Name: ____ Block: ____________

PHYSICS: UNIT 4
Momentum, Impulse, and Collisions

Part 1: Fill in the blank with the vocabulary about momentum.

Collide	**Decrease**	**Elastic**	**Inertia**	**Stop**
Collision	**Direction**	**Increase**	**Magnitude**	**Velocity**
Conservation	**Distance**	**Inelastic**	**Mass**	

Momentum is characterized as the _____________________ of a moving object. Momentum is calculated as ____________________ multiplied by ___________________. Just like velocity, momentum is a vector because it has a ___________________ and a ____________________. Momentum is proportional to both the mass and the velocity. If the object's velocity gets faster, then momentum will ___________________. If the object's velocity gets slower, the momentum will ___________________. It takes a very large force to _______________________ an object that is moving with a very large momentum, such as when a football player tackles another running football player as he runs down the football field. Very massive, fast moving objects like trains and big trucks need a very long ______________________ to slow down and stop.

According to the law of ___________________ of momentum, in a closed system, the sum of momentum of all objects before they interact must equal the sum of momentums of all objects after they interact. In other words, when objects _________________ with each other, the total momentum before the _________________ must equal the total momentum after the collision. __________________ collisions are considered to be perfect collisions because no momentum and kinetic energy is lost or gained during the collision. Conversely, ___________________ collisions are considered to be imperfect because kinetic energy is lost because of damage to the colliding objects, or by friction, or when colliding objects conjoin.

Part 2: Calculate momentum, mass, or velocity. $p = m \cdot v$

____________________ Jerry has a mass of 80 kg. He runs with a velocity of 4.0 m/s. Calculate Jerry's momentum.

____________________ The car has a mass of 600 kg. The car moves with a velocity of 22 m/s. Calculate the momentum of the car.

____________________ The car has a mass of 500 kg. The car moves with a momentum of -13,500 $kg\ ^{m}\!/_{s}$. Calculate the velocity of the car.

____________________ The motorcycle has a mass of 220 kg. The motorcycle moves with a momentum of -14,000 $kg\ ^{m}\!/_{s}$. Calculate the velocity of the motorcycle.

____________________ A train moves with a momentum of 250,000,000 $kg\ ^{m}\!/_{s}$. The train's velocity is 25 m/s. Calculate the train's mass.

____________________ Annette runs with a momentum of 360 $kg\ ^{m}\!/_{s}$. Annette's running velocity is 6.0 m/s. Calculate Annette's mass.

Part 3. MOMENTUM and KINETIC ENERGY. The following problems involve momentum and translational kinetic energy (KE). Calculate the momentum and the KE.

1. A toy airplane flies at a velocity of 20 m/s. The mass of the airplane is 1.2 kg. Calculate the airplane's momentum and translational KE.

2. A car travels on the freeway at a velocity of 15 m/s. The mass of the car is 650 kg. Calculate the car's momentum and translational KE.

3. Suzanne rides her bicycle. The combined mass of Suzanne and her bicycle is 57 kg. Suzanne's velocity is 2.0 m/s. Calculate Suzanne's momentum and translational KE.

Part 4. IMPULSE. Read the problems carefully. Calculate the impulse, contact time, applied force, or the acceleration affecting the object.

A car gets faster with time. In 30 seconds, the car's velocity changed from 10 m/s to 25 m/s. The car's mass is 500 kg. Calculate the car's initial momentum, final momentum, acceleration, impulse, and the applied force of the car's engine.

p_0 = ____________________

p_f = ____________________

a = ____________________

J =Δp = ____________________

F = ____________________

A tennis ball traveled with an initial velocity of -25 m/s. The tennis player hit it with the racquet. The ball changed direction after the impact and moved with a new velocity of 35 m/s. The contact time between the racquet and the ball was 0.25 seconds. The mass of the ball is 0.10 kg

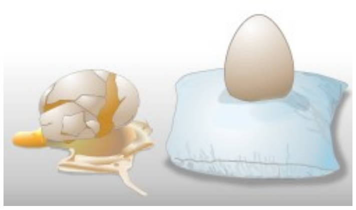
p_0 = ____________________

p_f = ____________________

a = ____________________

J =Δp = ____________________

F = ____________________



A 0.080 kg egg was dropped from the top of a house onto the sidewalk below. The velocity of the egg at the instant of impact with the sidewalk was -30 m/s. It came to a stop in 0.04 seconds. (The egg shattered)

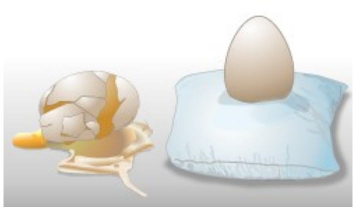
p_0 = ____________________

p_f = ____________________

a = ____________________

J =Δp = ____________________

F = ____________________



A 0.080 kg egg was dropped from the top of a house onto the sidewalk below. It landed in a well-cushioned pillow. The velocity of the egg at the instant of impact into the pillow was -30 m/s. It came to a stop in 0.75 seconds. (The egg did not shatter)

p_0 = ____________________

p_f = ____________________

a = ____________________

J =Δp = ____________________

F = ____________________

Part 5: TRUE OR FALSE. On the line, print the word TRUE or FALSE to correctly answer the question. Any answers of T or F will be ignored.

____________ The bigger the mass of the object, the more momentum attributed to the object.

____________ The bigger the mass of the object, the lesser the momentum attributed to the object.

____________ The faster the object moves, the more inertia the object has.

____________ The bigger the mass, the more inertia the object has.

____________ If an object is motionless, it does not have a velocity.

____________ The greater the momentum, the more force needed to stop the moving object.

____________ The greater the momentum, the more force needed to change the object's direction.

____________ When two objects collide and damage occurs to the objects, the sum of momentums before the collision is greater than the sums of momentums after the collision.

____________ When two objects collide and damage occurs to the objects, the sum of momentums before the collision is less than the sums of momentums after the collision.

____________ When two objects collide and damage occurs to the objects, the sum of momentums before the collision is equal to the sums of momentums after the collision.

____________ If two objects of equal mass collide, and the collision is perfect, the velocity of the faster moving object before the collision is slower moving after the collision.

____________ If two objects of equal mass collide, and the collision is perfect, the objects will exchange velocities after the collision.

____________ During an elastic collision, the total momentum before the collision equals the total momentum after the collision.

____________ During an inelastic collision, the total momentum before the collision equals the total momentum after the collision.

____________ During an elastic collision, the total kinetic energy of the objects before the collision equals the total kinetic energy of the objects after the collision.

____________ During an inelastic collision, the total kinetic energy of the objects before the collision equals the total kinetic energy of the objects after the collision.

____________ Impulse is the sudden change in momentum.

____________ An object does not accelerate when impulse occurs.

____________ The longer the contact time, the stronger the force causing the impulse.