CHEMISTRY ONLINE
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CHEMISTRY

ORGANIC CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	ORGANIC SYNTHESIS
PAPER TYPE:	SOLUTION - 4
TOTAL QUESTIONS	10
TOTAL MARKS	/37

Organic Synthesis - 4

1.

Chemical Tests

Tollens' Reagent:

- **Propanal ($CH_3\ CH_2\ CHO$):**
  Gives a silver mirror
- **Propanone ($CH_3\ COCH_3$):**
  No reaction

Potassium Dichromate ($K_2\ Cr_2\ O_7\ /H^+$):

- **Propanal ($CH_3\ CH_2\ CHO$):**
  Solution goes green.

- **Propanone ($CH_3\ COCH_3$):**
  No reaction (negative result).

Propanal ($CH_3\ CH_2\ CHO$):

- Number of peaks: 3 distinct peaks.
  - Due to the CH_3 (methyl group), CH_2 (methylene group), and CHO (aldehyde proton).

Propanone ($CH_3\ COCH_3$):

- Number of peaks: 1 peak.
  - Due to the equivalent CH_3 (methyl groups) on both sides of the carbonyl group.

(5)

2.

Compound being insoluble in water: Compound is non-polar

Compound being soluble in water: Compound is polar.

(3)

3. A

(1)

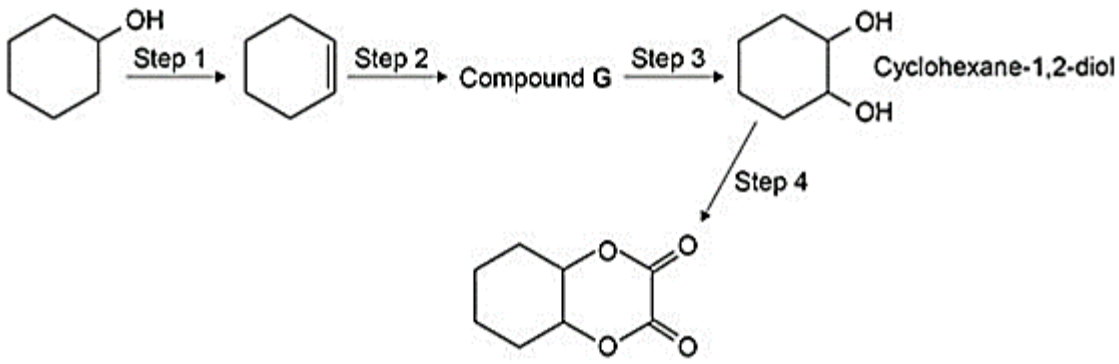
4.

(a)

Type of reaction:
Dehydration / acid catalyzed Elimination
Reagent needed: Conc H_2SO_4

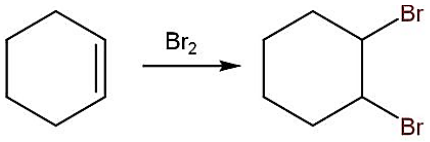
(2)

(b)



Step 2:

Reagents: Br_2



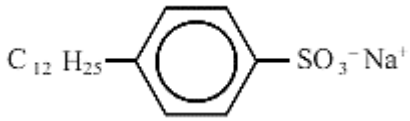
Step 3:

Reagents: NaOH

(4)

5.

(a)



Step 1:
Sulfonation of Benzene

- **Reagent:** Fuming sulfuric acid (oleum, $H_2 S_2 O_7$) or sulfur trioxide (SO_3)
- **Conditions:** Heat above 75°C or reflux

Step 2:
Neutralization of Benzene Sulfonic Acid

- **Reagent:** Sodium carbonate ($Na_2 CO_3$), or sodium hydroxide (NaOH)

(3)

(b)

Type of reaction:

Step 1 electrophilic substitution
Step 2 neutralisation or acid-base

(2)

6.

Aldehydes react with Tollen's or Fehling's reagent because these reagents are oxidizing agents.

Aldehydes can be easily oxidized due to the presence of a hydrogen atom attached to the carbonyl carbon.

On the other hand, ketones are not easily oxidized because they lack this hydrogen atom and their carbonyl group is bonded to two carbon atoms.

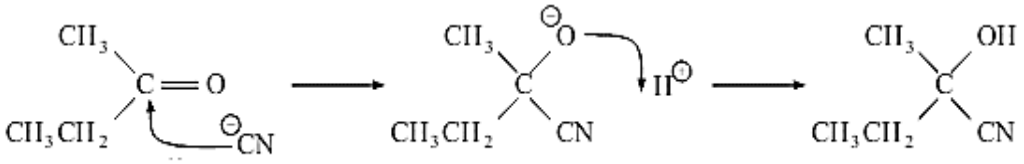
So, aldehydes react with Tollen's and Fehling's reagents due to their structural ability to be oxidized at the carbonyl carbon, facilitated by the presence of a hydrogen atom. Ketones, lacking this hydrogen, do not undergo such reactions under the same conditions.

(3)

7.

Name of mechanism:
Nucleophilic addition

Mechanism:



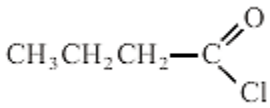
(5)

8.

(a)

Name of compound:

butanoyl chloride



(1)

(b)

The mass spectrum of the compound contains two molecular ion peaks because the compound contains chlorine atoms.

Chlorine has two stable isotopes, ^{35}Cl and ^{37}Cl which exist in approximately a 3:1 ratio.

(1)

(c)

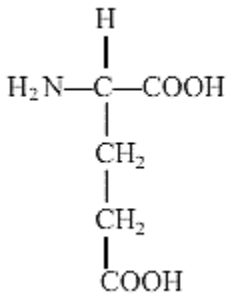
m/z values of two peaks is 106 and 108.

(1)

9.

(a)

Glutamic acid is chiral because the molecule has four different groups attached to a carbon atom (the α-carbon), making it an asymmetric carbon.



This results in the molecule having no plane of symmetry and existing as mirror images which are not superimposable .

(1)

(b)

Two optical isomers of glutamic acid be distinguished from each other by using polarized light.

The isomers of glutamic acid rotate the plane of polarized light in opposite directions.

(2)

10.

(a)

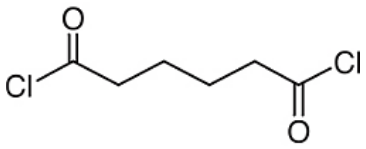
Condensation polymer:

A condensation polymer is formed by the elimination or removal of a small molecule, typically water, between two monomers.

(1)

(b)

Structural formula of a diacid dichloride:



Structural formula of diamine that could be reacted to form a polyamide.

$H_2NCH_2NH_2$

Or

$H_2N{-}R'{-}NH_2$

(2)

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