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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.

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(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.

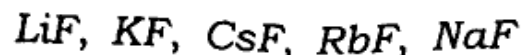
$HClO_4$, $HClO_3$, $HClO_2$, $HClO$

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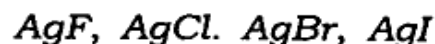
(iii) Bond strengths of $F-F$ in F_2 and $O-O$ in H_2O_2 are very weak. Why?

(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: $5 \times 3 = 15$

(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 : $10 \times 3 = 30$

(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. $5+2+3=10$

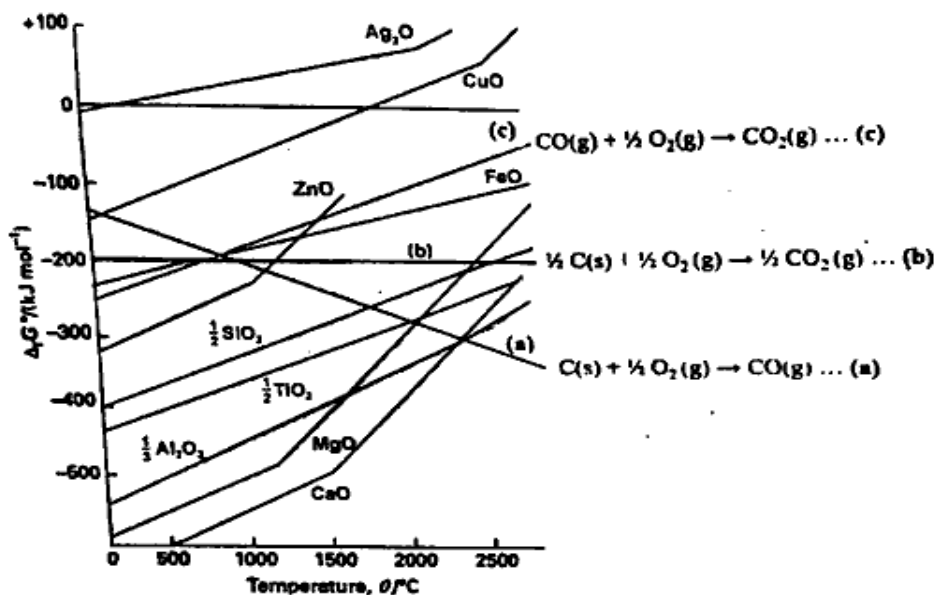


Fig. Ellingham diagram for the reduction of various metal oxides.

(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. $5+5=10$
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(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