DPP - Daily Practice Problems

Name : _____ Date : _____

Start Time : _____ End Time : _____

CHEMISTRY 43

SYLLABUS : *d*- & *f*-Block elements I : General characteristics of *d*- & *f*-block elements

Max. Marks : 120 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE choice is correct.

Q.1 Which of the following has highest ionic radii ?

(a) Cr^{3+} (b) Mn^{3+}

(c) Fe^{3+} (d) Co^{3+}

Q.2 In a reaction, ferrous (Fe^{++}) ion is oxidised to ferric (Fe^{+++})ion. The equivalent weight of the ion in the above reaction is equal to

(a) half of the atomic weight

(b) 1/5 of the atomic weight

(c) equal to the atomic weight

(d) twice of the atomic weight

Q.3 Which ion has maximum magnetic moment ?

(a) V^{3+} (b) Mn^{3+}

(c) Fe^{3+} (d) Cu^{2+}

Q.4 Which of the following transition metal is present in misch metal ?

(a) La (b) Sc

(c) Ni (d) Cr

Q.5 Which of the following is not amphoteric ?

(a) Al^{3+} (b) Cr^{3+}

(c) Fe^{3+} (d) Zn^{2+}

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ

Space for Rough Work

Q.6 Elements which generally exhibit multiple oxidation states and whose ions are usually coloured are

(a) metalloids (b) transition elements

(c) non-metals (d) gases

Q.7 Maximum oxidation states of Cr, Mn and Os are respectively

(a) +3, +5 and +6 (b) +6, +5, +7

(c) +6, +7, +8 (d) none of these

Q.8 A transition element X has a configuration $[Ar]3d^4$ in its +3 oxidation state. Its atomic number is

(a) 25 (b) 26

(c) 22 (d) 19

Q.9 Which of the following element does not show variable valency?

(a) Ni (b) Zn

(c) Cu (d) Mn

Q.10 Which element gives maximum number of oxides?

(a) V (b) Cr

(c) Mn (d) Fe

Q.11 Which of the following ions has the least magnetic moment?

(a) Cu^{2+} (b) Ni^{2+}

(c) Co^{3+} (d) Fe^{2+}

Q.12 Which of the following is a colourless ion?

(a) Cu^{2+} (b) Fe^{3+}

(c) Ti^{3+} (d) Zn^{2+}

Q.13 Which has the maximum ferromagnetic character?

(a) Fe (b) Co

(c) Ni (d) Pt

Q.14 Which forms interstitial compounds?

(a) Fe (b) Co

(c) Ni (d) All of these

Q.15 Which of the following is the weakest reducing agent?

(a) Zn (b) Cu

(c) H_2 (d) Li

Q.16 Which of the following ions is paramagnetic?

(a) Cu^+ (b) Zn^{2+}

(c) Ti^{3+} (d) Ti^{4+}

Q.17 The magnetic moment of a metal ion of first transition series is 2.83BM. Therefore it will have how many unpaired electrons ?

(a) 6 (b) 4

(c) 3 (d) 2

Q.18 The atomic radii of the elements are almost same of which series

(a) Fe - Co - Ni

(b) Na -K - Rb

(c) F - Cl -Br

(d) Li - Be- B

Q.19 Lanthanoids are

(a) 14 elements in the sixth period (atomic no. = 58 to 71) that are filling 4*f* sublevel

(b) 14 elements in the seventh period (atomic no. = 58 to 71) that are filling 4*f* sublevel

(c) 14 elements in the sixth period (atomic no. = 90 to 103) that are filling 4*f* sublevel

(d) 14 elements in the seventh period (atomic no. = 90 to 103) that are filling 4*f* sublevel

RESPONSE GRID					
	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ	10. ⓐⓑⓒⓓ
	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ	15. ⓐⓑⓒⓓ
	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ	

Space for Rough Work

Q.20 Which of the following element has maximum first ionisation potential?

(a) V (b) Ti

(c) Cr (d) Mn

Q.21 Which of the following pairs of elements cannot form an alloy?

(a) Zn, Cu (b) Fe,Hg

(c) Fe,C (d) Hg, Na

DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following 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

Q.22 Select the correct statement(s) –

(1) Transition metals and many of their compounds show paramagnetic behaviour

(2) The enthalpies of atomisation of the transition metals are high

(3) Transition metals and their many compounds act as good catalyst.

(4) The enthalpies of atomisation of the transition metals are lower than alkali metals.

Q.23 Which of the following statements are not correct?

(1) Iron belongs to 3rd transition series of the periodic table

(2) Iron belongs to *f*-block of the periodic table

(3) Iron belongs to second transition series of the perodic table

(4) Iron belongs to group VIII of the periodic table

Q.24 Which of the following are true for transition elements?

(1) They are all metals

(2) They show variable valency

(3) They form coloured ions

(4) They do not form co-ordinate compounds

DIRECTIONS (Q.25-Q.27) : Read the passage given below and answer the questions that follows :

When we pass carbon dioxide gas through a green coloured solution of potassium manganate, the colour of solution changes to purple and a brown coloured solid gets precipitated.

The green colour of potassium manganate solution also becomes purple when it is subjected to electrolysis using iron rods as cathodes as well as anode.

Q.25 The change of colour from green to purple is due to

(a) conversion of Mn^{6+} to Mn^{7+}

(b) conversion of Mn^{6+} to Mn^{4+}

(c) conversion of Mn^{4+} to Mn^{7+}

(d) conversion of Mn^{4+} to Mn^{6+}

Q.26 In the brown solid precipitate, oxidation state of Mn is

(a) +2 (b) +4

(c) +6 (d) +7

Q.27 In following reaction

$$\underset{\text{(green)}}{3K_2MnO_4} + 2H_2O + 4CO_2 \longrightarrow \underset{\text{(purple)}}{2KMnO_4} + MnO_2 + 4KHCO_3$$

the function of CO_2 is

(a) to make solution acidic by formation of $KHCO_3$

(b) to make solution basic by formation of CO_3^{2-}

(c) to act only as a medium of reaction

(d) none of the above

RESPONSE GRID					
	20. ⓐⓑⓒⓓ	21. ⓐⓑⓒⓓ	22. ⓐⓑⓒⓓ	23. ⓐⓑⓒⓓ	24. ⓐⓑⓒⓓ
	25. ⓐⓑⓒⓓ	26. ⓐⓑⓒⓓ	27. ⓐⓑⓒⓓ		

Space for Rough Work

DIRECTIONS (Qs. 28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(c) Statement -1 is False, Statement-2 is True.

(d) Statement -1 is True, Statement-2 is False.

Q.28 **Statement-1:** Cuprous ion (Cu^{+})has unpaired electrons while cupric ion (Cu^{++}) does not

Statement-2: Cuprous ion (Cu^{+}) is colourless whereas cupric ion (Cu^{++}) is blue in the aqueous solution

Q.29 **Statement-1:** The aqueous solution of $FeCl_3$ is basic in nature.

Statement-2: $FeCl_3$ hydrolyses in water

Q.30 **Statement-1:** Copper metal gets readily corroded in an acidic aqueous solution.

Statement-2: Free energy change for this process is negative.

RESPONSE GRID	28.ⓐⓑⓒⓓ	29.ⓐⓑⓒⓓ	30.ⓐⓑⓒⓓ

DAILY PRACTICE PROBLEM SHEET 43 - CHEMISTRY			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	36	Qualifying Score	56
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

DAILY PRACTICE PROBLEMS

CHEMISTRY SOLUTIONS

43

1. (a) Ionic radii $\propto \frac{1}{\text{Atomic No.}}$ Ionic radius decreases from left to right in a period.

2. (c) The atomic weight;

$$\text{Equivalent weight} = \frac{\text{Atomic weight}}{\text{No. of } e^- \text{ lost or gained}}$$

$Fe^{2+} \rightarrow Fe^{3+} + e^-$

$\therefore$ Equivalent weight = Atomic weight

3. (c) Fe^{3+}

S.No	Outer configuration	No. of unpaired *es*	Magnetic moment
V^{3+}	$3d^2$	2	2.76
Mn^{3+}	$3d^4$	4	1.9
Fe^{3+}	$3d^5$	5	5.96
Cu^{2+}	$3d^9$	1	1.9

4. (a) Misch metal is an alloy of rare earth metals with composition:

Rare earth metals - 94.95%

Iron (Fe) - 5%

5. (c) All the oxides of Fe (FeO, Fe_2O_3 and Fe_3O_4) are basic in nature.

6. (b) Transition metals show multiple oxidation state due to availability of vacant *d*- orbitals.

They are coloured due to *d*-*d* transition.

7. (c)

8. (a) Number of electrons in excited state

$X^{3+} = 18 + 4 = 22$

Number of electrons in ground state

$X = 22 + 3 = 25$.

9. (b) The electronic configuration of Zn is $[Ar]3d^{10}\,4s^2$. Hence due to complete *d*- subshell, it does not show variable valency.

10. (c) Among the transition metals, Mn forms maximum no. of oxides.

MnO	Mn_3O_4	Mn_2O_3	MnO_2	Mn_2O_7
basic	amphoteric	amphoteric	amphoteric	acidic

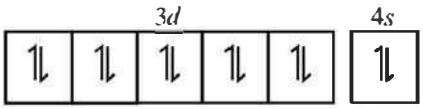
11. (a) Cu^{2+}

S.No	Ion	Electronic configuration	No. of unpaired electrons
(i)	Cu^{2+}	d^9	1
(ii)	Ni^{2+}	d^8	2
(iii)	Co^{3+}	d^7	3
(iv)	Fe^{2+}	d^6	4

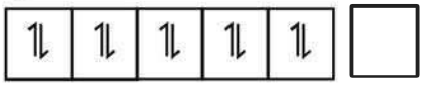
Cu^{2+} has only 1 unpaired electron, so its magnetic moment is least.

12. (d) Zn^{2+} ion has no unpaired electrons.

Zn

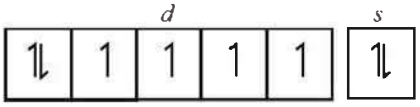


Zn^{2+}

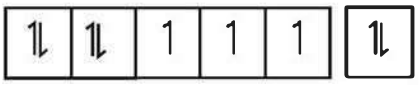


13. (a)

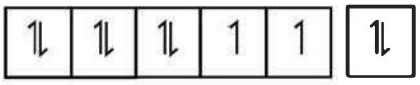
Fe



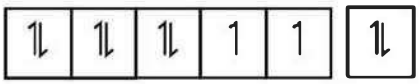
Co



Ni



Pt

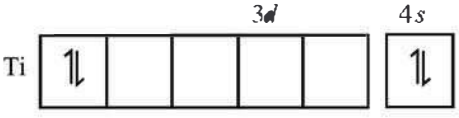


Therefore, Fe is most ferromagnetic as it has maximum number of unpaired electrons.

14. (d) The transition metals form a large number of interstitial compounds in which small atoms like hydrogen, carbon, boron and nitrogen occupy interstitial sites in their lattices.

15. (b) Cu comes after H in electrochemical series. It has positive standard reduction potential thus does not provide electrons for reduction.

16. (c) Ti^{3+} is paramagnetic due to the presence of an unpaired electron.



17. **(d)** $\mu = \sqrt{n(n+2)}$

$2.83 = \sqrt{n(n+2)}$

$n(n+2) = 8$

$n^2 + 2n - 8 = 0$

$n = 2$

18. **(a)** Fe-Co-Ni with the increase in the *d*-electrons, screening effect increases, this counter balances the increased nuclear charge due to increase in atomic number. As a result atomic radii remain practically same after chromium.

19. **(a)** As sixth period can accommodate only 18 elements in the table, 14 members of series (atomic number 58 to 71) are separately accommodated in a horizontal row below the periodic table. These are called as lanthanides.

20. **(d)** The first ionization energies of Ti, V, Cr and Mn are 656, 650, 652 and 717 kJ/mole respectively. I.E. increases in a period from L → R hence, manganese has maximum first ionisation potential.

21. **(b)** Mercury has the property of dissolving nearly all metals, forming liquid or solid solutions called amalgams. It amalgamates well with gold, silver and tin, but does not dissolve iron or platinum. Presence of these may result in sickening of the mercury.

22. **(a)** (1) Transition metals ions generally contain one or more unpaired electrons in them and hence their complexes are generally paramagnetic.

(2) Because of having larger number of unpaired electrons in their atoms, they have stronger inter atomic interaction and hence stronger bonding between the atoms.

(3) This activity is due to their ability to adopt multiple oxidation states and formation of unstable intermediates.

23. **(a)** Iron belongs to group VIII B of the periodic table.

24. **(a)** Transition elements form co-ordinate compounds because of

(i) High nuclear charge

(ii) Small size

(iii) Vacant *d*-orbital

25. **(a)** The green colour is due to presence of MnO_4^{2-} which changes to MnO_4^- which has a purple colour.

$$\underset{\substack{\text{(green)}\\ Mn^{6+}}}{3K_2MnO_4} + 2H_2O + 4CO_2 \longrightarrow \underset{\substack{\text{(purple)}\\ Mn^{7+}}}{2KMnO_4} + \underset{\substack{\text{(brown)}\\ Mn^{4+}}}{MnO_2} + 4KHCO_3$$

26. **(b)** The brown solid is MnO_2.

27. **(a)** Its function is to make solution acidic.

28. **(c)** Statement-1 is false, statement-2 is true.

$Cu^+ = [Ar]3d^{10}$

No unpaired electron

$Cu^{2+} = [Ar]\ 3d^9$

1 unpaired electron

29. **(c)** The aqueous solution of $FeCl_3$ is acidic in nature because $FeCl_3$ hydrolyses in water to produce HCl(a strong acid).

$FeCl_3 + 3H_2O \rightarrow Fe(OH)_3 + 3HCl$

Therefore, statement-1 is false but statement-2 is true.

30. **(c)** Copper corrodes at negligible rate in unpolluted air, water and deaerated non- oxidizing acids. Pure copper and the high copper alloys can be considered to exhibit similar resistance to most corrosive environments. They posses excellent resistance to atmospheric environments. Corrosion is a spontaneous process for which free energy change must be negative. Thus, statement-1 is false and statement-2 is true.