SMART SKILLS

SYLLABUS 2017 -2018

CHEMISTRY

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SYLLABUS

Class XI (Theory)

UNIT No.	TITLE	MARKS
I	Some basic concepts of chemistry	6
II	Structure of atom	6
III	Classification of elements and periodicity in properties	5
IV	Chemical bonding and molecular structure	7
V	States of matter: Gases and liquids	4
VI	Thermodynamics	6
VII	Equilibrium	6
VIII	Redox reactions	5
IX	s- block elements	3
X	Some p-block elements	3
XI	Organic chemistry: some basic principles and techniques	9
XII	Hydrocarbons	10
TOTAL		70

COURSE STRUCTURE
CLASS–XI (THEORY)

Total Periods (Theory 160 + Practical 60)

Time: 3 Hours **Total Marks 70**

Unit No.	Title	No. of Periods	Marks
Unit I	Some Basic Concepts of Chemistry	12	11
Unit II	Structure of Atom	14	
Unit III	Classification of Elements and Periodicity in Properties	08	04
Unit IV	Chemical Bonding and Molecular Structure	14	21
Unit V	States of Matter: Gases and Liquids	12	
Unit VI	Thermodynamics	16	
Unit VII	Equilibrium	14	
Unit VIII	Redox Reactions	06	16
Unit IX	Hydrogen	08	
Unit X	s -Block Elements	10	
Unit XI	Some p -Block Elements	14	
Unit XII	Organic Chemistry: Some basic Principles and Techniques	14	18
Unit XIII	Hydrocarbons	12	
Unit XIV	Environmental Chemistry	06	
	Total	**160**	**70**

PRACTICALS

Evaluation Scheme for Examination	Marks
Volumetric Analysis	**10**
Salt Analysis	**10**
Class record and viva	**10**
Total	**30**

SYLLABUS

MARCH - MAY

Unit I: Some Basic Concepts of Chemistry

General Introduction: Importance and scope of chemistry.
Nature of matter, laws of chemical combination.
Dalton's atomic theory: concept of elements, atoms and molecules.
Atomic and molecular masses. Mole concept and molar mass: percentage composition, empirical and molecular formula; chemical reactions, stoichiometry and calculations based on stoichiometry.

Unit V: States of Matter: Gases and Liquids.

Three states of matter. Intermolecular interactions, type of bonding, melting and boiling points. Role of gas laws in elucidating the concept of the molecule, Boyle's law. Charles law, Gay Lussac's law, Avogadro's law. Ideal behaviour, empirical derivation of gas equation,

Unit XIV: Environmental Chemistry

14.1 Environmental pollution
14.2 Atmospheric Pollution 14.2.1 Tropospheric Pollution - Gaseous air pollutants: Oxides of Sulphur, Oxides of Nitrogen, Hydrocarbons, Oxides of Carbon. Global warming and Greenhouse Effect, Acid Rain. 14.2.2 Stratospheric Pollution: formation and breakdown of Ozone, The ozone hole, Effects of Depletion of the Ozone layer (without equations).
14.3 Water Pollution 14.3.1 Causes of water pollution (i) Pathogens (ii) Organic wastes (iii) Chemical Pollutants.
14.6 Strategies to control Environmental Pollution 14.6.1 Waste management, Collection and Disposal
14.7 Green Chemistry 14.7.1 Introduction 14.7.2 Green Chemistry in day-to-day life.

PRACTICALS: Quantitative estimation:

(i) Preparation of standard solution of oxalic acid .
Determination of strength of NaOH solution by titrating it against standard solution of oxalic acid.

PROJECT WORK (To be done in summer holidays)

Students are required to prepare a HAND WRITTEN project report on ANY ONE of the following topics in about 10-15 PAGES and to be compiled in a folder. The report must include index at the start and bibliography in the end:

1) Stratospheric pollution – ozone and its effects.
2) Green chemistry as an alternate tool for reducing pollution
3) Chromatography and its various kinds
4) Environmental pollution: (a) Air- tropospheric pollution (b) Water (c) Soil
5) Acid rain, green house effect and global warming
6) Hydrogen- Position, isotopes, preparation, properties, use
7) Water- structure, physical and chemical properties, hard and soft water, heavy water, method of removing hardness.

8) Hydrogen peroxide- structure, preparation, physical and chemical properties, storage and use.
9) Methods of purification of organic compounds (excluding chromatography)

Suggested Resource Material: NCERT Text book/ Internet

Criteria for evaluation will be:
(a) Organization of the content (aim, index, content details and bibliography)
(b) Information and research
(c) Creativity (pictures, diagrams etc.)
(d) Overall presentation

How the students have to be assessed:

Topics/Marks	2	1.5	1.0	0.5
Organization of the content (aim, index, content details and bibliography)	Descriptions of scientific terms, facts, concepts, principles, theories and methods are complete and correct	Descriptions of scientific terms, facts, concepts, principles, theories and methods are mostly complete and correct	Descriptions of scientific terms, facts, concepts, principles, theories and methods are somewhat complete and correct	Descriptions of scientific terms, facts, concepts, principles, theories and methods are minimally present /missing and correct
Information and research	Research is thorough, specific, has many examples. All ideas are clearly explained. Preparations, equations, formulaes and pros and cons are fully addressed.	Research has many specifics and some examples. Most ideas are explained. Student mostly addresses the preparations, equations, formulaes and pros and cons.	Research has some specifics and a couple examples. Few ideas are explained. Student doesn't address all areas: preparation, equations, formulaes and pros and cons	Research has little specifics and one example. Very few ideas are explained. Student doesn't address all areas: preparation, equations, formulaes and pros and cons.
Creativity (pictures, diagrams etc.)	Text is legible. Graphics and effects are used throughout to enhance presentation. Information consistently supports images.	Presentation is attractive. Text is legible. More than half of the project use graphics and its effect enhance the presentation.	Presentation is legible. Amount of text is too great for the amount of space provided. Less than half the project has graphics.	The project is not very attractive and legible. The amount of text is too great for the space provided. There is little use of graphics.
Overall presentation	The project has exceptionally attractive formatting and well-organized information.	Information is supported by images but sometimes they distract from the text. The project has attractive formatting and well-organized information.	Information supports images at times and has well organized information.	The information does not consistently support images. The project's formatting and organization of material are confusing with the information.
On time submission	On time submission	Delayed by a day	Delayed by two days	Delayed indefinitely.

JULY -AUGUST

Unit V: States of Matter: Gases and Liquids (continued..)

Ideal gas equation. Kinetic molecular theory of Gases. Behaviour of real gases; Deviation from ideal behaviour, liquefaction of gases, critical temperature.
Liquid State - Vapour pressure (qualitative idea only, no mathematical derivations)

Unit II: Structure of Atom

Discovery of electron, proton and neutron; atomic number, isotopes and isobars. Thomson's model and its limitations, Rutherford's model and its limitations. Bohr's model and its limitations, concept of shells and subshells,
Dual nature of matter and light, De Broglie's relationship, Heisenberg uncertainty principle, concept of orbitals, quantum numbers, shapes of s, p, and d orbitals, rules for filling electrons in orbitals - Aufbau principle, Pauli exclusion principle and Hund's rule, electronic configuration of atoms, stability of half filled and completely filled orbitals.

Unit III: Classification of Elements and Periodicity in Properties

Significance of classification, brief history of the development of periodic table.
Modem periodic law and the present form of periodic table, periodic trends in properties of elements-atomic radii, ionic radii, Ionization enthalpy, electron gain enthalpy, electro negativity, valency.
Nomenclature of elements with atomic number greater than 100

Unit X : s-Block Elements (Alkali and Alkaline earth metals)

Group 1 and Group 2 elements: General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii)

Unit IV: Chemical Bonding and Molecular Structure

Valence electrons, ionic bond, covalent bond: bond parameters. Lewis structure, polar character of covalent bond, covalent character of ionic bond, valence bond theory, resonance, geometry of covalent molecules, VSEPR theory.

PRACTICALS: Quantitative estimation:

(ii) Preparation of standard solution of sodium carbonate.
(iii) Determination of strength of a given solution of hydrochloric acid by titrating it against standard sodium carbonate solution.

Anion analysis: CO_3^{2-} , S^{-2} , SO_3^{-2} , NO_2^- , Cl^- , Br^- , I^- , NO_3^- , **CH_3COO^- , SO_4^{2-}, PO_4^{3-},**

SEPTEMBER –OCTOBER

TERM I Examination

SEPTEMBER –OCTOBER

Unit IV: Chemical Bonding and Molecular Structure (continued)

Concept of hybridization, involving s, p and d orbitals and shapes of some simple molecules, molecular orbital theory of homo nuclear diatomic molecules (qualitative idea only), hydrogen bond

Unit XI: Some p-Block Elements

General Introduction to p-Block Elements
Group 13 elements: General introduction, electronic configuration, occurrence. Variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group; Boron- physical and chemical properties.
Group 14 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first element, Carbon - catenation, allotropic forms, physical and chemical properties.

Unit VI: Thermodynamics

Concepts of System, types of systems, surroundings. Work, heat, energy, extensive and intensive properties, state functions.
First law of thermodynamics - internal energy and enthalpy, Hess's law of constant heat summation, enthalpy of: bond dissociation, combustion, formation, atomization, sublimation. Phase transformation, ionization, and solution, lattice enthalpy, born haber cycle
Second law of Thermodynamics (brief introduction). Introduction of entropy as a state function, Gibb's energy change for spontaneous and non-spontaneous processes, criteria for equilibrium.
Third law of thermodynamics (brief introduction).

NOVEMBER

Unit VII: Equilibrium

Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of mass action, equilibrium constant, factors affecting equilibrium - Le Chatelier's principle; ionic equilibrium - ionization of acids and bases, strong and weak electrolytes, degree of ionization, concept of pH. Hydrolysis of salts (elementary idea). Buffer solutions, solubility product, common . ion effect (with illustrative examples).

PRACTICALS: **Cation analysis- Cu^{+2} , As^{+3} , Al^{+3} , Fe^{+3}, Zn^{+2}, Mn^{+2}**

DECEMBER:

Unit VIII: Redox Reactions

Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions, applications of redox reactions.

Unit XII: Organic Chemistry - Some Basic Principles and Techniques

General introduction, methods of qualitative and quantitative analysis, classification and IUPAC . Nomenclature of organic compounds. Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation. Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions

PRACTICALS: Cation analysis- , Ni^{+2} , Co^{+2} , Ca^{+2} , Sr^{+2}, Ba^{2+}, Mg^{2+}

JANUARY-FEBRUARY

Unit XIII: Hydrocarbons

Classification of hydrocarbons

A1kanes - Nomenclature, isomerism, confonnations (ethane only), physical properties, chemical reactions including halogenation, free radical mechanism, combustion and pyrolysis.

Alkenes - Nomenclature, structure of double bond (ethene) geometrical isomerism, physical properties, methods of preparation; chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition.

Alkynes - Nomenclature, structure of triple bond (ethyne), physical properties. Methods of preparation, chemical reactions: acidic character of alkynes, addition reaction of -. hydrogen, halogens, hydrogen halides and water.

Aromatic hydrocarbons: Introduction, IUPAC nomenclature; Benzene: resonance aromaticity; chemical properties: mechanism of electrophilic substitution. - nitration sulphonation, halogenation, Friedel Craft's alkylation and acylation: directive influence of functional group in mono-substituted benzene; carcinogenicity and toxicity.

PRACTICALS : Unknown salt

CHEMISTRY (CODE-043)
QUESTION PAPER DESIGN
CLASS - XI

Time 3 Hours **Max. Marks: 70**

S. No	Typology of Questions	Very Short Answer (VSA) (1 mark)	Short Answer-I (SA-I) (2 marks)	Short Answer-II (SA-II) (3 marks)	Value based question (4 marks)	Long Answer question (L.A.) (5 marks)	Total Marks
1.	**Remembering- (Knowledge based** Simple recall questions, to know specific facts, terms, concepts, principles, or theories, Identify, define, or recite, information)	2	1	1	-	-	7
2.	**Understanding- (Comprehension -**to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase information)	-	1	2	4	-	21
3.	**Application**(Use abstract information in concrete situation, to apply knowledge to new situations, Use given content to interpret a situation, provide an example, or solve a problem)	-	2	4	-	1	21
4.	**High Order Thinking Skills (Analysis & Synthesis-** Classify, compare, contrast, or differentiate between different pieces of information, Organize and/or integrate unique pieces of information from a variety of sources)	2	-	1	-	1	10
5.	**Evaluation and Multi-Disciplinary-** (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values)	1	-	2	1	-	11
	TOTAL	**5x1=5**	**5x2=10**	**12x3=36**	**1x4=4**	**3x5=15**	**70(26)**

QUESTION WISE BREAK UP

Type of Question(s)	Mark(s) per Question	Total No. of Questions	Total Marks
VSA	1	5	05
SA-I	2	5	10
SA-II	3	12	36
VBQ	4	1	04
LA	5	3	15
Total		**26**	**70**

1. **Internal Choice:** ***There is no overall choice in the paper. However, there is an internal choice in one question of 2 marks weightage, one question of 3 marks weightage and all the three questions of 5 marks weightage.***
2. *The above template is only a sample. Suitable internal variations may be made for generating similar templates keeping the overall weightage to different form of questions and typology of questions same.*

Assignment No. 1

SOME BASIC CONCEPTS OF CHEMISTRY

Q1. The empirical formula and molecular mass of a compound are CH_2Cl and 99g respectively. What will be the molecular formula of the compound?
(a) $C_9H_{18}Cl_9$ (b) CH_2Cl
(c) $C_2H_4Cl_2$ (d) $C_4H_8O_4$

Q2. One mole of CO_2 contain?
(a) $6.02X10^{23}$atoms of C (b) $6.02X10^{23}$atoms of O
(c) $18.1X10^{23}$ molecules of CO_2 (d) 3g atoms of CO_2

Q3. State the law of multiple proportion and explain it with the help of an example.

Q4. Calculate number of moles in (i) 45.4 litres of sulphur dioxide at N.T.P. (ii) $6.022X10^{22}$ molecules of oxygen (iii) 8g of calcium.

[2mol, 0.1 mol, 0.2mol]

Q5. Calculate number of atoms in (i) 0.25 mole atoms of carbon (ii) 0.20 mole molecules of oxygen.

[1.5057×10^{23} atoms, 2.4092×10^{23} atoms]

Q6. Calculate (a) Mass of 2.5g atoms of magnesium. (At mass of Mg = 24u)
(b) Mass of 0.72 gram molecules of CO_2 (at mass of C=12u , O = 16u)

[60.0g, 31.68g]

Q7. What is the number of CO_2 which contain the 8g of O_2?

[$1.5X10^{23}$]

Q8. How many molecules of CO_2 are present in one litre of air containing 0.03% volume of CO_2 at N.T.P?

[$8.07X10^{18}$ molecules]

Q9. What is the mass of carbon present in 0.5 mole of $K_4[Fe(CN)_6]$(At mass of Fe=56u, K=39u C=12u, N=14u, H=1u)

[36 g]

Q10. A coating of cobalt that is 0.005 cm thick is deposited on a plate that is 0.5 m^2 in total area. How many atoms of cobalt were deposited on the plate?
(Density of Co= 8.9g/cc, atomic mass of Co= 59u)

[2.27×10^{24} atoms]

Q11. Hemoglobin contains 0.25%iron by mass. The molecular mass of hemoglobin is 89600. Calculate the number of iron atoms per molecule of hemoglobin.(atomic mass of Fe=56u)

[4 atoms]

Q 12 What volume of oxygen at S.T.P is needed to cause the complete combustion of 200mL of C_2H_2? Also calculate the volume of carbon dioxide formed?

[500 ml of O_2, 400 ml of CO_2]

Q13. A solution has been prepared by dissolving 60g of methyl alcohol in 120g of water. What is the mole fraction of methyl alcohol and water?

[X_{CH3OH}= 0.22, X_{H20} =0.78]

Q14. An organic compound on analysis gave the following percentage composition; C=57.8%, H=3.6% and the rest is oxygen. The molecular mass of the compound was found to be 166. Find out the molecular formula of the compound.

[$C_4H_3O_2$]

Q15. Zinc and HCl react according to the following reaction: $Zn + HCl \rightarrow ZnCl_2 + H_2$
If 0.8 mol of Zn is added to HCl containing 0.62 mol of HCl, how many moles of hydrogen are produced? What is the limiting reagent?

[LR- HCl, 0.31 moles of H_2]

Q16. 3M solution of $NaNO_3$ has density 1.25g/l. Calculate its molality.
(M M of $NaNO_3$=85$gmol^{-1}$) [2.79m]

Q17. Value based question-

Rakesh and Rohan were waiting for their chemistry class. But they learnt that their chemistry teacher was on leave that day. "Let us discuss something about chemistry" said Rakesh to Rohan. Both sat down in the park outside. "Our teacher frequently talks about atoms which we cannot see with our eyes. What would be the size and mass of an atom" asked Rohan to Rakesh. Rakesh said "Atoms are very small in size and they possess a very small mass."

a) What is Avogadro number?
b) How do we express the mass of large number of atoms?

Practice Assignment-1

SOME BASIC CONCEPTS OF CHEMISTRY

Q1. Calculate number of moles in 1.6g of S (Atomic mass of S=32u)

[0.05]

Q2. Calculate number of atoms present in 18g of glucose($C_6H_{12}O_6$)

[$6.02X10^{22}$]

Q3. Calculate the mass of 1 molecule of N_2. (Given : Atomic mass of N=14u)

[$4.65X10^{-23}$]

Q4. How many moles of gold are present in 49.25g of gold rod? (atomic mass of gold=197u)

[0.25]

Q5. What is the number of molecules of CO_2 which contain 8g of O_2?

[$1.505 \text{ x}10^{23}$ molecules]

Q6. A compound contains 42.3913% K, 15.2173% Fe, 19.5652% C and 22.8260%N. The molecular mass of the compound is 368u. Find the molecular formula of the compound. (Given At mass of K=39u, Fe=56u, C=12u, N=14u)

[$K_4Fe(CN)_6$]

Q7. How many moles of Nitrogen are needed to produce 8.2 moles of Ammonia by reaction with Hydrogen?

[4.1mol]

Q8. 250 ml of 0.5M Na_2SO_4 solution is added to an aqueous solution containing 10g of $BaCl_2$ resulting in the formation of white precipitate of $BaSO_4$.

a) Which is the limiting reagent?
b) How many moles of $BaSO_4$ will be obtained?

How many grams of $BaSO_4$ will be obtained? [$BaCl_2$, 0.047, 11.2g]

Q9. Calculate molarity of a solution containing 13.8g of potassium carbonate (molar mass =138g/mol) dissolved in 500ml of solution.

[0.2M]

Q10. Calculate the molarity and molality of 93% H_2SO_4 (weight/volume). The density of the solution is 1.84 g/cc.

[9.5 M, 10.44 m]

Q11. The density of water at room temperature is 1g/cc. How many molecules are there in a drop of water if its volume is 0.05 mL?

[$1.67 \text{ x } 10^{21}$ molecules]

Q12. Calculate the weight of carbon monoxide having same number of oxygen atoms as are present in 88g of carbon dioxide.

[112g]

Q13. An organic compound on analysis gave the following percentage composition; C=40%, H=6.67% and the rest is oxygen. The molecular mass of the compound was found to be 166. Find out the molecular formula of the compound.

[$C_6H_{12}O_6$]

Q14. 1M solution of $NaNO_3$ has density 1.25g/cc. Calculate its molality.
(M M of $NaNO_3$=85gmol^{-1})

[0.858m]

Assignment No. 2

STRUCTURE OF ATOM

Q1. The pair of ions having same electronic configuration is
(a) Cr^{3+} and Fe^{3+} (b) Fe^{3+} and Mn^{2+}
(b) Fe^{3+} and Ni^{2+} (d) Sc^{3+} and Cr^{3+}

Q2. The electrons are identified by their quantum numbers n and l:
(1) n=4,l=1 (2) n=4,l=0 (3) n=3,l=2 (4) n=3,l=1 can be placed in order of increasing energy as :
(a) 1<3<2<4 (b) 3<4<2<1
(c) 4<2<3<1 (d) 2<4<1<3

Q3. Discuss the drawbacks of (1) Rutherford model (2) Bohr model

Q4. The threshold frequency υ_o for a metal is $7x10^{14}$ s^{-1}. Calculate the kinetic energy of an electron emitted when radiation of $\upsilon=1x10^{15}$ s^{-1} hits the metal. Given h=$6.6x10^{-34}$Js.
[$1.99X10^{-19}$J]

Q5. Calculate the frequency and energy of a photon of radiation of wavelength 6000 A^0.
[5×10^{14} s^{-1}, $3.3125X10^{-19}$J]

Q6. What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from n=5 to n=2? In what region of the electromagnetic spectrum will this radiation lie? [434nm]

Q7. Calculate the wave number for the longest wavelength transition in the Balmer series of atomic hydrogen. [$1.523 X 10^{-18}m^{-1}$]

Q8. Anion with mass number 56 contains 3 units of positive charge and 30.4% more neutrons than electrons. Assign the symbol to this ion.

Q9. a) What is meant by quantization of energy?
b) Draw the shapes of d orbitals.
c) Calculate the energy associated with the first orbit of He^+. Calculate the radius of this orbit.
[$-8.72X10^{-18}$J]

Q10. Explain why electronic energy is negative.

Q11. Calculate the wavelength of an electron moving with a velocity of 10^3 m/s
[7.25×10^{-7} m]

Q12. A moving electron has $3 x10^{-25}$ joules of kinetic energy. What is the de Broglie wavelength?
[$8967 X10^{-10}$m]

Q13. If the electron is to be located within $5x10^{-5}$ A^0, what will be the uncertainty in its velocity?
[1.16×10^{10} m/s]

Q14. Write short notes on:
(a) Heisenberg's uncertainity principle
(b) Pauli's Exclusion principle
(c) Hund's rule of maximum multiplicity

Q15. (a) Which quantum no. determines (i) energy of an electron, (ii) orientation of orbital?
(b) Which shell would be the first to have 'g' sub shell?
(c) Which orbital is non directional?

Q16. Explain why atoms with half filled and full filled orbitals have extra stability. Write down the electronic configuration of: Si(14), Cr (24), Cu(29), Xe (54)

Q17. Write the electronic configuration of Cu^{+}, Ca^{2+}, Ni^{2+}, Cr^{3+}. Also indicate the no. of unpaired electrons present in each case.

Q18. Write the designation for orbital with the following quantum numbers:

a) n = 4; l = 1 b) n = 2; l = 0 c) n = 5; l = 2

Practice Assignment-2

STRUCTURE OF ATOM

Q1. Yellow light emitted form a sodium lamp has a wavelength of 580 nm Calculate the frequency and wave number.

[$5.17X10^{14}s^{-1}$]

Q2. What is the number of photons of light with wavelength 400 pm which provide 1J of energy.

[$20.11X10^{14}$]

Q3. The quantized energy of electron in hydrogen atom for the nth energy level is given by $E_n = -1.312/n^2 \times 10^6$ J/mol. Calculate the minimum energy required to remove the electron completely from hydrogen atom when its quantized energy level n equals 2. What should be the wavelength of light that can be used to cause this transition? (h = 6.6×10^{-34} Js, C= $3x10^8$ m/s)

[5×10^{-19} J/mol , 3.63×10^{-7} m]

Q4. What is the energy in joules required to shift the electron of the hydrogen atom from the first Bohr orbit to the fifth Bohr orbit and what is the wave length of light emitted when the electron returns to the ground state? The ground state electronic energy is -2.18×10^{-18} J.

[$9.5X10^{-8}$ m]

Q5. Energy associated with the 1st orbit in the H atom is $-13.12 X 10^5$ J/mol. What is the energy required for excitation to 2nd Bohr's orbit?

[$9.84x10^5$ J/mol]

Q6. Using Aufbau's principle, write the ground state electronic configuration of the following:

a) Ca (Z=20) b) Mn (Z=25) c) Cu (Z=29) d) Rb (Z=37)

Q7. Give the values of all the four quantum numbers for 2p electrons in Nitrogen (Z=7)

Q8. Write the electronic configuration of the elements with Z=17 and predict the a) number of p electrons b) number of filled orbitals c) number of half filled orbitals

Q9. Write the electronic configuration of the following and report the number of unpaired electrons in each case:

a) Mn^{4+} (Z=25) b) F^- (Z=9) c) Zn^{2+} (Z=30)

Q10. a) Write the values of azimuthal and magnetic quantum numbers for n=2.

b) Write the four quantum numbers for 21st electron of Sc (Z=21)

Q11. From the following sets of quantum numbers, state which are possible:

i) n=0, l=0, m=0, s=1/2
ii) n=2, l=2, m=0, s=1/2
iii) n=2, l=2, m=0, s=-1/2
(iv) n=1, l=0, m=1, s=1/2
(v) n=1, l=0, m=0, s=-1/2
(vi) n=1, l=1, m=0, s=1/2

Q12. A photon of wavelength $4 X 10^{-7}$m strikes on a metal surface, the work function of the metal being 2.1 eV. Calculate the energy of the photon, kinetic energy of the emission and the velocity of the photoelectron. (1eV= $1.6 X 10^{-19}$ J)

[E=3.1 eV, K.E = 1 eV, v=$5.91 x10^5$ m/s]

Assignment No.3

Classification of Elements

Q1. The The first ionization enthalpies of Na, Mg, Al and Si are in the order:
(a) Na<Mg>Al<Si (b) Na>Mg>Al>Si
(c) Na<Mg<Al<Si (d) Na>Mg>Al<Si

Q2 The highest third ionization energy is exhibited by
(a) Magnesium (b) Boron
(c) Beryllium (d) Aluminium

Q3. Consider the following species : N^{-3} , O^{-2} ,F^{-} , Na^{+} , Mg^{2+} and Al^{+3}
(i) What is common in them?
(ii) Arrange them in increasing order of ionic radii. Give reason also.

Q4. Elements A and B have the atomic numbers 12 and 29 respectively. Write down their electronic configuration and predict
(i) group (ii) period (iii) block to which they belong.

Q5. What is the IUPAC name and symbol of an element with atomic number 117? Also predict the electronic configuration.

Q6. Among the elements of the second period Li to Ne and pick out the element:
(i) with highest first ionization energy.
(ii) that is most reactive non -metal
(iii) that is most reactive metal.
(iv) with largest atomic radius
(v) with highest electronegativity

Q7. What is the general electronic configuration of lanthanides and actinides? Why they are placed in separate rows at the bottom of periodic table?

Q8. (i) Arrange F, Cl, Br, I in increasing order of negative electron gain enthalpy. Also explain the reason of that arrangement.
(ii) Which is largest in size—Cu^{+}, Cu^{2+}, Cu and why?
(iii) Which element is more metallic - Mg or Al and why?

Q9. Account for the following:
(i) Mg has higher value of first ionization energy than Al atom.
(ii) The ionization energy of Na^{+} is higher than that of Ne although they have the same configuration.
(iii) Electron gain enthalpy of O is less negative than that of S.
(iv) Mg^{+2} ion is smaller than O^{-2} ion although both have the same electronic structure.

Q10. Give reasons:
(i) Noble gases are less reactive.
(ii) First ionization energy of Mg is more than that of Na but second ionization energy of Mg is less than Na.
(iii) Ionization enthalpy of oxygen is less than N.

Practice Assignment-3

CLASSIFICATION OF ELEMENTS

Q1. Give the IUPAC name and the symbol of an element with Z=109.

Q2. Elements A and B have the atomic numbers 12 and 29 respectively. Write down their electronic configuration and predict
(i) group (ii) period (iii) block to which they belong.

Q3. Which is largest in size Al^+, Al^{2+} and Al, why?

Q4. Among the elements with atomic number 9, 12 and 36. Identify the element which is a) highly electronegative b) an inert gas in nature c) highly electropositive in nature. Give reason for your answer.

Q5. Arrange the following in increasing order of the property indicated:
a) F, Cl , Br, I (Electron gain enthalpy)
b) Mg^{2+}, O^{2-}, Na^+, F^-, N^{3-} (Ionic size)
c) Mg, Al, Si, Na (Ionization enthalpy)
d) C, N, O,F (Second Ionization enthalpy)

Q6. Name a species that will be isoelectronic with each of the following atoms or ions,
(a) Ar (b) Cl^- (c) F^- (d) Rb^+ (e) Ca^{2+}

Q7. The first ionization enthalpy of B is less than that of C. On the other hand, the second ionization enthalpy of boron is very much higher than that of carbon. Explain.

Assignment No. 4

Chemical Bonding and Molecular Structure

Q1. Which of the following is a polar molecule?
(a) BF_3
(b) SF_4
(c) SiF_4
(d) XeF_4

Q2. The pairs of species of oxygen and their magnetic behavior are listed below. Which of the following presents the correct description?
(a) O_2^- , O_2^{2-} - Both diamagnetic
(b) O^+ , O_2^{2-} - Both paramagnetic
(c) O_2^+ , O_2 - Both paramagnetic
(d) O , O_2^{2-} - Both paramagnetic

Q3. Draw Lewis structure of the following molecules:
H_2, H_2S, CH_4,, C_2H_6, CO_2, CN^-, SO_3^{2-}

Q4. Write the formal charges of the atoms in the following ions:
CO_3^{2-}, NO_2^-

Q5. How many σ and π bonds are there in $CH_2= CH—C= CH_2$?

Q6. Predict the shapes of $BeCl_2$, SF_6, PCl_5, BF_3 , ClF_3, XeF_4, NH_3 based on VSEPR theory .

Q7. Considering x-axis as the internuclear axis, what kind of bond shall be formed in the following?
1s/1s, 1s/2px, 2px/2py, 2py/2py

Q8. Which of the compounds in the following pairs have higher dipole moment: NH_3 and NF_3, H_2O and H_2S. Give reason for your answer.

Q9. Account for the following:
1. The H—S—H bond angle in H_2S is less than the H—O—H bond angle in H_2O.
2. Dipole moment of CO_2, BF_3, CCl_4 are zero
3. NF_3 is pyramidal but BF_3 is triangular planar

Q10. Draw the resonating structures of NO_3^-, CH_3COO^- , $CH_2=CH-CH_2^+$, SO_3^{-2}

Q11. Predict the hybridization state of S in SF_6 and P in PCl_5 and C in C_2H_4. Explain the same with the box diagram.

Q12. Draw the molecular orbital formed on sideways overlap of $2p_x$ with $2p_x$.

Q13. Explain why O_2 molecule is paramagnetic in nature?

Q14. Why does He_2 not exist?

Q15. Draw the molecular orbital diagram of N_2, N_2^+ N_2^-. Write their electronic configuration, find the bond order and predict their magnetic behavior. Arrange the above in increasing order of bond length.

Q16. a) What are dispersion forces?
b) What type of intermolecular forces of attraction exists between H_2O and C_2H_5OH?

Q17. Value Based Question-

The teacher in the chemistry class asked the students," You know oxygen and sulphur belong to the same group, i.e, group 16 of the periodic table. They must possess similar characteristics. While the hydride of oxygen,i.e, water is a liquid at room temperature, the hydride of sulphur ,i.e, H_2S is a gas. Isn't it strange", said the teacher.

a) How do you account for the different physical states of hydrides of oxygen and sulphur at room temperature?
b) How do you explain that ice floats on water?

Practice Assignment-4

CHEMICAL BONDING AND MOLECULAR STRUCTURE

Q1. Write Lewis dot structure of CO_2, CN^-, BF_3, PH_3.

Q2. Predict the shapes of the following molecules using VSEPR theory:
a) $BeCl_2$ b) $SiCl_4$ c) AsF_5 d) H_2S e) SO_2 f) PH_3

Q3. Arrange NH_3, H_2O, CH_4 in increasing order of bond angles. Give reason for your answer.

Q4. Both NH_3 and BF_3 are tetra atomic molecules but have different shapes. Explain.

Q5. Which out of the following pairs has dipole moment and why?
a) BF_3 and NF_3 b) CO_2 and H_2S

Q6. Calculate the formal charge on every atom of nitrite ion.

Q7. What is the hybridization state of O in H_2O, B in BH_3, C in ethyne and ethane? Draw their orbital pictures specifying sigma and pi bonds.

Q8. Draw resonating structures of SO_3 and SO_4^{2-}.

Q9. Write molecular orbital configuration of F_2, F_2^+. Calculate their bond order. Comment on the bond length and magnetic behavior.

Q10. What is the change in hybridization of Al atom in the reaction
$AlCl_3 + Cl^- \longrightarrow AlCl_4^-$

Q11. Why o-nitrophenol is steam volatile where as p-nitrophenol has higher boiling point. Explain.

Q12. The internuclear separation in HCl is 0.283 nm. Calculate the dipole moment of HCl. Charge of an electron is 1.6×10^{-19} C

Q13. With the help of VB Theory, explain the formation of H_2 molecule. Draw the graph for the same.

ASSIGNMENT No. 5

STATES OF MATTER

Q1. The temperature at which real gases obey the ideal gas laws over a wide range of pressures is called

a) Critical temperature c) inversion temperature
b) Boyle temperature d) reduced temperature

Q2. Consider the equation Z = pV/RT. Which of the following statements is correct?

a) When Z>1, real gases are easier to compress than the ideal gas.
b) When Z=1, real gases get compressed easily
c) When Z> 1, real gases are difficult to compress
d) When Z=1, real gases are difficult to compress

Q3. A sample of gas occupies 100dm^3 volume at 1 bar pressure and 35^{o}C. If the volume of the gas is reduced to 5dm^3 at the same temperature, what is the additional pressure that must be applied? (19 bar)

Q4. Based upon Boyle's law draw the plot of P Vs V and also PV Vs P.

Q5. What do you understand by "Absolute Zero temperature"? What is its significance?

Q7. The density of a gas is found to be 3.43g/l at 1atm pressure and 300 K. Calculate the molar mass of the gas. (84.5g/mol)

Q8. Two flasks A and B have equal volume. Flask A contains H_2 and is maintained at 300 K While flask B contains an equal mass of CH_4 and is maintained at 600k.
(i) Which flask contains greater number of molecules? How many times more? (H_2, 8times)
(ii) In which flask is pressure greater? How many times greater? (H_2, 4 times)

Q9. A certain quantity of gas occupies a volume of 919.0 ml at STP in dry conditions . The same gas when collected over water at 15^0 C and a pressure of 750 mm occupied a volume of one litre. Calculate the aqueous tension at 15^{0}C. (13.3mm)

Q10. A vessel of 5 liters capacity contains 7.0 g of N_2 and 2.0 g of CH_4 at 27^{o}C.
(a) Calculate the partial pressure of each gas and also the total pressure in the vessel.
(p_{N2}=1.245 bar, p_{CH4}=0.6235 bar, P_{total}=1.8675 bar)
(b) 10 g of O_2 are introduced into and evacuated vessel of 5 liters capacity maintained at 27^{o}C. Calculate the pressure of the gas in the vessel. (1.5565 bar)

Q11. If density of a gas is found to be 3.80 g/l at STP. What will be density at at 27^{0}C and 0.93 bar pressure? (3.185g/l)

Q12. At what temperature centigrade will the volume of a gas at 0^{0}C double itself, pressure remaining constant? (546 K)

Q13. What do you mean by the terms 'ideal gas' and 'real gas'? What are the conditions under which real gases behave as ideal gases?

Q14. What is the significance of the vander waal's constants 'a' and 'b' and what are their units.

Q15. Account for the following-
a) The size of weather balloon becomes larger and larger as it ascends to higher altitudes.
b) Critical temperature for carbon dioxide and methane are 31.1^oC and -81.9^0 C respectively. Which of these have stronger intermolecular forces and why?

Q16. Give Reasons:
a) Boiling point of water is less than 100^0C at higher altitude.
b) Boiling point of water is greater than 100^0C in the pressure cooker.
c) Ether and acetone are kept at cool temperature during summer.

Q17. One mole of CO_2 occupies 1.5L at 25^oC. Calculate the pressure exerted by the gas using Vander waal's gas equation with a=3.6 L^2bar/mol^2 and b=0.04 $Lmol^{-1}$
(Given R=0.083 Lbar/mol/K)

[14.9bar]

Q18. Value based question-
Esha and Jyoti were preparing for the class test. Esha asked Jyoti, "We have the general gas equation pV = RT, but on substituting the value we find that pV is almost never equal to RT, it is either less than or more than RT. What is the reason?" Jyoti said, "The pV = RT equation is based on certain assumptions which aren't always met. That is why pV is not equal to RT always".
(a) What assumptions we make in the derivation of gas equation?
(b) What is the gas equation for n moles of a real gas?

STP: Standard Temperature=273K
Standard Pressure= 1 bar
R = 0.083 barL/K/mol
Relation between various pressure units:
1 bar= 0.987atm= $10^5N/m^2$= 10^5 Pa= 75cm of Hg= 750 mm of Hg= 750 torr
1 atm = 76 cm Hg = 760mm Hg = 760 torr

Practice Assignment-5

STATES OF MATTER

Q1. A gas occupies a volume of 250 mL at 745 mm of Hg and 25^oC. What additional pressure is required to reduce the volume of the gas to 200 mL at the same temperature?

Q2. A balloon is inflated in a warm living room (24^oC) to a volume of 2.5L. It was taken out on a very cold winter day (-30^oC). Assuming that mass of air and pressure inside the balloon are constant, find out the volume of the balloon.

Q3. A gas cylinder containing cooking gas can withstand a pressure of 14.9 atm. The pressure gauge of the cylinder indicates 12 atm at 27^oC. Due to sudden fire in the building, the temperature starts rising. At what temperature will the cylinder explode?

[99.5^0C]

Q4. A sample of gas occupies a volume of 2.74L at 0.9 atm and 27^oC.What will be the volume at 0.75 atm and 15^oC?

Q5. Calculate the mass of 120mL of N_2 at 150^oC and 750mm of Hg pressure. Given: R=0.0821 L atm/K/mol, molar mass of N_2=28 g/mol

Q6. The density of a gas is found to be 5.46 g/dm^3 at 27^oC and under 2 bar pressure. What will be its density at STP. [3g/dm^3]

Q7. Potassium chlorate decomposes as:

$$2KClO_3 \rightarrow 2KCl + 3O_2$$

Calculate the volume of oxygen at 0^0C and 1atm when 24.50g of $KClO_3$ are heated. (R=0.0821 Latm $K^{-1}mol^{-1}$)

Q8. The drain cleaner "drainex" contains small bits of aluminium which reacts with caustic soda to produce hydrogen gas. What volume of hydrogen at 20^oC and 1 bar will be released when 0.15 g of aluminium reacts?

The equation for the reaction is:

$$2Al + 2NaOH + 2H_2O \longrightarrow 2NaAlO_2 + 3H_2$$

[203.0ml]

Q9. The pressure of a mixture of H_2 and N_2 in a container is 1200 torr. The partial pressure of N_2 in the mixture is 300 torr. What is the ratio of H_2 and N_2 molecules in the mixture?

Q10. A bulb 'X' of unknown volume containing a gas at one bar pressure is connected to an evacuated bulb of 0.5 liter capacity through a stopcock. On opening the stopcock, the pressure in the whole system after some time was found to have a constant value of 570 mm at the same temperature What is the volume of the bulb X?

(1.5 L)

ASSIGNMENT No. 6

THERMODYNAMICS

Q1. A system does 200J of work and at the same time absorbs 150J of heat. What is the internal energy change?

[-50 J]

Q2. A gas absorbs 125 J of heat and expands against the external pressure of 1.2 atm from a volume of 0.5 L to 1.0L. What is the change in internal energy? (100J = 1Latm).

[W= 0.6 L atm or 60.7J, ΔU = 65 J]

Q4. 2 mols of ideal gas at 2 atm and 27^0C are compressed isothermally to half the volume against the external pressure of 4 atm. Calculate work done (w), q and ΔU .

(w= 5150 J, ΔU =0, q= -5150 J)

Q5. The reaction of cyamamide, $NH_2CN(s)$, with dioxygen was carried out in a bomb calorimeter, and ΔU was found to be -742.7 kJ mol^{-1} at 298 K. Calculate enthalpy change for the reaction at 298 K.

$NH_2CN(s) + 3/2O_2(g) \longrightarrow N_2(g) + CO_2(g) + H_2O(l)$

[-741.46 KJ/mol]

Q6. Answer the following in brief:

a) Which of the two isomers of butane is more stable at 25^0C and why?
Given: n-butane (Δ_fH^o = -120 KJ mol^{-1}) and isobutane (Δ_fH^o = -130 $kJmol^{-1}$)

b) For the change H_2O (l) → $H_2O(g)$, predict the sign of ΔS.

Q7. Enthalpies of formation of CO(g), $CO_2(g)$, $N_2O(g)$ and $N_2O_4(g)$ are -110, -393, 81 and 9.7 KJ mol^{-1} respectively. Find the value of ΔrH for the reaction:

$N_2O_4 (g) + 3CO(g) \longrightarrow N_2O (g) + 3CO_2(g)$

[-777.7 KJ/mol]

Q8. Calculate the enthalpy change ΔH for the following reaction

$C_2H_4 (g) + 3O_2 (g) \longrightarrow 2CO_2 (g) + 2H_2O (g)$

Given average bond enthalpies of various bonds C-H, C=C, O=O, C=O, O-H as 414, 619, 499, 724, 640 KJ/mol respectively.

[-2573kJ/mol]

Q9. Calculate the lattice enthalpy of NaCl from the data $\Delta_{sub}H^o$(Na)= 317.57 KJ/mol, Δ_fH^o of NaCl= -410.87 KJ/mol, $\Delta_{diss}H^o(Cl_2,g)$= 241.84 KJ/mol, Δ_iH^o(Na,g)= 495.8 KJ/mol and $\Delta_{eg}H^o(Cl_2,g)$= -365.26KJ/mol.

[979.9KJ/mol]

Q10. Calculate the free energy change when 1 mole of NaCl is dissolved in water at 298 K. (Given: Lattice energy of NaCl = 777.8 KJ mol^{-1}, Hydration energy = -774.1 KJ mol^{-1} and ΔS = 0.043 KJ K^{-1} mol^{-1} at 298 K)

[-9.114 KJ/mol]

Q11. For the reaction ,A + B $\longrightarrow$ C + D , ΔH = -10,000 J mol^{-1} and ΔS = -33.3 J K^{-1} mol^{-1},

(i) At what temperature will the reaction occur spontaneously fro left to right?

(ii) At what temperature, the reaction will reverse? [T<300.3K, T > 300.3 K]

Q12. The equilibrium constant for a reaction is 10. What will be the value of ΔG^o?
R= 8.314 JK^{-1} mol^{-1}, T = 300K (log 10 = 1)

[-5744.14 J/mol]

Q13. Give reasons:

a) Thermodynamically an exothermic reaction is sometimes not spontaneous.
b) The entropy of steam is more than that of water at its boiling point.
c) The equilibrium constant for a reaction is one or more if ΔrG^o for it is less than zero.
d) Entropy of a perfectly crystalline substance is less than that of its imperfect crystal.

Q14. Predict the entropy change (Positive/Negative) in the following:

(i) A liquid substance crystallizes into a solid.
(ii) Temperature of crystal is increased.
(iii) $CaCO_3 (s) \longrightarrow CaO (s) + CO_2(g)$
(iv) $N_2(g)$ (1 atm) $\longrightarrow$ $N_2(g)$ (0.5 atm)
(v) $2Cl (g) \longrightarrow Cl_2(g)$

Q15. Calculate the electron gain enthalpy of fluorine from the data given below. ΔH_f of KF is -560.8 KJ/mol, dissociation energy of F_2 is 158.9 KJ/mol. Lattice energy of KF is 807.5 KJ/mol , ionization energy of potassium is 414.2KJ/mol and enthalpy of sublimation of K= 87.8 KJ/mol. [-334.7 KJ]

Q16. Calculate $\Delta H_{lattice}$ of SnO_2, If ΔH_f of SnO_2 is -588 KJ/mol, Enthalpy of Sublimation (Sn) = 292 KJ/mol, Enthalpy of Dissociation(O_2) = 454 KJ/mol. Total Electron gain enthalpy for O = 636 KJ/mol, Ionization enthalpy ($Sn \longrightarrow Sn^{4+}$) = 8990kJ/mol.

[11596 KJ/mol]

PRACTICE ASSIGNMENT -6

THERMODYNAMICS

Q1. In a process 701 J of heat is absorbed by a system and 394 J of work is done by the system. What is the change in internal energy for the process? [307J]

Q2. (a) 2.5 mol of ideal gas at 2 atm and 27oC expands isothermally t 2.5 times of its original volume against the external pressure of 1 atm. Calculate work done.
(b) If the same gas expands isothermally in a reversible manner, then what will the value of work done be. (W = -4672.4 J, W= -5701.06 J)

Q3. The combustion of one mole of benzene takes place at 298 K and 1 atm. After combustion, CO_2(g) and H_2O (g) are produced and 3267 KJ of heat is liberated. Calculate the standard enthalpy of formation of benzene. Standard enthalpies of formation of CO_2 (g) and H_2O (l) are -393.5 KJ mol^{-1} and -285.83 KJ mol^{-1} respectively. (48.51 KJ mol^{-1})

Q4. Enthalpy of combustion of carbon to CO_2 is -393.5 KJ mol^{-1}. Calculate the heat released upon formation of 35.2g of CO_2 from carbon and dioxygen gas.
[-314.8 KJ/mol]

Q5. For a gaseous reaction $2A_2(g) + 5B_2(g) \longrightarrow 2A_2B_5(g)$ at 27°C the heat change at constant pressure is found to be -50160 J. Calculate the value of internal energy change.
(-37689 J)

Q6. The heat of combustion of methane ($C_{10}H_8(s)$) at constant volume was measured to be -5130KJ/mol at 298 K. Calculate the value of enthalpy change.

Q7. Calculate the standard enthalpy of formation of $C_2H_4(g)$ from the following thermochemical equation:
$C_2H_4(g) + 3O_2(g) \longrightarrow 2CO_2(g) + 2H_2O(g)$; ΔH^o = -1323 KJ. Given that ΔH_f^o of $CO_2(g)$, $H_2O(g)$ as -393.5 and -249 KJ/mol respectively.

Q8. Calculate the enthalpy change for the process

$$CCl_4(g) \longrightarrow C(g) + 4Cl(g)$$

and calculate bond enthalpy of C—Cl in $CCl_4(g)$

Given, $\Delta_{vap}H^o(CCl_4)$ = 30.5 kJ mol^{-1}
$\Delta_f H^o(CCl_4)$ = -135.5 kJ mol^{-1}
$\Delta_a H^o(C)$ = 715.0 kJ mol^{-1}
$\Delta_a H^o(Cl_2)$ = 242 kJ mol^{-1} (327 KJ/mol)

Q9. Calculate the heat of combustion of glucose from the following data:
(i) $C(graphite) + O_2(g) \qquad CO_2(g)$; ΔH=-395 KJ
(ii) $H_2(g) + 1/2\ O_2(g) \longrightarrow H_2O(l)$; ΔH =-269.4 KJ
(iii) $6C(graphite) + 6H_2(g) + 3O_2(g) \longrightarrow C_6H_{12}O_6(s)$; ΔH = -1169.8 KJ

Q10. ΔrH^o for the reaction
$H\text{-}C{\equiv}N(g) + 2H_2(g) \longrightarrow CH_3NH_2$
Is -150 KJ. Calculate the bond energy of C≡N bond. Given, bond energies of C-H= 414 KJ/mol, H-H= 435 KJ/mol, C-N =293KJ/mol, N-H= 369KJ/mol.

Q11. Calculate the lattice enthalpy of LiF; given that the enthalpy of

(i) Sublimation of lithium is 155.2 KJ/mol.
(ii) Dissociation of 1 mole of F_2 at 75.3 KJ/mole.
(iii) Ionization of lithium is 520 KJ/mole.
(iv) Electron gain enthalpy of 1 mole of F(g) is -333 KJ. (v) $\Delta_f H^o$ is -594.1 KJ/mole

[973.95 KJ/mol]

Q12. For the oxidation of iron, $4Fe(s) + 3O_2(g) \longrightarrow 2Fe_2O_3(s)$; entropy change is -549.4 J/k/mol at 298 K.Inspite of negative entropy change of this reaction, why is the reaction spontaneous?

(ΔrH^o for this reaction is -1648000J/mol)

Q13. For a reaction

$M_2O(s) \longrightarrow 2M(s) + 1`/2\ O_2(g)$; ΔrH^o=30 KJ/mol, ΔrS^o=0.07 KJ/K/mol at 1 atm.

Calculate upto what temperature the reaction would not be spontaneous.

Q14. A gas expands against constant external pressure of 1 atm from a volume of 10 dm^3 to a volume of 20 dm^3. In the process, it absorbs 800 J of thermal energy from surroundings. Calculate the value of internal energy change.

(W = -1013 J, ΔU = -213 J)

Q15. For the reaction at 298 K,

$2A + B \longrightarrow C$, ΔH = 400 KJ mol^{-1} and ΔS = 0.2 KJ K^{-1} mol^{-1},

At what temperature will the reaction become spontaneous considering ΔH and ΔS to be constant over the temperature range.

[T > 2000 K]

ASSIGNMENT No. 7(a)

EQUILIBRIUM

Q1. The equilibrium constant for gaseous reaction is

$Kc = [Fe_3O_4(g)][H_2(g)]^4 / [Fe(s)]^3[H_2O(g)]^4$

Write the balanced chemical reaction to this expression.

Q2. Write the expression for Kc and Kp for the following processes:

(i) $FeO(s) + CO(g) \rightleftharpoons Fe(s) + CO_2(g)$

(ii) $4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g)$

Q3. For the reaction, $CH_4(g) + 2H_2S(g) \rightleftharpoons CS_2(g) + 4H_2(g)$ at 1173 K,

The magnitude of the equilibrium constant, Kc is 3.6. For each of the following composition, decide whether reaction mixture is at equilibrium. If it is not, decide which direction reaction should go:

(i) $(CH_4) = 1.07M$, $(H_2S) = 1.20M$, $(CS_2) = 0.90M$, $(H_2) = 1.78M$

(ii) $(CH_4) = 1.45M$, $(H_2S) = 1.29M$, $(CS_2) = 1.25M$, $(H_2) = 1.75M$

Q4. (a) State Le-Chatelier's principle.

(b) In reaction $CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$; $\Delta_fH^o = -92.0$ KJ/mol

What will happen if:

(i) Volume of the reaction vessel in which reactants is reduced to half?
(ii) Some amount of CH_3OH is removed?
(iii) The partial pressure of hydrogen is suddenly doubled?
(iv) An inert gas is added to the system under constant volume conditions?

Q5. A sample of pure PCl_5 was introduced into an evacuated vessel at 473K. After equilibrium was attained, concentration of PCl_5 was found to be 0.5×10^{-1} mol L^{-1}. If the value of K_c is 8.3×10^{-3}, what are the concentrations of PCl_3 and Cl_2 at equilibrium?

[2.031×10^{-2} mol/L]

Q6. Two moles of PCl_5 were heated to 327^0C in a closed two litre vessel and when equilibrium was achieved, PCl_5 was found to be 40% dissociated in PCl_3 and Cl_2. Calculate equilibrium constants Kp and Kc for this reaction. [13.15atm, 0.267mol/l]

Q7. The equilibrium constant for the following reaction is 1.6×10^5 at 1024 K.

$H_2(g) + Br_2(g) \rightleftharpoons 2HBr(g)$ Find the equilibrium pressure of all gases if 10.0 bar of HBr is introduced into a sealed container at 1024 K.

[$P_{H2} = P_{Br2} = 0.025$ bar, $P_{HBr} = 9.95$ bar]

ASSIGNMENT No. 7(b)

EQUILIBRIUM

Q1. Write the proton transfer equilibria for the following acids in aqueous solution and identify the conjugate acid base pair in each case.
(i) H_2SO_4 (ii) $H_2PO_4^-$

Q2. Write the conjugate acid of (i) NH_3, (ii) OH^- (iii) CH_3COO^-

Q3. Classify the following as Lewis acids and Lewis bases:
Cl^-, H_2O, NH_3, BF_3, Al^{3+}, C_2H_5OH

Q4. What is the ionic product of water? Ionic product of water at 310 K is 2.7 X10^{-14}. What is the pH of neutral water at this temperature? [pH =6.19]

Q5. Calculate the hydrogen ion concentration in the following biological fluids whose pH are given below:
(i) Human muscle fluid (pH = 6.83) (iii) Human Blood (pH = 7.38)
[1.479 x 10^{-7}M, 4.169 x 10^{-8} M]

Q6. Calculate the degree of dissociation of acetic acid in its 0.05 M solution. Also calculate the concentration of acetate ion in the solution and its pH .
K_a (CH_3COOH) = 1.8 x 10^{-5} M [0.095 x10^{-2}, 3.023]

Q7. 20 ml of 2 X10^{-5} M $BaCl_2$ solution is mixed with 20 ml of 1 X10^{-5} M Na_2SO_4 solution , will a precipitate form ? (Ksp of $BaSO_4$ is 1.0 X10^{-10}).
[no, K_{IP} = 5 x 10^{-11}]

Q8. The solubility of MgC_2O_4 in water is 0.0093 mol^{-1}. Calculate K_{sp}.
[8.6 x 10^{-5}]

Q9. What is the pH of 0.001 M aniline solution? The ionization constant of aniline is 4.27x10^{-10}. Calculate the degree of ionization of aniline in the solution. Also calculate the concentration of the conjugate acid of aniline. The equation is as follows:
$C_6H_5NH_2 + H_2O \rightleftharpoons C_6H_5NH_3^+ + OH^-$
[pH=7.82, degree of ionization=6.53x10^{-4}, [OH^-]= 6.534x10^{-7} mol/L]

Q10. Give reason for the following :
(i) The precipitation of $Mg(OH)_2$ is prevented by the addition of NH_4Cl prior to addition of NH_4OH but its precipitation by NaOH is not prevented by the prior addition of NaCl.
(ii) In qualitative analysis , NH_4Cl is added before adding NH_4OH for testing Fe^{+3}, Al^{+3}.
(iii) Group IV ions are not precipitated in Group II even though both are precipitated as their sulphides.

Q19. Value based question-
"Come on, I shall perform an interesting experiment today", said the chemistry teacher, "This is related to the chapter on equilibrium." All the students got closer to the demonstration table. The reaction involved NO_2 gas taken in two sealed tubes. The teacher placed two test tubes containing NO_2 gas in water at room temperature. Then she placed one test tube in cold water in one beaker and the other test tube in hot water at 90^0C taken in another beaker.
(a) Can you tell what happened when the test tubes were shifted?
(b) State Le Chatelier's principle

PRACTICE ASSIGNMENT - 7

EQUILIBRIUM

Q1. The equilibrium constant for gaseous reaction is

$Kc = (NH_3)^4(O_2)^5 / (NO)^4(H_2O)^6$

Write the balanced chemical reaction to this expression.

Q2. Write the conjugate bases for the following Bronsted acids:
HCl, HNO_3, HSO_4^-, H_2S

Q3. Write the conjugate acids for the following Bronsted bases:
H_2O, CO_3^{2-}, HSO_4^- , I^-

Q4. The dissociation constant of an acid HA is 1.6×10^{-5}. Calculate H_3O^+ ion concentration in its 0.01 M solution.

Q5. Calculate the degree of ionization of 0.01 M solution of HCN, Ka of HCN is 4.8×10^{-10}. Also calculate the pH of the solution.

Q6. Calculate the concentration of H_3O^+ ion in a mixture of 0.02 M of acetic acid and 0.2 M sodium acetate. Given: Ka for acetic acid is 1.8×10^{-5}.

Q7. Calculate the pH value of

(a) 0.01 M HCl (b) 0.001M NaOH (c) 0.001 M $Ba(OH)_2$

Q8. (a) The value of K_w at a certain temperature is 2.5×10^{-14}. What is the pH of pure water at this temperature?

(b) Calculate the pH of a 10^{-7} M solution of H_2SO_4.

Q9. Calculate the pH of 0.1 M solution of pyridine, C_5H_5N. K_b for pyridine is 1.5×10^{-9}.The equation is as given : $C_5H_5N + \rightleftharpoons H_2O \quad C_5H_5NH^+ + OH^-$

Q10. The solubility product of AgBr at a certain temperature is 2.5×10^{-13}. Find out solubility of AgBr in grams per litre at this temperature. Given ; molecular mass of AgBr= 188 g/mol .

Q11. 50 mL of 0.01M solution of $Ca(NO_3)_2$ is added to 150mL of 0.08 M solution of $(NH_4)_2SO_4$. Predict whether $CaSO_4$ will be precipitated or not. Ksp of $CaSO_4 = 4 \times 10^{-5}$.

Q12. The solubility product constant of Ag_2CrO_4 and AgBr are 1.1×10^{-12} and 5.0×10^{-13} respectively. Calculate the ratio of the molarities of their saturated solutions. [91:9]

Q13. K_{a1} , K_{a2} , K_{a3} are the respective ionization constants for the following reactions,

$H_2S \rightleftharpoons H^+ + HS^-$

$HS^- \rightleftharpoons H^+ + S^{2-}$

$H_2S \rightleftharpoons 2H^+ + S^{2-}$

The correct relationship between them are

(a) $K_{a3} = K_{a1} \times K_{a2}$ (c) $K_{a3} = K_{a1}$ -- K_{a2}

(b) $K_{a3} = K_{a1} + K_{a2}$ (d) $K_{a3} = K_{a1} / K_{a2}$

Q14. *p*H value of which of the following is NOT equal to one?

(a) 0.1 M CH_3COOH (c) 0.05MH_2SO_4

(b) 0.1M HNO_3 (d) 50cm^3 0.4 M HCl + 50cm^3 0.2 M NaOH

ASSIGNMENT No. 8
REDOX REACTIONS

Q1. Calculate the oxidation number of the element in bold in the following:
SiH_4, **B**F_3, , **Br**O_4^-, H_2S, **S**$_2O_8^{2-}$, **Cr**$_2O_7^{2-}$, **Sb**$_2O_5$

Q2. Identify the substance oxidized, reduced, oxidizing agent and reducing agent for the following reactions:

(a) $3N_2H_4(g)$ + + $2\ H_2O_2(l)$ → $N_2(g) + 4H_2O(l)$

(b) $Pb(s) + PbO_2(s) + 2H_2SO_4(aq)$ → $2PbSO_4(s) + 2\ H_2O(l)$

Q3. Write Stock notation of the following compounds:
(a) Mercury(II) chloride
(b) Chromium(III)oxide
(c) Nickel(II)sulphate
(d) Tin(IV)oxide

Q4. Balance the following equation by oxidation number method:
(a) $MnO_4^- + H_2C_2O_4 \longrightarrow Mn^{2+} + CO_2$ (acidic medium)
(b) $N_2H_4 + ClO_3^- \longrightarrow NO + Cl^-$ (basic medium)

Q4. Balance the following equations by ion electron method:
i) $Cr(OH)_4^-(aq) + H_2O_2(aq) \rightarrow CrO_4^{-2}(aq) + H_2O(l)$ (in basic medium)
ii) $H_2O_2 + Fe^{2+} \rightarrow Fe^{3+} + H_2O$ (acidic medium)

Q5. In which of the following reaction, there is no change in valency?
(a) $SO_2 + 2H_2S \rightarrow 2H_2O + 3S$
(b) $2Na + O_2 \rightarrow Na_2O_2$
(c) $Na_2O_2 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O_2$
(d) $4KClO_3 \rightarrow KClO_4 + KCl$

Q6. In which of the following compounds, carbon exhibits a valency of 4 but oxidation state of -2?
(a) CH_3Cl
(b) CH_2Cl_2
(c) $CHCl_3$
(d) HCHO

PRACTICE ASSIGNMENT - 8

REDOX REACTIONS

Q1. Calculate the oxidation number of the element in bold in the following:

$\mathbf{B}H_3$, $\mathbf{S}_2O_3^{2-}$, $H_3\mathbf{P}O_4$, $\mathbf{Br}F_3$

Q2. Identify the substance oxidized, reduced, oxidizing agent and reducing agent for the following reactions:

(a) $Pb(s) + PbO_2(s) + 2H_2SO_4(aq) \rightarrow 2PbSO_4(s) + 2\,H_2O(l)$

(b) $N_2H_4(l) + 2\,H_2O_2(l) \rightarrow N_2(g) + 4H_2O(l)$

Q3. Write Stock notation of the following compounds:

(a) Stronsium(II) chloride
(b) Iron(III)oxide
(c) Barium(II)sulphate
(d) Tin(IV)Carbonate

Q4. Balance the following equations by ion electron and oxidation number method:

i) $MnO_4^- + I^- \longrightarrow MnO_2 + I_2$ (basic)
ii) $Cr_2O_7^{2-} + SO_2 \longrightarrow Cr^{3+} + SO_4^{2-}$ (acidic)
iii) $H_2O_2 + Fe^{2+} \longrightarrow Fe^{3+} + H_2O$ (acidic)

s-Block Elements

The s-block elements of the Periodic Table are those in which the last electron enters the outermost s-orbital. Elements of group 1 & 2 of the Periodic table belong to s-block.

Group-1 Elements

Li, Na, K, Rb, Cs, Fr

Commonly called alkali metals. They are so called because they form hydroxides on reaction with water which are strongly alkaline in nature.

1. General Electronic Configuration: The general electronic config. is [noble gas]ns^1. All alkali metals have one valance electron outside noble gas core. The loosely held s-electron in the outermost shell makes them more electropositive metals. The readily loose an electron to form M^+ ion.

Lithium	Li	[He] $2s^1$
Sodium	Na	[Ne] $2s^1$
Potassium	K	[Ar] $2s^1$
Rubidium	Rb	[Kr] $2s^1$
Caesuium	Cs	[Xe] $2s^1$
Francium	Fr	[Rn] $2s^1$

2. Atomic and ionic Radii
   a) They have the largest sizes in a particular period.
   b) The atomic and ionic radii increase on moving down the group, i.e. from Li to Cs because of increase in no. of shells on moving down the group.
   c) The monovalent ions (M^+) are smaller than the parent atom as on forming cations the nuclear charge per electron increases on forming a cation.
   For example: Na (At No 11) → 2,8,1 Number of e^- - 11
   Na^+ (At No 11) Number of e^- - 10
   So same nuclear charge is acting on less number of electrons hence nuclear charge per electron increases, so atomic radii decreases.

3. Ionization Enthalpy
   Energy required to remove the most loosely bound electron i.e. the outermost e^- from an isolated gaseous atom.
   a) I.E of alkali metals is considerably low due to large size of the atom in a particular period and by losing one e^-, they acquire nearest noble gas config.
   b) I.E decreases down the group from Li to Cs. This is because the effect of increasing size outweighs the increasing nuclear charge and the outermost electron is well screened from the nuclear charge.

c) The second ionization enthalpies of alkali metals are very high. This is because when an e^- is removed from alkali metals, they form monovalent cations which have stable noble gas config and to remove second e^-, it has to be removed from a stable noble gas config. Hence IE_2 is high.

4. Hydration Energy

The alkali metal ions are highly hydrated.

a) The hydrated enthalpies of alkali metal ions decrease with increase in ionic sizes.
$Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$
The extent of hydration decreases from Li^+ to Cs^+ because of increase in ionic radii from Li^+ to Cs^+.

b) Hydrated Li^+ ion being largest in size has lowest mobility in water. Hence, lithium salts are mostly hydrated, e.g. $LiCl.2H_2O$.

c) Hydrated Cs^+ ion being smallest in size has highest mobility in water.

d) So, due to greater hydration of Li^+, Li is most reducing amongst alkali metals

Physical Properties

1. Alkali metals are silvery white, soft and light metals.
2. The densities of alkali metals are low as compared to other metals. Li, Na and K are even lighter than water. This is because of their large size.
3. The densities increase down the group from Li to Cs due to increase in size. But atomic mass increase as well. But increase in atomic mass is more than compensates the increase in atomic size. Hence mass/volume increase from Li to Cs. Exception – K is lighter than Na probably due to its larger size.
4. All these metals have low m.p & b.p. Because they have only one valance e^- per atom. Hence energy binding the atoms in the crystal lattice of the metal is low. Thus metallic bonding is weak.
5. m.p & b.p decreases as moving down the group from Li to Cs.
6. All alkali metals are strongly electropositive in nature as they have one valence e^- and also have low I.E, so the valance e^- can easily be lost to acquire noble gas config.
7. Alkali metals and their salts impart characteristics colour to an oxidizing flame. This is because alkali metals have low ionization enthalpies. The energy from the flame of bunsen burner is sufficient to excite the electrons of alkali metals to higher energy levels. The excited state is unstable, so excited electrons come back to their original energy levels, they emit extra energy, which falls in the visible region in the electromagnetic spectrum and thus appear coloured.

   E.g Li (crimson red), Na (yellow), K (violet), Rb (red violet), Cs(blue)
   Thus alkali metals can be detected by their respective flame tests. The different colours are on the basis of the E absorbed for excitation of valance electrons.
8. Alkali metals exhibit photoelectric effect – The phenomenon of emission of electrons when electromagnetic radiation strikes them is called photoelectric effect. Because

they have low I.E. and are easily ejected when exposed to light. Cs which has the lowest I.E hs the maximum tendency to show photoelectric effect and hence useful as electrodes in photoelectric cells.

9. Lattice enthalpy of alkali metals is high. IT is defined as the energy required to break one mole of a crystal into its free ions.

$$MX\,(s) \xrightarrow{\text{Lattice Enthalpy}} M^{+}\,(g) + X^{-}\,(g)$$

High lattice enthalpy is because of strong electrostatic forces of attraction between cations & anions. Larger is the forces of attraction, greater will be the lattice enthalpy. Lattice enthalpy also depends on size of ions and charge. Larger the size, lesser is the lattice enthalpy.

Group II (Alkaline Earth Metals)

Be, Mg, Ca, Sr, Ba

They are called alkaline earth metals because their oxides and hydroxides are alkaline in nature and metal oxides are found in earth's crust.

1. Electronic Configuration – These elements have two electrons in their valance shell. The general electronic configuration is [noble gas] ns^2.

Beryllium	Be	$1s^2\ 2s^2$	[He] $2s^2$
Magnesium	Mg	$1s^2\ 2s^2\ 2p^6\ 3s^2$	[Ne] $3s^2$
Calcium	Ca	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$	[Ar] $4s^2$
Strontium	Sr	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 5s^2$	[Kr] $5s^2$
Barium	Ba	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^6\ 6s^2$	[Xe] $6s^2$
Radium	Ra		[Rn] $7s^2$

2. Atomic and ionic radii-
   a) Radii are smaller than the corresponding alkali metals in the same period. This is because alkaline earth metals have higher nuclear charge and electrons are attracted more towards the nucleus.
   b) On moving down the group, the radii increases due to gradual increase in no of shells and screening effect.
3. Ionization Enthalpies
   a) Alkaline earth metals have low ionization energies id due to large size of the atoms.
   b) Down the group I.E decreases due to increase in atomic radii down the group.
   c) I.E of group-2 members is higher than group 1 members because they have smaller size and electrons are more attracted towards the nucleus of the atoms.
   d) $I.E_1$ values of alkaline earth metals ar higher than those of alkali metals and $I.E_2$ values of alkaline earth metals are smaller than alkali metals

	I.E$_1$	I.E$_2$
Na	496 KJmol^{-1}	4562 KJmol^{-1}
Mg	737 KJmol^{-1}	1450 KJmol^{-1}

In case of alkali metals, (e.g, Na) the second electrons to be removed is removed from a cation which has already acquired noble gas config. On the other hand, in alkaline earth metals (i.e. Mg), second electron is removed from a monovalent cation (Mg^+) ($1s^2\ 2s^2\ 2p^6\ 3s^1$) which has one electron in the outermost shell. So second electron can be removed easily.

Na (g) $\xrightarrow{I.E1}$ Na^+ $\xrightarrow{I.E2}$ Na^{2+}

$1s^2\ 2s^2\ 2p^6\ 3s^1$ $\quad$ $1s^2\ 2s^2\ 2p^6$ $\quad$ $1s^2\ 2s^2\ 2p^5$

Mg (g) $\quad$ Mg^+ $\quad$ Mg^{2+}

$1s^2\ 2s^2\ 2p^6\ 3s^1$ $\quad$ $1s^2\ 2s^2\ 2p^6$ $\quad$ $1s^2\ 2s^2\ 2p^5$

4. Hydration Enthalpies
   Decreases with the increase in ionic sizes down the group $Be^{2+} > Mg^{2+} > Ca^{2+} > Sr^{2+} > Ba^{2+}$
   The hydration enthalpies of alkaline metal ions are larger than those of alkali metal ions. Thus, compounds of alkaline earth metals are more hydrated, e.g. $MgCl_2.6H_2O$ and $CaCl_2.6H_2O$. White NaCl and KCl do not form hydrates.

Physical Properties

1. Alkaline earth metals are generally silvery white, lustrous and relatively soft but harder than alkali metals. Be and Mg are grayish.
2. M.P and B.P are higher than corresponding alali metals. This is because of smaller size of alkaline earth metals. They are more closely packed. M.P and B.P do not show a regular trend.
3. They are strongly electropositive in nature because of their low ionization enthalpy.
4. Electropositive nature is less than alkali metals because of their higher I.E.
5. Electropositive character increases down the group from Be to Ba.
6. Except Be and Mg, the alkaline earth metals impart characteristics colours to flame.

Be	Mg	Ca	Sr	Ba	Ra
-	--	Brick Red	Crimson Red	Grassy Green	

- The alkaline earth metals give characteristics colours because of their low ionization enthalpy. The valance electrons are easily excited to higher energy level by the energy of the flame of Bunsen burner. When these excited electrons come back to ground state they emit radiations which fall in the visible regions. Therefore, they give colours to the flame.

Be and Mg being smaller in size has higher I.E. The energy of the flame is not sufficient to excite their e^- to higher energy levels. Therefore, they do not give any colour in Bunsen flame.

7. They have <u>high electrical and thermal conductivities</u> which are typical characteristics of metals.

ASSIGNMENT No. 9

s-BLOCK ELEMENTS

Q1. Arrange the following in order of the increasing covalent character.
MCl, MBr, MF, MI

Q2. Why is first ionization energy of alkali metals lower than those of alkaline earth metals?

Q3. Why are alkali metals not found in free state in nature?

Q4. Discuss the trends of :
(i) Ionization enthalpies of alkali metals as we move down the group from Li to Cs.
(ii) Metallic character of group 2 elements.

Q5. Why are lithium salts commonly hydrated and those of other alkali metal ions usually anhydrous?

Q6. Beryllium and magnesium do not give colour to flame whereas other alkaline earth metals do so .Why?

Q7. Why potassium and caesium, rather than lithium used in photoelectric cells?

Q8. Why are alkali metals strong reducing agent?

Q9. The correct order of reducing character of alkali metals is :
(a) Rb < K < Na < Li
(b) Li < Na < K < Rb
(c) Na < K < Rb < Li
(d) Rb < Na < K < Li

p-Block Element

The elements belonging to group 13 to 18 constitute p-block elements. Their valance shell electronic config. is $ns^2\ np^{1-6}$. In p-block, the last e^- enters into outermost p-orbital. The inner core electronic config. may differ. The difference in inner core elements greatly influence their physical as well as chemical properties. The maximum oxidation state shown is equal to total number of valance e^- (i.e. sum of s- and p- electrons)

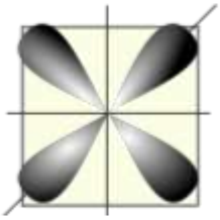
Gp 13 ns^2np^1	14 ns^2np^2	15 ns^2np^3	16 ns^2np^4	17 ns^2np^5	18 ns^2np^6
Gp O.S +3	+4	+5	+6	+7	+8
Other O.S +1	+2, -4	+3, -3	+4, +2, -2	+5, +3, +1, -1	+6, +4, +2

The number of possible O.S increases towards the right of periodic table. In addition to gp. O.S the p-block elements show more O.S. They can also show O.S less by two units from the group O.S. The O.S less by two units becomes more stable for heavier elements in each group. This is because of a property called inert pair effect- Inert pair effect is the reluctance of s-electrons to participate in chemical combination due to its high penetration effect. Hence, O.S decreases by two units.

- Non-metals and metalloids exist in p-block. The non-metallic character decreases down the group. The heaviest element is most metallic in nature.
- In general, non metals have higher ionization enthalpies and higher electronegativities than metals. In contrast to metals which readily form cations, non- metals form anions.
- First element of each group as compared to the subsequent members of the same group differ because of:
  a) Size and other properties (such as electronegativity, ionization enthalpy) which depend upon size.
  b) Absence of d-orbitals in their valance shell.

1. Due to small size, high electronegativity and high I.E the first member differ from the rest of the members.
2. The first member of each group has four orbitals (one 2s and three 2p orbitals) in the valance shell for bonding and hence it can accomodate8e^-. In the third pd. of p-block (gen. confg. $3s^23p^n$) has vacant 3d orbitals lying between 3p and 4s levels of energy. Using these d-orbitals, the elements of third (and higher) periods can expand their covalency beyond four. For example:
   a) Boron forms only Bf_4^- while Al gives AlF_6^{3-} ion.
   b) Carbon forms only tetrahalides while other members form hexahalides $[SiF_6]^{2-}$, $[GeCl_6]^{2-}$ etc.
   c) Nitrogen forms only NF_3 (have an octet of e^- in valance shell) while phosphorous forms both trihalides and pentahalides. E.g PF_5 and PCl_5.
   d) Fluorine does not form FCl_3 while chlorine forms ClF_3.
3. Due to presence of d-orbitals the elements of third and higher pd. are more reactive than elements of second which do not contain d-orbitals. For e.g., tetrahalides of carbon are not hydrolysed by water while tetrahalides of gp14 are readily hydrolysed.

4. The <u>first member shows greater tendency to form pπ- pπ multiple bonds to itself</u>, such as, C=C, C≡C, N≡N and to other second row elements C=0, C≡N, N=O etc. This type of π bonding is not strong in case of heavier p-block. The heavier elements also form π-bonds but these d-orbitals (i.e. dπ- pπ or pπ- dπ). Eg. In SO_2 one of the two π-bonds between S and O involves dπ- pπ bonding while in SO_3, two of three π-bonds involves dπ- pπ bonding. In this, half filled 3d-orbital of s overlaps with half filled 2p orbital of oxygen.



Half filled 3d-orbital

Half filled p-orbital

<u>Group-13 Elements (The Boron Family)</u>

B, Al, Ga, In, Tl

Boron is non-metal and Al is metal but shows many chemical similarities. Ga, In, Tl are almost metallic in character.

<u>Occurrence of Boron</u>: Occurs as orthoboric acid (H_3BO_3), borax $Na_2B_4O_7.10H_2O$ and Kernite $Na_2B_4O_7.4H_2O$

<u>Occurrence of Al</u>: Most abundant metal. Exists as bauxite $Al_2O_3.2H_2O$ and cryolite Na_3AlF_6. Boron, the first member of gp13 differs from other members of group13. Compounds of B has one e^- pair less and hence these electron deficient compounds act as lewis acids.

<u>Electronic Configuration</u>: Electronic Configuration of gp13 elements is ns^2np^1.

<u>Atomic Radii</u>: On moving down the group atomic radii increases as for each successive member one extra shell of electrons is added. <u>Exception</u> - Atomic radius of Ga is less than Al. This is because in the inner core of electronic configuration there are 10 additional d^- electrons which offer only poor screening effect for outer electrons from the increased nuclear charge in gallium. Hence atomic radius of Ga is less than Al.

<u>Ionization enthalpy</u>: Shows variation in trend as we move down the group. I.E decreases from B to Al due to increase in size. From Al to Ga and from In to Tl, the variation is due to inability of d^- and f^- electrons, which have low screening effect, to compensate the increase in nuclear charge. The order of I.E are $\Delta_iH_1 < \Delta_iH_2 < \Delta_iH_3$

<u>Electronegativity</u>: Down the group, electronegativity first decreases from B to Al and then increases. This is because of the variation in atomic size of the elements.

<u>Physical Properties (General)</u>

1. Boron is non- metallic in nature.
2. It is extremely hard solid next to diamond.
3. Its melting point is very high.
4. Other members are soft metals with low m.p and high electrical conductivity.
5. Gallium has very low m.p 303K and exits in liquid state in summer, but it's b.p is very high and hence can be used for measuring high temperature.
6. Density of the elements increases down the group from B to Tl.

Electropositive Character – Metallic Nature:

a) The elements in group 13 are less electropositive or metallic as compared to alkali metals or alkaline earth metals due to decrease in size along a pd, they have high I.E.
b) On moving down the group electropositive character first increases from B to Al and then decreases from Al to Tl. This is because as we move from B to Al, there is increase in atomic size and hence Al has high tendency to loose electrons. From Al to Tl electropositive character decreases because of increase in electrode potential.
c) Amongst the elements of gp 13, B has highest I.E and hence it has very less tendency to loose electrons and hence it is a non-metal and poor conduction of electricity.

M.P and B.P: Do not show a regular trend. m.p decreases on moving down the group from B to Ga and then increase from Ga to Tl. This is probably due to unusual crystal structures of B and Ga.

Density: Due to smaller atomic and ionic radii, the elements of group 13 have higher densities as compared to elements of group2. Because increase in atomic mass outweighs increase in atomic size.

Group-14 (Carbon Family)

C, Si → Non metals
Ge → Metelloid
Sn, Pb → Metals

The valence shell electronic configuration Is ns^2np^2. The inner core is electronic configuration of the elements in this group also differs.

1. Covalent Radius
   a) The covalent radii of gp14 are smaller than the corresponding elements of gp13. This is because when we move from gp13 to gp14 within the same period, the effective nuclear charge increases and hence covalent radii decreases due to stronger attractive influence of the nucleus on outer electrons.
   b) Covalent radii of gp14 regularly increase on moving down the group. This is because of addition of new shells in each succeeding element.
2. Ionization Enthalpy
   a) The first I.E of gp14 elements is higher than those of corresponding gp13 elements. This is because of greater nuclear charge and smaller size of atoms of gp14 elements.
   b) The first ionization enthalpies of gp14 elements follow the order: C > Si > Ge > Sn < Pb
      The decrease in I.E is due to increase in atomic size and screening effect of inner electrons which outweighs the effect of increased nuclear charge. Small increase in I.E from Sn to Pb is due to the effect of increased nuclear charge outweighs the shielding effect due to the presence of additional $4f^-$ and $5d^-$ electrons.
3. Electronegativity

a) The elements of gp14 are more electronegative than gp13 elements because of small size.
b) Electronegativity decreases from C to Si remains constant from Si to Sn and then increases for Pb.

4. Metallic Character
   a) They are less electropositive and hence less metallic than gp13 elements because of smaller size and high I.E.
   b) On moving down the group metallic character increases.
5. M.P and B.P
   M.P and B.P of gp14 elements are higher than gp13 elements as gp14 elements form 4 covalent bonds with each other and hence strong binding. M.P and B.P decrease down the group due to decrease in inter atomic forces of attraction.

ASSIGNMENT No. 10

SOME p-BLOCK ELEMENTS

Q1. What are electron deficient compounds? Why does boron trifluoride behave as lewis acid?

Q2. Discuss the pattern of variation in oxidation states :
(i) B to Tl (ii) C to Pb .

Q3. How can you explain higher stability of BCl_3 as compared to $TlCl_3$?

Q4. Why Lead (IV) chloride is highly unstable towards heat.

Q5. Describe the shapes of BF_3 and BH^-_4 . Assign the hybridization of boron in these species.

Q6. Discuss the trends of :
(i) Atomic radii of group 13 elements from B to Al.
(ii)First ionization enthalpy of group 14 elements.

Q7. Why NH_3 has higher boiling point than PH_3?

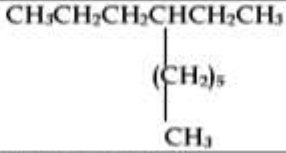
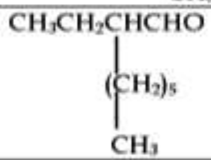
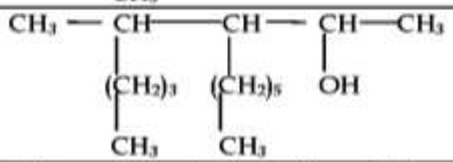
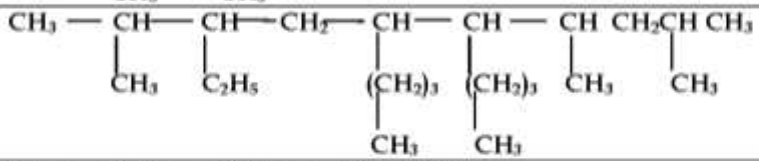
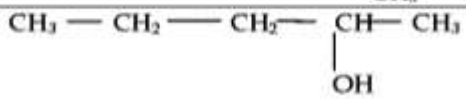
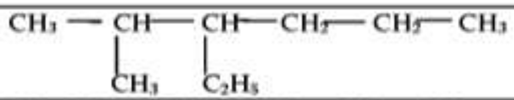
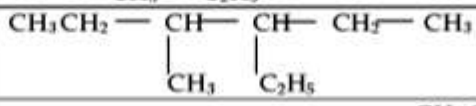
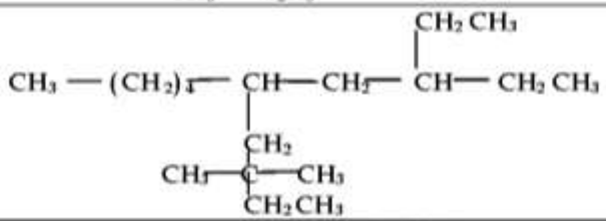
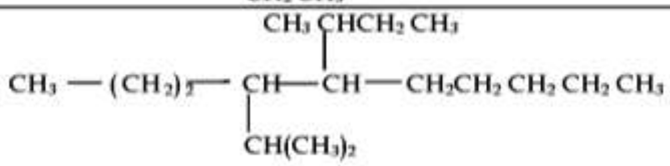
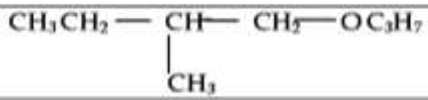
Q8. Phosphorus forms PCl_5 but nitrogen does not form NCl_5. Why?

Q9. Why carbon forms covalent compounds whereas lead forms ionic compounds?

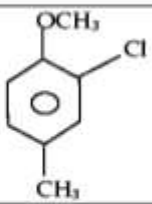
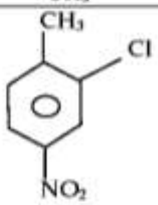
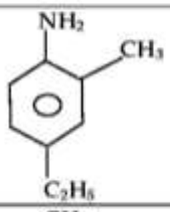
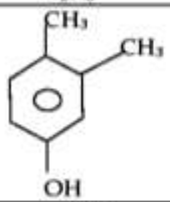
Q10. The amphoteric oxide is
(a) H_2O (b) CaO (c) Al_2O_3 (d) Cl_2

ASSIGNMENT NO. 11 (A)

WORK SHEET ON NOMENCLATURE OF ORGANIC COMPOUNDS

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10	$CH_3CH_2OCH_2CH_2CH_3$
11	$CH_3(CH_2)_4CH_2OCH_2CH_3$
12	

13.	$C_6H_5OCH_3$
14.	$C_6H_5OC_7H_{15}$
15.	$C_6H_5OC_6H_{13}$
16.	$CH_3CH=CHCH_2CHCHO$ $\quad\quad\quad\quad\quad\quad\quad\quad |$ $\quad\quad\quad\quad\quad\quad\quad\quad Br$
17.	$CH_3CH\ CH_2C\equiv C\text{-}CHO$ $\quad\quad |$ $\quad\quad CONH_2$
18.	$OHC\text{--}CH_2CH_2CHO$
19.	$OHC\text{--}CH_2CHCH_2CHO$ $\quad\quad\quad\quad\quad |$ $\quad\quad\quad\quad\quad CHO$
20.	$HOOC\text{--}CH_2CH_2COOH$
21.	$HOOC\text{--}CH_2CHCH_2COOH$ $\quad\quad\quad\quad\quad\quad |$ $\quad\quad\quad\quad\quad\quad COOH$
22.	$CH_2=CH-CH=CH_2$
23.	$CH\equiv C-CH_2CH_2-C\equiv CH$
24.	$CH\equiv C-CH=CH-CH=CH_2$
25.	$CH_3CH=CH-C\equiv CH$
26.	$CH_3CH-CHCH_3$ $\quad\quad | \quad\quad |$ $\quad\quad OH \quad OH$
27.	$CH_2 - CH-CH_2 - COOCH_3$ $|\quad\quad\quad |$ $CN \quad\quad OCH_3$
28.	$\quad\quad\quad\quad\quad CH_3$ $\quad\quad\quad\quad\quad |$ $CH_3 - O - C - CH_3$ $\quad\quad\quad\quad\quad |$ $\quad\quad\quad\quad\quad CH_3$
29.	$C_6H_5\ CH_2\text{--}CHCH_2CH_3$ $\quad\quad\quad\quad\quad |$ $\quad\quad\quad\quad\quad OH$
30.	$C_6H_5CH_2CHCHCH_2CH_3$ $\quad\quad\quad\quad\quad | \ |$ $\quad\quad\quad\quad\quad Br\ Br$
31.	$C_6H_5CH_3$, $C_6H_5OCH_3$, $C_6H_5NH_2$, $C_6H_5NO_2$, C_6H_5Br

32	
33	
34	
35	
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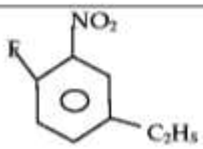
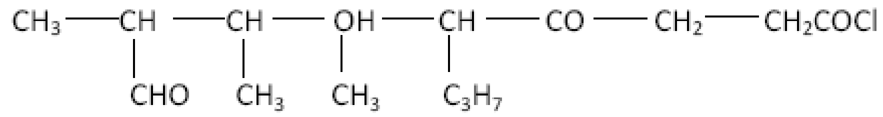
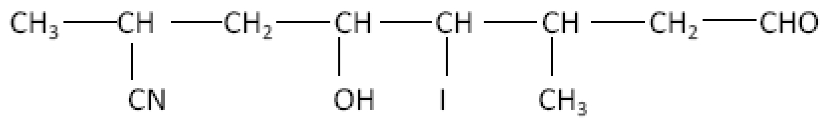
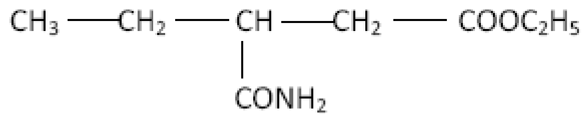
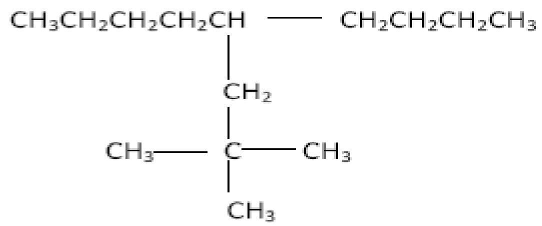
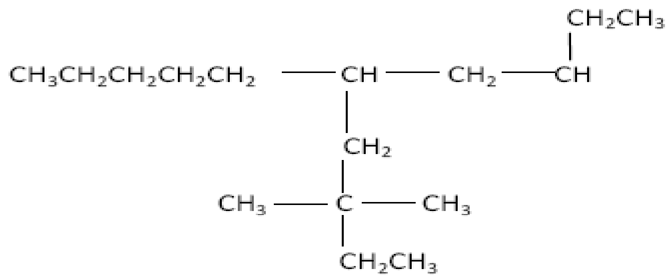
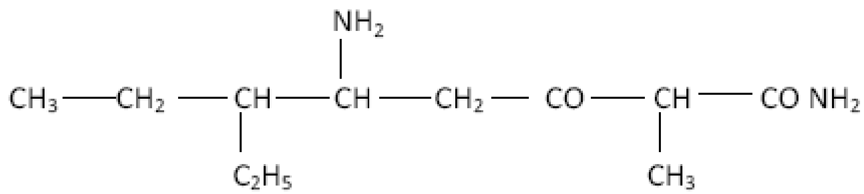
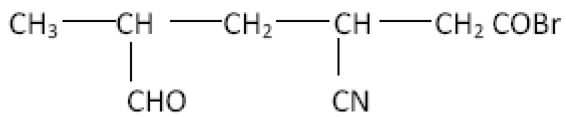
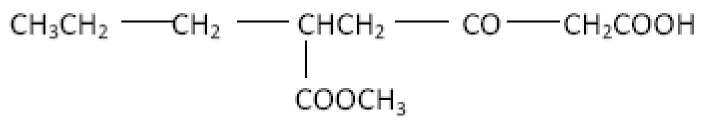
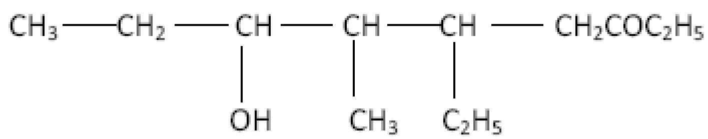
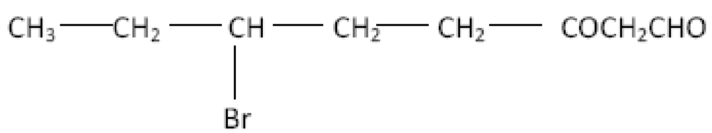
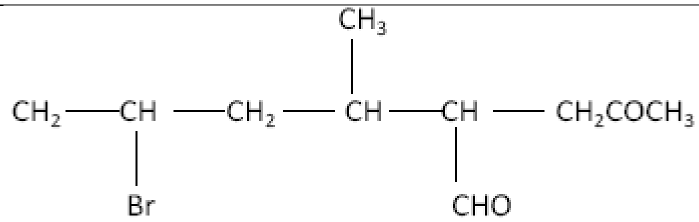
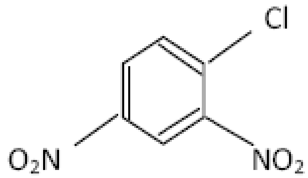
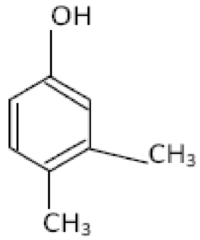
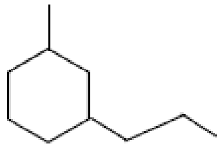
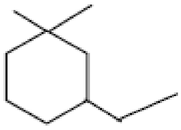
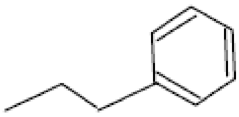
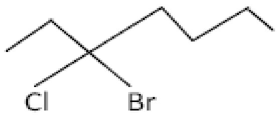
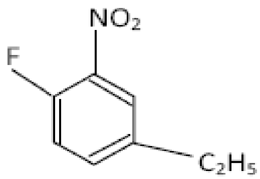
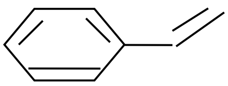
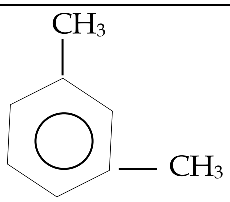
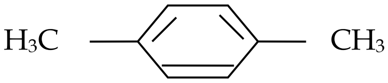
37	
38	$CH_3-CH_2-\underset{\large C_2H_5}{\underset{\mid}{CH}}-\overset{\large NH_2}{\overset{\mid}{CH}}-CH_2-CO-\underset{\large CH_3}{\underset{\mid}{CH}}-CO\,NH_2$
39	$CH_3-\underset{\large CHO}{\underset{\mid}{CH}}-CH_2-\underset{\large CN}{\underset{\mid}{CH}}-CH_2\,COBr$

MORE PRACTICE ON NOMENCLATURE

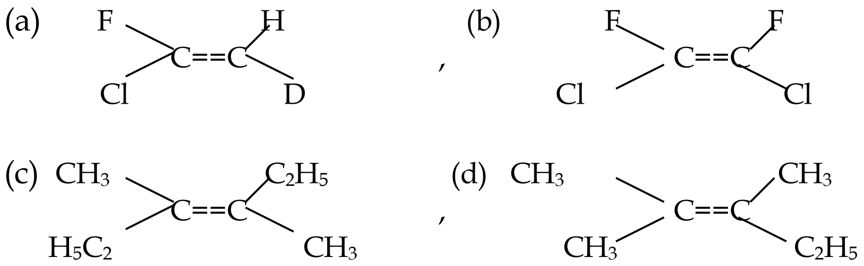
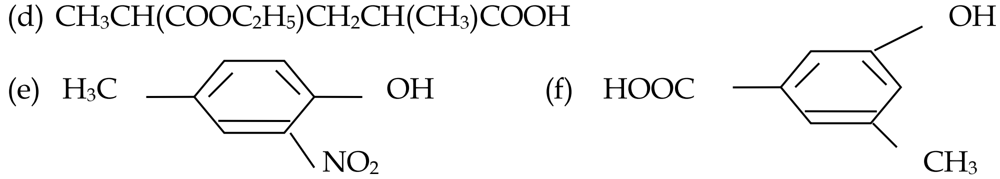
1	$CH_3-CH(CH_3)-CH(CH_3)-CH_2-CHO$
2	$CH_3-CH_2-CH(Br)-CH_2\,COCH_2CH_3$
3	$CH_3CH_2-CH_2-CH(CH_3)-CH(I)CH_2COOH$
4	$CH_3CH_2CH_2\,COOCH_3$
5	$CH_3-CH(NO_2)-CH_2CH(OH)-CH_3$
6	$CH_3CH_2-CH(C_3H_7)-CH_2-CH(Br)-CONH_2$
7	$CH_3CH_2-CH(OH)-CH(OH)-CH_2-CH_3$
8	$CH_3-CH_2-CH(NH_2)-CH_2-CH_2CH_3$
9	$CH_3-CH(I)-CH_2-CH(CH_3)-CH_2-COCH_3$
10	$CH_3-CH_2CH_2\,COOC_3H_7$
11	$CH_3-CH_2-CH(C_4H_9)-CH_2CH(Br)-CH_2COOH$
12	$C_2H_5-CH(C_2H_5)-CH(CH_3)-CH(CH_3)-CONH_2$
13	$CH_3-CH_2-CH(COOC_2H_5)-OH_2-CH(CH_3)-CH(Br)-CH_2COOH$

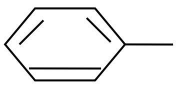
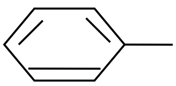
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	

24	
25	
26	
27	
28	
29	
30	
31	
32	

33	
34	

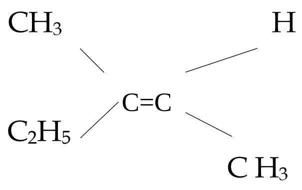
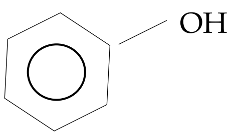
ASSIGNMENT No.: 11
Organic Chemistry: Some basic Principles and Techniques

Q1.	Which of the following has neither secondary nor tertiary hydrogen? (a) Isobutane (b) Isopentane (c) Pentane (d) Neopentane
Q2.	Which of the following will not show geometrical isomerism? 
Q3.	Write the IUPAC names of the following organic compounds: (a) $CH_3CH(CHO)CH_2CH(CH_3)CH(CH_3)COBr$ (b) $CH_3CH(NO_2)CH_2\,CH_2CH(Cl)COOCH_2CH_2\,CH_3$ (c) $CH_3CH_2CH(C_2H_5)CH_2COCH_2COCH_2CH_3$ (d) $CH_3CH(COOC_2H_5)CH_2CH(CH_3)COOH$ 
Q4.	Identify the following as electrophiles or nucleophiles: CH_3^+, OH^-, Cl^+, NH_3, BH_3, H_2O
Q5.	Expand each of the following condensed formulae into their complete structural formulae and indicate the hybridization state of each carbon atom: (a) $(CH_3)_3CCH_2CH_2COCH_2NO_2$ (b) $CH\equiv CCH_2(CH_2)_2COOH$ (c) $CH_3CH=C(NH_2)CONH_2$
Q6.	Write bond line formulae for the following: (a) Sec-butyl alcohol (b) Neo-pentylbromide (c) Isoprpyl chloride (d) 2,3-Dimethyl butanal
Q7.	Arrange the following carbocations in increasing order of stability: $(CH_3)_2CH^+$, $(CH_3)_3C^+$, CH_3^+, $CH_3CH_2^+$. Explain the reason also.
Q8.	Explain the relationship between the members of following pairs of structures? Are they structural or geometrical isomers or resonance contributors? (i) $CH_3CH_2COCH_2CH_3$, $CH_3COCH_2CH_2CH_3$ (ii) 

	(iii) $CH_3CH_2CH=CH_2$, $CH_3CH_2C=O$ $\quad\quad\quad\quad |$ $\quad\quad\quad\quad\quad\quad |$ $\quad\quad\quad OH$ $\quad\quad\quad\quad\quad CH_3$ (iii) $CH_3CH_2CH_2CH_2CH_3$, $CH_3CH(CH_3)CH_2CH_3$
Q9.	For the following bond cleavages, use curved-arrows to show the electron flow and classify each as homolysis or hetrolysis, Identify reactive intermediate produced as free-radical, carbocation and carbonion: (a) $C_2H_5O\text{-}OCH_3 \rightarrow C_2H_5O\cdot + \cdot OCH_3$ (b) $(CH_3)_3C\text{-}Br \rightarrow (CH_3)_3C^+ + Br^-$ (c) $CH_3CH_2\text{-}Cu \rightarrow C_2H_5^- + Cu^+$
Q10.	Explain the terms Inductive and Electromeric effects. Which electron displacement effect explains the following correct order of acidity of the carboxylic acids? (a) $Cl_3CCOOH > Cl_2CHCOOH > ClCH_2COOH$ (b) $CH_3CH_2COOH > (CH_3)_2CHCOOH > (CH_3)_3CCOOH$
Q11.	Draw resonating structures of the following: (a) $CH_2=CHCHO$ (b) CH_3COO^- (c)  NH_2 (d)  COOH
Q12.	Write the structures of : (a) 4-nitroaniline (b) 2-Ethylanisole 3-Bromo-5-ethylbenzaldehyde (d) Cyclohex-2-en-1-ol (e) Hept-4-en-3-ol
Q 13.	Draw geometrical isomers of But-2-ene.Which of these have high boiling point and why?

ASSIGNMENT No.: 12

HYDROCARBONS

1.	Which of the following has least boiling point? (a) n-Hexane (b) n-Pentane (c) 2-Methyl butane (d) 2,2-Dimethyl propane
2.	An aqueous solution of compound A gives ethane on electrolysis. The compound A is (a) Ethyl acetate (b) sodium acetate (c) sodium propanoate (d) sodium ethoxide
3.	Draw Sawhorse projection and eclipsed conformation of ethane? Which of the two is more stable?
4.	Give the mechanism of addition of HBr to propylene in the presence of peroxide.
5.	Branched chain alkanes have lesser boiling points than straight chain alkanes. Explain.
6.	Complete the following reaction: (i) $HC{\equiv}CH + NaNH_2 \longrightarrow$ (ii) $HC{\equiv}CH + H_2O \xrightarrow[\text{dil. } H_2SO_4]{Hg2+}$ (iii) $HC{\equiv}CH \xrightarrow{?} HC{\equiv}C-CH_3$ (iv) ? + 2Zn $\xrightarrow{heat}$ $HC{\equiv}CH + 2ZnBr_2$ (v) $nCH_2 = CHCl \xrightarrow[\text{Polymerization}]{\text{Benzoyl Peroxide}}$ (vi)  $\xrightarrow[\text{(ii) } Zn/H_2O]{\text{(i) } O_3}$ (vii) $RCH_2CH_2X \xrightarrow{?} RCH = CH_2 + HX$ (viii) $3\ CH \equiv CH \xrightarrow[\text{Fe tube}]{\text{Red hot}}$ (ix)  + Zn $\xrightarrow{?}$

	(x) CH_3--C ≡ C--- CH_3 $\xrightarrow{?}$ $CH_3-CH = CH-CH_3$
7	How does benzene react with: (i) ethyl chloride in the presence of $AlCl_3$ (ii) nitric acid in the presence of sulphuric acid. (iii) Halogen in the presence of lewis acid.
8	Explain the following reaction with example: (i) Wurtz reaction (ii) Friedel craft's Acylation. (iii) Kolbe's electrolysis
9.	Carry out the following conversions: (i) Propene to 2- bromopropane (ii) Propene to 1-bromopropane (iii) Ethyl alcohol to ethane (iv) Isopropyl alcohol to n- propyl alcohol (v) Isopropyl bromide to n-propyl bromide (vi) n-Propyl bromide to isopropyl bromide (vii) Isopropyl alcohol to n-propyl bromide (viii) n-propyl alcohol to isopropyl alcohol (ix) propane to Propene (x) propene to propyne (xi) 2-Butene to Butane (xii) 1-chloropropane to propan-1-ol (xiii) Propanoic acid to butane (xiv) Isopropyl bromide to 2,3 dimethyl butane (xv) Propanoic acid to ethane (xvi) Benzene to Toluene (xvii) Ethyne to Acetophenone (xviii) 2-Butyne to trans 2- butene (xix) 2-butyne to cis 2- butene
10.	What happens when : (i) Ethylene dibromide is heated with zinc dust. (ii) Isopropyl bromide is heated with ethanolic solution of potassium hydroxide.

ASSIGNMENT No. 13

ENVIORNMENTAL CHEMISTRY

Q1. What do you understand by ozone hole? Why does it occur mainly over Antarctica?

Q2. (a)What do you understand by Green house effect? What are the major green house gases?
(b)What would have happened if the greenhouse gases were totally missing in earth's atmosphere?

Q3. What is the cause of acid rain? How is it harmful to the environment?

Q4. Name the factors which cause soil pollution.

Q5. How does detergent cause water pollution?

Q6. What is green chemistry? Give two importance of green chemistry in day to day life.

Q7. Besides CO_2, other greenhouse gas is
(a) CH_4 (b) N_2 (c) Ar (d) O_2

Q8. The region closest to earth's atmosphere is
(a) stratosphere (b) mesosphere (c) troposphere (d) ionosphere

REVISION PAPER-1 (For First Term)

Time :3 hrs *Max. Marks – 70*

No. of printed pages: 3

General Instructions:

(i) All questions are compulsory.
(ii) Questions nos. 1 to 5 are very short answer questions and carry 1 mark each.
(iii) Questions nos. 6 to 10 are short answer questions and carry 2 marks each.
(iv) Questions nos. 11 to 22 are also short answer questions and carry 3 marks each.
(v) Question nos. 23 is a value based question and carry 4 marks.
(vi) Question nos. 24 to 26 are long answer questions and carry 5 marks each.
(vii) Use log tables if necessary, use of calculators is not permitted.

1 Why does the boiling point of liquid rise on increasing external pressure? 1

2 Why the orbital '2d' not possible. 1

3 Write electronic configuration of Copper. (Z =29) 1

4 Give name and symbol of the element with atomic no.114 1

5 State a law that correlates the mass and volume of gas. 1

6 How many molecules of CO_2 are present in one litre of air containing 0.03% volume of CO_2 at N.T.P.? 2

7 The molecular mass of cyclohexane is 84 and its percentage composition is 85.7% C and 14.3% H. Determine the molecular formula of cyclohexane. (at. Mass: C= 12u, H = 1u). 2

8 If volume, mass and temperature of two gases H_2 and O_2 kept in separate vessels are the same , in which vessel the pressure will be greater and how many times? 2

9 Calculate the weight of carbon monoxide having the same number of oxygen atoms as are present in 22 g of carbon dioxide. (At. Mass O= 16 u) 2

10 a) State Hund's Rule of maximum multiplicity. 2

b) An electron orbiting in n^{th} energy level is associated with -5.45×10^{-19} J $atom^{-1}$. What will be the energy required to remove this electron completely.

11	a) What is an ideal gas? b) At 0°C, the density of a gaseous oxide at 2 bar is the same as that of nitrogen gas at 5 bar. What is the molecular mass of the oxide? (At. Mass N= 14 u)	3
12	a) What is partial pressure? b) A mixture of hydrogen and oxygen at one bar pressure contains 20 % by weight of hydrogen. Calculate the partial pressure of hydrogen.	3
13	a) Why the boiling point of water is more than that of ethyl alcohol b) What is the significance of the following: i) Value of vanderwaals constant 'a ' for a gas is zero ii) Compressibility factor (Z) for a gas is less than one.	3
14	Answer the following: a) How many electrons can be filled in all the orbitals with $n + l = 5$ b) How many unpaired electrons are present in Pd (Z = 46)? c) The ion of an element has configuration $[Ar]3d^4$ in +3 oxidation state. What will be the electronic configuration of its atom.	3
15	a) What was the reason for failure of Rutherford model of an atom. b) What were the two developments that led to the advent of Bohr model of an atom.	3
16	a) What is the significance of ψ^2? b) Which orbital does not have any directional properties. c) Distinguish between orbit and orbital.	3
17	a) State Heisenberg Uncertainity Principle. b) Dual behavior of matter proposed by de Broglie led to the discovery of electron microscope. If the velocity of the electron in this microscope is $1.6 \times 10^6\ ms^{-1}$. Calculate de Broglie wavelength associated with the electron.	3
18	What is Green Chemistry? Give two examples where it is made use of .	3
19	a) What is the energy in joules required to shift the electron of the hydrogen atom from the first Bohr orbit to the fifth Bohr orbit . b) Also calculate the radius of the fifth Bohr orbit of hydrogen atom.	3
20	Give reasons: a) Na^+ (Z=11) and Ne (Z=10) do not have same ionization enthalpy, though both are isoelectronic, b) Boron (Z = 5) has lower ionization energy than Beryllium (Z=4). c) Alkali metals do not form dipositive ions.	3

21 1.0 g of Mg is burnt in a closed vessel which contains 0.5 g of O_2. Which is the limiting reactant? What is the amount of MgO formed in the reaction? (At. Mass of Mg = 24 u) 3

22 What is Global warming? Mention its two illeffects. 3

23 Shyam had bought a new car. He was particular and cautious about the safety and maintainence of his car. It was a hot summer day, when he had to go for a long drive , he had to get the tyres filled with the desired level of air pressure. His son advised him to get the tyre inflated to lesser pressure than desired. 4

a) Why do you think Shyam's son advised him to inflate to a lesser pressure?
b) Name and state the law.
c) What are the values portrayed by Shyam's son.

24 a) How much water should be added to 100 ml of 3M H_2SO_4 solution to bring down its molarity to decimolar. 5

b) The density of 2 molal aqueous solution of NaOH is 1.10 gmL^{-1}. Calculate the molarity of the solution. (At. Mass of Na = 23 u, O = 16 u, H = 1 u).

25 a) Draw emission spectrum of Hydrogen atom showing all possible lines/ series and also label the region in which they fall. 5

b) What kind of spectra is this and what does it predict about an atom.
c) Write the Rydberg's formula for wave number with proper units.

26 Arrange the following as directed: 5

a) i) C,N, B, F (increasing non metallic character)
ii) N^{3-}, Na^+, F^-, O^{2-}, Mg^{2+} (increasing ionic sizes)

b) From the elements : Cl, Br, F, O, Al, C, Li, Cs and Xe; Choose the following:

i) the element with lowest ionization enthalpy
ii) the element with smallest atomic radius
iii) the element with six electrons in the valence shell.
iv) the element which is liquid at room temperature.
v) the element which belongs to zero group
vi) the element which forms largest number of compounds.

REVISION PAPER-2 (For First Term)

1 What is the maximum no. of electrons f subshell can hold. What are the no. of unpaired electrons if there resides 5 electron in f subshell. 1

2 Draw an isobar showing the variation of volume with temperature for an ideal gas. 1

3 State a law that correlates the moles and volume of gas. 1

4 Give the IUPAC name and symbol of element with atomic no. 118 1

5 Write the electronic configuration of Chromium with three unit positive charge.(Z =24) 1

6 Calculate the moles of NaOH required to neutralize the solution produced by dissolving 0.005 moles of P_4O_6 in water. Use the following equation : 2

$P_4O_6 + 6H_2O \quad 4H_3PO_3$

$2NaOH + H_3PO_3 \quad Na_2HPO_3 + 2H_2O$

7 2

a) How many moles are present in 52 g of He.

b) A solution is prepared by adding 4 g of a substance to 16 g of water. Calculate the mass per cent of the solute.

8 Calculate the volume occupied by 8.8 g of CO_2 at 31.1^oC and 1 bar pressure. 2

9 Calculate the weight of carbon and hydrogen present in welding gas which on burning in oxygen, gives 3.38 g of CO_2 and 0.69 g of H_20 and no other products. 2

10 Give reasons: 2

a) Aluminium (Z = 13) has lower first ionization energy than Magnesium (Z=12).

b) Chlorine (Z=17) has higher negative electron gain enthalpy than Fluorine (Z =9).

11 a) Define Bond Angle. 3

b) Draw the lewis structure of an ionic compound sodium sulphide.

c) What kind of intermolecular forces shall exist when sodium sulphide is put in water

12 3

a) What is partial pressure?

b) A mixture of hydrogen and oxygen at one bar pressure contains 20 % by weight of hydrogen. Calculate the partial pressure of hydrogen.

13 a) Why is it advised to fill less air in the car tyres during summer. 3

b) Why the weather balloon expands as it soars high in the sky.

c) Why a person at higher altitude has the problem of breathlessness.

14	a) How much water should be added to 100 ml of 3M H_2SO_4 solution to bring down its molarity to decimolar. (0.1 M) b) If ten volumes of dihydrogen gas reacts with five volumes of oxygen , then how many volumes of water vapour would be produced?	3
15	a) Write the Einstein Equation to explain the Photoelectric effect. b) Write the equation developed by Planck to explain the phenomenon of Black body radiation. What was the name given to the smallest quantity of energy that can be emitted or absorbed in the form of electromagntic radiation. c) What were the two developments that led to the advent of Quantum mechanical model of an atom.	3
16	a) What is the significance of probability density, ψ_2? b) Draw all the orientations of p subshell and label. c) Distinguish between orbit and orbital.	3
17	a) State Heisenberg Uncertainity Principle. b) Assuming that ' g' subshell exsists, from what principal quatum no. will it start. c) Identify the subshells represented by the following. i) n= 3, l= 1 and ii) n= 1, l =0	3
18	What is ozone layer? Give two factors responsible for its depletion.	3
19	a) Give one limitation of octet rule with an example. b) Draw the shape of ClF_3 based on VSEPR theory. c) Arrange the following in the increasing order of covalent character. NaCl, NaBr, NaI.	3
20	Give reasons: a) Be and Mg do not show show colour in flame. b) In aqueous solution Lithium ion has lesser mobility than Caesium ion. c) Alkali metals do not form dipositive ions.	3
21	Calculate the weight of FeO formed from 2 g of VO and 5 g of Fe2O3. Also, report the limiting reagent. $2VO + 3Fe_2O_3\ 6FeO + V_2O_5$	3
22	A golf ball has a mass of 40 g, and a speed of 45 m/s . If the speed can be measured within accuracy of 2%. Calculate the uncertainity in the position. What inference can be drawn from the value of uncertainity of the position.	3
23	Rahul sharma, an intelligent student of class 12 follows the lesson taught in class easily, has friendship with Amit and Krishan who do not follow the lessons easily. Rahul helps Amit and Krishan to understand the concepts and , in turn, they are thankful to him. Their friendship is long lasting because both are happy. Rahul feels sense of achievement. a) Should intelligent students make friends with weak students? Give reason. b) If you compare this kind of friendship to atoms what kind of bond will be formed. c) Comment on the stength of such bonding. Name the force that keeps them bonded.	4

d) Discuss any one property in which these atoms are different from each other.

24 a) Draw the lewis dot structure of water 5
b) What shall be the geometry , shape, bond angle of this molecule. Will this molecule show dipole moment.
c) Draw the resonating structures and resonance hybrid of

25 a) An electron orbiting in n_{th} energy level is associated with -5.45×10^{-19} J $atom^{-1}$. What will be the energy required to remove this electron completely. 5
b) What is the energy in joules required to shift the electron of the hydrogen atom from the second Bohr orbit to the fifth Bohr orbit .
c) Calculate the radius of the first orbit of He^+ ?

26 Arrange the following as directed: 5
a) i) C,N, B, F (increasing non metallic character)
ii) N^{3-}, Na^+, F^-, O^{2-}, Mg^{2+} (increasing ionic sizes)
b)The first (IE_1) and second (IE_2) ionization enthalpies (KJ/mol) of three elements A, B, C are given below:

Element	IE 1 (kJ/ mol)	IE 2 (kJ/mol)
A	403	2640
B	549	1060
C	1142	2080

Identify the element which is likely to be (i) non-metal (ii) an alkali metal (iii) an alkaline earth metal. Give reason in support of your prediction.

REVISION PAPER-3 (For Second Term)

Q1. Write the IUPAC name and the symbol of an element with atomic number 120. (1)

Q2. An element belongs to third period of p-block. It has four valance electrons. Predict its group number. How many unpaired electrons does it have? (1)

Q3. Mg^{2+} ion is more hydrated than Na^{+} ion. Explain. (1)

Q4. How can you explain higher stability of TlCl as compared to $TlCl_3$? (1)

Q5. Write the conjugate acid of H_2O and conjugate base of HCO^{-}_{3}. (1)

Q6. (2)
a. Why Mg does not give any colour to the bunsen flame while Ca does?
b. Why do alkali metals form uni positive ions and are strong reducing agents?

Q7. (2)
a. Identify the oxidant and reductant in the following redox reaction:
$2K_2MnO_4 + Cl_2 \rightarrow 2KCl + 2KMnO_4$
b. Arrange the following in order of increasing oxidation state of iodine:
I_2, HI, KIO_3, ICl

Q8. Describe the hybridization in case of PCl_5. Why are the axial bonds longer as compared to equatorial bonds? (2)

Q9. (2)
a. Draw the Newman projection of staggered conformation of ethane.
b. Arrange the following in increasing order of boiling point:
n-Pentane, iso pentane, neo pentane

OR

a. Write a short note on Wurtz reaction.
b. What is Lindlar's catalyst? Which geometrical isomer of alkene is obtained by treating an alkyne with it?

Q10. Explain the following: (2)
a. Gallium has higher ionization enthalpy than aluminum.
b. Aluminum forms $[AlF_6]^{3-}$ ion but boron does not form $[BF_6]^{3-}$ ion.

Q11. The reaction $2C + O_2 \rightarrow 2CO$ is carried out by taking 24g of C and 96g of O_2. Find out: (3)
(i) Which reactant is left in excess?
(ii) How much of it is left?
(iii) How many grams of the other reactant should be taken so that nothing is left at the end of the reaction?
(Given: Atomic mass of C=12u, O=16u)

Q12. 29.5% (w/w) HCl solution has a density of $1.25 gmL^{-1}$. The molecular mass of HCl is $36.5 gmol^{-1}$. Calculate the molarity of this solution. Also calculate the volume (mL) of the above solution required to prepare 200mL solution of 0.4M HCl. (3)

Q13. (3)
(i) Predict the change in internal energy for an isolated system at constant volume.
(ii) For the evaporation process, $H_2O\ (l) \rightleftharpoons H_2O\ (g)$, ΔH=44 KJ and ΔS=118.8 JK^{-1}.

Calculate the temperature at which water vapour and water are in equilibrium.

Q14. In a photoelectric effect experiment, irradiation of a metal with light of frequency $5.2x10^{-14}s^{-1}$ yields electrons with maximum kinetic energy $1.3x10^{-19}$J. Calculate the threshold frequency for the metal. (h= 6.6×10^{-34} Js) (3)

Q15. a. An ion with mass number 37 possesses one unit of negative charge. If the ion contains 11.1% more neutrons than the electrons, find the symbol of the ion. (3)
b. Write the electronic configuration of Cr. (Atomic number=24)

OR

a. What is electromagnetic spectrum?
b. Calculate the energy released for the shortest wavelength transition in the Balmer series of atomic hydrogen.

Q16. a. The first ionization enthalpy (Δ_iH) values for the third period elements Na, Mg and Si are respectively 496, 737 and 786 $KJmol^{-1}$. Predict whether the first Δ_iH value for Al will be more close to 575 or 760 $KJmol^{-1}$. Justify your answer. (3)
b. How does electronegativity vary down the group? Give reason for your answer.

OR

Arrange the following in increasing order of property indicated.
(i) F, Cl, Br and I (negative electron gain enthalpy)
(ii) Mg^{2+}, O^{2-}, Na^+, F^- and N^{3-} (ionic size)
(iii) Br^+, Br and Br^- (size)

Q17. a. The enthalpy of atomization for the reaction (3)
CH_4 (g) $\rightarrow$ C (g) + 4H (g) is 1665 $KJmol^{-1}$. What is the bond energy of C-H bond?
b. What will be enthalpy change for the following reaction?
H_2 (g) + Br_2 (g) $\rightarrow$ 2HBr (g)
Given that Bond energy of H_2, Br_2 and HBr are 435 $KJmol^{-1}$, 192 $KJmol^{-1}$ and 368 $KJmol^{-1}$ respectively.

Q18. a. Name the type of isomerism between the following pair of organic compound: (3)
$CH_2CH_2CH_2CH_2COCH_3$ and $CH_3CH_2COCH_2CH_2CH_3$
b. Why tertiary butyl carbocation is more stable than isopropyl carbocation?

Q19. a. Write the mechanism of addition of HBr to ethene. (3)
b. Give a distinguishing test between Ethyne and Ethene.

Q20. Balance the following redox reactions by half reaction method. (3)
(i) $MnO_4^- + SO_3^{2-} \rightarrow Mn^{2+} + SO_4^{2-}$ (in acidic medium)
(ii) N_2H_4 (l) $+ClO_3^-$ (aq)$\rightarrow$ NO(g) + Cl^- (in basic medium)

Q21. a. Draw the resonating structures and resonance hybrid of C_6H_5COOH. (3)

b. Which is expected to be more stable:

$O_2NCH_2CH_2O^-$ or $CH_3CH_2O^-$ and why?

OR

a. Draw resonating structures and resonance hybrid of C_6H_5OH.

b. Arrange the following in increasing order of acid strength:

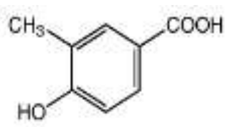
CH_3CH_2COOH, $(CH_3)_3COOH$, $(CH_3)_2CHCOOH$. Give reason.

Q22. Write the IUPAC names of the following organic compounds: (3)

a. $CH_3{-}\underset{\underset{C_2H_5}{|}}{C}{=}CH{-}COCH_2\underset{\underset{Br}{|}}{CH}{-}CHO$

b. $CH_3{-}\underset{\underset{CH_3}{|}}{CH}{-}\overset{\overset{NO_2}{|}}{CH}{-}CH_2{-}\underset{\underset{Cl}{|}}{CH}{-}\overset{\overset{CHO}{|}}{CH}{-}CH_2COBr$

c.



Q23. Charles law states that if the pressure of a gas is kept constant, the volume of the gas is directly proportional to temperature and Gay Lussac's law directly relates pressure and temperature keeping volume constant. This implies that in an ideal situation where the pressure does not change and the volume or the temperature is increased, the other one will increase in the same proportion, else if the volume is kept constant and the pressure or the temperature is increased, the other one will increase in the same proportion. These aspects have a number of applications in our daily life. (4)

a. (i) Rahul suggested his father to fill less air in the car tyre during summer season. Why?

(ii) What values are associated with Rahul's suggestion?

b. Inflated football gets deflated in winters. Why?

c. Why hot air is filled in balloons for meteorological observations?

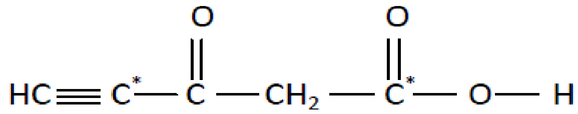
Q24. a. What is the effect of catalyst on the equilibrium reaction? (5)

b. How does dil HCl help in preventing the precipitation of Zn^{2+} ions in group II cation analysis?

c. The pH of 0.005M codeine solution is 9.95. Calculate the dissociation constant.

$Cod + H_2O \rightleftharpoons CodH^+ + OH^-$

Q25. a. Predict the hybridization of carbon indicated with (*) (5)



b. Although geometries of NH_3 and H_2O molecules are distorted tetrahedral, bond angle in water is less than that in ammonia. Discuss.

c. Explain why BeH_2 molecule has zero dipole moment although the Be-H bond is polar.

d. Why is LiI more covalent than NaI?

e. Write the molecular orbital configuration of O_2^+ and O_2^{2-}. Compare their relative stabilities.

Q26. a. How will you convert benzene into acetophenone? (5)

b. Why –OH group attached to benzene ring in ortho and para directing while –NO_2 group is meta directing?

c. An alkene on ozonolysis gives acetone and ethanal. Write the structure of alkene.

d. Complete the following reactions:

(i) $CH_3CH_2COONa \xrightarrow{\text{Electricity}}$ (ii) $CH_3C\equiv CH \xrightarrow[\text{Heat}]{HgSO_4\ /\ H_2O}$

OR

a. Carry out the following conversions:

(a) Hexane to toluene

(b) Propane to propene

b. Why cis-2-butene has higher boiling point than trans-2-butene?

c. Identify A ,B and C in the following reaction:

$$CH_3CH_2CH_2OH \xrightarrow{\text{Conc. } H_2SO_4/\text{ Heat}} A \xrightarrow{KMnO_4/H+} B + C$$

REVISION PAPER 4 (For SECOND TERM)

Q1. Mention one drawback of Bohr's model. (1)

Q2. Which one is more covalent and why? $BeCl_2$ or $MgCl_2$. (1)

Q3. Write a short note on Friedel- Craft's reaction. (1)

Q4. Draw the resonating structures of $C_6H_5NH_2$. (1)

(1)

Q5. $2N_2O(g) + O_2(g) \rightleftharpoons 4NO(g)$; $\Delta H>0$. What will be the effect on equilibrium when

(i) Volume of the vessel increases?

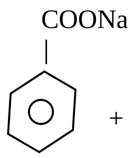
(ii) Temperature decreases?

Q6. Write the electronic configuration of Fe^{+2}ion and find the number of unpaired electrons in it. (Atomic number=26) (2)

Q7. (i) Write the IUPAC name and the symbol of an element with atomic number 120. (2)

(ii) Arrange the ions in decreasing order of ionic radii: Li^{+2}, He^{+}, Be^{+3}.

Q8. Complete the following reactions: (2)

(i)  + NaOH $\xrightarrow{CaO,\ \Delta}$

(ii) $RC \equiv CR' + H_2 \xrightarrow{\text{Lindlar's catalyst}}$

OR

Give reasons:

(i) Neo-pentane has lower boiling point as compared to n- pentane

(ii) Ethyne is acidic in nature as compared to ethene and ethane.

Q9. (i) What type of intermolecular force exists between He atoms and HCl molecules? (2)

(ii) What is Boyle temperature?

Q10. In a hospital, an oxygen cylinder holds 10*l* of oxygen at 200atm pressure. If a patient breathes in 0.5ml of oxygen at 1.0 atm pressure with each breathe, for how many breaths the cylinder will be sufficient. Assume all the data is at a constant temperature of 37^0C. (2)

Q11. If elemental composition of Butyric acid is found to be 54.2% C, 9.2% H and 36.6% O. (At. Mass of C=12, O=16, H=1u) (3)

(i) Determine the empirical formula.

(ii) If the molecular mass of Butyric acid was determined experimentally to be 88u. What is the molecular formula?

Q12. (i) In a photoelectric effect experiment, irradiation of a metal with light of frequency 5.2×10^{14} s $^{-1}$ yields electrons with kinetic energy 1.3×10^{-19}J of (3) emission. Calculate the threshold energy for the metal. (h= 6.6 x 10^{-34}Js).

(ii) Calculate the energy associated with first orbit of Li^{+2} ion.

Q13. (iii) The enthalpy change for the reaction (3)
CCl_4 (g) → C (g) + 4Cl (g) is 1304 $KJmol^{-1}$. What is the bond energy of C- Cl bond.

(iv) The standard free energy of a reaction is found to be zero. What is its equilibrium constant?

(v) A system absorbs 500 J of heat and does work of 50 J on its surroundings. Calculate the change in internal energy.

Q14. (i) Calculate the number of atoms of carbon in 34.2g of cane sugar($C_{12}H_{22}O_{11}$) . (3)

(ii) If 20.0g of $CaCO_3$ is treated with 20.0 g of HCl in the reaction:
$CaCO_3$ (s) + 2HCl(aq) → $CaCl_2$ (aq) + CO_2 (g) H_2O (l)

(a) Identify the limiting reactant.

(b) How many grams of CO_2 are formed? (At. Mass of Ca=40u, C=12, O=16, H=1u, Cl=35.5u)

Q15. (i) Which of the two elements- F or Cl would have more negative electron gain enthalpy ? Give reason. (3)

(ii) Among the elements B, C, Al, Si,

(a) Which element has the highest first ionization enthalpy?

(b) Which element has most metallic character?

OR

(i) An element has electronic configuration, $(n\text{-}1)d^1ns^2$ for n=4. To which group, period and block will the element belong?

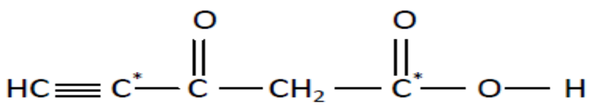
(ii) Why is the second ionization enthalpy always higher than the first ionization enthalpy ?

(iii) Would you expect the second electron gain enthalpy of O to be more or less negative than the first? Justify your answer.

Q16. (i) Write the molecular orbital configuration of the dicarbon species C_2^- and C_2^{2-}. Find their bond orders and arrange them in the increasing order of their bond lengths. (3)

(ii) What type of intermolecular force of attraction will be there between p-Nitrophenol molecules?

Q17. (i) Predict the hybridization of carbon indicated with (*). Also indicate the total number of sigma and pi bonds in this molecule. (3)



(ii) Which out of NH_3 and NF_3 has higher dipole moment and why?

Q18. (i) The enthalpy of the reaction:$2H_2(g)+O_2(g) \rightarrow 2H_2O(l)$ is Δ_rH^0 = -572 kJ/mol. (3)

What is the standard enthalpy of formation of H_2O (*l*).

(ii) For the reaction at 298K, 2A + B → C, ΔH = 400kJ/mol and ΔS=0.2kJ/K/mol. At what temperature will the reaction become spontaneous considering ΔH and ΔS to be constant over the temperature range.

Q19. Give reason: (3)

(i) Among the alkali metals ions in aqueous solution, Li^+ ion has the lowest mobility.

(ii) Caesium rather than lithium used in photoelectric cells.

(iii) Beryllium and Magnesium do not give any colour to the bunsen flame while other alkaline earth metals do.

Q20. (iii) Balance the following redox reactions by half reaction method (3)

$MnO_4^- + SO_3^{2-} \rightarrow Mn^{2+} + SO_4^{2-}$ (in acidic medium)

OR

$Cr(OH)_4^-(aq) + H_2O_2(aq) \rightarrow CrO_4^{-2}(aq) + H_2O(l)$ (in basic medium)

(iv) Identify the oxidant and reductant in the following redox reaction:

$3N_2H_4(g) + 4ClO_3^-(l) \rightarrow 6NO(g) + 4Cl^-(aq) + 6H_2O(l)$

Q21. Write the IUPAC names of the following organic compounds: (3)

(i) $CH_3CH(COOC_2H_5)CH_2CH(CH_3)COOH$

(ii)
```
      NO2 CHO
       |   |
CH3—CH—CH—CH2—CH—CH—CH2COCl
               |   |
              CH3  Br
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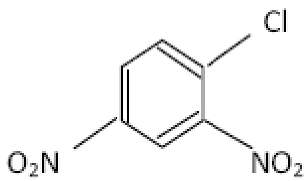
(v)



Q22. (i) The first ionization enthalpy values (in kJ/mol) of group 13 elements –B, Al, Ga, In, Tl are 801, 577, 579, 558 and 589 respectively. How will you explain the deviations from the general trend. (3)

(ii) The +2 oxidation state of Lead is more stable than +4 oxidation state. Give reason.

(iii) $[SiF_6]^{-2}$ is known whereas $[CCl_6]^{-2}$ is not. Give possible reason.

Q23. Teacher asked Hema to perform a test of unsaturation in the laboratory for 1-Butene. She took some chlorine water in a tube and added 1-Butene to it, no change was visible. Teacher asked her to use bromine water instead. The orange colour of bromine immediately got discharged. (4)

(i) What was the mistake committed by Hema? How did the teacher help Hema?

(ii) What is the type of reaction taking place between Bromine water and 1-Butene?

(iii) What rule is followed in the chemical reaction between HBr and 1-Butene. Write mechanism for the reaction.

Q24. (i) Arrange the following : (5)

(a) $(CH_3)_3C+$, $CH_3CH_2CH_2CH_2+$, $CH_3\overset{+}{C}HCH_2CH_3$, (carbocations in increasing order of stability)

(b) CH_3CH_2COOH, $(CH_3)_3CCOOH$, $(CH_3)_2CHCOOH$ (in increasing order of acid strength)

(ii) What type of isomerism is shown by the following pair of organic compound: $CH_2CH_2(OH)CH_3$ and $CH_3CH_2CH_2OH$?

(iii) Draw the bondline and condensed structural formula of 2,2,4-Trimethylpentane.

(iv) Draw structural formula of 5-Oxo-hex-3-enoic acid

OR

(i) Explain the term Electromeric effect giving examples.

(ii) Why tertiary butyl carbocation is more stable than isopropyl carbocation? Explain the reasons with structures.

(iii) Identify as electrophiles or nucleophiles: BF_3, HO^-, $(CH_3)_3N$, Cl^+.

Q25. (i) Write the conjugate acid of HSO_4^- and conjugate base of NH_3. (5)

(ii) Through a solution containing $Cu^{+2}$and Ni^{+2}, H_2S gas is passed after adding dil. HCl, which will precipitate out and why?

(iii) Calculate the pH of 0.08M solution of hypochlorous acid, HOCl. The ionization constant of the acid is $2.5X10^{-5}$. Determine the percentage dissociation of the acid. Also calculate the concentration of all the species present (H_3O^+, ClO^- and HOCl) in the solution at equilibrium.

$$HOCl + H_2O \rightleftharpoons H_3O^+ + ClO^-$$

OR

(i) Calculate the pH of 10^{-8}M HCl solution.

(ii) Give reasons: Zinc sulphide is precipitated by hydrogen sulphide from an ammonical solution but not from a hydrochloric acid solution.

(iii) The degree of ionization of a 0.1M solution of bromoacetic acid ($BrCH_2COOH$) solution is 0.132. Calculate the pH of the solution and the pKa of bromoacetic acid.

Q26. (i) Draw geometrical isomers of But-2-ene. Which of the two isomers have high boiling point and why? (5)

(ii) How will you convert

(a) benzene into p-Nitrobromobenzene.

(b) Ethyne to Benzene

(iii) Propanal and pentan-3-one are the ozonolysis products of an alkene. Write the structural formula and IUPAC nomenclature of the alkene.

OR

(i) Why –OH group attached to benzene ring is ortho and para directing while $–NO_2$ group is meta directing

(ii) Draw Saw horse projection of eclipsed and staggered conformations of ethane and compare their stability.

(iii) Carry out the following conversions:

(c) Benzene to acetophenone

(d) Iso-Propyl bromide to n-Propyl bromide.

Systematic analysis of anions

EXPERIMENT	OBSERVATION	INFERENCE
ANIONS		
CO_3^{2-}		
PRELIMNARY TEST-		
To the salt sample add a few drops of dil.h2so4	A brisk effervescence is seen due to evolutin of odourless colourless gas.	May be CO_3^{2}-
Confirmatory test-		
Collect the gas evolved in a dry test tube and add lime water to it and shake	Lime water turns milky	CO_3^{2}- confirmed
S^{2}-		
PRELIMINARY TEST		
To the salt sample add dil H2SO4	Colourless gas with smell of rotten eggs is evolved	Maybe S^{2}-
Confirmatory test		
Bring a filter paper dipped in lead acetate solution	The paper turns black	S^{2}-confirmed
SO_3^{2}-		
PRELIMINARY TEST		
To the salt sample add a few drops of dil H_2SO_4	Colourless pungent gas with smell of burning sulphur	Maybe SO_3^{2}-
CONFIRMATORY TEST		
Bring a filter paper dipped in potassium dichromate near the mouth of the test tube	It turns green	SO_3^{2}- confirmed
NO_2^-		
PRELIMINARY TEST		
To the salt sample add a few drops of dil H_2SO_4	Adark reddish brown coloured gas is evolved	Maybe NO_2-

	with effervescence .	
CONFIRMATORY TEST		
To the salt solution add a few drops of acetic acid followed by some $FeSO_4$	A dark brown solution is obtained	NO_2-
CH_3COO^-		
PRELIMINARY TEST		
To the salt add a few drops of dil H_2SO_4	Smell of vinegar is obtained	Maybe CH_3COO^-
CONFIRMATORY TEST		
To a solution of salt in water add a few drops of neutral $FeCl_3$	A reddish brown ppt	CH_3COO^- confirmed
TEST WITH Conc H_2SO_4		
Cl^-		
PRELIMINARY TEST		
To the salt add a few drops of conc H_2SO_4 and heat	Colourless pungent smelling gas is evolved	May be Cl^-
CONFIRMATORY TEST		
Bring a glass rod dipped in NH_4OH near the mouth of the test tube	Dense white fumes are evolved	
To the salt soltion adda few drops of dil HNO_3 followed by $AgNO_3$	White ppt is formed which is completely soluble in NH_4OH	Cl^- confirmed
Chromyl chloride test Take salt and potassium dichromate in the ratio of 1: 3 in a clean and dry test tube and add conc H_2SO_4 to it and	Orange brown fumes are evolved.	Cl- confirmed

heat 2 pass these fumes *through* sodium hydroxide solution	Thesolution turns yellow	Cl^- confirmed
To this yellow solution add a few drops of acetic acid and lead acetate	A yellow ppt is obtained	Cl^- confirmed
Br^- PRELIMINARY TEST To the salt add a few drops of conc H_2SO_4	Orange fumes are evolved and the solution turns orange	May be Br^-
CONFIRMATORY TEST To the salt solution add a few drops of dil $HNO_3 + AgNO_3$	A pale yellow ppt which is partially soluble in NH_4OH	Br^- confirmed
Organic layer test To the salt solution add some CS_2 followed by chlorine water and shake it vigorously	The organic layer becomes brown in colour	Br^- confirmed
I^- Preliminary test To the salt add some conc H_2SO_4 and heat	Violet fumes are evolved and the walls of the test tube become violet in colour	Maybe I^-
CONFIRMATORY TEST To the salt solution add dil $HNO_3 + AgNO_3$	Deep yellow ppt is obtained which is insoluble in NH_4OH	I^- Confirmed
Organic layer test To the salt solution add some CS_2 followed by chlorine water and shake vigorously	Organic layer becomes violet in colour	I^- confirmed
NO_3^- PRELIMINARY TEST To the salt add some conc H_2SO_4 and heat	Light brown fumes which become dark brown on heating with copper chips and the	May be NO_3^-

	solution in the test tube becomes blue	
CONFIRMATORY TEST Brown ring test To the salt solution add double the amount of ferrous sulphate and add conc H_2SO_4 to the tube along the walls of the test tube gradually and carefully	A brown ring is formed at the junction of two solutions NOTE if a white ppt is formed on the addition of ferrous sulphate filter the ppt and again add ferrous sulphate followed by sulphuric acid	NO_3^- Confirmed
SO_4^{2-} To the salt solution add some dil HCl+ $BaCl_2$	Curdy white ppt is obtained which is insoluble in conc . HCl or conc. HNO_3	SO_4^{2-} Confirmed
PO_4^{3-} To the salt solution add conc HNO_3 + Ammonium molybdate and heat	A canary yellow ppt is obtained	PO_4^{3-} confirmed

SYSTEMATIC ANALYSIS OF CATIONS [BASIC RADICALS]

0 group (NH_4^+)		
Preliminary test- To the salt add some sodium hydroxide and heat the test tube.	Smell of ammonia	Maybe ammonium ions NH_4^+
Confirmatory test-		
1. bring a glass rod dipped in conc HCl near the mouth of the test tube .	Dense white fumes are seen	NH_4^+ confirmed
2 Collect the gas obtained in the preliminary test in a test tube and add Nesslars reagent to it.	A brown ppt is obtained	NH_4^+confirmed
Preparation of original solution ***The salt is dissolved in the following solutions in the given order*** 1. *cold water* 2. *hot water* 3. *cold dil HCl* 4. *hot dil HCl* 5. *cold concHCl* 6. *hot conc HCl*		
Group 1-		
Pb^{2+}		
Preliminary test- To the original salt solution add dil HCl	1. white ppt	Maybe Pb^{2+}
Confirmatory test -		
Dissolve the white ppt in hot water and divide it into two parts 1. To the first part add KI solution 2. To the second part add K_2CrO_4	1. A yellow ppt is obtained 2. A yellow ppt is obtained	Pb^{2+} confirmed Pb^{2+} confirmed

Group 2 To the first group solution pass H_2S gas	Black ppt Yellow ppt	Cu^{2+} As^{3+}
CU^{2+} dissolve the black ppt in conc HNO_3	Agreenish solution is obtained which becomes deep blue on addition of NH_4OH . to this solution add a few drops of acetic acid and then add potassium ferrocyanide(K_4FeCN_6) Choclate brown ppt is obtained .	Cu^{2+} confirmed
As^{3+} Boil the yellow ppt with yellow ammonium silphide	Ppt dissolves	
To the above solution addconc HCl	A yellow ppt	As^{3+} confirmed
Dissolve the yellow ppt in conc HNO_3 and add ammonium molybdate and boil	A yellow ppt	As^{3+} confirmed
Group 3 boil off H_2Sgas from the second group solution , boil(if the salt is coloured) with concHNO_3 .Add NH_4Cl solid,dissolve and then add NH_4OH	1 Rust brown ppt 2 gelatinous ppt	1 Fe^{3+} 2Al^{3+}
Confirmatory test of Fe^{3+} dissolve the brown ppt in dilHCl and divide the solution into two parts 1. to the first part add K_4FeCN_6 2 to the second part add KCNS	1Prussian blue colouration is obtained 2 blood red colouration is obtained	Fe^{3+} confirmed
Confirmatory test for Al^{3+} Blue lake test –Dissolve the gelatinous ppt in dil HCl and add litmus solution and add NH_4OH	Blue lake is obtained	Al^{3+} confirmed

Group 4- $Co^{2+}Ni^{2+}Mn^{2+}Zn^{2+}$ To the third group solution pass H_2S gas	1 black ppt 2buff ppt 3dirty white ppt	1Co^{2+},Ni^{2+} 2Mn^{2+} 3Zn^{2+}
Confirmatory test for Co^{2+} dissolve the black ppt in aqua regia (conc HCl:concHNO$_3$ 3:1 in a china dish and heat to dryness	1 a blue residue 2 a yellow residue	1Co^{2+} 2Ni^{2+}
Dissolve the residue in water,add someammonium hydroxide and some solid KNO_2 followed by some acetic acid	Yellow ppt	Co^{2+} confirmed
Confirmatory test for Ni^{2+} dissolve the yellow residue in water and add ammonium hydroxide followed by DMG	Rose red ppt is seen	Ni^{2+}confirmed
Confirmatory test for Mn^{2+} dissolve the buff ppt in dil HCl and add NaOH.	Light brown ppt which changes to dark brown on standing	Mn^{2+}confirmed
Confirmatory test for Zn^{2+} dissolve the dirty ppt in dil HCl and add potassium ferrocyanide .	A greenish blue ppt is seen	Zn^{2+}
Group 5($Ba^{2+}Sr^{2+}$,Ca^{2+}) boil off H_2S gas from the fourth group solution and add ammonium carbonate and some ammonium hydroxide 2 dissolve the white ppt in acetic acid and divide this solution into 3 parts	White pptC	Group 5 present
Confirmatory test for Ba^{2+} to the first part add K_2CrO_4	Yellow ppt	Ba^{2+} confirmed
Confirmatory test for Sr^{2+} to the second part add ammonium sulphate	White ppt	Sr^{2+} confirmed

Confirmatory test for Ca^{2+} to the third part add ammonium oxalate	White ppt	Ca^{2+} confirmed
Flame test ***make a paste of salt and conc HCl on a watch glass nd perform the flame test***	1. ***1.apple green flame*** 2. ***crimson red flame*** 3. ***brick red flame***	***1.Ba^{2+}*** ***2.Sr^{2+}*** ***3Ca^{2+}***
Group 6 (Mg^{2+}) To group 5 solution add ammonium hydroxide and sodium dihydrogen phosphate	White ppt	Mg^{2+} confirmed

COMMON LOGARITHMIC TABLES $\log_{10} x$

x	0	1	2	3	4	5	6	7	8	9	Δ	1	2	3	4	5	6	7	8	9
											+				A	D	D			
10	0.0000	0043	0086	0128	0170	0212					42	4	8	13	17	21	25	29	34	38
							0253	0294	0334	0374	40	4	8	12	16	20	24	28	32	36
11	0.0414	0453	0492	0531	0569	0607					39	4	8	12	16	20	23	27	31	35
							0645	0682	0719	0755	37	4	7	11	15	19	22	26	30	33
12	0.0792	0828	0864	0899	0934	0969					35	4	7	11	14	18	21	25	28	32
							1004	1038	1072	1106	34	3	7	10	14	17	20	24	27	31
13	0.1139	1173	1206	1239	1271	1303					33	3	7	10	13	17	20	23	26	30
							1335	1367	1399	1430	32	3	6	10	13	16	19	22	26	29
14	0.1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	30	3	6	9	12	15	18	21	24	27
15	0.1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	28	3	6	8	11	14	17	20	22	25
16	0.2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	26	3	5	8	10	13	16	18	21	23
17	0.2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	25	3	5	8	10	13	15	18	20	23
18	0.2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	24	2	5	7	10	12	14	17	19	22
19	0.2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	22	2	4	7	9	11	13	15	18	20
20	0.3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	21	2	4	6	8	11	13	15	17	19
21	0.3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	20	2	4	6	8	10	12	14	16	18
22	0.3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	19	2	4	6	8	10	11	13	15	17
23	0.3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	18	2	4	5	7	9	11	13	14	16
24	0.3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	18	2	4	5	7	9	11	13	14	16
25	0.3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	17	2	3	5	7	9	10	12	14	15
26	0.4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	16	2	3	5	6	8	10	11	13	14
27	0.4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	16	2	3	5	6	8	10	11	13	14
28	0.4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	15	2	3	5	6	8	9	11	12	14
29	0.4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	15	2	3	5	6	8	9	11	12	14
30	0.4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	14	1	3	4	6	7	8	10	11	13
31	0.4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	14	1	3	4	6	7	8	10	11	13
32	0.5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	13	1	3	4	5	7	8	9	10	12
33	0.5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	13	1	3	4	5	7	8	9	10	12
34	0.5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	13	1	3	4	5	7	8	9	10	12
35	0.5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	12	1	2	4	5	6	7	8	10	11
36	0.5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	12	1	2	4	5	6	7	8	10	11
37	0.5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	12	1	2	4	5	6	7	8	10	11
38	0.5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	11	1	2	3	4	6	7	8	9	10
39	0.5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	11	1	2	3	4	6	7	8	9	10
40	0.6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	11	1	2	3	4	6	7	8	9	10
41	0.6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	10	1	2	3	4	5	6	7	8	9
42	0.6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	10	1	2	3	4	5	6	7	8	9
43	0.6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	10	1	2	3	4	5	6	7	8	9
44	0.6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	10	1	2	3	4	5	6	7	8	9
45	0.6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	10	1	2	3	4	5	6	7	8	9
46	0.6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	9	1	2	3	4	5	5	6	7	8
47	0.6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	9	1	2	3	4	5	5	6	7	8
48	0.6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	9	1	2	3	4	5	5	6	7	8
49	0.6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	9	1	2	3	4	5	5	6	7	8
50	0.6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	9	1	2	3	4	5	5	6	7	8
51	0.7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	8	1	2	2	3	4	5	6	6	7
52	0.7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	8	1	2	2	3	4	5	6	6	7

COMMON LOGARITHMIC TABLES $\log_{10} x$

x	0	1	2	3	4	5	6	7	8	9	Δ	1	2	3	4	5	6	7	8	9
											+				A	D	D			
53	0.7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	8	1	2	2	3	4	5	6	6	7
54	0.7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	8	1	2	2	3	4	5	6	6	7
55	0.7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	8	1	2	2	3	4	5	6	6	7
56	0.7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	8	1	2	2	3	4	5	6	6	7
57	0.7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	8	1	2	2	3	4	5	6	6	7
58	0.7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	8	1	2	2	3	4	5	6	6	7
59	0.7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	7	1	1	2	3	4	4	5	6	6
60	0.7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	7	1	1	2	3	4	4	5	6	6
61	0.7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	7	1	1	2	3	4	4	5	6	6
62	0.7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	7	1	1	2	3	4	4	5	6	6
63	0.7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	7	1	1	2	3	4	4	5	6	6
64	0.8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	7	1	1	2	3	4	4	5	6	6
65	0.8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	7	1	1	2	3	4	4	5	6	6
66	0.8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	7	1	1	2	3	4	4	5	6	6
67	0.8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	6	1	1	2	2	3	4	4	5	5
68	0.8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	6	1	1	2	2	3	4	4	5	5
69	0.8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	6	1	1	2	2	3	4	4	5	5
70	0.8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	6	1	1	2	2	3	4	4	5	5
71	0.8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	6	1	1	2	2	3	4	4	5	5
72	0.8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	6	1	1	2	2	3	4	4	5	5
73	0.8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	6	1	1	2	2	3	4	4	5	5
74	0.8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	6	1	1	2	2	3	4	4	5	5
75	0.8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	6	1	1	2	2	3	4	4	5	5
76	0.8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	6	1	1	2	2	3	4	4	5	5
77	0.8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	6	1	1	2	2	3	4	4	5	5
78	0.8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	6	1	1	2	2	3	4	4	5	5
79	0.8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	6	1	1	2	2	3	4	4	5	5
80	0.9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	5	1	1	2	2	3	3	4	4	5
81	0.9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	5	1	1	2	2	3	3	4	4	5
82	0.9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	5	1	1	2	2	3	3	4	4	5
83	0.9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	5	1	1	2	2	3	3	4	4	5
84	0.9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	5	1	1	2	2	3	3	4	4	5
85	0.9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	5	1	1	2	2	3	3	4	4	5
86	0.9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	5	1	1	2	2	3	3	4	4	5
87	0.9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	5	1	1	2	2	3	3	4	4	5
88	0.9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	5	1	1	2	2	3	3	4	4	5
89	0.9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	5	1	1	2	2	3	3	4	4	5
90	0.9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	5	1	1	2	2	3	3	4	4	5
91	0.9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	5	1	1	2	2	3	3	4	4	5
92	0.9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	5	1	1	2	2	3	3	4	4	5
93	0.9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	5	1	1	2	2	3	3	4	4	5
94	0.9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	5	1	1	2	2	3	3	4	4	5
95	0.9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	5	1	1	2	2	3	3	4	4	5
96	0.9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	4	0	1	1	2	2	2	3	3	4
97	0.9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	4	0	1	1	2	2	2	3	3	4
98	0.9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	4	0	1	1	2	2	2	3	3	4
99	0.9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	4	0	1	1	2	2	2	3	3	4

ANTILOGARITHMS 10^x

x	0	1	2	3	4	5	6	7	8	9	Δ	1	2	3	4	5	6	7	8	9
											+				A	D	D			
0.00	1000	1002	1005	1007	1009	1012	1014	1016	1019	1021	2	0	0	1	1	1	1	1	2	2
0.01	1023	1026	1028	1030	1033	1035	1038	1040	1042	1045	2	0	0	1	1	1	1	1	2	2
0.02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	2	0	0	1	1	1	1	1	2	2
0.03	1072	1074	1076	1079	1081	1084	1086	1089	1091	1094	2	0	0	1	1	1	1	1	2	2
0.04	1096	1099	1102	1104	1107	1109	1112	1114	1117	1119	3	0	1	1	1	2	2	2	2	3
0.05	1122	1125	1127	1130	1132	1135	1138	1140	1143	1146	3	0	1	1	1	2	2	2	2	3
0.06	1148	1151	1153	1156	1159	1161	1164	1167	1169	1172	3	0	1	1	1	2	2	2	2	3
0.07	1175	1178	1180	1183	1186	1189	1191	1194	1197	1199	3	0	1	1	1	2	2	2	2	3
0.08	1202	1205	1208	1211	1213	1216	1219	1222	1225	1227	3	0	1	1	1	2	2	2	2	3
0.09	1230	1233	1236	1239	1242	1245	1247	1250	1253	1256	3	0	1	1	1	2	2	2	2	3
0.10	1259	1262	1265	1268	1271	1274	1276	1279	1282	1285	3	0	1	1	1	2	2	2	2	3
0.11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	3	0	1	1	1	2	2	2	2	3
0.12	1318	1321	1324	1327	1330	1334	1337	1340	1343	1346	3	0	1	1	1	2	2	2	2	3
0.13	1349	1352	1355	1358	1361	1365	1368	1371	1374	1377	3	0	1	1	1	2	2	2	2	3
0.14	1380	1384	1387	1390	1393	1396	1400	1403	1406	1409	3	0	1	1	1	2	2	2	2	3
0.15	1413	1416	1419	1422	1426	1429	1432	1435	1439	1442	3	0	1	1	1	2	2	2	2	3
0.16	1445	1449	1452	1455	1459	1462	1466	1469	1472	1476	3	0	1	1	1	2	2	2	2	3
0.17	1479	1483	1486	1489	1493	1496	1500	1503	1507	1510	4	0	1	1	2	2	2	3	3	4
0.18	1514	1517	1521	1524	1528	1531	1535	1538	1542	1545	4	0	1	1	2	2	2	3	3	4
0.19	1549	1552	1556	1560	1563	1567	1570	1574	1578	1581	4	0	1	1	2	2	2	3	3	4
0.20	1585	1589	1592	1596	1600	1603	1607	1611	1614	1618	4	0	1	1	2	2	2	3	3	4
0.21	1622	1626	1629	1633	1637	1641	1644	1648	1652	1656	4	0	1	1	2	2	2	3	3	4
0.22	1660	1663	1667	1671	1675	1679	1683	1687	1690	1694	4	0	1	1	2	2	2	3	3	4
0.23	1698	1702	1706	1710	1714	1718	1722	1726	1730	1734	4	0	1	1	2	2	2	3	3	4
0.24	1738	1742	1746	1750	1754	1758	1762	1766	1770	1774	4	0	1	1	2	2	2	3	3	4
0.25	1778	1782	1786	1791	1795	1799	1803	1807	1811	1816	4	0	1	1	2	2	2	3	3	4
0.26	1820	1824	1828	1832	1837	1841	1845	1849	1854	1858	4	0	1	1	2	2	2	3	3	4
0.27	1862	1866	1871	1875	1879	1884	1888	1892	1897	1901	4	0	1	1	2	2	2	3	3	4
0.28	1905	1910	1914	1919	1923	1928	1932	1936	1941	1945	4	0	1	1	2	2	2	3	3	4
0.29	1950	1954	1959	1963	1968	1972	1977	1982	1986	1991	4	0	1	1	2	2	2	3	3	4
0.30	1995	2000	2004	2009	2014	2018	2023	2028	2032	2037	5	1	1	2	2	3	3	4	4	5
0.31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	5	1	1	2	2	3	3	4	4	5
0.32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	5	1	1	2	2	3	3	4	4	5
0.33	2138	2143	2148	2153	2158	2163	2168	2173	2178	2183	5	1	1	2	2	3	3	4	4	5
0.34	2188	2193	2198	2203	2208	2213	2218	2223	2228	2234	5	1	1	2	2	3	3	4	4	5
0.35	2239	2244	2249	2254	2259	2265	2270	2275	2280	2286	5	1	1	2	2	3	3	4	4	5
0.36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	5	1	1	2	2	3	3	4	4	5
0.37	2344	2350	2355	2360	2366	2371	2377	2382	2388	2393	6	1	1	2	2	3	4	4	5	5
0.38	2399	2404	2410	2415	2421	2427	2432	2438	2443	2449	6	1	1	2	2	3	4	4	5	5
0.39	2455	2460	2466	2472	2477	2483	2489	2495	2500	2506	6	1	1	2	2	3	4	4	5	5
0.40	2512	2518	2523	2529	2535	2541	2547	2553	2559	2564	6	1	1	2	2	3	4	4	5	5
0.41	2570	2576	2582	2588	2594	2600	2606	2612	2618	2624	6	1	1	2	2	3	4	4	5	5
0.42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	6	1	1	2	2	3	4	4	5	5
0.43	2692	2698	2704	2710	2716	2723	2729	2735	2742	2748	6	1	1	2	2	3	4	4	5	5
0.44	2754	2761	2767	2773	2780	2786	2793	2799	2805	2812	6	1	1	2	2	3	4	4	5	5
0.45	2818	2825	2831	2838	2844	2851	2858	2864	2871	2877	7	1	1	2	3	4	4	5	6	6
0.46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	7	1	1	2	3	4	4	5	6	6
0.47	2951	2958	2965	2972	2979	2985	2992	2999	3006	3013	7	1	1	2	3	4	4	5	6	6
0.48	3020	3027	3034	3041	3048	3055	3062	3069	3076	3083	7	1	1	2	3	4	4	5	6	6
0.49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	7	1	1	2	3	4	4	5	6	6

ANTILOGARITHMS 10^x

x	0	1	2	3	4	5	6	7	8	9	Δ	1	2	3	4	5	6	7	8	9
											+				A	D	D			
0.50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	7	1	1	2	3	4	4	5	6	6
0.51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	8	1	2	2	3	4	5	6	6	7
0.52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	8	1	2	2	3	4	5	6	6	7
0.53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	8	1	2	2	3	4	5	6	6	7
0.54	3467	3475	3483	3491	3499	3508	3516	3524	3532	3540	8	1	2	2	3	4	5	6	6	7
0.55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	8	1	2	2	3	4	5	6	6	7
0.56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	8	1	2	2	3	4	5	6	6	7
0.57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	9	1	2	3	4	5	5	6	7	8
0.58	3802	3811	3819	3828	3837	3846	3855	3864	3873	3882	9	1	2	3	4	5	5	6	7	8
0.59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	9	1	2	3	4	5	5	6	7	8
0.60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	9	1	2	3	4	5	5	6	7	8
0.61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	10	1	2	3	4	5	6	7	8	9
0.62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	10	1	2	3	4	5	6	7	8	9
0.63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	10	1	2	3	4	5	6	7	8	9
0.64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	10	1	2	3	4	5	6	7	8	9
0.65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	10	1	2	3	4	5	6	7	8	9
0.66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	11	1	2	3	4	6	7	8	9	10
0.67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	11	1	2	3	4	6	7	8	9	10
0.68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	11	1	2	3	4	6	7	8	9	10
0.69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	11	1	2	3	4	6	7	8	9	10
0.70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	12	1	2	4	5	6	7	8	10	11
0.71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	12	1	2	4	5	6	7	8	10	11
0.72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	12	1	2	4	5	6	7	8	10	11
0.73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	12	1	2	4	5	6	7	8	10	11
0.74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	13	1	3	4	5	7	8	9	10	12
0.75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	13	1	3	4	5	7	8	9	10	12
0.76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	13	1	3	4	5	7	8	9	10	12
0.77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	14	1	3	4	6	7	8	10	11	13
0.78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	14	1	3	4	6	7	8	10	11	13
0.79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	14	1	3	4	6	7	8	10	11	13
0.80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	15	2	3	5	6	8	9	11	12	14
0.81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	15	2	3	5	6	8	9	11	12	14
0.82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	15	2	3	5	6	8	9	11	12	14
0.83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	16	2	3	5	6	8	10	11	13	14
0.84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	16	2	3	5	6	8	10	11	13	14
0.85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	16	2	3	5	6	8	10	11	13	14
0.86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	17	2	3	5	7	9	10	12	14	15
0.87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	17	2	3	5	7	9	10	12	14	15
0.88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	18	2	4	5	7	9	11	13	14	16
0.89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	18	2	4	5	7	9	11	13	14	16
0.90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	18	2	4	5	7	9	11	13	14	16
0.91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	19	2	4	6	8	10	11	13	15	17
0.92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	19	2	4	6	8	10	11	13	15	17
0.93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	20	2	4	6	8	10	12	14	16	18
0.94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	20	2	4	6	8	10	12	14	16	18
0.95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	21	2	4	6	8	11	13	15	17	19
0.96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	21	2	4	6	8	11	13	15	17	19
0.97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	22	2	4	7	9	11	13	15	18	20
0.98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	22	2	4	7	9	11	13	15	18	20
0.99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	23	2	5	7	9	12	14	16	18	21