# Class 12 Chemistry · Chapter 4: The d- and f-Block Elements

**Worksheet** · 20 marks · about 40 minutes · based on NCERT

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**1.** The electronic configuration of the $Co^{3+}$ ion (Z of cobalt = 27) is [1]

(a) $[Ar]3d^6$ (b) $[Ar]3d^5 4s^1$

(c) $[Ar]3d^4 4s^2$ (d) $[Ar]3d^7$

**2.** Which of these ions has an incomplete d subshell, so that its metal counts as a transition element? [1]

(a) $Ag^{2+}$ (b) $Cd^{2+}$

(c) $Zn^{2+}$ (d) $Hg^{2+}$

**3.** Which pair of elements has almost identical atomic radii? [1]

(a) Zr and Hf (b) Sc and Y

(c) Ti and Zr (d) Cu and Ag

**4.** Which set contains only ions that are colourless in aqueous solution? [1]

(a) $Ti^{4+}$, $Cu^{2+}$, $Zn^{2+}$ (b) $Ti^{3+}$, $Sc^{3+}$, $Zn^{2+}$

(c) $Sc^{3+}$, $Zn^{2+}$, $Fe^{3+}$ (d) $Sc^{3+}$, $Ti^{4+}$, $Zn^{2+}$

**5.** A tripositive ion $M^{3+}$ of a 3d metal has a spin-only magnetic moment of 3.87 BM. The metal M is [1]

(a) vanadium (Z = 23) (b) iron (Z = 26)

(c) manganese (Z = 25) (d) chromium (Z = 24)

**6.** Chromium(II) salts liberate hydrogen from dilute acids. Write the ionic equation and give the reason for this behaviour in terms of the electronic configuration of the product. [2]

**7.** Most $Ln^{3+}$ ions are coloured, but $La^{3+}$ and $Lu^{3+}$ are colourless. Explain, and state whether these two ions are paramagnetic. [2]

**8.** The highest fluoride of manganese is $MnF_4$, but its highest oxide is $Mn_2O_7$. Explain. [2]

**9.** Write balanced ionic equations for the reactions of permanganate with (i) nitrite ion in acidic solution, (ii) iodide ion in acidic solution, and (iii) iodide ion in neutral or faintly alkaline solution. [3]



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**10.** Write the electronic configurations of europium (Z = 63) and gadolinium (Z = 64). Use them to explain why europium shows a +2 oxidation state, and why the $Gd^{3+}$ ion is especially stable. [3]

**11.** The standard electrode potentials $E°(M^{2+}/M)$ of some 3d metals are: V −1.18 V, Cr −0.90 V, Fe −0.44 V, Ni −0.25 V, Cu +0.34 V. (i) Judging by these values alone, which of these metals cannot liberate hydrogen from 1 M HCl? Give a reason. (ii) Arrange V, Fe and Ni in decreasing order of their tendency to form $M^{2+}$ ions. (iii) State the general trend in $E°(M^{2+}/M)$ across the series and the quantity it follows. [3]