CONCEPT: THERMAL DEPENDENCY

_____ is the process of measuring the actual quantity of mass, volume and other chemical measurements that relate to what we observe on an analytical scale.

In general, when taking the measurements of a solution you must take into account any type of thermal expansion that occurs with solutions and instrumentation.

Correction for thermal expansion: $$\frac{c'}{d'} = \frac{c}{d}$$

Volume of 1 g of water (mL)

Temperature (ºC)	Density	At Temp shown	Corrected to 20ºC
10	0.999 702 6	1.001 4	1.001 5
11	0.999 608 4	1.001 5	1.001 6
12	0.999 500 4	1.001 6	1.001 7
13	0.999 380 1	1.001 7	1.001 8
14	0.999 247 4	1.001 8	1.001 9
15	0.999 102 6	1.002 0	1.002 0
16	0.998 946 0	1.002 1	1.002 1
17	0.998 777 9	1.002 3	1.002 3
18	0.998 598 6	1.002 5	1.002 5
19	0.998 408 2	1.002 7	1.002 7
20	0.998 207 1	1.002 9	1.002 9
21	0.997 995 5	1.003 1	1.003 1
22	0.997 773 5	1.003 3	1.003 3
23	0.997 541 5	1.003 5	1.003 5
24	0.997 299 5	1.003 8	1.003 8
25	0.997 047 9	1.004 0	1.004 0
26	0.996 786 7	1.004 3	1.004 2
27	0.996 516 2	1.004 6	1.004 5
28	0.996 236 5	1.004 8	1.004 7
29	0.996 947 8	1.005 1	1.005 0
30	0.996 650 2	1.005 4	1.005 3

EXAMPLE 1: Massachusetts limits the amount of lead in drinking water to 219 ppb. a) Express this total in molarity. b) What will happen to the molarity of the solution as the temperature increases: will it increase, decrease or remain constant?

CONCEPT: THERMAL DEPENDENCY

EXAMPLE 2: If a 0.02135 M aqueous solution is prepared at 21ºC (d = 0.9979955 g/mL) what is the new concentration if the same experiment is performed a month later when the temperature is now 26 ºC (d = 0.9967867 g/mL)?

PRACTICE: The mass of an empty container at 28 ºC is 83.93 g. The mass of the container when filled with water from a 25-mL pipet is 108.70 g. Calculate the true volume of delivered water by the calibrated pipet.