

2017

CHEMISTRY

(Major)

Paper : 4.2

Full Marks : 60

Time : 3 hours

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

1. Select the correct answer/Answer the following questions : 1×7=7

(a) Pyrolusite is an ore of

- (i) iron
- (ii) chromium
- (iii) vanadium
- (iv) manganese

(b) Which of the following compounds is aromatic?

- | | |
|----------------|---------------|
| (i) P_4S_4 | (ii) S_4N_4 |
| (iii) S_2N_2 | (iv) P_4S_7 |

(c) Mica is made up of

- | | |
|------------------------|---------------------|
| (i) $(Si_2O_7)^{6-}$ | (ii) $(SiO_4)^{4-}$ |
| (iii) $(Si_2O_5)^{2-}$ | (iv) $(SiO_3)^{2-}$ |

(d) The chemical properties of Ru is most similar to those of

(i) Rh

(ii) Os

(iii) Fe

(iv) Re

(e) The origin of the yellow colour of an aqueous solution of K_2CrO_4 is due to

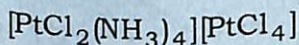
(i) $d-d$ transition

(ii) H_2O to Cr^{6+} charge transfer

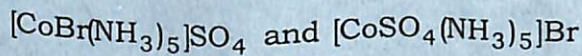
(iii) O^{2-} to K^+ charge transfer

(iv) O^{2-} to Cr^{6+} charge transfer

(f) Name the compound according to IUPAC



(g) Following are two coordination compounds :



What type of isomerism are they exhibiting?

2. Answer the following questions : 2×4=8

(a) Sketch the three isomers of dicarbido-closo-dodecaborane.

(b) Show with example the amphoteric behaviour of SnO_2 .

(c) Why are the coinage metals Cu, Ag, Au considered as transition metals although they have filled d -shells in the elemental state?

(d) Write a note on the coordination complexes of divalent Zn.

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

(a) Compare and contrast the properties and reactivity of borazine and benzene.

(b) What are phosphazines? Suggest synthesis and give balance equations for the preparation of $[\text{NP}(\text{OCH}_3)_2]_4$.

(c) Discuss the principle of extraction of vanadium from its ore.

(d) Although H_2 is a reducing agent yet it is not widely used as a reducing agent in metallurgical operations. Why?

(e) Suggest a method for the preparation of the complex cation $[\text{Cr}(\text{en})_3]^{3+}$.
Comment on its tendency to react with NH_3 in aqueous solution.

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

(a) Discuss the synthesis, structures and bonding in $\text{Fe}(\text{CO})_5$, $\text{Fe}_2(\text{CO})_9$ and $\text{Fe}_3(\text{CO})_{12}$. Explain why CO is called π -acid ligand. Compare the σ - and π -bonding ability of CO and NO^+ as ligands. 6+1+3=10

- (b) Taking nickel as a typical example, discuss the general characteristics of transition elements with special reference to complex formation and catalytic activity. 10
- (c) (i) What is the composition (formulae) of zeolites? How would you prepare a zeolite such as ZSM-5? Describe the structure of zeolites. 2+2+3=7
- (ii) Iodine is usually insoluble in water, but soluble in solution of KI. Discuss the structure of the product formed in solution. 3
- (d) (i) Explain the importance of alloys and intermetallic compounds. What make alloys different from intermetallic compounds? 6
- (ii) Explain why unlike other elements in group 14, Sn and Pb are more stable in the bivalent state than the tetravalent state. 4
- (e) Describe the trends in physical and chemical properties of second and third transition series in comparison to the first series. 10

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