CH4 Exercises

1. (4.1) Two dogs pull horizontally on ropes attached to a post; the angle between the ropes is 60^o. If Rover exerts a force of 270 N and Fido exerts a force of 300 N, find the magnitude of the resultant force and angle it makes with Rover's rope.

2. (4.5) Forces $\mathbf{F_1}$ and $\mathbf{F_2}$ act a point. The magnitude of $\mathbf{F_1}$ is 9 N, and its direction is 60 above the x-axis in the second quadrant. The magnitude of $\mathbf{F_2}$ is 6 N, and its direction is 53.1^o below the x-axis in the third quadrant. (a) What are the x- and y- components of the resultant force? (b) What is the magnitude of the resultant force?

3. (4.7) A 68.5 kg skater moving initially at 2.4 m/s on rough horizontal ice comes to rest uniformly in 3.52 s due to friction from the ice. What force does friction exert on the skater?

4. (4.15) A small 8 kg rocket burns fuel that exerts a time-vary upward force on the rocket (assume constant mass) as the equation $F = A + Bt^2$. Measurements show that at t = 0, the force is 100 N, and at the end of first t = 2 s, it is 150 N. (a) Find the constants A and B, including their SI units. (b) Find the net force on this rocket and its acceleration (i) the instant after the fuel ignites and (ii) 3 s after the fuel ignites. (c) Suppose that you were using this rocket in outer space, far from all gravity. What would its acceleration be 3 s after fuel ignition?

5. (4.19) At the surface of Jupiter's moon Io, the acceleration due to gravity is g 1.81 m/s^2. A watermelon weighs 44 N at the surface of the earth. (a) What is watermelon's mass on earth? (b) What would be its mass and weight on the surface of Io?

6. (4.23) Boxes A and B are in contact on a horizontal, frictionless surface Box A has mass 20 kg and box B has mass 5 kg. A horizontal force of 250 N is exerted on box A. What is the magnitude of the force that box A exerts on box B?

7. (4.28) A .22 caliber rifle bullet traveling at 350 m/s strikes a large tree and penetrates it to a depth of 0.13 m The mass of the bullet is 1.8 g. Assume a constant retarding force. (a) How much time is required for the bullet to stop? (b) What force, in Newtons, does the tree exert on the bullet?

8. (4.31) A 5.6 kg bucket of water is accelerated upward by a cord of negligible mass whose breaking strength is 75 N. If the bucket starts from rest, what is the minimum time required to raise the bucket a vertical distance of 12 m without breaking the cord?

9. Basketball player Darrel Griffith is on record as attaining a standing vertical jump of 1.2 m (4ft.). Griffith weighed 890 N (200 lb). (a) What was his speed as left the floor? (b) It the time of part of the jump before his feet left the floor was 0.3 s, what was his average acceleration (magnitude and direction) while he pushed against the floor?

10. (4.37) The fastest pitched baseball measured at 46 m/s. A typical baseball has a mass of 145 g. If the pitcher exerted his force (assumed to be horizontal and constant) over a distance of 1 m, (a) what force did he produce on the ball during this record-setting pitch? (b) Draw free-body diagrams of the ball during the pitch just after it left the pitchers hand.

11. (4.45) After an annual checkup, you leave your physician's office, where you weighed 683 N. You then get on an elevator that has a scale. Find the magnitude and direction of the elevator's acceleration if the scale reads (a) 725 N, and (b) 595 N.

12. (4.49) Two boxes are connected to each end of a light vertical rope. A constant upward force F = 80 N is applied to box A. Starting from rest, box B descends 12 m in 4 s. The tension in the rope connecting the two boxes is 36 N. What are the masses of (a) box B, (b) box A?

13. (4.41 CALC) To study damage to aircraft that collide with large birds, you design a gun that will accelerate chicken sized objects so that their displacement along the gun barrel is given by $x(t) = (9 \cdot 10^3\ m/s^2)t^2 - (8 \cdot 10^4\ m/s^3)t^3$. The object leave the end of the barrel at t = 0.025 s. (a) How long is the gun barrel? (b) What is the speed of the chicken as it leaves the end of barrel? (c) What net force is exerted on a 1.5 kg object at (i) t = 0, and (ii) t = 0.025 s?

14. (4.51 CALC) A mysterious rocket propelled object of mass 45 kg is initially at rest in the middle of the horizontal, frictionless surface of an ice covered lake. Then a force directed east and with magnitude with magnitude F(t) = (16.8 N/s)t is applied. How far does the object travel in the first 5 s after the force is applied?