1. An 867 kg dragster, starting from rest, attains a speed of 25.10-m/s (56.2 mph) in 0.59 s.
   (a) Find the average acceleration of the dragster during this time interval. (**42.54-m/s^2**)
   (b) What is the average net force on the dragster during this time? (**3.69 x 10^4-N**)
   (c) Assume that the driver has a mass of 68 kg. What horizontal force does the seat exert on the driver? (**2892.88-N**)

2. A dragster starts with zero velocity and completes a 401.10-m (1/4-mile) run in 4.94-s. If the car had a constant acceleration, what would be its acceleration and final velocity? (**32.9-m/s^2, 162-m/s**)

3. After a day of testing race cars, you decide to take your own 1410 kg car onto the test track. While moving down the track at 10.0 m/s, you uniformly accelerate to 29.0 m/s in 10 s. What is the average net force that you have applied to the car during the 10 s interval? (**2680-N**)

4. A 4590 kg helicopter accelerates upward at 2.1 m/s^2. What lift force is exerted by the air on the propellers? (**5.47 x 10^4-N**)

5. A force of 42.0 N accelerates a 5.0 kg block at 5.7 m/s^2 along a horizontal surface.
   (a) How large is the frictional force? (**13.50-N**)
   (b) What is the coefficient of friction? (**0.28**)

6. A 225 kg crate is pushed horizontally with a force of 735 N. If the coefficient of friction is 0.20, calculate the acceleration of the crate. (**1.31-m/s^2**)

7. You are driving a 2480.0 kg car at a constant speed of 14.0 m/s along an icy, but straight, level road. As you approach an intersection, the traffic light turns red. You slam on the brakes. Your wheels lock, the tires begin skidding, and the car slides to a halt in a distance of 25.5 m. What is the coefficient of kinetic friction between your tires and the icy road? (**0.39**)

8. A sled of mass 46.0 kg is pulled along flat, snow-covered ground. The static friction coefficient is 0.30, and the kinetic friction coefficient is 0.10.
   (a) What does the sled weigh? (**450.80-N**)
   (b) What force will be needed to start the sled moving? (**135.24-N**)
   (c) What force is needed to keep the sled moving at a constant velocity? (**45.08-N**)
   (d) What total force must be applied to the sled to accelerate it at 2.5 m/s^2? (**160.08-N**)

9. The instruments attached to a weather balloon have a mass of 4.5 kg. The balloon is released and exerts an upward force of 105.00-N on the instruments.
   (a) What is the acceleration of the balloon and instruments? (**13.53-m/s^2**)
   (b) After the balloon has accelerated for 10 s, the instruments are released. What is the velocity of the instruments at the moment of their release? (**135.33-m/s**)
   (c) What net force acts on the instruments after their release? (**-44.10-N**)
   (d) When does the direction of their velocity first become downward? (**13.81-s**)

10. A 69.00-kg boy and a 44.00-kg girl use an elastic rope while engaged in a tug-of-war on an icy, frictionless surface. If the acceleration of the girl toward the boy is 3.00-m/s^2, find the magnitude of the acceleration of the boy toward the girl. (**1.91-m/s^2**)

11. As a baseball is being caught, its speed goes from 31.5 m/s to 0.0 m/s in about 0.0050 s. The mass of the baseball is 0.130 kg.

(a) What is the baseball's acceleration? (**-6300-m/s^2**)

(b) What is the force acting on the ball? (**819-N**)

(c) What is the force acting on the player who caught it? (-**819-N**)

12. Tom has a mass of 67.0 kg and Sally has a mass of 45.0 kg. Tom and Sally are standing 20.0 m apart on the dance floor. Sally looks up and sees Tom. She feels an attraction. If the attraction is gravitational, find its size. Assume that both Tom and Sally can be replaced by spherical masses. (**5.03x10^{-10}-N**)

13. United States currency is printed using intaglio presses that generate a printing pressure of 8.60 x10^4 lb/in^2. A $20 bill is 6.1 in. by 2.6 in. Calculate the magnitude of the force that the printing press applies to one side of the bill. (**1.36 x 10^6-lb**)

14. The Mariana trench is located in the Pacific Ocean at a depth of about 11300 m below the surface of the water. The density of seawater is 1025 kg/m^3.

(a) If an underwater vehicle were to explore such a depth, what force would the water exert on the vehicle's observation window (radius = 0.11 m)? (**4.32 x 10^6-N**)

(b) For comparison, determine the weight of a jetliner whose mass is 1.20 x10^5 kg. (**1.18 x 10^6-N**)

(c) What is the ratio of the force on the window versus the jetliner? (**3.67 x**)

15. Assume that you have a mass of 56.0 kg and Earth has a mass of 5.97 x 10^{24} kg. The radius of Earth is 6.38 x 10^6 m.

(a) What is the force of gravitational attraction between you and Earth? (**548-N**)

(b) What is your weight? (**549-N**)

16. The gravitational force between two electrons 1.04 m apart is 5.01 x 10^{-71} N. Find the mass of an electron. (**9.01 x 10^{-31}-kg**)

17. A 1.0 kg mass weighs 9.8 N on Earth's surface, and the radius of Earth is roughly 6.4 x 10^6 m.

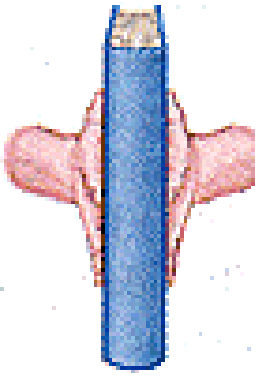
(a) Calculate the mass of Earth. (**6.02 x 10^{24}-kg**)

(b) Calculate the average density of Earth. (**5480-kg/m^3**)

E1. At a time when mining asteroids has become feasible, astronauts have connected a line between their 3780 kg space tug and a 6050 kg asteroid. Using their ship's engine, they pull on the asteroid with a force of 490 N. Initially the tug and the asteroid are at rest, 490 m apart. How much time does it take for the ship and the asteroid to meet? (**68.2-s**)

E2. A neutron star has a mass of 2.0 x 10^{30} kg (about the mass of our sun) and a radius of 5.4 x 10^{3} m (about the height of a good-sized mountain). Suppose an object falls from rest near the surface of such a star. How fast would it be moving after it had fallen a distance of 0.018 m? (**4.06 x 10^{5}-m/s**)

E3. A student presses a book between his hands, as the drawing indicates. The forces that he exerts on the front and back covers of the book are perpendicular to the book and are horizontal. The book weighs 28 N. The coefficient of static friction between his hands and the book is 0.44. To keep the book from falling, what is the magnitude of the minimum pressing force that each hand must exert? (**31.8-N**)



E4. The drawing shows a wire tooth brace used by orthodontists. The topmost tooth is protruding slightly, and the tension in the wire exerts two forces $\vec{\mathbf{T}}$ and $\vec{\mathbf{T}}'$ on this tooth in order to bring it back into alignment. If the forces have the same magnitude of 14.0 N, what is the magnitude of the net force exerted on the tooth by these forces? (**7.72-N**)