Spring 2025 CHM 2045 Exam 1 Review

The material covered is from chapters 1-5

1. The two most abundant isotopes of chlorine are ^{35}Cl (34.99 amu) and ^{37}Cl (36.99 amu). What are their percent abundances? (Hint: Use value from periodic table)

   a) ^{35}Cl is 37%; ^{37}Cl is 63%
   b) ^{35}Cl is 23%; ^{37}Cl is 77%
   c) ^{35}Cl is 77%; ^{37}Cl is 23%
   d) ^{35}Cl is 63%; ^{37}Cl is 37%
   e) ^{35}Cl is 50%; ^{37}Cl is 50%

2. Given the name of the compound, write its molecular formula.
   a) Vanadium (v) nitride:
   b) Iron (i) nitrate:
   c) Tin (iv) fluoride:
   d) Copper (ii) phosphate:
   e) Ammonium dichromate:

3. What are the moles of each ion and the number of each atom in 78.5 g of aluminum sulfate?

I.	0.241 mol Al^{3+}	V.	$2.76*10^{23}$ atoms Al	IX.	$1.66*10^{24}$ atoms O
II.	0.459 mol Al^{3+}	VI.	$5.47*10^{24}$ atoms Al	X.	$9.32*10^{23}$ atoms O
III.	0.987 mol SO_4^{2-}	VII.	$4.14*10^{23}$ atoms S		
IV.	0.688 mol SO_4^{2-}	VIII.	6.3510^{25} atoms S		

   a) II, IV, V, VII, IX
   b) I, III, VI, VIII, X
   c) I, II, IV, VI, VIII, X
   d) II, III, V, VII, IX
   e) None of the above

4. You have a concentrated stock solution of HCl. The concentration is 8.2 M and there is 1.5 L of stock solution. 752 mL of stock solution are taken and diluted to 1.2 L in a volumetric flask. 65 mL of this new solution are taken and diluted to 125 mL in another volumetric flask. What is the final concentration?

   a) 2.7 M
   b) 6.2 M
   c) 8.2 M

d) 3.4 M
e) 4.5 M

5. In an experiment, 25.0 mL of a gas with a pressure of 1.00 atm is contained in a balloon at 25.00°C. The balloon's temperature is adjusted until the pressure is 0.75 atm at a volume of 31.1 mL. What is the final temperature of the gas under the new conditions?
   a) 278°C
   b) 5°C
   c) 23°C
   d) 273°C
6. Write the balanced molecular and net ionic equations for the combination of silver nitrate and sodium chromate.

7. Given 2.68 M of strontium phosphate, what are the mols of phosphate ion in 689 mL? a) 9.81 mol
   b) 3.69 mol
   c) 7.78 mol
   d) 2.43 mol
   e) 6.75 mol
8. Gypsum is a common hydrate salt. It has the general formula $CaSO_4 \cdot xH_2O$. If the molar mass of gypsum is 172.17 g/mol, what is x?
   a) 1
   b) 2
   c) 3
   d) 4
   e) 5
9. What is the mass of CO_2 if 8.2g of nonene (C_9H_{18}) and 20g of O_2 are combusted? And which is the limiting reactant?

a) Nonene, 23g
b) O_2, 16g
c) Nonene, 25g
d) O_2, 18g
e) O_2, 27g

10. Consider 2.00 moles of Argon, an ideal gas, at a density of 5.00 g/L and a pressure of 2.00 atm. What is the closest value to the temperature (in K) of this gas?

a. 172 K
b. 273 K
c. 304 K
d. 195 K

11. What is the mass of $V(OH)_5$ formed when 624 mL of 0.389 M VCl_5 reacts with 893 mL of 0.651 M of $Ca(OH)_2$?

a. 30.6g
b. 98.2g
c. 33.0g
d. 74.6g
e. 31.6g

12. Using the question 11's chemical reaction, how many mL are left over of the excess reactant?

a. 30mL
b. 90mL
c. 512mL
d. 26mL
e. 410mL

13. Balance and identify the type of reaction, oxidizing agent, and reducing agent of each equation:

$N_2O_5 \rightarrow NO_2 + O_2$

$S_8 + F_2 \rightarrow SF_4$

$CsI + Cl_2 \rightarrow CsCl + I_2$

14. Given the reaction $Fe_3O_4 + H_2 \rightarrow Fe + H_2O$, if 0.250g H_2 makes 1.49 g of H_2O, what is the percent yield?

    a. 52.3%
    b. 66.7%
    c. 95.2%
    d. 12.4%
    e. 75.3%

15. Given $7.13*10^{19}$ Ca atoms, what is the mass of calcium in grams?

    a. $5.23*10^{-3}$
    b. $6.35*10^{-3}$
    c. $4.74*10^{-3}$
    d. $9.24*10^{-3}$
    e. $4.93*10^{-3}$

16. Given 1 mol, what is the mass percent of each element in $C_6H_{12}O_6$?

I.	60% C	III.	6.7% H	V.	31.6 % O
II.	40% C	IV.	8.4% H	VI.	53.3% O

    a. I, IV, VI
    b. II, IV, VI
    c. I, IV, V
    d. II, III, VI
    e. II, IV, V

17. What volume of 0.6143 M of strontium hydroxide would neutralize 72.59 mL of a 0.8291 M solution of hydrochloric acid?

    a. 62.43mL
    b. 48.99mL
    c. 75.12mL

d. 36.25mL
e. 95.13mL

18. An unknown metal M reacts with sulfur to make M_2S_3. If 1.62g of M reacts with 2.88g of sulfur, what is M and the name of M_2S_3?

a. V; vanadium (iii) sulfide
b. Fe; iron (iii) sulfide
c. Au; gold (iii) sulfide
d. Al; aluminum sulfide
e. Cr; chromium (iii) sulfide

19. Balance the equation and identify the oxidation numbers, oxidizing agent, and reducing agent for the combustion of C_7H_{14}.

20. What is the empirical formula of a compound that is 40% C, 6.71% H, and 53.3% O? What isthe molecular formula given that the molar mass is 240.24 g/mol?

a. CH_2O; $C_9H_{18}O_9$
b. C_2HO; $C_{16}H_8O_8$
c. CH_2O; $C_8H_{16}O_8$
d. CHO_2; $C_9H_9O_{18}$
e. CH_2O; $C_6H_{12}O_6$

21. Consider the following reaction in a closed reaction flask:

$$2\ A_{(g)} + 3\ B_{(g)} \rightarrow A_2B_{3\,(g)}$$

If 1.20 atm of gas A is allowed to react with 1.20 atm of gas B, and the reaction goes to completion at constant temperature and volume, what is the total pressure (in atm) in the reaction flask at the end of the reaction?

a. 0.4 atm
b. 0.8 atm
c. 1.2 atm
d. 2.4 atm