5 SEM TDC CHM M 3 (N/O)

2 0 1 6

(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 :

$1 \times 5 = 5$

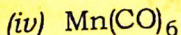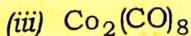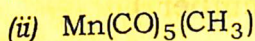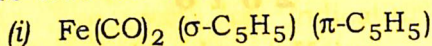 (a) The total electron count for the compound $Fe_5C(CO)_{15}$ is
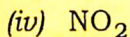
  (i) 62

  (ii) 72

  (iii) 74

  (iv) 86

(Turn Over)

(b) Which of the following does not obey 18-electron rule?

    (i) $Fe(CO)_2 \, (\sigma\text{-}C_5H_5) \, (\pi\text{-}C_5H_5)$

    (ii) $Mn(CO)_5(CH_3)$

    (iii) $Co_2(CO)_8$

    (iv) $Mn(CO)_6$

(c) Sodium nitroprusside contains species

    (i) NO (ii) NO^+

    (iii) NO^- (iv) NO_2
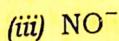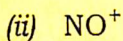
(d) $Mn(CO)_5$ is isolobal with

    (i) CH (ii) CH_2

    (iii) CH_2^+ (iv) CH_3
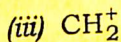
(e) 1,10-phenanthroline iron (II) sulphate may be used as

    (i) adsorption indicator

    (ii) metal ion indicator

    (iii) redox indicator

    (iv) neutralization indicator

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

(a) What do you mean by oxidative addition reaction?

(b) How will you detect bridging and terminal CO in $Fe_2(CO)_9$?

(c) What are metal cluster compounds? Give examples.

                (Continued)

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

(e) Write a note on adsorption indicator.

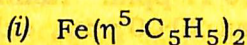3. Answer any *three* questions :   3×3=9

(a) Give two important reactions of ferrocene from which the aromatic character of the molecule can be established.   3

(b) Explain reductive elimination reaction with suitable example.   3

(c) What do you mean by heptacity of a ligand in organometallic compound? Give the name and formula of one monohepto and one pentahepto ligand.   3

(d) Discuss about the bonding in mononuclear metal carbonyls.   3

(e) How will you prepare the following?
                                   1½×2=3

   (i) $Fe(\eta^5\text{-}C_5H_5)_2$

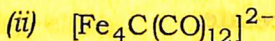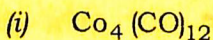   (ii) Zeise's salt

4. Answer any *three* questions :   3×3=9

(a) What are low nuclearity carbonyl clusters? Discuss the structure of one such cluster.   1+2=3

(b) Predict the structure of the following clusters in the light of PSEP theory : 1½×2=3

   (i) $Co_4(CO)_{12}$

   (ii) $[Fe_4C(CO)_{12}]^{2-}$

(c) What are nitrosyl complexes? Give one example of nitrosyl complex formed by Fe and Co.   2+1=3

(d) Outline the rules for polyhedral skeletal electron pair theory.   3

5. Answer any *three* questions :   3×3=9

(a) Define accuracy, precision and mean deviation.   3

(b) What indicator will you use in the titration of (i) strong acid with weak base and (ii) strong acid with strong base? Give reasons.   1½+1½=3

(c) What are metal ion indicators? Give two examples with structure.   1+2=3

(d) What are determinate and indeterminate errors? In a determination, the concentration of iron in a given sample was found to be 20·17 ppm. Taking the accepted value as 20·00 ppm, calculate the absolute error and the relative error as percent in the determination.   1+2=3

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

(a) Cupferron

(b) Magneson

(c) Dithizone

(d) 1,10-phenanthroline

(e) Zinc uranyl acetate

    (Continued)

(Old Course)

Full Marks : 48

Pass Marks : 19

Time : 3 hours

1. Select the correct answer from the following :

   $1 \times 5 = 5$

   (a) The stretching wave number of the CO molecule is $2143 \, cm^{-1}$. The C—O stretching wave number of CO in $Ni(CO)_4$ is

      (i) $2060 \, cm^{-1}$

      (ii) $2160 \, cm^{-1}$

      (iii) $2260 \, cm^{-1}$

      (iv) $2243 \, cm^{-1}$

   (b) $Mn(CO)_5$ is isolobal with

      (i) CH_2 (ii) CH_3

      (iii) CH_2^+ (iv) CH

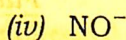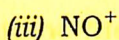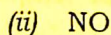   (c) The total electron count of a cluster is $12(n-2) + 2(n+1)$. The structure will be
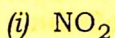
      (i) hypo

      (ii) arachno

      (iii) nido

      (iv) closo

     (Turn Over)

(d) Sodium nitroprusside contains species

    (i) NO_2 (ii) NO

    (iii) NO^+ (iv) NO^-

(e) Which of the following is a redox indicator?

    (i) Methyl orange

    (ii) Congo red

    (iii) Thymol blue

    (iv) Methylene blue

2. Answer the following questions : $2 \times 5 = 10$

(a) Explain oxidative addition reaction with the help of Vaska's compound.

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

(c) $Fe_2(CO)_9$ contains both bridging and terminal CO. Justify the statement.

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

(e) What do you mean by an error? How are they expressed?

               (Continued)

3. Answer any *three* questions : 3×3=9

(a) What do you mean by reductive elimination? Give an example.

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

(c) Describe briefly the structure of *bis*-(cyclopentadienyl) iron (II).

(d) Discuss about the bonding in mononuclear metal carbonyls.

(e) Give the preparation of the following :

   (i) $Fe(C_5H_5)_2$

   (ii) Zeise's salt

4. Answer any *three* questions : 3×3=9

(a) What are low nuclearity carbonyl clusters? Discuss the structure of one such cluster. 1+2=3

(b) Outline the rules for polyhedral skeletal electron pair theory. 3

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

(d) Predict the structure of the following clusters in the light of PSEP theory : 1½×2=3

   (i) $Co_4(CO)_{12}$

   (ii) $[Fe_4C(CO)_{12}]^{2-}$

(Turn Over)

5. Answer any *three* questions :　　　　3×3=9

(a) What are metal ion indicators? Give two examples with structure.　　1+2=3

(b) Explain additive and proportional errors.　　1½+1½=3

(c) What indicator will you use in the titration of (i) strong acid and weak base, and (ii) strong acid and strong base? Give reasons.　　1½+1½=3

(d) In a set of measurements, the following concentrations of Fe (ppm) were reported :

　　20·2, 20·4, 20·3, 20·1, 19·9, 20·0, 19·8

Calculate mean deviation and standard deviation.　　3

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

(a) Cupferron

(b) Magneson

(c) Dithizone

(d) 1,10-phenanthroline

(e) Zinc uranyl acetate

★ ★ ★