Practice 6.0 - Impulse and Momentum

Momentum $p = mv$

12190 kg m/s	1. What is the momentum of a 23 kg cannon shell going 530 m/s?
4.8 m/s	2. What speed must a 5 kg object go to have 24 kg m/s of momentum?
0.066 kg	3. A bullet going 640 m/s has 42 kg m/s of momentum. What is its mass?
2.825 kg m/s	4. What is the momentum of a 2.50 g bullet going 1130 m/s?
3.29 kg	5. What is the mass of a bowling ball that has a momentum of 46.0 kg m/s when it is going 14.0 m/s?
906 m/s	6. What speed must a 6.40 g bullet go to have the same momentum as a 145 g baseball going 40.0 m/s? (Roughly 90 mph)

Impulse   **Impulse = FΔt**

7.8 Ns	7. What is the impulse imparted by a rocket that exerts 4.8 N for 1.63 seconds?
0.36 s	8. For what time must you exert a force of 45 N to get an impulse of 16 Ns?
10.7 N	9. What force exerted over 6 seconds gives you an impulse of 64 Ns?
9.02 Ns	10. What is the impulse that a baseball bat gives a ball with a force of 2820 N exerted for 0.00320 s?
1.67 s	11. For what time must you exert a 12 N force to impart 20. Ns of impulse?
21.3 N	12. What force exerted for 15.0 s imparts an impulse of 320. Ns?

(These that follow are assessed on 6.1 - these are just extra practice problems)

Impulse and Momentum **FΔt = mΔv**

10.3 m/s	13. What is the change in velocity of a 0.35 Kg air track cart if you exert a force of 1.2 N on it for 3.0 seconds?
119 kg	14. A rocket engine exerts a force of 500 N on a space probe (in outer space!) for 5.0 seconds. The probe speeds up from rest to a speed of 21 m/s. What is its mass?
1184 N	15. What force exerted for 0.012 seconds will make a 0.145 Kg baseball change its velocity 98 m/s?
0.71 s	16. What time must the space probe in question 14. fire its engines to change its velocity by 3 m/s?

Rocket Propulsion

3040 N 3.95 s 19.7 kg	17. A rocket engine burns 5 kg of fuel per second. The exhaust gas velocity is 608 m/s. What is the thrust of the engine? What time must it burn to impart an impulse of 12,000 Ns? How much fuel will it burn to do this?
880 m/s	18. An 11 Ns rocket engine has 12.5 grams of fuel. What is the exhaust velocity?
0.02 kg/s 6.0 kg	19. A rocket generates 25 N of thrust, and the exhaust gas velocity is 1250 m/s. At what rate does it consume fuel in kg/s? How much fuel has it burned in 5 minutes?
180.8 s 2.63 m/s/s 7.73 m/s/s	20. A small rocket probe in deep space has a mass of 68.5 kg, 45.2 kg of which is fuel. Its engine consumes .250 kg of fuel per second, and it has an exhaust velocity of 720 m/s. For how much time will the engine burn? What is the initial acceleration of the rocket engine? What is the acceleration just before it runs out of fuel?
140 s 75 kN 5.2 m/s/s 40.2 m/s/s	21. A rocket takes off from the surface of Earth straight up. The total mass of the rocket is 5000 kg, 3500 kg of which is fuel. The exhaust gas velocity is 3000 m/s, and the rocket consumes 25 kg of fuel per second. For how long do the engines burn? What is the thrust of the engine? What are the initial and final accelerations of the rocket? (Don't forget gravity!)