

Preparatory chemistry course

Organic Chemistry

Day 4

28 May 2020

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(163) - Which of compounds (A), (B), (C) and (D) are isomers?

Correct answer (D)

Definition of ISOMER

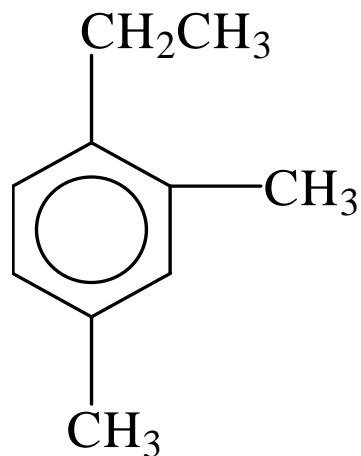
One of two or more compounds, that contain the same number of atoms of the same elements but differ in structural arrangement and properties.

(A) and (D) - Both structures are the same.

Position isomerism

In position isomerism, the basic carbon skeleton remains unchanged, but important groups are moved around on that skeleton.

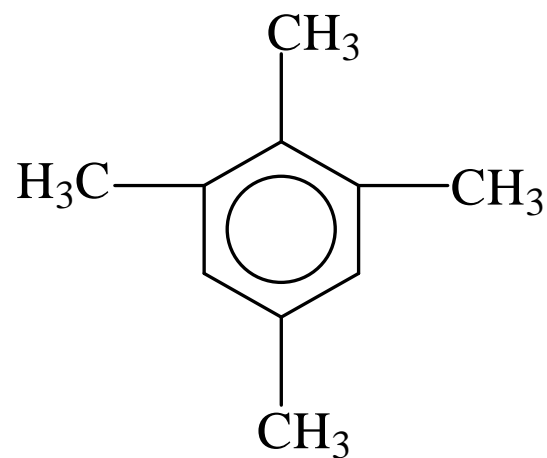
(B) and (C) are position isomers on benzene rings.



isomers

(C) 1,3- dimethyl-4-ethylbenzene, or 1-ethyl-2,4-dimethylbenzene

(B) 1,2,3,5-tetramethylbenzene



(164) - Which of the following hydrocarbons would be expected to have the highest boiling point?

Correct answer (B) C_5H_{12}

The boiling points of organic compounds can give important clues to other physical properties and structural characteristics.

As the chain length (numbers of carbons) increases the melting and boiling points of the alkanes gradually increase for these compounds.

The reason that longer chain molecules have higher boiling points is that longer chain molecules become wrapped around and enmeshed in each other much like the strands of spaghetti.

More energy is needed to separate them than short chain molecules which have only weak forces of attraction for each other.

(C) Propane C_3H_8 , boiling point $-42^\circ C$

(D) Methane CH_4 , boiling point $-164^\circ C$

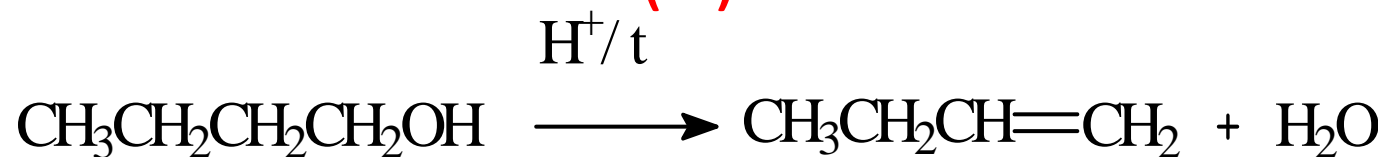
(A) Butane C_4H_{10} , boiling point $-0.5^\circ C$

(B) – Pentane C_5H_{12} , boiling point $36^\circ C$

(A), (B), (C), (D) - *State at
 $25^\circ C$ gas.*

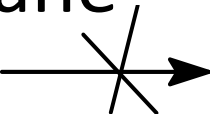
(165) – Which one of the following will give 1-butene as the only alkene by heating with concentrated sulfuric acid?

Correct answer (A) – 1-butanol



1-butene

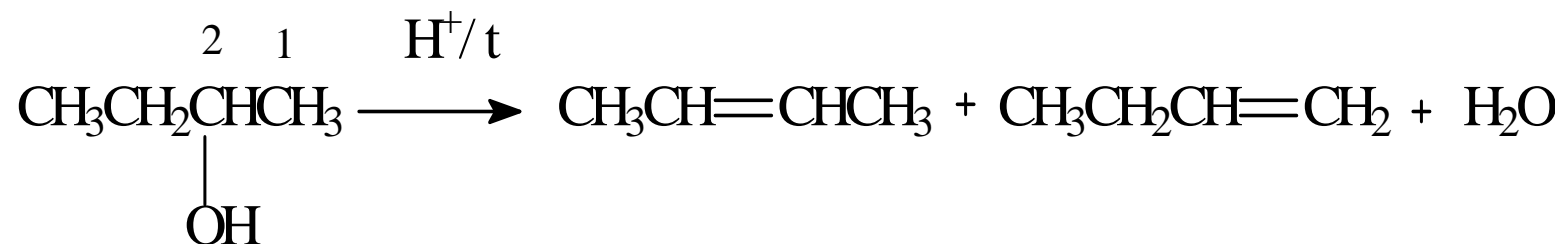
In this reaction only one alkene is obtained.

(B) 1-bromobutane
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$ 

(C) 1-butanamine

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$ 

(D) 2-butanol \longrightarrow 2-butene + 1-butene



2-Butanol is a secondary alcohol, and upon dehydration, two isomers are produced: 2-butene and 1-butene.

(166) - Which compound is INCORRECTLY matched to the functional group that it contains?

Correct answer (B)

Functional groups are specific groups of atoms within molecules that have very characteristic properties regardless of the other atoms present in a molecule.

The functional group **(FG)** approach "*works*" because the properties and reaction chemistry of a particular functional group can be remarkably independent of environment.

(A) CH_3OH - **FG** hydroxyl

Primary alcohols have an -OH function attached to an R- CH_2 - group.

(C) $\text{CH}_3\text{CH}_2\text{NH}_2$ - **FG** amine

Primary amines have an alkyl or aromatic group and two hydrogens attached to a nitrogen atom.

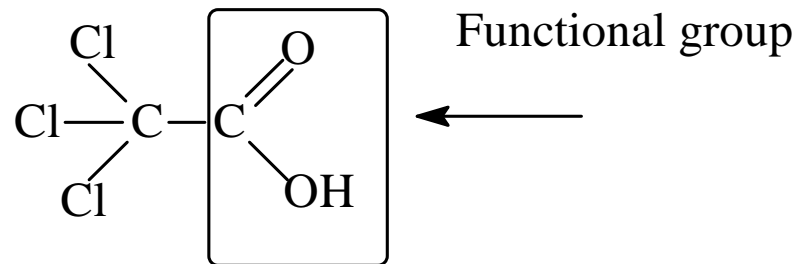
Primary amines can be shown in text as: RNH_2 .

(C) CCl_3COOH – **FG** carboxylic acid

Carboxylic acids have an alkyl or aromatic groups attached to a hydroxy-carbonyl (carboxylic) function.

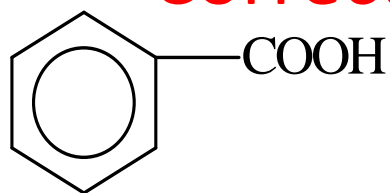
Carboxylic acids can be shown in text as: RCOOH .

(C) CCl_3COOH - Trichloroacetic acid

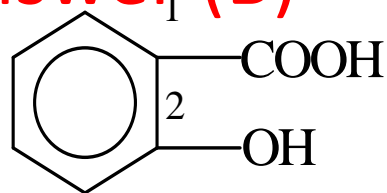


(167) - The other name of salicylic acid is:

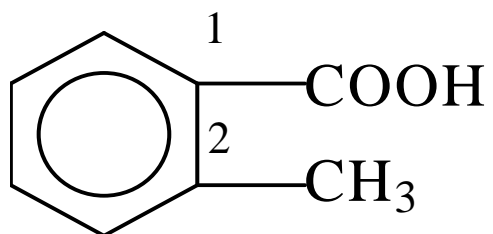
Correct answer (B)



benzoic acid

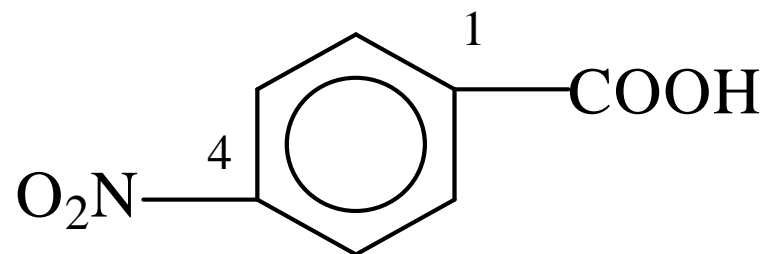
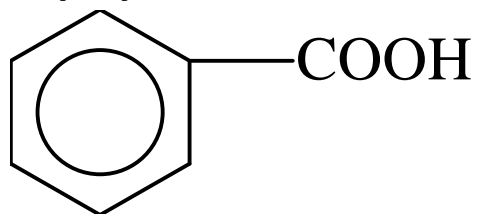


2 - hydroxybenzoic acid
(salicylic acid)



(A) 2-methylbenzoic acid

(C) benzenecarboxylic acid (benzoic acid)



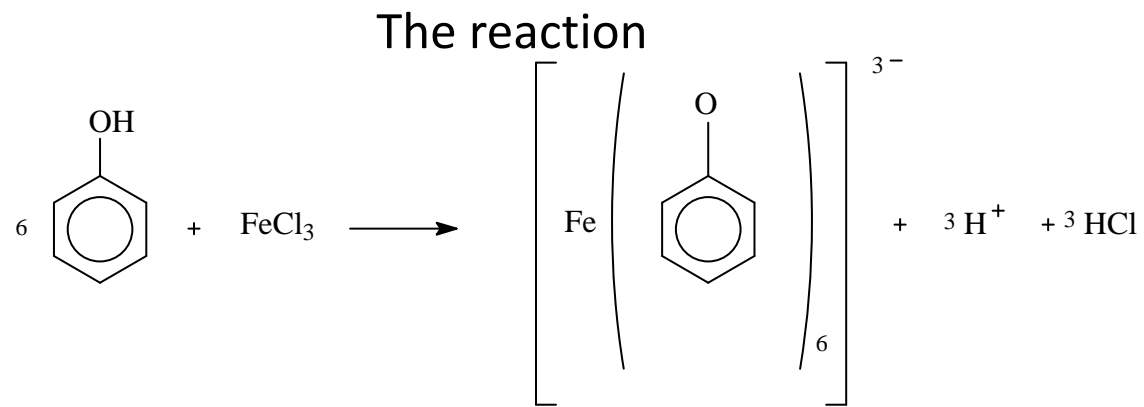
(D) 4 - nitrobenzoic acid

(169) By which of the presented processes and interactions can be distinguished phenol from benzoic acid?

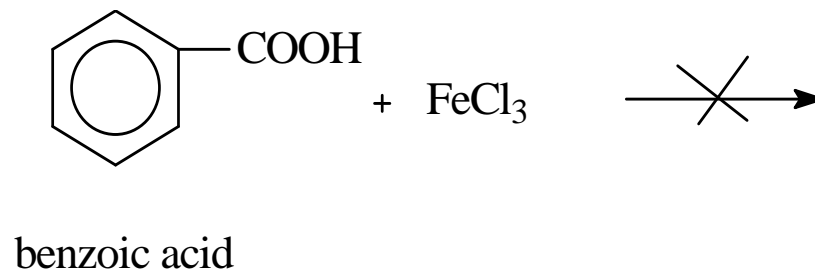
Correct answer (A) ferric chloride
(IUPAC names Iron(III) chloride,
Iron trichloride)

Phenol and benzoic acid are acids and interact with alkaline oxide (C), active metal (B) and alkaline hydroxide (D).

The chemical reaction between phenol and ferric chloride is a test for the presence of phenol. They react with each other to produce a violet complex.



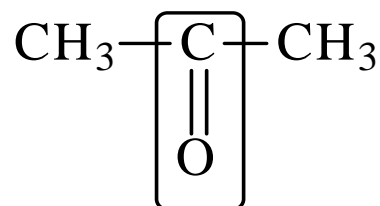
The formation of a complex



(170) Which of the listed compounds contains a keto group?

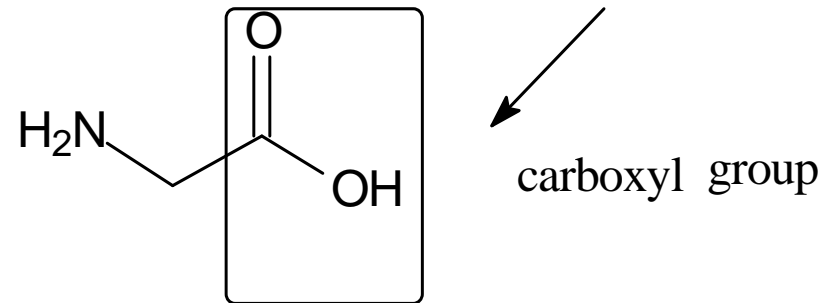
Correct answer (D) propanone

↙ keto group



propanone (acetone)

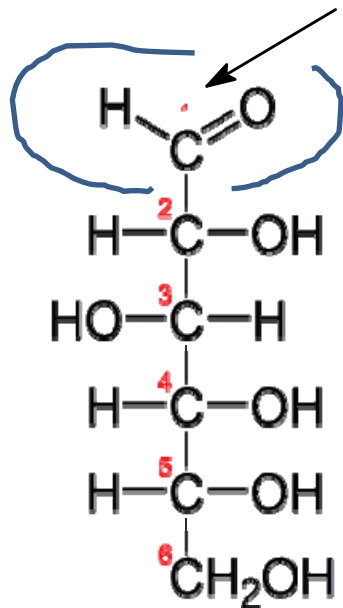
(A) Glycine (aminoacetic acid)



aldehyde group

(B) Methanol CH_3OH

hydroxy group



(C) glucose

(171) Which hydrocarbon will undergo a substitution reaction with a halogen?

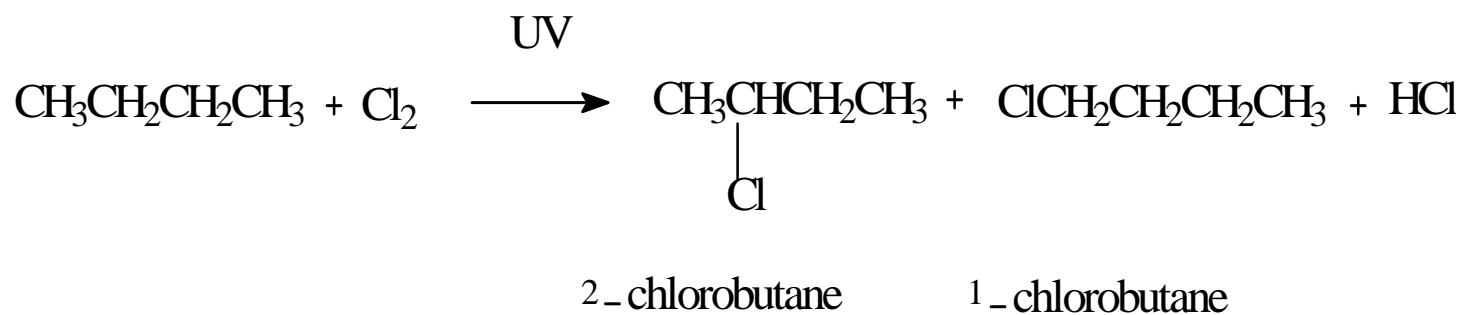
Correct answer (C) butane

Butane (C_4H_{10}) is an **alkane** with four carbon (C) atoms.

Hydrocarbon molecules such as saturated **alkanes** are reacted with chlorine or bromine to manufacture valuable chloroalkanes or bromoalkanes.

Alkanes will react with halogens such chlorine and bromine in the presence of ultraviolet light (UV) – substitution reaction.

butane



Two isomers

(A) pentyne - alkyne

(B) butene – alkene

(D) ethene - alkene

Alkenes and alkynes are unsaturated hydrocarbons.

Alkenes and alkynes react in many addition reactions.

(172) When methane, CH₄, burns in excess oxygen, the products would be:

Correct answer (D), CO₂ + H₂O



methane + oxygen → carbon dioxide + water

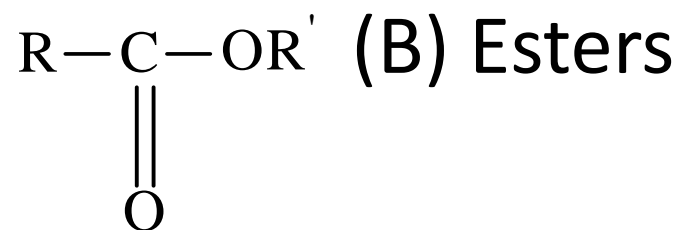
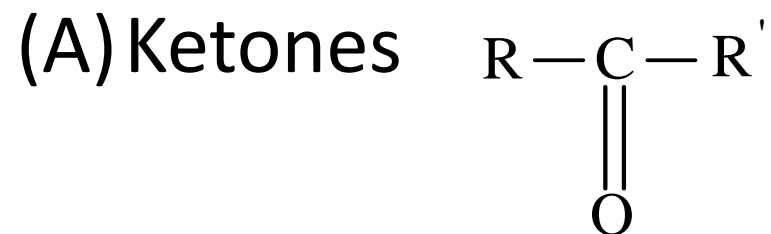
In the reaction, the the bonds in the methane and oxygen come apart, the atoms rearrange and then re-bond to form water and carbon dioxide.

(173) A carbonyl group is present in all of these functional groups except:

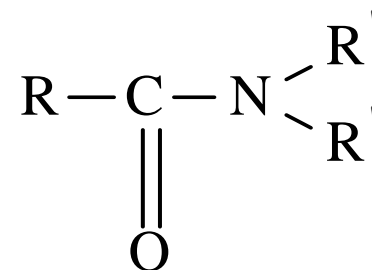
Correct answer (C) ethers

A carbonyl group is a chemically organic functional group composed of a carbon atom double-bonded to an oxygen atom \rightarrow $[C=O]$. Be sure to understand that the $C=O$ entity itself is known as the "Carbonyl group" while the members of this group are called "carbonyl compounds" \rightarrow $X-C=O$.

Some Carbonyl Compounds



(D) Amides



(C) Ethers

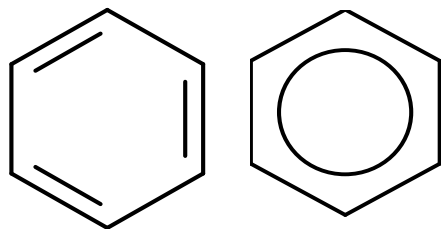
They are not carbonyl compounds.



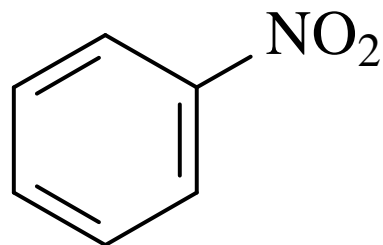
(174) What is the product of the reaction of benzene with solution of nitric in sulfuric acid at 50° C?

Correct answer (B)

nitrobenzene



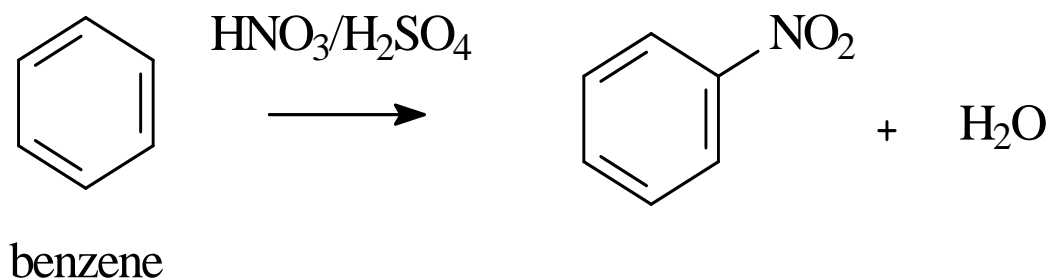
benzene



Benzene undergoes electrophilic substitution reaction easily.

Benzene reacts with nitronium ions (NO_2^+), which is a strong electrophile produced by **combining sulfuric and nitric acids**.

Typical nitration syntheses apply so-called "mixed acid", a mixture of concentrated nitric acid and sulfuric acids. This mixture produces the nitronium ion (NO_2^+), which is the active species in **aromatic nitration**.



(175) Tollens' reagent, basic diammine silver(I) solution, gives a positive test (in the form of a silver mirror) in the presence of aldehydes. Which sugars give a positive Tollens' test?

Correct answer (B) – II only

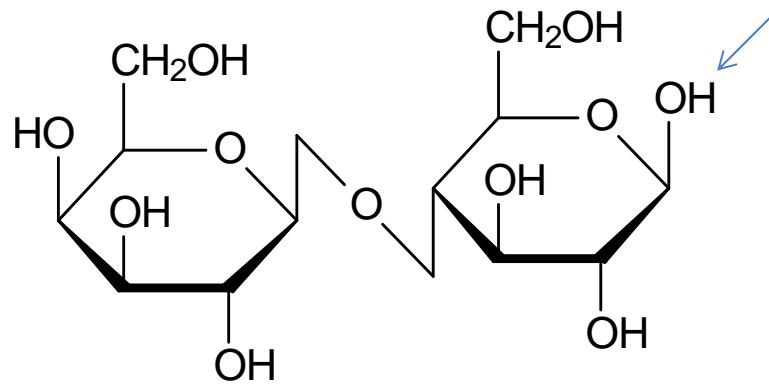
II. Lactose

Tollens reagent

A reagent used in testing for aldehydes, named after German chemist B. C. G. Tollens (1841–1918). It is made by adding sodium hydroxide to silver nitrate to give silver(I) oxide, which is dissolved in aqueous ammonia (giving the complex ion $[\text{Ag}(\text{NH}_3)_2]^+$). The sample is warmed with the reagent in a test tube. Aldehydes reduce the complex Ag^+ ion to metallic silver, forming a bright silver mirror on the inside of the tube (hence the name silver-mirror test). Ketones give a negative result.

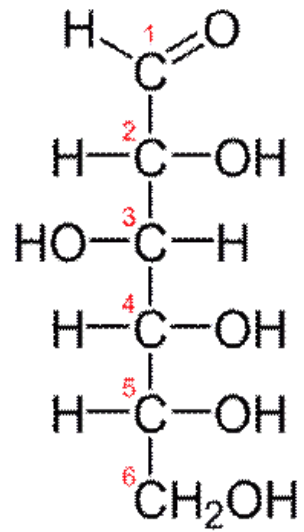
**Lactose is a disaccharide
sugar composed
of galactose and glucose.**

Lactose

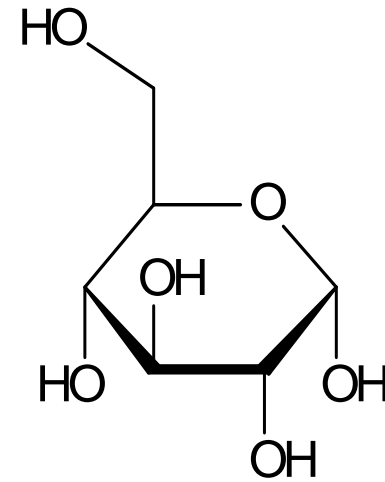


4-O-b-D-Galactopyranosyl-D-glucose

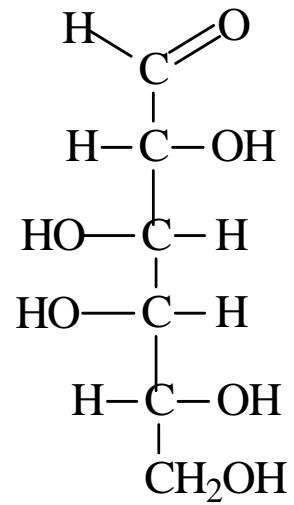
Carbohydrates having a free carbonyl group (in the formation of the half-acetal ring forms a glycosidic group is obtained) are called reducing sugars.



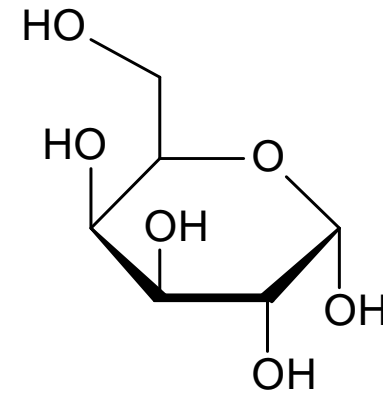
Glucose



α -D-Glucose



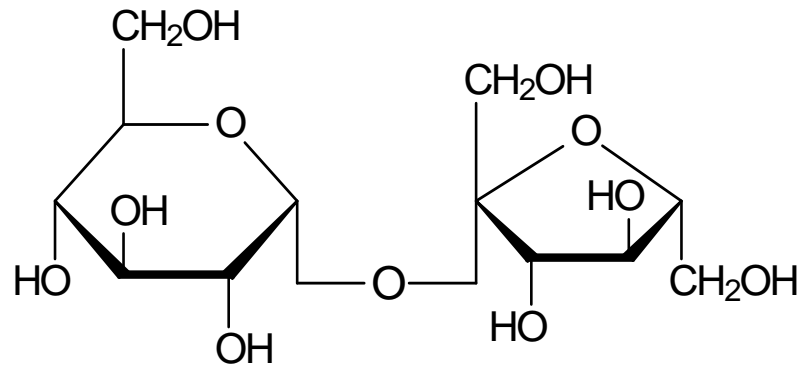
Galactose



α -form

Sucrose (Saccharose)

The molecule is a disaccharide combination of the glucose and fructose.



There are two types of disaccharides: reducing and non-reducing. In the reducers, one monosaccharide is a reducing agent.

Sucrose is non-reducing.

(176) Which of the following is not classified as a carbohydrate?

Correct answer (B) glycine

Glycine is an amino acid (aminoacetic acid).

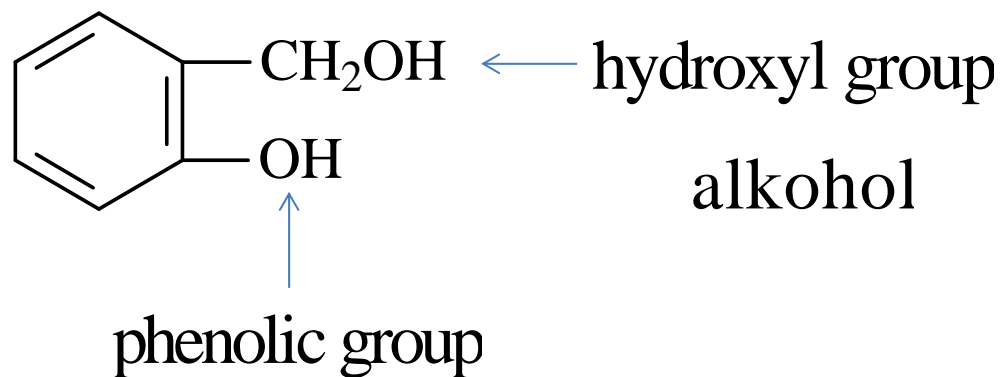


(A), (C) and (D) are carbohydrates.

(177) What is the major product of the following reaction?

Correct answer (C)

2-(hydroxymethyl)phenol or 2-hydroxybenzyl alcohol



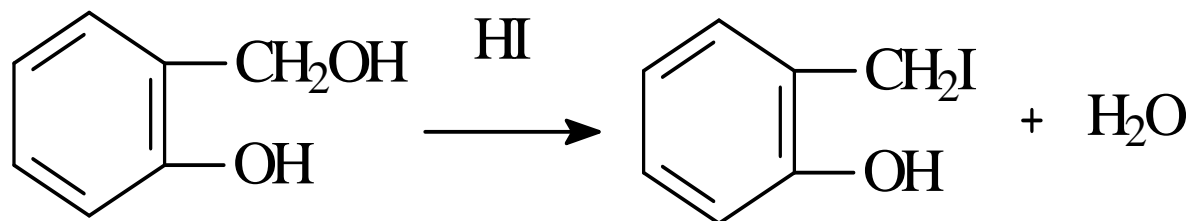
A 2-hydroxybenzyl alcohol that is phenol substituted by a hydroxymethyl group at C-2.

The phenol group **does not react** with hydrogen iodide (HI), hydrogen halides.

Alcohols react with hydrogen halides.

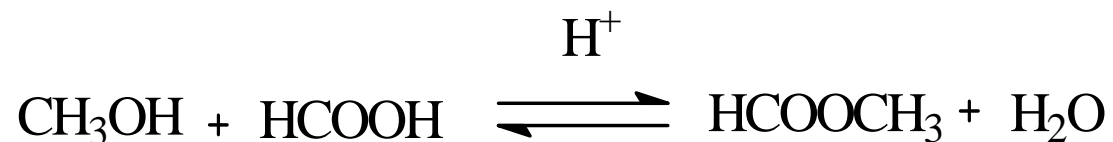
Hydrogen halides are compounds with the formula HX where X is one of the halogens: chlorine, bromine, iodine.

Possible reaction



(A), (B) and (D) - are not obtained

(179) The reaction below is best classified as:



Correct answer (B) esterification

Esterification occurs when a carboxylic acid reacts with an alcohol. This reaction can only occur in the presence of an acid catalyst and heat. It takes a lot of energy to remove the -OH from the carboxylic acid, so a catalyst and heat are needed to produce the necessary energy.

Reaction

Metanol (alcohol), Formic acid (acid) and Acid catalyst - ester (Methylformiat)

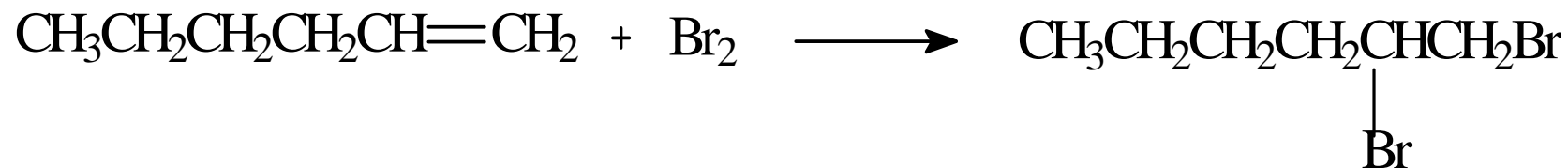
(180) Which compound will react rapidly with Br_2 ?

Correct answer (C) 1-hexene

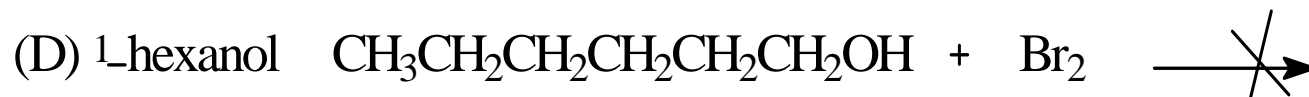
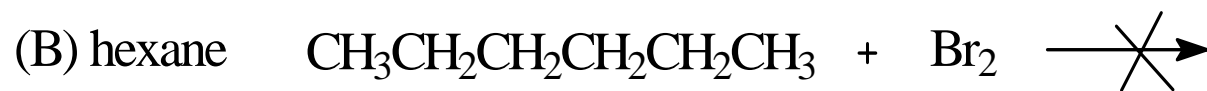
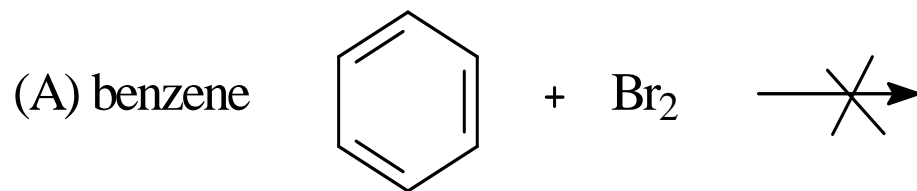


1-Hexene is an alkene. Alkenes contains a carbon-carbon double bond. Halogens readily add across the double bond of the alkenes to form dihalides.

Reaction



1,2-dibromohexane



(181) What is the IUPAC name for the compound $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$?

Correct answer (A) pentanal

Pentanal is an aldehyde.

The International Union of Pure and Applied Chemistry (IUPAC) is an international federation of National Adhering Organization that represents chemists in individual countries.

(B) Pentanoic acid
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$
acid

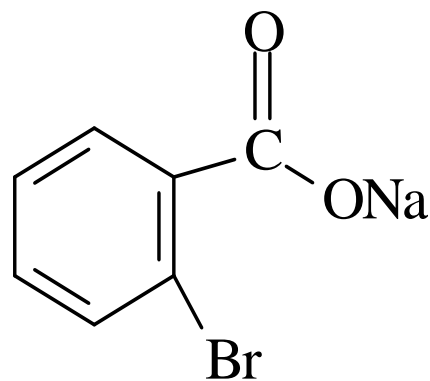
(C) 1-pentanol
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
alcohol

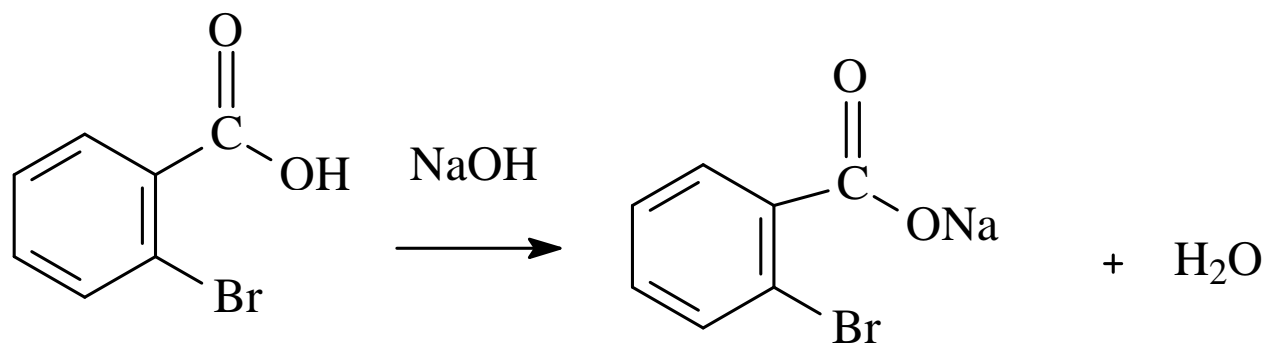
(D) 1-pentanone
 $\text{CH}_3\text{CH}_2\text{CH}_2\underset{\text{O}}{\parallel}{\text{C}}\text{CH}_3$
ketone

(182) What is the major product of the following reaction?

Correct answer (A)

Sodium salt of 2-bromobenzoic acid





This reaction is called neutralization.

(183) Which of the following hydrocarbons does NOT have isomers?

Correct answer (D) C_3H_8

propane

$CH_3CH_2CH_3$

Isomers are molecules that have the same molecular formula, but have a different arrangement of the atoms in space. **Chain isomerism** - these isomers arise because of the possibility of branching in carbon chains. **Position isomerism** -

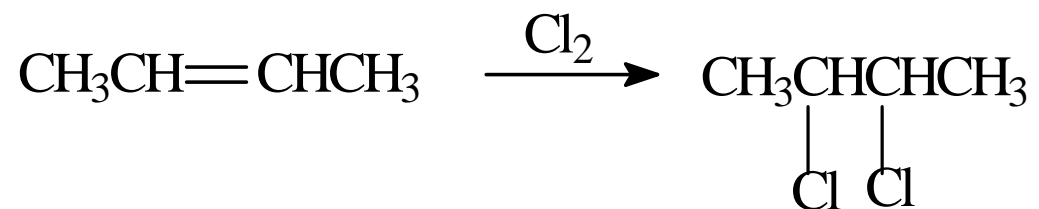
in position isomerism, the basic carbon skeleton remains unchanged, but important groups are moved around on that skeleton.

(A) alkane - Chain isomers, (B) and (C) alkenes - Chain isomers, Position isomers and Geometric isomers.

(184) What is the expected product formed from the reaction between 2-butene and Cl₂?

Correct answer (D)

2,2-dichlorobutane



Addition of Halogen

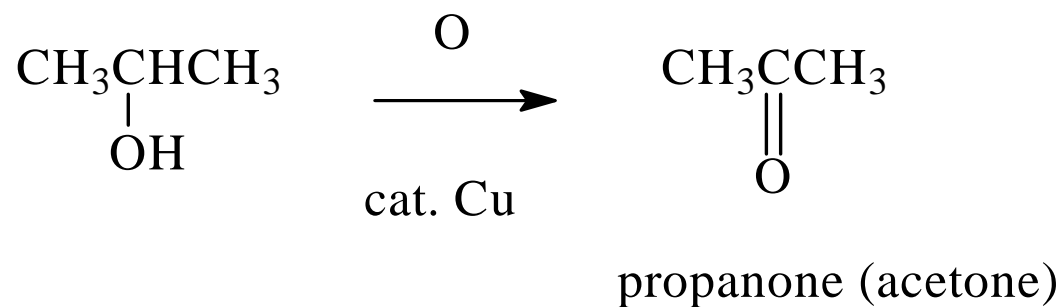
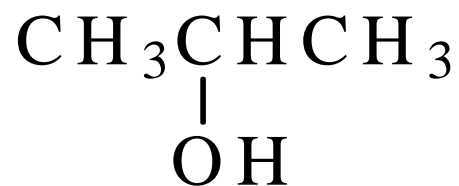
Halogens readily add across the double bond of the alkenes to form dihalides.

(A), (B) and (C)
are not received.

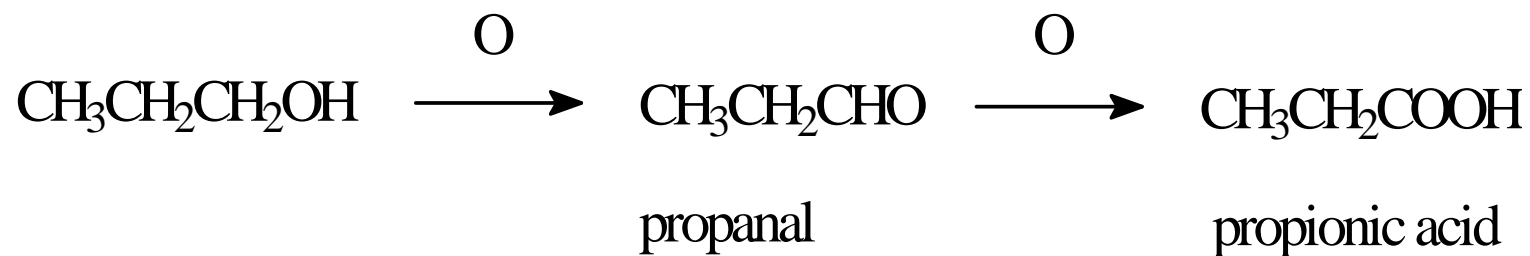
(185) Which of the following alcohols forms a ketone when oxidized?

Correct answer (C)

2-propanol

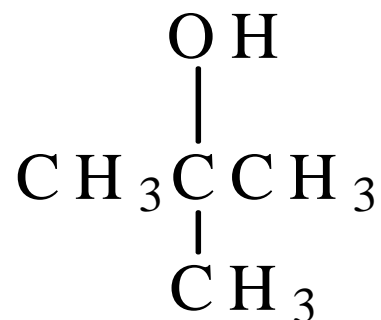


(A) 1-propanol



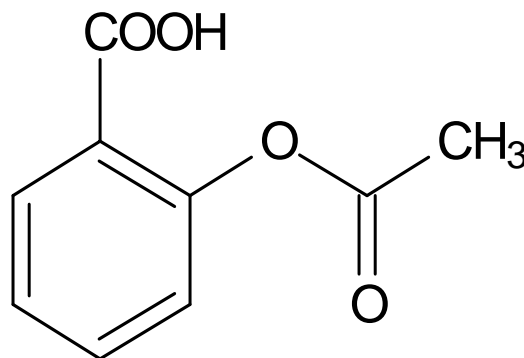
(B) 2-methyl-2-propanol

Tertiary alcohol



Tertiary alcohols aren't oxidised.

(186) Aspirin has the structural formula below.
Which functional group does this molecule
contain?



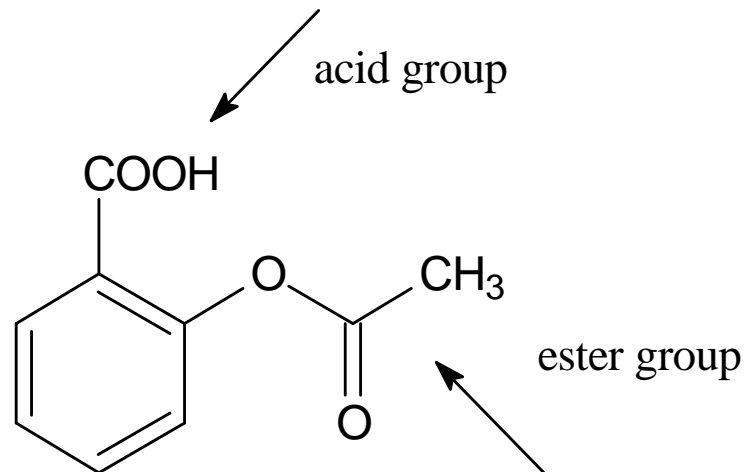
Correct answer (A) – acid and ester

R-COOH acid

R-COOR' ester

R-OH alcohol

R-OR' ether



(187) Which is NOT physical property of alcohols or phenols?

Correct answer (C)

The hydroxyl group of an alcohol is nonpolar.

Definition of PHYSICAL PROPERTY

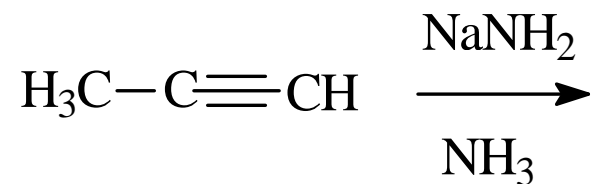
A physical property is defined as a characteristic of matter that may be observed and measured without changing the chemical identity of a sample. The measurement of a physical property may change the arrangement of matter in a sample, but not the structure of its molecules. In other words, a physical property may involve a physical change, but not a chemical change. If a chemical change or reaction occurs, the observed characteristics are chemical properties.

A nonpolar molecule is a molecule which has no separation of charge, so no positive or negative poles are formed. In other words, the electrical charges of nonpolar molecules are evenly distributed across the molecule.

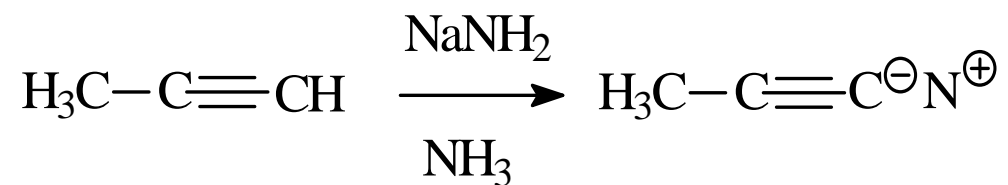
In contrast, in a polar molecule, one side of the molecule has a positive electrical charge and the other side has a negative electrical charge.

The hydroxy group makes the alcohol molecule polar.

(188) What is the major product expected from the following reaction?
Propyne with sodium amide



Correct answer (A)



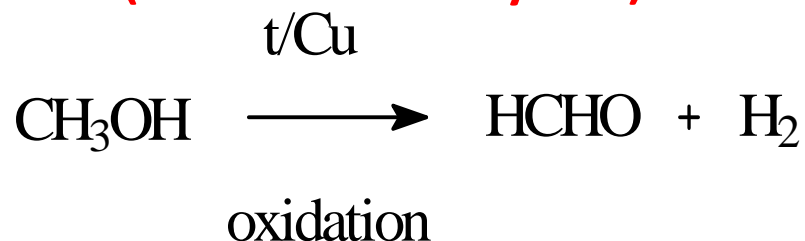
Propyne (*methylacetylene*) is an alkyne.

The alkynes in which the triple bond is in the end of the carbon chain is called as terminal alkyne. They are studied separately because the hydrogen attached with terminal carbon is acidic and can be released easily by bases like soda amide etc.

(B), (C) and (D) are not correct.

(189) Methanol can be gently oxidized with hot copper metal. What is (are) the product(s) of this oxidation?

Correct answer (D) methanal
(formaldehyde)

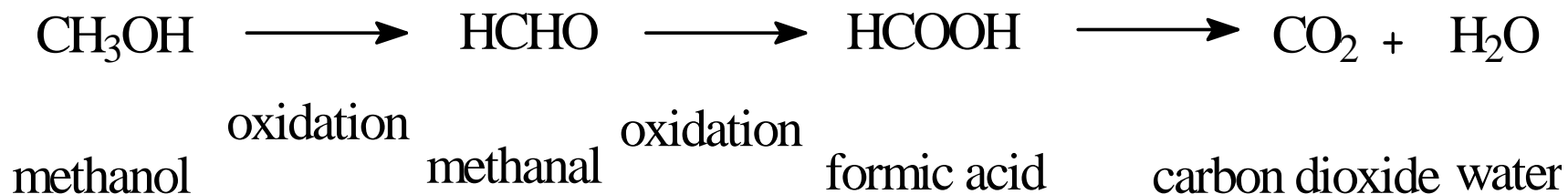


Methanol can be oxidised to formaldehyde by passing its vapour over copper heated to 300°C.

(A) and (C) are not correct.

(B) Carbon dioxide (CO₂) and water (H₂O)

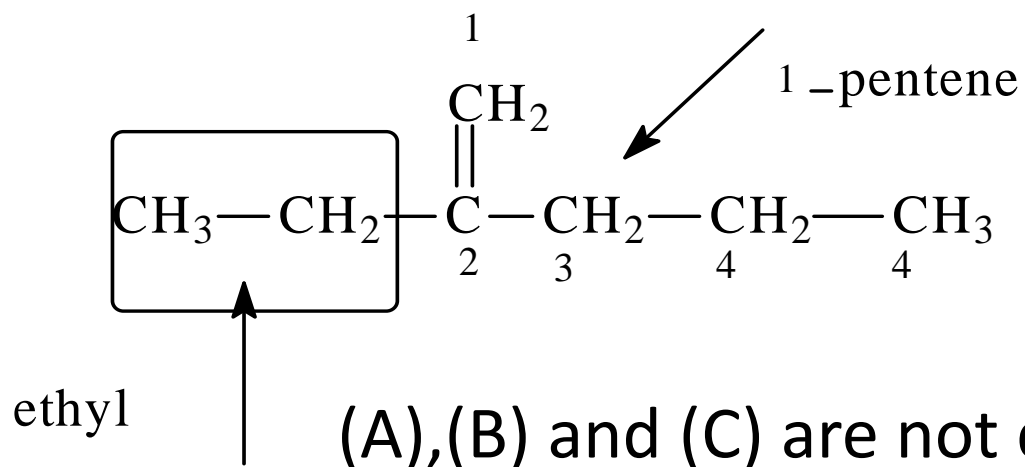
Without copper metal and If the oxidising agent is in excess, the formaldehyde is further oxidised to formic acid and then to carbon dioxide and water.



(190) What is the best name for the following compound?

Correct answer (D)

2-ethyl-1-pentene

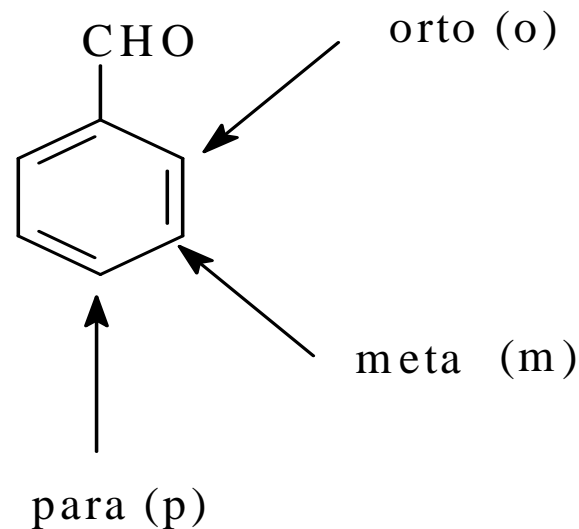


(193) The benzene ring of benzaldehyde substitutes at m-position to the aldehyde group, because it has:

Correct answer (C)

-M and -I effect

The CHO group is a deactivating functionality.



There are two categories of inductive effects: the electron withdrawing (-I effect) and the electron releasing (+I effect). The latter is also called the electron donating effect.

The -I effect is seen around a more electronegative atom or group, and electron density is higher there than elsewhere in the molecule.

TYPES OF INDUCTIVE EFFECT 1) Negative inductive effect (-I): The electron withdrawing nature of groups or atoms is called as negative inductive effect. It is indicated by -I. Following are the examples of groups in the decreasing order of their -I effect: $\text{NH}_3 > \text{NO}_2 > \text{CN} > \text{SO}_3\text{H} > \text{CHO} > \text{CO} > \text{COOH} > \text{COCl} > \text{CONH}_2 > \text{F} > \text{Cl} > \text{Br} > \text{I} > \text{OH} > \text{OR} > \text{NH}_2 > \text{C}_6\text{H}_5 > \text{H}$

RESONANCE EFFECT OR MESOMERIC EFFECT : The mesomeric effect is defined as the polarity produced in the molecule by the interaction of two π bonds or between a π bond and lone pair of electrons present on an adjacent atom. It is symbolized by M or R.

Negative resonance or mesomeric effect (-M or -R): It is shown by substituents or groups that withdraw electrons by delocalization mechanism from rest of the molecule and are denoted by -M or -R. The electron density on rest of the molecular entity is decreased due to this effect. E.g. -NO₂, **Carbonyl group** (C=O), -C≡N, -COOH, -SO₃H etc.

(194) Carbonyl derivatives DO NOT add one of the following substances:

Correct answer (C) bromine

The carbonyl derivatives are aldehydes and ketones. They add hydrogen (A). hydrogen cyanide (B) and ethanol (D).

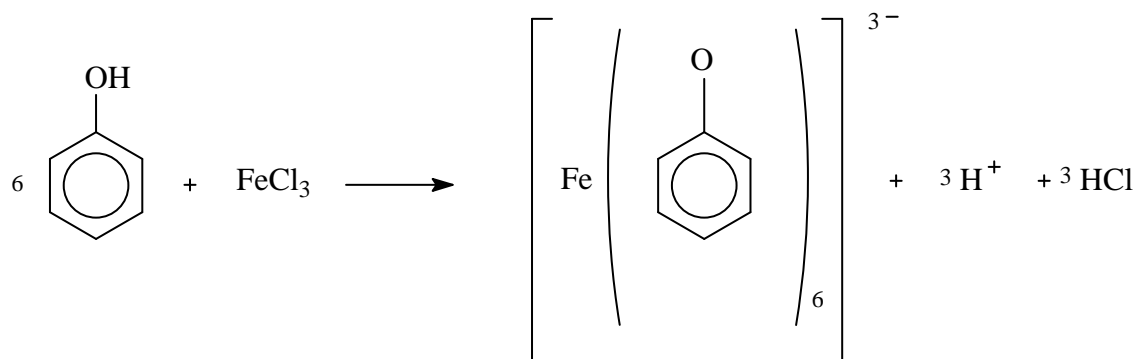
Carbonyl derivatives do not add bromine.

(195) Phenol is found with:

Correct answer (B) FeCl₃ solution.

The chemical reaction between phenol and ferric chloride (FeCl₃) is a test for the presence of phenol. They react with each other to produce a violet complex.

Complex



The formation of a complex

(196) The product of dehydration of primary alcohol is an:

Correct answer (A) aldehyde.

One way of classifying alcohols is based on which carbon atom is bonded to the hydroxyl group. If this carbon is primary (1° , bonded to only one other carbon atom), the compound is a **primary alcohol**.

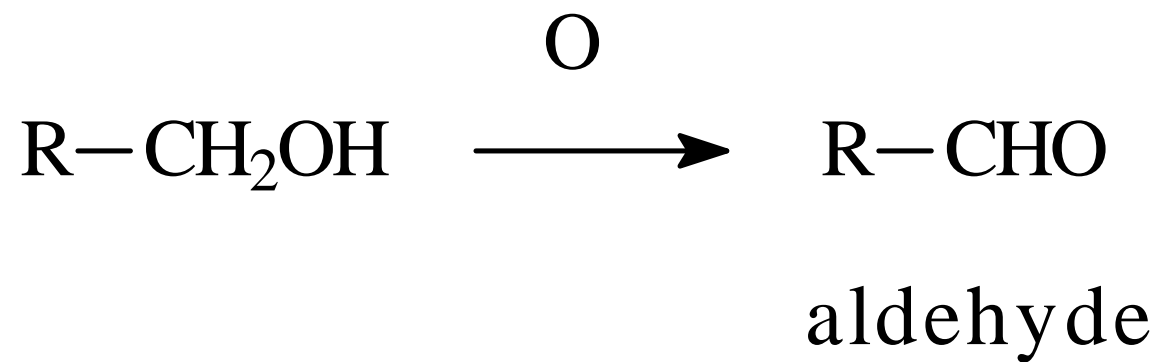
Primary alcohols



Alcohols may be oxidized to give ketones, **aldehydes**, and carboxylic acids.

Oxidizing a primary alcohol only as far as the aldehyde stage is more difficult because of the ease with which aldehydes are oxidized to acids. Special reagents have been developed to convert primary alcohols to aldehydes.

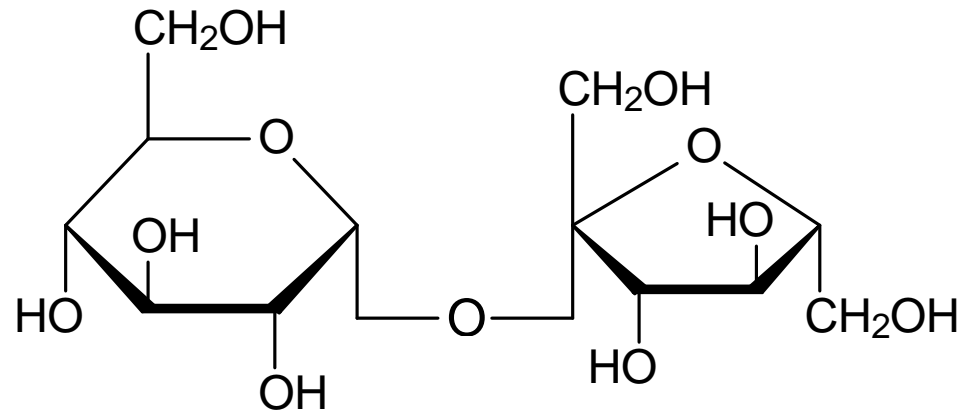
Primary alcohol



(197) Under hydrolytic conditions sucrose yields?

Correct answer (B) glucose and fructose.

Sucrose is a nonreducing disaccharide composed of **GLUCOSE** and **FRUCTOSE** linked via their anomeric carbons.



sucrose

Sucrose, a disaccharide formed from condensation of a molecule of glucose and a molecule of fructose.