CHEM 101
Make-up Quiz 3:
November 4, 2021
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Fe^{2+} O^{2-}

1) What is the correct chemical formula for sodium phosphate, calcium nitrate, aluminum
O^{2-} oxide, and iron (II) oxide:

Na^+ PO_4^{3-} Ca^{2+} NO_3^- Al^{3+}

$Na_3(PO_4)_1$ $Ca(NO_3)_2$

    a) Na_2PO_3 , $Ca(NO_3)_2$, Al_2O_3 , Fe_2O_3
    b) Na_3PO_4 , $Ca(NO_2)_2$, Al_2O_3 , Fe_2O_3
    c) Na_3PO_4 , $Ca(NO_3)_2$, Al_2O_3 , FeO
    d) Na_2SO_4 , $Ca(NO_2)_2$, Al_2O_3 , FeO

Al^{3+} O^{2-}
Al_2O_3

Fe^{2+} O^{2-}
Fe_2O_2
FeO
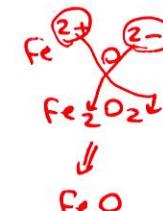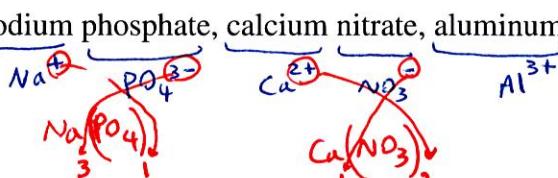
2) What is the formula mass of NH_3 and $Mg(OH)_2$?
    a) NH_3= 17.04, $Mg(OH)_2$= 58.33
    b) NH_3= 19, $Mg(OH)_2$= 41.32
    c) NH_3=19, $Mg(OH)_2$=58.33
    d) NH_3=17.04, $Mg(OH)_2$=41.32

N	H	Mg	O
14.01	1.01	24.31	16.00
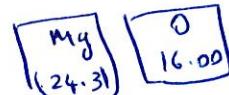
$$NH_3 = (N \times 1) + (H \times 3) = (14.01 \times 1) + (1.01 \times 3)$$

$$Mg(OH)_2 = (Mg \times 1) + (O \times 2) + (H \times 2) = (24.31 \times 1) + (16 \times 2) + (1.01 \times 2)$$

$$NH_3 = 17.04 \ amu$$
$$Mg(OH)_2 = 58.33 \ amu$$

metal → polyatomic ion ⟹ Ionic

3) Imagine we have 5 moles of the $MgSO_4$. What is the mass of this sample and determine if
this compound is ionic or molecular?
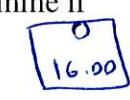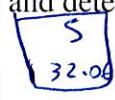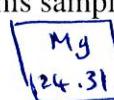
Mg	S	O
24.31	32.06	16.00

    a) Mass =755 , Ionic
    b) Mass=755 , Molecular
    c) Mass=601.85 , Ionic
    d) Mass=601.85 , Molecular

$$? \ g \ MgSO_4 = 5 \ mol \ MgSO_4 \times \frac{(24.31) + (32.06) + (16.00 \times 4) \ g \ MgSO_4}{1 \ mol \ MgSO_4} = 601.85 \ g \ MgSO_4$$

4) Which compound name is correct?
    a) MnO : Manganese (II) oxide
    b) $LiNO_3$: Lithium nitrite nitrite
    c) $Cr(OH)_2$: Chromium oxide hydroxide ⟹ Chromium (II) hydroxide
    d) NH_4NO_3 : Ammonium nitrite (II) ⟹ Ammonium nitrate
    nitrate

a) 1.78 g H
b) 2.52 g H
c) 1.12 g H

5) We have 10 g of each of the following compounds. Which of them consists of the least grams of hydrogen?

a) $? gH = 10 g\ NH_3 \times \dfrac{1\ mol\ NH_3}{17.04\ gNH_3} \times \dfrac{3\ mol\ H}{1\ mol\ NH_3} \times \dfrac{1.01\ gH}{1\ mol\ H}$

(a) NH₃

(b) CH₄

b) $? g\ CH_4 = 10 g\ CH_4 \times \dfrac{1\ mol\ CH_4}{16.05\ gCH_4} \times \dfrac{4\ mol\ H}{1\ mol\ CH_4} \times \dfrac{1.01\ gH}{1\ mol\ H}$

(c) H₂O ⟲

(d) All have the same grams of hydrogen

N	H
14.01	1.01

C	O
12.01	16.00

c) $? g\ H_2O = 10 g\ H_2O \times \dfrac{1\ mol\ H_2O}{18.02\ gH_2O} \times \dfrac{2\ mol\ H}{1\ mol\ H_2O} \times \dfrac{1.01\ gH}{1\ mol\ H}$

$NH_3 = (N \times 1) + (H \times 3) = (14.01 \times 1) + (1.01 \times 3) = 17.04\ g/mol$

$CH_4 = (C \times 1) + (H \times 4) = (12.01 \times 1) + (1.01 \times 4) = 16.05\ g/mol$

$H_2O_1 = (H \times 2) + (O \times 1) = (1.01 \times 2) + (16 \times 1) = 18.02\ g/mol$

6) What is the mass of O in 50 g of sulfurous acid?

a) 29.24 g ⟲

b) 19.53 g

c) 32.63 g

d) 16.34 g

$? g\ O = 50 g\ H_2SO_3 \times \dfrac{1\ mol\ H_2SO_3}{82.08\ gH_2SO_3} \times \dfrac{3\ mol\ O}{1\ mol\ H_2SO_3}$

$\times \dfrac{16.00\ g\ O}{1\ mol\ O} = 29.24\ g\ O$

$H_2SO_3 = (H \times 2) + (S \times 1) + (O \times 3) = (1.01 \times 2) + (32.06 \times 1) + (16 \times 3) = 82.08\ g/mol$

7) Which sample contains the most number of atoms?

a) One gram of hydrogen ⟲

$? \# H\ atoms = 1 g\ H_2 \times \dfrac{1\ mol\ H_2}{2 \times 1.01\ gH_2} \times \dfrac{2\ mol\ H}{1\ mol\ H_2} \times \dfrac{6.022 \times 10^{23}\ H\ atoms}{1\ mol\ H}$

b) One gram of nitrogen

c) One gram of lithium

d) All have the same number of atoms

$= 5.96 \times 10^{23}\ H\ atoms$

$? \# N\ atoms = 1 g\ N_2 \times \dfrac{1\ mol\ N_2}{2 \times 14.01\ gN_2} \times \dfrac{2\ mol\ N}{1\ mol\ N_2} \times \dfrac{6.022 \times 10^{23}\ N\ atoms}{1\ mol\ N} = 4.298 \times 10^{22}$

$\equiv 0.43 \times 10^{23}$

$? \# Li\ atoms = 1 g\ Li \times \dfrac{1\ mol\ Li}{6.94\ gLi} \times \dfrac{6.022 \times 10^{23}\ Li\ atoms}{1\ mol\ Li} = 8.677 \times 10^{22}$

$\equiv 0.8677 \times 10^{23}$

8) Which statement is NOT correct:

a) The molecular formula of sulfur hexachloride is SCl₆ ✓

b) HCl is a binary acid because it consists of two elements: H and Cl ✓

c) Dihydrogen monoxide is the other name of water H2O ✓

d) Magnesium (~~II~~) oxide has the chemical formula of MgO₂ ⟲

9) Which statement is NOT correct:

a) The value of an element's molar mass in ~~kilogram~~ grams per mole is numerically equal to the element's atomic mass in atomic mass units ✗

b) The mass of one mol of atoms of an element is its molar mass ✓

c) Just as the weight of 1 doz nails changes for different types of nails, so the mass of 1 mol of atoms changes for different atoms ✓

d) Avogadro's number, the number of atoms in a mole, is defined as the number of atoms in exactly 12 g of carbon-12 ✓

10) Which of the following consists of only metals?
   a) lead, lithium, sodium, potassium
   b) beryllium, magnesium, calcium, neon — *nonmetal*
   c) iridium, tellurium, boron, vanadium → *metalloids*
   d) aluminum, copper, zinc, hydrogen — *nonmetal*

11) Which of the following answers contain all metals with variant charges?
   a) cesium, silver, zinc, lead — *fixed charges*
   b) copper, zinc, strontium, barium — *fixed charges*
   c) tin, mercury, silver, lead
   d) chromium, mercury, lead, tin

12) Which statement is correct?
   a) The metals that form more than one type of ion are *usually* transition metals
   b) Cu and Ag are examples of transition metals that form ~~more than~~ one type of ion
   c) NH_4Cl is an ~~ionic~~ compound — *molecular*
   d) We categorize chemical formulas into three types: empirical, molecular, and ~~molar~~ *structural*

13) Which of the following is an ionic compound?
   a) Mg — *metal, not a compound (element ⟷ Mg)*
   b) NH_3 → *Molecular*
   c) $CrCl_2$ — *metal / nonmetal*
   d) None of the above

14) Which of these elements DO NOT exist as diatomic molecules?
   a) I
   b) H
   c) F
   d) B

15) Which formula represents the greatest total number of atoms?
   a) $Mg_1(OH)_2$: $1 + 2 + 2 = 5$
   b) $Mn(NO_3)_2$: $1 + 2 + (2 \times 3) = 9$
   c) $Li_2(HPO_4)$: $2 + 1 + 1 + 4 = 8$
   d) $HC_2H_3O_2$: $1 + 2 + 3 + 2 = 8$

16) Which of the following is an acid?
   a) $HC_2H_3O_2$
   b) $Mg(OH)_2$ → *Ionic*
   c) KCl → *Ionic*
   d) Al_2O_3 → *Ionic*

17) What is the mass of 23 mol of carbon monoxide?

CO

a) 208.23 g
b) 1012.23 g
c) 644.23 g *(circled)*
d) 1.22 g

$? \, g \, CO = 23 \, mol \, CO \times \dfrac{12.01+16.00 \, g \, CO}{1 \, mol \, CO} = 23 \times (28.01) = 644.23 \, g \, CO$

18) A mothball is composed of naphthalene ($C_{10}H_8$) and has a mass of 5 g. How many naphthalene molecules does it contain?

a) 3.01×10^{23}
b) 3.11×10^{21}
c) 2.35×10^{22}
d) 0.039×10^{23}

$? \, C_{10}H_8 \, molecules = 5 \, g \, C_{10}H_8 \times \dfrac{1 \, mol \, C_{10}H_8}{(10 \times 12.01)+(8 \times 1.01) \, g \, C_{10}H_8} \times \dfrac{6.022 \times 10^{23} \, molecules}{1 \, mol \, C_{10}H_8}$

$= 2.35 \times 10^{22} \, molecules$

19) Which sample has the most number of molecules?

a) 10 g CO
b) 10 g N_2
c) 10 g H_2O *(circled)*
d) 10 g O_2

a) $? \, CO \, molecules = 10 \, g \, CO \times \dfrac{1 \, mol \, CO}{12.01+16 \, g \, CO} \times \dfrac{6.022 \times 10^{23} \, \# \, molecules}{1 \, mol \, CO}$

b) $? \, N_2 \, molecules = 10 \, g \, N_2 \times \dfrac{1 \, mol \, N_2}{(14.01 \times 2) \, g \, N_2} \times \dfrac{6.022 \times 10^{23} \, \# \, molecules}{1 \, mol \, N_2}$

c) $? \, H_2O \, molecules = 10 \, g \, H_2O \times \dfrac{1 \, mol \, H_2O}{(1.01 \times 2)+16 \, g \, H_2O} \times \dfrac{6.022 \times 10^{23} \, \# \, molecules}{1 \, mol \, H_2O}$

$? \, O_2 \, molecules = 10 \, g \, O_2 \times \dfrac{1 \, mol \, O_2}{(16 \times 2) \, g \, O_2} \times \dfrac{6.022 \times 10^{23} \, \# \, molecules}{1 \, mol \, O_2}$

a) $\dfrac{1}{28.01}$ b) $\dfrac{1}{28.02}$ c) $\dfrac{1}{18.02}$ *(circled)* biggest number   d) $\dfrac{1}{32}$

20) What is the mass percent composition of N in $C_2H_8N_2$?

a) 3.36%
b) 13.44 %
c) 4.2 %
d) 46.6 % *(circled)*

$Mass \, percent \, composition \, of \, N = \dfrac{2 \times N}{(2 \times C)+(8 \times H)+(2 \times N)} \times 100 \%$

$= \dfrac{2 \times 14.01}{(2 \times 12.01)+(8 \times 1.01)+(2 \times 14.01)} \times 100 \%$

$= 46.60 \%$

21) Which of the following is an empirical formula?
    a. C_6H_{14} → can be simplified to C_3H_7
    b. C_2H_4 → can be simplified to CH_2
    c. H_2O_2 → can be simplified to HO
    d. C_5H_4 → cannot be simplified

22) What is the name of Li_2CrO_4?
    Li^+ , CrO_4^{2-}
    a. Lithium Chromate — Lithium   Chromate
    b. Dilithium monochrome tetroxide
    c. Dilithium monochromide → Not a molecular compound
    d. Lithium chromite
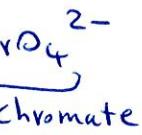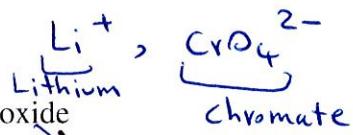
23) Write the chemical formula for a compound consisting of Cs and Cl. What type of compound do these elements form?
    Cs^+ Cl^-
    Metal   nonmetal
    a. $CsCl_2$, ionic
    b. $CsCl$, ionic
    c. $CsCl_2$, molecular
    d. $CsCl$, molecular

24) Calculate the formula mass of $(NH_4)_3PO_4$
    a. 112.01
    b. 121.1
    c. 149.12
    d. 140.03

$$(NH_4)_3PO_4 = (N \times 3) + (H \times 12) + (P \times 1)$$
$$+ (O \times 4) = 149.12 \text{ amu}$$

30.97   14.01   1.01   16.00

25) Which of the following is NOT a polyatomic cation?
    a. Hg_2^{2+}
    b. NH_4^+
    c. PO_4^{3-} → Anion
    d. All of the above are polyatomic cations

Should have a positive charge