

CHEM101 Report for Laboratory Exercise #1

Measurement of Volumes and Weights: Accuracy and Precision¹

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Abstract

By measuring the volume and weight of samples the density of a solution of NaCl (concentration **2.676 mol/L**) was determined to be **1.05 g/mL**.

Data/Results

Table 1. Experimental data and calculated values

10.00 mL of NaCl solution	# 1	# 2	# 3
Weight of sample from Volumetric pipette (g)	11.132	10.150	10.133
Calculated density (g/mL)	1.1132	1.0150	1.0133
Concentration (mol/L)	2.676		
Average calculated density of NaCl solution (g/mL)	$1.047166667 \cong 1.05$		
Standard Deviation, σ	$0.46697775345537 \cong 0.05$		
%RSD for the density of NaCl solution	5.462%		

Algebraic Equations

$$\text{Relative SD, \%RSD} = \frac{\text{Standard Deviation, } \sigma}{\text{Average Density, } \bar{X}} \times 100$$

$$\text{Standard Deviation, } \sigma = \sqrt{\sum \frac{(\text{Calculated Density} - \text{Average Density})^2}{n - 1}}$$

$$V = \frac{\text{Mass}}{\text{Density}} \quad \text{Density, } \rho = \frac{\text{Weight of NaCl solution, m (g)}}{\text{Volume of NaCl Solution, V (mL)}}$$

$$\text{Concentration} = \frac{\text{Moles of NaCl, mol or, } \left[\frac{\text{Mass of NaCl, g}}{\text{Molar Mass of NaCl, g/mol}} \right]}{\text{Volume of NaCl Solution, L}}$$

Discussion

The density of the prepared NaCl solution **2.676 mol/L** was determined to be **1.05 g/mL** by measuring 3 samples of 10.00 mL of the NaCl solution. The %RSD calculated for these measurements was **5.462%**. The accuracy of the measurement required the use of a pipette and not a graduated cylinder because **pipettes are designed to deliver precise volumes, ensuring that each 10.00 mL sample is consistent in volume.**

Conclusions

The measured density of the NaCl solution with concentration **2.676 mol/L** using a volumetric pipette is **1.05 g/mL** with a % relative standard deviation of **5.462%**.

References

1. Reimer, M. et al, *Laboratory Manual, Chemistry 101*, pp. 13-18. (University of Victoria: Victoria, B.C.). **Summer 2024.**