Quizlette 6.1 - Rocket Science **Name**_____

$F\Delta t = m\Delta v$

1) If you exert a force of 45 N on a 52 kg frictionless cart at rest for 3.5 seconds, what is its change in velocity?

2) A 295 kg spacecraft has rockets that exert a force of 0.050 N (ion propulsion).
For what time must you "burn" these engines to change the velocity of the spacecraft by 350. m/s?

3) A 540 kg stage set floating on air bearings undergoes a change in velocity of 1.2 m/s in 31 seconds.
What force was exerted?

1) 3.03 m/s, 2) 2,065,000 s, 3) 20.9 N, 4) 1220 N, 5) 0.00590 s, 6) 0.146 kg

Velocity reversal: the change of 34 m/s to the left to 40 m/s to the right is a **change** of 74 m/s, so **Δv** = 74 m/s. (Use **$F\Delta t = m\Delta v$**)

4) A 0.145 Kg baseball going 40.0 m/s, strikes a bat, and heads straight back to the outfield at 61.0 m/s. If the collision lasted for 0.0120 seconds, what force did the bat exert on the baseball?

5) A 0.141 Kg baseball going 32.0 m/s, strikes a bat, and heads straight back to the outfield at 50.0 m/s. If the bat exerted a force of 1960 N, for what time was it in contact with the bat?

6) A ball going 35.0 m/s, strikes a bat, and heads straight back to the outfield at 42.0 m/s. If the bat exerted a force of 1780 N for 0.00630 seconds, what is the mass of the ball?

Rocket Thrust: $F\Delta t = m\Delta v$ - remember, if it says 45 grams per second that is 0.045 kg in 1 second

7) A rocket engine produces 410. N of thrust for 17.0 s with an exhaust velocity of 710. m/s. What mass of fuel does it burn in this time?

8) A rocket engine burns 1.20 kg of fuel generating 72.0 N of thrust with an exhaust velocity of 540. m/s. What time does the engine burn?

9) A rocket engine burns fuel at a rate of 13.0 **grams** per second, and has an exhaust velocity of 690. m/s. What thrust does it develop? (1000 grams = 1 kg)

10) A rocket engine burns fuel at a rate of 12.0 **grams** per second, and develops a thrust of 8.50 N. What must be the exhaust velocity? (1000 grams = 1 kg)

Initial and final acceleration:

11) A 8.30 kg rocket, 5.20 kg of which is fuel, burns all of its fuel in 12.0 seconds with an exhaust velocity of 610. m/s. What are its initial and final acceleration as it takes off from earth? (Thrust = 264.3 N)

12) A 320. kg rocket, 280. kg of which is fuel, burns all of its fuel in 32.0 seconds with an exhaust velocity of 780. m/s. What are its initial and final acceleration as it takes off from earth? (Thrust = 6825 N)

13)A 71.0 kg rocket (total mass of fuel and rocket), burns 51.0 kg of fuel at a rate of 2.10 kg/s with an exhaust velocity of 650. m/s. What are its initial and final acceleration as it takes off from earth? (Thrust = 1365 N)

14) A 140. kg rocket (total mass of fuel and rocket), burns 110.0 kg of fuel at a rate of 3.20 kg/s with an exhaust velocity of 810. m/s. What are its initial and final acceleration as it takes off from earth? (Thrust = 2592 N)

7) 9.82 kg, 8) 9.00 s, 9) 8.97 N, 9), 10) 708 m/s, 11) 22.0 and 75.5 m/s/s, 12) 11.5 m/s/s and 161 m/s/s, 13) 9.43 m/s/s and 58.5 m/s/s, 14) 8.71 m/s/s and 76.6 m/s/s