

9. Electrolytes. Classify each of the following as strong, weak, or non-electrolytes.

- | | | | |
|--|-------|------------------------------------|-------|
| a) H_3PO_4 | _____ | d) HCl | _____ |
| b) Na_2SO_4 | _____ | e) NH_4Br | _____ |
| c) $\text{C}_6\text{H}_{12}\text{O}_6$ | _____ | f) $\text{C}_2\text{H}_5\text{OH}$ | _____ |

10. Periodic Trends. Select the best of the three choices:

- | | | | |
|--|------------------|---------------|--------------|
| a) highest ionization energy | Se | S | Te |
| b) smallest radius | Cl^- | Br^- | F^- |
| c) lowest (most positive) electron affinity | K | Rb | Cs |
| d) largest radius | S^{2-} | Cl^- | Cl |
| e) highest (most negative) electron affinity | P | S | Cl |
| f) largest radius | Mg^{2+} | Na^+ | Ne |

11. Precipitation Reactions and Net Ionic Equations. Give the net ionic equation and indicate the spectator ions if aqueous solutions of each of the following are mixed together. If no reaction occurs, write "NR".

- ammonium bromide and magnesium perchlorate
- magnesium chloride and lead (II) acetate
- calcium chloride and aluminum acetate
- potassium phosphate and nickel (II) chloride

12. Intermolecular Forces.

- What kinds of attractive forces must be overcome in order to:
 - melt ice
 - boil molecular bromine
 - melt solid iodine
 - dissociate F_2 into F atoms
- Arrange the following in order of increasing boiling point: RbF , CO_2 , CH_3OH , CH_3Br

Key

① $.7217(84.912) + .2783(86.909) = \boxed{85.47 \text{ amu}}$

② moles $\text{KMnO}_4 = \text{moles MnO}_4^- = (0.0123 \frac{\text{mol}}{\text{L}})(.02225 \text{ L}) = .000273, \text{ mol}$
 $(.000273, \text{ mol MnO}_4^-) \left(\frac{5 \text{ mol Fe}}{1 \text{ mol MnO}_4^-} \right) \left(\frac{55.845 \text{ g Fe}}{1 \text{ mol Fe}} \right) = 0.0764_2 \text{ g Fe}$
 $\% \text{ Fe} = \frac{0.0764_2 \text{ g}}{0.598 \text{ g}} \times 100 = \boxed{12.8\% \text{ Fe}}$

③ $(0.1356 \text{ g CO}_2) \left(\frac{1 \text{ mol CO}_2}{44.01 \text{ g CO}_2} \right) \left(\frac{1 \text{ mol C}}{1 \text{ mol CO}_2} \right) \left(\frac{12.011 \text{ g C}}{1 \text{ mol C}} \right) = 0.0370 \text{ g C}$
 $\hookrightarrow = .00308 \text{ mol C}$
 $(0.0833 \text{ g H}_2\text{O}) \left(\frac{1 \text{ mol H}_2\text{O}}{18.02 \text{ g H}_2\text{O}} \right) \left(\frac{2 \text{ mol H}}{1 \text{ mol H}_2\text{O}} \right) \left(\frac{1.0079 \text{ g H}}{1 \text{ mol H}} \right) = 0.00932 \text{ g H}$
 $\hookrightarrow = .00925 \text{ mol H}$
 $\text{mass O} = 0.0956 \text{ g total} - 0.0370 \text{ g C} - 0.00932 \text{ g H} = 0.0493 \text{ g O}$
 $(0.0493 \text{ g O}) \left(\frac{1 \text{ mol O}}{15.9994 \text{ g O}} \right) = 0.00308 \text{ mol O}$
 $\Rightarrow \text{C}_{.00308} \text{H}_{.00932} \text{O}_{.00308} \Rightarrow \boxed{\text{CH}_3\text{O} = \text{empirical formula}}$
 $\text{MW of CH}_3\text{O} = 31 \Rightarrow 2(31) = 62 \Rightarrow \boxed{\text{C}_2\text{H}_6\text{O}_2 = \text{molecular formula}}$

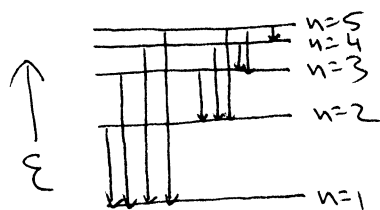
④

	Species	protons	neutrons	electrons
a)	^{63}Cu	29	34	29
b)	$^{24}\text{Mg}^{2+}$	12	12	10
c)	$^{35}\text{Cl}^-$	17	18	18

⑤ $(15 \text{ g Na}_2\text{SO}_4) \left(\frac{1 \text{ mol Na}_2\text{SO}_4}{142.042 \text{ g}} \right) \left(\frac{1 \text{ mol Na}_2\text{S}}{1 \text{ mol Na}_2\text{SO}_4} \right) \left(\frac{78.045 \text{ g Na}_2\text{S}}{1 \text{ mol Na}_2\text{S}} \right) = 8.2 \text{ g Na}_2\text{S}$
 $(7.5 \text{ g C}) \left(\frac{1 \text{ mol C}}{12.011 \text{ g C}} \right) \left(\frac{1 \text{ mol Na}_2\text{S}}{4 \text{ mol C}} \right) \left(\frac{78.045 \text{ g Na}_2\text{S}}{1 \text{ mol Na}_2\text{S}} \right) = 12 \text{ g Na}_2\text{S}$
 $\Rightarrow \text{Na}_2\text{SO}_4 \text{ is limiting} + \boxed{8.2 \text{ g Na}_2\text{S} \text{ can be produced}}$

- ⑥ a) none ($l=0 \Rightarrow m_l \neq +1$) c) eleven ($m_l = -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5$)
 b) three (s, p_x, p_y, p_z) d) one (a single $4d$ orbital)

⑦

a) ten

$$\begin{array}{cccc}
 2 \rightarrow 1 & 3 \rightarrow 2 & 4 \rightarrow 3 & 5 \rightarrow 4 \\
 3 \rightarrow 1 & 4 \rightarrow 2 & 5 \rightarrow 3 & \\
 4 \rightarrow 1 & 5 \rightarrow 2 & & \\
 5 \rightarrow 1 & & &
 \end{array}$$

b) highest frequency = highest energy = longest arrow
 \Rightarrow $n=5$ to $n=1$

c) longest wavelength = smallest frequency = lowest energy = shortest arrow
 \Rightarrow $n=5$ to $n=4$

d) $E_n = -2.18 \times 10^{-18} \text{ J} / n^2$

$$\begin{aligned}
 \Delta E &= E_3 - E_1 = \left[-2.18 \times 10^{-18} \text{ J} \left(\frac{1}{3^2} \right) \right] - \left[-2.18 \times 10^{-18} \text{ J} \left(\frac{1}{1^2} \right) \right] \\
 &= 1.94 \times 10^{-18} \text{ J}
 \end{aligned}$$

$$E = h\nu \Rightarrow 1.94 \times 10^{-18} \text{ J} = (6.626 \times 10^{-34} \text{ J}\cdot\text{s})(\nu)$$

$$\nu = 2.92 \times 10^{15} \text{ s}^{-1}$$

$$c = \lambda\nu \Rightarrow 3.00 \times 10^8 \text{ m/s} = (\lambda)(2.92 \times 10^{15} \text{ s}^{-1})$$

$$\begin{aligned}
 \lambda &= 1.03 \times 10^{-7} \text{ m} \\
 &= 103 \text{ nm}
 \end{aligned}
 \Rightarrow \text{UV region}$$

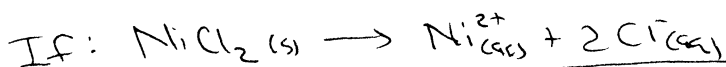
⑧ $(6.00 \text{ g NiCl}_2) \left(\frac{1 \text{ mole NiCl}_2}{129.60 \text{ g}} \right) = 0.04630 \text{ mole NiCl}_2$

$$\Rightarrow \frac{0.04630 \text{ mole}}{1.00 \text{ L}} = 0.0463 \text{ M} = [\text{NiCl}_2] \text{ in first flask}$$

$$M_1 V_1 = M_2 V_2$$

$$(0.0463 \text{ M})(100 \text{ mL}) = M_2 (5000 \text{ mL}) \Rightarrow M_2 = 9.26 \times 10^{-4} \text{ M}$$

$$= [\text{NiCl}_2] \text{ in flask \#2}$$



then $[\text{Ni}^{2+}] = 9.26 \times 10^{-4} \text{ M Ni}^{2+}$

$$[\text{Cl}^{-}] = 2(9.26 \times 10^{-4} \text{ M}) = 1.85 \times 10^{-3} \text{ M Cl}^{-}$$

- ⑨ a) weak
 b) strong
 c) non

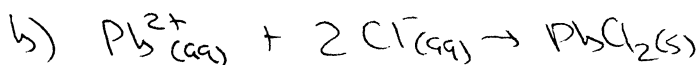
- d) strong
 e) strong
 f) non

- ⑩
- | | |
|-------------------|--------------------|
| a) S | d) S ²⁻ |
| b) F ⁻ | e) Cl |
| c) C ₅ | f) Ne |

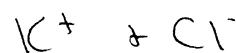
⑪

<u>Net Ionic Equation</u>	<u>Spectator Ions</u>
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a) NR



c) NR



- ⑫
- a)
- H-bonds + dispersion forces
 - Dispersion forces
 - Dispersion forces
 - covalent bonds

