

EXERCISE - O

SINGLE CORRECT TYPE QUESTIONS

General Properties of d-block elements

1. Transition elements having more tendency to form complex than representative elements (s and p-block elements) due to -
 (A) availability of d-orbitals for bonding
 (B) variable oxidation states are not shown by transition elements
 (C) all electrons are paired in d-orbitals
 (D) f-orbitals are available for bonding

CDF081

2. Transition elements are usually characterised by variable oxidation states but Zn does not show this property because of
 (A) completion of np-orbitals (B) completion of (n-1)d orbitals
 (C) completion of ns-orbitals (D) inert pair effect

CDF082

3. The d-block element which is a liquid at room temperature, having high specific heat, less reactivity than hydrogen and its chloride (MX_2) is volatile on heating is
 (A) Cu (B) Hg (C) Ce (D) Pm

CDF083

4. Coinage metals show the properties of
 (A) typical elements (B) normal elements
 (C) inner-transition elements (D) transition element

CDF084

5. The higher oxidation states of transition elements are found to be in the combination with A and B, which are
 (A) F, O (B) O, N (C) O, Cl (D) F, Cl

CDF085

6. The electrons which take part in order to exhibit variable oxidation states by transition metals are
 (A) ns only
 (B) (n-1)d only
 (C) ns and (n-1)d only but not np
 (D) (n-1)d and np only but not ns

CDF086

7. Metre scales are made-up of alloy
 (A) invar (B) stainless steel (C) elektron (D) magnalium

CDF087

ASSERTION & REASONING :

Questions given below consist of two statements each printed as Assertion (A) and Reason (R); while answering these questions you are required to choose any one of the following four responses:

- (A) if both (A) and (R) are true and (R) is the correct explanation of (A)
 (B) if both (A) and (R) are true but (R) is not correct explanation of (A)
 (C) if (A) is true but (R) is false
 (D) if (A) is false and (R) is true

8. **Assertion:** The highest oxidation state of chromium in its compounds is +6.
Reason : Chromium atom has only six electrons in ns and (n-1) d orbitals.

CDF088

9. **Assertion:** Zinc does not show characteristic properties of transition metals.
Reason : In zinc outermost shell is completely filled.

CDF089

10. **Assertion:** Tungsten has a very high melting point.
Reason : Tungsten is a covalent compound.

CDF090

Compounds of d-block elements

11. A compound of mercury used in cosmetics, in Ayurvedic and Yunani medicines and known as Vermilion is -
 (A) HgCl_2 (B) HgS (C) Hg_2Cl_2 (D) HgI

CDF091

12. Solution of MnO_4^- is purple-coloured due to
 (A) d-d-transition
 (B) charge transfer from O to Mn
 (C) due to both d-d-transition and charge transfer
 (D) none of these

CDF092

13. During estimation of oxalic acid Vs KMnO_4 , self indicator is
 (A) KMnO_4 (B) oxalic acid (C) K_2SO_4 (D) MnSO_4

CDF093

14. Acidified chromic acid + $\text{H}_2\text{O}_2 \xrightarrow[\text{(blue colour)}]{\text{Org.solvent}} \text{X} + \text{Y}$, X and Y are
 (A) CrO_5 and H_2O (B) Cr_2O_3 and H_2O (C) CrO_2 and H_2O (D) CrO and H_2O

CDF094

15. $\text{KMnO}_4 + \text{HCl} \longrightarrow \text{H}_2\text{O} + \text{X(g)}$, X is a
 (acidified)
 (A) red liquid (B) violet gas
 (C) greenish yellow gas (D) yellow-brown gas

CDF095

ASSERTION & REASONING :

Questions given below consist of two statements each printed as Assertion (A) and Reason (R); while answering these questions you are required to choose any one of the following four responses:

- (A) if both (A) and (R) are true and (R) is the correct explanation of (A)
 (B) if both (A) and (R) are true but (R) is not correct explanation of (A)
 (C) if (A) is true but (R) is false
 (D) if (A) is false and (R) is true

16. **Assertion:** KMnO_4 is purple in colour due to charge transfer.
Reason : In MnO_4^- , there is no electron present in d-orbitals of manganese.

CDF096

17. **Assertion:** K_2CrO_4 has yellow colour due to charge transfer.
Reason : CrO_4^{2-} ion is tetrahedral in shape.

CDF097

MULTIPLE CORRECT TYPE QUESTIONS

General Properties of d-block elements

18. Addition of non-metals like B and C to the interstitial sites of a transition metal results the metal
(A) of more ductability (B) of less ductability
(C) less malleable (D) of more hardness
CDF098
19. Mercury is a liquid at 0°C because of
(A) very high ionisation energy (B) weak metallic bonds
(C) high heat of hydration (D) high heat of sublimation
CDF099
20. The ionisation energies of transition elements are
(A) less than p-block elements (B) more than s-block elements
(C) less than s-block elements (D) more than p-block elements
CDF100
21. The highest oxidation state among transition elements is
(A) + 7 by Mn (B) + 8 by Os (C) + 8 by Ru (D) + 7 by Fe
CDF101
22. The catalytic activity of transition elements is related to their
(A) variable oxidation states (B) free surface valencies
(C) complex formation ability (D) magnetic moment
CDF102
23. Interstitial compounds are formed by
(A) Co (B) Ni (C) Fe (D) Ca
CDF103
24. The lanthanide contraction is responsible for the fact that
(A) Zr and Hf have same atomic sizes
(B) Zr and Hf have same properties
(C) Zr and Hf have different atomic sizes
(D) Zr and Hf have different properties
CDF104

Compounds of d-block elements

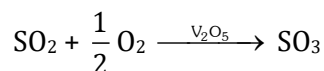
25. Amphoteric oxide(s) of Mn is/are
(A) MnO_2 (B) Mn_3O_4 (C) Mn_2O_7 (D) MnO
CDF105
26. Acidified KMnO_4 can be decolourised by
(A) SO_2 (B) H_2O_2 (C) FeSO_4 (D) $\text{Fe}_2(\text{SO}_4)_3$
CDF106

COMPREHENSION TYPE QUESTIONS

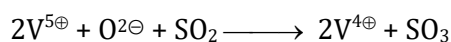
General Properties of d-block elements

Paragraph for Question No. 27 to 28

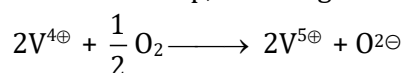
Transition metal and their compounds are used as catalysts in industry and in biological system. For example, in the Contact process, vanadium compounds in the +5 state (V_2O_5 or VO_3^-) are used to oxidise SO_2 to SO_3 :



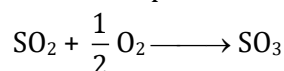
It is thought that the actual oxidation process takes place in two stages. In the first step, V^{5+} in the presence of oxide ions converts SO_2 to SO_3 . At the same time, V^{5+} is reduced to V^{4+} .



In the second step, V^{5+} is regenerated from V^{4+} by oxygen :



The overall process is, of course, the sum of these two steps:



27. During the course of the reaction :
- (A) Catalyst undergoes changes in oxidation state
 (B) Catalyst increases the rate constant
 (C) Catalyst is regenerated in its original form when the reactants form the products
 (D) All are correct.

CDF107

28. Which of the following ion involved in the above process will show paramagnetism?
- (A) V^{5+} (B) V^{4+} (C) O^{2-} (D) VO_3^-

CDF108

Comprehension # 29 to 31

Due to availability of vacant orbitals of sufficiently low energy, d-block elements form complexes, d-block elements have different properties such as- catalytic, magnetic, alloy formation, interstitial compounds formation. Interstitial compounds are those compounds in which small atoms like carbon and boron fits into interstices of d-block elements crystal. In interstitial compounds, there is no chemical bond formation takes place so , chemical properties remain almost same but physical properties may change.

29. Which of the property of interstitial compounds has the same behaviour as that of the element -
- (A) Malleability (B) Ductility
 (C) Electrical conductance (D) Hardness

CDF109

30. Which of the following property gets decreased in interstitial compounds compared to that of the element -
- (A) Malleability (B) Metallic lustre
 (C) Hardness (D) Density

CDF110

31. Select correct statement -
- (A) Highest oxidation state of 3d-series is +8.
 (B) Ni, Cu and Zn are not transition element.
 (C) Ziegler natta catalyst contain vanadium.
 (D) Aq. solution of Cu^{2+} , Fe^{3+} and Cr^{3+} are blue, yellow and green respectively.

CDF111

EXERCISE - S

General Properties of d-block elements

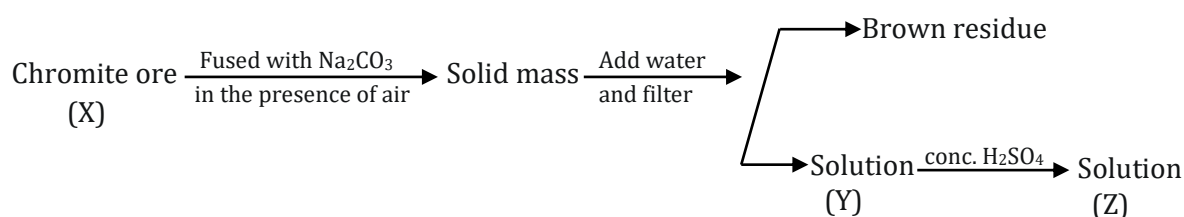
- Find the number of species from the following which has magnetic moment value of 1.73 B.M.
 Fe^{2+} , Cu^{2+} , Ni^{2+} , NO_2 , $\text{NO}_2^\ominus$, Ti^{3+}
CDF112
- How many elements of 1st transition series have half filled d-subshell ?
CDF113
- What is the oxidation no. of metal in catalyst which converts SO_2 to SO_3 in contact process for the making of H_2SO_4 ?
CDF114
- Select the number of correct matches for the outermost electronic configuration for d-block elements.

$\text{Nb-5s}^1\text{4d}^4$ (group-5)	$\text{W-6s}^2\text{5d}^4$ (group-6)
$\text{Tc-5s}^1\text{4d}^6$ (group-7)	$\text{Ru-5s}^1\text{4d}^7$ (group-8)
$\text{Rh-5s}^1\text{4d}^8$ (group-9)	$\text{Pd-5s}^0\text{4d}^{10}$ (group-10)
$\text{Pt-6s}^1\text{5d}^9$ (group-10)	$\text{V-4s}^2\text{3d}^3$ (group-5)

CDF115
- Find the number of species among the following which can exist.
 TiO_2 , $\text{VO}_2^\oplus$, $\text{CrO}_4^{2\ominus}$, $\text{MnO}_4^\ominus$, $\text{FeO}_4^{2\ominus}$, VO^{2+} , TiO^{2+} , Sc_2O_3 , Mn_2O_7
CDF116
- Find the number of halides which do not exist.
 TiI_4 , TiI_3 , TiI_2 , TiF_2 , TiBr_2 , TiCl_2 , TiF_4 , TiCl_4 , TiCl_3
CDF117
- The number of halides that do not exist among the following.
 CuF_2 , CuCl_2 , CuBr_2 , CuI_2 , CuCl , CuBr , Cu_2I_2 , CuF
CDF118

Compounds of d-block elements

- When mixture of NaCl and $\text{K}_2\text{Cr}_2\text{O}_7$ is gently warmed with conc. H_2SO_4 then compound X is formed. What is the oxidation state of central atom of X.
CDF119
- Find the total number of triangular faces in the geometry of $\text{MnO}_4^\ominus$ ion.
CDF120
- Following steps are involved in manufacturing of potassium dichromate :
 What is difference in the O.N. of Cr between X and Z ?



CDF121

11. Find total no. of oxygen atom which are in -1 oxidation state in CrO_5 . CDF122

12. Find the number of mixed oxides among the following :
 Mn_3O_4 , Fe_3O_4 , CO_3O_4 , Mn_2O_3 , MnO_2 , Fe_2O_3 , NiO , CrO_2 , CrO_3 . CDF123

13. Identify the number of amphoteric species amongst the following :
 Mn_2O_7 , CrO_3 , V_2O_5 , MnO_2 , V_2O_3 , CrO , Fe_2O_3 CDF124

f-block elements

14. Most common oxidation state of actinoids is CDF125

15. Find the number of inner transition elements among those having following atomic numbers :
29, 59, 74, 95, 102, 104, 89, 57, 72. CDF126

16. The number of unpaired electrons in Gd^{3+} is CDF127

EXERCISE - JEE (Main) PYQ

- The transition metal ions responsible for colour in ruby and emerald are, respectively :
 (1) $\text{Cr}^{3\oplus}$ and $\text{Cr}^{3\oplus}$ (2) $\text{Cr}^{3\oplus}$ and $\text{Co}^{3\oplus}$ (3) $\text{Co}^{3\oplus}$ and $\text{Cr}^{3\oplus}$ (4) $\text{Co}^{3\oplus}$ and $\text{Co}^{3\oplus}$
[JEE (Main) 2016]
CDF036
- Which one of the following species is stable in aqueous solution?
 (1) $\text{MnO}_4^{3\ominus}$ (2) $\text{MnO}_4^{2\ominus}$ (3) $\text{Cu}^{\oplus}$ (4) $\text{Cr}^{2\oplus}$
[JEE (Main) 2016]
CDF037
- Which of the following ions does not liberate hydrogen gas on reaction with dilute acids?
 (1) $\text{Ti}^{2\oplus}$ (2) $\text{Cr}^{2\oplus}$ (3) $\text{Mn}^{2\oplus}$ (4) $\text{V}^{2\oplus}$
[JEE (Main) 2017]
CDF038
- The correct order of atomic radii is :
 (1) $\text{Ce} > \text{Eu} > \text{Ho} > \text{Nd}$ (2) $\text{Nd} > \text{Ce} > \text{Eu} > \text{Ho}$
 (3) $\text{Eu} > \text{Ce} > \text{Nd} > \text{Ho}$ (4) $\text{Ho} > \text{Nd} > \text{Eu} > \text{Ce}$
[JEE-(Main) 2019]
CDF039
- The statement that is **INCORRECT** about the interstitial compounds is :
 (1) They have high melting points (2) They are chemically reactive
 (3) They have metallic conductivity (4) They are very hard
[JEE-(Main) 2019]
CDF040
- The transition element that has lowest enthalpy of atomisation, is :
 (1) Zn (2) Cu (3) V (4) Fe
[JEE-(Main) 2019]
CDF041
- The maximum number of possible oxidation states of actinides are shown by
 (1) berkelium (Bk) and californium (Cf) (2) nobelium (No) and lawrencium (Lr)
 (3) actinium (Ac) and thorium (Th) (4) neptunium (Np) and plutonium (Pu)
[JEE-(Main) 2020]
CDF042
- The electronic configurations of bivalent Europium and trivalent Cerium are
 (atomic number : Xe = 54, Ce = 58, Eu = 63)
 (1) $[\text{Xe}] 4f^4$ and $[\text{Xe}] 4f^9$ (2) $[\text{Xe}] 4f^7$ and $[\text{Xe}] 4f^1$
 (3) $[\text{Xe}] 4f^7 6s^2$ and $[\text{Xe}] 4f^2 6s^2$ (4) $[\text{Xe}] 4f^2$ and $[\text{Xe}] 4f^7$
[JEE-(Main) 2020]
CDF043
- Mischmetal is an alloy consisting mainly of:
 (1) lanthanoid metals (2) actinoid metals
 (3) actinoid and transition metals (4) lanthanoid and actinoid metals
[JEE-(Main) 2020]
CDF044
- Given below are two statements:
 Statement I : Potassium permanganate on heating at 573 K forms potassium manganate.
 Statement II : Both potassium permanganate and potassium manganate are tetrahedral and paramagnetic in nature.
 In the light of the above statements, choose the most appropriate answer from the options given below:
 (1) Statement I is true but statement II is false
 (2) Both statement I and statement II are true
 (3) Statement I is false but statement II is true
 (4) Both statement I and statement II are false
[JEE (Main) 2021]
CDF046

11. The spin-only magnetic moment value of M^{3+} ion (in gaseous state) from the pairs Cr^{3+}/Cr^{2+} , Mn^{3+}/Mn^{2+} , Fe^{3+}/Fe^{2+} and Co^{3+}/Co^{2+} that has negative standard electrode potential, isB.M. [Nearest integer] [JEE (Main) 2022]
CDF047
12. The reaction of H_2O_2 with potassium permanganate in acidic medium leads to the formation of Mainly. [JEE-(Main) 2022]
CDF048
- (1) Mn^{2+} (2) Mn^{4+} (3) Mn^{3+} (4) Mn^{6+}
13. Among Co^{3+} , Ti^{2+} , V^{2+} and Cr^{2+} ions, one if used as a reagent cannot liberate H_2 from dilute mineral acid solution, its spin-only magnetic moment in gaseous state isB.M. (Nearest integer) [JEE-(Main) 2022]
CDF049
14. Which one amongst the following are good oxidizing agents?
A. Sm^{2+} B. Ce^{2+} C. Ce^{4+} D. Tb^{4+}
Choose the most appropriate answer from the options given below : [JEE-(Main) 2023]
CDF050
- (1) C only (2) D only (3) A and B only (4) C and D only
15. Potassium dichromate acts as a strong oxidizing agent in acidic solution. During this process, the oxidation state changes from [JEE (Main)-2023]
CDF075
- (1) + 3 to + 1 (2) + 6 to + 3 (3) + 2 to + 1 (4) + 6 to + 2
16. During the borax bead test with $CuSO_4$, a blue green colour of the bead was observed in oxidising flame due to the formation of [JEE (Main)-2023]
CDF076
- (1) Cu_3B_2 (2) Cu (3) $Cu(BO_2)_2$ (4) CuO
17. The set of correct statements is:
(i) Manganese exhibits +7 oxidation state in its oxide.
(ii) Ruthenium and Osmium exhibit +8 oxidation in their oxides.
(iii) Sc shows +4 oxidation state which is oxidizing in nature.
(iv) Cr shows oxidising nature in +6 oxidation state. [JEE (Main)-2023]
CDF077
- (1) (ii) and (iii) (2) (i), (ii) and (iv) (3) (i) and (iii) (4) (ii), (iii) and (iv)
18. A solution of CrO_5 in amyl alcohol has a....colour [JEE (Main)-2023]
CDF078
- (1) Green (2) Orange-Red (3) Yellow (4) Blue
19. During the qualitative analysis of SO_3^{2-} using dilute H_2SO_4 , SO_2 gas is evolved which turns $K_2Cr_2O_7$ solution (acidified with dilute H_2SO_4): [JEE (Main)-2023]
CDF079
- (1) Black (2) Red (3) Green (4) Blue
20. The correct order of basicity of oxides of vanadium is [JEE (Main)-2023]
CDF080
- (1) $V_2O_3 > V_2O_4 > V_2O_5$ (2) $V_2O_3 > V_2O_5 > V_2O_4$
(3) $V_2O_5 > V_2O_4 > V_2O_3$ (4) $V_2O_4 > V_2O_3 > V_2O_5$

EXERCISE - JEE (Advanced) PYQ

1. The correct statement(s) about Cr^{2+} and Mn^{3+} is (are)
[Atomic numbers of Cr = 24 and Mn = 25] [JEE (Advanced) 2015]
(A) Cr^{2+} is a reducing agent
(B) Mn^{3+} is an oxidizing agent
(C) Both Cr^{2+} and Mn^{3+} exhibit d^4 electronic configuration
(D) When Cr^{2+} is used as a reducing agent, the chromium ion attains d^5 electronic configuration
CDF071
2. Fusion of MnO_2 with KOH in presence of O_2 produces a salt W. Alkaline solution of W upon electrolytic oxidation yields another salt X. The manganese containing ions present in W and X, respectively, are Y and Z. Correct statement(s) is (are) [JEE (Advanced) 2019]
(A) Y is diamagnetic in nature while Z is paramagnetic
(B) Both Y and Z are coloured and have tetrahedral shape
(C) In both Y and Z, π -bonding occurs between p-orbitals of oxygen and d-orbitals of manganese.
(D) In aqueous acidic solution, Y undergoes disproportionation reaction to give Z and MnO_2 .
CDF072
3. An acidified solution of potassium chromate was layered with an equal volume of amyl alcohol. When it was shaken after the addition of 1 mL of 3% H_2O_2 , a blue alcohol layer was obtained. The blue colour is due to the formation of a chromium (VI) compound 'X'. What is the number of oxygen atoms bonded to chromium through only single bonds in a molecule of X? [JEE (Advanced) 2020]
CDF073
4. Thermal decomposition of AgNO_3 produces two paramagnetic gases. The total number of electrons present in the antibonding molecular orbitals of the gas that has the higher number of unpaired electrons is _____. [JEE (Advanced) 2022]
CDF074

JEE (Main) Practice Paper

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION-A

- This section contains **TWENTY** questions.
 - Each question has **FOUR** options (1), (2), (3) and (4). **ONLY ONE** of these four options is correct.
 - For each question, darken the bubble corresponding to the correct option in the ORS.
 - For each question, marks will be awarded in one of the following categories :
Full Marks : +4, if only the bubble corresponding to the correct option is darkened.
Zero Marks : 0, if none of the bubbles is darkened.
Negative Marks : -1 in all other cases
-
1. Transition metal ions form interstitial compounds because -
 (1) Interstices are available in their crystal lattice
 (2) They have empty d-orbitals
 (3) They have high value of ionic potential
 (4) They show variable oxidation states
CDF001
 2. The basic character of the transition metal monoxide follows the order :-
 (1) VO > CrO > TiO > FeO
 (2) CrO > VO > FeO > TiO
 (3) TiO > FeO > VO > CrO
 (4) TiO > VO > CrO > FeO
CDF002
 3. The metallic bond strength in first transition series increases from -
 (1) Sc to Mn
 (2) Sc to Cr
 (3) Cr to Zn
 (4) Sc to Cu
CDF003
 4. The aqueous solution containing which one of the following ions will be colourless ?
 (Atomic number: Sc = 21, Fe = 26, Ti = 22, Mn = 25)
 (1) Sc^{3+}
 (2) Fe^{2+}
 (3) Ti^{3+}
 (4) Mn^{2+}
CDF004
 5. The product of oxidation of I^- with MnO_4^- in alkaline medium is :
 (1) IO_3^-
 (2) I_2
 (3) IO^-
 (4) IO_4^-
CDF005
 6. Which of the statements is not true?
 (1) $\text{K}_2\text{Cr}_2\text{O}_7$ solution in acidic medium is orange
 (2) $\text{K}_2\text{Cr}_2\text{O}_7$ solution becomes yellow on increasing the pH beyond 7
 (3) On passing H_2S through acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution, a milky colour is observed
 (4) $\text{Na}_2\text{Cr}_2\text{O}_7$ is preferred over $\text{K}_2\text{Cr}_2\text{O}_7$ in volumetric analysis
CDF006
 7. Which of the following ion does not exist ?
 (1) $[\text{CuI}_4]^{2-}$
 (2) VO_4^{3-}
 (3) WO_4^{2-}
 (4) CrO_4^{2-}
CDF007

8. $\text{Y} \xleftarrow{\text{KI}} \text{CuSO}_4 \xrightarrow{\text{dil H}_2\text{SO}_4} \text{X (Blue colour)}$, X and Y are
(diatomic covalent molecule)

- (1) X = I₂, Y = [Cu(H₂O)₄]²⁺ (2) X = [Cu(H₂O)₄]²⁺, Y = I₂
(3) X = [Cu(H₂O)₄]⁺, Y = I₂ (4) X = [Cu(H₂O)₅]²⁺, Y = I₂

CDF008

9. Pick out the incorrect statement:

- (1) MnO₄²⁻ is quite strongly oxidizing and stable only in very strong alkalies. In dilute alkali, neutral solutions, it disproportionates.
(2) In acidic solutions, MnO₄⁻ is reduced to Mn²⁺ and thus, KMnO₄ is widely used as oxidising agent
(3) KMnO₄ does not acts as oxidising agent in alkaline medium
(4) KMnO₄ is manufactured by the fusion of pyrolusite ore with KOH in presence of air or KNO₃, followed by electrolytic oxidation in strongly alkaline solution.

CDF009

10. The Ziegler-Natta catalyst used for polymerisation of ethene and styrene is TiCl₄ + (C₂H₅)₃Al, the catalysing species (active species) involved in the polymerisation is

- (1) TiCl₄ (2) TiCl₃ (3) TiCl₂ (4) TiCl

CDF010

11. When acidified KMnO₄ is added to hot oxalic acid solution, the decolourization is slow in the beginning, but becomes very rapid after some time. This is because:

- (1) Mn²⁺ acts as auto-catalyst (2) CO₂ is formed as the product
(3) Reaction is exothermic (4) MnO₄⁻ catalyses the reaction

CDF011

12. $\text{Cr}_2\text{O}_7^{2-} \xrightleftharpoons[\text{Y}]{\text{X}} 2\text{CrO}_4^{2-}$, X and Y are respectively

- (1) X = OH⁻, Y = H⁺ (2) X = H⁺, Y = OH⁻ (3) X = OH⁻, Y = H₂O₂ (4) X = H₂O₂, Y = OH⁻

CDF012

13. Catalytic activity of transition metals depends on :

- (1) Their ability to exist in different oxidation states
(2) The size of the metal atoms
(3) The number of empty atomic orbitals available
(4) None of these

CDF013

14. Questions given below consist of two statements each printed as Assertion (A) and Reason (R); while answering these questions you are required to choose any one of the following four responses:

Assertion : CrO₃ reacts with HCl to form chromyl chloride gas.

Reason : Chromyl chloride (CrO₂Cl₂) has tetrahedral shape.

- (1) if both (A) and (R) are true and (R) is the correct explanation of (A)
(2) if both (A) and (R) are true but (R) is not correct explanation of (A)
(3) if (A) is true but (R) is false
(4) if (A) is false and (R) is true

CDF014

15. Consider the following statements.
 (I) $\text{La}(\text{OH})_3$ is the least basic among hydroxides of lanthanides.
 (II) Zr^{4+} and Hf^{4+} possess almost the same ionic radii
 (III) Ce^{4+} can act as an oxidizing agent

Which of the above is incorrect

- (1) (I) and (III) (2) (II) and (III)
 (3) (I) and (II) (4) (I) only

CDF015

16. The point of dissimilarity between lanthanides and actinides is
 (1) three outermost shells are partially filled
 (2) they show oxidation state of +3 (common)
 (3) they are called inner transition elements
 (4) they are radioactive in nature

CDF016

17. The correct order of ionic radii of Y^{3+} , La^{3+} , Eu^{3+} and Lu^{3+} is.

- (1) $\text{Y}^{3+} < \text{La}^{3+} < \text{Eu}^{3+} < \text{Lu}^{3+}$
 (2) $\text{Lu}^{3+} < \text{Eu}^{3+} < \text{La}^{3+} < \text{Y}^{3+}$
 (3) $\text{La}^{3+} < \text{Eu}^{3+} < \text{Lu}^{3+} < \text{Y}^{3+}$
 (4) $\text{Y}^{3+} < \text{Lu}^{3+} < \text{Eu}^{3+} < \text{La}^{3+}$

CDF017

18. Cerium ($Z = 58$) is an important member of the lanthanides. Which of the following statements about cerium is incorrect ?

- (1) The common oxidation states of cerium are +3 and +4
 (2) The +3 oxidation state of cerium is more stable than the +4 oxidation state
 (3) The +4 oxidation state of cerium is not known in solutions
 (4) Cerium (IV) acts as an oxidizing agent

CDF018

19. Lanthanide contraction is caused due to

- (1) the same effective nuclear charge from Ce to Lu
 (2) the imperfect shielding on outer electrons by 4f electrons from the nuclear charge
 (3) the appreciable shielding on outer electrons by 4f electrons from the nuclear charge
 (4) the appreciable shielding on outer electrons by 5d electrons from the nuclear charge

CDF019

20. In the lanthanide series, the basicity of the lanthanide hydroxides

- (1) Increases
 (2) Decreases
 (3) First increase and then decrease
 (4) First decrease and then increases

CDF020

SECTION-B

- This section will have **TEN questions**. Candidate can choose to attempt any 5 questions out of these 10 questions. In case if candidate attempts more than 5 questions, first 5 attempted questions will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (Answer should be rounded off to the nearest integer).
- Answer to each question will be evaluated according to the following marking scheme:
 Full Marks : +4, if only correct answer is given.
 Zero Marks : 0, if no answer is given.
 Negative Marks :-1 for incorrect answer

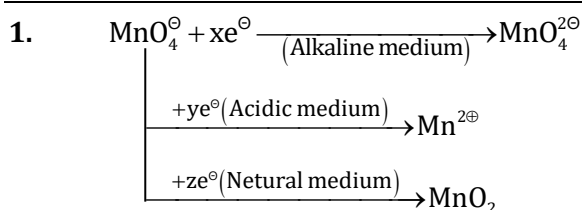
- Total number of transition metals which have only one oxidation state other than zero.
Fe, Cd, Zn, Hg, Ag, Au, Cu, Ni
CDF021
- (i) Change in oxidation state of Cr when $K_2Cr_2O_7$ reacts with H_2S in acidic medium = x
(ii) Change in oxidation state of Mn when $KMnO_4$ reacts with $H_2C_2O_4$ in acidic medium = y
determine, (x + y)
CDF022
- (a) Number of identical Cr–O bonds (having bond order more than 1) in $Cr_2O_7^{2-}$ = x
(b) Number of identical Mn – O bonds in MnO_4^- = y determine, (x + y)
CDF023
- When H_2O_2 reacts with acidified $Cr_2O_7^{2-}$ then deep blue coloured solution is obtained what is the change in oxidation state of Cr in the process?
CDF024
- Among the known Actinides, how many actinides are classified as natural elements.
CDF025
- The number of radioactive elements among lanthanides and actinide is/are.
(Fill your answer as sum of digits till you get the single digit answer)
CDF026
- Which of the following ions are diamagnetic
 Tb^{2+} , Ce^{4+} , Yb^{2+} , Lu^{3+} , Pr^{2+} , Nd^{2+} , Pm^{2+} , Sm^{2+} , Gd^{3+}
CDF027
- Number of the property gets increased in interstitial compounds compared to that of the element.
(i) Malleability (ii) Melting point (iii) Hardness (iv) density
CDF028
- Number of ions which gives blue colour in aqueous state :
 V^{4+} , Ni^{2+} , Ti^{3+} , Co^{2+} , Fe^{3+} , Cu^{2+}
CDF029
- Find number of reaction(s) in which no redox change takes place -
 (I) $BaCl_2 + Na_2CrO_4 \xrightarrow{CH_3COOH}$ (II) $K_2Cr_2O_7 + NaOH \longrightarrow$
 (III) $Cr_2O_7^{2-} + NO_3^- \xrightarrow{H^+}$ (IV) $Cr_2O_7^{2-} + C_2H_5OH \xrightarrow{H^+}$
CDF030

JEE (Advanced) Practice Paper

⌈ This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided. ⌋

SECTION-I

- This section contains **FIVE** questions.
- Each question has FOUR options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:
Full Marks : +3, if only the bubble corresponding to the correct option is darkened.
Zero Marks : 0, if none of the bubbles is darkened.
Negative Marks : -1, in all other cases



x, y and z are respectively

- (A) 1, 2, 3
(B) 1, 5, 3
(C) 1, 3, 5
(D) 5, 3, 1

CDF051

- 2.** The transition metal used in X-rays tube is

- (A) Mo (B) Ta
(C) Tc (D) Pm

CDF052

- 3. Transition metals and their compounds catalyse reactions because :**

- (A) They have completely filled s-subshell
(B) They have a comparable size due to poor shielding of d-subshell
(C) They introduce an entirely new reaction mechanism with a lower activation energy
(D) They have variable oxidation states differ by two units

CDF053

4. Which of the following exhibits only +3 oxidation state ?

- (A) Ac (B) Pa
(C) U (D) Th

CDF054

5. Select the ion which is larger than Ce^{3+}

- (A) $\text{Lu}^{3\oplus}$ (B) $\text{Eu}^{3\oplus}$
(C) $\text{Ce}^{4\oplus}$ (D) $\text{La}^{3\oplus}$

CDF055

SECTION-II

- This section contains **FOUR** questions.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4, if only (all) the correct option(s) is (are) chosen.

Partial Marks : +3, if all the four options are correct but **ONLY** three options are chosen.

Partial Marks : +2, if three or more options are correct but **ONLY** two options are chosen, both of which are correct options.

Partial Marks : +1, if two or more options are correct but **ONLY** one option is chosen and it is a correct option.

Zero Marks : 0, if none of the options is chosen (i.e. the question is unanswered).

Negative Marks : -2, in all other cases.

For Example : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

6. The correct statement(s) about transition elements is/are
- (A) the most stable oxidation state is +3 and its stability decreases across the period
- (B) transition elements of 3d-series have almost same atomic sizes from Cr to Cu
- (C) the stability of +2 oxidation state increases across the period
- (D) some transition elements like Ni, Fe, Cr may show zero oxidation state in some of their compounds

CDF056

7. Which of the following statements concern with d-block metals?
- (A) compounds containing ions of transition elements are usually coloured
- (B) Zinc has lowest melting point among 3d-series elements
- (C) they show variable oxidation states, which differ by two units only
- (D) they easily form complexes

CDF057

8. Amphoteric oxide(s) is/are
- (A) Al_2O_3 (B) SnO (C) ZnO (D) Fe_2O_3

CDF058

9. Identify the correct statement among the following.
- (A) order of Atomic Radii $\text{Eu} > \text{Ce} > \text{Nd} > \text{Ho}$
- (B) Sm^{3+} ion show colour
- (C) Pm is radioactive lanthanide
- (D) Cerium shows '+8' oxidation state.

CDF059

SECTION-III

- This section contains **FOUR** questions.
- Each question has matching lists. The codes for the lists have choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct
- For each question, marks will be awarded in one of the following categories :
 Full Marks : +3, if only the bubble corresponding to the correct option is darkened.
 Zero Marks : 0, if none of the bubbles is darkened.
 Negative Marks : -1, in all other cases.

- 10. Column-I**
 (P) Cr_2O_3
 (Q) CrO_3
 (R) Fe_3O_4
 (S) N_2O
 Select correct code for matching -
Code :
- | | | | | |
|-----|---|---|---|---|
| | P | Q | R | S |
| (A) | 2 | 4 | 3 | 1 |
| (B) | 2 | 3 | 4 | 1 |
| (C) | 4 | 2 | 3 | 1 |
| (D) | 4 | 3 | 1 | 2 |
- Column-II**
 (1) Neutral oxide
 (2) Amphoteric oxide
 (3) Mix oxide
 (4) Acidic oxide
- CDF060**
- 11. Column-I**
(Metal ion of 3d-series)
 (P) Ni^{2+}
 (Q) Cr^{2+}
 (R) V^{2+}
 (S) Ti^{4+}
 Select correct code for matching -
Code :
- | | | | | |
|-----|---|---|---|---|
| | P | Q | R | S |
| (A) | 4 | 2 | 1 | 3 |
| (B) | 3 | 1 | 2 | 4 |
| (C) | 4 | 1 | 2 | 3 |
| (D) | 1 | 2 | 4 | 3 |
- Column-II**
(Characteristic)
 (1) produce blue aq. solution
 (2) half filled t_{2g} orbitals in octahedral complex
 (3) diamagnetic ion
 (4) calculated $\mu = 2.84$ B.M. (spin only)
- CDF061**
- 12. Column-I (catalyst)**
 (A) TiCl_4
 (B) PdCl_2
 (C) Pt/PtO_2
 (D) Cu
 (A) $A \rightarrow R, B \rightarrow S, C \rightarrow P, D \rightarrow Q$
 (C) $A \rightarrow S, B \rightarrow R, C \rightarrow P, D \rightarrow Q$
- Column-II (Used)**
 (P) Adam's catalyst in reduction
 (Q) In preparation of $(\text{CH}_3)_2\text{SiCl}_2$
 (R) Used as the Ziegler-Natta catalyst in polythene production
 (S) Wacker process for converting C_2H_4 to CH_3CHO
 (B) $A \rightarrow Q, B \rightarrow S, C \rightarrow P, D \rightarrow R$
 (D) $A \rightarrow P, B \rightarrow Q, C \rightarrow R, D \rightarrow S$
- CDF062**

13. List I

- (1) Reactivity of Ln with acids.
 (2) MC_2 Lanthanides on hydrolysis.
 (3) Ln reacts with water
 (4) Ln Burns in presence of O_2
 (A) $1 \rightarrow \text{A}, 2 \rightarrow \text{B}, 3 \rightarrow \text{C}, \text{A}, 4 \rightarrow \text{D}$
 (C) $1 \rightarrow \text{A}, 2 \rightarrow \text{B}, 3 \rightarrow \text{C}, 4 \rightarrow \text{A}$

List II

- (A) Evolve H_2
 (B) C_2H_2 gas
 (C) $\text{Ln}(\text{OH})_3$
 (D) Ln_2O_3
 (B) $1 \rightarrow \text{B}, 2 \rightarrow \text{A}, 3 \rightarrow \text{C}, \text{A}, 4 \rightarrow \text{D}$
 (D) $1 \rightarrow \text{A}, 2 \rightarrow \text{B}, 3 \rightarrow \text{A}, 4 \rightarrow \text{D}$

CDF063

SECTION-IV

- This section contains **TWO** paragraphs.
- Based on each paragraph, there are **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D) **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
 Full Marks : +3, if only the bubble corresponding to the correct answer is darkened.
 Zero Marks : 0, in all other cases.

Paragraph for Question No. 14 & 15

Pyrolusite (A) when fused with alkali in the presence of O_2 , green compound (B) is produced. (B) is converted into (C) in presence of acidic medium.

14. (B) on reaction with acid gives (C) & (C) on reaction with alkali gives (B) what is (B) & (C) respectively.
 (A) $\text{KMnO}_4, \text{K}_2\text{MnO}_4$ (B) $\text{K}_2\text{MnO}_4, \text{KMnO}_4$
 (C) $\text{K}_2\text{MnO}_4, \text{MnO}_2$ (D) $\text{KMnO}_4, \text{MnO}_2$

CDF064

15. Select the correct statements :
 (A) (C) is tetrahedral & diamagnetic
 (B) (B) is tetrahedral & paramagnetic
 (C) (C) produce dimanganese hepta oxide (oily liquid) with conc. H_2SO_4
 (D) All are correct

CDF065

Paragraph for Question No. 16 & 17

In the lanthanide series with increasing atomic number, in general, there is a progressive decrease in the size from Lanthanum to Lutetium and regular decreases in ionic size from La^{3+} to Lu^{3+} . This decrease in size is known as lanthanide contraction. The general electronic configuration of these elements is $4f^{1-14} 5d^{0-1} 6s^2$. In these elements the added electron enters the deep-seated f-orbitals. Due to very poor shielding effect of (n-2)f electrons, they exert very little screening effect on the outermost $6s^2$ electrons and therefore experiences considerable pull by the nucleus. Hence, with increasing atomic number, the enhanced nuclear charge leads to contraction in the size of atoms and ions. The atomic volumes of Europium and Ytterbium are unexpectedly large. The large atomic size of Eu and Yb suggest weaker bonding in the solid elements. Both these elements have only two electrons extra than the stable configurations (half filled, f^7 , and completely filled, f^{14}), hence they utilise two electrons in metallic bonding as in the case with Barium.

16. Number of electron present in f-subshell in Gd.
(A) 6 (B) 7 (C) 8 (D) 10 CDF066
17. Which of the following option is/are true.
(A) $\text{La}(\text{OH})_3$ is more basic than $\text{Lu}(\text{OH})_3$
(B) $\text{Lu}(\text{OH})_3$ is more basic than $\text{La}(\text{OH})_3$.
(C) Atomic volume of Europium and Ytterbium are small.
(D) Thermal decomposition temperature of nitrates of Lanthanides increases on moving left to right CDF067

SECTION-V

- This section contains **THREE** questions.
 - The answer to each question is a **NUMERICAL VALUE**.
 - For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct).
 - Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +3, if ONLY the correct numerical value is entered as answer.
Zero Marks : 0, in all other cases.
-
18. Define the oxidation states of Mn in product of the given reaction

$$3\text{K}_2\text{MnO}_4 + 2\text{H}_2\text{O} + 4\text{CO}_2 \rightarrow 2\text{X} + \text{Y} + 4\text{KHCO}_3$$
 If the oxidation state of Mn in product X and Y are n_1 and n_2 respectively. Then find out the value of $(n_1 + n_2) -$ CDF068
19. Total no. of moles of Mohr's salt are required for per mole of dichromate ions during volumetric analysis. CDF069
20. Percentage of lanthanide in Misch metal. (If your answer is 50% then mark your answer as 50). CDF070

ANSWER KEY

EXERCISE - O

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	A	B	B	D	A	C	A	A	C	C
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	B	B	A	A	C	B	B	BCD	AB	AB
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	BC	ABC	ABC	AB	AB	ABC	D	B	C	A
Que.	31									
Ans.	D									

EXERCISE - S

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	3	2	5	8	9	7	3	6	4	3
Que.	11	12	13	14	15	16				
Ans.	4	3	2	3	3	7				

EXERCISE - JEE (Main) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	1	2	3	3	2	2	4	2	1	1
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	4	1	5	4	2	3	2	4	3	1

EXERCISE - JEE (Advanced) PYQ

Que.	1	2	3	4	
Ans.	ABC	BCD	4	6	

JEE (Main) Practice Paper

Section-A	Q.	1	2	3	4	5	6	7	8	9	10
	A.	1	4	2	1	1	4	1	2	3	2
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	1	1	1	2	4	4	4	3	2	2
Section-B	Q.	1	2	3	4	5	6	7	8	9	10
	A.	3	8	10	0	3	6	3	3	2	3

JEE (Advanced) Practice Paper

Section-I	Q.	1	2	3	4	5	
	A.	B	A	C	A	D	
Section-II	Q.	6	7	8	9		
	A.	ACD	ABD	ABC	ABC		
Section-III	Q.	10	11	12	13		
	A.	A	C	A	A		
Section-IV	Q.	14	15	16	17		
	A.	B	D	B	A		
Section-V	Q.	18	19	20			
	A.	11	6	95			