ANSWER SHEET

ENROLLMENT NO :	031 BPB19GT 062		
NAME OF SUBJECT :	Chemistry		
SEMESTER :	3rd	SUBECT CODE :	BSC 302T
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Q1. MCQs

(i) Phenol is acidic
(a) Due to resonance

(ii) A buffer is one which keeps its
(b) Constant

(iii) The carbon atoms in benzene rings are -
(b) sp^2 hybridized

(iv) Which element shows +1 oxidation state in the Zn group?
(a) Hg

(v) Lucas reagent is
(c) $HCl/ZnCl_2$

Part-B

Q.1 Write Volhard's synthesis reaction.

Volhard's synthesis is a method used to prepare carboxylic acids by converting an alkyl halide to an acyl halide and then hydrolyzing it. The general reaction involves the following steps:
1. The alkyl halide (R-X) is treated with sodium cyanide

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(NaCN) to form an alkyl cyanide (R-CN).
2. The alkyl cyanide is then hydrolyzed in the presence of an acid or base to form the corresponding carboxylic acid (R-COOH).

Q.2 Write Hess's law of heat summation.

Hess's Law states that the total enthalpy change during the complete course of a chemical reaction is the same, regardless of the number of steps in which the reaction is carried out. Mathematically, it can be expressed as:
\[\Delta H_{total} = \Delta H_1 + \Delta H_2 + \Delta H_3 + \ldots + \Delta H_n \]
This means that if a reaction can be expressed as the sum of two or more reactions, the enthalpy change for the overall reaction is the sum of the enthalpy changes for the individual reactions.

Q.3 What is a buffer?

A buffer is a solution that can resist changes in pH upon the addition of small amounts of an acid or a base. Buffers are typically made from a weak acid and its conjugate base or a weak base and its conjugate acid. They work by neutralizing added acids or bases, maintaining a relatively constant pH.

Q.4 Write Friedel-Crafts reaction.

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The Friedel-Crafts reaction refers to a set of reactions developed by Charles Friedel and James Crafts to attach substituents to an aromatic ring. There are two main types:

1. Friedel-Crafts Alkylation: An alkyl group is added to an aromatic ring using an alkyl halide and a Lewis acid catalyst such as $AlCl_3$.

$$\text{C}_6\text{H}_6 + \text{R-Cl} \xrightarrow{\text{AlCl}_3} \text{C}_6\text{H}_5\text{R} + \text{HCl}$$

2. Friedel-Crafts Acylation: An acyl group is added to an aromatic ring using an acyl chloride and a Lewis acid catalyst such as $AlCl_3$.

$$\text{C}_6\text{H}_6 + \text{R-COCl} \xrightarrow{\text{AlCl}_3} \text{C}_6\text{H}_5\text{COR} + \text{HCl}$$

Q.5 Explain the rule of Curie-Weiss.

The Curie-Weiss Law describes the magnetic susceptibility (χ) of a ferromagnet in the paramagnetic region above the Curie temperature (T_C).

The law indicates that the magnetic susceptibility is inversely proportional to the temperature difference from

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the Curie temperature.

Part-C

Q.1 Explain the method of preparation and properties of chlorobenzene.

Preparation:
Chlorobenzene is typically prepared by the direct chlorination of benzene using chlorine gas in the presence of a Lewis acid catalyst like $FeCl_3$ or $AlCl_3$.

$$\text{C}_6\text{H}_6 + \text{Cl}_2 \xrightarrow{\text{FeCl}_3} \text{C}_6\text{H}_5\text{Cl} + \text{HCl}$$

Properties:
- Physical Properties: Chlorobenzene is a colorless, flammable liquid with an almond-like odor. It has a boiling point of 132°C and is insoluble in water but soluble in organic solvents.
- Chemical Properties: Chlorobenzene undergoes electrophilic substitution reactions, such as nitration, sulfonation, and Friedel-Crafts alkylation/acylation. It is also a precursor to phenol and aniline through hydrolysis and amination reactions, respectively.

Q.2 Explain the Hauben-Hoesch reaction with mechanism.

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The Hauben-Hoesch reaction, also known as the Hoesch reaction, is used to form aryl ketones from nitriles and aromatic compounds. The reaction involves the use of a Lewis acid, such as $AlCl_3$ or $ZnCl_2$, to catalyze the process.

Mechanism:
1. The nitrile (R-C≡N) is activated by the Lewis acid to form a complex.
2. The aromatic compound (Ar-H) attacks the activated nitrile to form an imine intermediate.
3. Hydrolysis of the imine intermediate yields the aryl ketone (Ar-CO-R).

Q.3 Explain stereochemistry with an example.

Stereochemistry is the study of the spatial arrangement of atoms in molecules and how this affects their chemical behavior. One common example is the comparison between the enantiomers of lactic acid (2-hydroxypropanoic acid):

- (R)-Lactic Acid: Has the hydroxyl group (-OH) on the right side when drawn in a standard Fischer projection.
- (S)-Lactic Acid: Has the hydroxyl group (-OH) on the left side in the Fischer projection.

These two enantiomers are mirror images of each other and cannot be superimposed, which results in different interactions with polarized light and different reactions

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with other chiral substances.

Q.4 What are chelate compounds? Explain the structure of a chelate with a suitable example and uses.

Chelate Compounds:
Chelate compounds are complexes where a single ligand forms multiple bonds to a single central atom, typically a metal ion. This forms a ring-like structure.

Example:
Ethylenediaminetetraacetic acid (EDTA) is a common chelating agent. In its chelate form with a metal ion such as calcium (Ca^{2+}), EDTA coordinates to the metal through its four carboxylate and two amine groups, forming a stable complex.

Uses:
- Medical: EDTA is used to treat heavy metal poisoning by binding to the metal ions and facilitating their excretion.
- Industrial: EDTA is used in water treatment to sequester metal ions that could cause scale and corrosion.
- Agriculture: Chelate compounds are used to deliver essential metal ions like iron to plants.