**Unit II Problem Solving Worksheet**

This assignment will allow you to demonstrate the following objectives:

* Illustrate the scientific method within everyday situations.
* Identify the appropriate formulas necessary to solve specific scenario questions.
* Calculate and analyze the acceleration and the force in various situations.
* Explain Newton's laws of motion at work in common phenomena.
* Solve problems using mass and weight.
* Explore the relationship between the first and second laws.
* Identify action-reaction pairs in the third law.

**Instructions:** Choose 10 of the 12 problems below. Show your work. Answer the questions directly in this template.

1. James operates an airplane that departs from JFK Airport with a constant net force of 40,000 N. The mass of James is 80 kg and the plane’s mass is 30,000 kg. What is the net force that acts on James?

2. Susan pushes her dad, David, on an ice rink with a force of 30 N. She weighs 45 kg and her dad weighs 100 kg. What are the accelerations of Susan and David?

3. Alice holds a black belt in Taekwondo and her fist has a mass of 0.5 kg. Her fist obtains a velocity of 5 m/s in 0.1 seconds from rest. Evaluate the average net force applied to the fist.

4. A lunar exploration vehicle was created by a research team. It weighs 3,000 kg on the earth. It needs an acceleration of 10 m/s2 on the moon. In order to have the same acceleration, what will be the net force acting on the vehicle on the earth?

5. Three people are pushing a 500 kg of box in the same direction. Applied forces are 30 N, 20 N, and 10 N respectively. If the acceleration of the box is 0.02 m/s2, what is the magnitude of a force created by friction?

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20 N

30 N

88

10 N

6. You drive a 6,000 kg boat due north, while the wind exerts a force of 600 N due south and the water exerts a resistive force of 1,200 N due south. The generated force by the boat’s engines is 4,200 N. Find the magnitude and direction of the boat’s acceleration.

7. A machine accelerates a 5 kg missile from rest to a speed of 5 km/s. The net force accelerating the missile 500,000 N. How long does it take to arrive at the speed of 5 km/s?

8. Peter found an amazing fact in an amusement park when he tried to ride the Magic Mountain Superman. Powerful magnets accelerate a car and its riders from zero to 45 m/s in 7 seconds. Suppose the mass of the car and riders is 5,600 kg. What is the average net force exerted on the car and riders by the magnets?

9. Two forces of 10 N and 30 N are applied to a 10 kg box. Find (1) the box’s acceleration when both forces point due east and (2) the box’s acceleration when 10 N force points due east and 30 N force points due west.

10. When a 60 g (=0.06 kg) tennis ball is served by a newly invented machine, it accelerates from zero to 50 m/s. The ball experiences a constant acceleration due to the impact with the racket over a distance of 0.5 m. What is the net force acting on the ball? Use the relation among acceleration, distance, and velocity: a=v2/2d, where v is the velocity change, d is the traveled distance, and a is the acceleration.

11. Cole is riding a sled with initial speed of 5 m/s from west to east. The frictional force of 50 N exists due west. The mass of the sled and Cole together is 100 kg. How far does the sled go before stopping? Use the relation among acceleration, distance and velocity: a=v2/2d, where v is the velocity change, d is the traveled distance, and a is the acceleration.

12. A 1,600 kg car is traveling with a speed of 20 m/s. Find the net force that is required to bring the car to a halt in a distance of 50m. Use the relation among acceleration, distance, and velocity: a=v2/2d, where v is the velocity change, d is the traveled distance, and a is the acceleration.