

CHEMISTRY
Grade: 11

Specification Grid 2077

| SN | Content Area | Working hour | Competency level | | | | | | | | | | | | Unit wise Marks | | | | | | | | | | | | |
|--------------|---------------------|--------------|------------------|-------|------------------|-------|------------------|-------|------------------|-------|------------------|----------------|------------------|-------|-----------------|----|---|---|---|---|---|----|---|---|----|--|----|
| | | | Remembering | | Understanding | | | | Applying | | | Higher Ability | | | | | | | | | | | | | | | |
| | | | MCQ | SAQ | MCQ | SAQ | LAQ | MCQ | SAQ | LAQ | MCQ | SAQ | LAQ | | | | | | | | | | | | | | |
| | | | No. of Questions | Marks | No. of Questions | Marks | No. of Questions | Marks | No. of Questions | Marks | No. of Questions | Marks | No. of Questions | Marks | | | | | | | | | | | | | |
| 1 | Physical chemistry | 48 | | | | | | | | | | | | | 28 | | | | | | | | | | | | |
| 2 | Inorganic chemistry | 35 | 2 | 2 | 2 | 10 | 5 | 5 | 1 | 5 | 1 | 8 | 3 | 3 | 2 | 10 | 1 | 8 | 1 | 1 | 3 | 15 | 1 | 8 | 18 | | |
| 3 | Organic chemistry | 30 | | | | | | | | | | | | | | | | | | | | | | | | | 9 |
| 4 | Applied chemistry | 15 | | | | | | | | | | | | | | | | | | | | | | | | | 24 |
| Total | | 128 | 12 | | 18 | | | | 21 | | | 24 | | | 75 | | | | | | | | | | | | |

Item format plan

| Score per item | Total item | Total score | Time |
|----------------|------------|-------------|------------|
| 11 | 11 | 11 | 25 minutes |

Item format plan

| S.N. | Type of item | Score per item | Total item | Total score | Time |
|--------------------|---------------------------|----------------|------------|-------------|----------------|
| 1 | Multiple Choice Questions | 1 | 11 | 11 | 25 minutes |
| 2. | Short Question Answer | 5 | 8 | 40 | 155 minutes |
| 3 | Long Question Answer | 8 | 3 | 24 | |
| Grand Total | | | 22 | 75 | 3 hours |

Remarks:

- Item format in composite should be met as per the specification grid.
- Designated weightage of the units/content areas should be met.
- In the case of SAQ and LAQ, these should ensure that 1 mark will be assigned per element expected as correct response.
- The distribution of cognitive domain of questions should be nearly 15% knowledge/remembers, 25% understanding, 30% applying and 30% higher ability level. Higher ability includes analyzing, evaluating and creating level.
- SAQ and LAQ can be structured (have two or more sub-items). SAQ and LAQ can be distributed to two or more cognitive behaviors.
- In such case these will be added to their respective cognitive behavior. In sum the distribution of cognitive behavior should be approximately to the required distribution. In the case of SAQ there will be 2 "OR" questions and in the case of LAQ there will be 1 "OR" question.

NEB Grade XI (Class 11)
Chemistry (New Course)
Model Question Paper 2077/78

Grade XI

Subject Code : Che. 301

Time : 3 hours

Attempt all questions

Subject: Chemistry (Theory)

Full marks: 75

Group 'A'

Circle the best alternative to the following questions.

(11×1 = 11)

- How many atoms are there in two molecules of water?
 - 3
 - 4
 - 5
 - 6
- What is the number of moles of ammonia gas formed when 0.5 mole of nitrogen gas is reacted with excess of hydrogen gas?
 - 0.5
 - 1
 - 2
 - 3
- Which of the following bonding is responsible for the solubility of ammonia gas in water?
 - Hydrogen bonding
 - Ionic bonding
 - Covalent bonding
 - Van der Waals' force
- What happens when Sulphur dioxide (SO_2) gas is passed through an acidified solution of hydrogen sulfide (H_2S) gas?
 - SO_2 is oxidized to Sulphur
 - H_2S is reduced to Sulphur
 - SO_2 is oxidized to H_2SO_4
 - SO_2 is reduced to Sulphur

5. Which chemical
a. Is
b. Is
c. A
d. Is
6. SO_3 gas
by con
oxygen

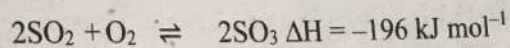
Which
a. I
b. I
c. I
d. I
7. Which
Group
a. I
b. C
c. I
d. I

8. Which
a. I
b. C
c. I
d. I
9. Sodium
a.
b.
c.

5. Which of the following property of crystalline substance describes the similar chemical composition?

- a. Isotopism
- b. Isotopism
- c. Allotropism
- d. Isomorphism

6. SO_3 gas is formed as an intermediate during the manufacture of Sulphuric acid by contact process. The formation of Sulphur trioxide from sulfur dioxide and oxygen is reversible.



Which conditions of pressure and temperature favor the reverse reaction?

- a. High pressure and high temperature
 - b. High pressure and low temperature
 - c. Low pressure and high temperature
 - d. Low pressure and low temperature
7. Which is the correct order of ease of carbon dioxide production by heating the Group II metal carbonates?
- a. $\text{MgCO}_3 > \text{BeCO}_3 > \text{CaCO}_3 > \text{RaCO}_3$
 - b. $\text{CaCO}_3 > \text{MgCO}_3 > \text{BeCO}_3 > \text{RaCO}_3$
 - c. $\text{BeCO}_3 > \text{MgCO}_3 > \text{CaCO}_3 > \text{BaCO}_3$
 - d. $\text{BeCO}_3 < \text{MgCO}_3 < \text{CaCO}_3 < \text{RaCO}_3$
8. Which of the following is related to Batch process?
- a. Requires high- cost equipment
 - b. Can -not be controlled easily
 - c. Generally available in fully automated plant
 - d. Involves sequence of steps followed in specific order
9. Sodium-glucose pump is an example of
- a. Primary active transport protein
 - b. Secondary active transport protein
 - c. Primary passive transport protein

d. Secondary passive transport protein

10. An intermediate compound X is formed during the production of urea through ammonia/carbon dioxide technology. What is the molecular formula of X?

- a. $\text{NH}_2\text{COONH}_2$
- b. $\text{NH}_2\text{COONH}_4$
- c. $\text{NH}_4\text{COONH}_2$
- d. $\text{NH}_4\text{COONH}_4$

11. Which of the following are recycled in the manufacture of sodium carbonate by Solvay's process?

- a. CO_2 and NH_4Cl
- b. CO_2 and NH_3
- c. NaCl and CaO
- d. NaCl and NH_3

Group 'B'

Give short answer to the following questions.

(8 × 5=40)

1. An element X has 2 electrons in K shell, 8 electrons in L shell and 5 electrons in M shell.

- i. Identify the element X and write the number of protons and electrons in it. [3]
- ii. Size of X^{2-} ion is greater than that of X atom though both contain the same number of protons. Give reason [1]
- iii. Write down the formula of one of the compounds of X where X is in -3 oxidation state. [1]

OR

Know-how about ionization energy (IE) of elements is crucial aspect in the study of chemical bonding whether they form ionic or covalent bond. The first ionization energies of period second elements are given below

| | | | | | | | | | |
|---------------------------|--|--|--|--|--|--|--|--|--|
| of elements | | | | | | | | | |
| ionization energy(kJ/mol) | | | | | | | | | |

- i. Define first ionization energy. [1]
 - ii. Name a factor that affects the value of IE. [1]
 - iii. Which of the element is most difficult to ionize? [1]
 - iv. Why is there steep rise in IE from carbon to nitrogen? [2]
2. When electricity is passed through the molten NaCl in the presence of CaCl₂ in the ratio of 2:3 by weight using graphite anode and iron cathode as electrodes, sodium metal is deposited at cathode and chlorine gas is liberated at anode in the electrolytic cell

- i. Define electrolytic cell. [1]
 - ii. Find the mass of sodium metal deposited at cathode when 0.1 ampere of current is passed for half an hour and the process has 75% efficiency. [2]
 - iii. Why does calcium metal not deposit instead of sodium at the cathode? [1]
 - iv. Aqueous solution of sodium chloride cannot be instead of molten sodium chloride for the same intended product? Give reason. [1]
3. Derive the relationship between K_p and K_c . Give one example of chemical reaction where K_p is greater than K_c [4+1]

OR

Derive the ideal gas equation $PV=nRT$ where the symbols have their usual meaning. State two conditions under which behavior of real gas approaches that of an ideal gas. [3+2]

4. Concentrated sulphuric acid can be used in the laboratory to produce hydrogen chloride gas by the reaction with solid sodium chloride.
- i. Hydrogen iodide is not produced by the same method as for hydrogen chloride. Why? [1]
 - ii. What is the difference between hydrogen chloride gas and hydrochloric acid? [2]
 - iii. How could you identify the bottle containing HCl using ammonia gas? [2]
5. Depending upon the nature of minerals present in the ores, calcination and roasting are mainly used for the conversion of ores into their respective oxides.
- i. What do you mean by roasting and calcination in the metallurgical process? [2]

- ii. Name the vessel in which roasting is carried out [1]
- iii. Write the name of two possible impurities that are removed in the roasting [2]

6. One of the examples of homologous series is given below.

| |
|---|
| H |
| H ₂ OH |
| X |
| H ₂ CH ₂ CH ₂ OH |

- i. Define homologous series. [1]
 - ii. Find the mass difference between successive member of above homologous series and calculate the molecular mass of X [2]
 - iii. What is the reason behind the highest boiling point but least solubility of the fourth member in the given series? [2]
7. An unsaturated hydrocarbon **B** upon treatment with Hydrogen bromide produces compound **C**. Compound **C** reacts with sodium metal in the presence of organic ether produces compound **D** of molecular formula C₆H₁₄.
- i. Give the chemical equations for the conversion of compound **B** to compound **C** and compound **C** to compound **D** [2]
 - ii. Write down the IUPAC name of compound **C** and **D** [2]
 - iii. Give the structural formula of positional isomer of compound **C** [1]
8. Urea is a very much demanded chemical fertilizer in agricultural country like Nepal because of the lack of domestic production. One of the raw materials for urea production is ammonia which is obtained from Haber's process.
- i. Draw a flow sheet diagram for the manufacture of Ammonia by Haber's-Bosch Process [3]
 - ii. What is the major challenge in establishing chemical industries in the countries like Nepal? Mention how such challenge can be strategically overcome? [2]

Give long answer
9. In the presence of reaction is

- i. Calculate the amount of ammonia
- ii. What is the reason for the excess
- iii. If 2 moles of excess
- iv. Calculate the amount of ammonia which is

10. Oxygen is combined with other elements



- i. Identify the compound from
- ii. Write the name of ammonia
- iii. Why is ammonia
- iv. Write the chemical equation

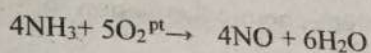
Sulfuric acid is used in the world. Over the world, sulfuric acid is

- i. Write the chemical equation for the preparation of sulphuric acid
- ii. Give the name of the precipitate

Group 'C'

Give long answer to the following questions (3 × 8 = 24)

9. In the presence of platinum catalyst ammonia is oxidized to nitric oxide. The reaction is given below.



- Calculate the mass of Nitric oxide produced by the reaction of 2 mole of ammonia with 2 moles of oxygen. [2]
 - What is the importance of limiting reactant in chemical calculation? [1]
 - If 2 moles of ammonia produce 50 grams of water upon reaction with excess of ammonia. what is the percentage yield of the reaction? [2]
 - Calculate the volume of HCl gas required at 20°C and 750mm Hg pressure which can completely react with 2 mole of ammonia gas to produce ammonium chloride [3]
10. Oxygen is the third most abundant element by mass which readily forms oxides with other elements. Some of the oxides are given below

| | | | | | |
|-------------------|--------------------------------|----|-----------------|--------------------------------|-------------------------------|
| Na ₂ O | Al ₂ O ₃ | CO | SO ₂ | Fe ₃ O ₄ | H ₂ O ₂ |
|-------------------|--------------------------------|----|-----------------|--------------------------------|-------------------------------|

- Identify the acidic oxide, basic oxide, neutral oxide and mixed oxide from the above table [4]
- Write two chemical equation to prove that the particular oxide is amphoteric in nature. [2]
- Why is CO a harmful gas? [1]
- Write any one industrial applications of oxygen gas. [1]

OR

Sulfuric acid is one of the largest volumes of industrial chemical produced in the world. Over the last decades the contact process has been used to produce sulfuric acid, replacing the traditional (Lead Chamber) process.

- Write the four steps of chemical equation for the manufacturing of sulphuric acid by contact process starting from iron sulfide. [4]
- Give any two chemical equations in which sulphuric acid acts as precipitant and dehydrating agent. [2]

- iii. Write the chemical equation producing fertilizer using H_2SO_4 [1]
- iv. Why does H_2SO_4 always act as an oxidizing agent? [1]
11. An alkene X undergoes ozonolysis and gives two compounds Y and Z of molecular formula $\text{C}_3\text{H}_6\text{O}$. Y and Z are functional isomers of each other
- Write the two-steps chemical equation for the conversion of X into Y and Z. [2]
 - Write the structural formula of Y and Z. Why are they called functional isomers? [3]
 - What happens when hydrogen gas in the presence of nickel catalyst is passed over X? [1]
 - What is the application of ozonolysis in the organic reaction mechanism? [1]
 - How can you prove chemically the compound X is unsaturated? [1]

End

HISSAN
Class : XI
Time : 3hrs
Attempts all c

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a. lov
b. lov
c. hi
d. hi
- Zinc
com
a. N
- Oxa
a. F
c. S
- WH
me

HISSAN CENTRAL EXAMINATION - 2080 (2023)

Class : XI

Time : 3hrs

CHEMISTRY (3021 A)

F.M: 75

Attempts all questions.

GROUP A

Write the correct option in your answer sheet.

[11 × 1 = 11]

1. A compound was found to contain nitrogen and oxygen in the ratio 28 g and 80 g respectively. Then the formula of compound is
a. NO b. N_2O_3 c. N_2O_5 d. N_2O_4
2. Shape of orbital is given by:
a. Principal quantum number b. Azimuthal quantum number
c. Magnetic quantum number d. Spin quantum number
3. Electrons of an atom can be removed by supplying energy. This energy is ionization potential. Among the following elements which one has the highest second ionization potential?
a. Nitrogen b. Oxygen c. Carbon d. Fluorine
4. On passing 3F of electricity through the three electrolytic cells connected in series containing A^+ , B^{++} and C^{+++} respectively. The equivalent weight of B is
a. $M/3$ b. $M/2$ c. M d. 2M
5. Most favorable condition for the formation of electrovalent compounds are
a. low charge of ions, large cation and small anion
b. low charge of ions, small cation and large cation
c. high charge of ions, small cation and small anion
d. high charge of ions, large cation and large anion
6. Zinc reacts with very dilute HNO_3 to give zinc nitrate and other compound is
a. NO_2 b. NH_4NO_3 c. NO d. O_2
7. Oxalic acid when heated with conc. H_2SO_4 gives out
a. H_2O and CO_2 b. CO and CO_2
c. SO_2 and CO_2 d. CO and SO_2
8. When limestone ore is heated, CO_2 is given off. This operation in metallurgy is known as
a. Smelting b. Calcination
c. Roasting d. Poling

9. Which of the following oxides react with HCl and NaOH?

- a. CaO b. ZnO c. N_2O_5 d. CO_2

10. Minamata diseases caused by toxicity of metal.

- a. As b. Hg c. Pb d. Cd

11. Batch process is used to manufacture.

- a. cosmetics b. petrol c. cement d. diesel

GROUP B

[8 × 5 = 40]

12. To detect the foreign elements like N, S, X present in an organic compound, the organic compound is fused with sodium to make sodium extract by plunging in distilled water.

i. Why is it necessary to make sodium extract to detect the foreign element? [2]

ii. How would you identify the presence of N in the organic compound? [3]

13. i. Define homologous series. [1]

ii. Give any two important characteristics of homologous series. [2]

iii. Draw structure formula of first member of ketone and its IUPAC name. What is its functional isomer? [1+1]

14. i. State Boyle's law. [1]

ii. Derive the relation $P_1V_1 = P_2V_2$ [1]

iii. Draw a plot of volumes of a gas against changing pressure at constant temperature. [1]

iv. A fire extinguisher of capacity 5 litres contains 5 kg of CO_2 gas. What volume of the gas will the extinguisher deliver to extinguish fire at STP? [2]

15. Rutherford performed a α -ray scattering experiment in order to explain the sub-atomic particles in an atom.

i. What observations in the scattering experiment led Rutherford to make the following conclusions. [1]

a. A nucleus is positively charged. [1]

b. The whole mass of an atom is concentrated at the centre of the nucleus. [1]

c. Most of the space in an atom is empty. [1]

ii. How would you point out the limitation of Rutherford atomic model? [2]

i. Justify w
simultane

ii. Balance t
ion electro

16. You are given
configuration i

i. What type
molecular s

ii. Draw Lewi

iii. Mention an

a. Give reason

i. Na^+ and
 Na^+ is g

ii. Alkali m

b. Summarize t

17. a. Write chemical

b. What is the act

c. How would yo
solution?

18. i. What is meant

ii. Give two chem
reducing agent

iii. Distinguish bet

19. Carbon monoxide i
place in insufficien

a. Write the che
monoxide.

b. What happens v

i. Nickel and

ii. NaOH

iii. Why is CO

OR

- i. Justify with an example that oxidation and reduction is simultaneous process. [2]
 - ii. Balance the following redox-reaction by oxidation number or ion electron method. $\text{HNO}_3 + \text{H}_2\text{S} \rightarrow \text{NO}_2 + \text{S} + \text{H}_2\text{O}$ [3]
16. You are given to two elements P and Q where outermost electronic configuration is $3s^2$ and $3s^2 3p^5$ respectively.
- i. What type of compound is formed between P and Q. Write its molecular structure? [2]
 - ii. Draw Lewis structure of the compound. [1]
 - iii. Mention any two important properties of the compound. [2]

OR

- a. Give reason
 - i. Na^+ and Mg^{++} contain same number of electron but size of Na^+ is greater than Mg^{++} . [2]
 - ii. Alkali metals have low ionization energy. [1]
 - b. Summarize the factors that affect on electron affinity. [2]
17. a. Write chemical reaction for the preparation of Cl_2 in laboratory. [2]
b. What is the action of chlorine on NaOH ? [2]
c. How would you test the presence of chloride ion in aqueous solution? [1]
18. i. What is meant by nascent hydrogen? [1]
ii. Give two chemical reactions to show nascent hydrogen is strong reducing agent than molecular hydrogen. [2]
iii. Distinguish between ortho and para hydrogen. [2]
19. Carbon monoxide is present in chimney gas when combustion takes place in insufficient supply of air.
- a. Write the chemical reaction for the preparation of carbon monoxide. [1]
 - b. What happens when carbon monoxide is treated with
 - i. Nickel and [2]
 - ii. NaOH [2]
 - iii. Why is CO gas harmful? [2]

HISSAN CENTRAL EXAMINATION - 2079 (2022)

Grade: XI

F.M.: 75

Time : 3 hrs

CHEMISTRY

Attempt ALL questions.

Group 'A'

Circle the best alternative to the following questions. [11 × 1 = 11]

- Number of electrons present in CO_2 is
a. 22 b. 44 c. 11 d. 24
- The unit of the universal gas constant is
a. Joule atom mol^{-1} degree b. Cal degree $^{-1}$ mol^{-1}
c. Joule mol^{-1} d. Cal meter degree $^{-1}$ mol^{-1}
- The internal resistance to the flow of liquid is
a. Surface tension b. Specific resistance
c. Surface energy d. Viscosity
- The oxidation number of Na is zero in
a. Sodium amalgam b. Soda ash
c. Soda lime d. Washing soda
- Which is correct? The atomic size of
a. $\text{Na} > \text{K} > \text{Mg}$ b. $\text{K} > \text{Mg} > \text{Na}$
c. $\text{K} > \text{Na} > \text{Mg}$ d. $\text{Mg} > \text{Na} > \text{K}$
- How many neutrons are there in tritium?
a. 0 b. 1 c. 3 d. 2
- The function of the sodium-glucose pump is
a. digest glucose
b. the balance glucose level in blood
c. transfer glucose inside the cell
d. transfer glucose in the outside cell
- Which of the following compounds is assigned the octane number of zero?
a. *iso*-Octane b. *n*-Octane c. *n*-Heptane d. *n*-Nonane
- The formation of violet/purple colour on the addition of sodium nitroprusside in sodium extract shows the presence of
a. Nitrogen b. Sulphur
c. Halogens d. Both nitrogen and sulphur
- Benzene is a homopolymer of
a. Ethyne b. Ethene c. Ethane d. Hexane

11. The correct molecular formula of soda ash in
 a. NaHCO_3 b. $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$
 c. Na_2CO_3 d. NaOH

Attempts all questions.

Short questions:

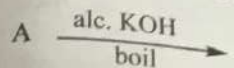
[8 × 5 = 40]

1. 17 g of ammonia is reacted with 45 g of oxygen to produce NO and H_2O
- Which one is limiting reagent and why? [2]
 - Calculate the number of moles of unreacted reagent left over. [1]
 - What volume of NO are produced at NTP? [1]
 - Calculate the mass of water produced? [1]

OR

- Hydrogen bond is a specific type of dipole-dipole attraction. Many chemists categorize hydrogen bonds as vanderwaal's force of attraction.
 - Define hydrogen bond. [1]
 - Distinguish between intermolecular hydrogen bonds and intramolecular hydrogen bonds with an example of each. [2]
 - Write the Lewis dot structure of
 - MgCl_2
 - NaNO_3 [1+1]
2. What is meant by redox reaction? Balance the following equation by oxidation number method. [1+4]
- $$\text{KMnO}_4 + \text{Na}_2\text{O}_2 + \text{Na}_2\text{SO}_4 \longrightarrow \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{Na}_2\text{SO}_4 + \text{H}_2\text{O} + \text{O}_2$$
3. The le-Chatelier principle is applied for gaseous equilibrium to explain the effect of concentration, temperature and pressure on it.
- State Le-Chatelier principle.
 - How does the change in temperature and pressure affect the following reaction [1+2+2]
- $$\text{N}_2(\text{g}) + \text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g}) + 22.4 \text{ kcal}$$
4. Oxygen is the third most abundant element by mass which readily forms oxides with other elements. Some of the oxides are given below.
- CO_2 ZNO Na_2O_2 Fe_3O_4
- What are oxides? [1]
 - Classify the above-given oxides. [4]
5. a. HCl , HBr and HI are known as halogen acid.
- Write the chemical reaction for the preparation of HBr ? [1]
 - Why it can't be prepared by heating NaBr with conc. H_2SO_4 ? [2]

- b. Write down the
 6. Complete the follow



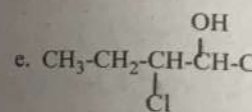
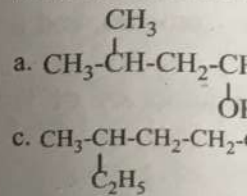
Where A is vicinal with molecular for

7. The systematic a functional groups
 a. Define function
 b. Write the third acid.

c. Write the func the IUPAC nan

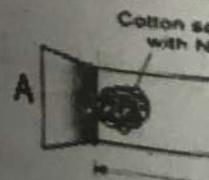
d. Write any one i

8. Write the IUPAC n

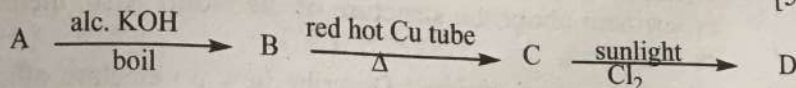


Answer the following

9. On the given exper
 a. Which gas law
 b. State the law.
 c. Why does a w
 d. Write any one
 e. If the length of

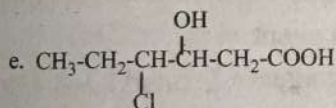
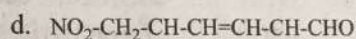
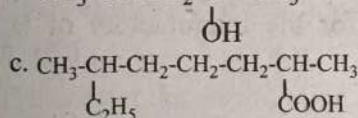
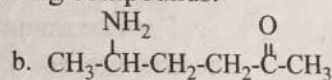
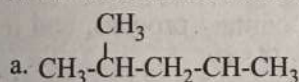


- b. Write down the ring test for NO_3^- . [2]
 6. Complete the following reaction. [5]



Where A is vicinal di haloalkane and D is used as an insecticide with molecular formula $\text{C}_6\text{H}_6\text{Cl}_6$.

7. The systematic arrangement of compounds containing similar functional groups gives homologous series.
- Define functional group. [1]
 - Write the third member of the homologous series of carboxylic acid. [1]
 - Write the functional isomers of the above carboxylic acid and the IUPAC name. [2]
 - Write any one important characteristics of homologous series. [1]
8. Write the IUPAC name of the following compounds. [5]

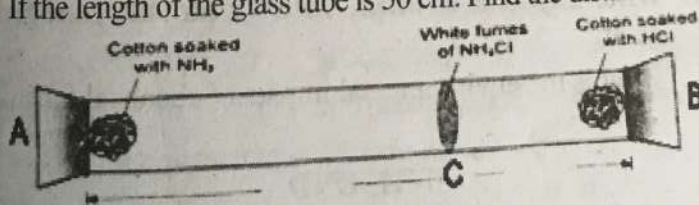


GROUP C

Answer the following questions:

[8 × 3 = 24]

9. On the given experiment:
- Which gas law is demonstrated by the above experiment? [1]
 - State the law. [2]
 - Why does a white ring of NH_4Cl form near the HCl end? [1]
 - Write any one application of this gas law. [1]
 - If the length of the glass tube is 50 cm. Find the distance of AC. [3]



OR

- a. What are the conclusions made by Rutherford from his α -ray experiment about the structure of the atom? Also, mention its limitation. [4+1]
- b. What is electron affinity? Describe how do electron affinity vary in the group? Arrange the order of electron affinity of Br, F, Cl, I. [1+1+1]
10. a. What is the carbon reduction process? Write the role of acidic and basic flux in the metallurgical process and give a suitable reaction. [1+2]
- b. Caustic soda is one of the most widely used chemicals in laboratories and industries. It is also known as lye.
- Write the molecular formula of caustic soda. [1]
 - Why it is called lye? [1]
 - How does it react with white phosphorous? [2]
 - What happens when it is treated with FeCl_3 solution? [1]
11. Sulphuric acid can be manufactured by contact process, and it is a modern industrial process for producing H_2SO_4 .
- Write the chemical reaction for the manufacture of H_2SO_4 starting from iron pyrites. [3]
 - Why it is called oil of vitriol? [1]
 - Give the chemical reaction to show. [1+1+1]
 - H_2SO_4 as dehydrating agent
 - H_2SO_4 is precipitating agent
 - H_2SO_4 as an oxidizing agent
 - How is sulphuric acid diluted? [1]

OR

Urea is common chemical fertilizer which provides nitrogen for plants. Urea is manufactured in industries by using ammonia and carbon dioxide.

- Write two steps of chemical reaction for the manufacture of urea. Draw the flow sheet diagram for the manufacture of urea. [2+3]
- Write any one fertilizer used to provide nitrogen to the plant. [1]
 - What is the environmental impact of chemical fertilizer? [2]

THE END

Grade: XI

Time : 3 hrs

Attempt ALL questions.

Circle the best alternative to the

- Balance the following equation
 $\text{NH}_3 + \text{O}_2 \rightarrow \text{NO}_2 + \text{H}_2\text{O}$ The stoichiometric coefficients are
a. 1 b. 4
- Calcium carbide, CaC_2 , is a common material in various industries producing synthetic gas. It is produced by heating calcium oxide with carbon.
 $\text{CaO} + 3\text{C} \rightarrow \text{CaC}_2 + \text{CO}$
What is the amount of calcium carbide produced by the reaction of excess calcium oxide with 100% efficiency of reaction?
a. 18.1 g b. 28.4 g
- The correct dot formulation for NCl_3 is
a. 3 N-Cl bonds and 10 lone pairs
b. 3 N=Cl bonds and 6 lone pairs
c. 1 N-Cl bond, 2 N=Cl bonds and 4 lone pairs
d. 2 N-Cl bonds, 1 N=Cl bond and 4 lone pairs
- A sample of hydrogen gas occupies 30.0 mL at 24°C and 736 torr. What volume will it occupy if it is cooled, dried and at STP? The vapor pressure of water at 24°C is 22.4 torr.
a. 32.4 mL b. 21.6 mL
- Sulphur dioxide is added to food products to prevent rancidity.
a. Oxidation of fats only
b. Reduction of sugar
c. Reduction of fats only
d. Oxidation of sugar
- Alkali metals dissolving in water. The blue color of the solution is due to the formation of
a. ions
b. hydroxide ions
c. metalcations and electrons
d. metal anions

SET - 1

Grade: XI

Time : 3 hrs

F.M.: 75

CHEMISTRY

Attempt ALL questions.

Group 'A'

Circle the best alternative to the following questions. [11 × 1 = 11]

1. Balance the following equation using minimum integral coefficients:
 $\text{NH}_3 + \text{O}_2 \rightarrow \text{NO}_2 + \text{H}_2\text{O}$ The stoichiometric coefficient for oxygen gas O_2 is:
a. 1 b. 4 c. 3 d. 7
2. Calcium carbide, CaC_2 , is an important preliminary chemical for industries producing synthetic fabrics and plastics. CaC_2 may be produced by heating calcium oxide with coke:
 $\text{CaO} + 3\text{C} \rightarrow \text{CaC}_2 + \text{CO}$
What is the amount of CaC_2 which can be produced from the reaction of excess calcium oxide and 10.2 g of carbon? (Assume 100% efficiency of reaction for purposes of this problem.)
a. 18.1 g b. 28.4 g c. 20.8 g d. 19.8 g
3. The correct dot formulation for nitrogen trichloride has:
a. 3 N-Cl bonds and 10 lone pairs of electrons.
b. 3 N=Cl bonds and 6 lone pairs of electrons.
c. 1 N-Cl bond, 2 N=Cl bonds and 7 lone pairs of electrons.
d. 2 N-Cl bonds, 1 N=Cl bond and 8 lone pairs of electrons.
4. A sample of hydrogen gas collected by displacement of water occupied 30.0 mL at 24°C on a day when the barometric pressure was 736 torr. What volume would the hydrogen occupy if it were dry and at STP? The vapor pressure of water at 24.0°C is 22.4 torr.
a. 32.4 mL b. 21.6 mL c. 36.8 mL d. 25.9 mL
5. Sulphur dioxide is added to foods to stop
a. Oxidation of fats only b. Over ripening only
c. Reduction of sugar d. Oxidation of fats and over ripening
6. Alkali metals dissolving in Ammonia liquid give the blue solution, this is due to the formation of ammoniated.....
a. ions b. metal cations only
c. metalcations and electrons d. electrons only

7. Which of the following compounds is a functional group isomer of C_2H_5OH , ethanol (ethyl alcohol)?
- a. ethanal, CH_3CHO b. acetic acid, CH_3COOH
 c. diethyl ether, $(C_2H_5)_2O$ d. dimethyl ether, $(CH_3)_2O$
8. Which of the following is used to reduce phenol vapours to benzene?
- a. Hydrogen gas b. Oleum
 c. Zinc dust d. Anhydrous $AlCl_3$
9. The organic compound..... is obtained by the electrolysis of Maleic anhydride.
- a. Ethane b. Ethene
 c. Ethyne d. Ethanol
10. The molecular formula of Bleaching powder is
- a. CaO_2Cl_2 b. $CaOCl_2$
 c. CaO_2Cl d. $CaOCl$
11. The mode of hybridization of C_2H_2 is
- a. sp^2 b. sp^3 c. sp d. sp^3d

Group 'B'

Give short answer to the following questions. [8 × 5 = 40]

1. An organic compound (A) is obtained by the treatment of calcium carbide with water and it is unsaturated hydrocarbon.
- a. Convert compound (A) into butane. [2]
 b. What happens when compound (A) is passed through red hot copper tube at $400^\circ C$? [1]
 c. How can you prepare compound (A) from Kolbe's electrolysis? [2]
2. An inorganic compound (X) is prepared by heating slaked lime with ammonium chloride and having molecular mass 17 amu. It has pungent smell.
- a. How can you manufacture compound (X) by Haber's process? Write reaction with proper condition. [2]
 b. What happens when compound (X) is passed through a paper wetted with mercurous nitrate solution? [2]
 c. Write a reaction which show compound (X) is reducing agent. [1]
3. An Element (E) has two electron in K shell, 8 electron in L shell and 2 electron in M shell.
- a. Write the electronic configuration of element (E). [1]

- b. What happens when (E) is heated?
 c. Compare the size of E-ion and F-ion.
 d. Write the name and formula of the compound and it is used as relieve pain.
- a. Why are vegetables cooked before eating?
 b. What type of graph do we draw for the reaction of P? What is shown by this graph?
 c. Both propane (C_3H_8) and ethane (C_2H_6) burn at the same rate under identical conditions.
4. Sodium and sodium hydroxide are produced by electrolytic processes.
- i. Name the electrolyte used in the electrolysis of sodium hydroxide.
 ii. What is produced at the cathode during the manufacture of sodium metal? Write the half-cell reaction. Product: ?
 iii. Give one use of each substance.
5. A mineral acid (Y) is also called as 'king of acids'. Its molecular mass is 98 amu. It is diprotic acid and has strong oxidizing property.
- i. Write an equation to show the preparation of acid (Y) from its salt.
 ii. What are the proper conditions for the manufacture of acid (Y) from its salt?
 iii. Give one large scale use of acid (Y).
6. In Nepal, fairly good amount of silver and copper have been reported. Nepal has abundant amount of metals if their proper extraction is done.
- i. Write the molecular formula of silver and copper.
 ii. What is meant by flux and slag? Write the chemical reaction for the formation of slag.
 iii. Which type of metal is silver and copper?
- Ammonia is manufactured by Haber Process.
- $$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$
- i. What is meant by the following terms?

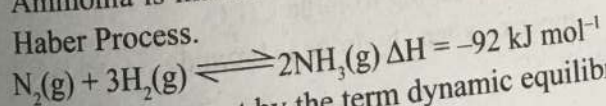
- b. What happens when (E) is heated with concentrated nitric acid? [2]
 c. Compare the size of E-ion and E-atom with proper reason. [1]
 d. Write the name and formula of salt which is prepared from (E) and it is used to relieve pain at shoulder, neck, skull. [2]

OR

- a. Why are vegetables cooked with difficulty at a hill station? [1]
 b. What type of graph do we get when we plot a graph PV against P? What is shown by this graph? [2]
 c. Both propane (C_3H_8) and carbon dioxide (CO_2) diffuse at the same rate under identical conditions of temperature and pressure. Why? [2]
4. Sodium and sodium hydroxide are both manufactured by electrolytic processes.
- Name the electrolyte used in the manufacture of sodium hydroxide. [1]
 - What is produced at the anode and cathode during the manufacture of sodium hydroxide? Write an equation for its formation. Product: ? Equation: ? [3]
 - Give one use of each sodium and sodium hydroxide. [1]
5. A mineral acid (Y) is also called oil of vitriol and it has molecular weight 98 amu. It is diprotic acid and gives hydrogen gas with zinc metal.
- Write an equation to show the dehydrating nature of (Y) [1]
 - What are the proper reaction and proper condition for the manufacture of acid (Y)? [3]
 - Give one large scale use of acid (Y). [1]
6. In Nepal, fairly good amounts of different types of minerals have been reported. Nepal may become a major supplier of these metals if their proper execution is made.
- Write the molecular formula of two important ore of metal. [2]
 - What is meant by flux and slag? Write one example of ferrous alloy. [2]
 - Which type of metal can be purified by electrolytic method? [1]

OR

Ammonia is manufactured from hydrogen and nitrogen in the Haber Process.



- i. What is meant by the term dynamic equilibrium? [1]

- ii. What is the effect of concentration, pressure and temperature in the above equilibrium reaction? [3]
- iii. Give one fertilizer with formula which is formed by ammonia. [1]
7. i. Define the term unit crystal and Efflorescent solid. [1]
- ii. The shape of ammonia is pyramidal but the shape of water is angular because both have sp^3 hybridization, give reason. [2]
- iii. Draw the Lewis structure of Na_2CO_3 and N_2O_5 . [2]
8. Electrolysis finds many applications both in experimental and industrial products.
- i. Write an example of Oxidizing and reducing agent. [1]
- ii. Calculate the oxidation number of S in $Na_2S_2O_3$ and Cr in $Cr_2(SO_4)_3$. [2]
- iii. An electric current of 100 ampere is passed through a molten liquid of sodium chloride for 5 hours. Calculate the volume of chlorine gas liberated at the electrode at NTP. [2]

Group 'C'

Give long answer to the following equations. [3 × 8 = 24]

9. Complete the following table [1]

| Element | State at Room temperature |
|----------|---------------------------|
| Chlorine | Gas |
| Bromine | |
| Iodine | |

- i. Describe the chemical test for chloride and bromide ion in the given inorganic salt sample. [2]
- ii. Can HCl and HBr gas prepare by the same method? If not why? [2]
- iii. What happens when chlorine gas passed through the carbon monoxide gas? [1]
- iv. What is effect when a bottle containing hydrogen chloride gas is kept near ammonia gas? [2]
10. An alkene X undergoes ozonolysis gives two compound Y having formula C_2H_4O and Z having formula CH_2O .
- i. What happens when hydrogen bromide is added to the compound X? [2]

- ii. How can you prepare compound X from 1-chloropropane? [1]
iii. How can you prove chemically the compound X is unsaturated? [1]
iv. Convert compound Y into ethane. [2]
v. How can you prepare ethene from Kolbe's electrolysis? [2]

OR

Draw the shape of each of the following molecules and mark on the diagram a value for the bond angle in each case. [3]

- i. CH_4 ii. C_2H_4 iii. BeCl_2

Nitrogen and phosphorus are in the same group of the Periodic Table. Phosphorus and hydrogen form the compound phosphine, PH_3 , and nitrogen and hydrogen form ammonia, NH_3 .

- i. State the number of bond pairs and lone pairs of electrons in a molecule of phosphine and ammonia.
Bond pairs of electrons? Lone pairs of electrons? [3]
ii. Explain why the boiling temperature of phosphine is lower than that for ammonia. [2]
11. A student carries out a titration to find the concentration of some hydrochloric acid. 20 g of 40% pure CaCO_3 if reacted with 5g of HCl to produce CaCl_2 , H_2O and CO_2 .
- i. Find which one is limiting reactant and why? [2]
ii. Calculate mass of CaCl_2 formed. [1]
iii. How many number of water molecules are produced? [2]
iv. Calculate the volume of CO_2 produced at 27°C and 0.5 atm pressure. [2]
v. Calculate the mass of CO_2 evolved. [1]

SET - 2

Grade: XI

Time : 3 hrs

Attempt ALL questions.

CHEMISTRY

F.M.: 75

Group 'A'

Circle the best alternative to the following questions. [11 × 1 = 11]

1. What is the total number of electrons in the correct Lewis dot formula of the sulphite ion?
a. 8 b. 24 c. 26 d. 30
2. Calculate the mass of hydrogen formed when 25 grams of aluminum reacts with excess hydrochloric acid.
 $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$
a. 0.41 g b. 1.2 g c. 1.8 g d. 2.8 g
3. Which of the following set belongs to same period?
a. Li, Na, K b. Li, Mg, Ca
c. Cu, Ni, Zn d. F, Cl, Br
4. Which of the following is slag?
a. CaSiO_3 b. CaO c. SiO_2 d. Both b & c
5. The weight of quick lime obtained by strongly heating 25 g of marble is
a. 14 g b. 28 g c. 42 g d. 56 g
6. The solubility order of metal hydroxide in group II is increasing toward.....
a. Group b. Period c. Both a & b d. None of the above
7. The compound having a dipole moment is
a. CO_2 b. CCl_4 c. C_6H_6 d. H_2O
8. The sodium metal is extracted from.....
a. Aqueous NaCl b. Molten NaCl
c. Brine solution d. Alkaline NaCl
9. Which has highest percentage of nitrogen?
a. Urea b. CAN
c. Ammonium nitrate d. Calcium nitrate
10. Which of following can exhibit cis-trans isomerism?
a. $\text{HC}\equiv\text{CH}$ b. $\text{ClCH}=\text{CHCl}$
c. $\text{CH}_3\text{CHClCOOH}$ d. $\text{ClCH}_2-\text{CH}_2\text{Cl}$
11. Benzene cannot undergo
a. Substitution b. Addition c. Elimination d. Oxidation

Give short answer to the following questions.

1. The homologous series of alkanes.
 - i. Write two characteristics.
 - ii. Find the member X of the series whose molecular mass is 58.
 - iii. What happens when ethane reacts with oxygen?

A metal (M) lies in the 3rd period and has an atomic number 23 amu. It is silver.

- i. Write the reaction of metal with oxygen.
 - ii. The metal hydroxide MOH is treated with dilute HCl. Write the reaction.
 - iii. What product would be formed when metal is treated with copper sulfate solution?
2. i. Write four postulates of Dalton's atomic theory.
ii. Write two applications of Dalton's atomic theory.
iii. 0.23g of volatile liquid vaporizes at 100°C and 1 atm pressure. Calculate the molecular mass of the liquid.
 3. Complete the table to show the number of protons and neutrons in the sulfur atom.

| Symbol | Number of electrons |
|----------------------------|---------------------|
| $^{34}_{16}\text{S}$ | |
| $^{63}_{29}\text{Cu}^{2+}$ | |

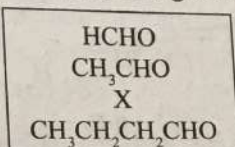
- i. State modern periodic law.
- ii. Why does the first ionization energy increase across a given period of the periodic table?

Group 'B'

Give short answer to the following questions.

[8 × 5 = 40]

1. The homologous series of aldehyde is given below



- Write two character of homologous series. [1]
- Find the member X in the series of compound and calculate the molecular mass. [2]
- What happens when X is reduced with Zn-Hg and hydrochloric acid? [2]

OR

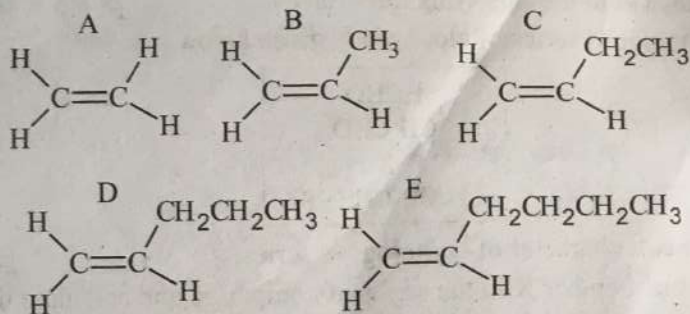
A metal (M) lies in the 1st group of periodic table which having mass number 23 amu. It is silvery white and very soft metal.

- Write the reaction of (M) with ammonia. [1]
 - The metal hydroxide of (M) is MOH. What happens when MOH is treated with carbon dioxide gas? [2]
 - What product would you obtain when metal hydroxide MOH is treated with copper sulphate solution? [2]
- Write four postulates of Kinetic theory of gas. [2]
 - Write two application of Graham's law of diffusion. [1]
 - 0.23g of volatile liquid occupies 126.4 cc at 27°C and 760 mm pressure. Calculate the molecular mass of the liquid. [2]
 - Complete the table to show the number of electrons, protons and neutrons in the sulfur atom and copper ion shown. [2]

| Symbol | Number of electron | Number of proton | Number of neutron |
|--|--------------------|------------------|-------------------|
| ³⁴ ₁₆ S | | | |
| ⁶³ ₂₉ Cu ²⁺ | | 29 | |

- State modern periodic law. [1]
- Why does the first ionization energy increase from left to right in a given period of the periodic table? [2]

4. The structures of five alkenes, A, B, C, D and E, are shown.



- i. What is the molecular formula of alkene D? [1]
 - ii. State the reagent and conditions needed to produce an alcohol from alkene B. [2]
 - iii. A student added aqueous bromine to alkene C. Describe the colour change seen and draw the structure of the product. [2]
5. Washing soda is a chemical compound that can be used to remove stubborn stains from laundry and is an essential component in most homemade laundry detergent.
- i. Write a principle reaction for the manufacture of washing soda. [2]
 - ii. Draw a flow sheet diagram for the manufacture of washing soda by Solvay ammonia process. [1]
 - iii. What is the major challenge for establishing chemical industries in Nepal? Mention how such challenge can be strategically overcome? [2]
6. Chlorine also is part of salt, sodium chloride, which is one of the most widely used chemical compounds. Fluorine is used in fluorides, which are added to water supplies to prevent tooth decay.
- i. Why can't HI be prepared by the action of conc. H_2SO_4 on NaI? [2]
 - ii. A test tube contains a solution of one of the following salt: NaCl, NaBr and NaI. Describe single test that can distinguish among these salts. [2]
 - iii. Mention one use of chlorine. [1]
7. Redox reactions are used in the process of electroplating by applying a thin coating of a material on an object. It is used in the production of goldplated jewellery.

$HNO_3 + H_2S \rightarrow SO_2 + NO$

- i. Balance the redox reaction using ion-electron method.
- ii. Point out oxidant and reductant.
- iii. Write the molecular formula of the product and its oxidation state -3 and

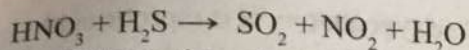
Chemical equilibrium is the state of a system present in concentrations which are constant.

- i. What are the favourable conditions for the synthesis of ammonia by Haber's process?
- ii. What is the condition for the maximum yield of ammonia?
- iii. How does the value of the equilibrium constant change with the direction of the equilibrium?

8. An inorganic compound reacts with concentrated sulphuric acid to form an oil of vitriol.
- i. What happens when this oil is mixed with a solution of potassium dichromate?
 - ii. Show the mode of hybridization of the central atom in this compound.
 - iii. Write two differences between chlorine and bromine.

Give long answer to the following questions.

9. A common and cheap reagent is used in the laboratory. The most prominent example of its use is in the balanced chemical equation: $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
- i. Which one is limiting reagent?
 - ii. How many moles of iron are produced?
 - iii. Calculate the molecular mass of iron.
 - iv. What mass of NaCl is produced?
 - v. Calculate the mass of iron produced.
10. A mineral acid (A) with a molecular mass of 100 is used in the laboratory.



- i. Balance the redox reaction by oxidation number method or ion-electron method. [2]
- ii. Point out oxidant and reductant in the above redox reaction. [1]
- iii. Write the molecular formula of compound in which (P) has oxidation state -3 and +5. [2]

OR

Chemical equilibrium is the state in which both reactants and products are present in concentrations which have no tendency to change with time.

- i. What are the favourable conditions for the manufacture of ammonia by Haber's process? [2]
 - ii. What is the condition for a gaseous reaction to have $K_p = K_c$? [1]
 - iii. How does the value of equilibrium constant (K_c) predict the direction of the equilibrium reaction? [2]
8. An inorganic compound (P) is prepared by heating copper turning with concentrated sulphuric acid. It is used in the manufacture of oil of vitriol.
- i. What happens when compound (P) is passed through acidified solution of potassium dichromate solution? [2]
 - ii. Show the mode of hybridization and shape of compound (P). [2]
 - iii. Write two difference of bleaching action of compound (P) and chlorine. [1]

Group 'C'

Give long answer to the following questions. [3 × 8 = 24]

9. A common and cheap reducing agent is carbon in the form of coke. The most prominent example is that of iron ore smelting. In the balanced chemical equation, 10g of Fe_2O_3 is reacted with 9 g of CO.
- $$\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$$
- i. Which one is limiting reagent and why? [2]
 - ii. How many moles of unreacted reactant left over? [1]
 - iii. Calculate the mole of CO consumed in the reaction. [2]
 - iv. What mass of NaOH is required to absorb whole CO_2 produced? [2]
 - v. Calculate the mass of CO_2 formed. [1]
10. A mineral acid (A) which is also known as oil of vitriol and having molecular mass 98 amu. This acid has central atom

sulphur and having four oxygen atom. It is diprotic acid.

- Write four steps of chemical reaction for the manufacture of (A) by Contact process. [2]
- Draw the flow sheet diagram for the manufacture of (A). [2]
- Write two chemical reaction in which (A) acts as dehydrating agent and precipitating agent. [2]
- How does concentrated solution of (A) react with sugar? [1]
- Give the test of sulphate ion in its aqueous solution. [1]

OR

a. In an atom the electrons occupy sub-shells in order of increasing energy.

- Complete the table below to show the order in which the next two sub-shells are filled. [1]

| | | | | | | | |
|----|----|----|----|----|----|--|--|
| 1s | 2s | 2p | 3s | 3p | 4s | | |
|----|----|----|----|----|----|--|--|

Increasing energy

- What is meant by an orbital? [1]
 - State the total number of electrons occupying the p orbitals in one chlorine atom. [1]
 - How many electrons are there in one ion of Ca^{2+} ? [1]
- b. Barium reacts with water in a redox reaction.
- $$\text{Ba(s)} + 2\text{H}_2\text{O(l)} \rightarrow \text{Ba(OH)}_2\text{(aq.)} + \text{H}_2\text{(g)}$$
- Explain, in terms of electrons, what is meant by oxidation. [2]
 - Which element has been oxidized in this reaction? Deduce the change in its oxidation number. [2]
11. An organic compound A is produced by heating ethanol with conc. H_2SO_4 at 170°C . The compound A is treated with hydrogen in the presence of Platinum catalyst, compound B is formed. The compound B is treated with chlorine in the presence of sunlight, compound C is obtained. The compound C is heated with sodium metal in the presence of organic ether, the compound D is obtained. The compound D having molecular formula C_4H_{10} .
- Write the reaction sequence of the conversion of A to D. [4]
 - Write the IUPAC name of C and D. [2]
 - How can you prove chemically the compound A is unsaturated? [1]
 - Write the name of reaction for the conversion of compound C to D. [1]

Grade: XI

Time : 3 hrs

Attempt ALL questions.

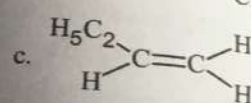
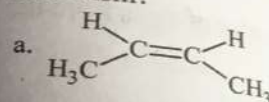
SET -

CHEMISTRY

Group

Circle the best alternative to the following

- The atom having the valence-shell configuration is
a. Group VIA and Period 5
b. Group IVB and Period 4
c. Group VIB and Period 7
d. Group VIIA and Period 4
- Which of the following compounds shows geometric isomerism?



- The IUPAC name of the Cl_3CCHO is
a. Chloral
b. Trichloroacetaldehyde
c. 1,1,1-trichloroethanal
d. 2,2,2-trichloroethanal
- Which statement about the number of electrons in atoms is incorrect?
a. n = principal quantum number
b. l = subsidiary (or azimuthal) quantum number
c. m_l = magnetic quantum number
d. m_s = spin quantum number
- Silver metal can be extracted by
a. Hydrometallurgy
b. Pyrometallurgy
c. Electrometallurgy
d. Both a & c

SET - 3

Grade: XI

F.M.: 75

Time : 3 hrs

CHEMISTRY

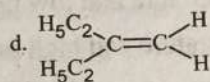
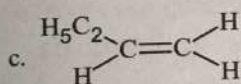
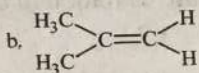
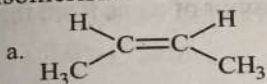
Attempt ALL questions.

Group 'A'

Circle the best alternative to the following questions. [11 × 1 = 11]

- The atom having the valence-shell configuration $4s^2 4p^5$ would be in:
 - Group VIA and Period 5
 - Group IVB and Period 4
 - Group VIB and Period 7
 - Group VIIA and Period 4

- Which of the following compounds will show geometrical isomerism?



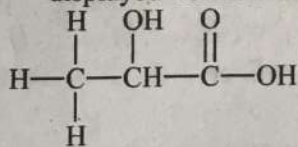
- The IUPAC name of the $Cl_3C.CHO$ is
 - Chloral
 - Trichloroacetaldehyde
 - 1,1,1-trichloroethanal
 - 2,2,2-trichloroethanal
- Which statement about the four quantum numbers which describe electrons in atoms is **incorrect**?
 - n = principal quantum number, $n = 1, 2, 3, \dots$
 - l = subsidiary (or azimuthal) quantum number, $l = 1, 2, 3, \dots, (n+1)$
 - m_l = magnetic quantum number, $m_l = (-l), \dots, 0, \dots, (+l)$
 - m_s = spin quantum number, $m_s = +1/2$ or $-1/2$.
- Silver metal can be extracted by.....
 - Hydrometallurgy
 - Pyrometallurgy
 - Electrometallurgy
 - Both a & c

6. In Haber's process for the manufacture of ammonia, the catalyst used is
- Finely divided nickel
 - Finely divided molybdenum
 - Finely divided iron
 - Finely divided platinum
7. The molecular formula of Plaster of paris is
- $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
 - $\text{CaSO}_4 \cdot \text{H}_2\text{O}$
 - $\text{CaSO}_4 \cdot 12 \text{H}_2\text{O}$
 - $\text{CaSO}_4 \cdot 112 \text{H}_2\text{O}$
9. What mass of ZnCl_2 can be prepared from the reaction of 3.27 grams of zinc with 3.30 grams of HCl ?
- $$\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$$
- 6.89 g
 - 6.82 g
 - 6.46 g
 - 6.17 g
10. When there is more deviation in the behavior of a gas from the ideal gas equation $PV = nRT$
- At high temperature and low pressure
 - At low temperature and high pressure
 - At high temperature and high pressure
 - At low temperature and low pressure
11. Which of the following is bleaching agent?
- CaOCl_2
 - CaCl_2
 - Cl_2
 - Both a & c

Group 'B'

Give short answer to the following questions. [8 × 5 = 40]

1. a. One of the organic acids present in milk is lactic acid. The displayed formula of lactic acid is shown in Figure.



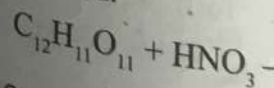
- Draw a circle around the carboxylic acid functional group on the structure. [1]
- Write the name of salt of acid which gives ethane from Kolbe's electrolysis. [1]

- Write the name of product
- Write the name of product

Complete the given table in formula and IUPAC name of

| General formula | Molecular formula |
|-----------------------------|-------------------|
| $\text{C}_n\text{H}_{2n+2}$ | |
| X | |
| Y | |
| Z | |

- Write the structure of compound U.
 - Write the functional group and IUPAC name.
 - Write the general formula of compound U.
2. Bohr atomic model explains the basis of certain allowed energy levels. An atom has 2 electrons in the M-shell.
- Write the electronic configuration of the atom.
 - Write the value of the principal quantum number of the outermost shell.
 - Write the total number of electrons in the atom.
3. A non-metal A is an important component of oxides B and C. Oxide B is acidic and oxide C is basic.
- Identify A, B and C.
 - To which Group of the periodic table does A belong?
 - How can you prepare B and C?
- Balance the redox reaction by the half-reaction method.



- c. Write the functional isomer of molecular formula C_3H_6O . [2]
 d. Write the name of product which is formed by the reaction of benzene with ethanoic anhydride in the presence of Lewis acid. [1]

OR

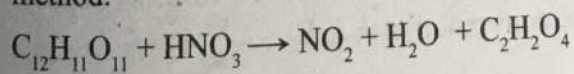
Complete the given table indicating General formula, molecular formula and IUPAC name of the organic compounds.

| General formula | Molecular formula | IUPAC name |
|-----------------|-------------------|-------------|
| C_nH_{2n+2} | C_3H_8 | Propane |
| X | C_4H_8 | U |
| Y | W | Buntan-2-ol |
| Z | C_3H_6O | V |

- Write the structure of compound W from the above table. [1]
 - Write the functional isomer of compound V and give their IUPAC name. [2]
 - Write the general formula of compound X and IUPAC name of compound U. [2]
2. Bohr atomic model explain the properties of atomic electrons on the basis of certain allowed possible values.
 An atom has 2 electrons in K-shell, 8 electron in L-shell and 2-electron in M-shell.
- Write the electronic configuration of atom and group in periodic table. [2]
 - Write the value of principle quantum number and azimuthal quantum number of 10th electron. [2]
 - Write the total number of s-electrons. [1]
3. A non-metal A is an important constituent of our food and forms two oxides B and C. Oxide B is toxic whereas C causes global warming.
- Identify A, B and C. [3]
 - To which Group of Periodic Table does A belong? [1]
 - How can you prepare oxide B from oxalic acid? [1]

OR

- Balance the redox reaction by oxidation number or ion-electron method. [2]



- ii. Find the mass of sodium metal deposited at cathode when 0.5 ampere of current is passed for half an hour and the process has 80% efficiency. [2]
- iii. Calculate the oxidation of Fe in $K_3[Fe(CN)_6]$ and $Fe_2(SO_4)_3$. [1]
4. Le-Chatelier's principle of equilibrium is used in the industrial applications as the reaction scheme involves parameters like temperature, pressure, concentration of reaction.
- i. Derive the relationship between K_p and K_c . [2]
- ii. Write one example of chemical reaction where K_p is smaller than K_c . [1]
- iii. What is the effect of concentration and pressure of $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$? [2]
5. The shape of a covalent molecule can be predicted using the Valence Shell Electron Pair Repulsion (VSEPR) theory.
- i. Complete the given table indicating shape and bond angle of molecule. [2]
- | Molecule | Shape | Bond angle | Hybridization |
|----------|-----------|-------------|---------------|
| NH_3 | Pyramidal | 107° | sp^3 |
| H_2O | | | |
| C_2H_2 | | | |
| C_2H_4 | | | |
- ii. Draw the Lewis structure of H_2SO_4 . [1]
- iii. Explain why H_2O is liquid whereas H_2S is gas. [2]
6. Our body is composed of about 60% water. The functions of these bodily fluids include digestion, absorption, circulation, creation of saliva, transportation of nutrients, and maintenance of body temperature.
- i. How does glucose get into our body cell? [2]
- ii. What is the most toxic form of mercury? [2]
- iii. How can you test chloride ion present in drinking water? [1]
7. The organic compound A is formed by reacting water with Calcium carbide. The compound A is treated with 42% H_2SO_4 and 1% $HgSO_4$ to give compound B. The compound A is heated with Fe-tube to give C with molecular formula (C_6H_6) .
- i. Write the conversion of A to B. [2]

- ii. Write the name of gas.
- iii. How can you test the compound?
8. i. Complete the given table.
- | Oxide | Class |
|-----------|-------|
| P_2O_5 | |
| ZnO | |
| CaO | |
| Fe_3O_4 | |
- ii. Write two important uses of oxygen.
- iii. Which gas is used for welding? Write its name.

Give long answer to the following questions.

9. The kinetic theory of gases explains the properties of gases, such as volume, pressure, diffusion, and transport properties such as mass diffusivity.
- i. Explain why gases do not have a definite shape and volume.
- ii. On the basis of Boyle's law, explain why the pressure in oxygen cylinders with a fixed volume of gas increases when the temperature rises.
- iii. Under what condition will the volume of an ideal gas be maximum?
- iv. An evacuated glass vessel is filled with a volatile liquid. The vessel is then filled with an ideal gas at a certain pressure. The volume of ideal gas STP is 100 ml.
10. A mineral acid (A) has many uses in the production of ammonium salts and in the manufacture of explosives such as nitroglycerin.
- i. Write three steps of the process of production of (A) by Ostwald's process.
- ii. Draw a flow sheet diagram of Ostwald's process.

ii. Write the IUPAC name of compound B and C. [2]

iii. How can you test the compound A? [1]

8. i. Complete the given table. [2]

| Oxide | Class |
|-----------|-------|
| P_2O_5 | |
| ZnO | |
| CaO | |
| Fe_3O_4 | |

ii. Write two important use of hydrogen peroxide and medical oxygen. [2]

iii. Which gas is used for detection of basic radical? Write the name. [1]

Group 'C'

Give long answer to the following questions. [3 × 8 = 24]

9. The kinetic theory of gases explains the macroscopic properties of gases, such as volume, pressure, and temperature, as well as transport properties such as viscosity, thermal conductivity and mass diffusivity.

i. Explain why gases do not settle down at the bottom of container? [2]

ii. On the basis of Boyle's law, explain why mountaineers carry oxygen cylinders with them? [2]

iii. Under what condition will a gas behave nearly like an ideal gas? [1]

iv. An evacuated glass vessel weight 50 g when empty, 148 g when filled with a volatile liquid of density 0.98 g/cc and 50.5 g when filled with an ideal gas at 760 mm Hg at 27°C. Calculate the volume of ideal gas STP. [3]

10. A mineral acid (A) has molecular mass 63 amu. It is used in the production of ammonium nitrate for fertilizers, making plastics, and in the manufacture of dyes. It is also used for making explosives such as nitroglycerin and TNT. It is monoprotic acid.

i. Write three steps of chemical equation for the manufacture of (A) by Ostwald's process. [3]

ii. Draw a flow sheet diagram for the manufacture of (A) by Ostwald's process. [2]

- iii. What product would you expect when concentrated solution of (A) is treated with iodine? [1]
- iv. How would you perform the laboratory test of nitrate ion present in its aqueous solution? [2]

OR

In industry Hydrogen, a highly reactive gas, is widely used in many industrial applications to produce different materials.

- Mention one example to show nascent hydrogen is more powerful reducing agent than molecular hydrogen. [1]
 - Mention one use of the followings: Heavy water, Tritium, Deuterium, ozone layer. [2]
 - Suggest your ideas to protect ozone layer from its depletion. [1]
 - Write the names of two acidic and amphoteric oxides. [2]
 - Draw the resonance structure of ozone and Sulphur trioxide. [2]
11. An organic compound A is produced by the dehydrohalogenation of C_3H_7Br . The compound A is treated with ozone in the presence of CCl_4 , compound B and C is formed. The compound B is reduced in the presence of Zn-Hg/HCl, compound D is obtained.
- Write the reaction sequence of the conversion of A to D. [3]
 - Write the IUPAC name of C and D. [2]
 - How can you prove chemically the compound A is unsaturated? [1]
 - How can you convert compound A into 2,3-dimethylbutane? [2]

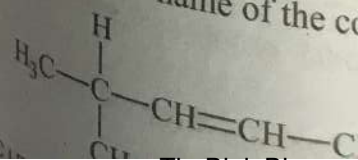
Grade: XI

Time : 3 hrs

Attempt ALL questions.

Circle the best alternative to

- The structure of ammonia is
 - Pyramidal
 - Tetrahedral
 - Trigonal
 - Trigonal bipyramidal
- An element M has an atomic number 19. Its symbol is represented by
 - M^+
 - M^{+2}
- How many grams of H_2SO_4 are present in 24.5 g of H_2SO_4 ?
 - 2.45
 - 24.5
- An element with atomic number 19 is located in which group of the periodic table?
 - 4
 - 3
- Sodium is made by the electrolysis of a mixture of 40% NaCl and 60% $CaCl_2$.
 - Ca^{+2} ion can reduce NaCl
 - $CaCl_2$ helps in conducting electricity
 - This mixture has a lower melting point than NaCl
 - Ca^{+2} can displace Na from NaCl
- Which one of the following forms a brown complex?
 - N_2O
 - NO
- A considerable part of the greenhouse effect does not reach the surface of the earth's atmosphere there
 - Carbon dioxide
 - Hydrogen
 - Ozone
 - Ammonia
- The IUPAC name of the compound is



SET - 4

Grade: XI

F.M.: 75

Time : 3 hrs

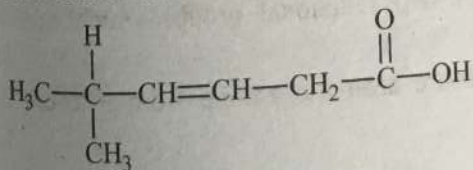
CHEMISTRY

Attempt ALL questions.

Group 'A'

Circle the best alternative to the following questions. [11 × 1 = 11]

- The structure of ammonia is
a. Pyramidal b. Tetrahedral
c. Trigonal d. Trigonalbipyramidal
- An element M has an atomic mass 19 and atomic number 9, its ion is represented by
a. M^+ b. M^{+2} c. M^- d. M^{2-}
- How many gram of H_2SO_4 are present in 0.25 mole of H_2SO_4 ?
a. 2.45 b. 24.5 c. 0.245 d. 0.25
- An element with atomic number 20 will be placed in which period of the periodic table?
a. 4 b. 3 c. 2 d. 1
- Sodium is made by the electrolysis of a molten mixture of about 40% NaCl and 60% $CaCl_2$ because
a. Ca^{+2} ion can reduce NaCl to Na
b. $CaCl_2$ helps in conduction of electricity
c. This mixture has a lower melting point than NaCl
d. Ca^{+2} can displace Na from NaCl
- Which one of the following combines with Fe(II) ions to form a brown complex?
a. N_2O b. NO c. N_2O_3 d. N_2O_5
- A considerable part of the harmful ultraviolet radiation of the sun does not reach the surface of the earth. This is because high above earth's atmosphere there is a layer of
a. Carbon dioxide b. Hydrogen
c. Ozone d. Ammonia
- The IUPAC name of the compound



- a. 5-methyl-4-hexanoic acid
 b. 5-carboxyl-2-methylpentene
 c. 4-isopropyl-3-butenic acid
 d. None
9. Deviation from Markovnikov's rule occurs in presence of
 a. Zinc b. Peroxides c. Zn-Hg/HCl d. All
10. Lead tetraethyl is used as
 a. Fire extinguisher b. Pain killer
 c. Petroleum additive d. Mosquito repellent
11. When CaC_2 was hydrolysed and a gas was obtained. It had a garlic odour due to phosgene present as impurity. The gas was passed through ammoniacal solution of Cu_2Cl_2 , a red ppt was obtained. The gas was
 a. Ethylene b. Ethyne c. Propyne d. Ethane

Group 'B'

Give short answer to the following questions. [8 × 5 = 40]

1. Alkynes and alkenes are homologous series of unsaturated hydrocarbons. All alkynes contain a $\text{C}\equiv\text{C}$ triple bond.
- i. Complete Table showing information about the first three alkynes. [1]
- | | | | |
|-----------|--|---|---|
| Formula | C_2H_2 | C_3H_4 | |
| Structure | $\text{H}-\text{C}\equiv\text{C}-\text{H}$ | $\text{H}-\text{C}\equiv\text{C}-\text{CH}_3$ | $\text{H}-\text{C}\equiv\text{C}-\text{CH}_2-\text{CH}_3$ |
| Name | ethyne | | But-1-yne |
- ii. What happens when first member of alkyne is heated with ammoniacal solution of silver nitrate solution? [2]
- iii. What product is formed when second member of alkyne is on ozonolysis? [2]

OR

Reaction mechanism describes the successive steps at the molecular level that take place in a chemical reaction.

| | | | | | |
|-----------------|-----|---------------|---------------|---------------|---------------|
| AlCl_3 | ROH | NH_3 | Br^+ | CN^- | SO_3 |
|-----------------|-----|---------------|---------------|---------------|---------------|

- i. Identify the electrophile and nucleophile from the above table. [2]
- ii. Write the name of two functional groups which negative inductive effect. [1]
- iii. How can you prepare aromatic ketone from Friedel-Craft reaction? [2]

2. A white solid sulphur
 N, 24.12%; H, 6.94%
 i. Define empirical formula
 ii. Calculate the empirical formula
 iii. Suggest a balanced equation from the reaction of water
3. An inorganic compound (Z) has a central atom one nitrogen and one hydrogen atom.
 i. Write a balanced equation for the reaction of (Z) with water
 ii. What is a dative? Is there any dative bond in (Z)?
 iii. Write the formulae of (Z) and its conjugate acid
 iv. Draw the Lewis structure of (Z)

Le-Chatelier's principle of a system due to change in concentration.

- i. Define equilibrium constant
 ii. What is the relationship between K_c and K_p for the following reaction

$$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$$

$$\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$$
 iii. What is the effect of temperature in the following reaction

$$2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$$
 4. Oxygen is the third most abundant element in the earth. It forms oxides with other elements.

| | | | |
|----|-------------------------|---------------|-----|
| NO | Na_2O_2 | CO_2 | ZnO |
|----|-------------------------|---------------|-----|

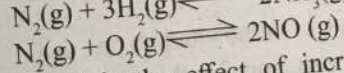
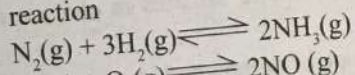
 i. Identify the oxide from the above table
 ii. How are CFC responsible for global warming?
 iii. Write two uses of hydrogen
 5. You can observe a real-life example of Le-Chatelier's principle if you fill your bike tires with air

2. Water, ammonia and sulphur dioxide react together to form a compound A which has the following percentage composition by mass:
N, 24.12%; H, 6.94%; S, 27.61%; O, 41.33%.
- Define empirical formula. [1]
 - Calculate the empirical formula of compound A. [2]
 - Suggest a balanced equation for the formation of compound A from the reaction of water, ammonia and sulphur dioxide. [2]
3. An inorganic compound (Z) having molecular mass 17 and have central atom one nitrogen which is covalent bonded with three hydrogen atom.
- Write a balanced equation for the preparation of compound (X) from compound (Z) with HCl. [1]
 - What is a dative? Is this bond present in compound (X)? [2]
 - Write the formulae of the ions which is present in (X). [1]
 - Draw the Lewis structure of (X). [1]

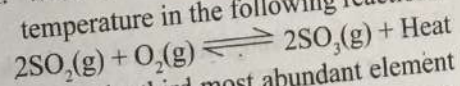
OR

Le-Chatelier's principle can be used to predict the behavior of a system due to changes in pressure, temperature, or concentration.

- Define equilibrium constant (K_c). [1]
- What is the relationship between K_p and K_c for the following reaction [2]



- What is the effect of increase pressure and decrease of temperature in the following reaction? [2]



4. Oxygen is the third most abundant element by mass which readily forms oxides with other elements. Some of oxides are given below:

| | | | | | |
|----|-----------------------|---------------|-----|-------------------------|-----|
| NO | Na_2O | CO_2 | ZnO | Pb_2O_3 | CaO |
|----|-----------------------|---------------|-----|-------------------------|-----|

- Identify the oxide from the above table. [3]
 - How are CFC responsible for the detection of ozone layer? [1]
 - Write two uses of hydrogen peroxide. [1]
5. You can observe a real-life application of Boyle's Law when you fill your bike tires with air.

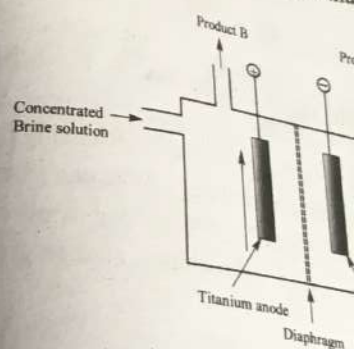
- i. What information would you get in the graph of pressure against product of pressure and volume? [1]
 - ii. Why is mountaineer carry oxygen cylinder with him while climbing Mount Everest? [1]
 - ii. How long will it take 500 mL of hydrogen gas to diffuse through a partition if 250 mL of oxygen diffuse in 50 minutes under similar condition? [3]
6. A monoprotic mineral acid (Y) having molecular mass 63 and having one hydrogen, one nitrogen and three oxygen.
- i. How can you prepare aquaregia from (Y)? Give the action of aquaregia on gold. [2]
 - ii. In a ring test of nitrate what is the role of (Y)? What chemical compound is formed in the ring test? [2]
 - iii. Which gas is evolved when cold and conc. acid (Y) treated with iron metal? [1]
7. Urea is much demanded fertilizer in agriculture like Nepal. One of the raw material for manufacture of urea is ammonia.
- i. Write a stepwise reaction to manufacture of urea in the industry and also draw flow sheet diagram. [3]
 - ii. Write one example of each phosphatic fertilizer and potash fertilizer with its application. [2]
8. Graphite is used in pencils, to make brushes in electric motors and in furnace linings.
- i. Name the hardest allotrope of carbon and its one use. [1]
 - ii. Give balanced chemical equation for the preparation of CO from oxalic acid. [2]
 - iii. What happens CO gas is passed through heated Nickel powder? [2]

Group 'C'

Give long answer to the following questions. [3 × 8 = 24]

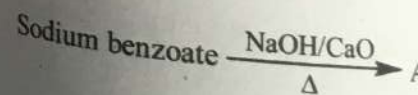
9. a. In this questions K, L and M refer to a halogen atom or halide ion. For each part question, read the information and complete the answer lies below.
- i. When conc. H_2SO_4 is added to solid NaK, white fumes are produced than turns damp blue litmus paper red. No other colour change are observed. Identify the K with proper colour and equation. [2]

- ii. When silver... ion is added... after the... meter eq...
- iii. M_2 is a liquid at room temperature than that of chlorine but lower than the...



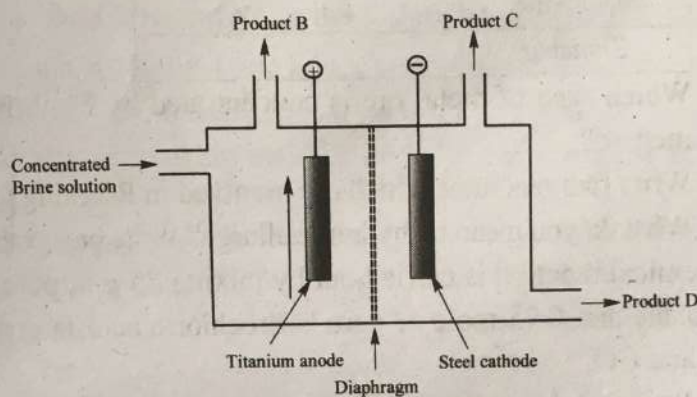
- b. The diagram below is a simplified re...
- i. Give equation for two electrodes.
 - ii. Identify B, C, D.
10. a. Complete the reaction sequence
- $$A \xrightarrow{B} H_3C-CH=CH_2 \xrightarrow{KMnO_4} D$$
- $\downarrow H_2O/H^+$

- b. Identify the major product A in the reaction sequence.



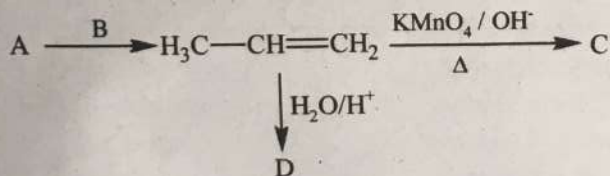
- i. Write a reaction sequence.
- ii. How can you prepare compound OR Metals are the main component in

- ii. When silver nitrate solution is added to an aqueous solution of NaL, a ppt forms that remains after the addition of conc. Ammonia solution. Identify L with complete equation having colour. [2]
- iii. M₂ is a liquid at room temperature with a boiling point higher than that of chlorine but lower than that of iodine. Identify M. [1]

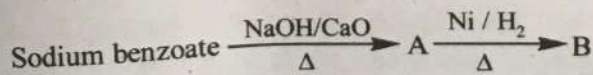


- b. The diagram below is a simplified representation of a diaphragm cell.
- i. Give equation for two electrodes. [2]
- ii. Identify B, C, D. [1]

10. a. Complete the reaction sequence with proper reagent. [1+1+1+1]



- b. Identify the major product A and B in the following reactions sequence.



- i. Write a reaction sequence. [2]
- ii. How can you prepare compound A from phenol? [2]

OR

Metals are the main component in the construction industry. Metals

like iron, steel amongst others are the main materials used in construction of buildings and even homes.

i. Complete the table showing information. [3]

| Name of ores | Metal can be extracted |
|--------------|------------------------|
| Bauxite | Al |
| Argentite | |
| Haematite | |
| Cinnabar | |

ii. Which type of metal ore is concentrated by Froth Flootation method? [1]

iii. Write two reactions which are involved in Roasting. [2]

iv. What do you mean by hydrometallurgy? Write one example. [2]

11. A chemical reaction is carried out by mixing 25 g of pure calcium carbonate and 0.75 mole of pure hydrochloric acid to give CaCl_2 , H_2O and CO_2 .

i. Write a balanced chemical equation. [1]

ii. Which one is limiting reagent and why? [2]

iii. Calculate the mass of CaCl_2 produced. [1]

iv. How many moles of water molecules are formed? [2]

v. What mass of NaOH is required to absorb the whole CO_2 produced in the reaction? [2]

Grade: XI

Time : 3 hrs

Attempt ALL questions

Circle the best alternative

1. In which species is

a. CH_3 b. C

2. Under which condition is the rate of reaction maximum?

Temperature

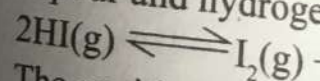
a. low

b. high

c. low

d. high

3. Hydrogen iodide gas is in equilibrium with hydrogen vapour and hydrogen iodide gas.



The position of the equilibrium is

changing the external pressure.

change in position of equilibrium.

Effect of increasing temperature

a. Moves to right

b. Moves to left

c. No change

d. No change

4. Which statement is correct?

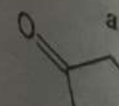
a. Ammonia reacts with water to form ammonium hydroxide.

b. Ammonium chloride is a weak acid.

c. The ammonium ion is a weak base.

d. The bond angle in ammonia is 109.5° .

5. Which compound has the highest boiling point?



SET - 5

Grade: XI

F.M.: 75

Time : 3 hrs

CHEMISTRY

Attempt ALL questions.

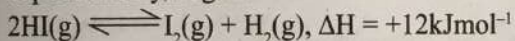
Group 'A'

Circle the best alternative to the following questions. [11 × 1 = 11]

- In which species is there a lone pair of electrons?
a. CH_3 b. CH_3^+ c. CH_3^- d. CH_4
- Under which conditions will nitrogen behave most like an ideal gas?

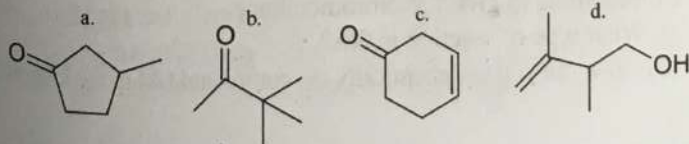
| | Temperature | Pressure |
|----|-------------|----------|
| a. | low | high |
| b. | high | low |
| c. | low | low |
| d. | high | high |

- Hydrogen iodide gas decomposes reversibly producing iodine vapour and hydrogen.



The position of the equilibrium for this reaction may be altered by changing the external conditions. Which row correctly describes the change in position of equilibrium?

- | | Effect of increasing pressure | Effect of increasing temperature |
|----|-------------------------------|----------------------------------|
| a. | Moves to right | Moves to right |
| b. | Moves to right | Moves to left |
| c. | No change | Moves to right |
| d. | No change | Moves to left |
- Which statement is correct?
a. Ammonia reacts with alkalis to form the ammonium ion.
b. Ammonium chloride contains ionic, covalent and co-ordinate bonds.
c. The ammonium ion reacts with acids to produce ammonia.
d. The bond angle in the ammonium ion is approximately 107° .
 - Which compound has the molecular formula $\text{C}_6\text{H}_{10}\text{O}$?



6. What is the structural formula of the major product when hydrogen bromide reacts with 2-methylbut-2-ene?
- $\text{CH}_2\text{BrCH}(\text{CH}_3)\text{CH}_2\text{CH}_3$
 - $(\text{CH}_3)_2\text{CBrCH}_2\text{CH}_3$
 - $(\text{CH}_3)_2\text{CHCHBrCH}_3$
 - $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{Br}$
7. An atom of calcium-48 can form a $2+$ ion. Which statements about this ion are correct?
- It has 20 protons.
 - It has 28 neutrons.
 - It has 22 electrons.
 - It has 29 electrons.
8. Which oxides, when placed in cold water for one day, will react with the water?
- a. MgO b. Al_2O_3 c. SiO_2 d. Na_2O
9. Concentrated sulfuric acid is added to separate solid samples of sodium chloride, sodium bromide and sodium iodide. With which samples does sulfuric acid act as an oxidising agent?
- sodium chloride only
 - sodium chloride and sodium bromide
 - sodium bromide and sodium iodide
 - sodium iodide only
10. Which molecule contains eight bonding electrons?
- a. CO_2 b. C_2H_4 c. C_3H_6 d. NH_3
11. Diamond, graphite and buckminsterfullerene are different forms of the element carbon. Which statement is correct for all three substances?
- Bond angles of 120° are present.
 - Delocalised electrons are present.
 - Giant molecular crystalline lattice structures are present.
 - σ -bonds are present.

Group 'B'

Give short answer to the following questions.

[8 × 5 = 40]

1. Alkenes are important industrially because the $\text{C}=\text{C}$ bond makes them very reactive. An alkene (A) having two carbon atoms reacts with bromine to give 1,2-dibromoethane.
- What type of reaction is this? [1]
 - How can you test chemically the compound (A) in the laboratory? [2]

- (iii) Write the name of polymer which is formed by the compound (A) and write its one use. [2]

OR

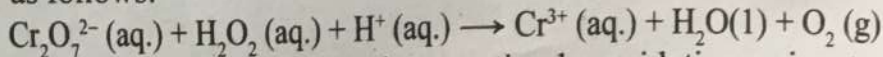
An organic compound contains three foreign element N, S and halogens.

- i. Why is aqueous solution of sodium extract alkaline? [1]
 - ii. How would you detect N and S both in the organic compound? [2]
 - iii. Why is Lassaigne extract boiled with conc. HNO_3 while testing for halogen? [2]
2. A non-metal M form two allotropes, one is used as ornament and another is uses as pencil. The non-metal M form two oxide A and B, one is poisonous and other is used in photosynthesis.
- i. How can you prepare in the laboratory A and B? [2]
 - ii. What is happens when oxide A is heated with cobalt and nickel metal? [2]
 - iii. Can you prepare organic compound form oxide A? If yes, write a reaction. [1]
3. Water is the most abundant compound on the earth. Much of the chemistry of water is influenced by its polarity and its ability to form hydrogen bond Polarity is explained in term of electronegativity.
- i. Define the term electronegativity. [1]
 - ii. Why are water molecules polar? [1]
 - iii. Draw a diagram to show hydrogen bonding between two water molecules. Your diagram must include the dipoles and lone pair of electrons. [2]
 - iv. Write the hybridization and bond angle in a water molecule. [1]
4. a. Draw the structural formula of: An alkene with 4 carbon atoms. [1]
- b. Draw the structural formula of the product(s) of reacting the alkene you have chosen with chlorine gas. [2]
- c. Draw the structural formula of the product(s) of reacting the unsymmetrical alkene you have chosen with HBr gas. [2]

OR

- a. (i) Explain the term homologous series. [2]
- (ii) To which homologous series does ethene, C_2H_4 , belong? [1]
- b. Draw the full structural formulae, showing all the bonds, for each of the following: [2]
- (i) 3,4-dimethylhex-2-ene.
- (ii) Give the systematic name for $\text{C}_2\text{H}_5\text{Cl}$.

5. Hydrogen peroxide reacts with acidified potassium dichromate(VI) as follows:



- i. Balance the above redox reaction by oxidation or ion-electron method. [3]
 - ii. Point out the oxidant and reductant in the above redox reaction. [1]
 - iii. Calculate the oxidation number of P in Na_3PO_4 . [1]
6. a. Complete and balance the following equations: [3]
- (i) $\text{Ca} + \text{O}_2$
 - (ii) $\text{Na}_2\text{O} + \text{H}_2\text{O}$
 - (iii) $\text{Na}_2\text{O} + \text{HCl}$
- b. State and explain the trend in thermal stability of the carbonates of the Group 2 elements as the group is descended. [2]
7. (a) Complete the following table. [2]

| Particle | Relative charge | Relative mass |
|----------|-----------------|---------------|
| Proton | | |
| Neutron | | |
| Electron | | |

- (b) Complete the electronic configurations for the sulphur atom, S, and the sulphide ion, S^{2-} . [2]
 - (c) State the block in the Periodic Table in which sulphur is placed. [1]
8. i. Complete the table given below indicating class of oxide. [2]

| | |
|-----------------------|-------------|
| Na_2O | Basic oxide |
| BaO_2 | |
| ZnO | |
| NO | |
| SO_2 | |

- ii. Write one medical application of oxygen gas [1]
- iii. How is oxygen converted into ozone? Give one use of ozone. [2]

Group 'C'

Give long answer to the following questions. [3 × 8 = 24]

9. a. Explain the meaning of the following terms. [2]
- (i) Electrophile. [2]
 - (ii) Nucleophile. [2]
- (b) Explain the difference between heterolytic and homolytic bond breaking. [2]

- (c) Write a reaction between 2-chlorobutane and alcoholic solution of KOH. [2]

OR

Sodium is used as a heat exchanger in some nuclear reactors, and as a reagent in the chemicals industry.

- i. Write the formula of rock salt and chile salt peter. [1]
 - ii. Why Calcium chloride is added during the electrolysis of aqueous sodium chloride in Down's process? [1]
 - iii. Why is sodium fire not extinguished by adding water? [2]
 - iv. What is the action heat on washing soda? [2]
 - v. Write two precipitation of sodium hydroxide. [2]
10. The manufacture of ammonia is an important industrial process based on the equilibrium
- $$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3, \Delta H = -92.4 \text{ kJ mol}^{-1}$$
- a. Explain the meaning of the term dynamic equilibrium. [2]
 - b. Explain why raising the equilibrium temperature results in less ammonia being produced. [1]
 - b. State why, despite the lower yield of ammonia, the industrial process operates at about 450°C. [1]
 - d. How is ammonia removed from the mixture of gases? [1]
 - e. (i) Give the meaning of the term catalyst. [1]
(ii) State the effect of the presence of a catalyst on the yield of ammonia. [1]
 - f. Give one large scale use of ammonia. [1]
11. 300 g of 80% pure CaCO_3 is completely reacted with excess HCl to produce CaCl_2 , H_2O and CO_2 .
- a. Write the balance chemical equation. [1]
 - b. Which one is limiting reagent and why? [2]
 - b. Calculate the mass of CaCl_2 formed. [1]
 - c. How many moles of water are produced? [1]
 - d. What volumes of CO_2 are produced if the reaction is carried out at 25°C temperature and 780 mm Hg pressure? [3]

SET - 6

F.M.: 75

Grade: XI

Time : 3 hrs

CHEMISTRY

Attempt ALL questions.

Group 'A'

Circle the best alternative to the following questions. [11 × 1 = 11]

- All the law of stoichiometry are based on
 - Boyle's law
 - Charles' law
 - Richter law
 - Dalton's atomic theory
- Solubility of alkaline earth metal carbonates decreases in an order,
 - $\text{BeCO}_3 > \text{MgCO}_3 > \text{CaCO}_3 > \text{SrCO}_3 > \text{BaCO}_3$
 - $\text{BaCO}_3 > \text{SrCO}_3 > \text{CaCO}_3 > \text{MgCO}_3 > \text{BeCO}_3$
 - $\text{SrCO}_3 > \text{BaCO}_3 > \text{CaCO}_3 > \text{MgCO}_3 > \text{BeCO}_3$
 - $\text{MgCO}_3 > \text{CaCO}_3 > \text{SrCO}_3 > \text{BeCO}_3 > \text{BaCO}_3$
- Reducing agent used in the smelting process is
 - Fe
 - Zn
 - C
 - Al
- Real gas shows ideal behavior?
 - At high temperature and low pressure
 - At low temperature and high pressure
 - At normal temperature and pressure
 - All the above
- Brown colour of ring in nitrate test is due to
 - Ferrous nitrate
 - Ferrous nitrite
 - Nitroso-ferrous nitrate
 - Nitroso-ferrous sulphate
- In the manufacture of Sulphuric acid by Contact process, SO_3 gas is formed as an intermediate. The formation of Sulphur trioxide from sulfur dioxide and oxygen is reversible.
 $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3, \Delta H = -196 \text{ kJ mol}^{-1}$ The conditions of pressure and temperature that favors the forward reaction are
 - High pressure and high temperature
 - High pressure and low temperature
 - Low pressure and high temperature
 - Low pressure and low temperature

- Which coord
- a. NH_3
- Which
- a. Safety
- c. Labour
- Sodium-potass
- a. Primary active tran
- b. Secondary active t
- c. Primary passive tr
- d. Secondary passiv
- Propanal and propan
- a. Chain isomers
- c. Functional isome
- In the manufactur
- formed after reactio
- a. Na_2CO_3
- c. $(\text{NH}_4)_2\text{CO}_3$

Give short answer to

- Ernest Rutherford structure of an atom to locate electron conclusion did Ru on the scattering e
 - Most of the α -atom.
 - Some of the angles.
 - Few of the α -p much as 90° , o
 - What conclusion scattering exper
 - (e) What are the li atom?

7. Which of the following molecule contains both covalent and coordinate covalent bond?
 a. NH_3 b. NaCl c. H_2O d. SO_2
8. Which of the following is variable cost of production?
 a. Safety b. Laboratory services
 c. Labour d. Raw materials
9. Sodium-potassium pump is an example of
 a. Primary active transport
 b. Secondary active transport
 c. Primary passive transport
 d. Secondary passive transport
10. Propanal and propanone are the example of
 a. Chain isomers b. Position isomers
 c. Functional isomers d. Metamers
11. In the manufacturing of washing soda, Na_2CO_3 the compound formed after reacting ammonical brine solution with CO_2 is
 a. Na_2CO_3 b. NH_4HCO_3
 c. $(\text{NH}_4)_2\text{CO}_3$ d. NaHCO_3

Group- B

Give short answer to the following questions. (8×5=40)

1. Ernest Rutherford was the co-worker of Thomson regarding the structure of an atom. He performed α -particle scattering experiment to locate electrons and protons in an atom in 1911. To what conclusion did Rutherford reach from the following observations on the scattering experiment of α -particles by thin gold foil?
- Most of the α -particles (about 99%) passed straight through the atom.
 - Some of the α -particles deflected through different small angles.
 - Few of the α -particles (about 1 in 10,000) were deflected by as much as 90° , or even larger angles.
 - What conclusions can be drawn from Rutherford's α -particle scattering experiment?
 - What are the limitations of Rutherford's nuclear model of the atom? [1+1+1+1+1]

OR

Bigger value of electron affinity (negative sign indicates energy is lost) indicates greater tendency of an atom to accept the electron. Electron affinity of elements increase along the second period are tabulated.

| Element | Li | Be | B | C | N | O | F | Ne |
|------------|-------|----|-------|------|-------|--------|--------|----|
| EA(kJ/mol) | -59.8 | 0 | -23.0 | -122 | -20.1 | -140.9 | -327.9 | 0 |

- Define electron affinity. [1]
 - Name the factors affecting the electron affinity. [1]
 - Why Be and Ne have zero electron affinity? [1]
 - Halogen has the highest affinity in the period, why? [1]
 - The first electron affinity of oxygen is negative, while second electron affinity is positive. [1]
2. Redox reaction consists of two halves. You are given the redox equation.
- $$\text{MnO}_4^- + \text{H}_2\text{C}_2\text{O}_4 \longrightarrow \text{Mn}^{2+} + \text{H}_2\text{O} + \text{CO}_2$$
- Identify, which are anodic and cathodic reaction? [1]
 - What is the basis behind the balancing redox reaction? [1]
 - Split the given reaction into two halves and balance each of them by either ion electron or oxidation number method. [2]
 - If 5A current is passed through zinc sulphate solution till 12 minutes deposits 1.2g of Zn. Calculate the current efficiency. [1]
3. To predict the shape of covalent molecules and ions, valence shell electron pair repulsion (VSEPR) theory was proposed by Sidgwick and Powell in 1940 initially and developed by Gillespie and Nyholm in 1957.
- Write the full form of VSEPR. [1]
 - How does electronegativity of an atom affect the shape of molecules? Explain it the molecules H_2S & H_2O . [1]
 - Why do NH_3 and BF_3 have dissimilar geometries? [1]
 - The central atom in H_2S , NH_3 , and H_2O is sp^3 hybridized. But the reported bond angle in these molecules is 92.5° , $107^\circ 48'$ and $104^\circ 28'$ respectively. Account for this fact. [2]

OR

- a. Derive the ideal gas equation $PV = nRT$ where the symbols have their usual meaning.
- b. If NH_3 and dry HCl gases are simultaneously introduced into opposite ends of 150 cm long tube and allowed to diffuse each other. At what distance from the HCl end would the molecules of two gases form white dense fume? [3+2]
4. Concentrated sulphuric acid can be used in the laboratory to produce hydrogen chloride gas by the reaction with solid sodium chloride.
- a. Hydrogen bromide is not produced by the same method like hydrogen chloride. Why? [1]
- b. What is the difference between hydrogen bromide gas and hydrobromic acid? [2]
- c. Why is hydroiodic acid more acidic than hydrochloric acid? [1]
- d. HCl is a covalent molecule but is soluble in water and conducts electricity in an aqueous medium, why? [1]
5. Sodium is extracted from its economical and the most accessible compound sodium chloride by electric reduction process.
- i. Point out the difficulties during the electrolysis [1]
- ii. How did *J.C. Down* overcome these difficulties? [1]
- iii. Write the principle and diagram for the extraction of sodium from Down's process. [3]
6. Homologous series is the series of compounds having same functional group and same general formula but similar chemical properties.
- a. The second member of homologous series of alcohol is C_2H_5OH . What is the fourth member of the series? [1]
- b. Why is the first member of the homologous series always unique than remaining members? [1]
- c. What could be the reason behind greater boiling point and least solubility of higher member than lower member of homologous series? [1]
- d. Write the functional isomer of second member of alcohol? [2]
7. An unsaturated hydrocarbon **A** upon treatment with hydrogen iodide produces compound **B**. Compound **B** undergoes a Wurtz reaction to give 2,3-dimethylbutane as the major product.

- a. Give the chemical equations for the conversion of compound A to compound B and compound 2,3-dimethylbutane. [2]
- b. Write down the IUPAC name of compound A and B [1]
- c. What is the role of dry ether in Wurtz reaction? Also mention the limitation of this reaction. [2]
8. Urea is a very much demanded chemical fertilizer in agricultural country like Nepal because of the lack of domestic production. Bazarov Alexander gave a method to manufacture urea by reacting ammonia and carbon dioxide under suitable temperature and pressure.
- a. Draw a flow sheet diagram for manufacture of urea by ammonium carbamate process [3]
- b. What is the major challenge in establishing such industries in the countries like Nepal? Mention how such challenges can be strategically overcome? [2]

Group C

Give long answer to the following questions (3 × 8 = 24)

9. 17 g of ammonia is reacted with 45 g of oxygen to produce NO and H₂O.
- a. Find limiting reagent in this case and why is it first calculated? [2]
- b. What volume of NO is produced at NTP? [1]
- c. Calculate the volume of nitric oxide at NTP obtained by heating 7 kg of ammonia in excess of air in Ostwald process. [2]
- d. Ammonia and nitric acid form fertilizer. Name it with chemical reaction. [1]
- e. If the daily consumption of ammonia is 2400 Kg. Calculate the fertilizer produced daily in reaction (d). Assume that the factory is 100% efficient. (N=14, H=1, O=16). [2]
10. Oxides are binary compounds of oxygen with other elements except for noble gases and noble metals (Au, Pt, Pd). They are classified on the basis of acidic or basic behavior and structural considerations. Some of the oxides are given below.
- | | | | | |
|----|-----------------|-----|--------------------------------|-----------------|
| CO | CO ₂ | ZnO | Pb ₃ O ₄ | SO ₂ |
|----|-----------------|-----|--------------------------------|-----------------|
- i) CO is neutral oxide while CO₂ is acidic. Justify. [2]
- ii) Write two chemical reactions to show certain oxide from above table is amphoteric oxide. [2]
- iii) Red lead is called *Sindur* in Nepali, and its molecular formula is Pb₃O₄. Why is it considered to be mixed oxide? [1]

- iv) How
v) How does
- Hydrogen sulphide gas analysis in small volume called Kipp's apparatus called pharmacist Petrus Jacobus Kipp.
- a. How is it used to reaction of a liquid
b. Why the apparatus bottle?
c. Name the group reaction when H₂S gas is passed
d. How do you test the
e. Write the reaction KMnO₄.
11. An alcohol (A) on heating gives compound (B) which gives methanal and ethanal.
- a. Identify A and B, conversion of A into
b. Write the ozonolysis reaction
c. What happens when compound reacts with organic peroxide?
d. What happens when compound reacts with alc. KOH?

- iv) How do you convert SO_2 into SO_3 ? [1]
v) How does bleaching property of SO_2 differ from Cl_2 ? [2]

OR

Hydrogen sulphide gas is used in the laboratory for qualitative salt analysis in small volumes at frequent intervals in a special device called Kipp's apparatus. It was invented around 1844 by the Dutch pharmacist Petrus Jacobus Kipp.

- a. How is it used to produce hydrogen sulphide by the controlled reaction of a liquid on a solid without heating? [2]
b. Why the apparatus is more harmless than normal Woulfe's bottle? [1]
c. Name the group reagent used and any two metal ions precipitated when H_2S gas is passed in alkaline medium. [2]
d. How do you test the presence of hydrogen gas in the laboratory? [1]
e. Write the reaction of sulphureted hydrogen with acidified KMnO_4 . [2]
11. An alcohol (A) on heating with conc. H_2SO_4 at 170°C (dehydration) gives compound (B) which on ozonolysis forms the mixture of methanal and ethanal.
- a. Identify A and B, and write the complete reaction for the conversion of A into B. [3]
b. Write the ozonolysis reaction of compound B. [2]
c. What happens when compound B reacts with HBr in presence of organic peroxide? [2]
d. What happens when the product formed in question creacts with alc. KOH ? [1]

SET - 7

Grade: XI

F.M.: 75

Time : 3 hrs

CHEMISTRY

Attempt ALL questions.

Group 'A'

Circle the best alternative to the following questions. (11 × 1=11)

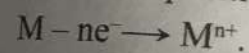
- How many number of atoms present in the one molecule of dolomite?
a. 5 b. 8 c. 10 d. 12
- One atomic mass unit (1amu) equals to
a) 1.67×10^{-24} g b. 1.67×10^{-27} g
c) 1.67×10^{-24} Kg d. 1.07×10^{-24} g
- The unit of universal gas constant in ideal gas equation depends on
a. Temperature of gas b. Nature of gas
c. Units of measurement d. Pressure of gas
- Oxidation number of carbon in glucose is,
a. +4 b. -4 c. 0 d. None of them
- Iron sulphide is heated in air to form 'A' an oxide of sulphur. A is dissolved in water to give an acid. The basicity of that acid is
a. 1 b. 2 c. 3 d. 4
- The most reactive form of hydrogen is
a) Nascent hydrogen b. Atomic hydrogen
c. Ortho hydrogen d. Para hydrogen
- The heating of pyrites to remove sulphur is termed as
a) Clacination b. Roasting
c. Smelting d. Bessemerisation
- Batch process is used to manufacture
a. Cement b. Petrol c. Diesel d. Drugs
- Which of the following is necessary for thyroid regulation?
a. Fe b. I c. Ca d. Zn
- Ozonolysis of 2-methylbut-2-ene gives
a. Propanone/ethanal b. Propanone/propanal
c. Propanal/ethanal d. Methanol/butanone

11. Catalyst used in Ostwa
is/are
a. Pt b. Rh

Give short answer to the

- A scientist investigated filling the electrons in filling the electrons in of energy. An atom h respectively. Find
a. Electronic configura
b. Total number of p
c. Total number of su
d. Total number of s-
e. What is the bond f

The electropositive cha



- How does the meta
period and group?
b) Metals form positiv
c) Why potassium is
than lithium?
d. Arrange Na, Mg an
character.
- Equivalent weight of a
faraday law of electrolys
a. Show that 1F charge
b. Express chemical equ
equivalent
c. The same current is pa
of metal M. The volu
NTP and the weight of
equivalent weight of th

11. Catalyst used in Ostwald's process for the manufacture of Aqua fortis is/are
- a. Pt b. Rh c. Pt & Rh (9:1) d. Pt & Rh (1:9)

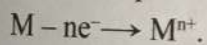
Group 'B'

Give short answer to the following questions. (8 × 5=40)

1. A scientist investigating the atomic structure of the element X by filling the electrons in various subshells in their increasing order of energy. An atom has 2, 8, and 5 electrons in K, L, and M shells, respectively. Find
- Electronic configuration of the species X.
 - Total number of principal quantum numbers in X.
 - Total number of subshells in X.
 - Total number of s-electrons of X.
 - What is the bond formed between Mg and X? [1+1+1+1+1]

OR

The electropositive character of metal is called a metallic character.



- How does the metallic character of elements vary along with the period and group?
 - Metals form positive ions and non-metals form negative ions?
 - Why potassium is more electropositive (metallic characters) than lithium?
 - Arrange Na, Mg and Al in descending order of metallic character. [2+1+1+1]
2. Equivalent weight of an element can be determined by using Faraday law of electrolysis.
- Show that 1F charge is nearly equal to 96500 coulomb.
 - Express chemical equivalent of aluminum into electrochemical equivalent
 - The same current is passed through acidified water and sulphate of metal M. The volume of hydrogen liberated is 9.87 litres at NTP and the weight of the metal deposited is 28g. Calculate the equivalent weight of the metal M.

- d. Write the anodic and cathodic half reaction if aqueous solution of NaCl is electrolyzed using graphite anode and mercury as cathode. [1+1+1+2]
3. Primary bonds (ionic, covalent, and dative bonds) are responsible for valency.
- Ionic reactions are faster than molecular reactions, why?
 - What is a coordinate covalent bond? Why does such a type of bonding arise?
 - HCl is a covalent compound but its aqueous solution conducts electricity, why?
 - Write the Lewis structure of NH_4Cl and H_3PO_4 . [1+1+1+2]

OR

The volume of a certain mass of a gas is changed by changing the temperature at constant pressure. This volume and temperature relationship was formulated mathematically by Jacques Charle's in 1787, which is named after him as Charle's law.

- State Charle's law. How does it give the concept of absolute scales of temperature? [1+1]
 - What is meant by normal temperature and pressure? [1]
 - Write the application of Charle's law. [1]
 - Why do gases show deviation from ideal behaviour? [1]
4. To detect the presence of nitrate ion in any solution, a chemical test called a brown ring test is conducted. In the presence of nitrate, the solution form a brown ring in the test tube.
- Which chemical compound is formed during ring test? Write its molecular formula. [2]
 - What is the purpose of adding double volume of concentrated sulfuric acid? [1]
 - What happens when freshly prepared FeSO_4 solution is added to a well-cooled mixture of dil. nitric acid and conc. H_2SO_4 ? [1]
 - What is the reason behind the use of freshly prepared saturated solution of FeSO_4 ? [1]
5. The flux is added with ores during the metallurgical process to remove the refractory impurities. The flux removes the impurities by converting it into slag.
- What do you mean by refractory impurities? Define with examples [2]

- b. Define the terms flux, slag and gangue with suitable examples. [2]
c. Is slag fusible or infusible mass? [1]
6. The compound 'A' ($C_7H_6O_2$) reacts with NaOH solution gives compound 'B'. The sodium salt of 'B' is heated with NaOH and CaO gives the compound 'C'. The compound 'C' is subjected to Friedel-Craft's alkylation gives the compound toluene.
- a. Give the chemical equations for the conversion of compound A to compound B and compound C. [3]
b) What is the role of CaO in this reaction? [1]
c. Acyl carbocation is electrophile which displaces hydrogen ion from benzene. Write its structure. [1]
7. Halogens in the organic compound are detected by boiling sodium extract with dilute nitric acid followed by adding few drops of silver nitrate solution.
- a. Why is sodium extract heated with conc. HNO_3 before adding $AgNO_3$ for halogens test? [2]
b. How will you test chlorine in organic compound by silver nitrate solution? Write the reactions involved. [2]
c. Give any one organic compound which contain chlorine as hetero elements. [1]
8. Nitric acid also known as aqua fortis (Latin for "strong water") and spirit of niter, is a highly corrosive mineral acid. Commercially available nitric acid is an azeotrope with water at a concentration of 68% HNO_3 .
- a. Write the reaction principle for the manufacture of nitric acid from Ostwald's process. [1]
d. Draw the well-labeled flow sheet diagram for the manufacture of nitric acid by Ostwald's process. [2]
c) Why is higher ratio of air used in Ostwald's process? [1]
d. Why is nitric acid not produced industrially by dissolving nitrogen dioxide in water without air? [1]

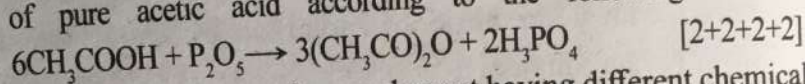
Group 'C'

(3 × 8 = 24)

Give long answer to the following questions.

9. P_2O_5 is also used as the dehydrating agent. Industrial processes are principally concerned with the percentage yield. Following reaction is used to manufacture phosphoric acid. $P_2O_5 + 3H_2O \rightarrow 2H_3PO_4$

- What is the mass of H_3PO_4 produced if 35g of P_2O_5 reacts with excess water?
- Define the term theoretical yield and percentage yield.
- For the above reaction if 45g of H_3PO_4 is actually produced what will be the percentage yield?
- Calculate the mass of P_2O_5 required to dehydrate 105 g of pure acetic acid according to the following reaction.



10. Allotropes are the forms of same element having different chemical bonds, crystal structure and molecular masses. O_2 and O_3 are the allotropes of oxygen.

- Ozone is more reactive than oxygen, why?
- Ozone is useful in the upper level of the atmosphere, but is harmful at the lower level." Justify the statement.
- Why are the O-O distances in ozone equal?
- Write the mechanism to show one molecule of chlorofluoro carbon is capable of destroying several ozone molecules. $[2+2+2+2]$

OR

Sulphuric acid is versatile chemical and is called King of chemical due to its high consumption in the world. In large scale, it is manufactured by Contact process starting from ferrous sulphide.

- How would you show that sulphuric acid acts dehydrating agent? $[2]$
- Write the name of the fertilizer formed if sulphuric acid reacts with ammonia. $[2]$
- Conc. H_2SO_4 is diluted by adding acid to water and not by adding water to acid, why? $[2]$
- Conc. H_2SO_4 chars the paper, wood and sugars. Write the chemistry behind it. $[2]$

11. Functional group is present most of the organic compound. It is important to be able to recognize the functional groups as they afford the physical and chemical properties of the compounds. In C_2H_5OH , C_2H_5 is alkyl group and $-OH$ is functional group.

- i. Define alkyl group and functional group.
- ii. Write the functional group of a) ketone b) acid anhydride c) aldehyde d) amine e) alcohol. Mention an example of compound containing each functional group.
- iii. How do you prepare benzene starting from a) phenol b) ethyne c) sodium benzoate?

[2+3+3]

Grade: XI

Time : 3 hrs

CHEMISTRY

Attempt ALL questions.

Group 'A'

Circle the best alternative to the following questions. (11 × 1=11)

- The number of atoms present in 28 g of nitrogen are
 a. 1.2×10^{24} b. 12×10^{24}
 c. 6.023×10^{23} d. 6.023×10^{24}
- The maximum energy required for the transition in the H atom is
 a. From $n = 1$ to $n = 2$ b. From $n = 2$ to $n = 3$
 c. From $n = \infty$ to $n = 1$ d. From $n = 0$ to $n = 1$
- Which one is polar molecule?
 a. BF_3 b. CCl_4 c. CH_3Cl d. CO_2
- Deliquescent substances are used for
 a. Cooling b. Melting c. Drying d. Wetting
- The atomicity of nitrogen and phosphorus respectively are
 a. 2 & 5 b. 2 & 3 c. 2 & 2 d. 2 & 4
- Calamine is an ore of
 a. Hg b. Zn c. Cd d. Ca
- Which has maximum electron affinity?
 a. F b. Cl c. Br d. I
- Chemical industry makes a profit mostly in
 a. Immediately after establishment b. 0 - 4 years of running
 c) 4 - 7 years of running d. After seven years
- If 3Na^+ ions pumped out from the cells and 2K^+ pumped into the cells then the number of ATP molecule hydrolysed
 a. 1 b. 2 c. 3 d. 4
- The gases coming out of the tube containing ethane, ethylene and acetylene by passing ammonical AgNO_3 are:
 a. Ethane and ethylene b. Ethylene and acetylene
 c. Ethane and acetylene d. None the above all
- In Solvay ammonia process for manufacturing sodium carbonate, the substance which are circulated is
 a. $\text{NaCl} + \text{CO}_2$ b. $\text{NH}_4\text{Cl} + \text{CO}_2$
 c. $\text{CaCl}_2 + \text{CO}_2$ d. $\text{NH}_3 + \text{CO}_2$

Group 'B'

Give short answer to the following questions.

(8 × 5=40)

1. An element (A) has 1 electron in its N shell.
 - a. Identify the element (A) with number of proton and neutron in it. [2]
 - b. Write the four set of quantum number of this electron of N shell. [1]
 - c. Size of A⁺ ion is smaller than that of (A) atom though both contain the same number of protons. Give reason [1].
 - d. Write the type of bond formed by A⁺ with chlorine. [1]

OR

Given below are some elements with their atomic radii

| Element | Cs | Li | K | Rb | Na |
|------------------|------|------|------|------|------|
| Atomic radii (Å) | 2.25 | 1.34 | 1.96 | 0.77 | 1.54 |

- a. Infer, to which group of the periodic table they belong, and how does the atomic radius vary from top to bottom in a group of the periodic table? [1+2]
 - b. Alkaline earth metal ions are smaller than the alkali metal ions of the same period. Explain. [2]
2. If you are given following redox reaction
$$\text{Zn} + \text{HNO}_3 \rightarrow \text{Zn}(\text{NO}_3)_2 + \text{NH}_4\text{NO}_3 + \text{H}_2\text{O}$$
 - a. Identify with electronic concept, which is oxidised and which is reduced. [1]
 - b. Define the oxidant and reductant in terms of oxidation number. [1]
 - c. Balance the given reaction either by oxidation number or ion-electron method. [2]
 - d. Indicate the number of HNO₃ molecules acting as an oxidizing and as an acidic agent. [1]
 3. On heating blue vitriol crystals, at first one molecule escapes and more heat is needed to remove others. It is explained on the basis of hydrogen bonding.
 - a. Define hydrogen bonding. Write an example. [1]
 - b. Give an example of an intermolecular and intramolecular hydrogen bond. [1]
 - c. Why is H₂O exist as liquid whereas H₂S in gas? [1]
 - d. HF has an abnormally high boiling point than HCl, HBr, and HI. [1]
 - e. Why is glycerine more viscous than ethanol? [1]

OR

Gases having equal molecular weight also have the same rate of diffusion. e.g., CO_2 & N_2O diffuse at the same rate.

- a. State and explain Graham's law of diffusion. [3]
- b. A saturated hydrocarbon having molecular formula $\text{C}_n\text{H}_{2n+2}$ diffuses through a porous membrane twice as fast as sulphur dioxide. Calculate the volume occupied by the hydrocarbon at 27°C and 2 atmospheric pressure. [2]
4. Ammonia is a good complexing agent due to the presence of a lone pair electron in its nitrogen atom. It forms complex with copper sulphate solution.
 - i) Write the name of the complex formed between them. [1]
 - ii) Write the balance chemical reaction between them. [1]
 - iii) What is Schweitzer's reagent? Write its application. [1]
 - iv) Why does ammonia form white dense fume with conc. HCl ? [1]
 - v) Ammonia is starting material for manufacture of urea from carbamate process. Write the chemical reaction. [1]
5. Smelting is a process in which the roasted or calcined form of oxide ore is reduced to metal.
 - a. Name the furnace used for smelting process. [1]
 - b. Why is coke used as reducing agent in smelting? [1]
 - c. Smelting process is not suitable for reactive metals like Na, Ca, Al, etc, why? [2]
 - d) Though hydrogen is powerful reducing agent but it is not widely used in metallurgical process, why? [1]
6. 1-bromopropane on treatment with sodium and dry ether forms compound A.
 - a. What is the name of this reaction? Write the complete reaction. (2)
 - b. Write the IUPAC name of compound A. (1)
 - c. Write all the possible isomers of Compound A. (2)
7. The phenomenon of existing isomers of organic compound is called isomerism. The term isomer was proposed by Berzelius. The word isomers have been derived from Greek words, meaning equal or like parts (isos = equal and meros = parts).
 - i) What is meant by isomerism? [1]
 - ii) Homologs cannot be isomer, why? [1]
 - iii) Write the functional isomers of $\text{C}_3\text{H}_6\text{O}_2$ and write their IUPAC name. [2]

8. C
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m
ha
a.
b.
c. W

Give long ans.

9. Calcium carbonate reacts with hydrochloric acid.
 $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
 - a) Calculate the moles of CO_2 evolved.
 - b) What is the volume of CO_2 evolved at STP?
 - c) If 2 moles of HCl are used, how many moles of CaCl_2 are formed?
 - d) If 250 g of CaCO_3 are used, how many moles of CO_2 are evolved?
10. Aqua fortis (hydrochloric acid, HNO_3) is used in aqua fortis.
 - a. Fuming nitric acid
 - b) What are the uses of aqua fortis?
 - c. Gold dissolves in aqua fortis.
 - d. What happens when aqua fortis is added to a metal?
 - e. Draw the structure of aqua fortis.
 - f. Write the chemical reaction of aqua fortis with a metal.

Sodium potassium

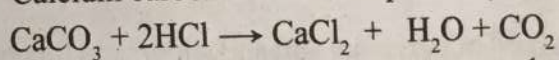
- a) What is the structure of sodium potassium?
- b) What is the use of sodium potassium?
- c) How many moles of sodium potassium are present in 1 mole of sodium potassium?

- v) Which isomerism is exhibited by the pair $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$ and $\text{CH}_3\text{CH}(\text{Cl})\text{CH}_3$? [1]
8. Caustic soda (NaOH) is manufactured by Diaphragm cell by electrolysis of brine due to its more efficiency in preference to mercury cathode cell of Nelson where mercury has potential health hazards effects.
- Write the anodic and cathodic reaction occurs in the cell. [2]
 - Draw the flow sheet diagram for revised Nelson Diaphragm cell. [2]
 - What are the advantages of this cell? [1]

Group 'C'

Give long answer to the following questions. (3×8 = 24)

9. Calcium carbonate is decomposed by HCl as given below:



- Calculate the mass of water produced by the reaction of 4 moles of CaCO_3 with 4 moles of HCl . [2]
 - What is the importance of limiting reagent in chemical reactions? [2]
 - If 2 moles of CaCO_3 produces 40L of CO_2 at STP with excess HCl . What is the percentage yield of the reaction? [2]
 - If 250 g of CaCO_3 upon reaction with excess HCl gives 222 g of CaCl_2 . What is the percentage purity of CaCO_3 ? [2]
10. Aqua fortis is nitric acid and aqua regia is a solution of conc. hydrochloric acid and conc. nitric acid in the ratio 3:1. Aqua fortis (HNO_3) is used in the purification of gold and silver. Silver dissolves in aqua fortis but gold is insoluble.
- Fuming nitric acid is yellow, why? [1]
 - What are aquafortis and fuming nitric acid? [1]
 - Gold dissolves in aquaregia but silver does not. Why? [1]
 - What happens when pure nitric acid is exposed to light? [2]
 - Draw the Lewis structure of (i) nitric acid (ii) nitrous acid. [2]
 - Write the acid anhydrides of (i) HNO_3 (ii) HNO_2 . [1]

OR

Sodium potassium pump is an example of primary active transport.

- What is meant by active transport? [2]
- What is the main function of sodium potassium pump? [2]
- How many K^+ ions enters and Na^+ ions comes out to the cell [1]

per computation of ATP molecule in Na-K pump? [2]

d) Write two symptoms of mercury and arsenic poisoning. [2]

Carbon is a solid nonmetallic element exists in nature as crystalline and amorphous allotropic forms.

- Why is carbon used as the most common reducing agent in thermal metallurgy? [1]
 - Graphite is a good conductor whereas diamond is an insulator. Justify this. [1]
 - What is meant by fullerene? Mention its use. [2]
 - Which one oxide of carbon is more dangerous and why? [2]
 - What happens when carbon monoxide is heated over finely divided nickel? [1]
 - Why is diamond hard but graphite soft and slippery to touch? [1]
11. An aromatic compound A when heated with zinc dust gives compound B. B on reacts with Cl_2 in presence of FeCl_3 gives compound C. Similarly B reacts with Cl_2 in presence of sunlight gives D which is a main insecticide.
- Identify A, B, C and D with their name giving suitable chemical reaction. [4]
 - What major product would you expect when B reacts with conc. HNO_3 in presence of conc. H_2SO_4 below 60°C ? [2]
 - Benzene does not decolourise bromine water though it contains three double bonds, why? [2]

Grade: _____
Time : 3 hrs
Attempt ALL ques

Circle the best alt

- One mole of C
a. 6.022×10^{23}
b. 6.022×10^{24}
c. 18.1×10^{23}
d. 3g atoms
- What makes
a. Number
b. Quantu
c. Wave na
d. Presenc
- Two electron
(a) Same sp
(b) Opposit
(c) Differen
(d) Differen
- Liquid cryst
a. Propert
b. Propert
c. The flu
d. None o
- The allotrop
a. Lamp b
c. Graphit
- In Down's pr
to NaCl in o
a. Increase
b. Increase
c. Decreas
d. Increase

Grade: XI

Time : 3 hrs

CHEMISTRY

Attempt ALL questions.

Group 'A'

Circle the best alternative to the following questions. (11 × 1=11)

- One mole of CO_2 contains
 - 6.022×10^{23} atoms of C
 - 6.022×10^{23} atoms of oxygen
 - 18.1×10^{23} molecules of CO_2
 - 3g atoms of C
- What makes the atomic mass fractional?
 - Number of unpaired electrons
 - Quantum number
 - Wave nature of electron
 - Presence of isotopes
- Two electrons in an orientation possess,
 - Same spin
 - Opposite spin
 - Different energy
 - Different values of magnetic quantum number
- Liquid crystals have
 - Properties of super cooled liquid
 - Properties of amorphous liquid
 - The fluidity of a liquid and optical properties of a solid
 - None of these
- The allotrope of carbon used for making lead pencil is
 - Lamp black
 - Charcoal
 - Graphite
 - Gas carbon
- In Down's process for manufacture of sodium metal, CaCl_2 is added to NaCl in order to
 - Increase ionization of NaCl
 - Increase the melting point of NaCl
 - Decrease the melting point of NaCl
 - Increase conductance of electrolyte

7. A radioactive isotope of hydrogen is,
 - (a) Protium
 - (b) Deuterium
 - (c) Tritium
 - (d) None
8. The stages of the product life cycle are
 - a. Research and development
 - b. Production and growth
 - c. Maturity and decline
 - d. All of these
9. Which one is useful in contraction of muscle?
 - a. Na^+
 - b. Ca^{2+}
 - c. Zn^{2+}
 - d. Fe^{2+}
10. The double bond present in the alkene and its position can be identified by
 - a. Bromine water
 - b. Ammonical AgNO_3
 - c. Ozonolysis
 - d. None of the above
11. The major problem in Contact process is/are
 - a. Designation of catalytic converter
 - b. Fed gas to the tower
 - c. Control the velocity of gases while passing to the catalytic converter
 - d. All these

Group 'B'

Give short answer to the following questions. (8 × 5=40)

1. Niels Henrik David Bohr, a Danish physicist worked with Rutherford in formulating the atomic structure and thus put forward his atomic model in 1913 based on the shortcomings of Rutherford's atomic model.
 - a. How does it explain the stability of an atom? [1]
 - b. Explain the origin of hydrogen spectra with the help of Bohr's atomic model. [3]
 - c) What is the main defect of Bohr's atomic model in light of the uncertainty principle? [1]

OR

Given below are some elements with their first, second and third ionization energies.

| Element | Na | Mg | Al |
|---------------------------------------|-------|------|------|
| IE_1 (kJ mol ⁻¹) | 495.8 | 736 | 577 |
| IE_2 (kJ mol ⁻¹) | 4563 | 1443 | 1833 |
| IE_3 (kJ mol ⁻¹) | 6916 | 7690 | 2745 |

- i) Infer, to which period of the periodic table they belong? [1]

- ii) IE_1 of Mg is more than Al, why? [2]
- iii) Why is there steep rise in IE of sodium from IE_1 to IE_2 to IE_3 ? [2]
2. When concentrated aqueous solution of NaCl is electrolyzed using mercury as cathode and graphite as anode, sodium is obtained at cathode and chlorine gas at anode.
- What is meant by electrolytes? Give examples. How do they conduct electric current?
 - Write the reaction occurs at anode and cathode for above example.
 - Why is hydrogen not discharged at mercury cathode?
 - Define catholyte and anolyte.
 - Mention the factors that affect the product of electrolysis [1+1+1+1+1]
3. The equilibrium state is reached if the reversible process is carried out in a closed vessel.
- Define reversible with examples and how does it differ from irreversible reactions?
 - Does equilibrium exist between water and water vapours in an open container, why?
 - An equilibrium has a dynamic nature. Comment this statement.
 - Does catalyst influence the state of equilibrium?
 - Do the mixture of $CaCO_3$, CaO and CO_2 kept in sealed vessel attain chemical equilibrium? [1+1+1+1+1]

OR

- The pressure of the individual gas in the mixture of non-reacting gases if it is kept in the same vessel at the same temperature is termed as partial pressure of gas.
- State and explain Dalton's law of partial pressure. [2]
 - How does temperature affect aqueous tension? [1]
 - Two vessels of capacity 1500 mL and 2000 mL contain hydrogen and oxygen gas respectively under a pressure of 750 mm and 100 mm. The gases are mixed in a five litres vessel. Find the final pressure of the mixture?
4. Ammonia was first isolated in 1774 by the English chemist Joseph Priestley; in 1787, the Frenchman Claude Louis Berthollet showed that it was NH_3 .
- How does liquid ammonia differ from liquor ammonia? [1]
 - Name the ions present in the solution of ammonia in water. [1]

- c. What happens when NH_3 is passed into (i) FeCl_3 solution (ii) Mercurous nitrate paper? [2]
- d. What are possible health effects of ammonia? [1]
5. When plaster of Paris is mixed with water, it forms a plastic mass and evolves heat (exothermic process), and quickly sets to a hard porous mass within 5 to 15 minutes. This is called the setting of plaster of Paris.
- Write a chemical reaction to prepare plaster of Paris from gypsum.
 - What is dead burnt plaster?
 - What do you mean by the setting of plaster in Paris?
 - Why is plaster of Paris suitable for immobilizing broken limbs?
 - Plaster in Paris should be stored in moisture proof container. Why? [1+1+1+1+1]
6. Nitrogen in the organic compound is detected by boiling alkaline mixture of sodium extract and fresh solution of ferrous sulphate followed by adding ferric chloride and concentrated HCl at last. Urea (NH_2CONH_2) is the organic compound containing nitrogen as foreign element.
- Why is fresh solution of ferrous sulphate needed for nitrogen test? [1]
 - What is the function of the addition of conc. HCl in the detection of nitrogen? [1]
 - Give any two organic compound which contain nitrogen as hetero elements. [1]
 - Sometimes a blood red colour is obtained during nitrogen test, what is this due to? [1]
 - Give chemical reactions involved if both sulphur and nitrogen are present in the test. [1]
7. A saturated hydrocarbon 'A' on chlorination gives compound 'B'. Compound 'B' on boiling with alc. KOH gives compound 'C'. Compound 'C' on ozonolysis gives formaldehyde whose aqueous solution is used to preserve the biological specimens.
- Write chemical reactions for the conversion of A to B to C with IUPAC names of each. [2]
 - Also write the reaction to convert C to formaldehyde. [2]

- c. KMnO₄
8. Sodium carbonate is prepared by Solvay process. The commercial process. The commercial process. The commercial process. The commercial process.
- Write the basic principle of Solvay process.
 - Draw the flow sheet of Solvay process.
 - Define the term spent brine (NaCl).
- Give long answer to the following questions.**
9. The chemists more interested in the industry. The process in a chemical industry.
- What is the reason for the low theoretical yield?
 - 6.5g of 98% impure hydrogen gas is 0.1g the theoretical yield.
 - 10 grams of compound of dilute hydrochloric acid gas liberated is for percentage purity reagent.
10. Phosphorous mainly exists in allotropic forms.
- Yellow phosphorous is a highly reactive phenomenon?
 - Why is yellow phosphorous stored under water?
 - Name the allotropic forms of phosphorous.
 - What happens when phosphorous is added to a sulphate solution?

- c. What happens when 'C' reacts with Baeyer's reagent (alkaline KMnO_4)? [1]
8. Sodium carbonate is manufactured by the Solvay or ammonia soda process. The commercial plant was designed by Ernest Solvay.
- Write the basic principle involved in the manufacture of sodium carbonate from Solvay's process. [2]
 - Draw the flow sheet diagram for manufacture of Na_2CO_3 . [2]
 - Define the term brine solution. Why is NaHCO_3 less soluble in spent brine (NaCl)? [1]

Group 'C'

Give long answer to the following questions. (3×8 = 24)

9. The chemists more interested in the calculation of percentage yield in the industry. The percentage yield indicates the efficacy of the process in a chemical production.
- What is the reason behind the experimental yield differ from theoretical yield? [2]
 - 6.5g of 98% impure zinc reacts with 7.3 g HCl. Calculate the theoretical yield of H_2 produced. If experimental yield of hydrogen gas is 0.175g. Calculate the percent yield. [3]
 - 10 grams of commercial zinc is made to react with an excess of dilute hydrochloric acid. The total volume of hydrogen gas liberated is found to be 3.1 liters at STP. Determine the percentage purity of the zinc sample. Also, name the limiting reagent. [3]
10. Phosphorous mainly exists in white (or yellow), red and black allotropic forms.
- Yellow phosphorous glow in dark. What is the name of this phenomena? [2]
 - Why is yellow phosphorous kept under water? [2]
 - Name the allotrope of phosphorous used in match industry. [2]
 - What happens when phosphine reacts with aqueous copper sulphate solution? [2]

OR

According to Armstrong's view, in electrochemical series, metals that are more electropositive than hydrogen, react with HNO_3 to produce nascent hydrogen, and metals that are less electropositive than hydrogen react with HNO_3 to produce nascent oxygen.

- a. Iron becomes passive in highly conc. HNO_3 . Why? [2]
 - b. What happens when a copper coin is dropped into conc. HNO_3 in a test tube? [2]
 - c. What happens when zinc metal is treated with (1:1) nitric acid? [2]
 - d. Name two metals that liberate hydrogen from very dilute nitric acid. [1]
 - e. Can we store conc. nitric acid in iron container? [1]
11. When propene reacts with HBr in the presence of organic peroxide gives major products opposite to Markovnikov's rule. Only unsymmetrical reagents are used for Markovnikov's rule.
- a. Write the complete reaction with major products. [2]
 - b. State Peroxide effect. [2]
 - c. Why is it found only with HBr but not with HCl and HI ? [2]
 - d) What are unsymmetrical reagent? Write example. [2]

Gr
Time : 3 hrs
Attempt ALL q

Circle the best a

1. When 8g of water produced
a. 9g
2. Na^+ ion is i
(a) Mg^{2+}
3. An atom ha
(a) Carbo
4. Which of th
a. N_2O
5. All tetra val
a. sp^3
6. Plaster of P
composition
a. CaSO_2
c. CaSO_4
7. A red flower
tube then Cl
a. The pa
b. Both a
c. None ar
d. The flowe
8. Which of the
a) Uses low
b) Involves
c) More mar
Generally
mple c
ium - p

Grade: XI

F.M.: 75

Time : 3 hrs

CHEMISTRY

Attempt ALL questions.

Group 'A'

Circle the best alternative to the following questions. (11 × 1=11)

- When 8g of hydrogen and 8g of oxygen combine, the amount of water produced is
 - 9g
 - 8g
 - 27g
 - 4.5g
- Na⁺ ion is isoelectronic with,
 - Mg²⁺
 - Ca²⁺
 - Li⁺
 - K⁺
- An atom having maximum unpaired electrons in p-orbital is,
 - Carbon
 - Nitrogen
 - Oxygen
 - Fluorine
- Which of the following gases have the same rate of diffusion?
 - N₂O
 - CO₂
 - NH₃
 - both a and b
- All tetravalent compound of carbon shows hybridization?
 - sp³
 - sp
 - sp²
 - can show any
- Plaster of Paris in contact with water sets into hard mass. The composition of hard mass is
 - CaSO₄.H₂O
 - CaSO₄.Ca(OH)₂
 - CaSO₄.2H₂O
 - CaSO₄.2Ca(OH)₂
- A red flower and a paper dipped in printer 'ink' is placed in a test tube then Cl₂ gas is passed then
 - The paper is bleached
 - Both are bleached
 - None are bleached
 - The flower is bleached but the paper is not
- Which of the following is not for the batch process?
 - Uses low cost equipment
 - Involves a sequence of steps in order
 - More manpower is used
 - Generally automated
- An example of secondary active transport is
 - Sodium -potassium pump
 - Sodium -glucose pump
 - Osmosis
 - Diffusion

10. Ethane is obtained from ethylene by
 a. Wurtz reaction b. Sabatier-Senderen's reaction
 c. Decarboxylation d. Dehydrogenation

11. In contact process, the impurities of arsenic are removed by
 a. Fe_2O_3 b. $\text{Fe}(\text{OH})_3$ c. $\text{Al}(\text{OH})_3$ d. $\text{Cr}(\text{OH})_3$

Ans Key:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| a | a | b | d | a | c | d | c | b | b | b |

Group 'B'

Give short answer to the following questions. ($8 \times 5=40$)

1. Hund's rule of maximum multiplicity states that electrons are filled up singly in degenerate orbitals then only pairing occurs.
- State Hund's rule of maximum multiplicity. Why this rule is called rule of maximum multiplicity? [2]
 - Which quantum numbers are same for two electrons in an orbital of an atom? [1]
 - State Pauli's exclusion principle. Why this principle is called exclusion principle? [1]
 - Describe the extra-stability of half-filled and completely-filled orbitals with suitable examples. [1]

OR

The electronegativity of alkali metals and halogens are given below.

| | | | | | |
|--------------------|-----|-----|-----|-----|-----|
| Element (gr. IA) | Li | Na | K | Rb | Cs |
| Electronegativity | 1.0 | 0.9 | 0.8 | 0.8 | 0.7 |
| Element (gr. VIIA) | F | Cl | Br | I | At |
| Electronegativity | 4.0 | 3.2 | 2.9 | 2.6 | 2.2 |

Answer the following questions:

- Define electronegativity. [1]
- Name a factor that affects the value of electronegativity. [1]
- Why does electronegativity decrease from Li to Rb? [1]
- Halogens (Group 7) have the highest electronegativity. Give reason. [1]
- Write the difference between electron affinity and electronegativity [1]

The combined gas law
 an ideal gas equation

- State Boyle's law
 - 0.50 g of a vapour occupies 1000 mL capacity at all the liquid. Calculate the molar mass ($\text{atm mol}^{-1}\text{K}^{-1}$).
4. Ozone was discovered by an electric discharge through oxygen. **Schonbein (ozonator)**
- Name the allotropic form of oxygen that protects us from UV rays coming from the sun.

2. Amount of a substance deposited by one coulomb charge is called electrochemical equivalent.
- What is meant by the term electrolysis?
 - What are the direction of flow of electrons and conventional current in electrolysis?
 - Does concentration of electrolyte change during electrolysis process?
 - How do you relate electrochemical equivalent and chemical equivalent?
 - How many coulombs of electricity are required to discharge 0.1 mole of Na^+ ion? [1+1+1+1+1]

3. What would be the effect on the position of equilibrium of the reaction?



On

- Addition of Cl_2
- Addition of PCl_3
- Decreasing the pressure by increasing the volume of the system
- Increasing temperature (the reaction is endothermic in the forward reaction)
- Adding a catalyst. [1+1+1+1+1]

OR

The combined gas law which is specified for an ideal gas is called an ideal gas equation.

- State Boyle's law and Charles' law. Derive $PV = nRT$. [1+2]
 - 0.50 g of a volatile liquid was introduced into a globe of 1000 mL capacity. The globe was heated to 91°C . So that all the liquid vaporized exerted pressure of 190 mmHg. Calculate the molecular mass of the liquid ($R = 0.082 \text{ litre-atm mol}^{-1}\text{K}^{-1}$). [2]Ans: 59.69 amu
4. Ozone was discovered by *Van Muran* by passing air through an electric discharge tube and its name was proposed by *Schonbein* (*ozooterr* = I smell).
- Name the allotropes of oxygen. Which of the allotrope protects us on earth from the harmful ultraviolet radiation coming from the sun? [2]

- b) Why are the O–O distances in ozone equal? [1]
- c) Write the name of any three chemicals responsible for destroying ozone layer. [1]
- d) How does ozone acts as a bleaching agent? [1]
5. The lattice energy and effect of polarizability (degree of deformation) of carbonate ions determines the relative thermal stability of carbonates and nitrates of alkaline earth metals. Following is the data for thermal decomposition for metal carbonate of group IIA metals. Answer the following questions:

| Elements | Decomposition temperature (Metal carbonate) °C |
|----------|--|
| Be | 25 |
| Mg | 540 |
| Ca | 900 |
| Sr | 1290 |
| Ba | 1360 |

- a) The extent of thermal stability is decided by the combined effect of lattice energy and effect of polarizability (degree of deformation). Define these two terminology [2].
- b) Predict the order of stability of carbonates of alkaline earth metals. [1]
- c) How do you justify this variation about thermal stability in question (a)? [1]
- d) Why is the decomposition temperature of CaCO_3 more than MgCO_3 ? [1]
6. Diesel fuel contains hydrocarbons with approximately 12–20 carbon atoms and the boiling range is between 170 and 360 °C.
- a) Which terminology is used to express the quality of diesel fuel used in diesel engines? [1]
- b) Define the terminology mentioned in (a). [1]
- c) The cetane number of cetane (n-hexadecane; $\text{n-C}_{16}\text{H}_{34}$) is assigned 100 while α -methyl naphthalene is taken zero. Why? [1]
- d) What is meant by a diesel with Cetane number 70? [1]

7. Conversion of a single or multiple substances into a single or multiple substances happens when?
- a. 2-Chloropropane reacts with sodium acetate in dry ether. Write the reaction and name of the product.
- b. Sodium acetate reacts with quicklime.
- c. Ethyne is treated with potassium permanganate solution.
- d. Benzene is subjected to nitration.
8. In large scale, ammonia is produced by a cheap synthetic method. Answer the following questions.
- a) What are the sources of nitrogen and hydrogen from Haber's process?
- b) Write the reaction for the synthesis of ammonia from Haber's process.
- c) Though low temperature is more productive for the synthesis of ammonia, why is the temperature of 450°C– 500°C used?
- d) Finely divided iron is used as a catalyst for the synthesis of K_2O , and ZrO and ZrO_2 . Why are porous catalysts used?
- Give long answer to the following questions.**
9. In 1923 A.D., Amadeo Avogadro's molecule in chemistry was named Avogadro's hypothesis. State Avogadro's hypothesis.
- i) State Avogadro's hypothesis.
- ii) What was the name of the hypothesis?
- iii) Avogadro's hypothesis is a part of atomic theory, justify.

- e) Why is tetra ethyl lead phased out in the petroleum refinery in the production of gasoline? [1]
7. Converting one organic compound to another organic compound by using one or more other organic compounds or reagents by a single or multiple steps is called an organic conversion. What happens when?
- 2-Chloropropane is heated with sodium metal in presence of dry ether. Write the IUPAC name of the product. [2]
 - Sodium acetate is heated with soda-lime in presence of quicklime. [1]
 - Ethyne is treated with ammonical cuprous chloride [1]
 - Benzene is subjected to ozonolysis followed by hydrolysis [1]
8. In large scale, ammonia is prepared by Haber's process which is a cheap synthetic method.
- What are the sources of raw material for Haber's process? [1]
 - Write the reaction principle for the manufacture of ammonia from Haber's process. [2]
 - Though low temperature and high pressure favours the more production of ammonia but optimum temperature of 450°C – 500°C and compromised pressure of 200 – 900 atmospheres are applied for the Haber's process. Why? [1]
 - Finely divided (porous) promoted iron containing Al_2O_3 , K_2O , and ZrO as a *promoter* should be used in the process. Why are porous iron and promoter required? [1]

Group 'C'

Give long answer to the following questions. (3x8 = 24)

9. In 1923 A.D., Amadeo Avogadro has introduced a new term i.e. molecule in chemistry for the first time. Before Avogadro, a molecule was named a compound atom.
- State Avogadro's hypothesis. [1]
 - What was the name given by Dalton for molecule? [1]
 - Avogadro's hypothesis is in accordance with Dalton's atomic theory, justify it. [2]

iv) 1 mole of any gas contains Avogadro's number (6.023×10^{23}) molecules. Deduce it. [2]

v) How is vapour density related to molar mass? Write relation between them. [2]

10. In Latin, the word nascor meaning newly born. This hydrogen (nascent hydrogen) is associated with some amount of energy at the time of birth.

a) Define nascent hydrogen. How is it prepared? [2]

b) Show that nascent hydrogen is powerful reducing agent than molecular hydrogen with the help of a suitable chemical reaction. [2]

c) Write the notation for atomic hydrogen and nascent hydrogen. [1]

d) What is meant by isotope effect? [1]

e) Write two applications of three isotopes of hydrogen. [2]

OR

Ammonia gas is obtained by heating sal ammonia with slaked lime.

a) What is meant by salammoniac? Write molecular formula. [2]

b) Ammonia is highly soluble in water. [1]

c) Ammonia has exceptionally high melting and boiling points than phosphine (PH_3). [2]

d) Ammonia gas cannot be collected over water. [2]

e) Nitric acid is generally stored in brown bottles. [1]

11. Compound 'A' is heated with Silver powder and gives compound 'B'. Compound 'B' on passing into the red hot iron or copper tube at 500°C produces compound 'C' of molecular formula C_6H_6 .

i. Identify compound 'A' and 'B' with IUPAC name. [2]

ii. Write a chemical reaction to confirm the acidic nature of compound 'B'. [2]

iii. What happens when compound 'C' reacts with chlorine in the presence of sunlight? [2]

iv. Convert compound 'C' into cyclohexane. [2]

| Competency level | Applying | | Understanding | | Remembering | | Working hour | Content Area | S.N. |
|------------------|----------|-----|---------------|-----|-------------|-----|--------------|--------------|------|
| | LAQ | SAQ | LAQ | SAQ | MCQ | SAQ | | | |
| Higher Ability | LAQ | SAQ | LAQ | SAQ | MCQ | SAQ | MCQ | | |
| Unit wise | | | | | | | | | |
| Group wise | | | | | | | | | |