

IIT-JEE - Previous year Papers -CHEMISTRY (Mains) - 2005
CHEMISTRY
(Mains – 2005)

1. (i) $\mu_{\text{obs}} = \sum \mu_i x_i$.

Where μ_i is the dipole moment of a stable conformer of the molecule, Z-CH₂-CH₂-Z and x_i is the mole fraction of the stable conformer. Given : $\mu_{\text{obs}} = 1.0$ D and $x(\text{anti}) = 0.82$

Draw all the stable conformers of Z-CH₂-CH₂-Z and calculate the value of μ (Gauche).

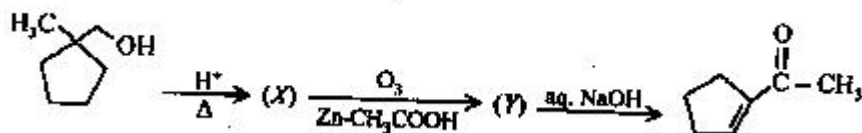
(ii) Draw the stable conformer of Y-CHD-CHD-Y (mesoform)

When Y=CH₃ (rotation about C₂-C₃)

Y=OH (rotation about C₁-C₂) in Newmann projection.

2. Identify (X) and (Y) in the following reaction sequence.

3. In face centred cubic (fcc) crystal lattice, edge length is 400 m. Find the diameter of greatest sphere which can be fit into the interstitial void without distortion of lattice.

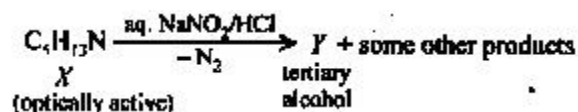


4.

(i) Identify (X) and (Y).

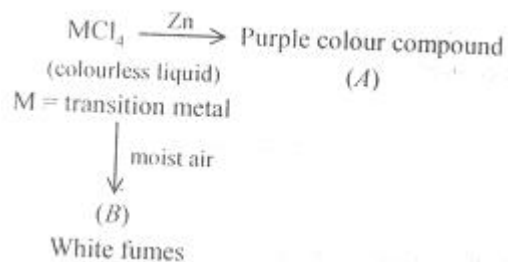
(ii) Is (Y) optically active?

(iii) Give structure(s) of intermediate(s) if any in the formation from (X) to (Y)?

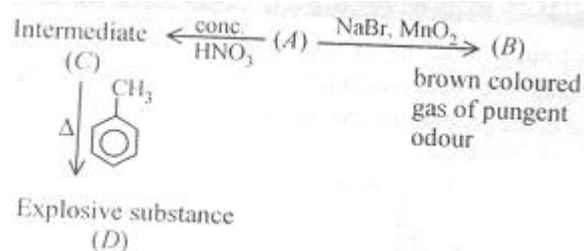


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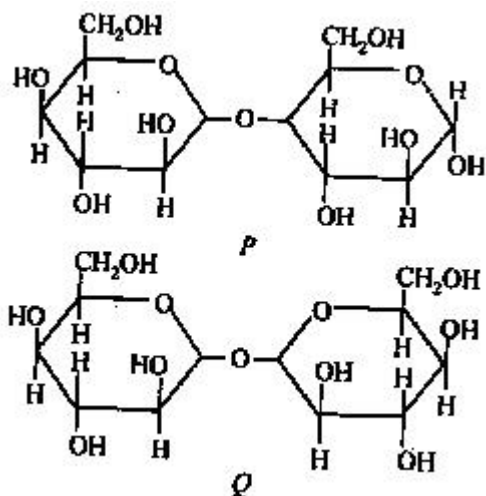
Identify (A), (B) and MCl₄. Also explain colour difference between MCl₄ and (A).



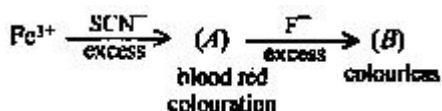
6. Identify (A),(B),(C) and (D). Give the reason for (A)→(B) and (A)→(C).



7. Which of the following will reduce Tollen's reagent? Explain.



8. Write the structures of $(\text{CH}_3)_3\text{N}$ and $(\text{Me}_3\text{Si})_3\text{N}$. Are they isostructural? Justify your answer.



9.

What are (A) and (B)? Give IUPAC name of (A). Find the spin only magnetic moment of (B).

10. Find the velocity (in ms^{-1}) of electron in first Bohr's orbit of radius a_0 . Also find the de Broglie's wavelength (in m). Find the orbital momentum of 2p orbital of hydrogen atom in units of $h/2\pi$.

11. At constant temperature and volume X decomposes as $2\text{X}_{(\text{g})} \rightarrow 3\text{Y}_{(\text{g})} + 2\text{Z}_{(\text{g})}$. P_x is the partial pressure of X.

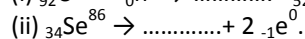
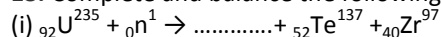
Observation No.	Time (in minutes)	P_x (in mm of Hg)
1.	0	800
2.	100	400
3.	200	200

What is the order of reaction with respect of X?

- Find the rate of constant.
- Find the time for 75% completion of the reaction.
- Find total pressure when pressure of X is 700 mm of Hg.

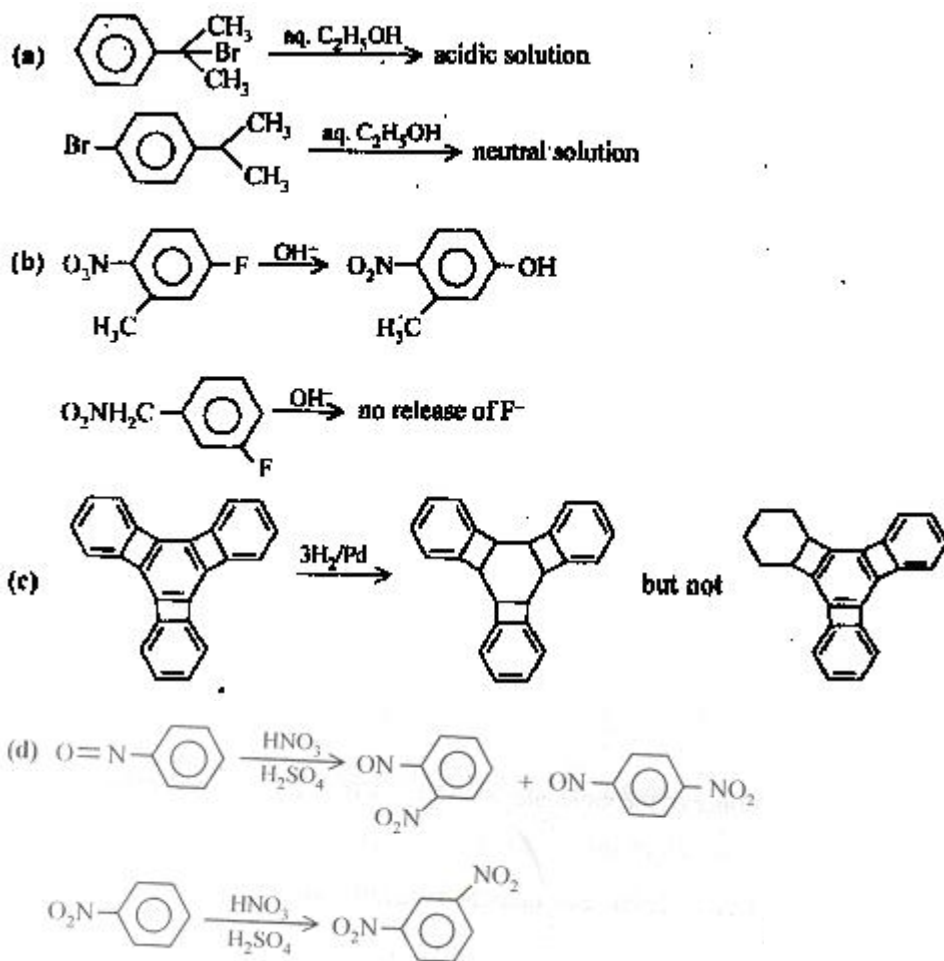
12. A monomer of a polymer on ozonolysis gives two moles of CH_2O and one mole of CH_3COCHO . Write the structure of monomer and write 'all-cis' configuration of polymer chain.

13. Complete and balance the following reactions.



14. How many grams of CaO are required to neutralize 852 g of P_4O_{10} ? Draw structure of P_4O_{10} molecule.

15. Give reasons:



16. Write the chemical reaction involved in developing of a black and white photographic film. An aqueous $\text{Na}_2\text{S}_2\text{O}_3$ solution is acidified to give a milky white turbidity. Identify the product and write the balanced half chemical reaction for it.

17. For the reaction, $\text{Ag}^+_{(\text{aq})} + \text{Cl}^-_{(\text{aq})} \rightleftharpoons \text{AgCl}_{(\text{s})}$;

Species	ΔG^0 (kJ/mol)
$\text{Ag}^+_{(\text{aq})}$	+77
$\text{Cl}^-_{(\text{aq})}$	-129
$\text{AgCl}_{(\text{s})}$	-109

Write the cell representation of above reaction and calculate E^0 at 298 K. Calculate the $\log_{10} K_{\text{sp}}(\text{AgCl})$ at 298 K. If 6.539×10^{-2} g of metallic zinc is added to 100 ml saturated solution of AgCl, find the value of $\log_{10} [\text{Zn}^{2+}]/[\text{Ag}^+]^2$ How many moles of Ag will be precipitated in the above reaction?

Given that : $\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag}$; $E^0 = 0.80\text{V}$ $\text{Zn}^{2+} + 2\text{e}^- \rightarrow \text{Zn}$; $E^0 = -0.76\text{V}$ (It was given that atomic mass of Zn = 65.39).

18. 20% of surface sites are occupied by N_2 molecules. The density of surface site is $6.023 \times 10^{14} \text{ cm}^{-2}$ and total surface area is 1000 cm^2 . The catalyst is heated to 300 K while N_2 is completely desorbed into a pressure of 0.001 atm and volume 2.46 cm^3 . Find the number of active sites occupied by each N_2 molecule.

(Screening – 2005)

1. Which of the following is correct for lyophilic sol?

- (a) readily coagulated by addition electron
- (b) formed from inorganic substances
- (c) irreversible sol
- (d) self stabilized.

2. Radial nodes present in 3s and 2p orbitals are respectively.

- (a) 0,2
- (b) 1,2
- (c) 2,0
- (d) 2,1

3. The elevation in boiling point for 13.44 g of CuCl_2 dissolved in 1 kg of water as solvent will be ($K_b = 0.52 \text{ kg/J}$, molar mass of $\text{CuCl}_2 = 134.4 \text{ g/mol}$)

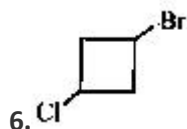
- (a) 0.05
- (b) 0.16
- (c) 0.20
- (d) 0.10

4. $[\text{SiO}_4]^{4-}$ has tetrahedral structure the silicate formed by using three oxygen has a

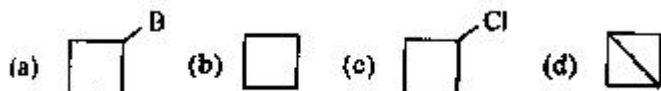
- (a) linear polymeric structure
- (b) two dimensional sheet structure
- (c) pyrosilicate structure
- (d) three dimensional structure.

5. The gas O_3 (ozone) can not oxidize

- (a) K_2MnO_4 .
- (b) KMnO_4
- (c) KI
- (d) FeSO_4



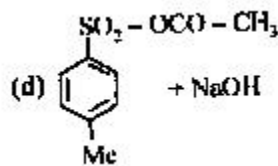
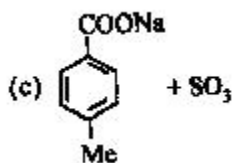
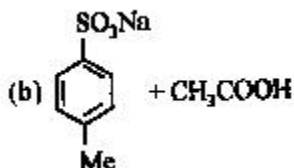
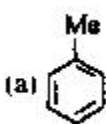
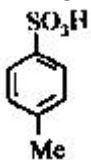
When treated with two equivalents Na in dry ether gives



7. The pair of which salts is expected to have same colour in their freshly prepared aqueous solutions.

- (a) FeCl_2 , VOCl_2
- (b) CuCl_2 , FeCl_2
- (c) MnCl_2 , FeCl_2
- (d) VOCl_2 , CuCl_2

8. When



Reacts with CH₃COO⁻ Na⁺ (excess), the product formed is

9. When phenyl magnesium bromide reacts with tertiary butanol, the product formed will be

- (a) benzene (b) tertiary butyl phenyl ether
(c) phenol (d) tertiary butyl benzene.

10. To convert 2-butanone into propionic acid

- (a) I₂/NaOH/H⁺ (b) NaOH + NaI/H⁺ (c) Fehling's test (d) Tollen's reagent

11. The ore which contains copper and iron both is

- (a) cuprite (b) malachite. (c) chalcocite (d) chalcopyrite

12. Which allotrope of phosphorous is thermodynamically most stable?

- (a) red (b) yellow (c) white (d) black

13. Which of the reagents on reaction with cyclo hexanol gives best yield of cyclohexene?

- (a) conc. HCl (b) conc. HBr (c) conc. H₃PO₄ (d) conc. HCl with ZnCl₂.

14. The gas which is liberated when PbO₂ reacts with conc. HNO₃.

- (a) N₂O (b) N₂. (c) O₂ (d) NO₂

15. The blue liquid formed by equimolar mixture of two gases at -30° is

- (a) N₂O₃ (b) N₂O (c) N₂O₅. (d) N₂O₄

16. Which one of the following resonating structures of 1-methoxy-1,3-butadiene is least stable?

- (a) $\text{CH}_2 = \overset{\ominus}{\text{C}}\text{H} = \text{CH} - \overset{\oplus}{\text{O}} - \text{CH}_3$ (b) $\text{CH}_2 = \overset{\oplus}{\text{C}}\text{H} - \text{CH} = \text{CH} - \text{O} - \text{CH}_3$
(c) $\text{CH}_2 = \text{CH} - \overset{\ominus}{\text{C}}\text{H} - \overset{\oplus}{\text{O}} - \text{CH}_3$ (d) $\text{CH}_2 = \text{CH} - \overset{\ominus}{\text{C}}\text{H} - \overset{\oplus}{\text{C}}\text{H} - \text{O} - \text{CH}_3$

17. Which of the following is incorrect about order of reaction?

- (a) It is calculated experimentally
- (b) There is not necessarily a connection between order and stoichiometry of a reaction.
- (c) The order of reaction cannot be fractional
- (d) It is sum of powers of concentration in rate law expression

18. Isomerism shown by octahedral complex $\text{Co}(\text{NH}_3)_4(\text{Br}_2)\text{Cl}$ are

- (a) geometrical and ionization
- (b) geometrical and optical
- (c) optical and ionization
- (d) only geometrical.

19. The ratio of rate of diffusion of helium with respect to methane under similar conditions of constant temperature and pressure

- (a) 2
- (b) 4
- (c) 16
- (d) 0.5

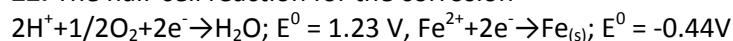
20. When 0.1 mole of CH_3NH_2 (ionization constant $K_b = 5 \times 10^{-4}$) is mixed with 0.08 mol HCl and the volume is made up of 1 lit. Find the $[\text{H}^+]$ of resulting solution.

- (a) 8×10^{-2}
- (b) 2×10^{-11}
- (c) 8×10^{-11}
- (d) 1.23×10^{-4}

21. The compound which has maximum number of lone pairs of electrons on central atom

- (a) $[\text{I}_3]^-$
- (b) $[\text{ClO}_3]^-$
- (c) XeF_4
- (d) SF_4

22. The half-cell reaction for the corrosion



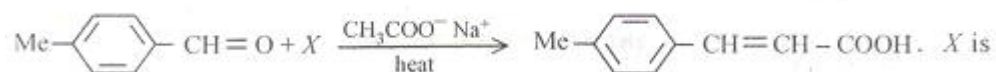
Find the ΔG^0 (in KJ) for the overall reaction.

- (a) -322
- (b) -152
- (c) -161
- (d) -76

23. A metal nitrate on reaction with KI gives black precipitate and with excess of KI gives orange solution. The metal is

- (a) Cu^{2+}
- (b) Pb^{2+}
- (c) Hg^{2+}
- (d) Bi^{3+}

24.



- (a) BrCH_2COOH
- (b) CH_3COOH
- (c) $\text{OHC}-\text{COOH}$
- (d) $(\text{CH}_3\text{CO})_2\text{O}$

25. The two structure of D-glucopyranose forms are

- (a) enantiomers
- (b) anomers
- (c) epimer
- (d) geometrical isomers.

26. The compound in which cation occupy alternate tetrahedral voids in cubic closed packing (CCP)

- (a) CaF_2 (b) NaCl (c) Na_2O (d) ZnS

27. One mole of monoatomic ideal gas at $T(\text{K})$ is expanded from 1 l to 2 l adiabatically under a constant external pressure of 1 atm the final temperature of the gas in Kelvin is

- (a) $T - 2/3 \times 0.0821$ (b) T (c) $T/2^{5/3-1}$ (d) $T + 3/0.0821$

28. The compound (J) on hydrolysis in presence of aqueous acetone gives mainly

- (a) M only
(b) mixture of K and L
(c) Mixture of K and M
(d) K only.