

# TEST SERIES UGC-CSIR-NET/JRF June 2016

BOOKLET SERIES **A**

Paper Code **01**

Test Type: **TEST SERIES**

## CHEMICAL SCIENCES

Duration: 2:00 Hours

Date: 20-05-2016

Maximum Marks: 220

Read the following instructions carefully:

\* Single Paper Test is divided into three Parts.

**Part - A:** This part shall carry 30 questions. Each question shall be of **2 marks**.

**Part - B:** This part shall contain 40 questions. Each question shall be of **4 marks**.

\* Darken the appropriate bubbles with HB pencil/Ball Pen to write your answer.

\* There will be negative marking @25% for each wrong answer.

\* The candidates shall be allowed to carry the Question Paper Booklet after completion of the exam.

\* For rough work, blank sheet is attached at the end of test booklet.



## CAREER ENDEAVOUR

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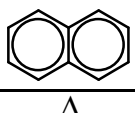
**South Delhi Centre:**

28-A/11, Jia Sarai, Near-IIT Hauz Khas, New Delhi-16  
T : 011-26851008, 26861009

**North Delhi Centre:**

33-35, Mall Road, G.T.B. Nagar (Opp. Metro Gate No.3), Delhi-09  
T : 011-65462244, 65662255  
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## PART-A

1. Arrange the following in increasing order of  $\nu_{C-O}$  stretching frequencies  
 (A)  $[\text{Mn}(\text{CO})_6]^+$  (B)  $[\text{Cr}(\text{CO})_6]$  (C)  $[\text{V}(\text{CO})_6]^-$  (D) CO free  
 (a)  $D < B < C < A$  (b)  $C < B < D < A$  (c)  $C < B < A < D$  (d)  $D < A < B < C$
2.  $\text{Fe}(\text{CO})_5 \xrightarrow{\text{I}_2} (\text{A}) \xrightarrow[\text{THF}]{\text{NaBH}_4} (\text{B})$   
 The product (A) and (B) are respectively  
 (a)  $[\text{Fe}(\text{CO})_4]^{2+}$ ,  $[\text{Fe}(\text{CO})_4]^{2-}$  (b)  $[\text{Fe}(\text{CO})_5 \text{I}_2]$ ,  $[\text{Fe}(\text{CO})_5 \text{H}_2]$   
 (c)  $[\text{Fe}(\text{CO})_4 \text{I}_2]$ ,  $[\text{H}_2\text{Fe}(\text{CO})_4]$  (d)  $[\text{H}_2\text{Fe}(\text{CO})_4]$ ,  $[\text{Fe}(\text{CO})_4 \text{I}_2]$
3. The bond order of the cluster  $[\text{Cp}_2\text{Cr}_2(\text{CO})_4]$  and  $[(\text{SiR})\text{Co}_3(\text{CO})_9]$  are respectively  
 (a) 3, 2 (b) 3, 3 (c) 2, 3 (d) 4, 3
4.  $[(\text{dmpe})_2\text{Ru}] \xrightarrow[\Delta]{\text{C}_{10}\text{H}_7} [(\text{dmpe})_2\text{RuH}(\text{C}_{10}\text{H}_7)]$   
  
 The above reaction is an example of  
 (a) Oxidative coupling (b) Oxidative addition  
 (c) Reductive elimination (d) Oxidative addition followed by reductive elimination
5. In the MO configuration of  $\text{XeF}_2$ , how many electrons are present in BMO, NBO, ABMO, respectively  
 (a) 2, 0, 2 (b) 2, 1, 1 (c) 2, 2, 0 (d) 1, 2, 1
6. In which of following C–C bond length will be longest  
 (a)  $\text{H}_3\text{C}-\text{CF}_3$  (b)  $\text{FH}_2\text{C}-\text{CH}_2\text{F}$  (c)  $\text{F}_2\text{HC}-\text{CHF}_2$  (d)  $\text{F}_3\text{C}-\text{CF}_3$
7. The number of peroxide linkages and oxidation state of Cr in  $\text{CrO}_5$ :  
 (a) 2, +6 (b) 1, +6 (c) 1, +8 (d) 2, +8
8. The correct order of thermal stability  
 (a)  $\text{LiBH}_4 > \text{LiAlH}_4 > \text{LiGaH}_4$   
 (b)  $\text{B}_2\text{H}_6 > \text{Al}_2\text{H}_6 > \text{Ga}_2\text{H}_6$   
 (c)  $\text{Al}_2\text{Cl}_6 > \text{Al}_2\text{Br}_6 > \text{Al}_2(\text{MeS})_6$  (MeS = Mesityl)  
 (d) all are correct.
9. Find the value of 'x' in  $[\text{Na}_3\text{Ba}_x\text{Si}_5\text{O}_{15}]_2$   
 (a) 7 (b)  $\frac{7}{2}$  (c) 14 (d) 2
10. The electronegativity of As in  $\text{AsF}_3$  and  $\text{AsF}_5$  if  $E_{\text{As-As}} = 146$  kJ/mole,  $E_{\text{F-F}} = 155$  kJ/mole,  $E_{\text{As-F}}(\text{AsF}_5) = 484$  kJ/mole,  $E_{\text{As-F}}(\text{AsF}_3) = 406$  kJ/mole  
 (a) 1.86, 2.37 (b) 2.37, 1.86 (c) 1.86, 1.86 (d) 2.37, 2.37
11. The easiest LMCT can occur in  
 (a) ZnS (b) CdS (c) HgS (d) all are equal

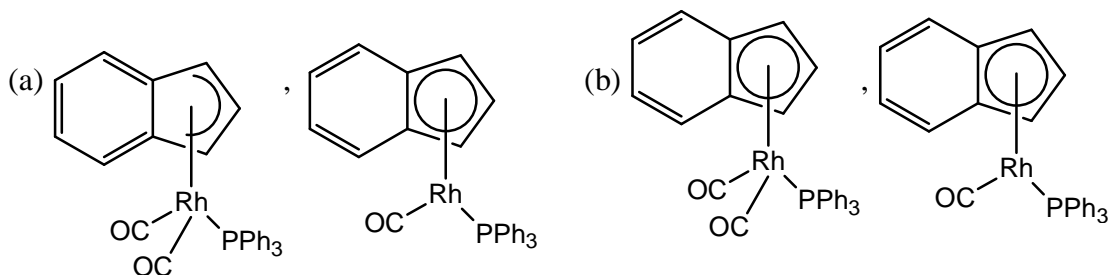
12. The ESR spectrum of  $[\text{Cu}(\text{en})_2]^{2+}$  exhibits
- [ Given :  $I_{\text{Cu}} = \frac{3}{2}$ ,  $I_{\text{N}} = 1$  ]
- (a) 36 fine lines      (b) 36 hyperfine lines      (c) 45 fine lines      (d) 60 hyperfine line
13. The number of Mössbauer lines in the presence and absence of magnetic field respectively for  $\text{K}_2[\text{Fe}(\text{CN})_5\text{NO}]$
- (a) 6 and 1      (b) 6 and 2      (c) 2 and 6      (d) 1 and 6
14. Which of the following statements are correct for Flame Photometry
- (a) the presence of atom-ion equilibrium in flames has a number of consequences  
 (b) the intensity of atomic emission lines for the alkali metals are affected in a complex may be temperature  
 (c) increased temperature causes an increase in the population of the excited atoms  
 (d) all of the above are correct.
15. Using phenolphthalein indicator which of the following titration is possible?
- (a) acetic acid with pyridine      (b) oxalic acid with sodium hydroxide  
 (c) hydrochloric acid with aniline      (d) sulphuric acid with aqueous ammonia
16. The half-life of radioactive nucleus is 2.5 days. The percentage of the original substance which will disintegrate in 7.5 days is
- (a) 8.75 %      (b) 100%      (c) 87.5%      (d) 12.5%
17. Which of the following radioactive decay chains is it possible to observe ?
- (a)  ${}^{206}_{82}\text{Pb} \rightarrow {}^{202}_{80}\text{Hg} \rightarrow {}^{202}_{79}\text{Au}$       (b)  ${}^{210}_{83}\text{Bi} \rightarrow {}^{210}_{84}\text{Po} \rightarrow {}^{206}_{82}\text{Pb}$   
 (c)  ${}^{214}_{88}\text{Ra} \rightarrow {}^{210}_{86}\text{Rn} \rightarrow {}^{207}_{82}\text{Pb}$       (d)  ${}^{206}_{82}\text{Pb} \rightarrow {}^{202}_{80}\text{Hg} \rightarrow {}^{202}_{72}\text{Au}$
18. The following is the example of
- $$n \rightarrow p + e^- + \bar{\nu}$$
- (a)  $\gamma$ -decay      (b)  $\alpha$ -decay      (c)  $\beta$ -decay      (d)  $\alpha$ ,  $\beta$  &  $\gamma$ -decay
19. Select the pair of normal and inverse spinel from followings
- (a)  $\text{ZnFe}_2\text{O}_4$  and  $\text{MgAl}_2\text{O}_4$       (b)  $\text{FeAl}_2\text{O}_4$  and  $\text{NiGa}_2\text{O}_4$   
 (c)  $\text{NiAl}_2\text{O}_4$  and  $\text{NiGa}_2\text{O}_4$       (d)  $\text{FeCr}_2\text{O}_4$  and  $\text{NiCr}_2\text{O}_4$
20. The equilibrium constant for following reaction of ethylenediamine with  $\text{Co}^{2+}$ ,  $\text{Ni}^{2+}$  and  $\text{Cu}^{2+}$  are  $k_1$ ,  $k_2$  and  $k_3$  respectively.
- $$[\text{M}(\text{H}_2\text{O})_2(\text{AA})_2]^{2+} \xrightarrow{\text{AA}} [\text{M}(\text{AA})_3]^{2+}$$
- then select the correct statement from the following
- (a)  $k_2 > k_1 > k_3$       (b)  $k_3 > k_2 > k_1$       (c)  $k_2 > k_3 > k_1$       (d)  $k_2 \approx k_3 > k_1$
21. The intense red color of an  $[\text{Fe}(\text{phen})_3]^{2+}$  solution is replaced by pale blue when cerium (IV) sulfate is added to its. The colour of reactant and product is due to respectively
- (a) d-d transition in both  
 (b) MLCT in reactant while LMCT in product  
 (c) MLCT in reactant and d-d transition in product  
 (d) d-d transition in reactant while MLCT in product

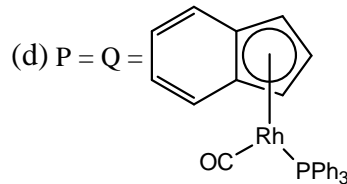
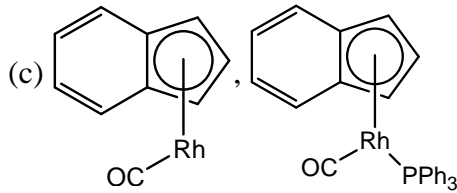
22. Correct statement for oxyhemerythrin is  
 (a) both the Fe are same (b) oxyhemerythrin is paramagnetic in nature  
 (c)  $O_2$  is present as  $HO_2^-$  (d) it is colourless
23. Which of followings are involve in electron transfer processes  
 (A) Cytochrome (B) Plastocyanin  
 (C) Ferredoxin (D) Azurin  
 (a) A, C (b) A, B, C, D (c) A, C, D (d) A, B, C
24. Total number of stereoisomers of  $[CoCl_3(NO_2)_3]^{2-}$  and  $[Co(gly)_2Cl_2]^-$  are (only geometrical)  
 (a) 2, 3 (b) 2, 4 (c) 3, 5 (d) 2, 5
25. Which of following oxides have highest Neel temperature  
 (a) MnO (b) NiO (c) FeO (d) CoO
26. Which of the following protein is hemeprotein  
 (a) Hemocyanin (b) Hemerythrin (c) Ferritin (d) Cytochrome
27. Which noble gas is used in crysoscropy  
 (a) He (b) Ne (c) Ar (d) Xe
28. The correct order of second ionization potential of carbon, nitrogen, oxygen and fluorine is:  
 (a)  $C > N > O > F$  (b)  $O > N > F > C$   
 (c)  $O > F > N > C$  (d)  $F > O > N > C$
29. The series with the correct order of decreasing ionic size is:  
 (a)  $K^+ > Ca^{2+} > S^{2-} > Cl^-$  (b)  $S^{2-} > Cl^- > K^+ > Ca^{2+}$   
 (c)  $K^+ > Cl^- > Ca^{2+} > S^{2-}$  (d)  $Cl^- > K^+ > S^{2-} > Ca^{2+}$
30. For an odd nucleon in 'f' nuclear orbital and parallel to I spin and parity are  
 (a)  $\frac{7}{2}$  and (+) (b)  $\frac{7}{2}$  and (-) (c)  $\frac{9}{2}$  and (+) (d)  $\frac{9}{2}$  and (-)

## PART-B

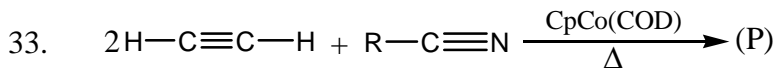


The intermediate P and the product Q are respectively

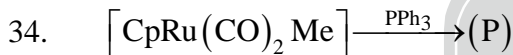
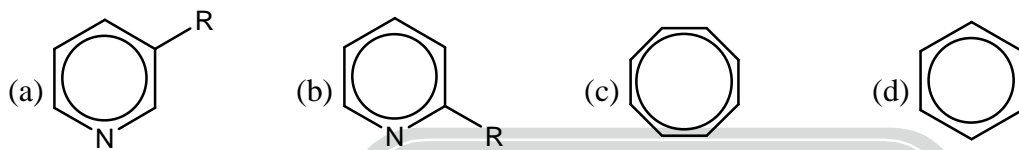




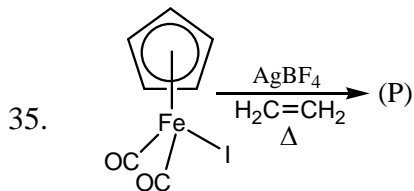
32. The structure of the cluster anion  $[\text{HCo}_6(\text{CO})_{15}]^-$  in the crystal shows  $\text{Co}_6$  octahedron holds ten terminal CO ligand, four unsymmetrical CO bridges and one symmetrical 'CO' bridges. The H-atom readily leaves the center of  $\text{Co}_6$  octahedron as the pH value increases. The  $^1\text{H}$  NMR of this cluster shows chemical shift at  
 (a) +23 ppm (b) -7.5 (c) -19.5 (d) 2.90 ppm



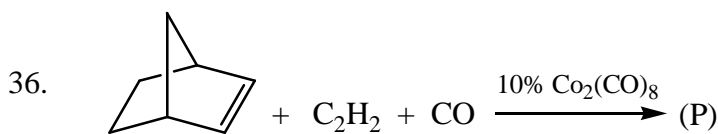
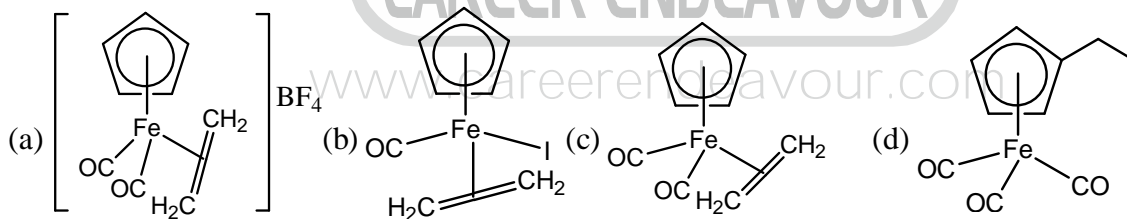
The major product (P) in the above reaction is



The major product of the reaction is



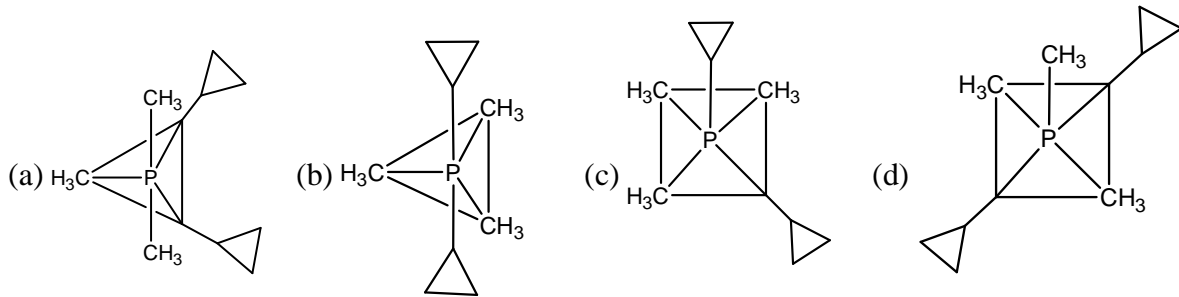
The major product (P) in the above reaction is



The major product (P) in the above reactions



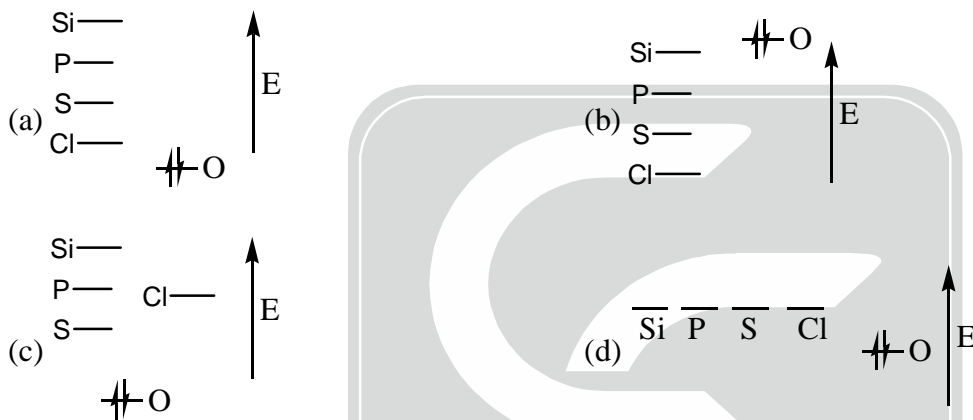
37. The correct structure of  $[P(C_3H_5)_2(CH_3)_3]$  is



38. Find the correct order of bond angles

- (I)  $H_3O^+ > NH_3$       (II)  $BCl_3 > COF_2$       (III)  $\overset{\oplus}{N}H_4 = \overset{\oplus}{N}Me_4$       (IV)  $AsH_3 > AsF_3$   
 (a) I, II      (b) I, II, III, IV      (c) I, II, III      (d) III only

39. The correct matching of MO for the  $\pi$ -back donation in Si-O, P-O, S-O, Cl-O units



40. (I)  $H_4P_2O_6 \xrightarrow{\text{Hydrolysis}}$   
 (III)  $NCl_3 \xrightarrow{H_2O}$   
 (V)  $Br_2 \xrightarrow{H_2O}$

- (II)  $BF_3 \xrightarrow{H_2O}$   
 (IV)  $S_8 \xrightarrow{H_2O}$

In how many hydrolysis reactions two types of acids are formed

- (a) 5      (b) 4      (c) 3      (d) 2

41. The correct order of acidic strength

- (a)  $P_2O_3 < SO_2$   
 (c)  $XeOF_4 > XeF_4$

- (b)  $>$   
 (d) all are correct.

42. The number of correct orders of ionisation energies in

- (I)  $NH_3 > PH_3$       (II)  $S^- > O^-$       (III)  $C^- > B^-$       (IV)  $Al^- > B^-$   
 (V)  $NO > N > O$       (VI)  $HF < HCl > HBr$   
 (a) 4      (b) 3      (c) 2      (d) 5

43. At low aqueous concentrations and at ordinary temperature the extent of exchange of ions in exchanger column is
- (a)  $\text{Li}^+ < \text{H}^+ < \text{Na}^+ < \text{NH}_4^+ < \text{K}^+ < \text{Rb}^+ < \text{Cs}^+$   
 (b)  $\text{Li}^+ > \text{H}^+ > \text{Na}^+ > \text{NH}_4^+ > \text{K}^+ > \text{Rb}^+ > \text{Cs}^+$   
 (c)  $\text{H}^+ < \text{Li}^+ < \text{Na}^+ < \text{NH}_4^+ < \text{K}^+ < \text{Rb}^+ < \text{Cs}^+$   
 (d)  $\text{Li}^+ < \text{Na}^+ < \text{NH}_4^+ < \text{K}^+ < \text{Rb}^+ < \text{Cs}^+ < \text{H}^+$
44.  $\text{P}_2\text{I}_4 + \text{PI}_3 \xrightarrow[\text{Ag}^+]{\text{DCM}} [\text{P}_3\text{I}_6]^+$
- Which is correct for  $[\text{P}_3\text{I}_6]^+$
- (a) it gives two  $^{31}\text{P}$ -NMR signals with triplet and doublet patterns  
 (b) it gives one  $^{31}\text{P}$ -NMR signals with triplet  
 (c) it gives three  $^{31}\text{P}$ -NMR signals with singlet  
 (d) it gives two  $^{31}\text{P}$ -NMR signals with singlet-doublet pattern.
45. Which of the following is not the neutralization reaction(s)?
- (i)  $\text{NH}_4\text{Cl} + \text{KNH}_2 \xrightarrow{\text{liq. NH}_3} \text{KCl} + 2\text{NH}_3$   
 (ii)  $\text{SOCl}_2 + \text{Cs}_2\text{SO}_3 \xrightarrow{\text{liq. SO}_2} 2\text{CsCl} + 2\text{SO}_2$   
 (iii)  $\text{NaOH} + \text{HCl} \xrightarrow{\text{H}_2\text{O}} \text{NaCl} + \text{H}_2\text{O}$   
 (iv)  $\text{Na} + \text{H}_2\text{O} \longrightarrow \text{NaOH} + \frac{1}{2}\text{H}_2(\text{g})$
- (a) only (i)                      (b) only (i) and (ii)                      (c) only (i), (ii), (iv)                      (d) only (iv)
46. Arrange the following aqua ions in the order of increasing acid strength  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ ,  $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$ ,  $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$  and  $[\text{Hg}(\text{H}_2\text{O})_6]^{2+}$
- (a)  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+} < [\text{Al}(\text{H}_2\text{O})_6]^{3+} < [\text{Sc}(\text{H}_2\text{O})_6]^{3+} < [\text{Hg}(\text{H}_2\text{O})_6]^{2+}$   
 (b)  $[\text{Al}(\text{H}_2\text{O})_6]^{3+} < [\text{Sc}(\text{H}_2\text{O})_6]^{3+} < [\text{Cr}(\text{H}_2\text{O})_6]^{3+} < [\text{Hg}(\text{H}_2\text{O})_6]^{2+}$   
 (c)  $[\text{Hg}(\text{H}_2\text{O})_6]^{2+} < [\text{Al}(\text{H}_2\text{O})_6]^{3+} < [\text{Sc}(\text{H}_2\text{O})_6]^{3+} < [\text{Cr}(\text{H}_2\text{O})_6]^{3+}$   
 (d)  $[\text{Hg}(\text{H}_2\text{O})_6]^{2+} < [\text{Sc}(\text{H}_2\text{O})_6]^{3+} < [\text{Cr}(\text{H}_2\text{O})_6]^{3+} < [\text{Al}(\text{H}_2\text{O})_6]^{3+}$
47. The ground state term and the magnetic moment of the  $\text{Ho}^{3+}$  ion is
- (a)  $^5\text{H}$  and 10.60 B.M.                      (b)  $^6\text{I}$  and 4.9 B.M.  
 (c)  $^5\text{I}$  and 10.60 B.M.                      (d)  $^5\text{I}$  and 4.9 B.M.
48. The order of separation of tripositive lanthanide ions is
- (a)  $\text{Ce}^{3+}, \text{Nd}^{3+}, \text{Eu}^{3+}, \text{Er}^{3+}, \text{Yb}^{3+}$                       (b)  $\text{Yb}^{3+}, \text{Er}^{3+}, \text{Eu}^{3+}, \text{Nd}^{3+}, \text{Ce}^{3+}$   
 (c)  $\text{Nd}^{3+}, \text{Eu}^{3+}, \text{Er}^{3+}, \text{Yb}^{3+}, \text{Ce}^{3+}$                       (d)  $\text{Ce}^{3+}, \text{Nd}^{3+}, \text{Er}^{3+}, \text{Eu}^{3+}, \text{Yb}^{3+}$
49. Total number of expected ESR lines for  $\text{NH}_2$  radical will be  
 [Given :  $A_{\text{N}} = 30.0 \text{ mT}$  and  $A_{\text{H}} = 15.0 \text{ mT}$ ]
- (a) 5 lines                      (b) 9 lines                      (c) 7 lines                      (d) 10 lines

50. Consider the following

Volumetric Method for Ag(I)	Indicator used
(i) Fajans method	Chromate
(ii) Mohr's method	Fluorescein
(iii) Vohlard method	Ferric salt

The method and indicator matched correctly is

- (a) I and II only      (b) II and III only      (c) III only      (d) II only

51. Find the incorrect statement

- (a) the dipole moment of  $\text{NHF}_2$  is 1.92D and that of  $\text{NF}_3$  is 0.24D.  
 (b) the dipole moment of  $\text{H}_2\text{O}$  is greater than that of HF  
 (c)  $\text{HCOOH}$  is stronger acid than  $\text{H}_2\text{CO}_3$ .  
 (d)  $\text{HF}_2^-$  has 3c-4e bonding

52. Select the correct statement from following?

- (A) spin multiplicity allowed transition are broad while spin multiplicity forbidden are usually sharp  
 (B) spin multiplicity allowed transitions are sharp while spin multiplicity forbidden transition are usually broad  
 (C) Generally  $f \leftarrow f$  transition have more molar extinction coefficient than d-d transition.  
 (D) Generally d-d transition have more molar extinction coefficient than  $f \leftarrow f$  transition  
 (a) A and D      (b) A and C      (c) B and C      (d) B and D

53. The number of stereoisomers and pairs of isomers for compound having formula  $\text{Ma}_2\text{bcde}$  is

- (a) 12, 6      (b) 15, 6      (c) 10, 5      (d) 9, 3

54. Select the correct option from following

- (A)  $d_{z^2} > d_{x^2-y^2} > d_{xz} > d_{xy} = d_{yz}$  {energy of d-orbital for square pyramidal}  
 (B)  $d_{z^2} > d_{x^2-y^2} > d_{xz} = d_{yz} > d_{xy}$  {energy of d-orbital in z-in}  
 (C)  $d_{xz} > d_{yz} > d_{xy} \approx d_{x^2-y^2} > d_{z^2}$  {energy of d-orbital in square antiprismatic}  
 (D)  $\frac{\Delta_{sp}}{\Delta_C}$  is approximately  $\approx 2$   
 (a) A, B, C      (b) B, C      (c) A, C, D      (d) C, D

55. Correct statement regarding uranium is

- (1) most stable oxidation state of uranium is +6  
 (2) in uranocene its oxidation state is +4  
 (3) in  $\text{UO}_2^+$  colour is due to LMCT  
 (4) Electronic configuration of uranium corresponds  $(\text{Rn})5f^3 6d^1 7s^2$   
 (a) 1, 2      (b) 1, 2, 4      (c) 1, 2, 3, 4      (d) 2, 3, 4

56. Among  $(\text{CH}_3)_3\text{N}-\text{SO}_3$  and  $\text{H}_3\text{N}-\text{SO}_3$ , correct statement is

- (a) S-N bond length in I is greater than II  
 (b) N-S-O bond angle in I is less than II  
 (c) N-S bond length in I is smaller than II and N-S-O bond angle in I is larger than II  
 (d) none of these





57. In a complex  $\text{trans-}[\text{CuX}_4\text{Y}_2]^{2+}$  the  $\text{Cu}-\text{X}$  bond is larger than that of  $\text{Cu}-\text{Y}$  bond, what is correct electron arrangement of complex
- (a)  $(d_{xy})^2 (d_{yz})^2 (d_{xz})^2 (d_{x^2-y^2})^2 (d_{z^2})^1$       (b)  $(d_{xy})^1 (d_{yz})^2 (d_{xz})^2 (d_{x^2-y^2})^2 (d_{z^2})^2$   
 (c)  $(d_{xy})^2 (d_{yz})^2 (d_{xz})^2 (d_{x^2-y^2})^1 (d_{z^2})^2$       (d)  $(d_{xy})^2 (d_{yz})^2 (d_{xz})^1 (d_{x^2-y^2})^2 (d_{z^2})^2$
58. Which of the following show strong emission spectra?
- (a)  $\text{Gd}^{3+}$ ,  $\text{Tb}^{3+}$       (b)  $\text{Eu}^{3+}$ ,  $\text{Tb}^{3+}$       (c)  $\text{Lu}^{3+}$ ,  $\text{Eu}^{3+}$       (d)  $\text{Nd}^{3+}$ ,  $\text{Tb}^{3+}$
59. Which of the following statement is not correct about hemerythrin
- (a) The structure consists of two differently co-ordinated Fe-atoms joined by  $\mu$ -oxo and two bridging carboxylato group.  
 (b) The oxidized form is diamagnetic.  
 (c) Deoxy hemerythrin contains two high-spin ferrous ions as established by Mossbauer and EPR spectroscopy  
 (d) The deoxy or oxy hemerythrin undergo two electron oxidation and reduction reaction.
60. Which of the following statement is not correct
- (a) In deoxy Hb, the  $\text{Fe}(+2)$  is high spin ( $S = 2$ )  
 (b) Addition of  $\text{O}_2$  on deoxy Hb to form the  $\text{Fe}^{(\text{III})} - \text{O}_2^-$   
 (c) In both Hb and Mb, there is a histidine situated in  $\text{O}_2$  binding pocket on the side way from co-ordinated imidazole base.  
 (d) The Co-ordination of dioxygen to deoxy Hb or Mb is accompanied by electron transfer to form peroxide ion, which in turn is stabilized by H-bonding to distal imidazole proton .
61. Consider the following statements  
 (A) The rubredoxin active site consist of a high spin  $\text{Fe}(\text{II}, \text{III})$  ion  
 (B) It is co-ordinated to four cysteinate sulfur atoms in an approximately tetrahedral arrays.  
 (C) The oxidised form of rubredoxin is coloured due to d-d transition  
 (D) The oxidised form at  $[\text{2Fe2S}]$  ferredoxin contains two  $\text{Fe}(+3)$  ions.  
 (E) Blue copper proteins such as plastocyanin involved atom transfer reaction.  
 Which of the following statements are correct  
 (a) A and C      (b) B and C      (c) A, B, C      (d) A and B only
62. The **FALSE** statement for a polarographic measurement procedure is:  
 (a)  $\text{O}_2$  is removed  
 (b) Dropping mercury electrode is working electrode  
 (c)  $I_d$  is proportional to concentration of electroactive species.  
 (d) Residual current is made zero by adding supporting electrolyte.
63. Red and yellow isomers exist for the coordination complex  $[\text{Co}(\text{NH}_3)_5\text{NO}_2]^{2+}$ . If the red isomer has  $\nu_{\text{NO}}$  bands at  $1470$  and  $1065 \text{ cm}^{-1}$  and the yellow isomer has  $\nu_{\text{NO}}$  band at  $1430$  and  $1310 \text{ cm}^{-1}$ . What will be the coordination mode of  $\text{NO}_2$ .
- (a) Yellow  $\text{Co}-\text{ONO}$       red  $\text{Co}-\text{NO}_2$ .  
 (b) Yellow  $\text{Co}-\text{NO}_2$       red  $\text{Co}-\text{ONO}$   
 (c) Red  $\text{Co}-\text{NO}_2$       yellow  $\text{Co}-\text{NO}_2$   
 (d) Red  $\text{Co}-\text{ONO}$       yellow  $\text{Co}-\text{ONO}$

64. Which of the following pairs match the correct  $\nu_{\text{NO}}$  ( $\text{cm}^{-1}$ ) frequencies?
- (A)  $\text{N} \equiv \text{O}^+$  (1) 1880  
 (B) NO (2) 886  
 (C)  $\text{NO}^-$  (3) 1366  
 (D)  $\text{NO}^{2-}$  (4) 2273
- (a) A-1, B-2, C-3, D-4 (b) A-4, B-1, C-3, D-2  
 (c) A-2, B-4, C-3, D-1 (d) A-3, B-4, C-1, D-2
65. What will be the correct order of  $\nu(\text{O}-\text{O})/\text{cm}^{-1}$  (absorption frequency) for the compounds  $\text{O}_2[\text{AsF}_6]$ ,  $\text{O}_2(\text{g})$ ,  $\text{KO}_2$ ,  $\text{Na}_2\text{O}_2$  is
- (a)  $\text{O}_2[\text{AsF}_6] > \text{O}_2 > \text{KO}_2 > \text{Na}_2\text{O}_2$  (b)  $\text{O}_2[\text{AsF}_6] < \text{O}_2 < \text{KO}_2 < \text{Na}_2\text{O}_2$   
 (c)  $\text{O}_2[\text{AsF}_6] > \text{KO}_2 > \text{Na}_2\text{O}_2 > \text{O}_2$  (d)  $\text{O}_2 > \text{O}_2[\text{AsF}_6] > \text{KO}_2 > \text{Na}_2\text{O}_2$
66. An aqueous solution of  $\text{Ni}(\text{NO}_3)_2$  is treated with  $\text{Cl}^-$  ions to give a compound for which  $K_4 > K_3$ . The compound is:
- (a)  $[\text{Ni}(\text{H}_2\text{O})_6]\text{Cl}_2$  (b)  $[\text{NiCl}_4]^{2-}$  (c)  $[\text{Ni}(\text{H}_2\text{O})_4\text{Cl}_2]$  (d)  $[\text{NiCl}_6]^{4-}$
67. The crystal field stabilization energy (CFSE) value for  $[\text{Co}(\text{NH}_3)_6]^{3+}$  that has an absorption maximum at 690 nm
- (a) 415.56 kJ/mole (b) 69.260 kJ/mole (c) 455.56 kJ/mole (d) 84.26 kJ/mole
68. Substitution of  $\text{Cl}^-$  by  $\text{H}_2\text{O}$  in  $\text{cis}-[\text{Co}(\text{en})_2\text{Cl}_2]^+$  and  $\text{trans}-[\text{Co}(\text{en})_2\text{Cl}_2]^+$  leads to formation of
- (a) cis and trans product respectively  
 (b) cis-product in both  
 (c) mixer of cis and trans-isomer in both  
 (d) cis and mixture of cis-and trans-product respectively
69. Select the correct order regarding rate of electron transfer process (outer sphere) for following complex
- (A)  $[\text{Co}(\text{NH}_3)_6]^{2+} | [\text{Co}(\text{NH}_3)_6]^{3+}$  (B)  $[\text{Co}(\text{H}_2\text{O})_6]^{2+} | [\text{Co}(\text{H}_2\text{O})_6]^{3+}$   
 (C)  $[\text{Co}(\text{phen})_3]^{2+} | [\text{Co}(\text{phen})_3]^{3+}$
- (a)  $A > B > C$  (b)  $A > C > B$  (c)  $C > A > B$  (d)  $C > B > A$
70. The number of ambident ligand from following
- $\text{SO}_3^{2-}$ ,  $\text{ClO}_3^-$ ,  $\text{CO}$ ,  $\text{CN}^-$ ,  $\text{CNO}^-$ ,  $\text{S}_2\text{O}_3^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{ClO}_4^-$ ,  $\text{SCN}^-$ ,  $\text{NO}_2^-$ ,  $\text{NO}_2^+$
- (a) 5 (b) 7 (c) 8 (d) 6

*Space for rough work*



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**South Delhi : 28-A/11, Jia Sarai, Near-IIT Hauz Khas, New Delhi-16, Ph : 011-26851008, 26861009**

**North Delhi : 33-35, Mall Road, G.T.B. Nagar (Opp. Metro Gate No. 3), Delhi-09, Ph: 011-65462244, 65662255**

## ANSWER KEY

## PART-A

1. (c)	2. (c)	3. (a)	4. (b)	5. (c)	6. (b)	7. (a)
8. (d)	9. (a)	10. (a)	11. (c)	12. (b)	13. (b)	14. (d)
15. (b)	16. (c)	17. (b)	18. (c)	19. (b)	20. (a)	21. (c)
22. (c)	23. (b)	24. (d)	25. (b)	26. (d)	27. (a)	28. (c)
29. (b)	30. (b)					

## PART-B

31. (a)	32. (a)	33. (b)	34. (b)	35. (a)	36. (c)	37. (b)
38. (c)	39. (a)	40. (c)	41. (d)	42. (a)	43. (a)	44. (a)
45. (d)	46. (b)	47. (c)	48. (b)	49. (c)	50. (c)	51. (d)
52. (a)	53. (b)	54. (b)	55. (c)	56. (c)	57. (a)	58. (b)
59. (d)	60. (d)	61. (c)	62. (d)	63. (b)	64. (b)	65. (a)
66. (b)	67. (a)	68. (d)	69. (d)	70. (a)		



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