Directions: Answer the following questions.

1. What does Newton's second law of motion state?

$a = F/m$ {accel. is proportional to net force, and inversely proportional to mass

2. What two factors affect the rate of acceleration of an object?

- mass
- force

Directions: Use Newton's 2nd Law to solve the following problems. **Show your work!**

3. How much force is needed to accelerate a 1000 kg car at a rate of 3 m/s^2?

$F = ma = (1000\,kg)(3\,m/s^2) = 3000\,N$

4. If a 70. kg swimmer pushes off a pool wall with a force of 250 N, at what rate will the swimmer accelerate from the wall? *(Use the correct number of significant digits.)*

$a = F/m = 250\,N / 70.\,kg = 3.6\,m/s^2$

5. A weightlifter raises a 200 kg barbell with an acceleration of 3 m/s^2. How much force does the weightlifter use to raise the barbell?

$F = ma = (200\,kg)(3\,m/s^2) = 600\,N$

6. A dancer lifts his partner above his head with an acceleration of 2.5 m/s^2. The dancer exerts a force of 200 N. What is the mass of the partner?

$m = F/a = \frac{200\,N}{2.5\,m/s} = 80\,kg$

7. What is the acceleration of a 2,000.-kilogram truck if a force of 4,200. N is used to make it start moving forward?

$a = F/m = \frac{4200.\,N}{2000.\,kg} = 2.100\,m/s^2$

8. What is the acceleration of a 0.30-kilogram ball that is hit with a force of 25 N?

$a = F/m = 25\,N / 0.30\,kg = 83\,m/s^2$

9. How much force is needed to accelerate a 68-kilogram skier at 1.2 m/s^2?

$F = ma = (68\,kg)(1.2\,m/s^2) = 57\,N$

10. What is the mass of an object that requires a force of 30 N to accelerate at 5 m/s^2?

$m = \frac{F}{a} = \frac{30\,N}{5\,m/s^2} = 6\,kg$

11. What is the force on a 1,000.-kilogram elevator that is falling freely under the acceleration of gravity only?

$F = ma = (1000.\,kg)(9.8\,m/s^2) = 9800\,N$

12. What is the mass of an object that needs a force of 4,500 N to accelerate it at a rate of 5 m/s^2?

$m = \frac{F}{a} = \frac{4500\,N}{5\,m/s^2} = 900\,kg$

13. What is the acceleration of a 6.4-kilogram bowling ball if a force of 12 N is applied to it?

$a = \frac{F}{m} = \frac{12\,N}{6.4\,kg} = 1.9\,m/s^2$

14. Your shopping cart has a mass of 65 kilograms. In order to accelerate the shopping cart down an aisle at 0.30 m/s^2, what force would you need to use or apply to the cart?

$F = ma = (65\,kg)(0.30\,m/s^2 = 20.\,N$

15. A small child has a wagon with a mass of 10 kilograms. The child pulls on the wagon with a force of 2 newtons. What is the acceleration of the wagon?

$a = \frac{F}{m} = \frac{2N}{10\,kg} = 0.2\,m/s^2$