JBA 2025 – Chemistry Content Check 3

Name:_____ **Score:**_____

1. Which of the following contains the greatest number of moles of O? (2 points)

   a. 2.3 mol H_2O
   b. 1.2 mol H_2O_2
   c. 0.9 mol $NaNO_3$
   d. 0.5 mol $Ca(NO_3)_2$

   Answer __d____

2. Consider the reaction below. How many moles of B need to react to produce 2 moles of C? (2 points)

   $$5A + 4B \rightarrow 3C$$

   a. 0.75 mol
   b. 2.67 mol
   c. 3.00 mol
   d. 4.00 mol

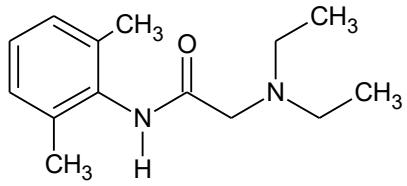
   Answer __b____

3. Ammonium sulfate has the formula $(NH_4)_2SO_4$. What is the molar mass of ammonium sulfate? (2 points)

   a. 114.10 g/mol
   b. 132.14 g/mol
   c. 84.14 g/mol
   d. 63.08 g/mol

   Answer __b____

4. Lidocaine, shown below, is both a local anesthetic and an antiarrhythmic drug. In emergency medical situations, patients with irregular heartbeats frequently receive lidocaine injections or drips. What is the molecular formula of lidocaine? (2 points)



   a. $C_{14}H_{20}N_2O$
   b. $C_{14}H_{17}N_2O$
   c. $C_{14}H_{13}N_2O$
   d. $C_{14}H_{22}N_2O$

   Answer __d____

5. Match the term with its definition. (4 points)

__D__alkene	A. one Avogadro's number of anything
__F__stoichiometry	B. a collection of atoms in a molecule that has predictable properties and reactivity
__B__functional group	C. a compound of carbon and hydrogen containing at least one carbon-carbon triple bond
__A__mole	D. a compound of carbon and hydrogen containing at least one carbon-carbon double bond
	E. a compound of carbon and hydrogen containing at least one carbon-carbon single bond
	F. the process of using a balanced reaction to determine the relationships between reactants and products.

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6. Complete the following table. (6 points) (*Avogadro's number: 6.02x10^{23} molecules = 1 mol)*

_____ g H_2O	=	8.14 mol H_2O	=	_____molecules H_2O

In order to relate moles and mass, we need to use the molar mass, so we must calculate the molar mass of water:

$$\frac{2\ \cancel{\text{mol H}}}{1\ \text{mol } H_2O} \times \frac{1.01\ \text{g}}{1\ \cancel{\text{mol H}}} + \frac{1\ \cancel{\text{mol O}}}{1\ \text{mol } H_2O} \times \frac{16.00\ \text{g}}{1\ \cancel{\text{mol O}}} = \frac{18.02\ \text{g}}{1\ \text{mol } H_2O}$$

Therefore, the molar mass of H_2O is 18.02 g/mol

Now the conversion between moles and grams:

$$8.14\ \cancel{\text{mol } H_2O} \times \frac{18.02\ \text{g}}{1\ \cancel{\text{mol } H_2O}} = 146.68\ \text{g} = \mathbf{147\ g\ H_2O}$$

To convert between moles and molecules, we use Avogadro's number that tells us that 1 mol = 6.022 x 10^{23} molecules.

$$8.14\ \cancel{\text{mol } H_2O} \times \frac{6.022 \times 10^{23}\ \text{molecules}}{1\ \cancel{\text{mol } H_2O}} = 4.9019 \times 10^{24}\ \text{molecules} = \mathbf{4.90 \times 10^{24}\ molecules\ H_2O}$$

7. Balance the following reactions: (6 points)

a. __2__C_2H_6 + __7__O_2 → ___4__CO_2 + __6__H_2O

b. ____PCl_5 + __4_H_2O → ____H_3PO_4 + __5__HCl

8. For the reaction below, what is the mass of $AlCl_3$ that is formed when 0.771 g Cl_2 reacts with an excess of aluminum? (6 pts)

$$2Al(s) + 3Cl_2(g) \rightarrow 2AlCl_3(s)$$

The process requires us to convert from grams of chlorin to moles of chlorine using its molar mass, then use the balanced reaction to convert to moles of aluminum chloride, before using the molar mass of aluminum chloride to determine grams of aluminum chloride.

$$0.771\ \cancel{\text{g } Cl_2} \times \frac{1\ \text{mol } Cl_2}{70.90\ \cancel{\text{g } Cl_2}} = \mathbf{0.01087\ mol\ Cl_2}$$

$$\mathbf{0.01087\ \cancel{mol\ Cl_2}} \times \frac{2\ \text{mol } AlCl_3}{3\ \cancel{\text{mol } Cl_2}} = \mathbf{0.00725\ mol\ AlCl_3}$$

$$\mathbf{0.00725\ \cancel{mol\ AlCl_3}} \times \frac{133.34\ \text{g } AlCl_3}{1\ \cancel{\text{mol } AlCl_3}} = \mathbf{0.967g\ AlCl_3}$$

Periodic Table of the Elements

1 IA 1A	2 IIA 2A	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8	9 VIII 8	10	11 IB 1B	12 IIB 2B	13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 VIIIA 8A
1 **H** Hydrogen 1.008																	2 **He** Helium 4.003
3 **Li** Lithium 6.941	4 **Be** Beryllium 9.012											5 **B** Boron 10.811	6 **C** Carbon 12.011	7 **N** Nitrogen 14.007	8 **O** Oxygen 15.999	9 **F** Fluorine 18.998	10 **Ne** Neon 20.180
11 **Na** Sodium 22.990	12 **Mg** Magnesium 24.305											13 **Al** Aluminum 26.982	14 **Si** Silicon 28.086	15 **P** Phosphorus 30.974	16 **S** Sulfur 32.066	17 **Cl** Chlorine 35.453	18 **Ar** Argon 39.948
19 **K** Potassium 39.098	20 **Ca** Calcium 40.078	21 **Sc** Scandium 44.956	22 **Ti** Titanium 47.867	23 **V** Vanadium 50.942	24 **Cr** Chromium 51.996	25 **Mn** Manganese 54.938	26 **Fe** Iron 55.845	27 **Co** Cobalt 58.933	28 **Ni** Nickel 58.693	29 **Cu** Copper 63.546	30 **Zn** Zinc 65.38	31 **Ga** Gallium 69.723	32 **Ge** Germanium 72.631	33 **As** Arsenic 74.922	34 **Se** Selenium 78.971	35 **Br** Bromine 79.904	36 **Kr** Krypton 83.798
37 **Rb** Rubidium 85.468	38 **Sr** Strontium 87.62	39 **Y** Yttrium 88.906	40 **Zr** Zirconium 91.224	41 **Nb** Niobium 92.906	42 **Mo** Molybdenum 95.95	43 **Tc** Technetium 98.907	44 **Ru** Ruthenium 101.07	45 **Rh** Rhodium 102.906	46 **Pd** Palladium 106.42	47 **Ag** Silver 107.868	48 **Cd** Cadmium 112.414	49 **In** Indium 114.818	50 **Sn** Tin 118.711	51 **Sb** Antimony 121.760	52 **Te** Tellurium 127.6	53 **I** Iodine 126.904	54 **Xe** Xenon 131.294
55 **Cs** Cesium 132.905	56 **Ba** Barium 137.328	57-71	72 **Hf** Hafnium 178.49	73 **Ta** Tantalum 180.948	74 **W** Tungsten 183.84	75 **Re** Rhenium 186.207	76 **Os** Osmium 190.23	77 **Ir** Iridium 192.217	78 **Pt** Platinum 195.085	79 **Au** Gold 196.967	80 **Hg** Mercury 200.592	81 **Tl** Thallium 204.383	82 **Pb** Lead 207.2	83 **Bi** Bismuth 208.980	84 **Po** Polonium [208.982]	85 **At** Astatine 209.987	86 **Rn** Radon 222.018
87 **Fr** Francium 223.020	88 **Ra** Radium 226.025	89-103	104 **Rf** Rutherfordium [261]	105 **Db** Dubnium [262]	106 **Sg** Seaborgium [266]	107 **Bh** Bohrium [264]	108 **Hs** Hassium [269]	109 **Mt** Meitnerium [278]	110 **Ds** Darmstadtium [281]	111 **Rg** Roentgenium [280]	112 **Cn** Copernicium [285]	113 **Nh** Nihonium [286]	114 **Fl** Flerovium [289]	115 **Mc** Moscovium [289]	116 **Lv** Livermorium [293]	117 **Ts** Tennessine [294]	118 **Og** Oganesson [294]

Lanthanide Series	57 **La** Lanthanum 138.905	58 **Ce** Cerium 140.116	59 **Pr** Praseodymium 140.908	60 **Nd** Neodymium 144.243	61 **Pm** Promethium 144.913	62 **Sm** Samarium 150.36	63 **Eu** Europium 151.964	64 **Gd** Gadolinium 157.25	65 **Tb** Terbium 158.925	66 **Dy** Dysprosium 162.500	67 **Ho** Holmium 164.930	68 **Er** Erbium 167.259	69 **Tm** Thulium 168.934	70 **Yb** Ytterbium 173.055	71 **Lu** Lutetium 174.967
Actinide Series	89 **Ac** Actinium 227.028	90 **Th** Thorium 232.038	91 **Pa** Protactinium 231.036	92 **U** Uranium 238.029	93 **Np** Neptunium 237.048	94 **Pu** Plutonium 244.064	95 **Am** Americium 243.061	96 **Cm** Curium 247.070	97 **Bk** Berkelium 247.070	98 **Cf** Californium 251.080	99 **Es** Einsteinium [254]	100 **Fm** Fermium 257.095	101 **Md** Mendelevium 258.1	102 **No** Nobelium 259.101	103 **Lr** Lawrencium [262]

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