THE COLLEGE OF THE BAHAMAS
FACULTY OF PURE AND APPLIED SCIENCES
SCHOOL OF NATURAL SCIENCES AND
ENVIRONMENTAL STUDIES

NASSAU: X FREEPORT:

DEPARTMENT OF CHEMISTRY
FINAL EXAMINATION FOR SEMESTER 042004
COURSE NUMBER: 115

COURSE TITLE: INTRODUCTORY CHEMISTRY

DATE AND TIME: DURATION: 2 1/2 HOURS

INSTRUCTIONS TO CANDIDATES: The exam paper consists of 9 pages exclusive of this introductory page. Section A consists of twenty six Multiple Choice Questions. These questions are to be answered on the Multiple-Choice answer sheet provided. Section B consists of eight short answer questions. These questions are to be answered in the spaces provided on this question paper. You are provided with a PERIODIC TABLE overleaf.

YOUMUST RETURN THE EXAMINATION PAPER AND YOUR MULTIPLE CHOICE ANSWER SHEET AT THE END OF THE EXAMINATION.

LECTURER'S NAME: _____

STUDENT NAME: _____

STUDENT NUMBER: _____

USEFUL INFORMATION:

- Avogadro's constant: 6×10^{23}
- One mole of a gas at STP occupies 22.4 dm^3

Chemistry Department
C115fin prepared by GLH, JB, RS:
November 16, 2004

SECTION A: MULTIPLE CHOICE QUESTIONS

Five possible answers (a, b c, d and e) are given for each of the twenty questions in this section. Choose the one you consider to be correct and mark your response on the multiple choice answer sheet provided. Each question in this section is worth one mark.

THE MOLE CONCEPT

1) 2 moles of Al_2O_3 contain:

a) 2 moles of oxygen atoms
b) 2 moles of aluminum atoms
c) 6 moles of oxygen atoms
d) 3 moles of oxygen atoms
e) 6 moles of aluminum atoms

2) How many hydrogen atoms are in 2 mol of water?

a) 12×10^{23}
b) 12×10^{25}
c) 4
d) 24×10^{23}
e) 24×10^{24}

3) What mass of oxygen is in 49.9 g of $CuSO_4.5H_2O$? (RFM =249.5)

a) 0.2 g
b) 1.8 g
c) 9 g
d) 28.8 g
e) 36g.

4) The number of molecules of nitrogen gas N_2, in $11.2dm^3$ at STP is

a) 1.5×10^{23}
b) 3.0×10^{23}
c) 6×10^{23}
d) 2.4×10^{24}
e) 3.6×10^{24}

5) 50 cm^3 of water is added to 20 cm^3 of a solution with molarity M at a constant temperature. After dilution the molarity of the solution is

a) 2/7 M
b) 3/7 M
c) 5/7 M
d) 7/5 M
e) 5/2 M

6) What is the molarity of a solution containing 8.0 g of NaOH hydroxide (RFM=40) in 100 cm^3 of solution?

a) 2.0M
b) 0.20M
c) 0.08M
d) 0.80M
e) 8000M

7) How many moles of the first reactant would be required to react completely with two mole of the second reactant in the following chemical equation?

$C_8H_{12} + 8\ O_2 \rightarrow 5CO2 + 6H_2O$

a) 0.25 mol
b) 0.56 mol
c) 2 mol
d) 16 mol
e) 36 mol

8) If the relative molecular mass of a compound is 105, then

a) One mole of the compound has a mass of 105g.
b) One molecule of the compound has a mass of 105g.
c) One mole of the compound has $105 \times 6 \times 10^{23}$ molecules.
d) The empirical formula of this compound is the same as the molecular formula.
e) One mole of the compound has a mass that is 105 times the mass of carbon.

THE REACTIVITY SERIES

9) Group (I) elements react with water to form

a) Hydroxides only
b) Oxides only
c) Hydroxides + hydrogen gas
d) Hydrides + hydrogen gas
e) Hydrogen gas only

10) Which element has an oxide that decomposes with heat?

a) iron
b) zinc
c) potassium
d) magnesium
e) Gold

11) This metal hydroxide does not decomposes readily on heating. The metal could be

a) magnesium
b) sodium
c) zinc
d) copper
e) silver

12) Which of the following substances do not react with water.

a) MgO
b) Al_2O_3
c) Na_2O
d) CaO
e) Li_2O

13) Which of the following substances give only oxygen as a gaseous product upon heating?

a) Ag_2O
b) $MgNO_3$
c) $ZnCO_3$
d) Na_2CO_3
e) $CaCO_3$

THE PERIODIC TABLE

14) When elements in Group VII react with elements in group II, they generally form

a) Covalent bonds
b) Ionic bonds
c) Metallic bonds
d) Double bonds
e) Do not react

15) Which oxide of the following elements dissolve in water to give the strongest base?

a) Ca
b) Mg
c) Na
d) Al
e) Cu

16) The atom with the smallest atomic radius is

a) Na
b) Mg
c) Al
d) Si
e) P

17) The atom with the largest first ionization energy is

a) Li
b) Na
c) K
d) Rb
e) Cs

18) Which of the following elements have the greater metallic character?

a) K
b) Mg
c) Al
d) Ca
e) Na

19) An element in period 3 and group 6 would have an electronic configuration of:

a) 2, 3, 6
b) 2, 8, 6
c) 2, 8, 8
d) 2, 8, 8, 6
e) 2, 8, 3

20) Which of the following elements is the most electronegative.

a) Cl
b) S
c) O
d) F
e) N

RATE AND EQUILIBRIUM

21) Which of the following is *not true.*

a) The reaction rate is a measure of how quickly the reactants are consumed.
b) The reaction rate is a measure of how quickly the products are produced..
c) The reaction rate is not constant but changes with time
d) Reaction depends on temperature.
e) The mass of a catalyst after a reaction is different than before a reaction.

22) For a chemical reaction which has reached equilibrium which statement is true?

a) The reaction has stopped.
b) The rate of the forward reaction is decreasing.
c) The concentrations of the reactants and products are constant.
d) there is always more products than reactants.
e) the reactants always have more potential energy than the products.

ELECTROLYSIS

23) If a metal is above hydrogen in the reactivity series, electrolysis of dilute aqueous solutions of its salts produce

a) Metals at the cathode
b) metals at the anode
c) oxygen gas at the cathode
d) hydrogen gas at the cathode
e) hydrogen gas at the anode

24) In electrolysis the cathode

a) is the electrode where oxidation occurs.
b) is the electrode where reduction occurs.
c) is positive.
d) dissolves during the electrolytic process.
e) does not conduct electricity.

25) Each of the following compounds is electrolysed, first molten, and then as a concentrated aqueous solution. For which compound would the products of electroylsis most likely be the same?

a) copper(II) iodide
b) magnesium bromide
c) potassium iodide
d) sodium hydroxide
e) sodium chloride

26) A weak electrolyte

a) contains no ions
b) contains covalent molecules only
c) contains mobile electrons
d) is totally dissociated
e) contains few ions and many molecules

SECTION B: SHORT ANSWER QUESTIONS

Answer ALL OF THE FOLLOWING QUESTIONS in the space provided on your question paper. Indicate clearly how you arrive at your answers. This section is worth 74 marks.

1) A compound containing carbon, oxygen, hydrogen and chlorine has a molar mass of 213g mol^{-1}. The compound consists of 45.1% carbon, 6.6% hydrogen and 15.0% oxygen.
(a) Calculate the empirical formula of the compound. (5 marks)

(b) Determine its molecular formula. (2 marks)

2) Calculate the molarity of the following solutions;

a) $5x10^{24}$ molecules of sodium sulphate in $200cm^3$ of water(2 marks)

b) 16g of calcium chloride in 1.5 dm^3 of water(2 marks)

c) $200cm^3$ of 0.30M HCl is diluted to $600cm^3$ (2 marks)

Note: I would detach c) part from b) so they have a chance of not getting both wrong.

3) Calculate the number of grams of the following

a) $165cm^3$ of a 0.36M $MgSO_4$ solution (2 marks)

b) $11.3dm^3$ of SO_2 at STP (1 marks)

c) 0.16 moles of magnesium sulphate (1 marks)

4) What is the percentage by mass of carbon, hydrogen, oxygen and chlorine in $C_6H_{12}O_2Cl_2$? (4 marks)

5) For the following complete combustion reaction answer the following questions: (8 marks)

$C_9H_{14}(g) + 25/2\ O_2(g) \rightarrow 9\ CO_2(g) + 7\ H_2O(g)$ equation not balanced correctly

a) How many grams of O_2 are needed to react with 122g of C_9H_{14}

b) What volume of CO_2 at stp will be produced by this mass of C_9H_{14} ?

6) Write a balanced chemical equation for the reaction that occurs when the following compounds are heated with a bunsen flame. (8 marks)

a) Sodium nitrate

b) Calcium nitrate

c) Zinc carbonate

d) Calcium Hydroxide

7) Predict the products of the following reactions and write a balanced equation, including states symbols. In each case if there is no chemical change, write "no reaction". (6 marks)

a) $K(s) + H_2O(l) \rightarrow$

b) $Pb(NO_3)_2(s) + Ca(s) \rightarrow$

c) $Mg(s) + HCl(aq) \rightarrow$

8) State whether the following are true or false. (5 marks)

a) An element which conducts heat would most likely be found in group 2.

b) An element which forms anions would most likely be found in group 6.

c) Fluorine has the highest first ionization energy.

d) An element with a high melting point would most likely be found in group 7.

e) Most nonmetal oxides are basic.

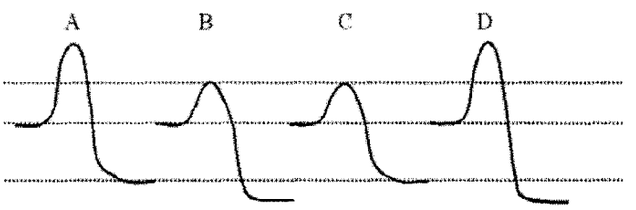
9) For the following endothermic reaction at equilibrium? (5 marks)

$$2CS_2(g) + H_2(g) <=> CH_4(g) + 3H_2S(g)$$

Describe what would happen to the concentration of $H_2S(g)$ and $CS_2(g)$ (increase/decrease/remain same) if:

Condition	$CS_2(g)$ Concentration	$H_2S(g)$ Concentration
The pressure is decreased		
The temperature is increased		
Some catalyst is added		
Some H_2 (g) is removed		
Some $CH_4(g)$ is added		

10) Answer the following questions: (3 marks)



a) Which reaction would have the slowest reverse reaction rate?

b) Which of reaction A, B or C would release the most energy?

c) Which reaction might represent the effects of a catalyst added to reaction A?

11) Explain the following: (6 marks)

a) Burning is more violent in an atmosphere of pure oxygen compared to air.

b) Car mufflers rust more quickly than any other part of a cars body.

c) Paper mills must control the levels of sawdust in the air of their factories, otherwise they may explode.

12) State Le Châtelier's Principle(2 marks)

13) For electrolysis of the following aqueous solutions and molten liquids, (i) list all of the ions present in the solution/molten liquid and (ii) write the electrode half reactions, identifying the electrode as cathode or anode.

a) A very dilute aqueous solution of KBr and $CaCl_2$.

b) A molten mixture of copper(II) chloride and sodium bromide.

14) For the following reactions, write the overall ionic equation, net ionic equation and the half reactions. State which of the half reactions is oxidation and which one is reduction. Include the states. (6 marks)

a) $Fe(s) + PbSO_4(aq) \rightarrow FeSO_4(aq) + Pb(s)$

b) $Ca(s) + 2AgBr\ (aq) \rightarrow 2Ag(s) + CaBr_2\ (aq)$(4)