Chapter 3 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 — Mass vs. Weight

1. What is the weight (in pounds) of a 9.0-kg backpack on Earth's surface?
2. What is the weight of the same 9.0-kg backpack on the Moon? *(Use 0.37 lb/kg on the Moon.)*
3. If an astronaut carries the backpack from Earth to the Moon, what is its mass on the Moon?
4. Would a balance scale give the same mass reading on Earth and on the Moon? Explain why or why not.
5. A bathroom scale reads your weight, not your mass. Explain why astronauts appear weightless while orbiting Earth even though Earth's gravity is still acting on them.

Part II — Net Force & Newton's First Law

6. A shopping cart is pushed with a force of 45 N. Friction opposes the motion with a force of 45 N. What is the net force on the cart?
7. Using Question 6, describe the cart's motion according to Newton's First Law.
8. A shopper pushes with 50 N, but friction decreases to 20 N after the cart rolls onto a slippery floor. What is the net force?
9. Why is it easier to push one empty shopping cart than twenty nested shopping carts?
10. A cart weighs 150 N while sitting on a level floor. What is the normal force acting on the cart?

Part III — Newton's Second Law

Use: $$F = ma$$

11. A 2,000-kg truck experiences a force of 4,200 N. Find its acceleration.
12. A 0.50-kg soccer ball is kicked with a force of 30 N. Find its acceleration.
13. How much force is needed to accelerate a 72-kg skier at 1.5 m/s²?
14. An object requires a force of 48 N to accelerate at 6.0 m/s². Find its mass.
15. A 7.5-kg sled accelerates at 2.8 m/s². Find the net force acting on the sled.

Part IV — Mass, Weight & Gravity

Use: $$W = mg$$

16. A textbook has a mass of 3.0 kg. What is its weight on Earth? *(Use (g = 9.8\ \text{N/kg}).)*
17. What would the same textbook weigh on Mars? *(Use (g = 3.7\ \text{N/kg}).)*
18. An astronaut weighs 128 N on the Moon where (g = 1.6\ \text{N/kg}). Find the astronaut's mass.
19. A 0.75-kg football weighs 17.3 N on Jupiter. Find Jupiter's gravitational field strength.
20. A truck weighs 22,000 pounds. Convert its weight into newtons. *(Use (1\ \text{lb}=4.448\ \text{N}).)*

Part V — Acceleration Due to Gravity

Use: $v = v_0 + gt$ $y = \frac{1}{2}gt^2$

Take $g = -9.8\ \mathrm{m/s^2}$ for downward motion.

21. A penny is dropped into a well. How fast is it moving after 2.0 seconds?
22. A baseball is thrown straight upward at 30.0 m/s. What is its velocity after 2.0 seconds?
23. A stone falls freely for 5.0 seconds. How deep is the mine shaft?
24. A water balloon is dropped from a rooftop. How far does it fall in 1.5 seconds?
25. How long would it take an object in free fall to reach a speed of 49 m/s downward?