

Chemistry 212

MEASUREMENT TECHNIQUES AND DENSITY

LEARNING OBJECTIVES

The objectives of this experiment are to . . .

- Introduce the proper use of volumetric glassware and the top loading balance.
- Calculate density mathematical and graphically.
- Evaluate experimental results and demonstrate knowledge of precision and accuracy.

SAFETY PROCEDURES

There are no special hazards associated with this experiment. As always, safety goggles must be worn at all times in the laboratory.

Measuring Techniques

Part A.

Volumetric glassware needed:

- a. 100 mL Graduated Cylinder (use to measure 25 mL)
- b. 10 mL Pipet
- c. 50 mL Volumetric Flask

Measure and weigh given volumes of deionized water 5 times for each of the above measuring techniques.

Part B.

Volumetric glassware needed:

- a. 5 mL Graduated Pipet
- b. 50 mL Buret

For the graduated pipet measure then weigh 1, 2, 3, 4, and 5 mL aliquots of water. Record weight and volume measurements.

For the buret measure and weigh 10 mL of water. To the original 10 mL add another aliquot of 10 mL and reweigh. Repeat until total volume of water is being weighed is 50 mL. Record weight and volume as the experiment progresses.

Report

You will **not** do a formal report for this experiment. Each student will turn in one set of data sheets with graphs attached. Make sure graphs are labeled correctly with titles and units. Make sure the equation for the linear fit trend line has sufficient significant figures displayed on the graph.

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Data Sheet

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Part A Results:

	Volume Measured	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average Mass	Calculated Density	Percent Error
	mL	g	g	g	g	g	g	g/mL	
Graduated Cylinder									
Volumetric Flask									
Pipet									

Temperature of water _____ °C

Theoretical density for water (from attached table) _____ (g/mL)

Discuss and compare the precision and accuracy of each measuring technique:

Part B Results:

Volumetric Pipet Experiment

Volume (mL)	1	2	3	4	5
Mass (g)					

Make a graph of mass vs. volume. (From the graph) Slope = _____(g/mL)

Discuss the precision and accuracy of the results:

Buret Experiment

Volume (mL)	10	20	30	40	50
Mass (g)					

Make a graph of mass vs. volume. From the graph the slope = _____(g/mL)

Discuss the precision and accuracy of the results:

Density of water at 0.1 degree intervals in (g/mL)

Temp °C.	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.999841	0.999847	0.999854	0.99986	0.999866	0.999872	0.999878	0.999884	0.999889	0.999895
1	0.9999	0.999905	0.999909	0.999914	0.999918	0.999923	0.999927	0.99993	0.999934	0.999938
2	0.999941	0.999944	0.999947	0.99995	0.999953	0.999955	0.999958	0.99996	0.999962	0.999964
3	0.999965	0.999967	0.999968	0.999969	0.99997	0.999971	0.999972	0.999972	0.999973	0.999973
4	0.999973	0.999973	0.999973	0.999972	0.999972	0.999972	0.99997	0.999969	0.999968	0.999966
5	0.999965	0.999963	0.999961	0.999959	0.999957	0.999955	0.999952	0.99995	0.999947	0.999944
6	0.999941	0.999938	0.999935	0.999931	0.999927	0.999924	0.99992	0.999916	0.999911	0.999907
7	0.999902	0.999898	0.999893	0.999888	0.999883	0.999877	0.999872	0.999866	0.999861	0.999855
8	0.999849	0.999843	0.999837	0.99983	0.999824	0.999817	0.99981	0.999803	0.999796	0.999789
9	0.999781	0.999774	0.999766	0.999758	0.999751	0.999742	0.999734	0.999726	0.999717	0.999709
10	0.9997	0.999691	0.999682	0.999673	0.999664	0.999654	0.999645	0.999635	0.999625	0.999615
11	0.999605	0.999595	0.999585	0.999574	0.999564	0.999553	0.999542	0.999531	0.99952	0.999509
12	0.999498	0.999486	0.999475	0.999463	0.999451	0.999439	0.999427	0.999415	0.999402	0.99939
13	0.999377	0.999364	0.999352	0.999339	0.999326	0.999312	0.999299	0.999285	0.999272	0.999258
14	0.999244	0.99923	0.999216	0.999202	0.999188	0.999173	0.999159	0.999144	0.999129	0.999114
15	0.999099	0.999084	0.999069	0.999054	0.999038	0.999023	0.999007	0.998991	0.998975	0.998959
16	0.998943	0.998926	0.99891	0.998893	0.998877	0.99886	0.998843	0.998826	0.998809	0.998792
17	0.998774	0.998757	0.998739	0.998722	0.998704	0.998686	0.998668	0.99865	0.998632	0.998613
18	0.998595	0.998576	0.998558	0.998539	0.99852	0.998501	0.998482	0.998463	0.998444	0.998424
19	0.998405	0.998385	0.998365	0.998345	0.998325	0.998305	0.998285	0.998265	0.998244	0.998224
20	0.998203	0.998183	0.998162	0.998141	0.99812	0.998099	0.998078	0.998056	0.998035	0.998013
21	0.997992	0.99797	0.997948	0.997926	0.997904	0.997882	0.99786	0.997837	0.997815	0.997792
22	0.99777	0.997747	0.997724	0.997701	0.997678	0.997655	0.997632	0.997608	0.997585	0.997561
23	0.997538	0.997514	0.99749	0.997466	0.997442	0.997418	0.997394	0.997369	0.997345	0.99732
24	0.997296	0.997271	0.997246	0.997221	0.997196	0.997171	0.997146	0.99712	0.997095	0.997069
25	0.997044	0.997018	0.996992	0.996967	0.996941	0.996914	0.996888	0.996862	0.996836	0.996809
26	0.996783	0.996756	0.996729	0.996703	0.996676	0.996649	0.996621	0.996594	0.996567	0.99654
27	0.996512	0.996485	0.996457	0.996429	0.996401	0.996373	0.996345	0.996317	0.996289	0.996261
28	0.996232	0.996204	0.996175	0.996147	0.996118	0.996089	0.99606	0.996031	0.996002	0.995973
29	0.995944	0.995914	0.995885	0.995855	0.995826	0.995796	0.995766	0.995736	0.995706	0.995676
30	0.995646	0.995616	0.995586	0.995555	0.995525	0.995494	0.995464	0.995433	0.995402	0.995371
Temp.	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9