CHEMISTRY SYLLABUS

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BOARD

INTERIM JOINT MATRICULATION BOARD EXAMINATION (IJMBE) CHEMISTRY SYLLABUS (REVISED 2012)

1.0 Introduction

1.1 Preamble

The IJMB syllabus prepares candidates for A-level examination and the Chemistry syllabus is designed to lay a solid and broad-based foundation on the advanced principles of the subject matter. The organization of the syllabus is as far experienced teacher may well wish to vary the order of presentation of topics. The basic and advanced principles of Chemistry are best understood by investigating them in the laboratory, therefore the Chemistry course should be firmly based on practical work. The theoretical and practical aspects of the subject should form an integrated whole. It is intended that most areas of the syllabus will be illustrated by references to Applications of Chemistry.

The assumptions that are made while drawing this syllabus includes

- i. that candidates must have covered and passed at credit level, the Chemistry and Mathematics syllabus at the Senior Secondary School (S.S.S) level.
- ii. that candidates have developed competencies and skills as spelt out in the Chemistry teaching syllabus at the Senior Secondary School level.
- iii. that each center has a well-equipped laboratory
- iv. that candidates are familiar with the use of significance figures, S.I units and the IUPAC system of nomenclature

1.2 Aims and Objectives

- a. Aims: The broad aims of the syllabus are to provide knowledge in Chemistry adequate for candidates who:
 - i. wish to continue the study of Chemistry in tertiary institutions particularly for entry at 200 level in the universities.
 - ii. require the advanced principle and application of Chemistry in their vocational studies.

- iii. want broad knowledge of Chemistry to enable them fit into the middle manpower requirements at the Chemical industry and therefore will end their study of Chemistry at this level.
- Objectives: The broad objectives of the syllabus are to:
 - build on the knowledge and skills acquired in Chemistry at the Senior i. Secondary
 - provide students with advanced knowledge in Chemical concepts and ii. principles
 - through efficient selection of content enable students to appreciate experimentation, accurate observation,
 - iii. recording, deduction and interpretation of scientific data.
 - laboratory skills enable students improve on and develop new i۷. including an awareness of hazards and safety in the laboratory.
 - appreciate the inter-relations of Chemistry with Physics, Geology, ν. Biology, etc.
 - appreciate the link between Chemistry and the industry, the vi. environment and everyday life in terms of benefits and hazards.

Syllabus Contents 1.3

The syllabus content consists of course topics/contents/duration and performance objectives/activities. The performance objectives are defined in specific, measurable and behavioural terms such as recall, state, identify, deduce, define, differentiate, sketch interpret, analyze, etc.; these performance objectives clearly reflect what the learners are expected to gain after they have been taught the topics.

A time framework has been attached to each main topic to ensure that the syllabus is covered before the IJMB examination. Some of the lecture hours could be used for tutorials on each topic to further enhance the teaching and learning process making for a better understanding of the lecture topics by students.

The Examination Structure

The examination will consist of three papers, paper 1, paper 2, and paper 3. Paper 1: The paper is a theory paper divided into section A and section B, a. which covers all aspects of General, Physical and Inorganic Chemistry. The paper shall be for duration of 3 hours and carries a total score of 150 marks.

- Section A: shall consist of ten (10) structured questions. Students are required to attend to at i.
- required to attempt all questions within I hour. (Total marks = 50) Section B: shall consist of six (6) essay questions. Students are required to attempt and formation of six (6) essay questions. ii. (Total marks. (1992) (1992) (Total marks. (25 marks.) (Total marks = 100).
- Paper 2: The paper is a theory paper divided into section A and section B, b. which covers all aspects of Organic Chemistry. The paper shall be for duration of 2 hours and carries a total score of 100 marks.
 - i. Section A: shall consist of ten (10) structured questions each carrying five (5) marks. Students are required to attempt all questions within I hour (Total marks = 50).
 - Section B: shall consist of four (4) essay questions. Students are ii. required to attempt any two (2) questions, within 1 hour. Each carries 25 marks. (Total marks = 50.
- Paper 3: the paper is a three (3) hour practical paper comprising of two c. questions and shall carry a total of 80 marks. Candidates will be required to answer all the two questions. One question is on quantitative analyses (50 marks) and one question on qualitative analyses (30 marks). The questions may also contain some aspects of theory of practicals.

1.5 Results

- The final IJMB examinations account for 80 percent (i.e. 330 marks scaled 1. down to 80 by multiplying score obtained with 0.2424) of the final score while the continuous assessment accounts for the remaining 20 percent.
- The 20 percent continuous assessment score is made up of 10 percent from 2. end of semester/mock examinations, 5 percent from practical exercises, 3 percent from class tests/assignments and 2 percent from regular class should be conducted under assessments attendance. written All examination condition. Record of continuous assessment should be kept up-to-date so that the examiner can periodically check question papers, scripts and marks obtained by students.

- 3. It is a condition that a candidate must have a score in each of the three examination papers and the continuous assessment to qualify for a final
- 4. At the end of the marking exercise each year, the subject panel will recommend to the IJMB board for approval a final grade scheme for the examination. The final grade recommended shall be in order of merit from A to F, with A, B, C, D, E, as pass grades and F as failure. The letter grade shall conform to the score range structure for the IJMB examination.

DETAILED SYLLABUS

FIRST SEMESTER SYLLABUS 132 Hours Lectures + 24 Hours Tutorials=156 Hours

S/	TOPICS AND CONTENTS	ACTIVITIES /	INSTRUCTIONA	DURAT
No	CONTENTS	PRACTICAL GUIDE	L MATERIALS	ION
_	NERAL CHEMISTRY	TRACTICIES COSS		
1.	ATOMS, MOLECULES	THE RESERVE OF THE PERSON OF T	P 1	
1.	ELEMENTS ANI	1		
	COMPOUNDS	Differentiate	Recommended	
	COMPOUNDS	· atoms	texts	8 hours
	(a) Definition of atoms	, between		8 nours
	molecules, elements and			
	compounds and interrelation	4 .		
	with one another			
1		Recall the laws of	Periodic table of	1
- 1	(b) The law of conservation of	i i a ambination		
- 1	matter, law of constant			
- 1	proportion, the combining		Four figure table	
	volumes, Avogadro's	and calculations based on		
	hypothesis: definitions and	the	Simple electronic	
	experimental verifications and	appropriate data	calculator	
1	calculations. Limitations of the	Egiptory and and the first		
	laws	(1) = 1		
- 1		a. Recall the ¹² C atomic	TO SELECTION OF	21 (
	(c) Atomic mass scale: 12C as the	a. Recall the C atomic	ababbas 1479	A
- 1	standard determination of the	Scale for resident	1012201	
Ι.	relative atomic and molecular	and molecular masses	The section of the se	
1 '	masses by mass spectrometry	b. Define isotopes and	5 PHOTON TRANSPORT	1
xii _ 1	(Details of mass spectrometry	give some examples	THE SUCHES SHOW	1.75
- 19	(Details of mass of	c. Calculate the relative	to observe all in	2.1
1	not required).	atomic mass of an	with Transport.	
	Lance to covered the	element from the	The branch a confe-	2.
1	Sunt 20	percentage abundances of	A thus golden	14
1	"Table Ma	the isotopes	out house. A	W.
1	Gibrari Vasal	no line to the restorest	ni.cd. Qualitative	50 [.
1	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	a. Define relative vapour		10
1 (0	d) Relative vapour densities and	density and state its		
Te	lationship With relative	relationship with RMM of		
l m	olecular mass (KIVIIVI).	relationship with Rivilly of		
n	etermination of molecular	a compound		
D	ass by Victor Meyer's method.	b. Describe Victor	source of source	
m	se of the simple gas law, PV =	Meyer's experiment for		17%
Us		RMM determination and		-12
nR	T to determine relative	the calculations involved		
mo	olecular masses of gases	c. Recall that the molar		
	1	volume of a gas at S.T.P.		
		is 22.4dm ³ declaration of	et a new weekland	
	biolitada 2	r to be to d		1 4
	Avogadro's number, the	ner to a same A Albania and	in the first of the second	11

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	mole as a fundamental unit in	DED BY WWW.READNIGERIANE	I WORK.COM
	Chemistry, mass and mole ratios	a. Define the mole and	1
4	in reaction	Explain the relationship	
	in reactions, mole concept and	with Avogadro's number	4.000
	its applications in volumetric	b. Recall that Avogadro's	Smoll 951 = Fire ison i
	analysis should be treated in	number is 6.023 x 10 ²³	· • • • • • • • • • • • • • • • • • • •
	details.	mole ⁻¹ .	
17,2	THE STATE OF SALES	c. Define molarity and	
	2 II Careb et au a	molality	
		d. Convert from one	2011년 전 기계
		concentration unit to	
		concentration and	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
		another	ROM CONTROL TO
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1	Lan ette.	expressing concentration:	Notice to the second se
1		moldm ⁻³ molkg ⁻¹ solvent,	
		w/w percent w/v percent,	32 (1973) 27 (17. c)
		mole ratio.	
1	as of Penedictals of the	f. Steps involved in	makes to work to
-	statements alone, at	solution preparation and	(3 Wil (32)) (1)
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	calculations involving	, get the set of
	there are I out I are best I	standard solutions of	13.00
	waying .	simple salts acids/bases	COSTINUE CONTRACTOR OF
	curentuals atems?	g. Explain and use the	to temporary tree
	Translated a		Annual Company del
	The state of the s	dilution principle m _c v _c =	
		$m_d v_d$ (c = concentrated	
<u></u>	CD OGG FE LOW DEG OF	d = dilute)	
2.	GROSS FEATURES OF	1311 110, 2124 312 1 1 1 1 2 2	The state of the s
1 .	ATOMIC STRUCTURE	to the result for retain-	St. Board. slet ma.c.abe
	rg/m	masurathin bin pulsasian	lime twends avident!
	(a) Electrical nature of atoms:	a. Describe Dalton's	Periodic table of 12 hours
	electrons, protons and neutrons	atomic theory and test it	elements
	from the works of Faraday,	in the light of the	e contamente la re-
	Goldstein, Thompson, Millikan,	contribution of each listed	Models of atomic
ĺ			1
	Moseley and Rutherford.		structure
		elucidation of atomic	
	Mathematical aspect not		Recommended
l	required. Qualitative treatment	0	texts
	only.	charges and masses of the	ch magaz svirateff ()
	5.0	3 fundamental particles in	hie distribution
	KANA Y CANA	an atom	1
		uded thitle . L or he return	110 [11] [2]
	(b) Atomic number, mass		Tr. Bullion roller
	number isotopes – detection and	a. Recall the definition of	TO CAME THE AND A SEC IS
		isotopes, atomic number	com Signer, segreta ving from the
	uses have read	and mass number	PRINCES OF THE STATE OF
	, 1 (\$37107)	b. Recall some methods	ed - greener nelp solver
- 1	10,000 11	of detection of isotopes	100 100 100 100 100 100 100 100 100 100
	1 1 1 1 1 1 1 m	described of isotopes	
17	(c) Models of the atom,	a State the arm "	
	qualitative descriptions of (i)	a. State the contributions	Models chart of s,
1	D 1 0 11	of - Rutherford,	I D and d out:
	Rutherford's atomic models,	Thompson and Bohr to	P and d officials
		4 5	400
		62	

electronic levels' energy (evidence emission from spectra). (ii) Bohr's atomic theory: the basic postulates arrangement of the electrons in the energy levels. Main levels, sublevels orbitals, electron spin, quantum numbers: principal, subsidiary, magnetic and spin. Shapes and symmetries of s, p and d orbitals. Energy level diagrams principle, Aufbau Pauli's principle, exclusion Heisenberg Hund's rule. uncertainty principle configuration. electron Degeneration of atomic orbitals and filling of electrons

The periodic law periodic table: The periodicity of electronic configuration leading to periodicity of properties such as atomic radius, ionization electronegativity and energy, electron affinities. Classification into s, p, d and f block elements. Horizontal, vertical and diagonal relationships to be mentioned. Note: Periodic table giving symbol, atomic number and be provided mass shall time the students at examination

- the theories of the atom
 b. Give the limitations of
 Rutherford and Bohr's
 analyses of the atom
 c. Explain the origin of
 lines in the spectrum of
 hydrogen using Bohr's
 theory
 d. Recall the use of K, L,
- d. Recall the use of K, L, M, N, etc to identify electron shells
- e. Define an orbital
- f. List and explain the significance of the 4 quantum numbers.
- g. Recall simple charge cloud representations of the s, p and d orbitals and the rules for assigning electrons into orbitals
- h. Sketch the shapes of the s, p and d orbitals
- i. Write electron configuration of atoms
- j. Recall the advantages of quantum model of the atom over other atomic models
- a. State the periodic law and Explain the terms period and group as they relate to the periodic table.
- b. Define the terms:
 electron affinity,
 electronegativity,
 ionization potential, etc.
 and Account for the
 variation of these
 properties in the periodic
 table
- c. Account for horizontal relationships between elements in the periodic table
- d. Identify s, p, d and f block elements from their electronic configuration and their block chemical

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3.	to and a solution of the solut	virtue of their ionization energy, electron affinities	of the Parker power of the effects o	
٥.	CHEMICAL BONDING Use of Lewis structure (electron dot/cross formula)		and exemply all loss	Emily
	dot/cross formular) to discuss;	of or year of M. M. See	a supposition of their s	ogenic, i
		lovel electron shippy	. Zar∳D i zburdidi.i	iny j
1	(a) Electrovalent (ionic bond)	a. Write Lewis structures	Periodic table of	12 hours
	importance of octet mile		elements	MG T
	explainvalences, importance of	b. List factors that will		a was
	ionization potential, electron affinity and electronegativity in	Market Control of the	Chart / model	suala F
	predicting bond types.	is ionic or otherwise.	showing nature of	Dager
	byna z	c. Recall that octet of electrons confer stability.	bonding in	er hun'
	Lning	d. Explain physical and	molecules	
		chemical properties of		
	10.75	ionic solids in relation to		-
	non.	bond type		
		Call Water Paris		
	(b) Covalent Bonds, comparison	a. Write Lewis structures for covalent compounds.	Model of diamond	
	of electron dot structures for	b. Explain unequal	and graphite	
	ionic, partially ionic and	sharing of electron pair by	structures	
	covalent bonds. Valence bond	bonded atoms.		
	description, electron sharing,	c. List some properties of		
	concept of hybridization, single,	covalent compounds.	rai stering of rugasa 1981 Jawa	(10)
	double and triple bonds. Polar covalent bonds e.g. H ₂ S, H ₂ O,	d. Explain sp, sp ² and		
	BCl ₃ etc. Prediction of bond	sp hybridization in carbons.	the state of the s	
	types using Fajan's rules and	e. Explain the	Models of CO,	
1 .	properties associated with bond	arrangement of carbon	H ₂ O, CO ₂ , CH ₄ ,	Trun To
1	types. The concepts of resonance	atoms and differences in	etc. molecules	Tieles
	to rationalize the possible	the physical properties in	Signal of the Louis Co.	P of the
	existence of multiple structures	diamond and graphite.	SO MARINE STATE OF THE	of the contract of
1.	1 Department	f. State Fajan's rule and use it to predict bond	make at a palety	1-1-1
ì	digi	type.	refined protein 6	italovi ot
1		g. Explain the concept of	Wall be the	Juny 1
	1 1000	resonance	to find the party of	
-	1 115 3 2/1	h. List common	action	UNITED AND
	7	compounds that have		1
	(c) Co-ordinate covalent bonds –	multiple bonds		4
7		Diff.		
	ammonium chloride,	a. Differentiate a covalent		1
1		bond from a co-ordinate covalent bond.		,
		64		

ammonia/borontrifluoride complex

(d) Metallic bonding – General properties of metals and explanation for them in terms of electron cloud structure e.g. metallic lustre, ductility, malleability, conductivity and cation formation. Brief comparison of electrons in atoms, molecules and metals in terms of energy levels

(e) Intermolecular bonding:

i. Hydrogen Bonding especially using hydrides of Group V to VII. Explanation of molecular association for H₂O and HF compare the dipoledipole effect that exists in acetone but not in butane.

ii. van der Waals forces. Explanation of existence in non-polar molecules, e.g. Helium. Relationship between the strength of van der Waals forces and phase change temperature e.g. bpt of inert gases and hydrogen halides: iodine(s) and ehlorine (g)

b. Explain the formation of co-ordinate bonding in transition metal complexes and hydrated ions, e.g. Cu with NH₃ and H₂O.

c. Identify some common ligands, e.g. NH₃, H₂O.

d. Relate ligands to Lewis bases

a. Explain metallic bonding and Account for metallic properties based on nature of bonding.

b. Differentiate between metallic and electrolytic conduction

a. Explain why Hbonding and van der Waals forces are called intermolecular forces.

b. Use H-bonding to explain why H₂O is a liquid but H₂S and HCl are gases; and why HF is a weaker acid than HCl

c. Explain why dipoledipole effect is absent in butane

a. Recall that in non-polar molecules electron arrangement occurs.

b. Recall that van der Waals forces increase with increasing dipole and size of the electron cloud.

c. Explain why Cl_2 is a gas but I_2 is a solid.

d. Use van der Waals forces to explain the low melting points of molecular solids such as candle wax, jodine etc.

Chart showing metallic bonding

Chart showing hydrogen bonding

- (f) Molecular orbital theory: Qualitative Description. Comparison with valence bond theory, combination of atomic orbitals for hydrogen and helium to give bonding and antibonding orbitals, non-existence of Be₂. Existence of H₂, O₂, and F₂. Introduction of p-orbital overlap and rules for electron distribution applied to second period molecules. Bond order calculations and application to simple molecules
- (g) Dipole moment:

Qualitative description and comparison for some molecules. Bond dipoles and molecular dipoles. No numerical problems to be given

(h) Shapes of molecules. Use molecular dipole moment in predicting and/or rationalizing molecular shape CO₂ e.g. (linear) SO₂ (non-linear). The concepts of bond angles and bond lengths (effect of atomic number, bond type and nature of group). Electron pair repulsion theory, basic assumptions e.g. octet molecules/ions: CH₄, NH₄⁺, H₂O, NH₃. Non-octet molecules: BF₃ SnCl₂, HgCl₂. Reasons for deviation in bond angles from expected values

- a. Differentiate between the valence bond theory and the molecular orbital theory.
- b. Write electron configurations for simple diatomic molecules using the molecular orbital theory.
- c. Calculate bond orders
- d. Predict existence or non-existence of simple molecules from bond order calculations.
- e. Differentiate between σ_s and σ_p orbitals.
- a. Define (qualitatively) dipole moment.
- b. Differentiate between bond dipoles and molecular dipoles.
- molecular dipoles.
 c. Use molecular dipoles to predict shapes of simple molecules e.g. CO_2 and SO_2
- a. Explain shapes of simple molecules.
- b. Explain the concepts of bond angles and bond lengths.
- c. State the effects of factors such as atomic number, bond type and nature of group on bond angle and length.
- d. Sketch shapes of some simple molecules.
- e. State the electron pair repulsion theory and use it to explain deviations in bond angles from expected values for some molecules.
- g. Use the concept of hybridization to explain bond angles in some octet molecules such as CH₄,

Saturated in too god se

	STOICHIOMETRY,	NH ₃ , H ₂ O, etc.		
4.	STOICHIOMETRY, OXIDATION- REDUCTION REACTIONS	in growth a landom parties con less to anticipate the season of season parties and seaso		
	Electronic concepts, half	a. Define oxidation reduction (Redox)	Voltmeter	4 hours
	reactions and oxidation number, Candidates will be expected to	reactions b. Recall the rules for		
	use the concept of oxidation	assigning oxidation	an State of to	10.5
	numbers and half reaction equations to balance oxidation	numbers to elements in	to the base of the second	11.2 29
 	reduction (Redox) reactions	- Bothe Common	organisations	A TOU !
	Walls to a received the W	oxidizing and reducing agents and their reactions.	0	A
1	101 (1	d. Use half reaction and		.]
- 1	rd un	oxidation number		
	O	methods to balance Redox reaction equations.		
		e. State and apply the		
	bendq	Total Calalicate Acady		
	imple A chart showing	equations in aqueous acid/alkaline medium.		
	g. of phase changes	f. Do volumetric analysis		4 🕪
	reid a mortic Distillation set up	with some Redox systems in aqueous medium	The state of the s	tanta i
	of the		and the line and	ra-cib f
		SICAL CHEMISTRY	it passing and h	SANGE !
	STATES OF MATTER	apour fath, sketchy co (m) a not heading curves	graffied begins to	t control
	(a) Gases - Ideal. Boyle's Law,	a. State all ideal gas laws	Simple charts	12 hou
- 1	Charles Law and the absolute		showing graphical	(Interest)
- 1	temperature scales, Dalton's Law of partial pressures,	b. Illustrate Boyle's and Charles' laws graphically.	representation of the gas laws	
	Graham's Law of diffusion,	c. Explain the concept of	the gas laws	
	General gas equation, Gay	absolute zero		
	Lussac's Law of combining	temperature. d. Evaluate volumes of		
	volumes, Avogadro's Law, the concepts of molar volume and	ideal gases (from moles at		6
	the value of the gas constant R=	S.T.P.) given suitable		
8	8.314 Jk ⁻¹ mol ⁻¹	data.		1
		e. Recall 22.4 dm ³ as molar volume of an ideal		1
	51	gas at S.T.P.		
-				!
	(1) 77	a. State the postulate of the kinetic molecular		
	(b) Kinetic molecular theory.	the kinetic molecular theory for an ideal gas	· ·	
	Derivation of the equation $PV = 1/3$ nmc ² from the postulate of	and the derivation of the		
			1	1
	the theory and its application to	expression PV=1/3nmc ² . b. Deduce the ideal gas	Eline z	

kinetic Alays Afron the **UPLOADED BY** molecular theory equation and State the causes of

(c) Real gases **Oualitative** account of deviations from ideal behaviour. Introduction of van der Waals' equation (qualitative account)

Liquids:

curves, super cooling, vapour

pressure and boiling point.

Effect of bond type on the

(d)

boiling point.

ideal and real gases. b. Identify the kinetic theory molecular postulate that may not hold for real gases at certain temperatures and pressures.

deviation of real gases from ideal behaviour a. Differentiate between

c. State the van der Waals equation and account for the constants 'a' and 'b' in the equation and relate the values for H₂& CO₂

intermediates between gases and solids. Changes of state, phase diagrams of one component system, cooling and heating

Liquids

a. Define phase and phase diagram

b. Sketch and label simple phase diagrams e.g. of water and carbon dioxide.

Use the kinetic molecular theory explain phase change.

d. Sketch cooling and heating curves and explain the various segments of the curves.

e. Account for liquid vapour pressure.

f. Define normal boiling point.

g. State the effect of bond type on b.pt of liquids.

h. Arrange liquids in order of increasing/ decreasing b.pt when the saturated vapour pressures are given at a particular temperature

a. List different types of solution.

Express solution concentration in different units.

C. Predict temperature

A chart showing phase changes

Distillation set up

Charts of liquid mixtures

(e) Solutions: solution solubility terminology,

THERMOCHEMISTRY (a) Relationship between chemical energy and thermal energy. Exothermic & endothermic reactions endothermic reactions, reactions, equations for reactions (b) Relationship between endothermic reactions thermal endothermic reactions equations for reactions (a) Relationship between endothermic reactions (b) Write thermochemical equations for reactions	separation of liquid mixtures by distillation or by cooling. Colligative properties, effect of non-volatile solutes on the phase diagram of pure solvents e.g. b.pt elevation and freezing point depression, boiling point elevation and related calculations. Osmotic pressure. Deviation from Raoults law. Brief mention of separation of non-ideal liquid mixture and formation of azeotropes.	Bronellics Dasca on with	Models of crystal lattice	
Landothermic [Cacions,]	(a) Relationship between chemical energy and thermal energy. Exothermic &	b. Write thermochemical	calculator / four	8 hours

thermochemical equations, effect of physical state on the heart of reaction and the use of energy level diagrams.

(b) Heat (or enthalpy) of formation, combustion, neutralization, solution (effect of lattice energy on the heat of solution, difference between integral heat of solution & at infinite dilution) dilution, reaction and change of state.

- (c) Hess's Law and its application
- (d) Energy factor in the formation of ionic compounds, the Born Haber cycle, lattice energy and calculations
- (e) Bond dissociation energy and calculation of enthalpy with particular reference to certain bonds e.g. C-C, C = C, $C \equiv C$, C-H, C = O, $C \equiv N$

ffect c. Draw energy level for exothermic months for exothermic and endothermic reactions and endothermic reactions.

a. Define the different heats of reaction.

b. Differentiate between the integral heat of solution and heat of solution at infinite dilution.

c. Relate latent heat to heat of change of state.

d. Explain the effect of dilution on heats of solution and hydration.

State Hess's law and apply to problems, e.g. in calculation of heat of reaction and heat of formation for reactants and products.

Calculate lattice energy using Born Haber cycle given relevant data.

- a. Differentiate between bond energy and mean bond energy.
- b. Write thermochemical equations to depict bond dissociation.
- c. Calculate heat of a reaction from mean bond energies and Explain why the heat of reaction by means of bond energy method may differ markedly from experimental values.
- d. Calculate bond energies for specified bonds in a compound from suitable data.
- a. Explain the concepts of spontaneity of reactions and entropy.

(f) Spontaneity of a reaction. Entropy as a driving force in thermochemical equations, effect of physical state on the heat of reaction and the use of energy level diagrams.

- (b) Heat (or enthalpy) of formation, combustion, neutralization, solution (effect of lattice energy on the heat of solution, difference between integral heat of solution & at infinite dilution) dilution, reaction and change of state.
- (c) Hess's Law and its application
- (d) Energy factor in the formation of ionic compounds, the Born Haber cycle, lattice energy and calculations
- (e) Bond dissociation energy and calculation of enthalpy with particular reference to certain bonds e.g. C-C, C=C, C=C,

(f) Spontaneity of a reaction. Entropy as a driving force in

- c. Draw energy level diagrams for exothermic and endothermic reactions a. Define the different heats of reaction.
- b. Differentiate between the integral heat of solution and heat of solution at infinite dilution.
- c. Relate latent heat to heat of change of state.
 d. Explain the effect of dilution on heats of solution and hydration.

State Hess's law and apply to problems, e.g. in calculation of heat of reaction and heat of formation for reactants and products.

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- d. Calculate bond energies for specified bonds in a compound from suitable data.
- a. Explain the concepts of spontaneity of reactions and entropy.

chemical reactions. Introduction of the idea of structural stability and thermal stability of products. The concept of free energy as a predictor of spontaneity. $\Delta G'' = \Delta H'' - T\Delta S''$ Alt'' - TAS'' Alt'' - TAS''		91 = 91 = = = = 11111111	READNIGERIANETWORK.COM
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viii. Sublimation melting and boiling points melting and boiling points to purify of organic		VI. D. (C.)	compounds.
viii. Sublimation melting and boiling points melting and boiling points to purify of organic	Ī		c. Relate the concept of
viii. Sublimation to purify of organic		vii. Liquid extraction	malting and boiling points
ix. Chromatographic separation		viii. Sublimation	of organic
i i i i i i i i i i i i i i i i i i i		ix. Chromatographic separation	compounds.
Som P			COT
(c) Detection and determination		(c) Detection and determination	
of elements (C, H, N, S and		of elements (C. H. N. S and	d
$\frac{1}{71}$		or cicinents (c, 11, -,	71

			of an ist of building	114 - 2
	halogens - sodium fusion test)	Candidates should:	and some to come of	
	1 10 10	the Lassigne	March State Con March	70
-1	Determination of empirical and	test (sodium fusion test)	The second of the second	7, (= ,)
1	molecular formular	in the detection of the	Thomas No. 11 PA PT	
1	1 17 19 1	in the detection of the	1g * 11 =	
1		elements nitrogen,		
1		sulphur and halogen in		
		organic compounds.		
	l distribution of the second o	ii Calculate empirical and		
		molecular formula from		
	p 1.	experimental data.		
	TO GOVERN	Схрениены		
8.	ELECTRONIC CONCEPTS			
	IN ORGANIC COMPOUNDS	. इंदियां की कि		•
	1 5 1007 3	ally de a long of the	Periodic table	6 hours
	(a) Hybridization (sp, sp ² , sp ³)	Candidates should:	Periodic table	Onours
- 1		i. Define hybridization		
	• :	ii. Sketch the shapes of	Charts on bonding	
	and the same of th	sp, sp ² , sp ³ hybridization.		
	3.21	iii. Describe the bond	Recommended	- 3
	. 4	angles of organic	text sendence oven	H at
	1			an ee
-	1	compounds that are sp,	วายเล่าเครียกคล ใช้ เหต	- 1/4
		sp ² , sp ³ hybridized.	Chart showing s,	
	1		p and hybrid	7
(b) Characterization of bond	Candidates should:	orbitals	go l
t	ypes into H ₃ C-CH ₃ , H ₂ C=CH ₂	a. Recall the term orbitals		
a	nd HC≡CH	and explain their	SAME OFFICE PRINCES I	Price 1
	bornet		garanti es piez ; i	100
-1	[[[[[[[[[[[[[[[[[[[involvement in bond		
- 1	siyortir d	types.		- 1
1		b. Characterize bond		
1		types of single, double		
1		and triple bond in organic	Parameter in the forests	Man 1
1		compounds.		eau
1			for management	(C) 1 -
		- covalcili.	nyunds d	
	tures of the police	bonding and explain σ	bus vinus	
1	2000 1 (m) 1 (m)	and π bonds formation,		3 1 0
		41 I		sale (Fig.
			to webbanian had	
	The second of th	characterize bond types		Leen
(c)	Effect of structure on	Marine of the or Fibrary		
` '	tivity:	Candidates should be able		. 55
: n		0:	walking to the	
1. P	plarity and dipole moments.		many this display	4
11.	Molecular association	Define each of the	halfield become	
hvdro	gen bonding.	oncepts with suitable	THE PERSON NAMED	1.1
ili In	ductive effect	kamples		n i port
en Tu	Factive Check	Polot	a desail a may all a	
v. El	ectrometric effect ii.	Relate polarity of		
v. Ste	eric effect bo	onds and dipole		Maria 1
	i mo	oments		1
•				
		Relate molecular		A STATE
	as	sociation and hydrogen		
	bo	nding.		
	00	nding.		
	iv.	Describe inductive		
		Describe inductive		

	1 0/101 - 10	effect particularly groups
	108	or atoms that exhibit
- 1	Tr' (1-17)	positive and negative
	n n	inductive effect.
	*	v. Explain the influence
	the state of the s	of electrometric effect in
		000000000000000000000000000000000000000
- 1	i i i i i i i i i i i i i i i i i i i	πbonded groups such as
		carbonyl, alkenes,
		alkynes, and benzene ring during chemical
- 1		during chemical reactions.
	0 2	
	Tory CL37 - 101	vi. Describe the effect of
1	1 (3)	bulky groups on the
-1	Melonia	reaction centre of an
1	no sino	organic compound during
		chemical reaction.
L-	1 forms of	rea awiting in the control of the strong con
-		YSICAL CHEMISTRY
9.		ed common i
	(a) Overall reaction and	a. Define overall reaction
1	elementary process	and Differentiate from Graph board 14 hours
	bas	elementary process.
1	l to b	b. Write overall reaction Calculators / four
		from a number of figure table
	order	reactions elementary
1	of half-	processes and identify
		intermediates of the
1		reaction.
	The state of the s	c. Differentiate between a
1		reaction intermediate and
1		
		an activated complex.
ĺ		7.00
	(b) Order and molecularity	a. Differentiate between
	concept	order and molecularity.
	Lightner	b. Differentiate between
	order	overall order and order
	making	with respect to a reactant
		of the reaction.
	10 2/	c. Deduce order from a
		given rate law.
	ban as-	d. Predict the change on
7	A Total	reaction rate with a
		change in a reactant
1		concentration given data.
7	thought a	1 1 1 1 1 1 1 1
	lmy-in	a. Represent graphically
	(c) First order rate law. Analysis	l
	of experimental results for first	the change in rate with
	order reactions.	reactant concentration
	order reactions.	a 1 st order reactant.
		J

- i. For gaseous reactions when pressure measurements are observed.
- ii. For homogenous liquid reactions e.g. acid hydrolysis of an ester.
- iii. For reactions in solution when a physical property is used, e.g. application of a polarimeter to measure angle of rotation.

- (d) Second order rate law. Analysis of experimental results for second order reactions.
 - i. For gaseous reactions and
 - ii. For reactions in solution

(e) Reaction of any order.
Analysis of experimental results.
The differential method of analysis log Rate = log k + nlogC as used in various physical systems.

THE R

- b. Recall that for a first order reaction 'ln (a/a-x) = kt' and perform calculations using the equation.
- c. Suggest suitable experimental methods to monitor the rate of known reactions.
- d. Recall that the rate law is an experimental law.
- e. Relate measured reactant or product concentration to a practically measurable quantity like pressure or angle of rotation.
- f. Analyze experimental results for first order reactions by making graphs or calculation.
- g. Differentiate between the differential and integral method of analysis.
- h. Interpret first order reaction in terms of half-life.
- a. Recall that for a 2nd order reaction
 - =1+kt
- a-x a

and perform calculations dom has using the equation.

- b. Analyze experimental results for second order reactions by making appropriate graphs or calculation.
- a. List the advantages and disadvantages of the differential method of kinetic data analysis when compared to the integral method
- b. Calculation of rate constant and order from suitable kinetic data for

- (f) Factors influencing the rate of reactions
- i. Concentration –
 Determination of rate law by
 observing the effect of
 concentration on rate and related
 calculation
- ii. Temperature Using simple collision theory to explain the effect of concentration and temperature.
- iii. Catalysis Qualitative treatment of types of catalysts and their modes of action.

(g) Activation energy.

Introduction of Arrhenius equation and the plotting of log k versus T¹ values from experiment.

reaction of any order.

- a. List factors that will affect the rate of reactions.
- b. Sketch the distribution of molecular energies at given temperature.
- c. Explain the effect of increased temperature on the energy distribution in 'b' above.
- d. Explain the effect of concentration and temp. on reaction rate using the collision theory.
- e. Relate activation energy to effective collisions.
- f. Explain catalyst effect on the activation energy of a reaction.
- g. Recall the two types of catalysts with examples.
- h. Explain the modes of action of heterogeneous & homogeneous catalyst.
- i. Define and explain the action of a catalyst poison.
- a. Recall that rate usually increases with temperature.
- b. Use the Arrhenius plot to explain the effect of temperature on the reaction rate.
- c. Deduce the activation energy from calculation and graphically given suitable kinetic data.
- d. Explain the significance of the activation energy and the pre-exponential factor in the Arrhenius equation.

ORGANIC CHEMISTRY

10. ALIPHATIC HYDROCARBONS

	Candidates should:		12 hours
(a) Aliphatic Hydrocarbon	(i) Recall the general		
i. Alkane	molecular formula	Models and chart	-
1.72	(ii) List the characteristics	showing nature of	
- Homologous series -	of a homologous series.	bonding in	
general formula	(iii) List and give IUPAC	organic molecules	
1 =	nomenclatures of the	ก็อ พ⊈ คุกค.	da I
- Nomenclature	members of the	NO. SECTION OF DAY	roo 1
	homologous series up to	uro i. fe	10 1
- Alkyl groups (up to decyl	carbon atom 20.		1. 1
and phenyl).	(iv) Recall how alkyl groups are derived from		
1	their corresponding	materials to the	
[(n 1 5)	alkanes and phenyl from	Suter	-51
Cast.	benzene.		
1.416 20	(v) List the alkyl groups		
	(up to decyl)		
arer a constant	(ap to accys)	14 years and the second of the second	
SV9ff-Oat	(i) Describe structural		1 1
- Structural isomerism (up to	isomerism in alkanes with		
decane)	up to five carbon atoms		
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	(pentane)		
	(ii) Draw the structural		
i i i i i i i i i i i i i i i i i i i	isomers of butane and		
	pentane.		
	(iii) Predict and draw		
	structural isomers in	5 1	1
1	cyclic compounds up to	21	
	five carbon atom.		
		Chart showing	
	Candidates should explain	variables of	' I I I
- Physical properties	the gradation of physical	physical	
(gradation)	properties from simpler to	properties of	f
	higher alkanes.	homologous	
	State of the state	series	
7.	Candidates should recall	Series	
- Preparation of alkanes from:	the methods used to	37590	
(i) Carbon(II) oxide,	prepare alkanes stating		
carbon(IV) oxide, and			
	reaction conditions.		. 1.
(ii) Alkenes and alkynes-	to area little of		
reduction.	Candidates should explain		.
(iii) Alkyl halides (Wurtz	the relative inertness of		
synthesis) and Grignard	alkanes to react.		
reagents.			
(iv) Other methods	e, como incerención de la como	, ,	
	Alegra especial di		
	Candidates should be able		1
- Chemical properties	to recall the following:	material property and the second seco	-
(i) December / 1	(i) halogenation of	Electrical Action of Applications on the second	, m
	alkanes and show	1	
to the property of the second	ulu Silow		

(ii) Reactions of alkanes mechanism of 1. Combustion chlorination of methane. 2. Substitution (ii) nitration of alkanes - Halogenations stating reaction condition(s) and product. (iii) combustion alkanes and relate this to the use of alkanes as fuels for energy production. (iv) the pyrolysis alkanes as an important industrial process e.g. cracking of petroleum. Candidates should recall that crude oil is made up of mainly hydrocarbons (To be treated in details - Petroleum later) Candidates should recall the name and general properties of cyclopropane cyclohexane. - Simple cycloalkanes: a. Nomenclature Candidates should: General properties of (i) Recall the differences cyclopropane to cyclohexane. between straight chain and ring compounds -- Shape and stereochemistry ring strain of molecules. (ii) Draw the shape of the first four members of the cycloalkane. (iii) Define conformation isomers in cyclic systems. Candidates should be able to: (i) Recall the general molecular formula

ii. Alkenes

- Nomenclature (dienes and trienes) (ii) Name members of the alkene homologous series

the

(iii) Describe the alkenes

using

nomenclature.

IUPAC

- Physical properties

- Positional and geometric isomerism (cis-trans influence on the properties)

- Preparation of alkenes from:

- a. Alkanols
- b. Haloalkanes
- c. Dihalides
- d. Petroleum

- Chemical properties

(a) Addition reaction

Candidates should recall and account for the gradation in properties from simple to higher members.

Candidates should:

i. Recall positional isomerism in alkenes due to the relative position of the double bond e.g. but-1-ene and but-2-ene.

ii. Recall that geometric isomerism is due to the nature of arrangement of groups around the double bond.

Candidates should:

a. Recall the methods of preparation of alkenes. In each case the starting materials and reaction conditions must be stated.

b. Define the terms, dehydration, dehalogenation, dehydrohalogenation.

c. Recall the process of cracking of petroleum.

Note:

(a) Differences in reactions involving alkanes and alkenes relates to the nature of single and double bonds.

(b) Starting materials and reaction conditions must be mentioned.

(i) Recall addition reactions with halogens e.g. bromination, with bromine water, with hydrogen (hydrogenation) and alkyl halide.

(ii) State Markovnikoff's rule and apply the rule to predict the product

Models showing shapes & stereo-chemistry of organic molecules- cis & trans isomerism

obtained from an unsymmetrical alkene compound. (iii) Describe the relevance of hydrogenation in the hardening of fats in the margarine industry. Recall the oxidation reactions of alkenes with O2, H2O2, RCO3H, H2SO4, MnO4 in each case stating the starting materials and reaction conditions. Explain ozonolysis and the decomposition products obtainable from ozonide. (c) Ozonolysis (i) Define polymerization (ii) Describe briefly addition polymers and their monomers. (iii) State the uses of polymerization, e.g. in the manufacture of PE, PVC, etc Recall the use of addition materials made
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(c) Ozonolysis (i) Define polymerization (ii) Describe briefly addition polymerization and List some addition polymers and their monomers. (iii) State the uses of polymerization, e.g. in the manufacture of PE, PVC, etc Samples of polymetic
(i) Define polymerization (ii) Describe briefly addition polymerization and List some addition polymers and their monomers. (iii) State the uses of polymerization, e.g. in the manufacture of PE, PVC, etc Samples of polymetic
(d) Polymerization (d) Polymerization (d) Polymerization (ii) Describe briefly addition polymerization and List some addition polymers and their monomers. (iii) State the uses of polymerization, e.g. in the manufacture of PE, PVC, etc Samples of polymetic
addition polymerization and List some addition polymers and their monomers. (ii) State the uses of polymerization, e.g. in the manufacture of PE, PVC, etc Samples of polymetic
and List some addition polymers and their monomers. (iii) State the uses of polymerization, e.g. in the manufacture of PE, PVC, etc Samples of polymetic
(d) Polymerization polymers and their monomers. (iii) State the uses of polymerization, e.g. in the manufacture of PE, PVC, etc Samples of polymetic
monomers. (iii) State the uses of polymerization, e.g. in the manufacture of PE, PVC, etc Samples of polymetic
monomers. (iii) State the uses of polymerization, e.g. in the manufacture of PE, PVC, etc Samples of polymeric
polymerization, e.g. in the manufacture of PE, PVC, etc Samples of polymeric
manufacture of PE, PVC, etc Samples of polymetic
manufacture of PE, PVC, etc Samples of polymetic
etc Samples of polymetic
polymetic
Recall the use of addition materials
Teaction with ordinary
water or bromine to test
for alkenes and to make a
- Test for alkenes distinguish between
alkenes & alkanes
551031 Million 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Candidates should:
Candidates silouid.
i. Recall the general
molecular formula and
name the members of the
homologous series up to
iii. Alkynes
Lam corbon atoms
ten carbon atoms.
ii. Recall alkynes as
- IUPAC nomenclature ii. Recall alkynes as another example of
ii. Recall alkynes as

as alkenes. - explain all the gradation in physical properties. Candidates should: i. Recall the terms dehydropagnation and dehydrohalogenation of ethyne and other alkynes from dihalides and tetrahalides. - Chemical properties a) Acetylide formation (Cu, Ag and Na acetylides) Chemical properties a) Acetylide formation (Cu, Ag and Na acetylides) Candidates should: i. Recall the formation of metallic derivatives of alkynes by Cu, Ag and Na using terminal alkynes. Candidates should in Recontermic nature of reactions of carbides obtained in (i) and their use in welding. Candidates should be able to: Show the mechanism of addition of water (hydration); hydrogen halides (hydrohalogenation) and hydrogen (reduction) to alkynes. Candidates should recall the polymerization of ethyne to benzene stating the reaction conditions. - Conversion of ethyne to benzene stating the reaction conditions. - Conversion of ethyne to benzene stating the reaction conditions. - Conversion of ethyne to distinguish between alkynes and alkanes. ii. Recall the formation of metallic derivatives to distinguish between terminal alkynes and alkenes.			A comment of the control of the cont	. 1
in physical properties. Candidates should: i. Recall the terms dehydrogenation and dehydrohalogenation. ii. Describe the preparation of ethyne and other alkynes to the preparation of ethyne and other alkynes from dihalides and tetrahalides. Chemical properties a) Acetylide formation (Cu, Ag and Na acetylides) Chemical properties a) Acetylide formation (Cu, Ag and Na acetylides) Candidates should: i. Recall the formation of metallic derivatives of alkynes by Cu. Ag and Na using terminal alkynes. ii. Recall the exothermic nature of reactions of carbides obtained in (i) and their use in welding. Candidates should be able to: Show the mechanism-of addition of water (hydration); hydrogen (hydration); hydrogen (hydration); hydrogen (reduction) to alkynes. Candidates should recall the polymerization of ethyne to benzene stating the reaction conditions. Candidates should: i. Recall the terms dehydrorand on mater of reactions of carbides obtained in (i) and their use in welding. Candidates should be able to: Show the mechanism-of addition of water (hydration); hydrogen (reduction) to alkynes. Candidates should recall the polymerization of ethyne to benzene stating the reaction conditions. Candidates should: i. Recall the use of bromination with bromine or bromine water to distinguish between alkynes and alkanes. ii. Recall the formation of metallic derivatives to distinguish between terminal alkynes and alkanes.		as alkenes.	-	
i. Recall the terms dehydrogenation and dehydrohalogenation and dehydrohalogenation. ii. Describe the preparation of ethyne and other alkynes from dihalides and alkynes from dihalides and tetrahalides. - Chemical properties a) Acetylide formation (Cu, Ag and Na acetylides) - Chemical properties a) Acetylide formation (Cu, Ag and Na acetylides) - Chemical properties a) Acetylide formation (Cu, Ag and Na acetylides) - Candidates should: i. Recall the terms dehydrogen and other alkynes by Cu, Ag and Na using terminal alkynes. ii. Recall the exothermic nature of reactions of carbides obtained in (i) and their use in welding. - Candidates should be able to: Show the mechanism of addition of water (hydration); hydrogen halides (hydrobalogenation) and hydrogen (reduction) to alkynes. - Chydrogen (reduction) to alkynes. - Conversion of ethyne to benzene stating the reaction conditions. - Conversion of ethyne to benzene stating the reaction conditions. - Conversion of ethyne to benzene stating the reaction conditions. - Candidates should: i. Recall the use of bromination with bromine or bromine water to distinguish between alkynes and alkanes. ii. Recall the formation of metallic derivatives to distinguish between terminal alkynes and alkenes.		- explain all the gradation in physical properties.		
alkynes from dihalides and tetrahalides. Candidates should: i. Recall the formation of metallic derivatives of alkynes by Cu. Ag and Na using terminal alkynes. ii. Recall the exothermic nature of reactions of carbides obtained in (i) and their use in welding. Candidates should be able to: Show the mechanism of addition of water (hydration); hydrogen halides (flydrohalogenation) and hydrogen (reduction) to alkynes. Candidates should recall the polymerization of ethyne to benzene stating the reaction conditions. Candidates should recall the polymerization of ethyne to benzene stating the reaction conditions. Candidates should: i. Recall the formation of metallic derivatives to distinguish between terminal alkynes and alkenes.	Preparation methods of	 i. Recall the terms dehydrogenation and dehydrohalogenation. ii. Describe the preparation of ethyne and 		
to: Show the mechanism of addition of water (hydration); hydrogen halides (hydrohalogenation) and hydrogen (reduction) to alkynes. Candidates should recall the polymerization of ethyne to benzene stating the reaction conditions. Candidates should: i. Recall the use of bromination with bromine or bromine water to distinguish between alkynes and alkanes. ii. Recall the formation of metallic derivatives to distinguish between terminal alkynes and alkenes. AROMATIC	carbide alkynes from dihalides and tetrahalides. - Chemical properties a) Acetylide formation	i. Recall the formation of metallic derivatives of alkynes by Cu, Ag and Na using terminal alkynes. ii. Recall the exothermic nature of reactions of carbides obtained in (i)		
i. Recall the use of bromination with bromine or bromine water to distinguish between alkynes and alkanes. ii. Recall the formation of metallic derivatives to distinguish between terminal alkynes and alkenes. AROMATIC	1. Water 2. Hydrogen	to: Show the mechanism of addition of water (hydration); hydrogen halides (hydrohalogenation) and hydrogen (reduction) to alkynes. Candidates should recall the polymerization of ethyne to benzene stating		
terminal alkynes and alkenes. AROMATIC	- Test for alkynes	i. Recall the use of bromination with bromine or bromine water to distinguish between alkynes and alkanes. ii. Recall the formation of metallic derivatives to	em divini se	
HYDROCARBONS	AROMATIC t	erminal alkynes and		
	HYDROCARBONS			

- (a) Structure and names of simple aromatic compound
- i) Benzenes and alkyl benzene
- Isomerism of benzene derivatives.
- iii) Naphthalene and anthracene
- (b) Benzene
- i. Physical properties
- ii. Aromaticity
- iii. Chemical properties
- Electrophilic substitution reaction

- Nitration
- Sulphonation
- Halogenation
- Alkylation and Acylation
- 2) Addition reactions
- i. Hydrogenation
- ii. Halogenation

- Candidates should:
- Draw the structure of benzene and its functional derivatives.
- Name the functional derivatives of benzene using IUPAC nomenclature.
- iii. Recall the existence of 1:2, 1:3, 1:4 isomers of disubstituted benzene.
- Draw the structures of naphthalene and anthracene.

Candidates should list the physical properties of benzene.

Candidates should describe the aromaticity of benzene.

Candidates should:

- i. List electrophiles and the reagents they are derived from.
- ii. Recall in terms of reagents, reaction conditions and products, the electrophilic substitution reaction of:

 Benzene with
- mixture of concentrated tetraoxosulphate(VI) acid and trioxonitrate(V) acid.
- conc. Tetraoxosulphate
 (VI) acid.
- chlorine and bromine.
- haloalkanes and alkanoyl halides in the presence of Lewis acids – Friedel Crafts reaction.

Benzene with

- hydrogen in the presence of transition metal catalyst.
- chlorine in the presence

Orbital models of benzene

8 hours

81

	.,		The second secon	
_		of light.	The second secon	
	3) Effect of substituents on the reactivity of benzene ring.	Candidates should: i. Explain the directing	rang land grow, areas as a second of the sec	
	Sit nov	iv. Show canonical	A STATE OF THE STA	
	11 20%	structures for ortho, para,		
		and meta attack.	in Chemical process	
	iv. Contrast benzene with	Candidates should use the		
	aliphatic unsaturated	following to contrast	50.07 Sillagorison [2]	
	compounds.	benzene with aliphatic	111 271 271 - 1	
	19	unsaturated compound.		
	1	i. Concept of resonance		
		stabilization.		
	i edelje.	ii. The electrophilic		
	1	substitution reactions.		
		iii. Aromaticity		
	(c) Resonance	Condition of the		
	(c) Resoliance	Candidates should - describe and draw the	nonett,v - i	
	i. Orbital model of benzene	orbital model of benzene.		
		oronar model of belizelle.		
	ii. Comparison with	- explain why benzene is	admentaletes -	
	hypothetical cyclohexatriene	more stable than		
	hder #	cyclohexatriene.	coductografist -	
	iii. Resonance energy	The state of the s	stead being non-strain.	
. \$	The resonance energy	- define resonance energy	Control of the State of the Sta	
	o.F.Go.	and explain and draw		
1		resonating structures of	atolicas moint (x, x)	
		benzene.	THE WAY AND THE STATE OF THE ST	
	iv. Rules for resonance	A de la companya de l	no missign Dit	
		- describe and apply the		
	v. Resonating structures of	rules for resonance.	100 100 100 100 100 100 100 100 100 100	
	- 31	20 20 20 20 20 20 20 20 20 20 20 20 20 2		

	benzene and directing influence of functional groups.	- relate the concept of resonance to the mechanism of substitution	-	4
	2.110	reactions of benzene and its derivatives.	1	
12.	TYPES OF ORGANIC	1772		
12.	REACTIONS			
	(a) Substitution reactions	Candidates should	Chart showing	6 hours
	i. Mechanism of S _N 1	- describe the mechanism	nature of $S_N 1$,	
	ii. Mechanism of S _N 2	of S_NI reactions and of	S_N2 , E1 and E2	
	1 1 7 1	S_N2 reactions	reactions	
	T	Candidates should:		
	iii. Factors that influences	i. Relate the structural		1
- 1	substitution reaction	effects of alkyl		
	a. Alkyl substituents	substituents, leaving		
	b. Leaving groups c. Nucleophiles	group on the halo- alkanes and the influence		
	d. Solvents effect	of nucleophilic reagents		1
	u. Solvents effect	on S_N1 and S_N2 reactions.		1
		ii. Recognize and list		
		nucleophilic reagent and		
		the nucleophiles derived		
		from them.		
	The second secon	iii. Recall the effects of		-
-		specific solvents in S _N 1		1
	- Lets	and S _N 2 reactions.	77 -	
	Posterillo e a c			1
	overtor 1	Candidates should:	1111	
	the state of the s	i. Recall the mechanism	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1,11
10	(b) Elimination reaction	of E1 and E2 processes		4 de
1	i. Mechanism of E1	using haloalkanes and		,
1	ii. Mechanism of E2	alcoholic		
	ii. Mechanism of 22	potassium/sodium	1 (15-49	e 1
		hydroxide to produce	The Board of the Me	
		alkenes.	1152	71.00
		ii. Recall the effects of the	The second of	1227
		nature of alkyl group,	,	1000
1		nucleophilic reagents and	ille on side.	e 1992 v
		solvents on the E1 and E2		
		mechanism.	second is become	311
		- predict reaction path		
	114			
	1 3.00	(Cililination	`	
ii	ii. Elimination versus	substitution) of substrate	f	
su	ıbstitution	under the influence o	1	
	1 81 60	nucleophilic reagents	,	
	i i i i i i i i i i i i i i i i i i i	solvents and the nature o	T	
		alkyl group.	1	1

i. Nucleophilic addition to polar double bonds.	compound with a polar double bond e.g. alkanals and alkanones. ii. The addition of an electrophile to an organic	and to a manufacture of the manu	
(d) Rearrangement reactions Brief mention only	compound with a non-polar multiple bonds e.g. alkenes and alkynes. Candidates should briefly describe the rearrangement reactions of carbonium ion. RGANIC CHEMISTRY		.d
13. HYDROGEN	Candidate should be able		4 hours
(a) Variable position of hydrogen in the periodic table.	to: - give reasons why hydrogen is placed in either group I (as group 1) or VII (as group 17).	Periodic table	(d)
(b) Occurrence and preparation from acid and water using active metal in the laboratory. Large-scale preparation of hydrogen from water gas (only the autility)	i. recall that hydrogen occurs as a molecule. ii. recall the methods of preparing hydrogen from active metals e.g. Na, K, Ca, etc from water.		
water gas (only the outline).			
water gas (only the outline). (c) Isotopes of hydrogen.			

EARTH METALS

Position in the periodic table and electronic configuration.

Occurrence

General properties with emphasis on comparison with the group (i.e. trends) in the light of physical and chemical properties.

Nature of their compounds: oxides, hydrides, halides, trioxocarbonates(IV) and hydrogen trioxocarbonates(IV)

Candidates should:

i. Write the electron configurations of the metals.

ii. Recall that, because the valence electron is in the s-orbital they are also called s-block elements.

Candidates should:

i. Recall that the elements are very reactive and as a result are always found in combined state.

ii. Give few examples of the important mineral ores.

Candidates should recall:

i. Characteristic physical properties of the elements and how these properties vary down a group and between the alkali and alkali earth metals.

ii. The characteristic flame colours shown by the compounds of the elements and application of this to qualitative analysis.

i. The reactions of the elements with oxygen, chlorine and water.

ii. That the oxides are normally basic and react with water to give alkaline solutions.

iii. That the oxidation states of the alkali and alkaline earth metals are +1 and +2 respectively.

iv. That sodium and potassium form peroxides while potassium alone forms superoxide, which is paramagnetic.

v. That the hydrides of

Periodic table

6 hours

-		these elements are ionic		
	and the second s	and react with water to		
	4 5 40	give alkaline solutions.	for the state of a	
1	ten.	vi. That the	and partial authorities at	
1		trioxocarbonates(IV) of		
1	T vest of	the alkaline earth metals		
		are not soluble in water.	1	4
1		vii. The uses of some of		
1	1	the salts e.g. NaCl,		
		CaCO ₃ , Na ₂ CO ₃ , MgCO ₃		
	i i			
			sommer:	011
1	1 - 11 3	domostro		
	\$ 10 L	pharmaceutical purposes.		
15.	BORON AND ALUMINIUM			
	GROUP	da er til a litter i i		
1	1 1 98	promote will be a		6 hours
1	Electron configuration	Candidates should:		
1		i. Write the electron		
1.	1	configuration of the		
1	1 500	elements.		
		ii. Recall that the		
			Almener brain	
	The state of the s	elements belong to the p-		
		block elements.	The state of the state of the state of	
- 1			1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	
		Candidates should recall	ate man presented to his	
	Occurrence	the important ores of		12
		aluminium, e.g. Bauxite	1	
- 1		and cryolite.		
- 1		1	, 1	
- 1	General properties	Candidates should ward		
		Candidates should recall		
,		the variation in the		
10	only)	physical properties of the	lı .	
		group (i.e. ionization		
- 1		potential, atomic/ionic	7.	
1		size, electronegativity,		
-		etc). A lane and a salar a shine	minus distribution	
1	1 4m 5	Lieu will be II il what	A second to	
10	hamical must a dis	a seed the seed of		
	hemical properties	Candidates should:	IV 15' andrush	111
	rief treatment of their	i. Give reasons why B ³⁺ is	no-jon	1011
0)	xides, hydrides (only borane	not normally formed but	· (Markette, ex	Joseph J
an	nd diborane) and halides.	Al ³⁺ exist is a simple ion.		[]
	, and mandes.	Chist is a simple ion.	(m)	1 1
	1 000	ii. Recall that alumina		
		(Al2O3) is used in		
V	1 71	chromatographic		
1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	separations.		
71	3050.0	::: D		
	[iii. Recall the chemical		
- 1	1 20M	reactions that lead to the	· · · · · · · · · · · · · · · · · · ·	
	10000	formation of boranes and		
		diboranes.		
		in D		-
		iv. Recall that boranes are		
		and all		

		- 1 , -	electron deficient and		
	Maria Maria		could form dative bonds		
			with an electron donor		
		915 B.	such as ammonia (NH ₃).		
		10.1	v. Describe the bonding		
	1 3 9 9 1 30 1		in diboranes.		
	21,	10	and disordines.		· \
16.	CARBON GROUP	A sec.			
	i Weigning	mit 5!	and the same of th		
mus A	Electronic configuration	n	Candidates should write		
	brogadly a	la unq	the group electron		
	- throughour	91.7	configuration		
	200 Julia - 1	inflat	gas lamper and the grant		6 hours
	20,000		Candidates should:		1. 3
		nemical	i. Explain trends in		4
	properties. The	unique	physical properties within		
	properties of carbon	should	the group.		
	be discussed.		ii. Recall that metallic		
			character increases down	112	1
			the group.	-	
- 1			iii. Recall that the +2	And I Bassin	11 4
			oxidation state becomes		
			more stable than the +4		
a ari d			oxidation state as the		
			atomic number increases.		
			iv. Recall that Sn(II) is		Y
			reducing and Pb(IV) is		
- 1			oxidizing.		
		55 1.0	v. Recall the concept of		
1		50/10/0	catenation and how it can	a long receiping the con-	
		7	be explained using	p. va h. rodel neme	
			ionization potential and	ear weeking	to a
- 1			inert-pair effect.		
1			In an Deller	1	
	Brief treatment of		Candidates should:		
			i. List few examples of	<u>}</u>	
	Oxides,		the oxides formed.		
	Hydrides,		ii. Describe the bond in		
	Halides and		CO ₂ and CO.		
	Sulphides		iii. Recall the poisonous	-	
	*		nature of CO.	v postublished V	
	Fire examplifiers.		Taille of CO.		
	Sand backers, fire		iv. Explain the differences		
11	Jerif W. eta. (m. (4)		I III tile sirastare		
7			properties of CO ₂ and		
			SO ₂ .		
			v. Recall that CO ₂ is an		
			acidic gas while CO is		
			neutral.		
			vi. Write simple chemical		
- 1			oguations for the	I	

		i do on escrit gradio	formations of hydrides (i.e. silanes), chlorides and sulphides. vii. List few uses of the sulphides such as PbS.		
	P	RACTIO	CAL CHEMISTRY = 60 Hou	irs ast 60 hours per semest	er
	Practical Chemistry is to	run conc	currently with Theory for at le Candidates should be able	Weighing	
A	WEIGHING PRACTI	[CE	to:	balances - top	6 hours
			i. Recall the principle of	loading and	
			weighing using the	analytical; -	
	-		analytical and top loading	- weighing	
			balances.	practice	
		Pa 200	ii. Recall the precision of		
		Alleria de	the two balances iii. Use the analytical	nerence to the same	
		all contra	balance to weigh	The second secon	
		nout I	accurately		
			All the second s		
В	INTRODUCTION	ТО	Candidates should be able	Burettes, pipettes	
	COMMON LABORA	TORY	to: have the stable to	beaker, conical	
	APPARATUS,	the self	i. Identify and recall the	flask, cylinder,	
	GLASSWARE,	AND	names of common	etc.	6 hours
	SAFETY PRECAUTION	DNS	laboratory apparatus.		
		2) (1) (ii. Recall the use of each		
		81 - 1 9 -	laboratory apparatus or		
	1	factors t	glassware.		
	Identification and us	es of	iii. Select the appropriate	* ************************************	
			apparatus for quantitative measurements based on		
	and glasswares.	Inc. h	the level of accuracy		
	3		required in the	1 02.5	1
- 1			experiment.		
4			iv. Take quantitative	A Chromosom Tain	
		Mar appli	measurement of volume		5
		1	using burette, pipette,		3 1 1
1		ar ichoff	beaker, measuring	Land Settinia	
			cylinder, etc. (Activity).	The 17	2
	Cafatyana	Strate St.			
	Safety precautions		i. Recall the safety	Fire extinguishers,	
			precautions to be	sand buckets, fire	
V			observed in the	blankets & first	
7		smalls of h	laboratory.	aid box	
3			ii. Demonstrate the use of	wid OOA	
			some common laboratory		2
			safety e.g. fire		
	1 1		extinguisher, first aid box		
		THE POST OF	etc (Activity).		
		3/1.			
				Apparatus for	1

		a L deidos	1	
		formations of hydrides		
		(1.C. Situites)		
	The second secon	and sulphides.		
		vii. List few uses of the		
	The state of the s	sulphides such as PbS.		
	i i	CO Ho	nrc	
	PRACTI	CAL CHEMISTRY = 60 Ho	east 60 hours per seme	ctor
	PRACTI Practical Chemistry is to run cor	icurrently with Theory for at h	Weighing	3101
A	WEIGHING PRACTICE	Candidates should be able	balances – top	
• -		to:		6 hours
	1 4 7 -	i. Recall the principle of	analytical; -	
	1.	weighing using the	- weighing	
	1	analytical and top loading	practice	*
		balances.	practice	
	71, 20	ii. Recall the precision of		
	27(4 ⁴ / ₂ *19)	the two balances	and the state of the state of	
		iii. Use the analytical	or and a second	
	F 600 100	balance to weigh	N	
	- vob	accurately		1
			Dan	
3	INTRODUCTION TO	Candidates should be able		
	COMMON LABORATORY	to:	beaker, conical	
	APPARATUS,	i. Identify and recall the	flask, cylinder,	1.
	GLASSWARE, AND	names of common	etc.	6 hours
	SAFETY PRECAUTIONS	laboratory apparatus.		
		ii. Recall the use of each		
	AND CO.	laboratory apparatus or	•	
		glassware.		
- 1		iii. Select the appropriate		
1	Identification and uses of	apparatus for quantitative		
	common laboratory apparatus	measurements based on		
	and glasswares.	the level of accuracy		
		required in the		
		experiment.		
		iv. Take quantitative	Selferma Selfent	
		measurement of volume	Les line	
		using burette, pipette,	i entinte	
		beaker, measuring	per - Jild	
		cylinder, etc. (Activity).	- Pales	2
	Con	in the first of the second sec		
-	Safety precautions	i. Recall the safety	Fine aution 1	
		Drocout's	Fire extinguishers,	
	production of the state of	Cheamad	sand buckets, fire	
4	y Your v	laboratory.	blankets & first	
		ii. Demonstrate at	aid box	
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ii. Demonstrate the use of		
		some common laboratory		
		safety e.g. fire		
	a transfer to the second of th	extinguisher, first aid box,		
	1 5 1 3 4 4 1 5 1	etc (Activity).	1	

	TITRIMETRIC ANALYSIS			
C	(a) Acid-Base Titration	Candidata	titration-burettes, 6 ho	
	- Acid-base titration	auto oc auto	pipettes, etc 6 ho	urs
	(neutralization)	10.	1	
	(neutralization)	i. Define neutralization.	pH meters	
	- Theory of acid base	ii. Recall common acids and bases and write	100 - 100	
	- Theory of acid base titrations	, , , , , , , , , , , , , , , , , , , ,		
İ	titrations	balanced reaction		
		equations for their reactions.		
	0.700.00			
	and out	iii. Explain the terms		
	1 1 Jan 2 1	weak acid and weak base		
	5. 8. 5.	or strong acid and strong		
	+ microsophic	base, hydroxonium ion,		
		concentration and pH. iv. Differentiate between		
	†			
	6-74 6	end point and equivalence		
Salter of		point.		9 hours
	Library	v. Explain why indicators		
		are used in neutralization		
		reaction		
		vi. Explain the working of		
		some common acid-base		
		indicator.	.	
		vii. Explain the choice of		
		indicators for	1	6 hours
		neutralization reactions.	Apparatus for	o nours
		viii. Sketch and explain		
- 1		the change of pH of a		
	, and	titration mixture with		
	1,000	volume of acid or alkal	1	
ł		added.	ı	
		Candidates should be able	e	
	- Preparation and	to:		Chours
	standardization of solutions	i. Explain the term		6 hours
2019/06/03	Statidardization	primary and secondar	y 1 12/1 (1.45	
1		standard substances an	d / / 1522 mg recirci na n	1 1
	1Ed the	solutions.	pa 1 1 1 4 1	
		ii. List some commo	n bytomeral at-object	1
_	10 1.0	primary standar	rd : grannuerus alfan e sen	1
1	to now	substances and the	2.0	-
7	A SIM ME	Substances		
		properties iii Prepare a standa	rd	
	to ca	1111		9 hours
11.2		solution of NaOH.	on.	
		iv. Standardize a solution	34	1
		of dilute H ₂ SO ₄ ac	cia	
		using standard NaC)H	
		solution.	1	
		v. Standardize a soluti	on .	
		of ethane-1,2-dioic ac	cid	
		or culture and		

Service Printing 10		using standard NaOH	man is all tank of	
25.15		solution	myldoda .	
- Titration using	double	Candidate should be able	(eranodoria sa	
indicator		i. Explain why Na ₂ CO ₃ is	Throny of an	
		titrations	, , .	
	ı	ii. Obtain suitable titration data to calculate the	and the C	
		concentration of NaOH and Na ₂ CO ₃ present in a		
		mixture using double indicator methods.		•
	na la	Candidates should be able		
(b) Redox Titrations	0.1 - 1	to: i. Define oxidation and		6 hours
- Introduction to reaction titration	redox	reduction reactions. ii. Balance redox		
reaction thration		reactions in aqueous acids		
		solutions using common oxidizing and reducing		
		agent. iii. give names and		
		formula of some common oxidizing and reducing		
		agents in the laboratory. iv. List some primary		li d
		standard substances used in redox titrations.		
	-21			
- Redox properties		Candidates should be able to:		
potassium	of	i. Explain why titrations with KMnO ₄ do not		6 hou
tetraoxomanganate(VII), potassium		require an external indicator.		
heptaoxodichromate(VI) tetraoxodicarbonate(III)	and	ii. Explain the effect of		
(oxalate).		pH on the reaction of KMnO ₄ with a reducing		
3	1 '	iii. List advant		
40.		KIVIIIU4 Or KaCr O		
Y = 11.		volumetric analysis		
	i	KMnO ₄ solution		
		KMnO ₄ solution using a standard ethane-1,2-dioic acid solution (Activity)		

v. Recall that the titration aqueous tetraoxodicarbonate(III) ion with common oxidizing agent is always at elevated temperature. vi. Standardize a solution of iron(II) using standard solution of KMnO₄ (Activity) vii. Recall that ethane-1. 2-dioic acid can react as an acid and as a reducing agent. viii. Analyse quantitatively an ethane-1,2-dioic acid Na₂C₂O₄ mixture by the double titration method (acid-base and redox) Candidates should be able to: i. Explain the iodometry - Redox reactions involving iodine (iodometric titrations) Write balanced reaction chemical equation for the reaction of iodine with Na₂S₂O₃. iii. Explain why the starch indicator is added only close to verv equivalence point of the titration and not at the beginning. iv. Explain the role of the and iodate tetraoxomanganate (VII) ion in iodometry. v. Standardize aqueous Na₂S₂O₃ solution using standard potassium iodate hence and solution determine the number of molecules of water of hydration in the hydrated Na₂S₂O₃ (Activity). Candidates should be able

Iodometry applied to the determination of percentage purity of an impure sample of copper(II) tetraoxosulphate(VI) pentahydrate solution.	i. Write balanced chemical reaction equation for the reaction of copper(II) ions with the iodate ion. ii. Titrate the liberated iodine from the reaction in (i) above with Na ₂ S ₂ O ₃ solution using starch indicator. iii. Calculate the percentage purity of the copper (II) tetraoxosulphate(VI) pentahydrate using the titre data in (ii) above. iv. List the precautions that are taken. v. Explain the functions of potassium thiocyanate in the reaction.	
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SECOND SEMESTER SYLLABUS 108 Hours Lectures + 24 Hours Tutorials = 132

S/NC	: TOPICS AND CONTENTS	ACTIVITIES	10 1	
3,1.0	10 . Edgide	ACTIVITIES / PRACTICAL GUIDE	INSTRUCTIONA	DURAT
	PH	YSICAL CHEMISTRY	L MATERIALS	ION
17.	CHEWICAL	CHEWISTRY		10.1
	EQUILIBRIUM	1 12 10 10 10 10 10 10 10 10 10 10 10 10 10		M
H	(a) Familitain V	a. Recall various	pH meter	
	(a) Equilibrium Laws and Equilibrium Constants -		, and the	14 hours
į.	Equilibrium Constants -	various terms up to e.g.	Universal	14 nours
	Properties of a system in	$Kp = Kc (RT)^{\Delta n}$	indicator paper,	1
	equilibrium, the general	indic di	litmus paper	
	equilibrium expression as an	equilibrium $\Delta G = 0$	acid/base	
	experimental result, (No	c. Write expressions for some equilibrium	indicators	1
	derivation based on rates of	some equilibrium reactions e.g. dissociation	Standard buffer	
	opposing reactions). The	of H ₂ O ₂ , contact process		
	dynamic nature of	etc.	Solutions	**
	equilibrium should be	d. Recall that equilibrium	1017	1
	appreciated especially when	are dynamic and that the	The second second	1.
	$\Delta G = 0$. K should be	principles of equilibrium		
	expressed both in terms of	depends on the		
	pressure Kp, and in terms of	equilibrium amount of		
	concentration Kc.	reactants and products,		
		which is dependent on		
		temperature.		
		e. State the factors that affect the equilibrium		
		values and position.		
		f. State Le Chartelier's		
	10. 10	principle		
1		g. Explain why catalyst	-	
		has no effect on position		
j		of equilibrium but affect		
- 1		the rate at which	·	
	2	equilibrium is attained.		
	(b) Relationship between Kp	a. Deduce the effect of		
	and Kc - examples	change in concentration,		
7	i. Dissociation of H ₂ O ₂	pressure and temperature		
	ii. Esterification reaction	on the position of		
	iii. HI equilibrium	equilibrium using the Le-		
	iv. Contact process in the	Chartelier's principle,		
	manufacture of H ₂ SO ₄	given suitable data	9.0	
	v. Synthesis of NH ₃ and PCl ₅	b. Compare and contrast	5	6
		values of Kp and Kc for a	gra - 7 T	
		given reaction, and	21	
		distinguish between the		

(c) Ionic Equilibrium

Ionic Product of Water, pH, pH scale:

Dissociation of water, water acting as a base as well as an acid.

pΗ Definition of measure of hydrogen ions concentration in solution. pH scale, common ion effect definition. Mixtures of weak acids and its highly ionizable solution, buffer definition and composition. Buffer actions of NH4Cl / CH₃COONa NH4OH; CH₃COOH, calculation of pH values of buffer mixtures from Hasselbach Henderson equation.

(d) Acid/Base Equilibrium
Definitions of acids, bases
and salts in terms of
Arrehnius concept, Proton
transfer concept (Bronsted

Kp and Kc.

a. Define pH in terms of hydrogen ion concentration.

b. Write $pH = -\log_{10}[H^+]$ c. Write expression for the dissociation of water as $Kw = [H^+][OH^-]$.

d. State why water is acting both as acid and base.

e. Calculate pH of a solution given the concentration of hydrogen ion present in moldm⁻³ for strong acid/base and for weak acid/base when K_a or K_b is given.

f. Define the term common ion effect and state the effect of common ion in solutions such as CH₃COONa/CH₃COOH_(aq)

CH₃COONH₄/CH₃COOH₍
aq), etc

g. State the importance of pH in various disciplines e.g. Agriculture

h. Write Hasselbach Henderson's equation for buffer solution i.e.

pH = pKa + log[salt][Acid]

i. Calculate the pH of a buffer solution using the expression above.

j. State the importance of selecting an acid whose pKa is very close to the pH desired.

a. Recall various definitions of Acids and Bases in terms of Arrhenius, Bronsted-Lowry and Lewis concepts.

b. Define conjugate

Samples of hydrolysable salts such as CH₃COONa, FeCl₃, NH₄Cl

Lowry), conjugate acid/base pair and Lewis concept. Relative strengths of acids and bases. Dissociation of weak acids and bases in water. (Do not treat dissociation of polybasic acids and bases).

base/acid and be able to write the conjugate base of an acid e.g. the conjugate base of CH₃COOH (acid) is CH₃COO based on the fact that the difference between an acid and its conjugate base is a proton (H⁺).

- c. The calculation of pH of a solution when the H ion conc. is given.
- d. Write equilibrium expression for dissociation of weak acids and bases in water.
- e. Recognize the fact that H⁺ ion cannot exist and so easily combine with H₂O to give H₃O⁺ ion, which is a measure of acidity of a solution.

(e) Hydrolysis of salts
Definition and types e.g.
hydrolysis of salts formed
from strong acid/weak base,
weak acid/ strong base, weak
acid/weak base.

- a. Define hydrolysis and
- b. Distinguish hydrolysis from hydration.
- c. Write expression for hydrolysis of various salts in solution e.g. CH₃COONa, NH₄Cl, and CH₃COONH₄.
- d. Explain why salts such as NaCl, KCl, Na₂SO₄ do not undergo hydrolysis.
- e. Write expression for hydrolysis and get the hydrolysis constant K_h given suitable data.
- f. Calculate the extent of hydrolysis.
- g. Calculate the pH of hydrolysed solution.
- a. Categorise indicators into weak acids or weak base.
- b. Categorize from their dissociation constants e.g.

(f) Hydrogen ion Indicatorsor acid-base IndicatorsTheory of acid-base

			11.27 - 12.70 - 12.70 - 12.11	
		phenolphthalein has $K_{In} =$	Service Street	
	of of	phenolphthalein has 1511 2.0 x 10 ⁻¹⁰ is a weak acid 2.0 x 10 ⁻¹⁰ is a weak acid 2.0 x 10 ⁻¹⁰ is a weak acid	The last of the la	
	selection	2.0 x 10 ⁻¹⁰ is a weak = 3.1 while methyl orange = 3.1	Missile Andrews	
	suitable indicator for a	I weffivior	3. 21-1	
	titration.	v10 a Weak base in hie	1 / Vill 2 / 1 / 1 / 1 / 1	
	mation.		1 7	
		indicators for a titration.	productions	
			the section of the second	
		Lativeen Cliu Por		
		- the number and the		
		end point can have the		
	ing indicator	end point can with		
	Hydrogen ion indicator	same value with		
		equivalence point.		
	1	i a distribute illustration i		\
		- cuitable Dri Colour		
		charge data 101 titue	</td <td></td>	
	1 -51 - 41	auch as HCI VCISUS		
	1	NOT HEL VEISUS	_ () `	
	1 4.72 14.	NI OH (use weak base		
	1 - 1 - 1	indicator), CH ₃ COOH		
	1	indicator), CH ₃ COOH versus NaOH (use weak		1
	1.54.50	versus NaOII (dase		
		acid indicator)		
		e. Sketch the curves of pH		
		versus concentration of		
		base or acid (titration	- 1	
	1 1000	ourse)		
	1 2000	f. Use of pH meters in	THE TO MACHINE A TO	
		volumetric analysis.	is the boundary	
	Tell de	Volumente attas	Service And Services	
	1 - 11: - 20	a. Distinguish solubility	s a play Buoles may	
	1 11.0	a. Distinguish solution	and moule them inco	
	Lm N	product expression from	ment distribution	
		general equilibrium		
	(g) Solubility Products	expression e.g. $AB(s) \rightleftharpoons$		
	Limit to slightly soluble salts	$A^{+} + B^{-}; K_{sp} = [A^{+}][B^{-}]$	l au la min a	
	Limit to Signify Solution	b. State the meaning of	Chart showing	
	(and no hydrolysis).	solubility products in	solubility curves	
	10	terms of products of		
		concentration of ions in		
	1 A 1			
		solution.		*
	lo tare	c. Determine the solubility		
		of sparingly soluble salt in		
_ 7	1 90 15	water when the solubility		
	312 131	product constant is given		
		and vice versa.		
7				
		d. State the effect of		
) (200m)	common ion on solubility		
	Il a so	of compounds such as		
		BaSO ₄ e.g. solubility of	th you associated	
	•	BaSO ₄ in 100 dm ³ of	•	
- 1		0.100 mole dm ⁻³ Na ₂ SO ₄		
	Parties 1 and 1 an	0.100 mole am Na_2SO_4		

		solution [K _{sp} = 1.5 ×10 ³]. e. State various applications of solubility product - Determination of sparingly soluble salts - Precipitation (prediction) - Precipitation of insoluble salts - Inorganic analysis – precipitation of sulphides
	Ol	RGANIC CHEMISTRY
18.	HALOALKANES	
N	(a) Nomenclature	Candidates should name any haloalkanes using IUPAC nomenclature 8 hours
	(b) Preparation from i. Alkenes and hydrogen halides	Candidates should recall all the preparative method stating starting materials

and reaction condition ii. Alkanols and PX3 or PX5 Candidates should recall and apply Markovnikoff's (X=Cl, Br) iii. Alkanols and hydrogen predict to rule halides products. Candidates should recall stating starting materials (c) Chemical properties and reaction conditions of i. Nucleophilic substitution the following reactions of reaction with Grignard haloalkanes with: reagents, Ag₂O/H₂O, aqueous i. Grignard reagent for alkanol, potassium cyanide, alkanol formation after KSH and NH₃ hydrolysis. ii. Ag₂O/H₂O for alkanol formation iii. Wurtz coupling for alkanes synthesis. iv. Potassium cyanide for nitrile formation. for Ammonia alkanamine formation. vi. KSH for thiol and sulphide formation. Candidates should recall the formation of alkenes ii. Elimination reaction with the elimination alcoholic potassium/sodium reaction of haloalkanes hydroxide with alcoholic potassium/sodium hydroxide Candidates should: i. Name, draw structure (d) Name, structure and uses and mention the uses of of trihalomethanes CHCl₃, CHI₃ and CHBr₃ ii. Mention the use of fluorochloromethanes as refrigerants and its effects on ozone layer. Candidates should

(e) Halogen derivatives of aromatic compounds (only chlorobenzene)

i. Physical properties

Candidates should describe the chemistry of only chlorobenzene as representative of halobenzenes.

Candidates should list the physical properties of

1				
	9-12-1	chlorobenzene		
	ii. Methods of preparation	Candidates should: i. Recall the Friedel Crafts chlorination of benzene ii. Describe the Sandmeyer's reaction (i.e.		
	gu Tipy also	benzenediazonium ion and Cu ₂ Cl ₂ / HCl reaction	900	
	iii. Chemical properties i. Grignard ii. Wurtz - Fitting iii. Aryl Lithium iv. Reactions with amines	Candidates should recall the reactions of haloalkanes stating the starting materials, reaction conditions and products.		
19.	HYDROXYL	non tending to a		
	COMPOUNDS (a) Alkanols i. Introduction – primary, secondary and tertiary alkanols.	Candidates should recall the classification of alkanol as primary, secondary and tertiary with examples.		8 hours
	ii. Nomenclature	Candidates should: i. Name alkanols using IUPAC nomenclature. ii. List the uses of important alkanols e.g.	zita Manera da	
	iii, Preparation	candidates should be able to describe the methods of preparation of alkanols stating reaction conditions, starting materials and class of		
11	Para sa gentus:	alkanol product.i. Recall the hydration and	majarus teleprod () udis to enderso ()	
	- From alkenes	hydrolysis of alkenes and haloalkanes respectively	TOUGHT IN WALL	
	- From alkanals and alkanones	ii. Recall the importance of reduction process and Grignard reagents in		1 1 1 1
	From alkanoic acidsBy hydrolysis of	alkanol synthesis.		

)	
haloalkanes - Industrial method of preparation of ethanol by fermentation	iii. Describe in detail the industrial preparation of ethanol by fermentation and the economic importance of fermentation industry.
iv. Physical properties of hydroxyl groups	Candidates should describe the effect of -OH group on physical properties - hydrogen bonding.
v. Chemical properties - Williamson synthesis - Esterification - Dehydration - Alcoholysis	Candidates should: i. Recall all the reactions of alkanols listed stating starting materials, reaction conditions and product formed.
- Oxidation - Acidic and basic properties	ii. Explain acidity of ROH, metal alkoxides and salt formation with Bronsted acids.
vi. Polyhydroxyalkanes: diols and triols	Candidates should: i. Draw the structure and names of simple polyhydroxylalkanes e.g. ethane-1,2-diol and

and mple e.g. and propane-1,2,3-triol ii. Recall the oxidation of alkenes to diols. iii. Mention the source of propane-1,2,3-triol from hydrolysis of triglycerides in soap manufacture. Candidates should: a. Explain the acidic nature of phenol. (b) Phenols: comparison of b. Recall the directing the properties of alkanols ability of -OH with those of phenol. electrophilic substitution reaction on the benzene ring of phenol: i. Bromination, ii. Nitration

c. Relate the reactions of

iii. Sulphonation

-				
		the -OH group on alkanols		
	the second second second	I to the -OH group on		
	Lite in	bucilot III.		
	1 0.11 713	i. Ether formation		
	1 100	ii. Esterification	,	
		iii. Alcoholysis in reaction		1
		With haloalkanes		
	l valura.	d. Recall the test for	the the lateral control of	
1		phenol using iron(III)	" despi manhat a	
1	and the t	chloride	marken branghi)	
1	B107327	110/0 2 2/105	The sales of the	
7.	1	Candidates should	- Sodwin learner	
J		compare the properties of	At the diployoners and	
	l za	alkanols with those of	- An adoptica	*
	al and	phenols.	with his difference	
	CAPPONT	auto to roug		
20.	CARBONYL	in a series and a		
	COMPOUNDS	Candidates should:		8 hours
1	(a) Polarization of carbonyl	i. Recognize the carbonyl		
	compounds	functional group		
	l mostly	ii. Describe the		
	The same of the sa	polarization of the		
	stations	carbonyl group in alkanal		
	Transfer me	and alkanone.		
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	iii. Recall the differences		
		in their structures.		
	lisser			
	13	Candidates should draw		P .
	(b) Structure and	the structure and give		
	nomenclature	IUPAC names of some		
	in the fact to	alkanals and alkanones.		
	The state of the s	Thomas and		
	(c) Alkanals - preparation	Candidates should recall		4
	from:	the preparation of alkanals		
	i. Oxidation of primary	stating starting materials,	a manabiyO vi	
	alkanols	reaction conditions and	Janiorana	
	ii. Ozonolysis of alkenes	products.		
	iii. Reduction of alkanoic	- stabon inc		
	acids	and the same of th		
	iv. Addition of water to	the state of the s		
	alkynes	and the same of the same	to minusted of	1
	to not	Military Strategic Control	, beginning	
7	(d) Alkanones - preparation	Candidates should recall	with any or significant	
	from:	the preparation of		
11	i. Oxidation of secondary	alkanones stating starting		
1	alkanols	material, reaction		
	ii. Alkanoic acids	condition and products.		
	iii. Alkanols	and or the other	in the second second	
		e ya podame da d	11 29 3	
-	iv. Ozonolysis of alkenes			
	v. Decarboxylation of			

	calcium salt			
	(e) Physical properties	Candidates should recall the effect of alkanals and alkanone structures on		
	(f) Chemical properties i. Addition reactions with - Grignard reagents - Hydrogen cyanide - Sodium hydrogen tetraoxosulphate (IV) - Ammonia - Alkanols	physical properties. Candidates should: i. Recall the nucleophilic addition with all the reagents stating starting material, reaction conditions and products. ii. Use illustrations of these reactions to understand the basic principles of organic reaction mechanisms.		
	ii. Condensation reactions		maximin's (a)	
	with - Methylamine, - Hydrazine - Hydroxylamine - Phenylhydrazine	the condensation reactions and apply this to explain the reactions, stating starting materials, reaction conditions and products.		
	iii. Aldol condensation	Candidates should recall the steps or mechanism of aldol condensation and	b) Suncture	
		understand the structural requirement for aldol condensation	c) Alkanals + p	
	iv. Oxidation of carbonyl compounds	alkanones using VM-O	i Oxidazion of elkanols u. Ozonolysis of al in. Reduction of	
1	v. Reduction of carbonyl compounds - Hydride reduction	Candidates should: i. Recall the reduction of alkanals and alkanones to	k.ids iv. Addutest of tikynes 3) Alkanomis - (
	The species of the sp	borohydride, lithium aluminum hydride and other hydrides	mener Li Goldanson od Oktobersky	
	, as reduction	ii. Recall reduction of hydrocarbon by hydrogen and	, eti ja sikla i Rykliji . Li oren 192	

	vi. Cannizzaro reaction vii. Tautomerism	reduction. Candidates should describe Cannizzaro's reaction showing its mechanisms Candidates should recognize and recall ketoenol tautomerism in certain carbonyl compounds.		
	(g) Distinguishing test for alkanols and alkanones.	Candidates should recall and explain the silver mirror test (Tollen's reagent), Fehling's test and the Iodoform test distinguishes between alkanals and alkanones.		CO,
	(h) Aromatic carbonyl compounds (benzaldehyde and benzophenone only)	Candidates should: i. Name and draw the structure of simple aromatic alkanals and alkanones. ii. Recall the influence of the aryl ring on the reactivity of the carbonyl group.	mos, on leason of the owner treath. moit about the owner treath. moit about the owner.	
(a	ALKANOIC ACIDS a) Structure and omenclature	Candidates should: i. Recall the alkanoic acid functionality ii. Draw the structure and name of simple alkanoic acid.		10 hours
) Physical properties lydrogen bonding)	Candidates should: a. Explain the existence of hydrogen bonding in alkanoic acid and its effect on physical properties b. Explain the difference of hydrogen bond in alkanol and alkanoic acid with emphasis on their relative strength.		

(c) Resonance effects acidity Comparison with alkanols.	Candidates should recall: i. The acidic behaviour of alkanoic acid when compared to alkanols. ii. The effect of resonance stabilization of the carbonyl group on acidity.	
(d) Preparation from i. Oxidation of alkanols and alkanals. ii. Hydrolysis of nitriles iii. Grignard and carbon(IV) oxide	starting materials and	
(e) Chemical properties i. Esterification ii. Reduction iii. Decarboxylation electrolysis	Candidates should: i. Recall the esterification with alkanol, the reduction with lithium aluminum hydride, decarboxylation of acids and Kolbe electrolysis. Stating starting materials, reaction conditions, and products. ii. Recall the reactions as attack of nucleophiles at the carbonyl groups of the acid.	Annat Almary in the annathment of the second district of the second
Suns.	Candidates should: i. Draw structure and name some aliphatic acyl halides ii. Describe the preparation from the reaction of alkanoic acid with phosphorus(V) chloride, phosphorus(III) chloride and thionyl chloride.	Anti-paginansymi gard and angorba

ii. Alkanoic anhydrides

Candidates should:
i. Draw the structure and

	- Structure and name	name of alkanoic	
1	Proposition	anhydride (both aliphatic	
1	- Preparation	and simple aromatic)	
1	fac-ritte	ii. Describe the preparation of ethanoic	
	and the second	anhydride.	
	1 heap	(10.5)	ne in early a way
		Candidates should:	
	iii. Alkanamides (Amides)	i. Draw and name some	
	- Structure and name	alkanamides	2 32 31
	- Preparation	ii. Describe the	
1		preparation of amides	
		using - Ammonium	
		trioxocarbonate(IV) and	*
1		heat	
. [- Alkanoic acid and	
		ammonia or alkanamines	Section 1
		Candidates should:	N
	iv. Nitriles	i. Describe nitrile as	
	- Structure and name	organic compounds with	
- 1		the cyano group and being	
		unsaturated.	In the second se
}		ii. Draw structure and	
		name some nitriles	
1		iii. Describe the	
	- Preparation	preparation by the	
		following methods:	4. so summer A 10
1		Dehydration of amides	
	100	with phosphorus(V)	
		oxide.	* 1
1		- Heating haloalkanes	
1		with alcoholic potassium	
		cyanide.	
		with a second type of the	*
		Candidates should	eta a emilia de 1
		describe the method of	
		preparation and chemical	
		reaction in detail.	
		The same I was a grant of the same of	
	1 +	Candidates should recall	
	Alkanoates (esters)	the preparation of	
	Alkandates (esters)	alkanoates stating starting	
17"		material and reaction	
	franci	conditions:	
	- Method of preparation		
1		i. Reaction of alkanols	
		with alkanoic acid	
		ii. Reaction of alkanols	
1		with acyl chloride or acid	

	onbudrida		
- Chemical reactions Hydrolysis Reduction	anhydride. Candidates should recall the following reactions stating starting materials, reaction condition and products: (i) Alkali and acid hydrolysis - The industrial importance of alkali hydrolysis which is known as saponification reaction, which results in soap formation must be mentioned. (ii) Reduction with lithium aluminum hydride, sodium in ethanol and Reduction with ammonia/Na Candidates should draw the structure and name	Alkanamides (Am., Smuchare und nes., Preparation.)	
(g) Dialkanoic acid (Dicarboxylic acid)	oxalic and malonic acid using nomenclature. Candidates should:	moitumopas -	
(h) Aromatic acids	i. Mention benzoic, salicylic and phthalic acids as examples of aromatic acids. ii. Draw the structure of the acids.		
(i) Fatty acids	Candidates should: i. Mention fatty acid as long chain alkanoates. ii. List some members of the fatty acid group. iii. Recall the process involved in the saponification and hardening of oil and its	V Parkhel Ho Foundation	
22. NITROGEN AND	relevance to the chemical industry. NORGANIC CHEMISTRY		
OXYGEN GROUPS			

(a) Electron configuration and occurrence (b) Physical and chemical properties - Formation of simple oxides and nitrides (b) Physical and chemical properties - Formation of simple oxides and nitrides (c) Explain the differences between nitrogen and oxygen in their respective groups. (ii. Recall that oxygen and sulphur combine with many other elements directly, forming compounds that are abundant in nature. (iii. Recall the formation and properties of NO, N ₂ O and NO ₂ . (iv. Describe the industrial preparation of sulphur (IV) oxide and ammonia. v. Give the stoichgmetry of the principal oxoanions of uitrogen and sulphur (Recall the properties). vii. List the allotropes of sulphur and recall how they are formed. viii. Give the importance of inorganic nitrogen and phosphorus compounds in agriculture. viii. Give the importance of tetraoxosulphate(VI) acid in the manufacture of detergents. ix. List some environmental impact of some compounds of nitrogen and sulphur. x. Relate the formation of nitrides to the diagonal relationship that exist						
properties - Formation of simple oxides and nitrides between nitrogen and oxygen in their respective groups. ii. Recall that oxygen and sulphur combine with many other elements directly, forming compounds that are abundant in nature. iii. Recall the formation and properties of NO, N2O and NO2. iv. Describe the industrial preparation of sulphur (IV) oxide, sulphur(VI) oxide and ammonia. v. Give the stoichometry of the principal oxoanions of uitrogen and sulphur (e., NO3, SO3, NO	(a an	n) Electron configured occurrence	guration	recall the percentages of nitrogen and oxygen in	The transfer of the state of th	
nitrides to the diagonal	1 1	operties - Formatinple oxides and nitri	ides The property of the prop	The candidates should: i. Explain the differences between nitrogen and oxygen in their respective groups. ii. Recall that oxygen and sulphur combine with many other elements directly, forming compounds that are abundant in nature. iii. Recall the formation and properties of NO, N2O and NO2. iv. Describe the industrial preparation of sulphur (IV) oxide, sulphur(VI) oxide and ammonia. v. Give the stoichometry of the principal oxoanions of nitrogen and sulphur i.e. NO2, SO3 ² , NO3, SO3 ² , SO4 ² . vi. List the allotropes of sulphur and recall how they are formed. vii. Give the importance of inorganic nitrogen and phosphorus compounds in agriculture. viii. Give the importance of tetraoxosulphate(VI) acid in the manufacture of detergents. ix. List some environmental impact of some compounds of nitrogen and sulphur. Pedete the formation of	tion persons a	8 hours
hetween Li and Mg.			anoth l	relationship that exist between Li and Mg.		4 1

90.00.1	(a) Occurrence and electron configuration	Candidates should: i. List some compounds from which the elements are obtained. ii. Write electron	THE PRODUCT OF	6 hours
	14 2 mg/4/92	configuration of the elements	Accel Carrier	
	(b) Physical properties (fluorine, chlorine, bromine and iodine).	Candidates should recall and explain the trend in physical properties within the group.		
	(c) Chemical properties	Candidates should be able to recall i. that all HX compounds	01	
	i. Formation of TIX compounds. ii. Formation of metal halides	are water-soluble and are acidic in nature.	10,	
	including AgCl. iii. Simple reaction of halide salts.	ii. the reactions of halide salts with concentrated tetraoxosulphate(VI) acid.		
	iv. Formation of oxo compounds.	iii. the analytical importance of the		
	v. Formation of inter-halogen compounds.	reactions between Ag ⁺ and X iv. the existence of the		
	50°,	various oxidation states of chlorine as exhibited in the oxo-anions.		
		v. the uses of chlorine gas as a poisonous gas and as		
	in the	a disinfectant. vi. the uses in the manufacture of pesticides,		
	Some	polymers and refrigerants. vii. few examples of inter-		
	hu sho	halogen compounds		
24.		SICAL CHEMISTRY		
7. 1	ELECTROCHEMISTRY	a. Explain oxidation and		
F	Explanation of oxidation-	reduction in terms of	Simple galvanic	
r	eduction reactions in terms	oxidation number and	cells, Batteries	12 ho
	f oxidation number and	electron transfer.		
e	lectron transfer.	b. Identify oxidation-		
	1 1 2 2 2	reduction from equations		
D	EDOV Događina	e.g. in $Z_n(s) + Cu^{2+}(aa) =$		
1	EDOX Reactions	$Zn^{2+}(aq) + Cu(s)$ as $Zn(s)$		
(a) Metallic conduction,	$= Zn^{2+} + 2e^{-} $ (oxid) and		

electrolytic conduction, electrolysis of molten NaCl, aqueous NaCl, Na₂SO₄, molten cryolite, aqueous CuSO₄ using inert electrodes, aqueous CuSO₄ using copper anode.

(b) Electrochemical cells and Faraday's laws. Standard Electrode potential (IUPAC). Drawing / writing of cell diagrams e.g. Li⁺ + e⁻ = Li (E° = 3.06 V).

Laws of Electrolysis
Application to simple system.
Solutions to problems
relating mass and current.

(c) Chemical Changes result in generation of Electric Energy, Galvanic cells, study of some cells – Daniel cell, Dry cell, storage cell, Fuel cell, etc. $\frac{Cu^{2+}(aq) + 2e^{-} = Cu(s)}{(red)}$

- c. Deduce/write equations of redox reaction.
- a Define the terms, conductor, electrolytes electrodes cathode anode ions etc.
- b. Predict the direction of spontaneous change for redox reaction.
- c. Analyse the electrolysis of certain electrolytes e.g. dil.HCl, NaCl (molten), NaCl(aq), CuSO₄(aq).
- d. State the effect of concentration, position of ions in electrochemical series and nature of electrodes.
- e. Write half equation i.e. what happens at the anode and cathode respectively. The nature of resultant electrolyte.

Importance of Electrolysis in industry:

- a. Recall definition of standard electrode potential and standard redox potential and the convention for presentation of all.
- b. Recall the bases for defining a standard electrode potential
- c. State the use of the standard hydrogen electrode.
- d. Interpret ionic half equation in terms of electron transfer.
- e. State laws of electrolysis.
- f. Calculate the masses and volumes of substances deposited or liberated given suitable data.

(d) Electrode - Potential and Electrochemical series. Variation of change in free with energy (ΔG) Graphical concentration. explanation of the relationship $\Delta G = \Delta G^* - RT$. Derivations of equation $E=E^*-0.059 \log_{10}K$ Variation of cell potential with concentration. Solution to problems relating E and K. i.e. Determination of e.m.f. of a cell when concentration are not unity. Spontaneity of reaction. ΔG = - nFE Calculation of standard free energy change (<Gs) and equilibrium constant of a cell reaction. a. (e) Corrosion of Metals

g. State the significance of the Faraday. h. State the applications of electrolysis in connection with corrosion. Distinguish between and electrochemical electrolytic cell. i.e. the electrochemical cell is used to generate energy electrolytic while decompose energy to compounds. b. Recall that Galvanic cell is an example of electrochemical cells and give examples. c. State the importance of storage cells. standard the Use electrode potential of each element to ion determine the species that will be oxidized and reduced in each case. i.e. predict the direction of spontaneous change. b. Interpret the electrochemical series in terms of electrode potentials. c. State the application of electrode potentials connection with corrosion problem. d. Relate ΔG to the electrode potential, E of the cell. e. Recall that there is a relationship between E and the equilibrium constant (Nernst equation). State causes of corrosion of metals. Explain various

methods of prevention of

	From the standpoint of	corrosion.		
	electron transfer.	0011031011		
	Prevention of corrosion,	c. Explain why particular		
		13 USC(1 In COOK)	(Action reco	
	1	The Hall Other	The second second	
1150	Lotte 17	1 C.S. FC Coated with 7	.14	1 530
		I and not be coated with	The state of the s	110000
25.	NUCLEAR CHEMISTRY	Tin (Sn).		
23.	ACCESS AC	The state of the s		
	(a) Type and nature of	10 100 000		
1	Radiations, charges, relative	T Suigusti Delween		
- 1	mass of particles and	ordinary and nuclear	Chart showing	
	i una		penetrating power	
- 11	penetrating power of radiations.	simple indereal	of α , β , γ radiation	6 hours
		reaction equations.	7777 = = = = = = = = = = = = = = = = =	• Hours
	Simple nuclear equations.	c. State type of changes		
		and particles and their	entropy of the	
		relative masses.		
		query Hall	() Y	
1	(b) Half-life as a measure of	a. Define half-life and		1 30
1.1	stability of the nucleus,	explain its significance.		12.13
1	stability belts. Types of	b. Distinguish between		1.35
	radioactivity - natural and	natural and artificial		10-01
	artificial.	radioactivity i.e. one is		1 - 2
	Alpha and beta particles,	due to excess mass while		
- 1	gamma rays. Geiger Muller's	the other is caused by	nauthous le visiones	3
	detectors, Radioactive carbon	(energizing) bombardment	1	
	dating.	with particles such as	d d	
-		neutrons.		
		c. Give uses of nuclear		
1	N. Las Francis	fission and fusion.		1 1 2
	Nuclear Energy	d. Name common detector	2 1	
	Nuclear fusion and fission;		in to head with	1.0
	nuclear reactors as means of	used.	153	107
	thermal power generation	e. Evaluate quantitatively	som theoloff	
	(General discussions in	energy, using Einstein		
	details)	equation $E = mc^2$		iii
1	Uses of radioactivity in	f. Recall the various units		
	agriculture, medicine and	of energy e.g. MeV and	BOROLES SERVICE	1 10
	industry.	Joules.		
	bas.	g. Recall uses as atomic		
	165.0	bomb (Give examples of		
		Hiroshima, Japan event) -		
1		Carbon dating etc.		
		h. Define Isotopes, Isobars	Sections in the second	
		and Isotones.		¥
	Street	i. Recall the specific uses		9
-	grote	of radioactivity in specific	185 th 201 - 1 cg	
	5,012	fields e.g. in Analytical		
		Chemistry as a tracer	92.11.2	
	1			and the second
		(reaction mechanism).		1

	ORO	GANIC CHEMISTRY		
26.	AMINOALKANES		y 0, 4 1. **	
	(Amines)	and the second second	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	, , ,	Candidates should:		
	(a) Structure and	a Classify aminoalkanes		6 hours
	nomenclature	as primary, secondary and		
	nomenetatare	4 - 4		-
		the structure of		
		mantioned III (m)		
		shows For aromane district	en bus 33 1	
		of amino benzene	PROTESTS SHOULD	
		or we also	of particle	
	- 155 - 500 Table 7	Name the amilies using	ewort \$1,000m	
	Transmitted to the second	IUPAC nomenclature.		1
	A Second Control of the Control of t	, and the second	marie and the supply	
		Candidates should		
		the Dhysical		
	(b) Physical properties	showing that		
			and a sun shid-link	(1)
		bonding and	कता के साल	B k
		strength		P 5
		when compared with -OH	men - Ti honon	La l
		group.	ficeal.	17.2
			and but the	q l
		Candidates should		nus l
		describe the basicity of		or b
	(c) Basicity of aminoalkanes	aminoalkanes and	25	m Park
		compare basicity of		
		aromatic and aliphatic	,	
		aminoalkanes	local male	
		annioaikanes	icar Energy lear favion	
		Candidates should be able	THE PERSON NAMED IN COLUMN 1	
		2007 1 10/2	THE REPORT OF THE PARTY OF THE	
	(d) Method of preparation	to: i. Recall the methods of	is reword fru	
	from:		secured foro	. 1
	i. Haloalkanes	proparation	(88	Halland I.
	ii. Alkanols	starting material, reaction	a Lagorbia To	25]
	iii. Hoffmann degradation	conditions and products.	afters, moderne	1011 L
1 1 2	iv. Beckmann	ii. The mechanism of	Tr.y.	end -
	rearrangement	reaction for Hoffmann		
1	v. Reduction of nitro and	degradation and	/ ·	
	cyano compounds.	Beckmann rearrangement		
		must be shown.		
		and the second second		
	(e) Chemical properties	Candidates should:		
	Co, Comment Property	i. Recall the reactions		
	1 100	listed stating starting		
	- Diazotization	materials, reaction	III.	1
	- Diazotization	,	ia l	
	Agylatias	conditions and products.		
	- Acylation	ii. Describe in detail the		
		diazotization reaction of		

	(f) Methods to distinguish the classes of aminoalkanes.	aminoalkanes with nitrous acid and its industrial importance in the dye industry. Candidates should recall: a. The test used to distinguish primary, secondary and tertiary aminoalkanes [p-toluene sulphonyl chloride test]. b. The test used to distinguish between aliphatic and aromatic aminoalkane, which is diazotization.	in al mental and the state of t	
27.	CHEMISTRY, NATURE, INDUSTRY AND ENVIRONMENT	Character Sales of Control of Con	NO	·
	(a) Chemistry in Nature i. Carbohydrates - Structure and nomenclature	Candidates should: i. List simple carbohydrates ii. Draw the straight chain structure of carbohydrates and name them.	Lan vice Lan in the control of the c	14 hours
	- Classes of carbohydrates	i. Classify carbohydrates as monosaccharides, disaccharides and polysaccharides. ii. Recall glucose and fructose as monosaccharide, sucrose as disaccharide, starch and cellulose as	Samples of carbohydrates, sugars, starch, iodine solution	
	Simple reactions Reducing action Osazone formation Hydrolysis	i. Recall the reducing reactions of glucose with Fehling's reagent, and Tollen's reagent. ii. Recall the formation of an osazone by monosaccharides. iii. Recall the hydrolysis of sucrose, starch and cellulose to glucose. Stating reaction	Cheausty in keiner. Petrolansi inani-ri	

conditions.	
- Importance of carbohydrates of carbohydrate in the sustenance of life.	
ii. Amino Acids and Proteins - Introduction to amino acids and proteins. Candidates should: i. Describe the functional groups in an amino acid – bifunctional nature. ii. List and draw the structure of the 20 naturally occurring amino acids. iii. Use IUPAC nomenclature to name	S
- Behaviour of amino acids and proteins in an electric field. - Peptide, dipeptide and polypeptide and polypeptide and polypeptide - Importance of amino acids and proteins. - Importance of amino acids and proteins in the sustenance of life. - Candidates should describe the role and relevance of amino acids and proteins in the sustenance of life. - Candidates should: i. List the products	
obtained by fractional distillation of crude oil and their utility in our day-to-day life. ii. Discuss the uses of petroleum products as the	1
ii. Polymer Industry starting material for most organic chemical	

	- Nature of polymer	industries _
	The state of the state of the state of	petrochemicals.
	Test test	Candidates should:
	in mercure and it	i. Define monomers
7	27011 1518.	ii. Describe polymers as
	13. 20	aggregates of many
		aggregates of monomers
1	- Types of polymers	iii. List some natural and
		synthetic polymers and
		their precursor monomers
		- cellulose, rubber, nylon,
	1	polythene, etc.
	Three 6	A Director with the Carlot
	l les	Candidates should:
	Santhatia nalumara	i. Define addition and
	- Synthetic polymers	
	Nylon	condensation polymers
	Polythene	ii. Classify polymers into
		addition and condensation
	Polychloroethene	polymers
	off t	iii. Distinguish between
	(Polyvinylchloride)	thermosetting and Samples of
		thermoplastic polymer, thermoplastic and
	Resins	thermoplastic polymer.
	Teflon	
	Rubber	Candidates should: plastics
	Terylene	i. Briefly describe the
	the relation of the state of th	industrial process leading
	and the same of th	to the manufacture of the
	t teatru	polymers, stating
	er C. James and	reagents, reaction Samples of
	 Uses of polymers 	condition and nature of polymeric
		Condition and the continued
	. 25. 1	broaders.
		industrial process not and synthetic
		required.
		ii. Write simple
		mechanism for the
		polymerization process –
	the case of the contract of th	polymerization process
		free radical and ionic
		polymerization.
Tropies or consideration		iii Distinguish between
A CARLES AND ADDRESS OF THE		low density and high-
		density polymers.
9 w		iv. Recall the importance
	are one	iv. Recall the importance
	The state of the s	OI Catalysis
	de la lace de clarat	polymerization.
13	574	A 1 C 1 2 (180 2-7)
1		Candidates should list
	P. Carlotte	Candidates shows and
		Collinon porting
		their typical uses.
		1 1 Page 22 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	1	Candidates should:
		i. Explain the principle
		1. Explain the property

			1
iii. Biotechnology - Introduction	involved in biotechnology ii. List the advantages in the use of biotechnology	Schematic sketch of the	
- Food processing	Candidates should describe the process of fermentation as it relate to production of garri, bread and alcoholic beverages (e.g. ogogoro)	fermentation process	-C
- Uses	Candidates should list and recall applications of biotechnology in our day-to-day life. Candidates should	led stades	J
(c) Environmental Chemistry	i. Describe the positive and negative impact of the chemical industry on the environment. ii. Recall the sources,	emschomonissen gel moldsingen (g) Resing to	
i. Environmental impact of the Chemical Industry ii. Pollution	effects and control of pollution iii. List air, water and soil pollutions iv. Recall the green house	Reliber Inches	
and an analysis of the second	effect and depletion of the ozone layer v. Classify pollutants as biodegradable and non-biodegradable	de to section	
diane	vi. Identify local chemical industries and the pollutants they release into the environment.		
 INOI	RGANIC CHEMISTRY		11000
TRANSITION METALS (OR 3d-BLOCK METALS (a) Electron configuration	Candidates should recall: i. That the elements Sc to Cu (inclusive) are transition elements. ii. That transition elements have		8 hours
(b) Variable oxidation states	characteristic electron configurations. i. Give reasons for the		
(b) Facilities Orithment states	multiplicity of oxidation states.		

			ii. Recall the oxidizing		-
		$\Lambda_{\rm h}$	ability of the		
		1 '	permanganates, chromates		
		I carred	and dichromates in acid		\
			medium.	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
		H (+ sur ress)	i - Dimlain all		
		(c) General properties	i. Explain the origin of		1
	1	(c) General properties	colour and paramagnetism in transition metal		
- 1		del filosofi and	in transition metal complexes.		
.	- Ellia: w-		1		11/11
	i	1 9 9 9	ii. Explain the contraction in atomic radii of the		
- 1		1 -200	metals as atomic number		/
			increases.		1
		· Allerson	iii. Relate the contraction		1
- 1	1 - 1	a man a	in atomic radii to		\
	!	· · · · · · · · · · · · · · · · · · ·	ionization potential.		\
	1	1	iv. Recall that they are all		\ !
	1	2001(5)	metals as a result, have	() '	1
		Libert Lands	high melting points and		\ /
		articles of	densities.	4	1 1
			uchsities.		\ !
		- tonee	i. Distinguish between a	1	. \!
		l l ni	double salt and a complex		\!
		(d) Introduction to	5.11. DOG 1.1-1-0-1		\!
	1		ii. Define and give	, , , , , , , , , , , , , , , , , , ,	\!
	- 1	coordination chemistry.	examples of ligands.		1
	- 1		iii. To name simple metal		1
	1				\ ¹
	- 1	4	complexes using IUPAC	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	,
	1		system.	- , - 1	:
			iv. Recall the concept of		
			isomerism and apply this	American Company	I
			concept to transition metal		
1	espendin	Isan Massacra and	complexes.		
	- 1	Tel Payaby - Tor	The state of the s		
		PRACTI	CAL CHEMISTRY = 60 Hour	rs	
- [F	Practical Chemistry to run conc	urrently with Theory for at leas	t 60 nours per semeste.	1
	$\overline{}$	Tuction		Pro-	
1	D	QUALITATIVE	Candidates should be able	M. Carlotte and A. Carlotte and A.	
	ا ا	INORGANIC ANALYSIS	to:	A me to the sale	ī
	second i	INORGANIC ANALLS	i. Recall some reactions	1	1
	CHU	$c \sim 10^{-2}$	that will indicate the	Common reagents	's bour
	12	Analysis of anions CO ₃ ² ,	presence of the anions	and apparatus for	15 hours
		HCO_3 , S^2 , NO_2 , CI , Br , I ,	ii. Confirm the reactions	qualitative	1
47		NO ₃ , SO ₄ ² , SO ₃ ²	in (i) above by test with	1	
	•		in (1) above by		1
	2		known anions.	1	1.
	1		iii. Recall confirmatory	1	
	- 1		test for common anions.		
			iv Carry out tests to		
			confirm the presence of		
			117		1

	The state of the s	1 - 11	and the second second second second	
	Sail	the unknown anions in solution.		
	istan n	The state of the s		
		Candidates should be able to:	- 18	
	10 n.	i. Recall characteristics		
	Analysis of cations Na ⁺ ,	reactions of the listed	ednogora latorno (o	
	Ca^{2+} , K^+ Pb^{2+} Cv^{2+} $Nur +$	cation (flame test)		
	Ca ²⁺ , K ⁺ , Pb ²⁺ , Cu ²⁺ , NH ₄ ⁺ , Zn ²⁺ , Fe ²⁺ , Fe ³⁺ , Ba ²⁺ , Sn ²⁺ ,	ii. Confirm these reactions		18 hours
	Sn ⁴⁺ , Al ³⁺	with known cations. iii. Recall the		
	06 1)	confirmatory test for the		
		listed cations.		
		iv. Carry out test to isolate		
		and confirm the presence		
		of the unknown cations in		
		solution.	() Y	
	5 sund	v. Group the cations		
		according to their		
		characteristics reactions		
		with some reagents. vi. Recall the importance		
		of precipitation in		
-		isolating and confirming	noitovional (1)	
-		the presence of	coordination chemistr	
	7.18	cations.		
-	IC PART	10% N 10% + T 100		
	QUALITATIVE ORGANIC	John Custom o		
	ANALYSIS	711 124 2		
	711 (125 1 515	i. Test solubility hot		
ı	Solubility and Litmus Test	water and ethanol	- 1	
		ii. State the effect of red	Reagents and	3 hours
		and blue litmus paper	apparatus for	
	problems	Constitution of the last	qualitative organic	
	Organic functional groups	Candidates should be able to:	analysis	
	analysis: unsaturation,	i. Recall the reactions of		
k	alkanols, alkanals, alkanones,	the listed functional	UALITATIVE	
	alkanoic acid, amines,	groups	PURCHARIO ANALL	18 hours
1	phenols.	ii. Perform test with	Same to the first	
		known substances to	100 COM 100 MICHAEL	
	The same of the sa	confirm the presence of	of so A so:	
	Lessing and this	the functional groups.		
		iii. Perform test to		
	i version	differentiate one functional group from		
	The second second	functional group from another e.g.	2 'I	
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	another e.g. alkanals/alkanones,		
	Link many Altonoo	alkanols/phenols,		
		The products,		

E

The state of the s		Saturated	
		saturated/unsaturated,	
		phenols/alkanoic acid etc.	Ì
		iv. Recall the use of common reagents	
		qualitation reagents in	
	I STORY OF THE STORY	organic i	
		analysis e.g. Tollen's, Fehlings', iodoform, ferric	1
	1:	chloride, saturated	
		aqueous sodium hydrogen	
		trioxocarbonate(IV).	
	1101 CON 7177-1-00-10-10-1	Ly Dorform	
		1.00	
		[
	and an arm than the a	secondary and tertiary amines.	
		winnes.	-
3 (1.4)	granifications and removaling	Candidates should be able	
-		to:	
		i. Recall the use of these	
		reagents in qualitative	
	Tests for starch, proteins, fats		1
. M	and oils.	organic analysis: iodine solution, Biuret test,	6 hours
	and ons.	solution, Biuret test, Sudan III solution.	o nours
		ii. Recall some common	
		tests for the compounds	
		iii. Confirm known	
- 1		substances using suitable	
		test.	
		iv. Perform testito confirm	
		the presence of one or	
		more substances in a	
1 25) 즉 · 기가하게 하는데 : (POP - 기	given sample.	

Basic Recommended Textbooks

- Philips Mattews: "Advanced Level Chemistry" (1996). Cambridge University Press, ISBN 0521 566983.Low price paperback.
- Graham Hill and John Holman: "Chemistry in Context", 4th Edition (1995). Publishers – Thomas Nelson and Sons Ltd.ISBN 0-17-448191-8.
- Lee, J.D.: "A New Concise Inorganic Chemistry", 4th Edition (2007), ISBN: 0 442 30179 0. Van Nostrand Reinhold Company Ltd, England.

- Morrison Boyd: "Organic Chemistry", Sixth Edition (2008), ISBN: 0-13-630179-7. Prentice-Hall International Inc.
- 5. Addae-Mensah, I., Asomaning, W.A., Bempah, O.A. and Yeboah, S.K.: "Intermediate Chemistry" Fifth Edition (2002). ISBN: 978 153 079-0
- 6. Sharma, K.K. & Sharma, L.K.: A Textbook of Physical Chemistry", Fourth Revised Edition (2006). ISBN 0-7069-9571-6. Vikas Publishing House.
- 7. Mukherjee, K.S.: "Textbook on Practical Chemistry", (2008). ISBN: 81-7381-583-6. New Central Book Agency, India. www.newcentralgroup.net

Recommended Further Readings

- 8. Bahl, A. & Bahl, S.K.: "Advanced Organic Chemistry", (2007). ISBN: 81 219 0061-1
- 9. E.N. Ramsden: "A-Level Chemistry", 4thEdition(2000). Stanley Thornes (Publishers) Ltd.ISBN 0 7487 5299 4.
- 10. Chadwick: "Chemistry I and II and III".
- 11. Kneen, W.R., Rogers, M.J. & Cimpson. P: "Chemistry: Facts, Patterns & Principles".
- 12. Plane, R.A. and Sienko, M.J.: "Chemistry: Principles and Properties". McGraw Hill.
- 13. Prakash, S., Tull, G.D., Basu, S.K. and Madan, R.D.: "Advanced Inorganic Chemistry" (2007). ISBN 81 219 0263-0.
- 14. Clugston M. & Flemming R: "Advanced Chemistry" (2000) ISBN: 978 0