Force Practice Calculations

1. An unbalanced force of 48 N west is applied to a 4 kg cart. Calculate the cart's acceleration.

2. A 2200 kg car travelling at 25 m/s south comes to a stop in 10 s. Calculate the following:
    a. What is the car's acceleration?

    b. What is the unbalanced force required to cause that acceleration?

3. A particular pressure on the accelerator of a 4-wheel drive van with a mass of 2000 kg, travelling along a smooth, level road supplies sufficient force from the engine to accelerate the van at 5 m/s^2. When this same van travels through soft sand, the same pressure on the accelerator results in a constant velocity of the van. Determine the force due to friction acting on the van in the soft sand.

4. The driver's handbook in a particular country states that the minimum safe distance between vehicles on the road is the distance a vehicle can travel in 2 s at constant speed. Assume that a 1200 kg car is travelling south at 72 km/hr when the truck ahead crashes into a north bound truck and comes to a sudden stop. If the car is at the required safe distance behind the truck, what is the separation distance between the car and the truck in meters?

5. Assume that a catcher in a professional baseball game exerts a force of -65.0 N to stop the ball. If the baseball has a mass of 0.145 kg, what is its acceleration just before it hits the catcher's glove?

6. A type of elevator called a cage is used to raise and lower miners in a mineshaft. Suppose the cage carries a group of miners down the shaft. If the unbalanced force on the cage is 60.0 N, and the mass of the loaded cage is 1.50×10^2 kg, what is the acceleration on the cage?

7. While boating out on the ocean, you suddenly hit an unknown mass and your 214 kg boat begins to sink. The force of gravity pulling the boat down at 9.8 m/s^2 is partially offset by the buoyant force of the water so that the net unbalanced force pulling the boat down is -1310 N. What is the acceleration of the boat?

8. Suppose you have been hired to clean the top of the Empire State Building. The highest that you will be cleaning is at a height of 646 m above the street surface. While doing your work, you accidentally drop one of your tools and it falls to the street surface. If the force acting on your tool is 3.6 N and gravity is pulling it down towards the earth at 9.8 m/s^2, what was the mass of your tool?

9. On your annual road trip with friends, you get bored driving across the plains of Kansas. Your friend pulls out a GPS that gives an accurate measure of the car's speed. He finds that you are currently traveling at 2.5 m/s. You know from common knowledge, that every 10 meters, you are passing a road marker. From the start of his timing to the end, you pass a total of three road markers. How long was your friend timing you?

10. An additional thirty seconds later, reaching new constant velocity of 4.0 m/s, what is the acceleration of your car?

11. As you finally pull in to get some gas, for fun, you decide to drive across a scale and find the weight of your car plus four passengers and luggage. You calculate the mass to be 4,000 kg. An hour later, your two identical twin friends, with a mass of 45 kg each, exit the car to get sodas and meet up with other friends. You continue on your journey. Once back on the interstate, you get back up to the same velocity and acceleration as before. If all of this were true, what would be the forward force of your vehicle?