

Applied Chemistry

T2-172

Friday, 17 July, 2026

02:00 PM – 05:00 PM

Names:

Index number:

TSS NATIONAL EXAMINATIONS, LEVEL 5, 2025-2026

QUESTIONS and ANSWERS BOOKLET

**TRADES: MAT, AUT, PLT, WOT, FOR, AGR, ANH, BDC, FPA,
FOP, IND, LSV, FBO, PWO, WIR**

SUBJECT: Applied Chemistry

DURATION: 3 Hours

Read carefully the instructions on page 3

TOTAL MARKS...../100

FOR MARKER'S USE ONLY

QUESTIONS	1	2	3	4	5	6	7	8	9	10	Total
Marks											
QUESTIONS	11	12	13	14	15	16	17	18	19	20	Total
Marks											
QUESTIONS	21	22	23	24	25	26	27	28	29	30	Total
Marks											

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INSTRUCTIONS TO CANDIDATES:

1. This Exam paper is composed of **three sections (A, B and C)**. Follow the instructions given below and answer the indicated questions for a total of **100 marks**.

Section **A**: All questions are **Compulsory** **55 marks**

Section **B**: Attempt any three (3) **30 marks**

Section **C**: Attempt anyone (1) **15 marks**

2. Fill in your actual **names** and **Index number** on the provided space(Cover).
3. Do not remove or tear any page or part of it of this Questions and Answers Booklet.
4. Answer in the language in which the Examination is set.
5. In section **A** answer questions in the provided space. In case of multiple choice questions, just **circle** the letter corresponding to the correct option.
6. In sections **B** and **C**, answer questions in the provided space after section C questions.
7. **You do not need the Periodic Table.**
8. **Allowed materials:**
 - Blue pen.
 - Geometrical Instruments
 - Silent non-programmable calculators

Note: The use of Black Pen/Green Pen/Red Pen, and Pencils is strictly prohibited, except when recommended.

SECTION A: ATTEMPT ALL QUESTIONS

(55 MARKS)

1) An atom is the basic unit of matter.

i) The arrangement of electrons in an atom is known as:

(1 mark)

- A) atomic mass
- B) mass number
- C) number of mole
- D) electron configuration

ii) Which of the following is the particle with a positive charge in an atom?

(1 mark)

- A) Electron
- B) Neutron
- C) Proton
- D) Photon

iii) Isotopes are atoms of the same element with different numbers of:

(1 mark)

- A) protons
- B) neutrons
- C) electrons
- D) positrons

iv) What is the maximum number of electrons in the first energy level (K shell) of the atom?

(1 mark)

- A) 2 electrons
- B) 1 electron
- C) 8 electrons
- D) 4 electrons

v) A molecule is formed when:

(1 mark)

- A) atoms gain electrons
- B) atoms lose electrons

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- C) two or more atoms chemically combine
- D) neutrons, protons, and electrons combine

2) There are different types of reactions.

i) What is the purpose of balancing a chemical equation? **(1 mark)**

- A) To change the chemical substances in the reaction.
- B) To ensure that the number of atoms and charges of each element is the same on both sides.
- C) To ensure that the rate of a chemical reaction speeds up.
- D) To ensure that all atoms of elements are in the same physical state on both sides.

ii) What is the correct name for a chemical reaction occurring between an acid and a base? **(1 mark)**

- A) Neutralization reaction
- B) Redox reaction
- C) Combustion reaction
- D) Decomposition reaction

iii) Indicate which of the following chemical equations is well balanced.

(1 mark)

- A) $2\text{Al} + 3\text{HCl} \rightarrow \text{AlCl}_3 + 3\text{H}_2$
- B) $\text{Al} + 6\text{HCl} \rightarrow \text{AlCl}_3 + 3\text{H}_2$
- C) $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$
- D) $2\text{Al} + 3\text{HCl} \rightarrow \text{AlCl}_3 + 3\text{H}_2$

iv) What is the correct name for a substance that acts as both acid and base?

(1 mark)

- A) Neutral
- B) Alkali
- C) Salt
- D) Amphoteric

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3) Organic compounds are commonly found in living things.

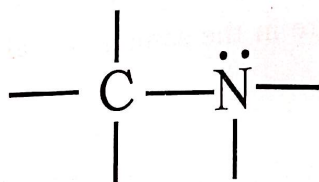
i) What is the correct name for saturated hydrocarbons?

(1 mark)

- A) Alkenes
- B) Arenes
- C) Alkanes
- D) Alkynes

ii) The functional group shown below is characteristic of:

(1 mark)



- A) Amines
- B) Amides
- C) Esters
- D) Carboxylic acids

iii) Ethanoic acid is a carboxylic acid used in:

(1 mark)

- A) Plastics
- B) Vinegar
- C) Electricity generation
- D) Cement manufacture

4) Fill in the blanks of the following sentences with the provided terms:

thymine, monosaccharides, phospholipids, carboxylic acids.

guanine, disaccharides, triglycerides, amino acids.

- i) Adenine pairs with in DNA. (1 mark)
- ii) Simple sugar that cannot be hydrolyzed into smaller units are called (1 mark)

iii) Lipids that contain a phosphate group along with fatty acids and glycerol are called (1 mark)

iv) Proteins are polymers made of repeating units called (1 mark)

5) Match polymer structure in the left column with its most corresponding name in the right column. (3 marks)

Polymer structure	Polymer name	Answer
i) $\left[\begin{array}{c} \text{CH}-\text{CH}_2 \\ \\ \text{CH}_3 \end{array} \right]_n$	A) Polystyrene	i)=.....
ii) $\left[\text{CH}_2-\text{CH}_2 \right]_n$	B) Polypropene	ii)=.....
iii) $\left[\begin{array}{c} \text{CH}-\text{CH}_2 \\ \\ \text{C}_6\text{H}_5 \end{array} \right]_n$	C) Polyethene	iii)=.....

6) Match each laboratory technique in the left column with its definition in the right column. (3 marks)

Technique	Definition	Answers
i) Precipitation	A) separates miscible liquid components with different boiling points	i)=.....
ii) Distillation	B) separates substances based on solubility differences	ii)=.....
iii) Solvent extraction	C) separates substances by first converting a solution into insoluble.	iii)=.....

7) Fill in the blanks of the following sentences with the provided terms.

potential difference, cathode, anode, electrolysis, electrochemistry,

i) The branch of chemistry that studies the relationship between chemical and electrical energy is called.....(1 mark)

- ii) In an electrolytic cell, oxidation reaction occurs at (1 mark)
- iii) The electromotive force (EMF) of a galvanic cell is the (1 mark)
between the two electrodes.
- 8) Circle a letter corresponding to the correct pair of terms. The order of provided terms should be followed accordingly.
- i) Atoms are, and compounds are formed when atoms combine in (1 mark)
- A) divisible; random proportions
B) indivisible; simple whole number ratios
C) fractional ratios; indivisible
D) variable; equal masses
- ii) Transition metals often form colored compounds and show variable oxidation states because of partially filled orbitals, and they are good conductors of electricity due to electrons. (1 mark)
- A) d; delocalized
B) s; bound
C) p; bound
D) f; localized
- iii) Elements in the same group of the Periodic Table of elements have similarbecause they have the same number of (1 mark)
- A) physical properties; neutrons
B) atomic radii; protons
C) chemical properties; valence electrons
D) atomic masses; energy levels

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9) Circle a letter corresponding to the correct pair of terms. The order of provided terms should be followed accordingly.

i) When preparing a solution, the substance taken in great amount is the while the substance in small amount is the (1 mark)

- A) solvent; solute
- B) solute; solvent
- C) solvent; solution
- D) solute; reagent

ii) In acid-base titration, a standard solution is used to, and the end point is usually indicated by (1 mark)

- A) change the pH of unknown solution; temperature change
- B) dilute the solution; increase in volume
- C) act as solvent; formation of the precipitate
- D) determine the concentration of an unknown solution; colour change of the indicator

iii) One of the main applications of acid-base titration is: (1 mark)

- A) determining boiling points of liquids
- B) measuring the density of solids
- C) determining the concentration of chlorine in drinking water
- D) separating mixtures by filtration

10) Answer with **True (T)** or **False (F)** each of the following statements about organic molecules.

i) Functional isomers have the same molecular formula and the same functional groups. (1 mark)

ii) The boiling point of members of a homologous series decreases as the number of carbon atoms increases. (1 mark)

iii) The molecular formula C_2H_6O can exist in two compounds with different functional groups: *ethanol* and *methoxymethane*. (1 mark)

11) Biochemical molecules are essential for life processes.

i) Which statement correctly describes the *main function* of carbohydrates in living organisms? (1 mark)

- A) Storage of genetic information
- B) Provision immediate source energy
- C) Long-term energy storage
- D) Formation of hormones

ii) Which statement correctly explains the *structure* and *role* of nucleic acids? (1 mark)

- A) Nucleic acids are long chains of nucleotides that store and transmit genetic information in living organisms.
- B) Nucleic acids are made of amino acids and mainly act as enzymes that speed up chemical reactions.
- C) Nucleic acids are composed of fatty acids and glycerol and serve as long-term energy storage molecules.
- D) Nucleic acids are polymers of simple sugar that provide structural support in cells.

iii) Which statement correctly describes *proteins* in terms of structure?

(1 mark)

- A) Proteins are made of glucose units.
- B) Proteins are triglycerides.
- C) Proteins are nucleotides.
- D) Proteins are polymers of amino acids.

iv) Which statement correctly describes the difference between DNA and RNA?

(1 mark)

- A) DNA contains ribose sugar, while RNA contains deoxyribose sugar.
- B) DNA uses the base uracil, while RNA uses the base thymine.

- C) DNA is usually double-stranded and contains thymine, while RNA usually single-stranded and contains uracil.
- D) DNA is found only in the cytoplasm, while RNA is found only in the nucleus.

12) Polymers are useful materials in daily life.

i) Which of the following is a natural polymer? **(1 mark)**

- A) Nylon-6,6-
- B) Polyethylene
- C) Cellulose
- D) Polyvinyl chloride

ii) Which of the following is a synthetic polymer? **(1 mark)**

- A) Starch
- B) Natural rubber
- C) Protein
- D) Nylon-6,6-

iii) Polymer reuse means: **(1 mark)**

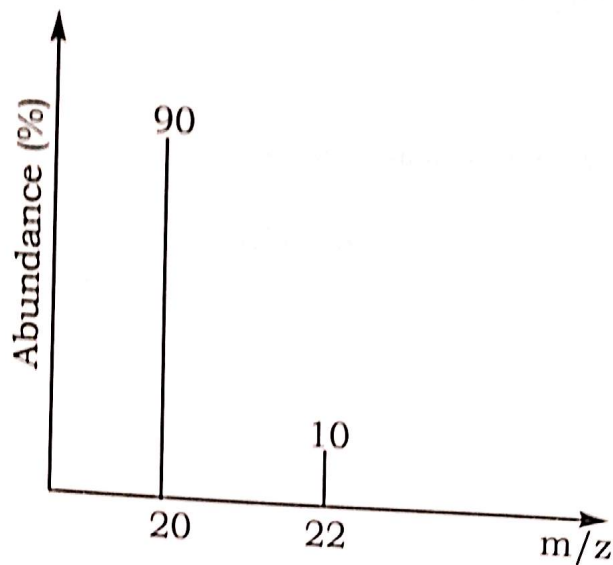
- A) Using polymer products again without changing their structure.
- B) Burning plastics after use.
- C) Breaking polymers into monomers.
- D) Burying plastic waste underground.

iv) Which property best explains why many polymers are used in making plastic containers like plastic water bottles? **(1 mark)**

- A) High electrical conductivity
- B) Lightweight and resistant to chemicals
- C) Solubility in water
- D) High melting point like metals

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- 13) The atomic number of an element **E** is 10 and its mass spectrum is shown in the figure below.



- i) How many isotopes does element **E** possess?

(1 mark)

- A) 4 isotopes
- B) 6 isotopes
- C) 10 isotopes
- D) 2 isotopes

- ii) How many protons does element **E** contain?

(1 mark)

- A) 10 protons
- B) 20 protons
- C) 22 protons
- D) 90 protons

- iii) How many electrons does element **E** contain?

(1 mark)

- A) 20 electrons
- B) 22 electrons
- C) 10 electrons
- D) 90 electrons

iv) What is the relative atomic mass (RAM) of **E**?

(2 marks)

- A) 90.0 amu
- B) 20.2 amu
- C) 22.0 amu
- D) 20.5 amu

14) When balancing chemical equations, different methods can be used.

i) Which one of the following is the correct method used to balance chemical equations? (1 mark)

- A) Filtration method
- B) Algebraic method
- C) Distillation method
- D) Precipitation method

ii) The balanced equation for the reaction between hydrogen and oxygen to form water is: (1 mark)

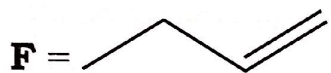
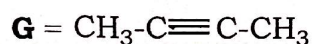
- A) $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$
- B) $\text{H}_2 + 2\text{O}_2 \rightarrow 2\text{H}_2\text{O}$
- C) $2\text{H} + \text{O} \rightarrow 2\text{H}_2\text{O}$
- D) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

iii) Which set of stoichiometric coefficients **x**, **y** and **z**, required to balance correctly the chemical equation: $x\text{KClO}_3 \longrightarrow y\text{KCl} + z\text{O}_2$?

(2 marks)

- A) $x = 2$, $y = 2$ and $z = 3$
- B) $x = 1$, $y = 1$ and $z = 2$
- C) $x = 1$, $y = 2$ and $z = 2$
- D) $x = 3$, $y = 3$ and $z = 1$

15) The structural formulae for compounds **F** and **G** are shown below.



- (1 mark)

(1 mark)

(2 marks)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

SECTION B: ATTEMPT ONLY THREE (3) QUESTIONS

(30 MARKS)

16) On analysis, an organic compound **Z** was found to be composed of 70.9% of carbon, 4.48% of hydrogen, and 24.62% of oxygen by mass.

i) What is meant by empirical formula? (1 mark)

ii) Determine the empirical formula for **Z**. (6 marks)

iii) Find the molecular formula for **Z** given that its molar mass is 201g/mol.

(Atomic masses: H = 1, C = 12, O = 16) (3 marks)

17) Organic compounds may be saturated or unsaturated.

i) Butane is a hydrocarbon, **H** with molecular formula, C_4H_{10} .

a) Write the structural formula for the two isomers of **H**. (2 marks)

b) Give the IUPAC names for isomers of **H** in (a) above. (2 marks)

c) Name the type of isomerism observed in (a)? (1 mark)

d) Write a balanced chemical equation that occurs when oxygen reacts with **H**? (2 marks)

e) State whether **H** is saturated or unsaturated. (1 mark)

ii) Given a compound **J** with molecular formula C_3H_6 . Give the two isomers of **J**, where one is acyclic while another is cyclic. (2 marks)

18) Qualitative and quantitative chemical analyses are two essential components of analytical chemistry.

i) Which of the following combinations best illustrates factors considered in qualitative chemical analysis? (1 mark)

A) pH, conductivity, concentration

B) Mass, volume, density

C) Pressure, temperature, viscosity

D) Colour, odour, solubility

ii) Which of the following is an application of chemical analysis in agriculture?

(1 mark)

- A) Determining water hardness in rivers
- B) Testing drug purity in pharmaceuticals
- C) Measuring nutrient content in soil for fertilizers
- D) Detecting food contamination in restaurants

iii) Given a list of statements that serve to compare between qualitative and quantitative chemical analyses. Fill in the table by matching the letters, A, B, C... with their corresponding numbers, 1,2 3.....

(8 marks)

- 1) Results are numerical, providing precise quantity or concentration of the substance.
- 2) Determines the presence or absence of a specific substance in a sample.
- 3) The primary objective is to measure the quantity or concentration of the substance accurately.
- 4) Flame test
- 5) Determines the amount or concentration of a specific substance in a sample.
- 6) Results are descriptive and non-numeric, providing information on identity of the substance.
- 7) The primary objective is to identify the qualitative composition of a substance
- 8) Titration

Criterion	Qualitative analysis	Quantitative analysis
Focuses on determining what?	A	E
Primary objective	B	F
One example of method involved	C	G
Types of results obtained	D	H

19) This question concerns acid base titration.

i) When sulfuric acid was reacted with sodium hydroxide, 25.0 cm³ required 30.0 cm³ of 0.200 M NaOH for complete neutralization.

a) Write the balanced chemical equation. **(2 marks)**

b) Calculate number of moles for each of NaOH and H₂SO₄. **(3 marks)**

c) Calculate the molarity of H₂SO₄. **(2 marks)**

ii) 250 mL of 0.12 M hydrochloric acid solution was prepared by diluting 10.0 mL of concentrated hydrochloric acid. Determine the original concentration. **(3 marks)**

20) This question is about solubility of sparingly soluble salts.

i) A solution is labelled *supersaturated*. Which statement best explains this condition? **(1 mark)**

A) It contains less solute than a saturated solution.

B) It contains maximum solute and cannot dissolve more.

C) It contains more dissolved solute than equilibrium allows and unstable.

D) It has equal ionic product (Q) and solubility product constant (K_{sp}).

ii) Which condition best justifies *precipitation* occurring in a solution?

(1 mark)

A) $Q > K_{sp}$

B) $Q < K_{sp}$

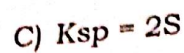
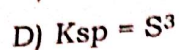
C) $Q = K_{sp}$

D) $Q = 0$

iii) Which expression correctly relates the solubility (S) to the solubility product constant, K_{sp}, for silver chloride? **(2 marks)**

A) $K_{sp} = S$

B) $K_{sp} = S^2$



iv) At 25°C, the solubility product constant, K_{sp} , for strontium sulfate, $SrSO_4$, is 2.8×10^{-7} .

a) Write down the dissociation equation for $SrSO_4$. (2 marks)

b) Calculate the molar solubility of $SrSO_4$ in pure water. (4 marks)

(Atomic masses: Sr = 88, S = 32, O = 16)

SECTION C: ATTEMPT ONLY ONE (1) QUESTION

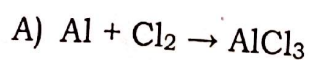
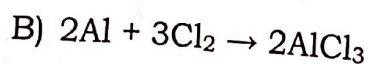
(15 MARKS)

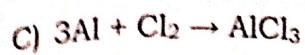
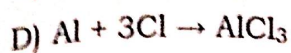
21) This question reflects on basics of inorganic chemistry.

i) Match each expression of concentration in column **A** with its most corresponding unit in column **B**. (4 marks)

Expression of concentration	Unit	Answer
A) Molarity	1) grams of solute/100 grams of solution	A)=..... B)= C)= D)=
B) Molality	2) moles/liter of solution	
C) Normality	3) moles/kg solvent	
D) Percentage (%)	4) equivalents/liter	

ii) Which chemical equation is *correctly* balanced for the reaction between aluminum and chlorine? (1 mark)





iii) Which of the following solutions has the highest molarity? **(2 marks)**

A) 2 moles in 2L

B) 0.5 mole in 1L

C) 3.0 moles in 5L

D) 1.0 mole in 0.5L

iv) A solution with molarity of 0.5M H_3PO_4 has a normality of: **(2 marks)**

A) 0.5 N

B) 1.0 N

C) 1.5 N

D) 2.0 N

v) When 9.8g of H_2SO_4 is dissolved in 200g of water, what is the calculated molality for this solution? (Atomic masses: H =1, O = 16, S =32) **(2 marks)**

A) 49 m

B) 0.20 m

C) 5.00 m

D) 0.50 m

vi) If 10 g NaOH are dissolved in 90 g of water. The calculated percentage (%) by mass (w/w) of this solution is: **(2 marks)**

A) 10%

B) 12%

C) 90%

D) 100%

vii) You are required to prepare 500 mL of 0.2 M sodium chloride (NaCl) solution. What is the mass of NaCl required? **(2 marks)**

A) 0.585 g

B) 5.85 g

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- C) 58.5 g
- D) 0.855 g

22) This question concerns electrochemical cells.

i) In a galvanic cell, the anode is:

(1 mark)

- A) site of reduction
- B) positive electrode
- C) site of oxidation
- D) high standard electrode potential

ii) In first Faraday's law, the mass of substance deposited depends on:

(1 mark)

- A) voltage only
- B) current and time
- C) electrode size
- D) power supply type

iii) Lead-acid battery is a:

(1 mark)

- A) primary battery
- B) non-rechargeable battery
- C) single-use
- D) secondary battery

iv) During electrolysis of molten NaCl, which *correct* half-reaction occurs at the anode?

(1 mark)

- A) $\text{Na}^+ \rightarrow \text{Na} + \text{e}$
- B) $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}$
- C) $2\text{Cl}_2 + 2\text{e} \rightarrow 2\text{Cl}^-$
- D) $\text{Na}^{++} + \text{e} \rightarrow \text{Na}$

- v) Match each technique in column A with its most appropriate explanation in the column B.

(3 marks)

Column A: Technique	Column B: Explanation	Answer
A) Electroplating	1) Extraction and purification of metals by use of electricity	A) =..... B) =..... C) =.....
B) Electrorefining	2) Coating an object with thin layer of metal by use of electricity	
C) Electrometallurgy	3) Purification of metals using electricity	

- vi) Consider a galvanic cell made of: $E^\circ (\text{Ag}^+/\text{Ag}) = +0.80 \text{ V}$

$$E^\circ (\text{Zn}^{2+}/\text{Zn}) = -0.76 \text{ V}$$

- a) Identify anode and cathode half-reactions.
b) Calculate the overall EMF of the cell.

(2 marks)

(2 marks)

- vii) Calculate the mass of silver (Ag) deposited when 3A of current flow for 20 minutes through silver nitrate (AgNO_3) solution.

(4 marks)

(Atomic mass Ag = 108, $1F = 96500 \text{ C}$)

END OF THE EXAM