TEVETA

DIPLOMA IN SCIENCE LABORATORY TECHNOLOGY

LEVEL 6 YEAR I EXAMINATIONS

FINAL INTEGRATED SUMMATIVE EXAMINATIONS

SITTING: JULY/AUGUST 2026

SUBJECT: FOUNDATION CHEMISTRY THEORY

TIME: THREE (3) HOURS **TOTAL MARKS: 100**

PASS MARK: 50

INSTRUCTIONS TO CANDIDATE

1. Write your Examination number and National Registration Card (NRC) number on the answer booklet provided. Ensure you append your signature in the space provided on the answer booklet.
2. Write the ANSWER SCRIPT SERIAL NUMBER on the examination register and on the entry slip.
3. This paper has TWO (2) Sections.
   - Section A: Answer ALL questions.
   - Section B: Question One (1) is compulsory. Answer FIVE (5) questions.
4. Diagrams may be used where necessary to clarify your answer.
5. Cellphones and programmable calculators are not allowed in the examination room.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

SECTION A **TOTAL MARKS: 20**

ANSWER ALL QUESTIONS BY CHOOSING THE BEST OPTION.

1. Which branch focuses on the identification and quantification of chemical substances (e.g., measuring pollutant levels in air)?
   A. Analytical Chemistry
   B. Organic Chemistry
   C. Nuclear Chemistry
   D. Polymer Chemistry

2. The number of particles in one mole is known as:
   A. Faraday constant
   B. Plank's constant
   C. Gas constant
   D. Avogadro's number

3. In which reaction will the point of equilibrium shift to the left when the pressure on the system is increased?
   A. $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$
   B. $CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$
   C. $2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(s)}$
   D. $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$

4. Which law describes the relationship between pressure, volume, and temperature of gases?
   A. Ideal Gas Law
   B. Dalton's Law
   C. Raoult's Law
   D. Graham's Law

5. Express the concentration of 10 g of solid sodium carbonate dissolved in $1\ dm^3$ of solution as molarity.
   A. $0.1dm^3$
   B. 0.1M
   C. 0.1moles
   D. 0.001M

6. What is the oxidation number of Sulfur in H_2SO_4?
   A. +2
   B. +4
   C. +6
   D. -2

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7. Explain the term "titration".
   A. The process that consists of running one solution into a known volume of the other until the two solutions have just not reacted completely.
   B. The process that consists of running one solution into a known volume of the other until the two solutions have just reacted partially.
   C. The process that consists of running one solution into unknown volume of the other until the two solutions have just reacted completely.
   D. The process that consists of running one solution into a known volume of the other until the two solutions have just reacted completely.

8. Which solution is the most concentrated?
   A. 1 mole of solute dissolved in 1liter solution
   B. 2 moles of solute dissolved in 3 liters of solution
   C. 6 moles of solute dissolved in 4 liters of solution
   D. 4 moles of solute dissolved in 8 liters of solution.

9. During chemical reactions heat is either lost or gained. This is referred to as:
   A. Enthalpy change.
   B. Chemical change.
   C. Heat content
   D. Internal energy.

10. A formula that shows the simplest whole-number ratio of atoms in a compound is the:
   A. Structural formula
   B. Empirical formula
   C. Molecular formula
   D. Chemical equation

11. Which orbital has lowest energy?
   A. 3d
   B. 4s
   C. 3p
   D. 4f

12. The bond formed by the electrostatic attraction between negative end of one molecule and positive end of the other is called:
   A. Ionic bond
   B. Hydrogen bond
   C. Covalent bond
   D. Co-ordinate covalent bond

13. Which of the following is a renewable natural resource?
   A. Coal

B. Phosphate
C. Metal
D. Forest

14. The process of losing electrons during a chemical reaction is known as:
    A. Reduction
    B. Oxidation
    C. Neutralization
    D. Sublimation

15. The point in a titration where the indicator changes color is the:
    A. Equivalence point
    B. Starting point
    C. Neutral point
    D. End point

16. Which of the following elements is a noble gas?
    A. F
    B. Cl
    C. Kr
    D. Mg

17. For the reaction $CaCO_{3(s)} \leftrightarrow CaO_{(s)} + CO_{2(g)}$, increasing the pressure will cause the equilibrium to:
    A. Shift to the right
    B. Shift to the left
    C. Remain unchanged
    D. Increase Kp

18. The reaction, Zn + CuSO4 → ZnSO4 + Cu, is an example of ....
    A. Single replacement
    B. Double replacement
    C. Synthesis
    D. Decomposition

19. A device that converts chemical energy into electrical energy is:
    A. Ammeter
    B. Voltmeter
    C. Calorimeter
    D. Voltaic cell

20. Which compound is responsible for fizz in carbonated soft drinks?

A. Sodium chloride
B. Hydrogen peroxide
C. Carbon dioxide
D. Calcium oxide

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SECTION B **TOTAL MARKS: 80**

QUESTION ONE (1) IS COMPULSORY. ANSWER ANY OTHER FOUR (4) QUESTIONS.

QUESTION ONE

a. Define the following terms:
   i. Atomic orbital. [2 marks]
   ii. Ionization energy. [2 marks]
b. Write the electron configurations for the following elements:
   i. Chlorine (Cl). [3 marks]
   ii. Calcium (Ca). [3 marks]
c. Chlorine is made up of two isotopes, Cl-35 (34.969 amu) and Cl-37 (36.966 amu). Given chlorine's atomic weight of 35.453 amu, calculate the percent abundance of each isotope? [10 marks]

TOTAL MARKS: 20

QUESTION TWO

a) Write the orbitals for which

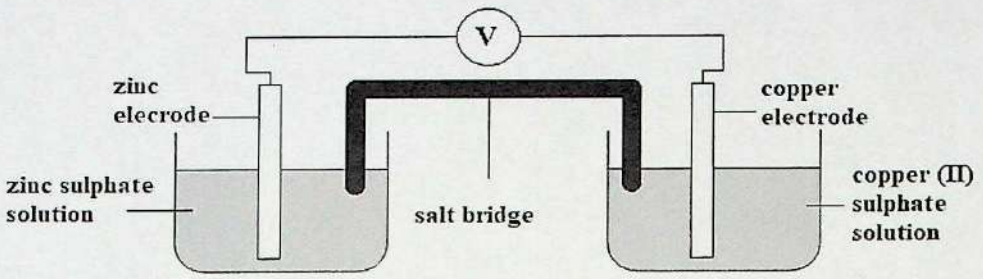
   i. $n = 3,\ l = 1$ [2 marks]
   ii. $n = 5,\ l = 2$ [2 marks]

b) Describe the nature of matter. [5 marks]
c) Explain quantum numbers and their significance in characterizing an electron in an atom. [6 marks]

TOTAL MARKS: 15

QUESTION THREE

a) Study the diagram below.



i. State one (1) function of the salt bridge. [1 mark]

ii. Define voltaic cell. [2 marks]

iii. On the diagram above, identify anode and cathode. [2 marks]

iv. Write half reaction equations that occur at each electrode from the diagram above. [4 marks]

b) A hydrocarbon molecule contains 85.7% carbon and 14.3% hydrogen. Calculate its empirical formula. [6 marks]

TOTAL MARKS: 15

QUESTION FOUR

a) Define reducing agent. [2 marks]

b) Determine the oxidation state of carbon in the oxalate ion ($C_2O_4^{2-}$). [3 marks]

c) Balance the following redox reaction occurring in basic medium:

$$ClO^- + I^- \rightarrow Cl^- + IO_3^-$$ [10 Marks]

TOTAL MARKS: 15

QUESTION FIVE

a) An organic compound has the condensed formula CH_3CH_2-COOH. State;

i. The homologous series of the compound above. [1 mark]
ii. The functional group of the homologous series of the compound above.

[2 marks]

b) Ethene is an alkene. Draw;

i. A display structure of ethene. [3 marks]
ii. A condensed formula of ethene. [3 marks]

iii. Using a chemical equation, describe the test used to show that ethene is an unsaturated hydrocarbon compound. [6 marks]

TOTAL MARKS: 15

QUESTION SIX

a) Define a base according to Bronsted Lowry Theory. [3 marks]
b) The pH of a sample of human blood was measured to be 7.41 at 25^0c.
   i. What do the letters pH stand for? [3 marks]
   ii. Calculate the pOH. [3 marks]
c) Explain three (3) industrial applications of acids. [6 marks]

TOTAL MARKS: 15

Useful data

Avogadro's constant = 6.022×10^{23}

Rydberg's constant = 1.0967×10^{7}

Speed of light 2.998×10^{8} m/s

Planck's h: 6.626×10^{-34} Js

R=0:08206Latm/Kmol

R=0:08314Lbar/Kmol

R=82:06cm3atm=Kmol

R=8:314J/Kmol

R=1:987cal/Kmol

Proton mass : $1.672621637\ 10^{-27}$ kg

Molar volume at room temperature and pressure = 2400 dm^3

Molar volume at standard temperature and pressure = 22.4 dm^3

Periodic Table of the Elements

hydrogen 1 **H** 1.00794																	helium 2 **He** 4.002602
lithium 3 **Li** 6.941	beryllium 4 **Be** 9.012182											boron 5 **B** 10.811	carbon 6 **C** 12.0107	nitrogen 7 **N** 14.00674	oxygen 8 **O** 15.9994	fluorine 9 **F** 18.9984	neon 10 **Ne** 20.1797
sodium 11 **Na** 22.98977	magnesium 12 **Mg** 24.3050											aluminium 13 **Al** 26.981538	silicon 14 **Si** 28.0855	phosphorus 15 **P** 30.97376	sulphur 16 **S** 32.065	chlorine 17 **Cl** 35.453	argon 18 **Ar** 39.984
potassium 19 **K** 39.0983	calcium 20 **Ca** 40.078	scandium 21 **Sc** 44.95591	titanium 22 **Ti** 47.867	vanadium 23 **V** 50.9415	chromium 24 **Cr** 51.9961	manganese 25 **Mn** 54.93805	iron 26 **Fe** 55.845	cobalt 27 **Co** 58.9332	nickel 28 **Ni** 58.6934	copper 29 **Cu** 63.546	zinc 30 **Zn** 65.409	gallium 31 **Ga** 69.723	germanium 32 **Ge** 72.64	arsenic 33 **As** 74.9216	selenium 34 **Se** 78.96	bromine 35 **Br** 79.904	krypton 36 **Kr** 83.798
rubidium 37 **Rb** 85.4678	strontium 38 **Sr** 87.62	yttrium 39 **Y** 88.90585	zirconium 40 **Zr** 91.225	niobium 41 **Nb** 92.90638	molybdenum 42 **Mo** 95.94	technetium 43 **Tc** [98]	ruthenium 44 **Ru** 101.07	rhodium 45 **Rh** 102.9055	palladium 46 **Pd** 106.42	silver 47 **Ag** 107.8682	cadmium 48 **Cd** 112.411	indium 49 **In** 114.818	tin 50 **Sn** 118.710	antimony 51 **Sb** 121.760	tellurium 52 **Te** 127.60	iodine 53 **I** 126.9045	xenon 54 **Xe** 131.293
caesium 55 **Cs** 132.90545	barium 56 **Ba** 137.327	lutetium 71 **Lu** 174.967	hafnium 72 **Hf** 178.49	tantalum 73 **Ta** 180.9479	tungsten 74 **W** 183.84	rhenium 75 **Re** 186.207	osmium 76 **Os** 190.23	iridium 77 **Ir** 192.217	platinum 78 **Pt** 195.078	gold 79 **Au** 196.96655	mercury 80 **Hg** 200.59	thallium 81 **Tl** 204.3833	lead 82 **Pb** 207.2	bismuth 83 **Bi** 208.980	polonium 84 **Po** [209]	astatine 85 **At** [210]	radon 86 **Rn** [222]
francium 87 **Fr** [223]	radium 88 **Ra** [226]	lawrencium 103 **Lr** [262]	rutherfordium 104 **Rf** [261]	dubnium 105 **Db** [262]	seaborgium 106 **Sg** [266]	bohrium 107 **Bh** [264]	hassium 108 **Hs** [269]	meitnerium 109 **Mt** [268]	darmstadtium 110 **Ds** [271]	roentgenium 111 **Rg** [272]	ununbium 112 **Uub** [285]		ununquadium 114 **Uuq** [289]				

Key:

element name
atomic number
symbol
atomic weight

lanthanum 57 **La** 138.9055	cerium 58 **Ce** 140.116	praseodymium 59 **Pr** 140.90765	neodymium 60 **Nd** 144.24	promethium 61 **Pm** [145]	samarium 62 **Sm** 150.36	europium 63 **Eu** 151.964	gadolinium 64 **Gd** 157.25	terbium 65 **Tb** 158.9253	dysprosium 66 **Dy** 162.50	holmium 67 **Ho** 164.930	erbium 68 **Er** 167.259	thulium 69 **Tm** 168.934	ytterbium 70 **Yb** 173.04
actinium 89 **Ac** [227]	thorium 90 **Th** 232.038	protactinium 91 **Pa** 231.0359	uranium 92 **U** 238.0289	neptunium 93 **Np** [237]	plutonium 94 **Pu** [244]	americium 95 **Am** [243]	curium 96 **Cm** [247]	berkelium 97 **Bk** [247]	californium 98 **Cf** [251]	einsteinium 99 **Es** [252]	fermium 100 **Fm** [257]	mendelevium 101 **Md** [258]	nobelium 102 **No** [259]