CHEMISTRY 2202

MID-YEAR EXAMINATION

Mealy Mountain Collegiate

PART 1 – SELECTED RESPONSE

**January 2012**

 **GENERAL INSTRUCTIONS**

1. This is Part 1 of a two part exam. It consists of 40 selected response items. **The value of this part is 40 points.**
2. Please write the examination pencil, clearly indicating your selected response. Any items that are answered ambiguously will be considered incorrect. (i.e. selecting two answers)
3. The duration of the two part exam is three (3) hours. Part 1 should be completed in one and a half (1.5) hours.
4. A Periodic Table is provided, including Data Tables on the Reverse Side
5. Please submit all test materials to your supervisor upon completion of the exam. This includes the questions, answer forms, data tables and any paper used for rough workings, etc.
6. Please attempt all items.
7. The Exam consists of 18 pages. Please ensure that all pages are attached to your exam.

 **Part 1: Multiple Choice - 40 marks, 1% each**

**Place the letter corresponding to the best answer on the answer sheet provided.**

1. The name of the substance KHSO4 is:

(A) potassium bisulphate

(B) potassium hyposulfide

(C) potassium sulfate

(D) potassium sulfite

2. How many neutrons are in an atom of Oxygen 18?

(A) 8

(B) 10

(C) 16

(D) 18

3. What is the isotope name of $$ ?

(A) copper-29

(B) copper-39

(C) copper-68

(D) copper-97

4. The number of molecules in 2.0 mol of O2(g) is

(A) 1.2 x 1023

(B) 2.4 x 1023

(C) 1.2 x 1024

(D) 1.8 x 1024

5. Determine the molar mass of sulfuric acid, H2SO4

(A) 68.1 g/mol

(B) 64.1 g/mol

(C) 80.1 g/mol

(D) 98.1 g/mol

6. The formula for sucrose is C12H22O11. How many moles are in 10.0 g of sucrose?

(A) 34.2 mol

(B) 0.0292 mol

(C) 3.42 mol

(D) 0.292 mol

7. What is the total number of atoms in 0.30 moles of CaCl2 ?

(A) 0.3

(B) 0.9

(C) 5.4 x 1023

(D) 1.8 x 1025

8. What is the molar mass of BaCl2®2H2O?

(A) 228.27 g/mol

(A) 244.27 g/mol

(B) 381.60 g/mol

(C) 365.60 g/mol

 9. A sample of sulfur trioxide, SO3(g), has a volume of 5.6 L at STP. How many moles are in the sample?

(A) 0.20 mol

(B) 0.25 mol

(C) 0.50 mol

(D) 0.75 mol

10. A diamond is made purely of Carbon, C, and has a mass of 1.00g. How many carbon atoms are in the diamond?

(A) 5.01 x 1022

(B) 0.083

(C) 6.02 x 1023

(D) 1.66 x 10-24

11. Hydrogen sulfide, H2S(g), is present in some sources of natural gas. Natural gas that contains hydrogen sulfide is called sour gas because of its powerful stench. What is the mass of 20 L of hydrogen sulfide at STP?

(A) 0.026 g

(B) 0.893 g

(C) 20 g

(D) 30 g

12. Carbon is what percentage (by mass) of sucrose, C12H22O11?

(A) 31%

(B) 35%

(C) 42%

(D) 47%

13. The empirical formula for a compound is determined by analysis to be CH3 and its molar mass is determined to be 45.0 g/mol. What is the molecular formula of the compound?

(A) CH3

(B) C2H6

(C) C2H21

(D) C3H9

14. What is the mass of one mole of laughing gas, N2O?

(A) 30.0 g

(B) 36.0 g

(C) 44.0 g

(D) 55.0 g

15. Large deposits of gypsum, an ionic hydrate, are located in western Newfoundland. By mass, what percentage of gypsum, $CaSO\_{4}∙2 H\_{2}O$, is water?

(A) 6.210%

(B) 20.93%

(C) 66.67%

(D) 79.07%

***Use the following reaction for questions 16 and 17:***

$$4 Ag\_{(s)}+2 H\_{2}S\_{(g)}+ O\_{2(g)}\rightarrow 2 Ag\_{2}S\_{(s)}+ 2 H\_{2}O\_{(g)}$$

16. If you are given 0.208 mol of Ag and excess Dihydrogen Sulfide and Oxygen gas, how many moles of water can be produced?

(A) 0.104 mol

(B) 0.208 mol

(C) 2 mol

(D) 18.02 mol

17. What volume of $H\_{2}O\_{(g)}$ should be produced at STP by the reaction of 0.208 mol of $Ag\_{(s)}$ with sufficient quantities of $H\_{2}S\_{(g)}$ and $O\_{2(g)}$?

(A) 0.104 L

(B) 2.33 L

(C) 4.66 L

(D) 9.30 L

***Use the following information for questions 18 and 19:***

In a lab activity, students react solid copper in a silver nitrate solution:

 $2 AgNO\_{3(aq)}+ Cu\_{(s)} \rightarrow 2 Ag\_{\left(s\right) }+ Cu\left(NO\_{3}\right)\_{2(aq)}$

 5 mol of $AgNO\_{3(aq)}$ is mixed with 3 mol of $Cu\_{(s)}$,

18. What is the limiting reactant?

(A) Ag

(B) AgNO3

(C) Cu

(D Cu(NO3)2

19. How many moles of Ag(s) will be produced?

(A) 2 mol

(B) 3 mol

(C) 5 mol

(D) 6 mol

20. There are two stable isotopes of element “B”. One isotope has an atomic mass of 10.01 and a percent abundance of 19.78%. The other has an atomic mass of 11.01 and an abundance of 80.22%. What is the average atomic mass of element “B” ?

(A) 10.81amu

(B) 11.01amu

(C) 21.02amu

(D) 1081 amu

21. After combining solutions of sodium carbonate and calcium nitrate, a student filtered the reaction mixture to collect a precipitate of calcium carbonate. Which occurs if the precipitate is weighed before it is completely dry?

(A) % yield is higher than it should be

(B) % yield is lower than it should be

(C) theoretical yield is higher than it should be

(D) theoretical yield is lower than it should be

 22. Which term best describes a solution that cannot dissolve any more solute at a constant temperature?

(A) dilute

(B) polyunsaturated

(C) saturated

(D) unsaturated

 23. How would you increase the concentration of an unsaturated solution of a solid in a liquid?

(A) decrease the temperature slightly

(B) evaporate a substantial amount of solvent

(C) filter the solution

(D) increase the pressure greatly

24. How many moles of Sodium Chloride would be needed to make 4.0L of a 3.5 mol/L solution?

(A) 0.88 mol

(B) 1.1 mol

(C) 7.5 mol

(D) 14 mol

25. What is the concentration of a 500ml solution made from 40.0g of KBr?

(A) 0.0800 mol/L

(B) 0.440 mol/L

(C) 1.67 mol/L

(D) 80.0 mol/L

26. Which of the following ions is soluble with Chloride ions, Cl-?

(A) Na+

(B) Ag+

(C) Pb2+

(D) All of the above

27. Which has low solubility in water?

(A) $Ba\left(OH\right)\_{2}$

(B) $CaSO\_{4}$

(C) $Cu(NO\_{3})\_{2}$

(D) Mg$Cl\_{2}$

28. What is the concentration of nitrate ions in a 0.60 mol/L solution of lead(IV) nitrate, $Pb\left(NO\_{3}\right)\_{4(aq)}$?

(A) 0.15 mol/L

(B) 0.60 mol/L

(C) 1.8 mol/L

(D) 2.4 mol/L

29. Which is the correct equation for the dissociation of potassium phosphate, $K\_{3}PO\_{4(s)}$?

(A) $K\_{3}PO\_{4(s)} \rightarrow 3K\_{(aq)}^{+}+ PO\_{4(aq)}^{3-} $

(B) $K\_{3}PO\_{4(s)} \rightarrow K\_{3(aq)}^{+}+ PO\_{4(aq)}^{3-} $

(C) $K\_{3}PO\_{4(s)} \rightarrow 3K\_{(aq)}^{+}+ P\_{(aq)}^{3-} + 4O\_{(aq)}^{2-} $

(D) $K\_{3}PO\_{4(s)} \rightarrow K\_{(aq)}^{3+}+ PO\_{4(aq)}^{3-} $

30. A sample of brass consists of 80% Copper and 20% Zinc. In this solution, what is the solute?

(A) Brass

(B) Copper

(C) Zinc

(D) Cannot be determined

31. When a solution of AgNO3 and KCl are combined, what is the resulting precipitate?

(A) Ag+

(B) AgCl

(C) KNO3

(D) No reaction takes place

32. In question 31, what are the spectator ions?

(A) Ag+ and K+

(B) Cl- and NO3-

(C) K+ and NO3-

(D) Ag+ and Cl-

33. How much water would have to be ***added*** to 4.0L of a 0.500mol/L solution to dilute it to 0.200mol/L?

(A) 4.0L

(B) 6.0L

(C) 10.0L

(D) 14.0L

34. 1.5L of a 2.0mol/L sucrose solution is added to 2.0L of a 1.5mol/L sucrose solution. What is the concentration of the resulting solution?

(A) 1.71 mol/L

(B) 1.75 mol/L

(C) 3.5 mol/L

(D) 6.0 mol/L

35. Which term describes two liquids that do not mix whatsoever, such as oil and water?

(A) Insoluble

(B) Immiscible

(C) Miscible

(D) Soluble

36. Glucose C6H12O6 is added to water. Which term describes this type of dissolving?

 C6H12O6(s) 🡪C6H12O6(aq)

(A) Dissociation

(B) Ionization

(C) Molecular Solvation

(D) Solubility

37. Which solution would contain the largest mass of Sodium Chloride?

(A) 0.12 mol/L of a 100ml solution

(B) 0.62 mol/L of a 199ml solution

(c) 0.23 mol/L of a 200ml solution

(D) 0.080 mol/L of a 1000ml solution

***Use the following information to solve questions 38-40.***

Hank drinks a 355ml can of Big 8 cola. There are 45g of sucrose in the can (C12H22O11 ).

38. What is the concentration of sucrose in the can (in g/L)?

(A) 0.127 g/L

(B) 45 g/L

(C) 7.89 g/L

(D) 127 g/L

39. What is the concentration of sucrose in the can in mol/L? (Molar Mass = 342.34 g/mol)

(A) 0.131 mol/L

(B) 0.370 mol/L

(c) 0.963 mol/L

(D) 1.03 mol/L

40. Sucrose is used up by the body in the following reaction:

 C12H22O11 (aq) + 12O2(g) 🡪 12CO2(g) + 11H2O(g)

How many moles of Carbon Dioxide gas will be produced if Hanks body uses up all of the sucrose in the can?

(A) 0.131 mol

(B) 1.58 mol

(C) 4.44 mol

(D) 12.0 mol

**Answer Sheet: Place your answers to part 1 on this sheet.**

|  |  |
| --- | --- |
| 1 | 2 |
| 3 | 4 |
| 5 | 6 |
| 7 | 8 |
| 9 | 10 |
| 11 | 12 |
| 13 | 14 |
| 15 | 16 |
| 17 | 18 |
| 19 | 20 |
| 21 | 22 |
| 23 | 24 |
| 25 | 26 |
| 27 | 28 |
| 29 | 30 |
| 31 | 32 |
| 33 | 34 |
| 35 | 36 |
| 37 | 38 |
| 39 | 40 |

CHEMISTRY 2202

MID-YEAR EXAMINATION

PART 2 – Constructed Response Items

**January 2012**

 **GENERAL INSTRUCTIONS**

1. This is Part 2 of a two part exam. It consists of ten (10) major items. The total value of this part of the exam is 60 points.
2. Please use a blue or black ink pen to write your answers neatly in the spaces provided on the test paper. There should be sufficient space for your responses; however, if more space is required use an additional unlined 8 ½ x 14” sheet of copy paper and label the responses appropriately. On the main test paper, indicate that the response is continued on the extra page.
3. The full exam (Parts 1 and 2) should be completed in a three (3) hour examination period.
4. Data tables were provided in Part 1.
5. Please submit all test materials, including sheets containing rough workings, to your supervisor upon completion of the exam.
6. Please attempt all items.

41. The average atomic mass of naturally occurring Boron is 10.81 amu. There are 2 main isotopes of Boron, Boron-10 (10.01 amu) and Boron -11 (11.01 amu). Calculate the percentage composition of Boron-10 and Boron-11. (5 marks)

42. Fill in the following table regarding Isotopes of different neutral atoms: (5 marks)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Isotope Notation | Atomic # | Atomic Mass | # Protons | # Neutrons | # electrons | Name of Isotope |
| http://t0.gstatic.com/images?q=tbn:ANd9GcSGeHaxi_PGAfm2dcJjCGCGlcx40IW2z5OLTojKc_DYRHyPLYAgJUo1dzU | 2 |  |  |  |  |  |
|  |  | 63 |  |  | 29 |  |

43. a. Determine the empirical formula of the compound containing 26.1% C, 4.4% H, and 69.5% O by mass. (3 marks)

b. If the molar mass of the compound in (a) is 138.09 g/mol, what is the molecular formula? (2 marks)

44. Calculate the mass of Zinc metal required to produce 140.0L of Hydrogen gas at STP. ( 5 marks)

 Zn(aq) + HCl(g)  🡪 ZnCl2(aq)  + H2(g)

45. Determine the number of molecules of NH3(g) formed when 42.0g of nitrogen gas react with excess hydrogen gas: (5 marks)

 N2(g) + 3H2(g) 🡪 2NH3(g)

46. Calculate the percent composition by mass of Sodium Dichromate for all elements. (5 marks)

47. A 10.0g sample of Ethanol C2H5OH is combusted in the presence of 10.0g of Oxygen gas to produce Carbon Dioxide and Water in the reaction shown below:

 C2H5OH(l) + 3O2(g)  🡪 2CO2(g) + 3H2O(g)

a. Determine the limiting reactant. (5 marks)

b. Determine the volume of Carbon Dioxide Gas that is produced at STP. (2 marks)

c. Determine the amount of excess product remaining after the reaction has completed. (5 marks)

48. A solution of Lead(II) Nitrate is added to a solution of Lithium Sulfate.

a. Write down the total ionic equation for this reaction. (2 marks)

b. Write the net ionic equation for this reaction. (1 mark.)

c. Write down the spectator ions for this reaction. (1 mark.)

49. A solution of Ammonium Sulfide is produced by adding 30.0g of the solid to 600.0ml of water.

a. Write the dissociation equation for Ammonium Sulfide in water. (2 marks)

b. Calculate the concentration of Ammonium Sulfide in the solution. (3 marks)

c. Calculate the concentration of Ammonium Ions in the solution. (1 mark)

d. The solution is left out on the lab bench for a week, and some water evaporates from the solution. The solution now has a volume of 450.0ml. Calculate the new concentration for the solution. (3 marks)

50. A 100.0ml solution of 0.600M Calcium Chloride and a 75.0ml solution of Silver Nitrate are combined in the following reaction:

 CaCl2(aq) + 2AgNO3(aq) 🡪 2AgCl(s) + Ca(NO3)2(aq)

a. Calculate the concentration of silver nitrate required to completely react with the Calcium Chloride Solution. (4 marks)

b. Calculate the concentration of Nitrate ions in the resulting solution. (1 mark)