Chemistry Review – 1st Half

1) Safety: Read the following paragraph and indicate all of the lab safety violations. Explain what Edith needs to do in order to practice proper lab procedures.

Once upon a time, in the far away land of Chemistry, Edith needed to make up a lab that she had missed. When she got to the classroom, nobody else was around. She was a bit impatient and decided to get started on her own. As she was measuring Liquid Chemical A, she noticed that she had a bit too much, so she carefully poured some back into the bottle. She was quite proud that she had managed to do so without spilling anything. As she was calculating the mass of the chemical, she couldn't help but notice the reflection of her hair in the balance. She had spent some extra time curling her hair this morning and was pleased with her decision to not put it up in a ponytail. As Edith was working, a test tube accidentally rolled off of the counter and shattered on the floor. So, she carefully picked up the broken pieces with her hands and gently placed them into the garbage can. After completing the lab, she put everything away and washed up her lab station with Shine. She was excited to go home and complete her lab write-up!

① Never work alone!
② Never return chemicals to original containers! → ★ Can't always pour down sink either!!
③ Tie back long hair! (Burning hair is #1 accident!)
④ Use broom + pan for broken glass! → ★ Teacher should do!!
⑤ Place broken glass in designated container!
⑥ Last Step - wash hands!

2) Scientific Notation: Express the following in scientific notation.

a) 123,456.789 1.23456789×10^{5}

b) 23.2040205 2.3204025×10^{1}

c) 0.0001020304 1.020304×10^{-4}

3) Significant Figures: State the number of significant figures in the following.

a) 0.0000000040 2

b) 45.00 4

c) 50000000.00 10

4) Density: Solve the following showing all work. $D = \frac{M}{V}$

a) Find the density of a brick whose volume in 321 mL and has a mass of 53.8 grams.

$$D = \frac{53.8\ g}{321\ mL} = \boxed{0.168\ g/mL}$$

b) Find the volume of an egg whose density is 1.234 g/mL and has a mass of 112.5 grams.

$$1.234\ \frac{g}{mL} = \frac{112.5\ g}{V} \qquad \boxed{V = 91.17\ mL}$$

KHOBDCM

5) Metric: Convert the following by factor labeling.

a) Convert 145.2 mg/cL to g/cm^3

$$\frac{1\ g}{1000\ mg} \left| \frac{145.2\ mg}{1\ cL} \right| \frac{100\ cL}{1\ L} \left| \frac{1\ L}{1000\ mL} \right| \frac{1\ mL}{1\ cm^3} = \boxed{0.01452\ g/cm^3}$$

b) Convert 26.3 cm/hr to km/day

$$\frac{1\ Km}{1000\ m} \left| \frac{1\ m}{100\ cm} \right| \frac{26.3\ cm}{1\ hr} \left| \frac{24\ hr}{1\ day} \right. = \boxed{0.00631\ Km/day}$$

6) Naming Compounds: Write the correct names for each of the following.

a) LiBr Lithium Bromide

b) CaF_2 Calcium Fluoride

c) N_2O_5 Dinitrogen Pentoxide

d) $\overset{+2}{Pb}\overset{-1}{Cl_2}$ Lead (II) Chloride

e) LiOH Lithium Hydroxide

f) NO Nitrogen Monoxide

g) HF Hydrofluoric Acid

h) HClO Hypochlorous Acid

7) Writing Formulas: Write the correct formula for each of the following.

a) $\overset{+3}{Al}\overset{-1}{Cl_3}$ Aluminum Chloride

b) $\overset{+3}{Al}_2\overset{-2}{S_3}$ Aluminum Sulfide

c) $\overset{+2}{Ca}\overset{-2}{CO_3}$ Calcium Carbonate

d) $\overset{+2}{Ca}(\overset{-1}{NO_3})_2$ Calcium Nitrate

e) $\overset{+3}{Al}(\overset{-1}{OH})_3$ Aluminum Hydroxide

f) $(\overset{+1}{NH_4})_2\overset{-2}{SO_4}$ Ammonium Sulfate

g) HF Hydrofluoric Acid

h) H_3PO_4 Phosphoric Acid

-ate -ic

8) Mole Conversions: Complete the following using factor label.

a) Convert 50.0 g FeO to moles.

$$\frac{1\ mol\ FeO}{71.85\ g\ FeO} \left| \frac{50.0\ g\ FeO}{} \right. = \boxed{0.696\ mol\ FeO}$$

b) Convert 32.5×10^{11} molecules NaI to moles.

$$\frac{1\ mol\ NaI}{6.02 \times 10^{23}\ molecules\ NaI} \left| \frac{32.5 \times 10^{11}\ molecules\ NaI}{} \right. = \boxed{5.40 \times 10^{-12}\ mol\ NaI}$$

c) Convert 3.8×10^{29} molecules $CaSO_4$ to grams.

$$\frac{136.15\ g\ CaSO_4}{1\ mol\ CaSO_4} \left| \frac{1\ mol\ CaSO_4}{6.02 \times 10^{23}\ molecules\ CaSO_4} \right| \frac{3.8 \times 10^{29}\ molecules\ CaSO_4}{} = \boxed{8.6 \times 10^{7}\ g\ CaSO_4}$$

d) Convert 0.098 mole CO_2 to grams.

$$\frac{44.01\ g\ CO_2}{1\ mol\ CO_2} \left| 0.098\ mol\ CO_2 \right. = \boxed{4.3\ g\ CO_2}$$

9) Percent Composition

a) Find the percent composition of O in $CaSO_4$

$$\frac{64\ g\ O}{136.15\ g\ CaSO_4} \times 100 = \boxed{47.01\%\ O\ in\ CaSO_4}$$

b) Find the percent composition of S in $CaSO_4$

$$\frac{32.07\ g\ S}{136.15\ g\ CaSO_4} \times 100 = \boxed{23.55\%\ S\ in\ CaSO_4}$$

10) Empirical & Molecular & Hydrate Formulas

a) Find the empirical formula given 58.54% C, 4.91% H, 17.06% N, and 19.49% O.

$$\frac{1\ mol\ C}{12.01\ g\ C} \left| 58.54\ g\ C = \frac{4.8743\ mol\ C}{1.2177} = 4 \right.$$

$$\frac{1\ mol\ H}{1.01\ g\ H} \left| 4.91\ g\ H = \frac{4.8614\ mol\ H}{1.2177} = 4 \right.$$

$$\frac{1\ mol\ N}{14.01\ g\ N} \left| 17.06\ g\ N = \frac{1.2177\ mol\ N}{1.2177} = 1 \right.$$

$$\frac{1\ mol\ O}{16\ g\ O} \left| 19.49\ g\ O = \frac{1.2181\ mol\ O}{1.2177} = 1 \right.$$

$$\boxed{C_4H_4NO}$$

b) The compound borazine consists of 40.29% boron, 7.51% hydrogen, and 52.20% nitrogen, and its molar mass is 80.50 g/mol. Calculate the molecular formula for borazine.

$$\frac{1\ mol\ B}{10.81\ g\ B} \left| 40.29\ g\ B = \frac{3.7271\ mol\ B}{3.7259} = 1 \right.$$

$$\frac{1\ mol\ H}{1.01\ g\ H} \left| 7.51\ g\ H = \frac{7.4356\ mol\ H}{3.7259} = 2 \right.$$

$$\frac{1\ mol\ N}{14.01\ g\ N} \left| 52.2\ g\ N = \frac{3.7259\ mol\ N}{3.7259} = 1 \right.$$

Empirical = BH_2N

$26.84\ g$

$$\frac{80.50\ g}{26.84\ g} = 3$$

$$\boxed{Molecular = B_3H_6N_3}$$

c) A hydrate of aluminum bromide is composed of 71.16% $AlBr_3$ and 28.84% H_2O. What is the formula for the hydrate?

$AlBr_3 \cdot 6H_2O$

$$\frac{1 \text{ mol } AlBr_3}{266.68 \text{ g } AlBr_3} \left| \frac{71.16 \text{ g } AlBr_3}{} \right. = \frac{0.26684 \text{ mol } AlBr_3}{0.26684} = 1$$

$$\frac{1 \text{ mol } H_2O}{18.02 \text{ g } H_2O} \left| \frac{28.84 \text{ g } H_2O}{} \right. = \frac{1.6004 \text{ mol } H_2O}{0.26684} = 6$$

11) Balancing Equations

a) $2H_2O_2 \rightarrow O_2 + 2H_2O$

b) $H_2CO_3 \rightarrow H_2O + CO_2$

c) $4HCl + O_2 \rightarrow 2H_2O + 2Cl_2$

d) $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$

e) $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

12) Mass-Mass

Nitrogen combines with oxygen in a synthesis reaction to form nitrogen monoxide. How many grams of nitrogen monoxide can be formed from 4.56 grams of oxygen?

$$N_2 + \overset{4.56 \text{ g}}{O_2} \rightarrow 2\overset{2}{NO}$$

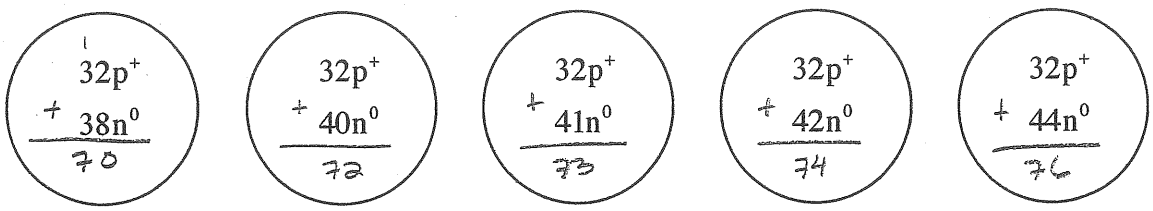
$$\frac{30.01 \text{ g NO}}{1 \text{ mol NO}} \left| \frac{2 \text{ mol NO}}{1 \text{ mol } O_2} \right| \frac{1 \text{ mol } O_2}{32 \text{ g } O_2} \left| \frac{4.56 \text{ g } O_2}{} \right. = 8.55 \text{ g NO}$$

13) Sub-Atomic Particles: Complete the table.

Atomic Number	Mass Number	Number of Protons	Number of Neutrons	Number of Electrons	Element Symbol
35	80	35	45	35	Br
53	127	53	74	56	I^{-3}
73	181	73	108	73	Ta

14) Isotopes

The five isotopes of germanium found in nature are shown below, each with its percent by mass abundance and the composition of its nucleus. Using this data, calculate the average atomic mass of germanium.



21.23% 27.66% 7.73% 35.94% 7.44%

70 amu × .2123 = 14.861
72 amu × .2766 = 19.9152
73 amu × .0773 = 5.6429
74 amu × .3594 = 26.5956
76 amu × .0744 = 5.6544
72.6691 → 72.67 amu

15) Electron Configurations: Write the electron configurations for these atoms.

a) K 19 e⁻ [Ar] 4s¹ -or- $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

b) S 16 e⁻ [Ne] $3s^2 3p^4$ $1s^2 2s^2 2p^6 3s^2 3p^4$

16) Energy of a Photon

Calculate the energy of a gamma ray photon whose frequency is 5.02×10^{20} Hz.

$E = h\nu$ (E: Energy; h: Planck's constant 6.626×10^{-34} J·s; ν: frequency s^{-1})

$E = (6.626 \times 10^{-34}\ J \cdot s)(5.02 \times 10^{20}\ Hz)$

$E = 3.33 \times 10^{-13}\ J$