

Read page 104 – 114.

Show your work on all math problems.

1. What is a force?
2. With what units do you measure force?
3. List the four fundamental forces of the universe.
4. For each example, indicate if the contact force is compression, tension, torsion, or shear.
 - a. Towing a car with a chain.
 - b. Twisting the cap off a ketchup bottle.
 - c. Cutting a piece of paper with scissors.
 - d. Crushing an aluminum can with your foot.
5. What is inertia?
6. Write Newton's First Law of Motion.
7. You are riding in a car and your books are on the seat next to you. Your car has leather seats. Your mom slams on the brakes because a ball rolled into the street in front of the car. Use Newton's first law of motion to explain why the books slide off the seat.
8. What is the formula for Newton's Second Law of Motion?
9. A rocket ship that has a mass of 25,000 kg blasts off with an acceleration of 5 meters per second². What is the size of the force accelerating it?
10. A pitcher throws a ball (mass = 0.14 kg) with a force of 2800 Newtons. What is the acceleration of the ball?
11. The mass of the Washington Monument in Washington, D. C. is 83,743,600 kg. Use the formula $\text{Weight} = \text{Mass} \times \text{Gravity's Acceleration}$ to calculate its weight. Gravity's Acceleration = 9.8 m/s^2 .
12. Write Newton's Third Law of Motion.
13. Explain how burning fuel causes a rocket to blast off.
14. What is friction?
15. What is a normal force?
16. What does the "normal" in normal force mean?
17. List five factors that affect friction.

Read page 115 -120.

Show your work on all math problems.

1. Which is greater: the gravitational force between two 5 kg masses that are 1 meter apart or two 5 kg masses that are 10 meters apart?
2. Which is greater: the gravitational force between you and a 10 kg mass 1 meter away from you or you and a 20 kg mass 1 meter away from you?
3. Who proved that objects of different mass would fall at the same rate?
4. If you drop a golf ball (mass = 46 grams) and a baseball ball (mass = 145 grams) from the same height, which would hit the ground first?
5. What is free fall?
6. What is the measurement of gravitational acceleration in:
 - a. metric units?
 - b. English units?
7. A box of rocks has a mass of 40 kilograms. What is its weight in Newtons? Use the formula for weight on page 117.
8. A mountain climber drops his rock hammer and it falls straight down for 2.3 seconds before hitting the ground. What was the hammer's free-fall speed in meters per second? Use the formula for velocity on page 118.
9. A person jumps out of an airplane and free falls for 6 seconds before opening a parachute. How far will that person fall in meters during that time? Use the formula for distance on page 119.
10. How will air resistance affect the speed of a falling object: speed it up, slow it down, no change?
11. What is terminal velocity?
12. Which would have a faster terminal velocity: a skydiver with an open parachute or a skydiver with a closed parachute?

Read page 121 -125.

Show your work on all math problems.

1. If you want to change the motion of an object, the amount of change you can make depends on two things. What are those two things?

Use the formula for momentum to solve Problems 2 and 3:

$$\mathbf{Momentum = Mass \times Velocity}$$

2. A person on a bicycle with a mass of 70 kg is zooming toward you at a velocity of 8 meters per second. What is the momentum of the person?
3. A speeding bullet has a mass of 0.02 kg and a momentum of 1.4 kg·m/s. What is the velocity of the bullet?
4. How can a 240 pound football player and a 120 pound cheerleader have the same momentum?
5. What's the difference between linear and angular momentum?
6. A 15 pound bowling ball and a 25 pound bowling ball are dropped from the same height at the same time. They are in free fall and have the same velocity. Would they have the same momentum?
7. Two 800 kg cars are traveling at 20 meters per second. Car A takes 5 seconds to stop and Car B takes 10 seconds to stop. The cars had the same change in momentum. Which car used the larger force to stop?
8. When a gun is shot, it recoils or "kicks back". Why does it do this? Use the concept of the Conservation of Momentum to explain it.