
UGC POINT ACADEMY

LEADING INSTITUTE FOR CSIR-JRF/NET, GATE & JAM

BOOKLET CODE

CH

CHEMICAL SCIENCE

SUBJECT CODE

01

TEST SERIES # 1

Inorganic - Chemistry

Date: 20/11/2015

Timing: 2:00 H
Maximum Marks: 110

Instructions

1. This test paper has a total of 55 questions carrying 110 marks. The entire question paper is divided in two sections, A and B. All sections are compulsory. Question in each section are different type.
2. Read the Questions carefully and mark your appropriate response to the **OMR** sheet
3. There is Negative marking of **1/4** for Each wrong answer
4. Mark the response by **Black** or **Blue** Ball Pen only
5. Any other belongings like Book/ Notes / Electronic device etc are not permitted in the examination hall.
6. Submit your answer sheet (OMR Sheet) to the invigilator before leaving the examination hall
7. Do not write in the questions paper

1. The common features of Rb^+ , Kr and Br^- is/are that they

- (a) Have same number of valence electron
- (b) Have same magnitude of effective nuclear charge
- (c) Have same magnitude of first ionisation potential
- (d) Are iso-electronic species

Which option is correct:-

- (1) a, b & c (2) a & d (3) only b & c (4) all are correct

2. The species responsible for the super-acidity of $\text{SbF}_5 - \text{HSO}_3\text{F}$ is

- (1) HSO_3F (2) SbF_5 (3) HF (4) $\text{H}_2\text{SO}_3\text{F}^+$

3. Among the following the isoelectronic pair is

- (1) NO and CO (2) O_2^- (superoxide) and NO^-
(3) NO^+ and CO (4) O_2^- (superoxide) and NO^+

4. The most polar compound among the following is

- (1) SF_4 (2) BF_3 (3) XeF_4 (4) SO_3

5. The lattice energy of LiF calculated from Born Lande-equation is -1000 kJmol^{-1} . Assume that for both LiF and MgO the modelung constants, interionic distance and Born exponents have the same value. The lattice energy of MgO in kJmol^{-1} is

- (1) -2000 (2) -4000 (3) 1000 (4) 2000

6. In the structure of $\text{B}_4\text{O}_5(\text{OH})_4^{2-}$

- (1) All four B-atoms are trigonal planner
- (2) One B-atom is tetrahedral and other three are trional planner
- (3) Three B-atoms are tetrahedral and one is trigonal planer
- (4) Two B-atoms are tetrahedral and two are trigonal planer

7. B_2H_6 and B_4H_{10} respectively, are example of

- (1) Nido and Arachno Borane (2) Nido and Closo
(3) Closo and Arachno (4) Both are Nido

8. Hydrolysis of $(\text{CH}_3)_2\text{SiCl}_2$ and CH_3SiCl_3 leads to

- (1) Linear chain and cross-linked silicon respectively
- (2) Cross-linked and linear chain silicones respectively
- (3) Linear chain silicon only
- (4) Cross-linked silicon only

-
9. The compound having and (S-S) single bond is
(1) $\text{H}_2\text{S}_2\text{O}_3$ (2) $\text{H}_2\text{S}_2\text{O}_4$ (3) $\text{H}_2\text{S}_2\text{O}_7$ (d) $\text{H}_2\text{S}_2\text{O}_8$
10. The atomicity and total number of bond in element white phosphorous molecules are, respectively
(1) 4 and 6 (2) 6 and 4 (3) 4 and 4 (4) 6 and 6
11. A chemical compound [X] is used for water softening to remove temporary hardness [X] reacts with Na_2CO_3 to form caustic soda. When CO_2 is bubbled through 'X' it becomes cloudy. The chemical formula of 'X' is
(1) CaO (2) $\text{Ca}(\text{OH})_2$ (3) $\text{Ca}(\text{HCO}_3)_2$ (4) CaCO_3
12. The correct order of acidic strength of CrO_3 , CrO_2 , Cr_2O_3 and CrO
(1) $\text{CrO}_2 > \text{CrO}_3 > \text{Cr}_2\text{O}_3 > \text{CrO}$
(2) $\text{CrO}_3 < \text{CrO}_2 < \text{Cr}_2\text{O}_3 < \text{CrO}$
(3) $\text{CrO}_3 > \text{CrO}_2 > \text{Cr}_2\text{O}_3 > \text{CrO}$
(4) $\text{CrO}_2 > \text{Cr}_2\text{O}_3 > \text{CrO} > \text{CrO}_3$
13. Mn^{2+} forms a complex with Br^- ion. The magnetic moment of complex is 5.92 BM the probable formula and geometry of the complex
(1) $[\text{MnBr}_4]^{-2}$, Tetrahedral (2) $[\text{MnBr}_4]^{-2}$, square planer
(3) $[\text{MnBr}_6]^{-4}$, octahedral (4) $[\text{MnBr}_5]^{-3}$, Trigonal planar
14. Which is incorrectly given according to order indicated
(1) $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$; oxidising power
(2) $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$; Acidic strength
(3) $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$; Bond dissociation enthalpy
(4) $\text{HF} > \text{HI} > \text{HBr} > \text{HCl}$; Boiling point
15. The CFSE (crystal field stabilization energy) in units of Δ_0 for $[\text{CoF}_3(\text{H}_2\text{O})_3]$ is
(1) 0 (2) 0.4 (3) 0.8 (4) 1.8
16. The crystal field stabilization energy will be highest for
(1) CoF_6^{3-} (2) $\text{Co}(\text{CNS})_4^{2-}$ (3) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ (4) $[\text{Co}(\text{NH}_3)_6]^{3+}$
17. The correct order of d-orbital splitting in trigonal prismatic geometry is
(1) $dz^2 > dx^2 - y^2, dxy > dxz, dyz$ (2) $dxz, dyz > dx^2 - y^2, dxy > dz^2$
(3) $dxz, dyz > dz^2 > dx^2 - y^2, dxy$ (4) $dz^2 > dxy, dzy > dx^2 - y^2, dxy$

18. The enthalpies of hydration of Ca^{2+} , Mn^{+2} & Zn^{2+} follow the order

- (1) $\text{Zn}^{2+} > \text{Mn}^{+2} > \text{Ca}^{+2}$ (2) $\text{Mn}^{+2} > \text{Zn}^{+2} > \text{Ca}^{+2}$
(3) $\text{Zn}^{+2} > \text{Ca}^{+2} > \text{Mn}^{+2}$ (4) $\text{Mn}^{+2} > \text{Ca}^{+2} > \text{Zn}^{+2}$

19. The spinels MgFe_2O_4 and MgAl_2O_4 respectively are

- (1) Inverse & Normal (2) Inverse & Inverse
(3) Normal & Normal (4) Normal & Normal

20. The complex that absorbs light of shortest wavelength is

- (1) $[\text{CoF}_3]^{3-}$ (2) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
(3) $[\text{Co}(\text{NH}_3)_6]^{+3}$ (4) $[\text{Co}(\text{Ox})_3]^{-3}$ Where $\{\text{Ox} = (\text{C}_2\text{O}_4)^{-2}\}$

21. Which statement are incorrect for $L \rightarrow \text{MCT}$

- (1) Ligand should not be e^- rich
(2) Metal should be in high positive oxidation state
(3) The charge is transfer to ligand based orbital he metal based orbital
(4) They produce intense colour

22. The light pink colour of $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ and the deep blue colour of $(\text{CoCl}_4)^{2-}$ are due to

- (1) MLCT transition in the first & d – d transition in second
(2) LMCT transition both
(3) d – d transition in first & MLCT in the second
(4) d – d transition in both

23. The first excited state configuration for low spin octahedral d^4 system.

- (1) 2E_g (2) ${}^3T_{2g}$ (3) 5E_g (4) ${}^5T_{2g}$

24. In $[\text{Mo}_2(\text{S}_2)_6]^{2-}$ cluster the number of bridging S_2^{2-} and coordination number of Mo respectively are

- (1) 1 & 8 (2) 1 & 6 (3) 2 & 6 (4) 2 & 8

25. The compound which has four M – M bond is

- (1) $\text{Fe}_2(\text{CO})_9$ (2) $\text{Co}_2(\text{CO})_8$ (3) $[\text{Re}_2\text{Cl}_8]^{-2}$ (4) $[\text{Ru}_3(\text{CO})_{12}]$

26. The bond order of M – M bond in $[\text{Re}_2\text{Cl}_8]^{-2}$ $[\text{Re}_2\text{Cl}_2\{(\text{P})(\text{C}_2\text{H}_5)_3\}]_2$ & $[\text{Re}_2\text{Cl}_2\{(\text{P})(\text{C}_2\text{H}_5)\text{Ph}_2\}_4]$

respectively is

- (1) 3, 4 & 4 (2) 4, 4 & 3 (3) 4, 2 & 3 (4) 2, 3 & 4

27. The maximum oxidation state of osmium is

- (1) +6 (2) +7 (3) +8 (4) +5

28. Which of the following oxides of chromium is amphoteric in nature

- (1) CrO (2) Cr₂O₃ (3) CrO₃ (4) CrO₅

29. Which is used as a substitute for platinum in Jewellery

- (1) White gold (2) Rolled gold (3) Purple of cassius (4) Cadmium

30. Basic properties of TiO₂, ZrO₂ & HfO₂ are in the order

- (1) TiO₂ < ZrO₂ < HfO₂ (2) ZrO₂ < HfO₂ < TiO₂
(3) HfO₂ < ZrO₂ < TiO₂ (4) TiO₂ < HfO₂ < ZrO₂

31. The spin only (μ_s) and spin plus orbital ($\mu_{(s+L)}$) magnetic moments of [CrCl₆]³⁻ are

- (1) 3.87 BM & 5.20 BM (2) 2.84 BM & 5.20 BM
(3) 3.87 BM & 6.34 BM (4) 2.84 BM & 6.34 BM

32. Match the following

S.No.	Col(I)	S.No.	Col(II)
A.	Metallothionen	(i)	Ca
B	Calmodulin	(ii)	Fe
C	Hemocyanin	(iii)	Hg & Zn
D	Transferrin	(iv)	Cu

- (1) A → iii, B → i, C → iv, D → ii
(2) A → ii, B → i, C → iv, D → iii
(3) A → iii, B → iv, C → i, D → ii
(4) A → iv, B → iii, C → ii, D → i

33. The ion exchange chromatography can be used in the separation of

- (I) Rare earth & trans-uranium elements
(II) Octahedral & tetrahedral complexes
(III) Zirconium & hafnium
(IV) Cis-trans isomeric complexes of cobalt & platinum

The correct answer is

- (1) I, II, & III (2) I & IV only (3) I, II, III & IV (4) I, III & IV

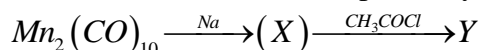
34. In metallocenes of Fe, Co & Ni the bond distance of Cp-Cp are 3.29 Å, 3.44 Å & 3.63 Å respectively. Which of the following statements are true for the explanation of above statement?

- (1) Metal covalent radius decrease from Ni to Fe
(2) Metal covalent radius decreases from Fe to Ni
(3) Extra electron of Co and Ni are going in anti-bonding orbital's of (M-Cp)
(4) Extra electron are going to empty d-orbital's of Co and Ni (Cp-M)

The correct answer is

- (1) A & B only (2) B and C only (3) A, B & C (4) Only B

35. In the reaction below ; X and Y respectively are



- (1) $[Mn(CO)_5]^-$; $[ClMn(CO)_5]$ (2) $[Mn(CO)_5]^-$, $[CH_3C(O)Mn(CO)_5]$
 (3) $[Mn(CO)_4]^{2-}$; $[CH_3C(O)Mn(CO)_5]^-$ (4) $[Mn(CO)_5]^{2-}$; $[CH_3COMn(CO)_4Cl]$

36. Consider the following statements

- (a) The size of the lanthanide M^{+3} ion decreases as the atomic number of M increases
 (b) Electronic spectra of lanthanides show very broad band
 (c) $La(OH)_3$ is less basic than $Lu(OH)_3$
 (d) $Y(acac)_3 \cdot 3H_2O$ is distorted square anti prism, Y is +3 oxidation state

Which of the statements given above are correct?

- (1) a and d (2) b and c (3) only a (d) All of above

37. Match column I (coordination compounds) with column II (Type of Isomerism) and select the correct answer

S.NO	Column I	S.No	Column II
A	$[Co(NH_3)_4Cl_2]^+$	(i)	Ionization isomerism
B	$[Co(end)_2(NO_2)Cl]SCN$	(ii)	Optical isomerism
C	Cis $[Co(end)_2Cl_2]$	(iii)	Geometrical isomerism

- (1) $A \rightarrow iii, B \rightarrow ii, C \rightarrow i$ (2) $A \rightarrow iii, B \rightarrow i, C \rightarrow ii$
 (3) $A \rightarrow i, B \rightarrow iii, C \rightarrow ii$ (4) $A \rightarrow i, B \rightarrow ii, C \rightarrow iii$

38. ν_{CO} for $[Fe(CO)_4]^{2-}$ is 1800 cm^{-1} , then $\nu_{CO^{17}}$ will be for $[Fe(CO^{17})_4]^{2-}$

- (1) 2000 cm^{-1} (2) 2100 cm^{-1} (3) 1850 cm^{-1} (4) 1755 cm^{-1}

39. Effective point group of SO_4^{2-} ion of uncoordinated, unidentate, & bidentate, respectively

- (1) D_{4h}, C_{3v}, C_{2v} (2) T_d, C_{3v}, C_{2v} (3) D_{4h}, D_{3d}, C_2 (4) D_{3d}, C_{3v}, D_{4d}

40. Synthesis of Cis- $[PtNH_3NO_2Cl_2]$ can be occurred by following mechanism.

- (1) Reaction of $[PtCl_4]^{2-}$ followed by addition of NO_2 then NH_3
 (2) Reaction of $[PtCl_4]^{2-}$ followed by addition of NH_3 then NO_2
 (3) Reaction of $[PtNH_3]_4^{2+}$ followed by addition by NH_3 then NO_2
 (4) Reaction of $[PtCl_4]^{2+}$ followed by addition of NH_3 then NO_2

41. Reduction of $[Ru(NH_3)_5(\text{isonicotinamide})]^{3+}$ with $[Cr(H_2O)_6]^{+2}$ occurs by inner sphere mechanism and one rate of the reaction is determined by dissociation of successor complex it is due to
- (1) Inert ruthenium bridged to inert chromium centre
 - (2) Inert ruthenium bridged to labile chromium centre
 - (3) Labile ruthenium bridged to inert chromium centre
 - (4) Labile ruthenium bridged to labile chromium centre
42. The correct order of LMCT energies is
- (1) $MnO_4^- < CrO_4^{2-} < VO_4^{3-}$
 - (2) $MnO_4^- > CrO_4^{2-} > VO_4^{3-}$
 - (3) $MnO_4^- > CrO_4^{2-} < VO_4^{3-}$
 - (4) $MnO_4^- < CrO_4^{2-} > VO_4^{3-}$
43. The molecule which have highest number of lone-pair and has a linear shape based on VSEPR theory is
- (1) CO_2
 - (2) I_3^-
 - (3) NO_2^-
 - (4) NO_2^+
44. For the complex
- A) $[Ni(H_2O)_6]^{2+}$ B) $[Mn(H_2O)_6]^{2+}$ C) $[Cr(H_2O)_6]^{3+}$ D) $[Ti(H_2O)_6]^{3+}$
- The ideal oh geometry will not be observed in
- (1) A & D
 - (2) C & D
 - (3) B only
 - (4) D only
45. The complex $[Ni(dmg)_2]$ have
- (1) 2 five membered ring and 2 six membered ring
 - (2) 2 five membered ring and 3 six membered ring
 - (3) 4 five membered ring
 - (4) 4 six membered ring
46. In ^{19}F NMR spectrum of PF_5 the number of signals and multiplicity, at room temperature are
- (1) One singlet
 - (2) One doublet
 - (3) Two doublet
 - (4) Two singlet
47. Superoxide dismutase contains the metal ion
- (1) Zn(II) and Ni(II)
 - (2) Cu(II) and Zn(II)
 - (3) Ni(II) and Co(III)
 - (4) Cu(II) and Fe(III)
48. The number of M – M bond in the dimer, $[CpFe(CO)(NO)]_2$ and $[CpMo(CO)_3]_2$
- (1) 2 & 2
 - (2) 2 and 3
 - (3) 1 and 2
 - (4) 0 and 1
49. The number of possible isomer of $[Ru(PPh_3)_2(acac)_2]$ [$acac \rightarrow \text{acetyl acetate}$] is
- (1) 2
 - (2) 3
 - (3) 4
 - (4) 5
50. For the formation of $[Fe(bipy)_3]^{2+}$ from the aqueous Fe octahedral complex the correct order of rate constants are
- (1) $K_1 > K_2 > K_3$
 - (2) $K_1 < K_2 < K_3$
 - (3) $K_1 > K_2 < K_3$
 - (4) $K_1 < K_2 > K_3$

51. $C_2B_4H_8$ has structure

- (1) Closo (2) Nido
(3) Archano (4) Hypo

52. Complexes of general formula, $fac [Mo(CO)_3(Phosphile)_3]$ have the C–O stretching band as given below:

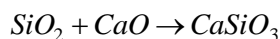
Phosphines: $PF_3(A)$; $PCL_3(B)$; $P(Cl)Ph_2(C)$; $Pme_3(D)$

$\nu(co), cm^{-1}$: 2090(i); 2040(ii); 1977(iii); 1945(iv)

The correct combination of the phosphine and the stretching frequency is

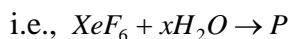
- (1) (A–i), (B–ii), (C–iii), (D–iv)
(2) (A–ii), (B–i), (C–iv), (D–iii)
(3) (A–iv), (B–iii), (C–ii), (D–i)
(4) (A–iii), (B–iv), (C–i), (D–ii)

53. In the given reaction



- (1) SiO_2 act as an base (2) CaO act as an acid
(3) SiO_2 act as an acid (4) $CaSiO_3$ have amphoteric character

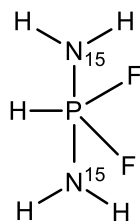
54. Partial hydrolysis of XeF_6



The product P is

- (1) $XeOF_4 + 2HF$ (2) $XeO_2F_2 + F_2$
(3) $XeO_3 + HF$ (4) $XeOF_4 + H_2 + F_2$

55. ^{31}P -NMR signal of given compound is



- (1) 90 lines (2) 57 lines (3) 60 lines (4) 40 lines

Test Series ----1 Inorganic Chemistry

ANSWER KEY

1.(2)	2.(4)	3.(3)	4.(1)	5.(2)	6.(4)	7.(1)	8.(4)	9.(2)	10.(1)
11.(2)	12.(3)	13.(1)	14.(3)	15.(2)	16.(4)	17.(1)	18.(1)	19.(1)	20.(3)
21.(1)	22.(4)	23.(3)	24.(4)	25.(3)	26.(2)	27.(3)	28.	29.(1)	30.(1)
31.(1)	32.(1)	33.(4)	34.(2)	35.(2)	36.(1)	37.(2)	38.(4)	39.(2)	40.(2)
41.(1)	42.(1)	43.(2)	44.(2)	45.(1)	46.(2)	47.(2)	48.(3)	49.(2)	50.(3)
51.(2)	53.(3)	54.(1)	55.(1)						