

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

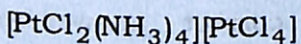
(b) Which of the following compounds is aromatic?

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

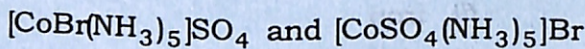
(c) Mica is made up of

- (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 dicarbocloso-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
