Spring 2024 CHM 2045 Exam 1 Review

The material covered is from chapters 1-4

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) Fill in the missing information. Circle the compound that would have the most amount of moles in 10 grams of its compound.

	Name	Molecular Formula	Molecular Mass
a)	Vanadium (v) nitride:	V_3N_5	222.9 amu
b)	Tin (iv) fluoride:	SnF4	194.7 amu
c)	Copper (ii) phosphate:	$Cu_3(PO_4)_2$	380.6 amu
d)	Ammonium dichromate	$(NH_4)_2Cr_2O_7$	252.1 amu

3) How many significant figures would the answer to (2.91 + 3.002)*62 have?
   a) 1
   b) 2
   c) 3
   d) 4
   e) 5

4) 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+} II. 0.459 mol Al^{3+} III. 0.987 mol $SO4^{2-}$
IV. 0.688 mol $SO4^{2-}$ V. $2.76*10^{23}$ atoms Al VI. $5.47*10^{24}$ atoms Al
VII. $4.14*10^{23}$ atoms S VIII. 6.3510^{25} atoms S IX. $1.66 * 10^{24}$ atoms O
X. $9.32*10^{23}$ atoms O

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

5) 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

6) Write the balanced molecular, complete ionic, and net ionic equations for the combination of silver nitrate and sodium chromate. Label the spectator ions (if there are any). What is the sum of moles in the net ionic equation?

Balanced equation: $2\ AgNO_3\ (aq) + Na_2CrO_4\ (aq) \rightarrow NaNO_3\ (aq) + Ag_2CrO_4\ (s)$
Complete ionic equation:
$2\ Ag^+\ (aq) + 2\ NO_3^-\ (aq) + 2\ Na^+\ (aq) + CrO_4^{2-}\ (aq) \rightarrow 2\ Na^+\ (aq) + 2\ NO_3^-\ (aq) + Ag_2CrO_4\ (s)$

Net ionic equation:
$2\ Ag^+\ (aq) + CrO_4^{2-}\ (aq) \rightarrow Ag_2CrO_4\ (s)$
Spectator ions: Na^+ and NO_3^-
Coefficient sum: 2+1+1 = 4

7) What is 2.59 in^2/mL in m^2/gal?

a) 52.7 m^2/gal
b) 6.32 m^2/gal
c) 2.84 m^2/gal
d) 249 m^2/gal
e) 4.35 m^2/gal

8) Given 2.68 M of strontium phosphate, what are the mols of oxygen in 689 mL?

a) 9.81 mol
b) 1.84 mol
c) 2.43 mol
d) 14.7 mol
e) 7.78 mol

9) 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

10) 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

11) Using the question 10's chemical reaction, how many mL are left over of the excess reactant?

f) 30mL
g) 90mL
h) 512mL
i) 26mL
j) 410mL

12) Using the information from question 10, if 18.4g of $V(OH)_5$ was produced during the experiment, what is the percent yield?

a) 58.2%
b) 24.7%
c) 52.2%
d) 171.7%
e) 71.8%

13) Balance and identify the type of reaction, salt produced, oxidizing agent, and reducing agent of each equation:

$N_2O_5 \rightarrow NO_2 + O_2$

$2N_2O_5 \rightarrow 4NO_2 + O_2$

Decomposition reaction; Oxidizing Agent is N_2O_5, Reducing Agent is N_2O_5

$S_8 + F_2 \rightarrow SF_4$

$S_8 + 16F_2 \rightarrow 8SF_4$
Combination reaction; Oxidizing Agent is F_2, Reducing Agent is S_8

$CsI + Cl_2 \rightarrow CsCl + I_2$

$2CsI + Cl_2 \rightarrow 2CsCl + I_2$

Single displacement reaction; Oxidizing Agent is Cl_2, Reducing Agent is CsI

14. Use the following reactions:

$A_2B + 2C \rightarrow 2AC + B_2$	84%
$B_2 + DE_2 \rightarrow DB_2 + E_2$	46%

If 2.44 moles of E_2 was produced, how many moles of C did we start with?

a. 10.9 moles C
b. 6.31 moles C
c. 12.6 moles C
d. 0.91 moles C
e. 3.26 moles C

15. 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

16. How many neutrons, protons, and electrons does $^{130}Te^{2-}$ have?

a. 130 protons, 130 neutrons, 130 electrons
b. 52 protons, 130 neutrons, 52 electrons
c. 52 protons, 52 neutrons, 52 electrons
d. 52 protons, 78 neutrons, 54 electrons
e. 54 protons, 78 neutrons, 54 electrons

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) If 26.13g of CO_2 and 14.25g of H_2O were produced from a combustion reaction, what is the empirical formula for the C_xH_y molecule burned?

a) CH4
b) C_4H_6
c) C_2H_4
d) C_4H_{10}
e) C_3H_8

20. What is the empirical formula of a compound that is 40% C, 6.71% H, and 53.3% O? What is the 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; $C_6H_{12}O_6$