

Science of the Brain[®]

Knowing Science[®]

First Grade

MOVEMENT

STEM
Knowledge[®]



Kid
Knowledge[®]



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MOVEMENT

Lesson 4: Weighing with a Double Pan Balance

PURPOSE

This lesson continues students' exploration of weight as a property of matter. In this activity, students are introduced to a double pan balance as an instrument to compare and measure the weights of objects. The double pan balance confirms students' judgments of lighter/heavier items and extends their ability to discriminate between objects that are very similar in weight.

OBJECTIVES

By the end of the lesson, students will be able to:

- Use a double pan balance to determine which of two objects is heavier or lighter
- Use the lesson vocabulary to explain their conclusions about the objects' weights
- Relate the activity to real world situations

VOCABULARY

Introduce the following vocabulary words during the course of the lesson. Display the words prominently on chart paper, word wall, or pocket chart inserts. Even if students cannot read all these words, they will use them to communicate about the activities of the lesson. ELL students will be encouraged to ask for information pertaining to these and other vocabulary words that are required for basic communication in academic and social contexts. The teacher will encourage the ELL student to use these vocabulary words and expressions needed for basic communication during extended speaking assignments and their daily experiences. Students should be encouraged to speak in front of small groups, in front of a fellow student and in front of the entire classroom when appropriate.

- Pan balance
- Weight
- Balance
- Equal
- Heavier
- Lighter


PREPARING FOR THE LESSON

1. Allow 30-40 minutes for this activity. Students sit in a circle on the floor around the double pan balance.

Session 1: How do we use a double pan balance to compare weights of objects?

Time: 30-40 minutes

Materials:

- A collection of objects that differ in weight. The collection should include some similar objects, such as different sized blocks, to illustrate that bigger objects typically weigh more (have greater mass). Include items that are similar in weight so that it is difficult to determine which is heavier without the pan balance. Books work well for this purpose.
- Two strong, plastic grocery bags with handles
- 1-inch Eco-Cubes
- A double pan balance
-  A copy of *Balancing Act* by Ellen Stoll Walsh

TEACHING THE LESSON**Session 1**

How do we use a double pan balance to compare weights of objects?

1. Gather the students in a circle, keeping your collection of objects nearby. Read *Balancing Act* aloud to students. As you read, ask questions that help students grasp what it means to balance. After reading, ask students to describe what it means to balance. Give them a few moments to brainstorm this idea. Tell students that they will be learning about a double pan balance. It is a device with two pans that can be balanced against one another to show equal weight. With two objects of unequal weight, this device offers visual proof of which is the lighter object and which is the heavier.
2. Next tell the students that they are going to observe a human pan balance in action. Ask for a volunteer to act out how a pan balance works.
 - Have the student stand in the middle of the circle with arms extended straight out at shoulder height. Give the student an empty plastic bag to hold in each hand.
 - While the student remains standing with arms outstretched, put two 1-inch Eco-Cubes in one of the plastic bags. The student's arms should stay level.
 - Next, with the student holding the plastic bags in his/her hands and arms still outstretched, put a very heavy object (such as a book) in the other plastic bag. At this point, the student will have trouble keeping his/her arms level because the object is so heavy. The arm holding the heavy object will drift down, while the arm holding the Eco-Cubes will stay up.

- Ask the other students, “**Which object is heavier?**” The students indicate the second object, and the teacher questions, “**How do you know it is heavier?**” The students know intuitively that the second object is heavier because it “went down,” while the bag with the Eco-Cubes did not.



3. Introduce students to the “real” double balance pan. Place the device in the center of the circle and tell the class what it is called. Explain that the balance pan is designed to measure and compare weights. Tell students that it is called a double pan balance, because the device will *balance* when the weight is the same in each pan. Take the same two objects (Eco-Cubes, heavy book) you used in Step 2 and put one on each of the pans. As the students observe the results of this action, ask, “**What do you notice?**” The students can tell that the pan with the heavier object “went down,” just as the student’s arm did earlier. The lighter object rose or “went up.”



4. From your collection of objects, select two that obviously differ in weight. Ask students to predict which object will be heavier when weighed. Invite a student to place each object in the pan balance. Discuss whether the students' predictions were confirmed. Repeat this step several times, using different objects and asking different students to place them in the pans. Instead of always asking students to predict what will happen to the pan with the heavier object, vary the procedure by asking students to forecast what will happen to the pan with the lighter object.
5. Finally, from your collection of objects pick two that are very close in weight. Send the pair of objects around the circle, giving each child a chance to hold the objects in his/her hands to compare the weights. Some may think the objects weigh the same, and others may think one or the other is heavier. Then ask for a volunteer to put the objects in the balance pans. Discuss whether students' predictions were correct. Conclude the experiment by saying, **"Sometimes scientists use tools to answer questions that they have difficulty answering on their own, just as we used the balance pans to help us."**
6. Ask students to relate the activity to a real world situation. **"When we used the pan balance, we saw that the heavier side went down. Has anyone ever seen a similar thing happen, where something is heavier and that side goes down?"** (If the students have difficulty, ask further questions to elicit ideas, such as a playground seesaw, an amusement park ride, or a boat that is not evenly balanced.)
7. Now that students understand how a double pan balance works, explain to students that they can begin to experiment like real scientists. Now would be a good time to introduce the topic of "safety" during classroom and outdoor investigations. Advise students that just like scientists, everyone must follow safe practices while conducting experiments. It is important that all tools and materials be used safely and appropriately. Tell students, **"The double pan balance we are using for our experiments is a tool not a toy. Can you think of other tools scientists might use to conduct investigations?"** (Tape measures, timers, clocks, stop watches, cameras, etc). Tell students, **"It is important to always keep yourself and other students and the teacher safe and healthy, when conducting experiments by, listening and following all instructions."** Lead a discussion with the students discussing why it is important for students to keep themselves and other safe during indoor and outdoor experiments.
8. Now ask students to predict what will happen to water when it is cooled by placing it in a freezer. Ask students, **"How can we check if our predictions are correct?"** (We can do an experiment to test our prediction). Explain to students that these are the first two steps in planning an investigation. Ask students to provide a simple description of the experiment that will follow. Students should understand that scientists predict what they think will occur (hypothesis) and test their hypothesis with an experiment. The teacher will demonstrate that materials can change during heating and cooling. In addition the weight of the materials will not change as demonstrated when students compare weights on the double pan balance.
9. The teacher fills two identical cups with the same amount of water, covers them with thin plastic (Saran wrap), and confirms that they are the same weight on the double pan balance. Next the teacher places one cup in the freezer in order to freeze the water. Lastly the comparison on the double pan balance is made between the ice and liquid water, demonstrating that the state of the matter has changed due to a temperature change, but the weights remain the same. Ask students to organize and speak about the data of the weight of the frozen container and the container filled with water.

10. After the teacher has demonstrated that the weight of the glass of water does not change before and after freezing, the teacher can ask the students to predict what will happen to the frozen water if it is left in the classroom at room temperature.
11. The teacher should ask students to identify the change in water by freezing it and then letting it warm up in the classroom at room temperature.
12. The teacher can demonstrate evaporation by placing two cups half filled with the same amount of water on the double pan balance and after several days the water will evaporate equally into the air of the classroom and maintain a balanced weight leaving the cups eventually empty.
13. Finally the teacher can cover one of the cups half filled with water with thin plastic and repeat the experiment above, however the same amount of plastic should be placed on the double pan balance next to the open cup. This will ensure that both cups are equally balanced. Over several days as the water evaporates the pan with the uncovered cup will gradually rise on the double pan balance as the weight decreases and the water evaporates. The teacher can explain to the students that the water does not disappear but is contained in the air.

BUILDING LANGUAGE FOR LITERACY

The *Knowing Science* curriculum emphasizes guided student discovery through the use of teacher modeling and questioning. Social interaction among students is a major feature of the program so that students can share and explain background knowledge, process new learning effectively, and connect the two. In most lessons, students pursue the lesson objectives in a small group context. Small collaborative group work is a comfortable setting where students (including ELL students) are expected to share experiences and ask questions to clarify content, explore ideas, challenge one another's thinking, and carry out investigations.

1. Use the following sentence frames to describe the comparative weight of two objects (e.g., a block and a pen) when using the double pan balance. For example, "The block went down because it is heavier." Or "The pen went up because it is lighter."

The ____ went up because it is lighter.

The ____ went down because it is heavier.

The ____ and the ____ balance because they weigh the same amount.

The goal is for students to speak in complete sentences using the vocabulary of the activity.

2. ELL students should seek clarification of the spoken language, as needed, when students practice speaking the sentence frames above.
3. Reread *Balancing Act* to students. After reading the story, call on students to share how the teeter-totter that the mice balanced on is similar to the double pan balance. Encourage students to use the pictures in the book to describe the teeter totter when it was balanced and how one side became heavier or lighter as animals joined one side or the other. The retelling of the story provides an opportunity to use the language structures in a context.

EXTENDING THE LESSON

1. Put a pan balance and a variety of objects at a center and allow the children to experiment with them. Have students draw a picture to record their work.
2. Design an experiment to answer the question: “What would happen to the sides of the pan balance if both objects were the same weight?”

ASSESSING STUDENT LEARNING

You can use a rubric such as the one below to assess students’ learning.

	Emerging	Achieved	Advanced
Uses a pan balance to determine which of two objects is heavier or lighter	Student needs teacher guidance to use the pan balance or has difficulty with the concepts of heavier/lighter.	Student can use the balance to determine which object is heavier or lighter.	Student uses the pan balance, determines which object is heavier/lighter, and makes observations or asks questions that indicate higher level thinking.
Uses the lesson vocabulary to explain his/her conclusions about the objects’ weights	Student has difficulty with the vocabulary or the concepts.	Student can use the vocabulary appropriately.	Student uses vocabulary in a way that conveys an advanced understanding of the concepts.
Relate the activity to real world situations	Student demonstrates limited ability to connect the activity to a real world situation.	Student connects the activity to a real world situation.	Student makes connections and is able to explain his/her reasoning.
Predict and identify changes in materials by heating and cooling	Student can describe that materials change when frozen and materials change when heated.	Student can give examples of water freezing or chocolate melting.	Student can describe the effect on materials by heating and cooling.

CROSCUTTING CONCEPTS

Patterns; Cause and Effect: Mechanism and Prediction; Scale, Proportion, and Quantity

This lesson involves students observing what happens when objects of unequal weight are put on both sides of a double pan balance. After several observations, they note that the heaviest object depresses one of the pans, while the pan with the lighter object rises. Multiple observations of this phenomenon allow students to predict that the heavier object will always make the pan sink. Though this activity does not call on students to quantify weight, it serves as a precursor for learning about standard units that apply to weight.

SCIENTIFIC AND ENGINEERING PRACTICES*Asking Questions; Constructing Explanations*

The question that is the focal point of this lesson—how do we use a double pan balance to compare weight?—gives rise to experimenting with pairs of objects in each pan of the balance to determine which object weighs more. Students are then called upon to explain why one pan went down and the other up.

GUIDELINES FOR TEXAS SAFETY STANDARDS

During classroom and outdoor investigations students should be advised to wash hands as frequently as possible, wear safety goggles when appropriate and always use materials appropriately.

First Grade activities and assessments do not require any open flames or heating of objects nor the use of any dangerous materials.

SAFE PRACTICES

During the lesson, students must be instructed on how to keep themselves and others safe, as well as how to keep themselves healthy and others healthy.

NATURAL RESOURCES AND MATERIALS

During the lesson students should be instructed on how to use, conserve and dispose of natural resources and materials.