Delight classes

d and f block elements

1

The following belongs to d – block but it is not a transition element

1) Mn 2) Fe 3) Zn 4) Cr

2

The electronic configuration of chromium is :

1) $[Ne]3s^2 3p^6 3d^4 4s^2$ 2) $[Ne]3s^2 3p^6 3d^5 4s^1$

3) $[Ne]3s^2 3p^5 3d^5 4s^2$ 4) $[Ne]3s^2 3p^5 3d^6 4s^1$

3

Which one of the following pairs of ions have the same electronic configuration ?

1) Cr^{+3}, Fe^{+3} 2) Fe^{+3}, Mn^{+2} 3) Fe^{+3}, Co^{+3} 4) Sc^{+3}, Cr^{+3}

4

Match the following columns

Column I (Metal ions)	Column II (Magnetic moment (BM)
A. Cr^{3+}	1. $\sqrt{35}$
B. Fe^{2+}	2. $\sqrt{30}$
C. Ni^{2+}	3. $\sqrt{24}$
D. Mn^{2+}	4. $\sqrt{15}$
	5. $\sqrt{8}$

1) A – 1, B – 3, C – 5, D - 4 2) A – 2, B – 3, C – 5, D – 1

3) A – 4, B – 3, C – 5, D - 1 4) A – 4, B – 5, C – 3, D – 1

5

The electronic configuration of Cu(II) is $3d^9$ where as that of Cu(I) is $3d^{10}$. Which of the following is correct (in aqueous medium)?

1) Cu(II) is more stable 2) Cu(II) is less stable

3) Cu(I) and Cu(II) are equally stable

4) Stability of Cu(I) and Cu(II) depends on nature of copper salts

6

Most stable ion in aqueous solution is

1) Cr^{+3} **2)** Mn^{+3} **3)** Ti^{+3} **4)** V^{+3}

7

Fluorine stabilize highest oxidation state is due to higher lattice energy in case of

1) VF_5 2) CrF_6 3) CoF_3 4) both 2 & 3

8	Which one of the following pairs of elements is called chemical twins because of their very similar chemical properties? 1) Mn and W 2) Mo andTc 3) Fe and Re 4) Hf and Zr
9	The spin only magnetic moment of $[MnBr_4]^{2-}$ is 5.9 B.M. The geometry of complex ion is (1) Tetrahedral (2) Square planar (3) Trigonal bipyramidal (4) Octahedral
10	Which of the following oxides shows electrical properties like metals? (1) SiO_2 (2) MgO (3) $SO_2(s)$ (4) CrO_2
11	A common observation seen in $Fe_3O_4$is that it is ferromagnetic at room temperature but at 850K it, becomes (1) diamagnetic (2) Paramagnetic (3) Ferromagnetic (4) Non magnetic
12	German silver is an alloy of (1) Cu, Zn and Ag (2) Cu, Zn and Ni (3) Cu, Zn, Tin (4) Mn, Cr, Ni
13	Which of the following is an amphoteric oxide? (1) V_2O_5, Cr_2O_3 (2) Mn_2O_7, Cr_2O_3 (3) CrO, V_2O_5 (4) V_2O_5, V_2O_4
14	Among the following, mixed oxide is 1) Pb_3O_4 2) Al_2O_3 3) Fe_3O_4 4) both 1 and 3
15	The nature of transition metal oxide 'C' in the above reaction is 1) Acidic 2) Basic 3) Amphoteric 4) Neutral
16	Which of the following compound conductivity similar to metallic copper? 1) $NaCl$ 2) K_2SO_4 3) ReO_3 4) All of these
17	Which of the following substance lose ferrimagnetism on heating and become paramagnetic? 1) $MgFe_2O_4$ 2) $AgBr$ 3) Fe_3O_4 4) Both 1 and 3

18 Which of the following oxide shows metallic or insulating properties depending on temperature?

1) VO 2) VO_3 3) TiO_3 4) All of these

19 The magnetic moment is associated with its spin angular momentum and orbital angular momentum. Spin only magnetic moment value of Cr^{3+} ion is.....

1) 2.87 B.M. 2) 3.87 B.M. 3) 3.47 B.M. 4) 3.57 B.M.

20 Which of the following metals of 3d series do not show variable oxidation state?

1) Sc, Ti 2) Ti , Cu 3) Sc, Zn 4) Co, Ni

21 Interstitial compounds are not formed by

1) Co 2) Ni 3) Fe 4) Ca

22 Of the following transition metals, the maximum number of oxidation states are exhibited by

1) manganese (Z=25) 2) iron (Z=26)

23 Incorrect statement of the following is

(1) $K_2Cr_2O_7$ has six shorter and two longer bonds

(2) $K_2Cr_2O_7$ is less soluble in water than $Na_2Cr_2O_7$

(3) $KMnO_4$ oxidises KI to KIO_3 in faint alkaline medium

(4) Colour of $KMnO_4$ and $K_2Cr_2O_7$ is due to d – d transitions

24 Four successive members of the first row transition elements are listed below with their atomic numbers. Which one of them is expected to have the highest third ionization enthalpy?

1) vanadium(Z=23) 2) manganese (Z=25)

3) chromium (Z=24) 4) iron (Z=26)

25 In which of the following pairs are both the ions coloured in aqueous solution?

1) Sc^{3+}, Co^{2+} 2) Ni^{2+}, Cu^{+} 3) Ni^{2+}, Ti^{3+} 4) Sc^{3+}, Ti^{3+}

26 The catalytic activity of transition metals and their compounds is ascribed mainly to

1) their ability to adopt variable oxidation states

2) their chemical reactivity

3) their magnetic behavior

4) their unfilled d-orbitals

27 Four successive members of the first series of the transition metals are listed below. For which one of them, the standard potential $\left(E^0_{M^{2+}/M}\right)$ value has a positive sign?

1) $Cu(Z=29)$ 2) $Fe(Z=26)$ 3) $Co(Z=27)$ 4) $Ni(Z=28)$

28 The IP of Zr is 674 kJ/mole. The IP of Hf is

1) 656 kJ 2) 760 kJ 3) 616 kJ 4) 631 kJ

29 The atomic numbers of V,Cr, Mn and Fe are respectively 23, 24,25 and 26. Which one of these may be expected to have the highest second ionization energy?

1) Cr 2) Mn 3) Fe 4) V

30 Maximum oxidation state exhibited by Osmium is

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

31 The $KMnO_4$ oxidises KI in faint alkaline medium as

(1) KIO_3 (2) I_2 (3) KIO (4) KIO_4

32 When acidified $K_2Cr_2O_7$ solution is added to Sn^{2+} salts, then Sn^{2+} changes to

1) Sn 2) Sn^{3+} 3) Sn^{4+} 4) Sn^{+}

33 Why is HCl not used to make the medium acidic in oxidation reactions of $KMnO_4$ in acidic medium?

1) Both HCl and $KMnO_4$ act as oxidizing agents

2) $KMnO_4$ oxidizesHCl into Cl_2

3) $KMnO_4$ is a weaker oxidizing agent than HCl

4) $KMnO_4$ acts as a reducing agent in the presence of HCl

34 $CrO_4^{2-} \underset{\text{pH=Y}}{\overset{\text{pH=X}}{\rightleftharpoons}} Cr_2O_7^{2-}$

The pH values of (X) and (Y) are respectively

1) 3 and 5 2) 3 and 8 3) 8 and 3 4) 8 and 9

35 During estimation of oxalic acid vs $KMnO_4$, the auto catalyst is

1) $KMnO_4$ 2) Oxalic acid 3) K_2SO_4 4) Mn^{+2}

36 Coloured and paramagnetic oxoanion is

1) MnO_4^- 2) CrO_4^{-2} 3) MnO_4^{-2} 4) $Cr_2O_7^{-2}$

37 The colourless species is

1) VCl_3 2) $VOSO_4$ 3) Na_3VO_4 4) $\left[V\left(H_2O\right)_6 SO_4\right].H_2O$

38 How many moles of iodine are liberated when 1 mole of potassium dichromate reacts with excess potassium iodide?

1) 1 2) 2 3) 3 4) 4

39 The bonds present in the structure dichromate ion are

1) four equivalent Cr-O bonds only

2) six equivalent Cr-O bonds and one O-O bond

3) six equivalent Cr-O bonds and one Cr-Cr bond

4) six equivalent Cr-O bonds and one Cr-O-Cr bond

40 In a volumetric experiment, it was found that a solution of $KMnO_4$ is reduced to $MnSO_4$. If the normality of the solution is 1.0N, then molarity of the solution will be

1) 0.5 M 2) 0.2 M 3) 1.0 M 4) 0.4 M

41 Which of the following compounds are coloured due to change transfer phenominon?

1) $K_2Cr_2O_7$ 2) H_2SO_4 3) $AgCl$ 4) $FeSO_4$

42 The number of moles of $KMnO_4$ that will be needed to react with one mole of sulphite ion in acidic solution is

1) 2/5 2) 3/5 3) 4/5 4) 1

43 The correct basic strength of hydroxides of lanthanide ions will be:

(1) $La^{+3} > Lu^{+3} > Ce^{+3} > Eu^{+3}$

(2) $Ce^{+3} > Lu^{+3} > La^{+3} > Eu^{+3}$

(3) $Lu^{+3} > Ce^{+3} > Eu^{+3} > La^{+3}$

(4) $La^{+3} > Ce^{+3} > Eu^{+3} > Lu^{+3}$

44 Which of the following oxidation state is common for all lanthanides?

(1)+2 (2)+3 (3)+4 (4)+5

45 Approximate percentage of lanthanoids in misch metal is

(1)75% (2) 25% (3) 50% (4) 95%

46 Arrange the following ions in increasingorder of their ionic radius.

$Ce^{+3}, La^{+3}, Pm^{+3}, Yb^{+3}$

(1) $Pm^{+3} < La^{+3} < Ce^{+3} < Yb^{+3}$ (2) $Yb^{+3} < Pm^{+3} < Ce^{+3} < La^{+3}$

(3) $Yb^{+3} < Pm^{+3} < La^{+3} < Ce^{+3}$ (4) $Ce^{+3} < Yb^{+3} < Pm^{+3} < La^{+3}$

47	Gadolinium belongs to $4f$ series. It's atomic number is 64. Which of the following is the correct electronic configuration of gadolinium? 1) $[Xe]4f^7 5d^1 6s^2$ 2) $[Xe]4f^6 5d^2 6s^2$ 3) $[Xe]4f^8 6s^2$ 4) $[Xe]4f^9 5s^1$
48	Which of the following Lanthanoid is radioactive 1) Cerium 2) Promethium 3) Thulium 4) Lutetium
49	The most common oxidation state of Lanthanoidsis 1) +4 2) +3 3) +6 4) +2
50	Across the lanthanide series, the basicity of the lanthanide hydroxides 1) Increases 2) Decreases 3) First increases and then decreases 4) First decreases and then increases
51	Which of the following is not an actinide? 1) Curium 2) Californmium 3) Uranium 4) Terbium
52	Incorrect statement in the following 1)Actinoids on reaction with boiling water form mixture of oxide and hydride 2)5f orbitals resemble to 4f orbitals in their angular part of the wave function 3)Np and Pu can exhibit + 7 oxidation state 4)Misch metal contains 95% Lanthanum,5% iron and traces of S, C, Ca and Al

KEY

1	**ANS-3**
2	Key : 2 Hint : d^5 configuration is stable
3	Key : 2 Hint : Fe^{3+} and Mn^{2+} are iso electronic ions
4	Key : 3 Hint :The no of unpaired electrons are respectively 3,4,2 and 5
5	Key: 1 Hint: Cu(I) has more stable $3d^{10}$configuration while Cu(II) has less stable $3d^9$ configuration. But Cu(II) is more stable due to greater effective nuclear charge. Electrons of the outer energy level attracted towards the nucleus by greater force
6	Key: 1 Hint: In aqueous solution Cr^{+3} has exactly half filled t_{2g} orbitals $\therefore$ stable
7	Key: 3 Hint: CoF_3 is stable due to high lattice enthalpy
8	Key: 4 Hint: Zr, Hf due to Lanthanoid contraction have similar size and properties and called chemical twins

9	**Key:1** **Hint:** $\sqrt{n(n+2)} = 5.9 \Rightarrow n = 5$  It is tetrahedral compound with 5 unpaired electrons and sp^3hybridisation
10	**Key: 4** Hint: CrO_2
11	Key: 2 Hint: At 850K, Fe_3O_4 becomes paeamagnetic
12	Key: 2 Hint: German silver is composed of Cu, Ni, Zn.
13	Key: 1 Hint: V_2O_5, Cr_2O_3
14	**Key: 4.** $(NH_4)_2 Cr_2O_7 \xrightarrow{\Delta} B + C + A\uparrow$
15	**Key: 3** Hint: . Cr_2O_3 is amphoteric
16	**Key: 3** **Hint:** The compound conductivity similar to metallic copper ReO_3
17	**Key: 4** **Hint:** The substance lose ferrimagnetism on heating and become paramagnetic are $MgFe_2O_4$ and Fe_3O_4
18	**Key: 4** **Hint:** Oxide shows metallic or insulating properties depending on temperature are VO , VO_3 and TiO_3

19	**Key: 2** **Hint:** $Cr^{3+} = 3d^3$ It has 3 unpaired electrons and $\mu = \sqrt{n(n+2)} = \sqrt{3(3+2)}$ $= \sqrt{15} = 3.87\ B.M$
20	**Key: 3** **Hint:** Sc^{+3}, Zn^{+2}
21	**Key: 4** **Hint:** 'Ca' is not transition metal $\because$ Transition metals from interstitial compounds
22	**Key: 1** **Hint:** $_{25}Mn$ can exhibit $+2, +3, +4, +5, +6$ and $+7$
23	Ans-4 **Sol:** Colour of $K_2Cr_2O_7$ and $KMnO_4\left(d^0\right)$ is due to charge transfer phenomenon
24	**Key: 2** **Hint:** IE_3 is more for Mn $\because Mn^{+2}: 3d^5$ stable species more energy needed to remove electron
25	**Key: 3** **Hint:** Ni^{+2}, Ti^{+3} have unpaired electrons exhibit colour in aqueous solution
26	**Key: 1** **Hint:** Transition elements exhibits variable oxidation states due to this they can acts as catalysts
27	**Key: 1** **Hint:** $E^0_{Cu^{+2}/Cu} = +0.34V$

28	**Key: 2** **Hint:** The I.P of Hf, is slightly more than Zr due to lanthanide contraction
29	**Key: 1** **Hint:** Cr after the loss of one electron acquires stable half filled $3d^5$ configuration. Thus, its second ionization enthalpy is highest
30	**Key: 1** **Hint:** In OsO_4 the oxidation number of osmium is +8
31	**Key:1** **Hint:** $I^- \rightarrow IO_3^-$
32	**Key: 3** **Hint:** $Cr_2O_7^{-2} + 3Sn^{+2} + 14H^+ \rightarrow 2Cr^{+3} + 3Sn^{+4} + 7H_2O$
33	**Key: 2** **Hint:** $KMnO_4$ is very strong oxidizing agent and it can oxidize HCl to liberate $Cl_2(g)$ $\therefore HCl$ cannot be used to acidity $KMnO_4$ solution in volumetric analysis
34	**Key: 2** **Hint:** $2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$ $Cr_2O_7^{2-} + 2OH^- \rightarrow 2CrO_4^{2-} + H_2O$
35	**Key: 4** **Hint:** $KMnO_4$ is self indicator at end point pale pink colour become colourless
36	**Key: 3** **Hint:** MnO_4^{-2} Manganate ion $Mn^{+6}4s^0 3d^1$ 1 unpaired electron is present $\therefore$ coloured and paramagnetic

37

Key: 3

Hint: In Na_3VO_4 the vanadium is present in +5 oxidation state. In V^{5+} the d-orbitals are vacant.

38

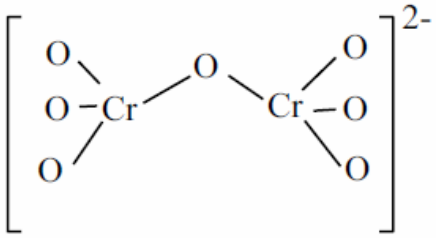
Key: 3

Hint: $Cr_2O_7^{2-} + 6I^- + 14H^+ \rightarrow 2Cr^{3+} + 3I_2 + 7H_2O$

39

Key: 4

Hint:



40

Key: 2

Hint: $\overset{+}{K}\overset{+}{M}nO_4 \rightarrow \overset{+}{M}n\overset{+}{S}O_4$

$$Eq.wt. = \frac{Molecular\ weigl}{5}$$

$$Molarity = \frac{Normality}{5}$$

$$= \frac{1}{5} = 0.2$$

41

Key: 1

Hint: The colour of $Cr_2O_7^{-2}$ can be explained by charge transfer spectra

42

	Key: 1 **Hint:** $6H^+ + 2MnO_4^- + 5SO_3^{-2} \rightarrow 2Mn^2 + 5SO_4^{2-} + 3H_2O$ 5 mole of $SO_3^{-2} \equiv 2\,moles\ of\ MnO_4^-$ 1 mole of $SO_3^{-2} \equiv \frac{2}{5}\,moles\ of\ MnO_4^-$
43	Key: 4 Hint: Top to bottom basicity decreases
44	**Ans-2**
45	**Key:4** **Hint:** Approximate percentage of lanthanoids in mischmetal is 95%
46	**Key:2** **Hint:** Due to Lanthanoid contraction their is greater decrease in ionic radius of Lanthanide series, because of poor shielding of 4f electrons. Hence the order will be : $Yb^{+3} < Pm^{+3} < Ce^{+3} < La^{+3}$
47	**Key: 1** **Hint:**. $_{64}Gd = [Xe]^{54}\,4f^7 5d^1 6s^2$ It is due to the extra stability of half-filled 4f subshell
48	**Key: 2** **Hint:** Among Lanthanoids promethium is radioactive
49	**Key: 2** **Hint:** +3 is the most stable state of lanthanide

50	**Key: 2** **Hint:** Due to Lanthanoid contraction
51	**Key: 4** **Hint:** Terbium is a lanthanide as it belongs to 4f-series having configuration [Xe]$4f^9$, $6s^2$. However, the remaining members belong to 5f-series of actinides
52	Ans-4 **Sol:**Misch metal contains 95% lanthanoid 5% iron and Traces of S, C, Ca, Al