

Chemistry - XI

SET 1

Time: 3 hrs
Stream: Science

Full Marks: 75
Pass Marks: 27

Group - A

Attempt any fifteen questions.

(15×2 = 30)

1. One million silver atoms weigh 1.79×10^{-16} gram. Calculate the atomic mass of Ag?
2. State Boyle's law.
3. What are alpha, beta and gamma rays?
4. An oxide of trivalent metal contains 68% of metal. Determine the atomic weight of metal.
5. Define equivalent weight of an element.
6. Prove that one mole of any gas is equal to 22.4 litres at NTP
7. CO is taken as polar molecule but not CO_2 , why?
8. What are the defects of Rutherford atomic model?
9. What is the cause of periodicity?
10. Define equilibrium. Write its characteristics.
11. Define oxidation and reduction electronically.
12. What happens when the gas obtained by heating powdered potassium permagnate with HCl is allowed to pass through hot and cone. NaOH? Give chemical reaction.
13. What happens when the gas obtained by heating formic acid with cone, sulphuric acid is allowed to pass through caustic soda? Give chemical reaction.
14. Write the Lewis structure of the compound formed by two element X and Y whose atomic numbers are 8 and 15.
15. Why is position of hydrogen in periodic table still controversial?
16. What is chlorinated lime? What happens when it is treated with dil.HCl?
17. Write the two uses of bleaching powder.
18. Why sodium cannot be extracted from aq. NaCl solution?
19. Write the IUPAC name of the followings compounds
 - a. $(\text{CH}_3)_3\text{CCHCHO}$
 - b. $\text{H}_2\text{C} = \text{C}(\text{OH})\text{COC1}$
20. Define electrophile and nucleophile.
21. Why is ethyne more acidic than ethene?
22. How the presence of chlorine in the organic compound is detected?

Group - B

Attempt any five questions.

(5×5 = 25)

23. Explain how Rutherford could not but Bohr could explain the origin of Balmer spectral series of hydrogen atom? Mention the defect of Bohr's atomic model.

24. Consider a chemical reaction
 $\text{Na}_2\text{CO}_3 + \text{HCl} \text{ -----} > \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
- How many moles of CO_2 are produced when 212 gm of Na_2CO_3 is completely reacted with hydrochloric acid? (2)
 - How many number of water molecules are produced when 0.5 moles of sodium carbonate is dissolved with hydrochloric acid? (1.5)
 - How many number of moles of sodium carbonate is required to produce 44.8 gm of CO_2 gas at NTP?
25. Define oxidation and reduction electronically. Balance the following redox reaction by oxidation number method or ion electron method
 $\text{Br}_2 + \text{HNO}_3 \text{ -----} > \text{HBrO}_3 + \text{NO}_2 + \text{H}_2\text{O}$
26. Describe the principle and self-explanatory sketch for the manufacture of ammonia by Haber's process.
27. How the bromine is manufactured from carnallite process?
28. What happens when?
- concentrated caustic soda solution is boiled with Chlorine gas (1)
 - SO_2 gas is passed through chlorine water. (1)
 - cone. nitric acid reacts with magnesium ribbon (1)
 - ammonia is passed through copper sulphate solution till excess (2)
29. Define homologous series. What are the characteristics features of a homologous series. (2+3)

Group - C

Attempt any two questions (10×2= 20)

30.
 - State and explain the law of reciprocal proportion.
 - Nitric acid contains 36.85% nitrogen and 63.15% oxygen, water contains 11.21% hydrogen and 88.79% oxygen. Ammonia contains 17.78% hydrogen and 82.22% nitrogen. Use these data to verify the law of reciprocal proportion.
31. Describe the principle and process for the manufacture of sulphuric acid with a labeled diagram by Contact process. How does cone. H_2SO_4 reacts with:
- oxalic acid
 - hydrogen sulphide
- (principle-3-marks, diagram-2, description-3) (8 + 2)
32. How is sodium extracted by Down's process? What happens when sodium reacts with ammonia? Convert sodium into sodium carbonate. (7+1+2)
33. Write short notes on (any two) (5×2 = 10)
- postulates of kinetic theory of gases
 - allotropes of carbon
 - Le-chatelier's principle
 - Structural isomerism

SET 2

Group -A

Attempt any fifteen questions.

(15×2 = 30)

1. One drop of water weighs 0.04 gm. Calculate the number of H₂O molecules in one drop of water.
2. State Charle's law.
3. The oxide of metal contains 53% of metal the vapour density of its chloride is 66. Calculate the valency and the atomic weight of the metal.
4. What is the capacity of a cylinder when 2gm of CO₂ gas enclosed in it exerts a pressure of 2atm. at 0°C?
5. One atom of an element 'A' weighs 6.644×10^{-27} kg. Calculate the number of gram atom in 80kg of it.
6. State Dalton's law of partial pressure.
7. Why is solid sodium chloride a non-conductor of electricity?
8. What is co-ordinate covalent bond? Why does such type of bonding arise?
9. Define nuclear reaction with an example.
10. Calculate the oxidation number of sulphur in sodium thiosulphate and Cr in dichromate ion.
11. Why is it the electron does not jump into the nucleus?
12. Why is ionization energy of oxygen less than that of nitrogen?
13. What happens when the gas obtained by heating salammoniac and slaked lime is allowed to pass through excess of chlorine? Give chemical reaction.
14. Draw Lewis structure of a) NO₂ b) N₂O₃
15. HF is liquid but HCl, HBr and HI are gases. Explain.
16. The boiling point of ammonia is higher than that of phosphine. Why?
17. What is meant by slag? Why is it important in metallurgy?
18. Give an important uses of each of the following:
 - i) Boron
 - ii) noble gas
 - iii) silicon
 - iv) red phosphorus
19. Give the molecular structure of
 - a) 2-ethyl-3-methylbut-1-ene
 - b) 3-hydroxy-3-methylhexanal
20. Convert ethene to benzene.
21. Define dehydrohalogenation reaction with an example.
22. How the presence of sulphur in the organic compound is detected?

Group - B

Attempt any five questions.

(5×5 = 25)

23. One litre of gaseous mixture containing methane and hydrogen effused in five minutes while one litre of oxygen took 10 minutes. Calculate the percentage by volume of gas in the mixture.

24. Consider a chemical reaction
 $\text{CaCO}_3 (\text{s}) + \text{HCl} (\text{s}) = \text{CaCl}_2 (\text{s}) + \text{H}_2\text{O} + \text{CO}_2$. if reaction is carried out by mixing 80% CaCO_3 and 20 gins of molal hydrochloric acid find out
- The no. of moles of each reactant? (1-5)
 - The number of gms of salt formed. (1-5)
 - The volume of CO_2 liberated at 27°c and 770 mm pressure. (2)
25. Define oxidation and reduction electronically. Balance the redox reaction in which zinc is allowed to react with very dilute HNO_3 by oxidation number method or ion electron method. [2+3]
26. Describe the principle and self-explanatory sketch for the manufacture of nitric acid by Ostwald's process.
27. Give the chemistry of quick lime and plaster of Paris.
28. What happens when?
- Concentrated HCl is dropped on powdered KMnO_4 ? (1)
 - A gas obtained by heating the mixture of common salt, conc. H_2SO_4 and manganese dioxide undergo photochemical reaction with the gas obtained by dropping methanoic acid on the surface of hot and conc. sulphuric acid ?
 - Freshly prepared ferrous sulphate is added to the mixture of cone, nitric acid and cone, sulphuric acid. Give chemical reaction (2)
29. Define isomerism. Give the possible isomers of molecular formula with their IUPAC names a) $\text{C}_2\text{H}_6\text{O}$ b) C_5H_{12}

Group - C

Attempt any two questions. (10×2 = 20)

30. a) State and explain the law of a) multiple proportion b) definite proportion 0.36 gm of a metal when burnt in oxygen yields 0.60gm oxide. The carbonate of that metal contains 28.57% of metal. Assuming the validity of law of definite proportion, determine the weight of oxide formed by heating 1 gm of that carbonate. (4+3+3)
31. Describe the principle and process for the manufactured of sulphuric acid with a labeled diagram by Contact process. Prove that H_2SO_4 acts as
- an oxidizing agent
 - a dehydrating agent
- (principle-3-marks, diagram-2, description-3) (8+2)
32. Explain the principle and process and write a well diagram for the manufactured of washing soda by Solvey ammonia process. Write the molecular formula of baking soda and soda ash. How would you convert NaOH into sodium carbonate?
33. Write short notes on (any two) (5×2 =10)
- Bohr's atomic model
 - Law of mass action
 - Homologous series
 - inductive effect

SET 3

Group -A

Attempt any fifteen questions.

(15×2 = 30)

1. What do you mean by gram equivalent mass? How is equivalent mass of an element related to atomic mass?
2. Calculate the mass of
 - a. i) two atom of nitrogen
 - ii) one molecule of carbondioxide.
3. Define boiling point and evaporation..
4. Why is 1st ionization of an element smaller than that of second ionization energy?
5. An electron of an atom possesses the quantum numbers $n=3$, $l=0$ and $m=0$. What do they mean?
6. Define hydrogen bond. Give an example of intramolecular hydrogen bond.
7. One mole of a gas occupies a volume of 1000 ml at 27°C. What will be the pressure of the gas?
8. Calculate the oxidation number of following underline atoms
 - a) K_3AsO_4
 - b) HNO_3
9. Write down the ground state electric configuration of Cu ($Z=29$) and Cr ($Z = 24$) in terms of s, p and d orbitals.
10. How is K_p related to K_c ? What is condition for a gaseous reaction to have $K_p = K_c$?
11. What are radio isotopes? Write any two examples.
12. Define the term
 - a) photochemical smog
 - b) acid rain
13. Differentiate between alloy and amalgam.
14. What do you mean by aluminothermite process? Give an example.
15. What happens when the gas obtained by heating salammoniac with slaked lime is allowed to pass through copper sulphate solution till excess? Give chemical reaction.
16. What are noble gases? Write any one use of noble gases?
17. Why cannot HI be prepared by the action of cone. H_2SO_4 on NaI?
18. Write the formula of borax and boric acid? Give their one use.
19. What is functional isomerism? Give an example.
20. What happens when ethene gas is passed through Bayer's reagent? Give chemical reaction.
21. Write the structure of the following organic compounds,
 - a) Prop-2-ene-1-nitrile
 - b) 2,2,4-trimethylpentanoic acid.
22. State Markovnikov's rule.

Group - B

Attempt any five questions:

(5×5 =25)

23. How did Bohr's model explain the origin of spectral lines in hydrogen atom?
24. Define oxidation and reduction in terms of electronic concept. Balance the following equation by ion electron or oxidation number method. (2+3)
$$\text{Zn} + \text{HNO}_3 \text{ -----} > \text{Zn}(\text{NO}_3)_2 + \text{NO}_2 + \text{H}_2\text{O}$$
25. A 1g sample of an alcohol was burnt in oxygen to produce 1.913g of O_2 and 1.174 g of H_2O . The mol. wt of the alcohol is 46. Find the molecular formula of the alcohol.
26. How is bromine manufactured from carnallite?
27. How is carbon monoxide prepared in laboratory? Write its action on (3+2)
a) nickel b) ferric oxide
28. Describe the principle involved in the manufacture of ammonia by Haber's process with self-explanatory diagram.
29. Describe the preparation of ethene (ethylene) in laboratory.

Group - C

Attempt any two questions.

(10×2 = 20)

30. a) Derive an expression to show that the relationship between Boyle's and Charle's law. [5]
b) A cylinder of 2.5 litre capacity contains 0.44 gm of CO_2 gas. Find
i) the pressure exerted by the gas at 25°C
ii) the number of moles of CO_2
iii) the numbers of moles of atoms of Oxygen. (2+1.5+1.5)
31. Describe the principle and process for the manufacture of sulphuric acid with a labeled diagram by contact method. Give one chemical equation to show sulphuric acid is
a) a dehydrating agent
b) an oxidizing agent
c) a precipitating agent (7+1+1+1)
32. Describe the extraction of sodium by Down's process. Write the action of sodium with
a) hydrogen b) water c) ammonia
33. Write short notes on any two. (2×5 = 10)
a. Chemistry of bleaching powder.
b. Le-Chatelier's principle.
c. Functional groups
d. Graham's law of diffusion

SET 4

Group -A

Attempt any fifteen questions.

(15×2 = 30)

1. What mass of 60% of CaCO_3 is required to react with 50 gm of hydrochloric acid?
2. Define atomic mass unit. How heavy is one atom of hydrogen?
3. The equivalent weight of magnesium is 12. What does it mean?
4. A carbon dioxide fire extinguisher of 3 litre capacity contains 4.4 kg of carbon dioxide. What volume of gas could this extinguisher deliver at NTP?
5. Define viscosity of a liquid. Why honey is more viscous than water?
6. What is the cause of extra stability of half-filled and completely filled orbital?
7. Distinguish between a covalent bond and coordinate covalent bond.
8. Why do atomic radii decreases across a period and increase in a group with the increase of atomic number?
9. Calculate the oxidation number of
 - a) chromium in potassium dichromate
 - b) sulphur in sulphate ion
10. How do increase in temperature and pressure affect the equilibrium of the following reactions
$$\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g}) + \text{Heat}$$
11. Define nuclear fission reaction with an example.
12. Draw the Lewis structure of
 - a) K_2CO_3
 - b) N_2O_4
13. What happens when the gas obtained by the action of dilute H_2SO_4 on iron sulphide is allowed to pass through acidified potassium permanganate solution?
14. Give the reaction of chlorine with slaked lime.
15. Why is carbon monoxide extremely poisonous?
16. Distinguish ortho and para hydrogen.
17. Define flux, gangue and slag with an example.
18. Give the method of preparation of plaster of Paris?
19. Give the molecular structure of
 - a) prop-2-ene-1-nitrile
 - b) 2-methoxypropan-1-ol.
20. Convert methane into ethane
21. The octane number of fuel is 75. What does it mean?
22. State Anti-Markovnikov's rule.

Group - B

Attempt any five questions:

(5×5=25)

23. State and explain the law of multiple proportion

24. Define redox reaction. Balance the following equation by oxidation number or ion electron method. ----- (1+4)

$$\text{Zn} + \text{HNO}_3 \longrightarrow \text{Zn}(\text{NO}_3)_2 + \text{NH}_4\text{NO}_3 + \text{H}_2\text{O}$$
25. Consider a chemical reaction

$$\text{Na}_2\text{CO}_3 + \text{HCl} \longrightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$$
 If reaction is carried out by mixing 2.12 gms of sodium carbonate and 1.5 gm of hydrochloric acid, find out
- Which one is limiting reactant and why? (2)
 - The number of excess reagent left over unused. (1)
 - How many grams of NaCl is formed? (1)
 - The volume of CO_2 produced at NTP. (1)
26. Describe the lab preparation of H_2S gas in laboratory. Give two reaction to show that H_2S is a reducing agent (3+2)
27. How the HI is prepared in laboratory? Give its action on conc. H_2SO_4 . (4+1)
28. How the sodium hydroxide is prepared by Solvay Kellener's process?
29. Explain ozonolysis and Markovnikov's rule with examples. (2.5+2.5)

Group - C

- Attempt any two questions. (2×10 = 20)
30. i) State Boyle's law and Charle's law. Derive $PV = nRT$ [3+3]
 ii) A volume of 95 ml of N_2O at 27°C is collected in a graduated tube over mercury the level of mercury inside the tube being 60 mm above outside mercury level when barometers reads 750 mm. Calculate the volume of N_2O at NTP. [4]
31. Describe the principle and process for the manufactured of ammonia with a labeled diagram by Haber's process. What happens when ammonia reacts with
 a) CO_2 b) heated copper oxide c) heated sodium.
 (principle-3-marks, diagram-2, description-2) [7 + 3]
32. Describe the extraction of sodium carbonate by Solvay-Kellner process. Describe the action of heat on washing soda. Give the molecular formula of baking soda. [7+2+1]
33. Write short notes on (any two) [5×2=10]
 a) Law of mass action b) Bohr's model of an atom
 c) inductive effect d) structural isomerism

SET 5

Group -A

- Attempt any fifteen questions. (15×2 = 30)
- How many atoms of hydrogen and oxygen are there in 9 gram of water?
 - Calculate the mass of
 a) 1 ml of oxygen gas at NTP. b) 3 gram atom of nitrogen
 - P-orbital contains 6 electrons and d orbital contains 10 electrons. Why?

4. Write down the isotopes of hydrogen. Which is radio isotope?
5. What mole percent of O_2 must be supplied to a space capsule in which the pressure is 0.3 atm., if the partial pressure of O_2 is equal the partial pressure of O_2 in air at sea level? (partial pressure of $O_2 = 0.21 \text{ atm.}$)
6. What is an ideal gas? Under what condition gases will behave nearly like an ideal gas?
7. Define surface tension. Give its unit.
8. How is dipole moment is originated in a molecule? Why its value is zero in CO_2 molecule?
9. What are the values of n, l and m for the $2P_y$ orbitals ?
10. How is Bohr's atomic model originated?
11. Write the formula of the substances containing Nitrogen which shows the following oxidation state: $-1/3$, -3 , $+3$ and $+4$
12. State the law of mass action.
13. What happens when the gas obtained by heating salammoniac and slaked lime is allowed to pass through copper sulphate solution till excess? Give chemical reaction.
14. What happens when the gas obtained by heating iron sulphide and dil.sulphuric acid is allowed to pass through acidified potassium dichromate solution? Give rxⁿ
15. Draw the resonance structure of ozone.
16. Define the term
 - a) BOD
 - b) COD
17. What is meant by Froth-flotation process? What types of ores are subjected to this process?
18. How is plaster of Paris prepared?
19. Define electrophile and nucleophile with an examples.
20. Write the IUPAC name of the followings compounds
 - a) $(CH_3)_3 CC(CH_3)_3$
 - b) $H_2C = C(OH)CH_2COOH$
21. What happens when water is dropped on calcium carbide?
22. Why is sodium extract solution alkaline in nature?
23. How the presence of sulphur in the organic compound is detected?

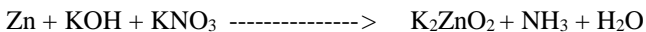
Group - B

Attempt any five questions:

(5×5 = 25)

23. When 2.035 gms of slaked lime and 2.675gms of salammoniac react, calcium chloride, ammonia and water are formed. Find out
 - a) limiting reactant.
 - b) the wt of $CaCl_2$ formed.
 - c) the number of gms of unreacted reagent left over.
 - d) the volume of dry ammonia produced at NTP.
 - e) the number of water molecules formed.

24. Define re-dox reaction. Balance the following redox reaction by oxidation number method or ion electron method



25. In four experiment, the following % composition of hydrocarbons were obtained

Hydrocarbon	carbon	hydrogen
A	75%	25%
B	80%	20%
C	85.7%	14.3%
D	92.3%	7.7%

Show that these data are in agreement with law of multiple proportion.

26. Describe the principle and self-explanatory sketch for the manufacture of ammonia by Haber's.
27. Describe ozone layer and its depletion.
28. What happens when?
- Dilute nitric acid is treated with Mg ribbon (1)
 - SO_2 gas is passed through chlorine water (1)
 - H_2S is passed through acidified KMnO_4 solution. (1.5)
 - Ammonia is passed through heated copper oxide (1.5)
29. Define isomerism. Give the possible isomers of C_6H_{14} with IUPAC names. (1+4)

Group - C

Attempt any two questions. (2×10 = 20)

30. i) State and explain Graham's law of diffusion. [6]
 ii) Ammonia gas and hydrochloric acid gas are allowed to diffuse from the opposite ends of a tube of 200cm length; at what distance from Hydrochloric acid gas and the white ring of ammonium chloride is formed. [4]
31. Describe the principle and process for the manufacture of sulphuric acid with a labeled diagram by Contact process. How does conc. H_2SO_4 react with:
- barium chloride
 - hydrogen sulphide
- (principle-3-marks, diagram-2, description-3) (8+2)
32. Write the principle of the manufacture of Down's, Castner-Kellner, Solvay-ammonia and Hesse's process.
33. Write short notes on (any two) (5×2 = 10)
- Le -Chatelier's principle
 - Modern periodic table
 - Detection of nitrogen in the organic compound
 - Allotropes of carbon