WEIRD CHEMIST

d-Block Elements

Potassium Permanganate ($KMnO_4$)

DPP – 08

Topic: $KMnO_4$ **Questions:** 41 Questions **Exam:** NEET / JEE

▶ TYPE 1 : Preparation of $KMnO_4$

Q1. Pyrolusite is used to prepare potassium permanganate:

$$MnO_2 \xrightarrow{X} MnO_4^{2-} \xrightarrow{Y} MnO_4^-$$

X and Y are

(1) Fuse with KOH/air, electrolytic reduction
(2) Fuse with KOH/air, electrolytic oxidation
(3) Fuse with conc. HNO_3/air, electrolytic reduction
(4) All are correct

Q2. $X + KOH + O_2 \rightarrow Y + H_2O$
$Y + H_2SO_4 \rightarrow Z + K_2SO_4 + MnO_2 + H_2O$
What are X, Y and Z in the above reactions?

(1) X = K_2MnO_4, Y = MnO_2, Z = $KMnO_4$
(2) X = K_2MnO_4, Y = MnO_4, Z = $KMnO_4$
(3) X = MnO_2, Y = K_2MnO_4, Z = $KMnO_4$
(4) X = MnO_2, Y = $KMnO_4 \cdot MnO_4$, Z = K_2MnO_4

Q3. $K_2MnO_4 + H_2SO_4 \rightarrow KMnO_4 + K_2SO_4 + MnO_2 + H_2O$
What will be the mole ratio of reactants in the above (unbalanced) reaction?

(1) 3:2 (2) 2:1 (3) 1:2 (4) 2:2

Q4. $K_2MnO_4 + H_2SO_4 \rightarrow KMnO_4 + K_2SO_4 + MnO_2 + H_2O$
What will be the mole ratio of products in the above (unbalanced) reaction?

(1) 1:1:1:1 (2) 2:1:1:2 (3) 1:1:1:2 (4) 2:2:1:1

Q5. What will be obtained when manganese dioxide is fused with KOH in presence of an oxidizing agent like KNO_3? What will be the colour of the product?

(1) K_2MnO_4, dark green (2) $KMnO_4$, Violet (3) Mn_2O_3, Grey (4) Mn_2O_4, Black

Q6. When MnO_2 is fused with KOH, a coloured compound is formed. The product is:–

(1) K_2MnO_4 (2) $KMnO_4$ (3) Mn_2O_3 (4) Mn_3O_4

Q7. Potassium manganate (K_2MnO_4) is formed when:–

(1) Cl_2 is passed into an aqueous $KMnO_4$ solution.
(2) MnO_2 is fused with KOH in air
(3) Formaldehyde reacts with $KMnO_4$ in presence of strong alkali.
(4) $KMnO_4$ reacts with concentrated H_2SO_4

▶ TYPE 2 : Structure, Bonding & Colour

Q8. The manganate and permanganate ions are tetrahedral, due to [NEET-2019]

(1) The π-bonding involves overlap of p-orbitals of oxygen with d-orbitals of manganese
(2) There is no π-bonding
(3) The π-bonding involves overlap of p-orbitals of oxygen with p-orbitals of manganese
(4) The π-bonding involves overlap of d-orbitals of oxygen with d-orbitals of manganese

Q9. Which one of the following ions exhibits d-d transition and paramagnetism as well? [NEET-2018]

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

Q10. MnO_4^- is of pale pink colour due to

(1) Charge transfer from metal to oxygen
(2) Charge transfer from oxygen to metal
(3) d-d transition
(4) All of these

Q11. Assertion: MnO_4^- has a perfectly tetrahedral structure with bond angle of $109°28'$.
Reason: MnO_4^- has all four equal bonds due to resonance.

(1) Both Assertion and Reason are true, Reason gives correct explanation
(2) Both Assertion and Reason are true, it doesn't give correct explanation
(3) Assertion is correct but Reason is false
(4) Both Assertion and Reason are false

Q12. Purple colour of $KMnO_4$ is due to:–

(1) Charge transfer spectra
(2) d-d transition
(3) Homo-Lumo transition
(4) None

Q13. MnO_4^- is of intense pink colour, though Mn is in $(+7)$ oxidation state. It is due to.

(1) Oxygen gives colour to it
(2) Charge transfer when Mn gives its electron to oxygen
(3) Charge transfer when oxygen gives its electron to Mn, making it Mn(+VI) and hence coloured
(4) None is correct

▶ TYPE 3 : Behaviour of MnO_4^-/MnO_4^{2-} in Different Media & Disproportionation

Q14. MnO_4^{2-} in acidic medium undergoes disproportionation to give [NCERT Pg. 231]

(1) Mn_2O_3 + MnO_4^-
(2) MnO_2 + MnO_4^-
(3) Mn_2O_7 + Mn_2O_3
(4) Mn_2O_7 + MnO_2

Q15. The change in the oxidation state of Mn from permanganate ion to the product obtained from its reaction in faintly alkaline medium is [NCERT Pg. 234]

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

Q16. When neutral or faintly alkaline $KMnO_4$ is treated with potassium iodide, iodide ion is converted into 'X'. 'X' is [NEET-2019 (Odisha)]

(1) IO^-
(2) I_2
(3) IO_4^-
(4) IO_3^-

Q17. In dilute alkaline solution, MnO_4^- changes to

(1) MnO_4^{2-} (2) MnO_2 (3) Mn_2O_3 (4) MnO

Q18. The product of I^- with MnO_4^- in alkaline medium is

(1) I_2 (2) IO_3^- (3) IO^- (4) IO_4^-

Q19. A purple coloured solution is made alkaline with KOH and is treated with KI, forming potassium iodate. The same solution is acidified with H_2SO_4 and again treated with KI. However this time, instead of potassium iodate, iodine gas is released. The purple coloured solution is of

(1) $K_2Cr_2O_7$ (2) K_2CrO_4 (3) $KMnO_4$ (4) K_2MnO_4

Q20. Which of the following reactions are disproportionation reactions?

(a) $2Cu^+ \rightarrow Cu^{2+} + Cu$
(b) $3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$
(c) $2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$
(d) $2MnO_4^- + 3Mn^{2+} + 2H_2O \rightarrow 5MnO_2 + 4H^+$

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

Q21. When $KMnO_4$ reacts in slightly alkaline medium and acidic medium, the respective products obtained are:–

(1) K_2MnO_4 and Mn^{+2}
(2) MnO_2 and MnO_2
(3) MnO_2 and Mn^{+2}
(4) Mn^{+2} and MnO_2

▶ TYPE 4 : Redox Reactions of $KMnO_4$ as an Oxidising Agent

Q22. Permanganate titrations in presence of hydrochloric acid are unsatisfactory since [NCERT Pg. 234]

(1) Hydrochloric acid is oxidised to hydrogen
(2) Hydrochloric acid is oxidised to chlorine
(3) Hydrochloric acid is highly volatile in nature
(4) Hydrochloric acid forms salt with permanganate ion

Q23. n-factor of KI when treated with alkaline $KMnO_4$ solution is

(1) 2 (2) 3 (3) 5 (4) 6

Q24. The reaction of aqueous $KMnO_4$ with H_2O_2 in acidic conditions gives [AIPMT-2014]

(1) Mn^{4+} and O_2
(2) Mn^{2+} and O_2
(3) Mn^{2+} and O_3
(4) Mn^{4+} and MnO_2

Q25. Number of moles of MnO_4^- required to oxidize one mole of ferrous oxalate completely in acidic medium will be [AIPMT (Prelims)-2008]

(1) 0.2 moles
(2) 0.6 moles
(3) 0.4 moles
(4) 7.5 moles

Q26. The number of moles of $KMnO_4$ that reduce one mole of KI in alkaline medium is [AIPMT (Prelims)-2005]

(1) One fifth
(2) Five
(3) One
(4) Two

Q27. The equivalent weight of $MnSO_4$ is equal to its molecular weight when it is converted to

(1) Mn_2O_3 (2) MnO_2 (3) MnO_4^- (4) MnO_4^{2-}

Q28. Which one of the following compounds does not decolourise an acidified aqueous solution of $KMnO_4$:–

(1) SO_2 (2) $FeCl_3$ (3) H_2O_2 (4) $FeSO_4$

Q29. $KMnO_4$ is a strong oxidizing agent in acidic medium. To provide acidic medium, dil. H_2SO_4 is used, not HCl. This is due to:–

(1) H_2SO_4 is a stronger acid than HCl
(2) HCl is oxidised by $KMnO_4$ to Cl_2
(3) H_2SO_4 is a dibasic acid
(4) Rate of reaction is faster in presence of H_2SO_4

Q30. Acidified potassium permanganate is decolourised by:

(1) White vitriol (2) Bleaching powder (3) Laughing gas (4) Mohr's salt

▶ TYPE 5 : Thermal Decomposition & Reaction with Conc. Acid

Q31. On heating $KMnO_4$, one among the following is not formed–

(1) K_2MnO_4 (2) O_2 (3) MnO_2 (4) MnO

Q32. Which of the following products is not formed by heating $KMnO_4$

(1) K_2MnO_4 (2) MnO_2 (3) O_2 (4) Mn_2O_7

Q33. $KMnO_4$ is acidified by:–

(1) Conc. H_2SO_4 (2) dil. HCl (3) Conc. HNO_3 (4) dil. H_2SO_4

Q34. The final products obtained for the following reaction are:

$$KMnO_4 \text{ (excess)} + \text{dil. } H_2SO_4$$

(1) Mn_2O_7 (2) MnO (3) Mn_3O_4 (4) MnO_3^+

Q35. A student accidentally added conc. H_2SO_4 to potassium permanganate and it exploded due to the formation of an explosive. Which of the following is formed?

(1) Mn_2O_7 (2) MnO_2 (3) Mn_2O_5 (4) Mn_2O_3

▶ TYPE 6 : General Properties & Uses

Q36. Which of the following characteristic properties of $KMnO_4$ is/are correct?

(1) $KMnO_4$ forms dark purple crystals
(2) SO_2 is oxidised to SO_4^{2-} with $KMnO_4$ in acidic medium
(3) Purple colour of MnO_4^- ion is due to charge transfer
(4) All of these

Q37. Statement-A: In the $3d$-series, the m.p. of Mn is low.
Statement-B: Electronic configuration of Mn is $[Ar]\,3d^5\,4s^2$.
Statement-C: Highest O.S. of Mn is $+6$.
Statement-D: $KMnO_4$ is colourless.
Which of the following are correct?

(1) A, B, C
(2) B, C
(3) A, B
(4) B, C, D

Q38. Which of the following is used in dry cell?

(1) $KMnO_4$ (2) MnO_2 (3) $K_2Cr_2O_7$ (4) K_2MnO_2

Q39. Potassium permanganate is used as.....

(1) As reducing agent
(2) As corrosion inhibitor
(3) As strong oxidant
(4) In preparation of azo compounds

Q40. Anhydride of permanganic acid $HMnO_4$ is:–

(1) Mn_2O_7 (2) MnO_2 (3) Mn_2O_3 (4) MnO

Q41. Which of the following is a use of potassium permanganate?

(1) Bleaching of wool, cotton and silk fibres
(2) Decolourisation of oils
(3) In analytical chemistry
(4) All of these