Physics 100

Momentum and Impulse Review

**Provide the following formulas**

1.KE = 2. PE = 3. p = 4. Δp =

5. General formula for average velocity… v =

6. Average velocity of an object accelerating at a constant rate to some final velocity… v =

**Short Answer:**

7. Provide a definition of momentum.

8. State the law of conservation of momentum.

9. What are the units for momentum?

10. What is the symbol for momentum?

11. Define impulse.

12. What are the units for impulse?

**Problems:**

13. A 7kg object has a velocity of -4m/s. What is its momentum?

14. 0.65kg basketball is moving with a velocity of 3m/s. It collides with a stationary 0.05kg tennis ball, transferring half of its momentum to the tennis ball.

1. What is the basketball’s velocity after the collision?
2. What is the tennis ball’s velocity after the collision?

15. An impulse of 6kgm/s is applied to a mouse. What is the mouse’s change in momentum?

16. A 1,000kg car accelerates from 20m/s to 50m/s.

1. What is the car’s Δp?
2. If this acceleration takes place over a 30 second time period, what force is being applied?

17. Starting from rest, a 200kg motorcycle accelerates over a distance of 100m during this acceleration. At the 100m mark, the motorcycle passes between two photogates that are 1 meter apart. It takes the motorcycle 0.033 seconds to pass through the gates. Just after passing through the photogates, the motorcycle crashes into a series of cardboard boxes. The cardboard boxes bring the motorcycle to a stop over a distance of 30m.

a. What is the motorcycle’s velocity as it passes through the photogates?

b. What is the motorcycle’s Δp during its **acceleration** period?

c. What is the motorcycle’s Δp during its **deceleration** period?

d. What is the motorcycle’s average velocity during its acceleration period?

e. What is the motorcycle’s average velocity during its deceleration period?

f. How much time did the motorcycle spend accelerating?

g. How much time did the motorcycle spend decelerating?

h. What force caused the motorcycle’s acceleration?

i. What force caused the motorcycle’s deceleration?

18. a. Explain the difference between an *elastic* collision and an *inelastic* collision.

b. Is the collision that occurs when a projectile hits a ballistic pendulum elastic or inelastic? How can you tell?

19. Car A has a velocity of -10m/s and a mass of 500kg. Car B has a mass of 800kg and a velocity of 6m/s. If the two cars collide and stick together, what is their shared velocity after the collision?

20. Suppose a 3kg steel sphere is moving with a velocity of 4m/s. The steel sphere strikes a second stationary sphere with a mass of 2kg and a velocity of 2m/s. After the collision, the 3kg sphere has a velocity of 3m/s.

1. What is the net momentum of this system before the collision?
2. What is the net momentum of this system after the collision?
3. What is the velocity of the 2kg steel sphere, after the collision?

21. A 2kg projectile is fired into an 8kg ballistic pendulum that swings to a height of 3m after the impact.

a. What is the total potential energy of the projectile + pendulum at the top of their swing?

b. What is the total kinetic energy of the projectile + pendulum at the moment that they begin their swing?

c. What is the shared velocity of the projectile + pendulum at the moment that they begin their swing?

d. What is the shared momentum of the projectile + pendulum at the moment that they begin their swing?

e. What was the momentum of the projectile before it hit the pendulum?

f. What was the velocity of the projectile before it hit the pendulum?

Bonus: Was the collision in problem # \*\* elastic or inelastic. Prove your answer numerically.