

## Force Problems II

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1. A space ship in interstellar space has a mass of 1,250,000 kg. If it accelerates at a constant rate of  $3.5 \text{ m/s}^2$  for 1 hour,
  - a. How much faster is it traveling after that hour?
  
  
  
  
  
  
  
  
  
  
  - b. How much does the spaceship weigh in interstellar space?
  
  
  
  
  
  
  
  
  
  
  - c. How much force is needed to keep the spaceship traveling with a constant velocity? Explain.
  
2. You are really bored one day and decide to see what happens if you “really accelerate” on a skateboard. You tie a rope to a car and get on your skateboard, and have a friend drive the car. The force of the car pulling you is a constant 250 N, and the magnitude of the force of friction is a constant 35 N. Assuming your mass (with the skateboard) is 80 kg and that you start from rest,
  - a. What is your acceleration?
  
  
  
  
  
  
  
  
  
  
  - b. How fast would you be going after a total of 2 seconds?
  
  
  
  
  
  
  
  
  
  
  - c. How fast would you be going after a total of 15 seconds?
  
  
  
  
  
  
  
  
  
  
  - d. What would happen if your friend had to hit the brakes in the car suddenly?
  
  
  
  
  
  
  
  
  
  
  - e. Why should you never, ever do this?
  
3. Imagine you (mass 65 kg) are in an elevator at the bottom of the Prudential building. You then accelerate up at a constant rate of  $2 \text{ m/s}^2$  for 1.5 seconds.
  - a. What is the net force acting on you?
  
  
  
  
  
  
  
  
  
  
  - b. What is your weight?
  
  
  
  
  
  
  
  
  
  
  - c. What must be the support force acting on you?
  
  
  
  
  
  
  
  
  
  
  - d. How fast are going at the end of this?

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4. Still in the elevator, you are traveling up with a constant velocity (your answer to letter d above.) for a time of 30 seconds.
  - a. What is the net force acting on you?
  - b. What is your weight?
  - c. What must be the support force acting on you?
  - d. How fast are going at the end of this?
  
5. Still in the elevator, you are traveling up with the velocity from above when the elevator slows down at a rate of  $2 \text{ m/s}^2$  for a time of 1.5 seconds. Then the doors open and you get off the elevator.
  - a. What is the net force acting on you while slowing down?
  - b. What is your weight?
  - c. What must be the support force acting on you while slowing down?
  - d. How fast are going at the end of this?
  
6. A 15000 N car is driving down the road with an initial velocity of 12 m/s. The car then speeds up to a final velocity 20 m/s in a time of 11 seconds. If the magnitude of the force of friction acting on the car during this speeding up was 2500 N, how much force did the engine have to produce for this acceleration?
  
7. You do a lab in which a friend pulls you on a skateboard with a constant force. You start from rest, and are pulled for a distance of 7 meters, at which point your friend stops pulling and you coast to a stop in 14 meters. (That means the total distance you were pulled and coasted was 21 meters.) The time it took your friend to pull you the 7 meters was 6.5 seconds. You and the skateboard have a mass of 60 kg. With how much force did your friend pull you?

1. a) 12,600 m/s b) 0 N c) 0 N    2. a)  $2.7 \text{ m/s}^2$     b) 5.4 m/s    c) 40.5 m/s    d) you continue at 40.5 m/s and smash into car    e) you will die    3. a) 130 N up    b) 650 N down    c) 780 N    d) 3 m/s up
4. a) 0 N b) 650 N c) 650 N d) 3 m/s    5. a) 130 N down b) 650 N c) 520 N up d) 0 m/s
6. 3590 N    7. 30 N