

Dynamics Problems

For credit: draw the event, show your work and box your answers.

1. When a karate expert strikes a wooden block, the hand undergoes an acceleration of -6500 m/s^2 . Medical data indicates the mass of the forearm and hand to be about 0.7 kg. What is the force exerted on the hand by the blocks? What is its direction?
2. When you drop a 0.4 kg apple, Earth exerts a force on it that accelerates it at 9.8 m/s^2 toward the Earth's surface. According to Newton's third law, the apple must exert an equal and opposite force on the Earth. What force does the Earth feel?
3. In problem #2 above, if the mass of the Earth is $5.98 \times 10^{24} \text{ kg}$, what's the magnitude of Earth's acceleration?
4. A 95 kg boxer has his first match in the Canal Zone ($g = 9.782 \text{ m/s}^2$) and his second match at the North Pole ($g = 9.832 \text{ m/s}^2$).
 - a) What is his mass in the Canal Zone? What is his weight in the Canal Zone?
 - b) What is the mass at the North Pole? What is his weight at the North Pole?
5. The acceleration of a 925 kg car while braking is -12.2 m/s^2 . What is the frictional force that brings the car to a stop?
6. An 873 kg dragster, starting from rest, attains a speed of 26.3 m/s in 0.59 seconds. Find the average acceleration of the dragster. What is the size of the average force on the dragster during this time interval?
7. A racecar has a mass of 710 kg. It starts from rest and travels 40 m in 3 seconds. The car is uniformly accelerated during the entire time. What net force is applied to it?
8. A 4500 kg helicopter accelerates upward at 2 m/s^2 . Calculate the lift force exerted by the air on the propellers.
9. The maximum force a grocery sack can withstand and not rip is 250 N. If 20 kg of groceries are lifted from the floor to the table with an acceleration of 5 m/s^2 , will the sack hold?
10. A student stands on a bathroom scale in an elevator at rest on the 64th floor of a building. The scale reads 836 N. As the elevator moves up, the scale reading increases to 935 N. What is the acceleration of the elevator during this time?
11. A 40 kg crate is pulled across the ice with a rope. A force of 100 N is applied at an angle of 30° with the horizontal. Neglecting friction, calculate the acceleration of the crate and the upward force the ice exerts on the crate as it is pulled.
12. Joe pushes the handle of a 10 kg fertilizer spreader. The handle makes a 45° with the horizontal. Joe wishes to accelerate the spreader from rest to 1.39 m/s in 1.5 seconds. What force must Joe apply to the handle?
13. If you use a horizontal force of 30 N to slide a 12 kg wooden crate across a floor at a constant velocity, what is the coefficient of sliding friction between the crate and the floor?

14. You are driving a 2500 kg car at a constant speed of 14 m/s along an icy, but straight and level road. You slam on the brakes and the wheels lock. Sending you sliding and skidding to a halt in a distance of 25 m. What is the coefficient of sliding friction between your tires and the icy road?
15. A force of 40 N accelerates a 5 kg block at 6 m/s^2 along a horizontal surface. How large is the frictional force? What is the coefficient of friction?
16. A 200 kg crate is pushed horizontally with a force of 700 N. If the coefficient of friction is 0.2, calculate the acceleration of the crate.

Answers to the odd numbered problems.

1. 4550 N, upward	3. $6.56 * 10^{-25} \text{ m/s}^2$	5. 11285 N
7. 6311 N	11. 2.17 m/s^2 and 342 N	9. 5.5 m/s^2 , yes it will hold
13. 0.255	15. 10 N, 0.2	