Roll No. _____

Code : 11–201718CH–A

Please check that this question paper contains **26** questions and **8** printed pages.

CLASS–XI
SUBJECT–CHEMISTRY (THEORY)

Time allowed : 3 Hrs. **M.Marks : 70**

General Instructions :

- *All the questions are compulsory.*
- *There are 26 questions in total.*
- *Questions 1 to 5 are very short answer type questions and carry one mark each.*
- *Questions 6 to 10 carry two marks each.*
- *Questions 11 to 22 carry three marks each.*
- *Question 23 is value based question carrying four marks.*
- *Questions 24 to 26 carry five marks each.*
- *There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the choices in such questions.*
- *Use of calculator is not permitted. However, you may use log tables if necessary.*

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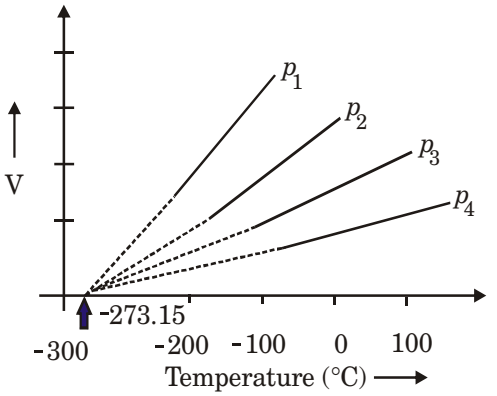
1. Give values of n and l for an unpaired electron in Cu (29).

2. The plots of volume verses temperature of an ideal gas at different pressures are given below. Arrange the pressure in increasing order.



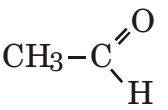
3. Predict which of the following reaction proceeds nearly to completion, with reason :

   (a) H_2 (g) + Cl_2 (g) $\rightleftharpoons$ 2HCl (g) at 300 K with $K_C = 4 \times 10^{31}$

   (b) N_2 (g) + O_2 (g) $\rightleftharpoons$ 2NO (g) at 298 K with $K_C = 4.8 \times 10^{-31}$

4. What happens when quicklime is heated with silica ?

5. Identify the electrophilic centre in



   Support your answer with appropriate reason.

6. The density of 3 molal solution of NaOH is 1.110 g/mL. Calculate the molarity of the solution.

   At. mass of Na = 23, O = 16 and H = 1 g mol^{-1}.

7. Consider the following species :

   P^{3-}, S^{2-}, Cl^-, K^+ and Ca^{2+}

   (a) What is common in them ?

   (b) Arrange them in order of increasing ionic radii.

8. Give reason for the following :

   (a) Oxygen has less negative electron gain enthalpy than sulphur.

   (b) Oxygen has lower first ionization enthalpy than nitrogen and fluorine.

9. Explain the following facts :

   (a) Though the electronegativities of nitrogen and chlorine are same. However NH_3 exist as liquid whereas HCl as gas.

   (b) Carbon-Oxygen bond lengths are equal in carbonate ion.

10. Write balanced equation for–

   (a) Dimethyldichlorisilane is hydrolysed followed by condensation polymerisation.

   (b) Boric acid is added to water.

OR

   Give chemical equation to show the reaction between :

   (a) Borontrifluoride with sodium hydride.

   (b) Silica is treated with hydrogen fluoride.

11. (a) Why are the atomic masses of most of the elements fractional ?

   (b) What is the law called which deals with the ratios of the volume of the gaseous reactants and products under similar conditions of temperature and pressure ?

   (c) How many significant figures are present in 0.04597 ?

12. (a) Write two conditions required for the linear combination of atomic orbitals to form molecular orbitals.

   (b) Draw the shape of the molecular orbitals formed by linear combination of 2p-orbitals.

      (i) End to end overlap

      (ii) Side by side overlap

13. (i) Which type of intermolecular forces exist among the following molecules

(a) H_2S molecules (b) Cl_2 and CCl_4 molecules

(ii) A mixture of dihydrogen and dioxygen at one bar pressure contains 20% by weight of dihydrogen. Calculate the partial pressure of dihydrogen.

14. Calculate the equilibrium constant for the following reaction at 298 K and 1 atm pressure :

$$NO\ (g) + \frac{1}{2}\ O_2\ (g) \rightleftharpoons NO_2\ (g)$$

Given $\Delta_f H^\circ$ at 298 K

For NO (g) = 90.4 kJ mol^{-1}

For NO_2 (g) = 33.8 kJ mol^{-1}

ΔS° at 298 K for the reaction = – 70.8 J K^{-1} mol^{-1}

R = 8.31 J K^{-1} mol^{-1}

15. (i) Predict the feasibility of a reaction when both ΔH & ΔS increase.

(ii) How do heat capacity at constant volume and that at constant pressure are related ? Derive the relationship.

16. (i) Depict the galvanic cell in which following reaction takes place :

$$Ni\ (s) + 2Ag^+\ (aq) \longrightarrow Ni^{2+}\ (aq) + 2Ag\ (s)$$

(ii) The Mn^{3+} ion is unstable in solution and under goes disproportionation to give Mn^{2+}, MnO_2 and H^+ ion. Write an ionic equation for the reaction and balance it using ION e^- method.

17. State as to why :

(a) In aqueous solution, Li^+ ion has lowest ionic mobility among all the alkali metals.

(b) Alkali metals are prepared by electrolysis of their fused chlorides.

(c) When an alkali metal dissolves in liquid ammonia the solution acquires different colours.

18. Account for the following :

(a) Elemental silicon does not form graphite like structure.

(b) Boron does not form B^{3+} ion.

(c) +2 oxidation state of lead is more stable than +4 oxidation state.

19. (i) What conclusion would you draw if during Lassaigne's test, a blood red coluration is obtained ?

(ii) Give structural formula of

Methyl 4-oxopentanoate

(iii) Draw resonance structure of

CH_3COO^-

OR

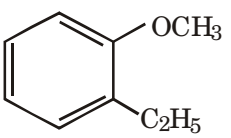
(i) Write the name of isomerism shown by the pair of following compounds :

$CH_3 - O - CH_2\ CH_2\ CH_3$ and

$C_2H_5 - O - C_2H_5$

(ii) An organic compound is fused with sodium for testing halogen, nitrogen and sulphur. Why ?

(iii) Give the IUPAC name of :



20. (i) Explain the terms inductive and electromeric effects.

(ii) Which electron displacement effect explains the following correct order of the acidity of the carboxylic acids ?

(a) $FCH_2\ COOH > Cl\ CH_2\ COOH > CH_3\ COOH$

(b) $CH_3CH_2COOH > (CH_3)_2\ CHCOOH > (CH_3)_3C–COOH$

21. (i) Justify the following :

(a) Isolation of staggered and eclipsed forms of ethane at room temperature is not possible.

(b) Rotation around carbon-carbon single bond of ethane is not completely free.

(ii) Arrange the following alkanes in increasing order of their boiling points, also explain the basis for your order :

2, 2–dimethylbutane, 3–methylpentane, n–hexane

22. Explain the following terms :

(a) Photochemical smog

(b) Ozone layer depletion

(c) Eutrophication

23. In India, we have a lot of shortage of drinking water. Green Park association has started rain water harvesting which will increase level of underground water. Rain water is almost pure form of water after heavy shower. First shower contains dissolved gases from atmosphere. Being a good solvent, when it flows on the surface of the earth, it dissolves many salts in the form of hydrogen carbonate, chloride and sulphate in water which makes it hard.

Answer the following questions :

(i) Define soft water.

(ii) State one disadvantage of hard water.

(iii) Mention one method to remove permanent hardness of water.

(iv) What are the values possessed by office bearer of Green Park association ?

24. (a) How many radial and angular nodes will be there in 5f orbital ?

(b) The unpaired electrons in Al and Si are present in 3p orbital. Which electron will experience more effective charge from the nucleus ? Give reason for your answer.

(c) A tennis ball of mass 6×10^{-2} kg is moving with a speed of 62 m/sec. Calculate the wavelength associated with this moving tennis ball. Will the movement of this ball exhibit a wave character ? Explain. Plank's constant h = 6.626×10^{-34} Js.

OR

(a) State Heisenberg's Uncertainty Principle. How does it contradicts the Bohr's Model of Atom ?

(b) Calculate the frequency and wavelength of the radiation in nanometers emitted when an electron in the hydrogen atom jumps from third orbit to the ground state.

Rydberg constant (R) = 109, 677 cm^{-1}.

25. (a) In reaction

$CO\ (g) + 2H_2\ (g) \rightleftharpoons CH_3OH\ (g) \qquad \Delta_r H^\circ = -92.0\ KJ\ mol^{-1}$

Concentration of hydrogen, carbon monoxide and methanol becomes constant at equilibrium. What will happen if–

(i) Volume of reaction vessel in which reactants and products are contained is suddenly reduced by half ?

(ii) Temperature of reaction vessel increases ?

(b) 20 ml of 0.001 M $AgNO_3$ solution is added to one litre of 0.002 M K_2CrO_4 solution. Will there be any precipitation ?

Ksp for Ag_2CrO_4 is 2.4×10^{-12}

OR

(i) Write the conjugate acid of NH_3.

(ii) Calculate pH of a 1.0×10^{-8} M solution of HCl.

(iii) The equilibrium constant at 278 K for

$Cu\ (s) + 2Ag^+\ (aq) \rightleftharpoons Cu^{2+}\ (aq) + 2Ag\ (s)$

is 2×10^{15}. In a solution in which copper has displaced some silver ions from the solution, the concentration of Cu^{2+} ion is 1.8×10^{-2} mol L^{-1} and the concentration of Ag^+ ions is 3×10^{-9} mol L^{-1}. Is the system at equilibrium ? Justify your answer.

26. (i) Write one chemical equation each to illustrate the following reactions

(a) Friedal–Crafts alkylation

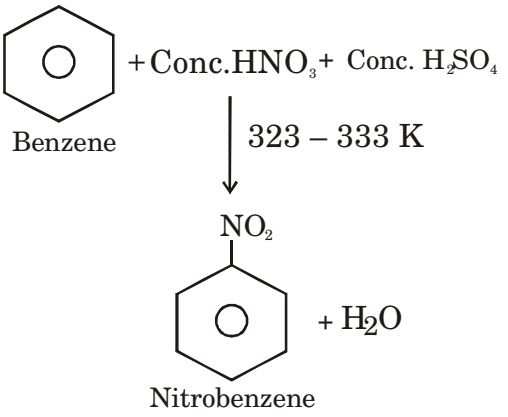
(b) Decarboxylation

(ii) An alkene 'A' on ozonolysis gives a mixture of benzaldehyde and butan-2-one. Write structure and IUPAC name of 'A'.

(iii) Give one chemical test to distinguish between ethane and ethene.

OR

(i) Give mechanism of the following reaction :



(ii) Carry out the following conversions :

(a) Benzene to acetophenone

(b) Ethanoic acid to methane

(c) Propyne to propanone

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