Preparatory chemistry course

Organic Chemistry

Day 3

Assoc.prof. Lily Peikova
Faculty of Pharmacy
Medical University - Sofia

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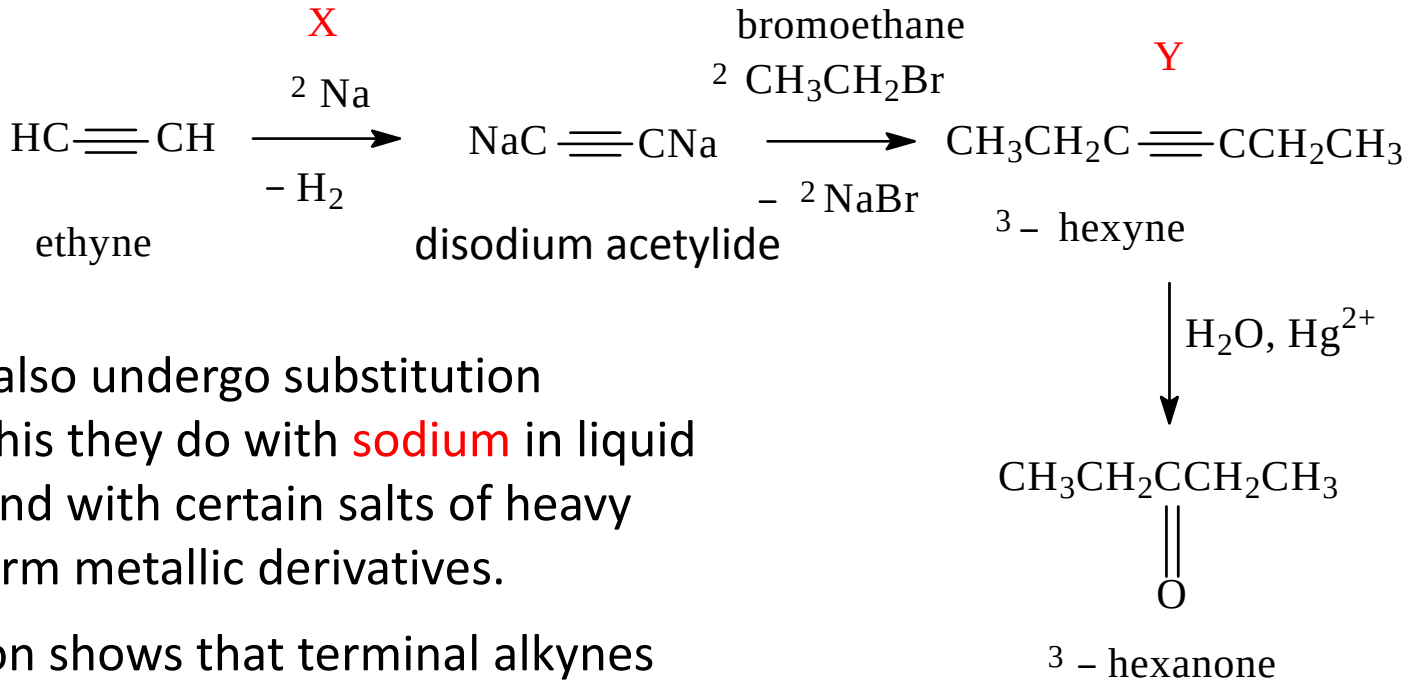
(119). The following reaction scheme is given:

Correct answer (D) X = sodium; Y = 3-hexyne

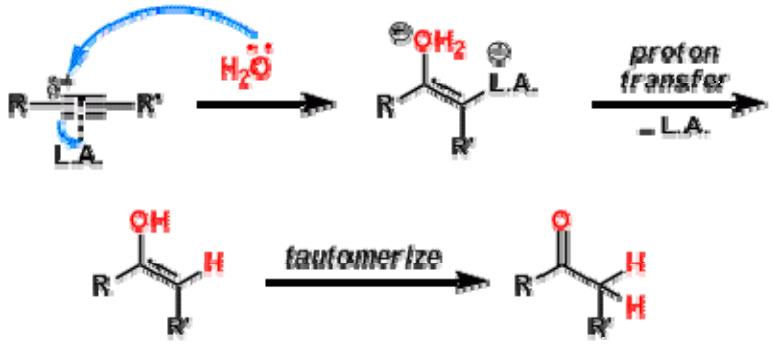


Ethyne can also undergo substitution reactions. This they do with sodium in liquid ammonia, and with certain salts of heavy metals to form metallic derivatives.

This reaction shows that terminal alkynes show acidic behavior.

Kucherov Reaction

The activation of the carbon-carbon triple bond toward nucleophilic attack of water can be performed by metals with high Lewis acidity (alkyne activation). It is easy to realize that as a result of the anti-addition of the nucleophile, the product should be obtained with trans-stereochemistry. In the case of water as the nucleophile, Proton transfer from O to C converts enol to more stable keto tautomer.



(122). The followng reaction scheme is given:

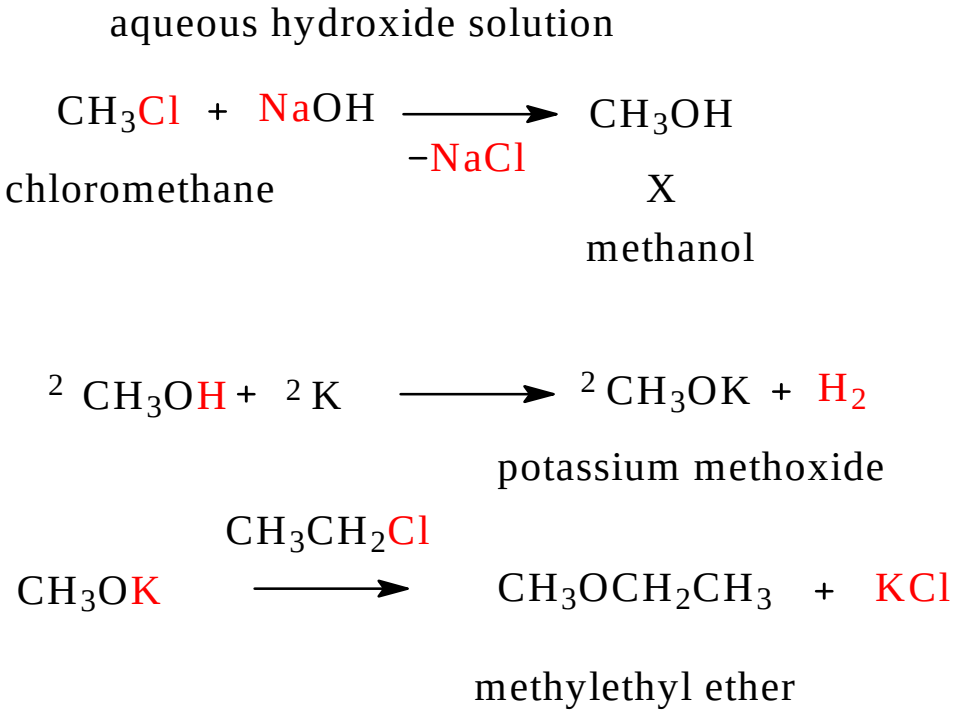
CHLOROMETHANE ⟶ X ⟶ POTASSIUM METHOXIDE

CH_3CH_2Cl

⟶ Y

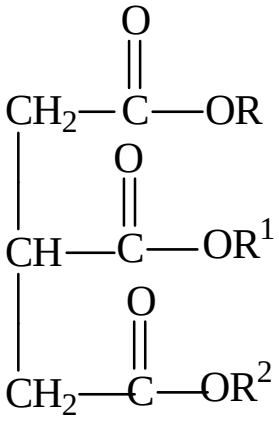
Determine which are compounds X and Y?

Correct answer (B) methanol and methylethyl ether

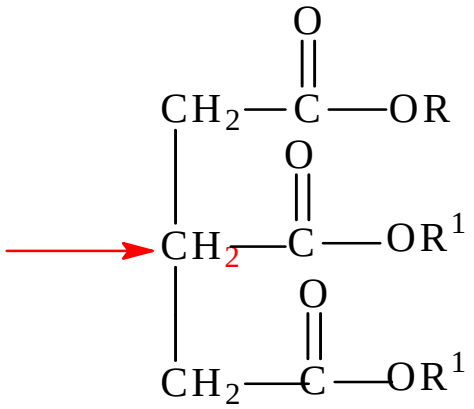


(148). Which of the following represents the structure of a triacylglyceride?

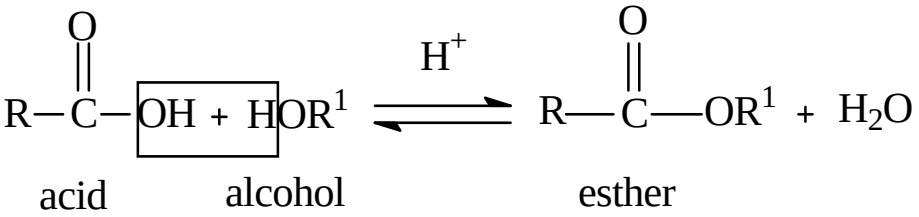
Correct answer (C)

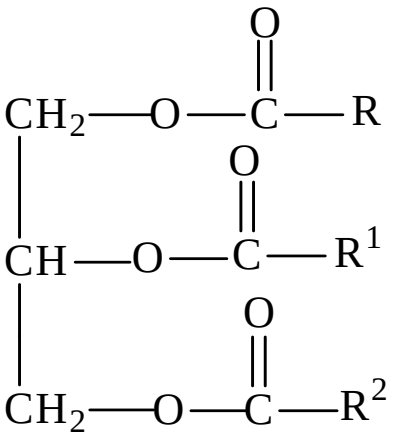


(A) esther

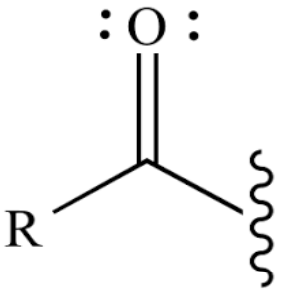


(B) wrong structure

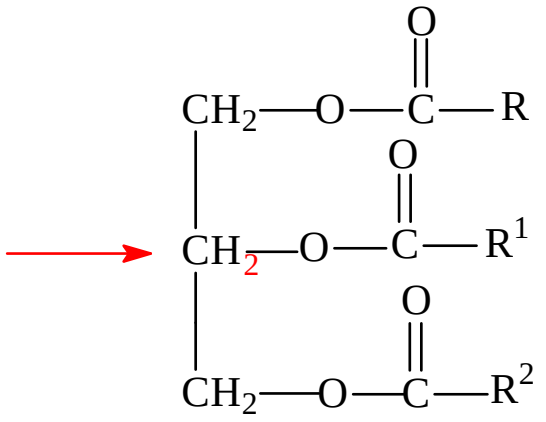




(C)

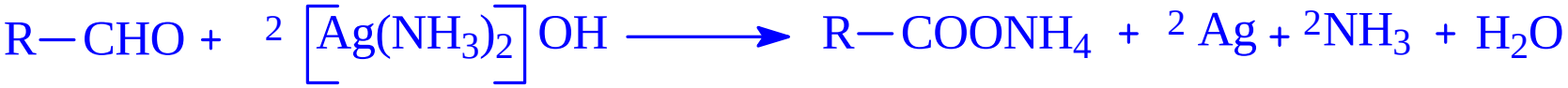


acyl group



(D) wrong structure

(151). Consider the following reaction:



Correct answer (D)

Tollen's test is a test for aldehydes. So aldehydes gives positive Tollen's test.

Tollens' reagent is a chemical reagent used to determine the presence of an aldehyde, aromatic aldehyde and alpha-hydroxy ketone functional groups. The reagent consists of a solution of silver nitrate and ammonia. It was named after its discoverer, the German chemist Berhard Tollens. A positive test with Tollens' reagent is indicated by the precipitation of elemental silver, often producing a characteristic "silver mirror" on the inner surface of the reaction vessal.

Being a mixture of Silver Nitrate and Ammonia in solution. Its active ingredient is Di-ammine-silver(I) complex ($[Ag(NH_3)_2]^+$).

Fehling test

The reaction is carried out using two separate solutions, aqueous copper (II) sulphate and an alkaline solution of potassium sodium tartrate (usually in sodium hydroxide). When combined, a copper II tartrate complex is formed (bistartratocuprate(II)) and it’s this that oxidises the aldehyde or alphahydroxy-ketone to a carboxylic acid. Once the redox reaction is complete, the copper II ions are reduced to Copper I oxide, which is insoluble in water and forms a red precipitate. The presence of this indicates a positive test. The sodium salt of the acid remains behind in solution.

Benedict test

It is a complex mixture of sodium carbonate, sodium citrate and copper(II) sulfate pentahydrate.

Benedict's test detects the presence of aldehydes and alpha-hydroxy-ketones, also by hemiacetal, including those that occur in certain ketoses. Thus, although the ketose fructose is not strictly a reducing sugar, it is an alpha-hydroxy-ketone, and gives a positive test because it is converted to the aldoses glucose and mannose by the base in the reagent.

Benedict’s Test is used to test for simple carbohydrates. The Benedict’s test identifies reducing sugars (monosaccharide’s and some disaccharides), which have free ketone or aldehyde functional groups.

Ninhydrin is 2,2-dihydroxyidane-1,3-dione.

Amines (including α-amino acids) react with ninhydrin to give a coloured product.
It can be used qualitatively (e.g. for chromatographic visualisation) or quantitatively (e.g. for peptide sequencing).
The α-amino acids typically give a blue-purple product.
Proline, a secondary amine, gives a yellow-orange product.
The test is sensitive enough that ninhydrin can be used for the visualisation of fingerprints.

(154). Which pair of structures represents a pair of isomers?

Correct answer (B), because the two structures are chain isomers.

Isomers

Definition of ISOMER

One of two or more compounds, that contain the same number of atoms of the same elements but differ in structural arrangement and properties.

In **structural isomers**, the atoms and functional groups are joined together in different ways. Structural isomers have different IUPAC names and may or may not belong to the same functional group. This group includes **chain isomerism** whereby hydrocarbon chains have variable amounts of branching.

P**osition isomerism**, which deals with the position of a functional group on a chain; and **functional group isomerism**, in which one functional group is split up into different ones.

Functional groups
are specific groups of atoms within molecules that have very characteristic properties regardless of the other atoms present in a molecule. You're probably familiar with several of them by now – alcohols, amines, carboxylic acids, ketones, and ethers are all common examples.

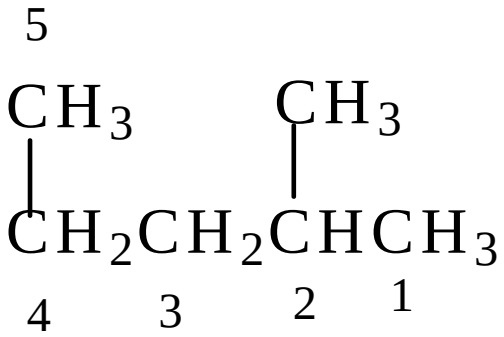
IUPAC

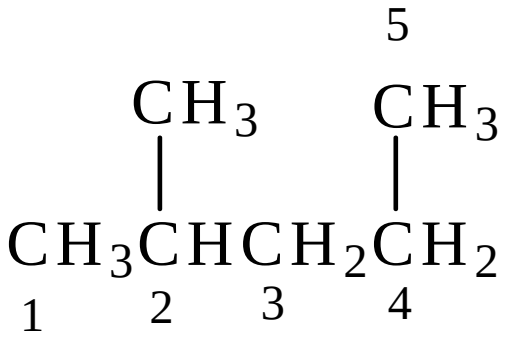
International Union of Pure and Applied Chemistry

IUPAC is the universally-recognized authority on chemical nomenclature and terminology.

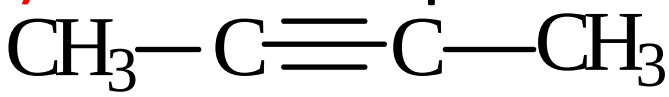
(A) and (D) - Different number of C - atoms and H – atoms.

(C) - Both structures are the same - 2-methyl-pentane





(155) – The compound is?



Correct answer (C) - Alkyne

Alkynes

Alkynes are hydrocarbons, which are organic chemical compounds containing carbon (C) and hydrogen (H) atoms, and the feature that makes them recognized as alkynes is the presence of triple bonds.

$$C_nH_{2n-2}$$

Alkanes are the simplest organic molecules, consisting of only carbon and hydrogen and with only single bonds between carbon atoms. Alkanes have the general formula C_nH_{2n+2}.

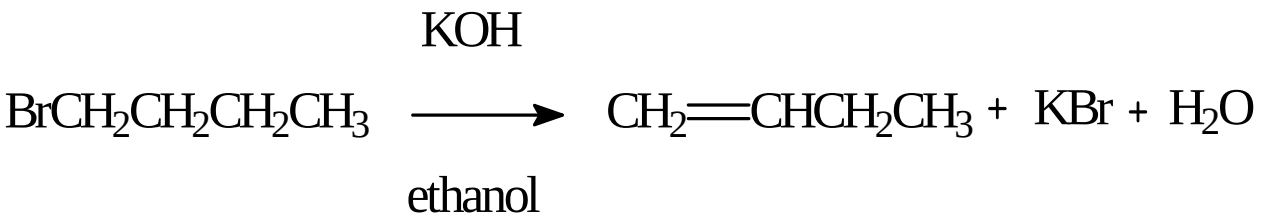
Alkenes, also known as olefins, are organic compounds that consist of carbon and hydrogen atoms with one or more carbon-carbon double bonds in their chemical structure. Alkenes are unsaturated hydrocarbons. They are hydrocarbons because they are made of only carbon and hydrogen atoms, and they are unsaturated because they have one or more double bonds in their chemical structure.

$$C_nH_{2n}$$

Aromatic carbohydrate (arene),
for example – benzene.

(156) – Which one of the following will give 1-buten as the only alkene by heating with KOH in ethanol?

Correct answer (A)

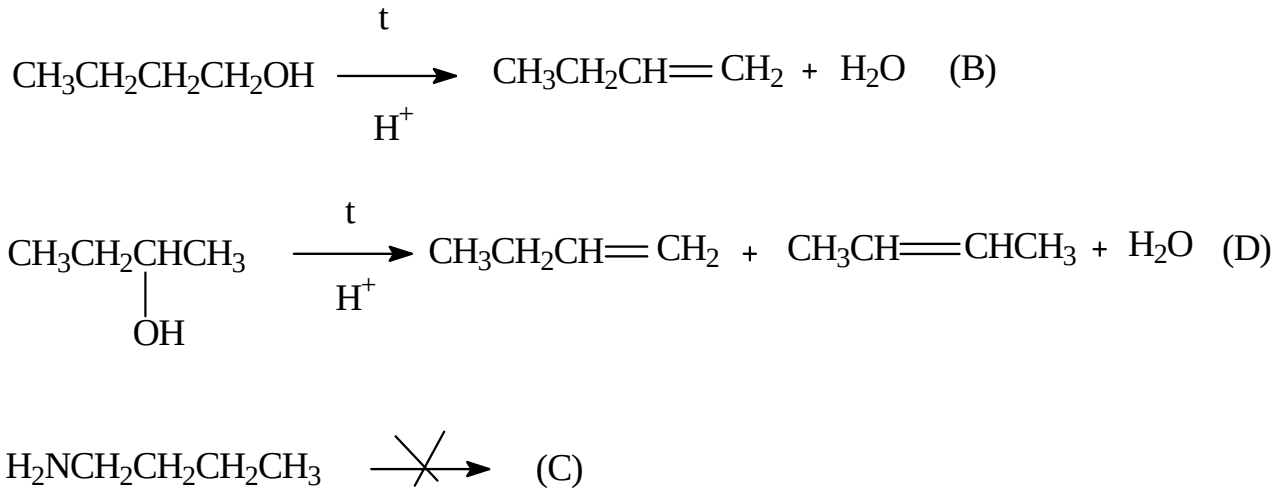


Alkenes are usually prepared from either alcohols or haloalkanes (alkyl halides), although there are several methods
for creating alkenes.

What is the difference?

Haloalkanes with KOH in ethanol.

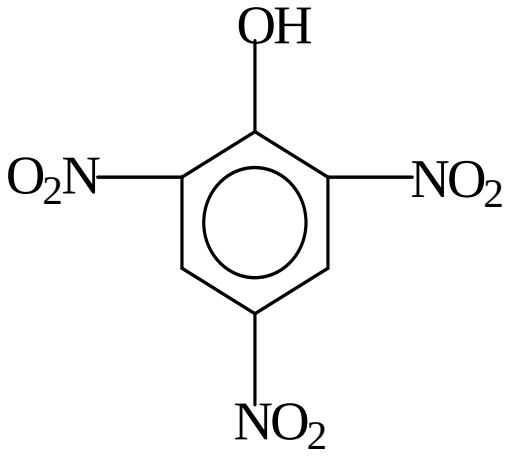
Alcohols at a temperature higher than 140°C and acid medium.



(157) - The other name of picric acid is?

Correct answer (B) – 2,4,6-trinitrophenol

Picric acid (from Greek πικρός (*pikros),* “bitter”), Its IUPAC name is 2,4,6-trinitrophenol.



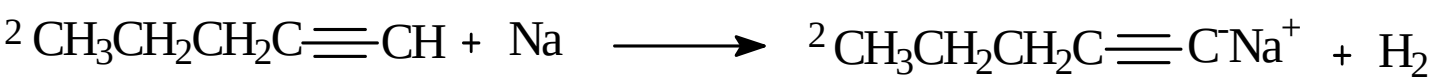
(158) - 1-pentine and 2-pentine may be distinguished by interaction with?

Correct answer (C) – sodium.

Properties of Alkynes

Substitution Reactions

Because of their acidic nature, alkanes form metallic salts called alkynides, when the triple bond is at the end of the chain.



(159) – By which of the presented processes and interactions can be distinguished formic acid from ethanolic acid?

Correct answer (A) – cuprum dihydroxide (Copper(II) hydroxide, IUPAC name).

The oxidation reaction involve Fehling`s reagent as a test. The Cu^{2+} complex ions are reduced to a red brick colored Cu_2O precipitate. Formic acid (HCO_2H) gives a positive Fehling's test result.

Fehling's solution, for information

Two solutions are required:

Fehling's "A" uses 7 g $CuSO_4.5H_2O$ dissolved in distilled water containing 2 drops of dilute sulfuric acid.
Fehling's "B" uses 35g of potassium tartrate and 12g of NaOH in 100 ml of distilled water.

These two solutions should be stoppered and stored until needed.

For the test:
Mix 15 ml of solution-"A" with 15 ml of solution-"B"
Add 2 ml of this mixture to an empty test tube.
Add 3 drops of the compound to be tested to the tube.
Place the tube in a water-bath at 60° C.

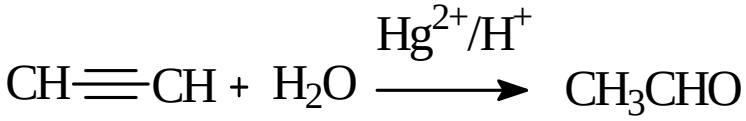
(160) -For the carboxylic acids is NOT typical the reaction of:

Correct answer (A) – hydration in the presence of mercury ions and sulfuric acid media.

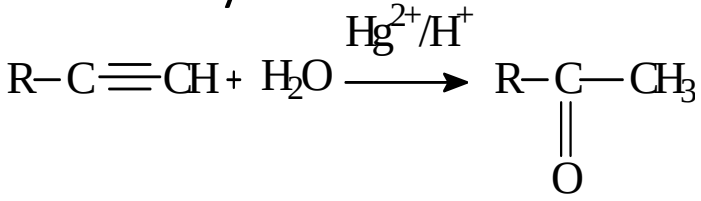
(B), (C) and (D) are typical reactions for acids.

(A) is the typical reaction for alkynes.

ethine – ethanal (acetaldehyde)



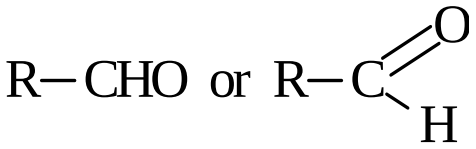
alkynes - ketones



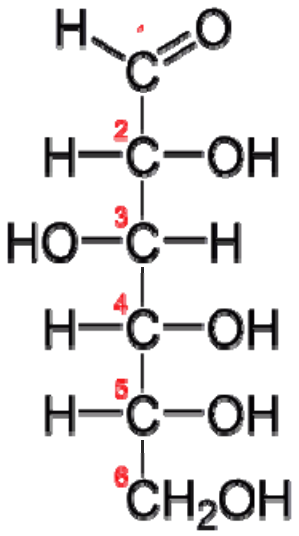
(161) – Which of the listed compounds contains an aldrhyde group?

Correct answer (D) – glucose.

This is the aldehyde group:



(D) Glucose



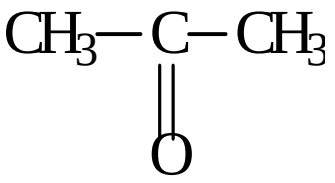
(A) glycine H_2NCH_2COOH

Glycine is an amino acid.

Aminoacetic acid

(B) methanol – alcohol CH_3OH

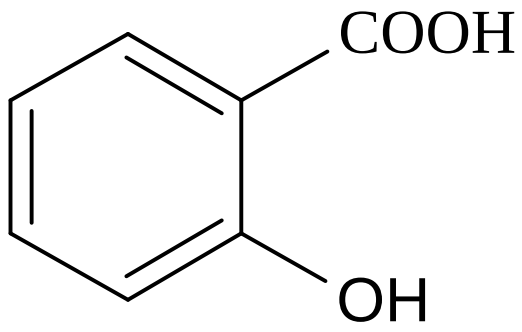
(C) propanone(acetone) - ketone

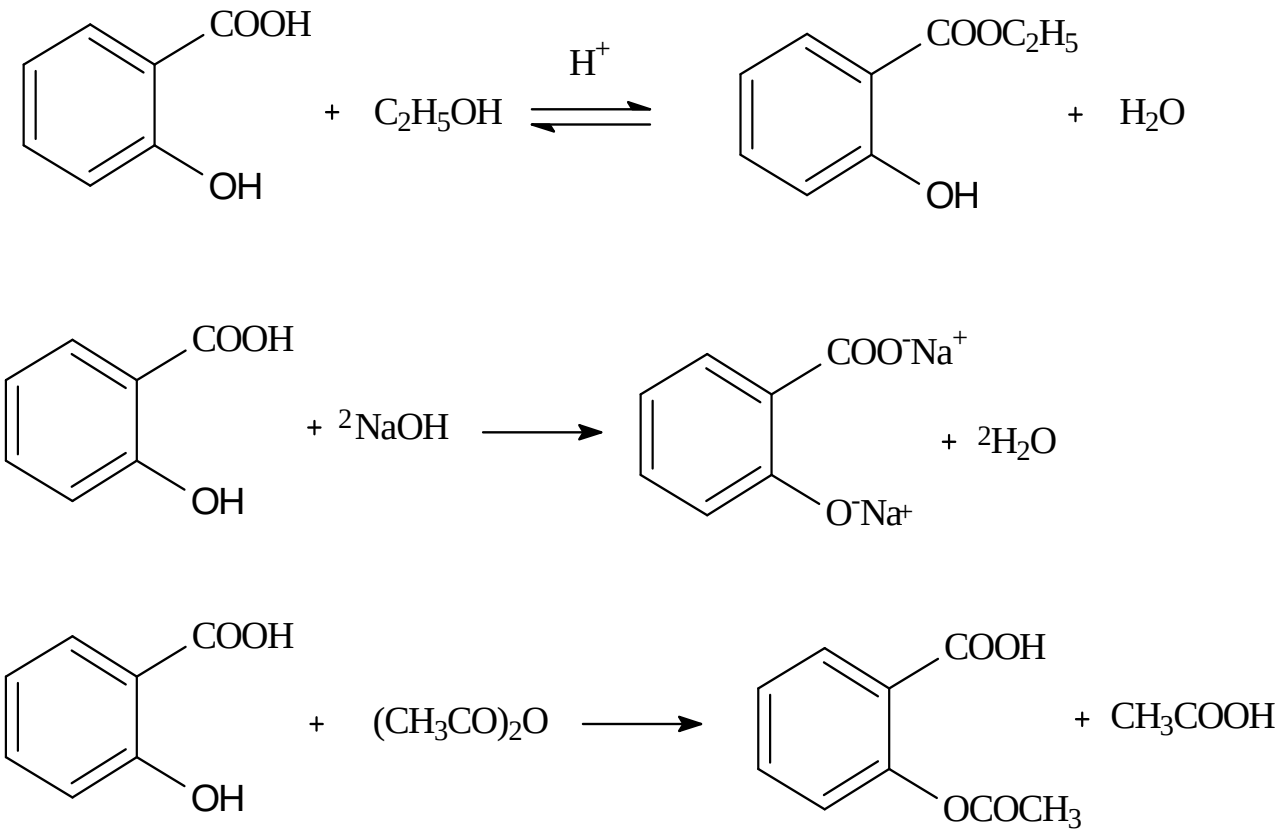


(162) – With which of the compounds: ethanol,sodium hydroxide and acetic anhydride, salicylic acid is interacting?

Correct answer (D)

Salicylic acid (2-Hydroxybenzoic acid, where the OH group is ortho to the carboxyl group).





Salicylic acid

Salicylic acid has double property of phenol and carboxylic acid.

Aspirin
(acetylsalicylic acid)

The synthesis of aspirin is classified as an esterification reaction. Salicylic acid is treated with acetic anhydride, an acid derivative, causing a chemical reaction that turns salicylic acid's hydroxy group into an ester group (R-OH → R-$OCOCH_3$).