

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) F^- 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

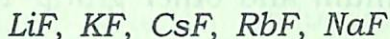
(i) Applying Wade's rule, predict and draw the structure of $2-CB_5H_9$.

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

$HClO_4$, $HClO_3$, $HClO_2$, $HClO$

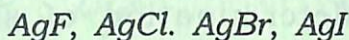
(iii) Bond strengths of $F-F$ in F_2 and $O-O$ in H_2O_2 are very weak. Why?

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



(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.



(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 . 2½ + 2½ = 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 : $10 \times 3 = 30$

(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.

$5+2+3=10$

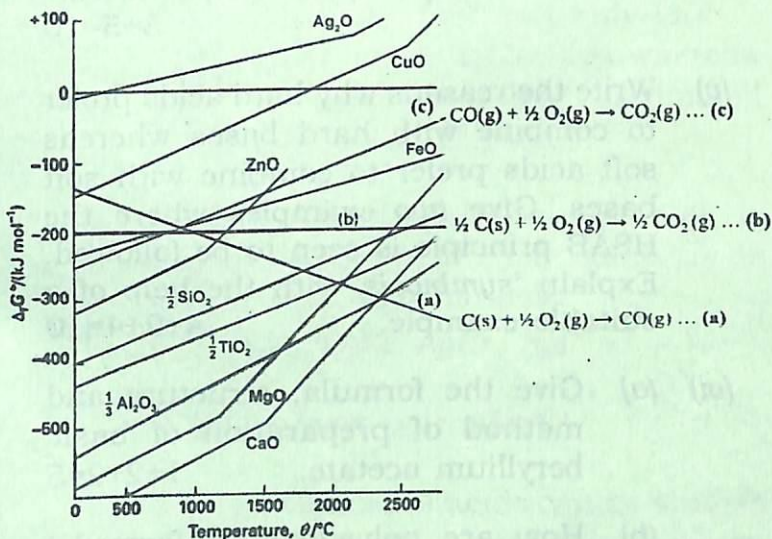


Fig. Ellingham diagram for the reduction of various metal oxides.

(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
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