Recitation Worksheet (Optional Extra Practice)

Name: Hey UGA ID:

Textbook:
Chemistry & Chemical Reactivity
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Instructions:
- This recitation worksheet is optional extra practice for Ch. 2.1-2.6, simple organic naming.
- You **do not** need to submit it to Gradescope.
- The answer key has been posted with this worksheet to eLC.
- A periodic table and formula sheet are attached to the end of this worksheet.

1. Which of the statements is **not** an idea from Dalton's Atomic Theory?

C

A. An element is composed of extremely small indivisible particles called atoms.
B. All atoms of a given element have identical properties which differ from those of all other elements.
C. Atoms can be transformed into atoms of another element.
D. Compounds are formed when atoms of different elements combine with each other in small whole-number ratios.
E. The relative numbers and kind of atoms are consistent in a given compound.

2. Which of the following did Rutherford's Gold Foil Experiment help prove?

B

A. The concept of isotopes
B. The mass of an atom mostly belongs in a densely packed space
C. The charge of electrons   └→ nucleus
D. The presence and charge of neutrons   (protons + neutrons)
E. The mass to charge ratio of electrons in gold

3. The atomic number of an element gives the number of _____ and _____ in the atom while the mass number gives the total number of _____ and _____.

D

A. neutrons, electrons; protons, electrons
B. protons, electrons; neutrons, electrons
C. neutrons, electrons; neutrons, protons
D. protons, electrons; neutrons, protons
E. neutrons, protons; neutrons, electrons

4. Which of the following statements are **true**? Select any that apply and answer using capital letters with no spaces (e.g. ABCDE).

G

↱ +1   ↱ neutral

A. The charges on protons and neutrons are opposite, but equal in overall magnitude
B. Protons and electrons have nearly identical masses (Protons = neutrons > electrons)
C. The mass of the atom is mostly made up from neutrons, with small contributions from protons and electrons
D. A neutral atom will ~~not~~ always contain the same number of protons and electrons
E. Isotopes of the same element will always have the same mass (mass varies)
F. Isotopes of the same element differ only by the number of protons they contain
G. None of the above are true   (neutrons)

5. Krypton has over 30 isotopes that have been identified. What do all of these *neutral* isotopes have an identical number of?

D

A. electrons
B. protons
C. neutrons
D. protons and electrons
E. protons, electrons, and neutrons
F. None of the above

↱ p⁺ and n

6. How many protons, neutrons, and electrons are there in: $^{40}_{18}$ X
Answer by using integers (e.g. 0, 1, etc.).

↳ p⁺

(a) protons: 18

(b) neutrons: 22   40 - 18

(c) electrons: 18   p⁺ = e⁻ = neutral atom

7. How many protons, neutrons, and electrons are there in: $^{65}_{?}Cu^{2+}$ (loses 2 e⁻'s)
Answer by using integers (e.g. 0, 1, etc.).

(a) protons: | 29 | atomic # Cu

(b) neutrons: | 36 | 65 - 29

(c) electrons: | 27 | 29 - 2

8. How many protons, neutrons, and electrons are there in bromine-81?
Answer by using integers (e.g. 0, 1, etc.).

mass #

(a) protons: | 35 | atomic # Br

(b) neutrons: | 46 | 81 - 35

(c) electrons: | 35 | p⁺ = e⁻ = neutral atom

9. Consider an atom or ion with 56 protons, 56 electrons, and 81 neutrons. What is its identity? Answer with the atomic symbol and if applicable, the charge (e.g. Ar, Be^{2+}, etc.).

↳ Ba

| Ba | p⁺ = e⁻ = neutral atom

$\rightarrow Mg$

10. Consider an atom or ion with 12 protons, 10 electrons, and 14 neutrons. What is its identity? Answer with the atomic symbol and if applicable, the charge (e.g. Ar, Be^{2+}, etc.).

loses $2e^-$s = $\boxed{+2}$

$\boxed{Mg^{2+}}$

$\rightarrow Cl$
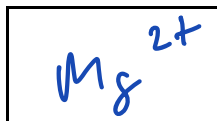
11. Consider an atom or ion with 17 protons, 18 electrons, and 18 neutrons. What is its identity? Answer with the atomic symbol and if applicable, the charge (e.g. Ar, Be^{2+}, etc.).
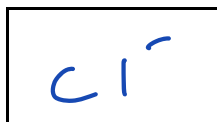
gains $1e^-$ = $\boxed{-1}$

$\boxed{Cl^-}$

12. Identify the ion which has 31 neutrons, a 2+ net charge, and has 26 electrons.

$\boxed{D}$

$\rightarrow$ loses $2e^-$s

neutral atom = $26 + 2 = 28 e^-$s

natural atom = $p^+ = e^-$

$\rightarrow 28 p^+ = Ni$

mass # = $31 n + 28 p^+$

= 59

A. $^{57}_{28} Ni^{2+}$

B. $^{57}_{31} Ga^{2+}$

C. $^{59}_{31} Ga^{2+}$

D. $^{59}_{28} Ni^{2+}$

E. $^{55}_{24} Cr^{2+}$

13. Gallium has two naturally occurring isotopes. Based on the information provided below, what is the mass of Ga-69? Report your answer to **five significant figures** and in **standard notation**.

Isotope	Mass (amu)	Relative Abundance (%)
Ga-69	?	60.108
Ga-71	70.925	39.892

$$\boxed{68.920} \quad \text{amu}$$

$69.72 \text{ amu} = (x)(0.60108) + (70.925 \text{ amu})(0.39852)$

14. An element has two naturally occurring isotopes. Isotope 1 has a mass of 120.9038 amu and a relative abundance of 57.4%. Isotope 2 has a mass of 122.9042 amu. Calculate the atomic mass (amu) of the atom. Report your answer in **standard notation**.

↱ fair sig figs here! $100 - 57.4 = 42.6 \%$

$$\boxed{121.8} \quad \text{amu}$$

$\text{Atomic Mass} = (120.9038 \text{ amu} \times 0.574) + (122.9042 \text{ amu} \times 0.426)$

$= (69.39878 \text{ amu}) + (52.35719 \text{ amu})$

$= 121.75597 \text{ amu}$

15. Which of the following elements is an alkaline earth metal?

D

A. Sodium
B. Bromine
C. Krypton
D. Calcium
E. Iron

16. Which element is in group 6 and period 4 of the periodic table? Write the chemical symbol in the box below (e.g. H, Br, etc.).

Cr

17. Which of the following elements will behave (chemically) most similarly to strontium?

E

A. Rubidium
B. Yttrium
C. Scandium
D. Oxygen
E. Calcium
  └→ same group

18. A general chemistry student goes to the drugstore to pick up a bottle of mineral sunscreen (at least SPF 30). They notice on the back of the bottle that the active ingredient written is "TiO_2, titanium dioxide". Based on what you have learned in general chemistry, is TiO_2 named correctly here?

C

A. Yes, titanium dioxide is the (only) correct name
B. No, the correct name is titanium(IV) dioxide
C. No, the correct name is titanium(IV) oxide
D. Both titanium dioxide and titanium(IV) dioxide are correct
E. Both titanium dioxide and titanium(IV) oxide are correct
F. Titanium dioxide, titanium(IV) dioxide, and titanium(IV) oxide are correct

19. Which of the following compounds is named mercury(I) sulfide?

B

Hg_2^{2+} S^{2-}
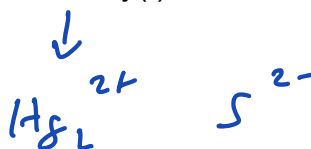
A. HgS
B. Hg_2S
C. HgS_2
D. Hg_2S_2
E. None of the above

20. Which of the following elements has a variant charge when it forms cations?

C

A. Aluminum
B. Rubidium
C. Manganese
D. Zinc
E. More than one of the above
F. None of the above

21. Which of the following is/are named **correctly**? Select any that apply and answer with capital letters with no spaces in between (e.g. ABCDE).

D

A. $MgCl_2$, ~~manganese~~ chloride → magnesium chloride
B. AgBr, silver(I) bromide → silver bromide
C. Na_2O_2, sodium oxide → sodium peroxide
D. $KMnO_4$, potassium permanganate
E. $NiCl_2 \cdot 6\ H_2O$, nickel(II) chloride hexahydrate

22. Which of the following is/are named **incorrectly**? Select any that apply and answer with capital letters with no spaces in between (e.g. ABCDE).

BC

A. P_2O_5, diphosphorus pentoxide ✓
B. NO, ~~mono~~nitrogen monoxide → nitrogen monoxide
C. NH_4^+, ~~nitrogen tetrahydride~~ → ammonium ion
D. S_2Cl_2, disulfur dichloride ✓
E. HCN, hydrocyanic acid ✓

23. The names of multiple compounds and their proposed chemical formulas are given below. Which of the options below have the chemical formula written **incorrectly**? Select any that apply and answer using capital letters with no spaces (e.g. ABCDE).

BD

A. Carbonic acid, H_2CO_3
B. Titanium(II) sulfite, $TiSO_4$ → titanium (II) sulfate
C. Magnesium perchlorate, $Mg(ClO_4)_2$
D. Decanoic acid, $CH_3(CH_2)_9COOH$ → undecanoic acid
E. Selenium dibromide, $SeBr_2$

24. In the following drawings, shaded spheres represent cations and unshaded spheres represent anions, either monatomic or polyatomic. Answer the question with the letter of the box.

I. Which drawing represents the ionic compound zinc phosphate?

$Zn_3(PO_4)_2$

[box: D]

II. Which drawing represents the ionic compound silver carbonate?

Ag_2CO_3

[box: B]

III. Which drawing represents the ionic compound potassium perchlorate?

$KClO_4$

[box: A]

IV. Which drawing represents the ionic compound magnesium fluoride?

MgF_2

[box: C]

(a)   (b)   (c)   (d)
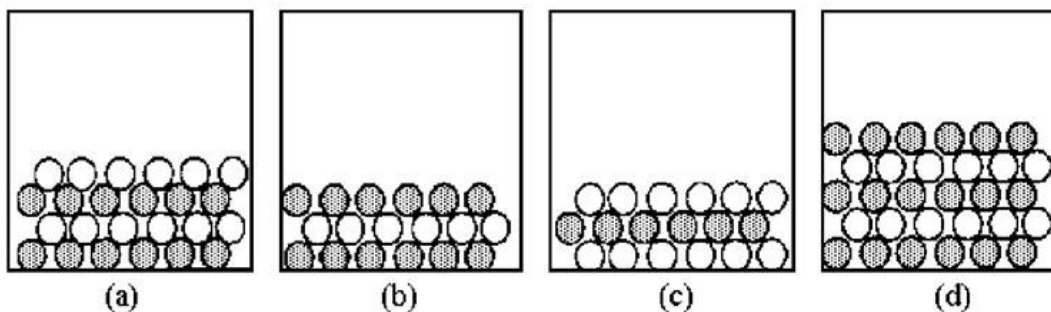
25. Which of the following name/formula combinations is **incorrect**?

[box: A]

$(A)^{-2}$
FeO_2

$+4 \quad -4 = 0$
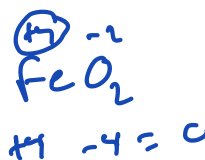
(A) FeO_2: iron(II) oxide → iron (IV) oxide
B. $CdCrO_4$: cadmium chromate
C. HI: hydroiodic acid
D. $Ca(CN)_2$: calcium cyanide
E. HNO_2: nitrous acid
F. More than one of the above is incorrect

26. Which of the following is/are **invalid** name(s) for an acid? Select any that apply and answer with capital letters with no spaces in between (e.g. ABCDE).

AF

A. Hypochloric acid
B. Chloric acid
C. Chlorous acid
D. Perchloric acid
E. Hydrochloric acid
F. Hydrochlorous acid
G. All of the following are valid names

27. What is the correct name for C_5H_{12}?

E

A. Tetracarbon hydride
B. Pentacarbon hydride
C. Hexacarbon hydride
D. Propane
E. Pentane
F. Hexane

28. What is the correct formula for octanoic acid?
↳ 8 carbon acid

C

A. $CH_3CH_2CH_2CH_2CH_2CH_2COOH$
B. $H_3C—(CH_2)_5—COOH$
C. $C_7H_{15}COOH$ → 8 carbons
D. $CH_3(CH_2)_7OH$
E. None of the above

29. What is the correct name for the following compound?

Red
(Oxygen)

White
(Hydrogen)

Black
(Carbon)

CH_3OH
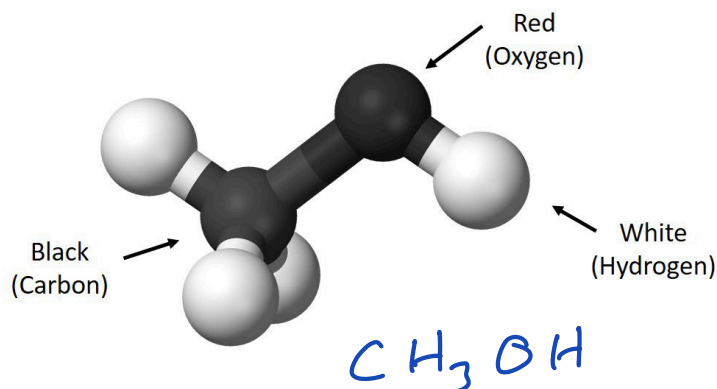
E

A. Ethane
B. Ethanol
C. Methane
D. Methanoic acid
E. Methanol

30. Various organic compounds such as cholesterol, estradiol (an estrogen hormone), and metoprolol (a drug for hypertension) have complex structures. Based on their names alone, which of the following categories below would you predict to *broadly* classify these compounds?

D

A. Ionic compounds
B. Inorganic acids
C. Carboxylic acids
D. Alcohols → -ol ending
E. More information is needed

Additional Practice Questions:

1. What is the unknown element represented by "X" here: $^{28}_{14}X$

$\rightarrow p^+ = 14$

D

A. Nickel
B. Aluminum
C. Copper
D. Silicon
E. Calcium

2. What element has 17 protons, 17 electrons, and 20 neutrons?

D

A. Calcium
B. Potassium
C. Argon
D. Chlorine
E. Sulfur

3. How many protons, neutrons, and electrons are there in: $^{25}_{12}$ X
Answer by using integers (e.g. 0, 1, etc.).

→ p$^+$ and n

→ p$^+$

(a) protons:

$\boxed{12}$

(b) neutrons:

$\boxed{13}$

(c) electrons:

$\boxed{12}$ p$^+$ = e$^-$ = neutral atom

4. Consider an atom or ion with 47 protons, 46 electrons, and 62 neutrons. What is its identity? Answer with the atomic symbol and if applicable, the charge (e.g. Ar, Be^{2+}, etc.).

→ Ag

loses e$^-$ = $\boxed{+1}$

$\boxed{Ag^+}$

5. Which of the following elements has the **greatest** number of protons?

$\boxed{C}$

A. Fluorine
B. Zinc
C. Strontium
D. Sodium
E. Krypton
F. The mass number of each element is needed to determine this

6. The element rhenium (Re) has two naturally occurring isotopes, ^{X}Re and ^{Y}Re, with an average atomic mass of 186.207 amu. Rhenium is 62.60% ^{Y}Re, which has an atomic mass of 186.956 amu. Calculate the mass of ^{X}Re. Report your answer in **standard notation**.

┌→ only 3 sf!

$X_{Re} = 100 - 62.60 = 37.40$ %

| 185 | amu |

$186.207 \text{ amu} = (X)(0.3740) + (186.956 \text{ amu})(0.6260)$

$186.207 \text{ amu} = (X)(0.3740) + (117.039456 \text{ amu})$

$69.172544 \text{ amu} = (X)(0.3740)$

$X = 184.9533$

7. Which of the following is the correct formula for rubidium nitride?

D

A. RbN
B. Rb_2N
C. RbN_2
D. Rb_3N
E. RbN_3
F. None of the above

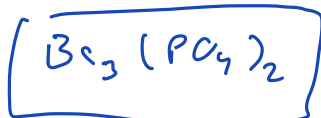8. What is the correct name for Al_2O_3?

D

A. Aluminum oxygenide
B. Aluminum(III) oxygenide
C. Aluminum(III) oxide
D. Aluminum oxide
E. None of the above

9. Which of the following compounds is named barium phosphate?

$\boxed{E}$

$Ba^{2+} \quad PO_4^{3-}$

$\boxed{Ba_3(PO_4)_2}$

A. $BaPO_3$
B. $BaPO_4$
C. $Ba_3(PO_3)_2$
D. $Ba_2(PO_3)_3$
E. None of the above

10. What is the correct formula for oxalic acid?

$\boxed{H}$

oxalate → $C_2O_4^{2-}$

-ate → -ic
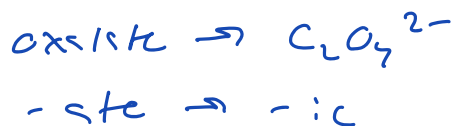
A. HCO_3 E. HCO_4
B. H_2CO_3 F. H_2CO_4
C. HC_2O_3 G. HC_2O_4
D. $H_2C_2O_3$ H. $H_2C_2O_4$

11. What is the correct name of the organic compound provided below?

$$H-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-H$$

10 carbons

$\boxed{F}$
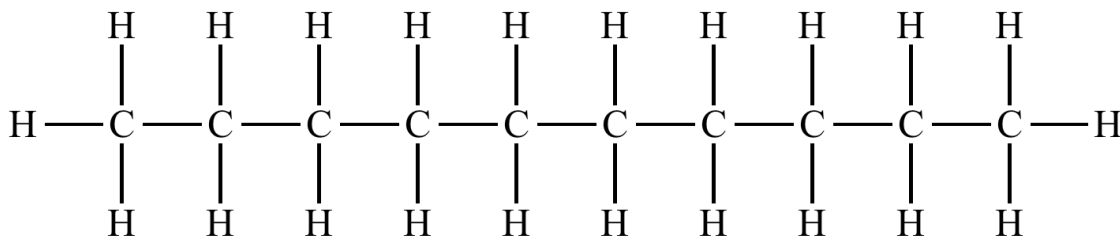
A. Octacarbon hydride
B. Nonacarbon hydride
C. Decacarbon hydride
D. Octane
E. Nonane
F. Decane

12. What is the name of the compound C_4H_{10}?

C

A. Butanol
B. Tetranol
C. Butane
D. Butanoic acid
E. Tetrane

Periodic Table of the Elements

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 **H** 1.01																	2 **He** 4.00
3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.87	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.38	31 **Ga** 69.72	32 **Ge** 72.63	33 **As** 74.92	34 **Se** 78.97	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.95	43 **Tc** [97]	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.76	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.29
55 **Cs** 132.91	56 **Ba** 137.33	57 **La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.84	75 **Re** 186.21	76 **Os** 190.23	77 **Ir** 192.22	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.2	83 **Bi** 208.98	84 **Po** [209]	85 **At** [210]	86 **Rn** [222]
87 **Fr** [223]	88 **Ra** [226]	89 **Ac** [227]	104 **Rf** [267]	105 **Db** [268]	106 **Sg** [269]	107 **Bh** [270]	108 **Hs** [269]	109 **Mt** [277]	110 **Ds** [281]	111 **Rg** [282]	112 **Cn** [285]	113 **Nh** [286]	114 **Fl** [290]	115 **Mc** [290]	116 **Lv** [293]	117 **Ts** [294]	118 **Og** [294]

Lanthanides

57 **La** 138.91	58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** [145]	62 **Sm** 150.36	63 **Eu** 151.96	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.05	71 **Lu** 174.97

Actinides

89 **Ac** [227]	90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** [237]	94 **Pu** [244]	95 **Am** [243]	96 **Cm** [247]	97 **Bk** [247]	98 **Cf** [251]	99 **Es** [252]	100 **Fm** [257]	101 **Md** [258]	102 **No** [259]	103 **Lr** [262]

Formula Sheet

Length
1 kilometer = 0.62137 mile
1 inch = 2.54 centimeters (exactly)
1 Ångstrom = 1×10^{-10} meter

Energy
1 joule = 1 kg·m^2/s^2
1 calorie = 4.184 joules
1 Calorie = 1 kilocalorie = 1000 calories
1 L·atm = 101.325 joules

Pressure
1 pascal = 1 N/m^3 = 1 kg/m·s^2
1 atmosphere = 101.325 kilopascals = 760 mm Hg = 760 torr = 14.70 lb/in^2
1 bar = 1×10^5 Pa (exactly)

Temperature
0 K = −273.15°C
K = °C + 273.15
°C = (5/9)(°F − 32)

Mass
1 kg = 2.205 lbs

Volume
1 mL = 1 cm^3 = 1 cc

Constants
c = 2.998×10^8 m/sec
h = 6.626×10^{-34} J·sec
R = 0.08206 L·atm/mol·K = 8.314 J/mol·K
Specific heat of water = 4.184 J/g·K
Mass of an electron: 9.109×10^{-31} kg
Mass of a proton: 1.673×10^{-27} kg
RH = 2.18×10^{-18} J
Specific heat of water = 4.184 J/g·K
Avogadro's number: 6.022×10^{23}
F = 96485 J/(V·mol e$^-$)
K_w = 1.0×10^{-14} at 25 °C
k_b = 1.381×10^{-23} J/K

Equations
$(P + a(n^2/V^2))\cdot(V − nb) = nRT$
molar mass (M) = mRT/PV
density (d) = MP/RT
$$KE = \frac{3}{2}RT$$
$$\mu_{rms} = \sqrt{\frac{3RT}{M}}$$

$$\frac{Rate\ of\ effusion\ A}{Rate\ of\ effusion\ B} = \sqrt{\frac{MW_B}{MW_A}}$$

$$\Delta E = -2.18 \times 10^{-18} J \left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$$

$$\ln\left(\frac{P_2}{P_1}\right) = \frac{\Delta H_{vap}}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

$C_g = kP_g$

$P_{solution} = P_{solvent}\, X_{solvent}$

$P_{solution} = \sum P_j = \sum P_j X_j$

$\pi = MRTi$

Thermodynamic and Electrochemistry

$S = k_b \times \ln(W)$

$\Delta S = q_{rev}/T$

$\Delta G = \Delta G^\circ + RT\cdot \ln Q$

$R = 8.314\ J/mol.K$

$\Delta G^\circ = -RT\cdot \ln K$

$\Delta G = -nFE_{cell}$

$E^\circ_{cell} = RT/nF\ \ln K$

$E^\circ_{cell} = (0.0257/n)\ \ln K = (0.0592/n)\ \log K$

$E_{cell} = E^\circ_{cell} - (RT/nF)\ \ln Q$

$E_{cell} = E^\circ_{cell} - (0.0257/n)\ \ln Q$

Electrolysis: Q (total charge) = I × t = n × F

Integrated Rate Laws & half-life

$$\ln\frac{[A]}{[A]_0} = -kt$$

$$\frac{1}{[A]} = kt + \frac{1}{[A]_0}$$

$$[A] = -kt + [A]_0$$

$$t_{1/2} = \frac{[A]_0}{2k}$$

$$t_{1/2} = \frac{\ln 2}{k} = \frac{0.693}{k}$$

$$t_{1/2} = \frac{1}{k[A]_0}$$

$$\ln\frac{k_2}{k_1} = -\frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

Equilibrium and Acid / Base

$K_P = K_c \times (RT)^{\Delta n}$

$$\ln\frac{K_2}{K_1} = \frac{\Delta H^\circ_{rxn}}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$