

Total number of printed pages-7

3 (Sem-3/CBCS) CHE HC 1

2022

**CHEMISTRY**

(Honours)

Paper : CHE-HC-3016

**(Inorganic Chemistry-II)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

1. Answer **any seven** of the following questions : 1×7=7
- (i) Find the Valence Electron Count of  $B_5H_9$ .
  - (ii) Explain why  $LiI$  is soluble in water whereas  $LiF$  is only slightly soluble.
  - (iii) Melting point of  $BeCl_2$  ( $405^\circ C$ ) is much less than that of  $CaCl_2$  ( $782^\circ C$ ). Why?
  - (iv) Why is  $F_2$  highly reactive?

Contd.

(v) Iodine is almost insoluble in water, but it readily dissolves in aqueous solution of KI. Explain.

(vi)  $I^-$  is a soft base. (True/False)

(vii) A decrease in lattice energy favours decreased solubility, but a decrease in hydration energy favours increased solubility. (True/False)

(viii) LiOH is more basic than NaOH.  
(True/False)

(ix)  $2XeF_6(s) + 3SiO_2(s) \rightarrow$

(x)  $B_2H_6 + 2(CH_3)_3N \rightarrow$

(xi)  $ZnCl_2 + 2N_2O_4 \rightarrow$

(xii) What is a levelling solvent?

2. Answer **any four** of the following questions:

2×4=8

(i) Applying Wade's rule, predict and draw the structure of  $2-CB_5H_9$ .

(ii) Arrange the following oxoacids of chlorine in decreasing order of their acid strengths. Write justification for your choice.

$HClO_4, HClO_3, HClO_2, HClO$

(iii) Bond strengths of F-F in  $F_2$  and O-O in  $H_2O_2$  are very weak. Why?

(iv) List the following in order of increasing solubility in water. Give justification.

$LiF, KF, CsF, RbF, NaF$

(v) Compare  $[Be(H_2O)_4]SO_4$  and  $[Mg(H_2O)_6]SO_4$ .  $Be^{2+}$  has only four coordinated water molecules whereas  $Mg^{2+}$  has more than four coordinated water molecules. Explain.

(vi) Arrange the following compounds in ascending order of their solubility in water. Give explanations.

$AgF, AgCl, AgBr, AgI$

(vii) What is inert pair effect?

(viii) A large number of acids can be studied in which solvent — ammonia or water. Why?

3. Answer **any three** of the following questions: 5×3=15

(i) Briefly discuss bonding and structure of  $XeF_6$ .  $2\frac{1}{2} + 2\frac{1}{2} = 5$

(ii) What is diagonal relationship? Write *any four* similar properties of Be and Al. 1+4=5

(iii) Write *any five* differences between lithium and other group 1 elements.

(iv) Briefly discuss the reactions of lithium (Li) with water, dinitrogen and dioxygen.

(v) Briefly discuss hydrometallurgy with the help of a suitable example.

(vi) What is borazine? Describe its structure and bonding. 1+4=5

(vii) (a) State the Pauling's rules for determination of strength of mononuclear oxoacids.

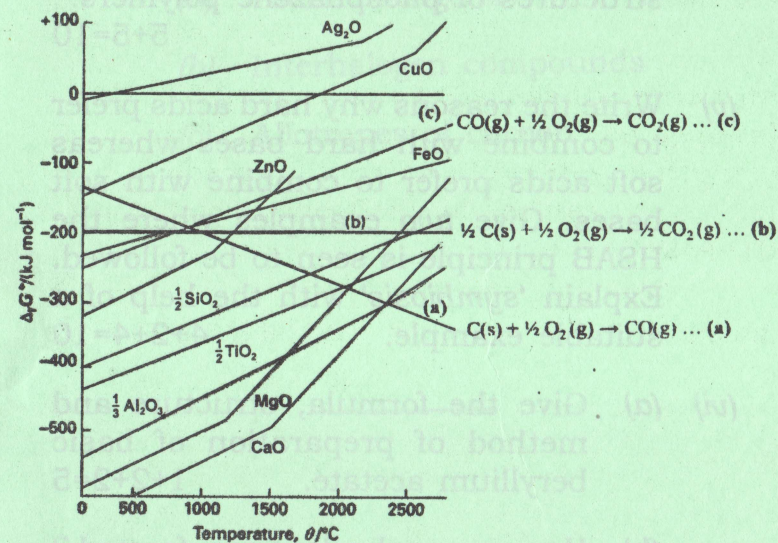
(b) Use the Pauling's rule to state which is the stronger acid —  $H_2SO_4$  or  $H_2SO_3$ .

(c) Pauling's rule is useful in detecting structural anomalies. Explain. 2+1+2=5

(viii) Describe the Mond's process for extraction and purification of Nickel.

4. Answer *any three* of the following questions : 10×3=30

(i) Discuss about the following Ellingham diagram. What will be the minimum temperature for reduction of MgO by carbon? Write the reduction reaction of MgO by carbon at this temperature. 5+2+3=10



**Fig. Ellingham diagram for the reduction of various metal oxides.**

(ii) What are clays? Discuss the structure of kaolinite clay. Write the general chemical formula of zeolites. Write *any two* applications of zeolites. 1+3+2+4=10

(iii) How are fullerenes synthesized? Discuss the structures of  $C_{60}$  and  $C_{70}$  fullerenes. Write the number of peaks that appear in the  $^{13}C$  NMR spectra of  $C_{60}$  and  $C_{70}$ .  $2+3+3+1+1=10$

(iv) Write about the allotropes of phosphorus. Discuss the synthesis and structures of phosphazene polymers.  $5+5=10$

(v) Write the reasons why hard acids prefer to combine with hard bases whereas soft acids prefer to combine with soft bases. Give *two* examples where the HSAB principle is seen to be followed. Explain 'symbiosis' with the help of a suitable example.  $4+2+4=10$

(vi) (a) Give the formula, structure and method of preparation of basic beryllium acetate.  $1+2+2=5$

(b) How are polysiloxanes formed? Distinguish between Silicon fluids and silicon rubbers.  $2+3=5$

(vii) (a) What are MDFs? Prepare a synthesis of *any one* MDF and give its structure. Mention *one* important application of MDF.  $1+3+1=5$

(b) What is the expected geometry of  $[BrF_6]^-$  and  $[IF_6]^-$ . Explain the similarity or difference in their geometry. 5

(viii) Write short notes on : (*any two*)  $5+5=10$

(a) Pseudohalogens

(b) Interhalogen compounds

(c) Allotropes of carbon