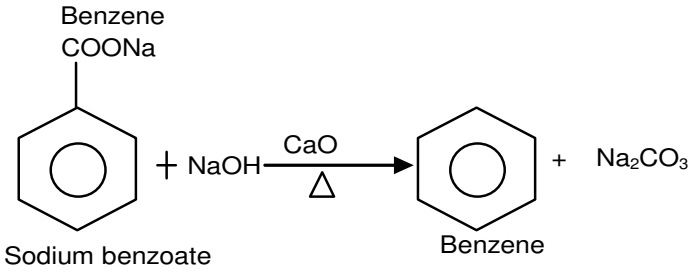
Model Question Paper I
CHEMISTRY

I PUC
Time: 3.15 hrs **Max Marks: 70**

General Instructions:
1) The question paper has four parts A, B, C and D. All Parts are compulsory
2) Write balanced chemical equations and draw Labelled diagram wherever necessary

PART A

I Answer ALL the following questions in a sentence or a word: 10 x 1 = 10

1. Equal volumes of all the gases at the same temperature and pressure should contain equal number of Molecules.
2. $P\nu = nRT$
3. CO_3^{2-}
4. The ability of an atom in a chemical compound to attract the shared compound to attract the shared pair of electrons towards itself is called electronegativity.
5. Zn or Zinc
6. $Na_2CO_3\ 10H_2O$
7. Solid form of CO_2 is called dry ice
8. sp^2 hybridisation
9. 4-Methyl pent-2-en
10. 

PART -B

II Answer Any FIVE questions. Each Question carries TWO marks: 5 x 2 = 10

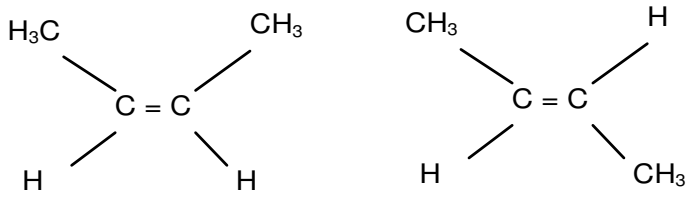
11. Mole is the amount of substance that contains as many particles or entities as there are atoms in exactly 12g of C – 12 isotope
    Molar Mass of $H_2SO_4 = 2 + 32 + 64 = 98$
    No. of Moles of $H_2SO_4 = \dfrac{\text{Mass}}{\text{Molar Mass}}$
    $= \dfrac{49}{98}$
    $= 0.5$
12. The volume of one mole of gas at critical temperature is called critical volume
    Unit of coefficient of viscosity is Poise or $1 g cm^{-1} s^{-1}$ or $10^{-1}\ kg m^{-1} s^{-1}$
13.

Sigma bond	Pi bond
1) The bond is formed by the axial overlap (head on) of the atomic orbitals	1) The bond is formed by the sideways overlapping of atomic orbitals
2) Strong bond	2) Weak bond

14. Sodium burns in air or oxygen to form sodium peroxide

$$2Na + O_2 \rightarrow \underset{\text{Sodium peroxide}}{Na_2O_2}$$

15. Carbon monoxide is poisonous because it combines with haemoglobin of the blood to form carboxy haemoglobin complex. This complex is 300 times More stable than haemoglobin this prevents haemoglobin from carrying oxygen round the body and resulting in death.
16. 2 – butane exhibits geometrical isomerism



Cis- But-2-ene Trans – But – 2 – ene

In Cis isomer the identical groups are on the same side of the double bond.
In trans isomer the identical groups are on the opposite side of the double bond

17. The electron deficient species are called electrophiles
    Ex: Br^+ or Cl^+ or NO_2^+ or $^+CH_3$
18. i) The amount of oxygen required by bacteria to break down the organic Matter present in a certain volume of a sample of water is called Biochemical oxygen demand
    ii) Gaseous pollutants: CO_2 or CO or NO or NO_2 or SO_3

PART -C

III Answer any FIVE questions. Each Question carries THREE marks: 5 x 3 = 15

19. <u>S – block element</u>

    S- block elements are those in which the last electron enters into the S- orbital of the outer electronic configuration is ns^{1-2}

    The S- block elements belong to group 1 and 2 of the periodic table

    <u>P – Block elements</u>

    P-block elements are those in which the last electron enters into the p-orbital of the outer most shell.

    The general outer electronic configuration is ns^2np^{1-6}

    The P- block elements belong to group 13 to 18 of the periodic table

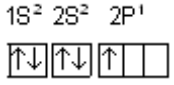
    <u>d- block elements</u>

    d- block elements are those in which added electron goes into inner d – orbital of the penultimate shell.

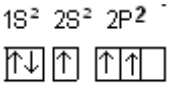
    The general outer electronic configuration is $(n-1)d^{1-10}\ ns^{1-2}$

    The d- block elements belong to group 3 to 12 of the periodic table

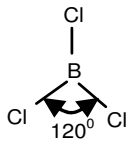
    d- block elements are also called as transition elements.
20. Electrons configuration of B in ground state is

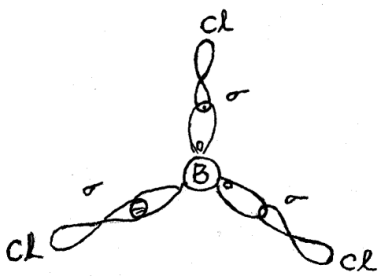


Electronic configuration of B in excited state is



Bron undergoes sp^2 hybridisation by using one 2 S and two 2p orbitals to give: three half filled sp^2 hybrid orbitals which are oriented in trigonal planar arrangement and overlap with $2p_z$ orbital of chlorine to form three B – Cl bonds





21. 1. The shape of a Molecule depends upon the number of valence shell electron pairs (bonding or non bonding) around the central atom
    2. Pairs of electrons in the valence shell repel one another since their electron clouds are negatively charged.
    These pars of electrons tend to occupy such positions in space that Minimize repulsion and thus Maximize distance between them.
    3. If the central atom is surrounded by lone pairs as well as bond pairs, then the Molecule will have distorted geometry.

22. $C_2 : (\sigma 1s)^2(\sigma^* 1s)^2(\sigma 2s)^2(\sigma^* 2s)^2(\pi 2P_x^2 = \pi 2P_y^2)$

    Or

    $KK(\sigma 2s)^2(\sigma^* 2s)^2\ \pi 2P_x^2 = \pi 2P_y^2)$

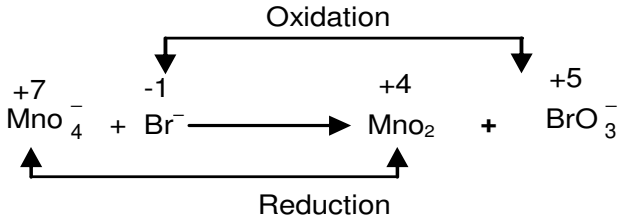
    Bond order = $\frac{N_b - N_a}{2}$

    $= \frac{8-4}{2}$

    = 2

    Since there are no unpaired electrons it is diamagnetic in nature.

23.



Reduction	$MnO_4^- \xrightarrow{3units} MnO_2$
Oxidation	$Br^- \xrightarrow{6units} BrO_3^-$
Reduction eq n x 2	$2MnO_4^- \longrightarrow 2MnO_2$
Oxidation eq n x 1	$Br^- \longrightarrow BrO_3^-$
Adding	$2MnO_4^- + Br^- \longrightarrow 2MnO_2 + BrO_3^-$

As the reaction occur in basic medium to equalize ionic charges 2 OH^- are added on RHS. To balance hydrogen atoms add H_2O on LHS

$2MnO_4^- + Br^- + H_2O \longrightarrow 2MnO_2 + BrO_3^- + 2OH^-$

24. i) $C_{(s)} + H_2O_{(g)} \xrightarrow{\Delta} CO_{(g)} + H_{2_{(g)}}$

ii) $CO_{(g)} + H_2O_{(g)} \xrightarrow{\Delta} CO_{2_{(g)}} + H_{2_{(g)}}$

iii) $Zn_{(s)} + 2H^+_{(aq)} \xrightarrow{\Delta} Zn^{2+}_{(aq)} + H_{2(g)}$

25. $2NH_3 + H_2O + CO_2 \rightarrow (NH_4)_2CO_3$

$(NH_4)_2CO_3 + H_2O + CO_2 \rightarrow 2NH_4HCO_3$

$NH_4HCO_3 + Nacl \rightarrow NH_4Cl + NaHCO_3$

$2NaHCO_3 \rightarrow NO_2CO_3 + CO_2 + H_2O$

$NH_4Cl + Ca(OH)_2 \rightarrow NH_3 + CaCl_2 + H_2O$

26. a) In graphite each carbon atom has one outer shell electron that s not used to form covalent bonds. These electrons are delocalized over the whole structure. Electrons are mobile and therefore graphite conducts electricity

b) $B_3N_3H_6$

c) $H-COOH \xrightarrow[373K]{\text{Conc. } H_2SO_4} CO + H_2O$

PART -D

IV Answer any FIVE questions. Each Question carries FIVE marks: 5 x 5 = 25

27. a)

Element	C	H	CL
Percentage composition	24.26%	4.05%	71.67%
Atomic Mass	12	1	3.45
$\frac{\text{Percentage}}{\text{Atomic Mass}}$	$\frac{24.26}{12} = 2.02$	$\frac{4.05}{1} = 4.05$	$\frac{71.67}{35.45} = 2.02$
Dividing the values by Smallest of them	$\frac{2.02}{2.02} = 1$	$\frac{4.05}{2.02} = 2$	$\frac{2.02}{2.02} = 1$

Empirical formula = CH_2Cl

Molecular formula = (empirical formula)n

$$n = \frac{\text{Molecular Mass}}{\text{Empiriacl formula Mass}}$$

$$= \frac{98.96}{49.48}$$

$= 2$

$\therefore$ Molecular formula $(CH_2Cl)_2$

$C_2H_4Cl_2$

b) Molecular formula of Glucose = $C_6H_{12}O_6$

Molar Mass of Glucose = (6 x 12) +(12 x 1) + (6 x 16)

= 180

28. a) 1. Electrons revolve around the nucleus in certain selected circular paths called orbitals or energy levels

2. A long as electron revolve in a particular orbit it does not emit energy

3. If an electron jumps from higher energy level to a lower energy level, energy is emitted and when electron jumps from lower energy level to higher energy level. Energy is absorbed

b) $\lambda = \frac{h}{mv}$ or $\lambda = \frac{h}{p}$

c) 3P

29. a) 1. Principal quantum number 'n'
Indicates the size or energy of the orbital
2. Azimuthal quantum number 'L'
Indicates the shape of the orbital
3) Magnetic quantum number 'm'
Indicates orientation of orbitals in space
4) Spin quantum number –S
Indicates direction of spin of an electron
b) It states that in the ground state of the atom the orbitals are filled in order of their increasing energies

30. a) 1. Gases consist of large number of minute discrete particles called Molecules
2. Molecules move randomly in straight lines in all directions and at various Speeds and the direction of Motion are changes when colliding with each other or with wall of the container.
3. There is no force of attraction between the particles of a gas at ordinary temperature and pressure.
4. The Collisions between the Molecules are perfectly elastic i.e., no energy loss on collision due to friction
b) From Charge's law

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\quad V_1 = 2L. \quad T_1 = 296.4K$

$\therefore V_2 = \frac{V_1 \times T_2}{T_1}$ $\quad V_2 = ? \quad T_2 = 299.1K$

$= \frac{2L \times 299.1K}{296.4K}$

$= 2.018L$

31. a) Hess's law states that the enthalpy change is same whether a reaction is carried out in one step or several steps
b) $\Delta G^0 = -2.303\ RT\ Log K_p$

$\Delta G^0 = -2.303 \times 8.314 \times 298 \times \log 2.47 \times 10^{-29}$

$= 163000\ J mol^{-1}$

$= 163.0\ KJ\ mol^{-1}$

c) Enthalpy of formulation of water

Molecule is $\frac{-571.6}{2} = -285.8 KJMol^{-1}$

32. a) Required equation

$6C_{(s)} + 3H_{2(g)} \longrightarrow C_6H_{6_{(l)}} \quad \Delta_f H^0 = ?$

Given

1) $C_6H_{6_{(l)}} + 15/2\ O_{2_{(g)}} \longrightarrow 6CO_{2_{(g)}} + 3H_2O_{(l)}\ \Delta_f H^0 = -3267\ KJMol^{-1}$

2) $C_{(s)} + O_{2_{(g)}} \longrightarrow CO_{2_{(g)}} \quad \Delta_f H^0 = -393.5\ KJMol^{-1}$

3) $H_{2_{(g)}} + 1/2\ O_{2_{(g)}} \longrightarrow H_2O_{(l)} \quad \Delta_f H^0 = -285.8\ KJMol^{-1}$

Reverse eqn 1, Equation 2 x 6, Equation 3 x 3 and adding

$6CO_{2_{(g)}} + 3H_2O_{(l)} \longrightarrow C_6H_{6_{(l)}} + 15/2\ O_2\ \Delta_f H^0 = 3267 KJ\ Mol^{-1}$

$6C_{(s)} + 6O_{2_{(g)}} \longrightarrow 6CO_{2_{(g)}} \quad \Delta_f H^0 = -2361\ KJMol^{-1}$

$3H_{2_{(g)}} + 3/2\ O_{2_{(g)}} \longrightarrow 3H_2O_{(l)} \quad \Delta_f H^0 = -857.4 KJMol^{-1}$

Adding $6C_{(s)} + 3H_{2_{(g)}} \longrightarrow C_6H_{6_{(l)}} \quad \Delta_f H^0 = +48.6 KJMol^{-1}$

b) Entropy increases

33. a) Water is weak electrolyte, it undergoes partial ionsation.

$H_2O_{(c)} + H_2O_{(c)} \rightleftharpoons H_3O^+_{(aq)} + OH^-_{(aq)}$

$K = \frac{[H_3O^+][OH^-]}{[H_2O]}$

By Convention $[H_2O]$ is taken as constant

$\therefore K_w = [H^+][OH^-]$

Where Kw is called ionic product of water and its value at 25^0C is 1×10^{-14}

b) A solution which resists the change in the pH by the addition of little acid or base is called buffer solution example for acidic buffer $CH_3COOH + CH_3COONa$ or $HCOOH + HCOONa$

34. a) Pka = $-\log Ka$

$= -\log 1.78\times10^{-5}$

$= -0.2504 + 5$

$= 4.7496$

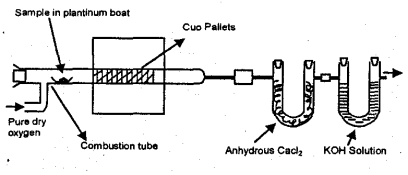
b) pH decreases, because NH_4Cl is a Salt of strong acid and weak base undergoes hydrolysis to give acidic solution

$K_p = \frac{P^2_{HI}}{P_{H_2}\times P_{I_2}}$

PART – D

IV Answer any TWO questions. Each Question carries FIVE marks: 2 x 5 = 10

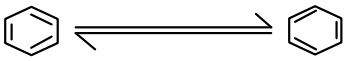
35. a) Principle: A known Mass of an organic compound is burnt in presence of excess of oxygen and cupric oxide carbon and hydrogen in the compound are converted into CO_2 and H_2O respectively. The Masses of CO_2 and H_2O produced is determined From which the percentage of carbon and hydrogen are calculated.



Calculation

Percentage of carbon = $\frac{12\times\text{Mass of } CO_2\times100}{44\times\text{Mass of organic compound}}$

Percentage of Hydrogen = $\frac{2\times\text{Mass of } H_2O\times100}{18\times\text{Mass of organic compound}}$

b) 

36. a) A known Mass of an organic compound is heated in a carius tube with Sodium peroxide or fuming HNO_3, Sulphur present in the compound is oxidised: to Sulphuric acid. It is precipitated as barium Sulphate by adding Barium chloride solution. The precipitate is filtered, dried and weighed. The mass of Barium Sulphate is noted

Calculation

Mass of Organic Compound taken = Wg

Mass of $BaSO_4$ Formed = Mg

1 mol of $BaSO_4$=233 g of $BaSO_4$=32g of sulphur

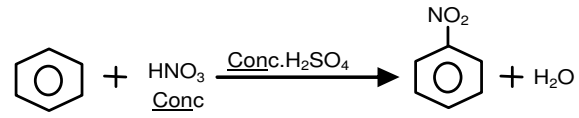
Wg of $BaSO_4$ contains $\frac{32\times W}{233}$ g Sulphur

Percentage of Sulphur = $\frac{32\times W\times100}{233\times m}$

b) Two or more compounds having. Same Molecular formula but differ in the position of functional group.

Ex: $\underset{\text{propan-1-ol}}{CH_3-CH_2-CH_2-OH}$ $\underset{\text{propan-2-ol}}{CH_3-\underset{\underset{OH}{|}}{CH}-CH_3}$

37. a) Benzene on heating with nitrating mixture (Conc. HNO_3 +Conc. H_2SO_4) gives nitrobenzene:



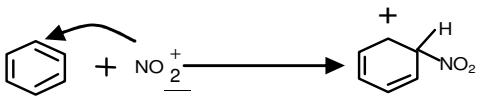
Benzene Nitrobenzene

It involves th following steps

i) Generation of an Electrophile:

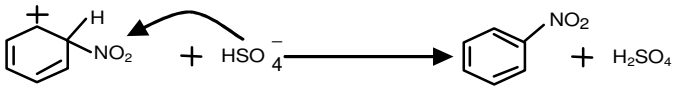
$$HNO_3 + H_2SO_4 \longrightarrow \underset{\text{Nitronium ion}}{NO_2^+} + HSO_4^- + H_2O$$

ii) Attack of electrophile NO_2^+



Carbocation

iii) Removal of proton



Nitrobenzene

b) Alkyl halides on treatment with Sodium metal in dry ether give higher alkanes

Ex:

$$\underset{\text{Bromo methane}}{CH_3Br} + 2Na + CH_3Br \xrightarrow{\text{dry ether}} \underset{\text{Ethane}}{CH_3 - CH_3} + 2NaBr$$