
    d. Momentum; $kg \bullet m/s$
5. If the <u>same</u> force is applied to 2 cars and car **A** has a greater mass than car **B**, which car will have the greater acceleration? (a Newton's 2nd Law application)
    a. Car **A**
    b. Car **B**
    c. Both will accelerate at the same rate
    d. Too little information to tell
6. Which of the following statements about **action-reaction** forces is <u>incorrect</u>?
    a. They act on the same object
    b. They always occur in pairs
    c. They act on different objects
    d. They are equal and opposite
7. An object's **momentum** is determined by the object's
    a. Weight and Velocity
    b. Mass and Acceleration
    c. Mass and Velocity
    d. Weight and Acceleration
8. Which of the following has the <u>least</u> amount of **momentum**?
    a. A newspaper lying on the table
    b. A plane flying overhead
    c. A leaf falling on the ground
    d. A ball rolling across the floor
9. When a moving bowling ball hits a pin, some of the ball's momentum
    a. Doubles in force
    b. Increases pin's mass
    c. Is transferred to the pin
    d. Is completely lost
10. How does the total **momentum** of 2 objects <u>before</u> a collision compare with the total **momentum** <u>after </u>the collision?
    a. It is the same
    b. It is less
    c. It is equal to zero
    d. It is greater

11. What is the **reaction** force when you place a 1 N apple on the table?
   a. The downward force of the apple on the table
   b. The upward force of the table on the apple
   c. The force of gravity on the table
   d. The force of gravity on the apple

Fill in the Blanks: Fill in the blanks on your answer sheet with the appropriate one of Newton's 3 Laws; **1st Law, 2nd Law, 3rd Law. (1pt each)**

1. This is Newton's "**Action-Reaction**" law
2. This law can be expressed in short form as $\mathbf{a = F_{net}/m}$
3. This is Newton's law of "**Inertia**"
4. This law is all about unbalanced forces and "change"
5. The illustration on the right is an example of this law (Hammer & Nail)
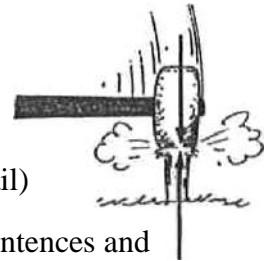
Constructed Responses: Discuss the following situations using complete sentences and thoroughly expressing your ideas.

1. Explain why seat belts are a necessary safety feature in a motor vehicle. Which of Newton's Laws does this apply to? (2pts)
2. Explain what would happen to a person who was not wearing their seat belt and was flown through the windshield and hit the pavement due to a collision in reference to Newton's Laws. (2pts)
3. Compare and contrast balanced and unbalance forces. Discuss how each impacts motion. (3pts)

Math Application: Solve the following math problems associated with the concepts of Newton's Laws of Motion. Please, show all work, round your answers to the nearest tenth. Don't forget UNITS!

1. What is the unbalanced force needed to give a **976 kg** vehicle an acceleration of **25 m/s^2?**

2. A force of **240.0 N** causes an object to accelerate at **3.2 m/s^2.** What is the mass of the object?

3. A **0.25 kg** steel ball experiences a net force of **1.15 N** as it rolls down a ramp. What is the acceleration of the ball?

4. Calculate the velocity of a **90.5 kg** man running south with a momentum of **389 kg● m/s.**
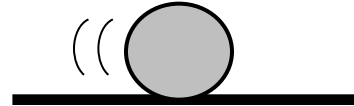
Extra Credit: The largest hummingbird, *Patagonia gigas*, can fly with a speed of up to **50.0 km/hr.** If this bird flies with a momentum of **2.78 x 10^{-1} kg m/s,** what is the mass of the bird?

Draw the force body diagram for the following situations. (1pt each)
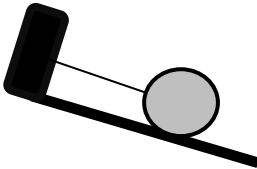
1. A ball is sliding at
    constant speed on a
    frictionless surface.
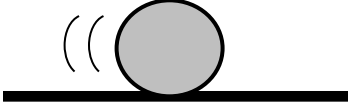
2. A ball is slowing down
   and will come to a stop.

3. A ball is tied to a string
    on a hill.

Extra Credit: A **6 kg** fish swimming at **4 m/s** encounters an absent minded **1.5 kg** fish at rest and swallows it! What is the speed of the larger fish after he had his lunch?