JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL, PHYSICAL, MATHEMATICS AND ACTUARIAL SCIENCES

UNIVERSITY EXAMINATION FOR THE DIPLOMA IN SCIENCE
1ST YEAR 2ND SEMESTER 2024
MAIN CAMPUS

COURSE CODE: WAT 01

COURSE TITLE: APPLIED CHEMISTRY & BIOLOGY

EXAM VENUE: **STREAM: Diploma in Science**

DATE: **EXAM SESSION:**

TIME: 2:00 HRS

Instructions:

1. **Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

SECTION A: COMPLUSORY (40 MARKS)

Question 1

a) Define the following terms;
   - i. Period
   - ii. Helminths
   - iii. Turbidity
   - iv. Irreversible reactions
   - v. Pathogens   (10 marks)

b) Briefly state **FOUR** examples of microorganisms commonly encountered in real life.
                                                                            (4 marks)

c) 1.2 litres of oxygen measured at 30 ºC and 760 mmHg has a mass of 1.5 g. Calculate the volume occupied by 24 g of oxygen at STP.   (2 marks)

d) Living things are classified into seven levels. Name them.   (7 marks)

e) Discuss any **THREE** types of chemical reactions.   (6 marks)

f) To 50 mL of 0.5 M H_2SO_4, 75 mL of 0.25 M H_2SO_4 is added. What is the concentration of the final solution if its volume is 150 mL?   (3 marks)

g) Describe any **FOUR** physical water quality tests.   (4 marks)

h) What is involved in microbial water quality testing?   (2 marks)

i) State any **TWO** properties of alkanes   (2 marks)

SECTION B: Answer Any Six questions

Question 2 (10 Marks)

a) Describe any **TWO** characteristics of living things.   (4 marks)

b) Differentiate between;
   - i. Physical and chemical change   (2 marks)
   - ii. Electrolyte and electrode   (2 marks)

   c) Briefly state the various chemical tests for drinking water.   (2 marks)

Question 3 (10 Marks)

a) Calculate the final pressure of gas at the specified conditions assuming the temperature and mass remain constant given that $V_1 = 205$ cm^3, $V_2 = 50$ cm^3 and $P_1 = 1.5$ atm.
                                                                            (2 marks)

b) How are elements grouped in the periodic table?   (2 marks)

c) What are the common features of each column in the periodic table?   (2 marks)

d) Briefly explain how wastewater sampling is done for chemical testing.   (4 marks)

Question 4 (10 marks)

a) A fixed mass of gas at a constant temperature has a pressure of 200 Pa and a volume of 0.02 m^3. It is compressed until the volume is 0.05 m^3. What is its new pressure?

(3 marks)

b) How many grams of Magnesium, are in 0.342 mol Mg? (Molar Mass Mg = 24).

(3 marks)

c) Iron is a most important metal in our society. How many moles of chlorine gas are present in cylinder weighing 95.8 g? (Molar mass of Cl = 35.5 g/mol). (3 marks)

d) Why is chlorination treatment done to drinking water? (1 mark)

Question 5 (10 marks)

a) Pathogens can e transmitted in several ways. Name **FOUR** of such ways. (4 marks)

b) Explain why elements of the same group have similar properties. (2 marks)

c) Briefly list any **FOUR** PPEs commonly used in the laboratory. (4 marks)

Question 6 (10 marks)

a) How many moles are in 46 g ammonium chloride, HNO_3? (Molar mass of N = 14 g/mol; H = 1.01 g/mol; O = 16 g/mol) (3 marks)

b) When do atoms attain stability? (1 mark)

c) Compare the **THREE** elements Li, K and Be. Arrange the elements in order of increasing non-metallic strength. Justify your answer (3 marks)

d) Distinguish between chemical equation and chemical reaction. (2 marks)

e) Define the term 'Molarity'. (1 mark)

Question 7 (10 marks)

a) What are the common features of each period in the periodic table? (2 marks)

b) Balance the following reaction: $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$. (2 marks)

c) Discuss the any **TWO** relevant applications of alkanes. (4 marks)

Question 8 (10 marks)

a) The periodic table is comprised of 8 families, briefly name them. (4 marks)

b) Briefly describe the **THREE** types of bonds commonly in chemistry. (6 marks)

Question 9 (10 marks)

a)   Differentiate between a galvanic cell and an electrolytic cell.   (4 marks)

b)   How many electrons fit in the inner shell of a Sodium atom?   (1 mark)

c)   Describe any **FIVE** general safety considerations in the laboratory.   (5 marks)

Question 10 (10 marks)

a)   Name the following with reference to the elements of Modern Periodic Table.

i) The number of electron shells in elements of period 4.   (2 marks)

ii) The period of elements having 2 valence electrons.   (2 marks)

b) Differentiate between chemical equation and balanced equation.   (3 marks)

c) Gas X has atomic number 96 and mass number 252. Give the number of electrons, protons and neutrons in its atom.   (3 marks)

Periodic table

Legend:
- Atomic number, Z
- Element symbol
- Relative atomic mass, A_r

1		
1		
H		
1.008		

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 **H** 1.008																	2 **He** 4.00
3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.90	23 **V** 50.94	24 **Cr** 52.01	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.54	30 **Zn** 65.41	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.91	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** 98.91	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.40	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.75	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.30
55 **Cs** 132.91	56 **Ba** 137.34	**La–Lu**	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.85	75 **Re** 186.21	76 **Os** 190.23	77 **Ir** 192.22	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.37	82 **Pb** 207.19	83 **Bi** 208.98	84 **Po** 210	85 **At** 210	86 **Rn** 222
87 **Fr** 223	88 **Ra** 226.03	**Ac–Lr**	104 **Rf** [261]	105 **Db** [262]	106 **Sg** [266]	107 **Bh** [264]	108 **Hs** [277]	109 **Mt** [268]	110 **Ds** [271]	111 **Rg** [272]	112 **Uub** [285]						

Lanthanoids

57 **La** 138.91	58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** 146.92	62 **Sm** 150.35	63 **Eu** 151.96	64 **Gd** 157.25	65 **Tb** 158.92	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.04	71 **Lu** 174.97

Actinoids

89 **Ac** 227.03	90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** 237.05	94 **Pu** 239.05	95 **Am** 241.06	96 **Cm** 244.07	97 **Bk** 249.08	98 **Cf** 252.08	99 **Es** 252.09	100 **Fm** 257.10	101 **Md** 258.10	102 **No** 259	103 **Lr** 262