**YOUR NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Final Exam: Honors Chemistry**

**Spring 2023**

The rules: You may use a calculator, writing implement, periodic table, and scratch paper for this final exam. All items except for the writing implement will be provided for you. You will have the entire exam period to finish your exam – however, the exam was written to be an hour long so you should have plenty of time at the end to check your work. Speaking of which, please *show your work* whenever possible. If you get the wrong answer to a question but have provided work that showed a minor mistake, you’ll get most of the credit – if you simply write a wrong answer, you will score a zero on the problem. I’d much rather give you partial credit.

When you are done with the exam, place the exam, your scratch paper, and your periodic table into the box. You may not use your iPad, so I sure hope you brought something interesting to do. If not, imagine what it would be like to be able to fly. That always keeps me entertained.

May God guide your mind and hand as you take this exam. St. John Baptist de la Salle, pray for us. Live Jesus in our hearts forever.

1. Consider the reaction MgCl2 + 2 NaF 🡪 MgF2 + 2 NaCl
2. What type of reaction is taking place (1 pt): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Will this reaction take place at all? (1 pt): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Assuming the reaction *does* occur, how much magnesium fluoride will be formed if 55.9 grams of magnesium chloride reacts with 85.3 grams of sodium fluoride? (7 pt)
5. What is the limiting reagent for the reaction above? (1 pt)

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1. How much of the excess reagent will remain after this reaction is performed? (5 pt)
2. If 29.7 grams of magnesium fluoride is actually formed in this reaction, what is the percent yield of the reaction? (2 pt)
3. What are some possible sources of systematic error that might be responsible for the error in part f above? (4 pt)
4. What are the four postulates (assumptions) of the kinetic molecular theory of gases? (8 pt)
5. Why do gases undergo diffusion? (3 pt)
6. Why are gases compressible? (3 pt)
7. What is pressure? (1 pt)
8. The Environmental Protection Agency describes a car with an interior volume of 2,500 liters as being a “subcompact car.”
9. If this car were to be at a winter temperature of -10o C at a pressure of 1.00 atm, how many moles of gas would it contain? (R = 0.08206 Latm/molK). (5 pt)
10. If this car sat in the sun and the temperature rose to 35o C, what would the pressure inside of the car be? Assume that the car is completely airtight and that gas is unable to enter or leave the car while the temperature change occurs. (5 pt)
11. A solution is made by adding water to 4.5 grams of sodium chloride until the final volume of the solution if 250 mL.
12. What is the molarity of the resulting solution? (3 pt)
13. If I were to add an additional 450 mL of water to this solution, what would be the molarity of the resulting solution? (3 pt)
14. A solution is made by adding 675 mL of water to 5.5 grams of NaNO3.
15. What is the molality of the resulting solution? (3 pt)
16. What would the boiling point of this solution be? Kb = 0.512oC/m. (5 pt)
17. What do the following terms describe? (3 pt each)
18. thermodynamics
19. kinetics
20. Consider the reaction H2 + O2 D H2O2. This is an exothermic reaction. If I wanted to maximize the amount of hydrogen peroxide (H2O2) formed in this reaction, what are two things I could do to make this happen? (5 pt)

**Solubility Table:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **C2H3O2-** | **Br-** | **CO3-2** | **Cl-** | **F-** | **OH-** | **I-** | **NO2-** | **NO3-** | **O-2** | **PO4-3** | **SO3-2** | **SO4-2** | **S-2** |
| **Al+3** | S | S | X | S | I | I | S | I | S | I | I | I | S | D |
| **NH4+** | S | S | S | S | S | S | S | S | S | X | S | S | S | S |
| **Ba+2** | S | S | P | S | I | S | S | S | S | S | I | S | I | D |
| **Ca+2** | S | S | P | S | I | I | S | S | S | P | P | S | P | P |
| **Cu+2** | S | S | X | S | I | S | X | I | S | I | I | I | S | I |
| **H+** | S | S | S | S | S | S | S | S | S | S | S | S | S | S |
| **Fe+2** | X | S | P | S | I | I | S | I | S | I | I | I | S | I |
| **Fe+3** | X | S | X | S | I | I | S | I | S | I | P | I | P | D |
| **Pb+2** | S | S | X | I | I | P | P | I | S | P | I | I | P | I |
| **Li+1** | S | S | S | S | S | S | S | S | S | S | S | S | S | S |
| **Mg+2** | S | S | P | S | I | I | S | S | S | I | P | S | S | D |
| **Mn+2** | S | S | P | S | I | I | S | I | S | I | P | I | S | I |
| **K+1** | S | S | S | S | S | S | S | S | S | S | S | S | S | S |
| **Ag+1** | P | I | I | I | S | X | I | I | S | P | I | I | P | I |
| **Na+1** | S | S | S | S | S | S | S | S | S | D | S | S | S | S |
| **Sr+2** | S | S | P | S | I | S | S | S | S | S | I | S | P | S |
| **Sn+2** | D | S | X | S | I | X | S | I | D | I | I | I | S | I |
| **Sn+4** | S | S | X | S | I | I | D | I | X | I | X | I | S | I |
| **Zn+2** | S | S | P | S | I | P | S | I | S | P | I | I | S | I |

S = soluble in water

P = partially soluble in water

I = insoluble in water

D = compound decomposes in water

X = unknown/compound doesn’t form under standard conditions

**Activity Series:**

Metals (most active to least active):

Li > K > Ca > Na > Mg > Al > Mn > Zn > Fe > Ni > Sn > Pb > Cu > Ag > Pt > Au

Halogens (most active to least active):

F > Cl > Br > I

**Common polyatomic ions:**

ammonium – NH4**+1**

acetate – C2H3O2**-1**

bicarbonate – HCO3**-1**

carbonate – CO3**-2**

cyanide – CN**-1**

hydroxide – OH**-1**

nitrate – NO3**-1**

nitrite – NO2**-1**

sulfate – SO4**-2**

sulfite – SO3**-2**

permanganate – MnO4**-1**

phosphate – PO4**-3**

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Description automatically generated with medium confidence