

GRADE XI

Chemistry

Model questions

विद्यार्थीले सकेसम्म आफ्नै शब्दमा उत्तर दिनुपर्नेछ । दायाँ किनारामा दिइएको अङ्कले पूर्णाङ्क जनाउँछ ।

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Time : 3 Hrs.

Full Marks: 75

Attempt all questions**Group 'A'**

Circle the best alternative to the following questions.

(11×1 = 11)

1. How many atoms are there in two molecules of water?
 - a. 3
 - b. 4
 - c. 5
 - d. 6
2. What is the number of moles of ammonia gas formed when 0.5 mole of nitrogen gas is reacted with excess of hydrogen gas?
 - a. 0.5
 - b. 1
 - c. 2
 - d. 3
3. Which of the following bonding is responsible for the solubility of ammonia gas in water?
 - a. Hydrogen bonding
 - b. Ionic bonding
 - c. Covalent bonding
 - d. Van der Waals' force
4. What happens when Sulphur dioxide (SO₂) gas is passed through an acidified solution of hydrogen sulfide (H₂S) gas?
 - a. SO₂ is oxidized to Sulphur
 - b. H₂S is reduced to Sulphur
 - c. SO₂ is oxidized to H₂SO₄
 - d. SO₂ is reduced to Sulphur
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.
- $$2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3 \quad \Delta H = -196 \text{ kJmol}^{-1}$$
- Which conditions of pressure and temperature favor the reverse reaction?
- High pressure and high temperature
 - High pressure and low temperature
 - Low pressure and high temperature
 - Low pressure and low temperature
7. Which is the correct order of ease of carbon dioxide production by heating the Group II metal carbonates?
- $\text{MgCO}_3 > \text{BeCO}_3 > \text{CaCO}_3 > \text{RaCO}_3$
 - $\text{CaCO}_3 > \text{MgCO}_3 > \text{BeCO}_3 > \text{RaCO}_3$
 - $\text{BeCO}_3 > \text{MgCO}_3 > \text{CaCO}_3 > \text{BaCO}_3$
 - $\text{BeCO}_3 < \text{MgCO}_3 < \text{CaCO}_3 < \text{RaCO}_3$
8. Which of the following is related to Batch process?
- Requires high- cost equipment
 - Can -not be controlled easily
 - Generally available in fully automated plant
 - Involves sequence of steps followed in specific order
9. Sodium-glucose pump is an example of
- Primary active transport protein
 - Secondary active transport protein
 - Primary passive transport protein
 - Secondary passive transportprotein
10. An intermediate compound X is formed during the production of urea through ammonia/carbon dioxide technology. What is the molecular formula of X?
- $\text{NH}_2\text{COONH}_2$
 - $\text{NH}_2\text{COONH}_4$
 - $\text{NH}_4\text{COONH}_2$
 - $\text{NH}_4\text{COONH}_4$
11. Which of the following are recycled in the manufacture of sodium Carbonate by Solvay's process?
- CO_2 and NH_4Cl
 - CO_2 and NH_3
 - NaCl and CaO
 - NaCl and NH_3

Group 'B'

Give short answer to the following questions.

(8 × 5=40)

- An element X has 2 electrons in K shell, 8 electrons in L shell and 5 electrons in M shell.
 - Identify the element X and write the number of protons and electrons in it.[3]

- ii. Size of X^{-} ion is greater than that of X atom though both contain the same number of protons. Give reason [1]
- iii. c. 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 CaCl_2 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

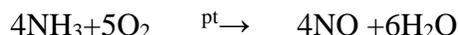
H ₂ OH
X
H ₂ CH ₂ CH ₂ OH

- 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]

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.



- i. Calculate the mass of Nitric oxide produced by the reaction of 2 mole of ammonia with 2 moles of oxygen. [2]
 - ii. What is the importance of limiting reactant in chemical calculation? [1]
 - iii. 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]
 - iv. Calculate the volume of HCl gas required at 20°C and 750 mm 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
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- i. Identify the acidic oxide, basic oxide, neutral oxide and mixed oxide from the above table [4]
- ii. Write two chemical equations to prove that the particular oxide is amphoteric in nature. [2]

- iii. Why is CO a harmful gas? [1]
- iv. 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.

- i. Write the four steps of chemical equation for the manufacturing of sulphuric acid by contact process starting from iron sulfide. [4]
 - ii. 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 C_3H_6O . Y and Z are functional isomers of each other
- i. Write the two-step chemical equation for the conversion of X into Y and Z. [2]
 - ii. Write the structural formula of Y and Z. Why are they called functional isomers? [3]
 - iii. What happens when hydrogen gas in the presence of nickel catalyst is passed over X? [1]
 - iv. What is the application of ozonolysis in the organic reaction mechanism? [1]
 - v. How can you prove chemically the compound X is unsaturated? [1]

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