**Fall 2021 Chemistry Final A**

*Choose the best answer to each of the following questions. (2 pt. each)*

1. Which is the smallest particle inside of an atom?
   1. Nucleus
   2. Proton
   3. Neutron
   4. Electron
2. Which particle has a negative charge?
   1. Nucleus
   2. Proton
   3. Neutron
   4. Electron
3. Given the following atom, 8035 Br, what does the number 80 represent?
   1. Atomic number
   2. Mass number
   3. Oxidation number
   4. Average atomic mass
4. How many neutrons are in 92Zr?
   1. 40
   2. 51
   3. 52
   4. 92
5. How many electrons are in Sc+?
   1. 20
   2. 21
   3. 22
   4. 25
6. How many protons are in 58Fe?
   1. 26
   2. 28
   3. 32
   4. 58
7. Isotopes of different elements must have different:
   1. Atomic numbers
   2. Oxidation numbers
   3. Mass numbers
   4. Numbers of valence electrons
8. Based on the Bohr model of Hydrogen, what type of energy is released if electrons move from n=5 to n=3?
   1. Infrared light
   2. Ultraviolet light
   3. Visible light—blue
   4. Visible light—red
9. Which form of electromagnetic radiation has the highest frequency?
   1. Infrared radiation
   2. Visible light
   3. Radio waves
   4. Gamma rays
10. Which element has the electron configuration: 1s22s22p63s23p1?
    1. Lithium
    2. Sodium
    3. Potassium
    4. Magnesium
11. Which element has the electron configuration: *[Xe] 6s24f 3*?
    1. Lanthanum
    2. Cerium
    3. Praseodymium
    4. Tantalum
12. What isotope is needed to make this nuclear equation true?

238U 🡪 234Th + \_\_\_\_\_

* 1. Alpha particle
  2. Beta particle
  3. Gamma particle
  4. Neutron

1. Bismuth-212 has a half-life of roughly 61 minutes. If you have a 200-gram sample of 212Bi and you leave it on the counter for 305 minutes, how much of your sample would be left?
   1. 0 grams
   2. 3.125 grams
   3. 6.25 grams
   4. 12.5 grams
2. Which type of nuclear reaction can be seen in the equation below?

226Ra 🡪 222Rn + α

* 1. Alpha decay
  2. Beta decay
  3. Nuclear fusion
  4. Nuclear fission

1. Which element is most likely to become an anion?
   1. Magnesium
   2. Aluminum
   3. Helium
   4. Nitrogen
2. Based on its electron configuration, which element is most likely stable?
   1. Phosphorus
   2. Neon
   3. Sulfur
   4. Silver
3. Based on this electron configuration, *[Kr] 5s24d7*, how many valence electrons does this element have?
   1. 2
   2. 4
   3. 5
   4. 7
4. What is the oxidation number of Calcium when it becomes an ion?
   1. 1+
   2. 2+
   3. 2-
   4. 1-
5. Which diatomic molecule is held together by a double covalent bond?
   1. F2
   2. O2
   3. N2
   4. H2
6. Which intermolecular force is the strongest?
   1. Triple covalent bond
   2. Ionic bond
   3. Hydrogen bond
   4. Van der Waals force
7. Which compound is an ionic compound?
   1. C6H12O6
   2. P2O5
   3. Ca(OH)2
   4. NH3
8. Which is the name of N2O5?
   1. Nitrogen oxide
   2. Nitrogen pentoxide
   3. Dinitrogen pentoxide
   4. Nitrogen (V) oxide
9. What is the formula for ammonium bromide?
   1. NH4Br
   2. NHBr4
   3. NH4Br4
   4. NH3Br
10. Which is the VSEPR shape of the molecule CO2?
    1. Linear
    2. Bent
    3. Trigonal planar
    4. tetrahedral
11. Which molecule is polar?
    1. CO2
    2. BCl3
    3. SiF4
    4. H2O
12. Which elements in each set are in the same family?
    1. Ru, Ag, Cd, Rh
    2. N, P, As, Sb
    3. F, S, Sn, Zn
    4. Y, Zr, Nb, Mo
13. Which element is an alkali metal?
    1. Iodine
    2. Oxygen
    3. Zinc
    4. Potassium
14. Based on periodic trends, which element in this set has the lowest first ionization energy?
    1. Aluminum
    2. Francium
    3. Fluorine
    4. Phosphorus
15. During a few chemical reactions, these salts were formed. Which of them would be considered a precipitate and would NOT make an aqueous solution?
    1. MgO
    2. Li2CO3
    3. Fe(NO3)2
    4. NaF
16. A student suggested that oxygen gas was produced during a chemical reaction. Which observation could be made to provide evidence that oxygen gas was released by the reaction?
    1. A smell was produced.
    2. A color change occurred.
    3. A nearby flame increased in size.
    4. A nearby flame was extinguished.
17. What type of reaction is represented by the equation below?

CaCO3 🡪 CaO + CO2

* 1. Synthesis
  2. Decomposition
  3. Single replacement
  4. Double replacement

1. Which single replacement reaction can occur?
   1. 3LiCl + Fe 🡪 FeCl3 + 3Li
   2. Ca(OH)2 + Mg 🡪 Mg(OH)2 + Ca
   3. H2O + Sr 🡪 Sr(OH)2 + H2
   4. MgF2 + Cl2 🡪 MgCl2 + F2
2. Which equation shows a neutralization reaction?
   1. 2KCl + Na2O 🡪 K2O + 2NaCl
   2. H2SO4 + Mg(OH)2 🡪 MgSO4 + 2H2O
   3. 2AgNO3 + FeS 🡪 Ag2S + Fe(NO3)2
   4. NaClO3 + KMnO4 🡪 NaMnO4 + KClO3
3. Which can be the (unbalanced) products of the following reaction?

C4H10 + O2 🡪 ???

* 1. C + H2O
  2. CO2 + H2O
  3. C6H12O6
  4. CO2 + H2

1. Which is a balanced equation?
   1. 3NH3 🡪 3N2 + H2
   2. 2H2O2 🡪 2H2O + O2
   3. 3Ag2CO3 🡪 3Ag2O + CO2
   4. KNO3 + FeI4 🡪 4 KI + Fe(NO3)4
2. Look at the following equation: Fe2(SO4)3 + 3Cr 🡪 3CrSO4 + 2Fe. If you have 3.0 moles of Fe2(SO4)3, how many moles of CrSO4 can be produced?
   1. 1.0 mole
   2. 3.0 moles
   3. 6.0 moles
   4. 9.0 moles
3. Using the same equation from #36, if you have 104.5 grams of Cr, how many atoms of Fe can be produced by the reaction?
   1. 6.123 x 1023 atoms
   2. 8.067 x 1023 atoms
   3. 1.227 x 1024 atoms
   4. 2.198 x 1024 atoms
4. Given the equation, C7H16 + 11O2 🡪 7CO2 + 8H2O, if you use 6.0 moles of O2 in the reaction, how many liters of CO2 would be produced at STP?
   1. 24 L
   2. 56 L
   3. 75 L
   4. 86 L
5. What is the empirical formula of a compound that contains 69.9% Fe and 30.1% O?
   1. FeO
   2. Fe2O
   3. Fe2O3
   4. Fe3O2
6. The empirical formula of a chemical is N2O5. The molecular mass of the chemical is 216 grams/mole. What is the molecular formula of the chemical?
   1. N2O5
   2. N4O10
   3. N6O15
   4. N8O15
7. What is the percent composition of water in the following hydrate: MgSO4\*7H2O?
   1. 51.2%
   2. 57.6%
   3. 62.1%
   4. 68.9%
8. What does it mean to say that set of reversible reactions is at equilibrium?
   1. The rates of forward and backward reactions are the same.
   2. The masses of reactants and products in the two reactions are the same.
   3. The concentrations of the reactants and products in the two reactions are the same.
   4. The volumes of the reactants and products in the two reactions are the same.
9. What is the equilibrium constant in the following reaction AND which side of the reaction is favored?

N2 (g) + 3H2 (g) 🡨🡪 2NH3 (g)

[N2] = 0.0375 M

[H2] = 0.0625 M

[NH3] = 0.0500 M

1. 0.00366; reactants favored
2. 0.00366; products favored
3. 273; reactants favored
4. 273; products favored

1. Using the same equation from #43, if we assume that we are at equilibrium, what happens if pressure is increased on the system?
   1. Reactants are favored and more N2 will be produced.
   2. Reactants are favored and more NH3 will be produced.
   3. Products are favored and more H2 will be produced.
   4. Products are favored and more NH3 will be produced.
2. Which of the chemicals below is an acid?
   1. H2O
   2. NaOH
   3. HNO3
   4. NH3
3. What is a characteristic of a chemical known as a base?
   1. pH less than 7
   2. sour to taste
   3. slippery to the touch
   4. releases H+ ions in a solution
4. What is the pH of a chemical that has a [H+] = 1 x 10-8 M?
   1. pH = 6; The chemical is an acid.
   2. pH = 6; The chemical is a base.
   3. pH = 8; The chemical is an acid.
   4. pH = 8; The chemical is a base.
5. You mix 68.95 grams of NaOH in 2.5 liters of water. What is the molarity of your solution?
   1. 0.69 M
   2. Chart, line chart

      Description automatically generated0.74 M
   3. 0.88 M
   4. 1.2 M
6. Look at the solubility curves on the right. If you wanted to make a saturated solution in 100 grams of water using NH4Cl at 70 degrees C, how much of the salt would you need to add?
   1. 50 grams
   2. 60 grams
   3. 65 grams
   4. 80 grams
7. In your Chemistry class, you were asked to perform a titration to determine the molarity of an unknown acid. You were given 15.0 mL of acid as well as a 0.20 M NaOH solution. When you ran the titration, you used 37 mL of the base. What was the molarity of your mystery acid?
   1. 0.25 M
   2. 0.33 M
   3. 0.49 M
   4. 0.67 M