

Roll No.

Total No. of Questions : 9]
(2034)

[Total No. of Printed Pages : 8

UG (CBCS) IInd Year Annual Examination

2801

B.Sc. CHEMISTRY

(Chemistry of Main Group Elements,
Chemical Energetics and Equilibria)

(Core)

Paper : CHEM 202 TH

Time : 3 Hours]

[Maximum Marks : 50

Note :— Attempt *five* questions in all, selecting *one* question from each Section. Section E is compulsory. Candidates are required to answer accurate and precise.

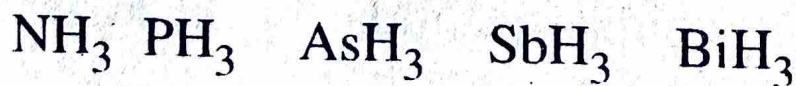
Section–A

1. (a) Discuss the unique position of hydrogen in periodic table.
- (b) What are metallic or interstitial hydrides ?
How do they differ from molecular hydrides ?
- (c) What is heavy water ? Give its important uses. 4,3,3

2. (a) Why is LiF insoluble in water whereas other alkali metal fluorides are soluble ?
- (b) NaOH is stronger base than that of Ba(OH)₂. Explain.
- (c) Discuss the factors on which ionization enthalpy depends.
- (d) Why alkali metals are stronger reducing agents ?
- (e) Why salts of alkaline earth metals are colourless and diamagnetic ? Explain. 2×5=10

Section-B

3. (a) Explain and arrange the following in increasing order of their bond angle :



- (b) Discuss the geometry of ICl_2^- .
- (c) BF_3 can act as Lewis acid but CCl_4 cannot do so. Why ?

(d) Explain the following :

(i) PCl_5 is known but NCl_5 is not known

(ii) H_3PO_4 is triprotic in nature whereas

H_3PO_3 is diprotic in nature.

3,2,2,3

4. (a) There is very little possibility of the formation of compounds of helium. Explain.

(b) What are clathrate compounds of noble gases ?
What are the conditions for clathrate formation ?

(c) Discuss the structure of XeF_4 . How does it react with water ?

(d) Complete the following reactions :

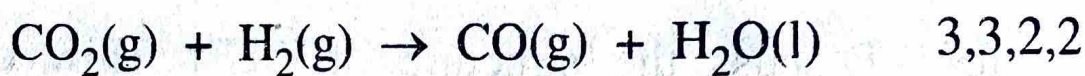


2,2,3,3

Section-C

5. (a) What are extensive and intensive properties ?
When does an extensive property become intensive property ?

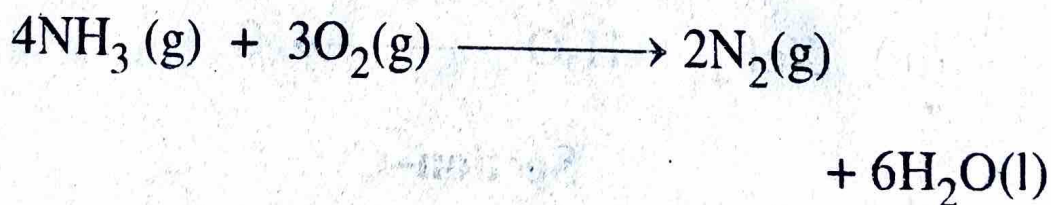
- (b) Derive an expression for ΔU and ΔH for adiabatic reversible expansion of an ideal gas.
- (c) Differentiate between state function and path functions. Explain with suitable examples.
- (d) Enthalpies of the formation of $\text{CO}_2(\text{g})$, $\text{CO}(\text{g})$ and $\text{H}_2\text{O}(\text{l})$ are -393.5 , -111.3 and -241.8 kJ/mole respectively. Calculate the ΔH^0 for the reaction :



6. (a) State and explain Nernst heat theorem and prove that :

$$\lim_{T \rightarrow 0} (\Delta S) = \lim_{T \rightarrow 0} (\Delta C_p) = 0$$

- (b) Calculate the enthalpy change in the reaction :

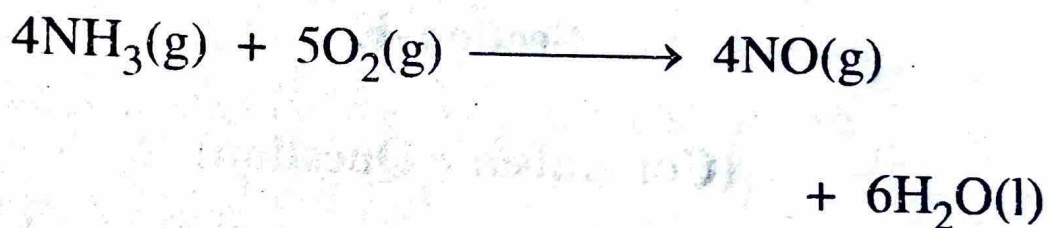


at 298 K, given that the enthalpy of formation at 298 K for $\text{NH}_3(\text{g})$ and $\text{H}_2\text{O}(\text{l})$ are -46.0 and -286.0 kJ/mole respectively.

- (c) Discuss the concept of residual entropy. How does it originate and how is it calculated ? 3,4,3

Section-D

7. (a) Define the law of chemical equilibrium. How it can be derived thermodynamically ?
- (b) Calculate the standard free energy change of the reaction and predict its feasibility :



Given that the standard free energies of formation of $\text{NH}_3(\text{g})$ and $\text{NO}(\text{g})$ and $\text{H}_2\text{O}(\text{l})$ are -16.74, 86.61 and 237.32 kJ/mole respectively.

- (c) State and explain Le-Chatelier's principle by applying it to the formation of ammonia by Haber's process. 4,3,3

8. (a) How does solubility product differ from ionic product ? Explain solubility product principle.

(b) 0.049g of H_2SO_4 is dissolved per liter of the given solution. Calculate the pH of solution.

(c) Discuss the effect of temperature on ionic product of water.

(d) What is a Buffer Solution ? Give an example of an acidic Buffer mixture and explain its Buffer action.

3,2,2,3

Section-E

(Compulsory Question)

9. Do as directed. Fill in the blanks/MCQ/True-False :

(i) Ortho and para hydrogen differ in :

(a) Atomic number

(b) Mass number

(c) Electron spin in two atoms

(d) Nuclear spin in two atoms

- (ii) Water has maximum density at :
- (a) 0°C (b) 273°C
(c) 4°C (d) -10°C
- (iii) Which one is more reactive : K or Ca ?
- (iv) HClO_4 is acidic than that of HClO_3 .
- (v) What is inorganic benzene ?
- (vi) XeO_3 molecule has pyramidal structure.
(True/False)
- (vii) An aqueous solution of CuCl_2 is basic.
(True/False)
- (viii) For cyclic system :
- (a) $q = 0$ (b) $q = -w$
(c) $\Delta U > 0$ (d) $\Delta U < 0$

(ix) In complete Carnot cycle, the change in entropy of the universe is :

- (a) Positive
- (b) Negative
- (c) Zero
- (d) Infinite .

(x) pH of water is 7 at 25°C . If water is heated at 80°C , then :

- (a) pH will increase
- (b) pH will decrease.
- (c) pH will remain same
- (d) H^{+} ion conc. increases but OH^{-} ion conc.

decreases

$$1 \times 10^{-10}$$