(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

KAKAMEGA (MAIN) AND KISUMU CAMPUSES

UNIVERSITY EXAMINATIONS 2017/2018 ACADEMIC YEAR

FIRST YEAR SPECIAL 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: ....…….. 2018 **TIME: ……**

INSTRUCTIONS TO CANDIDATES

1. This paper consists of three sections A, B and C. Answer all questions in all sections
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. In which of the following was investigated at constant pressure?

a) Charles' law
b) Boyle's
c) Graham's
d) Kinetic theory of gases

Q2. Which of the following is an ideal gas?

a) oxygen
b) nitrogen
c) water vapour
d) none of the above

Q3. 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

Q4. A bronsted acid is

a) A proton donor
b) A proton acceptor
c) An electron pair donor
d) An electron pair acceptor

Q5. Which of the following factors only affects the rate of a reaction involving solid reactants?

a) pressure
b) concentration
c) temperature
d) Surface area

Q6. Which of the following molecules has the biggest polarity?

a) HCl
b) HBr
c) HI
d) HF

Q7. 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

Q8. A negatively 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

Q9. Elements in the same period of the periodic table have the same

a) physical properties
b) number of energy shells
c) chemical properties
d) uses

Q10. Magnetism that comes about as a result of unpaired electrons in a substance is called

a) Paramagnetism
b) ferromagnestism
c) ferrimagnetism
d) Diamagnetism

Q11. An electrochemical cell in which electrical energy is produced as a result of the reactions occurring in the two half-cells is called

a) a galvanic cell
b) a secondary cell
c) an electrolytic cell
d) a primary cell

Q12. The oxidation number of Nitrogen in NO_3^- is

a) 1
b) -5
c) 3
d) +5

Q13. The negatively 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 false 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 a covalent bond
d) It is weaker than a pi bond

Q15. The azimuthal quantum number specifies

a) The orientation of an electron in an orbital
b) The energy level on which an electron is found
c) The sub level where an electron is fond
d) None of the above

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) The Aufbau principle
c) Pauli's exclusion principle
d) The "bus seating" rule

Q17. How many electrons are required to fill all the orbitals in the third energy level?

a) 18
b) 8
c) 24
d) 60

Q18. Which orbital has a double dumbbell shape?

a) f orbital
b) d orbital
c) s orbital
d) p orbital

Q19. Consider the chemical equation below

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

The species in bold on the left hand side of the equation is participating in the reaction as

a) a bronsted base
b) a Bronsted acid
c) an Arrhenius base
d) an Arrhenius acid

Q20. When a covalent bond between two atoms of same electronegativity breaks

a) Free radicals are formed
b) Ions are formed
c) Molecules are formed
d) All the above

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)**
$A^{2+}_{(aq)} + 2e^- \rightarrow A_{(s)}$	+1.6
$B^{+}_{(aq)} + e^- \rightarrow A_{(s)}$	-3.0
$C^{3+}_{(aq)} + 3e^- \rightarrow A_{(s)}$	+3.5
$D^{2+}_{(aq)} + 2e^- \rightarrow A_{(s)}$	+0.8
$E^{2+}_{(aq)} + 2e^- \rightarrow A_{(s)}$	-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 three roles of chemistry in medical laboratory sciences (3 marks)

Q3. State the second law of thermodynamics (2 marks)

Q4. Describe briefly how Iron is extracted from magnetite ore (5 marks)

Q5. A gas occupies 543 cm^3 at 927K and 584 mmHg Pressure. Calculate the new volume if its pressure is adjusted to 880 mmHg and temperature decreased to 165K (2 marks)

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

a. Br (35)
b. Au (79)
c. Zn^{3+} (Zn=30)

Q7. Solution K is prepared by dissolving 10 grams of sodium hydroxide in 500 cm^3 of distilled water. 20 cm^3 of solution K required exactly 7.5 cm^3 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. increase in temperature of the system
ii. decrease in pressure of the system
iii. removing the ammonia formed form the system immediately its formed
iv. failure to use 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 medium (10 marks)

$$Cr_2O_7^{2-}{}_{(aq)} + HNO_{2\,(aq)} \rightarrow Cr^{3+}{}_{(aq)} + NO_3^{-}{}_{(aq)}$$

Hint: use the half equations method

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

$$Ag_{(s)} + Zn^{2+}_{(aq)} \rightarrow Ag_2O_{(aq)} + Zn_{(s)}$$

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 500 cm^3 of dilute HCl with concentration of 1.5 Molar (4 marks)

Q4. a) Calculate the pH of 0.08M HNO_3 (2 marks)

b) Calculate the pH of 0.65M KOH (2 marks).

c) Calculate the molarity of a certain strong acid H_2X given that it has a pH of 1.7 (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 1.8×10^{-5} (5 marks)

Q6. Calculate the normality of 0.634g of sodium carbonate in 450 ml solution (3marks)