Practice Problems for 7.1

1. a. A rocket exerts 4.21 N of force for 1.47 seconds. What **impulse** does it impart? (6.19 N s)
b. A 35.0 N unbalanced force is exerted on a 3.10 Kg mass for 39.2 seconds. What is the change of **velocity** of the mass? (443 m/s)
c. A 0.147 Kg baseball going 37.0 m/s, strikes a bat, and heads straight **back** to the outfield at 48.0 m/s. If the bat exerted a force of 2341 N, for what **time** was it in contact with the bat? (0.00534 s)
d. A rocket engine burns fuel at a rate of 14.5 grams per second, and develops a force of 9.20 N. What must be the exhaust **velocity**? (1000 grams = 1 kg) (634 m/s)
e. A 122 kg rocket (total mass of fuel and rocket), burns its fuel at a rate of 3.45 kg/s for 23.0 seconds with an exhaust velocity of 772 m/s. What are its initial and final acceleration as it takes off from earth? (12.0 m/s/s, 52.6 m/s/s)

2. a. What is the **momentum** of a 1.22 kg hammer going 3.46 m/s? (4.22 kg m/s)
b. A 59.0 N unbalanced force is exerted on an object for 5.20 seconds. The mass changes velocity from rest to 44.0 m/s. What is the **mass** of the object? (6.97 kg)
c. A 0.142 Kg baseball going 37.0 m/s, strikes a bat, and heads straight **back** to the outfield at 59.0 m/s. If the collision lasted for 0.0135 seconds, what **force** did the bat exert on the baseball? (1010 N)
d. A rocket engine burns fuel at a rate of 9.84 grams per second, and has an exhaust velocity of 985 m/s. What **thrust** does it develop? (1000 grams = 1 kg) (9.69 N)
e. A 362 kg rocket, 282 kg of which is fuel, burns all of its fuel in 35.0 seconds with an exhaust velocity of 869 m/s. What are its initial and final acceleration as it takes off from earth? (9.53 m/s/s, 77.7 m/s/s)

3. a. A hammer has 22.3 kg m/s of momentum, and is going 3.57 m/s, what is its **mass**? (6.25 kg)
b. A 24.0 N unbalanced force is exerted on a 12.0 Kg mass. The mass changes velocity from rest to 36 m/s. What **time** did the force act? (18.0 s)
c. A 0.131 Kg baseball going 34.0 m/s, strikes a bat, and heads straight **back** to the outfield at 58.0 m/s. If the bat exerted a force of 952 N, for what **time** was it in contact with the bat? (0.0127 s)
d. A rocket engine burns fuel at a rate of 13.0 grams per second, and develops a force of 11.7 N. What must be the exhaust **velocity**? (1000 grams = 1 kg) (900. m/s)
e. A 19.0 kg rocket, 12.0 kg of which is fuel, burns its fuel at a rate of 0.465 kg/s with an exhaust velocity of 748 m/s. What are its initial and final acceleration as it takes off from earth? (8.50 m/s/s, 39.9 m/s/s)

4. a. A rocket imparts 24.0 Ns of impulse in 2.22 s. What **force** does it exert? (10.8 N)
b. A force is exerted on a 14.0 Kg mass for 17.0 seconds. The mass changes velocity from rest to 38.0 m/s. What was the **force**? (31.3 N)
c. A ball going 29.0 m/s, strikes a bat, and heads straight **back** to the outfield at 42.0 m/s. If the bat exerted a force of 1210 N for 0.00830 seconds, what is the **mass** of the ball? (0.141 kg)
d. A rocket develops a thrust of 14.2 N, with an exhaust velocity of 816 m/s. What **mass** in fuel does the engine burn every second? (0.0174 kg/s)
e. A 52.0 kg rocket (total mass of fuel and rocket), burns fuel at a rate of 2.17 kg/s for 19.3 seconds with an exhaust velocity of 748 m/s. What are its initial and final acceleration as it takes off from earth? (21.4 m/s/s, 160. m/s/s)

5. a. A rocket engine exerts 55.0 N of force, and imparts an impulse of 44.0 Ns. What **time** must it burn? (0.800 s)
b. A 59.0 N unbalanced force is exerted on a 11.0 Kg mass for 5.20 seconds. What is the change of **velocity** of the mass? (27.9 m/s)
c. A 0.148 Kg baseball going 35.0 m/s, strikes a bat, and heads straight **back** to the outfield at 67.0 m/s. If the collision lasted for 0.0125 seconds, what **force** did the bat exert on the baseball? (1210 N)
d. A rocket engine burns fuel at a rate of 11.0 grams per second, and has an exhaust velocity of 845 m/s. What **thrust** does it develop? (1000 grams = 1 kg) (9.30 N)
e. A 5.40 kg rocket, 4.30 kg of which is fuel, burns all of its fuel in 10.1 seconds with an exhaust velocity of 712 m/s. What are its initial and final acceleration as it takes off from earth? (46.3 m/s/s, 266 m/s/s)