

**Measuring Mass with a Two-Pan Balance**

It is important to wait until the pans are still. If two objects balance, they have the same mass. Also, if the two pans are level, the objects they contain have the same mass. If the arm of the balance tilts lower on one side, the object in the lower pan has more mass than the object in the other pan.



In order to measure mass we need a unit of measure. Common metric units of mass are the **gram (g)** and the **kilogram (kg)**. One kilogram is 1000 grams. We measure the mass of small objects in grams and the mass of large objects in kilograms. The mass of a centimeter connecting cube is one gram. The mass of a third grader is about 25–40 kilograms.



1. Complete the table for the Function Machine to compare kilograms to grams.

Rule: Multiply by 1000

Input	Output
Mass in Kilograms	Mass in Grams
5	
3	
11	
15	
12	
1	

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2. Levi used his two-pan balance to find the mass of his calculator. His standard masses have a mass of 1 gram and 10 grams. He found the mass was 92 grams. Explain how Levi found the mass of the calculator.



**✓ Check-In: Question 3**

3. Use a two-pan balance to find the mass of at least four objects. Record your results on the *Mass Data Table* page in the *Student Activity Book*.

Use your data to answer the following questions. Sometimes you will have to collect more data to provide an answer.

- Which object had the most mass?
- Which object had the least mass?
- Compare the mass of the objects from Questions 4 and 5. Describe how the masses compare using words or number sentences.
- Choose any two of your objects. Use your data to predict the total mass of those two objects.
  - Write down the mass of each object and your prediction.
  - Use the balance to find the actual mass of the two objects together.
  - Was your predicted mass close to the actual mass? How close?
- Put the object with the most mass in one pan. Put the object with the second largest mass in the other pan. Predict how much mass you will have to add to the lighter side to get the pans to balance. Write down your prediction.
  - Check your prediction by adding mass to the lighter side until the pans balance. Write down the actual amount. Are the two numbers close?

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**Measuring Mass (SG pp. 349–351)  
Questions 1–10**

1. Rule: Multiply by 1000

Input	Output
Mass in Kilograms	Mass in Grams
5	<b>5000</b>
3	<b>3000</b>
11	<b>11,000</b>
15	<b>15,000</b>
12	<b>12,000</b>
1	<b>1000</b>

- Possible response: Nine 10-gram masses is 90 grams plus 2 more grams is 92 g.
- The following is a sample data table. See the lesson for masses of other everyday objects.

<b>O</b> Object	<b>M</b> Mass (in grams)
Calculator	<b>81 g</b>
Eraser	<b>38 g</b>
Meterstick	<b>109 g</b>
Ruler	<b>10 g</b>

The answers to *Questions 4–10* are based on the sample data table above.

- meterstick
- ruler
- Answers will vary. The meterstick is about 10 or 11 times the mass of the ruler.  $109\text{ g} > 10\text{ g}$ .
- Answers will vary; ruler: 10 g; eraser: 38 g; prediction for the total mass: 48 g
  - Answers will vary.
  - Answers will vary.
- Prediction: 28 g ( $109\text{ g} - 81\text{ g} = 28\text{ g}$ )
  - Answers will vary.

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9. The prediction for the total mass of 2 objects was close to, but not exactly the same as, the actual result. This is due to measurement error. See the Content Note in the Lesson Guide.
- 10.\* The answers were probably not all the same but they were probably close. If not, discuss what might have gone wrong; the answers were not exactly the same because of measurement error.

**Homework (SG pp. 351–353)**

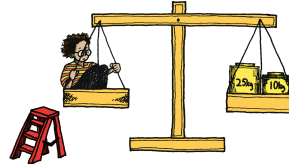
**Questions 1–6**

1. 35 kg
2. 70 pounds
3. Answers will vary. Many students might not want to share this information aloud. Have them find these answers independently.

**Discuss**

9. Were any of your predictions different from your actual results? Discuss why that might have happened.
10. All the groups in your class found the mass of at least one identical object. Did everyone get the same measurement for its mass? Were all the measurements close? Discuss why the answers were not exactly the same.

**Homework**



1. What is the mass of the boy in the balance?
2. A kilogram in the metric system is about 2.2 ( $2\frac{1}{5}$ ) pounds in the English system. You can estimate the weight in pounds of the boy in the balance by using a more convenient number. Multiply his mass by 2 to find his weight in pounds.
3. Estimate your weight in kilograms by dividing your weight in pounds by 2.

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4. A. Rule: Multiply by 2

Input	Output
Mass in Kilograms	Mass in Pounds
10	<b>20</b>
60	<b>120</b>
15	<b>30</b>
35	<b>70</b>

- B. Rule: Divide by 2

Input	Output
Mass in Pounds	Mass in Kilograms
100	<b>50</b>
42	<b>21</b>
50	<b>25</b>
16	<b>8</b>

4. One kilogram is 2.2 pounds. Copy and complete the Function Machine tables. Use the more convenient number 2 to find estimates.

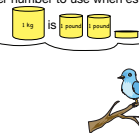
- A.  
Rule: Multiply by 2

Input	Output
Mass in Kilograms	Mass in Pounds
10	
60	
15	
35	

- B.  
Rule: Divide by 2

Input	Output
Mass in Pounds	Mass in Kilograms
100	
42	
50	
16	

1 kilogram is 2.2 pounds, but 2 is an easier number to use when estimating.



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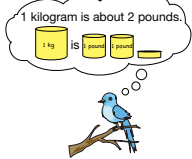
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\*Answers and/or discussion are included in the lesson.

5. Decide whether the following statements "could be" true or if they are "crazy." If the statement is crazy, tell what each student might have done wrong and correct the statement.

- A. The mass of Josh's brick is 3 kilograms. Peter doubled 3 to find that the brick's weight is about 6 pounds.
- B. Diana weighs 80 pounds. She said that her weight in kilograms is about 160 kilograms.
- C. Darius found his weight in kilograms. It was 32 kilograms. He said his weight in pounds is about 64 pounds.
- D. Emily found the weight of her bird. It weighs one pound. She said that her bird's weight in kilograms is about one-half of a kilogram.
- E. Suzanne's baby sister Jessica weighs 13 pounds. She said that Jessica's weight in kilograms is about 30 kilograms.
- F. Kathy's new puppy weighs 16 kilograms. She said that her puppy's weight in pounds is about 10 pounds.



6. Kathy's puppy walked across her homework with muddy paws. Look for patterns in the data to find the information missing in the table.

Kilograms to Grams

	Mass in Kilograms	Mass in Grams
	2	2000
	4	4000
A.	6	
B.		8000
C.	10	
D.	12	

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- 5. A. Could be.
- B. Crazy; she multiplied instead of dividing. Her weight is about 40 kilograms.
- C. Could be.
- D. Could be.
- E. Crazy; she might have multiplied. Her weight is about 7 to 8 kilograms.
- F. Crazy; she should have doubled 16 kilograms to make 32 pounds.

6.

Kilograms to Grams

	Mass in Kilograms	Mass in Grams
	2	2000
	4	4000
A.	6	<b>6000</b>
B.	<b>8</b>	8000
C.	10	<b>10,000</b>
D.	12	<b>12,000</b>

- A.
- B.
- C.
- D.