(University of Choice)

MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)

KAKAMEGA (MAIN) AND KISUMU CAMPUSES

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

FIRST YEAR SECOND TRIMESTER EXAMINATIONS

FOR THE DEGREES
OF
BACHELOR OF SCIENCE IN MEDICAL LABORATORY SCIENCES,

BACHELOR OF SCIENCE IN MEDICAL BIOTECHNOLOGY

COURSE CODE: BML 121

COURSE TITLE: Inorganic Chemistry

DATE: JULY…….. 2018   **TIME: ………**

INSTRUCTIONS TO CANDIDATES
1. This paper consists of three sections A, B and C
2. Write your registration number only on the answer booklet
3. Write your registration number on every new leaf of the paper

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over

SECTION A: MULTIPLE CHOICE QUESTIONS (MCQs)
Instructions to the candidate
   1. **This section has twenty (20) multiple choice questions (MCQs)**
   2. **Each question has a stem and four (4) options**
   3. **Indicate the correct options(s) for each question by writing the corresponding letter**
   4. **Use the provided university examination booklet only**

SECTION A: MULTIPLE CHOICE QUESTIONS (MCQs)

Q1. Which of the following is not a qualitative method of chemical analysis?
a)   Solvent extraction
b)   Gravimetric analysis
c)   NMR spectroscopy
d)   Flame testing

Q2. From which of the following laws was the absolute temperature scale developed?
a)   Charles' law
b)   Grahams law of diffusion
c)   Kinetic theory of gases
d)   Boyle's law

Q3.   The rate equation for a certain reaction is $R = k[A]^2[B]^3$. State the overall order of the reaction
a) 2
b) 5
c) 3
d) 6

Q4. The region inside an atom where an electron is most likely to be found is called
a) a sub shell
b) an energy level
c) a nucleus
d) An orbital

Q6. A Lewis acid is
a) A proton donor
b) A proton acceptor
c) An electron pair donor
d) An electron pair acceptor

Q7. When a covalent bond between two atoms of different electronegativity breaks?
a) Free radicals are formed
b) Ions are formed
c) Molecules are formed
d) All the above

Q8. Which of the following factors does not affect equilibrium position of a system?
a) Change in pressure of one of the reactants
b) Change in concentration
c) Change in pressure
d) Addition of a catalyst

Q5. A reaction is said to be of zero order with respect to a given reactant if
   a) It results in no change in temperature
   b) the concentration of the reactant reduces to zero by the end of the reaction
   c) a change in concentration of the reactant has no effect on the reaction rate
   d) all the reactants are used up

Q9. A positively charged ion is formed when
   a) there are more protons than electrons
   b) there are more neutrons than electrons
   c) there are more electrons than protons
   d) there are more electrons than neutrons

Q10.   Elements in the same group of the periodic table have the same
   a) atomic number
   b) mass number
   c) number of energy shells
   d) number of electrons in the valence sub level

Q11.   Magnetism that comes about as a result of paired electrons in a substance is called
   a) Paramagnetism
   b) ferromagnestism
   c) ferrimagnetism
   d) Diamagnetism

Q12. The oxidation number of Nitrogen in N_2O is
   a) 4
   b) 1
   c) 3
   d) 2

Q13. The positively charged end of a polar molecule is called
   a)   An electrophile
   b)   A cation
   c)   A nucleophile
   d)   A proton

Q14. Which of the following statements is true about a sigma bond?
   a)   It is formed when any two s orbitals have sufficient overlap
   b)   It is formed when any two p orbitals overlap head on
   c)   It is stronger than a pi bond
   d)   all the above

Q15. The spin quantum number specifies
   a)   The orientation of an electron in an orbital
   b) The energy level on which an electron is found
   c) The angular momentum of an electron
   d) The sub shell on which an electron is found

Q16. It is impossible to find any two electrons in an atom with the same set of all four quantum numbers. This statement is famously known as
   a)   Hund's rule
   b)   Kletchkowski's rule
   c)   Pauli's exclusion principle
   d)   The rule of stability

Q17. How many electrons are required to fill all the orbitals in the fourth energy level?
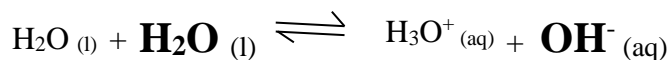   a)   8
   b)   32
   c) 24
   d) 60

Q18. Identify the atomic orbital pictured below
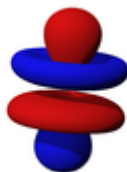
   a) f orbital
   b) d orbital
   c)   s orbital
   d)   p orbital

Q19. Consider the chemical equation below

$$H_2O_{(l)} + \mathbf{H_2O}_{(l)} \rightleftharpoons H_3O^+_{(aq)} + \mathbf{OH^-}_{(aq)}$$

The species in bold on the left hand side of the equation is participating in the reaction as
   a)   A neutral solvent
   b)   A bronsted acid
   c)   Lewis acid
   d)   An arrhenius acid

Q20. An electrochemical cell in which electrical energy is used to make a non-spontaneous reaction to take place is known as

 a)   A galvanic cell
 b)   A voltaic cell
 c)   An electrolytic cell
 d)   A primary cell

SECTION B (40 Marks)

Q1. Use the standard electrode Potentials (S.E.P) in the table below to answer the following questions

Half Equation	S.E.P (Volts)
$A^{2+}_{(aq)} + 2e^- \rightarrow A_{(s)}$	+2.8
$B^{+}_{(aq)} + e^- \rightarrow A_{(s)}$	-1.5
$C^{3+}_{(aq)} + 3e^- \rightarrow A_{(s)}$	-3.3
$D^{2+}_{(aq)} + 2e^- \rightarrow A_{(s)}$	+0.7
$E^{2+}_{(aq)} + 2e^- \rightarrow A_{(s)}$	-1.1

 a)   Calculate the E.M.F of the electrochemical cell that will be formed between half cells of the following elements (6 marks)

 i.   A and D
 ii.   B and C
 iii.   D and E

 b)   Identify (3 marks)
  i.   The strongest reducing agent

ii. The element that has the highest tendency to gain electrons

iii. The combination of half cells that would form an electrochemical with highest EMF

c) Predict whether a reaction would occur when an aqueous solution containing A^{2+} ions is kept in a container made of metal C (4 marks)

Q2. State one role of chemistry in medical laboratory sciences (1 mark)

Q3. State the first law of thermodynamics and provide the associated formula (2 marks)

Q4. Describe briefly how titanium is extracted from rutile ore (impure TiO_2) (5 marks)

Q5. A gas occupies 50 cm³ at 27K and 750 mmHg Pressure. Calculate the new volume if its pressure is adjusted to 800 mmHg and temperature decreased to 15K (2 marks)

Q6. Write the electron configuration of the each of the following (6 marks)

a. Iron (28)
b. Chromium (Cr=25)
c. Zn^+ (Zn=30)

Q7. Solution K is prepared by dissolving 10 grams of sodium hydroxide in 500 cm³ of distilled water. 20 cm³ of solution K required exactly 7.5 cm³ of dilute hydrochloric acid for complete neutralization. Calculate the molarity of the acid used. (Molar mass of NaOH = 40g) (4 marks)

Q8. Ammonia gas is prepared industrially by the Haber process by reacting nitrogen and hydrogen as shown in the equation below

$$N_{2\ (g)} + 3H_{2\ (g)} \rightleftharpoons 2NH_{3\ (g)} \quad \Delta H= -92kJ/Mole$$
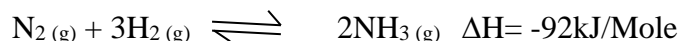
a) State and explain how each of the following affects the yield of Ammonia (4 marks)

i. decrease in temperature of the system

ii. increase in pressure of the system

iii. removing the ammonia formed form the system immediately its formed

iv.   use of iron as a catalyst

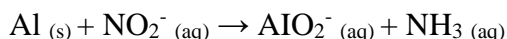b)   State   the   optimum
conditions for maximum yield of ammonia and justify your answer in each case (3 marks)

SECTION C (40 Marks)

Q1. Balance the following redox reaction in acidic conditions (10 marks)

$$ClO_3^-_{(aq)} + SO_2_{(g)} \rightarrow SO_4^{2-}_{(aq)} + Cl^-_{(aq)}$$
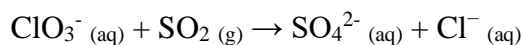
Hint: use the half equations method

Q2. Balance the following redox reaction in basic conditions (10 marks)

$$Al_{(s)} + NO_2^-_{(aq)} \rightarrow AlO_2^-_{(aq)} + NH_3_{(aq)}$$

Hint: use the half equations method

Q3. A stock solution of sulphuric acid has the following specifications from the manufacturer

Specific gravity=1.3
Molar mass=36.46
Percentage purity = 36% to 38%
By showing all calculations involved, explain how you would prepare 800 cm^3 of dilute
HCl with concentration of 2 Moles/Dm^3 (4 marks)

Q4. a) Calculate the pH of 0.02M H_2SO_4 (2 marks)
   b) Calculate the pH of 0.5M NaOH (2 marks).
   c) Calculate the molarity of a certain strong acid H_3X given that it has a PH of 2.5 (4 marks)

Q5. A buffer solution contains 0.10 moles of ethanoic acid and 0.13 moles of sodium ethanoate
in 1 litre of solution. Calculate the pH of the buffer if ka of ethanoic acid is 1.8 x 10^{-5} (5 marks)

Q6. Calculate the normality of 0.321g of sodium carbonate in 250 ml solution (3marks)