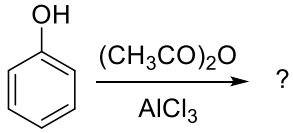
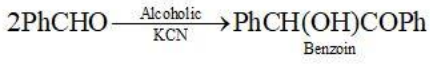
Chemistry GE 4 model theory questions

1. Describe the synthesis of 1º, 2º and 3º alcohol using Grignard reagent with reactions.
2. Write a note on Pinacol-pinacolone rearrangement.
3. State the industrial method for phenol preparation with reactions. What is the very useful side product obtained in this method?
4. Carry out Phenol → Salicylic acid conversion with mechanism.
5. Complete the following reaction with mechanism



6. Convert $R-C\equiv N$ to RC(O)R' using Grignard reagent.
7. Complete the following reactions and explain the observations.
   i) RCHO + Tollen's reagent →, ii) RCHO + Fehling's reagent →
8. Write a note on Iodoform reaction.
9. Write notes on Aldol condensation and Cannizaro reaction.
10. 

Give the mechanism for this conversion.
11. Give brief outlines of acid chloride, anhydrides, ester and amide synthesis from acids.
12. Synthesize cinnamic acid from benzaldehyde. Which reaction is applied for this conversion?
13. How can you prepare amine from amides? Give mechanism of the reaction.
14. Describe the diazo coupling reaction for 1º aromatic amine.
15. What are the products of acidic, neutral and alkaline reduction of nitrobenzene.
16. State the Strecker synthesis of amino acids.
17. State the Gabriel's phthalimide synthesis of amino acids.
18. What is Isoelectric point?
19. Explain how glucose and fructose forms the same osazone.
20. What are the products of i) Br_2 water and ii) hot HNO_3 oxidation of D-glucose?
21. Write notes on Kiliani-Fisher method and Ruff's method for aldose carbon chain length manipulation.
22. Write the normalized wave function form of motion of a particle in a one-dimensional box. Find the difference between E_{n+1} and E_n.
23. What is the difference between the atomic spectra and molecular spectra?

24. Write the expression for the rotational energy of a diatomic molecule. Find the energy difference between two consecutive rotational level.

25. What is the essential criterion for a molecule to exhibit rotational spectrum?

Practical Model Questions

1. Describe the Lassaigne's test

A small piece of metallic sodium was taken in a dry fusion tube. Then the tube was heated in non luminous flame to melt the sodium into a shiny silver coloured droplet. A small pinch of organic sample was added to the tube and it was heated to red hot condition. The lower portion of the red hot tube was then plunged quickly into 10 mL distilled water taken in a mortar. The cracked lower part of the tube containing the fused mixture was ground with a pestle. The resulting solution was filtered and divided into three portions to perform the following tests.

Experiment	Observation	Inference
i) To one portion of the fusion filtrate, few crystals of $FeSO_4$ or a pinch of Mohr salt was added. The mixture was boiled for a few minutes, cooled and acidified with dilute H_2SO_4.	Prussian blue colouration.	Nitrogen present.
ii) To another portion of the fusion filtrate, two drops of sodium nitroprusside solution was added.	Violet colouration.	Sulphur present.
iii) Last portion of fusion filtrate was acidified with dil. HNO_3, and boiled to reduce the volume in half. The solution was cooled and few drops of $AgNO_3$ solution was added to it.	Curdy white precipitation. Soluble in NH_4OH but insoluble in dilute HNO_3.	Chlorine present.

2. Explain the observations of chlorine detection test in Lassaigne's method

During Lassaigne's test the chlorine in the organic sample reacts with metallic Na to form NaCl. NaCl in reaction with $AgNO_3$ produces curdy white precipitate of AgCl. This AgCl is soluble in NH_4OH due to formation of soluble salt but insoluble in HNO_3.

$$Na + Cl \rightarrow NaCl$$

$$NaCl + AgNO_3 \rightarrow AgCl\downarrow + NaNO_3$$

3. Explain the observations of sulfur detection test in Lassaigne's method

During Lassaigne's test the sulfur in the organic sample reacts with metallic Na to form NaSCN and Na_2S. Sodium nitroprusside ($Na_2[Fe(CN)_5NO]$) solution reacts with Na_2S to form the violet coloured complex $Na_4[Fe(CN)_5NOS]$

$$Na_2S + Na_2[Fe(CN)_5NO] \rightarrow Na_4[Fe(CN)_5NOS]$$

4. Write down the formula of Prussian blue product produced during the detection of nitrogen by Lassaigne's test

$$Na + C + N \xrightarrow{\Delta} NaCN$$

From organic compound 1

Now to an part of L.F, freshly prepared $FeSO_4$ is added when the following reactions occur. A small amount of H_2SO_4 is added.

$$2NaCN + FeSO_4 \longrightarrow Fe(CN)_2 + Na_2SO_4$$

$$Fe(CN)_2 + 4NaCN \rightleftharpoons Na_4[Fe(CN)_6]$$

Sodium hexacyano ferrate (II)

Some of Fe^{2+} ions are oxidised on heating to Fe^{3+} ions

$$3Na_4[Fe(CN)_6] + 4Fe^{3+} \xrightarrow{xH_2O}$$

$$Fe_4[Fe(CN)_6]_3\, xH_2O + 12Na^+$$

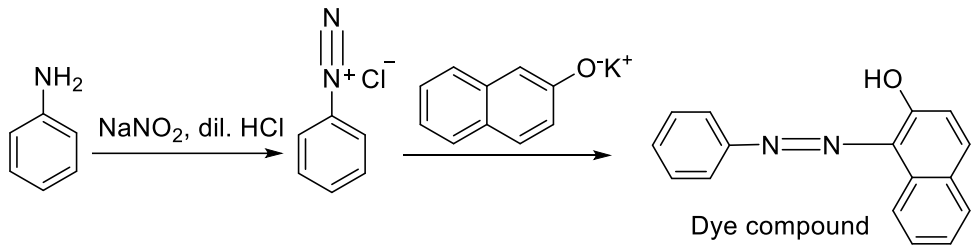
Iron (III) hexacyanoferrate (II)

(Prussian blue)

This Fe^{3+} ions give prussian blue colour which confirms the presence of nitrogen in the compound.

5. Describe the Dye test for aromatic primary amine sample with equation.

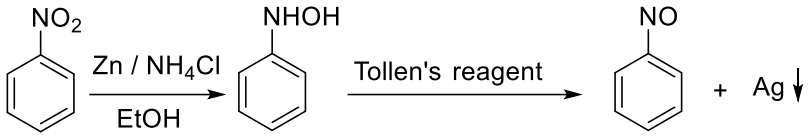
To a cold 5% HCl solution of the organic sample, chilled aqueous $NaNO_2$ solution was added at -5ºC. The resulting mixture was quickly added to alkaline was quickly added to alkaline β-Naphthol soluntion kept on ice salt bath. Bright orange or red coloured dye was formed confirming the presence of aromatic primary amine group.



Dye compound

6. Describe Mulliken Barker Test

Aromatic nitro groups can be confirmed in presence of primary amine group by Mulliken Barker Test. Nitro compounds are partially reduced to aromatic hydroxyl amines by reduction with Zn dust and NH_4Cl in ethanol. The resulting mixture is filtered upon freshly prepared Tollen's reagent. Formation of silver mirror or grey-black precipitate proves the presence of nitro group, as hydroxyl amine is oxidised to nitroso group and tollen's mixture is reduced to metallic silver (Ag).



7. Write down the reaction of $FeCl_3$ test of phenolic –OH group detection

Two drops of neutral ferric chloride solution was added to ethanolic solution of the sample compound. Red, green or violet colouration due to chelate formation indicates presence of phenolic –OH group.