

SAMPLE QUESTION PAPER
CHEMISTRY
CLASS XI (2026-27)

M M:70

Time:3 hours

General Instructions:

Read the following instructions carefully.

- (a) There are 33 questions in this question paper with internal choices.
- (b) **SECTION A** consists of 16 multiple-choice questions carrying 1 mark each.
- (c) **SECTION B** consists of 5 short answer questions carrying 2 marks each.
- (d) **SECTION C** consists of 7 short answer questions carrying 3 marks each.
- (e) **SECTION D** consists of 2 case - based questions carrying 4 marks each.
- (f) **SECTION E** consists of 3 long answer questions carrying 5 marks each.
- (g) All questions are compulsory.
- (h) Use of log tables and calculators is not allowed.

SECTION A

The following questions are multiple -choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Which sample contains the greatest number of atoms?
 - A. 1 mol of He
 - B. 0.5 mol of O₂
 - C. 0.25 mol of CH₄
 - D. 1 mol of H₂**
2. The number of significant digits in 1559.00 is ____
 - A. 6
 - B. 5
 - C. 3
 - D. 4**
3. What is the correct ground-state electron configuration for the Iron(II) ion Fe²⁺ ?
 - A. [Ar] 4s² 3d⁴**
 - B. [Ar] 3d⁶
 - C. [Ar] 4s¹ 3d⁵
 - D. [Ar] 3d⁷
4. Among the following elements, in which of the element the outermost electron is expected to be removed most easily:
 - A. Mg**
 - B. Al
 - C. Ga
 - D. Ca

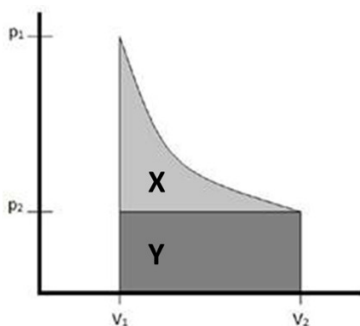
5. Choose the correct order of sizes of the following isoelectronic species - Na^+ , Mg^{2+} , Al^{3+} , S^{2-}

- A. $\text{Na}^+ < \text{Mg}^{2+} < \text{Al}^{3+} < \text{S}^{2-}$
- B. $\text{S}^{2-} < \text{Na}^+ < \text{Mg}^{2+} < \text{Al}^{3+}$
- C. $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+ < \text{S}^{2-}$
- D. $\text{Mg}^{2+} < \text{Al}^{3+} < \text{S}^{2-} < \text{Na}^+$

6. The correct order of increasing bond angle in NO_2 , NO_2^+ , NO_2^- is:

- A. $\text{NO}_2^- < \text{NO}_2 < \text{NO}_2^+$
- B. $\text{NO}_2 < \text{NO}_2^- < \text{NO}_2^+$
- C. $\text{NO}_2^+ < \text{NO}_2 < \text{NO}_2^-$
- D. $\text{NO}_2^+ < \text{NO}_2^- < \text{NO}_2$

7. The area under the P-V isotherm represents the total work done. X and Y represent the different shaded region under the isotherm. Which of the following is true for the reversible (W_{rev}) work done when an ideal gas is expanded reversibly or irreversibly from the volume V_1 to V_2 .



- A. $W_{\text{rev}} = x$
- B. $W_{\text{rev}} = y$
- C. $W_{\text{rev}} = x + y$
- D. $W_{\text{rev}} = x^2 - y^2$

8. In the reaction: $2\text{FeCl}_2 + \text{Cl}_2 \rightarrow 2\text{FeCl}_3$

The oxidation number of iron changes from _____ to _____, indicating that iron undergoes _____.

- A. +2 to +3 ; oxidation
- B. +3 to +2 : reduction
- C. +2 to 0 ; reduction
- D. 0 to +3; oxidation

9. A student places four metals in separate test tubes containing dilute hydrochloric acid. Which metal is most likely to produce hydrogen gas despite not reacting with steam?

- A. Copper
- B. Cadmium
- C. Silver
- D. Platinum

10. Identify the compound in which nitrogen cannot be estimated by Kjeldahl's method

- A. Azo compounds

- B. Aniline
- C. Hydrazine
- D. Benzamide

11 Electrophile that participates in sulphonation of benzene is :

- A. SO_3H^+
- B. SO_2
- C. SO_3
- D. SO_3^-

12 Identify the compound with highest boiling point:

- A. Neopentane
- B. iso pentane
- C. n-pentane
- D. n-Butane

Question number 13 to 16 are assertion reason types. Given below are two statements labelled as Assertion (A) and Reason (R). Select the most appropriate answer from the options given below:

- (A) Both A and R are true and R is the correct explanation of A
- (B) Both A and R are true but R is not the correct explanation of A.
- (C) A is true but R is false.
- (D) A is false but R is true.

13 Assertion (A): Two electrons having the same principal quantum number might not have the same energy in a multi-electron atom.

Reason (R): In multi-electron atoms, the energy of an electron depends on both the principal quantum number (n) and the azimuthal quantum number (l)

14 Assertion (A): The first electron gain enthalpy of oxygen is positive, whereas its second electron

gain enthalpy is negative.

Reason (R): The addition of a second electron to the negatively charged oxide ion requires energy to overcome the electrostatic repulsion between the incoming electron and the negatively charged ion.

15 Assertion (A): When the volume of a sealed container containing a liquid–vapour system at equilibrium is suddenly increased at constant temperature, the vapour pressure

initially decreases but eventually regains its original value.

Reason (R): At constant temperature, the equilibrium vapour pressure of a liquid depends only on temperature and is independent of the volume of the container.

16 Assertion (A) : -OH group is activating and o and p- directing towards electrophilic substitution

Reason (R): It is due to -I and - R which is dominating over -I effect.

SECTION B

This section contains 5 questions with internal choice in one question. The following questions are of a very short answer type and carry 2 marks each.

17. Calculate the minimum uncertainty in the momentum of an electron if its position is known within 2.0×10^{-10} m.
18. An electron and a proton have the same kinetic energy. Which particle has the greater de Broglie wavelength? Calculate the ratio of their wavelengths.
19. (A) At 500 K, for the reaction $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ $K_c = 100$. Considering the reactants and the products in their standard states calculate K_p .

OR

19. (B) A solution has a pH of 4. Another solution has a hydrogen ion concentration that is 100 times greater than the first solution. Calculate the pH of the second solution.

20. The following redox reaction takes place in an acidic medium:



Answer the following:

- (a) Identify x and y required to balance the above reaction.
- (b) Name the species that undergoes oxidation in the above reaction.
- (c) State the total number of electrons transferred in the balanced redox reaction.
- 21. A mixture contains two miscible liquids with boiling points of 95°C and 105°C. A student chooses simple distillation instead of fractional distillation. Analyze whether the student has made the correct choice. Justify your answer.**

SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer types and carry 3 marks each.

22. The threshold frequency of a metal is 5.5×10^{14} Hz. If light of frequency 8.5×10^{14} Hz is incident on it, calculate the maximum kinetic energy (in eV) of the emitted electrons.

23. Attempt any three out of the following four questions:

- (a) Why is the first ionisation enthalpy of calcium (Ca) higher than that of potassium (K)?
- (b) Why does oxygen generally show a covalency of 2, while sulphur can show covalencies of

2, 4, and 6?

(c) Which has a larger atomic radius: Cl^- or Cl ? Why?

(d) An element forms X^{2+} ion easily and has electronic configuration $[\text{Ne}]3s^2$. Identify the element and write its symbol.

24. Two diatomic species, X_2^- and X_2^{2-} , contain 17 and 18 electrons, respectively. Using Molecular Orbital Theory, answer the following:

(a) Predict the magnetic behaviour of X_2^- and X_2^{2-} .

(b) Which species is more stable? Give a reason.

(c) Which species has the longer bond length? Justify your answer.

25. (a) P and S in PCl_5 and SF_4 respectively have the same hybridisation but their molecules have different shapes. Explain this on the basis of VSEPR theory.

(b) Why is XeF_4 non-polar despite containing polar $\text{Xe}-\text{F}$ bonds?

26. (a) The heat evolved in combustion of methane is given by the equation



Calculate the amount of methane in grams that would be required to produce 445.15 kJ of heat of combustion.

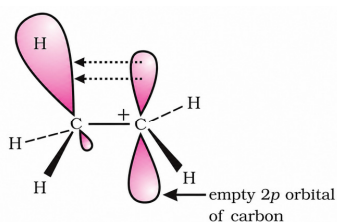
(b) Calculate the enthalpy of formation of HCl



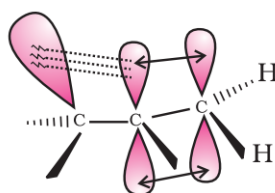
(c) No work is done on the system, but q amount of heat is taken out from the system and given to the surroundings. What type of wall does the system have?

27. Consider the following orbital diagrams and answer the questions that follow.

(i)



(ii)



(a) Identify the species represented by (i) and (ii)

(b) Which phenomenon is illustrated by these diagrams

(c) Identify the hybridization of positively charged Carbon in diagram (i)

28. (a) But-1-yne liberates H_2 with sodamide but But-2-yne does not. Give reason.

(b) An organic compound X C_4H_6 on complete ozonolysis followed by reaction $\text{Zn} / \text{H}_2\text{O}$ gives 2 moles of HCHO and one mole of glyoxal ($\text{OHC}-\text{CHO}$). Identify 'X' and write

the chemical reaction involved.

SECTION D

The following questions are case -based questions. Each question has an internal choice and carries 4 (2+1+1) marks each. Read the passage carefully and answer the questions that follow.

29. Sulphuric acid is manufactured by the Contact Process. In one of the important steps, sulphur dioxide reacts with oxygen according to the equilibrium:



This exothermic reaction produces sulphur trioxide which is further used in the production of sulphuric acid. Industrial chemists carefully choose the operating conditions to maximize the yield of sulphur trioxide while ensuring that the reaction proceeds at a practical rate. A catalyst is also used to speed up the attainment of equilibrium.

Answer the following questions:

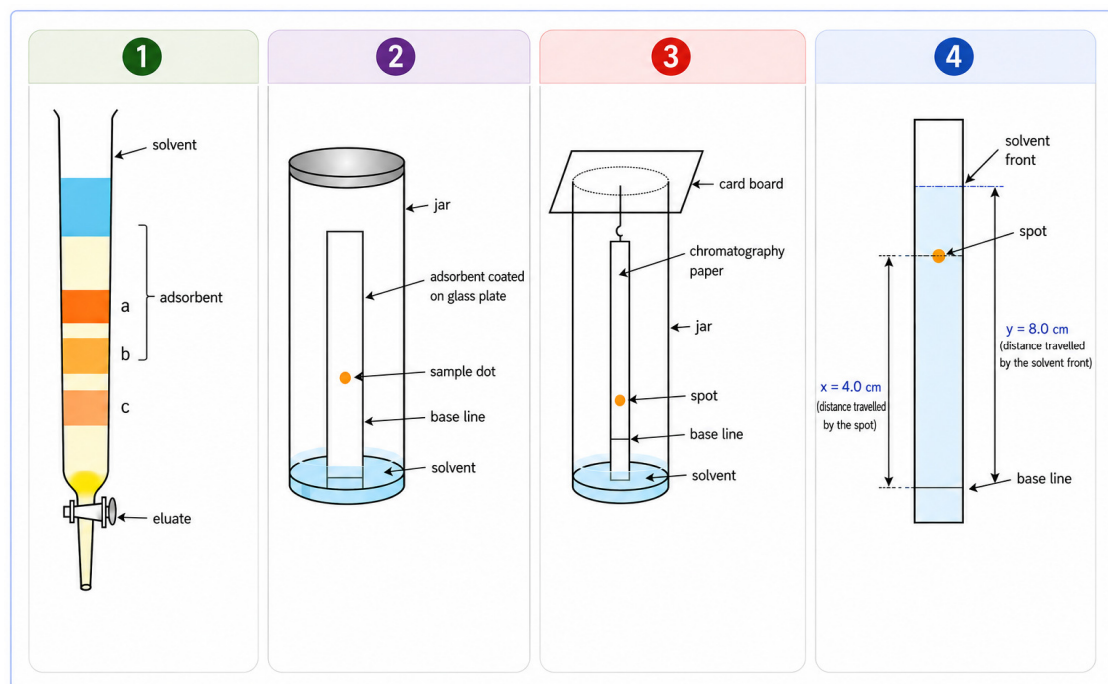
- (a) Why is high pressure favourable for this reaction?
- (b) What is the effect of increasing temperature on the equilibrium yield of SO_3 ?
- (c) How will the equilibrium constant for the above reaction be affected by:
 - (i) decreasing the temperature?
 - (ii) increasing the pressure?

Justify your answer.

OR

- (c) How does the catalyst affect the equilibrium constant of the above reaction? Give a reason.

30. Study the following figures showing different separation techniques and answer the questions that follow.



(a) Compare the principle of separation in Figure 2 and Figure 3

OR

Specify the separation technique shown in Figure 1.

(b) Name the stationary phase used in fig 3

(c) What is the significance of R_f value . Calculate R_f value for fig 4

SECTION E

The following questions are long answer type and carry 5 mark each. All questions have an internal choice.

31. A. (a) A gaseous mixture contains 2 moles of Gas A (Molar Mass = 20 g/mol) and 3 moles of Gas B (Molar Mass = 30 g/mol). What is the average molar mass of the mixture?
- (b) Hydrogen and oxygen are mixed in the mole ratio 3 : 2. Identify the limiting reagent in the Reaction : $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
- (c) A hydrocarbon has carbon and hydrogen in the molar ratio 1:2 and has a molecular Mass of 56. What is its molecular formula?

OR

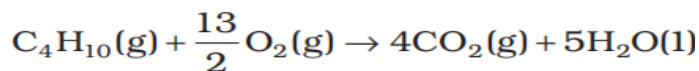
- B. (a) Two compounds are formed by the combination of carbon and oxygen. In compound A

12 g of carbon is combined with 16 g of oxygen. In compound B 24 g of carbon is combined with 64 g of oxygen. Using the given data, examine whether the compounds satisfy the Law of Multiple Proportions and justify your answer.

- (b) A laboratory technician accidentally labels a solution only with its molarity (4.0 M) and density (1.20 g mL^{-1}). The solution contains potassium nitrate (KNO_3) (Molar mass = 101 g mol^{-1}). To study freezing point depression, the technician prefers the molality

rather than the molarity. Give the reason for his preference and calculate the molality of the solution.

32. A. (a) Using the following thermochemical data, calculate the enthalpy of formation of butane:



Given:

$$\Delta_f H^\circ_{\text{CO}_2} = -393.5 \text{ kJ mol}^{-1}$$

$$\Delta_f H^\circ_{\text{H}_2\text{O}} = -285.83 \text{ kJ mol}^{-1}$$

$$\Delta_c H^\circ_{\text{C}_4\text{H}_{10}} = -2658 \text{ kJ mol}^{-1}$$

- (b) Rusting of iron : $4\text{Fe}(\text{s}) + 3\text{O}_{2(\text{g})} \Rightarrow 2\text{Fe}_2\text{O}_{3(\text{s})}$, is spontaneous process although entropy change for this reaction is negative. Explain.

OR

- B. (a) For the reaction in which compound is being formed from the elements in their standard

states, the enthalpy of reaction is equal to enthalpy of formation of the compound. Explain.

- (b) For the reaction :

$\text{N}_2(\text{g}) + 3\text{H}_{2(\text{g})} \Rightarrow 2\text{NH}_{3(\text{g})}$, $\Delta_f H^\circ_{\text{NH}_3} = -46.2 \text{ kJ mol}^{-1}$ and $\Delta_r S^\circ_{\text{NH}_3} = -198.75 \text{ J mol}^{-1}$. At what temperature will the reaction become spontaneous considering ΔH and ΔS to be constant over the temperature range.

- 33.A. (a) Benzene undergoes nitration in the presence of a mixture of concentrated nitric acid and concentrated sulphuric acid. The reaction follows the electrophilic substitution mechanism. For this reaction:

- Identify the electrophile generated in the reaction.
- Write the step showing the attack of the electrophile on the benzene ring.
- Write the step responsible for the restoration of aromaticity to form the final product.

- (b) An organic compound 'A' (C_6H_6) is obtained from 'B' by heating with soda lime. 'A' reacts with acetyl chloride in presence of AlCl_3 , to form 'D'. Identify 'B' and 'D'.

OR

- B. (a) Kolbe's electrolysis of sodium acetate produces ethane at the anode. Explain the mechanism of this reaction by writing the sequence of steps involved. Also write the overall reaction.

- (b) Answer the following questions:

- Give IUPAC name of the alkyne you would start with to prepare $\text{CH}_3\text{CH}_2\text{CH}_2\text{COCH}_3$
- Write the structure of alkene which on heating with KMnO_4/KOH gives Hexan-1,6-dioic acid