# CUET – 2023
# Chemistry
# Mock Paper - 1

**Time: 45 min** **Maximum Marks: 200**

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**General Instructions:**

1. Total duration of **Chemistry** Papers is **45** min.
2. You have to attempt 40 questions out of 50 in each Domain subjects.
3. All the questions provided are in MCQ format and have only single correct option.
4. Each questions carries 5 marks. For each correct response, the candidate will get 5 marks. For each incorrect response 1 mark will be deducted from the total scores. The maximum marks are 200.

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## SECTION – A

**Note:** Select the most appropriate option from those given below each question:

1. The formula to calculate the packing efficiency of the face centered unit cell is:

(a) $$\text{Packing efficiency} = \frac{\text{Volume occupied by 3 spheres in the unit cell}}{\text{Total volume of the unit cell}} \times 100\%$$

(b) $$\text{Packing efficiency} = \frac{\text{Total volume of the unit cell}}{\text{Volume occupied by 3 spheres in the unit cell}} \times 100\%$$

(c) $$\text{Packing efficiency} = \frac{\text{Volume occupied by 4 spheres in the unit cell}}{\text{Total volume of the unit cell}} \times 100\%$$

(d) $$\text{Packing efficiency} = \frac{\text{Volume occupied by 2 spheres in the unit cell}}{\text{Total volume of the unit cell}} \times 100\%$$

**Solution:**

Correct answer – (c): $$\text{Packing efficiency} = \frac{\text{Volume occupied by 4 spheres in the unit cell}}{\text{Total volume of the unit cell}} \times 100\%$$

Since a face centered unit cell, it has 4 spheres,

2. Rotation at high speed makes the colloid settle down and the impurities remain in solution. What is this process called?
   (a) Ultrafiltration
   (b) Dialysis
   (c) Ultra-centrifugation
   (d) Mechanical dispersion

   **Solution:**

   Correct answer – (c): Ultra-centrifugation

   Ultra-centrifugation is rotation at high speed which makes the colloid to settle down and the impurities remain in solution.

3. In the context of the Hall-Heroult process for the extraction of Al, which of the following statement is false?
   (a) CO and $CO_2$ are produced in this process
   (b) $Al_2O_3$ is mixed with $CaF_2$ which lowers the melting point of the mixture and brings conductivity
   (c) $Al^{3+}$ is reduced at the cathode to form Al
   (d) $Na_3AlF_6$ serves as the electrolyte

   **Solution:**

   Correct answer – (d): $Na_3AlF_6$ serves as the electrolyte

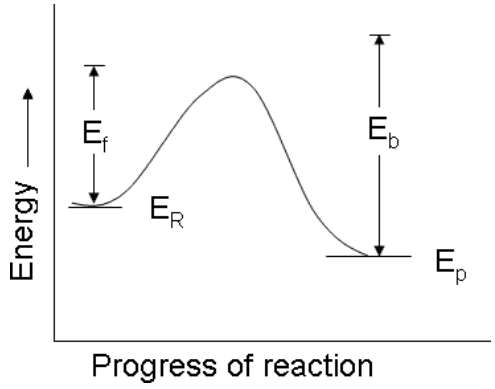
   Molten aluminium oxide ($Al_2O_3$) serves as an electrolyte in the extraction of aluminium. Molten cryolite serves as solvent and increases conductivity.

4. If $E_f$ and $E_b$ are the activation energies of the forward and reverse reactions and the reaction is known to be exothermic, then:
   (a) $E_f < E_b$
   (b) $E_f > E_b$
   (c) $E_f = E_b$
   (d) Data insufficient to predict

   **Solution:**

   Correct answer – (a): $E_f < E_b$

   For an exothermic reaction $E_b > E_f$




5. The second most abundant metal in the earth's crust is
   (a) Aluminium
   (b) Iron
   (c) Copper
   (d) Zinc

   **Solution:**

   Correct answer – (b): Iron

   Iron is the second most abundant metal in the earth's crust. It is also the most widely used metal.

6. Which of the following will give a white precipitate upon reacting with $AgNO_3$?
   (a) $K_2[Pt(en)_2Cl_2]$
   (b) $[CO(NH_3)_3Cl_3]$
   (c) $[Cr(H_2O)_6]Cl_3$
   (d) $[Fe(H_2O)_3Cl_3]$
   **Solution:**
   Correct answer – (c): $[Cr(H_2O)_6]Cl_3$
   On treatment with $AgNO_3$, $[Cr(H_2O)_6]Cl_3$ will form a white precipitate of AgCl because it will give three chloride ions upon dissociation as follows:
   $$[Cr(H_2O)_6]Cl_3 \rightleftarrows [Cr(H_2O)_6]^{+3} + 3Cl^-$$

7. Out of B, C, N and O the element with the highest first ionisation potential is:
   (a) Boron
   (b) Carbon
   (c) Nitrogen
   (d) Oxygen
   **Solution:**
   Correct answer – (c): Nitrogen
   Nitrogen has the highest value of first ionisation energy due to its half-filled 2p orbital which is more stable.

8. In case of noble gases the general trend in the melting points and boiling points, down the group, is
   (a) Decreases from He to Rn
   (b) Increases from He to Ar and decreases from Ar to Rn
   (c) Decreases from He to Ar and then increases from Ar to Rn.
   (d) Increases from He to Rn
   **Solution:**
   Correct answer – (d): Increases from He to Rn
   Melting point and boiling points show regular increase from top to bottom in the group, with rise in atomic numbers. This increase is due to the greater inter atomic attractive forces (van der Waals forces) between atoms as with the increase in atomic number their atomic sizes increase.

9. On increasing the temperature of the reacting system by 10° the rate of reaction becomes almost double. The most appropriate reason for this is
   (a) Activation energy decreases by increase of temperature
   (b) The fraction of molecules having threshold energy increases
   (c) Collision frequency increases
   (d) The value of threshold energy decreases
   **Solution:**
   Correct answer – (b): The fraction of molecules having threshold energy increases.

In a chemical reaction there is an energy barrier between the reactants and the products. To overcome this barrier energy is required. The increase in temperature increases the kinetic energy of the molecules. Hence it increases the fraction of molecules having threshold energy and helps them to overcome the energy barrier.

10. Match List I to List II

| | List I | | List II |
|---|---|---|---|
| A | Binary solution | I | A solution whose osmotic pressure is less than that of reference solution. |
| B | Isotonic solutions | II | Solutions having the same osmotic pressure at a given temperature. |
| C | Hypotonic solution | III | A solution that contains the maximum amount of solute that can be dissolved in a given amount of solvent at a given temperature. |
| D | Saturated solution | IV | Solution with two components |

(a) A-IV, B-II, C-I, D-III
(b) A-II, B-IV, C-I, D-III
(c) A-IV, B-II, C-III, D-I
(d) A-I, B-II, C-IV, D-III

**Solution:**

Correct answer- (c): A-IV, B-II, C-III, D-I

| List I | List II |
|---|---|
| Binary solution | Solution with two components |
| Isotonic solutions | Solutions having the same osmotic pressure at a given temperature. |
| Hypotonic solution | A solution that contains the maximum amount of solute that can be dissolved in a given amount of solvent at a given temperature. |
| Saturated solution | A solution whose osmotic pressure is less than that of reference solution. |

11. Among the elements of group 17, fluorine is the most reactive owing to its:
    (a) Electronegativity and small size of atom
    (b) Large size of the atom
    (c) Extremely low oxidizing power and high dissociation energy of F-F bond
    (d) Due to high ionization energy

    **Solution:**

    Correct answer – (a): Electronegativity and small size of atom

    Among the elements of group 17, fluorine is the most reactive owing to its electronegativity and small size of atom. Also, extremely high oxidizing power and low dissociation energy of F-F bond is responsible for its reactivity.

12. The electronic configuration of copper is:
    (a) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^2$
    (b) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$
    (c) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4 4s^2$
    (d) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$

    **Solution:**

    Correct answer – (b): $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$

    The electronic configuration of copper with atomic number 29 is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$

13. Identify the compound from the following which on exposure to lower levels in air can lead to slightly impaired hearing and vision
    (a) Chloromethane
    (b) Methylene chloride
    (c) Chloroform
    (d) Carbon tetrachloride

    **Solution:**

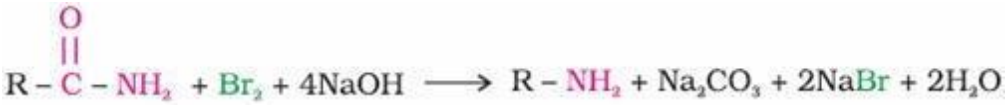
    Correct answer – (b): Methylene chloride

    Exposure to lower levels of methylene chloride in air can lead to slightly impaired hearing and vision.

14. Propanamide on treatment with bromine in an aqueous solution of sodium hydroxide gives:
    (a) Ethanamine
    (b) Propanamine
    (c) Butanamie
    (d) Butanamide

    **Solution:**

    Correct answer – (a): Ethanamine



15. Certain organic compounds are required in small amount in our diet but their deficiency causes diseases. The compounds are called:
    (a) Proteins
    (b) Amino acid
    (c) Carbohydrates
    (d) Vitamins
    **Solution:**
    Correct answer – (d): Vitamins
    Certain organic compounds are required in small amount but their deficiency causes diseases. The compounds are called Vitamins. Most of the vitamins cannot be synthesised in our body but plants can synthesise almost all of them, so they are considered as essential food factors.

16. Antidepressant drugs are the drugs which inhibit the enzymes which catalyse the degradation of:
    (a) Noradrenaline
    (b) Histamine
    (c) Hydrochloric acid
    (d) Chlordiazepoxide
    **Solution:**
    Correct answer – (a): Noradrenaline
    Noradrenaline is one of the neurotransmitters that play a role in mood changes. If the level of noradrenaline is low for some reason, then the signal-sending activity becomes low, and the person suffers from depression.

17. Enzymes belong to the class of compounds called:
    (a) Polysaccharides
    (b) Polypeptides
    (c) Polynitrogen heterocyclic compounds
    (d) Hydrocarbons
    **Solution:**
    Correct answer – (b): Polypeptides
    Enzymes are polypeptides. Chemically, peptide linkage is an amide formed between –COOH group and $-NH_2$ group. When the number of amino acids is more than ten, then the products are called polypeptides.

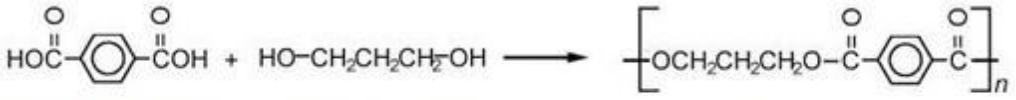
18. A condensation polymer among the following is:
    (a) Dacron
    (b) PVC
    (c) Polystyrene
    (d) Teflon
    **Solution:**
    Correct answer – (a): Dacron

Dacron or teylene is condensation polymer. The condensation polymers are formed by repeated condensation reaction between two different bi-functional or tri-functional monomeric units. In these polymerisation reactions, the elimination of small molecules such as water, alcohol, hydrogen chloride, etc. take place.

19. The limiting molar conductivity of the three electrolytes are given below
    A. ($PX_3$)
    B. ($PX_2$)
    C. ($PX_4$)
    Choose the correct option based on ascending order.
    (a) B<C<A
    (b) A<B<C
    (c) B<A<C
    (d) A<C<B
    **Solution:**
    Correct answer – (c): B<A<C
    More the number of ions greater is the limiting molar conductivity of electrolyte.

20. Reduction of alkanenitriles with sodium and alcohol or $LiAlH_4$ is called:
    (a) Rosenmund reduction
    (b) Catalytic reduction
    (c) Wolf-Kishner reduction
    (d) Mendius reaction
    **Solution:**
    Correct answer – (d): Mendius reaction
    In Mendius reaction, the carbon nitrogen triple bond of nitriles can be completely reduced in the presence of alcoholic sodium to yield the corresponding primary amines.
    $CH_3CN + 4[H] \xrightarrow{Na/Ethanol} CH_3CH_2NH_2$

21. Condensation polymerisation of ethylene glycol and terepthalic acid gives:
    (a) Buna-S
    (b) Terylene
    (c) Glyptal
    (d) PVC
    **Solution:**
    Correct answer – (b): Terylene
    Condensation polymerisation of ethylene glycol and terepthalic acid gives 'Terelyne' with elimination of water. The reaction is carried out at 425-475K.



Terephthalic acid (Benzene-1,4 - di carboxylic acid) | Ethylene glycol (Ethane-1, 2 - diol) | Terylene or Dacron

22. Which of the following is the strongest acid?
    (a) $BrCH_2COOH$
    (b) $FCH_2COOH$
    (c) $ICH_2COOH$
    (d) $ClCH_2COOH$

    **Solution:**

    Correct answer – (b): $FCH_2COOH$

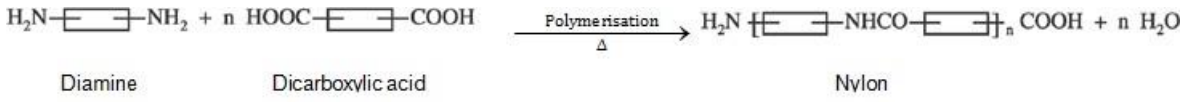
    $FCH_2COOH$ is the strongest acid out of all. Since, the electron withdrawing inductive effect (-I effect) of the halogens decreases in the order F>Cl> Br> I , therefore the acidic strength of the α- halo acids decreases in the same order. $FCH_2COOH$> $ClCH_2COOH$> $BrCH_2COOH$> $ICH_2COOH$

23. Nylon is a_____.
    (a) Vinyl polymer
    (b) Polyester
    (c) Polyamide
    (d) Polysaccharide

    **Solution:**

    Correct answer – (c): Polyamide

    Polymers having amide linkages are called as polyamides. They are formed by the condensation polymerisation of dibasic acids with diamines and are commonly known as nylons. The general method of preparation consists of the condensation polymerisation of diamines with dicarboxylic acids and also of amino acids and their lactams.



Diamine | Dicarboxylic acid | Nylon

Where ▭ shows hydrocarbon part.

24. When the polypeptide chain runs parallel and are held together by hydrogen and disulphide bond then the proteins formed is:
    (a) Fibrous protein
    (b) Globular protein
    (c) Spherical protein
    (d) Linear protein

    **Solution:**

Correct answer – (a): Fibrous protein

When the polypeptide chain runs parallel and are held together by hydrogen and disulphide bond then the proteins formed is known as fibrous protein.

25. Sodium salts of sulphonated long chain alcohols or hydrocarbons are examples of:
    (a) Non-ionic detergent
    (b) Cationic detergent
    (c) Anionic detergent
    (d) Soap

    **Solution:**

    Correct answer – (b): Anionic detergent

    Sodium salts of sulphonated long chain alcohols and hydrocarbons are examples of Anionic detergents.

26. Identify the most basic compound from the following.
    (a) $C_6H_5NH_2$
    (b) $C_6H_5)_2NH$
    (c) $CH_3NH_2$
    (d) $(CH_3)_2NH$

    **Solution:**

    Correct answer – (d): $(CH_3)_2NH$

    Aliphatic amines are more basic than aromatic amines. Further secondary amines are more basic than primary amines.

27. When the reaction between methyl iodide and sodium ethoxide occur, the product obtained is:
    (a) Methyl acetate
    (b) Ethyl acetate
    (c) Acetone
    (d) Methyl ethyl ether

    **Solution:**

    Correct answer – (d): Methyl ethyl ether

    Methyl ethyl ether is obtained when methyl iodide reacts with sodium ethoxide. $CH_3I + C_2H_5ONa \rightarrow CH_3OC_2H_5 + NaI$

28. In a complex $MA_3X_3$, unidentate ligands A and X may give:
    (a) two geometrical isomers
    (b) three geometrical isomers
    (c) two geometrical isomers which can be resolved into a pair of enentiomers
    (d) two geometrical isomers one of which can be resolved into a pair of enantiomers

    **Solution:**

    Correct answer – (a): two geometrical isomers

$MA_3X_3$ can exist as two geometrical isomers one facial isomer; and the other isomer will be meridianal isomer.

29. The formula to calculate the packing efficiency of the face centered unit cell is:
    (a) Carbon monoxide
    (b) Carbon dioxide
    (c) Hydrogen sulphide
    (d) Sulphur dioxide

    **Solution:**

    Correct answer – (a): Carbon monoxide

    Carbon monoxide is used in the reduction of oxides and sulphide of metals.

30. If the constituent particles are missing from lattice site the defect is called as:
    (a) Interstitial Defect.
    (b) Vacancy Defect.
    (c) Substitutional Defect.
    (d) Metal Deficiency.

    **Solution:**

    Correct answer – (b): Vacancy Defect.

    Vacancy Defect: Constituent particles are not present in the lattice site it's called vacancy defect and the density decreases due to missing particles.

31. Match List I to List II

| | List I | | List II |
|---|---|---|---|
| A | Sulphur vapor passed through cold water | I | Normal electrolyte solution |
| B | Soap mixed with water above critical micelle concentration | II | Molecular colloids |
| C | White of egg whipped with water | III | Associated colloid |
| D | Soap mixed with water below critical micelle concentration | IV | Macro-molecular colloids |

    (a) A-II, B-III, C-IV, D-I
    (b) A-II, B-IV, C-I, D-III
    (c) A-IV, B-II, C-III, D-I
    (d) A-I, B-II, C-IV, D-III

    **Solution:**

    Correct answer – (a): A-II, B-III, C-IV, D-I

| List I | List II |
|---|---|
| Sulphur vapor passed through cold water | Molecular colloids |
| Soap mixed with water above critical micelle concentration | Associated colloid |
| White of egg whipped with water | Macro-molecular colloids |
| Soap mixed with water below critical micelle concentration | Normal electrolyte solution |

32. In case of noble gases the general trend in the melting points and boiling points, down the group, is
    (a) Chromium sulphate
    (b) Chromyl chloride
    (c) Ferrochrome
    (d) Chromate
    **Solution:**
    Correct answer – (a): Chromium sulphate
    When potassium dichromate is treated with dilute sulphuric acid, it forms chromium sulphate.
    $K_2Cr_2O_7 + 4H_2SO_4 \rightarrow Cr_2(SO_4)_3 + K_2SO_4 + 4H_2O + 3[O]$

33. What happens when $K_2Cr_2O_7$ is treated with KI?
    (a) Chromate is formed
    (b) Chromyl chloride is obtained
    (c) Acetic acid is formed
    (d) It liberates $I_2$ from KI
    **Solution:**
    Correct answer – (d): It liberates $I_2$ from KI
    When $K_2Cr_2O_7$ is treated with KI, it liberates $I_2$ from KI.
    $2K_2Cr_2O_7 + 6KI + 7H_2SO_4 \rightarrow Cr_2(SO_4)_3 + 4\ K_2SO_4 + 7H_2O + 3I_2$

34. Metal possesses two types of valency- Primary (ionizable) and secondary (non-ionisable) is the postulate of
    (a) Rutherford
    (b) Werner
    (c) Pauling
    (d) Mendeleves
    **Solution:**
    Correct answer – (b): Werner

Metal possesses two types of valency- Primary (ionizable) and secondary (non-ionizable) is the postulate of 'Werner's theory'.

35. Match List I to List II

| | List I | | List II |
|---|---|---|---|
| A | Ethyl phenyl ether | I | Salol |
| B | Phenyl salicylate | II | Aspirin |
| C | Methyl salicylate | III | Phenetole |
| D | 2-Acetoxybenzoic acid | IV | Oil of wintergreen |

(a) A-II, B-III, C-IV, D-I
(b) A-II, B-IV, C-I, D-III
(c) A-III, B-I, C-IV, D-II
(d) A-I, B-II, C-IV, D-III

**Solution:**

Correct answer- (c): A-III, V-I, C-IV, D-II

| | List I | | List II |
|---|---|---|---|
| A | Ethyl phenyl ether | III | Phenetole |
| B | Phenyl salicylate | I | Salol |
| C | Methyl salicylate | IV | Oil of wintergreen |
| D | 2-Acetoxybenzoic acid | II | Aspirin |

36.

**Statement I:** 0.1 M solution of KCl has greater osmotic pressure than 0.1 M solution of glucose at the same temperature.

**Statement II:** In solution, KCl dissociates to produce more number of particles.

In the light of the above statement, choose the most appropriate answer from the options given below

(a) Both Statement I and Statement II are correct.
(b) Both Statement I and Statement II are incorrect.

(c) Statement I is correct and Statement II is incorrect.
(d) Statement I is incorrect and Statement II is correct.

**Solution:**

Correct answer – (a): Both Statement I and Statement II are correct.

Ionization of KCl-

$KCl \rightarrow K^{+} + Cl^{-}$

$\pi = iCRT, i = 2$

In case of Glucose, it is not ionized so

$\pi = iCRT, i = 1$

So, KCl is having high osmotic pressure because of its dissociation.

37.

**Statement I:** Conductivity of an electrolyte increases with a decrease in concentration.

**Statement II:** Number of ions per unit volume decreases on dilution.

In the light of the above statement, choose the most appropriate answer from the options given below

(a) Both Statement I and Statement II are correct.
(b) Both Statement I and Statement II are incorrect.
(c) Statement I is correct and Statement II is incorrect.
(d) Statement I is incorrect and Statement II is correct.

**Solution:**

Correct answer –(d): Statement I is incorrect and Statement II is correct.

Conductivity is directly proportional to the number of ions present in the solution. So, Statement I is incorrect. The number of ions per unit volume decreases on dilution; hence, the Statement II is correct.

38.

**Statement I:** Oxidation of ketones is easier than aldehydes.

**Statement II:** C–C bond of ketones is stronger than C–H bond of aldehydes.

In the light of the above statement, choose the most appropriate answer from the options given below

(a) Both Statement I and Statement II are correct.
(b) Both Statement I and Statement II are incorrect.
(c) Statement I is correct and Statement II is incorrect.
(d) Statement I is incorrect and Statement II is correct.

**Solution:**

Correct answer – (d): Statement I is incorrect and Statement II is correct.

Due to the presence of the C–H bond in aldehydes, aldehydes are easily oxidised as compared to ketones which lack the C–H bond.

39. Kohlrausch had given the following relation for strong electrolytes:

$\wedge = \wedge_0 - A\sqrt{C}$

Which of the following equality holds?

(a) $A=A_0$ as $C \rightarrow \sqrt{A}$

(b) $A=A_0$ as $C \rightarrow \infty$

(c) $A=A_0$ as $C \rightarrow 0$

(d) $A=A_0$ as $C \rightarrow 1$

**Solution:**

Correct answer – (c): $A=A_0$ as $C \rightarrow 0$

At infinite dilution($C \rightarrow 0$), Molar conductivity would be highest.

So according to given equation, $\Lambda=\Lambda_o$

40. The simplest way to check whether a system is a colloid is by using:

(a) Tyndall effect

(b) Brownian movement

(c) Electrodialysis

(d) Finding out particle size

**Solution:**

Correct answer – (a): Tyndall effect

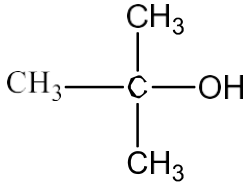
It is by the Tyndall effect as the path of light becomes visible due to scattering.

**Read the passage given below and answer the questions(41- 45):**

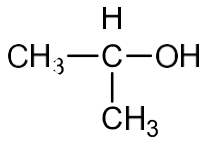
Alcohols and Phenols are acidic in nature. Electron withdrawing groups in phenol increase its acidic strength and electron donating groups decrease it. Alcohols undergo nucleophilic substitution with hydrogen halides to give alkyl halides. On oxidation primary alcohols yield aldehydes with mild oxidising agents and carboxylic acids with strong oxidising agents while secondary alcohols yield ketones. The presence of —OH groups in phenols activates the ring towards electrophilic substitution. Various important products are obtained from phenol like salicylaldehyde, salicylic acid, picric acid etc.

41. Which of the following alcohols is resistant to oxidation?

(a)




(b)

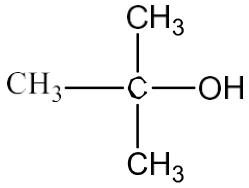


(c) $CH_3—CH_2—OH$

(d) $CH_3—OH$

**Solution:**

Correct answer – (a):



Alcohols which does not have any hydrogen attached with the C which contains -OH group are resistant to oxidation.

42. Which of the following group increases the acidic character of phenol?

(a) $CH_3O$-

(b) $CH_3$-

(c) $NO_2$-

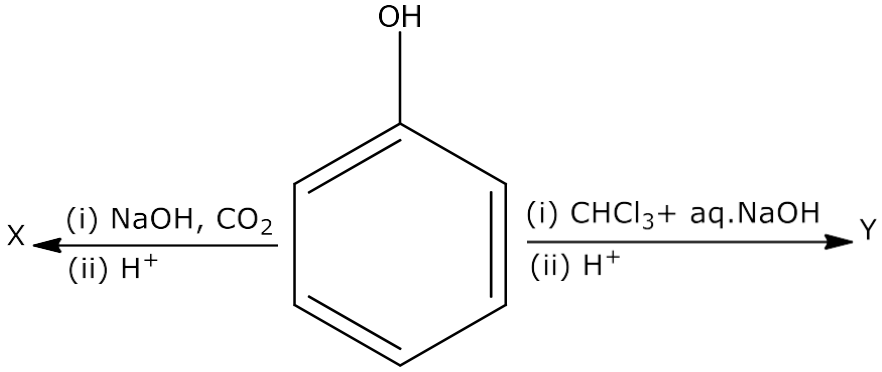
(d) All of these

**Solution:**

Correct answer – (c): $NO_2$–

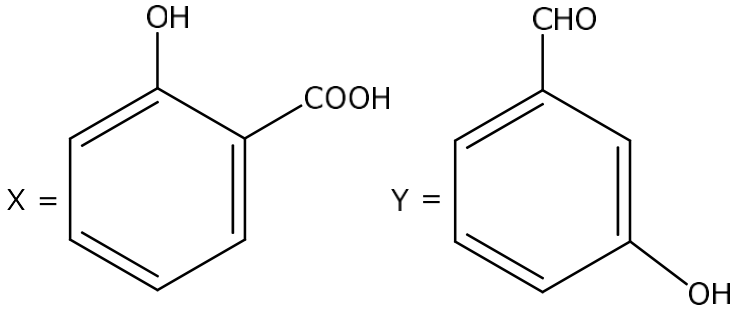
$NO_2$ group increases the acidic character of phenol because of -I effect.

43. Consider the following reaction:

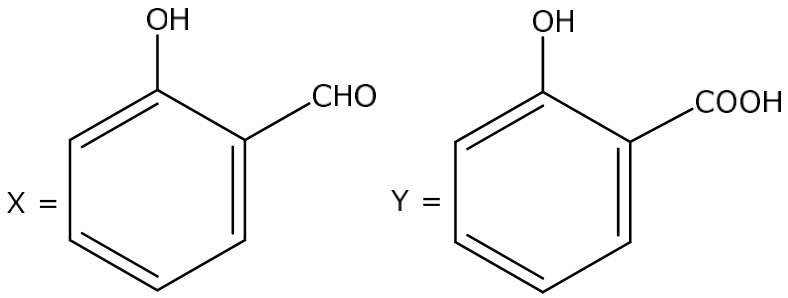



the products X and Y are

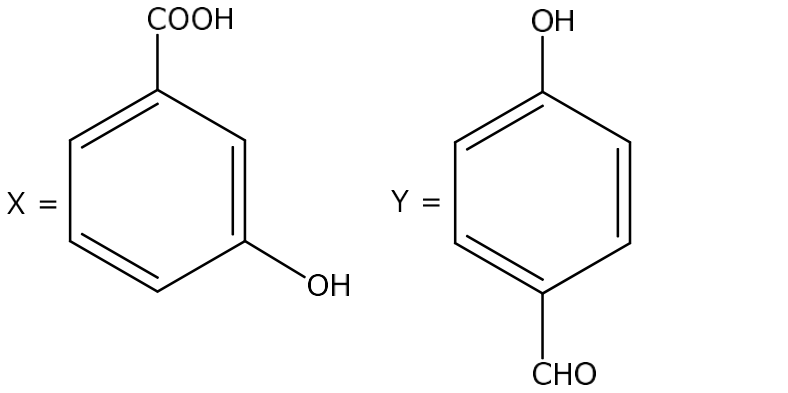
a)



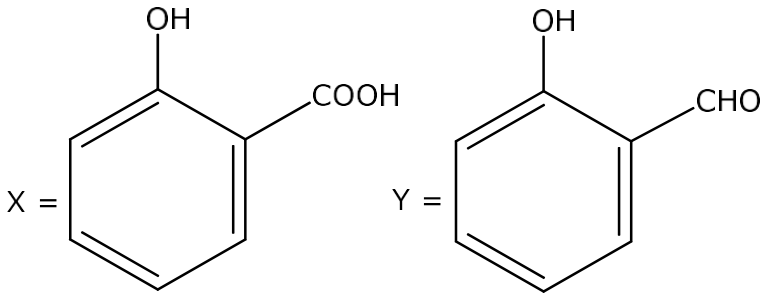
b)




c)

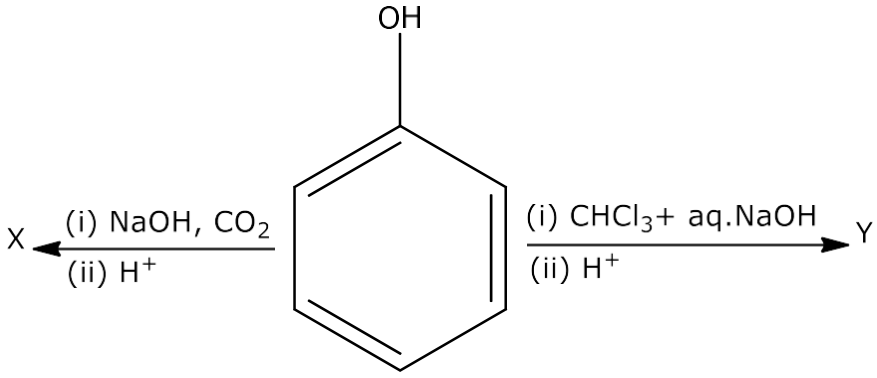



d)

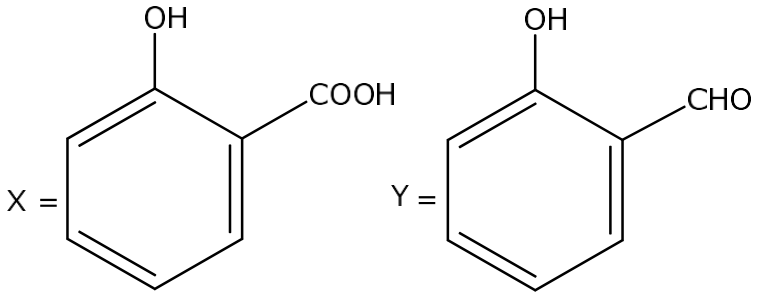



**Solution:**

Correct answer – (d): X is and acid and Y is an aldehyde




The products X and Y are:




44. What will be the product for the following reaction?

$CH_3CH_2OH \xrightarrow{CrO_3}$

(a) $CH_3CH_2COOH$

(b) $CH_3CHO$

(c) $CH_2CH_2$

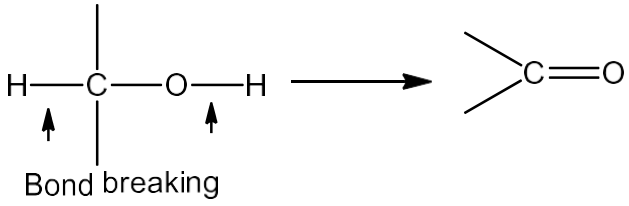
(d) $CH_3COOH$

**Solution:**

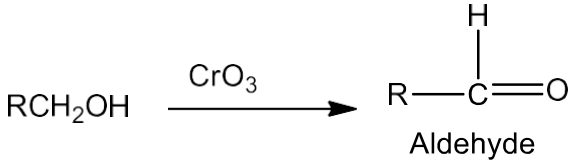
Correct answer – (b) $CH_3CHO$

$CH_3CH_2OH \xrightarrow{CrO_3} CH_3CHO$

The oxidation of alcohols results in the formation of a carbon-oxygen double bond with the cleavage of an O-H and C-H bonds. The reaction is known as dehydrogenation reaction as it involves loss of dihydrogen from an alcohol molecule.




$CrO_3$ in anhydrous medium is used for obtaining aldehydes.




45. Predict the product for the following reaction:

$C_2H_5OH \xrightarrow[443K]{H_2SO_4}$

(a) $CH_2=CH_2$

(b) $CH_3-CH_3$

(c) $CH_3CHO$

(d) $CH_3COOH$

**Solution:**

Correct answer – (a): $CH_2=CH_2$

$$C_2H_5OH \xrightarrow[443K]{H_2SO_4} CH_2=CH_2 + H_2O$$

Primary alcohol undergoes dehydration by heating it with conc. $H_2SO_4$ at 443K.

**Read the passage given below and answer the questions (46 to 50):**

Vapour pressure of a solvent in solution is less than that of the pure solvent. Vapour pressure of solution decreases when a non-volatile solute is added to a volatile solvent. There are many properties of solutions which are connected with this decrease of vapour pressure. These are:

- Relative lowering of vapour pressure of the solvent
- Elevation of boiling point of the solvent
- Depression of freezing point of the solvent
- Osmotic pressure of the solution

All these above properties depend on the number of solute particles irrespective of their nature relative to the total number of particles present in the solution. Such properties are called colligative properties. Colligative is a Latin word. In this, 'Co' means together and 'ligare' means to bind.

46. The best colligative property for the determination of molecular weight of proteins and polymers is:
    (a) Lowering in vapour pressure
    (b) Osmotic pressure of the solution
    (c) Elevation in boiling point
    (d) Lowering in freezing point
    **Solution:**
    Correct answer – (b) Osmotic pressure of the solution
    Osmotic pressure method is especially suitable for the determination of molecular masses of macromolecules such as protein & polymer because for these substances the value of other colligative properties such as elevation in boiling point or depression in freezing point are too small to be measured on the other hand osmotic pressure of such substances are measurable.

47. The one which is NOT a colligative property is:
    (a) Depression in freezing point
    (b) Osmotic pressure of solution
    (c) Lowering of vapour pressure
    (d) Boiling point elevation
    **Solution:**
    Correct answer – (c) Lowering of vapour pressure
    Relative lowering in vapour pressure is the colligative property but not the lowering in vapour pressure.

48. Elevation of boiling point of 1 M KCl solution in comparison to that of 1 M sugar solution is nearly:
(a) Double
(b) Triple
(c) Same
(d) None of the above
**Solution:**
Correct answer – (a) Double
KCl dissociates into $K^+$ and $Cl^-$, i.e., i = 2. Whereas, sugar doesn't dissociate to give ions. Since, elevation in boiling point is directly proportional to "i" value. Therefore, the elevation in boiling point of 1M KCl solution is nearly double than that of 1 M sugar solution.

49. Out of 0.1 molal aqueous solution of glucose and 0.1 molal aqueous solution of KCl, which one will have higher boiling point?
(a) 0.1 molal aqueous solution of glucose
(b) 0.1 molal aqueous solution of KCl
(c) Both will have same boiling point
(d) It will depend on atmospheric moisture
**Solution:**
Correct answer – (b) 0.1 molal KCl solution
In the same volume of water, 0.1 mole of KCl will have greater boiling point elevation, as boiling point elevation is a colligative property which depends on the relative amounts of constituents and not on their identity.
Since more ions will be produced by KCl (ionic compound) than glucose (covalent compound) as there are more component parts in the KCl molecule, the KCl solution will have a higher boiling point.

50. Addition of non-volatile potassium iodide in water at 298 K results into reduction of vapour pressure from 23.8 mm Hg to 2.0 cm Hg. What is the mole fraction of solute in the solution?
(a) 0.160
(b) 0.080
(c) 0.250
(d) 0.055
**Solution:**
Correct answer – (a) 0.160
$P^0_{water}$ = 23.8 mm Hg
$P_{water}$ = 2.0 mm Hg = 20.0 mm Hg (after addition of solute)
From the law of relative lowering vapour pressure,
$\Delta P = X_2 \times P°$ (where $X_2$ is the mole fraction of solute)
On rearranging, $\Delta P / P^0 = X_2$
$\Delta P$ = 23.8 – 20.0 = 3.8 mm Hg
$X_2$ = 3.8/23.8 = 0.160