20. Chemistry Education

Course Content

Unit-I : Language of Chemistry **Teaching hours:08**

- Atoms, molecules, elements and compounds
- Symbols, valency and formula
- Chemical equation, types, significances and limitations
- Balancing the chemical equation (hit and trial, partial equation method)

Unit-II : States of Matter **Teaching hours:22**

- Three states of matter
- Basic concepts of Kinetic theory of gas
- Boyle's Law
- Charles' Law, Kelvin scale of temperature
- Universal gas constant, Equation of state
- Dalton's law of partial pressure
- Graham's law of diffusion
- Deviation from ideal behaviour
- Laws of Stoichiometry
- Avogadro's Hypothesis
- Relation between Molecular weight and vapour density
- Properties of solid
- Simple chemical calculation

Unit-III : Atomic Structure and Valency **Teaching hours:12**

- Dalton's atomic theory
- Rutherford's atomic model
- Bohr's postulates
- Aufbau principle, electronic configuration of atoms
- Electronic theory of valency
- Concept of electrovalency, covalency and co-ordinate covalency with examples
- Basic principle of electrolysis
- Faradays Laws of Electrolysis

Unit-IV : Periodic Classification and Chemical Equilibrium **Teaching hours:08**

- Mendeleef's Periodic Law
- Modern Periodic Law
- Anomalies of Periodic Table
- Chemical Equilibrium
- Equilibrium constant
- Le Chatelers' Principle

Unit-V :Acids, Bases and Salts, and oxidation reduction **Teaching hours:15**

- Arrhenius, Bronsted-Lworry and Lewis concepts of acids, bases with suitable examples
- Oxidation and reduction
- Electronic interpretation of oxidation and reduction reaction

Unit-VI : Equivalent Weight, Acidimetry, Alkalimetry and pH **Teaching hours:05**

- Definition of Equivalent weight
- Equivalent weight of acid, base and salt
- Determination of equivalent weight by hydrogen displacement method
- Acidimetry and alkalimetry
- Simple acid, base titration
- Concept of pH

Unit-VII : Chemistry of Non-metals **Teaching hours:20**

- General preparation and properties of Halogens and its compounds (HCl, HBr and HI)
- General preparation and properties of compounds of Nitrogen (HNO_3 and NH_3)
- General preparation and properties of compounds of Sulphur (H_2S, H_2SO_4 and SO_2)
- Manufacture of NH_3 and H_2SO_4

Unit-VIII : Chemistry of Metals **Teaching hours:15**

- Introduction to metallurgy
- Mineral resources of Nepal
- Important processes in metallurgy (concentration, calcination, roasting, smelting and refining)
- Extraction of the following metals from their important ores and study of their physical and chemical properties and uses:
  a. Iron b. Sodium
- Preparation, properties and uses of the following compounds:
  a. Green vitriol b. Blue vitriol
  c. White vitriol d. Sodium Carbonate

Unit-IX : Carbon and its compounds **Teaching hours:30**

- Definition classification and uses of organic compounds
- Empirical and molecular formulae
- Qualitative analysis of organic compounds (detection of N,X and S)
- Functional group and IUPAC Nomenclature
- Orbital, hybridization and bonding
- Introduction to aliphatic and aromatic hydrocarbons
- General preparation and properties of Alkane, Alkene and Alkyne, aldehyde, ketone, carboxylic acid and chloroform.
- Lab preparation and properties of the following compounds:
  a. Methane b. Ethane
  c. Ethyl alcohol d. Phenol
  e. Nitrobenzene f. Aniline
  g. Benzoic acid

Unit-X : Uses of chemistry in daily life **Teaching hours:15**

- Structure uses and abuses of DDT, BHC
- Structures and uses of simple drugs [Analgeics and Antipyritics (aspirine and phenacetin)] Antibiotics(chloromycitin and penicillin)
- Polymers : synthetic polymers(nylon 66, dacron) and their uses
- Fertilizers : NPK fertilizers
  a. Nitrogenous fertilizer(urea, ammonium sulphate)
  b. Phosphorous fertilizer(supper-phosphate of lime)
  c. Potassium fertilizer(potassium- nitrate, sulphate and chloride)

MODEL QUESTION

[HSEB Examination 2069 (2012)]

Time: 3 hrs. **Full Marks:- 75**
Pass Marks:- 27

Group 'A'

Attempt any **fifteen** questions: 15×2=35

1. State Graham's law of diffusion. **[From Unit II]**
2. At what condiion the value of P × V is always constant? **[From Unit II]**
3. Write the electronic configuration of the following in terms of s, p, d, f orbitals. a) Cl^- b) Cu^{++} **[From Unit III]**

4. Give any two examples of ionic compound. [From Unit III]
5. Write the molecular formula of Aluminium Sulphate and Magnesium nitride. [From Unit I]
6. Write any two limitations of chemical equations. [From Unit I]
7. Define modern periodic law. [From Unit IV]
8. Write the equilibrium constant (Kc) for the following reaction. [From Unit IV]

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

9. "Water acts as acid as well as base", Justify it in terms of Bronsted lowery concept. [From Unit V]
10. Find the oxidation number of:
    a) 'Mn' is $KMnO_4$ b) 'C' in H_2CO_3 [From Unit V]
11. Calculate the equivalent weigh of 'Fe' in Fe_2O_3. [From Unit VI]
12. Define P^H value. What will be the P^H of 0.02 MHCl. [From Unit VI]
13. Write a principle reaction for lab preparation of chlorine. [From Unit VII]
14. Why does conc. sulphric acid diluted by adding acid into water but not water into acid in the laboratory. [From Unit V]
15. Why does iron get rusted? [From Unit VIII]
16. Write the action of heat on white vitriol. [From Unit VIII]
17. Write the reaction of detection of halogen in laboratory. [From Unit VII]
18. Write the IUPAC names of the following compounds: [From Unit IX]
    a) $CH_3 - CH_2 - CH_2CH = CH_2$
    b)

$$CH_3 - CH_2 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - CH_2 - CHO$$

19. Write the structure and use of Brufane and analgesics drug. [From Unit X]
20. State any two uses of synthetic polymer. [From Unit X]

Group 'B'

Attempt any **five** questions. 5×5=25

21. Define oxidation and reduction reaction. Balance the following redox-reaction by oxidation number method or ion electron method. 1+4=5 [From Unit V]

    $KMnO_4 + H_2SO_4 + H_2S \rightarrow K_2SO_4 + MnSO_4 + H_2O + S$

22. State and explain the Faraday's first law of electrolysis. 1+4=5 [From Unit III]
23. Write the chemistry of blue vitriol. 2+2+1=5 [From Unit VIII]
24. State avogadro's hypothesis prove that: 1+4=5 [From Unit II]
    Molecular weight = 2 × vapour density
25. What are the anamolies of Mendeleef's periodic table? Explain. 5 [From Unit IV]

26. Write short notes on: 2.5+2.5=5
   a) Markovenikov's rule [From Unit IX]
   b) Dehydration of alchohol [From Unit IX]

27. Write the names and importances of nitrogenous fertilizer. 2+3=5[From Unit X]

Group 'C'

Attempt any **two** questions. 2×10=20

28. Explain how iron can be extracts from its principle ore. What happens when iron reactor with: 8+2=10] [From Unit VIII]
   a) dil. HNO_3 b) dil.HCl

29. How bromine can be extractd from carnallite? Write the chemical reactions of Bromine with: 5+2+2+1=10 [From Unit VII]
   a) phosphorous b) cold and dil.alkalies c) magnesium

30. How is dry and pure nitrobenzene prepared in lab? What happen when nitrobenzene under go reduction in acidic medium and neutral medium? [From Unit IX]
   6+2+2=10

31. Write short notes on: (any **two**) 5+5
   a) Law of multiple proportion [From Unit II]
   b) Le–Chatelier's principle [From Unit IV]
   c) Laboratory preparation of methane [From Unit IX]
   d) Distinction between Metals and Nonmetals [From Unit VIII]

Exam Questions

Unit I : Language of Chemistry

1. Write the molecular formula of Aluminium Sulphate and Magnesium nitride. [Q.N.5, 2069]
2. Write any two limitations of chemical equations. [Q.N.6, 2069]
3. What are the significance of chemical equation ? [Q.N.22,2068]

Unit II : States of Matter

1. State Graham's law of diffusion. [Q.N.1, 2069]
2. At what condiion the value of P × V is always constant? [Q.N.2, 2069]
3. State avogadro's hypothesis prove that: 1+4=5
   Molecular weight = 2 × vapour density [Q.N.24, 2069]
4. Write short notes on: 5+5
   a) Law of multiple proportion [Q.N.31(a), 2069]
5. Write any four properties of solid. [Q.N.8,2068]
6. What is absolute zero temperature ? [Q.N.9,2068]
7. What do you mean by stationary state ? [Q.N.10,2068]
8. State and explain the law of multiple proportion with example. [Q.N.23,2068]
9. Establish the relationship between molecular weight and relative density of a gas. [Q.N.24,2068]

Unit III : Atomic Structure and Valency

1. Write the electronic configuration of the following in terms of s, p, d, f orbitals.
   a) Cl^- b) Cu^{++} [Q.N.3, 2069]
2. Give any two examples of ionic compound. [Q.N.4, 2069]
3. State and explain the Faraday's first law of electrolysis. 1+4=5[Q.N.22, 2069]
4. Why do the electron of an atom not jump into the nucleus ? [Q.N.1,2068]
5. Write the electronic configuration of Cr(24). [Q.N.11,2068]
6. Which one of the following has larger size ? Why ?
   Na or Na^+ [Q.N.13,2068]
7. State Faradays law of electrolysis. A current of 0.25 Amp. is passed through $CuSO_4$ solution for 45 minutes. Calculate the amount of Cu deposited on cathode. (Cu = 63.6). [Q.N.30,2068]

Unit IV : Periodic Classification and Chemical Equilibrium

1. Define modern periodic law. [Q.N.7, 2069]
2. Write the equilibrium constant (Kc) for the following reaction. [Q.N.8, 2069]

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

3. What are the anamolies of Mendeleef's periodic table? Explain. 5 [Q.N.25, 2069]
4. Write short notes on:
   a) Le – Chatelier's principle [Q.N.31(b), 2069]

Unit V :Acids, Bases and Salts, and oxidation reduction

1. "Water acts as acid as well as base", Justify it in terms of Bronsted lowery concept. [Q.N.9, 2069]
2. Find the oxidation number of: [Q.N.10, 2069]
   a) 'Mn' is $KMnO_4$ b) 'C' in H_2CO_3
3. Why does conc. sulphric acid diluted by adding acid into water but not water into acid in the laboratory. [Q.N.14, 2069]
4. Define oxidation and reduction reaction. Balance the following redox-reaction by oxidation number method or ion electron method. 1+4=5 [Q.N.21, 2069]

$$KMnO_4 + H_2SO_4 + H_2S \rightarrow K_2SO_4 + MnSO_4 + H_2O + S$$

5. Write the structure of picric acid. [Q.N.6,2068]
6. What do you mean by neutralization reaction ? [Q.N.7,2068]
7. Explain the activity "on effect of acid on tooth decay". [Q.N.26,2068]

Unit VI : Equivalent Weight, Acidimetry, Alkalimetry and pH

1. Calculate the equivalent weigh of 'Fe' in Fe_2O_3. [Q.N.11, 2069]
2. Define pH value. What will be the pH of 0.02 MHCl. [Q.N.12, 2069]
3. Define pH. Find the hydrogen ion concentration whose pH is 5.5. [Q.N.12,2068]

4. Why is aqueous solution of $FeCl_3$ acidic in nature ? [Q.N.14,2068]
5. Define equivalent weight. [Q.N.15,2068]
6. Write short notes on: 2×5=10
   (a) Activity for measuring the pH of soil. [Q.N.31(d),2068]

Unit VII: Chemistry of Non-metals

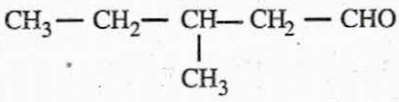
1. Write a principle reaction for lab preparation of chlorine. [Q.N.13, 2069]
2. Write the reaction of detection of halogen in laboratory. [Q.N.17, 2069]
3. How bromine can be extractd from carnallite? Write the chemical reactions of Bromine with: 5+2+2+1=10 [Q.N.29, 2069]
   a) phosphorous b) cold and dil.alkalies c) magnesium
4. Give the reaction of ammomia with copper sulphate. [Q.N.3,2068]
5. Give the name of a halogen which exist at solid state at room temperature. [Q.N.4,2068]
6. Differenciate between metal and non-metals. [Q.N.25,2068]
7. Write down the preparation, properties and uses of H_2S gas. [Q.N.29,2068]

Unit VIII: Chemistry of Metals

1. Why does iron get rusted? [Q.N.15, 2069]
2. Write the action of heat on white vitriol. [Q.N.16, 2069]
3. Write the chemistry of blue vitriol. 2+2+1=5 [Q.N.23, 2069]
4. Explain how iron can be extracts from its principle ore. What happens when iron reactor with: 8+2=10 [Q.N.28, 2069]
   a) dil. HNO_3 b) dil.HCl
5. Name two important ores of Iron and write down their formula ? [Q.N.2,2068]
6. Write the chemistry of green vitriol. [Q.N.21,2068]
7. Write short notes on:
   (a) Process of extraction of metals are in metallurgy. [Q.N.31(c),2068]
   (b) Distinction between Metals and Nonmetals [Q.N.31(d), 2069]

Unit-IX Carbon and its compounds

1. Write the IUPAC names of the following compounds: [Q.N.18, 2069]
   a) $CH_3 - CH_2 - CH_2CH = CH_2$
   b)



2. How is dry and pure nitrobenzene prepared in lab? What happen when nitrobenzene under go reduction in acidic medium and neutral medium? 6+2+2=10[Q.N.30, 2069]
3. What is tollen's reagent ? [Q.N.5,2068]
4. Write possible isomers of C_6H_{14} and give their IUPAC name. [Q.N.16,2068]
5. Write the structure of hex-1-en-5-yne. [Q.N.17,2068]
6. What is sulpha-drugs ? [Q.N.18,2068]
7. Write the structure of Aspirin. [Q.N.19,2068]
8. What is wurtz's reaction ? Give an example. [Q.N.20,2068]

9. How is acetylene prepared in laboratory ? What happens when acetylene gas is passed through ammonical solution of $AgNO_3$? [Q.N.27,2068]

10. How is nitrobenzene prepared in laboratory ? Give its reduction reaction in different medium. [Q.N.28,2068]

11. Write short notes on:

a) Dehydration of alchohol [Q.N.26(b), 2069]

b) Laboratory preparation of methane [Q.N.31(c), 2069]

c) Uses of ethyl alcohol. [Q.N.31(b),2068]

d) Markovenikov's rule [Q.N.26(a), 2069]

Unit-X: Uses of chemistry in daily life

1. Write the structure and use of Brufane and analgesics drug. [Q.N.19, 2069]

2. State any two uses of synthetic polymer. [Q.N.20, 2069]

3. Write the names and importances of nitrogenous fertilizer. 2+3=5[Q.N.27, 2069]

4. Write short notes on: 2×5=10

(a) Abuses and effect of DDT. [Q.N.31(a),2068]

The End