ASSOICATE DEGREE IN SCIENCE

Chemistry- I

(Outlines of Tests)	
Paper-A: Physical Chemistry (Written) :	40 Marks
Paper-B: Inorganic Chemistry (Written) :	40 Marks
Paper-C: Physical Chemistry & Inorganic Chemistry (Practical-I)	10+10=20 Marks

(Syllabi and Courses of Reading)

Paper A: Physical Chemistry **Marks: 40**

It is compulsory to attempt at least TWO questions from each section.

Section -I

1. Elementary Mathematics:

Weightage of marks 4

Logarithmic, exponential and trignometric functions, differentiation of elementary functions, methods of differentiation & integration, significance of differentiation & integration.

2. Physical States of Matter:

Weightage of marks 6

Gases: (van der Waal's equation, critical phenomena, critical values of T, P &V, liquification of gases, molecular collisions, collision diameter, mean free path); **Liquids:** (viscosity, parachor value, refractive index, molar refraction and its applications. Dipole moment; **Solids:** unit cells, Bragg crystal analysis, crystal structure of NaCl, powder method of crystal structure analysis.

3. Atomic Structure

Weightage of marks 4

de Brogile equation, Schrödinger wave equation and it's solution for particle in 1D box, equantization concept, Heisenberg uncertainty principle, Puali's exclusion principle, Hund's rule.

4. Chemical Thermodynamics

Weightage of marks 4

First law of thermodynamics, state functions, isothermal and adiabatic processes in ideal gases, heat capacity, reversible and irreversible processes. Spontaneous and non-spontaneous processes, second law of thermodynamics, change of entropy with change in T, P &V.

Section- II

5. Chemical Equilibrium:

Weightage of marks 4

Law of mass action, equilibrium constant (K_c), relationship between K_c, K_p, K_x and K_a, Le Chaterlier's principle.

6. Solutions:

Weightage of marks 4

Composition, ideal and non-ideal solutions. Raoult's law, colligative properties, ebullioscopy, cryoscopy, osmotic pressure, distillation and concept of azeotropes.

7. Chemical Kinetics

Weightage of marks 5

Zero, first and second order reactions, Arrhenius equation, activation energy, Lindermann's mechanism, collision theory and transition state theory.

8. Electrochemistry

Weightage of marks 4

Conductance, dependence of conductance on the nature of solvent and temperature, Kohlrausch's law and its applications, measurement of conductance, strong and weak electrolytes, degree of dissociation.

9. Surface Phenomena and Colloids

Weightage of marks 5

Physisorption and chemisorption, isotherms; types, properties, preparation and applications of colloids.

Recommended Books

1. Maron S. H. and Jerome, B. "Fundamentals of Physical Chemistry" Macruthan Publishing co. Inc. New York (2016).
2. Atkins P.W. and Clugston, M. J. "Principles of Physical Chemistry' Pitam Publishing Company. NY (2015).
3. Moore, W.J., "Physical Chemistry", 5th Ed. Longmans Publishers, NY (1972).
4. Jones, M., "Elements of Physical Chemistry" 3rd Ed. Benjamin Cummings Publishing Company Inc., NY (2014).
5. Adamson, A. W., "Understanding Physical Chemistry" 3rd Ed. Benjamin Cummings Publishing Company Inc. NY (2015).
6. Heald, C. and Smith, A.C.K. "Applied Physical Chemistry" MacMillan UK (1973).
7. Bhatti, H.N. and K. Hussain, "Principles of Physical Chemistry"; Carvan Book House, Lahore (2005).
8. Levitt, B.P., "Findlay's Practical Physical Chemistry". 9th Ed. Longman, London (1973).
9. Das, R.C. and B. Behera, "Experimental Physical Chemistry", Tata McGraw Hill, Delhi (2003).

10. Crocleford, H.D., H.W. Biard, F.W. Getzen & J.W. Nowell, "Laboratory Manual of Physical Chemistry", 2nd Ed., John Wiley & Sons, London (1975).

Paper-B: Inorganic Chemistry **Marks: 40**

It is compulsory to attempt at least TWO questions from each section.

Section-I

1. **Periodic Table and Periodicity of Properties**
   Weightage of marks 3
   Modern periodic table, group trends and periodic properties, atomic & ionic radii, ionization potentials, electron affinities and electronegativities; redox potential, electrochemical series and its applications; corrosion and electroplating.

2. **Acid Base Equilibria**
   Weightage of marks 4
   Acids and bases, relative strengths of acids, pH, pK_a, pK_b, Soft and hard acid-base (SHAB) concept: principle & applications. Buffers: types, preparation, capacity and applications. Indicators: acid-base, redox and adsorption. Solubility product, common ion effect and applications.

3. **Physical Techniques in Inorganic Chemistry**
   Weightage of marks 4
   Diffraction methods (X-ray and Neutron diffractions)
   Chemical analysis (Atomic absorption spectroscopy, X-ray fluorescence, elemental analysis and thermal analysis).

4. **Chemical Bonding**
   Weightage of marks 6
   Nature of a bond, hybridization, valence bond theory (VBT), the concept of resonance, molecular orbital theory (MOT), valence shell electron pair repulsion (VSEPR) theory. Special types of bonds, such as, metallic bonds, hydrogen bonding, bent bond, ion-dipole-dipole bond, ion induced-dipole bond.

5. **Alkali & Alkaline Earth Metals**
   Weightage of marks 3
   General characteristics and important compounds of elements of group IA & group IIA. Diagonal relationships between these elements.

Section-II

6. **Chemistry of p-Block Elements**
   Weightage of marks 12
   Introduction to p-block elements
   Group IIIA Elements: Group trends (physical properties, atomic sizes & chemical reactivity), comparison of boron with silicon, compounds of boron: boranes.
   Group IVA Elements: Group trends (physical properties, atomic sizes & chemical reactivity), allotropic forms of C: graphite, diamond and fullerene (synthesis, properties & structure), carbides (classification, preparation, properties and uses). Compounds of Ge, Sn and Pb. Silicates (structural aspects, classification and applications), silicones

(structural aspects, classification and applications); production of pure Si chips for solar energy cells, silicides.

Group VA Elements: Group trends (physical properties, atomic sizes & chemical reactivity); nitrides, phosphides, arsenides, antimonides and bismuthides, nitrogen cycle, phosphazenes, oxoacids of N and P.

Group VIA Elements: Group trends (physical & chemical properties), oxoacids and their salts thionic acids, peroxyacids of S. Oxoacids of Se and Te.

Group VIIA Elements (Halogens): Group trends, physical and chemical properties, haloacids.

Group VIIIA Elements (Noble gases): Discovery, separation and isolation, general chemistry of inert gases, xenon fluorides.

7. **Chemistry of d-Block Elements**
   Weightage of marks 8
   Electronic configuration, nomenclature, characteristics and nature of bonding in coordination complexes. Werner's theory, VBT, MOT and CFT for coordination compounds. Isomerism in coordination compounds. Chelates: classification and applications. Medicinal, industrial and agricultural applications of coordination compounds.

Recommended Books (Inorganic Chemistry)

1. Iqbal, M.Z., "Text Book of Inorganic Chemistry" Ilmi Kitab Khana, Revised Edition (2008).
2. Shaheen, M.A, Hazoor Ahmad, Jilani's "Concise Inorganic Chemistry" Jilani Notes, Sargodha, Lahore (2018)
3. Albert, C.F., Wilkinson G. and Gaus, P.L. "Basic Inorganic Chemistry" 3rd Edition, John Wiley & Sons, Inc. NY (2010).
4. Lee, J.D., "Concise Inorganic Chemistry" 5th Edition, Chapman & Hall, UK (2014).
5. Jolly, W.L., "Modern Inorganic Chemistry" 2nd Edition McGraw Hill, NY (2015).
6. Shriver, D.F., Atkins P.W. and Langord, C.H. "Inorganic Chemistry" 2nd Edition, Oxford Press, UK (2016).
7. Housecroft, C.E. and Sharpe, A.G., "Inorganic Chemistry" 3rd Edition, Longman, NY (2015).
8. Rayner-Canham, G. "Descriptive Inorganic Chemistry" W.H. Freeman & Co. UK (2014).
9. Jeffery, G.H., Bassett, J., Mendham, J. and Denney, R.C. "Vogel's Textbooks of Quantitative Chemical Analysis" 5th Edition, Benjamin-Cummings, NY (1989).
10. Vogel, A.I, "A Text Book of Macro and Semimicro Qualitative Inorganic Analysis" Longman Green & Co. NY (1995).
11. Skoog, D.A., West, D. M. and Holler, F.J. "Analytical Chemistry" 6th Edition Saunders College Publications, UK (1994).

12. Graham, H and Man, H. "Chemistry in Context" 5th Edition, Thomas Nelson Ltd. U.K. (2000).

Paper-C: Physical Chemistry & Inorganic Chemistry (Practical-I) **20 Marks**

Physical Chemistry: **10 Marks**

1. Determination of surface tension and Parachor value by stalagmometer.
2. Determination of % composition of liquid solutions by surface tension measurement.
3. Determination of viscosity and Rhechor value of liquids by viscosity measurement.
4. Determination of % composition of liquid solutions viscometrically.
5. Determination of refractive index and molar refractivity by refractometer.
6. Determination of % composition of liquid solutions by refractive index measurements.
7. Determination of heat of solution by solubility method.
8. Determination of heat of neutralization of an acid with a base.
9. A kinetic study of acid hydrolysis of EtOAc.
10. Kinetic study of saponification of EtOAc.
11. Determination of molecular weight of a compound by elevation in boiling point (ebullioscopic method).
12. Determination of molecular weight of a compound by lowering of freezing point (the cryoscopic method).
13. Determination of equilibrium constant of $KI + I_2 \rightarrow 3KI$.
14. Conductometric titration of strong acid and strong base.

Recommended Books (Physical Chemistry, Practical)

1. Crockford, H. D.; J. IV Nowell; H. W Baird and F. W. Getzen. 1976. "Laboratory Manual of Physical Chemistry" John Wiley and Sons (2nd Ed.) England.
2. Shaheen, M.A., 2017) Jilani "Manual of Practical Chemistry Laboratory" Vol-I for BS/B.Sc. Students, Jilani Notes, Sargodha, Lahore-Pakistan.
3. Das R. C. and B. Bahera. 1984. "Experimental Physical Chemistry" Tata McGraw Hill Publishing Company Limited USA.
4. Levitt B. P. 1972. "Findlay's Practical Physical Chemistry" Longman Group Limited (9th Ed.) USA.

Inorganic Chemistry **10 Marks**

1. Qualitative analysis of four radicals (cations and anions) for salt mixture.
2. Chromatographic separation of cations.
3. Determination of total hardness of water using EDTA.
4. Estimation of Mn(II) using EDTA.
5. Estimation of Cu(II) iodometrically.
6. Determination of $S_2O_3^-$ iodometrically.
7. Determination of ferricyanide ($[Fe(CN)_6]^{2-}$) using KI solution.
8. Determination of Cl^- by Volhard's and Mohr's methods.
9. Estimation of Cl^- using adsorption (Fluorescein) indicator.
10. Estimation of Br^- using adsorption (Eosin) indicator.

11. Estimation of %age of Fe^{2+} in the Mohr's salt using $KMnO_4$ solution.
12. Percentage determination of Fe^{3+} in ferric alum using $KMnO_4$ solution.
13. Determination of purity of commercial potassium oxalate [$K_2(COO)_2$] using $KMnO_4$ solution.
14. Estimation of Fe^{2+} using $K_2Cr_2O_7$ solution.

Recommended Books (Inorganic Chemistry, Practical)

1. Shaheen, M.A., (2017) Jilani, "Manual of Practical Chemistry" Vol-II for BS/BSc Students, Jilani Notes, Sargodha, Lahore-Pakistan.
2. Jefferey, G. H.; Bassett, Menclham, J. and Denney, R. C. (2007). "Vogel's TexBook of Quantitative Chemical Analysis" Benjamin Cummings (5th Ed) UK.
3. Vogel, A. I. A. (1995). "Text Book of Macro and Semi-micro Qualitative Inorganic Analysis" Longamn Green & Co England.
4. Skoog, D. A.; West, D. M. and. Holler, F. J. (1994). "Analytical Chemistry" Saunders College Publications (6th Ed).
5. Pass, G., Sutcliffe, II. (1975). "Practical Inorganic Chemistry: Preparations, Reactions and Instrumental Methods" 2nd Ed., Chapman and Hall England.