CBSE Class 11 Chemistry
Sample Paper 07 (2019-20)

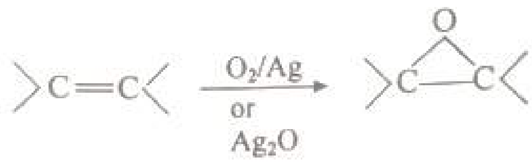
Maximum Marks: 70
Time Allowed: 3 hours

General Instructions:

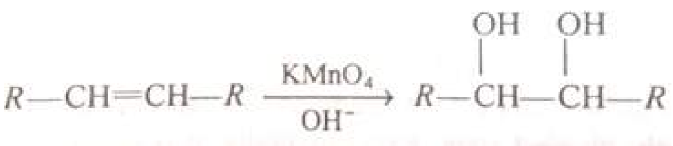
a. All questions are compulsory.
b. Section A: Q.no. 1 to 16 are very short answer questions (objective type) and carry 1 mark each.
c. Section B: Q.no. 17 to 23 are short answer questions and carry 2 marks each.
d. Section C: Q.no. 24 to 30 are long answer questions and carry 3 marks each.
e. Section 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

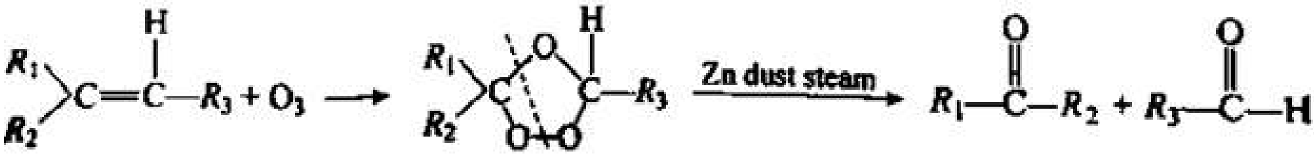
1. Oxidation without cleavage of sigma bond takes place in alkenes:



Presence of unsaturation in alkenes is detected using Baeyer's reagent.
Alkenes decolourise pink colour of Baeyer's reagent. In the presence of Baeyer's reagent, **syn** addition of -OH groups takes place on both carbons of the double bond.
The next reaction can be given as,



Ozonolysis of alkenes gives ozonide, which on further hydrolysis gives aldehyde and/or ketone.



Answer the following questions:

i. Linear polyenes on ozonolysis give two moles of acetaldehyde and one mole of propane dial. Linear polyene will be ________.
ii. Ortho xylene on ozonolysis will give ________.

(a) $CH_3 - \overset{\overset{O}{||}}{C} - \overset{\overset{O}{||}}{C} - CH_3$ and $CH_3 - \overset{\overset{O}{||}}{C} - CHO$ (b)

$CH_3 - \overset{\overset{O}{||}}{C} - \overset{\overset{O}{||}}{C} - CH_3, CH_3 - \overset{\overset{O}{||}}{C} - CHO \ and \ CHO - CHO$

iii. $CH_2=CH_2$ and CH_3-$CH=CH_2$ both will give formaldehyde on ozonolysis. (True/False)
iv. Product of ozonolysis gives information about:
   a. configuration
   b. conformation
   c. both of these
   d. none of these
v. Why would Bayer's Reagent is used for the detection of the alkene?

2. Why is energy of 1s electron lower than 2s electron?

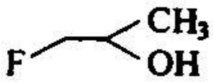
3. Na^+ has higher value of ionization enthalpy than Ne, though both have same electronic configuration. Explain why?

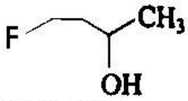
4. At 298 K, K_p for the reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ is 0.98. Predict whether the reaction is spontaneous or not.

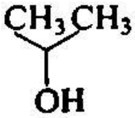
5. Why is Group 1 elements known as the most electropositive element?

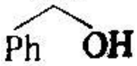
6. Name the five distinct zones of the atmosphere.

7. The order of reactivity of following alcohols,

I. 

II. 

III. 

IV. 

towards concentrated HCl is:

a. I > III > II > IV

b. I > II > III > IV

c. IV > III > II > I

d. IV > III > I > II

8. In which of the following compounds, an element exhibits two different oxidation states.

a. NH_4NO_3

b. N_3H

c. N_2H_4

d. NH_2OH

9. Gases possess characteristic critical temperature which depends upon the magnitude of intermolecular forces between the particles. Following are the critical temperatures of some gases. From the data what would be the order of liquefaction of these gases? Start writing the order from the gas liquefying first.

Gases	**H_2**	**He**	**O_2**	**N_2**
Critical temperature in Kelvin	**33.2**	**5.3**	**154.3**	**126**

a. N_2, O_2, He, H_2

b. He, O_2, H_2, N_2

c. O_2, N_2, H_2, He

d. H_2, He, O_2, N_2

10. Which of the following are not redox reactions?

a) $K_4[Fe(CN)_6] + H_2SO_4 + H_2O \rightarrow K_2SO_4 + CO + FeSO_4 + (NH_4)_2SO_4$.

b) $CuSO_4 + NH_3 \rightarrow [Cu(NH_3)_4SO_4$.

c) $Mg + N_2 \rightarrow Mg_3N_2$.

d) $I_2 + 3Cl_2 \rightarrow 2ICl_3$

a. c, d

b. b, d

c. b only

d. a, b

11. Hybridisation in methane $(CH4)$, ethene $(C2H4)$, ethyne (C2H2) involves s and p orbitals. Choose the correct hybrid orbitals in the options given below for CH_4, C_2H_4 and, C_2H_2 respectively

a. sp^2, sp, sp^3

b. sp^3, sp^2, sp

c. sp, sp^3, sp^2

d. sp^3, sp, sp^2

12. **Assertion:** Boron does not form BF_6^{3-} ion while AI_6^{3-} is known.
Reason: B does not have d-orbitals in valence shell while AI has d-orbitals in valence shell.

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:** Empirical formula of glucose is HCHO.
Reason: Molecular formula of glucose will also be equal to HCHO.

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:** A substance which gets reduced can act as reducing agent.
Reason: An oxidising agent itself gets oxidised.

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. Both assertion and reason are INCORRECT.

15. **Assertion:** Terminal alkynes on oxidation with Bayer's reagent give a mixture of carboxylic acid and CO_2.

Reason: Terminal alkynes show acidic character.

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:** The value for van der Waal's constant 'a' is higher for ammonia than for nitrogen.
Reason: Intermolecular hydrogen bonding is present in ammonia.

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. How is bond order related to the stability of a molecule?

18. What is the oxidation number of Fe in [Fe $(CO)_5$]?

19. The atomic radii of alkaline earth metals are smaller than those of the corresponding alkali metals. Explain why?

20. Cyclobutane is less reactive than cyclopropane. Justify.

21. Write the expression for the equilibrium constant for the reaction: $4NH_3$ (g) + $5O_2$ (g) $\rightleftharpoons$ 4NO (g) + $6H_2O$(g)

OR

Write the type of hybridisation involved in CH_4, C_2H_4 and C_2H_2.

22. Describe the method, which can be used to separate two compounds with different solubilities in a solvent.

OR

How are internal energy change, free energy change and entropy change are related to one another?

23. The boiling point of alkanes shows a steady increase with an increase in molecular mass. Why?

Section C

24. The enthalpy of vaporisation of liquid diethyl ether $(C_2H_5)_2O$ is 26.0 kJ mol^{-1} at its boiling point (35.0°C). Calculate $\Delta S°$ for the conversion of

    i. liquid to vapour and
    ii. vapour to liquid at 35°C.

25. i. Why a molecule is more stable in terms of energy than the uncombined atoms?
    ii. Why sodium chloride does not conduct electricity in a solid-state but does so in the molten state?
    iii. Why H_2O is liquid while H_2S is a gas at ordinary temperature?

OR

What is the maximum concentration of equimolar solutions of ferrous sulphate and sodium sulphide so that when mixed in equal volumes, there is no precipitation of iron sulphide? (For iron sulphide, $K_{sp} = 6.3 \times 10^{-18}$).

26. Justify that the following reactions are redox reactions:

    i. $CuO + H_2(g) \longrightarrow Cu(s) + H_2O(g)$
    ii. $Fe_2O_3(s) + 3CO(g) \longrightarrow 2Fe(s) + 3CO_2(g)$
    iii. $4BCl_3(g) + 3LiAlH_4(s) \longrightarrow 2B_2H_6(g) + 3LiCl(s) + 3\ AlCl_3(s)$

27. Analysis shows that a metal oxide has the empirical formula $M_{0.96}O_{1.00}$ Calculate the percentage of M^{2+} and M^{3+} ions in the crystal?

28. Chlorine is prepared in the laboratory by treating manganese dioxide (MnO_2) with aqueous hydrochloric acid given reaction,
$4HCl(aq) + MnO_2(s) \rightarrow 2H_2O(l)$ + $MnCI_2(aq)$ + $CI_2(g)$
Calculate how many gram of HCI reacts with 5.0 g of manganese dioxide?

29. The amount of energy released when 1×10^{10} atoms of chlorine in vapor state are converted to Cl^- ions according to the equation,
$\mathrm{Cl}(g) + e^- \longrightarrow \mathrm{Cl}^-(g)$ is 57.86×10^{-10}J
Calculate the electron gain enthalpy of the chlorine atom in terms of kJ mol^{-1} and eV per atom.

OR

Show by a chemical reaction with water that Na_2O is a basic oxide and Cl_2O_7, is an acidic oxide.

30. Discuss the water pollution caused by industrial water.

Section D

31. The Mn^{3+} ion is unstable in solution and undergoes disproportionation to give Mn^{2+}, MnO_2 and H^+ ion.
Write a balanced ionic equation for the reaction.

OR

Complete the following chemical reactions.

i. PbS (s) + $H_2O_2(aq) \rightarrow$
ii. $MnO_4^-(aq) + H_2O_2(aq) \rightarrow$
iii. CaO(s) + H_2O (l) $\rightarrow$
iv. $AlCl_3$ (g) + $H_2O(l) \rightarrow$

v. $Ca_3N_2(s) + H_2O(l) \rightarrow$

Classify the above into (a) hydrolysis, (b) redox reactions.

32. i. Draw the two geometrical isomers of but 2-en-1, 4-dioic acid. Which of these will have a higher dipole moment?
ii. How many isomers are possible for monosubstituted and disubstituted benzene?

OR

i. The reductive ozonolysis of an alkene gave butanone and propanal. Write the structure of alkene and its IUPAC name.
ii. Ozonolysis of an alkene **X** followed by decomposition with water and a reducing agent gave a mixture of two isomers of the formula C_3H_6O. Given the structure of the alkene and its IUPAC name.

33. i. The radius of the fourth orbit in a hydrogen atom is 0.85 nm. Calculate the velocity of the electron in this orbit (mass of electron = 9.1×10^{-31} kg).
ii. The wavelength of first spectral line in the Balmer series is 6561 $\overset{o}{A}$. Calculate the wavelength of the second spectral line in the Balmer series.

OR

The following data were obtained when dinitrogen and dioxygen react together to form different compounds:

Mass of dinitrogen	Mass of dioxygen
14 g	16 g
14 g	32 g
28 g	32 g
28 g	80 g

i. Which law of chemical combination is obeyed by the above experimental data? Give its statement.
ii. Fill in the blanks in the following conversations:
a. 1 km = ________ mm = ________ pm

b. 1 mg = ________ kg = ________ ng

c. 1 mL = ________ L = ________ dm^3

Solution

Section A

1. i. Linear polyene will be Alkadiene.
   ii. Ortho xylene on ozonolysis will give
   $$CH_3-\overset{\overset{O}{||}}{C}-\overset{\overset{O}{||}}{C}-CH_3, CH_3-\overset{\overset{O}{||}}{C}-CHO \; and \; CHO-CHO$$
   iii. False, because only $CH_2=CH_2$ will give formaldehyde on ozonolysis.
   iv. None of these
   v. Bayer's reagent detects the presence of unsaturation in alkenes. Hence, it is used for the detection of the alkene.

2. We know that, Energy of an electron is inversely proportional to principal quantum number. $E_n \propto \left(-\frac{1}{n^2}\right)$

   1s (n=1) electron being close to the nucleus experiences more force of attraction than 2s (n=2) electron which is away from the nucleus.

3. Both Na^+ and Ne both has 10 electrons but Na^+ having, 11 protons in its nucleus but Ne has 10 protons. There, In case of Na^+ effective nuclear charge is high and thus Na^+ has greater ionisation enthalpy than Ne.

4. Given, At 298 K, $\mathrm{N_2O_4}(g) \rightleftharpoons 2\mathrm{NO_2}(g)$.
   We know that, $\Delta_r G^\circ = -2.303RT\log K_p$
   According to the question, $K_p = 0.98$.
   As, $K_p < 1$, $\Delta_r G^\circ$ will be positive. $[\because \log(0.98) = -0.0087]$
   Hence, the reaction is non-spontaneous.

5. The loosely held s-electron in the outermost valence shell of these elements makes them the most electropositive metals. They readily lose an electron to give monovalent M^+ ions.

6. The five distinct zones of the atmosphere are as follows:

   i. Troposphere
   ii. Stratosphere
   iii. Mesosphere
   iv. Ionosphere
   v. Exosphere

7. (d) IV > III > I > II

   Explanation: IV > III > I > II

8. (a) NH_4NO_3 **Explanation:**

   $NH_4^+NO_3^-$.In NH_4^+

   N is -3 and

   NO_3^- , N is +5.

9. (c) O_2, N_2, H_2, He

   Explanation:

   $T_c = \frac{8a}{27}$ Rb. As T_c increases 'a' increases means force of attraction between molecules also increase hence liquification increases.

   In orther words, more the critical temperature more will be the ease of liquification.

10. (d) a, b

    Explanation: a) $K_4[Fe(CN)_6] + H_2SO_4 + H_2O$ $K_2SO_4 + CO + FeSO_4 + (NH_4)_2SO_4$

    b) $CuSO_4 + NH_3 \rightarrow [Cu(NH_3)_4SO_4$

    Since, oxidation number of each element does not change in these reactions, so these are not redox reactions.

11. (b) sp^3, sp^2, sp

    Explanation: In methane C is sp^3 hybridised because of 3 sigma bond formation. While in ethane both the C are sp^2 hybridised, and in ethyne both the C are sp hybridised.

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. (c) Assertion is CORRECT but, reason is INCORRECT.

    Explanation: Assertion is CORRECT but, reason is INCORRECT.

14. (d) Both assertion and reason are INCORRECT.

    Explanation: Both assertion and reason are INCORRECT.

15. (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.

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. **Bond order:** - Number of bonds between two atoms is called bond order. More the bonds between atoms more will be the **Dissociation Energy &** more will be the stability.

    Formula to find Bond order = N_B - N_A / 2

    Bond order directly proportional to stability of molecules and dissociation energy and inversely proportional to bond length

    where N_B = Number of the electron in bonding Molecular Orbits

    N_A = Number of the electron in antibonding Molecular Orbits

18. The oxidation number of Fe in $Fe(CO)_5$ is Zero

    Explanation/Calculations:

    $Fe(CO)_5$ is Iron carbonyl, containing Fe as the central atom which is linked with a neutral group/ligand CO (ie carbonyl group)

    Since the carbonyl group itself is a molecule its oxidation number = 0

    Now, let the oxidation number of Fe in $Fe(CO)_5$ be represented by x, then

$(x + 5 \times 0) = 0$
$\therefore\ x\ = 0$
Thus, the oxidation number of Fe in Fe $(CO)_5$ is Zero

19. As we move from left to right in modern periodic table, nuclear charge increases progressively by one unit. Therefore, the atomic and ionic radii of the alkaline earth metals are smaller than those of the corresponding alkali metals in the same period.

20. 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.

21. The given reaction is $4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g)$.

Hence equilibrium constant, $K_c = \frac{[NO(g)]^4 [H_2O(g)]^6}{[NH_3(g)]^4 [O_2(g)]^5}$

OR

Hybridisation = sigma bond + lone pair

If No. is 4 then sp^3, If No. is 3 then sp^2, If No. is 2 then sp

$CH_4 = Sp^3$ $C_2H_4 = Sp^2$ $C_2H_2 = Sp$

22. Fractional crystallization is used for this purpose. A hot saturated solution of these two compounds is allowed to cool, the less soluble compound crystallizes out while the more soluble remains in the solution. The crystal are separated from the mother liquor and the mother liquor is again concentrated and the hot solution again allowed to cool when the crystals of the second compound are obtained. These are again filtered and dried.

OR

The relation between internal energy change, free energy change and entropy change can be show an as :

$\Delta G = \Delta H - T\Delta S$. (At Constant Temperature)

23. With the increase in molecular weight or the molecular size of the molecule, the surface area of the molecule increases. Due to which the extent of the intermolecular Vanderwall forces increases which causes the increase in the boiling point of alkanes.

Section C

24. i. We know that, $\Delta_{\text{vap}} S^\circ = \frac{\Delta_{\text{vap}} H^\circ}{T}$
According to the question, $\Delta_{\text{vap}} H^\circ = 26.0 \text{kJmol}^{-1}, T = 273 + 35 = 308\text{K}$
So, $\Delta_{\text{vap}} S^\circ = \frac{26.0 \times 10^3 \text{Jmol}^{-1}}{308\text{K}} = 84.4 \text{JK}^{-1} \text{mol}^{-1}$
ii. The conversion of vapour into liquid is condensation.
The enthalpy of condensation is negative of enthalpy of vaporisation.
$\Delta_{\text{vap}} H^\circ = -\Delta_{\text{cond}} H^\circ$
We know that, $\Delta_{\text{ cond }} S^\circ = \frac{\Delta_{\text{ cond }} H^\circ}{T}$
$= \frac{-26.0 \times 10^3 \text{Jmol}^{-1}}{308K}$
= - 84.4 JK^{-1} mol^{-1}

25. i. When the atoms combine together to form a molecule, there is always the release of energy. Thus, the potential energy of a molecule is less than that of uncombined atoms and therefore, the molecule is more stable.
ii. Solid sodium chloride has a crystalline structure in which the ions are not free to move. The ions become mobile when it is in a molten state and thus, the electricity can be conducted.
iii. Oxygen has a high electronegativity than sulphur. As a result, H_2O forms hydrogen bonding. Consequently, molecules of water come nearer to each other through hydrogen bonding. This result is higher boiling point of water and hence it is a liquid.

OR

Suppose the concentration of each of $FeSO_4$ and Na_2S is x mol L^{-1}. Then after mixing equal volumes,
$[FeSO_4]$ = $[Na_2S]$ $= \frac{x}{2} M$, i.e. $[Fe^{2+}] = [S^{2-}] = \frac{x}{2} M$
K_{sp} for FeS = $[Fe^{2+}]$ $[S^{2-}]$ i.e. $6.3 \times 10^{-18} = \frac{x}{2} \times \frac{x}{2}$ [Since, equimolar solutions are to be mixed, hence on mixing concentration is halved.]
$x^2 = 25.2 \times 10^{-18}$, or $x = 5.02 \times 10^{-9} M$

26. The given equations for different reactions are :

i. $\overset{+2-2}{CuO}(s) + \overset{0}{H_2}(g) \rightarrow \overset{0}{Cu}(s) + \overset{+1-2}{H_2O}(g)$

As per above equation, it is noted that.

a. an atom of oxygen (O) is removed from CuO,

$\therefore$ it is reduced to Cu, while

b. O is added to H_2 to form H_2O

$\therefore$ it is oxidized.

Further,

Oxidation number. of Cu decreases from +2 in CuO to 0 in Cu,

oxidation number of H increases from 0 in H_2 to +1 in H_2O.

$\therefore$ CuO is reduced to Cu but H_2 is oxidized to H_2O.

Thus, the reaction is a redox reaction.

ii. $\overset{+3}{Fe_2}\overset{-2}{O_3}(s) + 3\overset{+2}{CO}(g) \rightarrow 2\overset{0}{Fe}(s) + 3C\overset{+4}{O_2}(g)$

In the above equation for reaction, it is seen that

a. The oxidation number of Fe decreases from +3 in Fe_2O_3 to 0 in Fe, and

oxidation number of C increases from +2 in CO to +4 in CO_2.

Further,

oxygen is removed from Fe_2O_3, and

added to CO to form CO_2

therefore, Fe_2O_3 is reduced while CO is oxidized.

Thus, the given reaction is a redox reaction.

iii. Similarly, in the given equation ,

$4B^{+3}Cl^{-1}{}_3(g) + 3Li^{+1}Al^{+3}H^{-1}{}_4(s) \longrightarrow 2B^{-3}{}_2H^{-1}{}_6(g) + 3LI^{+1}Cl^{-1}(s) + 3Al^{+3}Cl^{-1}{}_3$

Oxidation number of B decreases from +3 in BCl_3 to -3 in B_2H_6

while,

oxidation number of H increases from -1 in $LiAlH_4$ to +1 in B_2H_6.

Therefore, BCl_3 is reduced and

$LiAlH_4$ is oxidized.

Further, it is noted that,

H is added to B forming B_2 H6 from BCl_3 but is removed from $LiAlH_4$, therefore,

BCl_3 is reduced while $LiAlH_4$ is oxidised.

Thus,

the redox nature of above reaction is justfied.

27. Let the number of M^{2+} ion = x

Then, the number of M^{3+} ion will be = (0.96 - x)

Total no. of cations = 2x + 3(0.96 - x) = 2x+2.88-3x

= - x + 2.88

No. of anions O^{2-} = - 2 x 1 = - 2

No. of cations = No. of anions

$\Rightarrow$ - x + 2.88 = 2

$\Rightarrow$ - x = - 2.88 + 2

$\Rightarrow$- x = - 0.88

$\Rightarrow$ x = 0.88

Percentage of M^{2+} ion$=\frac{0.88}{0.96}\times 100$ = 91.67%

Percentage of M^{3+} = $\frac{0.08}{0.96}\times 100$ = 8.33%

28. The given chemical equation is:

$$\underset{4\times 36.5}{4HCl(aq)} + \underset{87g}{MnO_2} \rightarrow 2H_2O(l) + MnCl_2(aq) + Cl_2(g)$$

It is clear from balanced chemical equation,

87 g of MnO_2 reacts with 146 g HCI

Therefore, 5 g of MnO_2 will react with = $\frac{146\ \times 5}{87}$ = 8.4 g HCl.

29. The equation of conversion of Cl (g) into Cl^- is: .

$$\mathrm{Cl}(g) + e^- \longrightarrow \mathrm{Cl}^-(g)$$

Thee amount energy released when 1-mole $\left(6.023\times 10^{23}\right)$ chlorine are converted into Cl^- ions according to the above of the equation will be

$$= -\frac{57.86\times 10^{-10}}{1\times 10^{10}}\times 6.023\times 10^{23}$$

$$= -348.49\times 10^{3}\mathrm{Jmol}^{-1}$$

$= -348.49 \text{kJmol}^{-1}$

Now 1 eV/atom $= 96.49 \text{kJmol}^{-1}$

$\therefore$ Electron gain enthalpy of chlorine

$= -\frac{348.49}{96.49}$

$= -3.61 \text{eV/atom}$

OR

Na_2O reacts with water to form sodium oxide which turns red litmus blue.

$$Na_2O + H_2O \rightarrow 2NaOH$$

$$\underset{Sod\ oxide}{Na_2O} + H_2O \rightarrow \underset{Sod\ hydroxide}{2NaOH}$$

Therefore, Na_2O is a basic oxides.

In contrast, Cl_2O_7 reacts with water to form perchloric acid which turns blue litmus red.

$$Cl_2O_7 + H_2O \rightarrow \underset{perchloric\ acid}{2HCl_4}$$

Therefore, Cl_2O_7 is an acidic oxide.

30. The compounds of lead, mercury, Cd, Ni, Co, Zn etc which are the products of chemical reactions, carried in the industrial units, pollute water to a large extent and are responsible for many diseases. Mercury leads to minimata disease, lead poisoning leads to many deformities. In addition, these substances adds to the soil and harmfully affect the plant growth and the whole soil biotic system. Both ground water and water bodies are polluted due to chemical reactions known as leaching.

Section D

31. The following steps are processed to write the desired balanced ionic equation,

The skeletal equation is,

Mn^{3+} (aq) $\longrightarrow$ Mn^{2+} (aq) + MnO_2 + H^+ (aq)

Identify the oxidation and reduction of half equations from the skeletal equation

Oxidation half-equation:

$$\overset{3+}{\text{M}}\text{n}^{3+}\text{(aq)} \rightarrow \text{Mn}\underset{2}{\overset{+4}{\text{O}}}\text{(s)}$$

Balancing half equations in the following steps,

i. balance O.N. by adding electrons at the suitable side (ie. RHS)

$Mn^{3+}(aq) \rightarrow MnO_2 (s) + e^-$

ii. Balance charge by adding $4H^+$ ions on RHS,

$\overset{3+}{Mn}(aq) \longrightarrow MnO_2(s) + 4H^+(aq) + e^-$

iii. Balance O atoms by adding $2H_2O$ on a side opposite to that of H^+ ion :

$\overset{3+}{Mn}(aq) + 2H2O(l) \longrightarrow MnO_2(s) + 4H^+(aq) + e^-$ (i)

Reduction half equation:

$\overset{3+}{M}n^{3+}(aq) \rightarrow \overset{+2}{M}n^{2+}$

Balance O.N. by adding electrons on the suitable side (ie.LHS)

$Mn^{3+}(aq) + e^- \longrightarrow Mn^{2+}(aq)$ (ii)

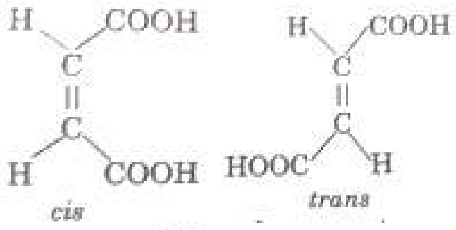
Adding Eq. (i) and Eq. (ii), the balanced equation for the ionic reaction is obtained as under ,

$2Mn^{3+}(aq) + 2H_2O(l) \longrightarrow MnO_2(s) + Mn^{2+}(aq) + 4H^+(aq)$

OR

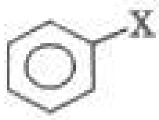
i. $PbS(s) + 4H_2O_2(aq) \rightarrow PbSO_4(s) + 4H_2O(l)$
ii. $2MnO_4^-(aq) + H_2O_2(aq) + 6H^+(aq) \rightarrow 2Mn^{+2}(aq) + 8H_2O(l) + 5O_2(g)$
iii. $CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq)$
iv. $AlCl_3(g) + 3H_3O(l) \rightarrow Al(OH)_3(s) + 3HCl(aq)$
v. $Ca_3N_2(s) + 6H_2O(l) \rightarrow 3Ca(OH)_2(aq) + 2NH_3(aq)$
   a. (iii) and (v) are hydrolysis reactions as given ionic compounds get hydrolysed in water.
   b. (iv) is a hydration reaction.
   c. (i) and (ii) are redox reactions as in (i) H_2O_2 acts an oxidising agent whereas in (ii) it acts as a reducing agent

32. The two geometrical isomers of but 2-en-1, 4-dioic acid are as follow:

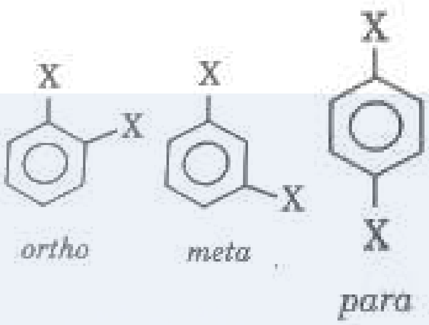


Cis isomers will have a higher dipole moment.

i. There is one monosubstituted benzene as

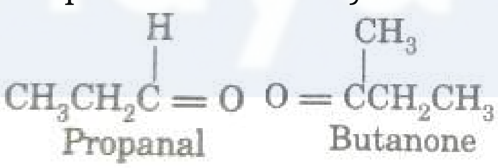


There are three disubstituted benzenes:



OR

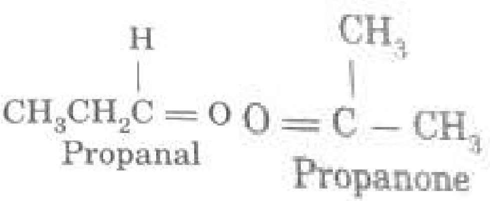
i. The products of ozonolysis are:



The alkene will be (remove oxygen atoms and make a double bond between the carbonyl carbon atoms).

IUPAC name: $\underset{3-Methylhex-3-ene}{\overset{6}{C}H_3\overset{5}{C}H_2\overset{4}{C}H = \overset{\overset{CH_3}{|_3}}{C}\ \overset{2}{C}H_2\overset{1}{C}H_3}$

ii. The two isomers of the molecular formula C_3H_6O are:



The alkene is

$$CH_3CH_2CH = \underset{|}{\overset{CH_3}{C}} - CH_3$$

IUPAC name: 2-Methylpent-2-ene

33. i. From Bohr's postulate, the angular momentum (mvr) is given as:

mvr = $\frac{nh}{2\pi}$ or v = $\frac{nh}{2\pi mr}$

n = 4, m = 9.1 $\times$ 10^{-31} kg, r = 0.85 $\times$ 10^{-9} m

$\therefore$ v = $\frac{4\times6.626\times10^{-34}}{2\times\frac{22}{7}\times9.1\times10^{-31}\times0.85\times10^{-9}}$

= 5.45 $\times$ 10^5 m s^{-1}

ii. According to Rydberg equation,

$\frac{1}{\lambda}$ = R $\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

For first line in balmer series, n_1 = 2, n_2 = 3

$\therefore$ $\frac{1}{6561}$ = R $\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$ = R $\left(\frac{5}{36}\right)$ ...(i)

For second line in balmer series, n_1 = 2, n_2 = 4

$\therefore$ $\frac{1}{\lambda}$ = R $\left(\frac{1}{2^2} - \frac{1}{4^2}\right)$ = R $\left(\frac{3}{16}\right)$ .....(ii)

Dividing eq. (i) by (ii),

$\frac{\lambda}{6561}$ = $\frac{5}{36}$ $\times$ $\frac{16}{3}$

$\therefore$ = $\frac{6561\times5\times16}{36\times3}$ = 4860 $\overset{o}{A}$

OR

i. Fixing the mass of dinitrogen as 14 g, the masses of dioxygen combined will be or

16 : 32 : 16 : 40

2 : 4 : 2 : 5

This is a simple whole-number ratio and hence, the data illustrate the law of multiple proportions.

The law of multiple proportions states that when two elements combine to form two or more than two compounds, then the mass of one of the elements which combine with a fixed mass of the other bear a simple whole-number ratio.

ii.

a. 1 km = 1 km $\times$ $\frac{1000m}{1km}$ $\times$ $\frac{100cm}{1m}$ $\times$ $\frac{10mm}{1cm}$ = 10^6 m

1 km = 1 km $\times \frac{1000m}{1km} \times \frac{1\text{pm}}{10^{-12}\text{m}}$ = 10^{15} pm

Correct answer : 10^6, 10^{15}

b. 1 mg = 1 mg $\times \frac{1\text{g}}{1000\text{mg}} \times \frac{1\text{kg}}{1000\text{g}}$ = 10^{-6} kg

1 mg = 1 mg $\times \frac{1\text{g}}{1000\text{mg}} \times \frac{1\text{ng}}{10^{-9}\text{g}}$ = 10^6 ng

Correct answer : 10^{-6}, 10^6

c. 1 mL = 1mL $\times \frac{1\text{L}}{1000\text{mL}}$ = 10^{-3} L

1 mL = 1 $\text{cm}^3 \times \left(\frac{1\text{dm}}{10\text{cm}}\right)^3$ = 10^{-3} dm^3

Correct answer : 10^{-3}, 10^{-3}