Physical properties & POC

Section (A) : Dipole Moment

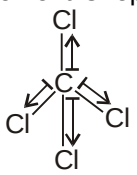
Due to difference in electronegativity polarity developes between two adjacent atoms in the molecule. The degree of polarity of a bond is called dipolemoment.

(a) Dipole moment is represented by μ.

$$\mu = e \times l$$

l = internuclear distance between two atoms, i.e., bond length in cm (Å = 10^{-8} cm).
e = magnitude of separated charge in e.s.u. (e = 10^{-10} e.s.u.)
So 1D = 1×10^{-18} esu.cm
The Debye (D) is the unit of dipole moment.

(b) The dipole moment is represented by arrow head pointing towards the positive to the negative end.



(c) Charge and distance oppose each other, with the larger halogens having longer bond but weaker electronegativity. The overall result is that the bond dipole moment increase in the order as follows.

Ex. $H_3C - I$ < $H_3C - Br$ < $H_3C - F$ < $H_3C - Cl$

μ : 1.29 D 1.48 D 1.51 D 1.56 D

Ex. μ : $CCl_4 < CHCl_3 < CH_2Cl_2 < CH_3Cl$

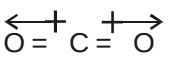
(d) Dipole moment of the compound does not depend only on the **polarity of the bond** but also depends on the **shape of the molecule.**

(e) Dipole moment of symmetrical compound is always zero. ($\mu = 0$)

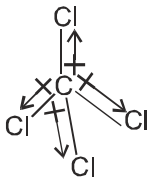
Symmetrical compounds are those compounds which fulfill the following two conditions.
(i) Central atom is bonded with the same atoms or groups.
(ii) Either central atom should not have lone pair of electrons or their dipole must be cancelled out.

Ex. CCl_4, CH_4, BF_3, CO_2, PCl_5, SF_6, XeO_4, XeF_2, XeF_4, SO_3

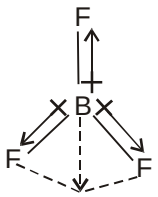
Ex.



Resultant $\mu = 0$



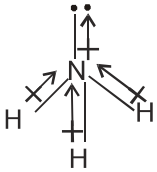
Carbontetrachloride
$\mu = 0.0$



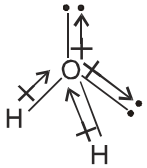
Borontrifluoride
$\mu = 0.0$

(f) Dipole moment of **unsymmetrical** compound is always greater than zero ($\mu > 0$).

Ex. $H_2\ddot{O}$ $H_2\ddot{S}$ $CHCl_3$ $\ddot{N}H_3$



Ammonia
$\mu = 1.46D$



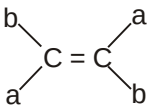
Water
$\mu = 1.84D$

(g) $\mu \propto$ electronegativity difference between central atom and **surrounding atoms** present on the central atom of the molecule.

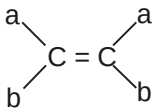
μ : $CHF_3 > CHCl_3 > CHBr_3 > CHI_3$

(i) Net dipole moment of the trans derivative of the compound will only be zero if both the atoms attached to carbons are in the form a and b with linear dipole moment.

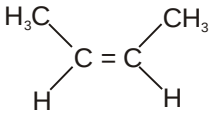
Ex.



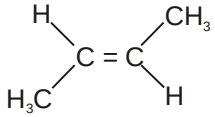
$\mu = 0$



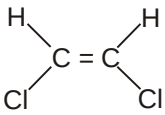
$\mu \neq 0$



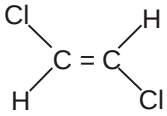
$\mu = 0.33D$



$\mu = 0D$



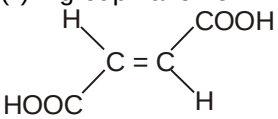
$\mu = 1.85D$
(cis)



$\mu = 0D$
(trans)

(ii) If group have non-linear moments, then the dipolemoment of the trans isomer will not be zero.

Ex.



$\mu = 2.38D$

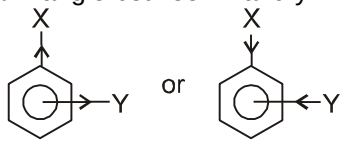
(h) Dipolemoment of the compounds like disubstituted benzene are :

Case I:- When both groups x and y are electron donating or both groups are electron withdrawing then:-

$$\mu = \sqrt{\mu_1^2 + \mu_2^2 + 2\mu_1\mu_2 \cos\theta}$$

μ_1 = dipolemoment of bond c – x μ_2 = dipolemoment of bond c – y

θ = angle between x and y



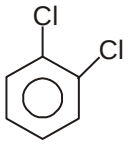
$\rightarrow$ If value of θ will be more, then cos θ will be less.

o-derivative > m-derivative > p-derivative $\longrightarrow$

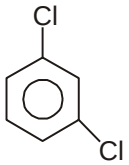
μ in decreasing order

(i) If x = y and both are atoms then dipole moment of para derivative will be zero.

Ex.



$\mu = 2.54D$

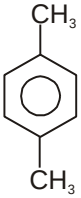


$\mu = 1.48D$

$\mu = 0D$

(ii) If x and y are same groups and group have linear moments then the dipolemoment of para derivative will be zero.

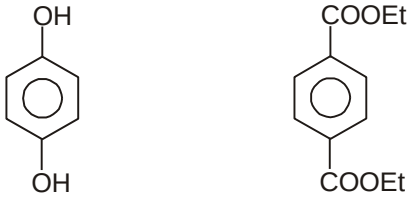
Ex.



$\mu = 0$

$\mu = 0$

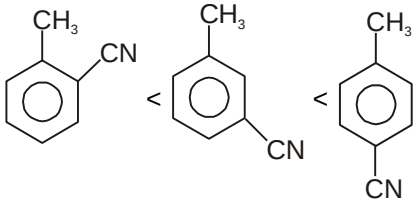
(iii) If x and y are same groups and x = y and group have non-linear moments then the dipolemoment of para derivative will not be zero.

Ex. 

$\mu \neq 0$ $\mu \neq 0$

Case-II:- When one group is electron withdrawing and the other group is electrondonating then:-

$\mu = \sqrt{\mu_1^2 + \mu_2^2 - 2\mu_1\mu_2 \cos\theta}$

Ex. 

(Para-derivative > meta-derivative > ortho-derivative)

Intermolecular forces:

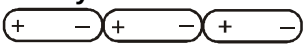
- Attractions between molecules are particularly important in solids and liquids. In these "Condensed" phases, the molecules are continously in contact with each other. The melting points, boiling points, and solubilities of organic compounds show the effects of these forces. Two major kinds of attractive forces cause molecules to associate into solids and liquids;
  (I) Dipole-dipole interactions (II) VanderWaals forces

(I) Dipole-Dipole interaction :

Dipole-dipole interactions result from the approach of two polar molecules.

- If their positive and negative ends approach, the interaction is an attractive one.
- If two negative ends or two positive ends approach, the interaction is repulsive one.
- In a liquid or a solid the molecules are mostly oriented with the positive and negative ends together and the net forces is attractive.

Symbolized by :



- **An especially strong kind of dipole-dipole attraction is hydrogen bonding**

Hydrogen Bonding :

(1). Definition :

The hydrogen bond is an electrostatic attractive force between covalently bonded hydrogen atom of one molecule and an electronegative atom (such as F, O, N) of another molecule.

eg:- Consider the hydrogen fluorine bond in hydrogen fluoride, HF. This bond is a polar covalent bond in which hydrogen is attached to a strongly electronegative element.

$\delta+$ $\delta-$
H —— F

The positive charge on hydrogen will be attracted electrostatically by the negative charge on F atom by another molecule of HF.

H – F ----- H – F ------ H – F
Covalent bond ← → hydrogen bond

Hydrogen bond is a very weak bond (strength about 2–10 kcal/mol) as compared to normal covalent bond. But stronger than vander Waal's force of attraction.

(2). Conditions for hydrogen bonding :

(a) The molecule must contain a highly electronegative atom linked to hydrogen atom.
(b) The size of electronegative atom should be small.
Only F, O and N atoms form effective hydrogen bonding.

Example : Greater the electronegativity and smaller the size of the atom (F, O, N), the stronger is the hydrogen bond.

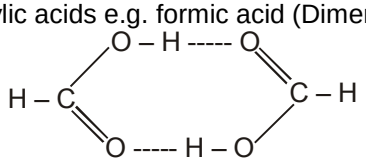
H – F ----- H > H – O ----- H > H – N ----- H

(3). Types of Hydrogen Bonding :

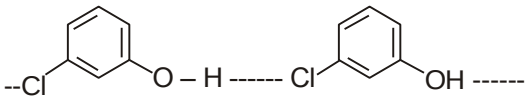
(a) **Intermolecular hydrogen bonding :** In such type of linkages the two or more than two molecules of the same compound combine together to give a polymeric aggregate.
This phenomena is also known as association.

Example :

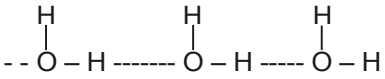
(I) Hydrogen bonding in carboxylic acids e.g. formic acid (Dimerisation)



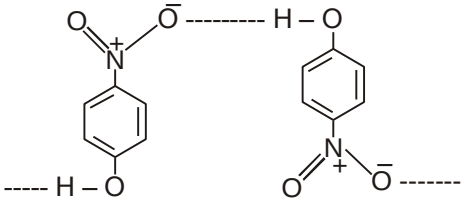
(II) In m-Chlorophenol



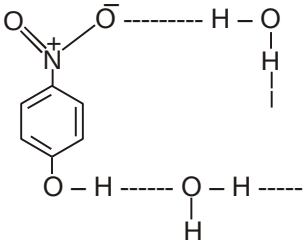
(III) In water



(IV) In p-Nitrophenol

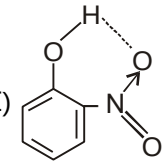


(V) In p-Nitrophenol & water

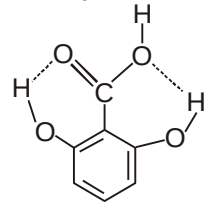


(b) **Intramolecular hydrogen bonding:-** In this type, hydrogen bonding occur within two atoms of the same molecule. This type of hydrogen bonding is commonly known as chelation.

Ex. (I)



o-Nitrophenol (II)



2, 6-Dihydroxybenzoic acid

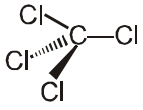
Conclusion :

(a) The chelation between the ortho substituted groups restricts the possibility of intermolecular hydrogen bonding.
(b) Chelation does not take place in m – & p – isomers because the two groups far away from each other.

(II) Vander-Waal forces :

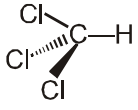
- **Vander Waals forces** or **London dispersion force** can be observed in nonpolar molecules such as carbon tetrachloride.
- A small temporary dipole moment is induced when one molecule approaches another molecule in which the electrons are slightly displaced from a symmetrical arrangement.
- The electron in the approaching molecule are displaced slightly so that an attractive dipole-dipole interaction results.
- These temporary dipoles last only a fraction of a second, and they change continuously; yet they are correlated so their net force is attractive.

- This attractive force depends on close surface contact of two molecules, so it is roughly proportional to the molecular surface area.
- Carbon tetrachloride (CCl_4) has zero dipole moment, yet its boiling point is higher than of chloroform (μ = 1.0D).



μ = 0

Carbon tetrachloride, bp = 77ºC



μ = 1.0D

chloroform, bp = 62ºC

- Carbon tetrachloride has a larger surface area than chloroform (a chlorine atom is much larger than a hydrogen atom), so the intermolecular van der Waals attractions between carbon tetrachloride molecules are stronger than they are between chloroform molecules.

Section (B) : Boiling point

The boiling point (bp) of a compound is the temperature at which the compound's vapor pressure equals the atmospheric pressure. In order for a compound to vaporize, the force that hold the molecules close to each other in the liquid must overcome. This means that the boiling point of a compound depends on the strength of the attractive forces between the individual molecules.

- If the molecules are held together by strong forces, it will take a lot of energy to pull the molecules away from each other and the compound will have a high boiling point.
- If however, the molecule are held together by weak forces, only a small amount of energy will be needed to pull the molecules away from each other and the compound will have a low boiling point.

Factors affecting boiling point :

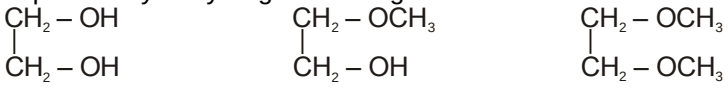
(1) Hydrogen Bonding :

Alcohols :

Alcohols have much higher boiling points than alkanes or ethers of comparable molecular weight because, in addition to van der Waals forces and the dipole–dipole interactions of the carbon–oxygen bond alcohols can form hydrogen bonds.

The successive replacement of hydrogen atom of the –OH group of alcohol by alkyl group to form ether blocks the probability of hydrogen bonding reduces and thus B.P. of alcohols are higher than ether.

Ex.

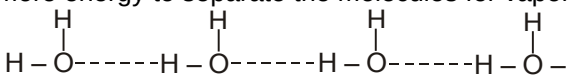


B.P.	197ºC	125ºC	84ºC

Water :

Water has the lowest molecular weight among hydrides of the VI group of periodic table, it has the highest boiling point. Water molecules associate through intermolecular hydrogen bonding and thus require more energy to separate the molecules for vaporization.

Ex.

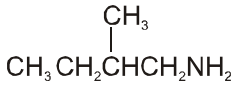


Compound	H_2O	H_2S	H_2Se
B.P.	100ºC	–59.6	–42ºC

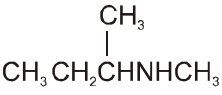
Amines :

- Primary and secondary amines also form hydrogen bonds, so these amines have higher boiling points than alkanes with similar molecular weights.
- Nitrogen is not as electronegative as oxygen, however, which means that the hydrogen bonds between amine molecules are weaker than the hydrogen bonds between alcohol molecules.
- Amines, therefore, have lower boiling points than alcohols with similar molecular weights.
- Because primary amines have two N–H bonds, hydrogen bonding is more significant for primary amines than for secondary amines. Tertiary amines cannot form hydrogen bonds with each other because they do not have a hydrogen attached to the nitrogen. Consequently if you compare amines with the same molecular weight and similar structures, primary amines have higher boiling point than secondary amines and secondary amines have higher boiling points than tertiary amines.

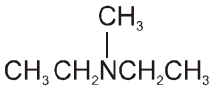
Ex.



a primary amine
bp = 97 °C



a secondary amine
bp = 84 °C

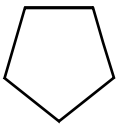


a tertiary amine
bp = 65 °C

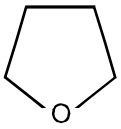
(2) Dipole - Dipole interactions :

Dipole–dipole interactions, are stronger than van der Waals forces but not as strong as ionic or covalent bonds. Ethers generally have higher boiling points than alkanes of comparable molecular weight because both van der Waals forces and dipole–dipole interactions must be overcome for an ether to boil.

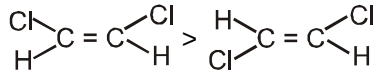
Ex.



cyclopentane
bp = 49.3°C



tetrahydrofuran
bp = 65°C

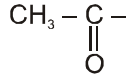
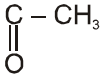
Ex. B.P : 

(3) Molecular weight :

The boiling points for any homologous series of compounds increase as their molecular weights increase because of the increase in van der Waals forces. So the boiling points of a homlogous series of ethers, alkyl halides, alcohols, and amines increase with increasing molecular weight.

Ex. B. P : $CH_3I > CH_3Br > CH_3 - Cl > CH_3 - F$

Ex. B.P: $\underset{\text{(Methanol)}}{CH_3OH} < \underset{\text{(Ethanol)}}{C_2H_5OH} < \underset{\text{(Propan-1-ol)}}{H_3C-CH_2-CH_2-OH} < \underset{\text{(Butan-1-ol)}}{H_3C-CH_2-CH_2-CH_2-OH} < \underset{\text{(Pentan-1-ol)}}{H_3C-CH_2-CH_2-CH_2-CH_2-OH}$

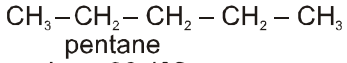
Ex. B.P : $CH_3CH_2CH_2CHO <$  $< Ph-CHO < Ph-CH_2CHO <$ 

(ketone is more polar than aldehyde).

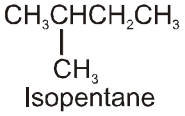
(4) Vander Waals forces

- The molecules of an alkane are held together by these induced dipole-induced dipole interactions known as van der Waals forces or London forces. In order for an alkane to boil, these van der Waals forces must be overcome.
- The homologous series of alkanes boiling points increase as their size increases. This occurs becuase each additional methylene group increases the area of contact between the molecules.
- Because the strength of van der Waals force depends on the area of contact between molecules, branching in a compound lowers its boiling point because it reduces the area of contact.
- If two alkanes have the same molecular weight, the more highly branched alkane will have a lower boiling point.

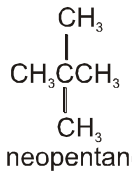
Ex.



pentane
bp = 36.1°C



Isopentane
bp = 27.9°C

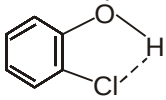


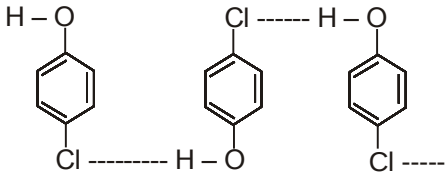
neopentane
bp = 9.5°C

General order of boiling point of various F.G. (if molecular mass is nearly same)

B.P : R–CONH$_2$ > R–COOH > R–OH >  **> R–X > R–OR > R–C≡CH > R–H > R–CH=CH$_2$ (Terminal)**

Ex. o-Chlorophenol has lower boiling point in comparison to its p-isomer.

 (Intramolecular H-bond in o-Chlorophenol)



(Intermolecular H-bond in p-chlorophenol)

Section (C) : Melting Point

The temperature at which the thermal energy of the particles is great enough to overcome the intracrystalline forces that hold them in position is known as melting point.

- Melting is the change from the highly orderd arrangment of particles in the crystalline lattice to the more random arrangment that characterizes a liquid.

Factors affecting melting point :

(1) Molecular weight :

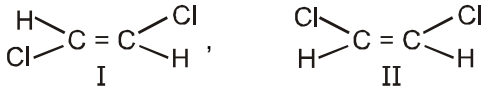
Melting points of alkanes increase in a homologous series as the molecular weight increases.

Ex. M.P. : $CH_3–CH_2–CH_3 < CH_3CH_2–CH_2–CH_3 < CH_3–CH_2–CH_2–CH_2–CH_3$

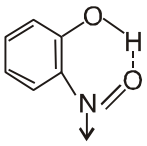
(2) Packing :

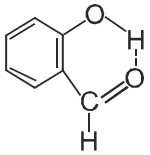
- Packing is a property that determines how well the individual molecules in a solid fit together in the crystal lattice. The tighter they fit, the more energy required to break the lattice and melt the compound.
- Alkanes with an odd number of carbon atoms pack less tightly than alkanes with an even number of carbon atoms. This decreases the intermolecular forces between alkanes with odd number of carbon atoms, which decreases their melting points.
- In geometrical isomers the trans isomers are more symmetrical than cis isomers ($C_{ab}=C_{ab}$ type alkenes) so trans form have higher M.P. than cis isomers.

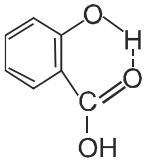
The heavier the molecule and stronger the intermolecular forces, higher will be the M.P. of the compound.

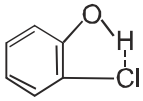
Ex.  , M.P. I > II

Ex. Ortho - hydroxy, nitro-, carbonyl, carboxylic or chloro compounds have lower melting and boiling points than the respective meta or para isomer due to intramolecular H-bonding in ortho substituted compound.


o-Nitrophenol


o-Hydroxy benzaldehyde


o-Hydroxy benzoic acid


o-Chlorophenol

Section (D) : Solubility in water

(1) Solvation of ionic salts by ion dipole interaction :

Intermolecular forces are of primary importance in explaining the solubilities of substances. Dissolution of a solid in a liquid is, in many respect, like the melting of a solid. The orderly crystal structure of the solid is destroyed, and result in the formation of the more disorderly arrangement of the molecules (or ions) in solution. In the process of dissolving, too, the molecules or ions must be separated from each other, and energy must be supplied for both changes. The energy required to overcome lattice energies and intermolecular or interionic attractions comes from the formation of new attractive forces between solute and solvent.

Consider the dissolution of an ionic substance as an example. Hence both the lattice energy and interionic attractions are large. We find that water and only a few other very polar solvents are capable of dissolving ionic compound. These solvents dissolve ionic compounds by hydrating or solvating the ions.

Water molecules, by virtue of their great polarity as well as their very small, compact shape, can very effectively surround the individual ions as they are free from the crystal surface. Positive ions are

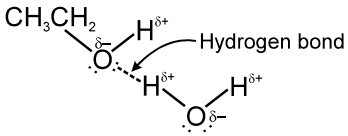
surrounded by water molecules with the negative end of the water dipole pointed toward the positive ion; negative ions are solvated in exactly the opposite way. Because water is highly polar, and because water is capable of forming strong hydrogen bond, the dipole-ion attractive forces are also large. The energy supplied by the formation of these forces is great enough to overcome both the lattice energy and interionic attractions of the crystal.

(2) Solvation of compounds by dipole-dipole interaction :

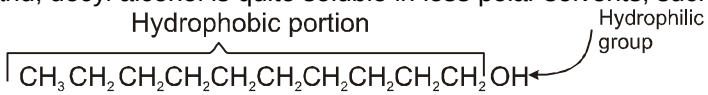
A thumb rule for predicting solubilities is that "like dissolves like." Polar and ionic compound tend to dissolve in polar solvents. Polar liquids are generally miscible with each other. Nonpolar solids are usually soluble in nonpolar solvents. On the other hand nonpolar solids are insoluble in polar solvents. Nonpolar liquids are usually mutually miscible, but nonpolar liquids and polar liquids "like oil and water" do not mix.

(3) Solvation of compounds by hydrogen bonding :

Methanol and water are miscible in all proportions; so too are mixtures of ethanol and water and mixtures of both propyl alcohols and water. In these cases the alkyl groups of the alcohols are relative small, and the molecules therefore resemble water more than they do an alkane. Another factor in understanding their solubility is that the molecules are capable of forming strong hydrogen bonds to each other.



If the carbon chain of an alcohol is long, however, we find that the alcohol is much less soluble in water. Decyl alcohol (see following structures) with a chain of 10 carbon atoms is only very slightly soluble in water. Decyl alcohol resembles an alkane more than it does water. The long carbon chain of decyl alcohol is said to be hydrophobic (hydro, water; phobic, fearing or avoiding – "water avoiding"). Only the OH group, a rather small part of the molecule, is hydrophilic (philic, loving or seeking – "water seeking"). (On the other hand, decyl alcohol is quite soluble in less polar solvents, such as chloroform.)

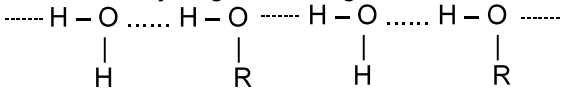


Decyl alcohol

An explanation for why nonpolar groups such as long alkane chains avoid an aqueous environment, that is, for the so-called hydrophobic effect, is complex. The most important factor seems to involve an unfavorable entropy change in the water. Entropy changes have to do with changes from a relatively ordered state to a more disordered one or the reverse. Changes from order to disorder are favorable, whereas changes from disorder to order are unfavorable. For a nonpolar hydrocarbon chain to be accommodated by water, the water molecules have to form a more ordered structure around the chain, and for this, the entropy change is unfavorable.

(4) Solubility in water :

As molecular weight increases solubility in water decreases. The lower alcohols are miscible with water. This is due to intermolecular hydrogen bonding between alcohol and water molecules.



Intermolecular H bond between water & alcohol molecules

But this is true only for the lower alcohols, where the – OH group constitutes a large part of the molecule. As the alkane like alkyl group becomes larger, water solubility decreases. For practical purpose we consider that the borderline between solubility and insolubility in water occurs at about four to five carbon atoms for normal primary alcohols.

Polyhydroxy alcohols provide more than one site per molecule for hydrogen bonding and their solubility is appreciable till seven carbon atoms. Amongst isomers, as branching increases, the surface area of hydrocarbon part (hydrophobic part) decreases so solubility increases.

It follows the order : 3° alcohol > 2° alcohol > 1° alcohol.

Section (E) : POC-II (Chemical separation of organic compounds)

Purification of organic compounds :

The organic compounds derived from natural sources or prepared in the laboratory are seldom pure. They are usually contaminated with other substances.

Purification means the removal of undesirable impurities associated with a particular organic compound, i.e to obtain the organic compound in pure state.

Various methods have been developed to purify organic compound

(1) Physical methods :

(i) Crystallisation (ii) Sublimation (iii) Distillation

(iv) solvent extraction (v) chromatography

(2) Chemical methods :

Chemical methods of separation depend upon the nature of the functional group present in the component. Hence these can be applied to solid as well as liquid compounds.

A chemical method can be applied only when one of the components of the mixture is soluble in a particular solvent while the other is insoluble in the same solvent .

Separation is the first step during the actual analysis of organic mixture. It is the most important step in the sense that if separation is incomplete the result will not be correct because the impure compound will give tests of different functional group and its melting point will also be very much different from that of the pure compound obtained from complete separation.

Separation of Binary mixtures of organic compounds :

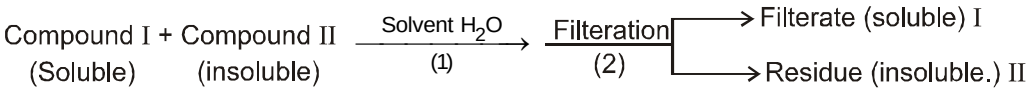
The usual systematic scheme for separating a solid binary mixture is discussed below.

(i) Separation with water (ii) Separation with sodium bicarbonate

(iii) Separation with sodium hydroxide (iv) Separation with hydrochloric acid

Solubility of two components.

Separation Scheme for organic compounds :



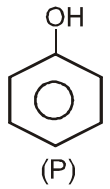
- The mixture of organic compounds can be separated by using appropriate solvent.
- Most of the aromatic compounds are water insoluble due to large hydrophobic group of six carbon atom
- Aromatic acids are insoluble in water but soluble in aqueous $NaHCO_3$ solution or NaOH solution, due to salt formation.
- Aromatic hydroxy compounds are water insoluble but are soluble in aqueous NaOH solution due to salt formation.
- Aromatic amine (Aniline 1º, 2º, 3º) are organic base and water insoluble but are soluble in aqueous HCl solution due to salt formation.
- Aliphatic compoud with atleast two functional group (which can form H-bonding) are water soluble.

Ex. Diacids, diols. diamines, hydroxy acids (OH,COOH), Amino acids ($–NH_2$, –COOH) .

Ex. oxalic acid, malonic, maleic, fumaric acid, glycol, glycerol, sucrose, glucose etc.

Table : Solubility of Organic Compounds

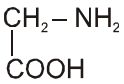
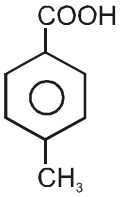
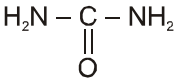
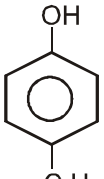
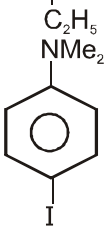
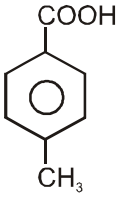
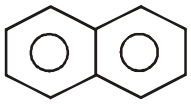
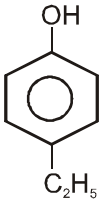
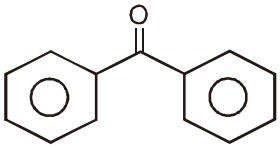
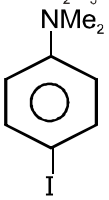
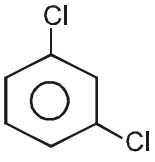
Compounds	**H_2O (cold)**	**Aq. $NaHCO_3$**	**Aq. NaOH**	**Aq. HCl**
(I) Small aliphatic compound with F.G. (Hydrogen bonding) C_1 to C_2 (a) R–COOH (b) R–OH (c) $R–NH_2$ (d) R–C–NH_2 ‖ O	Soluble	Soluble	Soluble	Soluble
(II) Small aliphatic compound containing two F.G (Hydrogen bonding) C_1 to C_5 (a) 2(COOH) – diacids (b) 2(–OH) – diols/glycol/ sugar (c) $2(NH_2)$ (d) – COOH + (–OH) (e) (–COOH) + (NH_2) (f) $–CONH_2$ some common compounds are urea, glucose, oxalic acid, succinic acid	Soluble	Soluble	Soluble	Soluble
(III) Aromatic acids (H_2O insoluble) Benzoic acid & derivative (a) Ar–COOH (b) $Ar–SO_3H$ (c) picric acid (d) Ar – C – Cl ‖ O	Insoluble Insoluble Insoluble Insoluble	Soluble ArCOONa Soluble Soluble -	soluble ArCOONa Soluble Soluble -	Insoluble Insoluble Insoluble Insoluble
(IV) Phenols	Insoluble	Insoluble	soluble Ph–ONa	Insoluble
(V) Aromatic Amines, Anilines (weaker bases) Ar – NH_2	Insoluble	Insoluble	Insoluble	Soluble $Ar\overset{+}{N}H_3Cl^-$

Ex.  + Glucose (Q) → Solvent (H_2O) → soluble → I; insoluble → II

Identify P, Q.

Sol. $I \rightarrow Q$, $II \rightarrow P$

Ex. Binary mixtures - (Two components)

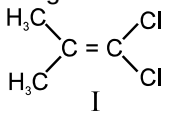
	A		**B**	**Appropriate Solvent**
(1)		+		H_2O
(2)		+		H_2O
(3)	Fructose	+		H_2O
(4)		+		aq. $NaHCO_3$
(5)		+		aq. NaOH
(6)		+		aq. HCl

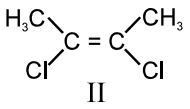
Exercise-1

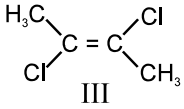
PART - I : ONLY ONE OPTION CORRECT TYPE

Section (A) : Dipole Moment

A-1. Arrange the following in decreasing order of dipole moments.


I

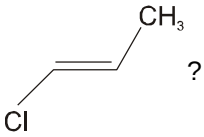

II

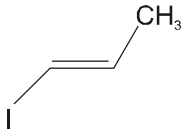
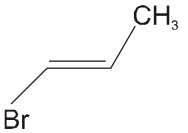
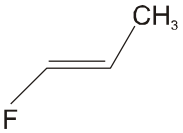
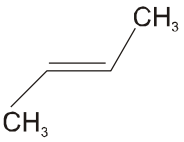

III

(A) I > II > III (B) III > II > I (C) III > I > II (D) II > I > III

A-2. Dipole moment is shown by :
(A) 1,4-Dichlorobenzene (B) Trans-1-chloroprop-1-ene
(C) E-1,2-Dibromoethene (D) $CH_2=C=CH_2$

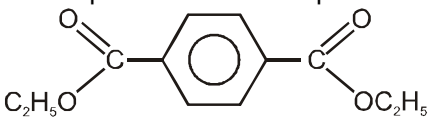
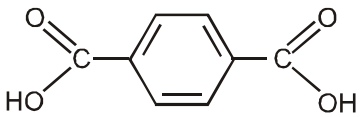
A-3. Which will have highest dipole moment ?
(A) CH_3–F (B) CH_3–Cl (C) CH_3–Br (D) CH_3–I

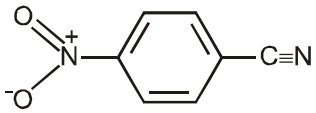
A-4. Which will have higher dipole moment than  ?

(A)  (B)  (C)  (D) 

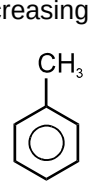
A-5. False statement about dipole moment is :
(A) Dipole moment is a vector quantity.
(B) Dipole moment depends on charge.
(C) Geometrical isomers have same dipole moment.
(D) Mirror image isomers have same dipole moment.

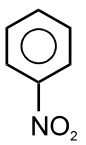
A-6. Which compound have zero dipole moment ?

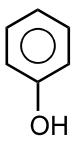
(A)  (B) 

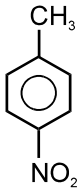
(C)  (D) 

A-7. The increasing order of dipole moment of following compounds is :


1

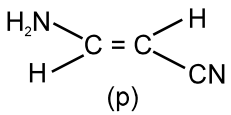

2

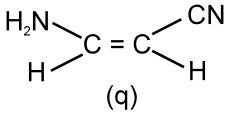

3

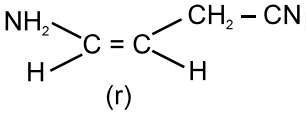

4

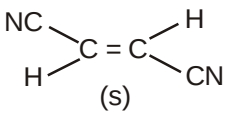
(A) 3 < 1 < 4 < 2 (B) 1 < 4 < 3 < 2 (C) 1 < 3 < 4 < 2 (D) 1 < 3 < 2 < 4

A-8. The correct order of dipole moment is :


(p)

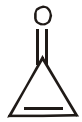
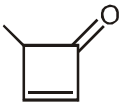
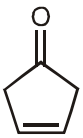
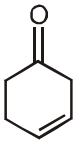

(q)

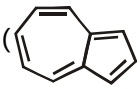

(r)

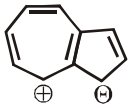

(s)

(A) p > r > q > s (B) q > p > r > s (C) r > s > q > p (D) p > q > r > s

A-9. Which compound have maximum dipole moment ?

(A)  (B)  (C)  (D) 

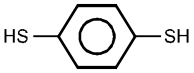
A-10. Azulene () has dipole moment 0.8 D because

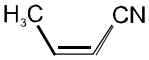
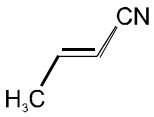
(A) It exists as aromatic compound  in which both the rings are aromatic.

(B) Charge separation permits conformational stability.
(C) The two rings are of different size.
(D) The molecules obey (4n + 2) Huckel rule.

A-11. Which of the following compounds posses highest dipole moment.
(A) Naphthalene (B) Phenanthrene (C) Anthracene (D) Azulene

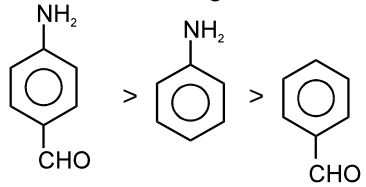
A-12. Which statement is incorrrect ?

(A) Dipole moment of  is non zero.

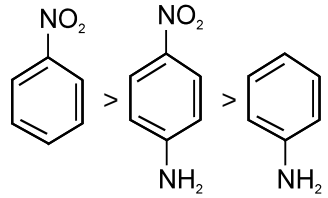
(B) Melting point of  is less than that of  .

(C) Benzene, naphthalene and anthracene can be separated by water.
(D) Aniline and phenol can be separated by common acid HCl

A-13. Which of the following is listed for correct order of polarities :

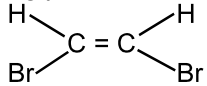
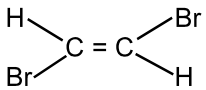
(A) 

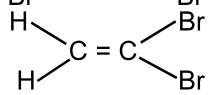
(B) $\underset{\text{(trans)}}{CH_3-CH=CH-NO_2} > \underset{\text{(cis)}}{CH_3CH=CH-NO_2}$

(C) 

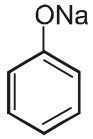
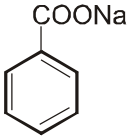
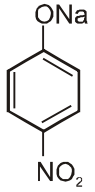
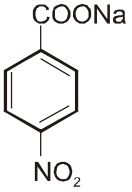
(D) $CH_3–CH_3 > CH_3–CH_2–Cl$

A-14. Which of the following isomers having molecular formula $C_2H_2Br_2$ has highest dipole moment and boiling point but lowest melting point.

(A)  (B) 

(C)  (D) Not applicable to any single isomer

A-15. Which compound have maximum dipole moment ?

(A)  (B)  (C)  (D) 

A-16. Glycerol is purified by :
(A) steam distillation (B) vacuum distillation
(C) fractional distillation (D) simple distillation

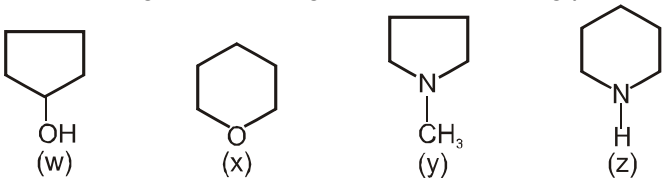
A-17. Two immiscible liquids are separated by :
(A) separating funnel (B) fractional distillation
(C) chromatrography (D) sublimation

A-18. Sublimation is a process in which a solid :
(A) changes into another allotropic form
(B) changes into liquid form
(C) changes into vapour form directly from solid form
(D) none of the above

Section (B) : Boiling point

B-1. (I) 1,2-dihydroxy benzene (II) 1,3-dihydroxy benzene
(III) 1,4-dihydroxy benzene (IV) Hydroxy benzene
The increasing order of boiling points of above mentioned alochols is
(A) I < II < III < IV (B) I < II < IV < III (C) IV < I < II < III (D) IV < II < I < III

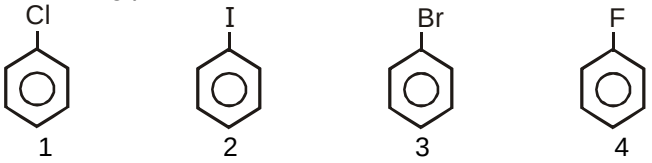
B-2. Arrange the following in decreasing order of their boiling points.



(w) (x) (y) (z)

(A) w > x > z > y (B) w > x > y > z (C) w > z > y > x (D) w > z > x > y

B-3. The correct boiling point order is :



1 2 3 4

(A) 4 > 1 > 3 > 2 (B) 2 > 3 > 1 > 4 (C) 1 > 2 > 3 > 4 (D) 2 > 4 > 1 > 3

B-4. Correct boiling point order for I to IV is :

CH_3F	CH_3Br	CH_3Cl	CH_3I
I	II	III	IV

(A) I > II > III > IV (B) IV > III > II > I (C) II > IV > I > III (D) IV > II > III > I

B-5. Which property of organic compound decreases boiling point.
(A) Increase in length of hydrocarbon chain (B) Increase in intermolecular H-bonding
(C) Increase in molecular weight (D) Increase in branching

B-6. Decreasing order of boiling point of I to IV follow

Methylformate	Ethylformate	Iso-propylformate	n-propylformate
I	II	III	IV

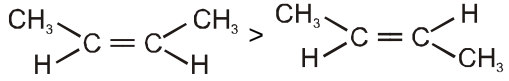
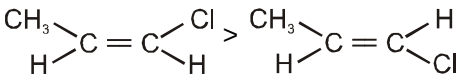
(A) I > II > III > IV (B) III > IV > II > I (C) IV > III > II > I (D) I > II > IV > III

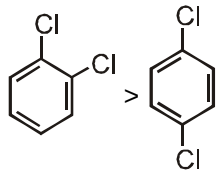
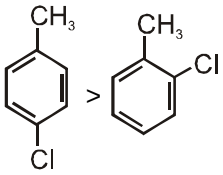
Section (C) : Melting Point

C-1. Which compound has highest melting point ?
(A) o-Dibromobenzene (B) m-Dibromobenzene
(C) p-Dibromobenzene (D) Bromobenzene

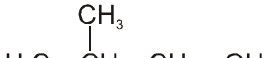
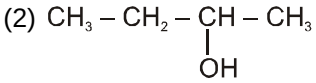
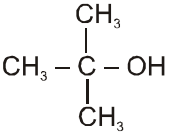
C-2. Which will have highest melting point?
(A) orthohydroxyphenol (B) metahydroxyphenol
(C) parahydroxyphenol (D) paramethylphenol

C-3. Which order is correct regarding melting point ?

(A)  (B) 

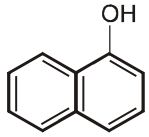
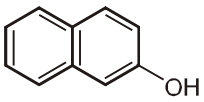
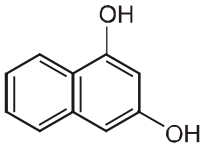
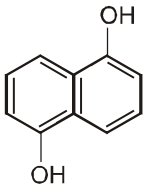
(C)  (D) 

C-4. Identify the correct order of melting point of the following compounds

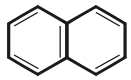
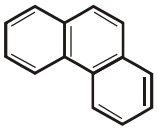
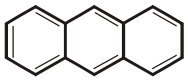
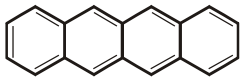
(1)  (2)  (3) 

(A) 3 > 1 > 2 (B) 3 > 2 > 1 (C) 1 > 2 > 3 (D) 2 > 1 > 3

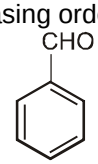
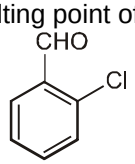
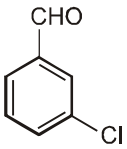
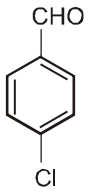
C-5. Which will have highest melting point ?

(A)  (B)  (C)  (D) 

C-6. Which of the following compounds have highest melting point ?

(A)  (B)  (C)  (D) 

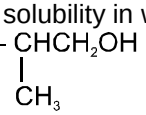
C-7. Decreasing order of melting point of compound I - IV follows :

 I  II  III  IV

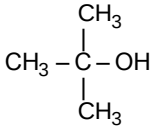
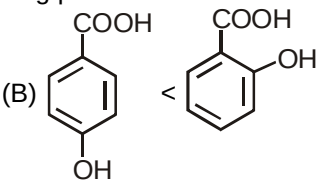
(A) IV > III > II > I (B) I > II > III > IV (C) II > III > IV > I (D) II > IV > III > I

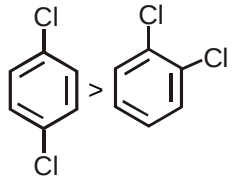
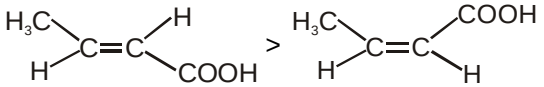
Section (D) : Solubility in water

D-1. Which of the following has lowest solubility in water ?

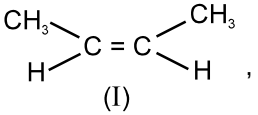
(A) $CH_3CH_2CH_2OH$ (B)  (C) $HOCH_2–CH_2OH$ (D) $C_6H_5CH_2CH_2OH$

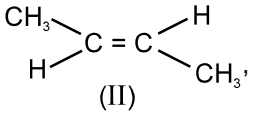
D-2. Correct water solubility order/s amongst the following pairs is/are :

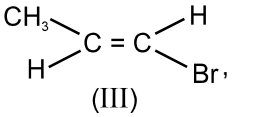
(A) $CH_3–CH_2–CH_2–CH_2–OH$ >  (B) 

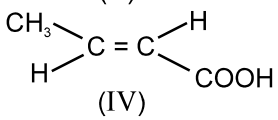
(C)  (D) 

D-3. Arrange the following in decreasing order of their solubility in water


(I)

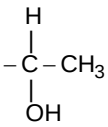
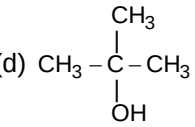

(II)


(III)


(IV)

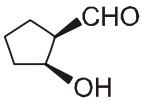
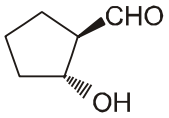
(A) III > I > II > IV (B) III > IV > I > II (C) IV > III > I > II (D) IV > III > II > I

D-4. The correct order of solubility in water is :

(a) CH_3OH (b) CH_3CH_2OH (c)  (d) 

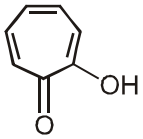
(A) a > b > c > d (B) b > a > c > d (C) d > a > b > c (D) b > c > a > d

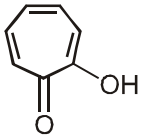
D-5. Which have maximum solubility in water, for nearly same molecular weight compounds ?
(A) Alkane (B) Alkene (C) Alcohol (D) Ether

D-6. In which case first has higher solubility than second ?
(I) Phenol, Benzene (II) Nitrobenzene, Phenol
(III) o-Hydroxybenzaldehyde, p-Hydroxy benzaldehyde (IV) CH_3CHO, $CH_3–O–CH_3$
(V) o-Nitrophenol, p–Nitrophenol (VI)  

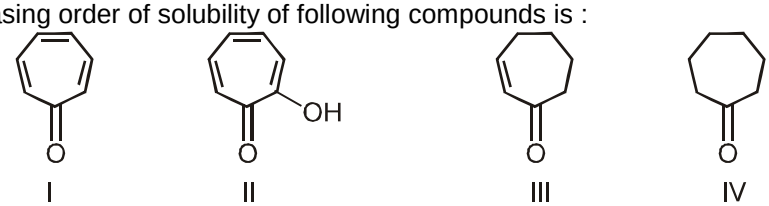
(A) only I (B) III, V (C) I, IV (D) I, IV, VI

D-7. Which of the following statement is correct about tropolone?



(A) Solubility of  (tropolone) is less than  (tropone).
(B) Tropolone has more stability and aromatic character than tropone.
(C) Tropolone has higher dipole moment than tropone.
(D) Tropolone has lower boiling point than tropone.

D-8. Decreasing order of solubility of following compounds is :

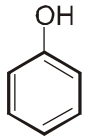
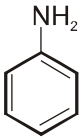
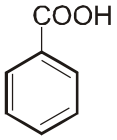
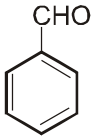

I II III IV

(A) I > II > III > IV (B) II > I > III > IV (C) II > III > I > IV (D) IV > III > II > I

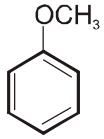
D-9. Which carboxylic acid has maximum solubility in water ?
(A) Malonic acid (B) Succinic acid (C) Salicylic acid (D) Phthalic acid

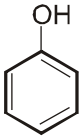
Section (E) : POC-II

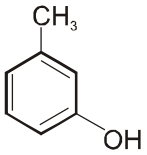
E-1. Which of the following compounds form salt with HCl ?

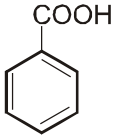
(A)  (B)  (C)  (D) 

E-2. Which of the following compounds does not form salt with NaOH ?

(A) 

(B) 

(C) 

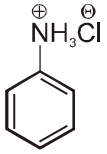
(D) 

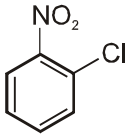
E-3. The blood red colour in the combination test of nitrogen and sulphur in organic compound is due to the formation of :

(A) ferric sulpho cyanide (B) ferric acetate
(C) ferrous sulpho cyanide (D) ferric cyanide

E-4. In Lassaigne's test, the organic compound is fused with sodium metal as to :

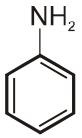
(A) hydrolyse the compound
(B) form a sodium derivative
(C) convert nitrogen, sulphur or halogens if present into soluble ionic sodium compound
(D) burn the compound

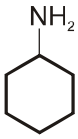
E-5. 

and 

can be differentiated by :

(A) Ammonical $AgNO_3$ (B) Fehling solution (C) $FeCl_3$ (D) Br_2 / H_2O

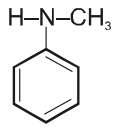
E-6. 

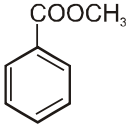
and 

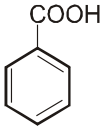
can be differentiated by :

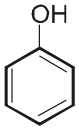
(A) $NaHCO_3$ (B) $CHCl_3$ and KOH
(C) $NaNO_2$, HCl then β-napthol (D) NaOH

E-7. Which of the following compounds form salt with $NaHCO_3$?

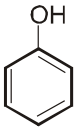
(A) 

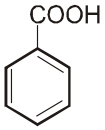
(B) 

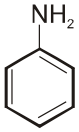
(C) 

(D) 

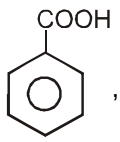
E-8. Which of the following compound cannot form salt with H_2O, $NaHCO_3$, NaOH and HCl ?

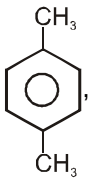
(A) 
(B) 

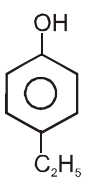
(C) 

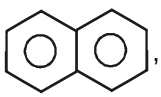
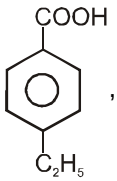
(D) 

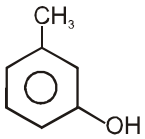
E-9. When the mixture of [A + B + C] is dissolved in $NaHCO_3$, A dissolves in $NaHCO_3$, B & C remain as a residue after that residue dissolves in aq. NaOH, C dissolves in it and B remains as residue. A, B and C will be respectively.

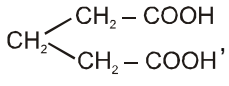
(A) 

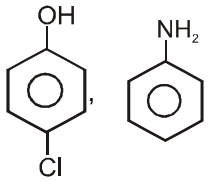
, 

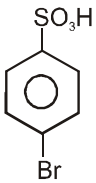
, 

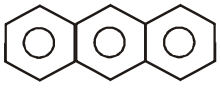
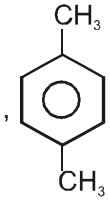
(B) 
, 

, 

(C) 

, 

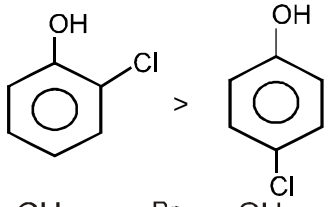
(D) 

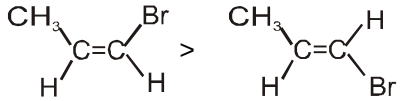
, 
, 

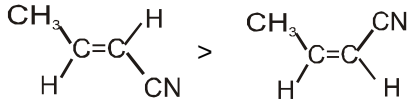
PART - II : ONE OR MORE THAN ONE OPTIONS CORRECT TYPE

1. In which of the following case/cases, is/are the order of indicated property correctly shown ?

(A) $CH_3CH=CHCHO > CH_3CHO$ (Dipole Moment)

(B)  (Boiling Point)

(C)  (Solubility)

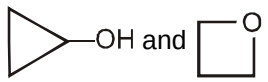
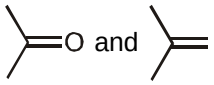
(D)  (Dipole Moment)

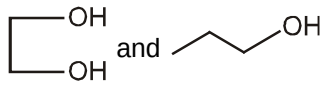
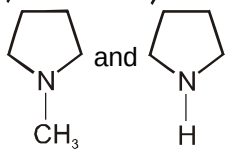
2. Which of the following has/have dipole moment of first compound greater than the dipole moment of second compound ?

(A) NaCl and HCl (B) $CFCl_3$ and $CHCl_3$

(C) $CH_3–NO_2$ and CH_3NH_2 (D) HF and BF_3

3. In which case second has lower boiling point than first ?

(A)  (B) 

(C)  (D) 

4. A water insoluble solid mixture of organic compounds containing p-Toluic acid, p-Toludine and naphthalene can be separated by using the sequence of reagents.

(A) $\xrightarrow[(1)]{\text{aq. NaCl}} \xrightarrow[(2)]{\text{aq. HCl}}$ (B) $\xrightarrow[(1)]{\text{aq. NaHCO}_3} \xrightarrow[(2)]{\text{aq. HCl}}$

(C) $\xrightarrow[(1)]{\text{aq. HCl}} \xrightarrow[(2)]{\text{aq. NaHCO}_3}$ (D) $\xrightarrow[(1)]{\text{aq. CH}_3\text{COOH}} \xrightarrow[(2)]{\text{aq. NH}_4\text{Cl}}$

PART - III : COMPREHENSION

Read the following passage carefully and answer the questions.

Comprehension # 1

The boiling point of a liquid is the temperature where its kinetic energy is sufficient to overcome the intermolecular attractive forces.

Boiling point depends on following :

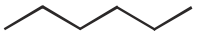
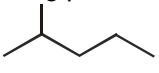
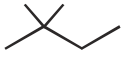
(a) Intermolecular H-bonding. (b) Molecular weight.

(c) Dipole-dipole attraction. (d) Strength of vander Waal's forces.

1. Which will have maximum boiling point ?

(A) $\begin{matrix} CH_2-OH \\ | \\ CH_2-OH \end{matrix}$ (B) $\begin{matrix} CH_2-O-CH_3 \\ | \\ CH_2-OH \end{matrix}$ (C) $\begin{matrix} CH_2-O-CH_3 \\ | \\ CH_2-O-CH_3 \end{matrix}$ (D) $\begin{matrix} O-CH_3 \\ | \\ CH_2-O-CH_3 \end{matrix}$

2. Which will have maximum boiling point ?

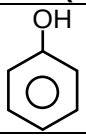
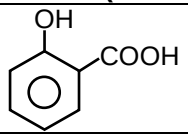
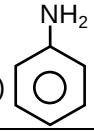
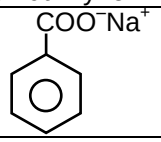
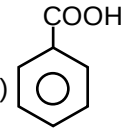
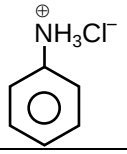
(A)  (B)  (C)  (D) 

3. Which will have maximum boiling point ?

(A) $CH_3–Cl$ (B) CH_2Cl_2 (C) $CHCl_3$ (D) CCl_4

Comprehension # 2

Q.4, Q.5 and Q.6 by appropriately matching the information given in the three columns of the following table.

Physical properties of the compounds affected by many facters like H-bond, dipole moment, vander walls forces etc.		
Column 1 (Reactant)	**Column 2 (Reagent)**	**Column 3 (Product)**
(I) 	(i) Na, NH_3 (ℓ)	(P) 
(II) $CH_3–C\equiv C–CH_3$	(ii) NaOH, CO_2, H^+	(Q) But-2-yne
(III) 	(iii) $NaHCO_3$ (aq)	(R) 
(IV) 	(iv) $HCl_{(aq)}$	(S) 

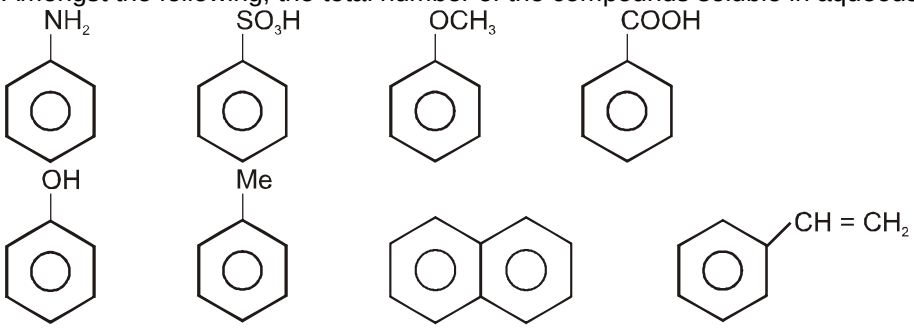
4. Sequence of the reaction, in which both reactant and product have zero dipole moment ?
(A) (I) (ii) (P) (B) (II) (i) (Q) (C) (III) (ii) (P) (D) (II) (i) (P)

5. The only correct combination in which salt is soluble ?
(A) (I) (ii) (P) (B) (III) (iii) (S) (C) (III) (iv) (S) (D) (IV) (iv) (R)

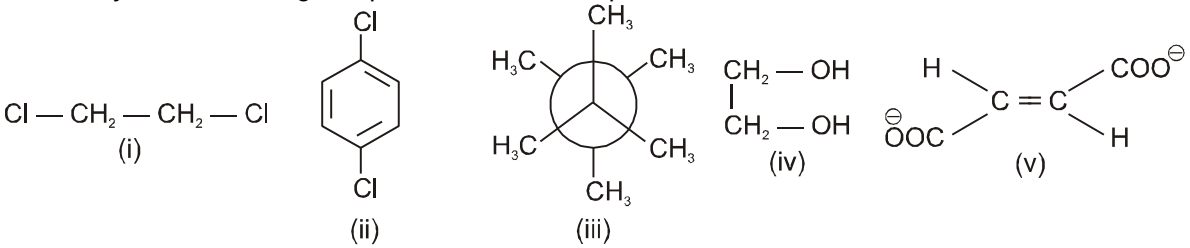
6. In which reaction series product have interamolecular H-bonding and used in the formation of Aspirin?
(A) (I) (ii) (P) (B) (I) (ii) (R) (C) (III) (iv) (S) (D) (I) (i) (P)

PART - IV : SINGLE AND DOUBLE VALUE INTEGER TYPE

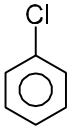
1. Amongst the following, the total number of the compounds soluble in aqueous NaOH is



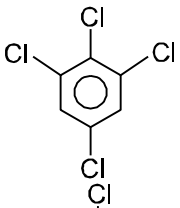
2. How many of the following compounds have zero dipole moment.

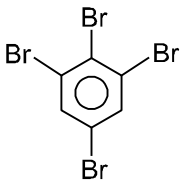


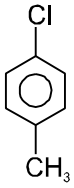
3. How many molecules of the following have non zero dipole moment ?

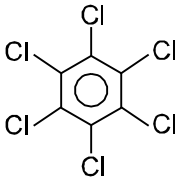
(i) 

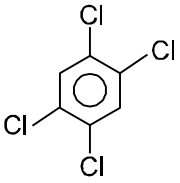
(ii) 

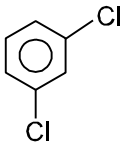
(iii) 

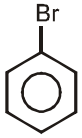
(iv) 

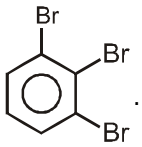
(v) 

(vi) 

(vii) 

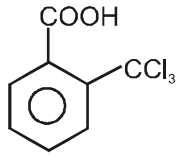
(viii) 

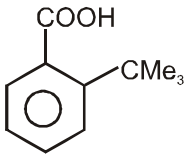
4. Considering benzene to be a planar symmetrical hexagon, if the dipole moment of 

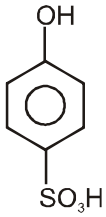
is 2D, find the dipole moment (in D) of 

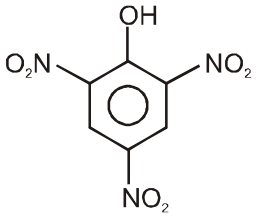
.

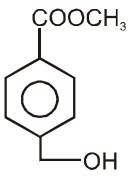
5. How many acids (given below) react with $NaHCO_3$ and liberate CO_2 ?

$CCl_3 - COOH$ $CCl_3 - CH_2 - OH$ 



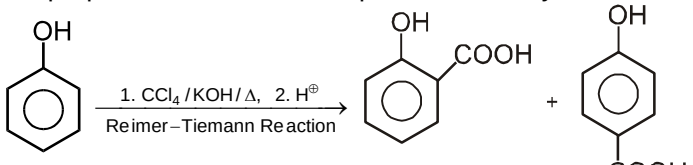






PART - V : MATCH THE COLUMN

1. Compare the properties of two isomeric products x and y formed in the following reaction.



(x) (y)

Match the following :

(A)	Dipole moment	(p)	X > Y
(B)	H_2O solubility	(q)	Y = X
(C)	Boiling point	(r)	Y > X
(D)	Melting point	(s)	Can't say

Exercise-2

*** Marked Questions may have more than one correct option.**

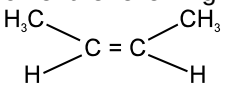
PART - I : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

1. Amongst H_2O, H_2S, H_2Se and H_2Te the one with highest boiling point is : **[IIT-JEE 2000, 1/35]**
(A) H_2O because of H-bonding. (B) H_2Te because of higher molecular weight.
(C) H_2S because of H-bonding. (D) H_2Se because of lower molecular weight.

2. Identify the correct order of boiling points of the following compounds : **[IIT-JEE 2002, 3/90]**

$\underset{1}{CH_3CH_2CH_2CH_2OH}$ $\underset{2}{CH_3CH_2CH_2CHO}$ $\underset{3}{CH_3CH_2CH_2COOH}$

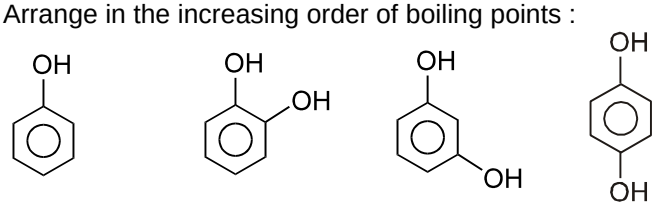
(A) 1 > 2 > 3 (B) 3 > 1 > 2 (C) 1 > 3 > 2 (D) 3 > 2 > 1

3. Which of the following hydrocarbons has the lowest dipole moment : **[IIT-JEE 2002, 3/90]**
(A)  (B) $CH_3C{\equiv}CCH_3$ (C) $CH_3CH_2C{\equiv}CH$ (D) $CH_2{=}CH{-}C{\equiv}CH$

4. Among the following the molecule with the highest dipole moment is : **[IIT-JEE 2003, 3/84]**
(A) CH_3Cl (B) CH_3Cl_2 (C) $CHCl_3$ (D) CCl_4

5. There is a solution of p-hydroxy benzoic acid and p-amino benzoic acid. Discuss one method by which we can separate them and also write down the confirmatory test of the functional groups present.
[IIT-JEE 2003, 4/60]

6. Arrange in the increasing order of boiling points :



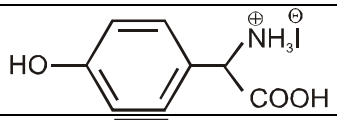
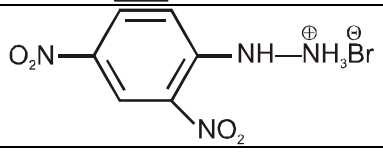
I II III IV **[IIT-JEE 2006, 3/184]**
(A) I < II < III < IV (B) I < II < IV < III (C) IV < I < II < III (D) IV < II < I < III

7. **Statement-1 :** p-Hydroxybenzoic acid has a lower boiling point than o-hydroxybenzoic acid.
Statement-2 : o-Hydroxybenzoic acid has intramolecular hydrogen bonding. **[IIT-JEE-2007, 3/162]**
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False.
(D) Statement-1 is False, Statement-2 is True.

8. **Statement-1 :** Aniline on reaction with $NaNO_2$ / HCl at 0ºC followed by coupling with β-naphthol gives a dark blue precipitate. **[IIT-JEE 2008,3/163]**
Statement-2 : The colour of the compound formed in the reaction of aniline with $NaNO_2$/HCl at 0ºC followed by coupling with β-naphthol is due to the extended conjugation.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

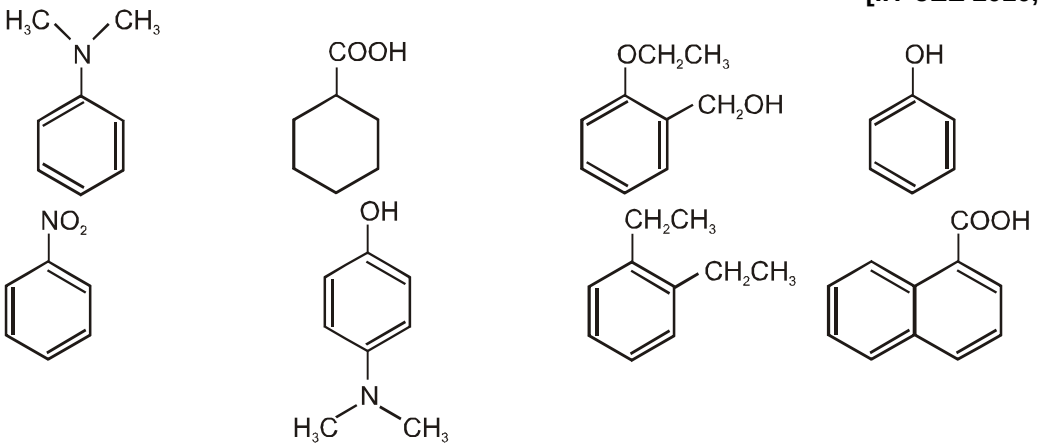
9. Match the entries in **Column I** with the correctly related quantum number(s) in **Column II.**
[IIT-JEE 2008, 6/163]

	Column I		**Column II**
(A)	$H_2N{-}\overset{\oplus}{N}H_3\,\overset{\ominus}{Cl}$	(p)	sodium fusion extract of the compound gives prussian blue colour with $FeSO_4$

(B)		(q)	gives positive $FeCl_3$ test
(C)		(r)	gives white precipitate with $AgNO_3$
(D)		(s)	reacts with aldehydes to form the corresponding hydrazone derivative

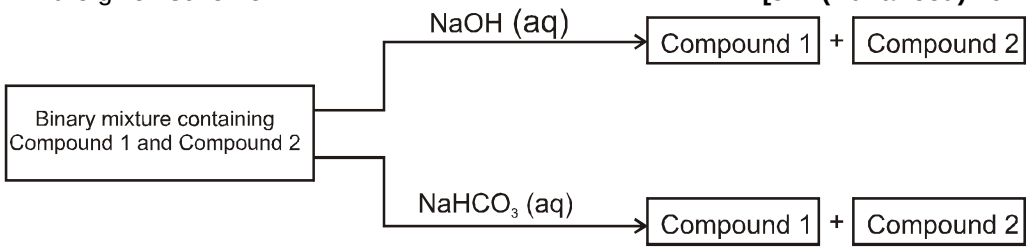
10. Amongst the following, the total number of compounds soluble in aqueous NaOH is :

[IIT-JEE 2010, 3/184]



11.* Identify the binary mixture(s) that can be separated into individual compounds, by differential extraction, as shown in the given scheme.

[JEE(Advanced) 2012, 4/136]



(A) C_6H_5OH and C_6H_5COOH
(B) C_6H_5COOH and $C_6H_5CH_2OH$
(C) $C_6H_5CH_2OH$ and C_6H_5OH
(D) $C_6H_5CH_2OH$ and $C_6H_5CH_2COOH$

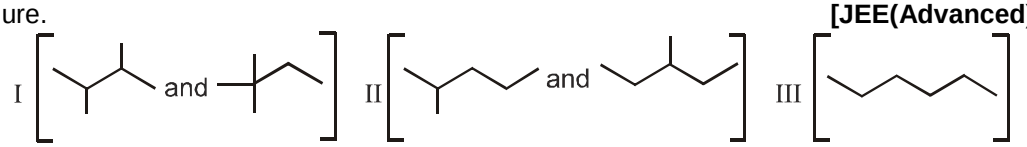
12. The compound that does **NOT** liberate CO_2, on treatment with aqueous sodium bicarbonate solution, is

[JEE(Advanced) 2013, 2/120]

(A) Benzoic acid
(B) Benzenesulphonic acid
(C) Salicylic acid
(D) Carbolic acid (Phenol)

13. Isomers of hexane, based on their branching, can be divided into three distinct classes as shown in the figure.

[JEE(Advanced) 2014, 3/120]



The correct order of their boiling point is

(A) I > II > III
(B) III > II > I
(C) II > III > I
(D) III > I > II

PART - II : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

JEE(MAIN) OFFLINE PROBLEMS

1. Which of the following statements is true? **[AIEEE - 2002, 3/225]**
(1) HF is less polar than HBr
(2) absolutely pure water does not contain any ions
(3) chemical bond formation takes place when forces of attraction overcome the forces fo repulsion
(4) in covalency transference of electron takes place.

2. An ether is more volatile than an alcohol having the same molecular formula. This is due to - **[AIEEE - 2003, 3/225]**
(1) Dipolar character of ethers
(2) Alcohols having resonance structures
(3) Inter-molecular hydrogen bonding in ethers
(4) Inter-molecular hydrogen bonding in alcohols

3. Which of the following pairs of molecules will have permanent dipole moments for both members ? **[AIEEE - 2003, 3/225]**
(1) SiF_4 and NO_2 (2) NO_2 and CO_2 (3) NO_2 and O_3 (4) SiF_4 and CO_2

4. The compound formed in the positive test for nitrogen with the Lassaigne solution of an organic compound is - **[AIEEE - 2004, 3/225]**
(1) $Fe_4[Fe(CN)_6]_3$ (2) $Na_3[Fe(CN)_6$ (3) $Fe(CN)_3$ (4) $Na_4[Fe(CN)_5NOS]$

5. Which one of the following has the minimum boiling point ? **[AIEEE - 2004, 3/225]**
(1) n-butane (2) 1-butyne (3) 1-butene (4) Isobutene

6. Which one of the following method is neither meant for the synthesis nor for separation of amines ? **[AIEEE-2005, 3/225]**
(1) Hinsberg method (2) Hofmann method
(3) Wurtz reaction (4) Curtius reaction

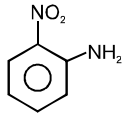
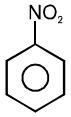
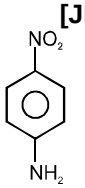
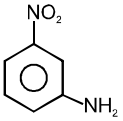
7. Among the following mixtures, dipole-dipole as the major interaction, is present in **[AIEEE-2006, 3/165]**
(1) benzene and ethanol (2) acetonitrile and acetone
(3) KCl and water (4) benzene and carbon tetrachloride

8. Which of the following reagents may be used to distinguish between phenol and benzoic acid ? **[AIEEE-2011, 4/120]**
(1) Aqueous NaOH (2) Tollen's reagent (3) Molisch reagent (4) Neutral $FeCl_3$

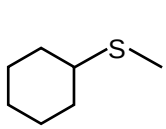
9. Ortho-Nitrophenol is less soluble in water than p- and m- Nitrophenols because : **[AIEEE-2012, 4/120]**
(1) o-Nitrophenol is more volatile steam than those of m- and p-isomers.
(2) o-Nitrophenol shows Intramolecular H-bonding
(3) o-Nitrophenol shows intermolecular H-bonding
(4) Melting point of o-Nitrophenol is lower than those of m- and p-isomers.

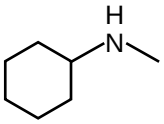
JEE(MAIN) ONLINE PROBLEMS

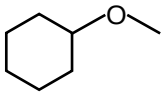
1. Which is the major product formed when acetone is heated with iodine and potassium hydroxide ? **[JEE(Main) 2014 Online (09-04-14), 4/120]**
(1) Iodoacetone (2) Acetic acid (3) Iodoform (4) Acetophenone

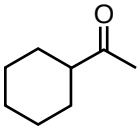
2. Which compound exhibits maximum dipole moment among the following ? **[JEE(Main) 2015 Online (11-04-15), 4/120]**
(1) 
(2) 
(3) 
(4) 

3. A mixture containing the following four compounds is extracted with 1M HCl. The compound that goes to aqueous layer is : **[JEE(Main) 2017 Online (08-04-15), 4/120]**


(I)

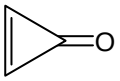

(II)

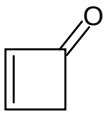

(III)

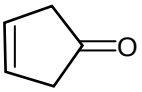

(IV)

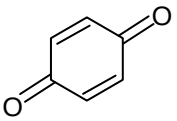
(1) (II) (2) (IV) (3) (I) (4) (III)

4. Which of the following compounds will show highest dipole moment ? **[JEE(Main) 2017 Online (09-04-17), 4/120]**

(I) 

(II) 

(III) 

(IV) 

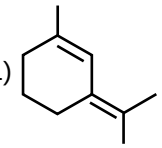
(1) (I) (2) (III) (3) (II) (4) (VI)

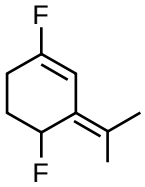
5. The increasing order of the boiling points for the following compounds is : **[JEE(Main) 2017 Online (09-04-17), 4/120]**

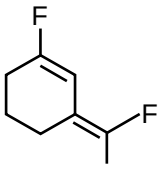
C_2H_5OH	C_2H_5Cl	$C_2H_5CH_3$	$C_2H_5OCH_3$
(I)	(II)	(III)	(IV)

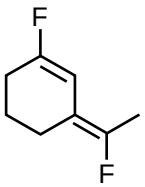
(1) (IV) < (III) < (I) < (II) (2) (III) < (II) < (I) < (IV)
(3) (II) < (III) < (IV) < (I) (4) (III) < (IV) < (II) < (I)

6. The most polar compound among the following is : **[JEE(Main) 2018 Online (16-04-18), 4/120]**

(1) 

(2) 

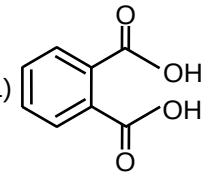
(3) 

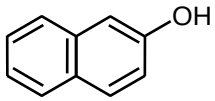
(4) 

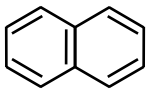
7. If dichloromethane (DCM) and water (H_2O) are used for differential extraction, which one of the following statements is correct ? **[JEE(Main) 2019 Online (10-01-19), 4/120]**

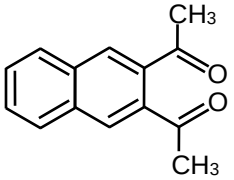
(1) DCM and H_2O will make turbid/colloidal mixture
(2) DCM and H_2O will be miscible clearly
(3) DCM and H_2O would stay as lower and upper layer respectively in the separating funnel (S.F.)
(4) DCM and H_2O would stay as upper and lower layer respectively in the separating funnel (S.F.)

8. Among the following four aromatic compounds, which one will have the lowest melting point ? **[JEE(Main) 2019 Online (12-01-19), 4/120]**

(1) 

(2) 

(3) 

(4) 

Answers

EXERCISE – 1

PART – I

A-1.	(A)	**A-2.**	(B)	**A-3.**	(B)	**A-4.**	(C)	**A-5.**	(C)
A-6.	(C)	**A-7.**	(D)	**A-8.**	(D)	**A-9.**	(A)	**A-10.**	(A)
A-11.	(D)	**A-12.**	(C)	**A-13.**	(B)	**A-14.**	(C)	**A-15.**	(C)
A-16.	(B)	**A-17.**	(A)	**A-18.**	(C)	**B-1.**	(C)	**B-2.**	(D)
B-3.	(B)	**B-4.**	(D)	**B-5.**	(D)	**B-6.**	(C)	**C-1.**	(C)
C-2.	(C)	**C-3.**	(D)	**C-4.**	(A)	**C-5.**	(D)	**C-6.**	(D)
C-7.	(A)	**D-1.**	(D)	**D-2.**	(D)	**D-3.**	(C)	**D-4.**	(A)
D-5.	(C)	**D-6.**	(C)	**D-7.**	(B)	**D-8.**	(B)	**D-9.**	(A)
E-1.	(B)	**E-2.**	(A)	**E-3.**	(A)	**E-4.**	(C)	**E-5.**	(A)
E-6.	(C)	**E-7.**	(C)	**E-8.**	(A)	**E-9.**	(A)		

PART – II

1.	(AD)	**2.**	(ACD)	**3.**	(ABC)	**4.**	(BC)

PART – III

1.	(A)	**2.**	(A)	**3.**	(D)	**4.**	(B)	**5.**	(C)
6.	(A)								

PART - IV

1.	3	**2.**	3 (ii, iii & v)	**3.**	5 (i, iii, iv, v, viii)
4.	4D	**5.**	5		

PART - V

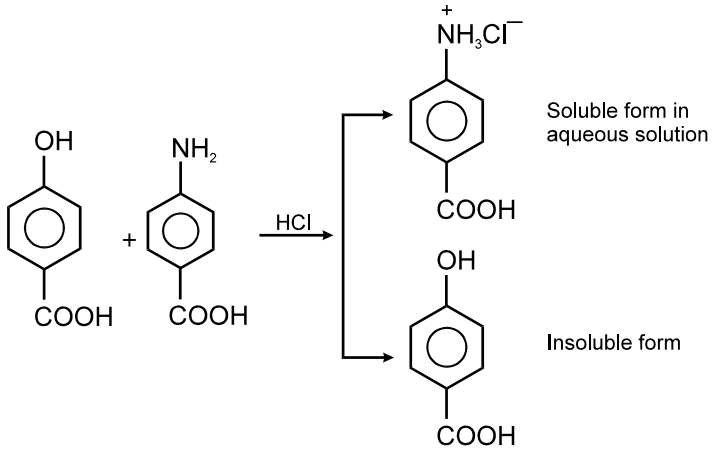
1. (A) - r ; (B) - r ; (C) - r ; (D) - r

EXERCISE – 2

PART – I

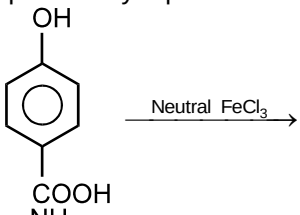
1.	(A)	**2.**	(B)	**3.**	(B)	**4.**	(A)

5.



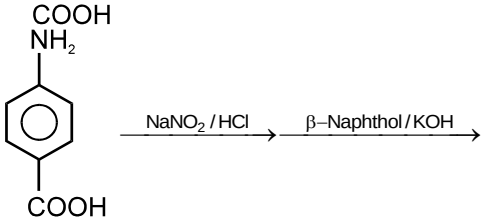
These can be separated by aq. HCl.

Test (1) :



Violet blue ppt.

Test (2) :



Red Orange dye.

6. (A) **7.** (D) **8.** (D)

9. (A) - (r, s); (B) - (p, q); (C) - (p, q, r); (D) – (p, s) **10.** 4 **11.*** (BD)

12. (D) **13.** (B)

PART – II

JEE(MAIN) OFFLINE PROBLEMS

1. (3) **2.** (4) **3.** (3) **4.** (1) **5.** (4)

6. (3) **7.** (2) **8.** (4) **9.** (2)

JEE(MAIN) ONLINE PROBLEMS

1. (3) **2.** (3) **3.** (1) **4.** (1) **5.** (4)

6. (3) **7.** (3) **8.** (3)

Additional Problems For Self Practice (APSP)

This Section is not meant for classroom discussion. It is being given to promote self-study and self testing amongst the Resonance students.

PART - I : PRACTICE TEST-1 (IIT-JEE (MAIN Pattern))

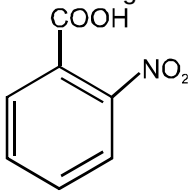
Max. Time : 1 Hr. **Max. Marks : 120**

Important Instructions

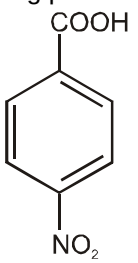
1. The test is of **1 hour** duration.
2. The Test Booklet consists of **30** questions. The maximum marks are **120.**
3. Each question is allotted **4 (four)** marks for correct response.
4. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question. **¼ (one fourth)** marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
5. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 4 above.

1. 2-Acetoxy benzoic acid is used as an :
(1) antimalarial (2) antidepressant (3) antiseptic (4) antipyretic

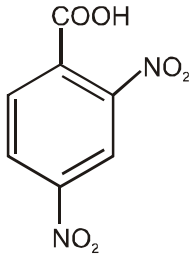
2. Decreasing order of melting point of compound I to IV follows.



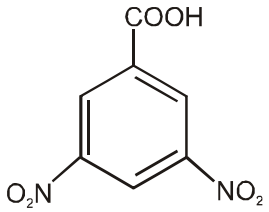
I



II



III



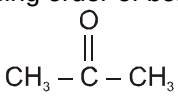
IV

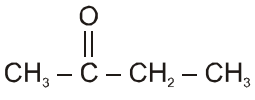
(1) I > II > III > IV (2) IV > III > II > I (3) III > IV > II > I (4) III > IV > I > II

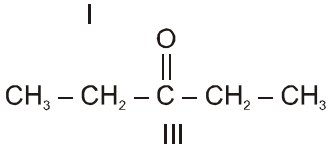
3. A drug that is antipyretic as well as analgesic is :
(1) chloroquin (2) penicillin
(3) paracetamol (4) chloropromazine hydrochloride

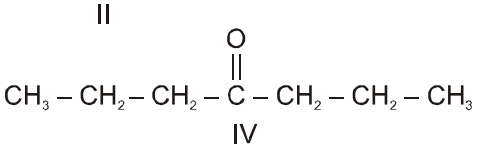
4. Which of the following compounds is used as a body deodorant ?
(1) Aspirin (2) Omeprazole (3) Indigosol-O (4) p-Chlorometaxylenol

5. Decreasing order of boiling point of I to IV follow.


I


II


III


IV

(1) I > II > III > IV (2) IV > III > II > I (3) II > III > IV > I (4) I > IV > III > II

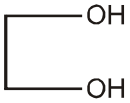
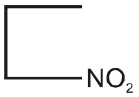
6. Bithional is an example of :
(1) disinfectant (2) antiseptic (3) antibiotic (4) analgesic

7. A is a lighter phenol and B is an aromatic carboxylic acid. Separation of a mixture of A and B can be carried out easily by using a solution of
(1) Sodium hydroxide (2) Sodium sulphate (3) Calcium chloride (4) Sodium bicarbonate

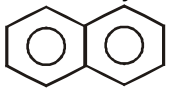
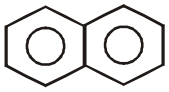
8. Novalgin is a common :
(1) Analgesic (2) Antibiotic (3) Antipyretic (4) Both (1) and (3)

9. Which of the following is/are antidepressant drug/s ?
(1) Cocaine (2) Benzedrine (3) Tofranil (4) All the three

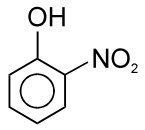
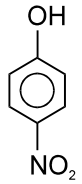
10. Salol can be used as :
(1) Antiseptic (2) Antipyretic (3) Analgesic (4) Disinfectant

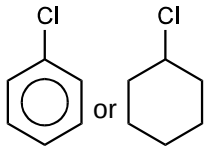
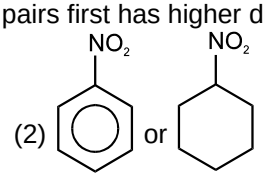
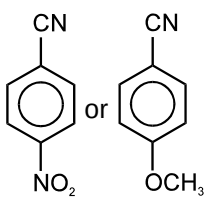
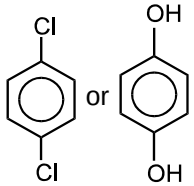
11. Which of the following compounds can be separated by water ?
(1)  (2)  (3)  (4) 

12. A mixture of two aromatic compound A and B when dissolve in NaOH, A is soluble and its residue B gives 2, 4 DNP test, identify compound A and B.
(1) Ph–COOH and Ph–OH (2) Ph – C(=O) – Ph and Ph–NH_2
(3) Ph–OH and Ph–NH_2 (4) Ph – OH and Ph – C(=O) – Ph

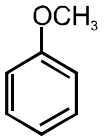
13. When a mixtrue of compound A & B dissolves in H_2O. A is soluble and gives smell of ammonia on heating with addition of conc. NaOH. Its residue B has sublimable nature. Identify A and B.
(1) $ArCONH_2$ and ArCOOH (2) R – C(=O) – NH_2 and 
(3)  and Ar – NO_2 (4) Ar – C(=O) – NH_2 and 

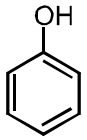
14. Which of the following statement is not true ?
(1) Small aliphatic compound with at least two functional group which can form hydrogen bond are water soluble
(2) Most of the aromatic compounds are water insoluble due to large hydrophobic group of six carbon atom.
(3) Aromatic amines are soluble in aq. NaOH but insoluble in aq. HCl.
(4) Aromatic hydroxy compounds are soluble in aq. NaOH solution.

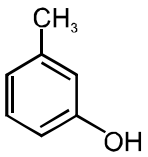
15. The correct orders about compounds I and II are :
 I  II
(1) B.P. $\longrightarrow$ I < II (2) Water solubility $\longrightarrow$ I > II
(3) Acid strength $\longrightarrow$ I < II (4) Melting point $\longrightarrow$ II > I

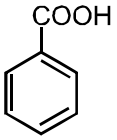
16. In which of the following pairs first has higher dipole moment than second ?
(1)  (2)  (3)  (4) 

17. Which of the following compounds does not form salt with NaOH ?

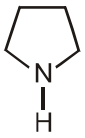
(1) 

(2) 

(3) 

(4) 

18. The boiling points of two miscible liquids, which do not form azeotropic mixture, are close to each other. Their separation is best carried out by :
(1) vacuum distillation (2) fractional distillation (3) steam distillation (4) redistillation

19. Which will have higher dipole moment than 

?

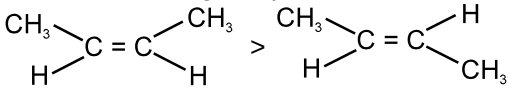
(1) 

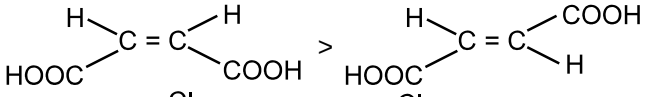
(2) 

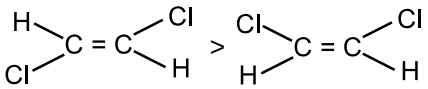
(3) 

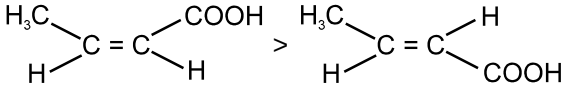
(4) 

20. The correct order for the given pair of isomers is :

(1)  (Melting point)

(2)  (Dipole moment)

(3)  (Boiling point)

(4)  (Water solubility)

21. The enzyme which hydrolyses cellulose into glucose is :
(1) Invertase (2) Maltase (3) Emulsin (4) Lactase

22. Which of the following sets of bases is present both in DNA and RNA ?
(1) Adenine, uracil, thymine (2) Adenine, guanine, cytosine
(3) Adenine, guanine, uracil (4) Adenine, guanine, thymine

23. The vitamin which is water soluble and antioxidant is :
(1) Vitamin E (2) Vitamin D (3) Vitamin C (4) Vitamin B_1

24. Which base is found only in the nucleotides of RNA ?
(1) Adenine (2) Uracil (3) Guanine (4) Cytosine

25. The couplings between base units of DNA is through :
(1) Hydrogen bonding (2) Electrostatic bonding
(3) Covalent bonding (4) Vander Waals forces

26. Mixture of chloroxylenol and terpineol acts as :
(1) Analgesic (2) Antiseptic (3) Antipyretic (4) Antibiotic

27. In a protein molecule various amino acids are linked together by :
(1) dative bond (2) α-glycosidic bond (3) β-glycosidic bond (4) peptide bond

28. Which of the following in an analgesic?
(1) Chloromycetin (2) Novalgin (3) Penicillin (4) Streptomycin

29. Artificial sweetner which is stable under cold conditions only is :
(1) Saccharine (2) Sucralose (3) Aspartame (4) Alitame

30. Which of the following hormones is produced under the condition of stress which stimulates glycogenolysis in the liver of human being ?
(1) Thyroxin (2) Insulin (3) Adrenaline (4) Estradiol

Practice Test-1 (IIT-JEE (Main Pattern))

OBJECTIVE RESPONSE SHEET (ORS)

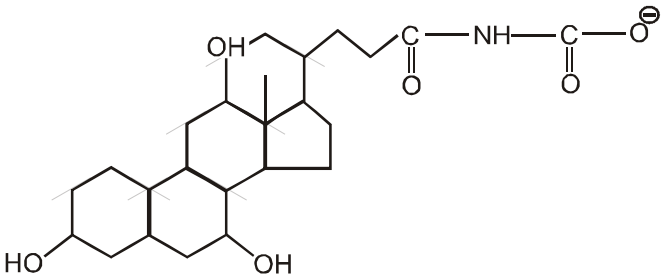
Que.	1	2	3	4	5	6	7	8	9	10
Ans.										
Que.	11	12	13	14	15	16	17	18	19	20
Ans.										
Que.	21	22	23	24	25	26	27	28	29	30
Ans.										

PART-II : NATIONAL STANDARD EXAMINATION IN CHEMISTRY (NSEC) STAGE-I

1. Drug which helps to reduce anxiety and brings about calmness is called as : **[NSEC-2001]**
(A) analgesic (B) diuretioc (C) tranquilizer (D) antihistamine

2. Which of the following vitamins are in water soluble ? **[NSEC-2001]**
(A) A and E (B) A and E (C) B and C (D) D and E

3.



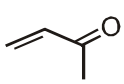
The compound shown above is : **[NSEC-2001]**
(A) a bile salt (B) a cholesterol
(C) vitamin D_3 (D) a steroid hormone

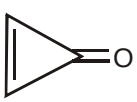
4. The molecule that will have dipole moment is : **[NSEC-2001]**
(A) trans 3-hexene (B) trans-2-pentene
(C) 2,2-dimethyl propane (D) 2,2,3,3-tetramethyl butane

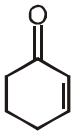
5. Which of the following is an unsaturated fatty acid ? **[NSEC-2001]**
(A) Stearic acid (B) Linolic acid (C) Lauric acid (D) Palmatic acid.

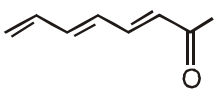
6. A person suffered from injury and there was considerable delay in clotting of blood. It may be due to the deficiency of **[NSEC-2002]**
(A) vitamin A (B) vitamin B (C) vitamin C (D) vitamin K

7. The compound having the highest dipole moment is **[NSEC-2003]**

(A) 

(B) 

(C) 

(D) 

8. Transport of oxygen is an important function of blood. Partial pressure of O_2 is highest and lowest, respectively in **[NSEC-2003]**
(A) muscles and heart (B) lungs and muscles
(C) heart and lungs (D) muscles and lungs.

9. Milk of magnesia used as a medicine for treating indigestion is a substance that : **[NSEC-2003]**
(A) helps in disintegration of food products leading to their facile metabolism
(B) combines with gastric hydrochloric acid thereby enhancing the latter`s efficiency
(C) improves the enzymatic activities inside the stomach
(D) neutralises excess acidity, providing a buffered medium inside the stomach.

10. Calcium gluconate syrup and calcium phosphate tablets are calcium supplements used to treat calcium deficiency. However, calcium gluconate is preferred over the latter because it is **[NSEC-2003]**
(A) more easily absorbed into the blood (B) released slowly in the body
(C) less toxic (D) more tasty

11. The fuel that is considered most polluting is : **[NSEC-2004]**
(A) petrol (B) coke (C) furnace oil (D) CNG.

12. The radioisotope used in the treatment of hyperthyroidism is : **[NSEC-2004]**
(A) Co-60 (B) Na-24 (C) I-131 (D) I-123

13. The haeme group found in haemoglobin **[NSEC-2005]**
(A) co-ordinates the iron atom in the plane of the haeme only when oxygen is bound
(B) contains centrally bound Fe(III) atom
(C) is covalently bound to the haemoglobin
(D) is held within the central cavity formed between the four haemoglobin subunits.

14. Proteins present inside the cell membrane are stabilized by **[NSEC-2007]**
(A) hydrogen bond (B) disulfide bond (C) hydrophobic force (D) phospho-diester bond

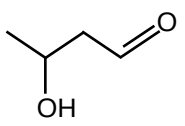
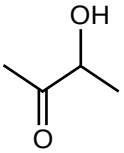
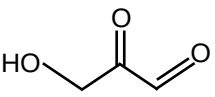
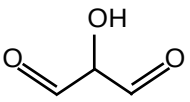
15. Reversible binding of oxygen occurs through **[NSEC-2008]**
(A) Fe (B) Cu (C) Mg (D) Ca

16. Essential vitamin required for the production of RBCs is **[NSEC-2012]**
(A) Folic acid (B) Nicotinic acid (C) Pantothenic acid (D) None of the above

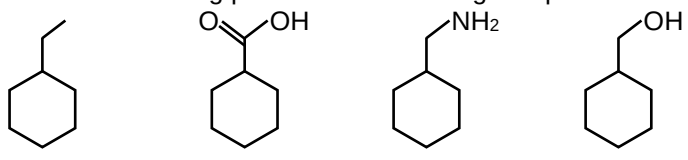
17. When a person suffers from typhoid, the metabolic process stimulates in the body to fight against this disease is synthesis of **[NSEC-2014]**
(A) Lipid (B) carbohydrate (C) protein (D) DNA

18. Wood or cattle dung ash is used for cleaning cooking utensils in many parts of India. The statement that is **not true** for this ash is : **[NSEC-2015]**
(A) It largely consists of metal oxides and silicates because non-metals are removed as gaseous compounds during buring of the wood/dung cakes.
(B) when added to water, it forms alkaline solution with pH~8 and above, which helps to remove oily substances from the utensils.
(C) several chemical components of ash remain undissolved as solids in water and these solids help in cleaning by providing scrubbing action.
(D) if left moist for a few hours in air, it slowly turns acidic because of oxidative decomposition.

19. Compound 'Y' (molar mass = 88.12 g mol^{-1}) containing 54.52% carbon, 9.17% hydrogen and 36.31% oxygen gives a reddish-brown precipitate in Fehling's test. 'Y' is **[NSEC-2018]**

(A) 
(B) 
(C) 
(D) 

20. The correct order of boiling points of the following compounds is **[NSEC-2018]**



(I) (II) (III) (IV)

(A) III < IV < II < I (B) I < III < IV < II (C) I < II < III < IV (D) IV < III < I < II

21. Among the following, the compound that has the highest dipole moment is **[NSEC-2018]**
(A) CH_3COOCH_3 (B) CH_3CONH_2 (C) $CH_3COC_2H_5$ (D) CH_3COCl

PART - III : PRACTICE TEST-2 (IIT-JEE (ADVANCED Pattern))

Max. Time : 1 Hr. **Max. Marks : 63**

Important Instructions

A. General :

1. The test is of 1 hour duration.
2. The Test Booklet consists of 21 questions. The maximum marks are 63.

B. Question Paper Format

3. Each part consists of five sections.
4. Section 1 contains 7 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE is correct.
5. Section 2 contains 7 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE OR MORE THAN ONE are correct.
6. Section 3 contains 3 questions. The answer to each of the questions is a single-digit integer, ranging from 0 to 9 (both inclusive).
7. Section 4 contains 1 paragraphs each describing theory, experiment and data etc. 3 questions relate to paragraph. Each question pertaining to a partcular passage should have only one correct answer among the four given choices (A), (B), (C) and (D).
8. Section 5 contains 1 multiple choice questions. Question has two lists (list-1 : P, Q, R and S; List-2 : 1, 2, 3 and 4). The options for the correct match are provided as (A), (B), (C) and (D) out of which ONLY ONE is correct.

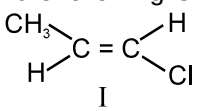
C. Marking Scheme

9. For each question in Section 1, 4 and 5 you will be awarded 3 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, minus one (– 1) mark will be awarded.
10. For each question in Section 2, you will be awarded 3 marks. If you darken all the bubble(s) corresponding to the correct answer(s) and zero mark. If no bubbles are darkened. No negative marks will be answered for incorrect answer in this section.
11. For each question in Section 3, you will be awarded 3 marks if you darken only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. No negative marks will be awarded for incorrect answer in this section.

SECTION-1 : (Only One option correct Type)

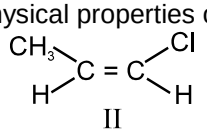
This section contains 7 multiple choice questions. Each questions has four choices (A), (B), (C) and (D) out of which Only ONE option is correct.

1. Which of the following is correct set of physical properties of the geometrical isomers ?



I

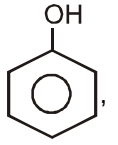
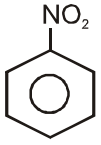
&

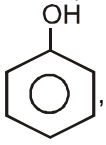
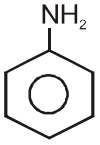


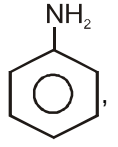
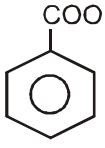
II

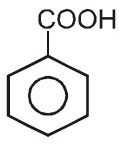
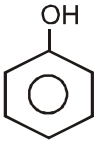
	Dipole moment	Boiling point	Melting point	Stability
(A)	I > II	I > II	II > I	I > II
(B)	II > I	II > I	II > I	II > I
(C)	I > II	I > II	I > II	I > II
(D)	II > I	II > I	I > II	I > II

2. A mixture of organic compounds A & B when dissolve in NaOH, A is soluble and its residue B gives positive test with Zn/ NH_4Cl followed by $AgNO_3$ + NH_4OH, (mulliken's barker test). Identify A & B

(A)  , 

(B)  , 

(C)  , 

(D)  , 

3. Which is/are the correct method for separating a mixture of benzoic acid, p-methylaniline & phenol ?

(A) $\xrightarrow{\text{aq. } NaHCO_3} \xrightarrow{\text{aq. NaOH}}$ (B) $\xrightarrow{\text{aq. HCl}} \xrightarrow{H_2O}$

(C) $\xrightarrow{\text{aq. NaOH}} \xrightarrow{\text{aq. } NaHCO_3}$ (D) $\xrightarrow{\text{aq. NaOH}} \xrightarrow{\text{aq. HCl}}$

4. Which of the following is not an antiseptic drug ?

(A) Iodoform (B) Dettol (C) Gammexane (D) Gentian violet

5. Which of the following represents a double base propellant ?

(A) Nitromethane (B) Nitrocellulose + nitroglycerine

(C) N_2O_4 + monomethylhydrazine (D) Liquid H_2 + liquid O_2

6. Which alcohol has least solubility in water ?

(A) Ethanol (B) Propan-1-ol (C) Butan-1-ol (D) Pentan-1-ol

7. Anthracene is purified by :

(A) filtration (B) distillation (C) crystallisation (D) sublimation

Section-2 : (One or More than one options correct Type)

This section contains 7 multipole choice questions. Each questions has four choices (A), (B), (C) and (D) out of which ONE or MORE THAN ONE are correct.

8. Which of the following are not used as food preservatives?

(A) Table salt (B) Sodium hydrogencarbonate

(C) Cane sugar (D) Benzoic acid

9. Compounds with antiseptic properties are _____.

(A) $CHCl_3$ (B) CHI_3

(C) Boric acid (D) 0.3 ppm aqueous solution of Cl_2

10. Which of the following statements are correct about barbiturates?

(A) Hypnotics or sleep producing agents.

(B) These are tranquilizers.

(C) Non-narcotic analgesics.

(D) Pain reducing without disturbing the nervous system.

11. Which of the following compounds are administered as antacids?

(A) Sodium carbonate (B) Sodium hydrogencarbonate

(C) Aluminium carbonate (D) Magnesium hydroxide

12. Amongst the following antihistamines, which are antacids?

(A) Ranitidine (B) Brompheniramine (C) Terfenadine (D) Cimetidine

13. Which of the following are anionic detergents?

(A) Sodium salts of sulphonated long chain alcohol.

(B) Ester of stearic acid and polyethylene glycol.

(C) Quarternary ammonium salt of amine with acetate ion.

(D) Sodium salts of sulphonated long chain hydrocarbons.

14. Which of the following statements are correct?

(A) Cationic detergents have germicidal properties

(B) Bacteria can degrade the detergents containing highly branched chains.

(C) Some synthetic detergents can give foam even in ice cold water.

(D) Synthetic detergents are not soaps.

Section-3 : (One Integer Value Correct Type.)

This section contains 3 questions. Each question, when worked out will result in one integer from 0 to 9 (both inclusive)

15. How many of the following are antifical sweeteners,

(i) Aspartame (ii) Saccharin (iii) Sucralose

(iv) Bithionol (v) Terpineol (vi) Chloroxylenol

(vii) Alitame (viii) Sodium Benzoate (ix) Sorbic acid

16. In how many of the following drugs, S is present.

(i) Histamine	(ii) Cimetidine	(iii) Ranitidine
(iv) Terfenadine	(v) Phenelzine	(vi) Veronal
(vii) Valium	(viii) Sulphonamide	(ix) Sulphapyridine

17. From the given set of drugs, how many of them can be used as antibiotics.

(i) Penicillin	(ii) Erythromycin	(iii) Ofloxacin.
(iv) Tetracycline	(v) Chloramphenicol	(vi) Salvarsan
(vii) Prontosil	(viii) Bithional	(ix) Chloroxylenol

SECTION-4 : Comprehension Type (Only One options correct)

This section contains 1 paragraphs, each describing theory, experiments, data etc. 3 questions relate to the paragraph. Each question has only one correct answer among the four given options (A), (B), (C) and (D)

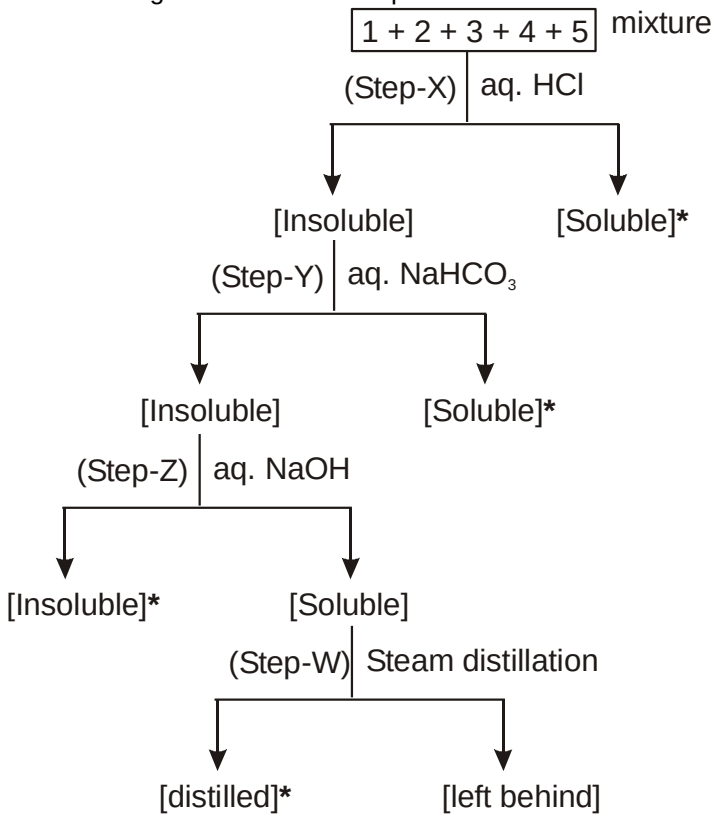
Paragraph for Questions 18 to 20

A water insoluble organic mixture contained following compounds

(1) Benzoic acid (2) Salicylaldehyde

(3) p-Hydroxybenzaldehyde (4) α-Naphthylamine (5) Naphthalene

The following sequence of reagents are used to separate this mixture



18. Soluble compound at step X is formed by compound :

(A) Benzoic acid (B) p-Hydroxybenzaldehyde

(C) α-Naphthylamine (D) Naphthalene

19. Soluble compound at step Y is formed by compound.

(A) Benzoic acid (B) p-Hydroxybenzaldehyde

(C) α-Naphthylamine (D) Naphthalene

20. Insoluble compound at step Z is formed by compound.

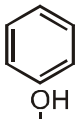
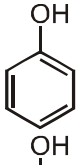
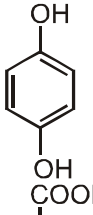
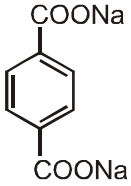
(A) p-Hydroxybenzaldehyde (B) Salicylaldehyde

(C) α-Naphthylamine (D) Naphthalene

SECTION-5 : Matching List Type (Only One options correct)

This section contains 1 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (A), (B), (C) and (D) out of which one is correct

21

	Column-I		**Column-II**
P		**1**	insoluble in water with $\mu = 0$.
Q		**2**	more soluble in water with $\mu \neq 0$.
R		**3**	most soluble in water with $\mu = 0$.
S		**4**	slightly soluble in water with $\mu \neq 0$.

Codes :

	P	Q	R	S		P	Q	R	S
(A)	1	2	3	4	(B)	1	4	2	3
(C)	3	4	1	2	(D)	4	3	2	1

Practice Test-2 (IIT-JEE (ADVANCED Pattern)

OBJECTIVE RESPONSE SHEET (ORS)

Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Ans.										
Que.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans.										
Que.	**21**									
Ans.										

APSP Answers

PART - I

1.	(4)	**2.**	(2)	**3.**	(3)	**4.**	(4)	**5.**	(2)
6.	(1)	**7.**	(4)	**8.**	(4)	**9.**	(4)	**10.**	(1)
11.	(1)	**12.**	(4)	**13.**	(2)	**14.**	(3)	**15.**	(4)
16.	(2)	**17.**	(1)	**18.**	(2)	**19.**	(2)	**20.**	(2)
21.	(3)	**22.**	(2)	**23.**	(3)	**24.**	(2)	**25.**	(1)
26.	(2)	**27.**	(4)	**28.**	(2)	**29.**	(3)	**30.**	(3)

PART-II

1.	(C)	**2.**	(C)	**3.**	(A)	**4.**	(B)	**5.**	(B)
6.	(D)	**7.**	(B)	**8.**	(B)	**9.**	(D)	**10.**	(A)
11.	(B)	**12.**	(C)	**13.**	(A)	**14.**	(D)	**15.**	(A)
16.	(A)	**17.**	(C)	**18.**	(D)	**19.**	(A)	**20.**	(B)
21.	(B)								

PART - III

1.	(C)	**2.**	(A)	**3.**	(A)	**4.**	(C)	**5.**	(B)
6.	(D)	**7.**	(D)	**8.**	(AC)	**9.**	(BC)	**10.**	(AB)
11.	(BD)	**12.**	(AD)	**13.**	(AD)	**14.**	(ACD)		
15.	4 (i, ii, iii and vii)	**16.**	4 (ii, iii, viii, ix)	**17.**	7 (i to vii only)	**18.**	(C)	**19.**	(A)
20.	(D)	**21.**	(B)						

APSP Solutions

PART - I

2. Melting point depends on symmetry of molecule.

5. Boiling point $\propto$ molecular weight.

7. Lighter phenol and aromatic carboxylic acid both reacts with sodium hydroxide, sodium sulphate and calcium chloride. While only aromatic carboxylic acid reacts with sodium bicarbonate. So, they can be seperated by sodium bicarbonate
$\therefore$ option (4) is correct.

8. Novalgin is a common analgesic and antipyretic.

9. This is informative question.

10. Salol is used as intestinal antiseptic.

11. Lower alcohol are soluble in water.

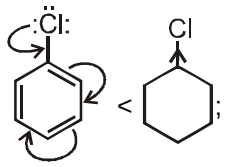
12. Ar–OH dissolve in NaOH and carbonyl group gives +ve test with 2,4-DNP so $Ph-\underset{\underset{O}{\|}}{C}-Ph$ gives +ve 2,4DNP test.

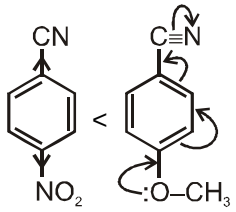
13. With conc. NaOH, amide gives smell of ammonia and aliphatic amides is soluble in H_2O.

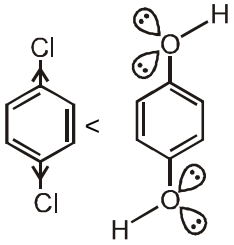
14. Aromatic amines are soluble in aq. HCl due to salt formation.

15. Correct orders are

B.P.	=	II > I	(pera > ortho)
H_2O (sol.)	=	II > I	(pera > ortho)
Acid strength	=	II > I	(pera > ortho)

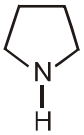
16. (1) 

; (3) 

; (4) 

17. Anisol does not form salt with NaOH.

18. If boiling points are closer then best separation is done by fractional distillation.

19. Due to more electronegativity of oxygen than N,  has higher dipole moment than  .

20. Dipole moment of cis isomer > dipole moment of trans isomer and hence water solubility. (cis isomer is greater than trans isomer).

21. The enzyme which hydrolyses cellulose into glucose is emulsin.

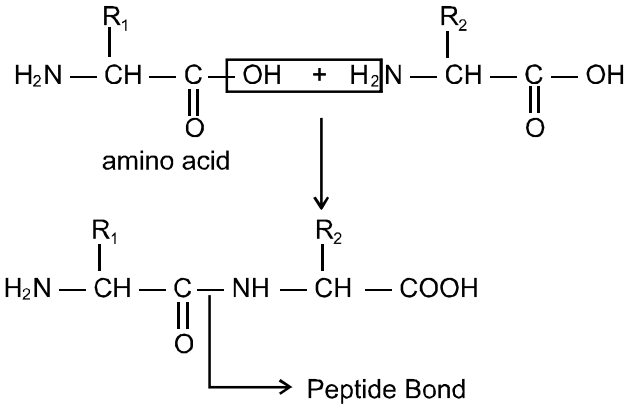
22. Adenine, guanine, cytosine sets of bases is present both in DNA and RNA.

23. Vitamin C is water soluble and antioxidant.

24. Uracil base is found only in the nucleotides of RNA

25. The couplings between base units of DNA is through hydrogen bonding.

26. It is fact.

27. 

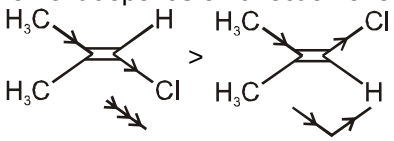
28. Novalgin is an analgesic it is a fact.

29. Aspartame is stable at cold conditions but unstable at cooking temperature.

30. Adrenaline hormone is produced by adrenal glands after receiving a massage from the brain that a stressfull situation has presented itself. It is commonly known as ***fight or flight*** hormone.

PART - III

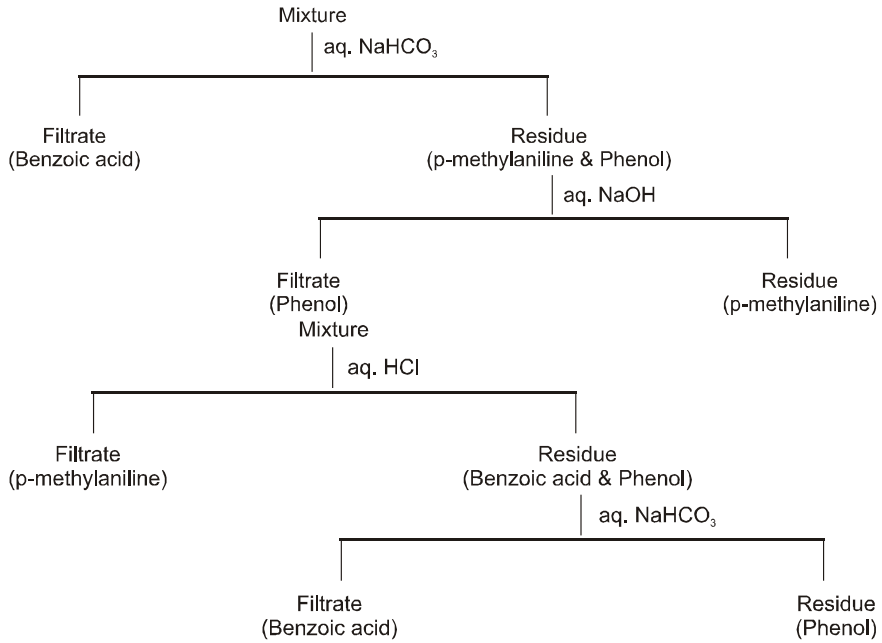
1. Dipole moment depends on direction of electron flow i.e.



melting point and boiling point also depends on dipole moment if H-bonding is absent. Greater the dipole moment, greater the melting point and boiling point.

2. $Ar–NO_2 \xrightarrow[\Delta]{Zn/NH_4Cl} ArNHOH \xrightarrow[NH_4OH]{AgNO_3^+} Ag\downarrow$

3.



4. Gammexane is insecticide.

6. Pentan-1-ol has larger alkyl group which decreases H-bonding so least soluble in water.

7. Anthracene (solid) $\underset{cool}{\overset{heat}{\rightleftharpoons}}$ vapours

15. 4 (i, ii, iii and vii) are antifical sweeteners.

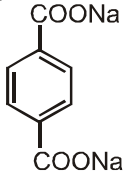
16. Cimetidine, Ranitidine, Sulphonamide and Sulphapyridine has "S" present in it.

17. Bithional and Chloroxylenol are antiseptics.

18. $–NH_2$ containing compound form salt with HCl.

19. –COOH group forms salt with $NaHCO_3$.

20. Naphthalene does not form salt with HCl, $NaHCO_3$ and NaOH.

21. Benzene is non-polar, phenol has –OH group so slightly soluble, p-hydroxyphenol has 2–OH group so more soluble on water,  is salt so is most soluble in water.