DEVELOPMENT OF QUESTION BANK IN CHEMISTRY AT HIGHER SECONDARY LEVEL

REPORT

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DEVELOPMENT OF QUESTION BANK IN CHEMISTRY AT HIGHER SECONDARY LEVEL

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PREFACE

Education is known to bring about behavioural modification. In similar wider sense, evaluation includes assessment of all such behavioural outcomes that are a result of teaching learning process. However, an examination have too many questions that call for a mere 'Recall' or 'Recognition' of certain facts, principles, etc. There is a dearth of questions that test achievement of higher level objectives, at least in our question papers.

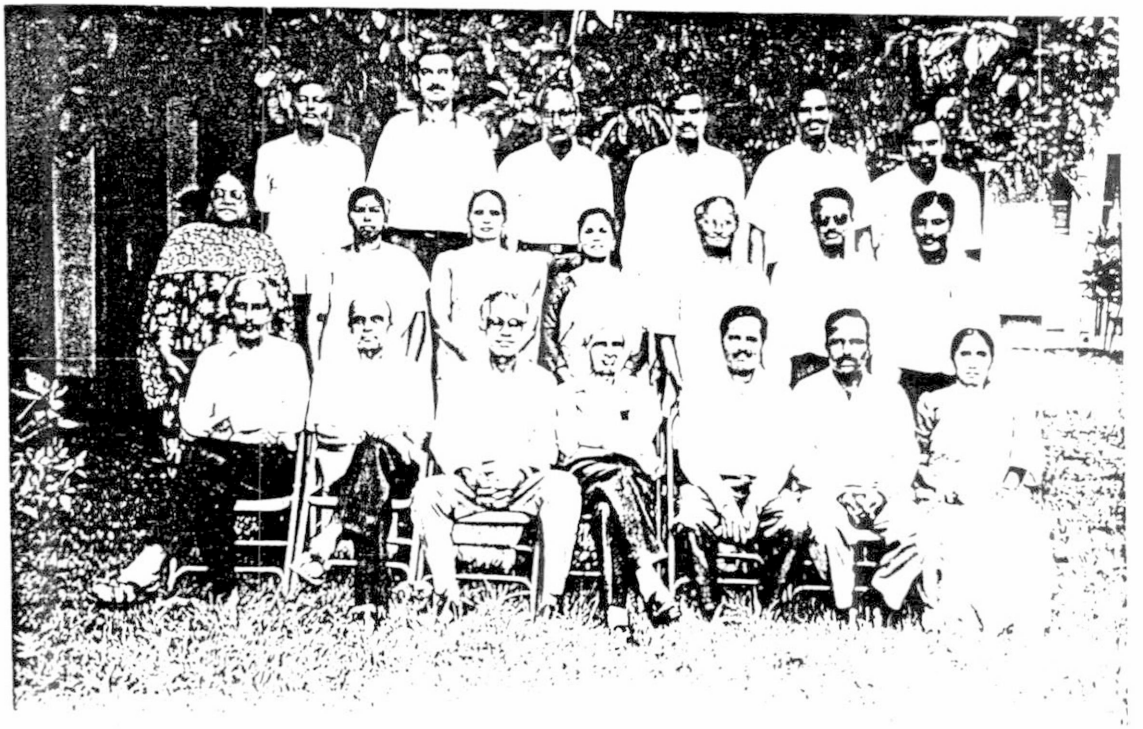
So, when there was a request from the junior college lecturers and southern region for the development of question bank in Chemistry, our Institute took up this task. The emphasis here has been a developing more questions to test understanding, application and skill. The items are not exhaustive but certainly diversified. I sincerely thank all my esteemed colleagues for their invaluable work. My special thanks are due to Dr. K.N. Tantry and Dr. A.S. Janardhan for giving directions and untiring support to us.

I thank our Principal for providing us all the help and facilities. My thanks to Mr. Venkatesh for his help in preparing this report.

25th June 1999
Mysore

Dr. G.R. PRAKASH
Academic Coordinator

Inaugural session



Participants and Resource Persons of the Workshop

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INTRODUCTION

It has been recognised that for meaningful education, the assessment of students must be sensitive to the aims and objectives of curriculum. Examinations are powerful tools to reflect both good and evil in teaching learning process. The public examinations more often encourage memorisation and repetition of factual chemistry and not the understanding and application of concepts.

Both internal assessment and public examinations have a few disadvantages. Assessment that is normally done is norm-referenced which helps in ranking. There is little emphasis on criterion referenced assessment, which is essentially diagnostic and helps in measuring comprehension and skills. However internal assessment is slightly better than public examinations in that it is both prognostic and diagnostic in nature. But the effectiveness depends on the design of the test items questions used in the evaluation. However writing good questions needs a systematic training in evaluation techniques. This workshop was organised in order to fulfill this need of the Junior college lecturers in the region.

PLAN OF ACTION

It was emphasized how a question calling for a simple "recall" of facts could be changed into a question which calls for manipulating the information thus requiring higher order mental abilities. A systematic approach to achieve this was to make a content analysis of specific topics selected from the syllabus and generate major contents from these. All possible types of questions on a given concept were written to provide a variety of behavioural outcomes. In the process the participants recognised that the task of writing questions is not only challenging but also an art in itself. Such creative work gives immense satisfaction for a teacher to carry out evaluation objectively.

For a given concept, all types of possible questions are written corresponding to various objective levels. This would enable the teachers to appreciate the possibility of testing the learning of a given concept in variety of ways. This workshop is only a beginning.

MEANING OF EVALUATION

From educational view point, evaluation may be defined as a systematic process of determining the extent to which educational objectives are achieved by the pupils.

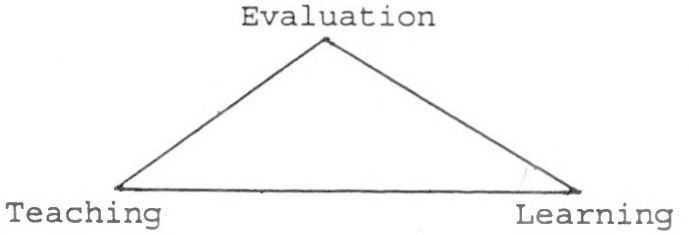
Firstly evaluation implies a systematic process, distinct from casual, uncontrolled observations of pupils.

Secondly, evaluation assumes previously identified educational objectives.

Evaluation is a much more comprehensive term than 'measurement' which is limited to quantitative descriptions of pupils' behaviour. Evaluation includes both qualitative and quantitative descriptions of pupil behaviour with value judgement concerning the desirability of that behaviour. Measurement does not include judgements concerning the value of the behaviour observed.

PURPOSE OF EVALUATION

The main purpose of evaluation in a classroom situation is to change pupil behaviour in a desired directions. Thus evaluation becomes an integral part of the teaching-learning situation. The desired directions are educational objectives established by curriculum. Thus evaluation becomes the process of determining the extent to which these objectives are achieved.



The interdependence of these three facets of education is clearly recognisable from the following steps.

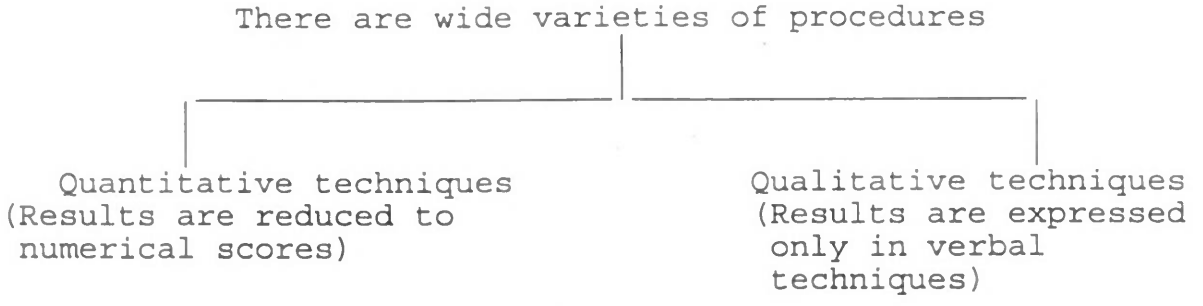
1. Identifying and defining objectives in terms of desired changes in pupil behaviour.

2. Planning and directing learning experiences in harmony with the stated educational objectives.

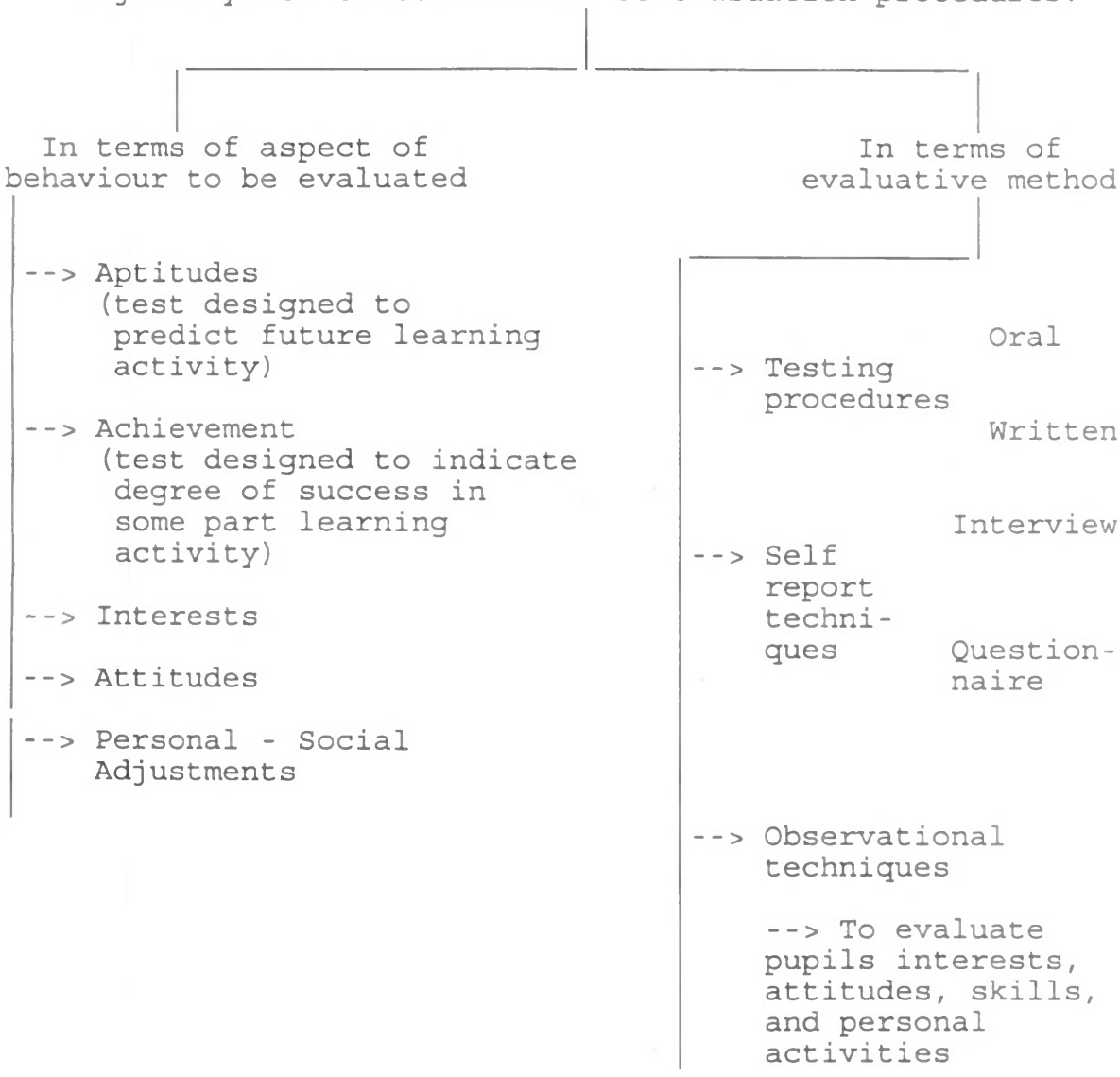
3. Determining pupil progress towards the stated educational objectives.

4. Using the results of evaluation to improve learning and instruction.

TYPES OF EVALUATION PROCEDURES



In addition to this broad classification there are two major ways of classification of evaluation procedures.



GENERAL PRINCIPLES OF EVALUATION

1. Determining and clarifying what is to be evaluated has priority in evaluation process.

2. Evaluation techniques should be selected in terms of purpose to be served.

3. Comprehensive evaluation requires a variety of evaluation techniques.

4. Proper use of evaluation techniques requires an awareness of their limitations as well as their strengths.

5. Evaluation is a means to an end but not an end itself. No evaluation procedure would be used unless it contributes to improved decisions of an instructional, guidance or administrative nature.

RELATING EVALUATION PROCEDURES TO OBJECTIVES

The following sequence of steps summarises this procedure

General Objectives
(Goals which direct our teaching)
|
Specific learning outcomes
(Pupils' behaviours are accepted as evidences of attainment of objectives)
|
Evaluation Techniques
(Procedures for obtaining samples of pupil behaviour described in the learning outcomes)

All the procedures used in evaluation program should possess certain common characteristics.

They are of

Validity

Reliability and

Objectivity

CRITERIA OF A GOOD EVALUATION

1. **Validity** : Any good test should measure what it claims to measure.
2. **Reliability**: A good test is one that is reliable, i.e. it gives same rating to a candidate even if he is examined by different examines at different times.
3. **Objectivity**: A test can be considered to be objective if the scoring of the test is not affected by examiner's personal judgement. Thus the opinion, bias or judgement of the examiner can have no influence on the results of objective test.

Other criteria are comprehensive practicability or acceptability.

"Assessment is not merely a part of teaching, it is central to teaching. It is an activity that goes most quickly and directly to the heart of teaching".

Functions of assessment

Two main functions of assessment can be perceived. One is norm referenced in which the main function is to discriminate among students and place them in an order of merit, it is essentially competitive, the results being used for selection purposes like within the school for higher education or outside by an employer. The second is criterion-referenced, it is essentially diagnostic, describing the knowledge or skins which students have attained or not.

STRUCTURE OF THE ATOM

Content analysis

* Experimental evidences for the presence of fundamental particles in an atom.
* Nature and properties of fundamental particles.
* Thomson's model of the atom.
* Rutherford's model of the atom.
* Line spectrum of the hydrogen atom.
* Planck's quantum theory.
* Bohr's model of the atom.
* Inadequacies of the Bohr's model.
* Dual nature of light.
* Wave nature of electrons.
* Heisenberg's Uncertainty principle.
* Quantum mechanical model of the atom.
* Significance of quantum numbers.
* Orbitals and their shapes.
* Electronic configuration of atoms.

STRUCTURE OF ATOM

Concept 1: Atoms are electrical in nature and they are composed of fundamental particles - electrons, protons, and neutrons.

Q. No.	Obj.	Question	Answer
1	K	Given an example of an atom which contain equal number of protons, neutrons and electrons.	He, Ca, Oxygen
2	U	In the case of <u>one</u> among the following conditions the cathode ray cannot be observed. Identify. (a) Very large potential difference between the electrodes. (b) Changing the metal used as the cathode. (c) Changing the gas in the discharge tube. (d) Using a gas at atmospheric pressure.	(d)
3	K	Which of the following statements about cathode rays is not correct ? (a) Cathode rays cast shadow of an object placed in their path. (b) Cathode rays can rotate a paddle wheel placed in their path. (c) Cathode rays are emanated in all directions from the cathode. (d) Cathode rays are deflected in an electric and magnetic field.	(c)
4	A	In which of the following cases the e/m of the anode ray particles be the highest ? (a) Oxygen (b) Nitrogen (c) Hydrogen (d) Helium	(c)

Q. No.	Obj.	Question	Answer
5	U	The e/m of cathode ray particle is the same irrespective of nature of gas taken in the discharge tube whereas it changes for the anode ray particles. Give reasons.	
6	A	Why can the cathode rays be observed in a discharge tube experiment only at very low pressures ?	
7	U	Isotopes of uranium have the mass numbers 233, 235, 238. Indicate how many neutrons are in excess in the second and third isotopes when compared to the first (a) 2, 5 (b) 2,3 (c) 3, 2 (d) 5, 2	(a)
8	K	The alpha particle emitted by radium in alpha-ray scattering experiment is (a) nucleus of helium (b) nucleus of hydrogen (c) atom of helium (d) atom of hydrogen	(a)
9	K	What are the fundamental particles of an atom ? Describe their properties	
10	U	Which atom does not contain neutron ?	Hydrogen

Concept 2: Rutherford's model of the atom suggests the arrangement of fundamental particles in an atom.

Q. No.	Obj.	Question	Answer
11	U	Rutherford's alpha-particle scattering experiment eventually led to the conclusion that (a) mass and energy are related. (b) electron occupy space around the nucleus. (c) neutrons are burried deep in the nucleus. (d) electrons move around the nucleus.	(b)
12	U	The Rutherford model need to be rectified because (a) the experimental observations would be true only if gold foil is used. (b) the experiment cannot be performed at all in the case of gaseous state. (c) a charged particle in motion would continuously lose energy. (d) a charged particle in motion would fly away from the nucleus.	(c)
13	K	Rutherford's experiment of alpha-particle scattering showed for the first time that atom has (a) Protons (b) Neutrons (c) Nucleus (d) Electrons	(c)

Q. No.	Obj.	Question	Answer
14	A	Which of the following observations would be expected if the Thomson's model of the atom were correct (a) most alpha-particles would pass through without deflection. (b) most alpha-particles would suffer weak deflection. (c) most alpha-particles would be strongly deflected. (d) only a few of the alpha-particles would be weakly deflected.	(b)
15	K	The diameter of the atom is in the order of _____	10^{-10} m
16	K	The charge on the alpha-particle is _____	+2
17	K	Which ratio active substance was used by Rutherford in his alpha-ray scattering experiment	Radium
18	U	List the significant observations in the experiment on scattering of alpha-particles which led Rutherford to conclude that all the positive charge and most of the mass of the atom is concentrated in a tiny nucleus.	

Concept 3: Bohr's model accounts for the line spectrum of hydrogen in terms of Quantum theory.

Q. No.	Obj.	Question	Answer
19	U	In Bohr's model of atom, the electron does not fall into the positively charged nucleus because the (a) electrostatic force of attraction is balanced by mechanical forces. (b) quantum rules do not allow it. (c) electron in motion cannot fall into the nucleus. (d) electron is a very light particle.	(b)
20	A	Which of the following transitions will emit highest energy in hydrogen atom (a) n = 4 ---> n = 3 (b) n = 5 ---> n = 4 (c) n = 2 ---> n = 1 (d) n = 3 ---> n = 2	(b)
21	K	In nth energy level the number of orbitals are (a) 2n (b) n (c) n^2 (d) n-1	(c)
22	U	Which of the following was not explained by Bohr's theory ? (a) The ionisation energy of hydrogen atom. (b) The atomic spectra of atoms with many electrons. (c) The location of lines in the hydrogen spectrum. (d) The spectra of hydrogen like atoms He^{+} and Li^{+2}.	(b)

Q. No.	Obj.	Question	Answer
23	K	The value of Rydberg's constant is _____	109677.8 cm^{-1}
24	K	The splitting of spectral lines when the atom is kept in magnetic field is called _____	Zeeman effect
25	K	The maximum number of electrons in any orbit is given by _____	$2n^2$
26	K	The further splitting of spectral lines under the influence of eletric field is known as	Stark effect
27	A	Calculate the wavelength of the spectral line when the electron in the hydrogen atom undergoes n(=4) ---> n(=2) (Rydberg constant = 109678 cm^{-1})	486 nm
28	A	Calculate the wavelength of the photon in angstroms that is emitted when an electron in Bohr's orbit n = 2 returns to the orbit n = 1 in the hydrogen atom (the ionisation energy of the ground state of hydrogen atom is 2.17 x 10^{-11} ergs per atom.	1220 A
29	U	How does Bohr's model of the atom account for the line spectrum of hydrogen atom ?	

Concept 4: Matter exhibits both particle and wave nature.

Q. No.	Obj.	Question	Answer
30	A	The wavelength of the green light from a traffic signal is centred at 522 nm. The frequency of this radiation is (a) $5.75 \times 10^{14}\ S^{-1}$ (b) $5.22 \times 10^{14}\ S^{-1}$ (c) $3.00 \times 10^{8}\ S^{-1}$ (d) $3.64 \times 10^{14}\ S^{-1}$	(a)
31	A	The frequency of yellow line in the spectrum of sodium is $5 \times 10^{14}\ sec^{-1}$. The wavelength of this light (in nm) is (a) 1660 (b) 400 (c) 6×10^{5} (d) 600	(d)
32	A	A certain radio station broadcasts on a frequency of 900 KHz. what is the wavelength of the electromagnetic radiation broadcast by the radio station ($c = 3 \times 10^{8}\ ms^{-1}$)	330 mtr
33	K,A	What is meant by the de Broglie wavelength ? Calculate the wavelength of an electron moving with a velocity of $10^{3}\ ms^{-1}$. ($h = 6.6 \times 10^{-34}\ kgm^2s^{-1}$, mass of electron = 9.1×10^{-31} kg)	0.725×10^{-6} m or 7.25×10^{-7} m
34	A	Calculate the wavelength of a cricket ball of mass 100 gms moving with a speed of 108 km/hr.	$2 \times 10^{-31}\ cms^{-1}$
35	K	What is photoelectric effect ? How is the particle nature of light explained by the photoelectric effect ?	
36	K	de Broglie equation is derived from _____ equation and _____ equation.	Plancks Eminstein

Q. No.	Obj.	Question	Answer
37	U	The wave nature of cricket ball is not realised because of its (a) High wavelength (b) Low wavelength (c) Low frequency (d) All the above	(b)
38	K	Define frequency of a wave.	
39	K	Define wave number.	
40	U	why is wave number introduced in addition to frequency ?	
41		What is de Broglie equation ?	= h/mv

Concept 5: The uncertainity principle states that "both the position and momentum of microscopic particles cannot be determined simultaneously with the same degree of certainty", Heisenberg's uncertainty principle.

Q. No.	Obj.	Question	Answer
42	U	Uncertainty principle expresses uncertainty about (a) the energy of an electron in the hydrogen atom. (b) simultaneous knowledge of the energy and position of an electron. (c) simultaneous knowledge of the energy and mass of an electron. (d) none of the above.	(d)
43	U	In the Heisenberg's equation $\Delta x.\Delta p \geq$, Δ p signifies (a) the momentum of the particle (b) the position of the particle (c) uncertainty in the position (d) uncertainty in the momentum	(d)
44	U	The uncertainty product is neglected for large particles, but it cannot be neglected for an electron because of its (a) small mass and high velocity (b) big mass and low velocity (c) big mass and high velocity (d) small mass and low velocity	(a)
45	K	State Heisenberg's uncertainty principle	
46	A	Calculate the uncertainty in position of an electron if uncertainty in its velocity is 5.7×10^5 ms^{-1}	1.02×10^{-10} m

Concept 6: An electron in an atom is completely described by a set of four quantum numbers.

Q. No.	Obj.	Question	Answer
47	U	An electron in an atom has the following quantum numbers, n = 4, l = 2, m_l = -2 and m_s = -1/2. On the basis of this information, we may conclude that the electron is in a (a) 4s orbital (b) 4p orbital (c) 4d orbital (d) 4f orbital	(c)
48	U	If the principal quantum number is 3, the azimuthal quantum number can have values (a) 1, 2, 3 (b) 3, 2, 1, 0, -1, -2, -3 (c) 0, 1, 2 (d) +1/2, -1/2	(c)
49	U	How many electrons in an atom can have quantum numbers n = 3, l = 2, m = +2, s = +1/2. (a) 5 (b) 3 (c) 1 (d) 9	(c)
50	A	Which set of quantum numbers (n, l, m_l, m_s) would <u>not</u> be possible for a 3d electron ? (a) 3, 2, 0, +1/2 (b) 3, 2, -1, +1/2 (c) 3, 2, 3, -1/2 (d) 3, 2, -2, -1/2	(c)

Q. No.	Obj.	Question	Answer
51	A	Which of the following statements concerning the quantum number is <u>false</u> ? (a) The magnetic quantum number 'm' indicates the possible orientation in a magnetic field. (b) The spin quantum indicates the orientation of the nucleus in a magnetic field.	(b)
52	U	Which of the following sets of quantum numbers is incorrect ? (a) n = 4, l = 0, m = 0, s = +1/2 (b) n = 5, l = 2, m = +3, s = -1/2 (c) n = 3, l = 1, m = 0, s = +1/2 (d) n = 6, l = 5, m = +5, s = -1/2	(b)
53	U	Which of the following represents the correct set of the four quantum numbers of a 4d electron ? (a) n = 4, l = 3, m = 2, s = +1/2 (b) n = 4, l = 1, m = 1, s = -1/2 (c) n = 4, l = 3, m = -2, s = +1/2 (d) n = 4, l = 2, m = 1, s = -1/2	(d)
54	U	A 2s orbital differs from 2p orbital in (a) Principle quantum number (b) Azimuthal quantum number (c) Magnetic quantum number (d) Spin quantum number	(b)

Q. No.	Obj.	Question	Answer
55	K	An electron in an atom is completely described by (a) Principle quantum number (b) Azimuthal quantum number (c) Spin quantum number (d) A set of four quantum numbers	(d)
56	A	An element has only one electron in its valence shell and the four quantum numbers of that electron are n = 3, l=0, m = 0, s = +1/2. Identify the element (a) Li (b) Na (c) K (d) Cs	(b)
57	U	The two electrons occupying the same orbital can be distinguished by (a) Principle quantum number (b) Azimuthal quantum number (c) Magnetic quantum number (d) Spin quantum number	(d)
58	K	For the 'f' electron the azimuthal quantum number is (a) 0 (b) 1 (c) 2 (d) 3	(d)
59	K	Explain the significance of the four quantum numbers.	

Q. No.	Obj.	Question	Answer
60	U	The quantum numbers for the 12th electron of Magnesium is _____	n l m s 3 0 0 -1/2
61	K	For the 'f' electron, the azimuthal quantum number is (a) 0 (b) 1 (c) 2 (d) 3	(d)
62	K	The principle quantum number signify (a) size and energy of orbit (b) shape of the orbital (c) orientation of orbital (d) direction of the electron	(a)

Concept 7: The distribution of electrons of the atom into various orbitals is governed by a set of rules.

Q. No.	Obj.	Question	Answer
63	U	In the electronic configuration given below which rule is violated. N:7: (a) Aufbau's principle (b) Pauli's exclusion principle (c) Hund's rule (d) All the above	(c)
64	A	Atomic number of sulphur is 16. In the ground state of the sulphide ion s^{-2}, the electronic configuration is (a) $1s^2\ 2s^2 2p^6\ 3s^2 3p^2$ (b) $1s^2\ 2s^2 2p^6\ 3s^2 3p^4$ (c) $1s^2\ 2s^2 2p^6\ 3s^2 3p^6$ (d) $1s^2\ 2s^2 2p^6\ 3s^2 3p^4\ 4s^2$	(c)
65	U	$2p_x$ orbital differs from $3p_x$ orbital in (a) shpae (b) orientation (c) direction (d) energies	(d)
66	K,U	Electronic configuration of an element is $1s^2\ 2s^2 2p^6\ 3s^2 3p^1$ (a) Identify the element (b) Write the quantum numbers associated with 3p electron of this element.	Al n l m s 3 1 0 1/2

Q. No.	Obj.	Question	Answer
67	S	Draw the shapes of 2s and 2p orbitals. Indicate the nodal planes.	
68	K,S	Define an orbital write the shapes and orientation of the d-orbitals.	
69	U	$1s^2\ 2s^2\ 2p'_x\ 2p'_y\ 2p'_z$ is the electronic configuration of (a) carbon in the ground state (b) carbon in the excited state (c) nitrogen in ground state (d) nitrogen in excited state	(c)
70	U	The total number of p-electrons in phosphorous atom are (a) 2 (b) 4 (c) 6 (d) 9	(d)
71	K	Which among the following orbital is non-directional (a) s (b) p (c) d (d) f	(a)

Q. No.	Obj.	Question	Answer
72		Match the following equations given in column 'B' with the name of the scientists given in column 'A'	
		A — B	
		1. Einstein — a. $E = h\nu$	b
		2. Planck — b. $E = mc^2$	a
		3. de Broglie — c. $\Delta x . \Delta p \geq (h/2\pi)$	d
		4. Heisenberg — d. $\lambda = h/(mv)$	c
		e. $\nu = c/\lambda$	
73		Match the following constants given in column 'A' with the physical constants given in column 'B'.	
		A — B	
		1. Planck's constant — a. 6.023×10^{23}	c
		2. Rydberg constant — b. 0.529Å	d
		3. Velocity of light — c. 6.627×10^{-27} erg sec	e
		4. Avagadro number — d. $109677.8\ cm^{-1}$	a
		5. Radius of first orbit of hydrogen — e. 2.99×10^{10} cms/sec	b
		f. 10^{-13} cms	
74		Match the following units give in column 'B' with the corresponding physical constants in column 'A'.	
		A — B	
		1. Planck's constant — a. m^{-1}	e
		2. Rydberg's constant — b. ms^{-1}	a
		3. Frequency — c. m	d
		4. Wavelength — d. s^{-1}	c
		5. Velocity of light — e. Js	a

Q. No.	Obj.	Question		Answer
75		Match the scientists in column 'A' with their contribution in column 'B'		
		A	B	
		1. Rutherford	a. Quantum theory	c
		2. Niels Bohr	b. Uncertainty principle	d
		3. Heisenberg	c. Nucleus	b
		4. De Broglie	d. Stationary wave	e
			e. Matter waves	

CHEMICAL BONDING

Content analysis

* Meaning of chemical bonding
* Theories of chemical bonding
* Electro theory of valency
* A: Ionic bond

  Lattice energy, crystal structure, Born-Haber cycle

  Properties of ionic compounds - Fajan's rule

  B: Co-valent bond

  Polar and non-polar covalent compounds with examples

  Properties of covalent compounds
* Valency bond theory

  and bonds

  Formation of molecules with examples

  Limitations of valency bond theory
* Theory of hybridisdation

  Explanation of shapes of molecules
* Valency shell electron pair repulsion theory
* Co-ordinate covalent bond

  Properties of coordinate covalent compounds
* Hydrogen bond and types of hydrogen bonding
* Consequence of hydrogen bonding
* Bond angle, bond length, bond energy, dipole moment and resonance

Concept 1: Chemical bond is the force of attraction between atoms to acquire stability.
Elements which have electronic configuration other than inert gases will have the tendency to acquire this for stability.

Q. No.	Obj.	Question	Answers
1	K	Inert gases do not actively participate in chemical reactions because they have (a) unstable electronic configuration (b) stable electronic configuration (c) electrons in p-sub shell (d) exist in gaseous state	(b)
2	U	Spontaneous chemical reactions occurs (a) with the gain in energy (b) with the loss of energy (c) without any change energy (d) with a loss or gain of energy	(b)
3	A	If two bonded atoms are brought nearer then the optimum distance of their chemical bond through (a) the bond becomes strong (b) the bond becomes weak (c) there will be no change in the strength of the bond (d) it may become strong or weak	(b)
4	U	The compound which does not give precipitate with a solution of silver nitrate. Why ? (a) Carbon tetrachloride (b) Hydrogen chloride (c) Ammonium chloride (d) Calcium chloride	

Concept 2: Atoms attain inert gas configuration by the complete transfer of one or more electrons from the valence shell of one atom to the valence shell of the other atom - Ionic bond.

Q. No.	Obj.	Question	Answers
5	K	Ionic bond is formed due to (a) complete transfer of one or more electrons (b) sharing of electrons (c) losing of electrons (d) all the above	(a)
6	U	Ionic compounds generally have high melting point because, (a) they are held together by strong electrostatic forces in solid state (b) they are held by weak Vander Waals forces of attraction (c) they are in solid state (d) they are soluble in polar solvents	(a)
7	U	Which among the following compound has the strongest electrovalent bond ? (a) LiF (b) NaF (c) RbF (d) CsF	(d)
8	U	Identify the compound which has the strongest electrovalent bond ? (a) NaF (b) NaCl (c) NaBr (d) NaI	(a)

Q. No.	Obj.	Question	Answers
9	K	A strong ionic bond is formed between _____ size cation and _____ size of anion.	large, small
10		Define hydration energy	
11		The second ionisation energy of sodium is much higher than first ionisation energy. While in the case of magnesium the second ionisatino enegy is not much higher than first one. Why ?	

Concept 3: Atoms attain inert gas configuration by sharing the electrons.
a. A covalent bond is formed by mutual sharing of electrons between two atoms in their valence shells.
b. If the shared pair of electrons belongs to one atom, then it is called as co-ordinate co-valent bond.

Q. No.	Obj.	Question	Answers
12	U	HCl is a co-valent compound, yet it is soluble in water. This is because (a) water is polar (b) water is non-polar (c) HCl is polar (d) HCl is non-polar	(c)
13	A	If z-1, z and z+1 are the atomic numbers of A, B and C respectively and z is an inert gas, the type of bond formed between A and C is _____ and the type of bond formed between A and A is _____.	ionic, co-valent
14	U	Which of the following exhibits co-valency ? (a) LiCl (b) NaCl (c) KCl (d) RbCl	(a)
15	U	Which among the following has maximum co-valent character ? (a) NaF (b) NaCl (c) NaBr (d) NaI	(d)

Q. No.	Obj.	Question	Answers
16	U	Purely co-valent bonding is possible between (a) two unlike electronegative atoms (b) two like electronegative atoms (c) an electronegative and an electro-positive atom (d) two electropositive atoms	(b)
17	U	Which of the following compounds cannot form a co-ordinate covalent bond (a) PH_3 (b) H_2S (c) CCl_4 (d) Cl_2O	(a)
18	K&U	What are the different types of bonds present in ammonium chloride ? Explain.	

Concept 4: The mixing of the atomic orbitals of the same atom with almost equal energy to form equal number of identical orbitals is known as hybridisation.

Q. No.	Obj.	Question	Answers
19	K	The four C-H bonds in methane are equally strong and symmetrically disposed in space. This can be explained by (a) VSEPR theory (b) Hybridisation (c) Fajan's rule (d) None of the above	(b)
20	U	Nitrogen in ammonia undergoes _____ hybridisation (a) sp (b) sp^2 (c) sp^3 (d) sp^3d	(c)
21	U	Beryllium in beryllium chloride undergoes _____ hybridisation (a) sp^3d (b) sp (c) sp^2 (d) sp^3	(b)
22	K	The molecule which has tetrahedralshape is (a) ethane (b) ethylene (c) acetylene (d) all the above	(a)

Q. No.	Obj.	Question	Answers
23	U	The hybridisation present in oxygen atom of hydrogen peroxide (a) sp (b) sp^2 (c) sp^3 (d) sp^3d	(c)
24	U	The structure of NH_4^+ ion is (a) tetrahedral (b) pyramidal (c) planar triangular (d) trigonal pyramidal	(a)
25	U	Which among the following compound, all the carbon atoms do not have the same type of hybridisation (a) Benzene (b) 1,3 Butadiene (c) Ethylene (d) Propdiene	(d)
26	U	$CH_2=C=CH_2$ type of hybridisation on the second carbon atom is (a) sp (b) sp^2 (c) sp^3 (d) sp^3d	(a)
27	K	The shape of the molecule which contains dsp^3 hybridisation is _____ The shape of the molecule which contains three bonded and one non-bonded pair of electrons.	Tri-gonal bi-pyramid

Q. No.	Obj.	Question	Answers
28	K	BCl_3 contains _____ type of hybridisation. (a) sp (b) sp^2 (c) sp^3 (d) sp^3d	tri-gonal pyramid
29	U	The hybridisation present in oxygen atom of water molecule is _____ (a) sp (b) sp^2 (c) sp^3 (d) sp^3d	sp^2
30	U	The hybridisation present in oxygen atom of water molecule is _____	sp^3
31	U	The hybridisation present in Boron in dibcrane is _____	sp^3
32	K	Define hybridisation	
33	K	Explain the structure of carbon dioxide	
34	K	Explain the structure and bonding in ethylene.	
35	U	Explain the structure and bonding in acetylene with the help of hybridisation.	
36	K	Explain the following hybridisation with an example (a) sp^3d (b) sp^3d^2	
37	K	Explain the following hybridisation with an example (a) sp (b) sp^2 (c) sp^3	

Q. No.	Obj.	Question	Answers
38	K	Explain the bonding in methane with the help of hybridisation.	
39	U	Which among the following molecules is trigonal bipyramidal ? (a) $BeCl_2$ (b) BeF_3 (c) PCl_5 (d) H_2O	(c)
40	U	Identify the linear molecule from the following (a) $BeCl_2$ (b) H_2O (c) H_2S (d) Na_2S	(a)

Concept 5: Valence bond theory gives the concept of overlapping of atomic orbitals. The σ bond is formed by the headon overlapping of pure or hybrid orbitals.
The π bond is formed by the lateral or side wise overlapping of pure atomic orbitals after the formation of σ bond.

Q. No.	Obj.	Question	Answers
41	A	Which among the following is not covered by valence bond theory ? (a) A chemical bond will form due to the overlaping of atomic orbitals. (b) Pauli's exclusion principle and Hund's rule are applicable. (c) Greater the extent of overlapping stronger the bond. (d) The repulsion between two non-bonded pairs is more than the repulsion between the bonded pairs.	(d)
42	U	Which of the following contains bonding (a) CH_4 (b) C_2H_6 (c) C_2H_4 (d) C_3H_8	(c)
43	U	Which among the following contains only bonds (a) Ethane (b) Ethylene (c) Acetylene (d) Benzene	(a)

Q. No.	Obj.	Question	Answers
44	U	Which of the following theory does not explain the bond angle of ammonia ? (a) Hybridisation theory (b) Valence bond theory (c) Electronic theory of valency (d) Valence shell electron pair repulsion theory	(c)
45	K	Acetylene contains _____ σ and _____ π bonds	3 σ, 3 π
46	U	σ p-p bond is more _____ than π p-p bond	Stronger
47	U	In acetylene molecules there were (a) 3 σ bonds and 2 π bonds (b) 5 σ bonds and 1 π bonds (c) 2 σ bonds and 3 π bonds (d) 2 σ bonds and 2 π bonds	(a)
48	S	Give the orbital and electron data representation for bonding in the following molecules. (a) HCl (b) Cl_2 (c) O_2 (d) N_2	
49	S	Draw the orbital overlapping in acetylene molecule and mention its shape.	

Concept 6: VSEPR theory explains the structural deviations due to repulsion between bonded and non-bonded electron pairs.

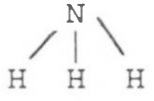
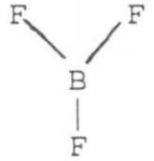
Q. No.	Obj.	Question	Answers
50	A	Bond angle in ammonia is less than in menthane due to (a) lone pair-bond pair electrons repulsion. (b) bond pair-bond pair electrons repulsion. (c) lone pair-long pair electrons repulsion. (d) All the above.	(a)
51	A	The bond angle in water is less than in ammonia because of (a) lone pair-bond pair electrons repulsion. (b) bond pair-bond pair electrons repulsion. (c) lone pair-long pair electrons repulsion. (d) All the above.	(c)
52	A	The bond angle in ammonia is less than in methane. Why ?	
53	A	The bond angle in water is less than in ammonia. Why ?	
54	U	How will you predict the shapes of the following molecules by the application of VSEPR theory ? (a) $BeCl_2$ (b) BF_3 (c) NH_3 (d) CH_4	

Concept 7: Hydrogen bond is the weak electrostatic attractive between the hydrogen and most electronegative atom of the same or the another molecule.

Q. No.	Obj.	Question	Answers
55	K	Hydogen bond is the electrostatic force between the (a) hydrogen and hydrogen atom. (b) hydrogen atom and more electronegative atom (c) hydrogen atom and more electronegative atom (d) between more electronegative and more electropositive atom.	(b)
56	U	Hydrogen bond is not found in (a) ammonia (b) water (c) hydrogen fluoride (d) hydrogen chloride	(d)
57	U	Hydrogen halide containing hydrogen bond is _____ (a) HF (b) HCl (c) HBr (d) HI	(a)
58	K	The hydrogen bond formed between two atoms of the same molecule is _____	Intra molecular hydrogen bond
59	U	Salicylaldehyde is an example for _____ type of hydrogen bonding.	Intra molecular hydrogen bond

Q. No.	Obj.	Question	Answers
60	U	_____ is responsible for high boiling point of water in liquid state.	Hydrogen bonding
61	U	Identify the molecule in which inter-molecular hydrogen bond is present. (a) Salicylaldehyde (b) Salicylic acid (c) O-Nitrophenol (d) Ethanol	(d)
62	U	Which molecule has intramolecular hydrogen bonding ? (a) Phenol (b) Acetic acid (c) Acetaldehyde (d) O-Nitrophenol	(d)

Concept 8: Dipole moment is the product of distance between the charged ions and their magnitude of charge.

Q. No.	Obj.	Question	Answers
63	K	The product of distance between the charged ions and their magnitude of charge is (a) Coulombic forces (b) Dipole moment (c) Band energy (d) Binding energy	(b)
64	U	The compound whose dipole moment is not zero is (a) CCl_4 (b) BCl_3 (c) $BeCl_2$ (d) HCl	(d)
65	K	The units for dipole moment are (a) esu cm (b) gm cm (c) cms^{-1} (d) erg sec	(a)
66	A	From the given data find the molecule whose dipole moment is not zero. (1) H-Cl (2) O-H (H) (3)  (4)  (a) 1 and 2 (b) 1, 2 and 3 (c) 4 and 5 (d) 1, 2 and 5	(b)

Q. No.	Obj.	Question	Answers
67	A	Find the molecule which has zero dipole moment. (a) H_2O (b) H_2S (c) CO_2 (d) NH_3	(c)
68	U	Which among the following is not a linear molecule ? (a) CO_2 (b) C_2H_2 (c) H_2S (d) $BeCl_2$	(c)
69	K	Define dipole moment.	
70	K	What are the units of dipole moment ?	Debye units

Concept 9: Lattice energy is the amount of energy released when one mole of ionic crystal is formed from the constituent ions in the gaseous state.

Q. No.	Obj.	Question	Answers
71	K	The shape of sodium chloride crystal is _____	Face centered cubic lattice
72	K	The co-ordination number of sodium in sodium chloride crystal is _____	six
73	U	The co-ordination number of cesium in cecium chloride is _____	eight
74	K	The energy required to convert solid sodium into gaseous state is _____	subbli mation energy
75	K	Born-Habar cycle is the application of _____	Hess law
75	K	Sodium chloride crystal is the systemic arrangement of (a) NaCl molecules (b) Na^+ and Cl^- ions (c) Na and Cl atoms (d) Na atom and Cl_2 molecules	(b)
77	K	Define Lattice energy	
78	K	What is unit cell ?	
79	K	Define subblimation energy.	

Concept 10: Molecules are characterised by bond length, bond angle, bond energies and resonance structures.

Q. No.	Obj.	Question	Answers
80	U	Which among the following will have the maximum carbon-carbon bond energy ? (a) Ethane (b) Ethylene (c) Acetylene (d) Benzene	(c)
81	K	The bond energies of four C-H bonds in methane are (a) equal (b) unequal (c) equal for two C-H bonds only (d) equal for three C-H bonds only	(b)
82	K	Benzene is more stable because (a) it contains σ bonds (b) it contains π bonds (c) it is a resonance hybrid (d) it is cyclic	(c)
83	U	The carbon-carbon bond length is maximum in (a) $H_3C\text{-}CH_3$ (b) $H_2C{=}CH_2$ (c) $HC{\equiv}CH$ (d) Benzene	(d)

Q. No.	Obj.	Question	Answers
84	U	Which among the following molecules will have more bond energy ? (a) F_2 (b) Cl_2 (c) Br_2 (d) I_2	(b)
85	U	The O-H bond length in the following molecules I. H_2O, II. H_2O_2, III. C_2H_5OH is (a) equal in all I, II and III (b) equal only in I and II (c) equal only in II and III (d) different for all the three	( )
86	K	Define bond energy.	
87	K	What is resonance hybrid ?	
88	U	Why acetylene is more stable than ethylene ?	
89	U	Match the type of chemical bond under column A with the appropriate examples under column B	

A	B	
1. Ionic bond	a. Nitrogen	c
2. Polar covalent bond	b. Water	e
3. Non-polar covalent bond	c. Sodium chloride	a
4. Hydrogen bond	d. Ammonium ion	b
5. Co-ordinate covalent bond	e. Hydrogen chloride f. Sodium	d

Q. No.	Obj.	Question	Answers
90	U	Match the type of hybridisation in column A with the examples given under column B.	
		A — B	
		1. sp hybridisation — a. Methane	e
		2. sp^2 hybridisation — b. Sulphurhexa chloride	c
		3. sp^3 hybridisation — c. Ethylene	a
		4. sp^3d hybridisation — d. Phosphorus trichloride	f
		5. sp^3d^2 hybridisation — e. Acetylene	b
		f. Phosphorus penta chloride	
91	U	Match the compounds under column B with the type of orbital overlaps in column A	
		A — B	
		1. s-s overlapping — a. Ethylene	f
		2. s-p overlapping — b. Acetylene	e
		3. p-p overlapping — c. Ethane	d
		4. sp-sp overlapping — d. Chlorine	b
		5. sp^2-sp^2 overlapping — e. Hydrogen chloride	a
		f. Hydrogen	

Q. No.	Obj.	Question	Answers
92	K	Match the bond angles under column B with the appropriate compounds under column A	
		A — B	
		1. Methane — a. 180°	c
		2. Ethylene — b. 104.5°	e
		3. Acetylene — c. 109°28'	a
		4. Water — d. 92°	b
		5. Ammonia — e. 120°	f
		f. 107°	
93	K	Match the shapes of molecules under column A with those given in column B.	
		A — B	
		1. Methane — a. Linear	b
		2. Beryllium chloride — b. Tetrahedron	a
		3. Boron trifluoride — c. Trigonal pyramid	d
		4. Water — d. Trigonal planar	e
		5. Ammonia — e. 'V' shaped	c
		f. Trigonal bipyramid	

PERIODIC CLASSIFICATION

Content analysis

* Historical development of classification of elements - Lothar Meyer and Mendeleev.

* Long form of the periodic table.

* Periodic properties-Atomic radius,ionic radius, ionisation energy, electron affinity and electronegativity.

* Trends in properties along a period and down the group.

Concept 1: Observation of periodicity in arrangement according to atomic size - Lothar Meyer

Q. No.	Obj.	Question	Answer
1	K	Lothar Meyer's observation of periodicity was based on the relationship between physical properties and (a) atomic masses (b) atomic numbers (c) electronic configuration (d) atomic volume	(a)
2	K	The law of triads is applicable to the following set (a) Cl, Br, I (b) H, O, N (c) Se, Te, As (d) C, N, O	(a)

Concept 2: Observation of periodicity in arrangement according to atomic weight -Mendeleev.

Q. No.	Obj.	Question	Answer
3	K	In the Mendeleev periodic table elements are arranged according to their (a) increasing atomic mass (b) decreasing atomic mass (c) increasing atomic number (d) increasing atomic size	(a)

Concept 3: Arrangement of elements in the increasing order of their atomic numbers show periodicity in their electronic configurations - Long form of periodic table.

Q. No.	Obj.	Question	Answer
4	K	In the long form of the periodic table the elements are arranged in the ascending order of their (a) atomic mass (b) atomic number (c) atomic mass (d) atomic volume	(b)
5	K	Elements in the same vertical group of the periodic table have same (a) number of electrons (b) atomic number (c) number of valency electron (d) electronic configuration	(c)
6	U	Elements with atomic number 20 is placed in which period of the periodic table (a) 4 (b) 3 (c) 2 (d) 1	(c)
7	K	Elements having outermost electronic configuration ns^2np^6 are called (a) noble gases (b) alkali metals (c) alkaline earth metals (d) halogens	(a)

Q. No.	Obj.	Question	Answer
8	K	The elements of a group in the periodic table have the same number of _____ in the valency shell.	Electrons
9	K	State modern periodic law	
10	K	What is meant by periodic classification ?	
11	K	What is the basis for the classification of the elements in the long form of the periodic table ?	
12	K	_____ is the liquid non-metal in the periodic table.	Bromine

Concept 4: Periodicity in properties of elements can be explained on the basis of their electronic configuration.

Q. No.	Obj.	Question	Answer
13	K	Which of the following does not reflect the periodicity of the element ? (a) atomic size (b) electronegativity (c) ionisation potential (d) neutron-proton ratio	(d)
14	U	Which of the following electronic configurations has lowest ionisation energy ? (a) $1s^2 2s^2 2p^6 3s^1$ (b) $1s^2 2s^2 2p^5$ (c) $1s^2 2s^2 2p^6 3s^2 3p^1$ (d) $1s^2 2s^2$	(c)
15	U	Which of the following properties always increases along a period in moving from left to right (a) ionisation energy (b) electron affinity (c) atomic size (d) nuclear charge	(d)
16	U	The largest number of unpaired electrons is present in (a) nitrogen (b) oxygen (c) fluorine (d) sulphide ion	(a)

Q. No.	Obj.	Question	Answer
17	K	Match the terms given in column A with those given in column B	
		A — B	
		1. Electronc affinity — a. Paulings scale	c
		2. Ionisation energy — b. Atomic radius	d
		3. Electro-negativity — c. Exothermic	a
		4. Covalent bond length — d. Endothermic	b
18	U	Oxygen molecule has paramagnetism because it has _____ electrons.	Unpaired
19	K	When a neutral atom is converted into an ion its atomic number _____	Remains same
20	K	What is meant by periodicity ?	

Concept 5: Classification of elements into different blocks in the long form of the periodic table.

Q. No.	Obj.	Question	Answer
21	U	Which of the following sets of the element has the strongest tendency to form positive ions in the gaseous state ? (a) Li, Na, K (b) Be, Mg, Ca (c) F, Cl, Br (d) O, S, Se	(a)
22	K	Which of the following statement is incorrect ? (a) Group I elements are called alkali metals (b) Group II metals are found in free state (c) Metallic character increases on moving down a group (d) p-block elements are non-metals	(d)
23	K	Which of the following represents the electronic configuration of the most electropositive element. (a) [He] $2s^1$ (b) [Xe] $6s^1$ (c) [He] $2s^2$ (d) [Xe] $6s^2$	(b)
24	K	If the electronic configuration is $1s^2 2s^2 2p^6 3s^2$. It is a _____ (a) metal (b) non-metal (c) metalloid (d) noble gas	(a)

Q. No.	Obj.	Question	Answer
25	U	The elements with atomic numbers 2, 10, 18, 36, 54 and 86 are all (a) noble gases (b) light metals (c) halogens (d) rare earths	(a)
26	K	How are elements classified based on electronic configuration ?	
27	U	Write the electronic configuration of an element with atomic number 12. Predict the block, group and period to which the element belongs.	
28	U	Explain why there are eight elements in the second period ?	
29	U	Atomic numbers of the some elements are given below which of them belongs to the same group of the periodic table. Z = 21, 30, 39, 48	

Concept 6: Atomic radius is a measure of the effective size of atom. It has a different value in different environment.

Q. No.	Obj.	Question	Answer
30	U	Which of the following sets of ions are iso electronic ? (a) Mg^{2+}, Ba^{2+} (b) Ca^{2+}, S^{2-} (c) Na^{+} Al^{+} (d) F^{-} O^{-}	(b)
31	U	Identify the set in which the elements are in the increasing order of their size. (a) I, Br, Cl (b) Na, Mg, C (c) Li, Na, K (d) C, N, O	(c)
32	U	How are ionic radii of Na^{+} and F^{-} determined by Pauling method ?	
33	K	The bond length between two identical atoms changes with _____ and ____ of bonds	Number, Nature
34	U	C^{4-}, N^{3-}, Na^{+}, Al^{3+} In these iso-electronic series size _____ with _____ in nuclear charge.	decreases increase
35	K	Mg^{2+}, Na^{+} and Ne are known as _____	Isoelectronic
36	U	Calculate the atomic radius of carbon given that C-C covalent bond length is 0.154 nm.	
37	K	State slater rule	

Q. No.	Obj.	Question	Answer
51	U	Contrary to the expectations, oxygen has lower ionisation energy than nitrogen. Why ?	
52	U	Arrange the following in the increasing order of their ionisation energy. Na, Li, Rb, K	Rb<K<Na<Li
53	U	Why are the ionisation energies of oxygen and sulphur less than that of nitrogen and phosphorus ?	
54	U	Why is the first ionisation energy less than that of subsequent ionisation energies ?	
55	U	The reason for the sudden drop in the ionisation energy values of Na from Ne. (a) Atomic size of Na is larger than Ne. (b) Added electron is added into the new level. (c) Both (a) and (b) are correct (d) Neither (a) nor (b) is correct.	(c)

Concept 8: Electron affinity is the energy released when an electron is added to a neutral gaseous atom.

Q. No.	Obj.	Question	Answer
56	K	Which of the following represents the correct order of electron affinity ? (a) F > Cl > Br > I (b) C < N < O < F (c) N < C < O < F (d) C > Si > P > N	(a)
57	K	Which of the following has zero value of electron affinity ? (a) Na (b) F (c) Mg (d) Ne	(d)
58	U	Electron affinity of nitrogen is zero while oxygen has substantial value of electron affinity. Why ?	
59	U	Adding an electron to a neutral gaseous atom is exothermic while addition of second electron is endothermic. Explain.	
60	K	Define electron affinity.	
61	K	Arrange the following in the increasing order of their electron affinities F, Cl, Br, I	I<Br<F<Cl
62	K	What are the factors affecting electron affinity of an atom ?	
63	U	The first electron affinity of oxygen atom has positive values whereas the second electron affinity has negative value. Why ?	
64	U	Why has fluorine less electron affinity than chlorine ?	

Concept 9: Electronegativity is the measure of the ability of an atom to attract electron towards itself in a molecule.

Q. No.	Obj.	Question	Answer
65	K	Which of the following is most electronegative ? (a) Be (b) Al (c) C (d) Ga	(c)
66	K	Select the most electronegative element among the following. (a) Al (b) S (c) Si (d) P	(b)
67	K	Which of the following is a relative property ? (a) electron affinity (b) electronegativity (c) ionisation energy (d) atomic size	(b)
68	K	Define electronegativity.	

Concept 10: The general trend in atomic size decreases along a period and increases down the group.

Q. No.	Obj.	Question	Answer
69	K	The size of the following species follows the order (a) $I^- > Br^- > Cl^- > F^-$ (b) $F^- > Cl^- > Br^- > I^-$ (c) $Cl^- > F^- > Br^- > I^-$ (d) $Br^- > Cl^- > I^- > F^-$	(a)
70	K	Explain the trend of atomic radius along a period and in a group.	
71	U	How does atomic size of elements in the same group vary ? Give reasons for the variation in size.	
72	U	Arrange the elements C, N, O, F in the increasing order of their size.	F<O<N<C

Concept 11: The general trend in ionisation energy is electron affinity and electronegativity increases along a peiod and decreases down a group.

Q. No.	Obj.	Question	Answer
73	K	Electron affinity of atoms decreases from top to bottom in a group because (a) atomic size increases (b) nuclear charge increases (c) shielding effect decreases (d) effective nuclear charge decreases	
74	U	How does electronegativity vary from left to right in a period ? and give reasons.	

Concept 12: Shielding effect is the screening of valence electrons by the intervening electrons present in the inner shells from nuclear attractions.

Q. No.	Obj.	Question	Answer
75	K	Which among the following electronic configurations screening effects is more ? (a) $1s^2 2s^2 2p^6$ (b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$ (c) $1s^2 2s^1$ (d) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$	(b)
76	K	The order of screening effect of orbital electron is (a) d > f > s > p (b) f > d > p > s (c) s > d > p > f (d) s > p > d > f	(b)
77	U	The increase in the number of shells, _____ the screening effect.	increases
78	U	The electronegativity values of A, B, C are 1, 2.1, 4 respectively. The nature of bond A-C and B-C are (a) covalent and ionic (b) ionic and ionic (c) ionic and covalent (d) covalent and covalent	(c)
79	K	The electronegativity of an element according to Mullikan's scale is _____	$\frac{IE+EA}{2}$

Q. No.	Obj.	Question	Answer
80	K	Arrange the following compounds in the decreasing order of ionic character. HCl, HBr, HF, HI	HF>HCl >HBr> HI
81	U	Classify the following as ionic compounds and covalent compounds CsF, NaCl, CCl_4, CH_4, CaF_2	CsF,NaCl CaF_2-Ionic CCl_4,CH_4 -Covalent
82	K	Define the term electronegativity. Give two example.	
83	U	How could the electronegativity value be used to predict the ionic character ?	

d-BLOCK ELEMENTS

Content Analysis

* Definition of d-block and transition elements.

* Electronic configuration of d-block elements.

* General trends in properties of d-block elements.

* Characteristics properties of transition elements.

* Formation of complex compounds.

* Werner's theory.

* Nomenclature of coordination compounds.

* Geometry of some complex compounds.

* Preparation and properties of some selected compounds of transition elements.

* Metallurgy of some transition elements.

Concept 1: The atoms in which electrons are being filled in the inner d-orbitals are known as d-block elements.

Q. No.	Obj.	Question	Answer
1	K	What is a transition element ? Give examples.	
2	K	Which one of the following is not a true transition element (a) Mn (b) Cr (c) Zn (d) Sc	Zn
3	K	Which one of the following represents the electronic configuration of d-block elements. (a) $(n-1)d^{1-9}\ ns^2$ (b) $nd^{1-9}\ (n+1)s^2$ (c) $(n-1)d^{1-10}\ ns^{1-2}$ (d) All the above	
4	A	Write the electronic configurations of copper and chromium.	
5	A	Why have the third series of transition elements almost the same size, when compared to II series of transition elements ?	
6	K	Zn, Cd, Hg are d-block elements but not _____	
7	K	What is the general electronic configuration d-block elements ?	
8	K	Name any two characteristic properties of d-block elements.	

Q. No.	Obj.	Question	Answer
9	K	The first transition series include (a) Ythium-cadmium (b) Scandium-Zinc (c) Lanthanum-Mercury (d) Scandium-Argon	(b)
10	K	The d-block elements include the following (a) 3-12 groups (b) 1-10 groups (c) 1-2 groups (d) 13-18 groups	(a)
11	K	The atomic number of the given element is 29. Identity the name, group and the colour of its salts.	
12	U	Which of the following group is not regarded as transition element (a) Fe, Ru, Os (b) Cu, Ag, Au (c) Zn, Cd, Hg (d) Ti, Zn, Hf	(c)

Concept 2: The atoms/ions with partially filled d-orbital are known as transition elements.

Q. No.	Obj.	Question	Answer
13	K	The electronic configuration of three successive transition elements are [Ar] $3d^1 4s^2$, [Ar] $3d^2 4s^2$, [Ar] $3d^3 4s^2$ Write the configuration of the next element.	
14	U	Cu has the configuration of [Ar] $3d^{10} 4s^1$. Even then it is considered as a transition metal. Explain	
15	U	The configuration of Mn is [Ar] $3d^5 4s^2$ The configuration of Mn^+ will be _____	
16	U	Half-filled d-orbital is possessed by (a) Fe^{2+} (b) Sc^{3+} (c) Mn^{2+} (d) Cr^{3+}	(c)
17	K	d-block elements are hard metals because they have high _____ and low _____	

Concept 3: The general trends in properties like size, ionisation energy and oxidation states are explained on the basis of their electronic configuration.

Q. No.	Obj.	Question	Answer
18	K	The atomic radius decreases as we move from Cr to Cu. Explain.	
19	U	The ionic size does not vary along a period with the increase of atomic number in d-block elements. Why ?	
20	U	The atomic radii of the d-block elements of a given I transition series generally _____ with increase in atomic number.	decrease
21	U	Why transition elements have varible oxidation states ?	
22	K	What is periodic variation of atomic radii along the period and down the grcup ?	
23	U	Manganese does not exist in the oxidation state of (a) +2 (b) +3 (c) +5 (d) +7	(c)
24	U	Which are the following is a stable pair of ion, (a) Fe^{+3}/Mn^{+3} (b) Fe^{+2}/Mn^{+2} (c) Fe^{+3}/Mn^{+2} (d) Fe^{+2}/Mn^{+3}	(c)

Q. No.	Obj.	Question	Answer
25	K	Name the transition metal that shows maximum oxidation state.	
26	K	Atomic radii of I transition series along the same period, (a) Increases (d) decreases (c) first increases then decreases (d) first decreases then increases	(b)
27	U	The maximum oxidation number is exhibited by (a) Mn (b) Cr (c) Os (d) Zn	(c)
28	U	Decrease in radius is small as we move from Cr to Cu because (a) The effective nuclear charge increases slightly (b) The effective nuclear charge increases leargely (c) The effective nuclear charge decreases slightly (d) The effective nuclear charge decreases largely.	(a)
29	K	Which of the following metals having zero oxidation state. (a) K_4 $[Fe(CN)_6]$ (b) $[Ni(CO)_4]$ $[Ni(CO)_4]$ (c) $[Co(NH_3)_6]Cl_3$ (d) $[Cu(NH_3)_4]So_4$	(b)

Concept 4: Transition elements are more prone to form co-ordination compounds due to the availability of vacant d-orbitals.

Q. No.	Obj.	Question	Answer
30	K	What is co-ordination number ?	
31	U	What is the oxidation number of Ni in $[Ni(CO)_4]$?	
32	U	What are the factors favourable for the formation of complexes ?	
33	K	Co-ordination number is, (a) effective atomic number (b) primary valency (c) number of elements attached to the central metal ion (d) number of chemical bonds formed between the central atom and ligard	(d)
34	U	Most stable complex ions are formed with metallic ions having (a) larger size and high nuclear charge (b) small size and high nuclear charge (c) larger size and small nuclear charge (d) small size and small nuclear charge	(b)

Concept 5: A co-ordination compound is one in which a central metal ion/atom is linked to a group of atoms/ions (ligands) through co-ordination bonds.

Q. No.	Obj.	Question	Answer
35	U	Write the equation for the dissociation of $[Co(NH_3)_6]Cl_3$ in water ?	$[Co(NH_3)_6]Cl_3 \xrightarrow{\quad} [Co(NH_3)_6]^{3+} + 3Cl^-$
36	U	The number of moles of AgCl precipitated when excess of $AgNO_3$ is mixed with one mole of $[Co(NH_3)_4Cl_2]Cl$ is _____.	One
37	S	Calculate the effective atomic number of metal ion in $K_3[Fe(CN)_6]$	
38	A	How many ions are produced by $[Co(NH_3)_6]Cl_3$	Two
39	U	The number of moles of AgCl precipitated when excess $AgNO_3$ is mixed with one mole of $[Co(NH_3)_4Cl_2]Cl$ is (a) 0 (b) 1 (c) 2 (d) 3	(b)
40	U	AgCl is soluble in (a) aqua regia (b) H_2SO_4 (c) HCl (d) NH_4OH	(d)
41	K	$FeSO_4 (NH_4)_2 SO_4.6H_2O$ is an example of (a) simple salt (b) double salt (c) complex compound (d) co-ordination compound	(b)

Q. No.	Obj.	Question	Answer
42	U	Zn^{2+} dissolves in excess of NaOH due to the formatino of (a) $[Zn(OH)_2]$ (b) $Na_2[Zn(OH)_4]$ (c) $Na_2[Zn(OH)_2]$ (d) $[Zn(OH)_4]$	(b)
43	K	What is monodentate ligand ? Give two examples.	CN^-, CO
44	S	Calculate the charge on the metal ions in the following complexes (a) $Fe[(CN)_6]^{3-}$ (b) $[Cu(NH_3)_4]^{2+}$ (c) $[Fe(CN)_6]^{4-}$	

Concept 6: The number of ligands attached to the central metal ion in a co-ordination compound is the co-ordination number.

Q. No.	Obj.	Question	Answer
45	K	In which of the following compounds the metal has zero oxidation state ? (a) $[Fe(CO)_5]$ (b) $K_4[Fe(CN)_6]$ (c) $[Fe(SCN)_3]$ (d) $Fe_4[Fe(CN)_6]_3$	(a)
46	K	What is co-ordination number ?	
47	U	A Ni^{2+} ion is bonded to two molecules of ethylenediamine. This shows that the ligand is _____.	bi-dentate
48	K	Co-ordination number is (a) effective atomic number (b) primary valency (c) number of elements attached to the central metal ion (d) Number of chemical bonds formed between the central atom/ion and ligands.	(d)
49	K	A metal with co-ordination number 4 will be found in _____ and _____ hybridization.	dsp^2, sp^3

Concept 7: There are specific ways in which co-ordination compounds are represented.

Q. No.	Obj.	Question	Answer
50	K	The correct formula for potassium ferricyanide is (a) $K_4[Fe(CN)_6]$ (b) $K[Fe(CN)_6]$ (c) $K_3[Fe(CN)_6]$ (d) $K_2[Fe(CN)_6]$	(c)
51	U	Which of the following Werner theory does not explain (a) Dual nature of anion (b) Oxidation state of central metal ion (c) Size of the central metal atom/ion (d) Co-ordination number.	(c)
52	S	The oxidation state of the inner and outer sphere of Fe in $Fe_4[Fe(CN)_6]_3$ respectively (a) 2 and 4 (b) 3 and 2 (c) 4 and 3 (d) 2 and 3	(d)

Concept 8: A set of rules given the naming of coordination compounds

Q. No.	Obj.	Question	Answer
53	K	The IUPAC name of $K_4[Fe(CN)_6]$ is (a) potassium hexacyanoferrate(II) (b) potassium cyanide (c) potassium hexacyanoferrate (d) prussian blue	(c)
54	K	Give the IUPAC name and structure of $[Cu(NH_3)_4]SO_4$	
55	U	Find out the co-ordination number of metal ion in the following complexes. (a) $[Co(NH_3)_6]Cl_3$ (b) $[Cu(NH_3)_4]SO_4$ (c) $K_3[Fe(CN)_6]$	

Concept 9: The case of electron transition from one energy state to another generally imparts colour to the transition metal compounds

Q. No.	Obj.	Question	Answer
56	U	Why is Sc^{3+} colourless ?	
57	K	Explain the nature of formation of coloured ions.	
58	K	Match the following metal ions in column A with the colour in the column B A: 1. Zn^{2+} 2. Cr^{3+} 3. Mn^{2+} 4. Fe^{2+} 5. Fe^{3+} B: a. Pink b. Yellow c. Green d. Colourless e. Green f. Violet g. Blue	
59	K	The colour of the transition metal is due to the presence of (a) vacant d-orbital (b) presence of paired electrons (c) partially filled d-orbitals (d) partially filled p-orbitals	(c)
60	U	Why is titanium ion (Ti^{3+}) purple ?	
61	K	Mention any three transition ions and their colours.	
62	K	An atom of an element has completely filled 'd' orbitals will its ion show any colour ? Why ?	

Q. No.	Obj.	Question	Answer
63	U	Acidified potassium dichromate solution when reduced using Mohr's salt solution the orange colour changes to gree due to the formation of (a) Cr^{+7} (b) Cr^{+3} (c) Cr^{+6} (d) Cr^{+2}	(b)
64	K	Which gives blue colour with ammonia solution (a) Mn^{+2} (b) Cu^{+2} (c) Cr^{+2} (d) Ni^{+2}	(b)
65	U	Which of the following is colourless ? (a) Mn^{+7} (b) Cr^{+3} (c) Zn^{+2} (d) Fe^{+2}	(c)
66	U	The ion which shows colour due to the absorption of _____ light	Visible
67	U	Cu^{+2} ion absorbs orange colour so it appears in _____ colour	Blue
68	U	Copper sulphate dissolves in ammonia solution giving deep blue colour due to the formation of (a) $[Cu(NH_3)_2]SO_4$ (b) $[Cu(NH_3)_4]SO_4$ (c) $CuSO_4\ 5H_2O$ (d) $[Cu(NH_3)_2(H_2O)_2]SO_4$	(b)

Q. No.	Obj.	Question	Answer
69	U	A transition metal 'X' has a configuration $[Ar]3d^4$ in its +3 oxidation state. The atomic number of 'X' is (a) 25 (b) 26 (c) 22 (d) 19	(a)

Concept 10: The magnetic properties of co-ordination compounds are explained on the basis of electronic configuration of central metal ions.

Q. No.	Obj.	Question	Answer
70	K	What is paramagnetism ? Which elements exhibit paramagnetism ?	
71	A	Which metals of d-block elements could be magnetized ?	
72	U	What type of magnetic property is shown by Cu^{+} ion ?	
73	U	In which of the following the maximum magnetic behaviour is observed ? (a) 2 upaired electron (b) 3 unpaired electron (c) 5 unpaierd electron (d) 1 electron	(c)
74	K	Differentiate between para-, dia- and ferromagnetism.	
75	U	If the number of unpaired electrons are more _____ property will be more.	Magnetic
76	K	Paramagnetism is shown by d-block elements due to (a) paired electrons (b) electrons in the valence shell (c) unpaired electrons (d) vacant d-orbitals	(c)

Concept 11: Geometry of coordination compounds can be explained using VSEPR theory.

Q. No.	Obj.	Question	Answer
77	U	The hybridisation that is taking place with co-ordination number 6 is (a) sp^3 (b) sp^2 (c) sp^3d^2 (d) sp^3d	(c)
78	U	dsp^2 hybridization would result in the formation of _____ shape of compounds. (a) square planar (b) tetrahedral (c) octahedral (d) trigonal	(a)
79	U	Match the following hybridisation in set A to to the geometrics in set B. A — B 1. sp — a. Tetrahedral 2. sp^2 — b. Octahydral 3. sp^3 — c. Linear 4. d^2sp^3 — d. Trigonal 5. sp^3d^2 — e. Square planar f. Trigonal bypyramidal	

Concept 12: Elements of d-block and their coordination compounds have many useful applications.

Q. No.	Obj.	Question	Answer
80	U	What property of tungsten makes it possible for use in light bulbs ?	High melting point
81	A	Antirust paint contains (a) ZnO (b) MnO (c) Cu_2O (d) Cr_2O_3	(c)
82	K	Blue print paper having a coating of (a) sodium nitroprusside (b) a mixture of potassium ferri cyanide and ammonium ferricitrate (c) Prussian blue (d) Turubull's blue	(b)
83	K	Indicate any two ions formed when carnalite is dissolved in water.	K^+, Mg^{2+}
84	K	In the preparation of vanaspathi _____ is used as a catalyst.	Ni
85	K	An alloy containing Cu-Zn is known as (a) Monel metal (b) Constantine (c) Bronze (d) German silver	

Q. No.	Obj.	Question	Answer
86	U	An alloy of _____ is used in fountain pen nib tips (a) Pt-Ag (b) Pt-Au (c) Pt-Ir (d) Pt-Cu	(c)
87	K	Stainless steel is an alloy of _____	
88	U	Which of the following is a false statement (a) Rusting of Fe can be prevented by acidic water (b) Rusting of Fe is electro chemical process (c) Rusting of Fe takes place in moist air (d) Rusting of Fe produces hydrated Fe_2O_3.	(b)
89	K	Which of the following is Quick silver ? (a) Cr (b) Ni (c) Ag (d) Hg	(d)
90	K	Name the composition of German silver and give its use.	
91	K	Which metal is the galvanizer of iron (a) Mn (b) C (c) Zn (d) Al	(c)

Q. No.	Obj.	Question	Answer
92	K	Stainless steel contains (a) Cr + W (b) Mg + Al (c) Cr + Ni (d) Cr + Co	(c)
93	K	Impurities present in spelter (a) Pb, Fe, Cd, As (b) Pb, Fe, Cd (c) Pb, Fe (d) Fe, Cd	(a)
94	U	_____ compounds are used in dyeing as pigments and in tanning of leather.	Cr
95	U	_____ is called Philospher's wool. Which compound of Cr is used in calico printing ?	ZnO $K_2Cr_2O_7$
96	K	What is the commercial name of copper sulphate ?	Blue vitriol
97	A	What is Bordeaux mixture ? and give its use.	$CuSO_4$+ lime
98	U	Silver nitrate is called as _____	Lunar caustic
99	U	Mercuric chloride is known as _____	Calomel

Concept 13: d-block elements form inner stitial compounds.

Q. No.	Obj.	Question	Answer
100	K	What are non-stoichiometric compounds ?	
101	U	What are interstitial compounds ? Give two examples.	
102	U	Compounds with indefinite structure and proportions are known as _____	

CHEMICAL ENERGETICS

Content Analysis

* Energy changes in chemical reactions - potential and kinetic energies.

* Definition of system, surroundings, heat, work and state functions.

* Law of conservation of energy - internal energy and enthalpy change.

* Thermochemical equations and illustration of Hess's law.

* Heats of reaction: Enthalpy of formation, combustion solution - dilution - hydration - fusion - vapourisation, sublimation and neutralisation.

* Determination and application of heat of reaction (By using Bomb calorimetric and Dewar flask).

Concept 1: All changes (physical and chemical) are accompanied with energy changes.

Q. No.	Obj.	Question	Answer
1	K	The combustion of petrol converts heat energy into _____ in an automobile. (a) electrical energy (b) kinetic energy (c) mechanical energy (d) potential energy	(c)
2	K	The form of kinetic energy of water falling from a dam is utilised for the generation of _____ (a) mechanical energy (b) chemical energy (c) solar energy (d) electrical energy	(d)
3	U	Interconversion of energy is based on the _____. (a) law of mass action (b) law of chemical combination (c) Hess's law of heat of summation (d) law of conservation of energy	(d)
4	U	A substance possesses potential energy and kinetic energy of 2 Cals and 20 Joules respectively. Calculate the total internal energy of the substance in Joules.	28.4 KJ

Concept 2: Energy is stored in the form of bonds and in the form of molecular motions (translational, rotational, vibrational) - Internal Energy.

Q. No.	Obj.	Question	Answer
5	K	The energy possessed by a system due to the movement of molecules is called _____.	Transitional energy
6	K	The energy possessed by the system due the rotation of the molecules is called _____.	Rotational energy
7	K	What are the components of internal energy of a system ?	Transitional rotational, vibrational, Coulombic & interaction energy
8	U	What are the changes in internal energy of a system if it, (a) absorbs 100 cal of heat and does 200 J of work ? (b) looses 155 cal of heat and does 236 J of work ?	
9	U	The internal energy of an object can be increased by doing a mechanical work on it. Explain.	

Concept 3: Energy change at constant pressure process is called enthalpy.

Q. No.	Obj.	Question	Answer
10	K	Which of the following expression represents the enthalpy of a system ? (a) $H = E - PV$ (b) $H = E + PV$ (c) $H = nRt - E$ (d) $H = E - nRT$	(b)
11	K	Enthalpy change refers to (a) energy change at constant volume (b) energy stored in the system (c) energy change at constant pressure (d) energy lowering in the system	(c)
12	U	In which of the following reactions ΔH is more than that of ΔE ? (a) $N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$ (b) $N_{2(g)} + O_{2(g)} \longrightarrow 2NO_{(g)}$ (c) $PCl_{5(g)} \longrightarrow PCl_{(g)} + Cl_{2(g)}$ (d) $4CO_{(g)} + 7H_{2(g)} \longrightarrow C_3H_{8(g)} + 3H_2O_{(l)}$	(c)
13	U	If the energy of the products is less than enegy of the reactant, the reaction is (a) exothermic (b) endothermic (c) not possible (d) always spontaneous	(a)

Q. No.	Obj.	Question	Answer
14	U	Why most of the exothermic reactions are spontaneous in nature ?	
15	K	Give some examples of exo and endo-thermic reactions.	
16	U	Derive the relationship between ΔH and ΔE.	$\Delta H = \Delta E + \Delta nRT$
17	A	The enthalpy change ΔH for the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ is -92.38 KJ at 298 K. What is ΔE at 298K.	$\Delta H = \Delta E + \Delta nRT$ =-90.88 KJ
18	U	Given the bond dissociation energies per mole of H_2 = 436.8 KJ C=C = 609 KJ C - C = 336 KJ Calculate enthalpy change of following reaction $C_2H_4 + H_2 \rightarrow C_2H_6$	
19		The heat capacity of a gas at constant volume is always greater than at constant pressure. Justify.	

Concept 4: System is that part of the universe on which observations are made and remaining part is described as surroundings.

Q. No.	Obj.	Question	Answer
20	K	Differentiate a system from its surroundings with some example.	
21	U	A system without a mechanical link with the surroundings cannot do any work. Justify.	

Concept 5: Law of conservation of energy states that energy can neither be created nor destroyed and the sum total of the energy remains constant in all changes.

Q. No.	Obj.	Question	Answer
22	U	200 Joules of heat supplied to the system and 0.2 KJ of work was done by the system. The internal energy of the system thus _____ (a) increases (b) remains the same (c) decreases (d) zero	(d)
23	K	State the law of conservation of energy.	

Concept 6: Heat and work are the methods of energy transfer between system and surroundings .

Q. No.	Obj.	Question	Answer
24	K	The energy transferance also occurs in the form of _____ on the surroundings by the system.	Work done
25		The transference of energy does not take place in the form of (a) heat (b) work (c) electrical energy (d) mass	(d)
26	K	The work done by a gas on expansion is given by _____	$P\Delta V$

Concept 7: Thermodynamic state is described by observable properties of the system like P, T, V, E, etc.

Q. No.	Obj.	Question	Answer
27	U	Which one of the following is an example of intensive property ? (a) Enthalpy (b) Mass (c) Temperature (d) Volume	(c)
28	U	Which one of the following is an example of extensive property ? (a) Volume (b) Density (c) Viscosity (d) Melting point of a solid	(a)
29	U	Explain the difference between extensive and intensive property with an example.	

Concept 8: Properties which are independant of the path followed during a change are called state functions, while path functions depend on the path followed.

Q. No.	Obj.	Question	Answer
30	U	State function is the property which depends on (a) the physical state (b) the path followed (c) the initial and final state of the system (d) the past history of the system	(c)
31		Which of the following term does not represent the state function ? (a) Pressure (b) Volume (c) Temperature (d) Heat	(d)
32	U	q and w are not state functions but (q-w) is a state function. Justify.	

Concept 9: Thermochemical equation is characterised by set of rules and it represents the energy change in a given type of reaction.

Q. No.	Obj.	Question	Answer
33	U	Which one of the following is a thermo-chemical equation ? (a) $CH_4(g)+2O_2(g)$ ---> $CO_2(g)+2H_2O(l)$ ΔH = -801.59 KJ (b) $2H_2(g)+2O_2(g)$ ---> $2H_2O(l)$ ΔH = 2 x -286 KJ (c) $CH_4(g)+2O_2(g)$ ---> $CO_2(g)+2H_2O(l)$ ΔH = -801.59 KJ (d) $2H_2(g)+O_2(g)$ ---> $2H_2O(g)$ ΔH = -242.7 KJ	(a)
34	U	Write a thermochemical equation for the combustion of methane.	CH_4+2O_2 ->CO_2+ $2H_2O+$ Heat
35	K	What are rules of writing thermochemical equations ?	
36		Out of the following which is not applicable to thermochemical equation ? (a) It indicates reactants and products physical states. (b) It indicates whether exo or endothermic. (c) It indicates the allotrope of the reactant (if it present). (d) It indicates whether the reaction takes place or not.	(d)

Concept 10: Standard state of each element and compound is attributed to its stable physical state at 1.0 atm pressure and at 298 K.

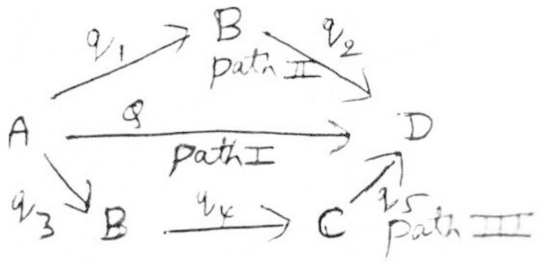
Q. No.	Obj.	Question	Answer
37	K	The standard enthalpty of formation of elemental gases like O_2, N_2, H_2 at 1 atm at 298 K is taken as (a) positive (b) negative (c) zero (d) unity	(c)
38	K	The standard state of carbon is (a) coal (b) diamond (c) coke (d) graphite	(d)
39	K	The standard state of H_2O is (a) water vapour (b) steam (c) ice (d) liquid	(d)

Concept 11: The enthalpy change that accompanies the formation of a compound in its standard state from its elements in their standard state is called enthalpy of formation.

Q. No.	Obj.	Question	Answer
40	U	The enthalpy of formation ethylene(C_2H_4) and ethane (C_2H_6) are 52.5 KJ and -85 KJ respectively the enthalpy of the reaction is C_2H_4 (g) + H_2 (g) ---> C_2H_6 (g) (a) -32.5 KJ (b) +32.5 KJ (c) -137.5 KJ (d) +137.5 KJ	(d)
41	U	For the reaction H_2 (g) + I_2 (g) + 6.2 KCal --> 2HI (g). The heat of formation of HI (g) is (a) +3.1 KCal (b) -3.1 KCal (c) +6.2 KCal (d) -6.2 KCal	
42	U	Given C (graphite) + O_2 (g) ---> CO_2 (g) ΔH = -393.5 KJ $2H_2$ (g) + O_2 (g) ---> $2H_2O$ (l) ΔH = -571.6 KJ CH_4 (g) + $2O_2$ (g) ---> CO_2 (g) + $2H_2O$ (l) ΔH = -890 KJ	

Q. No.	Obj.	Question	Answer
		The heat of formation of CH_4 (g) is (a) 1855 KJ (b) 1068.5 KJ (c) -712.3 KJ (d) -74.7 KJ	
43	U	The standard enthalpy of summation of ethanol C_2H_5-OH is -277.7 KJ/mole and heat of vapourisation of ethanol is 43.5 KJ mol^{-1}. Therefore the enthalpy of formation C_2H_5OH (g) is (a) 234.2 KJ (b) -234.2 KJ (c) 321.2 KJ (d) -321.2 KJ	
44	U	Find out the heat of formation of HCl from the given equation H_2 (g) + Cl_2 (g) ---> 2HCl (g) ΔH = -132 KCal	
45	A	What is the ΔH for the reaction $2H_2$ (g) + O (g) ---> $2H_2O$ (g) and energies for E_{H-H}, $E_{O=O}$, E_{O-H} are 105, 120, 110 KCal mol^{-1} respectively.	
46		C (g) + O_2 (g) --> CO_2 (g). The enthalpy of formation of CO_2 is -394 KJ/mole. What will be ΔE of the reaction at constant volume.	
47		Calculate the enthalpy of formation of benzene from the following data. The enthalpy of combustion of benzene is -3273 KJ. The enthalpy of formation of CO_2 and H_2O are -394 KJ and -286 KJ respectively.	

Concept 12: Hess's law states that enthalpy change in an overall process is the sum of the enthalpy changes for individual steps in the process - an evidence for conservation of energy principle.

Q. No.	Obj.	Question	Answer
48	U	Calculate the enthalpy of oxidation of methanol to formaldehyde and water. The enthalpies of formation of CH_3OH (l), HCHO (l) and H_2O (l) are -239 KJ,-116 KJ and -286 KJ respectively.	163 KJ
49	U	Heat of combustion of C_6H_6 is -3264.6 mol^{-1}. The heat energy of formation evolved when 39 gm of benzene was burnt in open container is (a) 816.5 KJ (b) 1632.3 KJ (c) 6528.2 KJ (d) 2448.45 KJ	1632.3 KJ
50	U	Substance A can be transformed to the product D by selecting either path I, II or III. The energy liberated at each stage is shown by the arrow.  Will there be any change in the total energy of the system by following either path I, II or III. Explain with the reason.	

Concept 13: Hess's law can be illustrated by applying to various types of reaction.

Q.	Obj.	Question	Answer
51	U	Heat of neutralisation is higher value in which one of the following reaction ? (a) acetic acid is neutralised by NaOH (b) HNO_3 is neutralised by NH_4OH (c) HCl is neutralised by NaOH (d) acetic acid is neutralised by NH_4OH	(c)
52	U	When 1.2 g of graphite is burnt in oxygen 39.5 KJs heat is liberated. The enthalpy of combustion of graphite is (a) -39.5 KJ (b) -395 KJ (c) 39.5 KJ (d) -395 KJ	(b)
53	U	The heat of neutralisation of KOH and HNO_3 is -57.3 KJ. The heat released when 0.5 M KOH is mixed with 0.25 M of HNO_3 is (a) 57.3 KJ (b) 28.5 KJ (c) 14.25 KJ (d) 7.15 KJ	
54	U	(a) State Hess's law of summation. (b) Calculate the enthalpy of hydration of anhydrous copper sulphate to hydrated copper sulphate from the given data, the enthalpies of solution of anhydrous, and hydrated copper sulphate are -78.2 KJ and -11.7 KJ respectively.	

Q. No.	Obj.	Question	Answer
55	U	For the decomposition of $MgCO_3$ by the reaction $MgCO_3$ (s) ---> MgO (s) + CO_2 (g) ΔH = 109.2 KJ at 900K and 1 atm pressure. If molar volume of $MgCO_3$ is 0.028 litre and that of MgO is 0.01 litre, calculate the ΔE of the above reaction.	
56		The heat of formation of CO_2(g) is -394 KJ/mol and that of H_2O (l) is -286 KJ mol^{-1}. The heat of combustion of $C_5H_{12}(l)+8O_2(g)$ ---> 5 CO_2(g) + $6H_2O$(l) is -3534 KJ mol^{-1}. Calculate the heat of formation of C_5H_{12} (l).	
57	U	Heat changes in the reaction H_2O (l) ---> H_2O (g) is known as (a) latent heat of vapour (b) latent heat of liquid (c) heat of solution (d) heat of formation	(a)
58		The heat of neutralisation of any acid with any base is (a) the same if either the acid or base is weak. (b) the same if both acid and base are strong. (c) more if either the acid or base is weak or both are weak. (d) less either an acid or base weak or both are weak.	(b)

Q. No.	Obj.	Question	Answer
59	K	Describe the determination of enthalpy of combustion of a compound using Bomb calorimeter.	
60	K	Define the following terms (a) enthalpy of fusion (b) enthalpy of sublimation (c) enthalpy of solution (d) enthalpy of transition	
61	U	$S\ (R) + O_2\ (g) \longrightarrow SO_2\ (g)$ $\triangle H = -297.5$ KJ $S\ (M) + O_2\ (g) \longrightarrow SO_2\ (g)$ $\triangle H = -299.9$ KJ From the above reactions heat of reaction S (M) ---> S (R) is (a) -2.4 KJ (b) 2.4 KJ (c) -597.4 KJ (d) 597.4 KJ	-2.4 KJ
62	U	Calculate the amount of heat required for the ionisation of acetic acid from the following reaction. $NaOH\ (aq) + HCl\ (aq) \longrightarrow NaCl\ (aq) + H_2O\ (l)$ $\triangle H = -13.7$ KCal $NaOH\ (aq) + CH_3COOH\ (aq) \longrightarrow CH_3COONa\ (aq) + H_2O\ (l)$ $\triangle H = -13.4$ KCal	300 Cal
63	U	When 1 mole of sulphuric acid is neutralised with a strong base $\triangle H = -57.4$ KJ, $\triangle Hf H_2O = -286.9$ KJ and $\triangle HFH^+ = 0$. Use these data to find $\triangle Hf(OH)$.	

Q. No.	Obj.	Question	Answer
64	U	Describe the determination of enthalpy of neutralisation of a strong acid by strong base using Dewar flask.	
65	U	The enthalpy of neutralisation of any strong acid with strong base is always a constant. Why ?	
66	U	The enthalpy of neutralisation of weak acid and weak base is less than that of strong acid and strong base. Why ?	
67	U	The enthalpy of fusion of H_2O is +6.02 KJ and enthalpy of vapourisation of water is 40.5 KJ. What is the enthalpy of the reaction H_2O (s) ---> H_2O (g) ?	
68	U	Given the heat of neutralisation of a strog acid and strong base is -57 KJ/mol Find out the energy released when 0.5N, 200 ml of HCl is neutralised by 0.5N of 200 ml of NaOH.	

CHEMICAL EQUILIBRIUM

Content Analysis

* Reversible reactions

* Equilibrium state

* Equilibrium systems

* Law of mass action

* Equilibrium constant and related problems

* Le-Chatelier's principle

Concept 1: Reactions which proceed in both directions are called reversible reactions.

Q. No.	Obj.	Question	Answers
1	K	What are reversible chemical reactions ? Give example ?	
2	A	In which of the following cases is the process reversible ? (a) Thermal dissociation of NH_4Cl in an open vessel (b) Decomposition of $CaCO_3$ in a closed system containing solid KOH (c) Saturated solution of I_2 in water containing some solid I_2 (d) Wet filter paper spread on a glass plate	
3	U	The condition for equilibrium is (a) rate of forward reaction = rateof reverse reaction (b) rate constant of forward reaction = rate constant of backward reaction (c) concentration of product = concentration of reactant (d) concentration of product > concentration of reactant	(a)
4	A	In a reversible reaction k_f is the rate constant for the forward reaction and k_b is the rate constant for the backward reaction, the ratio of k_f/k_b is called _____.	
5	U	$CaCO_3 \rightleftharpoons CaO + CO_2$ when the reaction is carried in a lime kiln, it proceeds to completion because (a) CaO and CO_2 do not combine (b) CaO is much more stable than $CaCO_3$ (c) The temperature in the kiln is very high (d) CO_2 escapes	(d)

Concept 2: Reversible reactions reach a state of equilibrium.

O. No.	Obj.	Question	Answers
6	K	50 ml of water is kept in a closed bottle at 30°C. Even after several hours, the volume of H_2O was found to be the same because (a) water evaporates at 100°C only. (b) in a closed vessel no evaporation can take place. (c) evaporation is independent of the volume of the container. (d) evaporation and condensation are reversible processes.	(d)
	K	NO_2 + CO ⇌ NO + CO_2 (Brown) (Colourless) In the above reacation at equilibrium the brown colour of NO_2. (a) Completely disappears (b) Brown colour remains the same (c) Brown colour fades (d) Brown colour intensifies	(c)
	K	What are revesible reactions ? Give one example. A chemical reaction is said to have reached equilibrium when (a) equal amounts of reactants and products formed. (b) reactants are completely converted to products. (c) the rate of forward reaction is equal to the rate of backward reaction. (d) the concentration of the reactants and products are the same.	
	U	How do we know that a system has reached equilibrium ? Illustrate with an example.	

Concept 3: Chemical equilibrium is dynamic.

Q. No.	Obj.	Question	Answers
10	K	Write the equilibrium constant expressions for the following. $H_2O_{(l)} \rightleftharpoons H^+_{(aq)} + OH^-_{(aq)}$ $Zn_{(s)} + 2Ag^+_{(aq)} \rightleftharpoons Zn^{2+}_{(aq)} + 2Ag_{(s)}$	
11	U	Arrange the following equilibrium in the increasing order of their reaction in the forward direction. $N_2O_4{}_{(g)} \rightleftharpoons 2NO_2{}_{(g)}$ K = 0.87 $2HI_{(g)} \rightleftharpoons H_2{}_{(g)} + I_2{}_{(g)}$ K = 0.018 $Ag_{(aq)} + 2NH_3{}_{(aq)} \rightleftharpoons Ag(NH_3)^+_{2\,(aq)}$ K = 1.7×10^7 $AgCl_{(s)} \rightleftharpoons Ag^+_{(aq)} + Cl^-_{(aq)}$ K = 1.7×10^{-10} $H_2O_{(l)} \rightleftharpoons H^+_{(aq)} + OH^-_{(aq)}$ K = 1×10^{-14}	
12	U	K_c for $H_2{}_{(g)} + I_2{}_{(g)} \rightleftharpoons 2HI_{(g)}$ is 55.5 at 700 K. How many moles of H_2 will be present at equilibrium if the experiment is started with one mole each of H_2 and I_2 in a one litre vessel.	
13	K	A saturated solution of iodine in water is prepared by using radioactive iodine. A crystal of ordinary iodine is dipped into the above. Which of the following observations indicates that the equilibrium is dynamic. (a) Colour of the solution deepens. (b) Colour of the solution fades. (c) The radioactivity of the solution decreases. (d) The radioactivity of the solution remains as before.	

Concept 3: The equilibrium systems may be homogeneous or heterogeneous.

Q. No.	Obj.	Question	Answers
14	K	What is homogeneous chemical equilibrium ? Give an example.	
15	K	What is heterogeneous chemical equilibrium ? Give an example.	
16	K	Classify the following into homogeneous and heterogeneous equilibrium systems. (a) $NH_4Cl_{(s)} \rightleftharpoons NH_{3(g)} + HCl_{(g)}$ (b) $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ (c) $AgNO_{3(aq)} + NaCl_{(aq)} \rightleftharpoons AgCl_{(s)} + NaNO_{3(aq)}$ (d) $Br_{2(l)} + H_2O \rightleftharpoons Br_{2(aq)}$ (e) $NaOH_{(aq)} + Cl_{2(aq)} \rightleftharpoons NaCl_{(aq)} + NaOCl_{(aq)}$ (f) $NO_{(g)} + CO_{2(g)} \rightleftharpoons NO_{2(g)} + CO_{(g)}$	
17	U	$3Fe_{(s)} + 4H_2O_{(g)} \rightleftharpoons Fe_3O_{4(s)} + 4H_{2(g)}$ is an example of (a) homogeneous equilibrium. (b) heterogeneous equilibrium. (c) hydrolysis. (d) hydrogenation.	

Concept 4: Law of mass action relates the rates of chemical reactions to the active masses of the reactants.

Q. No.	Obj.	Question	Answers
18	K	State the law of mass action.	
19	K	Define equilibrium constant.	
20	U	What is meant by active mass ?	
21	U	For the reaction $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ K_p and K_C are related as (a) $K_p = K_C(RT)$ (b) $K_p = K_C(RT)^2$ (c) $K_p = K_C(RT)^{-1}$ (d) $K_p = K_C(RT)^{-2}$	(a)
22	A	What is the expression for the equilibrium constant K_C for the reaction $aA + bB \rightleftharpoons cC + dD$	
23	K	The equilibrium constant for the reaction $A + 2B \rightleftharpoons C$ is (a) $K = \frac{[C]}{[A][B]}$ (b) $K = \frac{[C]}{[A][2B]}$ (c) $K = \frac{[C]}{[A][B]^{1/2}}$ (d) $K = \frac{[C]}{[A][B]^2}$	(d)

Sr. No.	Obj.	Question	Answers
4	U	In which of the following cases is $K_p = K_c$ (a) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ (b) $2KClO_3(s) \rightleftharpoons 2KCl(s) + 3O_2(g)$ (c) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ (d) $H_2(g) + Cl_2(g) \rightleftharpoons 2HCl(g)$	
5	U	From among the following identify the reactions where $k_p < k_c$. (a) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ (b) $2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$ (c) $2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(g)$ (d) $NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$	

Concept 5: Deriving equilibrium constants.

Q. No.	Obj.	Question	Answers
26	K	For a better equilibrium the equilibrium constant is found to be 1.0. What can be inferred from this ?	
27	U	$A_{(g)} + 2B_{(g)} \rightleftharpoons C_{(g)} + 2D_{(g)}$ for this reaction derive the equilibrium constants k_p and k_c.	
28	K	$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$, Derive k_p and k_c for this homogeneous gaseous equilibria.	
29	A	The value of k_c for the equilibrium $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ is 6.024×10^{-4} mol^{-3} at 500 K. Calculate k_p for the equilibrium at the same temperature.	
30	S	The value of equilibrium constant for the formation of PCl_5 at 250^{o}C is found to be 20. What is the equilibrium constant for the dissociation of PCl_5 at the same temperature.	
31	U	Write the chemical equation for the expression $K_c = \frac{[x]^3[y]^2}{[A]^2[B]}$	
32	S	$N_2 + 3H_2 \rightleftharpoons 2NH_3$, it was found at equilibrium at 300^{o}C, the mixture contained 0.25 mol dm^{-3} of N_2, 0.15 mol dm^{-3} of H_2 and 0.09 mol dm^{-3} of NH_3. Calculate the equilibrium constant.	

Q. No.	Obj.	Question	Answers
33	K	Equilibrium constant for the reaction $2NO_{(g)} + Cl_{2(g)} \rightleftharpoons 2NOCl_{(g)}$ is correctly given by the expression (a) $K = \frac{[2NOCl]}{[2NO][Cl_2]}$ (b) $K = \frac{[NOCl]^2}{[NO]^2[Cl_2]}$ (c) $K = \frac{[NOCl]^2}{[NO]^2[Cl_2]^2}$ (d) $K = \frac{[NOCl]^2}{[NO]^2 + [Cl_2]}$	(b)
34	A	Two litres of solution of acetic acid contains 15 g of acetic acid. What is the active mass ?	
35	U	In which one of the following reaction the pressure has no effect. (a) $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ (b) $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ (c) $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ (d) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$	(d)
36	U	For the reversible reaction $2A_{(g)} \rightleftharpoons B_{(g)} + C_{(g)}$ at $30^{o}C$, if the concentration of the reactant is doubled then the equilibrium constant value (a) doubled (b) halved (c) remains the same (d) increases four times	(c)

Concept 7: The effects of pressure, temperature and concentration on equilibrium system - Le Chatelier's principle.

Q. No.	Obj.	Question	Answers
37	A	K_c for the reaction $NH_3 \rightleftharpoons 1/2\ N_2 + 3/2\ H_2$ of K at 298 K for the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$	
38	U	Which one of the following has no effect on the equilibrium $H_2 + I_2 \rightleftharpoons 2HI$ (a) Addition of iodine (b) Increase of pressure (c) Addition of more amount of H_2 (d) Removal of HI	
39	K	A catalyst (a) increases the concentration of products in an equilibrium state. (b) increases the value of equilibrium constant. (c) increases the concentration of reactants. (d) decreases the time to reach equilibrium.	
40	K	Which among the following are the favouable conditions for the formation of ammonia ? $N_2 + 3H_2 \rightleftharpoons 2NH_3 \quad \Delta H = -224$ KCal (a) Low temperature high pressure (b) Low temperature low pressure (c) High temperature high pressure (d) High temperature low pressure	

No.	Obj.	Question	Answers
11	U	The effect of increasing the pressure on the following equilibrium $2A_{(g)} + 3B_{(g)} \rightleftharpoons 3C_{(g)} + 2D_{(g)}$ (a) favours forward reaction (b) favours backward reaction (c) affects both the reactions equally (d) does not favour both the reaction.	(d)
12	K	Consider the equilibrium $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ when we add H_2 gas to the above system at equilibrium, it favours (a) forward reaction (b) backward reaction (c) both the reactions (d) none of the above.	(a)
13		In the case of the reaction $2SO_2 + O_2 \rightleftharpoons 2SO_3 + 44$ KCal an increase in temperature will (a) decrease the yield of SO_3 (b) increases the yield of SO_3 (c) have no effect on the equilibrium constant (d) have no effect till an optimum concentration	(a)

Q. No.	Obj.	Question	Answers
44	U	In which of the following reactions will the yield of products will increase when the pressure is increased ? (a) $2HI_{(g)} \rightleftharpoons H_{2(g)} + I_{2(g)}$ (b) $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ (c) $H_2O_{(g)} + CO_{(g)} \rightleftharpoons H_{2(g)} + CO_{2(g)}$ (d) $H_{2(g)} + Br_{2(g)} \rightleftharpoons 2HBr_{(g)}$	(b)
45	K	A catalyst when added to a system at equilibrium (a) increases the rate of backward reaction. (b) decreases the rate of the forward reaction. (c) increases the rates of both the reaction equally. (d) decreases rates of both the reactions.	
46	U	When the reaction $CaCO_3 \rightleftharpoons CaO + CO_2$ is carried out in an open vessel $CaCO_3$ undergoes complete decomposition. The reason for this is (a) CO_2 is more stable than $CaCO_3$. (b) the temperature increases. (c) CO_2 escapes into the atmosphere. (d) no reaction is possible between CaO and CO_2.	(c)

Q. No.	Obj.	Question	Answers
47	U	Pick out the appropriate statement N_2 (g) + O_2 (g) $\rightleftharpoons$ 2NO (g) $\quad \Delta H = +43.2$ KCals Increase in the yield of NO is brought about by (a) increase of temperature (b) increase of total pressure (c) decrease of pressure (d) decrease in temperature	(a)
48	U	A chemical equilibrium is said to have been established when (a) no more reaction takesplace. (b) concentration of reactants and products are equal. (c) velocities of opposing reactions become equal to each other. (d) the reaction has gone to completion in the forward direction.	(c)
49	A	A mixture of 1.24×10^{-2} mol of H_2 and 2.46×10^{-2} mol of iodine was heated to $457.6^{o}C$ until equilibrium was reached. If the equilibrium constant is 48.7. Calculate the number of moles of HI present at equilibrium.	
50	A	5.2 moles of PCl_5 are heated in a closed vessel of capacity 2 litres. When equilibrium is attained, PCl_5 is 40% dissociated. Calculate the equilibrium constant.	
51	A	For the following reaction taking place at $400^{o}C$, $2H_2O$ (g) + $2Cl_2$ (g) $\rightleftharpoons$ 4HCl (g) + O_2 (g) K_p was found to be 0.035 when partial pressures were measured in atmospheric units. Calculate k_c.	

Q. No.	Obj.	Question	Answers
52	A	In a study of the reaction in the gaseous phase $A + 2B \rightleftharpoons 2C + D$, A and B are mixed in a reaction vessel and kept at 25°C. The initial concentration of B is 1.5 times the initial concentration of A. After the equilibrium has been established, the equilibrium concentration of A and D were equal. Calculate the equilibrium constant at 25°C.	
53	U	In the equilibrium $PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$ at a temperature T, the volume of the system is increased. At the same time Cl_2 is added to the system so as to maintain the partial pressure of chlorine constant. Then, (a) more PCl_5 is formed (b) more PCl_3 is formed (c) partial pressures of all the chemical species remain unchanged. (d) quantities of PCl_3 and PCl_5 are unchanged.	
54	U	For each of the following equilibria predict qualitatively the effect of increasing the total pressure upon the percentage of the products present under equilibrium. (a) $2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$ ΔH = Positive (b) $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$ (c) $2NO_2(g) \rightleftharpoons N_2O_4(g)$ ΔH = Negative (d) $CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$ In cases (a) and (b) predict also the effect of a decrease in temperature.	

No.	Obj.	Question	Answers
55	U	The following are various conditions under which hydrogen gas and iodine vapour are allowed to react at 400°C. In which case the reaction will be fastest? (a) 1 mole of H_2 + 1/2 mole of I_2 in a litre (b) 1 mole of H_2 + 2 moles of I_2 in a litre (c) 2 moles of H_2 + 1 mole of I_2 in a litre (d) 2 moles of H_2 + 2 moles of I_2 in a litre	(d)
56	A	In the reaction $H_2(g) + I_2(g) \xrightleftharpoons{400^\circ C} 2HI$, which of the following pairs of conditions results in the same rate of reaction. (a) (a) and (d) (b) (b) and (c) (c) (a) and (c) (d) (d) and (c)	(b)
57	U	Consider the following equilibrium $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ Under a certain set of conditions, it was found that there was 20% of NO at equilibrium. If the reaction had been started with NO alone the percentage of NO at equilibrium under the same conditions would be (a) 10 (b) 20 (c) 40 (d) 60	(b)

Q. No.	Obj.	Question	Answers
58		Which of the following reactions go farthest in the forward direction ? (a) $CH_3COOH \rightleftharpoons CH_3COO^- + H^+$ $K=1.8\times10^{-5}$ (b) $H^+ + HS^- \rightleftharpoons H_2S$ $K = 1.0 \times 10^{7}$ (c) $CdS \rightleftharpoons Cd^{++} + S^{2-}$ $K = 7.1 \times 10^{-28}$ (d) $H_2O \rightleftharpoons H^+ + OH^-$ $K = 1.0 \times 10^{-14}$	

CHEMICAL KINETICS

Content Analysis

* Homogeneous and Heterogeneous reactions

* Rates of reactions

* Factors influencing reaction rates

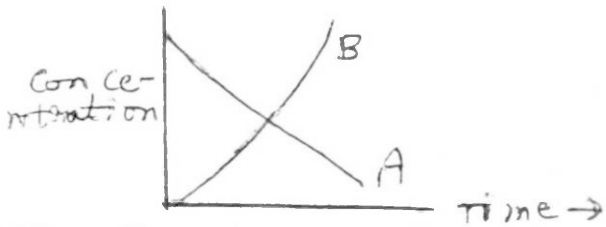
* Catalysts

Concept 1: Chemical reactions can be homogeneous or heterogeneous.

Q. No.	Obj.	Question	Answers
1	K	What are homogeneous reactions ? Give examples.	
2	K	What are heterogeneous reactions ? Give examples.	
3	K	Classify the following reactinos as homogeneous and heterogeneous. (a) $H_2(g) + Cl_2(g) \longrightarrow 2HCl(g)$ (b) $HCl(aq) + NaOH(aq) \longrightarrow NaCl(aq) + H_2O$ (c) $C(s) + O_2(g) \longrightarrow CO_2(g)$ (d) $CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$ (e) $NH_4HS(s) \longrightarrow NH_3(g) + H_2S(g)$	
4	K	Define active mass.	
5	U	How active mass of ideal gases are expressed ?	
6	U	What is the active mass of 80 gms of oxygen in 500 ml flask ?	5 moles/litre
7	U	Define reaction rate or rate of reaction.	
8	U	Write the reaction rate of $aA + bB \longrightarrow cC + dD$	
9	K	What is the unit of rate of reaction ?	
10	U	The active mass of 64 gms of HI in a two litre flask is _____.	
11	K	What is rate law ?	
12	K	Define rate constant.	

Q. No.	Obj.	Question	Answers
13	K	Define order of reaction.	
14		Match the following reactions given in column A with their orders given in column B.	
		A / B	
		1. $2HI \longrightarrow H_2 + I_2$ / a. Pseudo-first order reaction	b
		2. $2H_2O_2 \longrightarrow 2H_2O + O_2$ / b. Zero order reaction	d
		3. $K_2S_2O_8 + 2KI \longrightarrow 2K_2SO_4 + I_2$ / c. Third order reaction	e
		4. $2NO + O_2 \longrightarrow 2NO_2$ / d. First order reaction	c
		5. $C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Invertase}} C_6H_{12}P_6 + C_6H_{12}O_6$ / e. Second order reaction	a
		f. Pseudo-second order reaction	
15	K	What is meant by molecularity of reaction ?	
16	U	What are the differences between order and molecularity of reaction ?	

Q. No.	Obj.	Question	Answers
17	U	Which among the following statements is incorrect ? (a) Molecularity of the reaction can be understood while looking its stoichiometric equation (b) Order of the reaction can be known through the experiment (c) Molecularity of a reaction will be always a integer (d) Order of the reaction will be always an integer	(d)
18	K	Derive the expression for the rate constant of first order reaction.	$K=\frac{2.303}{t}x\log\frac{a}{a-x}$
19	K	Equation for rate constant of a first order reaction is _____	sec^{-1}
20	U	What is the unit of rate constant of first order reaction ?	
21	U	Pickup the unit for rate constant of first order reaction. (a) sec (b) sec^{-1} (c) mole sec^{-1} (d) mole $litre^{-1}$ sec^{-1}	(b)
22	K	Define half life period.	
23	U	Write the equation which corelates rate constant and half life period of first order reaction.	$t_{1/2}=\frac{0.693}{K}$

Q. No.	Obj.	Question	Answers
24	U	Pickout the incorrect statement Rate of the first order reaction (a) depends upon temperature (b) independent upon initial concentration of reactants (c) depends upon initial concentration of reactants (d) depends upon catalyst	(c)
25	K	Give an example for fractional order reaction.	Formation of HBr for H_2&Br_2
26	U	Give an example each for uni and bimolecular reactions.	
27	U	Which line in this graph indicates the change in concentration of reactants ?  	
28	U	All radioactive transformation are _____ order reactions.	First order
29	U	The half life period of a first order reaction is 1600 sec at 300 K. Calculate its rate constant at the same temperature.	4.33×10^{-4} s^{-1}
30	U	Rate constant of a first order reaction is 2.5×10^{-2} sec^{-1}. Calculate the time taken for completion of 40% of reaction.	Negative
31	U	Plot of log(a-x) against time for first order reaction has _____ slope.	Negative
32	K	What are pseudo first order reactions ? Give two examples.	
33	U	Explain how rate constant of pseudo first order reaction is determined experimentally.	

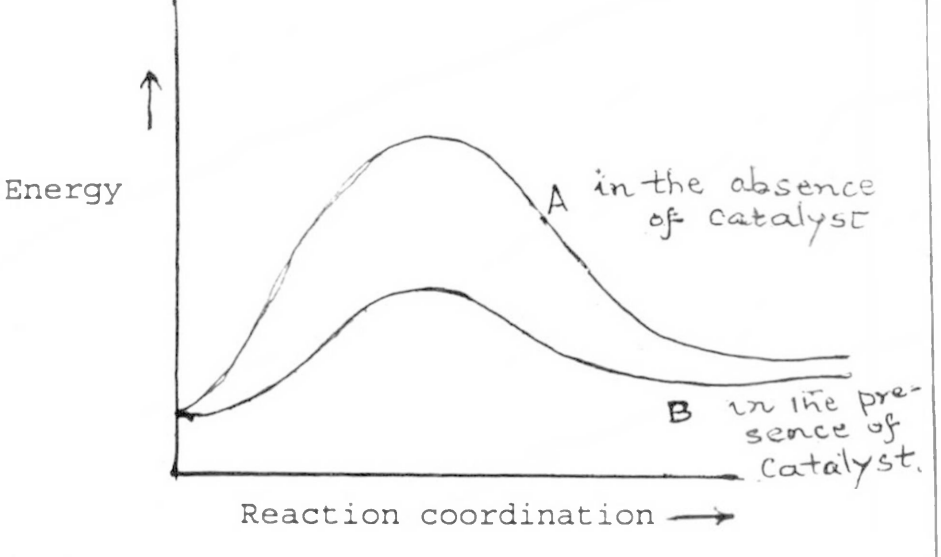
Concept 3: Rate of reaction will be influenced by several factors.

Q. No.	Obj.	Question	Answers
34	K	Rate of reaction and temperature are _____ proportional to each other.	Directly
35	U	Write Arrhenium equation which relates rate constant of a reaction with temperature.	$K=Ae^{-Ea/RT}$
36	K	Unit for activation energy is _____	J $mole^{-1}$
37	K	Define threshold energy.	
38	K	What is meant by effective collision ?	
39	K	What is meant by energy of activation ?	
40	K	Rate of reaction and energy of activation are _____ proportional to each other.	Inversely
41	K	List the factors which are effecting rate of reaction.	
42	U	Why the rate of reaction increases with increase in concentration of reactants ?	
43	U	Ferrous sulphate reduces acidified $KMnO_4$ readily, whereas oxalic acid slowly. Indicate the factor involved in this reaction.	

Q. No.	Obj.	Question	Answers
4	K	Why ionic reactions are faster than molecular reactions ?	
5	U	Pick out the faster reaction from the following. (a) Reaction of aq. $BaCl_2$ with sulphuric acid (b) Alkylation reaction of benzene (c) Reaction of ethyl alcohol with sulphuric acid (d) Sulphonation of benzene	(a)
6	U	$H_2 + I_2$ ----> 2HI. In this reaction rate of formation of HI is twice the rate of disappearance of H_2 or I_2, why ?	
47	U	Calculate the rate constant at 590 K for the following first order reaction ? SO_2Cl_2 ----> $SO_2 + Cl_2$, time for half reaction is 60 mts.	1.925×10^{-4} s^{-1}
48	U	The velocity constant for the decomposition of N_2O_5 is 6.2×10^{-4} sec^{-1}. What is the half life period of the reaction ?	$t_{1/2}$=1118 sec
9	U	The following data were reported for the decomposition of N_2O on gold at 990°C Time in min - 30 65 120 Percentage of decomposition - 32 57 78 Show that the reaction is first order and calculate the velocity constant.	

Q. No.	Obj.	Question	Answers
50	U	With which of the following zinc reacts fastly to liberate hydrogen gas ? (a) Decimolar HCl (b) Molar HCl (c) Milli molar HCl (d) 0.5 Molar HCl	(b)
51	U	Why increase in temperature increases rate of reaction ?	
52	U	Why smaller chips of wood burn very rapidly than log of wood of the same weight ?	

Concept 6: Catalyst effect the rate of reaction in different ways.

Q. No.	Obj.	Question	Answers
53	U	Match the following. A: $2KClO_3 \xrightarrow{MnO_2} 2KCl + 3O_2$ A: $2H_2O_2 \xrightarrow{\text{Glycerol}} 2H_2O + O_2$ A: $2SO_2(g) + O_2(g) \xrightarrow{NO\ (g)} 2SO_3(g)$ A: $N_2(g) + 3H_2(g) \xrightarrow{Fe\ (s)} 2NH_3(g)$ B: Homogenous catalysis B: Positive catalysis B: Heterogeneous catalysis B: Negative catalysis	
54	U	In what way catalyst affects the rate of reaction at constant temperature ?  	
55	U	Why finely divided nickel acts as more effective catalyst than a block of nickel ?	
56	K	What are the characteristics of a catalyst ?	

Q. No.	Obj.	Question	Answers
57	U	A catalyst at the end of the reaction (a) may undergo chemical change (b) may undergo physical change (c) may undergo mass change (d) may undergo both physical and chemical change	(b)
58	U	Find out which of the following statement is incorrect ? (a) Catalyst initiates reaction (b) Catalyst alters the energy barrier level (c) Catalyst increases to rate of reaction (d) Catalyst decreases the rate of reaction	(b)
59	U	Pick out the correct statement. Concentration of catalyst affect rate of reaction in the case of (a) homogeneous reaction (b) heterogeneous reaction (c) positive catalysis (d) negative catalysis	
60	U	In homogeneous catalysis intermediate compound decomposes at _____ rate than reactants.	faster
61	K	Explain adsorption theory of catalysis with suitable examples.	
62	K	What is promoter of a catalyst ? Give an example.	
63	K	What are catalytic poisons ?	
64	U	How do catalytic poisons retard the rate of reaction ?	
65	U	Give the application of catalysts in industries.	

ORGANIC CHEMISTRY-I

Content analysis

* Classification of organic compounds
  - Aliphatic, alicyclic, aromatic and heterocyclic compounds.

* Homologous series

* Nomenclature of organic compounds.
  - IUPAC and common names.

* IUPAC rules of nomenclature of organic compounds.

* Isomerism in organic compounds
  - Chain, position, functional.

* Sterioisomerism in organic compounds.
  - Geometrical and optical isomerism.

ISOMERISM

Concept 1: A set of compuonds having the same functional group and similar chemical characteristics differing from each other in their molecular formulae by C-CH_2 group.

Q. No.	Obj.	Question	Answer
1	K	What are homologous series ? Give an example. Write their important characteristics.	

Concept 2 & 3: Compounds having the same molecular formula but different structural formulae are called isomers.
Compounds having the same structural formulae but different special arrangements are calld stereoisomers.

Q. No.	Obj.	Question	Answer
2	K	Define isomerism	
3	U	Mention different types of isomerism exhbited by organic compounds. Give one example for each.	
4	U	Write down all the isomers represented by the molecular formula C_4H_8O.	
5	U	In what way structural isomers differ from stereoisomers ? Give examples	In spacial arrange ment of atoms or group
6	U	Write the possible chain isomers for the compounds having molecular formula C_5H_{10}.	
7	A	Write the strutures of two open chain compounds, two alicyclic compound and two heterocyclic compounds for molcular formula C_6H_8O	

Q. No.	Obj.	Question	Answer
8	K	Two couples A and B are isomers. They differ not only in their physical properteis but also in their chemical properties. Therefore they are (a) chain isomers (b) functional isomers (c) stereoisomers (d) position isomers	(b)
9	U	The correct statement about $HOCH_2CH(OH)CHO$ include that it (a) is a functional isomer of 2-hydroxy propanoic acid (b) is an isomers of 3-hydroxy-2-propanoic acid (c) can exhibit geometrical isomerism (d) has the same empirical formula of glycerol	(a)
10	U	Which of the following compounds displays geometrical isomerism. (a) $CH_2=CHBr$ (b) $CH_2=CBr_2$ (c) Cl-CH=CHBr (d) $Br_2C=CCl_2$	(c)
11	U	Acetic acid and methyl formate represent (a) chain isomerism (b) position isomerism (c) functional isomerism (d) geometrical isomers	(c)

Q. No.	Obj.	Question	Answer
12	U	Ethanol is the functional isomers (a) Methanol (b) Acetaldehyde (c) Dimethyl ether (d) Formic acid	(c)
13	U	Acetone is a functional isomer of (a) propanol (b) propanone (c) propanal (d) Proponoic acid	(c)
14	U	The compound $CH_3-\underset{\displaystyle OH}{\underset{\vert}{CH}}-CH_2-COOH$ is functional group isomer of (a) $OHC-CH_2-CH_2COOH$ (b) $HO-CH_2-\overset{\displaystyle O}{\overset{\Vert}{C}}-CH_2-CH_2OH$ (c) $CH_3-CH_2-\underset{\displaystyle OH}{\underset{\vert}{CH}}-COOH$ (d) $HO-CH_2-CH_2-CH_2-COOH$	(b)

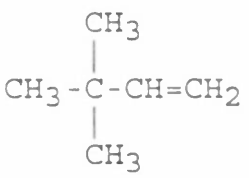
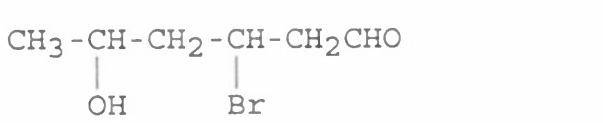
Q. No.	Obj.	Question	Answer
15	U	Given below are the pairs of some compounds. Indicate the specific type of isomerism they exhibit. (a) 1-butene and 2-butene — a. Positional (b) propenol and prepanone — b. Functional (c) aceti acid and methyl formate — c. Functional (d) test butylchloride and 2-chlorobutane — d. Chain (e) allylalcohol of acetone — e. Functional	
16	A	Write a pair of position isomers and functional group isomers for the molecular formula $C_4H_8O_2$.	
17	A	Which of the structures given below represents the tautomer of the compound $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH\_CH_3$ (a) $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_2-CH_3$ (b) $CH_3-\overset{\overset{OH}{\|}}{C}=CH-CH_2-CH_3$ (c) $CH_3-\overset{\overset{OH}{\|}}{CH}-CH=CH-CH_3$ (d) $HC(=O)-CH_2-CH_2-CH_2-CH_3$	(b)
18	K	In what ways do tautomers of a compound differ from each other ?	
19	A	The optical isomers of a compound rotate the plane polarized light in two opposite directions. In what ways are they dissimilar to each other ?	

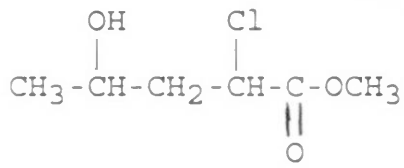
Concept 4: A set of rules govern the nomenclature of organic compounds - IUPAC.

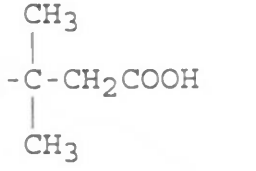
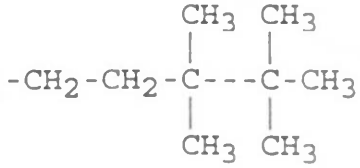
Q. No.	Obj.	Question	Answer
1	U	Assign IUPAC names for the following compounds	
		(a) $(CH_3)_3C-CH(CH_3)-CH_3$	2,2,3-Trimethyl butane
		(b) $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-\underset{\displaystyle Cl}{\underset{\vert}{CH}}-CH_2CH_3$	3-Chloro-4-methyl hexane
		(c) $CH_3-\overset{\displaystyle CH_3}{\overset{\vert}{C}}=C-CH-CH_2OH$	2-Methyl-3-pent-1-OL
		(d) $CH_2=CH-CH=CH_2$	1,3-Butadiene
		(e) $CH_3-CH(OH)-CH_2COOH$	3-Hydroxybutanoic acid
		(f) $CH_3-CH(OH)-CH_2-\underset{\displaystyle O}{\underset{\Vert}{C}}-CH_3$	4-Hydroxy,-2-Pentanone
		(g) $CH_3-\underset{\displaystyle Cl}{\underset{\vert}{CH}}-CH(OH)-CH_3$	3-Chloro-2-butanol
		(h) $CH_3-\underset{\displaystyle O}{\underset{\Vert}{C}}-CH_2-CH_2OH$	4-Hydroxy-2-butanone
		(i) $CH_2=\underset{\displaystyle Cl}{\underset{\vert}{CH}}-CH_2-CH_2OH$	3-Chloro-3-butenol
		(j) $CH_3-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-\underset{\displaystyle CH_2CH_3}{\underset{\vert}{CH}}-CH(OH)-CH_3$	3-Ethyl-4,5-dimethyl hexan-2-OL
		(k) $CH_2=C-CH\equiv CH_2$	But-1-en-3-yne

O

Q. No.	Obj.	Question	Answer
		(l) $CH_3-CH_2-CH_2-C(=O)-NH_2$	Butanamide
		(m) $CH_3-CH(CHO)-CH_2-CH(CH_2CH_3)-CH_3$	2,4-Dimethyl hexanal
		(n) $CH_3-C(=O)-CH_2-C(=O)-OCH_3$	Methyl-3-ketobutanoate
		(o) $COOH-COOH$	Ethan dioic acid
		(p) $CHO-CHO$	Ethan dial
2	U	Write structural formulae for the following	
		(a) 2-Chloro-3-bromo butanone	
		(b) 2-Butanone	
		(c) Ethandial	
		(d) Hepta-1,5-dien-3-ol	
		(e) 2,2,4,4-tetramethylpentane	
		(f) Methyl-2-chloro butanoate	
		(g) 3-methylbutanol	
		(h) 3-methyl-2-butenal	
		(i) Ethandioic acid	
		(f) 3-oxopentanal	

Q. No.	Obj.	Question	Answer
3	U	The IUPAC name of the compound  is	
		(a) 2,2-dimethyl-3-butene	
		(b) 3,3-Dimethyl-1-butene	
		(c) 3,3,3-Trimethyl-1-propene	
		(d) 2,2,3-Trimethyl-2-propene	
4	U	The IUPAC name of the compound 	
		(a) 3-Bromo-5-Hydroxyhexanal	
		(b) 4-Bromo-2-Hydroxyhexanal	
		(c) 4-Bromo-6-oxo-2-hexanal	
		(d) 4-Bromo-5-oxo-2-pentanol	
5	U	The IUPAC name of HOOC-COOH is	
		(a) Dioic acid	
		(b) Oxalic acid	
		(c) Ethandioic acid	
		(d) Carboxymethanoic acid	

Q. No.	Obj.	Question	Answer
6	U	The IUPAC name of the compound 	
		(a) 4-chloro-2-hydroxyhexanoate	
		(b) Methyl-2-chloro-4-hydroxy-pentanoate	
		(c) Methyl-2-hydroxy-4-chloro-pentanoate	
		(d) 4-chloro-2-hydroxy-5-methoxy-pentanone	
7	U	IUPAC name of the compound $HOCH_2CH_2OH$ is	(c)
		(a) Glycol	
		(b) 1,2-dihydroxy ethane	
		(c) Ethane-1,2-Diol	
		(d) Ethylene glycol	
8	A	Match the following	

IUPAC names	Structural formula
(a) 3-Hydroxypentanal	1. $CH_3-COCH_2Cl-CH_2\ CH_3$
(b) 3,3-Dimethylbutanoic acid	2. $CH_3-CH_2-CH(OH)-CH_2CHO$
(c) 3-chloro-2-pentanone	3. 
(d) 2,2-3,3, tetra methyl hexane	4. 

Q. No.	Obj.	Question	Answer
		(e) 2,3-Dimethyl-1-butene 5. $CH_2=C(CH_3)-CH-CH_3$	
		6. $OHC-CH_2-CH_2-CH_2-O-CH_3$	
9	A	Match the common names given under column (A) with the IUPAC name given under column (B)	
		A — B	
		(a) Acetic acid — 1. Propanone	
		(b) Formaldehyde — 2. Ethandial	
		(c) Acetone — 3. Ethanoic acid	
		(d) Glyoxal — 4. Methanal	
		(e) Glycerol — 5. Butandioic acid	
		(f) Succinic acid — 6. Ethyl ethanoate	
		(g) Diethylether — 7. Ethyoxyethane	
		(h) Etyl acetate — 8. 1,2,3-propantrial	
		9. Ethandioic acid	
		10. Propandioic acid	
10	K	Arrange the following functional groups in the increasing order of their priorities.	
		-OH, -COOH, $-NH_2$, -CHO, C=O, =, ≡, C≡N	
11	A	Given below is a set of compounds. The naming in each case violets an IUPAC rule. Identify the rule violated and correct the nomenclature.	
		(a) 4-bromo-5-Hexanone	
		(b) Carboxymethanoic acid	
		(c) 3-carboxy-1-butanol	
		(d) 4-propylhexanal	
12	K	Write IUPAC nomenclature rules	

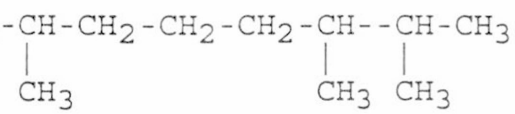
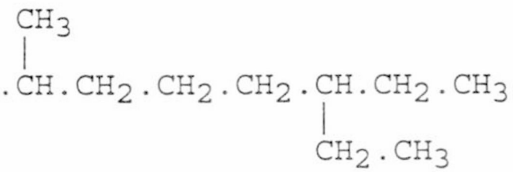
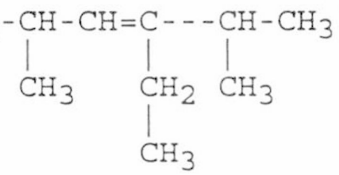
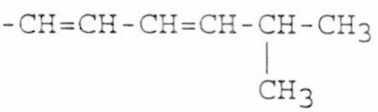
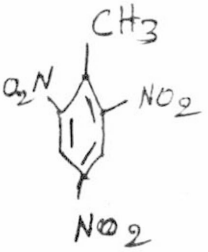
oncept 1: Hydrocarbons are classified into aliphatic, aromatic. Further aliphatic compounds are classified into saturated and unsaturated.

Q. No.	Obj.	Question	Answers
	K	The general formula of alkanes is (a) C_nH_{2n} (b) C_nH_{2n+2} (c) C_nH_{2n-2} (d) C_nH_{2n+4}	(b)
	U	Classify the following into aliphatic, alycyclic and aromatic hydrocarbons. (a) C_4H_{10} (b) C_3H_6 (c) C_5H_8 (d) Cyclobutane (e) Anthrascene	
3	A	Alkenes have the same molecular formula of cycloalkanes. The property that distinguish the alkenes from cycloalkanes is (a) cyclo alkanes decolourise bromine without evolution of HBr (b) cyclo alkanes decolourise bromine with evolution of HBr (c) Cyclo alkanes decolourise dil. alk. $KMnO_4$ (d) Cyclo alkanes undergo polymerisation	(b)

Concept 2: Hydrocarbon can be named according to IUPAC system. The shapes of hydrocarbons can be predicted on the basis of hybridisation utilised by the carbon atoms.

Q. No.	Obj.	Question	Answers
4	K	The type of hybridisation utilised by carbons in alkanes is (a) sp (b) sp^2 (c) sp^3 (d) both sp^3 and sp^2	(c)
5	K	sp hybridised carbon is present in (a) alkenes (b) cycloalkanes (c) alkynes (d) benzene	(c)
6	K	The number of σ bonds presents in propene is (a) 10 (b) 9 (c) 8 (d) 2	(b)
7	K	The number of σ bonds present in pent-3-yne-1-ene is (a) 1 (b) 2 (c) 3 (d) 4	(c)

Q. No.	Obj.	Question	Answers
8	K	The major component of Marsh gas is (a) methane (b) ethane (c) ethylene (d) acetylene	(a)
9	U	A hydrocarbon contains three π bonds. Which of the following is a correct statement in the case. The compound contain (a) two double bonds (b) one double bond and one triple bonds (c) two triple bonds (d) one double bond and two triple bonds	(b) (a)
10	U	Bonds present in ethyene are (a) 3 σ, 2 π (b) 4 σ, 1 π (c) 2 σ, 3 π (d) 1 σ, 4 π	(a)
11	U	The number of sp^2 hybridised carbon atoms present in the compound $CH_2=CH-CH=C=CH-CH_3$ is (a) 5 (b) 4 (c) 3 (d) 2	(b)

Q. No.	Obj.	Question	Answers
12	U	Give IUPAC names of the following compounds (a)  (b)  (c)  (d)  (e)  (f) 	
13	U	The carbon atoms in 1,2-Butadiene are (a) sp hybridised (b) sp^2 hybridised (c) sp and sp^2 hybridised (d) sp, sp^2 and sp^3 hybridised	(d)

Concept 3: Hydrocarbons exhibit both position, chain and stereo isomerism

Q. No.	Obj.	Question	Answers
15.	U	Write the possible chain isomers for the hydrocarbon having the molecular formula C_5H_{12}.	
	U	One of the position isomer of the compounds has the structure $CH_2=CH-CH=CH-CH_3$. What are its other position isomers ?	
16	K	An aliphatic hydrocarbon forms structural isomers if the minimum number of carbon atoms is (a) 1 (b) 2 (c) 3 (d) 4	(d)
17	U	Which type of isomerism is not observed in alkanes ? (a) Chain (b) Geometrical (c) Metamerism (d) Position	(c)

Concept 4: Varieties of methosd can be used to prepare hydrocarbons

Q. No.	Obj.	Question	Answers
18	A	A mixture of C_2H_5I and C_3H_7I is subjected to Klurtz synthesis. Pick up the compound which cannot be formed in this reaction ? (a) Butane (b) Propane (c) Pentane (d) Hexane	(b)
19	U	Ethylene is prepared by heating ethyl bromide with (a) $NH_4OH + AgNO_3$ (b) $H_2SO_4 + KMnO_4$ (c) Conc. H_2SO_4 (d) $C_2H_5OH + KOH$	(d)
20	U	Which of the following compounds cannot be converted into butane by catalytic reduction ? (a) $CH_2=CH-CH=CH_2$ (b) $CH_3-CH=CH-CH_3$ (c) $CH_2=CH-C\equiv CH$ (d) $CH_2=\underset{\displaystyle CH_3}{\underset{\vert}{C}}=CH_2$	(d)
21	U	The sodium salt of which of the carboxylic acid is used for the preparation of propane by decarboxylation ? (a) Ethanoic acid (b) Propanoic acid (c) Butanoic acid (d) Pentanoic acid	(c)

Q. No.	Obj.	Question	Answers
22	U	What is the hydrocarbon obtained by electrolysis of potassium salt of propanoic acid ?	
23	U	Which of the following reactions will not be suitable for the preparation of butane ? (a) Electrolysis of potassium acetate (b) Decarboxylation of sodium acetate (c) Catalytic reduction of 1,3-Butadiene (d) Reduction of 1-chlorobutane	(b)
24	A	$CH_3CH_2Cl \xrightarrow{Mg/Ether} A \xrightarrow[Hydrolysis]{HCHO} B$ $\xrightarrow[(-H_2O)]{Conc.\ H_2SO_4} C \xrightarrow{Ozonalysis} D + E$ Write equations for the conversions A to B, B to C and C to D+E. Find out compounds A, B, C, D and E.	
25	A	Why cannot water be used as solvent for Klurtz reaction ?	
26	U	How is C_2H_4 converted into butane ?	
27	U	Why dehydration of primary alcohols cannot be carried out with dilute H_2SO_4 of normal temperature ?	
28	A	Compound 'A' is prepared by dehydro-halogenation of an alkyl halide. The same compound 'A' is also prepared from alkyne by reduction. Alkyne gives benzene on polymerisation. Find out 'A'.	
29	U	1,2-Dichlorobutane gives ethylacetylene, whereas 1,3-dichlorobutane does not,why?	

Q. No.	Obj.	Question	Answers
30		Complete the following reactions	
	K	(a) _____ $\xrightarrow[\text{Heat}]{\text{Zn/HCl}}$ C_6H_6	Phenol (C_6H_5OH)
	K	(b) C_6H_6 + _____ $\xrightarrow[AlCl_3]{\text{Anhydrous}}$ Toluene	CH_3Cl
	K	(c) $C_6H_6 + CH_3COCl \xrightarrow[AlCl_3]{\text{Anhydrous}}$ _____	
31	U	A mixture of ethyl iodide and methyl iodide in dry ether is treated with sodium metal. What are the possible alkanes that can be obtained ?	

Concept 5: (a) Hydrocarbons are characterised by a set of properties. (b) Electrophiles are electron deficient species and unsaturated hydrocarbons undergo electrophilic addition reactions. (c) Ozoanalysis helps to identify the position of a double bond in an organic compound.

No.	Obj.	Question	Answers
32	K	The distance between two adjacent carbon atoms is largest in (a) Ethane (b) Ethene (c) Ethyne (d) Benzene	(a)
33	K	Which among the following compounds decolourises alk. $KMnO_4$ solution ? (a) 2-Hexene (b) 2-Methyl Hexane (c) Hexane (d) Neopentane	(a)
34	U	Oragnometallic compound among the following is (a) sodium carbonate (b) sodium ethoxide (c) sodamide (d) sodium acetylide	
35	U	Why do branched alkanes have lower boiling point, than the corresponding straight chain alkanes ?	
36		Predict the products	
	U	(a) $CH_3\text{-}CH{=}CH_2$ + HI ----->	
	U	(b) $CH_3\text{-}CH{=}CH_2$ + HI $\xrightarrow{\text{Peroxide}}$	

Q. No.	Obj.	Question	Answers
37	U	An organic compound 'A' on reaction with CH_3OH gives pleasant smelling compound on decarboxylation of its sodium salt C_2H_6 is obtained. Find out compound 'A' and write the reactions.	
38	A	Why is $CH_3-CH_2-CH_2Cl$ is not formed by the addtion reaction of HCl on propene in the absence of peroxide ?	
39	U	What is the product of the reaction between $CH_3-CH=CH_2$ $\xrightarrow{Br_2/H_2O}$?	
40	U	Compound 'A' on ozoanalysis gievs two moles of methanol and 'B' on ozo-analysis gives methanol and propanone. Find out the compounds A and B.	
41	U	An alkane 'A' gives 1,2-dihydroxy butane on reaction with Bayer's reagent. Find the compound 'A'.	
42	A	Infer the aliphatic hydrocarbons A, B and C from the following data.	
43	U	Compounds A and B are alkynes. 'A' gives an aldehyde and 'B' gives a ketone on hydration. What is the difference between A and B ?	
44	K	In what way does ethyne differ from other alkynes on ozoanalysis ?	

Compound	Br_2/H_2O bromine water	Ammonical silver nitrate
A	No reaction	No reaction
B	Decolourises	No reaction
C	Decolourises	Gives white precipitate

Q. No.	Obj.	Question	Answers
45	A	Why are terminal alkynes acidic ?	
46	U	How can be terminal and non-terminal alkynes differentiated ?	
47	U	There are two alkynes A and B. 'A' liberates hydrogen on reaction with metallic sodium, but 'B' does't. What is the difference ?	
48	K	Decreasing order of reactivity of propane, propene and propyne is (a) propane > propene > propyne (b) propene > propyne > propane (c) propene > propane > propyne (d) propyne > propane > propene	(b)
49	U	A gas on passing through ammonical cuprous chloride solution does not give any precipitate, but decolourises alkaline $KMnO_4$. The gas is (a) C_2H_6 (b) C_2H_4 (c) C_2H_2 (d) C_3H_8	(b)
50	U	The one having highest BP is _____ (a) n-pentane (b) 2-methyl butane (c) 2,2-dimethyl propane (d) n-hexane	(d)

Q. No.	Obj.	Question	Answers
51	U	During ozoanalysis the compound that gives only propanal is (a) 3-hexene (b) hexene-1 (c) propylene (d) 2-hexene	(a)
52	A	How methane and ethane are inter converted ?	
53	U	How can you distinguish ethene from ethyne ?	
54	A	Find out A, B and C in the following reaction. $CH_3-CH=CH_2 \xrightarrow{Br_2/CCl_4} A \xrightarrow{Alc.\ KOH} B$ $\xrightarrow{Br_2} C$	
55	U	Which among the following undergoes reaction with Tollen's reagent ? (a) $CH_2=CH_2$ (b) $CH_3-C\equiv C-CH_3$ (c) $CH_3-CH_2-C\equiv CH$ (d) $CH_3-CH=CH-CH_3$	(c)
56	U	Ozoanalysis of 2-methyl-2-butene yields (a) acetaldehyde (b) acetone (c) both acetaldehyde and acetone (d) 2 moles of acetaldehyde	

›ncept 6: The stability of benzene and its derivatives can be explained on the basis of resonance and molecular orbital theory.

Q. ›.	Obj.	Question	Answers
'	U	Write about resonance structures of benzene.	
3	K	Resonance structures differ only in the position of their _____	electrons
9	U	How does benzene differ from alkenes in its reaction with $KMnO_4$ and HX ?	
)	K	The carbons in benzene are _____ hybridised.	sp^2
1	K	The number of σ and π bonds in benzene are _____	12 σ & 3 π
2	U	Eventhough benzene and hexane differ in their degree of saturation, how do they resemble in the reaction with bromine.	Both undergo substitution reaction
3	U	What is delocalisation of electrons ? Explain with suitable examples.	
4	S	Account for the Kekule forms of structure of benzene based on electron delocalisation.	

Concept 7: Electrophilic substitution is characteristic property of benzene and its derivatives.

Q. No.	Obj.	Question	Answers
65	U	Why does benzene undergo electrophilic substitution ?	
66	U	How is benzene converted into aceto phenone ?	
67	U	What happens when benzene is treated wtih chlorine in presence of $FeCl_3$?	Chlorobenzene is formed
68	U	What is the product formed when benzene is heated with a mixture of conc. HNO_3 and H_2SO_4 at a temperature above 60^oC ?	m-dinitro-benzene
69	U	Predict the product in the reaction of benzene with fuming sulphuric acid.	m-benzene disulphonic acid
70	U	How benzophenone can be obtained from benzene ?	By reaction with C_6H_5COCl
71	U	What is the product formed in the alkylation of benzene ?	Alkyl benzene

ORGANIC CHEMISTRY-II

Content Analysis

* Classification of organic compounds containing nitrogen into amines and nitro compounds.

* Nomenclature and isomerism in nitro compounds.

* General methods of preparation of nitro compounds.

* General properties of nitro compounds.

* Electrophillic substitution in aromatic nitro compounds.

* Classification and nomenclature of aliphatic and aromatic amines.

* General methods of preparation of aliphatic and aromatic amines.

* Genearl properties of aliphatic and aromatic amines.

* Electrophillic substitution in aromatic amines.

* Distinction between aliphatic and aromatic amines.

* Uses of organic compounds containing nitrogen.

Concept 1: Organic compounds containing nitrogen can be classified into several groups.

Q. No.	Obj.	Question	Answers
1	K	Which is an example for aliphatic amine ? (a) $C_6H_5N_2Cl$ (b) CH_3NO_2 (c) CH_3CONH_2 (d) CH_3NH_2	(d)
2	K	Compounds containing $-NO_2$ group are called (a) nitro (b) amine (c) nitrile (d) acid amide	(a)
3	K	Pickout the aromatic nitrogen compounds (a) CH_3CN (b) CH_3CONH_2 (c) $C_6H_5NH_2$ (d) CH_3NH_2	(c)

Concept 2: IUPAC system is followed to name nitrogen containing compounds.

Q. No.	Obj.	Question	Answers
4	K	The structure of 2-nitropropane is (a) CH_3NO_2 (b) $CH_3CH_2NO_2$ (c) $CH_3CH_2CH_2NO_2$ (d) $CH_3-\underset{\displaystyle NO_2}{\underset{\vert}{CH}}-CH_3$	(d)
5	K	The IUPAC name $CH_3-\underset{\displaystyle NO_2}{\underset{\vert}{\overset{\displaystyle CH_3}{\overset{\vert}{C}}}}-CH_3$ is (a) 2-methyl-2-nitropropane (b) 2-nitro-2-methyl propane (c) 1-nitrobutane (d) nitroisobutane	(a)
6	U	IUPAC name of isopentylamines is (a) 1-amino-2-methyl butane (b) 2-amino-3-methyl butane (c) 1-amino butane (d) 2-amino pentane	(b)

Q. No.	Obj.	Question	Answers
7	K	CH_3-CH(NH_2)-CH_3 IUPAC name of this compound is (a) 2-aminopropane (b) 1-aminopropane (c) 1-amino-2-methyl propane (d) aminoethane	(a)
8	K	The IUPAC name of benzylamine is (a) phenylmethyl amine (b) phenylaminomethane (c) phenylamine (d) amiline	(b)

Concept 3: Aliphatic nitrocompounds and amines are classified into primary, secondary and tertiary.

Q. No.	Obj.	Question	Answers
9	K	Pick out the primary amine from the following compound. (a) isobutyl amine (b) methylethyl amine (c) dimethyl amine (d) trimethyl amine	(a)
10	K	Identify the tertiary nitro compounds (a) 1-nitrobutane (b) 2-nitrobutane (c) 2-methyl-2-nitropropane (d) 2-methyl-1-nitropropane	(c)
11	K	Classify the aliphatic nitro and amine compounds with an example.	

Concept 4: Organic compounds containing nitrogen exhibit different kinds of isomerism.

Q. No.	Obj.	Question	Answers
12	K	$CH_3-CH_2-CH_2-CH_2-NO_2$, $CH_3-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-CH_2-NO_2$	
		The type of isomerism exhibited by the set of compounds.	(c)
		(a) functional isomerism	
		(b) chain isomerism	
		(c) positional isomerism	
		(d) tautomerism	
13	K	Nitro compounds containing alpha-hydrogen can exhibit _____	Tautomerism
14	K	Which of the following set of compounds exhibit functional isomerism.	(b)
		(a) Primary and secondary nitro compounds	
		(b) Nitromethane and methylnitrite	
		(c) 1-nitropropane + 2-nitropropane	
		(d) 1-nitrobutane + 1-nitro-2-methyl propane	
15		Explain the different isomerism in nitro compounds with examples.	

Concept 5: Several methods are available for the preparation of nitro compounds.

Q. No.	Obj.	Question	Answers
5	K	Nitromethane and methyl nitrite are separated by _____	Fractional distillation
7	K	CH_4 + _____ $\xrightarrow{673\ K}$ $CH_3NO_2 + H_2O$	HNO_3
8	K	$C_2H_6 + HNO_3 \xrightarrow{673\ K} C_2H_5NO_2 + H_2O$ This reaction is known as (a) direct nitration (b) direct halogenation (c) deydrogenation (d) hydrolysis	( )
9	K	The nitration mixture used for the preparation of nitrobenzene from benzene is _____	Conc. HNO_3 + Conc. H_2SO_4

Concept 6: Organic nitro compounds are characterised by set of chemical properties.

Q. No.	Obj.	Question	Answers
20	K	When nitroalkanes are reduced in acidic medium, the compound obtained is (a) primary amine (b) secondary amine (c) tertiary amine (d) quarternary ammonium salts	(a)
21	K	The compound obtained when nito-methane is readily halogenated in the alpha-position with chlorine in alkaline medium is (a) nitrolic acid (b) chloropicrin (c) methylamine (d) methylhydroxylamine	(b)
22	K	The medium which converts nitro methane to methyl hydroxylamine is (a) Sn/HCl (b) Zn/NH_4Cl (c) NaOH (d) HONO	(b)
23	K	What type of reaction will nitro alkane undergo with aldehydes and ketones ? (a) Reduction (b) Halogenation (c) Hydrolysis (d) Condensation	(d)

Q. No.	Obj.	Question	Answers
24	K	When reduced with tin and hydrochloric acid or lithium aluminium hydride, nitrobenzene gives _____	Aniline
25	U	$C_6H_5NO_2 \xrightarrow[-H_2O]{Zn/NH_4Cl} A \xrightarrow{2[H]} B$ Identify A and B (a) Nitrosobenzene and phenylhydroxyl amine (b) Paminophenol and aniline (c) Anilin and m-chlorobenzene (d) m-chlorobenzene and p-aminophenol	(a)

Concept 7: Several methods are available for the preparation of amine compounds.

Q. No.	Obj.	Question	Answers
26	U	In Hoffmann reaction, if acetamide is used the primary amine obtained is (a) methylamine (b) butylamine (c) ethylamine (d) propylamine	(a)
27	K	By heating alkyl halide with alcoholic ammonia in a sealed tube, the compound obtained is (a) primaryamine (b) secondamine (c) mixture of amine (d) tertiaryamine	(c)
29	K	$R\text{-}CONH_2 \xrightarrow{X} RCH_2NH_2 + H_2O$ Identify the 'X' (a) Sn/HCl (b) Br_2/NaOH (c) $LiAlH_4$ (d) Zn/NH_4Cl	(a)
30	K	The starting material in Gabriel-phthalimide synthesis is _____	

Q. No.	Obj.	Question	Answers
	K	$C_6H_5\text{-}CN \xrightarrow[[H]]{LiAlH_4} ?$ Identify the compound obtained. (a) Benzylamine (b) Aniline (c) Benzenediazonium chlorine (d) Diphenylamine	(a)
32	K	When chlorobenzene is treated with ammonia at high temperature under pressure in presence of copper salts, the compound obtained is (a) Benzylamine (b) Aniline (c) Benzenediazonium chloride (d) Diphenylamine	(b)

Concept 8: Organic amines are characterised by set of chemical properties.

Q. No.	Obj.	Question	Answers
33	K	Amines have higher boiling points than alkanes of same molecular weight, it is due to (a) the presence of non-polar amino group (b) the presence of polar amino group (c) the presence diazonium chloride group (d) the presence of amino group	(b)
34	U	CH_3-NH_2, NH_3, C_6H_5-NH_2, CH_3-NH-CH_3 Write their increasing order of their basic nature.	$C_6H_5NH_2 < NH_3 <$ CH_3-$NH_2 < (CH_3)_2NH$
35		Explain why amines are known as Lewis bases.	
36	K	Which of the following compound does not react with acid chloride. (a) p-amine (b) s-amine (c) t-amine (d) NH_3	(c)
37		Give one test to identify primary amines ?	
38	K	In carbylamine reaction, the formation foul smelling is due to (a) alkyl isocyanide (b) alkyl thiocyanide (c) alkyl cyanide (d) alkyl isocyanate	(a)

Q. No.	Obj.	Question	Answers
39	K	The reagents used with primary amine in mustard oil reaction is (a) CS_2 and $HgCl_2$ (b) CS_2 and Hg_2Cl_2 (c) CS_2 (d) $HgCl_2$	(a)
40	K	Primary amines form ___ derivative with diethyl oxalate at room temperature.	Solid
41	K	$C_6H_5\text{-}NH_2 + NaNO_2 + HCl \xrightarrow{273\ K} C_6H_5N_2Cl + 2H_2O$ The reaction is (a) carbyl amine reaction (b) diazotisation (c) Sandmeyer's reaction (d) Gattermann's reaction	(b)
42	K	$C_6H_5\text{-}NH_2 + C_6H_5\text{-}CO\text{-}Cl \xrightarrow{NaOH} C_6H_5\text{-}NH\text{-}CO\text{-}C_6H_5$ This reaction is known as (a) Schotten-Baumann reaction (b) Friedel-Craft's reaction (c) Gattermann's reaction (d) Hoffmann's reaction	(a)

Q. No.	Obj.	Question	Answers
43	K	To differentiate the aniline and ethyl amine, using which of the following reagent. (a) alkylhalide (b) nitrous acid (c) metallic sodium (d) chloroform and alkali	(c)
44	K	Aniline on oxidation with acidified $K_2Cr_2O_7$ gives (a) p-benzoquinone (b) benzoic acid (c) cyclohexanol (d) phthalic acid	(a)
45	K	Which of the compound is the Schiffbuse obtained when aniline condenses with aromatic aldehyde ? (a) C_6H_5-N=N-C_6H_5 (b) C_6H_5-N=CH-C_6H_5 (c) C_6H_5-NH-NH-C_6H_5 (d) C_6H_5-NH-OH	(b)
46	K	The amino group of aniline is protected by acetylation before oxidation. Explain why ?	
47	K	When benzene diazonium chloride is boiled with water, it gives (a) Anisole (b) Phenol (c) Carboxylic aacid (d) Benzene	(b)

S. No.	Obj.	Question	Answers
8	U	$C_6H_5\text{-}N_2Cl \xrightarrow[\text{cupowde}]{\text{KCN, aquions}} A \xrightarrow[\text{HCl}]{H_2O,\ \text{dil.}} B$ Identify A and B. (a) phenylcyanide and benzoic acid (b) chlorobenzene and aniline (c) phenylhydrazine and diazoamino-benzene (d) chlorobenzene and phenol	(a)
9	K	Reaction between benzene diazonium chloride and phenol to form p-hydroxy azo benzene. It is an example of (a) diazotization (b) coupling reaction (c) nitration (d) hydrolysis	(b)
0	U	Compound A, C_6H_7N gievs foul smell with chloroform and alkali. A on diazotisation gives B. B with methanol form C with molecular formula C_7H_8O. Identify A, B, C and Explain.	A=Aniline B=Benzene diazonium chloride C=Anisole

Concept 9: Aromatic nitrogen containing compounds follow general mechanism of electrophilic substitution.

Q. No.	Obj.	Question	Answers
51	U	Explain the mechanism of nitration of nitrobenzene.	
52	U	Explain the mechanism of halogenation of aniline.	
53	K	The electrophile produced by the reaction of conc.HNO_3 and conc.H_2SO_4 is (a) NO_2^+ (b) NH_4^+ (c) Cl^+ (d) SO_3H^+	(a)
54	K	In sulphonation of nitrobenzene with fuming H_2SO_4, the electrophile is attached to _____ position in the benzene ring. (a) ortho (b) ortho and para (c) para (d) meta	(d)
55	K	The sulphonation of aniline with fuming H_2SO_4 gives _____	p-amino benzene sulphanilic acid

›ncept 10:Depending on the nature of nitrogen containing functional group in the aromatic system the incoming electrophilic directed to the different position of the ring.

›.	Obj.	Question	Answers
;	K	Complete the reaction and name the products a.  $\xrightarrow[H_2O]{Br_2}$ b.  $\xrightarrow[-HCl]{CH_3COCl}$ A $\xrightarrow[Conc.\ H_2SO_4]{Conc.\ HNO_3}$ c.  $\xrightarrow[FeCl_3]{Cl_2}$ d.  $\xrightarrow[H_2SO_4]{Fuming}$	
›7	U	Describe the mechanism of electrophilic substitution of nitrobenzene with conc. HNO_3 and conc. H_2SO_4.	

Concept 11: Nitro and amino compounds have variety of synthetic uses in chemical industry.

Q. No.	Obj.	Question	Answers
58	K	_____ is used intermediate in the production of explosives and detergents.	Nitro methane
59		_____ is used as a mild and cheap perfume in soaps and shoe polishes.	Nitro benzene
60		_____ and _____ amines are used as inhibitors of corrosion of iron.	di and tri amyl amines
61		_____ and _____ are usd as starting materials for the preparation insecticides and pharmaceuticals.	methylamine and dimethylamine of
62		Sulphanilic acid is an important drug intermediate in the manufacture of _____ drugs.	Sulpha
63		_____ is used as solvent in rubber industry.	Aniline

SUGGESTIONS

The workshop was successful in training the participants to write questions at understanding, application levels. Eventhough it is not exhaustive, there has been an attempt to make it comprehensive and objective. A variety of ways a concept can be tested (learnt/taught) is shown. Many more can be added, given more time. However the objective of the workshop was not to have a huge collection of questions to serve as a ready reckoner for preparing question papers. It was an attempt to provide the experience of writing different types and levels of questions, with the hope that the teachers will design their own questions on the same lines. This report therefore is intended to develop the art of writing questions with greater objectivity, reliability and validity.

SCHEDULE OF WORKSHOP ON DEVELOPMENT OF QUESTION BANK IN CHEMISTRY AT HIGHER SECONDARY LEVEL OF SOUTHERN REGION

(14th June 1999 to 25th June 1999)

Date	9 am to 12 pm	1 pm to 2.30 pm	2.30 pm to 4 pm
14-06-1999	Registration and Inauguration	Interaction/ Discussion	Concept of Evaluation
15-06-1999	Plan of action	Group work Content analysis (I cycle)	Group work Concepts identification
16-06-1999	Group work	Group work	Presentation and discussion
17-06-1999	Group work	Group work	Presentation and discussion
18-06-1999	Group work	Group work	Presentation and discussion
19-06-1999	Group work Content analysis (I I cycle)	Group work Concepts identification	Presentation and discussion
20-06-1999	Computer session		Library work
21-06-1999	Group work	Group work	Presentation and discussion
22-06-1999	Group work	Group work	Presentation and discussion
23-06-1999	Group work	Group work	Presentation and discussion
24-06-1999	Blue print preparation and question paper setting		
25-06-1999	Presentation and discussion		Valedictory

(Dr.G.R.Prakash)
Academic Co-ordinator

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