2017

CHEMISTRY

[Honours]

PAPER – VI (A + B)

Full Marks : 90

Time : 4 hours

The figures in the right hand margin indicate marks

Use separate scripts for Group–A and Group–B

[OLD SYLLABUS]

GROUP – A

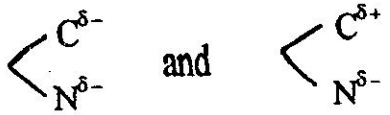
(*Organic*)

Group– A(a)

Answer any **one** question : 15 × 1

1. (*a*) Draw the structure of synthetic equivalent

of the following synthon skeleton : 1+1



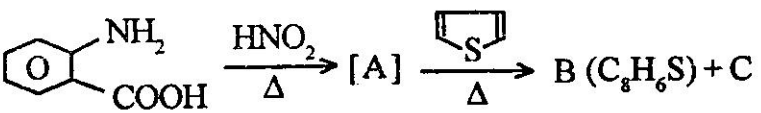
(*b*) Rationalise briefly the following facts : 2

"Phenanthrene reacts easily with diazomethane Where as anthracene fails to record this reaction"

(*c*) What do you mean by "Antipyretic drug" ? Out line the synthesis of paracetamol from nitrobenzene. 1+2

(*d*) Hydrolysis of sucrose results equimolar mixture of glucose and fructose. Specific rotation of mixture and glucose are -20° and $+52{\cdot}5^{\circ}$. What is the specific rotation of fructose ? 2

(*e*) Predict the products (A→ C) $1\frac{1}{2}$



(*f*) Write down the structure of an acidic amino acid at (*i*) pH < 7 (*ii*) pH > 7 (*iii*) isoelectric point. 1+1+1

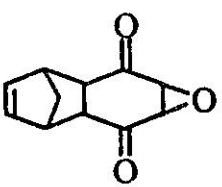
(*g*) Explain with appropriate reagent and mechanism of the reductive N-alkylation of primary amine. $1\frac{1}{2}$

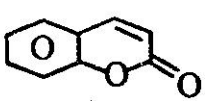
2. (*a*) Carry out the following conversion. 2

Glycine → Phenylalanine (Using Erlenmeyer azalactone synthesis)

(*b*) "Furan can be regarded as a masked 1, 4- dicarbonyl compound"– Explain. 2

(*c*) Predict the product of the following with mechanistic explanation (if any): 2 + 2 + 2

(*i*) 

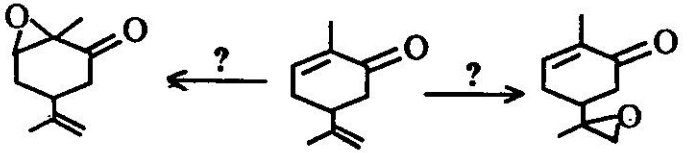
(*ii*) 

(*iii*) Glucose $\xrightarrow[\text{excess.}]{\text{Ph}-\text{N(Me)}-\text{NH}_2}$?

(*d*) What are the demerits of acyloin condensation in ring synthesis ? How these problem can be overcome ? 2+1

(*e*) Write down the structure of a *L*-amino acid which is a *R*-enantiomer. 1

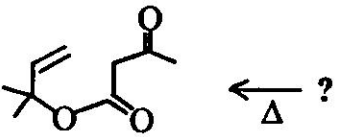
(*f*) Put the appropriate reagent. 1



Group– A(b)

Answer any **two** questions : 10×2

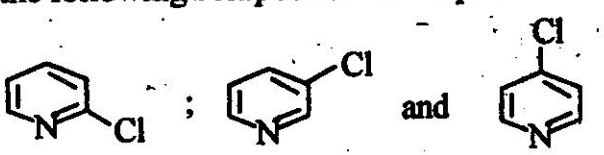
3. (*a*) Write down the product of the following reaction which follows [3, 3]- sigmatropic pathway and justify. 2



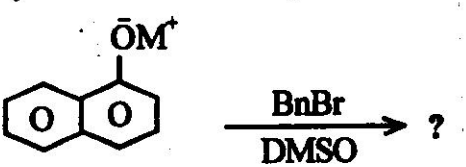
(*b*) Predict the 1 : 1 adduct of the following reaction under thermal condition and explain. 2

(*c*) Carry out the following transformation using Diels-Alder reaction as one of the steps. 2

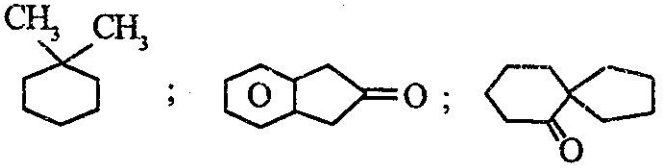
(*d*) Compare the rate of alkaline hydrolysis of the following compounds and explain. 2



(*e*) Predict the product(s) and explain why does a change from $Li^+ < Na^+ < K^+$ favour O-alkylation over C– alkylation. 2

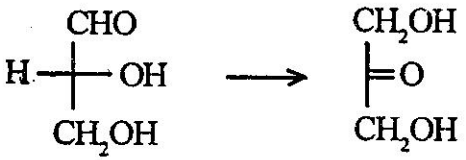


4. (*a*) Give retrosynthetic and synthetic path of the following compound from suitable starting material. (any *two*) : $2\frac{1}{2}+2\frac{1}{2}$

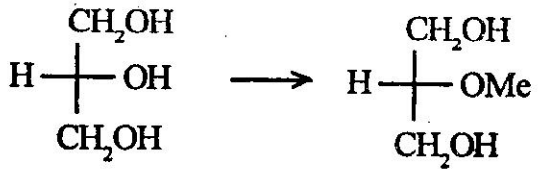


(*b*) Convert : $1\frac{1}{2}+1\frac{1}{2}$

(*i*)



(*ii*)

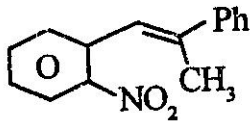


(*c*) What is isoelectric point ? Find out the relation between pH ; pKa_1 and pKa_2 of glycine at isoelectric point. 1+1

5. (*a*) Predict the product(s) (A→ C) with mechanism. 3×2

(*i*)

D-Fructose $\xrightarrow[\text{Reagent}]{\text{Tollen's}}$ A (A mixture of two aldonic acid)

(*ii*) 

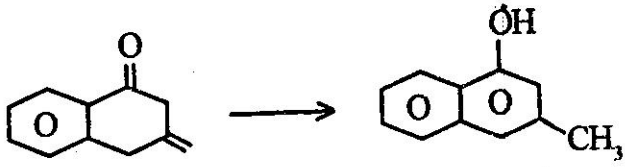
$\xrightarrow[\Delta]{P(OEt)_3}$ B

(*b*) What is meant by specific base pairing in double helix structure of a DNA molecule ? 2

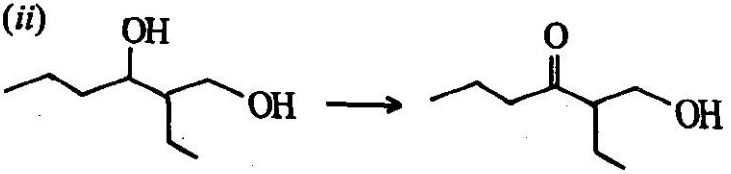
(*c*) How will you convert ? 2

Cyclohexanone → $EtOOC-(CH_2)_5-OH$

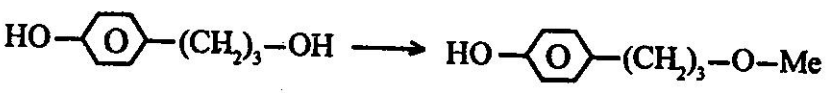
6. (*a*) Write suitable reagent(s) of the following transformations : 1+1+1

(*i*) 

(*ii*)

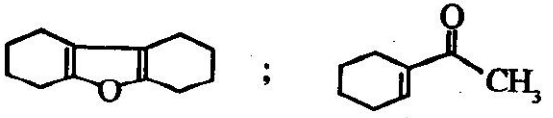


(*iii*)



(*b*) How will you convert $CH_3COCOCH_3$ to CH_3COCH_3 using CH_3Li as one of the steps. 2

(*c*) Write retrosynthesis and forward synthesis of the following : 2+2

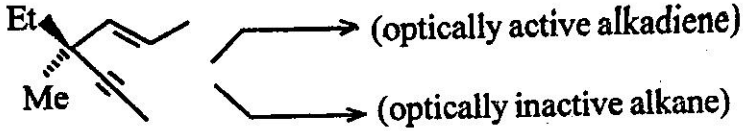


(*d*) What are metallo enzymes ? 1

Group– A(c)

Answer any **five** questions : 2×5

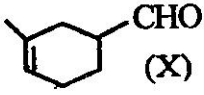
7. (*a*) Put the appropriate reagent.



(*b*) Write down the role of t-RNA and r-RNA in protein synthesis.

(*c*) What happens when pyridine N-oxide is refluxed with acetic anhydride ?

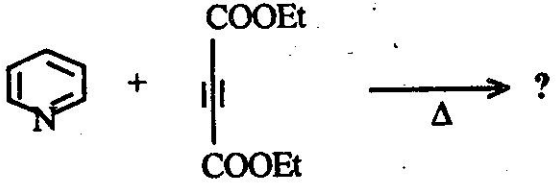
(*d*) A student wrote the following Diels-Alder adduct (X) from isoprene and acrolein. Is it correct ? Why ?



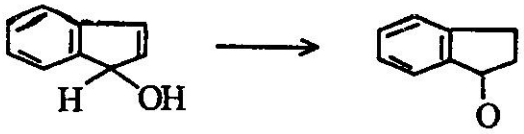
(*e*) How can you determine the C-terminal residue of a peptide chain ?

(*f*) How will you distinguish D-glucose and D-fructose chemically ?

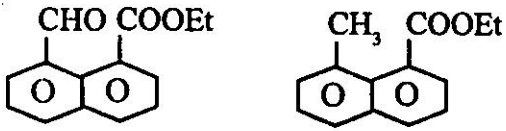
(*g*) Predict the product with mechanism.



(*h*) Find out the pericyclic path(s) of the following conversion :

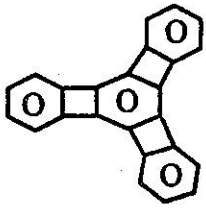


(*i*) Compound 'A' undergoes alkaline hydrolysis at faster rate than compound 'B'.— Explain.



A B

(*j*) On partial reduction by Ni/H_2, the middle benzene ring of 'P' undergoes reduction at faster rate than terminal one-- Explain.



'P'

GROUP – B

(*Inorganic*)

Group– B(a)

Answer any **one** question : 15×1

8. (*a*) Why $K_3[CuF_6]$ is paramagnetic while $K[AgF_4]$ is diamagnetic. 2

(*b*) The complex $[Cu(H_2O)_6]^{2+}$ is succeptible to John-Teller distortion more than $[Ti(H_2O)_6]^{3+}$ – Explain. 2

(*c*) What is the 'Co-operative effect' in the oxygen transport phenomena ? 2

(*d*) Explain briefly the principle of separation of lanthanides by ion exchange method. 3

(*e*) Starting from $K_2[PtCl_6]$ how would you prepare Zeise's salt ? 2

(*f*) Will oxidation of Cp_2Fe to $[Cp_2Fe]^+$ produce a substantial change in Metal-Carbon (M–C) bond length ? 2

(*g*) Metion the conditions for orbital contribution to spin only magnetic moment value. 2

9. (*a*) Give the preparation and uses of $(\eta^5-C_5H_5)_2TiCl_2$. 3

(*b*) $[NiCl_4]^{2-}$ is tetrahedral while $[PdCl_4]^{2-}$ and $[PtCl_4]^{2-}$ are square planar– Explain. 2

(*c*) cis-$[Co(en)_2F_2]^{\oplus}$ is more intensely coloured than transform. 2

(*d*) What is the role of globin chain in hemoglobin oxygenation ? 2

(*e*) The N–O distance in $[Co(diars)_2NO]^{2+}$ is 168 pm and the $\angle$Co–N–O bond angle is 180°. Reaction of the complex with $SCN^{\ominus}$ forms $[Co(diars)_2(NCS)NO]^{+}$ in which N–O distance is 185 pm and $\angle$Co–N–O bond angle is 135°– Explain.
[diars = 1, 2-bis(dimethylarsino) benzene] 3

(*f*) Name the metal ion(s) present in the active site of the following biomolecules : 2

(*i*) Carbonic Anhydrase
(*ii*) Rubredoxin.

(*g*) Explain why $V(CO)_6$ is readily reduced to the monoanion. 1

Group– B(b)

Answer any **two** questions : 10×2

10. (*a*) Define oxidative addition reaction. What type of compounds generally undergo this type of reaction ? 2

(*b*) $K_2Ba[Cu(NO_2)_6]$ has distorted octahedral structure but $K_2Pb[Cu(NO_2)_6]$ has regular octahedral. 2

(*c*) To remove Pb^{2+} from human body it is better to use Na_2Ca (edta) than Na_2H_2 (edta)– Explain. 2

(*d*) Draw a plot of $1/\chi_M$ vs temperature T(K) for materials which obey 2

(*i*) Curie law.

(*ii*) Curie-Weiss law.

(χ_M = Magnetic susceptibility)

(*e*) $[Pt(NH_3)_2Cl_2]$ forms two isomers. One isomer gives $[Pt(NH_3)_2(tu)_2]^{2+}$ on treatment with thiourea (tu); the other isomer gives $[Pt(tu)_4]^{2+}$ on similar treatment. Identify the isomers. 2

11. (*a*) The position of CO in the spectrochemical series is higher compared to $CN^{\ominus}$. 2

(*b*) Discuss about the Laporte selection rule for electronic spectral transitions. 2

(*c*) Write down the mechanism through which the nerve cells maintain Na^+ and K^+ concentrations inside and outside of the cell. 3

(*d*) Copper (II) formate tetrahydrate have a magnetic moment value of 1·67 BM. 2

(*e*) Give one example of optically active square planar complex. 1

12. (*a*) Lanthanides exhibit +3 oxidation state in general while actinides can show variable oxidation state–Explain. 3

(*b*) Draw the catalytic cycle for hydro-formylation reaction. 3

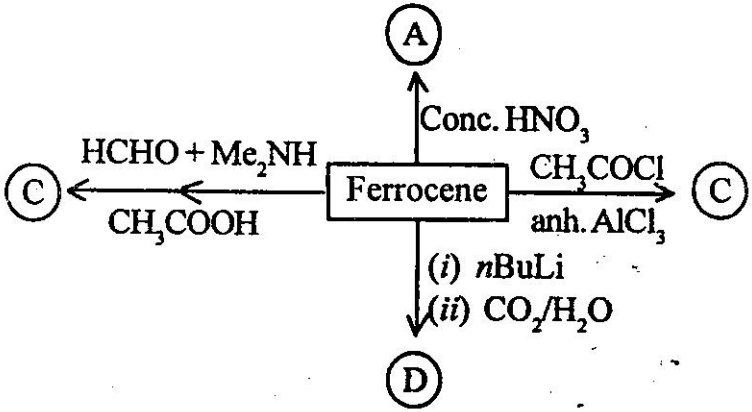
(*c*) A deep blue solution containing Co(II) in concentrated HCl gradually turns pale pink on addition of excess water. 2

(*d*) What do you mean by TDS and COD of a sample of water ? 2

13. (*a*) State the role of PS-I and PS-II in photo-synthesis using z-scheme. 3

(*b*) Give the flow-sheet diagram of extraction of pure Uranium metal from Pitchblende. Write the related chemical reactions. 3

(*c*) Identify A, B, C and D in the following reaction scheme : 2



(*d*) Compute Δ_0 and B′ for the CrF_6^{3-} from the given absorption energies 34, 400, 22700 and 14900 cm^{-1}. 2

Group– B(c)

Answer any **five** questions : 2×5

14. (*a*) Compare the coordination sphere of cytochrome a with that of cytochrome C. 2

(*b*) Draw the all possible isomers of $[Co(NH_3)(OH)_2Cl_3]^{2-}$. 2

(*c*) What happens when zinc uranyl acetate is added to an aqueous solution of NaCl ? Give equation. 2

(*d*) The C–C bond length in the co-ordinated olefin is greater than that in the free olefin. 2

(*e*) Electronic Absorption spectra of lanthanides consists of sharp lines whereas those of the transition metal ions consist of broad bands – Explain. 2

(*f*) Name one gold drug and state its therapeutic application. 2

(*g*) Find the values of x assuming validity of the $18e^{\ominus}$ rule. 2

(*i*) $Co_2(CO)_x(C_2H_2)$

(*ii*) $Fe(\eta^5 - Cp)(\eta^1 - Cp)(CO)_x$

(*h*) What do you mean by half-wave potential in polarography ? 2