Explore: The Land of Orb - Investigation

INSTRUCTOR:
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Introduction:

In this investigation, we will explore how Orbees, a type of children's toy, respond to different concentrations of salt in water. This experiment will help us understand the concept of osmosis and how cells interact with their environments, much like the Phoebies in the Land of Orb story.

Materials:

- Orbees
- Distilled water
- Tap water
- 10% salt water solution
- 35% salt water solution (sea water)
- Electronic balance (scale)
- Beakers or clear containers
- Timer
- Data tables for recording measurements

Procedure:

1. **First Investigation:**
    - Mass 12 Orbees and record the mass in grams.
    - Place 3 Orbees into each of the four solutions: distilled water, tap water, 10% salt water, and 35% salt water.
    - Leave the Orbees in the solutions for 20 minutes.
    - After 20 minutes, remove the Orbees, gently blot them dry, and mass them again. Record the new mass.

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2. **Second Investigation:**

- Place 12 Orbees in distilled water for 20 minutes - (Teacher - Before class)
- Mass the Orbees and record the mass.
- Transfer 3 Orbees from the distilled water into each of the four solutions: distilled water, tap water, 10% salt water, and 35% salt water.
- Leave the Orbees in the solutions for another 20 minutes.
- After 20 minutes, remove the Orbees, gently blot them dry, and mass them again. Record the new mass.

Data Tables:

First Investigation:

Solution Type	Trial	Initial Mass (g)	Final Mass (g)	Change in Mass (g)
Distilled Water	**1**			
	2			
	3			
	AVG			
Tap Water	**1**			
	2			
	3			
	AVG			
10% Salt Water	**1**			
	2			

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	3			
	AVG			
35% Salt Water	**1**			
	2			
	3			
	AVG			

Second Investigation:

Solution Type	Trial	Initial Mass (g)	Final Mass (g)	Change in Mass (g)
Distilled Water	**1**			
	2			
	3			
	AVG			
Tap Water	**1**			
	2			
	3			
	AVG			
	1			

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10% Salt Water	**2**			
	3			
	AVG			
35% Salt Water	**1**			
	2			
	3			
	AVG			

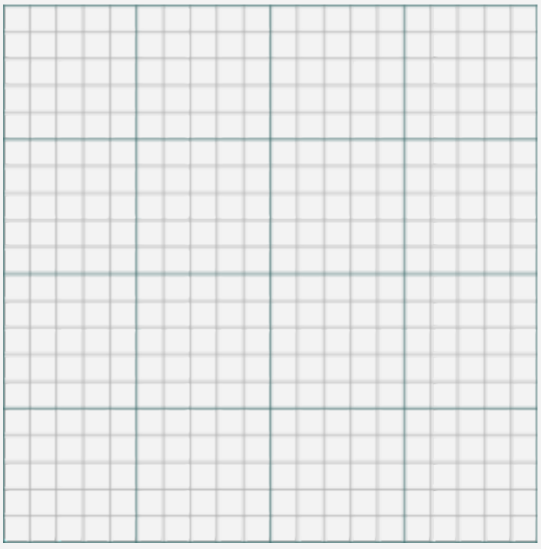
Hypothesis:

I predict that the Orbees in _____ will _____ because _____.

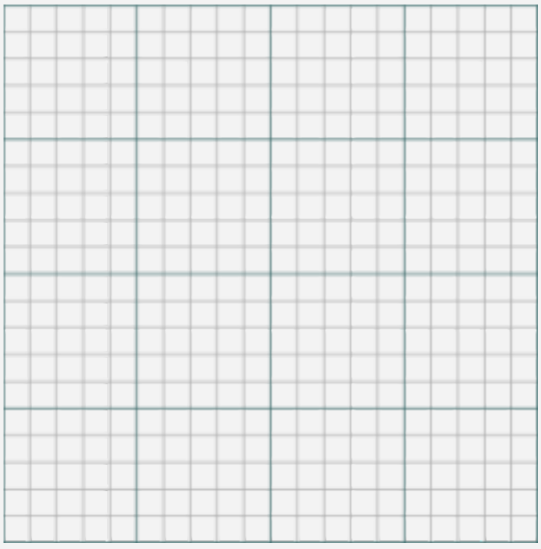
Graphing:

- Create a bar graph to show the average change in mass of the Orbees for each solution type.
- Label the x-axis with the different solution types.
- Label the y-axis with the change in mass (g).
- Plot the average change in mass for each solution.

Investigation 1



Investigation 2



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Conclusion:

Summarize the Results:

1. *The results showed that the Orbees in _____ had the greatest change in mass, while the Orbees in _____ had the least change in mass.*

Explain the Results:

2. *This happened because _____. The Orbees in _____ gained/lost water because _____. This relates to the concept of osmosis, where _____.*

Relate to the Story: Land of Orb

Once upon a time, in the mystical Land of Orb, Phoebe and her countless twin "sisters" formed a protective barrier around their beloved home. Each sister had a head and two arms, and together, they created an impenetrable wall, holding their heads close together to protect the Land of Orb from any unwanted invaders. The sisters called themselves "Phoebies."

The Phoebies were vigilant, constantly on the lookout for essential nutrients that the Land of Orb needed to thrive. They had a special way of working together, using their heads to draw in what was needed, creating tiny spaces just large enough for certain visitors to slip through.

One day, a green Orbie named Ion approached the Land of Orb. Ion was small and energetic, easily able to fit between the spaces created by the Phoebies' heads. "Hello, Phoebies!" Ion greeted. "I bring vital energy for the Land of Orb. May I come in?"

The Phoebies, recognizing Ion's importance, nodded their heads in unison, allowing Ion to slip through effortlessly. This was a simple task, requiring no extra energy—Ion was moving down the concentration gradient, from an area of high concentration outside the Land of Orb to a lower concentration inside.

Next, a group of Blue Orbies arrived, representing water molecules. They approached the Phoebies and asked, "Can we join the Land of Orb too?"

The Phoebies knew that water was crucial for maintaining balance. They allowed the Blue Orbies to pass through freely, thanks to their small size and the ease of their journey down the concentration gradient.

However, the story took a turn when a Red Orbie appeared. The Red Orbie was large and bulky, representing essential nutrients that couldn't fit through the small gaps between the Phoebies' heads. "Please, Phoebies, I need to enter the Land of Orb to provide nourishment," the Red Orbie pleaded.

The Phoebies pondered for a moment. They knew that while the Red Orbie was important, it required assistance to pass through the barrier. Luckily, the Land of Orb had special gatekeepers—proteins embedded in the Phoebies' wall that could help.

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"Fear not, Red Orbie," a Phoebie said, "we have protein gates to help you through. It will require some energy, but we are ready."

The Phoebies activated the protein gates, and with the use of energy, they helped the Red Orbie move against the concentration gradient, from an area of low concentration to high concentration inside the Land of Orb. This process, called active transport, ensured that the Red Orbie could enter despite the challenges.

Days passed, and the Phoebies continued their diligent work. They facilitated various forms of transport—allowing small molecules like Ion and water to pass through freely (passive transport), while helping larger molecules and ions through specialized gates using energy (active transport).

One day, the Land of Orb faced another challenge. Waste had accumulated inside, and it needed to be expelled to keep the land healthy. The Phoebies decided to use a special process called exocytosis. They gathered the waste into a large bubble-like vesicle, which represented a waste cart. The Phoebies then guided this waste cart towards the edge of their barrier. With careful coordination, they merged the waste cart with their barrier, creating a temporary gate. Using energy, they pushed the waste cart through the gate and out of the Land of Orb, moving the waste from an area of low concentration inside to a higher concentration outside. This ensured that the internal environment remained clean and balanced.

The Land of Orb thrived under the careful watch of Phoebe and her sisters. They ensured that only what was needed entered and left, maintaining the balance and homeostasis of their cherished land. And so, the Phoebies continued their eternal duty, a seamless blend of cooperation and vigilance, ensuring that the Land of Orb remained a vibrant and flourishing realm.

3. **In the story of the Land of Orb, the Phoebies had to manage different kinds of molecules entering and leaving their land. Similarly, in our experiment, ...**

4. **This helped us understand how cells work to maintain ...**

5. **The Orbees had to manage water entering and leaving depending on the solution they were in. This is similar to ...**

6. **In our experiment, the Orbees' management of water can be compared to ...**

7. **Like the Phoebies managing their land, cells need to ...**

Sentence Frames for Conclusion:

- *The Orbees in _____ changed the most because _____.*
- *This is similar to what happens when _____ because _____.*
- *From this experiment, I learned that _____.*

Safety Notes:

- Handle all solutions carefully.
- Clean up any spills immediately.
- Wash hands thoroughly after the experiment.