

CHEMISTRY
I PUC MODEL QUESTION PAPER -1

Time: 3 Hours 15 min

Max Marks: 70

INSTRUCTIONS:

- i) The question paper has four parts A.B.C and D. All the parts are compulsory.
- ii) Write balanced chemical equations and draw labeled diagrams wherever asked.
- iii) Use log tables and simple calculators if necessary.
(Use of scientific calculators is not allowed)

PART-A

Answer all the questions.

10x 1 =10

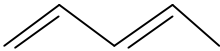
(Answer each question in one word or in one sentence)

1. State Law of definite Proportions
2. Mention the type of intermolecular attractions that exists between non-polar molecules
3. H^- is a Lewis base. Give reason.
4. Nitrogen has higher ionization enthalpy than that of Oxygen. Give reason.
5. What is the oxidation state of Mn in MnO_4^- ?
6. Which alkali metal is the strongest reducing agent?
7. Solid carbon dioxide is also known as _____
8. Mention the type of hybridization of carbon in diamond.
9. Mention one use of chromatography.
10. Draw the staggered conformation of ethane.

PART – B

Answer any FIVE questions (Each question carries two marks)

5x2=10

11. How many significant figures are in 0.2500 g?
If the mass of one molecule of water is 18 u(amu), what is the mass of one mole of water molecules?
12. State Charles's law.
Give the relationship between density and molar mass of a gas.
13. Write the electronic configuration of H_2 molecule. What is its bond order?
14. Differentiate between the reactions of Li and Na on burning them in oxygen.
15. What is the repeating unit in -Organo Silicon polymer? Name the starting (raw) material used in the manufacture of Organo Silicon Polymer.
16. Write the IUPAC names of the following hydrocarbons
i)  ii) $(\text{CH}_3)_3\text{C} - \text{CH}_3$
17. Give two tests to distinguish between Alkanes and Alkenes.
18. How is -Ozone layer formed in the stratosphere? Name a chief chemical that causes its depletion.

PART – C

Answer any FIVE questions (Each question carries three marks)

5x3=15

19. State modern periodic law and assign IUPAC name to the element with atomic number 114.

Arrange the following in the decreasing order of their ionic radius:



20. Mention two conditions for the linear combination of atomic orbitals.

Draw the shape of BMO formed by the LCAO of 1s and 1s atomic orbitals. 3

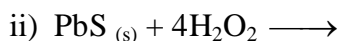
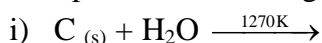
21. What are sigma and Pi bonds? Why is a sigma bond stronger than a Pi bond? 3

22. Define Dipole moment of a polar bond. Show that BeF_2 molecule has zero dipole moment. 3

23. Balance the Redox reaction using oxidation number method:



24. Complete the following equations:



25. Compare the hydration enthalpies and 2nd ionisation enthalpies of the alkali and alkaline earth metals.

Give the chemical formula of plaster of paris. 3

26. With equation explain what happens when diborane is exposed to air?

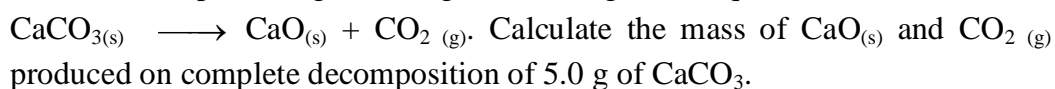
Boron cannot have covalency more than 4. Give reason. 3

PART-D (IV & V)

IV. Answer any FIVE questions. (Each question carries five marks)

5x5=25

27. a) $CaCO_3$ decomposes to give CO_2 gas according to the equation:



Given atomic masses of Ca = 40, C=12 and O = 16

b) Define i) Limiting Reagent ii) Molarity 3+2

28. a) Calculate the wave number of the spectral line of shortest wavelength appearing in the Balmer series of H- spectrum. ($R = 1.09 \times 10^7 \text{ m}^{-1}$)

b) The atomic number and mass number of iron are 26 and 56 respectively. Find the number of protons and neutrons in its atom. 3+2

29. a) For the Element with atomic number 24:

i) Write the Electronic configuration

ii) Write the value of l for its electron in the valence shell

iii) How many unpaired electrons are present in it? 3+2

b) State Pauli's exclusion principle. Is it possible to have the configuration $1s^3$?

30. a) Write any three postulates of Kinetic theory of gases.

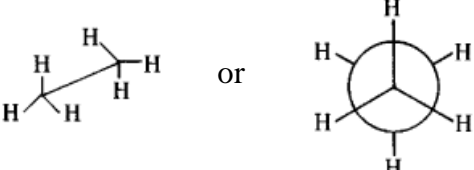
- b) Two gases A and B have critical temperature as 250 K and 125 K respectively. Which one of these i) can be liquified first ii) has greater intermolecular forces of attraction? 3+2
31. a) 2 mol of an ideal gas undergoes a reversible and isothermal expansion from volume of 2.5 L to 10 L at 27° C. Calculate the work done by the gas in this expansion. (Given R = 8.314 J/K/mol and $\log_{10} 4 = 0.6021$)
- b) What is intensive property of a system? Pick the intensive property among: mass, internal energy, density and volume. 3+2
32. a) Write Gibbs equation. Using $\hat{e}G$, how do you decide whether a reaction at a given temperature is spontaneous or non spontaneous?
- b) State Hess's law of constant heat summation. 3+2
33. a) Write the expression for equilibrium constant, K_C for the reaction :
 $aA + bB \rightleftharpoons cC + dD$.
 If the equilibrium constant for this reaction is 50, calculate the equilibrium constant for its reverse reaction : $cC + dD \rightleftharpoons aA + bB$?
- b) What is the effect of i) adding hydrogen ii) removing HI from the equilibrium:
 $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$? 3+2
34. a) Define acid and base by Bronsted - Lowry concept.
 Identify a conjugate acid- base pair in the following.
 $HNO_{3(aq)} + H_2O_{(l)} \longrightarrow H_3O^+_{(aq)} + NO_3^-_{(aq)}$. 3+2
- b) What happens to the pH of water when NH_4Cl solid is dissolved in it and why?

V. Answer any TWO questions. (Each question carries five marks) 2x5=10


35. For the molecule $CH_3-CH_2-\overset{\overset{H}{|}}{C}=O$
- Write its complete expanded structural formula.
 - How many sigma bonds are in it?
 - What is the hybridisation of the the carbon atom attached to oxygen?
 - Write the bond line formula of the compound.
 - Write a functional isomer for it. 5
36. a) How is sulphur estimated by Carius method?
- b) Identify the type of electron displacement effect in the following:
- $$\overset{\delta\delta+}{CH_3} \rightarrow \overset{\delta+}{CH_2} \rightarrow \overset{\delta-}{Cl}$$
 - $$\begin{array}{c} H & & H \\ & \backslash & / \\ & C = C & \\ & / & \backslash \\ H & & H \end{array} + H^+ \longrightarrow \begin{array}{c} H & & H \\ & \backslash & / \\ & C^+ - C & \\ & / & \backslash \\ H & & H \\ & & | \\ & & H \end{array}$$
3+2
37. a) Write the equations for the steps involved in the mechanism of nitration of benzene.
- b) How is Benzene prepared from Ethyne? Give the equation. 3+2

I PUC CHEMISTRY
SCHEME OF VALUATION FOR MODEL PAPER-1

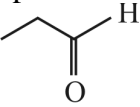

Note: Any correct alternate answer can be honoured wherever applicable.

Question No.	PART-A	Marks
1.	Correct statement of the law	1
2.	Dispersive or London forces	1
3.	Because it donates an electron pair	1
4.	Nitrogen has more stable half filled subshell (p^3)	1
5.	+7	1
6.	Lithium or Li	1
7.	Dry ice	1
8.	sp^3	1
9.	Separation of components in a mixture <u>OR</u> to purify a compound <u>OR</u> to test the purity of a compound. (Any one)	1
10.	Staggered conformation: 	1

PART-B		
11	Four 18 g	1 1
12	$d = \frac{PM}{RT}$ Correct statement	1 1
13.	$\sigma 1s^2$ 1 (one)	1 1
14.	Lithium on burning in oxygen gives its monoxide <u>OR</u> $4Li + O_2 \longrightarrow 2Li_2O$ Sodium on burning in oxygen gives its peroxide <u>OR</u> $4Na + O_2 \longrightarrow 2Na_2O$	1 1
15.	$\left[R_2SiO \right]_n$ Alkyl or aryl substituted silicon chloride	1 1
16	i) Penta δ 1,3 δ diene ii) 2,2 δ dimethylpropane	1 1
17.	Two differences	1+1
18.	By the action of UV radiations on Oxygen CFC or Chlorine or Chlorine containing compounds	1 1

PART-C		
19.	a) Correct Statement IUPAC name of element 114 = Ununquadium	1 1
	b) $N^{-3} > O^{-2} > Na^{+} > Mg^{+2}$	1
20.	a) Two conditions	2
	b) 	1
21.	a) Covalent bond found by head-on/axial/end to end overlapping of bonding orbitals along the inter nuclear axis is called sigma bond. Covalent bond found by parallel/lateral overlapping of bonding orbitals perpendicular to the inter nuclear axis is called pi bond.	1 1
	b) The extent of overlapping in a sigma bond is more than that in a pi bond.	1
22.	a) The product of the magnitude of the charge (q) and the distance between the centres of positive and negative charges (r) of a polar bond.	1
	b) The dipole moment of BeF_2 is zero because it is a linear molecule. The two equal bond dipoles point in opposite directions.	1 1
	$F \leftarrow Be \rightarrow F$ $\longleftarrow \qquad \longrightarrow$	
23.	$SO_2 + H_2S \longrightarrow S + H_2O$ +4 -2 0 $4e^{-} + SO_2 \longrightarrow S$ $H_2S \longrightarrow S + 2e^{-}$ Equalize the e- lost to e ⁻ gained $SO_2 + 2H_2S \longrightarrow 3S$ By inspection: $SO_2 + 2H_2S \longrightarrow 3S + 2H_2O$	1 1 1
24.	i) $\longrightarrow CO_{(g)} + H_{2(g)}$ ii) $\longrightarrow PbSO_{4(s)} + 4H_2O_{(l)}$ iii) $\longrightarrow NaOH_{(aq)} + H_{2(g)}$	1 1 1
25.	a) Alkali metals have <u>higher</u> value for 2 nd Ionisation Enthalpy Alkaline earth metal ions have higher value for hydration enthalpy	1 1
	b) $2(CaSO_4) \cdot H_2O$	1
26.	a) Diborane catches fire spontaneously when exposed to air and burns in oxygen releasing large amount of energy. $B_2H_6 + 3O_2 \longrightarrow B_2O_3 + 3H_2O \quad \Delta_c H = -Q \text{ kJ mol}^{-1}$	1 1
	b) Boron does not have $\text{nd} \delta$ sub shell in $n = 2$ level OR it has only 4 valence orbitals	1

		PART D	
IV. 27.	a)	$\text{CaCO}_3(\text{s}) \longrightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g}).$ <p>Molar masses 100 56 44</p> <p>100 g of $\text{CaCO}_3 \longrightarrow 56 \text{ g CaO}$</p> <p>5 g of $\text{CaCO}_3 \longrightarrow$ í í g of CaO $5 \times 56/100 = 2.8 \text{ g of CaO}$</p> <p>100 g of $\text{CaCO}_3 \longrightarrow 44 \text{ g CO}_2$</p> <p>5 g of $\text{CaCO}_3 \longrightarrow$ í í g of CO_2 $5 \times 44/100 = 2.2 \text{ g of CO}_2$</p>	1
			1
			1
	b)	(i) & (ii) correct definitions	2
28.	a)	$\bar{v} = R \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$ $\bar{v} = 1.09 \times 10^7 \left(\frac{1}{4} - 0 \right) \quad (\because n_2 = \infty)$ $\bar{v} = 2.725 \times 10^6 \text{ m}^{-1}$ <p>(Answer without unit deduct 1 mark)</p>	1
			1
			1
	b)	Number of protons = Z = 26; No. of Neutrons = (A-Z) = 56-26 = 30	1+1
29	a)	i) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$	1
		ii) $l = 0$	1
		iii) Six or 6	1
	b)	Correct statement	1
		No	1
30.	a)	Any three postulates	3
	b)	Gas A	1
		Gas A	1
31.	a)	$w = -2.303nRT \log \frac{V_2}{V_1}$ <p>Substitution: $w = -2.303 \times 2 \times 8.314 \times 300 \log \frac{10}{2.5}$</p> <p>$w = 6917 \text{ J}$ (answer without unit, deduct 1 mark)</p>	1
			1
			1
	b)	Definition of intensive property	1
		Density is the intensive property	1
32.	a)	$\hat{e} G = \hat{e} H - T \hat{e} S$ <p>If $\hat{e} G$ is negative, it means that the reaction is spontaneous</p> <p>If $\hat{e} G$ is positive, it means that the reaction is non-spontaneous</p>	1
			1
			1
	b)	Correct statement of Hess's law	2
33.	a)	$K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b}$ <p>$K'_c = \frac{1}{K_c}$ or equilibrium constant for the reverse reaction is $\frac{1}{K_c}$</p>	1
			1

	b)	$= \frac{1}{50} = 0.02$ i) Forward reaction is favoured. ii) Backward reaction is favoured.	1 1 1
34	a)	Acid- species which donates a proton/ proton donor/protogenic substance Base- species which accepts a proton/ proton acceptor/protophillic substance HNO_3 & NO_3^- or H_3O^+ & H_2O	1 1 1
	b)	pH decreases Because NH_4Cl being a salt of strong acid and weak base undergoes hydrolysis to give acidic solution	1 1
35	a)	i) Correct expanded structure ii) Sigma = 9 iii) sp^2  iv) O v) CH_3COCH_3	1 1 1 1 1
36	a)	Procedure: Organic compound + Sodium peroxide/ fuming HNO_3 heat to get sulfuric acid. Above mixture + excess of BaCl_2 solution to get white ppt of BaSO_4 filtered, washed, dried and weighted $\text{Percentage of sulphur} = \frac{32 \times \text{mass of BaSO}_4 \times 100}{233 \times \text{mass of organic compound}}$	1 1 1
	b)	i) Inductive effect ii) Positive electrometric effect	1 1
37	a)	Nitration of Benzene i) Equation for generation of electrophile ii) Equation for formation of carbocation (arenium ion) iii) Equation for removal of proton	1 1 1
	b)	Ethyne on passing through a red hot iron tube, undergoes cyclic polymerization to give benzene $3\text{C}_2\text{H}_2 \xrightarrow{\text{red hot iron tube}} \text{C}_6\text{H}_6$ or 	1 1