Chapter 4 Extra Credit

Name: _____ Date: _____

Directions: Show all work on a separate sheet of paper. Include formulas, substitutions, and units. Answers without work may receive reduced credit.

Part I — Momentum

Use: $p = mv$

1. A 1,200-kg car travels at 22 m/s. What is its momentum?
2. A 6.0-kg bowling ball has a momentum of 42 kg·m/s. How fast is it moving?
3. A beach ball travels at 0.80 m/s and has a momentum of 0.40 kg·m/s. What is its mass?
4. A 2,500-kg truck travels at 18 m/s. Find its momentum.
5. A baseball has a mass of 0.145 kg and travels at 38 m/s. What is its momentum?

Part II — Impulse

Use: $Ft = \Delta p$

6. A 12-kg cart speeds up from 2.0 m/s to 8.0 m/s when a force of 72 N is applied. How long was the force applied?
7. A 4.0-kg ball accelerates from rest to 15 m/s. What is the ball's change in momentum?
8. A 0.50-kg soccer ball is kicked with a force of 60 N for 0.15 s. What is the impulse delivered to the ball?
9. A 1,500-kg car experiences a braking force of 9,000 N for 4.0 seconds. Find the impulse.

10. A 70-kg skateboarder traveling 5.0 m/s comes to a stop in 0.50 s. What average stopping force acts on the skateboarder?

Part III — Work

Use: $$W = Fd$$

11. A 45-N box is lifted 2.0 m.b How much work is done?
12. A person pushes a sled with a force of 180 N for 25 m. How much work is done?
13. A crane performs 24,000 J of work while lifting an object 15 m. What force did the crane apply?
14. You perform 360 J of work lifting a backpack that weighs 90 N. How high was the backpack lifted?
15. A 500-N piano is carried 20 m across a level floor. How much work is done by the person on the piano in the direction of motion?

Part IV — Potential & Kinetic Energy

Use: $$PE = mgh$$

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

16. A 4.0-kg backpack sits on a shelf 2.5 m above the floor. Find its potential energy.
17. A 60-kg runner moves at 4.0 m/s. Find the runner's kinetic energy.
18. A 0.50-kg baseball has 225 J of kinetic energy. What is its speed?
19. A 75-N flowerpot rests on a ledge 3.2 m above the ground. Find its potential energy.
20. A 1,500-kg car travels at 18 m/s. Calculate its kinetic energy.

Part V — Conservation of Energy

Assume no energy is lost to friction.

21. A 2.0-kg ball is thrown upward with 98 J of kinetic energy. How high will it rise?
22. A 400-kg roller coaster starts from rest at the top of a 45-m hill. What is its speed at the bottom?
23. A 3.0-kg toy car moves at 6.0 m/s before rolling up a ramp. How high does it travel before stopping?
24. A 2.5-kg rock falls from a cliff. It strikes the ground traveling 28 m/s. How high was the cliff?
25. A 5.0-kg object is 12 m above the ground. How much potential energy does it have?

Part VI — Collisions & Conservation of Momentum

Assume all collisions are perfectly inelastic unless otherwise stated.

26. A 1,000-kg car moving 12 m/s collides with a 500-kg car at rest. They stick together. Find their final velocity.
27. A 0.20-kg ball moving 15 m/s strikes a 0.40-kg ball at rest. They stick together. Find their final velocity.
28. A 70-kg football player runs at 6.0 m/s and collides with a 90-kg player standing still. They remain together. Find their velocity immediately after the collision.
29. A 2,000-kg railroad car moving 4.0 m/s east couples with a 3,000-kg railroad car at rest. Find their final velocity.
30. A 0.080-kg hockey puck moving 20 m/s strikes and sticks to a 0.120-kg puck at rest. Find their final speed.

Part VII — Rate of Change of Momentum

Use: $$F = \frac{\Delta p}{\Delta t}$$

31. A 900-kg car traveling 18 m/s comes to a stop in 3.0 s. Find the average braking force.
32. A 0.16-kg baseball moving 35 m/s is caught in 0.020 s. Find the average force on the ball.
33. Water exits a hose at 4.0 kg/s with a speed of 40 m/s. Find the force exerted on the hose.
34. A 1,200-kg wrecking ball moving 3.0 m/s stops in 0.020 s. Find the average stopping force.
35. A 0.050-kg egg moving 9.0 m/s stops in 0.40 s on a pillow. Find the average stopping force.