5 SEM TDC CHM M 3 (N/O)

2017

(November)

CHEMISTRY

(Major)

Course : 503

(Inorganic Chemistry—II)

The figures in the margin indicate full marks for the questions

(New Course)

Full Marks : 48
Pass Marks : 14

Time : 2 hours

1. Select the correct answer from the following : 1×5=5

(a) $Ni(CO)_2$ is isolobal with

(i) CH_2^+

(ii) CH_2^-

(iii) CH^+

(iv) CH^-

(b) Rhodamine 6G is an example of

(i) acid-base indicator

(ii) metal-ion indicator

(iii) adsorption indicator

(iv) redox indicator

(c) EAN of $[Fe(CO)_2(NO)_2]$ is

(i) 35 (ii) 34

(iii) 38 (iv) 36

(d) The number 0·003040 has _____ significant figures.

(i) three (ii) four

(iii) five (iv) six

(e) Total electron count for the compound $[Fe_4C(CO)_{12}]^{2-}$ is

(i) 62

(ii) 72

(iii) 74

(iv) 86

2. Answer the following questions : 2×5=10

(a) Mention the conditions necessary for isolobality of two molecular fragments.

(b) What is meant by reductive elimination reaction? Give example.

(c) Explain why two nitrosyl groups can substitute three carbonyl groups from metal carbonyl compounds.

(d) Assuming 18-electron rule is valid, find the number of metal-metal bonds in $Fe_3(CO)_{12}$ and $Co_4(CO)_{12}$.

(e) Define standard deviation in quantitative analysis.

3. Answer the following questions (any *three*) : 3×3=9

(a) What is 18-electron rule? How is 18-electron rule helpful in determining the number of metal-metal bonds in metal carbonyl complexes?

(b) Give the reaction path of the hydrogenation of olefin with the help of Wilkinson's catalyst.

(c) Explain with example, the procedure for predicting the skeletal structures of low nuclearity carbonyl clusters.

(d) Complete the following reactions :

(i) $Fe(CO)_5 + NO \xrightarrow{95\,^\circ C} ?$

(ii) $[Mn(CO)_5I] + NO \longrightarrow ?$

(iii) $Na_4[Fe(CN)_6] + NO \longrightarrow ?$

(e) Discuss the structure and bonding of anion of Zeise's salt.

4. Answer the following questions (any *three*) : 3×3=9

(a) Explain how nitric oxide can form metal complexes as *(i)* 3-electron donor, *(ii)* 2-electron donor and *(iii)* 1-electron donor. Give one example of each.

(b) Give the chemical reactions involved in the preparation of sodium nitroprusside and explain its structure.

(c) Explain the term metal cluster compounds. How are they classified?

(d) Predict the structures of the following clusters in the light of PSEP theory :

(i) $Rh_6(CO)_{16}$

(ii) $[Fe_5C(CO)_{15}]$

(iii) $[Fe_4(CO)_{13}]^{2-}$

5. Answer the following questions (any *three*) : 3×3=9

(a) Explain the action of diphenyl amine indicator in titrating ferrous ion with potassium dichromate in acidic medium.

(b) Analysis of a sample of ferric oxide gave the following percentage values for the iron content :

7·08, 7·12, 7·21, 7·16, 7·09
7·14, 7·18, 7·11, 7·14, 7·07

Calculate the standard deviation.

(c) Mention the types of errors encountered in quantitative analysis. How can errors be minimized?

(d) Write a short note on adsorption indicator.

6. Discuss the uses of the following reagents in inorganic analysis (any *three*) : 2×3=6

(a) 8-hydroxyquinoline

(b) Diphenyl carbazide

(c) Thiourea

(d) Salicylaldoxime

(e) 1-nitroso-2-naphthol

(Old Course)

Full Marks : 48

Pass Marks : 19

Time : 3 hours

1. Select the correct answer from the following : 1×5=5

(a) $[Fe(CO)_3]^-$ is isoelectronic with

(i) $Mn(CO)_5$

(ii) $Cr(CO)_3$

(iii) $Co(CO)_3$

(iv) $Co(CO)_2$

(b) The number 0·007050 has _____ significant figures.

(i) three

(ii) four

(iii) five

(iv) six

(c) Sodium nitroprusside contains which species?

(i) NO (ii) NO^+

(iii) NO^- (iv) NO^{2-}

(d) Patton and Reeder's indicator is an example of

(i) adsorption indicator

(ii) acid-base indicator

(iii) metal-ion indicator

(iv) redox indicator

(e) Vaska's compound is

(i) $[IrCl_3CO(PPh_3)_2]$

(ii) $[IrCl(CO)(PPh_3)_2]$

(iii) $[HCo(CO)_4]$

(iv) $[Ir(CO)_4(PPh_3)_2]$

2. Answer the following questions : 2×5=10

(a) Assuming 18-electron rule is valid, find the number of metal-metal bonds in $Fe_3(CO)_{12}$ and $Co_4(CO)_{12}$.

(b) What do you mean by oxidative addition reaction? Give an example.

(c) Give a method of preparation of sodium nitroprusside.

(d) Define standard deviation in quantitative analysis.

(e) What are metal clusters? How are they generally classified?

3. Answer the following questions (any *three*) : 3×3=9

(a) Discuss the bonding in Zeise's salt in the light of DCD model.

(b) What is synergic effect? Discuss how this effect is observed in metal carbonyls.

(c) Discuss the structure of ferrocene.

(d) Explain the route of hydroformylation reaction catalysed by $HCo(CO)_4$.

4. Answer the following questions (any *three*) : 3×3=9

(a) Outline the rules for polyhedral skeletal electron pair theory.

(b) In what ways NO can form bond with a metal? Discuss.

(c) Give the preparation and structure of a metal cluster containing three metal atoms.

(d) Complete the following reactions :

(i) $Co_2(CO)_8 + H_2 \xrightarrow[200\,°C]{200\ atm} ?$

(ii) $Na_4[Fe(CN)_6] + NO \longrightarrow ?$

(iii) $Fe_2(CO)_9 \xrightarrow{50\,°C} ?$

5. Answer the following questions (any *three*) : 3×3=9

(a) What are determinate errors? Explain additive and proportional errors.

(b) Discuss the choice of indicator in acid-base titrations.

(c) What type of indicator is used in the titration of Fe^{2+} with potassium dichromate in acidic medium?

(d) Write a note on minimisation of errors.

6. Discuss the usees of the following reagents in inorganic analysis (any *three*) : 2×3=6

(a) 1-nitroso-2-naphthol

(b) Salicylaldoxime

(c) Diphenyl carbazide

(d) Oxine

(e) Thiourea

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