Newton's 2nd Law Story Problems Name: Key Per.____
Integrated Science: Physics/Design

Directions: Answer the following questions.

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

Acceleration is directly proportional to the net force and inversely proportional to the mass.

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

1. Force

2. mass

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?

$F = m \times a$

$F = (1000\ kg)(3\ m/s^2) =$ **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.)*

$a = F/m$

$a = \frac{250\ N}{70.\ kg} = 3.57142$ **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?

$F = m \times a$

$F = (200\ kg)(3\ m/s^2) =$ **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?

$m = F/a$

$m = \frac{200\ N}{2.5\ m/s^2} =$ **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?

$a = F/m$

$a = \frac{4,200\ N}{2,000\ kg} = 2.1$ **2 m/s^2**

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

$a = F/m$ $\quad a = \frac{25\ N}{0.30\ kg} = 83.333$ **83 m/s^2**

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

$F = (m)(a)$

$F = (68\,kg)(1.2\,m/s^2) = 81.6$ **82 N**

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

$m = F/a$

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

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

$F = (m)(a)$

$F = (1{,}000)(9.8\,m/s^2) =$ **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?

$m = F/a$

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

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

$a = F/m$

$a = \frac{12\,N}{6.4\,kg} = 1.875 =$ **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?

$F = (m)(a)$

$F = (65\,kg)(0.30\,m/s^2) = 19.5 =$ **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?

$a = F/m$

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