

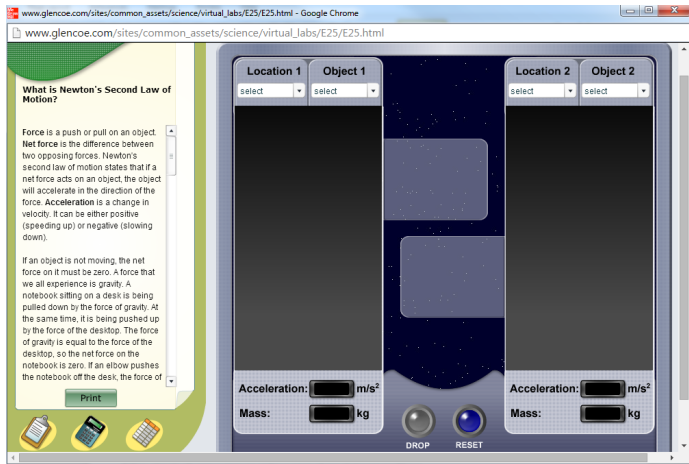
Name: _____

Period: _____

Newton's Second Law of Motion – Virtual Lab

What is Newton's Second Law of Motion?

http://www.glencoe.com/sites/common_assets/science/virtual_labs/E25/E25.html



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Force and Newton's Laws

What is Newton's Second Law of Motion?

Force is a push or pull on an object. Net force is the difference between two opposing forces. Newton's second law of motion states that if a net force acts on an object, the object will accelerate in the direction of the force. Acceleration is a change in velocity. It can be either positive (speeding up) or negative (slowing down).

If an object is not moving, the net force on it must be zero. A force that we all experience is gravity. A notebook sitting on a desk is being pulled down by the force of gravity. At the same time, it is being pushed up by the force of the desktop. The force of gravity is equal to the force of the desktop, so the net force on the notebook is zero. If an elbow pushes the notebook off the desk, the force of gravity is no longer balanced by the force of the desktop, and the notebook accelerates as it falls to the floor.

The formula for calculating a force on an object is:

$$F = ma \text{ (} F = \text{force, } m = \text{mass, and } a = \text{acceleration)}$$

Mass is the amount of matter contained in an object. Mass does not change with changes in gravity.

In the previous example, F refers to the force of gravity on the notebook, also known as its weight; m is the mass of the notebook; and a is the acceleration of the object caused by the force of gravity.

The acceleration of any object falling to the surface of Earth is 9.8 meters per second per second, or 9.8 m/s². This means that at the first second, the object will be falling with a speed of 9.8 m/s. At 2 seconds, the object will be falling at the rate of 19.6 m/s²; at 3 seconds, it will be falling at the rate of 29.4 m/s², and so on.

If the mass of the notebook is 0.5 kg, and the acceleration is 9.8 m/s², the force (weight) of the notebook can be calculated using the formula $F = ma$:

$$F = 0.5 \text{ kg} \times 9.8 \text{ m/s}^2 = 4.9$$

The Newton (N) is the measurement used to describe an amount of force. In the example above, $F = 4.9 \text{ N}$. Therefore, $4.9 \text{ kg} \cdot \text{m/s}^2 = 4.9 \text{ N}$

In this Virtual Lab you will investigate the relationship between mass, acceleration, and force by experimenting with falling objects of various masses under a range of gravitational conditions.

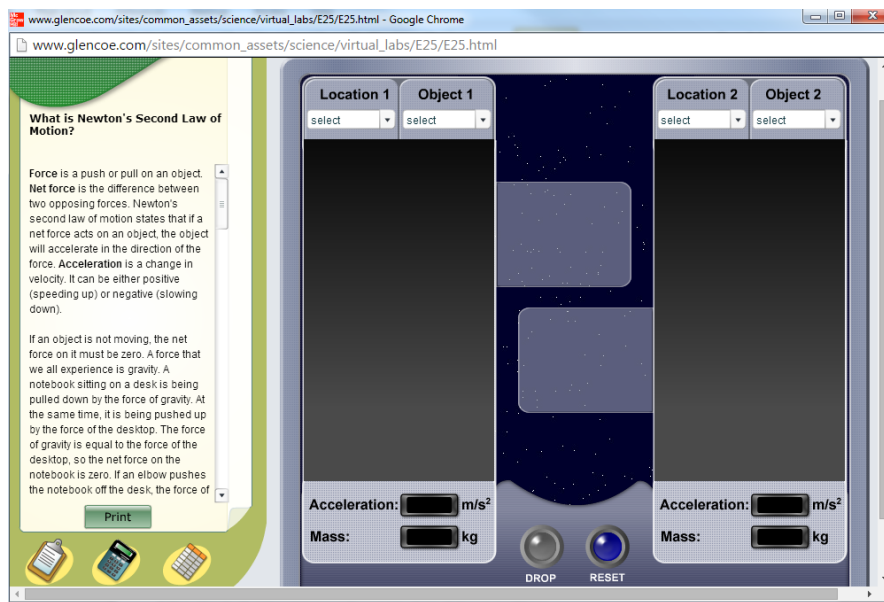
Objectives:

- Relate Newton's second law of motion to the effect of gravity on falling objects.
- Determine the effect of mass on the acceleration rate of falling objects.
- Observe the effect of gravitational conditions on the rate at which objects of identical mass fall.
- Given mass and acceleration, compute force.

Procedure:

Note: This activity assumes there are no atmospheric resistance, pressure, or temperature effects.

1. Click the arrow under Location 1 and select a planet to test. Click the arrow under Object 1 and select an object to test. Open the Table and record the gravitational rate of acceleration for this location and the mass of the object.
2. Select a second planet and object under Location 2 and Object 2. Open the Table and record the gravitational rate of acceleration for this location and the mass of the object.
3. Click the Drop button and observe the two objects as they fall. Click the Drop button again to see the objects fall again. The lines following a falling object indicate the object's relative position during each second of acceleration.
4. Using the mass and acceleration data displayed on the monitors, calculate the force (weight) of both objects. Record your results in the Table.
5. Repeat the above steps two more times with other objects and locations. Click the Reset button to clear the screen.
6. Complete the Journal questions.



Group Names: _____

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Data Table:

Test	Location	Acceleration (m/s ²)	Object	Mass of Object (kg)	Weight of Object (N)
1					
2					
3					
4					
5					

Journal Questions:

Directions: Complete the journal questions in complete sentences.

1: According to Newton's second law of motion, a net force on an object will cause it to accelerate. How does the Newton's law relate to the force of gravity?

2: How does the force of gravity affect the rate of acceleration?

3: Describe what happens when identical objects are dropped under different gravitational conditions.

4: Describe what happens when objects of different mass are dropped under same gravitational conditions.

5: What is weight? What is mass? How are mass and weight different?

6: Based on your experience with the experiments, how does mass affect weight?

7: What other conclusions can you draw from the data you collected in your table?
