

Units							
Exa (E)	Peta (P)	Tera (T)	Giga (G)	Mega (M)	Kilo (k)	Hecto (h)	Deca (da)
10^{18}	10^{15}	10^{12}	10^9	10^6	10^3	10^2	10^1
Deci (d)	Centi (c)	Milli (m)	Micro (μ)	Nano (n)	Pico (p)	Femto (f)	Atto (a)
10^{-1}	10^{-2}	10^{-3}	10^{-6}	10^{-9}	10^{-12}	10^{-15}	10^{-18}

Sig Figs

Zeros before numbers are not significant. If there is a decimal, zeros after non-zeros are significant.

Multiplication, division: sig figs based on given value at beginning with least sig figs +/-: align decimal places and go based off least decimal places. eg: $25.0 + 1 = 26$ since 1 has no decimal place

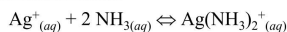
log: for $\log(x)$, digits after decimal place = sig figs of x

multi step equation: sig figs based off of last math step you perform

formation constant

Formation Constant

- the reaction between an ion and ligands to form a complex ion is called a complex ion formation reaction



- the equilibrium constant for the formation reaction is called the formation constant, K_f

$$K_f = \frac{[\text{Ag}(\text{NH}_3)_2^+]}{[\text{Ag}^+][\text{NH}_3]^2}$$

3

uncertainty

absolute uncertainty = the plus/minus value given

relative uncertainty = absolute uncertainty / value it is given with

% relative uncertainty = abs uncertainty / measured value * 100

+/- problem: abs uncertainty = square root (each abs uncertainty squared then added)

mult/divis: convert abs uncertainties to % relative uncertainties first, do same

squaring everything adding all sqrt, at the end undo % by remultiplying by measured value

sig figs

prop uncertainty

pH

$\text{pH} + \text{pOH} = 14$, $\text{pH} = -\log [\text{H}^+]$ so $10^{-\text{pH}} = [\text{H}^+]$,

$\text{pOH} = -\log [\text{OH}^-]$ (all log10)

$\text{pKa} = -\log K_a$; $\text{HA} (aq) \rightleftharpoons [\text{H}^+] (aq) + [\text{A}^-]$

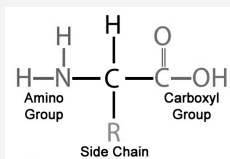
(aq) ; $K_a = [\text{H}^+][\text{A}^-]/[\text{HA}]$

confidence interval

CI = mean +/- ((t from table * stdev) / sqrt n)

(t table confidence%) confidence that the true value is x% away from avg

amino acid structure



F calc

variance 1/variance2

Precision accuracy

Precision = stdev/mean x 100

relative accuracy = (experimental mean - known mean) / known mean x 100,

accuracy = (experimental mean - known mean)

edta

- A solution is prepared by mixing 0.0500 moles of Ca^{2+} with 0.0500 moles of EDTA in 1.00 L of water at $\text{pH} = 9.00$. What are the concentrations of Ca^{2+} , and EDTA^{4-} at equilibrium?

- The math is easier if we assume complete reaction to form 0.0500 moles of complex

$$K_f' = \frac{[\text{CaEDTA}^{2-}]}{[\text{Ca}^{2+}][\text{EDTA}^{4-}]} = 10^{10.65} + 0.041 = \frac{10.0500 - x}{[x][x]} = 1.83 \times 10^9 \quad \alpha = 0.041$$

	Ca^{2+}	EDTA	CaEDTA^{2-}
initial	0	0	0.0500
change	x	x	-x
equilibrium	x	x	$0.0500 - x$

$X = 5.23 \times 10^{-6} = [\text{Ca}^{2+}] = [\text{EDTA}^{4-}]$ Total EDTA
 $[\text{EDTA}^{4-}] = [\text{EDTA}] 0.041 = 2.1 \times 10^{-7}$

Z stats

if given avg and stdev. μ mean, stdev sigma. find range away from mean which will be Z then use table

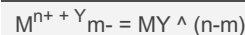
t calc 2 sets of data

$$t_{\text{calc}} = \frac{|\bar{x}_1 - \bar{x}_2|}{s_p} \sqrt{\frac{N_1 N_2}{N_1 + N_2}}$$

$$s_p^2 = \frac{(N_1 - 1)s_1^2 + (N_2 - 1)s_2^2}{N_1 + N_2 - 2}$$

- Compare standard deviations using the F-test
- If similar, calculate the pooled standard deviation and use it to calculate t
- Compare to t value in table at the % confidence that you are interested in.

EDTA



EDTA is Y

TABLE 3-1 Summary of rules for propagation of uncertainty

Function ^a	Uncertainty ^b
$y = x_1 + x_2$	$e_y = \sqrt{e_{x_1}^2 + e_{x_2}^2}$
$y = x_1 - x_2$	$e_y = \sqrt{e_{x_1}^2 + e_{x_2}^2}$
$y = x_1 \cdot x_2$	$\%e_y = \sqrt{\%e_{x_1}^2 + \%e_{x_2}^2}$
$y = \frac{x_1}{x_2}$	$\%e_y = \sqrt{\%e_{x_1}^2 + \%e_{x_2}^2}$
$y = x^a$	$\%e_y = a(\%e_x)$
$y = \log x$	$e_y = \frac{1}{\ln 10} \frac{e_x}{x} \approx 0.434 \frac{e_x}{x}$
$y = \ln x$	$e_y = \frac{e_x}{x}$
$y = 10^x$	$\frac{e_y}{y} = (\ln 10) e_x \approx 2.3026 e_x$
$y = e^x$	$\frac{e_y}{y} = e_x$

^a x represents a variable and a represents a constant that has no uncertainty.
^b e_x / x is the relative error in x and $\%e_x$ is $100 \times e_x / x$.

stdev²= variance. relative stdev= 100*
s/mean. stdev of mean= s/ sqrt n.
 $z = (x-\mu)/\sigma$

Equilibrium

$$K = \frac{[C]^c [D]^d}{[A]^a [B]^b}$$

Equilibrium

$K > 1 =$
Ksp, solubility in material= concentration of
both products multiplied. $AB \rightleftharpoons [A^+] + [B^-]$,
 $k_{sp} = [a][b]$
eg: dissolve in solution that is z molarity of
y reactant: corresponding concentration is
 $x+z$
solid= always 1



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Page 2 of 2.

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