

# HALF-YEARLY EXAMINATION 2023-2024

CLASS: X

SUBJECT: CHEMISTRY

NAME OF STUDENT: \_\_\_\_\_

DATE: \_\_\_\_\_

MAX. MARKS: 80

TIME: 2 HOURS

NOTE: You will not be allowed to write during the first 15 minutes. This time is to be spent in reading the question paper. The time given at the head of this paper is the time allowed for writing the answers.

Section A is compulsory. Attempt any four questions from Section B. The intended marks for questions or parts of questions are given in brackets [ ].

## SECTION A (40 Marks)

(Attempt all questions from this Section)

### Question 1

Choose the correct answers to the questions from the given options:

(Do not copy the question, write the correct answers only.)

[15]

- (i) When fused lead bromide is electrolysed, we observe :
- P. a silvery grey deposit at anode.
  - Q. a silvery grey deposit at cathode.
  - R. reddish brown fumes at anode.
- (a) only P  
(b) only Q  
(c) only R  
(d) both Q and R
- (ii) The salt 'S' in solution gives a dirty green precipitate with NaOH solution and a white precipitate with barium chloride solution. Which of the following could salt 'S' be?
- (a)  $\text{Fe}_2(\text{SO}_4)_3$
  - (b)  $\text{FeSO}_4$
  - (c)  $\text{FeCl}_2$
  - (d)  $\text{FeCl}_3$
- (iii) Which of the following contains maximum number of molecules?
- (a) 4g of  $\text{O}_2$
  - (b) 4g of  $\text{NH}_3$
  - (c) 4g of  $\text{CO}_2$
  - (d) 4 g of  $\text{SO}_2$
- (iv) The basicity of  $\text{H}_3\text{PO}_3$  is:
- (a) 1
  - (b) 2
  - (c) 3
  - (d) 4
- (v)  $\text{A} \rightarrow \text{A}^{3+}$  ;  $\text{B} \rightarrow \text{B}^{3-}$   
Number of electrons present in the outermost shell of atoms A and B respectively are:
- (a) 3, 3
  - (b) 5, 3
  - (c) 3, 5
  - (d) 5, 5
- (vi) The brown ring test is used for the detection of:
- (a)  $\text{CO}_3^{2-}$
  - (b)  $\text{NO}_3^-$
  - (c)  $\text{SO}_3^{2-}$
  - (d)  $\text{Cl}^-$

- (vii) An element with atomic number \_\_\_\_\_ will form a basic oxide.
- 7
  - 11
  - 15
  - 17
- (viii) An element belongs to third period and seventeenth group. It will have \_\_\_\_\_ electrons in its valence shell.
- 1
  - 3
  - 5
  - 7
- (ix) The pH of blood is around 7.4, of saliva is 6.5 and of acid rain is around 4.5. Which of the following statements regarding pH is correct?
- P. Saliva is more acidic than acid rain.  
Q. Blood is slightly alkaline
- only P
  - only Q
  - both P and Q
  - neither P nor Q
- (x) If the relative molecular mass of  $\text{CO}_2$  is 44, then its vapour density is:
- 22
  - 32
  - 44
  - 88
- (xi) The element which has greatest atomic radius is:
- Chlorine
  - Magnesium
  - Phosphorus
  - Sodium
- (xii) An organic weak acid is:
- Formic acid
  - Hydrochloric acid
  - Carbonic acid
  - Nitric acid
- (xiii) A polar covalent compound is:
- Methane
  - Ammonia
  - Nitrogen
  - Chlorine
- (xiv) An aqueous compound which turns colourless phenolphthalein to pink:
- Ammonium hydroxide
  - Nitric acid
  - Anhydrous Calcium chloride
  - Sulphuric acid
- (xv) Which of the following is NOT true in reference to electrolysis?
- Cathode is the oxidising electrode
  - As we descend the electrochemical series, the tendency of the cations to get discharged at the cathode increases.
  - Pure water contains entirely of molecules
  - Aqueous Copper chloride is a strong electrolyte.

Question 2

- (i) Name the following: [5]
- An oxide which forms salt when it reacts with both acids and alkalis.
  - A compound in which shared pair of electrons are equally distributed between the combining atoms.
  - An application of electrolysis in which the anode diminishes in size.

- (d) The electrons present in the outermost shell of an atom.  
 (e) The volume occupied by 1 mole of a gas at S.T.P.

(ii) [5]

(a) The atomic numbers of the three elements X, Y and Z are 2, 6 and 10 respectively:

- (1) Which two elements belong to the same group?  
 (2) Which two elements belong to the same period?  
 (b) An atom 'A' has electronic configuration 2, 7.  
 (1) To which of the following would it be chemically similar?

${}^7\text{N}$ ,  ${}^{15}\text{P}$ ,  ${}^{17}\text{Cl}$ ,  ${}^{18}\text{Ar}$

- (2) Why would you expect it to be similar?  
 (3) Is 'A' a metal or non-metal?

(iii) Solve the following: [5]

(a)  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \rightarrow \text{N}_2 + \text{Cr}_2\text{O}_3 + 4\text{H}_2\text{O}$

What volume of nitrogen, at STP, will be evolved when 63g of ammonium dichromate is decomposed?

(H = 1, N = 14, O = 16, Cr = 52)

(b) A gas jar contains  $7.2 \times 10^{20}$  molecules of  $\text{NH}_3$  gas. Find:

- (1) Number of moles.  
 (2) Weight in grams.  
 (3) Volume in  $\text{cm}^3$  of  $\text{NH}_3$  gas at STP.

(iv) Match the Column A with Column B: [5]

Column A

Column B

- |                       |  |
|-----------------------|--|
| (a) Acid salt         | (1) Reddish brown                      |
| (b) Chlorine          | (2) Methane                            |
| (c) Zinc hydroxide    | (3) Greenish yellow                    |
| (d) Copper metal      | (4) Sodium hydrogen carbonate          |
| (e) Covalent compound | (5) Soluble in excess sodium hydroxide |

(v) Fill in the blanks by choosing the correct answers from the brackets: [5]

- (a) A formula which tells the actual number of atoms present in one molecule of a substance is called \_\_\_\_\_ (empirical / molecular) formula.  
 (b) Maximum electron affinity is possessed by \_\_\_\_\_ (alkali metals / halogens).  
 (c) To distinguish soluble salts of zinc and lead \_\_\_\_\_ (NaOH/  $\text{NH}_4\text{OH}$ ) can be used.  
 (d) The process of separation of ions present in an ionic compound is known as \_\_\_\_\_ (ionisation/ dissociation).  
 (e) Nitric acid is a powerful \_\_\_\_\_ (reducing/oxidising) agent.

#### SECTION B (40 MARKS)

(Attempt any four questions from this Section)

#### Question 3

- (i) Give one chemical test to distinguish between following pairs of compounds. [2]  
 (a) Salts of  $\text{Na}_2\text{SO}_3$  and  $\text{Na}_2\text{CO}_3$ .  
 (b) Ammonium sulphate and copper sulphate solution.
- (ii) Three elements P, Q and R belong to the same period. The sulphate of P is  $\text{PSO}_4$ , the nitrate of Q is  $\text{Q}(\text{NO}_3)_3$  and the carbonate of R is  $\text{R}_2\text{CO}_3$ . [5]  
 (a) Arrange the elements in increasing order of valencies.  
 (b) Arrange the elements in decreasing order of atomic radii.  
 (c) Arrange the elements in increasing order of ionisation potential.  
 (d) State the group to which Q belongs.  
 (e) Which is the most metallic element?
- (iii) Classify the following substances into strong, weak and non-electrolytes: [3]  
 (a) NaCl solution (b)  $\text{CCl}_4$  (c)  $\text{NH}_4\text{OH}$

#### Question 4

- (i) An element 'X' combines with chlorine to form an ionic compound  $\text{XCl}_2$ . Without identifying X: [2]  
 (a) Draw the electron dot structure of the compound X with oxygen.  
 (b) If X belongs to period 3 of the periodic table, state its electronic configuration.

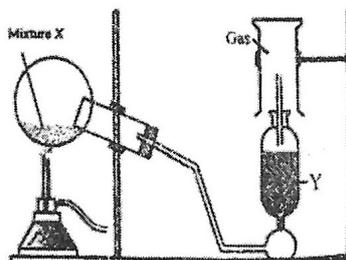
- (ii) Shikha prepared nitric acid in the laboratory from  $\text{KNO}_3$ . State: [3]  
 (a) The acid used by her  
 (b) The method used by her for the collection of the acid.  
 (c) The reason why she used all glass apparatus.
- (iii) Name: [2]  
 (a) The type of particles present in sugar solution.  
 (b) The metallic electrode which does not take part in an electrolytic reaction.
- (iv) During the electrolysis of Copper(II)sulphate solution using Pt as cathode and graphite as anode: [3]  
 (a) State what do you observe at the cathode.  
 (b) State the change noticed in the electrolyte.  
 (c) Write the reaction at the cathode.

Question 5

- (i) [3]  
 (a) Calculate the percentage of iron in  $\text{K}_4[\text{Fe}(\text{CN})_6]$   
 [Atomic mass : K = 39, Fe = 56, C = 12, N = 14]  
 (b) Determine the empirical formula and molecular formula of the compound having the following percentage composition:  
 C = 57.82% , O = 38.58% and the rest hydrogen. The vapour density of the compound is 83. [ C = 12, O = 16, H = 1]
- (ii) The following questions are pertaining to the laboratory preparation of Hydrogen chloride gas. [3]  
 (a) Write a balanced chemical equation for its preparation mentioning the conditions required.  
 (b) Why is concentrated Nitric acid not used in the preparation of hydrogen Chloride gas?  
 (c) How is hydrogen chloride gas collected?
- (iii) State one relevant observation when: [2]  
 (a) Hydrochloric acid is added to  $\text{AgNO}_3$  solution.  
 (b) A glass rod dipped in  $\text{NH}_4\text{OH}$  is brought near the mouth of a jar full of HCl gas.
- (iv) Draw the electron dot structure of the stable positive ion formed when an acid dissolves in water.  $\text{H}_3\text{O}^+$  [1]
- (v) State the property of HCl gas demonstrated in the Fountain experiment. [1]

Question 6

- (i) [3]  
 (a) Define Gay Lussac's law of combining volume.  
 (b) 1250 cc of oxygen was burnt with 300 cc of ethane ( $\text{C}_2\text{H}_6$ ). Calculate the volume of the unused oxygen and the volume of the carbon dioxide formed.  
 $2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$
- (ii) Give balanced chemical equations for the preparation of the following salts: [2]  
 (a) Lead sulphate from lead carbonate  
 (b) Copper chloride from copper carbonate
- (iii) Richa sets up an experiment as shown in diagram for the lab preparation of a pungent smelling gas. The gas is alkaline in nature: [3]



- (a) Name the gas collected in the gas jar.  
 (b) Write a balanced chemical equation for the above preparation.  
 (c) What is the purpose of using Y?

- (vi) (a) What would Ajay prove by passing ammonia gas over heated copper oxide? [2]  
(b) What will he observe on reacting excess chlorine with ammonia?

Question 7

- (i) Explain the following: [2]  
(a) Iron is rendered passive with fuming nitric acid.  
(b) Electron affinity of the elements decrease down the group.
- (ii) Mr Rajesh wants to electroplate his key chain with nickel to prevent rusting. For this electroplating: [5]  
(a) Name the electrolyte.  
(b) Name the cathode.  
(c) Name the anode.  
(d) Give the reaction at the cathode.  
(e) Give the reaction at the anode.
- (iii) Fill in the blanks by selecting the appropriate word from the given choice: [2]  
(a) A molecule which has a single lone pair of electrons is \_\_\_\_\_. ( $\text{NH}_3/\text{H}_2\text{O}$ )  
(b) Electrovalent compound does not conduct electricity in the \_\_\_\_\_ state. (molten/solid)
- (iv) State the conditions required for the conversion of ammonia to nitric acid. [1]

Question 8

- (i) Give reasons for the following: [2]  
(a) HCl gas cannot be dried over quicklime.  
(b) Dry HCl gas does not affect a dry strip of blue litmus paper.
- (ii) Why does pure nitric acid take on a yellowish brown colour when exposed to light? [1]
- (iii) Write chemical equations for the following reactions: [2]  
(a) Cu and conc. Nitric acid  
(b) CuO and dil. Nitric acid
- (iv) In what way is dil. Nitric acid different from the other acids when it reacts with metals? [1]
- (v) What is the purpose of using a funnel while preparing hydrochloric acid from HCl gas? [1]
- (vi) How will you distinguish between dil. HCl and dil.  $\text{H}_2\text{SO}_4$  using lead nitrate solution? [1]
- (vii) Write a balanced chemical equation for each of the following: [2]  
(a) Action of conc. nitric acid on sulphur.  
(b) Aluminium nitride is treated with warm water.

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END