Indiana Academic Standard Check

8.5.1: Understand and explain that a number must be written with an appropriate number of significant figures (determined by the measurements from which the number is derived).

✔ When several numbers are multiplied, what determines the number of significant digits in the product?

Precision and Number of Digits When might you need to round a number? Suppose you want to divide a 2-L bottle of soft drink equally among seven people. When you divide 2 by 7, your calculator display reads as shown in **Figure 7.** Will you measure exactly 0.285 714 285 L for each person? No. All you need to know is that each person gets about 0.3 L of soft drink.

Using Precision and Significant Digits The number of digits that truly reflect the precision of a number are called the significant digits or significant figures. They are figured as follows:

- Digits other than zero are always significant.
- Final zeros after a decimal point (6.545 600 g) are significant.
- Zeros between any other digits (507.0301 g) are significant.
- Initial zeros (0.000 2030 g) are NOT significant.
- Zeros in a whole number (1650) may or may not be significant.
- A number obtained by counting instead of measuring, such as the number of people in a room or the number of meters in a kilometer, has infinite significant figures.

Applying Math — Rounding

ROUNDED VALUES The mass of one object is 6.941 g. The mass of a second object is 20.180 g. You need to know these values only to the nearest whole number to solve a problem. What are the rounded values?

Solution

1. *This is what you know:*
   - mass of first object = 6.941 g
   - mass of second object = 20.180 g
2. *This is what you need to find out:*
   - the number to the right of the one's place
   - first object: 9; second object: 1
3. *This is the procedure you need to use:*
   digits 0, 1, 2, 3, 4 remain the same
   for digits 5, 6, 7, 8, 9, round up
4. *Check your answer:*
   - first object: 9 makes the 6 round up = 7
   - second object: 1 makes the 0 remain the same = 20

Practice Problems

1. What are the rounded masses of the objects to the nearest tenth of a unit?
2. Round the following numbers: 25.643 to the ones place, 3.429 to the tenths place, 5.982 to the hundredths place, and 9.8210 to the tenths place.

For more practice, visit in8.msscience.com/math_practice

Following the Rules In the soft drink example you have an exact number, seven, for the number of people. This number has infinite significant digits. You also have the number two, for how many liters of soft drink you have. This has only one significant digit.

There are also rules to follow when deciding the number of significant digits in the answer to a calculation. They depend on what kind of calculation you are doing.

- For multiplication and division, you determine the number of significant digits in each number in your problem. The significant digits of your answer are determined by the number with fewer digits.

$$6.14 \times 5.6 = \boxed{34}.384$$

3 digits 2 digits 2 digits

- For addition and subtraction, you determine the place value of each number in your problem. The significant digits of the answer are determined by the number that is least precise.

$$\begin{array}{rl} 6.14 & \text{to the hundredths} \\ +\ 5.6 & \text{to the tenths} \\ \hline \boxed{11.7}4 & \text{to the tenths} \end{array}$$

In the soft drink example you are dividing and the number of significant digits is determined by the amount of soft drink, 2 L. There is one significant digit there; therefore, the amount of soft drink each person gets is rounded to 0.3 L.

Figure 7 Sometimes considering the size of each digit will help you realize they are unneeded. In this calculation, the seven ten-thousandths of a liter represents just a few drops of soft drink.

section 1 review

Summary

Measurement

- Measurement is used to answer questions such as how much, how long, or how far.

Estimation

- When making an estimate, rely on previous knowledge to make an educated guess about the size of an object.

Precision and Accuracy

- Precision is the ability to remain consistent. Accuracy compares a measurement to an accepted value.
- Significant digits affect precision when calculating an answer and are determined by rules based on calculation.

Self Check

1. **Estimate** the distance between your desk and your teacher's desk. Explain the method you used.
2. **Infer** John's puppy has chewed on his ruler. Will John's measurements be accurate or precise? Why?
3. **Think Critically** Would the sum of 5.7 cm and 6.2 cm need to be rounded? Why or why not? Would the sum of 3.28 cm and 4.1 cm need to be rounded? Why or why not?

Applying Math

4. **Calculate** Perform the following calculations and express the answer using the correct number of significant digits: 42.35 + 214; 225/12. **For more help, refer to the Math Skill Handbook.**

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