Units and Measurements

Example Problem

A laboratory experiment measures the boiling point of water. The accepted value of the boiling point of water at standard atmospheric pressure is 100°C. The measured boiling point in the experiment is 98°C. Calculate the percentage error.

Solution:

1. **Determine the true value**: 100°C.
2. **Measure the quantity**: 98°C.
3. **Calculate the absolute error**:
   $$\text{Absolute Error} = |98 - 100| = 2°\text{C}$$
4. **Calculate the percentage error**:
   $$\text{Percentage Error} = (\frac{2}{100}) \times 100\% = 2\%$$

Similar Problems

1. A student measures the length of a table as 1.95 meters, but the actual length is 2 meters. Calculate the percentage error.

2. The true mass of a gold bar is 500 grams. A jeweler measures it and finds it to be 495 grams. Calculate the percentage error.

3. During an experiment, the density of a substance is measured as 8.1 g/cm³, but the true density is known to be 8.0 g/cm³. Calculate the percentage error.

4. A thermometer shows the temperature as 25.5°C, while the actual temperature is 26.0°C. Calculate the percentage error.

5. The actual speed of a car is 60 km/h, but a speedometer reads it as 58 km/h. Calculate the percentage error.

6. An electronic scale shows the weight of an object as 150 grams, but the true weight is 155 grams. Calculate the percentage error.

Key

1. **Problem 1**:
   $$\text{Absolute Error} = |1.95 - 2| = 0.05 \text{ meters}$$
   $$\text{Percentage Error} = (\frac{0.05}{2}) \times 100\% = 2.5\%$$

2. **Problem 2**:
   Absolute Error = $|495 - 500| = 5$ grams
   Percentage Error = $(\frac{5}{500}) \times 100\% = 1\%$

3. **Problem 3**:
   Absolute Error = $|8.1 - 8.0| = 0.1$ g/cm^3
   Percentage Error = $(\frac{0.1}{8.0}) \times 100\% = 1.25\%$

4. **Problem 4**:
   Absolute Error = $|25.5 - 26.0| = 0.5$°C
   Percentage Error = $(\frac{0.5}{26.0}) \times 100\% \approx 1.92\%$

5. **Problem 5**:
   Absolute Error = $|58 - 60| = 2$ km/h
   Percentage Error = $(\frac{2}{60}) \times 100\% \approx 3.33\%$

6. **Problem 6**:
   Absolute Error = $|150 - 155| = 5$ grams
   Percentage Error = $(\frac{5}{155}) \times 100\% \approx 3.23\%$