DAY TWENTY NINE

Unit Test 6

(Inorganic Chemistry II)

1 Which of the following element is extracted commercially by the electrolysis of an aqueous solution of its compound?
(a) Chlorine (b) Bromine (c) Sodium (d) Aluminium

2 Heating an ore in the absence of air below its melting point is called
(a) leaching (b) roasting
(c) smelting (d) calcination

3 A basic lining is given to a furnace by using
(a) calcined dolomite (b) limestone
(c) haematite (d) silica

4 Which of the following metal is leached by cyanide process?
(a) Ag (b) Na (c) Al (d) Cu

5 In the extraction of chlorine by electrolysis of brine
→ **[NCERT Exemplar]**
(a) oxidation of Cl^- ion to chlorine gas occurs
(b) reduction of Cl^- ion to chlorine gas occurs
(c) for overall reaction $\Delta G°$ has negative value
(d) a displacement reaction takes place

6 Refractory metals are used in the construction of furnaces because
(a) they can withstand high temperature
(b) they are chemically inert
(c) their melting point is high
(d) None of the above

7 The process of zone refining is used in the purification of
(a) Si (b) Al (c) Ag (d) Cu

8 Which one of the following benefication processes is used for the mineral $Al_2O_3 \cdot 2H_2O$?
(a) Froth floatation (b) Leaching
(c) Liquation (d) Magnetic separation

9 Purification of aluminium by electrolytic refining is known as
(a) Hall's process
(b) Serpeck's process
(c) Baeyer's process
(d) Hoope's process

10 Which one of the following ores is best concentrated by froth-floatation method?
(a) Magnetite (b) Cassiterite
(c) Galena (d) Malachite

11 A non copper alloy is
(a) solder (b) brass (c) bronze (d) bell metal

12 Which one of the following hydrides is maximum stable towards heat?
(a) H_2O (b) H_2S
(c) H_2Se (d) H_2Te

13 Fluorine is a stronger oxidising agent than chlorine in aqueous solution. This is due to many factors except
(a) heat of hydration (b) ionisation potential
(c) electron affinity (d) heat of dissociation

14 The shape of ClO_3^- is
(a) a triangular pyramidal (b) tetrahedral
(c) triangular planar (d) triangular bipyramidal

15 In which of the following groups, when He is placed, its all the properties are satisfied?
(a) With alkali metals (b) With halogens
(c) With inert gases (d) None of these

16 Which of the following exists as covalent crystals in the solid state?
(a) Iodine (b) Silicon
(c) Sulphur (d) Phosphorus

17 Which of the following is different from the other three oxides?
(a) MgO (b) SnO (c) ZnO (d) Cr_2O_3

18 Which among FeO and Fe_2O_3 is more basic?
(a) FeO
(b) Fe_2O_3
(c) Both have same basic strength
(d) None of the above is basic

19 The highest magnetic moment is shown by the transition metal ion with outer electronic configuration
(a) $3d^2$ (b) $3d^5$
(c) $3d^7$ (d) $3d^9$

20 When MnO_2 is fused with KOH in the presence of air, a coloured compound is formed, the product and its colour is
(a) K_2MnO_4, dark green (b) $KMnO_4$, purple
(c) Mn_2O_3, brown (d) Mn_3O_4, black

21 Which of the following compounds has colour but no unpaired electrons?
(a) $KMnO_4$ (b) K_2MnO_4
(c) $MnSO_4$ (d) $MnCl_2$

22 Gadolinium belongs to 4*f* series. Its atomic number is 64. Which of the following is the correct electronic configuration of gadolinium? **→ [NCERT Exemplar]**
(a) $[Xe]4f^75d^16s^2$ (b) $[Xe]4f^65d^26s^2$
(c) $[Xe]4f^86s^2$ (d) $[Xe]4f^95s^1$

23 Transition metals usually exhibit highest oxidation states in their
(a) chlorides (b) fluorides
(c) bromides (d) hydrides

24 The 3*d*-series ranges from
(a) $Z = 21 - 30$ (b) $Z = 22 - 30$
(c) $Z = 20 - 30$ (d) $Z = 31 - 40$

25 Formation of interstitial compound makes the transition metal
(a) more soft (b) more ductile
(c) more metallic (d) more hard

26 Of the following outer electronic configurations of atoms, the highest oxidation state is achieved by which one of them?
(a) $(n-1)d^8ns^2$ (b) $(n-1)d^5ns^1$
(c) $(n-1)d^3ns^2$ (d) $(n-1)d^5ns^2$

27 The most stable ion is
(a) $[Fe(OH)_5]^{3-}$ (b) $[FeCl_6]^{3-}$
(c) $[Fe(CN)_6]^{3-}$ (d) $[Fe(H_2O)_6]^{3+}$

28 A group of atoms can function as a ligand only when
(a) it is a small molecule
(b) it is a negatively charged ion
(c) it has an unshared electron pair
(d) it is positively charged ion

29 $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$ are the example of which type of isomerism?
(a) Linkage (b) Geometrical
(c) Ionisation (d) Optical

30 Which of the following hydrate is diamagnetic?
(a) $[Mn(H_2O)_6]^{2+}$ (b) $[Cu(H_2O)_6]^{3+}$
(c) $[Co(H_2O)_6]^{3+}$ (d) $[Co(H_2O)_6]^{2+}$

31 The EAN of iron in $[Fe(CN)_6]^{3-}$ is
(a) 34 (b) 36 (c) 37 (d) 35

32 Which one of the following is odd one out?
(a) Potassium ferricyanide
(b) Ferrous ammonium sulphate
(c) Potassium ferrocyanide
(d) Tetrammine copper (II) sulphate

33 The complex $CoCl_3 \cdot 3NH_3$ ionises to give
(a) two Cl^- ions (b) one Cl^- ion
(c) three Cl^- ions (d) no Cl^- ions

34 A mole of complex compound $Co(NH_3)_5Cl_3$ gives 3 moles of ions, when dissolved in water. One mole of the same complex reacts with two moles of $AgNO_3$ solution to form two moles of AgCl(*s*). The structure of complex is
(a) $[Co(NH_3)_5Cl]Cl_2$ (b) $[Co(NH_3)_3Cl_3] \cdot 2NH_3$
(c) $[Co(NH_3)_4Cl_2]Cl \cdot 2NH_3$ (d) $[Co(NH_3)_4Cl]Cl_2 \cdot NH_3$

35 Which one of the following has largest number of isomers?
(*R* = alkyl group, en = ethylenediamine)
(a) $[Ru(NH_3)_4Cl_2]^+$ (b) $[Co(NH_3)_5Cl]^{2+}$
(c) $[Ir(PR_3)_2H(CO)]^{2+}$ (d) $[Co(en)_2Cl_2]^+$

Direction (Q. Nos. 36-37) *In the following questions more than one of the answers given may be correct. Select the correct answers and mark it according to the codes.*

Codes
(a) 1, 2 and 3 are correct (b) 1 and 2 are correct
(c) 2 and 4 are correct (d) 1 and 3 are correct

36 Which of the following will yield H_2O with dilute HNO_3?
1. Cu 2. Zn 3. Hg 4. Mg
(a) 1, 2, 3 (b) 1, 2 4
(c) 2, 3, 4 (d) 1, 3, 4

37 Which of the following statements about noble gases are correct?
1. In Fisher Ringe's method, a mixture of $CaCl_2$ and CaC_2 is used to remove N_2 and O_2.
2. He and Ne are chemically inert due to lack of *d*-orbitals and high ionisation potential.
3. At 173 K He and Ne are absorbed on activated charcoal.
4. XeO_3 is an explosive tetrahedral molecule.

(a) 1, 2, 3 (b) 1, 2, 4
(c) 2, 3, 4 (d) 1, 3, 4

38 Match the complex in Column I with their structure and magnetic moments in Column II and choose the correct code given below.

	Column I		Column II
A.	$[Ag(NH_3)_2]^+$	1.	Square planar and 1.73 BM
B.	$[Co(NH_3)_6]^{3+}$	2.	Linear and 0
C.	$[Fe(CN)_6]^{3-}$	3.	Octahedral and 0
D.	$[Cu(NH_3)_4]^{2+}$	4.	Octahedral and 1.73 BM

Codes

	A	B	C	D
(a)	3	2	1	4
(b)	1	2	4	3
(c)	2	3	4	1
(d)	4	1	3	2

Direction (Q. Nos. 39-40) *Each of these questions contains two statements : Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.*

(a) Assertion is true, Reason is true; Reason is a correct explanation for Assertion

(b) Assertion is true, Reason is true; Reason is not a correct explanation for Assertion

(c) Assertion is true, Reason is false

(d) Assertion is false, Reason is true

39 **Assertion** Coke and flux are used in smelting.
Reason The phenomenon in which ore is mixed with suitable flux and coke and is heated to fusion is known as smelting.

40 **Assertion** Caro's acid has S-atom in +6 oxidation state.
Reason Caro's acid contains one peroxo, O_2^{2-} group.

ANSWERS

1 (a)	**2** (d)	**3** (a)	**4** (a)	**5** (a)	**6** (a)	**7** (a)	**8** (b)	**9** (d)	**10** (c)
11 (a)	**12** (a)	**13** (b)	**14** (a)	**15** (c)	**16** (b)	**17** (a)	**18** (a)	**19** (b)	**20** (a)
21 (a)	**22** (a)	**23** (b)	**24** (a)	**25** (d)	**26** (d)	**27** (c)	**28** (c)	**29** (c)	**30** (c)
31 (d)	**32** (b)	**33** (d)	**34** (a)	**35** (d)	**36** (a)	**37** (b)	**38** (c)	**39** (b)	**40** (b)

Hints and Explanations

1 Chlorine is extracted commercially by the electrolysis of an aqueous solution of sodium chloride (brine). Cl_2 is obtained at anode.

2 Heating of an ore in the absence of air below its melting point is called calcination.

3 Calcined dolomite is used to give a basic lining of a furnace.

4 Ag is leached by cyanide process.

5 For the extraction of metals and non-metals by electrolysis, ΔG° for the overall reaction is positive. Thus, option (a), i.e. oxidation of Cl^- ion to Cl_2 gas is correct.

6 Refractory metals can withstand high temperature so, they are used in the construction of furnaces.

7 Zone refining method is used for the purification of Si.

8 Leaching is done in case of bauxite ore ($Al_2O_3 \cdot 2H_2O$).

9 Hoope's process is used for purification of aluminium by electrolytic refining.

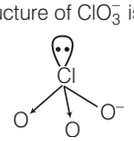
10 Froth floatation process is used to concentrate sulphide ores [Galena (PbS)].

11 Solder is a non-copper alloy.

12 Due to H—bonding, H_2O is more stable towards heat.

13 Greater reactivity of F_2 and Cl_2 in aqueous solutions is not due to ionisation potential. This is because halogens (Cl_2, F_2) are good oxidising agents, i.e. their reactivity depend upon their ability to take up an electron and not to give any electron.

14 Structure of ClO_3^- is as follows



Trigonal pyramidal

15 Electronic configuration of He is $1s^2$. Hence, it is *s*-block element. However its properties resembles with noble gases placed in *p*-block elements.

16 Silicon exists as covalent crystal in solid state. It exhibits a network structure like diamond.

17 MgO is a basic oxide while the other three SnO, ZnO and Cr_2O_3 are amphoteric.

18 FeO is more basic than Fe_2O_3.

19 The highest magnetic moment is shown by the transition metal ion having $3d^5$ configuration because it has maximum number of unpaired electrons, among the given choies i.e. five.

20 $2MnO_2 + 4KOH + O_2 \longrightarrow \underset{\text{Dark green}}{2K_2MnO_4} + 2H_2O$

21 In $KMnO_4$, Mn is in + 7 state. It has no unpaired electron. Its colour is due to charge transfer.

22 General configuration for lanthanides $= (n-2)f^{1-14}(n-1)s^2 p^6 d^{0-1} ns^2$

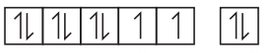
Therefore, the correct electronic configuration of Gd is $[Xe]4f^7 5d^1 6s^2$.

23 Transition metals show their highest oxidation states in their fluorides due to small size and higher electronegativity of 'F'.

24 The 3*d* series ranges from $_{21}Sc$ to $_{30}Zn$.

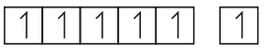
25 Formation of interstitial compound makes the transition metal more hard because small non metallic atoms present at interstitial sites form covalent bonds with the transition metal atoms.

26 $(n-1)\,d^8ns^2$



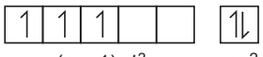
$(n-1)\,d^8$ ns^2 4(as in Ni)

$(n-1)\,d^5ns^1$



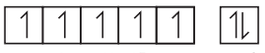
$(n-1)\,d^5$ ns^1 6(as in Cr)

$(n-1)\,d^3ns^2$



$(n-1)\,d^3$ ns^2 5(as in V)

$(n-1)\,d^5ns^2$



$(n-1)\,d^5$ ns^2 7(as in Mn)

27 Stability of complex increases with increase in charge on the central metal ion and with increase in strength of ligand causing more value of CFSE field.

In $[Fe(CN)_6]^{3-}$, oxidation state of Fe is +3 CN^- is a strong ligand than OH^-, Cl^- and H_2O. Hence, this complex is stable.

28 A group of atom which has unshared pair of electrons can act as a 'ligand'.

29 $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$ are examples of ionisation isomerism.

30 $[Co(H_2O)_6]^{3+}$; Co is in + 3 oxidation state. It has no unpaired electron hence, diamagnetic.

31 In $[Fe(CN)_6]^{3-}$

Oxidation state of Fe = + 3

EAN = 23 (for Fe^{3+}) + 6 × 2 (for $6CN^-$ ions)

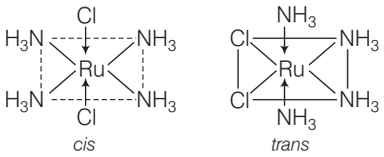
= 23 + 12 = 35

32 Ferrous ammonium sulphate is an example of double salt.

33 The complex $CoCl_3 \cdot 3NH_3$ is octahedral species having 6 coordination number, therefore, it will give no chloride ions in aqueous solution.

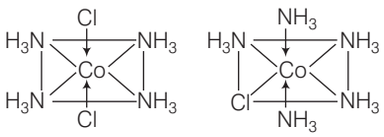
34 $[Co(NH_3)_5Cl]\,Cl_2$ complex gives 3 moles of ions in aqueous solution and reacts with two moles of $AgNO_3$ solution as it has 2 moles of Cl^- ions (primary valencies are ionisable).

35 $[Ru(NH_3)_4\,Cl_2]^+$ =

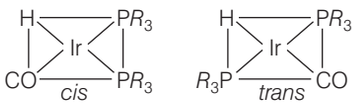


cis *trans*

$[Co(NH_3)_5\,Cl]^{2+}$ =

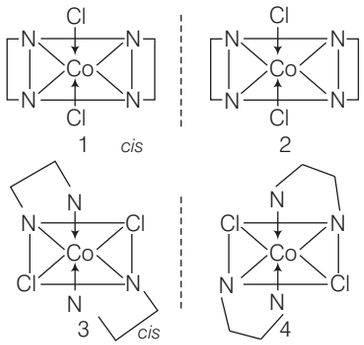


$[Ir(PR_3)_2\,H(CO)]^{2+}$ =



cis *trans*

$[Co(en)_2\,Cl_2]^+$ =



1 *cis* 2

3 *cis* 4

36 $3Cu + 8HNO_3$ (Dil.) $\longrightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$

$4Zn + 10HNO_3$ (Dil.) $\longrightarrow 4Zn(NO_3)_2 + N_2O + 5H_2O$

$6Hg + 8HNO_3$ (Dil.) $\longrightarrow 3Hg_2(NO_3)_2 + 2NO + 4H_2O$

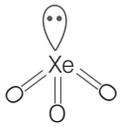
$Mg + 2HNO_3$ (Dil.) $\longrightarrow Mg(NO_3)_2 + H_2$

37 (1) In Fisher Ringe's method, the oxygen and nitrogen of air are removed by passing it over a mixture of calcium carbide and calcium chloride.

(2) He and Ne both have high ionisation energy and lack of *d*-orbitals, so they are chemically inert.

(3) Except He all inert gases are adsorbed on activated charcoal and the extent of adsorption increases on moving down the group.

(4) XeO_3 is an explosive pyramidal molecule due to the presence of one lone pair of electron.



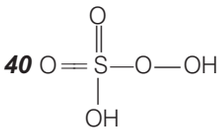
38 (A) $[Ag(NH_3)_2]^+$ has coordination number 2. It has linear structure and because of no unpaired electron, its magnetic moment is zero.

(B) $[Co(NH_3)_6]^{3+}$ has d^2sp^3 hybridisation and octahedral structure. Because of no unpaired electron, it is diamagnetic and magnetic moment is zero.

(C) $[Fe(CN)_6]^{3-}$ has d^2sp^3 hybridisation and octahedral structure. It has one unpaired electron. So, it is paramagnetic and has magnetic moment. $(\mu = \sqrt{1(1+1)} = 1.73 BM)$

(D) $[Cu(NH_3)_4]^{2+}$ is square planar in structure and has one unpaired electron. So, it is paramagnetic and has magnetic moment. $(\mu = 1.73\ BM)$

39 Non-fusible mass present in ore on mixing with suitable flux are fused which are then reduced by coke to give free metal.

40 

Caro's acid

Let oxidation number of S = x,

oxidation number of H = + 1

oxidation number of oxygen in peroxo linkage = – 1,

oxidation number of other oxygen atoms = – 2 (each)

$2 + x - 6 - 2 = 0,\ x = +6$