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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.

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

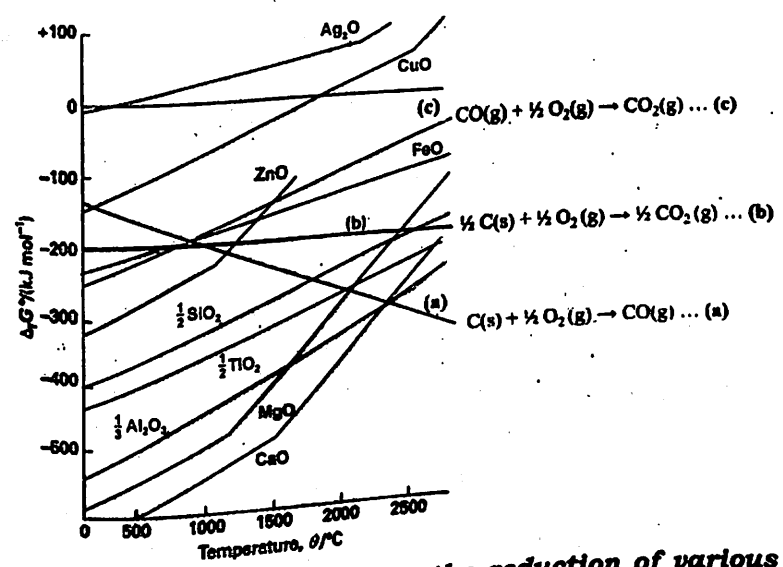


Fig. Ellingham diagram for the reduction of various metal oxides.

(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