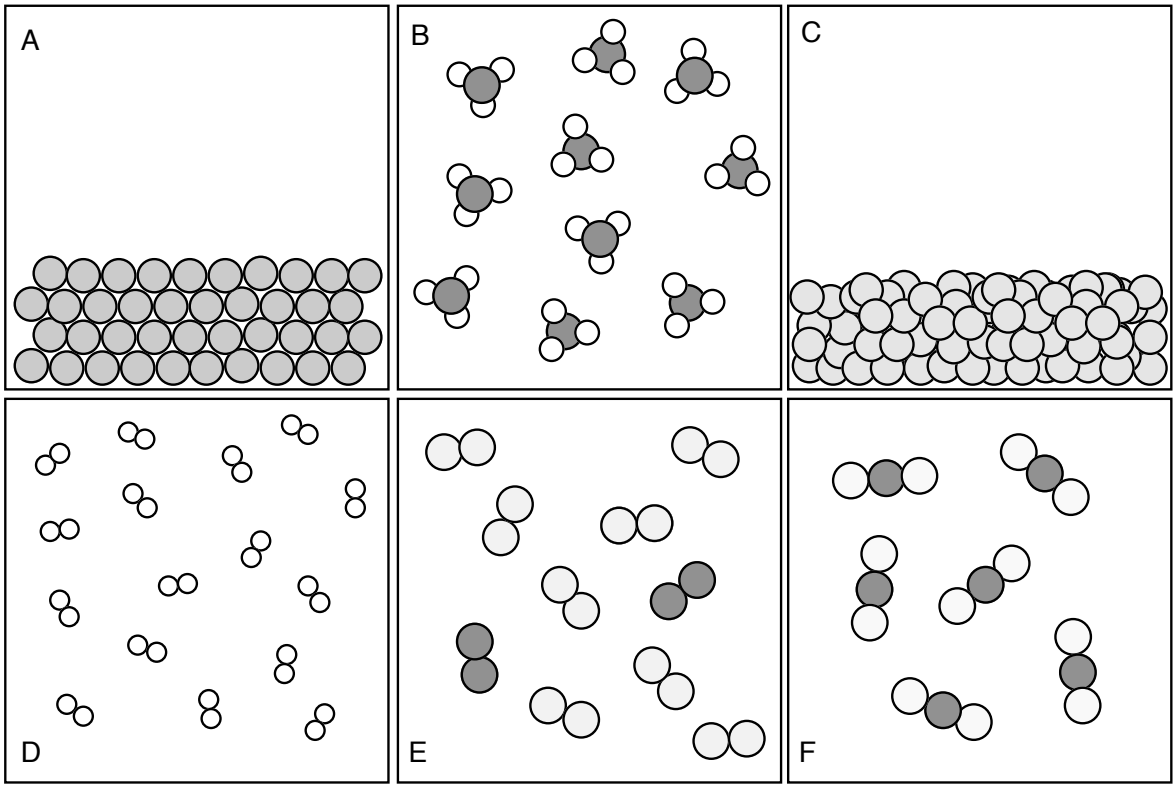
CHM 130: Final Exam Practice Problems

1. Complete the following table:

Isotope	Mass number	# of protons	# of neutrons	# of electrons
strontium-90				
neon-19				
iron-55				

2. Consider Figures A-F below:



Indicate the figure represented as an **element,** a **compound** or a **mixture AND** a **solid,** a **liquid** or a **gas**.

A.	element	compound	mixture	solid	liquid	gas
B.	element	compound	mixture	solid	liquid	gas
C.	element	compound	mixture	solid	liquid	gas
D.	element	compound	mixture	solid	liquid	gas
E.	element	compound	mixture	solid	liquid	gas
F.	element	compound	mixture	solid	liquid	gas

3. Circle all of the following changes that are **chemical**:
   vaporizing fizzing subliming precipitating burning rusting condensing

4. Indicate the **symbol for the element** that fits each of the following descriptions:

   _____ a. The noble gas in the fifth period.

   _____ b. The halogen with the greatest ionization energy.

   _____ c. The alkaline earth metal in the third period.

   _____ d. The alkali metal with the greatest metallic character.

   _____ e. The transition metal in the fourth period with the lowest atomic number.

   _____ f. The transition metal in the fifth period with the largest atomic radius.

5. A 6.252 g of sodium hydrogen carbonate is mixed with 2.709 g of hydrochloric acid to produce 4.348 g of sodium chloride, 3.273 g of carbon dioxide, and water. What mass of water forms?

6. A 25.00 g sample of piece of titanium is placed in a graduated cylinder containing 3.56 mL of water. If the density of titanium is 4.51 g/cm^3, what is the new level of the water after the piece of titanium is added.

7. For each the following compounds, indicate whether it is ionic (I) or molecular (M),and give the corresponding name or formula:

   I or M

   _____ a. nitric acid _____

   _____ b. zinc phosphate _____

   _____ c. silver nitride _____

   _____ d. ammonium chromate _____

   _____ e. $HC_2H_3O_2$*(aq)* _____

   _____ f. SrF_2 _____

   _____ g. H_2S*(aq)* _____

   _____ h. N_2O_5 _____

   _____ i. $Sn(CO_3)_2$ _____

   _____ j. CoN _____

8. For each of the following,
   i. Identify the **type of reaction** using the letters designated below:
      - Combination (**C**)
      - Decomposition (**D**)
      - Single Replacement (**SR**)
      - Double Replacement/Precipitation (**DR**)
      - Neutralization (**N**)
      - Combustion (**B**)

TYPE ii. Balance the equation

_____ A. _____ Na (s) + _____ H_2O (l) → _____ H_2 (g) + _____ NaOH (aq)

_____ B. _____ $Fe_2(SO_4)_3$ (aq) + _____ LiOH (aq) → _____ $Fe(OH)_3$ (s) + _____ Li_2SO_4 (aq)

_____ C. _____ C_5H_6O (l) + _____ O_2 (g) $\xrightarrow{\Delta}$ _____ H_2O (g) + _____ CO_2 (g)

_____ D. _____ H_3BO_3 (s) $\xrightarrow{\Delta}$ _____ B_2O_3 (s) + _____ H_2O (l)

9. For each of the following sets of reactants, write the formulas for the products and balance the equation if the reaction occurs, or write "NR" for no reaction.

a. HBr (aq) + Mg (s) →
b. KOH (aq) + H_3PO_4 (aq) →
c. NaOH (aq) + Al (s) →
d. C_5H_{12} (l) + O_2 (g) $\xrightarrow{\Delta}$

10. Circle all the examples below that are **equal to 1 mole**:

47.88 g tin	44.01 g carbon dioxide	22.4 L Br_2 (l) at STP
6.03×10^{22} H_2O molecules	22.4 L O_3(g) at STP	58.44 g sodium chloride

11. Consider the following reaction: **NH_4^+(aq) + HSO_3^-(aq) ⇒ H_2SO_3(aq) + NH_3(aq)**

Circle all that apply *for each of the following:*

a. **NH_4^+(aq)** is _____.

an Arrhenius acid a Bronsted-Lowry acid an Arrhenius base a Bronsted-Lowry base

b. **HSO_3^-(aq)** is _____.

an Arrhenius acid a Bronsted-Lowry acid an Arrhenius base a Bronsted-Lowry base

12. Calculate the number of hydrogen atoms in 25.0 g of urea, $(NH_2)_2CO$.

13. Consider the following reaction: $2\,Al\,(s) + 6\,HCl\,(aq) \rightarrow 2\,AlCl_3\,(aq) + 3\,H_2\,(g)$
    a. Calculate the volume of hydrogen gas produced when 5.00 g of aluminum reacts at STP.
    b. Calculate the volume of hydrogen gas produced when 15.00 g of hydrochloric acid reacts at STP.
    c. Identify the limiting reactant and the reactant in excess when 5.00 g of aluminum reacts with 15.00 g of hydrochloric acid at STP.

14. Consider the decomposition of sodium azide, NaN_3: $2\,NaN_3\,(s) \xrightarrow{spark} 2\,Na\,(s) + 3\,N_2\,(g)$
    What is the percent yield if 50.0 g of sodium azide produced 29.7 g of nitrogen.

15. Identify the reactant oxidized, the reactant reduced, the oxidizing agent, and the reducing agent in each of the following redox reactions:
    a. $Zn(s) + HCl(aq) \rightarrow ZnCl_2\,(aq) + H_2\,(g)$
    b. $CH_4(s) + 2\,O_2\,(g) \rightarrow 2\,H_2O(g) + CO_2\,(g)$
    c. $N_2(g) + 3\,H_2\,(g) \rightarrow 2\,NH_3(g)$
    d. $3\,SnCl_2(aq) + 2\,Al\,(s) \rightarrow 2\,AlCl_3\,(aq) + 3\,Sn\,(s)$

16. A 0.750 mL bubble at 4°C and 6.00 atm occupies what volume at 22.50°C and 725 mmHg?

17. Which of the following that ***increase*** from left to right across the Periodic Table?
    Atomic radius, Ionization energy, Metallic character, Electronegativity, # of valence electrons

18. Circle all of the following that ***increase*** from top to bottom down the Periodic Table?
    Atomic radius, Ionization energy, Metallic character, Electronegativity, # of valence electrons

19. For each of the following molecules: CF_4, NF_3, CH_2O, PCl_3, CH_2F_2, CO_2, SO_2, CO_3^{2-}, SO_4^{2-}, NO_2^-
    i. Draw the Lewis electron dot formula.
    ii. Indicate the shape of the molecule and its bond angles.
    iii. Indicate if the molecule is polar or nonpolar.

20. Consider the following six choices below:

A. ionic bond	D. dispersion (London) forces	G. metallic bonds
B. polar covalent bond	E. dipole-dipole forces	
C. nonpolar covalent bond	F. hydrogen bond	

    Give the letter for the type of bond or intermolecular force described for each of the following:
    i. The bonds broken when NH_3*(l)* boils.
    ii. The bonds holding atoms together in water.
    iii. The bonds broken when a sample of Br_2*(s)* boils.
    iv. The bonds holding the atoms together in a Cl_2 molecule.
    v. The bonds broken when a sample of KBr melts.
    vi. The bonds holding broken when a sample of H_2S*(l)* boils.
    vii. The bonds holding two HBr molecules together in a sample of HBr*(l)*.
    viii. The bonds holding atoms together in a sample of HF*(l)*.
    ix. The bonds holding atoms together in a sample of Pb*(s)*.

21. Which of the following does NOT increase with stronger intermolecular forces between molecules?
a. boiling point b. molar heat of vaporization c. surface tension d. vapor pressure

22. Circle all of the following that will be soluble in or miscible with water:
$CH_3Cl(l)$ $C_{graphite}(s)$ $CO_2(s)$ K_3PO_4 AgBr $HCN(l)$ $Ag(s)$ $I_2(s)$

23. Circle all of the following that will be soluble in or miscible with olive oil (a nonpolar solvent):
$CH_3Cl(l)$ $C_{graphite}(s)$ $CO_2(s)$ K_3PO_4 AgBr $HCN(l)$ $Ag(s)$ $I_2(s)$