JEE MAIN - 2005

CHEMISTRY
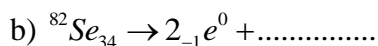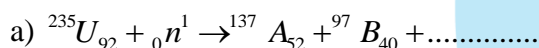
[Time: 2 hours]

General Instructions :

Note: Question number 1 to 8 carries **2 marks** each, 9 to 16 carries **4 marks** each and 17 to 18 carries **6 marks** each.

Q.1. Monomer A of a polymer on ozonolysis yields two moles of $HCHO$ and one mole of CH_3COCHO.

a) Deduce the structure of A.

b) Write the structure of "all cis" − form of polymer of compound A.

Q.2. Fill in the blanks

a) $^{235}U_{92} + {}_0n^1 \rightarrow {}^{137}A_{52} + {}^{97}B_{40} + \ldots\ldots\ldots\ldots$

b) $^{82}Se_{34} \rightarrow 2_{-1}e^0 + \ldots\ldots\ldots\ldots$

Q.3. a) Calculate the amount of Calcium oxide required when it reacts with 852 gm of P_4O_{10}.

b) Write the structure of P_4O_{10}.

Q.4. An element crystallizes in fcc lattice having edge length $400\ pm$. Calculate the maximum diameter of atom which can be placed in interstitial site without distorting the structure.

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Q.5. 20% surface sites have adsorbed N_2. On heating N_2 gas evolved from sites and were collected at 0.001 atm and $298\ K$ in a container of volume is $2.46\ \text{cm}^3$. Density of surface sites is $6.023 \times 10^{14}/\text{cm}^2$ and surface area is $1000\ \text{cm}^2$, find out the no. of surface sites occupied per molecule of N_2.

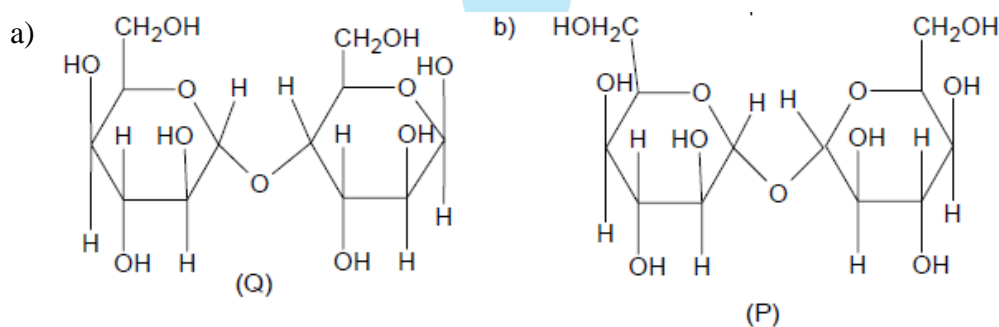**Q.6.** Predict whether the following molecules are iso structural or not. Justify your answer.

(i) NMe_3 (ii) $N(SiMe_3)_3$

Q.7.
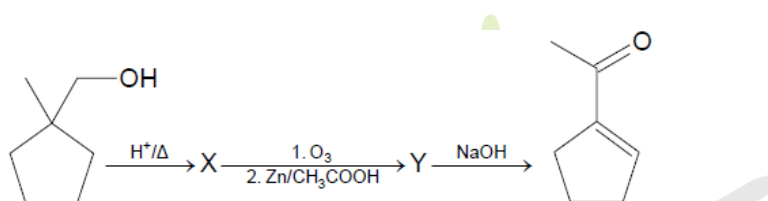
Identify X and Y.

Q.8. Which of the following disaccharide will not reduce Tollen's reagent?
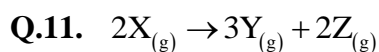

Q.9. Write balanced chemical equation for developing a black and white photographic film. Also give reason why the solution of sodium thiosulphate on acidification turns milky white and give balance equation of this reaction.

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Q.10. $Fe^{3+} \xrightarrow{SCN^-(excess)} blood\ red\,(A) \xrightarrow{F^-(excess)} colourless\,(B)$
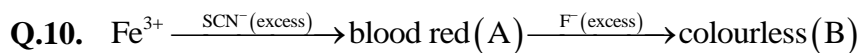
Identify A and B.

a) Write IUPAC name of A and B.

b) Find out spin only magnetic moment of B.

Q.11. $2X_{(g)} \rightarrow 3Y_{(g)} + 2Z_{(g)}$
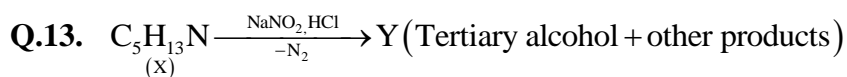
Time (in Min)	0	100	200
Partial pressure of X (in mm of Hg)	800	400	200

Assuming ideal gas condition. Calculate

a) Order of reaction

b) Rate constant.

c) Time taken for 75% completion of reaction.
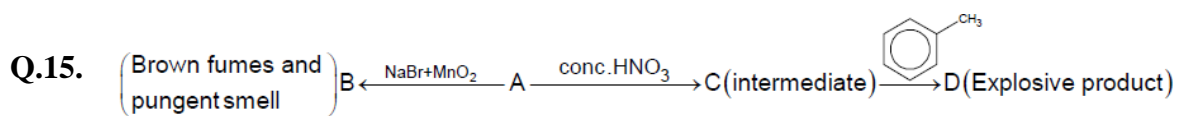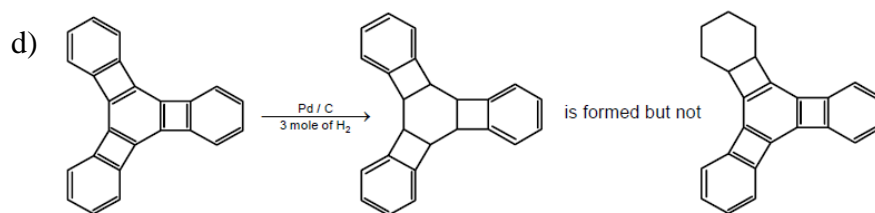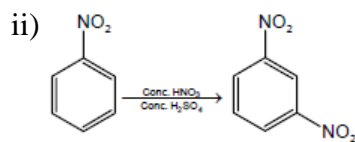
d) Total pressure when $P_x = 700\,mm$.

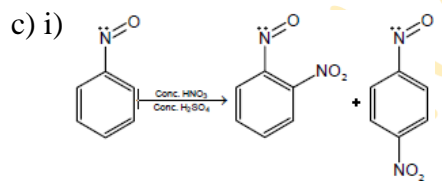**Q.12.** a) Calculate velocity of electron in first Bohr orbit of hydrogen atom $\left(Given\ r = a_0\right)$.

b) Find de-Broglie wavelength of the electron in first Bohr orbit.

c) Find the orbital angular momentum of $2p$ orbital in terms of $h/2\pi$ units.

Q.13. $C_5H_{13}N \xrightarrow[-N_2]{NaNO_2,\ HCl} Y\left(Tertiary\ alcohol + other\ products\right)$
(X)

(Optically active)

Find X and Y. Is Y optically active? Write the intermediate steps.

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Q.14. Give reasons:

a) i)

$$\xrightarrow{C_2H_5OH(aq)} \text{acidic solution}$$

ii)

$$\xrightarrow{C_2H_5OH(aq)} \text{neutral}$$

b) i)

$$\xrightarrow{NaOH(aq)} F^- \text{(liberated)}$$

ii)

$$\xrightarrow{NaOH(aq)} F^- \text{is not liberated}$$

c) i)

$$\xrightarrow[\text{Conc. } H_2SO_4]{\text{Conc. } HNO_3}$$

ii)

$$\xrightarrow[\text{Conc. } H_2SO_4]{\text{Conc. } HNO_3}$$

d)

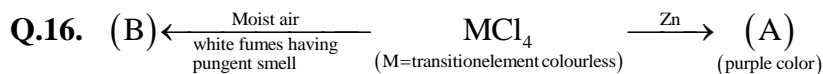$$\xrightarrow[\text{3 mole of } H_2]{\text{Pd / C}} \quad \text{is formed but not}$$

Q.15. $\left(\begin{array}{l}\text{Brown fumes and}\\ \text{pungent smell}\end{array}\right) B \xleftarrow{NaBr+MnO_2} A \xrightarrow{\text{conc.}HNO_3} C\,(\text{intermediate}) \longrightarrow D\,(\text{Explosive product})$
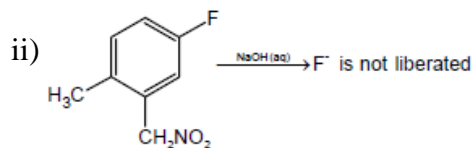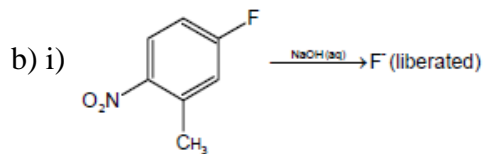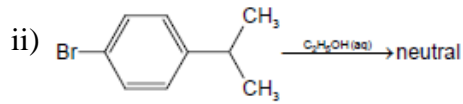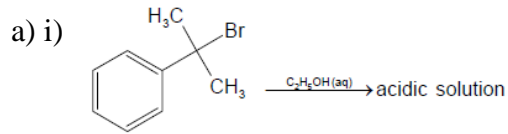
Find A, B, C and D. Also write equations A to B and A to C.

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Q.16. $(B) \xleftarrow[\substack{\text{white fumes having} \\ \text{pungent smell}}]{\text{Moist air}} \underset{(M = \text{transition element colourless})}{MCl_4} \xrightarrow{\text{Zn}} \underset{(\text{purple color})}{(A)}$

Identify the metal M and hence MCl_4. Explain the difference in colours of MCl4 and A.

Q.17. $\mu_{obs} = \sum \mu_i x_i$

Where μ_i is the dipole moment of stable conformer and x_i is the mole fraction of that conformer.

a) Write stable conformer for $Z - CH_2 - CH_2 - Z$ in Newman's projection. If $\mu_{solution} = 1.0 D$ and mole fraction of anti form $= 0.82$, find μ_{Gouche}.

b) Write most stable meso conformer of

$$\underset{\overset{|}{CHDY}}{CHDY}$$

If (i) $Y = CH_3$ about $C_2 - C_3$ rotation and (ii) $Y = OH$ about $C_1 - C_2$ rotation.

Q.18. a) Calculate ΔG_r^0 of the following reaction

$$Ag_{(aq)}^+ + Cl_{(aq.)}^- \rightarrow AgCl(s)$$
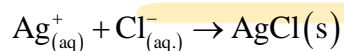
Given

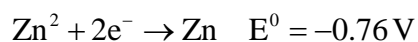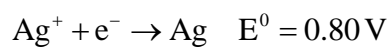|	
$\Delta G_f^0 (AgCl)$	$-109 \, KJ/mole$
$\Delta G_f^0 (Cl^-)$	$-129 \, kJ/mole$
$\Delta G_f^0 (Ag^+)$	$77 \, KJ/mole$

Represent the above reaction in form of a cell.

Calculate $E°$ of the cell. Find $\log_{10} K_{sp}$ of $AgCl$.

b) $6.539 \times 10^{-2} g$ of metallic $Zn(amu = 65.39)$ was added to 100 ml of saturated solution of $AgCl$.

Calculate $\log_{10} \dfrac{\left[Zn^{2+}\right]}{\left[Ag^+\right]^2}$. Given that

$$Ag^+ + e^- \rightarrow Ag \quad E^0 = 0.80 \, V$$
$$Zn^2 + 2e^- \rightarrow Zn \quad E^0 = -0.76 \, V$$

Also find how many moles of Ag will be formed?

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