Coordination Compounds + Metallurgy

1. In which of the following order the given complex ions are arranged correctly with respect to their decreasing spin only magnetic moment ?
(i) $[FeF_6]^{3-}$
(ii) $\left[Co(NH_3)_6\right]^{3+}$
(iii) $[NiCl_4]^{2-}$
(iv) $\left[Cu(NH_3)_4\right]^{2+}$

   A. $(iii) > (iv) > (iii) > (i)$

   B. $(ii) > (iii) > (i) > (iv)$

   C. $(i) > (iii) > (iv) > (ii)$

   D. $(ii) > (i) > (iii) > (iv)$

2. What is the spin-only magnetic moment value (BM) of a divalent metal ion with atomic number 25, in it's aqueous solution?

   A. 5.92

   B. 5.26

   C. 0

   D. 5.0

3. According to the valence bond theory the hybridization of central metal atom is dsp^2 for which one of the following compounds ?

   A. $NiCl_2.6H_2O$

   B. $[Ni(CO)_4]$

   C. $K_2[Ni(CN)_4]$

   D. $Na_2[NiCl_4]$

4. The type of hybridisation and magnetic property of the complex $[MnCl_6]^{3-}$, respectively, are

   A. d^2sp^3 and diamagnetic

   B. sp^3d^2 and diamagnetic

   C. d^2sp^3 and paramagnetic

   D. sp^3d^2 and paramagnetic

5. The number of geometrical isomers found in the metal complexes $[Pt(Cl)_2(NH_3)_2], [Ni(CO)_4], [Ru(H_2O)_3Cl_3]$ and $[CoCl_2(NH_3)_4]^+$ respectively, are

   A. 2, 1, 2, 1

   B. 2, 1, 2, 2

   C. 2, 0, 2, 2

   D. 1, 1, 1, 1

6. Which one of the following complexes is violet in colour ?

   A. $[Fe(SCN)_6]^{4-}$

   B. $[Fe(CN)_5NOS]^{4-}$

   C. $[Fe(CN)_6]^{4-}$

   D. $Fe_4[Fe(CN)_6]_3.H_2O$

7. Arrange the following cobalt complexes in the order of increasing crystal field stabilisation energy (CFSE) value.

Complexes :
A . $[CoF_6]^{3-}$
B . $\left[Co(H_2O)_6\right]^{2+}$
C . $\left[Co(NH_3)_6\right]^{3+}$
D . $\left[Co(en)_3\right]^{3+}$

Choose the correct option :

A. C < D < B < A

B. B < C < D < A

C. A < B < C < D

D. B < A < C < D

8. The denticity of an organic ligand, biuret is :

A. 3

B. 2

C. 4

D. 6

9. The complex that can show fac- and mer-isomers is

A. $[CoCl_2(en)_2]$

B. $[Co(NH_3)_3(NO_2)_3]$

C. $[Pt(NH_3)_2Cl_2]$

D. $[Co(NH_3)_4Cl_2]^+$

10. The electronic spectrum of $[Ti(H_2O)_6]^{3+}$ shows a single broad peak with a maximum at $20,300\ cm^{-1}$. The crystal field stabilization energy $CFSE$ of the complex ion, in $kJ\ mol^{-1}$, is $(1\ kJ\ mol^{-1} = 83.7\ cm^{-1})$

A. 145.5

B. 97

C. 242.5

D. 83.7

11. The complex that can show optical activity

A. $cis - [Fe(NH_2)_2(CN)_4]^-$

B. $trans - [Cr(Cl_2)(ox)_2]^{3-}$

C. $trans - [Fe(NH_3)_2(CN)_4]^-$

D. $cis - [CrCl_2(ox)_2]^{3-}\ (ox = oxalate)$

12. The major components of German Silver are:

A. $Cu, Zn\ and\ Ni$

B. $Zn, Ni\ and\ Ag$

C. $Ge, Cu\ and\ Ag$

D. $Cu, Zn\ and\ Ag$

13. Choose the correct answer :

Match List -I with List - II.

$List - I$ (Ore)	$List - II$ (Element Present)
(a) Kernite	(i) Tin
(b) Cassiterite	(ii) $Boron$
(c) Calamine	(iii) $Fluorine$
(d) Cryolite	(iv) $Zinc$

Choose the most appropriate answer from the options given below :

A. $(a) \rightarrow (ii),\ (b) \rightarrow (i),\ (c) \rightarrow (iv),\ d \rightarrow (iii)$

B. $(a) \rightarrow (iii),\ (b) \rightarrow (i),\ (c) \rightarrow (ii),\ d \rightarrow (iv)$

C. $(a) \rightarrow (ii),\ (b) \rightarrow (iv),\ (c) \rightarrow (i),\ d \rightarrow (iii)$

D. $(a) \rightarrow (i),\ (b) \rightarrow (iii),\ (c) \rightarrow (iv),\ d \rightarrow (ii)$

14. The process that involves the removal of sulphur from the ores is

A. Smelting

B. Refining

C. Roasting

D. Leaching

15. Which of the following reduction reaction cannot be carried out with coke ?

A. $Cu_2O \rightarrow Cu$

B. $Fe_2O_3 \rightarrow Fe$

C. $Al_2O_3 \rightarrow Al$

D. $ZnO \rightarrow Zn$

16. Choose the correct answer :

Match List-I with List-II :

List-I	List-II
(a) Haematite	(i) $Al_2O_3 \cdot xH_2O$
(b) Bauxite	(ii) Fe_2O_3
(c) Magnetite	(iii) $CuCO_3 \cdot Cu(OH)_2$
(d) Malachite	(iv) Fe_3O_4

Choose the **correct** answer from the option given below .

A. $(a)-(i),(b)-(iii),(c)-(ii),(d)-(iv)$

B. $(a)-(ii),(b)-(i),(c)-(iv),(d)-(iii)$

C. $(a)-(iv),(b)-(i),(c)-(ii),(d)-(iii)$

D. $(a)-(ii),(b)-(iii),(c)-(i),(d)-(iv)$

17. Given below are two statements :

Statement I : Sphalerite is a sulphide ore of zinc and copper glance is a sulphide ore of copper .

Statement II : It is possible to separate two sulphide ores by adjusting proportion of oil to water or by using depressants in a froth flotation method .

Choose the most appropriate answer from the options given below :

A. Statement I is true but Statement II is false

B. Statement I is false but Statement II is true

C. Both Statement I and Statement II are false

D. Both Statement I and Statement II are true

18. Which refining process is generally used in the purification of low melting metals ?

A. Electrolysis

B. Zone refining

C. Liquation

D. Chromatographic method

19. Given below are the two statements : one is labelled as Assertion (a) and the other is labelled as Reason (R).

Assertion (A) : Aluminium is extracted from bauxite by the electrolysis of molten mixture of Al_2O_3 with cryolite.

Reason(R) : The oxidation state of Al in cryolite is $+3$.

In the light of the above statements , choose the most appropriate answer from the options given below :

A. (A) is true but (R) is false

B. (A) is false but (R) is true

C. Both (A) and (R) are correct but (R) is not the correct explanation of (A)

D. Both (A) and (R) are correct but (R) is not the correct explanation of (A)

20. The purest form of commercial iron is

A. Scrap iron and pig iron

B. Cast iron

C. Wrought iron

D. Pig iron

21. Among statements (a) - (d), the correct ones are
(a) Lime stone is decomposed to CaO during the extraction of iron from its oxides.
(b) In the extraction of silver, silver is extracted as an anionic complex.
(c) Nickel is purified by Mond's process.
(d) Zr and Ti are purified by Van Arkel method.

A. (a), (c) and (d) only

B. (c) and (d) only

C. (b), (c) and (d) only

D. (a), (b), (c) and (d)

22. Cast iron is used for the manufacture of

A. Wrought iron, pig iron and steel

B. Pig iron, scrap iron and steel

C. Wrought iron and pig iron

D. Wrought iron and steel

23. Among the reactions (a)-(d) , the reactions (s) that does/do not occur in the blast furnance during the extraction of iron is/are

(a) $CaO + SiO_2 \rightarrow CaSiO_3$
(b) $3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$
(c) $FeO + SiO_2 \rightarrow FeSiO_3$
(d) $FeO \rightarrow Fe + \frac{1}{2}O_2$

A. (c) and (d)

B. (d)

C. (a)

D. (a) and (d)

24. The method used for the purification of Indium is

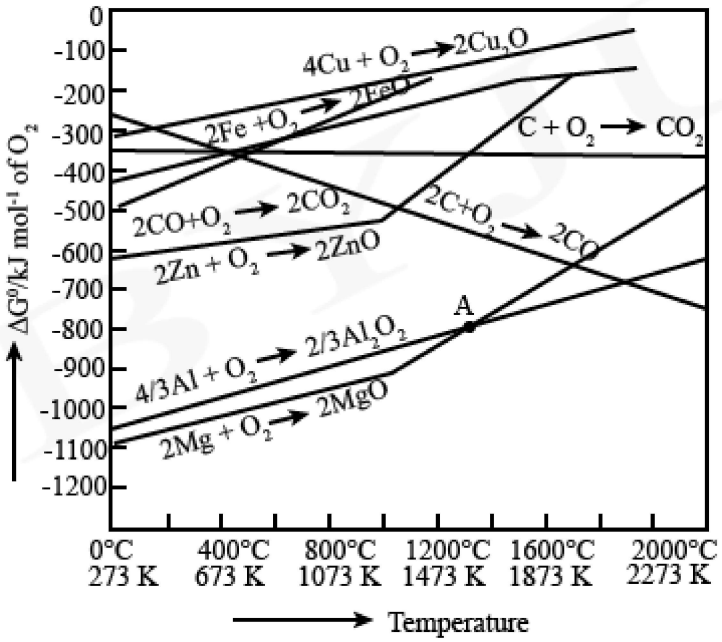
A. Vapour phase refining

B. Zone refining

C. Liquation

D. van Arkel method

25. The point of intersection and sudden increase in the slope., in the diagram given below, respectively indicates :



A. $\Delta G = 0$ and reduction of the metal oxide

B. $\Delta G < 0$ and decomposition of the metal oxide

C. $\Delta G = 0$ and melting or boiling point of the metal oxide

D. $\Delta G > 0$ and decomposition of the metal oxide

26. Number of bridging CO ligands in $[Mn_2(CO)_{10}]$ is _____ .

27. The total number of unpaired electrons present in the complex $K_3[Cr(\text{oxalate})_3]$ is _____.

28. Three moles of $AgCl$ get precipitated when one mole of an octahedral co-ordination compound with empirical formula $CrCl_3.3NH_3.3H_2O$ reacts with excess of silver nitrate. The number of chloride ions satisfying the secondary valency of the metal ion is_____.

29. 3 moles of metal complex with formula $Co(en)_2Cl_3$ gives 3 moles of silver chloride on treatment with excess of silver nitrate. The secondary valency of Co in the complex is _____. (Round off to the Nearest integer).

30. In the electrolytic refining of blister copper , the total number of main impurities , from the following , removed as anode mud is
$Pb, Sb, Se, Te, Ru, Ag, Au$ and Pt