CHEMISTRY 2202

MID-YEAR EXAMINATION

Mealy Mountain Collegiate

PART 1 – SELECTED RESPONSE (40 marks)

**January 2013**

 **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.** Part 1 consists of pages 1-10 inclusive, with the answer sheet for the selected response on page 17.
2. Please write the examination pencil, clearly indicating your selected response on the answer sheet provided on page 17 of the exam. 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.
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. What is the name of the substance NaHCO3?

(A) Sodium Bicarbonate

(B) Sodium Carbide

(C) Sodium Carbonate

(D) Sodium Hydrocarbonate

2. How many protons are in an atom of Calcium-43?

(A) 3

(B) 20

(C) 23

(D) 43

3. What is the isotope name of $$?

(A) Cobalt-27

(B) Cobalt-33

(C) Cobalt-60

(D) Cobalt-87

4. How many atoms are in 3.00 moles of CO2 ?

(A) 2.01 x 1023

(B) 6.02 x 1023

(C) 1.81 x 1024

(D) 5.42 x 1024

5. What is the molar mass of Al(OH)3?

(A) 43.99 g/mol

(B) 46.01 g/mol

(C) 78.01 g/mol

(D) 131.97 g/mol

6. What is the molar mass of Magnesium Chloride Dihydrate?

(A) 95.21 g/mol

(A) 95.80 g/mol

(B) 131.25 g/mol

(C) 155.56 g/mol

7. The formula for methanol is CH4O. How many moles are in 10.0 g of methanol?

(A) 0.312 mol

(B) 3.21 mol

(C) 32.1 mol

(D) 321 mol

8. What is the total number of atoms in 3.00g of CaCl2 ?

(A) 0.0270

(B) 333

(C) 1.63 x 1022

(D) 4.88 x 1022

 9. A sample of Nitrogen gas N2(g), has a volume of 5.6 L at STP. How many moles are in the sample?

(A) 0.13 mol

(B) 0.23 mol

(C) 0.25 mol

(D) 0.50 mol

10. What is the mass of a 45L volume of Carbon Monoxide gas, CO, at STP?

(A) 1.6 g

(B) 36 g

(C) 51 g

(D) 56 g

11. A sample of Argon gas, Ar, has a volume of 35.0L at STP. The gas is heated up to 25OC. What is the new volume of the gas?

(A) 1.41 L

(B) 1.56 L

(C) 31.6 L

(D) 38.8 L

12. What is the percent mass of Hydrogen in Sucrose, C12H22O11?

(A) 6.49 %

(B) 22.22%

(C) 42.09%

(D) 51.41%

13. What is the empirical formula of 2-Butene, C4H8?

(A) CH2

(B) C2H4

(C) C8H16

(D) Impossible to Determine

14. The empirical formula for a compound is determined by analysis to be CH2 and its molar mass is determined to be 84.12 g/mol. What is the molecular formula of the compound?

(A) CH2

(B) C2H4

(C) C6H12

(D) C12H24

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:***

N2(g) + 2O2(g) 🡪 2NO2(g)

16. How many moles of NO2 can be produced with 0.450 moles of Nitrogen gas?

(A) 0.225 mol

(B) 0.450 mol

(C) 0.900 mol

(D) 2 mol

17. What volume of Oxygen gas would be required to fully react with the Nitrogen gas at STP?

(A) 10.1 L

(B) 20.2 L

(C) 22.3 L

(D) 44.8 L

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

In a lab activity, students react Lithium Carbonate with Calcium Chloride as follows:

 3 Li2CO3(aq) + 2 AlCl3(aq) 🡪6 LiCl(aq) + Al2(CO3)3(s)

12 moles of Lithium Carbonate is mixed with 9 moles of Aluminum Chloride.

18. What is the limiting reactant?

(A) Al2(CO3)3(s)

(B) AlCl3(aq)

(C) Li2CO3(aq)

(D LiCl(aq)

19. How many moles of Al2(CO3)3(s) will be produced?

(A) 1 mol

(B) 3 mol

(C) 4 mol

(D) 4.5 mol

20. There are two stable isotopes of element “A”. One isotope has an atomic mass of 14.01 amu and a percent abundance of 19.78%. The other has an atomic mass of 15.01 amu and an abundance of 80.22%. What is the average atomic mass of element “A” ?

(A) 14.51 amu

(B) 14.81 amu

(C) 15.01 amu

(D) 29.02 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 can dissolve 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 Potassium Bromide would be needed to make 12.0L of a 0.75 mol/L solution?

(A) 0.063 mol

(B) 4.5 mol

(C) 9.0 mol

(D) 16 mol

25. What is the concentration of a 50ml solution made from 15g of ZnCl2?

(A) 0.0022 mol/L

(B) 0.11 mol/L

(C) 0.22 mol/L

(D) 2.2 mol/L

26. Which of the following ions is insoluble with Sulfide ions, S2-?

(A) Ca2+

(B) Fr+

(C) Hg2+

(D) NH4+

27. Which has low solubility in water?

(A) BaF2

(B) CuCO3

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

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

28. What is the concentration of Hydroxide ions in a 0.30 mol/L solution of lead(II) Hydroxide, Pb(II)(OH)2(aq)?

(A) 0.15 mol/L

(B) 0.30 mol/L

(C) 0.60 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. Air is a solution composed of 78% N2, 20% O2, 1%H2O and trace amounts of Carbon Dioxide, Methane and other gases. What is the solute ?

(A) All gases except Nitrogen

(B) Nitrogen and Oxygen

(C) Nitrogen

(D) Unable to determine

31. When a solution of SrCl2 and CuSO4 are combined, what is the resulting precipitate?

(A) Cu2+

(B) CuCl2

(C) SrSO4

(D) No reaction takes place

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

(A) Cu2+ and Cl-

(B) Cu2+ and SO42-

(C) Sr2+ and Cl-

(D) Sr2+ and SO42-

33. How much water would have to be ***added*** to 10.0L of a 0.500mol/L solution to dilute it to 0.200mol/L?

(A) 1.00L

(B) 5.00L

(C) 15.0L

(D) 25.0L

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 mix together in any proportion, such as ethanol and water?

(A) Insoluble

(B) Immiscible

(C) Miscible

(D) Soluble

36. Sodium Hydroxide dissolves into water as follows:

 NaOH(s) 🡪 Na+(aq) + OH-(aq)

 Which term describes this type of dissolving?

 (A) Dissociation

(B) Ionization

(C) Molecular Solvation

(D) Solubility

37. Which solution would contain the smallest mass of Sodium Sulfate?

(A) 0.12 mol/L of a 1.0L solution

(B) 0.23 mol/L of a 300ml solution

(c) 0.62 mol/L of a 200ml solution

(D) 0.800 mol/L of a 1000ml solution

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

Hank drinks a 250ml cup of tea. He puts 15g of sugar into his tea (C12H22O11 ).

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

(A) 0.060g/L

(B) 15g/L

(C) 17 g/L

(D) 60 g/L

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

(A) 0.00018 mol/L

(B) 0.044 mol/L

(C) 0.18 mol/L

(D) 11 mol/L

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

 C12H22O11(aq) +12 O2(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) 0.044 mol

(B) 0.53 mol

(C) 12 mol

(D) 180 mol

CHEMISTRY 2202

MID-YEAR EXAMINATION

PART 2 – Constructed Response Items (60 marks)

**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 are provided on a page separate from the exam.
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 Calcium is 40.08 amu. There are 2 main isotopes of Calcium, Calcium-40 (39.95 amu) and Calcium-41 (40.96 amu). Calculate the percentage composition of Calcium-40 and Calcium-41. (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 |
| $$$$ | 29 |  |  |  |  |  |
|  |  | 114 |  |  | 49 |  |

43. a. Determine the empirical formula of the compound containing 40.3% Boron, 52.2% Nitrogen, and 7.50% Hydrogen by mass. (3 marks)

b. If the molar mass of the compound in (a) is 80.52 g/mol, what is the molecular formula?

(2 marks)

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

 \_\_\_Al(s) + \_\_\_HCl(g)  🡪 \_\_\_AlCl3(s)  + \_\_\_H2(g)

45. Determine the number of molecules of NH3(g) formed when 20.0g of Hydrogen gas react with excess Nitrogen gas: (5 marks)

N2(g) + 3H2(g) 🡪 2NH3(g)

46. Calculate the percent composition by mass of Sodium Acetate, NaCH3COO for all elements. (5 marks)

47. A 100.0g sample of Pentane C5H12 combusted in the presence of 100.0g of Oxygen gas to produce Carbon Dioxide and Water in the reaction shown below:

 C5H12(g) + 8O2(g)  🡪 5CO2(g) + 6H2O(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 Zinc(II) Nitrate is added to a solution of Lithium Carbonate.

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

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

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

49. A solution of Potassium Sulfate is produced by adding 3.0 g of the solid to 600.0ml of water.

a. Write the dissociation equation for Potassium Sulfate in water. (2 marks)

b. Calculate the concentration of the solution in mol/L. (3 marks)

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

d. An additional 150.0ml of water is added to the beaker. Calculate the new concentration of Potassium Sulfate in the solution in Mol/L. (3 marks)

50. A 10.0ml solution of 0.600M Barium Fluoride and a 750.0ml solution of Silver Nitrate are combined in the following reaction:

 BaF2(aq) + 2AgNO3(aq) 🡪 2AgF(s) + Ba(NO3)2(aq)

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

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

 **Answer Sheet: Place your answers to Part 1 on this sheet. (You may remove this sheet from your exam). Place your name on this sheet in case it becomes separated from your exam.**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |
| --- | --- |
| 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 |

Extra Space – You may use this page for workings. It will NOT be evaluated. Submit this page with your exam.