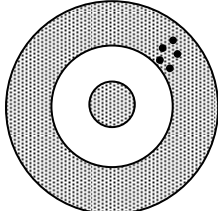
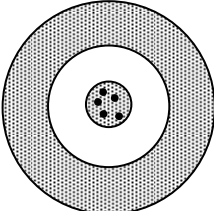
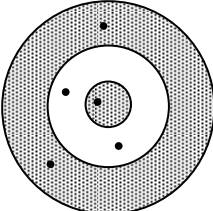


Name \_\_\_\_\_ Period \_\_\_\_\_ Date \_\_\_\_\_

**ACCURACY AND PRECISION****Definitions:****Accuracy** - how close a measurement is to \_\_\_\_\_**Precision** - how close a measurement is to \_\_\_\_\_**Precision versus Accuracy:**

Look at each target and decide whether the "hits" are accurate, precise, both accurate and precise, or neither accurate nor precise: (Note: An accurate "hit" is a bulls eye!)

|   |   |   |
|---|---|---|
|  |  |  |
| Accurate?: Yes / No   | Accurate?: Yes / No   | Accurate?: Yes / No   |
| Precise?: Yes / No  | Precise?: Yes / No  | Precise?: Yes / No  |

**Precision Problems:**

A group of students worked in separate teams to measure the length of an object. Here are their data:

| Team 1  | Team 2  | Team 3  | Team 4  | Team 5  | Team 6  | Team 7  |
|---------|---------|---------|---------|---------|---------|---------|
| 2.65 cm | 2.75 cm | 2.80 cm | 2.77 cm | 2.60 cm | 2.65 cm | 2.68 cm |

- The average length is \_\_\_\_\_ cm.  
This is the mean or average.
- Subtract the highest value from the lowest value: \_\_\_\_\_ cm.  
This is the range or spread.
- Divide this number by 2: \_\_\_\_\_ cm.  
This is the approximate  $\pm$  range from the average.
- The precision of the measurement can be shown as average  $\pm$  range.  
The precision of the measurement was \_\_\_\_\_  $\pm$  \_\_\_\_\_ cm.

A second group of students obtained the following data:

| Team 8  | Team 9  | Team 10 | Team 11 | Team 12 | Team 13 | Team 14 |
|---------|---------|---------|---------|---------|---------|---------|
| 2.60 cm | 2.70 cm | 2.80 cm | 2.75 cm | 2.65 cm | 2.62 cm | 2.78 cm |

- The average length is \_\_\_\_\_ cm.
- The precision of the measurement was \_\_\_\_\_ $\pm$ \_\_\_\_\_ cm.

In comparing groups, the first or the second, which group was more precise or was the precision the same? **Justify your answer.**

### **Expressing Errors in Measurement:**

Scientists often express their uncertainty and error in measurement by giving a percent error. The percent error is defined as:

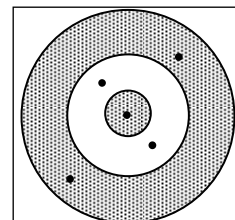
$$\% \text{ error} = \frac{\text{actual value} - \text{measured value}}{\text{actual value}} \times 100$$

Answer the following four questions. Pay attention to significant figures, and **show your work!**

1. While doing a lab, a student found the density of a piece of pure aluminum to be 2.85 g/cm<sup>3</sup>. The accepted value for the density of aluminum is 2.70 g/cm<sup>3</sup>. What was the student's percent error?

2. A student measured the specific heat of water to be  $4.29 \text{ J/g} \cdot ^\circ\text{C}$ . The literature value of the specific heat of water is  $4.18 \text{ J/g} \cdot ^\circ\text{C}$ . What was the student's percent error?
  
  
  
  
  
  
  
  
  
  
3. A student took a calibrated 200.0 gram mass, weighed it on a laboratory balance, and found it read 196.5 g. What was the student's percent error?

4. Accuracy is often expressed as an average of several measurements. Look at the target to the right. In your opinion, how well do the measurements on the target represent: **(Justify your opinion.)**



a. Accuracy?

b. Precision?

