CBSE Class 11 Chemistry

Sample Paper 02 (2019-20)

Maximum Marks: 70

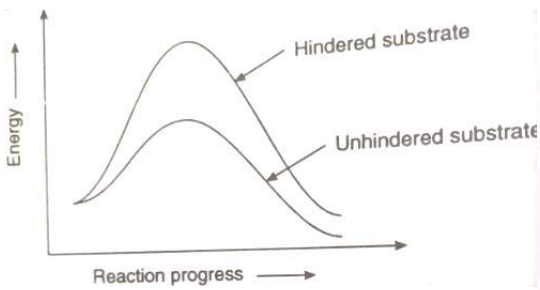
Time Allowed: 3 hours

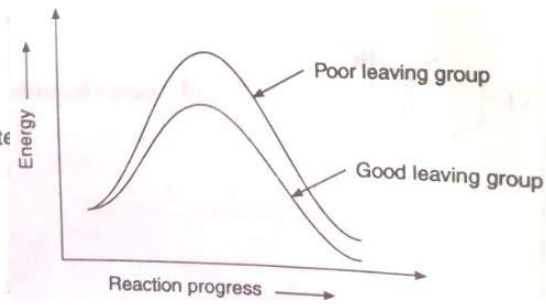
General Instructions:

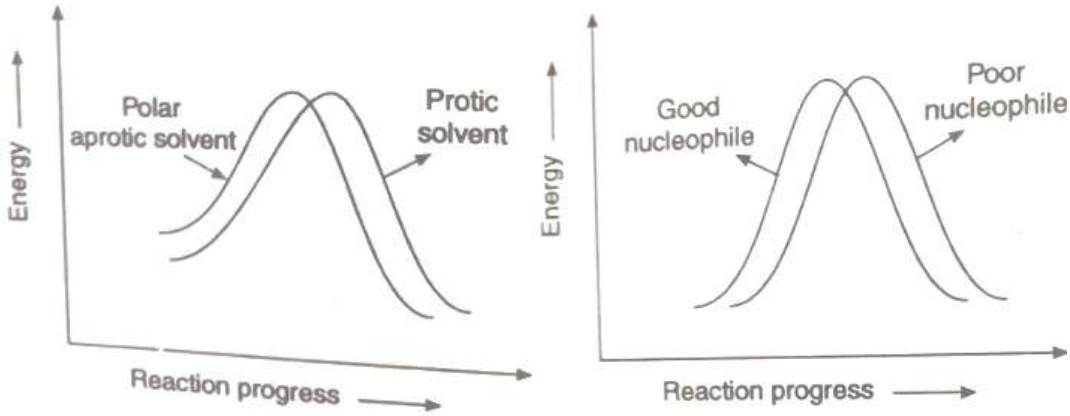
a. All questions are compulsory.
b. Section A: Q.no. 1 to 16 are very short answer questions (objective type) and carry 1 mark each.
c. Section B: Q.no. 17 to 23 are short answer questions and carry 2 marks each.
d. Section C: Q.no. 24 to 30 are long answer questions and carry 3 marks each.
e. Section D: Q.no. 31 to 33 are also long answer questions and carry 5 marks each.
f. There is no overall choice. However an internal choice has been provided in two questions of two marks, two questions of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
g. Use log tables if necessary, use of calculators is not allowed.

Section A

1. Bimolecular nucleophilic substitution (S_N2) has four variable, i.e., substrate structure, nucleophile, leaving group and solvent, Reaction energy level diagram for these factors are given in the following diagrams:







Answer the following questions.

i. Steric hindrance raises the energy of the transition state, increasing ΔG and decreasing the reaction rate. (True/False)
ii. How does more reactive nucleophile decrease the ΔG and increase the rate of reaction?
iii. Nueutral nucleophiles are _____ reactive than negatively charged nucleophiles.
iv. Good leaving groups, lower the energy of the transition staet, thus _____ ΔG and _____ the reaction rate.
v. How does Protic solvent affect the ΔG and rate of reaction?

2. Arrange X-rays, cosmic rays and radio waves according to frequency.

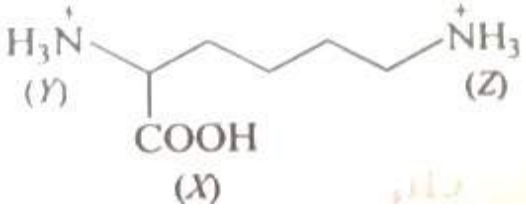
3. Arrange the following elements in the increasing order of metallic character: Si, Be, Mg, Na, P.

4. Neither q nor W is a state function but q + W is a state function. Explain why?

5. Why do hydrides and halides of Be polymerise?

6. Which oxide of nitrogen is a major concern as an air pollutant?

7. In the compound given below:



the correct order of acidity of the positions (X), (Y) and (Z) is:

a. (X) > (Y) > (Z)

b. (X) > (Z) > (Y)

c. (Z) > (X) > (Y)

d. (Y) > (X) > (Z)

8. When methane is burnt in oxygen to produce CO_2 and H_2O the oxidation number of carbon changes by

   a. +4

   b. Zero

   c. +8

   d. -8

9. Hot $\mathrm{H_2}$ can reduce copper(II) oxide, forming the pure metal and $\mathrm{H_2O}$. What volume of $\mathrm{H_2}$ at 765 torr and $225^{\circ}\mathrm{C}$ is needed to reduce 35.5 g of copper(II) oxide?

   a. 13.1 L

   b. 22.3 L

   c. 18.1 L

   d. 15.7 L

10. The oxidizing power of halogens increase in the order of

    a. $\mathrm{I_2 < Br_2 < Cl_2 < F_2}$

    b. $\mathrm{F_2 < I_2 < Br_2 < Cl_2}$

    c. $\mathrm{Br_2 < Cl_2 < F_2 < \ I_2}$

    d. $\mathrm{Cl_2 < F_2 < \ I_2 < \ Br_2}$

11. The principle of partition chromatography is

    a. continuous differential partitioning of components of a mixture

b. separation of ions and polar molecules based on their affinity to ion exchanger

c. separation of substances of a mixture over a thin layer of an adsorbent

d. separation of a mixture over a column of adsorbent

12. **Assertion:** Graphite is soft and a good lubricating agent.
Reason: The successive layers in graphite are held together by weak forces of attraction.

a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

c. Assertion is CORRECT but, reason is INCORRECT.

d. Assertion is INCORRECT but, reason is CORRECT.

13. **Assertion:** Vapour density of sulphur relative to oxygen is 2 because sulphur atom is twice as heavy as that of the oxygen atom.
Reason: Vapour density depends upon the molecular state of the substance in the vapour state.

a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

c. Assertion is CORRECT but, reason is INCORRECT.

d. Assertion is INCORRECT but, reason is CORRECT.

14. **Assertion:** Fluorine acts as a stronger reducing agent than oxygen.
Reason: Fluorine is more electronegative.

a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of

the assertion.

b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

c. Assertion is CORRECT but, reason is INCORRECT.

d. Assertion is INCORRECT but, reason is CORRECT.

15. **Assertion:** Addition of Br_2 to but-1-ene gives two optical isomers.
Reason: The product contains one asymmetric carbon atom.

a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

c. Assertion is CORRECT but, reason is INCORRECT.

d. Assertion is INCORRECT but, reason is CORRECT.

16. **Assertion:** Compressibility factor ideal gases is one.
Reason: For ideal gasses, pV = nRT equation is obeyed.

a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

c. Assertion is CORRECT but, reason is INCORRECT.

d. Assertion is INCORRECT but, reason is CORRECT.

Section B

17. Why does formic acid exist as dimer? What is it's one consequence?

18. An iron rod is immersed in a solution containing 1.0M $NiSO_4$ and 1.0M $ZnSO_4$. Predict

giving reasons which of the following reactions is likely to proceed?

i. Fe reduces Zn^{2+} ions

ii. Iron reduces Ni^{2+} ions.

Given:

$E^{\circ}_{Zn^{2+}/Zn}$ = -0.76 V, $E^{\circ}_{Fe^{2+}/Fe}$ = - 0.44 V and $E^{\circ}_{Ni^{2+}/Ni}$ = -0.25 V

19. What makes lithium to show properties uncommon to the rest of the alkali metals?

20. How will you account for the structure of benzene?

21. The pH of a sample of vinegar is 3.76. Calculate the concentration of hydrogen ion in it.

OR

Draw the Lewis structures for the following molecules and ions:

H_2S, $SiCl_4$, BeF_2, CO_3^{2-}, HCOOH

22. An organic liquid decomposes below its boiling point. How will you purify it?

OR

For the reaction 2 Cl (g) $\longrightarrow$ Cl_2 (g) what will be the signs of ΔH and ΔS?

23. Cyclobutane is less reactive than cyclopropane. Justify.

Section C

24. Justify the following statements.

i. Reaction with negative Gibb's energy always has an equilibrium constant greater than 1.

ii. Many thermodynamically feasible reactions do not occur under ordinary conditions.

iii. At low temperatures, enthalpy change dominates the ΔG expression and at high temperatures, it is the entropy that dominates the value of ΔG.

25. i. How bond energy varies from N_2^- to N_2^+ and why?

ii. On the basis of molecular orbital theory, what is a similarity theory
   a. F2 and N_2^{2-}
   b. CO, N^2, NO^+?

OR

If 0.561 g of KOH is dissolved in water to give 200 mL of solution at 298 K, calculate the concentrations of potassium, hydrogen and hydroxyl ions. What is its pH?

26. Consider the elements;
' Cs, Ne, I, F ',
and identify the element that exhibits,

i. -ve oxidation state.
ii. +ve oxidation state.
iii. both +ve and -ve oxidation states.
iv. neither exhibits neither +ve nor -ve oxidation state.

27. A 2.0 L container at 25°C contains 1.25 moles of O_2 and 3.2 moles of C.

i. What is the initial pressure in the flask?
ii. If the carbon and oxygen react as completely as possible to form CO, what will be the final pressure in the container?

28. A box contains some identical red coloured balls, labelled as A, each weighing 2 grams. Another box contains identical blue coloured balls, labelled as B, each weighing 5 grams. Consider the combinations AB, AB_2, A_2B and A_2B_3 and show that law of multiple proportions is applicable.

29. Use periodic table to answer the following questions: (a) Identify the element with five electrons in the outer sub-shell. (b) Identify the element that would tend to lose two electrons. (c) Identify the element that would tend to gain two electrons.

OR

Give the name and an atomic number of the inert gas atom in which the total number of d-electrons is equal to the difference in numbers of total p and s electrons.

30. What are the harmful effects of oxides of nitrogen in atmosphere?

Section D

31. Give justification and classify the following substances into oxidising and reducing agents.

    i. Carbon
    ii. Ozone
    iii. Nascent hydrogen
    iv. Nitric acid
    v. Chlorine
    vi. Sulphur dioxide

OR

Do you expect different products in solution when aluminium (III) chloride and potassium chloride treated separately with

i. normal water
ii. acidified water, and
iii. alkaline water

Write equations wherever necessary.

32. A monosubstituted alkyl benzene of the formula $C_{10}H_{14}$ resists vigorous oxidation to an aryl carboxylic acid. Name the compound and write its various monosubstituted isomers.

OR

How will you convert benzene into
(i) p-nitrobromobenzene
(ii) m-nitrochlorobenzene
(iii) p-nitrotoluene
(iv) acetophenone

33. i. The diameter of zinc atom is $2.6\overset{\circ}{A}$. Calculate
    a. the radius of zinc atom in pm
    b. number of atoms present in a length of 1.6 cm if the zinc atoms are arranged side by side lengthwise.

    ii. 2×10^8 atoms of carbon are arranged side by side. Calculate the radius of carbon atom if length of this arrangement is 2.4 cm.

OR

Arrange the following in order of their increasing masses in gram:

i. one atom of silver,
ii. one gram-atom of nitrogen,
iii. one mole of calcium, carbon and
iv. one mole of oxygen molecules,
v. 10^{23} atoms of carbon.

CBSE Class 11 Chemistry
Sample Paper 02 (2019-20)

Solution

Section A

1. i. The given statement is true.
   ii. More ractive nucleophile are less stable and have higher ground state energy thereby decreasing the ΔG and increasing the rate of reaction.
   iii. Less reactive.
   iv. Decreasing, Increasing
   v. Protic solvents solvate the nucleophile, thereby lowering its ground-state energy, increasing ΔG and decreasing the reaction rate.

2. Cosmic rays > X-rays > radio waves.

3. As we know the metallic character decreases as we move left to right (along the period) in the periodic table and increases as we move top to bottom (in group).
   Therefore, correct order of increase in metallic character is:
   P < Si < Be < Mg < Na

4. q and W are not state functions. But as we know that,
   q + W = ΔU, which is a state function.
   Hence, q + W is a state function.

5. BeH_2 and $BeCl_2$ have only four electrons in their valence shell. So, they are electron-deficient molecules.
   In order to gain stability, they polymerise to make long chains.
   They form coordinate bonds between lone pairs of halide atoms and adjacent beryllium atoms.
   Thus, BeH_2 and $BeCl_2$ have polymeric structures.

6. Nitrogen dioxide as an oxide of nitrogen is a major concern as an air pollutant.

7. (a) (X) > (Y) > (Z)
   Explanation: (X) > (Y) > (Z)

8. (a) +4

   Explanation: When methane is burnt in oxygen to produce CO_2 and H_2O with great amount of heat and light is produced ang the oxidation number of carbon changes from -4 to +4. During this following reaction takes place:

   CH_4+2O_2 ---------->CO_2+2H_2O+Energy.

9. (c) 18.1 L

   Explanation:

   $$CuO + H_2 \rightarrow Cu + H_2O$$

   1 mol of H_2 is required to reduce 1 mol of CuO. Mole of CuO=35.5/79.5=0.45 mol. So, moles of H_2 = 0.45mol.

   PV=nRT here P=765torr , n=0.45mol ,T=498K

   so V=18.1L

10. (a) $I_2 < Br_2 < Cl_2 < F_2$

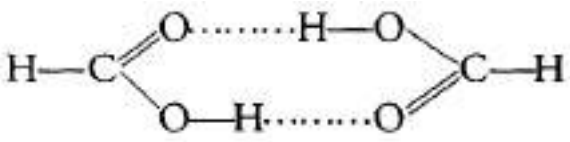
    Explanation: Halogens have high electronegativity and electron affinity. They have greater tendency to accept electrons or easily reduced, therefore they are strong oxidizing agent.

    As the reduction potential decrease down the group,the oxidizing power decrease down the group the order of the oxidizing power will be as under
    F2 > Cl2> Br2> I2
    ¥ The oxidizing power depends on,
    Heat of dissociation of halogen molecule.
    Electron affinity of atom.
    Hydration energy of the ion.
    Heat of vaporization
    If a halogen has low energy of dissociation, a high electron affinity, and higher hydration of its ion, it will have high oxidizing power.
    F has although low electron affinity than Cl but low dissociation energy and have high hydration energy of its ion, therefore Fluorine is strongest oxidizing agent.

11. (a) continuous differential partitioning of components of a mixture
    Explanation: Partition chromatography is based on continuous differential partitioning of components of a mixture between stationary and mobile phases. Paper chromatography is a type of partition chromatography. In paper chromatography, a special quality paper known as chromatography paper is used. Chromatography paper contains water trapped in it, which acts as the stationary phase.
12. (a) Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
    Explanation: Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
13. (d) Assertion is INCORRECT but, reason is CORRECT.
    Explanation: Assertion is INCORRECT but, reason is CORRECT.
14. (b) Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
    Explanation: Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
15. (a) Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
    Explanation: Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
16. (a) Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
    Explanation: Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

Section B

17. Formic acid exists as dimer due to intermolecular hydrogen bonding. The structure is shown below:



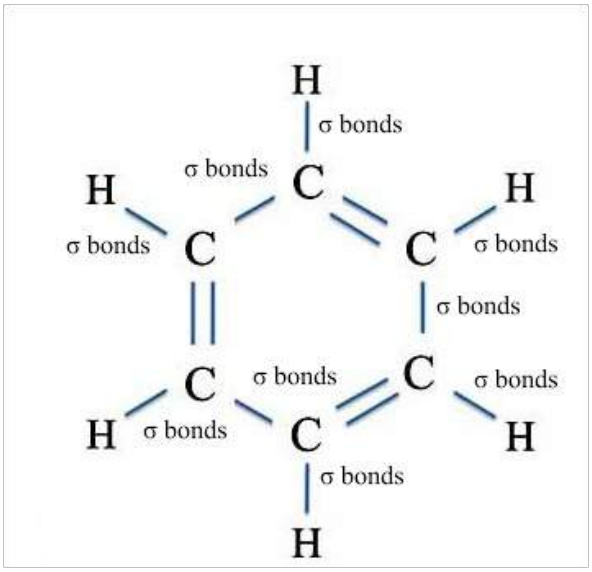
    Consequence: The molar mass of formic acid increases.

18. From Standard reduction potential data we know higher the negative value of E^o, higher is the reducing tendency of an atom and vice versa.

    i. Since E° of Zn is more negative than that of Fe, therefore, Zn will be oxidized to Zn^{2+} ions while Fe^{2+} ions will be reduced to Fe. In other words, Fe will not reduce Zn^{2+} ions.
    ii. Since E° of Fe is more negative than that of Ni, therefore, Fe will be oxidized to Fe^{2+} ions while Ni^{2+} ions will be reduced to Ni. Thus, Fe reduces Ni^{2+} ions.

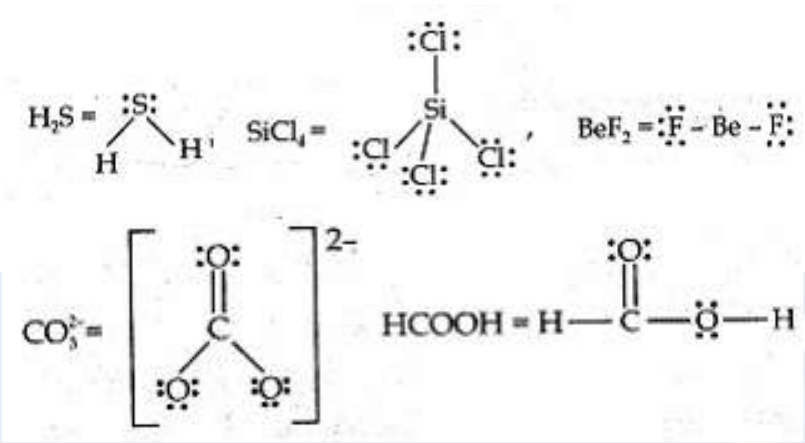
19. The anomalous behaviour of lithium is due to the : (i) exceptionally small size of lithium atom and lithium-ion, and (ii) high polarising power (i.e., charge/ radius ratio). As a result, there is increased covalent character of lithium compounds which is responsible for its anomalous behaviour.

20. Benzene is a six-carbon membered ring which includes three double bond. The double bonds within this structure are mainly separated by a single bond, hence this arrangement is recognized to have conjugated double bonds. All of the carbon-carbon bonds in the benzene molecule are of the same length. The six carbon atoms in benzene are sp^2 hydridised. Two sp^2 hydrid orbitals of each carbon atom overlap with sp^2 hydrid orbitals of adjacent carbon atoms to form six C-C sigma bonds with are in the hexagonal plane. The remaining sp^2 hybrid orbital of each carbon atom overlaps with s-orbital of a hydrogen atom to form six C-H sigma bonds. Each carbon atom is now left with one hybridized p-orbital perpendicular to the plane of the ring.



21. We know that, pH = -log[H^+] or log [H^+] = -pH = -3.76 = $\overline{4}.24$ Before taking antilog, add -1 in the characteristic (-3) and +1 in mantissa (0.76), i.e. (-3.76-1 +1 =$\overline{4}.24$)]
$\therefore [H^+] = Anti\log \overline{4}.24 = 1.738 \times 10^{-4} M = 1.74 \times 10^{-4} M$

OR



22. By distillation under reduced pressure.

OR

ΔH: negative (-ve) because energy is released in bond formation
ΔS: negative (-ve) because entropy decreases when atoms combine to form molecules.

23. In cyclobutane molecule, the C-C-C bond angle is 90^0 while it is 60^0 in cyclopropane. Thus, the deviation from the tetrahedral bond angle (109^0 28') in cyclobutane is less than in cyclopropane. Therefore, cyclobutane has less bond strain as compared to cyclopropane and thus, cyclobutane is less reactive as compared to cyclopropane.

Section C

24. i. We know that, ΔG = - 2.303 RT log K.
Thus, when ΔG° < 0, K > 1.
ii. Under ordinary conditions, the average energy of the reactants may be less than threshold energy. They requires some activation energy to initiate the reaction. So, many thermodynamically feasible reactions do not occur under ordinary

conditions.

iii. We know that, $\Delta G = \Delta H - T\Delta S$.

At low temperature, $T\Delta S$ is small.

Hence, ΔH dominates.

At high temperature, $T\Delta S$ is large.

Hence, ΔS dominates the value of ΔG.

25. i. Bond energy of N_2^+ = Bond energy of N_2^- because bond order is the same in both species. [However, N_2^+ is slightly more stable than N_2^- as antibonding electrons number is higher in N_2^- than in N_2^+]

ii.

a. Both F_2 and O_2^{2-} have some bond order some bond length and are diamagnetic

b. These are isoelectric species, possess the same bond order and same bond length.

OR

Molarity of KOH, M = $\frac{\text{mass of KOH(g)} \times 1000}{\text{molar mass (KOH)} \times \text{Volume of solution (in mL)}}$

$\Rightarrow$ M = $\frac{0.561 \times 1000}{56 \times 200}$

$\Rightarrow$ M = 0.05 mol L^{-1}

We know that, Molar mass of KOH = 39 + 16 + 1 = 56 g mol^{-1}

Reaction:

$$KOH \longrightarrow K^+ + OH^-$$

Now, $[K^+]$ = 0.05 M and $[OH^-]$ = 0.05 M

We know that, $[H^+][OH] = K_w = 1.0 \times 10^{-14}$

$\Rightarrow [H^+] = \frac{1.0 \times 10^{-14}}{0.05}$

$= 20 \times 10^{-14}$ M

$= 2 \times 10^{-13}$ M

We know that, $pH = -\log[H^+]$

$= -\log[2 \times 10^{-13}]$

= -0.3010 + 13

= 12.7

26. i. F.

Fluorine being the most electronegative element shows only a -ve oxidation state of -1.

ii. Cs.

Alkali metals because of the presence of a single electron in the valence shell, exhibit an oxidation state of + 1 only.

iii. I

Due to the presence of d -orbitals and seven electrons in the valence shell of iodine (I), it shows an oxidation state of

a. -1, in compounds of iodine with more electropositive elements with an oxidation state of +1 (such as H, Na, K Ca, etc.)
b. positive oxidation states of +2, +5 +7 in its compounds with more electronegative elements (such as i.e., O, F, etc.).
c. Ne

Explanation: It is an inert gas with high ionization enthalpy and high positive electron gain enthalpy. Hence, it exhibits neither +ve nor -ve oxidation states in its compounds.

27. According to the question, the container contains 1.25 moles of O_2 and 3.2 moles of C.

i. Since only oxygen is gaseous and carbon will not exert any pressure.

n = 1.25 mol, $V = 2.0\ L,\ T = 273 + 25 = 298\ K$

We know that, $p = \frac{nRT}{V}$

= $\frac{(1.25\ \text{mol}) \times \left(0.0821\ \text{L atm mol}^{-1}\text{K}^{-1}\right)(298\ \text{K})}{(2.0\ \text{L})}$

= 15.3 atm

ii. Reaction:

$C + \frac{1}{2}\ O_2 \rightarrow CO$

Here, $\frac{1}{2}$ mole of O_2 gives 1 mole CO.

1 mole of O_2 gives 2 mole CO.

1.25 mol of O_2 will give CO = $1 \times 2 \times 1.25$

= 2.50 mol

∴ Final pressure =

$$p = \frac{(2.50\ \text{mol}) \times \left(0.0821\ L\ atm\ K^{-1}\text{mol}^{-1}\right) \times (298\text{K})}{2.0\ L}$$

= 30.6 atm.

28. The law states that, when two elements combine to form two or more compounds, then the different masses of one element, which combine with a fixed mass of the other, bear a simple ratio to one another.

    For the combination, AB
    1g of A combines with $\frac{5}{2}g$ of B = 2.5g of B

    For AB_2
    1g of A combines with $\frac{10}{2}g$ of B = 5g of B

    For A_2B
    1g of A combines with $\frac{5}{4}g$ of B = 1.25g of B

    For A_2B_2
    1g of A combines with $\frac{15}{4}g$ of B = 3.75g of B

    Here the same mass of A(1g) combines with different masses of B i.e, 1.25, 2.5, 3.75 & 5g which bears a simple whole-number ratio i.e., 1 : 2 : 3 : 4. Hence the law of multiple proportions proved.

29. (a) Element belonging to Group 15 with outer electronic configuration as $ns^2\ np^3$ e.g., nitrogen. (b) Element belonging to Group 2 with outer electronic configuration as ns^2 e.g., magnesium. (c) Element belonging to Group 16 with outer electronic configuration as $ns^2\ np^4$ e.g., oxygen.

OR

The Kr is the first Noble gas with atomic number 36 that contains electrons in d-orbit.
The electronic configuration of Kr is: $1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^6$, $3d^{10}$, $4s^2$, $4p^6$
Total number of d-electrons = 10
Total number of p-electrons = 18
Total number of s-electrons = 8

∴ Difference in total number of p and s electrons =18 - 8 = 10
Thus, the inert gas is krypton.

30. Nitrogen oxides are mixture of NO (nitric oxide) and Nitrogen dioxide (NO_2) creating harmful health harzards. Some harmful effect of these oxides are:

i. High concentration of NO_2 in atmosphere is harmful to plants resulting in leaf spotting, retardation of photosynthetic activity and also suppression the vegetation growth.
ii. Nitrogen dioxide (NO_2) results in respiratory problems in human beings and leads to bronchitis. It causes acid rain and responsible for formation of photochemical smog.
iii. Oxides of nitrogen have harmful effects on the nylon, rayon and cotton yarns and also cause cracks in rubber.
iv. They also react with ozone (O_3) present in the atmosphere, and decrease the density of ozone.

Section D

31. i. Carbon has a high affinity towards oxygen so it is generally used as a reducing agent. However, in the case of highly reactive metals, it cannot be used as a reducing agent.
ii. Ozone is a source of oxygen generally behaves as an oxidizing agent.
iii. As we know the addition of hydrogen is called reduction so nascent hydrogen behaves as a reducing agent.
iv. Nitric acid is a good oxidant i.e., oxidizing agents as it readily provides oxygen.
v. Chlorine can behave as oxidant as well as reductant depending upon the nature of the other reactant.
vi. SO_2 can also behave as an oxidant as well as a reductant.

OR

i. $AlCl_3$ is salt of a weak base Al $(OH)_3$ and a strong acid HCI. Therefore, in normal water, it undergoes hydrolysis as:

$AlCl_3\,(s)\ 3H_2O(l) \rightarrow Al(OH)_3\,(s) + 3H^+\,(aq) + 3Cl^-\,(aq)$

ii. In acidic water, H^+ ions react with $Al(OH)_3$ to form Al^{3+} (aq) ions and water. Thus, in acidic water $AlCl_3$ exists as Al^{3+} (aq) and Cl^- (aq) ions.

$$AlCl_3\,(s) \xrightarrow[water]{acidified} Al^{3+}(aq)\,(s) + 3Cl^-\,(aq)$$

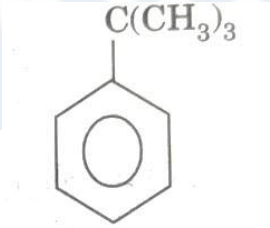
iii. In alkaline water, $Al(OH)_3$ reacts to form tetra hydroxoaluminate complex or metaluminate ion: $Al(OH)_3\,(s) + OH^-\,(aq) \rightarrow \underset{\text{Tetrahydroxo aluminate ion}}{[Al(OH)_4]^-}$ or

$$\underset{\text{Metaluminate ion}}{AlO_2^-} + 2H_2O(l)$$

Therefore, the aqueous solution of KCI is neutral and hence the ions do not react in acidified or alkaline water.

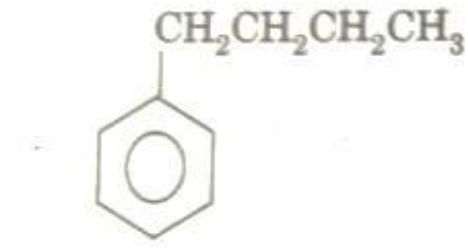
$$KCl\,(s)\,3H_2O(l) \xrightarrow{Water} K^+\,(aq) + Cl^-\,(aq)$$

32. An alkyl group on benzene nucleus undergoes oxidation if it has at least one benzylic hydrogen atom. Since it resists oxidation, it means that it has no hydrogen on benzylic carbon. Therefore, it should be tertiary. So, the compound is tert-burtyl benzene as

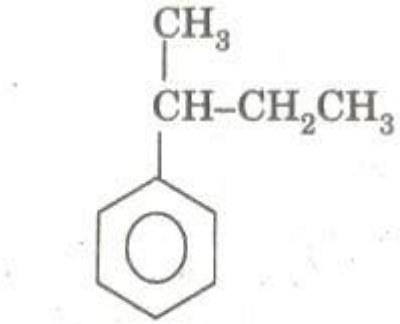


tert-butylbenzene

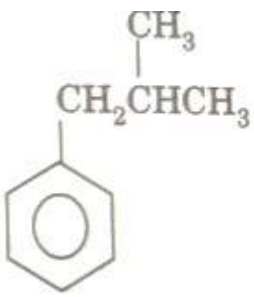
Other monosubstituted isomers are:



n-Butyl benzene



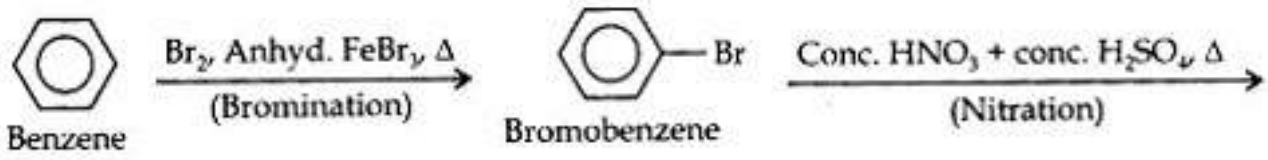
sec-Butyl benzene

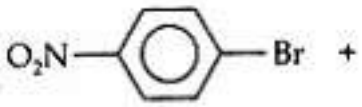


2-Methyl propyl benzene

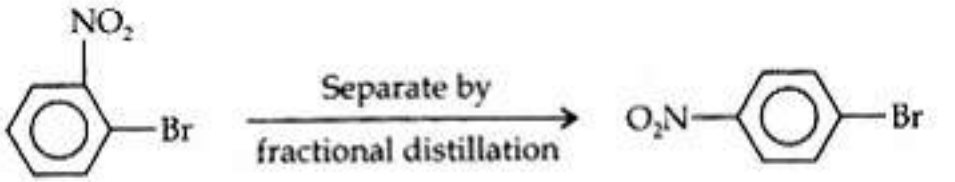
OR

(i) The two substituents in the benzene ring are present at p-positions. Therefore, the sequence of reactions should be such that first an o, p-directing group, i.e., Br atom should be introduced in the benzene ring and this should be followed by nitration. Thus,





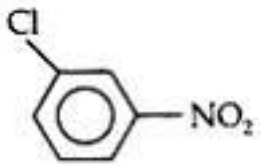
p-Bromonitrobenzene
(major)



o-Bromonitrobenzene
(minor)

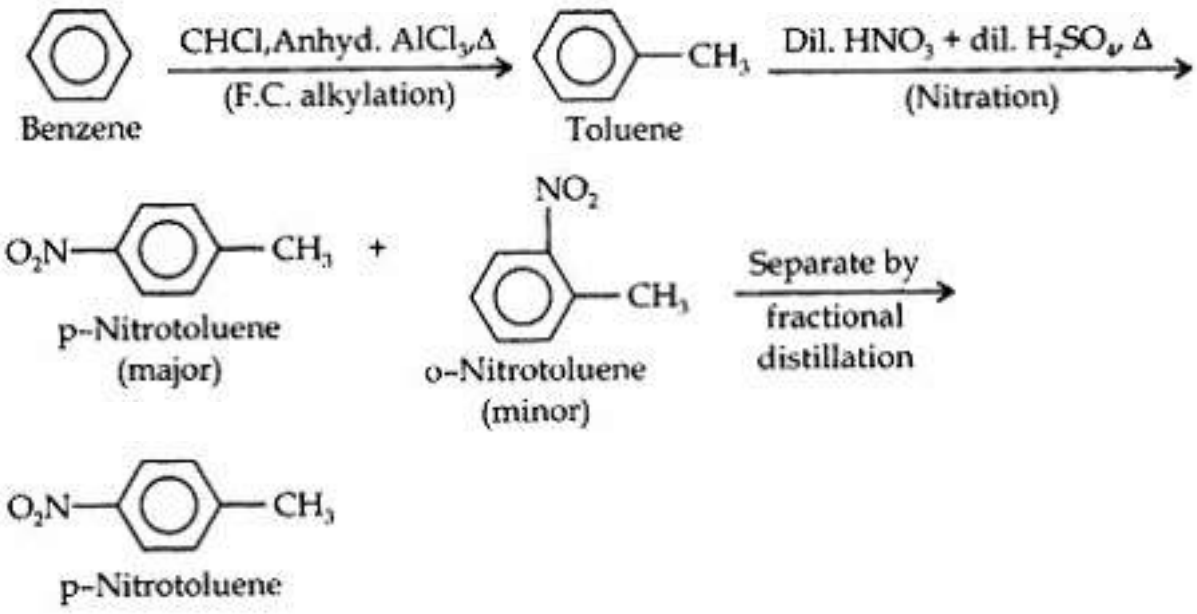
p-Bromonitrobenzene

(ii) Here since the two substituents are at m-position w.r.t each other, therefore the first substituent in the benzene ring should be a m-directing group (i.e. NO_2) and then other group (ie. Cl) should be introduced. Therefore the sequence of reactions is:

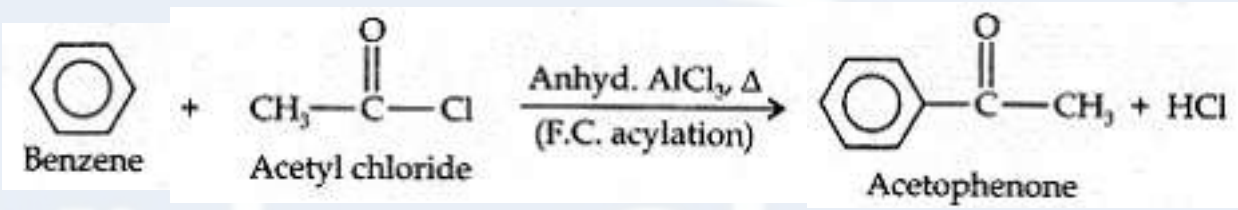


m-Chloronitrobenzene

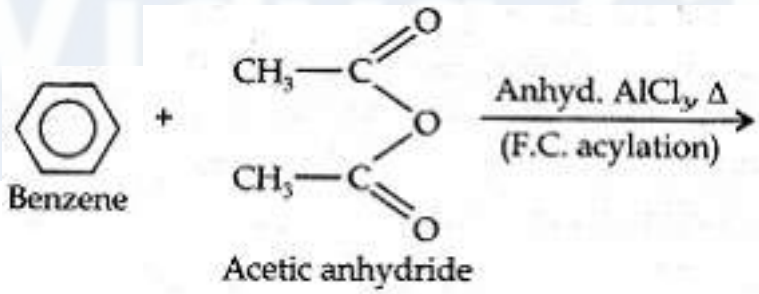
(iii) Here since the two substituents are at p-position w.r.t each other, therefore, the first substituent in the benzene ring should be a o, p-directing group (ie. CH_3) and then the other group (i.e. NO_2) should be introduced.

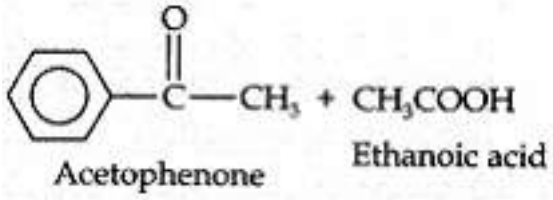


(iv) Acetophenone can be prepared by F.C acylation using either acetul chloride or acetic anhydride



or





33. i. a. Diameter of zinc atom = 2.6 $\mathring{A}$ = 2.6×10^{-10}m

Radius = $\frac{2.6\times10^{-10}}{2}$ = 1.3×10^{-10}m = 130×10^{-12}m

or = 130 pm

b. No. of Zn atoms present on a 1.6 cm length = $\frac{1.6}{2.6\times10^{-10}\times10^{2}}$ = 6.154×10^{7}

ii. The length of the arrangement = 2.4 cm

Total number of carbon atoms present = 2×10^8

The diameter of each carbon atom = $\frac{(2.4\text{cm})}{(2\times 10^8)} = 1.2 \times 10^{-8}$ cm

The radius of each carbon atom ,= $\frac{1}{2}\left(1.2 \times 10^{-8}\right)$ = 6.0×10^{-9} cm

= 0.06 nm

OR

i. 1 mole of silver (Ag) atom = 108 g = 6.022×10^{23} atoms.

   Mass of 6.022×10^{23} atoms of silver (Ag)= 108 g.

   Therefore, Mass of 1 atom of silver (Ag) = $\left(\frac{108}{6.022\times 10^{23}}\right)$ = 1.793×10^{-22} g

ii. Mass of 1 g atom of nitrogen (N) = gram atomic mass of nitrogen (N) = 14.0 g.

iii. Mass of a mole of calcium (Ca) = Gram Atomic mass of calcium (Ca)= 40.0 g.

iv. Mass of 1 mole of carbon (C) atom = 12 g = 6.023×10^{23} atoms.

   Mass of 6.023×10^{23} atoms of carbon (C) = 12 g.

   Therefore, Mass of 10^{23} atoms of carbon (C) = $\left(\frac{12}{6.023\times 10^{23}}\right) \times 10^{23} = 1.992\text{g}$

v. Mass of iron (Fe) = 1.0 g.

Hence, the required order of increasing masses is,

one atom of silver (Ag) < one gram of iron (Fe) < 10^{23} atoms of carbon (C) < one-gram atom of nitrogen (N) < one mole of oxygen (O) < one mole of calcium (Ca).