Uncertainty in Measurement

The glug as a unit of linear measurement

In science, numbers often represent data collected as measurements. Today we will practice comparing how the precision of measurements appear to change when the measured values are used to calculate new values. Consequently we will establish rules to determine the number of digits we should use in our final calculations.

Part I

You will be given a glug to measure sides of 3 items in the classroom. You will then calculate the area.

Table I

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item | Length | Width | Area (calculated) | Area (rounded) |
| 1 | Floor tile |  |  |  |  |
| 2 | Table top |  |  |  |  |
| 3 | Whiteboard |  |  |  |  |

*Estimate your glug measurement to the tenths place.*

1. Assuming that item one is identical for all groups, do you expect all the groups to get the same answer for the length and area? Explain.
2. When you measured the length and width of your items, what digit did you know for certain? What digit did you estimate?
3. After discussing Question 2 with your groupmates fill in the column “Area (rounded)”. Explain why you needed to round the numbers and how you chose where to round.

Table II

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | Item 3 Area | Average value | Range of values | Range percent of average |
| 1 |  | (Add all values and divide by the number of groups) | (Largest value minus smallest value) | (Range divided by average. Multiply by 100) |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 |  |
| 9 |  | Answer | Answer | Answer |
| 10 |  |

Part II

Using a ruler, divide your glug into 10 even divisions.

Table III

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item | Length | Width | Area (calculated) | Area (rounded) |
| 1 | Floor tile |  |  |  |  |
| 2 | Table top |  |  |  |  |
| 3 | Whiteboard |  |  |  |  |

*Estimate your glug measurement to the hundredths place.*

1. Explain the difference between “Area (calculated)” and “Area (rounded)”

Table IV

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | Item 3 Area | Average value | Range of values | Range percent of average |
| 1 |  | (Add all values and divide by the number of groups) | (Largest value minus smallest value) | (Range divided by average. Multiply by 100) |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 |  |
| 9 |  | Answer | Answer | Answer |
| 10 |  |

1. How did the “range of values” and “percent range of values” in Table II differ from that of Table IV?
2. If you were to publish your data in a scientific journal, would you use Table II or Table IV?
3. Did your technique change when you used a while glug versus a divided glug?