CBSE Class 11 Chemistry
Sample Paper 05 (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. Adolf von Baeyer suggested that, since carbon prefers to have tetrahedral geometry with bond angles of approximately 109^{o}, ring sizes other than five and six may be too strained to exist. Baeyer based his hypothesis on the geometrical notion that a three-membered ring (cyclopropane) should be an equilateral triangle with bond angles to 60^{o}, a four-membered ring (cyclobutane) should be a square with bond angles of 90^{o} and so on. According to Baeyer's analysis, cyclopropane, with a bond angle compression of 109^{o} - 60^{o} = 49^{o}, should have a large amount of angle strain and must therefore, be highly reactive. Cyclohexane becomes puckered to release its strain. The angular deviation of cycloalkane is (-11^{o}). Greater is the angular deviation more is the torsional strain.

   Answer the following questions:

i. Which of the following is most reactive cycloalkane?
   a. Cyclopropane
   b. Cyclobutane
   c. Cyclopentane
   d. Cyclohexane

ii. Out of Cyclopropane, Cyclobutane and Cyclopentane are most strained cycloalkane?

iii. Write the tendency of Cyclopropane (I), Cyclobutane (II) and Cyclopentane (III) to form addition compounds in the descending order.

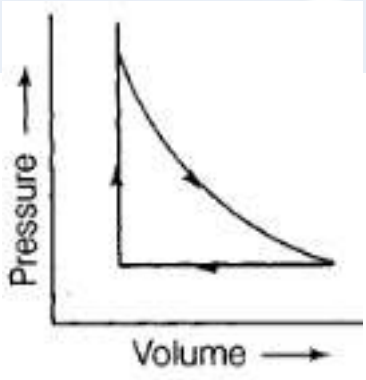
iv. _____ has the greatest bond angle and zero strain energy. (Cyclohexane/Cyclobutane)

v. If the angular deviation is higher then what would be the effect on the torsional strain?

2. Give the main features of Thomson's Model for an atom.

3. How do metals react in a group?

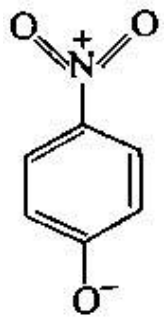
4. A sample of 1.0 mole of a monoatomic ideal gas is taken through a cyclic process of expansion and compression as shown in the figure. What will be the value of ΔH for the cycle as a whole?

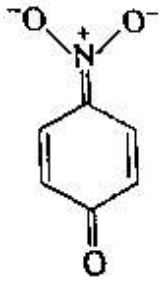


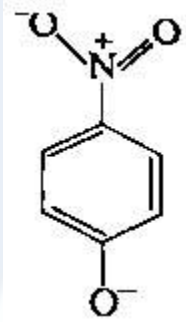
5. Explain. E° for $M^{2+}(aq) + Ze^{-} \longrightarrow M(s)$ (where, M = Ca, Sr or Ba) is nearly constant.

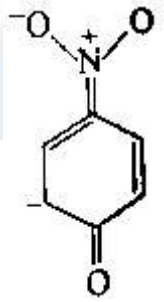
6. Name of the regions of the atmosphere where global warming and ozone depletion phenomenon occur.

7. The most unlikely representation of resonance structures of p-nitrophenoxide ion is:

a. 

b. 

c. 

d. 

8. All combustion reactions, which make use of elemental dioxygen, as well as other reactions involving elements other than dioxygen are:

   a. Combination reaction

   b. decomposition reactions

   c. disproportionation reactions

   d. displacement reactions

9. The ease with which the electron cloud of a particle can be distorted is called its
   a. negativity
   b. polarity
   c. cloud strength
   d. polarizability

10. The oxidation number of the carboxylic carbon atom in CH_3COOH is
   a. +4
   b. +2
   c. + 1
   d. +3

11. Which of the following compounds contain all the carbon atoms in the same hybridisation state?
   a. H—C ≡ C—C ≡ C—H
   b. $CH_2 = C = CH_2$
   c. CH_3—C ≡ C— CH_3
   d. $CH_2 = CH$—C ≡ CH

12. **Assertion:** Boric acid behaves as weak monobasic acid.
   Reason: It has only one ionizable hydrogen.
   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:** Steam is a mixture.
Reason: In a compound, the composition of the elements must be fixed.

    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:** In aqueous solution, SO_2 reacts with H_2S liberating sulphur.
Reason: SO_2 is an effective reducing agent.

    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:** Buta-1, 3-diene and but-1-yne can be distinguished with Tollen's reagent.
Reason: But-1-dyne gives ppt. with Tollen's reagent but buta-1, 3-diene does not.

    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 pressure of ideal gases is always less than the pressure of real gases.
Reason: The intermolecular forces of attraction in ideal gases are less than those of real gases.

    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. What is the total number of sigma and pi bonds in the following molecules?

    i. C_2H_2

    ii. C_2H_4

18. Calculate the oxidation number of sulphur in H_2SO_4 and Na_2SO_4.

19. Arrange the following in the increasing order of solubility in water?
$MgCl_2$, $CaCl_2$, $SrCl_2$, $BaCl_2$

20. Cyclobutane is less reactive than cyclopropane. Justify.

21. What is meant by conjugate acid base pair? Find the conjugate acid/ base for the following species:
HNO_2, CN^-, $HClO_4$, OH^-, CO_3^{2-}, S^{2-}

OR

Arrange $O_2^{2-} < O_2^- < O_2 < O_2^+$ in increasing order of bond energy.

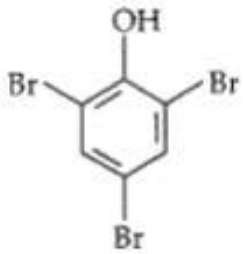
22. Write IUPAC name of the following:

i. $Ch_3 - \underset{\underset{C_2H_5}{|}}{C} - H - \underset{\underset{C_2H_5}{|}}{C} - H - CH_2OH$

ii. $CH_3 - \underset{\underset{O}{\|}}{C} - CH_3 - Cl$

iii. $Ch = C - CH = CH - CH = CH_2$

iv.



OR

Change in internal energy is a state function while work is not, why?

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

Section C

24. i. Why standard entropy of an elementary substance is not zero whereas standard enthalpy of formation is taken as zero?
    ii. Under what conditions will the reaction occur, if
        a. both ΔH and ΔS are positive
        b. both ΔH and ΔS are negative

25. In the equation, A + 2B + $H_2O \longrightarrow$ C + 2D

(A = HNO_2, B = H_2SO_3, C = NH_2OH), identify D. Draw the structures of A, B, C, and D.

OR

At 473 K, the equilibrium constant K_c, for the decomposition of phosphorus pentachloride (PCl_5) is 8.3×10^{-3}. If decomposition proceeds as:

$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g);$

a. Write an expression for K_c for the reaction

b. What is the value of K_c for the reverse reaction at the same temperature.

c. What would be the effect on K_c if

(i) More of PCl_5 is added (ii) Temperature is increased.

26. Consider the reactions :

a. $6CO_2(g) + 6H_2O(I) \longrightarrow C_6H_{12}O_6(aq) + 6O_2(g)$

b. $O3(g) + H_2O_2(I) \longrightarrow H_2O(I) + 2O_2(g)$

i. Why it is more appropriate to write these reactions as :

a. $6CO_2 + 12H_2O(I) \longrightarrow C_6H_{12}O_6(aq) + 6O_2(I) + 6O_2(g)$

b. $O3(g) + H_2O_2(I) \longrightarrow H_2O(I) + O_2(g) + O_2(g)$

ii. Also suggest a technique to investigate the path of the above (a) and (b) redox reactions.

27. The relation between pressure exerted by an ideal gas (p_{ideal}) and observed pressure (p_{real}) is given by the equation

$$p_{ideal} = p_{real} + \frac{an^2}{V^2}$$

If pressure is taken in Nm^{-2}, number of moles in mol and volume in m^3, calculate the unit of V.

What will be the unit of 'a' when pressure is in atmosphere and volume in dm^3?

28. Two oxides of a metal contain 27.6% and 30.0% of oxygen respectively. If the formula of the first oxide is M_3O_4, find that of the second.

29. How would you explain the fact that the first ionization enthalpy of sodium is lower than that of magnesium but its second ionization enthalpy is higher than that of magnesium?

OR

Assign the position of the element having outer electronic configuration.

(i) $ns^2\ np^4$ for n = 3 (ii) $(n - 1)d^2\ ns^2$ for n = 4 and (iii) $(n - 2)f^7\ (n - 1)d^1\ ns^2$ for n = 6 in the periodic table?

30. What is smog? How is classical smog different from photochemical smog?

Section D

31. Assign oxidation number to the underlined elements in each of the following species:

    i. $NaH_2\underline{P}O_4$
    ii. $NaH\underline{S}O_4$
    iii. $H_2\underline{P_2}O_7$
    iv. $K_2\underline{Mn}O_4$
    v. $Ca\underline{O_2}$

OR

    i. Name one industrial method for the preparation of dihydrogen.
    ii. Arrange H_2, D_2, and T_2 in the decreasing order of their
        a. boiling points
        b. heat of fusion
    iii. Name the products to obtain when hydrogen reacts under suitable conditions with
        a. Nitrogen
        b. Carbon monoxide
        c. Lead oxide
    iv. Does hydrogen support combustion?
    v. Name one compound each in which hydrogen exists in
        a. positive oxidation state, and
        b. negative oxidation state.

32. i. Arrange the three isomeric pentanes in order of increasing stability at room temperature,
    ii. Give a method of preparation of propane from
        a. an alkene
        b. an alkyl halide.

iii. Write the structure of all the alkenes that can be hydrogenated to form 2-methyl butane.

iv. Why is light or heat necessary to initiate the chlorination reaction?

OR

i. Which of the two: trans-but-2-ene or trans-pent is non-polar? Give reason.

ii. Write the structural formulae of all the possible isomers of $C_2H_2CI_2$ and indicate which of these is non-polar?

33. Expalin giving reasons, which of the following sets of quantum numbers are not possible.

i. n = 0, l = 0, m_l = 0, ms = +1/2

ii. n = 1, l = 0, m_l = 0, m_s = -1/2

iii. n = 1, l = 1, m_l = -0, m_s = +1/2

iv. n = 2, l = 1, m_l = 0, ms = -1/2

v. n = 3, l = 3, m_l = -3, m_s = +1/2

vi. n = 3, l = 2, m_l = 0, m_s = +1/2

OR

250 ml of 0.5 sodium sulphate (Na_2SO_4) solution are added to an aqueous solution containing 10.0 g of $BaCl_2$, resulting in the formation of white precipitate of $BaSO_4$, How many moles and how many grams of barium sulphate will be obtained?

CBSE Class 11 Chemistry

Sample Paper 05 (2019-20)

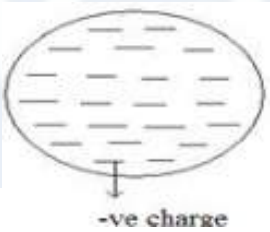
Solution

Section A

1. i. Option (a) Cyclopropane is most reactive cycloalkane is correct.
   ii. Cyclopropane is most strained.
   iii. The tendency to form addition compounds in the descending order is I > II > III.
   iv. Cyclohexane has the greatest bond angle and a zero strain energy.
   v. If the angular deviation is higher then torsional strain would also be higher.

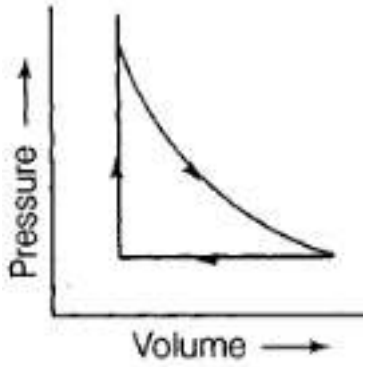
2. The main features of J.J. Thomson model of an atom are:

   i. J.J. Thomson proposed that an atom consists of a spherical sphere (radius of about 10^{-10}m) in which the positive charges are uniformly distributed the electrons are embedded into it in such a manner so as to give stable electrostatic arrangement.
   ii. This model is also called raisin pudding model.



3. The tendency to lose electrons increases as we go down a group so the reactivity of metals increases down the group.

4. According to the question, 1 mole of a mono atomic ideal gas is taken through a cyclic process of expansion and compression.



ΔH for a cyclic process is zero because enthalpy change is a state function.

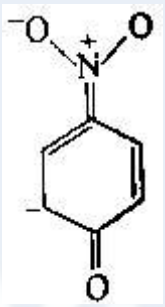
5. E° of any electrode depends upon three factors, they are:

   i. enthalpy of vaporization
   ii. enthalpy of hydration and
   iii. ionization enthalpy

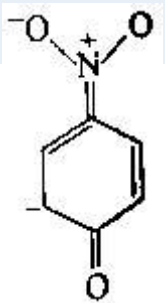
   The combined effect of these factors is approximately same for Ca, Sr and Ba. Hence, their electrode potentials are nearly constant.

6. Global warming- Troposphere, Ozone depletion-Stratosphere.

7. (d)



Explanation:



8. (a) Combination reaction
   Explanation: A combination reaction (also known as a synthesis reaction) is a reaction where two or more elements or compounds (reactants) combine to form a single compound (product). Such reactions may be represented by equations of the following form: X + Y → XY.
9. (d) polarizability
   Explanation: The polarizability in isotropic media is defined as the ratio of the

induced dipole moment of an atom to the electric field that produces this dipole moment.

10. (d) +3

    Explanation: In CH_3COOH the carbon on the right will lose all the electrons it contributes to the bonds with oxygen because oxygen is more electronegative than carbon.

    As a result, the right carbon will have an oxidation of **+3**.

11. (a) H—C ≡ C—C ≡ C—H

    Explanation: In option:A,all the 4 carbon atoms are sp-hybridized.

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

    Explanation: Assertion is CORRECT but, reason is INCORRECT.

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.

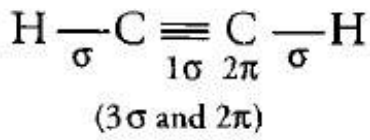
    Explanation: Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

16. (d) Assertion is INCORRECT but, reason is CORRECT.

    Explanation: Assertion is INCORRECT but, reason is CORRECT.

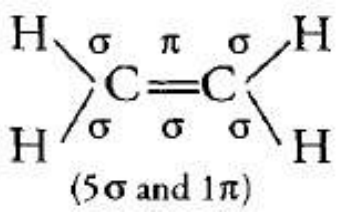
Section B

17. i. The complete structural representation of C_2H_2 is:



    The structure clearly indicates that it has 3σ bonds and 2π bonds.

    ii. The complete structural formula of C_2H_4 is:



(5σ and 1π)

The structure indicates that it has 5σ bonds and 1π bond.

18. Calculations:

    i. In H_2SO_4

    Let the oxidation number of S in H_2SO_4 be x.

    Write the oxidation number of each atom above its symbol.

    $\overset{+1}{H_2}\overset{x}{S}\overset{-2}{O_4}$

    Calculate the sum of the oxidation numbers of all the atoms, and equate it with zero. Thus,

    2(+1) + x + 4(-2) = 0

    or, x - 6 = 0

    $\therefore$ x = + 6

    Thus the oxidation number of sulphur in H2SO4 is (+6)

    ii. In Na_2SO_4

    Write the oxidation number of each atom its symbol, assuming an oxidation number of S as x.

    $\overset{+1}{Na_2}\overset{x}{S}\overset{-2}{O_4}$

    Calculate the sum of the oxidation numbers of all the atoms, and equate it with zero,

    2(+1) + x + 4(-2) = 0

    2 + x - 8 = 0

    or,(x - 6) = 0

    $\therefore$ x = + 6

    Thus. the oxidation number of S in Na_2 SO_4 is (+6)

19. Solubility of chlorides depends on their hydration energy value. As we move down the group, size of metal ion increases due to which their tendency to polarize water molecule decreases and hence hydration energy also decreases.

Thus, solubility of chlorides will follow the order: $BaCl_2 < SrCl_2 < CaCl_2 < MgCl_2$

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. An acid-base pair which differs by a proton only $(HA \rightleftharpoons A^- + H^+)$ is known as conjugate acid-base pair.
As, Base + H^+ = conjugate acid. Therefore, Conjugate acid of CN^- , OH^- , CO_3^{2-} and S^{2-} are: HCN, H_2O, HCO_3^- , HS^- respectively.
As, Acid - H^+ = conjugate base. Therefore, Conjugate base of HNO_2 , $HClO_4$ and OH^- are NO_2^- , ClO_4^- and O^{2-} respectively.

OR

$O_2^{2-} < O_2^- < O_2 < O_2^+$

22. i. 2-Ethyl-3-methylpentan-1-ol
ii. 1-Chloropropan-2-one
iii. Hex-1, 3-dien-5-yne
iv. 2, 4, 6-Tribromophenol

OR

The change in internal energy during a process depends only upon the initial and final state of the system. Hence, it is a state function.
While Work is related to the path followed. So, it is not a state function.

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. A substance has perfectly ordered arrangement of its constituent particles only at

absolute zero. When the element from itself. This means no heat change.
Thus $\Delta_f H = 0$

ii.

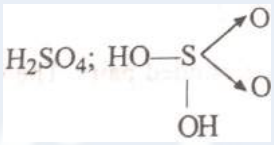
a. If both ΔH and ΔS are positive ΔG can be -ve only in magnitude. Thus the temperature should be high.
b. If both ΔH and ΔS are negative ΔG can be negative only $T\Delta S < \Delta H$ is magnitude. Thus the value of T should be low.

25. $\underset{(A)}{HNO_2} + \underset{(B)}{2H_2SO_3} + H_2O + \rightarrow \underset{(C)}{NH_2OH} + \underset{(D)}{2H_2SO_4}$

Structures: (A) HNO_2; HO - N = O,

(B) $H_2SO_3; HO - \underset{\underset{OH}{|}}{S} \rightarrow O,$

(C) $NH_2OH; H - \underset{\underset{H}{|}}{N} - OH$

(D) 

OR

$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$; $K_c = 8.3 \times 10^{-3}$

a. The expression for $K_c = \frac{[PCl_3(g)][Cl_2(g)]}{[PCl_5(g)]}$
b. For reverse reaction $K_c' = \frac{1}{K_c} = \frac{1}{8.3 \times 10^{-3}} = 120.48$
c. (i) By adding more of PCl_5, value of K_c will remain constant because there is no change in temperature.
(ii) By increasing the temperature, the forward reaction will be favoured since it is endothermic in nature. Therefore, the value of equilibrium constant will increase.

26. It is believed that the photosynthesis reaction occurs in two steps. In the first step, H_2O decomposes to give H_2 and O_2 in the presence of chlorophyll and the H_2 produced reduces CO_2, to $C_6H_{12}O_6$ in the second step. During the second step, some H_2O molecules are also produced and therefore, the reaction occurs as:

a.

i. $12H_2O\ (I) \longrightarrow 12H_2(g) + 6O_2\ (g)$

ii. $6CO_2(g) + 12H_2(g) \longrightarrow C_6H_{12}O_6\ (s) + 6H_2O(I)$

iii. $6CO_2(g) + 12H_2O(I) \longrightarrow C_6H_{12}O_6\ (s) + 6H_2O(I) + 6O_2(g)$

Therefore, it is more appropriate to write the reaction for photosynthesis as (III) because it means that 12 molecules of H_2O are used per molecule of carbohydrate and $6H_2O$ molecules are produced per molecule of carbohydrate during the process.

b. O_2 is written two times in the product which suggests that 0, is being obtained from the two reactants as:

$O_3\ (g) \longrightarrow O_2(g) + O\ (g)$

$$\frac{H_2O_2(l)+O(g)\longrightarrow H_2O(l)+O_2(g)}{O_3(g)+H_2O_2(l)\longrightarrow H_2O(l)+O_2(g)+O_2(g)}$$

The path of the reaction can be studied by using H_2O^{18} in reaction (a) or by using H_2O^{18} or $O_3{}^{18}$ in reaction (b).

27. According to the question, $p_{ideal} = p_{real} + \frac{an^2}{V^2}$

$\Rightarrow a = \frac{(p_{ideal} - p_{real})V^2}{n^2}$

i. If Unit of p = Nm^{-2}

Unit of V = m^3

Unit of n = mol

So, Unit of 'a' = $\frac{Nm^{-2} \times (m^3)^2}{(mol)^2}$

= $Nm^4\ mol^{-2}$

ii. If Unit of p = atm

Unit of V = dm^3

Unit of n = mol

So, Unit of 'a' = $\frac{atm \times (dm^3)^2}{(mol)^2}$

= atm $dm^6\ mol^{-2}$

28. Ratio of metal and oxygen in first oxide, M_3O_4 = 72.4 : 27.6

Ratio of metal and oxygen in second oxide = 70:30

Let molecular mass of metal =M

Therefore, the percentage by weight of the metal in the oxide = $\frac{3 \times M \times 100}{3 \times M + 4 \times O} = 72.4$

$\frac{3 \times M \times 100}{3 \times M + 4 \times 16} = \frac{72.4}{1}$

$300M = 217.2\ M + 4633.6$

$\Rightarrow 300M - 217.2M = 82.8M = 4633.6$

$\Rightarrow M = \frac{4633.6}{82.8} = 55.96 \approx 56$

Moles of of metal in second oxide = 70/56=1.25

Moles of oxygen in second oxide =30/16= 1.875

Ratio of moles of metal and oxygen in second oxide =1.25 : 1.875 = 1 :1.5 =2:3

Hence, Formula of second oxide =M_2O_3.

29. Electronic configurations of Na and Mg are

Na = $1s^2 2s^2 2p^6 3s^1$

Mg = $1s^2 2s^2 2p^6 3s^2$

The 1^{st} ionization enthalpy of magnesium is higher than that of Na due to higher nuclear charge and slightly smaller atomic radius of Mg than Na.

Electronic configurations of Na and Mg after loosing 1 electron are

Na^+ = $1s^2 2s^2 2p^6$

Mg^+ = $1s^2 2s^2 2p^6 3s^1$

After the loss of the first electron, Na^+ formed has the electronic configuration of neon (2,8). The higher stability of the completely filled noble gas configuration leads to very high second ionization enthalpy for sodium. On the other hand, Mg^+ formed after losing the first electron still has one more electron in its outermost orbital. Therefore, the second ionization enthalpy of magnesium is much smaller than that of sodium.

OR

i. n = 3

Thus element belong to 3 rd period, p-block element.

Since the valence shell contains = 6 electrons

Group No. = 10 + 6 = 16

Configuration = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$

Element name is sulphur.

ii. n = 4

Means element belongs to 4 th period belongs to group 4 as in the valence shell (2 + 2) = 4 electrons. Electronic configuration.

= $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2\ 4s^2$ and the element name is Titanium (T_i).

iii. n = 6

Means the element belongs to 6 th period. Last electron goes to the f-orbital, element is from f-block.

Group = 3

The element is gadolinium (z = 64)

Complete electronic configuration = $[X_e]\ 4f^7\ 5d^1\ 6s^2$

30. The word smog is a combination of smoke and fog. It is a type of air pollution that occurs in many cities throughout the world.

Classical smog occurs in cool humid climate. It is also called as *reducing smog*.

Whereas **photochemical smog** occurs in warm and dry sunny climate. It as high concentration of oxidising agents and therefore, it is also called as *oxidizing smog*.

Section D

31. Let the oxidation number of an underlined atom be x.

i. $\overset{+1}{\mathrm{Na}}\,\overset{+1}{\mathrm{H}}_2\,\overset{x}{\mathrm{P}}\,\overset{-2}{\underset{4}{\mathrm{O}}}$

1(+1) + 2(+1) + x + 4 (-2) = 0 ∴ x = +5

Oxidation number of P in NaH_2PO_4 is + 5

ii. $\overset{+1}{Na}\overset{+1}{H}\overset{x}{S}\overset{-2}{O_4}$

1(+1) + 1(+1) + x + 4 (-2) = 0

x - 6 = 0 ∴ x = + 6

iii. $\overset{+1}{N_4}\overset{x}{P_2}\overset{-2}{O_7}$

4(+1) + 2(x) + 7(-2) = 0

2 x - 10 = 0 ∴ x = + 5

iv. $\overset{+1}{K_4}\overset{x}{Mn}\overset{-2}{O_4}$

2(+1) + x + 4(-2) = 0

x - 6 = 0 ∴ x = + 6

v. $\overset{+2}{Ca}\overset{x}{O_4}$

+ 2 + 2(x) = 0 ∴ x = + 1

OR

i. Bosch process

ii.

a. $T_2 > D_2 > H_2$

b. $T_2 > D_2 > H_2$

iii.

a. Ammonia

b. Methanol

c. Lead

iv. No, it does not support combustion.

v.

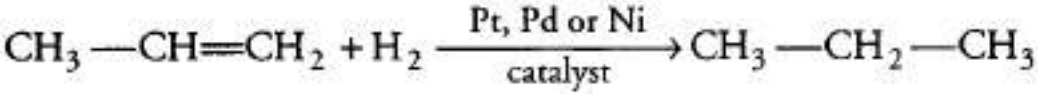
a. HCl

b. NaH

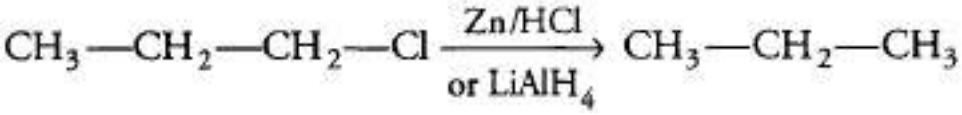
32. i. The stability of structural isomers is directly proportional to branching. As the branching increases, the structure becomes more compact and this decreases molecular surface area per atom and so leads to a lowering of energy and *increases* instability. Hence, correct order of stablity is:
Pentane, $CH_3(CH_2)_3CH_3$ < iso-pentane, $(CH_3)_2CH\ CH_2CH_3$ < neo-pentane, $(CH_3)_4C$

ii.

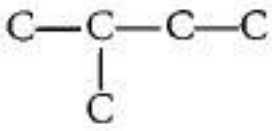
a. From alkene, alkane can be prepared by hydrogenation.



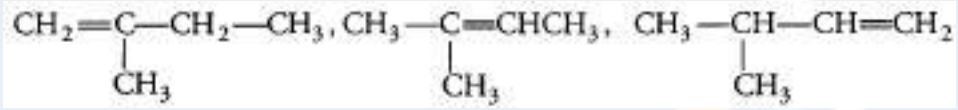
b. From alkyl halides, alkane can be prepared by reduction in the presence of Zn/HCl or $LiAlH_4$.



iii. The alkenes must have the same carbon skeleton as 2-methyl butane.



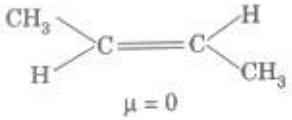
There are three different positions for the double bond; hence the three different alkenes are



iv. The Cl—Cl bond must be broken to form Cl radical before the reaction with methane. This homolysis requires energy, which is supplied either by heat or light.

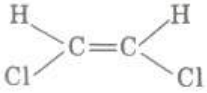
OR

i. In trans-but-2-ene, the dipole moments of the two C - CH_3 bonds are equal and opposite and therefore, they cancel out each other. Hence trans-2-butene is non-polar.

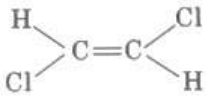


ii.

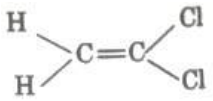
a. cis-1, 2-dichloroethene



b. trans-1, 2-dichloroethene



c. 1, 1-dichloroethene



Out of these (b) is non-polar

33. i. Not possible because n cannot have zero value.
    ii. Possible
    iii. Not possible because for n = 1, l = 1 is not possible. l can have values 0, 1 ... (n - 1) only.
    iv. Possible
    v. Not possible because for n = 3, l cannot have 3 value.
    vi. Possible

OR

The balanced chemical equation is :

$$BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow BaSO_4(s) + 2NaCl_{(aq)}$$

Let us first calculate moles of Na_2SO_4 and $BaCI_2$ 0.5 M solution of $NaSO_4$ means that 0.5 mol of Na_2SO_4 are present in 1000 ml of solution.

1000 ml of solution contain Na_2SO_4 = 0.5 mol

250 ml of solution contain $NaSO_4$ = $\frac{0.5}{1000} \times 250$

= 0.125 mol

Moles of $BaCI_2$ in solution = $\frac{10}{208}$

(Mol. mass of $BaCI_2$ = 137 + 2 $\times$ 35.5 = 208)

= 0.048

According to the balanced equation, 1 mol of $BaCl_2$ reacts with 1 mol of Na_2SO_4.. Therefore, BaCl of $BaCl_2$ limiting reactant, so only 0.048 mol of Na_2SO_4 reacts with 0.048 mol of Na_2SO_4.

Now, according to the equation,

1 mol of $BaCI_2$ produces $BaSO_4$ = 1 mol, 0.048 mol of $BaCI_2$ produces $BaSO_4$ = 1 $\times$ 0.048 = 0.048 mol

Amount of $BaSO_4$ obtained = 0.048 $\times$ 233, (Mol. mass of $BaSO_4$ = 233)

= 11.18 g