Question Paper 2007 Delhi Set-2
Class-12 Chemistry

General Instructions

1. All questions are compulsory.
2. Marks for each question are indicated against it.
3. Question numbers 1 to 5 are very short-answer questions, carrying 1 mark each. Answer these in one word or about one sentence each.
4. Question numbers 6 to 12 are short-answer questions, carrying 2 marks each. Answer these in about 30 words each.
5. Question numbers 13 to 24 are short-answer questions of 3 marks each. Answer these in about 40 words each.
6. Question numbers 25 to 27 are long-answer questions of 5 marks each. Answer these in about 70 words each.
7. Use Log Tables, if necessary Use of calculators is not permitted.

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1. Find out the number of atoms per unit cell in a face-centred cubic structure having only single atoms at its lattice points. **[1]**

2. State the condition resulting in reverse osmosis. **[1]**

3. Express the rate of the following reaction in terms of disappearance of hydrogen in the reaction. **[1]**

$$3H_2(g) + N_2(g) \rightarrow 2NH_3(g)$$

4. Name the following compound according to IUPAC system: **[1]**

$$CH_3COCH_2COCH_3$$

5. Why do amines react as nucleophiles? **[1]**

6. (a) Write the mathematical expression for the relationship of wavelength (λ) of a moving particle and its momentum (p).

(b) What physical meaning is attributed to the square of the absolute value of wave function,

$|\psi|^2$? **[2]**

OR

State the Heisenberg Uncertainty Principle and explain as to why it is not of real consequence when applied to a macroscopic object, like a cricket ball. **[2]**

7. Define conductivity and molar conductivity for the solution of an electrolyte. **[2]**

8. How would you account for the following: **[2]**
(i) Sulphur hexafluoride is less reactive than sulphur tetrafluoride.
(ii) Of the noble gases only xenon forms known chemical compounds.

9. On the basis of the standard electrode potential values stated for acid solution, predict whether Ti^{4+} species may be used to oxidise Fe^{II} to Fe^{III}. **[2]**

Reaction		$E^{\ominus}/V$
$Ti^{IV} + e^- \rightarrow Ti^{3+}$	:	$+0.01$
$Fe^{3} + e^- \rightarrow Fe^{2+}$	:	$+0.77$

10. What are chiral objects? Indicate the presence of centre of chirality, if any, in the molecules of 3-bromopent-l-ene. **[2]**

11. How may the following conversions be carried out: **[2]**
(i) Propene to propan-2-ol
(ii) Anisole to phenol
(Write the reaction only.)

12. Write formulae of the monomers of polythene and teflon. **[2]**

13. Define bond order in a diatomic molecule. Find the bond order in O_2 molecule. State and explain magnetic character of molecular oxygen. **[3]**

14. Assign reasons for the following: **[3]**
(i) Phosphorus doped silicon is a semiconductor.
(ii) Schottky defect lowers the density of a solid.
(iii) Some of the very old glass objects appear slightly milky instead of being transparent.

15. A $0.1539 \ molal$ aqueous solution of cane sugar $\left(mol.mass = 342 \ g \ mol^{-1}\right)$ has a freezing point of $271 \ K$ while the freezing point of pure water is $273.15 \ K$. What will be the freezing point of an aqueous solution containing 5 g of glucose $\left(mol.mass = 180 \ g \ mol^{-1}\right)$ per 100 g of solution? **[3]**

16. Calculate the standard cell potential of the galvanic cell in which the following reaction takes place: **[3]**

$$2Cr(s) + 3Cd^{2+} \rightarrow 2Cr^{3+}(aq.) + 3Cd(s)$$

Also calculate the $\Delta_r G^{\ominus}$ value of the reaction.

(Given: $E^{\ominus}_{Cr^{3+}/Cr} = +0.74 \ V; E^{\ominus}_{Cd^{2+}/Cd} = -0.40 \ V$ and $F = 96500 \ C \ mol^{-1}$)

17. The rate constant for a first order reaction is $60 \ s^{-1}$. How much time will it take to reduce the concentration of the reactant to 1/10th of its initial value? **[3]**

18. Describe the following types of colloids, giving an example for each: **[3]**
(i) Multimolecular colloids
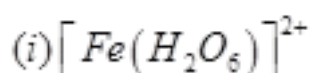(ii) Macromolecular colloids

OR

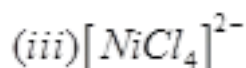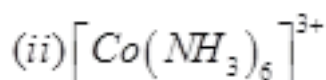Explain the following terms with a suitable example in each case: **[3]**
(i) Shape-selective catalysis
(ii) Dialysis

19. How would you account for the following: **[3]**
(i) The transition elements have high enthalpies of atomisation.
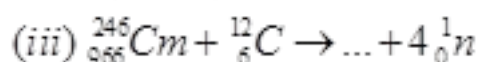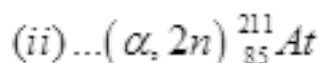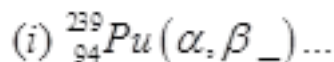(ii) The transition metals and their compounds are found to be good catalysts in many processes.

20. Describe for any two of the following complex ions, the type of hybridization, shape and magnetic property: **[3]**
(i) $\left[Fe(H_2O_6)\right]^{2+}$

(ii) $\left[Co(NH_3)_6 \right]^{3+}$

(iii) $\left[NiCl_4 \right]^{2-}$

(At. Nos. Fe = 26, Co = 27, Ni = 28)

21. Complete the following statements for nuclear reactions: **[3]**

(i) $^{239}_{94}Pu\left(\alpha, \beta\_ \right)\ldots$

(ii) $\ldots\left(\alpha, 2n \right) {}^{211}_{85}At$

(iii) $^{246}_{966}Cm + {}^{12}_{6}C \rightarrow \ldots + 4\,{}^{1}_{0}n$

(Note: You may use 'X' as symbol if the correct symbol in a reaction is not known)

22. Write one chemical equation for each, to illustrate the following reactions: **[3]**

(i) Rosenmund reduction

(ii) Cannizzaro reaction

(iii) Fischer esterification

23. Account for any two of the following: **[3]**

(a) Amines are basic substances while amides are neutral.

(b) Nitro compounds have higher boiling points than the hydrocarbons having almost the same molecular mass.

(c) Aromatic amines are weaker bases than aliphatic amines.

24. (a) Describe and illustrate with an example each, a mordant dye and a detergent,

(b) Give an example of a liquid.propellant. **[3]**

25. (a) Prove that $\Delta G_{system} = -T\,\Delta S_{total}$ for a system which is not isolated.

(b) The decomposition of Fe_2O_3 is a non-spontaneous process

$2Fe_2O_3(s) \rightarrow 4Fe(s) + 3O_2(g). \quad \Delta_r G^\circ = +1487\,kJ\,mol^{-1}$

Show that the reduction of Fe_2O_3 by CO can be made spontaneous by coupling with the following reaction:

$2CO(g) + O_2(g) \rightarrow 2CO_2(g). \quad \Delta_r G^\circ = -514\,kJ\,mol^{-1}$ **[2, 3]**
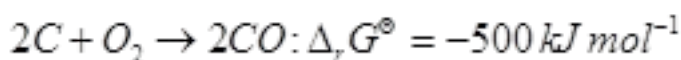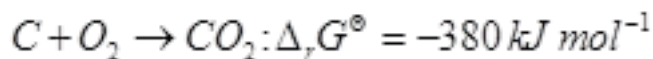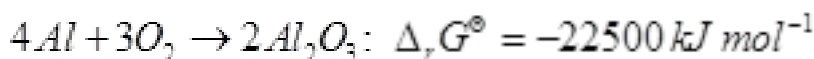
OR

(a) Define the following terms:

(i) Entropy

(ii) A spontaneous process

(b) Given below are the standard Gibbs energy changes for two reactions at 1773 K:

$$C + O_2 \rightarrow CO_2 : \Delta_r G^\circ = -380 \, kJ \, mol^{-1}$$
$$2C + O_2 \rightarrow 2CO : \Delta_r G^\circ = -500 \, kJ \, mol^{-1}$$

Discuss the possibility of reducing Al_2O_3 with carbon at this temperature. Given that: **[2, 3]**

$$4Al + 3O_2 \rightarrow 2Al_2O_3 : \Delta_r G^\circ = -22500 \, kJ \, mol^{-1}$$

26. (a) Assign reasons for the following:

(i) PbO_2 is a stronger oxidising agent than SnO_2.
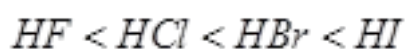
(ii) In solid state PCl_5 behaves as an ionic species,

(iii) Aluminium chloride $\left(AlCl_3 \right)$ is very often used as a catalyst.

(b) What is the structural difference between orthosilicates and pyrosilicates? **[3, 2]**

OR

(a) Assign reasons for the following:

(i) The acid strengths of acids increase in the order

$$HF < HCl < HBr < HI$$

(ii) The lower oxidation state becomes more stable with increasing atomic number in Group 13.

(iii) H_3PO_2 behaves as a monoprotic acid.

(b) Draw the structures of the following compounds:

(i) SF_4

(ii) XeF_2 **[3, 2]**

27. (a) Answer the following questions briefly:

(i) What are reducing sugars?

(ii) What is meant by denaturation of a protein?

(iii) How is oxygen replenished in our atmosphere?

(b) Define enzymes. **[3, 2]**

OR

(a) Answer the following questions briefly:

(i) What are any two good sources of vitamin A?

(ii) What are nucleotides?

(iii) Give an example of simple lipids.

(b) How are carbohydrates classified? **[3, 2]**