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**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=ma**

**Units:**

**Force = Newtons (N) Mass = Kilograms (kg) Acceleration = meters per second squared (m/s2)**

 1. An object with a mass of 2.0 kg accelerates 2.0 m/ s2when an unknown force is applied to it. What is the amount of the force? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. 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? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. An object accelerates 2.0 m/ s2 when a force of 12.0 Newtons is applied to it. What is the mass of the object? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. An object accelerates 3.0 m/ s2 when a force of 6.0 Newtons is applied to it. What is the mass of the object? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. 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? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. An object with a mass of 1500 g (**grams**) accelerates 10.0 m/s2 when an unknown force is applied to it. What is the amount of the force? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ force

7. 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? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. An object with a mass of 6.0 kg accelerates 4.0 m/ s2 when an unknown force is applied to it. What is the amount of the force? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. 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? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

10. An object accelerates 12.0 m/ s2 when a force of 6.0 Newtons is applied to it. What is the mass of the object? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11. 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? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Newton’s Law of Universal Gravitation**

F=G (M1)(M2) F=

 r2 G=

 M1=

M2=

 r2=

Answer the following problems. Show your work.

1. How would the gravitational force be affected if….
	1. The mass of object one was doubled?
	2. What if the distance between the two objects was doubled?
	3. The mass of object one was doubled and the mass of object two was tripled?
	4. The distance between object one and object two was quadrupled?

**Reminder: If we have a WHOLE NUMBER the force is that many times \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**If we end up with a FRACTION the force is that much \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

What is the force of gravity between two objects, both weighing
5000 kg and separated by 2 km?

If you were to increase the distance between the two objects above to 4 km (2x original), what would the force of gravity between them be?

Did gravity increase or decrease? By how much?

If you were to increase the distance between the two objects above to 6 km (3x the original distance), what would the force of gravity between them be?

Did gravity increase or decrease?   By how much (from original)?

If you were to increase the mass of object 1 from 5000 kg to 10,000 kg (2x original) and keep the mass of the second object at 5000 kg and the distance between them at 2 km, what would the force of gravity between them be?

Did gravity increase or decrease?   By how much (from original)?

If you were to increase the mass of object 1 from 10,000 kg to 15,000 kg (3x original) and keep the mass of the second object at 5000 kg and the distance between them at 2 km, what would the force of gravity between them be?

Did gravity increase or decrease?   By how much (from original)?

If you were to increase the mass of an object by 4x from the original, what do you think would happen to the force of gravity between them?

If you were to increase the distance between two objects by 4x, what do you think would happen to the force of gravity between them?

Based on your answers above, which is more important in determining the force of gravity between two objects, the mass or the distance?