

Important Questions On Physical Chemistry

https://byjusexamprep.com



Im	portant Questio	ns on Physical C	hemistry
Which of the fol i) HMO is an abs ii) HMO treats p iii) Pi electrons o	lowing is true regarding solute method. i electrons separately fro determine the properties	HMO theory? om sigma electrons. s of the conjugated mole	ecules.
iv) HMO uses or	nly the variation principle	2.	
A. Only iv		B. iii and iv	
C. ii and iii		D. only ii	
The rate constances respectively. Th	nt of a unimolecular read e rate constant (in s ⁻¹ un	ction was 2.56 x 10 ⁻³ and its) at 220K would be:	2.3 x 10 ⁻¹ at T= 110K and 330k
A. 2.43 x 10 ⁻²		B. 2.43 x 10 ⁻¹	
C. 4.81 x 10 ⁻²		D. 1.81 x 10 ⁻¹	
A system is exp would be the fir	anded Reversibly adiabanal temperature? C _P = 29.	atically from 1 L to 10 L 23 J/K mol.	. If initial temp. is 750 K, what
A. 500 K		B. 200 K	
С. 100 К		D. 300 K	
Which among th	ne following will show m	aximum flocculation val	ue for Fe(OH) ₃ Solution?
A. (NH ₄) ₃ PO ₄		B. Na ₂ S	
C. NH₄CI		D. NaCl	
Consider the reaction $Cu^{2+}_{(aq)} + 2e \rightarrow C$	action		
What will be the	e half-cell po <mark>tential at 29</mark>	8K where $[Cu^{2+} = 5.0 M]$	a <mark>nd</mark> Eº = +0.34V].
A. 4.6 mV		B. 0.466 V	-
C. 3.6 V		D. 0.36 V	
The extent of dia the pressure at	ssociation of PCl₅ at a cer which this substance is ⊦	tain temperature is 20% alf-dissociated at the sa	5 at one atm pressure. Calculate me temperature.
A. 0.123		B. 0.329	
C. 0.420		D. 0.789	
Improper Axis o A. Rotation	f symmetry refers to wh	ich of the following ope	rations?
B. Reflection			
C. Rotation follo	wed by perpendicular re	eflection	
D. None of the a	above		
Calculate the main is 24cm ⁻¹ .	aximum rotational level v	vhich can be occupied at	: 300K when rotational constant
A. 1	B. 2	C. 4	D. 10
	Image: Construct of the pressure at the press	Important QuestioWhich of the following is true regardingi) HMO is an absolute method.ii) HMO treats pi electrons separately froiii) Pi electrons determine the propertiesiv) HMO uses only the variation principleA. Only ivC. ii and iiiThe rate constant of a unimolecular readrespectively. The rate constant (in s ⁻¹ unA. 2.43 x 10 ⁻² C. 4.81 x 10 ⁻² A system is expanded Reversibly adiabawould be the final temperature? C _P = 29.A. 500 KC. 100 KWhich among the following will show mA. (NH ₄) ₃ PO ₄ C. NH ₄ ClConsider the reactionCu ²⁺ (aq) + 2e \rightarrow Cu(s)What will be the half-cell potential at 29A. 4.6 mVC. 3.6 VThe extent of dissociation of PCl ₅ at a certthe pressure at which this substance is FA. 0.123C. 0.420Improper Axis of symmetry refers to whA. RotationB. ReflectionC. Rotation followed by perpendicular reactionC. Rotation followed by perpendicular r	Important Questions on Physical CWhich of the following is true regarding HMO theory?i) HMO is an absolute method.ii) HMO treats pi electrons separately from sigma electrons.iii) Pi electrons determine the properties of the conjugated moleA. Only ivB. iii and ivC. ii and iiiD. only iiThe rate constant of a unimolecular reaction was 2.56 x 10 ⁻³ and respectively. The rate constant (in s ⁻¹ units) at 220K would be:A. 2.43 x 10 ⁻² B. 2.43 x 10 ⁻¹ C. 4.81 x 10 ⁻² D. 1.81 x 10 ⁻¹ A system is expanded Reversibly adiabatically from 1 L to 10 Lwould be the final temperature? C _P = 29.23 J/K mol.A. (NH ₄) 3PO ₄ B. 200 KC. 100 KB. 200 KC. 100 K



9. The ratio of HCP closed packed atoms to voids in HCP closed packing is:

A. 1:4	B. 2:3	C. 1:6	D. 1:3

10. Two miscible liquids A and B form a solution. Assume that the solution is non-ideal but the vapor above it behaves ideally. For pure A and B, the vapor pressures are 550 torr and 700 torr respectively at 35°C. If the total pressure above a solution that is 48 mole percent A, is 500 torr and the mole fraction of A in the vapor is 0.45, determine the activity coefficients of A and B in the solution.
 A 0.954 0.756

A. 0.854, 0.756	B. 0.765, 0.324
C. 0.854, 0.765	D. 0.845, 0.765

Answer Key									
1. C	2. A	3. D	4. D	5. D	6. A	7. C			
8. B	9. D	10. A							

Solutions

Solution 1. HMO calculates the energy and shape of the pi molecular orbitals of the planar conjugated molecules. The calculations are based on the variation principle along with LCAO for pi electrons. It differentiates pi electrons from sigma electrons as pi electrons take part in conjugation. This theory is approximate since it ignores electron-electron repulsions.

Solution 2. By applying Arrhenius equation:

$$T_{1}=110K \text{ and } T_{2}=360K$$

$$\ln \frac{k_{2}}{k_{1}} = \frac{Ea}{R} \left[\frac{1}{T_{1}} - \frac{1}{T_{2}} \right]$$

$$\ln \frac{2.2 \times 10^{-1}}{2.66 \times 10^{-3}} = \frac{Ea}{8.314 \text{J/Kmol}} \left[\frac{1}{120} - \frac{1}{360} \right]$$

$$E_{a}=1.64 \times 10^{-2}; T_{1}=110K \text{ and } T_{2}=220K$$

$$\ln \frac{k_{2}}{k_{1}} = \frac{Ea}{R} \left[\frac{1}{T_{1}} - \frac{1}{T_{2}} \right] = \ln \frac{k_{2}}{2.66 \times 10^{-3}} = \frac{1.64 \times 10^{-2}}{R} \left[\frac{1}{110} - \frac{1}{220} \right]$$

$$K=2.43 \times 10^{-2} \text{ s}^{-1}$$

Solution 3. As system is reversibly adiabatically expanded, so,

 $PV^{\gamma} = Comtt$ $P_1V_1^{\gamma} = P_2V_2^{\gamma}$...(i) From ideal equation: PV=nRT P= nRT/VPut the volume of P in eq (i):



$$\begin{split} & \mathsf{T}_1\mathsf{V}_1^{\gamma-1} = \mathsf{T}_2\mathsf{V}_2^{\gamma-1} \ ...(ii) \\ & \mathsf{Given } \mathsf{C}_\mathsf{P} = 29.23 \ \mathsf{J/K} \ \mathsf{mole} \\ & \mathsf{C}_\mathsf{P} - \mathsf{C}_\mathsf{V} = \mathsf{R} \\ & \mathsf{C}_\mathsf{V} = \mathsf{C}_\mathsf{P} - \mathsf{R} \\ & = 29.23 - 8.314 \\ & \mathsf{C}_\mathsf{V} = 20.9 \\ & \gamma = \frac{\mathsf{C}_\mathsf{P}}{\mathsf{C}_\mathsf{V}} = \frac{29.2}{20.9} = 1.4 \\ & \mathsf{From } \mathsf{eq.} \ (\mathsf{ii}) \mathsf{:} \\ & \mathsf{T}_1\mathsf{V}_1^{\gamma-1} = \mathsf{T}_2\mathsf{V}_2^{\gamma-1} \\ & \mathsf{750}(1)^{1.4-1} = \mathsf{T}_2(10)^{1.4-1} \\ & \mathsf{750} = \mathsf{T}_2(10)^{0.4} \\ & \mathsf{T}_2 = 300 \ \mathsf{K} \end{split}$$

Solution 4. Flocculation value or precipitation value is the minimum amount of an electrolyte in millimoles that must be added to one litre of colloidal sols to bring about complete coagulation or precipitation. Coagulation power is inversely proportional to coagulation value, i.e., smaller the coagulation value of an electrolyte ion, greater is the coagulating power.

Solution 5. According to Nernst equation: $E_{Cu}^{2+}/Cu} = E_{Cu}^{2+}/Cu} - 0.059/n \log 1/[Cu^{2+}]$ = 0.34 - 0.059/2 log (1/5) = 0.36 V

Solution 6. $K_p = \alpha^2 P / (1 - \alpha^2)$ $P = 1 \text{ atm}, \alpha = 0.2$ $\therefore K_p = (0.2)^2 (1 \text{ atm}) / (1 - 0.04) = 0.041 \text{ atm}$ Let P' be the pressure at which $\alpha = 0.5$, then $K_p = \alpha^2 P' / (1 - \alpha^2)$ $0.041 \text{ atm} = (0.5)^2 P' / (1 - 0.25)$ P = 0.123 atm

Solution 7. A molecule is said to have an improper Axis of rotation of order n if rotation of 2π/n about an axis followed by the reflection in a plane perpendicular to that axis. Solution 8. Maximum rotational level that can be occupied is:

$$J_{max} = \left(\frac{kT}{2B}\right)^{1/2} - \frac{1}{2}$$

Here, B = 24 cm⁻¹, T = 300 K, k = 1.38×10^{-23} J K⁻¹

k (in cm⁻¹) = (1.38×10⁻²³)/(6.626×10⁻³⁴×3×10¹⁰)=0.694 cm⁻¹ K⁻¹ $J_{max} = \left(\frac{0.694 \times 300}{(2 \times 24)}\right)^{1/2} - 1/2 = 1.583$ $J_{max} = 2$ 1

:

3



Solution 9. No. of Atoms present in HCP = 6 Total no. voids present in HCP = Td voids + Oh voids = 12 + 6 = 18 Atom : Voids 6 : 18

Solution 10. $x_{A, vap} = 0.45$ Since, the vapor behaves ideally, hence, $p_A = x_{A, vap} \times P = 0.45 \times 500$ torr = 225 torr $p_B = P - p_A = 500$ torr - 225 torr = 275 torr Since the solution behaves non-ideally, Raoult's law becomes: $p_i = a_i p_i^{\circ}$

 a_A = 225 torr/550 torr=0.41 Hence, $\gamma_A = a_A/x_A = 0.41/0.48 = 0.854$ a_B = 275 torr/700 torr=0.393 $\gamma_B = a_B/x_B = 0.393/0.52 = 0.756$

BYJU'S EXAM PREP



CSIR NET Chemical Science 2022 A Foundation Course

A Foundation Course

Complete Prep of Chemical Science for June 2022 Aspirants

Why take this course?

- > 450+ Hrs Live Classes & Doubt Sessions for complete conceptual clarity
- 3000+ Practice Questions covering all levels of difficulty
- 20+ Unit Wise Study Modules & Mind Maps
- 50+ Full Mock Tests, Chapter Wise Mock Tests, PYQs Mock Tests