Name: _____ Date: _____

Student Exploration: Weight and Mass

Vocabulary: balance, force, gravity, mass, newton, spring scale, weight

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. Your **weight** is the pull of **gravity** on your body. Suppose you step on a bathroom scale on the Moon. How would your weight on the Moon compare to your weight on Earth?

   A. greater on the Moon B. less on the Moon C. same on Earth and the Moon

2. Your **mass** is the amount of matter, or "stuff," in your body. How would your mass on the Moon compare to your mass on Earth?

   A. greater on the Moon B. less on the Moon C. same on Earth and the Moon

Gizmo Warm-up
On the *Weight and Mass* Gizmo™, you can use a **balance** to compare the masses of objects.

1. Place the **dog** on the right pan of the balance. What happens? _____

2. Place the **5-kilogram (kg) mass** on the other pan. Which has more mass, the dog or the 5-kg mass?

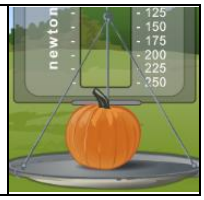
   _____

3. The 5-kg mass is heavier than the dog, so take it off the pan and place a 1-kg mass on the pan. Add 1-kg masses to the left pan until it goes down. Then take one of the 1-kg masses off the pan so that the masses are above the dog.

4. Use this process of adding and subtracting other masses from the left pan until the two pans are balanced. Add up all the masses on the left pan. This is equal to the mass of the dog.

   What is the mass of the dog? _____

   You can check your answer by clicking the center of the cross beam of the balance.

Activity A: **Weight on different planets**	Get the Gizmo ready: • Click **Clear scales** to remove all objects from the spring scale and the balance. • Click the center of the cross beam of the balance to turn off the mass display.	

Introduction: A **spring scale** is used to measure **force**. Since weight is a type of force, a spring scale can measure weight. The metric unit of force is the **newton** (N).

Question: Will an object's weight change on different planets?

1. Measure: Place the **pumpkin** on the spring scale. Click the red line on the scale to see the weight measured to the nearest newton.

   What is the weight of the pumpkin? _____

2. Predict: If you take an object to a different planet, do you think its weight will stay the same or be different? (Circle your answer.)

   Same Different

3. Collect data: Measure the weights of the following objects on Earth, the Moon, Mars, and Jupiter. Record your measurements in the data table below.

	Pumpkin	Dog	Watermelon
Weight on Earth			
Weight on Moon			
Weight on Mars			
Weight on Jupiter			

4. Analyze: Does the weight of an object change when it is moved to a different planet?

   _____

5. Extend your thinking: Which celestial body had the strongest gravity, Earth, the Moon, Mars, or Jupiter? Explain how you know. _____

   _____

   _____

   _____

Activity B: **Mass on different planets**	Get the Gizmo ready: • Click **Clear scales**.	

Question: How do weight and mass change on different planets?

1. Predict: If you take an object to a different planet, do you think its mass will stay the same or be different? (Circle your answer.)

   Same Different

2. Collect data: Use the balance to measure the masses of the following objects on Earth, the Moon, Mars, and Jupiter. Record your measurements in the data table below.

	Pumpkin	**Dog**	**Watermelon**
Mass on Earth			
Mass on Moon			
Mass on Mars			
Mass on Jupiter			

3. Analyze: Does the mass of an object change when it is moved to a different planet?

   _____

4. Draw conclusions: Based on what you have learned about mass and weight, why do you think the mass did *not* change but the weight did? _____

   _____

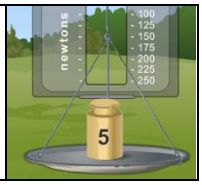
   _____

   _____

5. Extend your thinking: First, using the balance, find the *mass* of a pumpkin on Jupiter. Then place the pumpkin on the spring scale and record its *weight*. Finally remove the pumpkin and weigh the masses from the balance on the spring scale. How do the weights compare?

   _____

   _____

Extension: **Force of gravity**	Get the Gizmo ready: • Click **Clear scales**.	

Question: How strong is gravity on Mars, Jupiter, Earth, and the Moon?

1. Observe: Using the spring scale, measure the weights of objects on different planets. List the three planets and the Moon from strongest gravity to weakest.

   Strongest _____ _____ _____ _____ Weakest

2. Predict: On which planet or moon do you think the 5-kg mass will weigh the most? Least?

   _____

3. Collect data: Find the weight of the 5-kg mass at each location.

	Earth	Moon	Mars	Jupiter
Weight of 5-kg mass (N)				

   Was your prediction correct? _____

4. Calculate: Weight depends on mass and the strength of gravity. Estimate the strength of gravity on each location by dividing the weight of the 5-kg mass by 5.

	Earth	Moon	Mars	Jupiter
Strength of gravity (weight of 5-kg object ÷ 5)				

5. Calculate: First measure the mass of the flowerpot in the Gizmo. Then predict the weight of the flowerpot on each planet (multiply the mass by that planet's strength of gravity). Finally check your predictions by actually weighing the flowerpot on each planet, using the Gizmo.

	Earth	Moon	Mars	Jupiter
Flowerpot mass (kg or g)				
Predicted flowerpot weight (N)				
Measured flowerpot weight (N)				