Target IIT-JAM-2018

Test Series-2

INORGANIC CHEMISTRY **Booklet Code: B**

Duration: 3:00 Hours **CHEMISTRY-CY** **Date: 06-01-2018**

Maximum Marks: 100

Read the following instructions carefully:

1 Attempt all the questions.

2. **Section-A** contains **30** Multiple Choice Questions (MCQ). Each question has 4 choices (a), (b), (c) and (d), for its answer, out of which **ONLY ONE** is correct. From **Q.1 to Q.10** carries 1 Marks and **Q.11 to Q.3**0 carries 2 Marks each.

3. **Section-B** contains **10** Multiple Select Questions(MSQ). Each question has 4 choices (a), (b), (c) and (d) for its answer, out of which **ONE or MORE than ONE** is/are correct. For each correct answer you will be awarded **2 marks.**

4. Section-**C** contains **20** Numerical Answer Type (NAT) questions. From **Q.41 to Q.50** carries **1 Mark** each and **Q.51 to Q.60** carries **2 Marks** each. For each NAT type question, the value of answer in between 0 to 9.

5. In all sections, questions not attempted will result in zero mark. In Section–A (MCQ), wrong answer will result in negative marks. For all **1 mark** questions, **1/3 marks** will be deducted for each wrong answer. For all **2 marks** questions, **2/3 marks** will be deducted for each wrong answer. In Section–B (MSQ),there is no negative and no partial marking provision. There is no negative marking in Section –C (NAT) as well.

Regn. No. | | | | | | | | | | |

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Section-A : Multiple Choice Questions (MCQ)

Q.1 to Q.10: Carry 1 Mark each.

1. If polarizing power is in the order of $M_a^+ > M_b^+ > M_c^+$ and polarizability is in the order of $X^- > Y^- > Z^-$ then select which of the following compounds have more covalent character as compared to $M_b^+Y^-$?

   (a) $M_a^+Y^-$ (b) $M_c^+Z^-$ (c) $M_c^+X^-$ (d) $M_b^+Z^-$

2. If z is the molecular axis then which of the following overlapping results in non-bonding molecular orbital?

   (a) $\left(d_{x^2-y^2} + d_{x^2-y2}\right)$ (b) $\left(d_{xy} + d_{xy}\right)$ (c) $\left(d_{yz} + p_y\right)$ (d) $\left(d_{xz} + p_z\right)$

3. Which of the following types of silicate represents the mineral $Mg_3(OH)_2[Si_4O_{10}]$?

   (a) Linear silicate (b) Cyclic silicate (c) 3-D-silicate (d) Sheet silicate

4. Choose the correct option to complete the statement:
   As much the percentage *s* character increases in a particular hybrid orbital,
   (a) bulkiness of the orbital decreases (b) length of the orbital decreases
   (c) length of the orbital increases (d) thinness of the orbital increases

5. When $SiCl_4$ undergoes hydrolysis to produce $Si(OH)_4$, the state of hybdridization of Si atom in the transition state is

   (a) sp (b) sp^3d (c) sp^3 (d) sp^2

6. The biological function of cytochrome P_{450} and Fe–S proteins are respectively
   (a) O_2 transport and electron carrier (b) both electron carrier
   (c) oxidation of alkene and electron carrier (d) O_2 storage and electron carrier

7. $A + SbF_5 \longrightarrow B$

   $B + \text{tert} - \text{butane} \longrightarrow [\text{tert} - \text{butyl}]^+ + X^- + H_2$

   then A is
   (a) HCl (b) HF (c) HBr (d) HI

8. Complexes $[Co(NH_3)_5Cl]SO_4$ and $[Co(NH_3)_5(SO)_4]Cl$ can be distinguished by

   (a) using barium chloride (b) using silverniterate
   (c) conductance measurement (d) using all of these method

9. Arrange the following in decreasing order of Rh–C bond length

   (A) $Rh(CO)_2(Cl)(PPh_3)_2$ (B) $Rh(CO)_2(Cl)(PEt_3)_2$ (C) $Rh(CO)_2(Cl)[P(C_6F_5)_3]_2$

   (a) C > A > B (b) C > B > A (c) B > A > C (d) A > B > C

10. The occupation factor λ is 0 and 1/2 respectively for which of the following pairs of mixed oxides

    (I) $CuAl_2O_4$ and Mn_3O_4 (II) $NiCr_2O_4$ and $ZnFe_2O_4$
    (III) Co_3O_4 and $CoFe_2O_4$ (IV) $CoAl_2O_4$ and $ZnMn_2O_4$
    (a) I, II and IV (b) II and IV (c) III and IV (d) III only

Q.11 to Q.30: Carry 2 Marks each.

11. PCl_xF_{5-x} molecule will be polar and non-polar for what values of *x* respectively

Polar	Non-polar	Polar	Non-polar
(a) 2, 3, 5	and 0, 4, 1	(b) 0, 2, 5	and 3, 1, 4
(c) 4, 3, 0	and 2, 0, 4	(d) 2, 1, 4	and 3, 0, 5

12. $B_2H_6 + 2NH_3 \longrightarrow X\left[\text{Ionic product}\right] \xrightarrow[140^\circ C]{\Delta} Y$

Here Y is inorganic benzene

Which of the following statements is incorrect about Y molecule?

(a) Y is a planar molecule

(b) Y is aromatic and sp^3 hybridization of each B and N-atom

(c) Y is a non-polar molecule

(d) Back bonding takes place from N-atom to B-atom in Y

13. Molecular shape of XeF_3^+, SF_3^+ and CF_3^+ are

(a) the same with 2, 1 and 0 lone pairs of electrons, respectively

(b) different with 2, 1 and 0 lone pairs of electrons, respectively

(c) diffderent with 0, 1 nad 2 lone pairs of electrons, respectively

(d) the same with 2, 0 and 1 lone pairs of electrons, respectively.

14. Select the incorrect statement about metal carbonyl complex compounds

(a) Metal-carbon bonds in metal carbonyls possess both σ and π character

(b) Due to synergic, bonding metal-carbon bond becomes weak

(c) Due to synergic bonding carbon-oxygen bond strength decreases

(d) In metal carbonyls the extent of synergic bonding will increase with increase in negative charge on central metal ion.

15. When 0.1 mol of $CoCl_3(NH_3)_5$ is treated with excess of $AgNO_3$, 0.2 mol of AgCl obtained. The conductivity of solution will correspond to (cation : anion)

(a) 1 : 3 electrolyte (b) 1 : 2 electrolyte

(c) 1 : 1 electrolyte (d) 3 : 1 electrolyte

16. $A + FeCl_3 \longrightarrow \text{Deepblue ppt.}(B) \xrightarrow[\text{solution}]{H_2C_2O_4}$

Deep blue clear solution used as writing ink

$C + FeCl_2 \longrightarrow \text{Deepblue ppt.}(B)$

Magnetic moments of compounds A and C in BM are respectively

(a) zero and zero (b) zero and 1.73 (c) 4.89 and 1.73 (d) 4.89 and 5.92

17. o-H_2 and p-H_2 difffer in which of the following properties?

(a) spin of nucleus (b) nuclear magnetic moment

(c) boiling point (d) all of these

18. Choose the correct options from the following orders

(a) Basicity order : $NH_3 < NH_2 - NH_2 > NH_2OH > NF_3$

(b) Melting point order : $NH_3 > SbH_3 > AsH_3 > PH_3$

(c) Boiling point order : $NH_3 > SbH_3 > AsH_3 > PH_3$

(d) Thermal stability order : $NH_3 < PH_3 < AsH_3 < SbH_3$

19. When Cu^{2+} solution reacts with excess KI, which of the following statements is correct?

(a) white ppt. of Cu_2I_2 is obtained

(b) A clear brown solution is obtained

(c) A dark brown solution is obtained in which ppt. of Cu_2I_2 is invisible

(d) A blue solution is obtained.

20. The number of histidine amino acid nitrogen atom coordinated to bimetallic active state of oxyhemocyanin and oxyhemerythrin respectively are

(a) 2, 3 and 3, 3 (b) 3, 3 and 2, 3 (c) 3, 3 and 2, 2 (d) 2, 4 and 3, 2

21. Match the metalloproteins in Column-A with their function in Column-B

Column-A	**Column-B**
(1) Oxyhemocyanin	(A) hydrolysis of C-terminal peptide bond
(2) Carbonic anhydrase	(B) methylation
(3) Cytochrome P_{450}	(C) conversion of CO_2 to H_2CO_3
(4) Carboxy-peptidase A	(D) oxidation of alkene
	(E) oxygen storage
	(F) oxygen transport

The correct answer is

(a) 1-F, 2-C, 3-D, 4-A (b) 1-E, 2-C, 3-A, 4-F

(c) 1-F, 2-B, 3-C, 4-A (d) 1-E, 2-D, 3-C, 4-A

22. Identify correct statement for mercury as an environment pollutant

(A) carbanionic biomethylation converts it to $MeHg^+$

(B) thiol group of cysteine has strong diffnity for mercury

(C) mercury containing industrial catalyst release caused minimata disease

The correct answer is

(a) A and B (b) A and C (c) B and C (d) A, B and C

23. The correct order of thermal stability of the following Boron compounds is

$B_2Cl_4, B_2F_4, B_2(NR_2)_4, B_2(OR)_4$

(a) $B_2Cl_4 > B_2F_4 > B_2(NR_2)_4 > B_2(OR)_4$ (b) $B_2(OR)_4 > B_2(NR_2)_4 > B_2F_4 > B_2Cl_4$

(c) $B_2F_4 > B_2Cl_4 > B_2(OR)_4 > B_2(NR_2)_4$ (d) $B_2(NR_2)_4 > B_2(OR)_4 > B_2F_4 > B_2Cl_4$

24. The complexes $\left[NiCl_2(PPh_3)_2\right]$ and $\left[Ni(CN)_4\right]^{2-}$, respectively are

(a) sp^3, paramagnetic (b) diamagnetic, sp^3

(c) diamagnetic, dsp^2 (d) paramagnetic, dsp^2

25. Egyptian blue, $CaCuSi_4O_{10}$ (I) is pale blue and spinel $CuAl_2O_4$ (II) is an intense blue-green. The difference in colours is due to

(a) LMCT in I and d-d transition in II (b) d-d transition in both
(c) difference in geometry of Cu in I and II (d) d-d in first and LMCT in II

26. Compound $CoCl_3.5NH_3$(A) treated with an excess of $AgNO_3$ solution, two chloride ions are precipitated. A on reaction with $NaNO_2$ gives red colour compound B. Which react with warm HCl turns into yellow colour compound C. The relation between B and C is

(a) B is octahedral compound while C is tetrahedral compound
(b) C is octahedral compound while B is tetrahedral compound
(c) B and C are constitutional isomers
(d) B and C are geometrical isomers

27. The electron count, formal oxidation state, and d^n configuration of following respectively are

$\left[(R_3P)_3\,Ru(\mu-Cl)_3\,Ru(PR_3)_3\right]^+$, ReH_9^{2-}, $MeReO_3$

(a) 16 e^- (VII), d^0 (b) 16e^- (VII), d^5
(c) 18e^- (VII), d^0 (d) 18e^- (VIII), d^0

28. The lowest energy visible spectra band of an octahedral nickel (II) complex is due to the transition

(a) $^3T_{2g} \leftarrow {}^3T_{1g}$ (b) $^3A_{2g} \leftarrow {}^3T_{1g}$ (c) $^3T_{2g} \leftarrow {}^3A_{2g}$ (d) $^3T_{1g} \leftarrow {}^3A_{2g}$

29. $Mn_2(CO)_{10} \xrightarrow{Na}$ A $\xrightarrow{\text{Br}}$ B $\xrightarrow{\Delta}$ C

The product A, B and C are respectively.

(a) $\left[Mn(CO)_6\,Na\right], \left[\eta^1C_3H_5Mn(CO)_5\right], \left[\eta^3C_3H_5Mn(CO)_5\right]$

(b) $\left[Mn(CO)_5\,Na\right], \left[\eta^3C_3H_5Mn(CO)_5\right], \left[\eta^3C_3H_5Mn(CO)_4\right]$

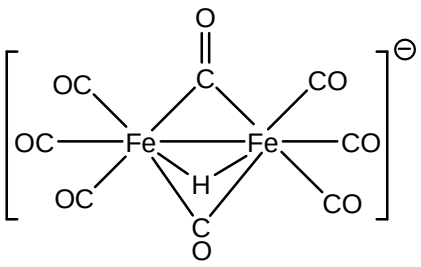
(c) $Na\left[Mn(CO)_5\right], \left[\eta^1C_3H_5Mn(CO)_5\right], \left[\eta^3C_3H_5Mn(CO)_5\right]$

(d) $Na\left[Mn(CO)_5\right], \left[\eta^1C_3H_5Mn(CO)_5\right], \left[\eta^3C_3H_5Mn(CO)_4\right]$

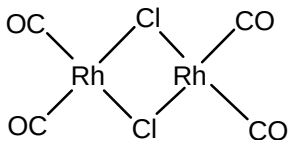
30. Which of the following complex does not obey 18 electron rule.

(a) $\left[W(CO)_3\left(\eta^2-H_2\right)\left(P\,{}^iPr_3\right)_2\right]$ (b) $\left[OsH\left(\eta^2-H_2\right)\left\{P(OEt)_3\right\}_4\right]^+$

(c)



(d)



Section-B : Multiple Select Questions (MSQ)

Q.31 to Q.40: Carry 2 Marks each.

31. $Be(OH)_2$ forms bridge bonding structure in their polymeric form of the compounds as given below. Which types of bonds are present in above compounds?

(I) $\left[Be_3(OH)_8\right]^{2-}$ (II) $\left[Be_4(OH)_{10}\right]^{2-}$

(a) 2c–2e bond (b) 3c–2e bond (c) 3c-4e bond (d) all of these

32. KO_2 or Na_2O_2 is used in submarines or space capsules because
(a) it absorbs CO_2
(b) it releases O_2
(c) it produces corresonding carbonate on reaction with CO_2
(d) none of these

33. Several alkali metals and alkaline earth metals when dissolved in NH_3 produce a bright blue solution. On addition of more metal to this solution which of the following characteristic get changed?
(a) electrical conductivity (b) colour
(c) magnetic behaviouir (d) density of solution

34. Which are the common hydrolysis products from XeF_2 and XeF_4?
(a) Xe (b) XeO_3 (c) HF (d) O_2

35. The change (from A-D given below) which occur when O_2 binds to hemerythrin are
(a) One iron atom is oxidized
(b) Both the iron atoms are oxidised
(c) O_2 binds to one iron atom and is also hydrogen bonded
(d) O_2 binds to both the iron atom and is also hydrogen bonded

36. Consider the *correct* statement(s) from following
(a) In the Fischer Carbene, the carbene carbon acts as a σ-donor and π – acceptor.
(b) The Fischer carbene carbon is singlet and nucleophilic in nature.
(c) The bond between the metal and the carbene carbon atom has double bond character.
(d) The rotational barrier across the M—C in schrock carbene is high and the carbene carbon is electrophilic.

37. Which of the following set(s) show(s) substaintial Jahn-Teller distortion
(a) $\left[Co(H_2O)_6\right]^{2+}$ and $\left[Mn(H_2O)_6\right]^{3+}$ (b) CrF_2 and $\left[Cu(H_2O)_6\right]^{2+}$
(c) $\left[Cr(H_2O)_6\right]^{2+}$ and $\left[Cu(H_2O)_6\right]^{2+}$ (d) $\left[Co(CN)_6\right]^{4-}$ and MnF_3

38. The increasing order of π-acceptor capacity of ligands is/are
(a) NH_3, Phen, NO_2^-, CH_3^-, CN^- (b) Phen, NH_3, NO_2^-, CH_3^-, CN^-
(c) I^-, Py, H_2O, Phen, CO (d) I^-, H_2O, Py, Phen, CO

39. For the $\left[Cr(H_2O)_6\right]^{2+}$ ion, the mean pairing energy P is found to be 23500 cm^{-1}. The magnitude of Δ is 13900 cm^{-1}. The crystal field stabilization for the complex in configurations corresponding to high-spin and low-spin states is
(a) 8340 cm^{-1}, –1260 cm^{-1} (b) –99.64 kJ mol^{-1}, 15.05 kJ mol^{-1}
(c) –8340 cm^{-1}, 1260 cm^{-1} (d) 15.05 kJ mol^{-1}, –99.64 kJ mol^{-1}

40. The correct order of hydration energy of following complexes is/are

(a) $\left[V(H_2O)_6\right]^{2+} > \left[Co(H_2O)_6\right]^{2+} > \left[Cr(H_2O)_6\right]^{2+} > \left[Mn(H_2O)_6\right]^{2+}$

(b) $\left[Co(H_2O)_6\right]^{2+} > \left[V(H_2O)_6\right]^{2+} > \left[Cr(H_2O)_6\right]^{2+} > \left[Mn(H_2O)_6\right]^{2+}$

(c) $\left[Co(H_2O)_6\right]^{3+} > \left[Ni(H_2O)_6\right]^{3+} > \left[Fe(H_2O)_6\right]^{3+} > \left[Mn(H_2O)_6\right]^{3+}$

(d) $\left[Co(H_2O)_6\right]^{3+} > \left[Ni(H_2O)_6\right]^{3+} > \left[Mn(H_2O)_6\right]^{3+} > \left[Fe(H_2O)_6\right]^{3+}$

Section-C : Numerical Answer Type (NAT)

Q.41 to Q.50: Carry 1 Mark each.

41. The Z_{eff} on the last electron of Zr^{3+} ion is _____

42. The total number of specie(s) among the following, containing 3c-2e bond is _____

$Be_2H_4, (BeH_2)_n, Be_2Cl_4, Al_2(CH_3)_6, Al_2Cl_6, I_2Cl_6, B_2H_6, B_2H_2(CH_3)_4$

43. TlI_3 is isomorphic with CsI_3, and then the oxidation state of Tl and TlI_3 is _____

44. The oxidation state of iron in met-hemoglobin is _____

45. The number of unpaired electron in Willikinson catalyst is _____

46. The number of species that undergoes disproportionation in an alkaline medium is _____

$ClO_4^-, Cl_2, MnO_4^{2-}, MnO_4^-, NO_2$

47. Among

$\left[Cr(H_2O)_6\right]^{2+}, \left[Cr(H_2O)_6\right]^{3+}, \left[Cu(H_2O)_6\right]^{2+}, \left[Mn(H_2O)_6\right]^{2+}, \left[Co(NH_3)_6\right]^{3+}, \left[Sc(H_2O)_6\right]^{2+}$

the number of kinetically labile complexes are _____

48. The value of *n* in $Zn_nCa_2(Si_3O_9)\cdot 2H_2O$ is _____

49. The species ^{19}Ne and ^{14}C emmit positron and β-particle respectively. The resulting species formed X and Y. The total sum of atomic number for X and Y is _____

50. Among the following pair,

(A) $Mn(CO)_5, CH_3$ (B) $Fe(CO)_4, O$ (C) $Co(CO)_3, R_2Si$

(D) $Mn(CO)_5, RS$ (E) $Mn(CO)_4, CH$ (F) $Co(CO)_4, CH_3$

The number of isolobal pairs are _____

Q.51 to Q.60: Carry 2 Marks each.

51. The half-life period of $^{125}_{53}Z$ is 100 days. The percentage of the original radioactivity would be present after 400 days is _____

52. The number of nodal planes when two d_{xy} orbitals from two atoms produce antibonding δ molecular orbital is _____

53. If an enzyme fixes N_2 in plants by evolving H_2, the sum of number of electron and protons associated with that _____

54. Among $MnO_4^-, ReO_4^-, CuSO_4 \cdot 5H_2O, Cu_2I_2, \left[Co(en)_3\right]^{3+}, Fe_4\left[Fe(CN)_6\right]_3, Fe_3O_4, HgI_2, BiI_3$
The number of complexes having colour due to charge transfer are _____

55. Treatment of nitroprusside ion with H_2S leads to complex having _____charge

56. The sum of number of M-M bond and number of μ_2–CO in complex $Fe_3(CO)_{12}$ are _____

57. Among $\left[Co(H_2O)_6\right]^{2+}, \left[Fe(H_2O)_6\right]^{3+}, K_3\left[Fe(CN)_6\right], \left[Co(H_2O)_3F_3\right], \left[MnCl_4\right]^{2-}, \left[CuCl_4\right]^{2-}$
The number of complexes having orbital contribution to magnetic moment are _____

58. Among C_2, N_2, B_2, O_2, CN^-. The sum of π-bond in all molecule are _____

59. The number of geometrical isomer for $B_3N_3H_3X_3$ are _____

60. $cis-\left[Co(en)_2Cl_2\right]^+, cis-\left[Co(en)_2(OH)Cl\right]^+, trans-\left[Co(en)_2(NO_2)Cl\right]^+,$
$cis-\left[Co(en)_2(CN)Cl\right]^+, trans-\left[Co(en)_2(OH)Cl\right]^+$
The complexes which show retention in configuration on acidic hydrolysis are _____

******* END OF QUESTION PAPER *******

Space for Rough Work

IIT-JAM CHEMISTRY-CY

TEST SERIES - 2
(Inorganic Chemistry)

Date : 06-01-2018

Booklet : B

ANSWER KEY

Section-A : Multiple Choice Questions (MCQ)

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

Section-B : Multiple Select Questions (MSQ)

31. (a),(c)	**32.** (a),(b),(c)	**33.** (a),(b),(c),(d)	**34.** (a),(c),(d)
35. (b),(c)	**36.** (a), (c)	**37.** (b),(c),(d)	**38.** (a),(d)
39. (b), (c)	**40.** (b), (d)		

Section-C : Numerical Answer Type (NAT)

41. (4 to 4)	**42.** (5 to 5)	**43.** (1 to 1)	**44.** (3 to 3)
45. (0)	**46.** (3 to 3)	**47.** (4 to 4)	**48.** (1 to 1)
49. (16 to 16)	**50.** (5 to 5)	**51.** (6.15 to 6.35)	**52.** (3 to 3)
53. (16 to 16)	**54.** (5 to 5)	**55.** (–4)	**56.** (5 to 5)
57. (4 to 4)	**58.** (8 to 8)	**59.** (6 to 6)	**60.** (4 to 4)