CBSE Class 11 Chemistry

Sample Paper 02 (2020-21)

Maximum Marks: 70

Time Allowed: 3 hours

General Instructions:

i. There are 33 questions in this question paper. All questions are compulsory.
ii. Section A: Q. No. 1 to 16 are objective type questions. Q. No. 1 and 2 are passage based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.
iii. Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.
iv. Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.
v. Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.
vi. There is no overall choice. However, internal choices have been provided.
vii. Use of calculators and log tables is not permitted.

Section A

1. **Read the following passage and answer the following questions:**

   Important compounds of calcium are calcium oxide, calcium hydroxide, calcium sulphate, calcium carbonate, and cement. These are industrially important compounds. Calcium carbonate occurs in nature in several forms like limestone, chalk, marble etc. It can be prepared by passing carbon dioxide through slaked lime or by the addition of sodium carbonate to calcium chloride.

   $CaCl_{(sq)} + Na_2CO_{3(aq)} \rightarrow CaCO_{3(s)} + 2NaCl_{(sq)}$

   Calcium oxide is a white amorphous solid. It has a melting point of 2870 K. On exposure to the atmosphere, it absorbs moisture and carbon dioxide. The addition of a limited amount of water breaks the lump of lime. This process is called slaking of lime. Quick lime slaked with soda gives solid soda lime. Being a basic oxide, it combines with acidic oxides at high temperature. Calcium hydroxide is prepared by adding water to quick lime, CaO. It is a white amorphous powder. It is sparingly soluble in water. The aqueous solution is known as lime water.

i. A suspension of slaked lime in water is known as
   a. limewater
   b. milk of magnesia
   c. milk of lime
   d. slaked of lime

ii. Which of the following is not the use of CaO?
   a. use in whitewash
   b. manufacture of sodium carbonate
   c. purification of sugar
   d. manufacture of dyestuffs

OR

When carbon dioxide is passed through lime water it turns milky due to the formation of compound A. Identify the compound A?
   a. calcium bicarbonate
   b. calcium carbonate
   c. calcium chloride
   d. none of these

iii. Important ingredients present in Portland cement are
   a. dicalcium silicate 26%
   b. tricalcium silicate 51%
   c. tricalcium aluminate 11%
   d. all of these

iv. Which of the following is used in the manufacturing of quick lime?
   a. $CaCO_3$
   b. CaO
   c. $CaCl_2$
   d. $Ca(OH)_2$

2. **Read the passage given below and answer the following questions:**

In view of the shortcoming of the Bohr's model, attempts were made to develop a more suitable and general model for atoms. Two important developments which contributed significantly in the formulation of such a model were Dual behaviour of matter, Heisenberg uncertainty principle. Uncertainty principle which is the consequence of dual

behaviour of matter and radiation. It states that it is impossible to determine simultaneously, the exact position and exact momentum (or velocity) of an electron. If the position of the electron is known with high degree of accuracy (Δx is small), then the velocity of the electron will be uncertain [$\Delta(v_x)$ is large]. Physical measurements on the electron's position or velocity, the outcome will always depict a fuzzy or blur picture. One of the important implications of the Heisenberg Uncertainty Principle is that it rules out existence of definite paths or trajectories of electrons and other similar particles.

In these questions, a statement of assertion followed by the statement of reason is given. Choose the correct answer out of the following choices

a. Assertion and reason both are correct statements and reason is the correct explanation for assertion.
b. Assertion and reason both are correct statements and reason is not the correct explanation for assertion.
c. Assertion is the correct statement but reason is wrong statement.
d. Assertion is the wrong statement but reason is correct statement.

i. **Assertion:** For a sub-atomic object such as an electron, it is not possible simultaneously to determine the position and velocity.
Reason: Δx is the uncertainty in momentum.

ii. **Assertion:** Radiation exhibits dual behaviour i.e., both particle and wavelike properties.
Reason: Electrons should also have momentum as well as wavelength.

iii. **Assertion:** The effect of the Heisenberg Uncertainty Principle is significant only for motion of microscopic objects.
Reason: The trajectory of an object is determined by its location and velocity at various moments.

iv. **Assertion:** De Broglie predicted that an electron beam undergoes convergence.
Reason: According to de Broglie, every object in motion has a wave character.

OR

Assertion: An orbit is a clearly defined path.
Reason: The wave character of the electron is not considered in the Bohr model.

3. In scientific notation for numbers, any number can be represented in the form, $N \times 10^n$ where,

a. n is an exponent having positive or negative values and N can vary from 10 to 100.
b. n is an exponent having positive values only and N can vary from 1 to 10.
c. n is an exponent having positive or negative values and N can vary from 0 to 1.
d. n is an exponent having positive or negative values. N represents a number that can vary from 1 to 10, but not 10 itself.

4. Absorption spectrum, seen as dark lines in an otherwise continuous spectrum, for the given material results from the material's (atom or molecules):
   a. absorbing selected wavelengths and returning to normal ground state
   b. absorbing selected wavelengths from an input of continuous spectrum
   c. absorbing all wavelengths and returning to normal ground state
   d. absorbing all wavelengths from an input of continuous spectrum

OR

Photoelectric effect established that light
   a. behaves like particles
   b. behaves like magnetic fields
   c. behaves like waves
   d. behaves like rays

5. Which of the following reactions will yield 2, 2-dibromopropane?
   a. $CH \equiv CH + 2HBr \rightarrow$
   b. $CH_3 - CH = CH_2 + HBr \rightarrow$
   c. $CH_3 - C \equiv CH + 2HBr \rightarrow$
   d. $CH_3CH \equiv CHBr + HBr \rightarrow$

6. ΔU^0 of combustion of methane is - X kJ mol^{-1}. The value of ΔH^0 is
   a. = ΔU^0
   b. > ΔU^0
   c. < ΔU^0
   d. zero

OR

A thermodynamic state function is a physical quantity whose value:
   a. depends on temperature only.
   b. determine PV work.

c. independent of path.

d. determine heat changes.

7. Choose the correct order of decrease in hydration enthalpies of alkaline earth metals in the options given below.

   a. $Be^{2+} < Mg^{2+} < Ca^{2+} < Sr^{2+} < Ba^{2+}$

   b. $Ca^{2+} < Sr^{2+} < Ba^{2+} < Be^{2+} < Mg^{2+}$

   c. $Sr^{2+} < Ba^{2+} < Be^{2+} < Mg^{2+} < Sr^{2+}$

   d. $Mg^{2+} < Ca^{2+} < Sr^{2+} < Ba^{2+} < Be^{2+}$

OR

Which of the following is not a peroxide?

a. Na_2O_2

b. CrO_5

c. BaO_2

d. KO_2

8. 2-methylbutane on reacting with bromine in the presence of sunlight gives mainly _____.

   a. 2-bromo 3-methylbutane

   b. 1-bromo 2-methylbutane

   c. 2-bromo 2-methylbutane

   d. 1-bromo 3-methylbutane

9. Lines in the hydrogen spectrum which appear in the infrared region of the electromagnetic Spectrum, then they are called as

   a. Balmer series

   b. Hydrogen line series

   c. Hydrogen series

   d. Paschen series

10. Which of these fuels given below is not a hydrocarbon?

    A. Hydrogen

    B. LNG

    C. LPG

    D. CNG

a. C
b. B
c. D
d. A

11. The species having pyramidal shape is:
    a. SF_2O
    b. BrF_3
    c. SiO_3^{2-}
    d. SO_3
12. **Assertion:** Both 32 g of SO_2 and 8 g of CH_4 contain the same number of molecules.

    Reason: Equal moles of two compounds contain the same number 0 molecules.
    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:** Boron has low electrical conductivity.

    Reason: At ordinary temperature boron behaves as metallic.
    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:** The kinetic energy of 8 gram of methane is equal to the kinetic energy of 16 gram of oxygen.

    Reason: The total heat change in a reaction is the same whether the chemical reaction takes place in one single step or in several steps.
    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.

OR

Assertion: At critical point, the densities of gaseous and liquid states become same.

Reason: At critical point, gases behave ideally.

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:** Oxidation number of phosphorus in P_4 is zero.

    Reason: Phosphorus has oxidation state zero in all its compound.

    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:** Lactic acid shows geometrical isomerism.

    Reason: It has C = C bond.

    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. Explain why chlorine can be converted into chloride ion more easily as compared to fluoride ion from fluorine?

OR

Write the atomic number of the element present in the third period and seventeenth group of the periodic table.

18. Draw the possible resonance structures for $CH_3 - \ddot{\underset{\ddot{}}{O}} - \overset{+}{C}H_2$ and predict which of the structures is more stable. Give reason for your answer.
19. 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-}

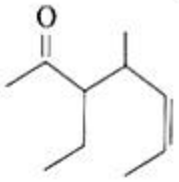
OR

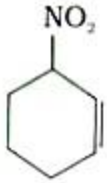
The value of K_c for the reaction $3O_2(g) \rightleftharpoons 2O_3(g)$ is 2.0×10^{-50} at 25°C. If equilibrium concentration of O_2 in air at 25°C is 1.6×10^{-2}, what is the concentration of O_3?

20. Identify the most stable species in the following set of ions giving reasons
    i. $\overset{-}{C}H_3, CH_2\overset{-}{C}l, CHCl_2^-, \overset{-}{C}Cl_3$
    ii. $\overset{+}{C}H_3, CH_2\overset{+}{C}Br, CH\overset{+}{C}Br_2, \overset{+}{C}Br_3$

OR

Name the compounds:

(i) 

(ii) 

21. Complete the following reactions:
    i. $CO(g) + H_2(g) \xrightarrow{\Delta}$
    ii. $Zn + (s) + NaOH(aq) \xrightarrow{heat}$
    iii. $C_3H_8(g) + 3H_2O(g) \xrightarrow[Catalyst]{\Delta}$
22. What is a zeolite?
23. How will you convert ethanoic acid into benzene?
24. Which element do you think would have been named by (i) Lawrence Berkeley Laboratory (ii) Seaborg's group?

25. How would you know whether a redox reaction is taking place in an acidic/alkaline or neutral medium?

Section C

26. The values of the Vander Waals constants for a gas are a = 4.10 dm^6 bar mol^{-2} and b = 0.035 b = 0.035 dm^3 mol^{-1}. Calculate the values of the critical temperature and critical pressure for the gas. Use R = 0.0821 dm^3 bar mol^{-1} k^{-1}

OR

A mixture of CO and CO_2 is found to have a density of 1.50 gL^{-1} at 20°C and 740 mm pressure. Calculate the composition of the mixture.

27. An alloy of iron (53.6%), nickel (45.8 %) and manganese (0.6 %) has a density of 8.17 g cm^{-3}. Calculate the number of Ni atoms present in the alloy of dimensions 10.0 cm × 20.0 cm × 15.0 cm

OR

Commercially available concentrated hydrochloric acid(HCl) contains 38% HCI by mass.

i. What is the molarity (M) of the solution (density of solution = 1.19 g mL^{-1})
ii. What volume required of concentrated HCI is required to make 1.0 L of an 0.10M HCI?

28. Write IUPAC names of the following compounds
    i. $(CH_3)_3CCH_2C(CH_3)_3$
    ii. $(CH_3)_2C(C_2H_5)_2$
    iii. Tetra-tert-butylmethane
29. Oxygen molecule has the formula O_2 while sulphur is S_8 .(Give reason)
30. A swimmer coming out from a pool is covered with a film of water weighing about 18g. How much heat must be supplied to evaporate this water at 298 K? Calculate the internal energy of vaporization at 298K.

    $\Delta_{vap}H^{\ominus}$ for water at 298K= 44.01kJ mol^{-1}

Section D

31. Use Lewis symbols to show electron transfer between the following atoms to form cations and anions:

a. K and S
b. Ca and O
c. Al and N

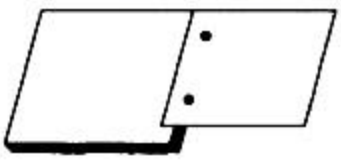
OR

i. What factors the formation of the ionic bond. Explain with examples.
ii. Arrange the following in increasing order of ionic character and also give the reason. NaCl, $CaCl_2$, $MgCl_2$, MgO.

32. Bromine monochloride (BrCl) decomposes into bromine and chlorine and reaches the equilibrium:
$2BrCl(g) \rightleftharpoons Br_2(g) + Cl_2(g)$
The value of K_c is 32 at 500 K. If initially pure BrCl is present at a concentration of $3.3 \times 10^{-3} mol\ L^{-1}$, what is its molar concentration in the mixture at equilibrium?

OR

Two long metallic strips are joined together by two rivets each of radius 0.1 cm (see Fig.). Each rivet can withstand the maximum shearing stress of 3.0×10^8 Nm^{-2}. Calculate the maximum tangential force a strip can exert.



33. Draw the structures of
i. 2-chlorohexane,
ii. pent-4-en-2-ol,
iii. 3-nitrocyclohexene,
iv. cyclohex-2-en-1-ol,
v. 6-hydroxy-heptanal.

OR

Write resonance structures of CH_2=CH–CHO. Indicate relative stability of the contributing structures.

CBSE Class 11 Chemistry

Sample Paper 02 (2020-21)

Solution

Section A

1. i. (c) milk of lime
   ii. (a) use in white wash

OR

(b) calcium carbonate

iii. (d) all of these
iv. (a) $CaCO_3$

2. i. (c) Assertion is the correct statement but reason is wrong statement.
   ii. (b) Assertion and reason both are correct statements and reason is not the correct explanation for assertion.
   iii. (b) Assertion and reason both are correct statements and reason is not the correct explanation for assertion.
   iv. (d) Assertion is the wrong statement but reason is correct statement.

OR

(b) Assertion and reason both are correct statements and reason is not the correct explanation for assertion.

3. (d) n is an exponent having positive or negative values. N represents a number that can vary from 1 to 10, but not 10 itself.

   Explanation: Scientific notation is conveniently used to represent extremely large or even very small numerical values. It is an exponential notation in which any number can be represented in the form, $N \times 10^n$, where n is an exponent having positive or negative values and N can vary between 1 and 10, but not 10 itself.

4. (b) absorbing selected wavelengths from an input of continuous spectrum

   Explanation: In an absorption spectrum, portions of a continuous spectrum (light containing all wavelengths) are missing because they have been absorbed by the medium through which the light has passed; the missing wavelengths appear as dark lines or gaps.

OR

(a) behaves like particles

Explanation: The emission of free electrons from a metal surface when light is shone on it is called the photoemission or the photoelectric effect. This effect led to the conclusion that light is made up of packets or quantum of energy. Einstein already associated the light quantum with momentum. This strongly supported the particle nature of light and these particles were named photons. Thus, the wave-particle duality of light came into the picture. Einstein won the Nobel Prize for Physics not for his work on relativity, but for explaining the photoelectric effect.

5. (c) $CH_3 - C \equiv CH + 2HBr \rightarrow$

Explanation: The reaction follows Markovnikoff's rule of addition which states that in addition of HBr to an unsymmetrical alkene, the major product is the one in which the Br gets attached to the more substituted carbon of the double bond.

6. (c) $< \Delta U^0$

Explanation: $CH_{4\,(g)} + 2O_2\,(g) \rightarrow CO_{2\,(g)} + 2H_2O\,(l)$

We know, $\Delta H^0 = \Delta U^0 + \Delta n_g$ RT

Δn_g is negative as product water in combustion reaction is in liquid state.

$\Delta H^0 = -X - \Delta n_g RT$

This implies ΔH^o will be more negative than ΔU^o

Hence, $\Delta H^o < \Delta U^o$

OR

(c) independent of path.

Explanation: State function is one which is only dependent on the initial and final state of the system and is independent of the path by which that change has occurred.

7. (a) $Be^{2+} < Mg^{2+} < Ca^{2+} < Sr^{2+} < Ba^{2+}$

Explanation: As the size increases due to increase in ionic radii , hydration energy decreases.

OR

(d) KO_2

Explanation: KO_2 is super oxide

8. (c) 2-bromo 2-methylbutane

   Explanation: The halogenation of alkanes follows free radical mechanism with the formation of free radical intermediates. As the secondary free radical is more stable than primary free radical, hence the product is 2-bromo-2-methylbutane.

9. (d) Paschen series

   Explanation: The Lyman series lies in the ultraviolet, whereas the Paschen, Brackett, and Pfund series lies in the infrared.

10. (d) A

    Explanation: Because hydrocarbons contain both C and H and hence Hydrogen is not a hydrocarbon.

11. (a) SF_2O

    Explanation: SF_2O has pyramidal shape as it is sp^3 hybridised and it has 3bp and 1 lp.

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. (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.

OR

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

Explanation: Assertion is CORRECT but, reason is INCORRECT.

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

    Explanation: Assertion is CORRECT but, reason is INCORRECT.

16. (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.

Section B

17. It is due to the relatively smaller size of flourine in which the ns and np electrons from the valence shell are effective in repelling the incoming electron. The bigger chlorine atom accepts the incoming electron easily, hence chlorine can form chloride easily.

OR

The element is chlorine (Cl) with atomic number (Z) = 17.

18. Two resonating structures can be of a given carbocation:

In structure $CH_3 - \ddot{\underset{\ddot{}}{O}} - \overset{+}{C}H_2, CH_2$ has +ve charge means octet is not completed, but in structure II, $CH_3 - \overset{+}{O} = CH_2$ both the carbon atoms and oxygen atom have an octet of electrons hence, it is more stable structure.

19. 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

For the given reaction, $3O_2(g) \rightleftharpoons 2O_3(g)$
Equilibrium concentration: 1.6×10^{-2} ?
Now, $K_c = \frac{[O_3]^2}{[O_2]^3}$ or $(2.0 \times 10^{-50}) = \frac{[O_3]^2}{(1.6 \times 10^{-2})^3}$
or $[O_3]^2 = (2.0 \times 10^{-50}) \times (1.6 \times 10^{-2})^3$
$[O_3]^2 = 8.192 \times 10^{-56}$
Or, $[O_3] = 2.86 \times 10^{-28}$ mol L^{-1}

20. i. $\bar{C}Cl_3$ is the most stable species because on replacing H by Cl, the negative charge on carbon is reduced and species is stabilised.

ii. $\overset{+}{C}H_3$ is the most stable species because the replacement of H by Br increases positive charge on the carbon atom and destabilises the species.

OR

i. 3-ethyl, 4-methylhept-5-en-2-one.

ii. 3-nitrocyclohex-1-ene.

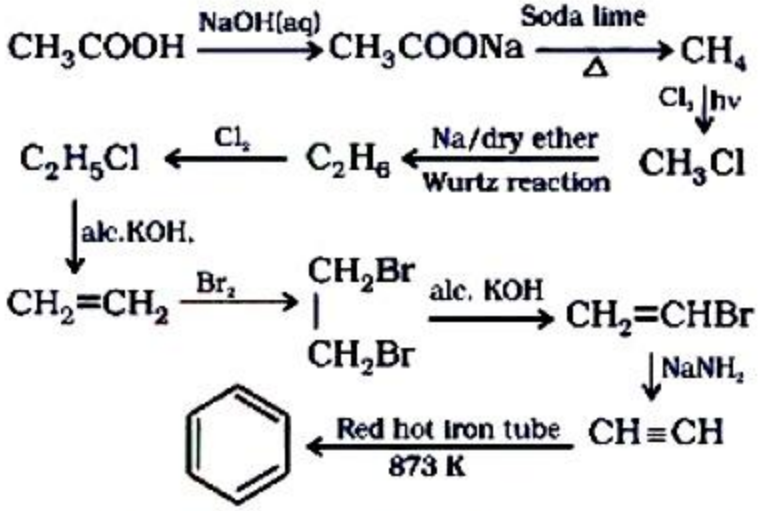
21. i. $CO(g) + 2H_2(g) \xrightarrow[Catalyst]{\Delta} CH_3OH(l)$

ii. $Z_n(s) + 2NaOH(aq) \xrightarrow[heat]{} Na_2ZnO_2(s) + H_2(g)$

iii. $C_3H_8(g) + 3H_2O \xrightarrow[1270\ K]{Ni} 3CO(g) + 7H_2(g)$

22. It is hydrated sodium aluminium silicate, $Na_2Al_2Si_2O_8 \cdot xH_2O$.
Zeolites are hydrated aluminosilicate minerals made from interlinked tetrahedra of alumina (AlO_4) and silica (SiO_4).They are solids with a relatively open, three-dimensional crystal structure built from the elements aluminium, oxygen, and silicon, with alkali or alkaline-earth metals (such as sodium, potassium, and magnesium) and water molecules trapped in the gaps between them. They are used to remove permanent hardness of water.

23. Ethanoic acid into benzene-



24. Lawrencium (Lr) with atomic number (Z) 103 and Seaborgium (Sg) with atomic number (Z) 106, have been named by Lawrence Berkeley Laboratory and Seaborg's group respectively.

25. If H^+ ion or OH^- ion is present on either side of the reaction then we can say that reaction is taking place in either acidic or basic medium respectively. If nothing is mentioned then

reaction takes place in a neutral medium.

Section C

26. **(i) Calculation of critical temperature (T_c)**

a = 4.10 dm^6 bar mol^{-2}

b = 0.035 dm^3 mol^{-1}

R = 0.0821 dm^3 bar mol^{-1} K^{-1}

Now, critical temperature, $T_c = \frac{8a}{27Rb}$

Substituting the values, $T_c = \frac{8\times4.10}{27\times0.0821\times0.035}$

T_c = 0.52°C

(ii) Calculation of critical pressure (P_c) $P_c = \frac{a}{27b^2} = \frac{4.10}{27\times0.035\times} = 123.96\ bar$

OR

Given, d = 1.50 gL^{-1}

T = 20°C = 293 K

We know that,

m = $\frac{dRT}{p}$

= $\frac{1.50L^{-1}\times0.0821\ L\ atm\ K^{-1}mol^{-1}\times293\ K}{(740/760)atm}$

= 37.06

Calculation of percentage composition:

Suppose mol % of CO in the mixture = x

Then, mol % of CO_2 in the mixture = (100 - x)

Average molecular mass = $\frac{x\times28+(100-x)\times44}{100}$

$\therefore \frac{28x+4400-44x}{100}$ = 37.06

$\Rightarrow 16x = 4400 - 3706$

$\Rightarrow 16x = 694$

$\Rightarrow x = \frac{694}{16}$

$\Rightarrow x = 43.38$

$\therefore$ Mol% of CO = 43.38 and Mol % of CO_2 = 100 - 43.38 = 56.62

27. Calculation of mass of nickel (Ni) in the alloy.

Volume of the alloy = (10.0 cm) × (20.9 cm) × (15.0 cm) = 3000 cm^3

Mass of the alloy piece = Density × volume

= (8,.17 g cm^{-3}) × (300 cm^3) = 24510 g

Mass of Ni in the alloy = (24510 g) × $\frac{45.8}{100}$

= 11225.6 g

Calculation of number of Nickel (Ni) atoms in the alloy

The gram atomic mass of Ni = 58.69

So, 58.69 g of Ni have atoms = 6.022 × 10^{23}; (as per Avogadro's hypothesis)

11225.6 g of Ni have atoms = (6.022 × 10^{23} × 11225.6 / 58.69)

= 1.15 × 10^{26} atoms

Thus, the number of nickel atoms in an alloy of given dimensions is 1.15 x 10^{26}

OR

i. Let assume the total mass of the solution is 100g.

38 % HCl by mass means 38 g of HCl is present in 100 g of solution.

The volume of solution (V) = $\frac{\text{mass}}{\text{density}} = \frac{100}{1.19} = 84.03\text{mL}$ (Density of solution = 1.19 g/mL)

Number of moles of HCl (n_B) = $\frac{38}{36.5}$ = 1.04

Molarity = $\frac{n_B \times 1000}{V(\,in\,mL)} = \frac{1.04 \times 1000}{84.03\,mL}$ = 12.38 M

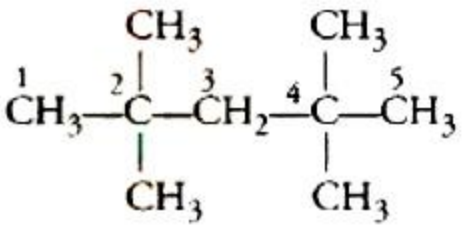
ii. From the molarity equation, $M_1V_1 = M_2V_2$

$\text{acid}_1 \quad \text{acid}_2$

$12.38\text{M} \times V_1 = 0.10\text{M} \times 1.0\text{L}$

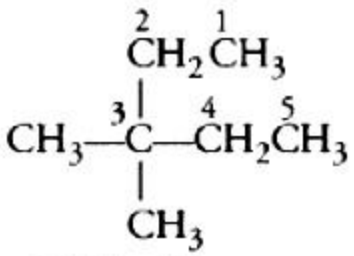
$\therefore V_1 = \frac{0.1 \times 1.0}{12.38} = 0.00808\text{L} = 8.08\text{cm}^3$

28. i. Structure and IUPAC name of $(CH_3)_3CCH_2C(CH_3)_3$:



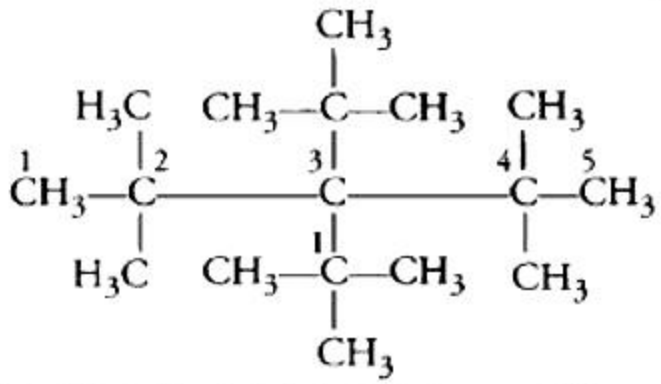
2,2,4, 4-tetramethylpentane

ii. Structure and IUPAC name of $(CH_3)_2C(C_2H_5)_2$:



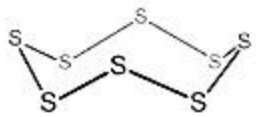
3, 3-dimethylpentane

iii. Structure and IUPAC name of Tetra-tert-butylmethane:



3, 3-di(1, 1-dimethylethyl)-2,2,4,4-tetramethylpentane
or 3,3-bis (1, 1-dimethylethyl)-2,2,4,4-tetramethylpentane

29. Due to the small size and high electronegativity oxygen forms $p\pi - p\pi$ multiple bonds. As a result, oxygen exists as diatomic (O_2) molecule. Due to its bigger size and lower electronegativity sulphur does not form $p\pi - p\pi$ multiple bonds. Consequently, sulphur because of its high tendency of catenation and a lower tendency of $p\pi - p\pi$ multiple bonds forms octa atomic (S8) molecules having an eight-membered puckered ring structure.



30. We can represent the process of evaporation as

$$\underset{1\text{ mol}}{H_2O(1)} \xrightarrow{\text{vapertation}} \underset{1\text{ mol}}{H_2O(g)}$$

No. of moles in 18 g H_2O(l) is

$= \frac{18g}{18gmol^{-1}} = 1$ mol

Heat supplied to evaporate18g water at

298 K = n × $\Delta_{vap}H^{\ominus}$

= (1 mol) × (44.01 kJ mol^{-1})

= 44.01 kJ

(assuming steam behaving as an ideal gas).

$\Delta_{\text{uap}} U = \Delta_{\text{uap}} H^{\text{e}} - p\Delta V = \Delta_{\text{oap}} H^{\ominus} - \Delta n_g RT$

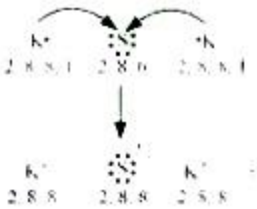
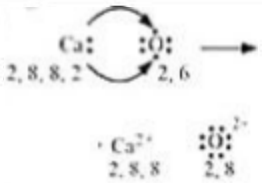
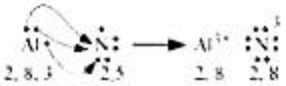
$\Delta_{\text{eq}} H'' - \Delta \text{n}_{\text{e}} \text{RT} = 44.01\text{kJ} - (1)\left(8.314\text{JK}^{-1}\text{mol}^{-1}\right)(298\text{K})\left(10^{-3}\text{kJJ}^{-1}\right)$

$\Delta_{\text{exp}} U^{\upsilon} = 44.01\text{kJ} - 2.48\text{kJ}$

$= 41.53\text{kJ}$

Section D

31.

Atoms	Atomic number	Electronic Configuration	No. of valence e^-	Transfer of electrons	cations and anions formed
K	19	2, 8, 8, 1	$1 \rightarrow \cdot\text{K}$	 (K requires one electrons and s seed 2 electrons to complete its octet)	$2K^+S^{2-}$
S	16	2, 8, 6	$6 \rightarrow :\ddot{\text{S}}\cdot$		
Ca	20	2, 8, 8, 2	$2 \rightarrow \text{Ca:}$	 (Oxygen requires two more electrons to complete its octet and Ca has two electrons more than noble gas)	$Ca^{2+}O^{2-}$
O	8	2, 6	$6 \rightarrow$ 		
Al	13	2, 8, 3	$3 \rightarrow :\dot{\text{A}}\text{l}$	 (Nitrogen requires three electrons to complete its octet and Al has 3 more electrons than the noble gas)	$Al^{3+}N^{3-}$
N	7	2, 5	$5 \rightarrow :\dot{\text{N}}\cdot$		

OR

i. The factors for the formation of an ionic bond are:

a. Ionization energy: It is the amount of energy required to remove the most loosely bound electron from an isolated gaseous atom. Thus, lesser the ionization enthalpy required, easier will be the formation of a cation. e.g.Generally metals (especially alkali metals and alkaline earth metals) form cations easily due to low ionization energy.

b. Electron gain enthalpy: It is the amount of energy released on the addition of an electron to an isolated gaseous neutral atom. Greater the negative electron gain enthalpy, easier will be the formation of an anion. e.g.Generally non-metals (specially Halogens) form anion easily due to high electron gain enthalpy.

c. High lattice enthalpy: It is the amount of energy released when 1 mole of a crystal is formed from the gaseous state. The greater the magnitude of lattice energy greater will be the stability of the ionic bond.

ii. Lattice energy depends on

(a) Inter-ionic distance: As the inter-ionic distance decrease, lattice energy increases.

(b) Product of ionic charges: As the product of ionic charges increases, lattice energy increases.

In MgO and $MgCl_2$, the product of the magnitude of ionic charges is 4 and 2 respectively. Hence MgO has higher lattice energy than $MgCl_2$. Again the size of Mg^{2+} is smaller than Na^+ and therefore $MgCl_2$ has higher lattice energy than NaCl.

Similarly, the product of the magnitude of ionic charges of $CaCl_2$ and NaCl is 2 and 1 respectively. So $CaCl_2$ has higher lattice energy than NaCl. The size of Ca^{2+} is greater than Mg^{2+} and hence the lattice energy of $CaCl_2$ is lower than $MgCl_2$.Therefore the order of lattice energy is

MgO > $MgCl_2$ > $CaCl_2$ > NaCl

32. Let x moles of BrCl decompose in order to attain the equilibrium. The initial molar concentration and the molar concentration at equilibrium point of different species may be represented as follows:

	$2BrCl\ (g)$	$\rightleftharpoons Br_2(g)$	$+Cl_2(g)$
$Initial\ molar/litre$	0.0033	0	0
$Moles/litres\ at\ eqn.\ point$	$0.0033 - x$	$x/2$	$x/2$

Applying law of chemical equilibrium,

$K_c = \frac{[Br_2][Cl_2]}{[BrCl]^2}$

$\Rightarrow 32 = \frac{\left[\frac{x}{2}\right]\left[\frac{x}{2}\right]}{[0.0033-x]^2}$

$\Rightarrow 5.656 = \frac{\left[\frac{x}{2}\right]}{[0.0033-x]}$ {taking sqaure root on both sides}

$\frac{x}{(0.0033-x)}$ = 11.31

or 12.31x = 0.037

$x = \frac{0.037}{12.31} = 0.003$

∴ Molar concentration of BrCl at equilibrium point = 0.0033 - 0.003

= 0.0003 mol $L^{-1} = 3 \times 10^{-4}\ mol\ L^{-1}$

OR

According to the question, r = 0.1 cm = 1×10^{-3} m, shearing stress = 3×10^8 Nm^{-2}.

Let F be the tensile force applied. Since each rivet shares the stretching force equally, so the shearing force on each rivet = F/2

If A is the area of each rivet, then shearing stress on each rivet = $\frac{F}{2A}$.

Now, maximum shearing stress on each strip = 3×10^{-8} Nm^{-2}

$\Rightarrow \frac{F_{max}}{2A}$ = 3×10^8 Nm^{-2}

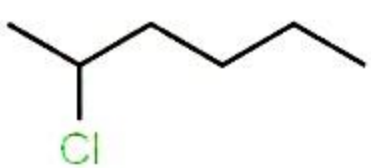
where F_{max} is the maximum tangential force.

$\Rightarrow F_{max} = 3 \times 10^8 \times 2A$

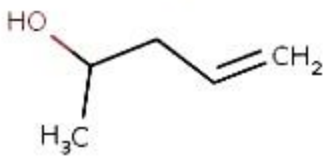
$= 6 \times 10^8 \times \frac{22}{7} \times (1 \times 10^{-3})^2$

= 1885 N

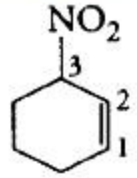
33. i. Structure of 2-chlorohexane:



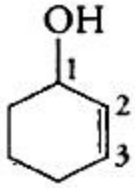
ii. Structure of pent-4-en-2-ol:



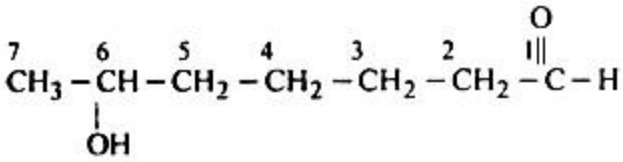
iii. Structure of 3-nitrocyclohexene:



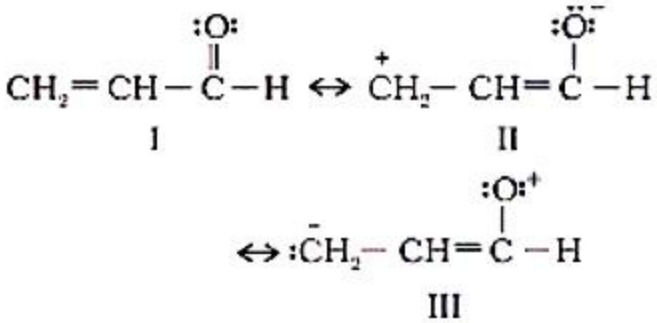
iv. Structure of cyclohex-2-en-1-ol:



v. Structure of 6-hydroxy-heptanal:



OR



Stability: I > II > III

[Structure I: Most stable, more number of covalent bonds, each carbon and oxygen atom has an octet and no separation of opposite charge present. Structure II: negative charge on the more electronegative atom and the positive charge on more electropositive atom; III: does not contribute as oxygen has a positive charge and carbon has a negative charge, hence the structure is least stable].