

## FINAL EXAM REVIEW QUESTIONS

### Matter and Chemical Bonding

- 1) Classify each of the following as either an element, compound, a solution or a heterogeneous mixture:
  - a) vinegar
  - b) mercury
  - c) brass
  - d) potassium chlorate
  - e) milk of magnesia
  - f) sodium iodate
  
- 2) Classify each of the following as either a physical change or a chemical change:
  - a) burning paper
  - b) freezing water
  - c) rusting of iron
  - d) dissolving sugar
  - e) sublimation of iodine
  - f) tarnishing of silver
  
- 3) State the number of protons, number of electrons and number of neutrons in each of the following:
  - a)  $^{11}_5\text{B}$
  - b)  $^{19}_9\text{F}$
  - c)  $^{29}_{14}\text{Si}$
  
- 4) Draw a Bohr-Rutherford diagram for each of the following:
  - a)  $^{12}_6\text{C}$
  - b)  $^{27}_{13}\text{Al}$
  - c)  $^{40}_{20}\text{Ca}$
  
- 5)
  - a) Which group of elements is the most metallic?
  - b) Which group of nonmetals is the most reactive?
  - c) Which group of nonmetals is the least reactive?
  
- 6) What is the most chemically reactive metal?
  
- 7) What is the most chemically reactive nonmetal?
  
- 8) Which one of the following has the largest atomic radius: Cl, Si, or Mg? Why?
  
- 9) Which one of the following has the largest ionization energy: S, Se, or O? Why?
  
- 10) Which one of the following has the largest electron affinity: S, Se, or O? Why?
  
- 11) Write an ionization equation for each of the following:
  - a) Ca
  - b) N
  
- 12) State five properties of
  - a) an ionically bonded substance
  - b) a covalently bonded substance
  
- 13) Determine the type of bond between the following pairs of elements.
  - a) H and P
  - b) H and S
  - c) Na and N
  - d) C and S
  - e) Cl and F
  - f) C and Si

14) Draw the Lewis structure for each of the following: (remember that ionic and covalent compounds are depicted differently so you must determine that first)

- |                          |                   |                         |
|--------------------------|-------------------|-------------------------|
| a) $\text{CCl}_4$        | b) $\text{AsH}_3$ | c) $\text{H}_2\text{S}$ |
| d) $\text{CO}_2$         | e) $\text{BH}_3$  | c) $\text{MgF}_2$       |
| d) $\text{Li}_3\text{P}$ |                   |                         |

15) Write the chemical formula for each of the following compounds:

- |                    |                           |
|--------------------|---------------------------|
| a) lithium bromide | b) calcium nitride        |
| c) carbon monoxide | d) phosphorus(V) fluoride |

16 i) Write the IUPAC/Stock name for each of the following compounds:

- |                    |                          |
|--------------------|--------------------------|
| a) $\text{SiCl}_4$ | b) $\text{BaS}$          |
| c) $\text{MgF}_2$  | d) $\text{Li}_3\text{P}$ |

17) Write the chemical formula for each of the following compounds:

- |                       |                      |
|-----------------------|----------------------|
| a) magnesium nitrate  | b) copper(II) oxide  |
| c) potassium sulphate | d) calcium carbonate |

18) Write the IUPAC/Stock name for each of the following compounds:

- |                             |                             |
|-----------------------------|-----------------------------|
| a) $\text{Ca}(\text{OH})_2$ | b) $\text{NaClO}_3$         |
| c) $\text{FeO}$             | d) $\text{NH}_4\text{NO}_3$ |

19) Write the chemical formula for each of the following compounds:

- |                    |                   |
|--------------------|-------------------|
| a) sulphurous acid | b) barium nitrite |
| c) tin(IV) bromide | d) ferric oxide   |

20) Write the IUPAC/Stock name for each of the following compounds:

- |                                       |                    |
|---------------------------------------|--------------------|
| a) $\text{H}_3\text{PO}_4(\text{aq})$ | b) $\text{CaSO}_3$ |
| c) $\text{Fe}(\text{NO}_3)_3$         | d) $\text{CuCO}_3$ |

21) Write the chemical formula for each of the following compounds:

- |                       |                         |
|-----------------------|-------------------------|
| a) sodium chlorite    | b) potassium sulphate   |
| c) copper(II) nitrate | d) ammonium perchlorate |

22) Write the IUPAC/Stock name for each of the following compounds:

- |                              |                             |
|------------------------------|-----------------------------|
| a) $\text{HNO}_2(\text{aq})$ | b) $\text{Fe}(\text{OH})_3$ |
| c) $\text{KClO}$             | d) $\text{HCl}(\text{aq})$  |

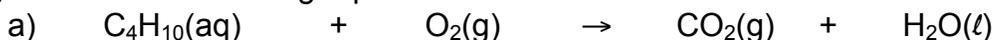
23) Write the chemical formula for each of the following compounds:

- |                                |                                   |
|--------------------------------|-----------------------------------|
| a) potassium hydrogen sulphite | b) magnesium dihydrogen phosphate |
| c) lead(II) nitrate            | d) sodium nitrite                 |

24) Write the IUPAC/Stock name for each of the following compounds:

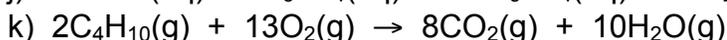
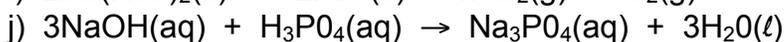
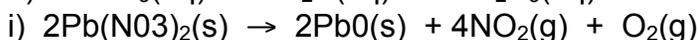
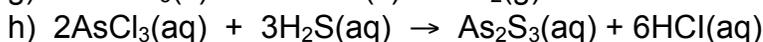
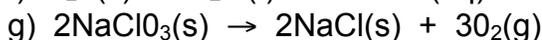
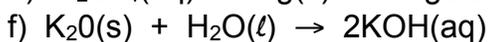
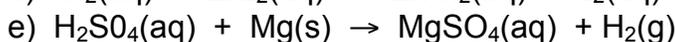
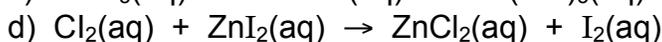
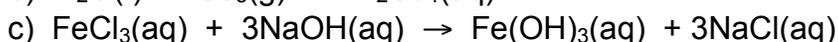
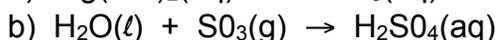
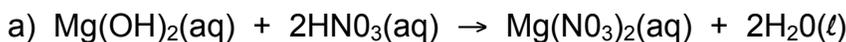
- |                               |                                    |
|-------------------------------|------------------------------------|
| a) $\text{Ba}(\text{NO}_2)_2$ | b) $\text{H}_2\text{S}(\text{aq})$ |
| c) $\text{LiHCO}_3$           | d) $\text{N}_2\text{O}_3$          |

25) Balance the following equations:



Which one of the above equations in Qu. 25 represents the combustion of a hydrocarbon?

26) Identify each of the following reactions as a synthesis, decomposition, combustion, single displacement or double displacement reaction:



### Quantities In Chemical Reactions

- 1) Calculate the molar mass of: a)  $\text{Mg}(\text{NO}_3)_2$     b) potassium carbonate
- 2) Calculate the number of moles in 556g of  $\text{Fe}(\text{NO}_3)_3$ .
- 3) Calculate the mass of 2.5 mol of sodium carbonate.
- 4) Calculate the # of molecules in 4.00 mol of carbon dioxide gas.
- 5) Calculate the mass of  $1.55 \times 10^{24}$  molecules of carbon dioxide gas.
- 6) Calculate the percentage composition of vitamin C ( $\text{C}_6\text{H}_8\text{O}_6$ ).
- 7) Calculate the empirical formula of a compound which contains 37.5% C, 12.5% H and 50.0% O.
- 8) Calculate the molecular formula of a compound if its simplest formula is  $\text{NaC}_4\text{H}_2\text{O}_2$  and its molar mass is 210 g/mol.
- 9) a) Calculate the percentage of water in  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ .  
b) When 100g of  $\text{ZnSO}_4 \cdot x\text{H}_2\text{O}$  is heated, 43.86g of water is given off. Calculate the formula of the hydrate.

- 10) Calculate the mass of oxygen gas that reacts with 23.4g of HBr(aq) in the following reaction:
- $$4\text{HBr}(\text{aq}) + \text{O}_2(\text{g}) \rightarrow 2\text{Br}_2(\text{aq}) + 2\text{H}_2\text{O}(\ell)$$
- 11)a) Sodium carbonate reacts with hydrochloric acid to produce carbon dioxide gas, water and sodium chloride solution. Calculate the mass of sodium chloride that would be produced when 50.0g of sodium carbonate reacts.
- b) Calculate the % yield if a student collects 10.50g of sodium chloride from the reaction in 12) a).
- 12) If 0.632g of  $\text{NH}_3(\text{g})$  are allowed to react with 0.438g of  $\text{O}_2(\text{g})$ , calculate the mass of  $\text{NO}(\text{g})$  that would be produced in the following reaction:
- $$4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 6\text{H}_2\text{O}(\text{g}) + 4\text{NO}(\text{g})$$

### Solutions and Solubility

- 30g of solute is dissolved in 100g of water. Calculate its % (m/m) concentration.
- Calculate the mass of solute that would be in 65g of a saturated solution, if its solubility is 35% (m/m).
- 0.045 g of insecticide is found in a 1.7 k sample. Calculate the concentration in ppm of insecticide in the sample.
- A solution was prepared by dissolving 105g of  $\text{AgNO}_3$  in enough water to make 1.50 L of solution. Calculate the concentration of the solution in mol/L.
- What is the difference between strong versus weak acid and bases and Concentrated versus dilute acids and bases?
- a) What volume of 12.0 mol/L HCl is required to make 10.0 L of 0.150 mol/L HCl?  
b) How much water is needed?
- Write the balanced molecular chemical equation, the total ionic equation and the net ionic equation for each of the following precipitation reactions:
  - iron(III) nitrate(aq) + sodium hydroxide(aq)
  - lead(II) nitrate(aq) + potassium iodide(aq)
- Calculate the volume of 0.165 mol/L sodium sulphate solution required to react with 65.0 mL of 0.175 mol/L barium chloride solution. (Double Displacement – 4 step calculation)

9) What mass of solute will dissolve in 100mL of water at the following temperatures?

a.  $\text{KNO}_3$  at  $70^\circ\text{C}$  = \_\_\_\_\_

b.  $\text{NaCl}$  at  $100^\circ\text{C}$  = \_\_\_\_\_

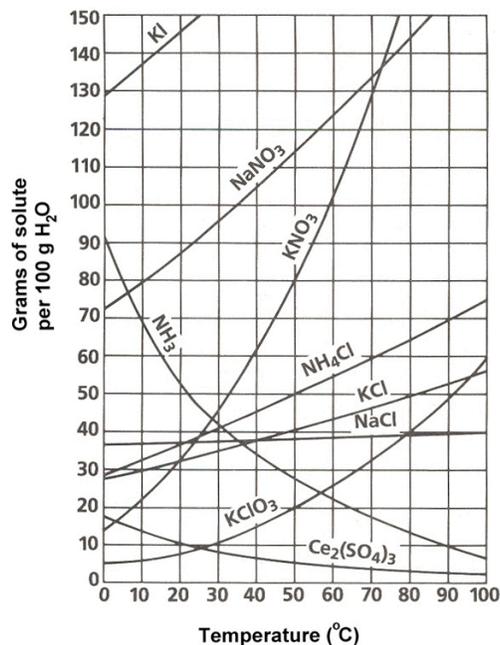
c. At  $90^\circ\text{C}$ , you dissolved 10 g of  $\text{KCl}$  in 100. g of water. Is this solution saturated or unsaturated?

d. Which compound is most soluble at  $20^\circ\text{C}$ ?

\_\_\_\_\_

e. Which is the least soluble at  $40^\circ\text{C}$ ?

\_\_\_\_\_



10) a)  $[\text{H}_3\text{O}^+]$  of a solution is  $6.67 \times 10^{-4}$  mol/L. Calculate the pH of the solution.  
 b) Is this an acidic solution or a basic solution?

11) Write the balanced chemical equation for each of the following:

- phosphoric acid + sodium hydroxide
- sulphuric acid + potassium carbonate

12) 75.0 mL of 0.0800 mol/L  $\text{HNO}_3$  solution was required to titrate 45.0 mL of  $\text{KOH}$  solution. Calculate the concentration of the  $\text{KOH}$  solution in mol/L. (Neutralization Question)

### Gases and Atmospheric Chemistry

1) Do the following conversions:

- $-15^\circ\text{C}$  to K
- 575 K to  $^\circ\text{C}$
- 743 Torr to kPa
- 99.4 kPa to atm

2) 8.0 L of a gas is at 112.5 kPa. What would the volume become if the pressure changed to 99.5 kPa?

3) 15 L of a gas is at  $25^\circ\text{C}$ . What would the volume become if the temperature changed to  $-5.0^\circ\text{C}$ ?

4) A gas has a volume of 25.0 L at  $20^\circ\text{C}$  and 101.3 kPa. What would the temperature become if the volume doubles and the pressure changes to 175 kPa?

- 5) What is the volume of 4.8 L of hydrogen gas if the pressure exerted on it increases from 55 kPa to 127 kPa?
- 6) A welder needs 5000 L of oxygen gas at 150 kPa at a temperature of 21°C. To what pressure must a 50.0 L tank be filled at 13°C?
- 7) What is the final volume if 3.4 L of nitrogen gas at 400 K is cooled to 200 K?
- 8) A gas mixture consists of 60.0% Ar, 30.0% Ne and 10.0% Kr. If the pressure of this gas mixture is 80.0 kPa, what is the partial pressure of each of the gases?
- 9) Calculate the number of moles in 13 L of HF(g) at STP.
- 10) What is the molar mass of a compound if 560 mL of it has a mass of 1.10g at STP?
- 11) Calculate the mass of 4.0 mol of bromine gas, Br<sub>2</sub>(g).
- 12) What volume will 220g of hydrogen sulphide gas occupy at STP?
- 13) What volume of oxygen gas will react with 5.0 L of hydrogen gas to form water vapour?
- 14) 5.95g of Al reacts with sulphuric acid to form aluminum sulphate solution and hydrogen gas. What volume of hydrogen gas would be produced at 273°C and 300 kPa?
- 15) If 0.632g of NH<sub>3</sub>(g) are allowed to react with 0.438g of O<sub>2</sub>(g), calculate the volume of NO(g) that would be produced at STP in the following reaction:
- $$4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 6\text{H}_2\text{O}(\text{g}) + 4\text{NO}(\text{g})$$