

## Newton's Second Law of Motion Problems Worksheet

**Newton's Second Law of Motion**, sometimes called the **law of force and motion** or **law of acceleration**, states that:

**An object acted on by an unbalanced force will accelerate in the direction of that force, in direct proportion to the strength of the force, and in inverse proportion to the mass of the object.**

Newton's second law is best described with a mathematical equation that relates three variables, force, acceleration and mass, to one another. The equation can be stated in three forms:

**force = mass • acceleration**

**f = m • a**

**mass =  $\frac{\text{force}}{\text{acceleration}}$**

**m = f/a**

**acceleration =  $\frac{\text{force}}{\text{mass}}$**

**a = f/m**

*In the first set of problems below, you will be given the mass of an object and the acceleration of that object, and then will need to solve for force, using the equation  $F = ma$ . In other words, you will need to multiply the mass times the acceleration to calculate the force. Be sure to convert any mass stated in grams into kilograms, by dividing it by 1000 (moving the decimal place over three places to the left). For example, 1000 grams is equal to 1 kilogram. Be sure to state the proper units in your answer, and state each answer to the nearest tenth of a unit, to match the accuracy of the measurements.*

1. An object with a mass of 2.0 kg accelerates 2.0 m/s<sup>2</sup> when an unknown force is applied to it. What is the amount of the force? 4N
  
2. An object with a mass of 5.0 kg accelerates 8.0 m/s<sup>2</sup> when an unknown force is applied to it. What is the amount of the force? 40N
  
3. An object with a mass of 1500 g (grams) accelerates 10.0 m/s<sup>2</sup> when an unknown force is applied to it. What is the amount of the force?  

*1.5 kg*

15000N

4. An object with a mass of 6.0 kg accelerates  $4.0 \text{ m/s}^2$  when an unknown force is applied to it. What is the amount of the force? 24 N
5. An object with a mass of 7.5 kg accelerates  $8.3 \text{ m/s}^2$  when an unknown force is applied to it. What is the amount of the force? 62.25 N
6. An object with a mass of 2000 g accelerates  $8.3 \text{ m/s}^2$  when an unknown force is applied to it. What is the amount of the force? 16.600 N

In the second set of problems below, you will be given the force applied to an object and the acceleration of that object, and then will need to solve for mass, using the equation  $m = F/a$ . In other words, you will need to divide the force by the acceleration to calculate the mass. Show your work in the space provided. Be sure to state the proper units in your answer, and state each answer to the nearest tenth of a unit, to match the accuracy of the measurements.

7. An object accelerates  $3.0 \text{ m/s}^2$  when a force of 6.0 newtons is applied to it. What is the mass of the object? 2 Kg
8. An object accelerates  $12.0 \text{ m/s}^2$  when a force of 6.0 newtons is applied to it. What is the mass of the object? 0.5 Kg
9. An object accelerates  $5.0 \text{ m/s}^2$  when a force of 20.0 newtons is applied to it. What is the mass of the object? 4 Kg
10. An object accelerates  $2.0 \text{ m/s}^2$  when a force of 12.0 newtons is applied to it. What is the mass of the object? 6 Kg
11. An object accelerates  $7.2 \text{ m/s}^2$  when a force of 4.0 newtons is applied to it. What is the mass of the object? 0.56 Kg
12. An object accelerates  $16.3 \text{ m/s}^2$  when a force of 4.6 newtons is applied to it. What is the mass of the object? 0.28 Kg

*In the third set of problems below, you will be given the force applied to an object and the mass of that object, and then will need to solve for acceleration, using the equation  $a = F/m$ . In other words, you will need to divide the force by the mass to calculate the acceleration. Be sure to convert any mass stated in grams into kilograms, by dividing it by 1000 (moving the decimal place over three places to the left). For example, 1000 grams is equal to 1 kilogram. Show your work in the space provided. Be sure to state the proper units in your answer, and state each answer to the nearest tenth of a unit, to match the accuracy of the measurements.*

13. An object with a mass of 2.0 kg has a force of 4.0 newtons applied to it. What is the resulting acceleration of the object?  $2 \text{ m/s}^2$

14. An object with a mass of 5.0 kg has a force of 20.0 newtons applied to it. What is the resulting acceleration of the object?  $4 \text{ m/s}^2$

15. An object with a mass of 20.0 kg has a force of 5.0 newtons applied to it. What is the resulting acceleration of the object?  $0.25 \text{ m/s}^2$

16. An object with a mass of 3.0 kg has a force of 9.0 newtons applied to it. What is the resulting acceleration of the object?  $3 \text{ m/s}^2$

17. An object with a mass of 2300 g has a force of 6.2 newtons applied to it. What is the resulting acceleration of the object?  $2.7 \text{ m/s}^2$

18. An object with a mass of 3.2 kg has a force of 7.3 newtons applied to it. What is the resulting acceleration of the object?  $2.3 \text{ m/s}^2$

*In the following problems, solve for the missing variable, using the two variables provided.*

19. An object accelerates  $8.2 \text{ m/s}^2$  when a force of 20.1 newtons is applied to it. What is the mass of the object?  $2.5 \text{ kg}$   $m = \frac{F}{a}$

20. An object with a mass of 6.3 kg has a force of 7.1 newtons applied to it. What is the resulting acceleration of the object?  $1.1 \text{ m/s}^2$   $a = \frac{F}{m}$

21. An object with a mass of 6.5 kg accelerates  $12.3 \text{ m/s}^2$  when an unknown force is applied to it. What is the amount of the force?  $80 \text{ N}$   $F = ma$

