CHEMISTRY

BOOKS - MODERN PUBLISHERS CHEMISTRY (HINGLISH)

REDOX REACTIONS

Solved Examples

1. Identify the species undergoing oxidation and reduction.

a. $H_2S(g) + Cl_2(g) \rightarrow 2HCl(g) + S(s)$

b. $3Fe_3O_4(s) + 8Al(s) \rightarrow 9Fe(s) + 4Al_2O_3(s)$

c. $2Na(s) + H_2(g) \rightarrow 2NaH(s)$

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2. Identify the oxidant and reduction in the following reactions.

(a) $Zn(s) + \frac{1}{2}O_2(g) \rightarrow ZnO(s)$

(b) $CH_4(g) + 4Cl_2(g) \rightarrow \mathrm{CCl_4}(g) + 4HCl(g)$

(c) $I_2(aq) + 2S_2O_3^{2-}(aq) \rightarrow 2I^-(aq) + S_4O_6^{2-}(aq)$

(d) $Zn(s) + 2H^+(aq) \rightarrow Zn^{2+} + (aq) + H_2(g)$

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3. Justify that reaction :

$2Na(s) + H_2(g) \rightarrow 2NaH(s)$ is redox reactions.

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4. Calculate the oxidation number of sulphur in the following molecules ions .

(a) H_2S (b) H_2SO_3 (c) SO_4^{2-}

(d) $Na_2S_2O_3$ (e) $S_2O_7^2$ (f) H_2SO_4

(g) $S_2O_4^{2-}$.

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5. What is the oxidation number of the underlined atoms in each of the following molecules / ions ?

(a) $\underline{Cl}O_3^-$ (b) $\underline{Br}F_3$ (c) $\underline{C}H_4$ (d) $\underline{C}_6H_{12}O_6$ (e) $Na_2\underline{B}_4O_7$

(f) $Na_4\left[Fe(\underline{C}N)_6\right](g)\underline{N}_2H_4$.

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6. Calculate the oxidation number of (i) Fe in Fe_3O_4 (ii) S in $Na_2S_4O_6$ (iii) Pb in Pb_3O_4 (iv) N in $(NH_4)_2SO_4$.

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7. Calculate the oxidation number of carbon in the following compounds .

$C_2H_2, CO_2, C_2H_6, CH_3OH, HCOOH, CH_2O$.

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8. Give examples of substances where carbon can exhibit oxidation states from -4 to +4 and nitrogen from -3 to +5.

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9. Calculate the oxidation number of all the atoms in the following compounds and ions :

$CO_2, SiO_2, PbSO_4, ClO_4^-$

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10. Calculate the oxidation number of sulphur in $S_2O_8^{2-}$ ion.

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11. Identify the oxidant and reductant in the following reactions:

a.

$10H^{\oplus}(aq) + 4Zn(s) + NO_3^{\ominus}(aq) \rightarrow 4Zn^{2+}(aq) + NH_4^{\oplus}(aq) + 3H_2O(l)$

b. $I_2(g) + H_2S(g) \rightarrow 2HI(g) + S(s)$

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12. Determine the change in the oxidation number of S in H_2S and SO_2 in the following industrial reaction:

$2H_2S(g) + SO_2(g) \rightarrow 3S(s) + 2H_2O(g)$

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13. Justify that the reaction

$2Cu_2O_s + Cu_2S(s) \rightarrow 6Cu(s) + SO_2(g)$ a redox reaction. Identify the species oxidised / reduced. Which acts as an oxidanat and which acts as a reductant?

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14. Write formulas for the following compounds

(i) Mercury (II) chloride (ii) Nickel (II) sulphate

(iii) Tin(IV) oxide (iv) Thallium (I) sulphate

(v) Iron (III) sulphate (vi) Chromium (III) oxide.

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15. Using stock notation represent the following compounds :

(i) $HAuCl_4$ (ii) Tl_2O (iii) FeO (iv) Fe_2O_3

(v) CuI (vi) CuO (vii) MnO (viii) MnO_2

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16. Which one of two , ClO_2^- or ClO_4^- shows disproportionation reaction and why ?

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17. Write the disproportionation reactions of the following species :

(i) ClO^- (ii) ClO_3^- (iii) Cl^- (iv) ClO_3^-

(v) ClO_4^- (vi) Tl^+

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18. Classify the following redox reactions:

a. $N_2(g) + O_2(g) \rightarrow 2NO(g)$

b. $2Pb(NO)_3(s) \rightarrow 2PbO(s) + 2NO_2(g) + \frac{1}{2}O_2(g)$

c. $NaH(s)H_2O(l) \rightarrow NaOH(aq) + H_2(g)$

d. $2NO_2(g) + 2\overset{\ominus}{O}H(aq) \rightarrow NO_2^{\ominus}(aq) + NO_3^{\ominus}(aq) + H_2O(l)$

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19. Copper reacts with nitric acid . A brown gas is formed and the solution turns blue. The equation may be written as :

$Cu + NO_3^- \rightarrow NO_2 + Cu^{2+}$

Balance the equation by oxidation number method.

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20. Balance the following equations :

(i) $Fe_2O_3 + C \rightarrow Fe + CO$

(ii) $Fe^{2+} + Cr_2O_7^{2-} + H^+ \rightarrow Fe^{3+} + Cr^{3+} + H_2O$

(iii) $Zn + HNO_3 \rightarrow NO_2 + H_2O$

(iv) $C_6H_6 + O_2 \rightarrow CO_2 + H_2O$

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21. Permanganate ion reacts with bromide ion in basic medium to give manganese dioxide and bromate ion. Write the balanced ionic equation for the reaction.

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22. Balance the following reactions by oxidation number method :

(i) $FeS_2 + O_2 \rightarrow Fe_2O_3 + SO_2$

(ii) $MnO_4^- + Fe^{2+} \rightarrow \underset{\text{(in acidic medium)}}{Mn^{2+} + Fe^{3+}}$

(iii) $Cr(OH)_3 + IO_3^- \rightarrow I^- + \underset{\text{(in basic medium)}}{CrO_4^{2-}}$

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23. How many grams of potassium dichromate are required to oxidise 20.0 g of Fe^{2+} in $FeSO_4$ to Fe^{3+} if the reaction is carried out in an acidic solution ?

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24. How many milliliters of 0.125 M $KMnO_4$ are required to react completely with 25.0 mL of 0.250 M $FeSO_4$ solution in the acidic medium ?

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25. How many milliliters of 0.025 M $K_2Cr_2O_7$ are required to react completely with 25.0 mK of 0.20 M solution of $FeSO_4$?

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26. Determine the volume of $\frac{M}{10}KMnO_4$ solution required to react completely with 25.0 mL of M/5 oxalic acid solution.

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27. 1.80 g of impure sample of oxalate was dissolved in water and the solution made to 250 mL. On titration 20 mL of this solution required 30 mL of M/50 $KMnO_4$ solution . Calculated the percentage purity of the sample.

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28. 2.48 g of hydrated sodium thiosulphate $(Na_2S_2O_3.xH_2O)$ was dissolved per litre of the solution. 25 mL of this solution required 12.5 mL of M /100 iodine solution . Determine the value of x.

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29. Write the half reactions for the following redox reactions:

(a) $2Fe^{3+}_{(aq.)} + 2I^{-}_{(aq.)} \rightarrow 2Fe^{2+}_{(aq.)} + I_{2(aq.)}$

(b) $Zn_{(s)} + 2H^{+}_{(aq.)} \rightarrow Zn^{2+}_{(aq.)} + H_{2(g)}$

(c) $Al_{(s)} + 3Ag^{+}_{(aq.)} \rightarrow Al^{3+}_{(aq)} + 3Ag_{(s)}$

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30. Write the half cell reaction and the overall cells reaction for the electrochemical cell :

$Zn\left|Zn^{2+}(1.0M)\right|\left|Pb^{2+}(1.0M)\right|Pb$

Calculate the standard e.m.f for the cell if standard electrode potentials

(reduction) for $Pb^{2+}|Pb$ and $Zn^{2+}|Zn$ electrodes are -0.126 V and -0.763 V respectively.

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31. I_2 and Br_2 are added to a solution containing Br^- and I^- ions. What reaction will occur if,

$I_2 + 2e^- \rightarrow 2I^-, \quad E^0 = +0.54V$ and $Br_2 + 2e^- \rightarrow 2Br^-, \quad E^0 = +1.09V$?

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32. What will be the spontaneous reaction between the following half cell reactions ?

(i) $Cr^{3+}(aq) + 3e^- \rightarrow Cr(s) \quad E^\circ = -0.74V$

(ii) $MnO_2(s) + 4H^+ + 2e^- \rightarrow Mn^{2+}(aq) + 2H_2O(l) \quad E^\circ = 1.28V$

Calculate E°_{cell}

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33. The standard electrode potential corresponding to the reaction : $Au^{3+}(aq) + 3e^- \rightarrow Au(s)$ is 1.42 V . Predict (i) if gold can be can be dissolved in 1 M HCl solution and (ii) on passing hydrogen gas through gold solt solution, metallic gold will be precipitated or not .

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34. Is it possible to store

(i) Copper sulphate in a zinc vessel ?

(ii) Copper sulphae in a silver vessel ?

(iii) Copper sulphate in a nickel vessel ?

(iv) Copper sulphate in a gold vessel

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35. Give two examples each of oxidants which can oxidize.

(i) $Cl^-(aq) \text{to} \quad Cl_2(g)$

(ii) $Fe(s)$ to $Fe^{2+}(aq)$

(iii) $I^-(aq)$ to $I_2(aq)$

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Practice Problems

1. What is the oxidation number of nitrogen in (a) nitric acid (b) nitrous acid (c) nitric oxide (d) nitrous oxide (e) ammonia (f) N_2 ?

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2. What is the oxidation number of the underlined atoms in the following ?

$K\underline{Mn}O_4, Na_2\underline{Cr}_2O_7, \underline{Fe}_3O_4, K\underline{Cl}O_3, \underline{P}O_4^{3-}\ \underline{C}Cl_4$

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3. What are the oxidation numbers of the following ?

(a) Cr in CrO_4^{2-} (b) C in $C_6H_{12}O_6$

(c) I in IF_7 (d) O in O_3

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4. Determine the oxidation number of the atom in bold in the following species :

$BH_3, BF_3, BrO_4^-, HPO_4^{2-}, S_2O_3^{2-}, SiH_4$

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5. Determine the oxidation number of Cl in $HCl, HClO, ClO_4^-$ and Ca (OCl) Cl and ClO_2 .

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6. Calculate the oxidation number of all the atoms in the following well known oxidants.

$KMnO_4, K_2Cr_2O_7, KClO_4$

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7. Calculate the oxidation number of oxygen in the following : OF_2, O_2, Na_2O_2 and CH_3COOH

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8. Calculate the oxidation number of C in the following : $C_2H_6, C_4H_{10}, CO, CO_2$ and HCO_3^-

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9. Identify the oxidant and resultants in the following reactions:

(a) $CH_4(g) + 4Cl_2(g) \rightarrow CCl_4(g) + 2HCl(g)$

(b)

$C_2H_4O_4(aq) + 2H^+ + MnO_2(s) \rightarrow Mn^{2+}(aq) + 2CO_2(g) + 2H_2O(l)$

(c) $I_2(aq) + S_2O_3^{-2}(aq) \rightarrow 2I^-(aq) + S_4O_6^{2-}(aq)$

(d) $Cl_2(g) + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$

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10. A 16.4 ml volume of 0.14 M $KMnO_4$ solution is required to oxidise 20.0 ml of $FeSO_4$ solution in acidic medium . What is the concentration of $FeSO_4$ solution ?

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11. Calculate E° For the cell :

$Al|Al^{3+}(1M)||Cu^{2+}(1M)Cu$

Given $E^{\circ}\left(Al^{3+} \mid Al\right) = -1.66V$ and

$E^{\circ}\left(Cu^{2+} \mid Cu\right) = 0.34V$

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12. The standard electrode potentials of some electrodes are :

Electrode	Electrode	$Zn^{2+} \mid Zn$	$Cd^{2+}\vert\mathrm{Cd}$	$Ag^{+}\vert Ag$	$Fe^{2+}\vert\mathrm{Fe}$
	$E^{\circ}(V)$	-0.76	-0.40	$0.80V$	$-0.44V$

Which of the following cells are feasible and give their $E^{\circ}(cell)$?

(i) $Zn\left|Zn^{2+}\right|\left|Cd^{2+}\right|Cd$ (ii) $Fe\left|Fe^{2+}\right|\left|Zn^{2+}\right|Zn$

(iii) $Cd\left|Cd^{2+}\right| \mid Ag^{+}\left|Ag\right.$ (iv) $Fe\left|Fe^{2+}\right| \mid Ag^{+}\left|Ag\right.$

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13. An iron wire is immersed in a solution containing $ZnSO_4, NiSO_4$. When the concentration of each salt is 1 M, predict giving reasons which of the following reactions is likely to proceed ?

(i) Iron reduced Zn^{2+} ions

(ii) Iron reduces Ni^{+} ions . Given

$E^{\circ}\left(Zn^{2+} \mid Zn\right) = -0.76V, E^{\circ}\left(Fe^{2+} \mid Fe\right) = -0.44V,$ and $E^{\circ}(Ni \mid$

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14. Can a solution of 1 M copper sulphate be stored in a vessel made of nickel metal ? Given that $E_{Ni^{-2}/Ni} = -0.25$ volt and $E^{\circ}_{Cu^{-2}/Cu} = +0.34$ volt

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15. Can chlorine gas be stored in a copper cylinder ? Given $E^{\circ}\left(Cu^{2+} \mid Cu\right) = -0.34V$ and $E^{\circ}\left(Cl^{-} \mid Cl\right) = 1.36V$

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16. Why blue colour of $CuSO_4$ solution gets discharged when zinc rod is dipped in it ? Given, $E^{\circ}_{Cu^{+2}/Cu} = 0.34V$ and $E^{\circ}_{Zn^{+2}/Zn} = -0.76V$

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17. A copper wire is dipped in silver nitrate solution in beaker A and a silver wire is dipped in a solution of copper sulphate kept in beaker B. If the standard electrode potential for

$Cu^{2+} + 2e^- \rightarrow Cu$ is $+0.34$and for

$Ag^+ + e^- \rightarrow Ag$ is 0.80 V .

Given $E^\circ\left(Ni^{2+} \mid Ni\right) = -0.25V$ and $E^\circ\left(Cu^{2+} \mid Cu\right) = 0.34V$

Predict in which beaker the ions present will get reduced ?

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Conceptual Questions

1. Arrange the following molecules in the decreasing order of oxidation state (+ve to -ve) of nitrogen : NO_2, NH_3, HN_3, NO_2^-, N_2H_4.

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2. Can the reaction, $Cr_2O_7^{2-} + H_2O \rightarrow 2CrO_4^{2-} + 2H^+$ be regarded as a redox reaction ?

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3. Calculate the oxidatin number of Fe in

(i) Fe_3O_4 (ii) $Fe_4\left[Fe(CN)_6\right]_3$

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4. Split the following redox reactions in the oxidation and reduction half reactions :

(i) $2K(s) + Cl_2(g) \rightarrow 2KCl(s)$

(ii) $2Al(s) + 3Cu^{2+}(aq) \rightarrow 2Al^{3+}(aq) + 3Cu(s)$

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5. Nitric acid acts only as an oxidising agent while nitrous acid acts both as an oxidising as well as reducing. Explain.

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6. Calculate the oxidation number of the underlined element in

(a) $\underline{V}O_2^+$ (b) $\underline{U}O_2^{2+}$ (c) $Ba_2\underline{Xe}O_6$ (d) $K_4\underline{P}_2O_7$ (e) $\underline{K}_2\underline{S}$

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7. Which of the following equations represent oxidation reduction reaction ? Identify each oxidising agent and each reducing agent.

$$(a)\quad KOH + H_2O_2 \longrightarrow KHO_2 + H_2O$$
$$(b)\quad Cr_2O_7^{2-} + 2OH^- \longrightarrow 2CrO_4^{2-} + H_2O$$
$$(c)\quad K + O_2 \longrightarrow 2CrO_4^{2-} + H_2O$$
$$(d)\quad Ca(HCO_3)_2 \longrightarrow caCO_3 + CO_2 + H_2O$$

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8. Identify the oxidsing and reducing agent agent in the following reaction :

$$Fe^{2+} + 2H^{+} + NO_3^{-} \rightarrow Fe^{3+} + NO_2 + H_2O$$

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9. Nitric acid is an oxidising agent and reacts with PbO but it does not react with PbO_2. Explain why?

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10. Predict the maximum and minimum oxidation states for (i) Cl (ii) Ti

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11. The standard electrode potential of four metallic elements (A, B, C and D) are + 0.80, –0.76, + 0.12 and +0.34 V respectively. Arrange them in order

of decreasing electropositive character

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12. An iron rod is immersed in a solution containing $NisO_4$ and $ZnSO_4$. When the concentration of each salt is 1 M, predict giving reasons which of the following reactions is likely to proceed ?

(i) Iron reduces Zn^{2+} ions (ii) Iron reduces Ni^{2+} ions

Given :

$E^{\circ}_{(Zn^{2+}|Zn)} = -0.76V, E^{\circ}_{(Fe^{2+}|Fe)} = 0.44V$ and $E_{(Ni^{2+}|Ni)^{\circ}} = -0.25V$

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13. Which of the following reactions are not feasible ?

$(a)\quad Zn(s) + 2Ag^{+}(aq) \longrightarrow Zn^{2+}(aq) + 2Ag(s)$

$(b)\quad I_2(s) + 2Br^{-}(aq) \longrightarrow 2I^{-}(aq) + Br_2$

$(c)\quad 2Fe^{3+}(aq) + 2I^{-}(aq) \longrightarrow I_2(aq) + 2Fe^{2+}(aq)$

$(d)\quad 2Ag + 2H^{+}(aq) \longrightarrow H_2 + 2Ag^{+}(aq)$

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14. At what concentration of Cu^{2+} (aq) will its electrode potential becomes equal to its standard electrode potential ?

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15. How does Cu_2O act as both oxidant and redcutant ? Explain with proper reactions showing the change of oxidation number in each case.

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16. A solution of silver nitrate was stirred with an iron rod. Will it cause any change in the concentration of silver and nitrate ions ?

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17. What is the oxidation number of N in HNO_4 ?

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18. Calculate the oxidation number of nickel in $Ni(CO)_4$ iron in $Fe(CO)_5$ and carbon in CH_2O.

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19. At what concentration of Zn^{2+} (aq) will its electrode potential becomes equal to its standard electrode potential ?

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20. Given that the standard potentials $((E^\circ))$ of CU^{2+}/Cu and CU^{+}/Cu are 0.34V and 0.522V respectively , the E° of CU^{2+}/CU^{+} is :

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Ncert File Solved Textbook Exercises

1. Assign oxidation number to the underlined elements in each of the following species:

a. NaH_2PO_4

b. $NaH\underline{S}O_4$

c. $H_4\underline{P_2}O_7$

d. $K_2\underline{Mn}O_4$

e. $\underline{Ca}O_2$

f. $Na\underline{B}H_4$

g. $H_2\underline{S_2}O_7$

h. $KAl(\underline{S}O_4)_2.12H_2O$

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2. What are the oxidation numbers of the underlined elements in each of the following and how do you rationalize your result?

(a) KI_3

(b) $H_2S_4O_6$

(c) Fe_3O_4

(d) CH_3CH_2OH

(e)CH_3COOH

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3. Justify that the following reaction are redox reactions:

a. $CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(g)$

b. $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$

c. $4BCl_3(g) + 3LiAlH_4(s) \rightarrow 2B_2H_6(g) + 3LiCl(s) + 3AlCl_3(s)$

d. $2K(s) + F_2(g) \rightarrow 2K^{\oplus}F^{\Theta}(s)$

e. $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$

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4. Fluorine reacts with ice and results in the change:

$H_2O(s) + F_2(g) \rightarrow HF(g) + HOF(g)$

Justify that this reaction is a redox reaction.

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5. Calculate the oxidation number of sulphur, chromium, and nitrogen in H_2SO_5, $Cr_2O_7^{2-}$ and NO_3^{Θ}. Suggest the structure of these compounds. Count for the fallacy.

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6. Write formulas for the following compounds

(a) Mercury (II) chloride

(b) Nickel (II) sulphate

(c) Tin (IV) oxide

(d) Thallium (I) sulphate

(e) Iron (III) sulphate

(f) Chromium (III) oxide

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7. Consider the reactions :

(a) $6CO_2(g) + 6H_2O(l) \rightarrow C_6H_{12}O_6(aq) + 6O_2(g)$

(b) $O_s(g) + H_2O_2(l) \rightarrow H_2O(l) + 2O_2(g)$

Why it is more appropriate to write these reactions as :

(a) $6CO_2(g) + 12H_2O(l) \rightarrow C_6H_{12}O_6(aq) + 6H_2O(l) + 6O_2(g)$

(b) $O_3(g) + H_2O_2(l) \rightarrow H_2O(l) + O_2(g) + O_2(g)$

Also suggest a technique to investigate the path of the above (a) and (b) redox reactions .

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8. The compound AgF_2 is unstable compound . However , if formed , the compound acts as a very strong oxidising agent . Why ?

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9. Whenever a reaction between an oxidising agent and a reducing agent is carried out, a compound of lower oxidation state is formed if the

reducing agent is in excess and a compound of higher oxidation state is formed if the oxidising agent is in excess. Justify this statement giving three illustrations.

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10. How do you count for the following observations ?

(a) Though alkaline potassium permanganate and acidic potassium permanganate both are used as oxidants, yet in the manufacture of benzoic acid from toluene we use alcoholic potassium permanganate as an oxidant. Why ? Write a balanced redox equation for the reaction.

(b) When concentrated sulphuric acid is added to an inorganic mixture containing chloride, we get colourless pungent smelling gas HCl, but if the mixture contains bromide then we get red vapour of bromine. Why ?

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11. Identify the substance oxidised, reduced , oxidising agent and reducing agent for each of the following reactions :

(a) $2AgBr(s) + C_6H_6O_2(aq) \rightarrow 2Ag(s) + 2HBr(aq) + C_6H_4O_2(aq)$

(b)

$HCHO(l) + 2\left[Ag(NH_3)_2\right]^{2+}(aq) + 3OH^-(aq) \rightarrow 2Ag(s) + HCOO^-(a$

(c)

$HCHO(l) + 2Cu^{2+}(aq) + 5OH^-(aq) \rightarrow Cu_2O(s) + HCOO^-(aq) + 3H$

(d) $N_2H_4(l) + 2H_2O_2(l) \rightarrow N_2(g) + 4H_2O(l)$

(e) $Pb(s) + PbO_2(s) + 2H_2SO_4(aq) \rightarrow 2PbSO_4(s) + 2H_2O(l)$

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12. Consider the reaction:

$2S_2O_3^{2-}(aq) + I_2(s) \rightarrow S_4O_6^{2-}(aq) + 2I^{\Theta}(aq)$

$2S_2O_3^{2-}(aq) + 2Br_2(l) + 5H_2O(l) \rightarrow 2SO_4^{2-}(aq) + 4Br^{\Theta}(aq) + 10H^{\oplus}(a$

Why does the same reductant, thiosulphate, react differently with iodine and bromine?

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13. Justify giving reaction that among halogens, fluorine is the best oxidant and among hydrohalic compounds, hydroiodic acid is the best reductant.

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14. Why does the following reaction occur?

$XeO_6^{4-}(aq) + 2F^{\Theta}(aq) + 6H^{\oplus}(aq) \rightarrow XeO_3(g) + F_2(g) + 3H_2O(l)$

What conclusion about the compound Na_4XeO_6 (of which XeO_6^{4-} is a part) can be drawn from the reaction?

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15. Consider the reactions:

a.

$H_3PO_2(aq) + 4AgNO_3(aq) + 2H_2O(l) \rightarrow H_3PO_4(aq) + 4Ag(s) + 4HNO$

b.

$H_3PO_2(aq) + 2CuSO_4(aq) + 2H_2O(l) \rightarrow H_3PO_4(aq) + 2Cu(s) + H_2SO$

c.

$C_6H_5CHO(l) + 2\left[Ag(NH_3)_2\right]^{\oplus}(aq) + 3\overset{\Theta}{O}H(aq) \rightarrow C_6H_5COO^{\Theta}(aq) + 2$

d. $C_6H_5CHO(l) + 2Cu^{2+}(aq) + 5\overset{\Theta}{O}H(aq) \rightarrow$ No change observed

What inference do you draw about the behaviour of $Ag^{\oplus}$ and Cu^{2+} from these reaction?

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16. Balance the following redox reactions by ion electron method:

a. $MnO_4^{\Theta}(aq) + I^{\Theta}(aq) \rightarrow MnO_2(s) + I_2(s)$ (in basic medium)

b. $MnO_4^{\Theta}(aq) + SO_2(g) \rightarrow Mn^{2+}(aq) + HSO_4^{\Theta}(aq)$ (in acidic solution)

c. $H_2O_2(aq) + Fe^{2+}(aq) \rightarrow Fe^{3+}(aq) + H_2O(l)$ (in acidic solution)

d. $Cr_2O_7^{2-} + SO_2(g) \rightarrow Cr^{3+}(aq) + SO_4^{2-}(aq)$ (in acidic solution)

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17. Balance the following equations in basic medium by ion-electron method and oxidation number methods and identify the oxidising agent and the reducing agent.

(a) $P_4(s) + OH^-(aq) \rightarrow PH_3(g) + HPO_2^-(aq)$

(b) $N_2H_4(1) + ClO_3^-(aq) \rightarrow NO(g) + Cl^-(g)$

(c) $Cl_2O_7(g) + H_2O_2(aq) \rightarrow ClO_2^-(aq) + O_2(g) + H^+$

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18. What sort of informations can you draw from the following reaction?

$(CN)_2(g) + 2\overset{\Theta}{O}H(aq) \rightarrow CN^{\Theta}(aq) + CNO^{\Theta}(aq) + H_2O(l)$

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19. The Mn^{3+} ion is unstable in solution and undergoes disproportionation reaction to give Mn^{+2}, MnO_2, and $H^{\oplus}$ ion. Write a balanced ionic equation for the reaction.

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20. Consider the elements :

Ca, Na, I and F

Identify the elements that exhibits only negative oxidation state.

Identify the element that exhibits only positive oxidation state.

Identify the element that exhibits neither the negative nor does the positive oxidation state.

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21. Chlorine is used purify drinking water . Excess of chlorine is harmful . The excess of chlorine is removed by treating with sulphur dioxide . Present a balanced equation for this redox change taking place in water .

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22. Refer to the periodic table given in your book and now answer the following questions:

a. Select the possible non metals that can show disproportionation reaction.

b. Select three metals that can show disproportionation reaction.

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23. In Ostwald's process for the manufacture of nitric acid, the first step involves the oxidation of ammonia gas by oxygen gas to give nitric oxide gas and steam. What is the maximum weight of nitric oxide that can obtained starting only with $10.00g$ of ammonia and $20.00g$ of oxygen?

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24. Using the standard electrode potentials given is the Table 1 predict if the reaction between the following is feasible :

(a) $Fe^{3+}(aq)$ and $I^{-}(aq)$

(b) $Ag^+(aq)$ and $Cu(s)$

(c) $Fe^{3+}(aq)$ and $Cu(s)$

(d) $Ag(s)$ and $Fe^{3+}(aq)$

(e) $Br_2(aq)$ and $Fe^{2+}(aq)$.

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25. Predict the products of electrolysis each of the following :

(i) An aqueous solution of $AgNO_3$ with silver electrodes

(ii) An aqueous solution of $AgNO_3$ with platinum electrodes

(iii) An aqueous solution of H_2SO_4 with platinum electrodes

(ii) An aqueous solution of $CuCl_2$ with platinum electrodes

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26. i) Arrange the following metals in the order in which they displace each other from the solution of their salts.

Al, Cu, Fe, Mg and Zn

ii) Calculate the molarity of sodium carbonate in a solution prepared by dissolving 5.3 g in enough water to form 250 ml of the solution.

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27. Given the standard electrode potentials ,

$K^+ \mid K = -2.93V, Ag^+ \mid Ag = 0.80V,$

$Hg^{2+} \mid Hg = 0.79V$

$Mg^{2+} \mid Mg = -2.37V, Cr^{3+} \mid Cr = -0.74V$

arrange these metals is their increasing order of reducing power .

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28. Depict the galvanic cell in which the reaction $Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$ takes place . Further show :

(i) which of the electrode is negatively charged,

(ii) the carriers of the current in the cell, and

(iii) individual reaction at each electrode.

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Ncert File Solved Ncert Exemplar Problems Multiple Choice Questions Type I

1. Which of the following is not an example of redox reaction?

A. $CuO + H_2 \rightarrow Cu + H_2O$

B. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

C. $2K + F_2 \rightarrow 2KF$

D. $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$

Answer: D

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Ncert File Solved Ncert Exemplar Problems Multiple Choice Questions Type I

1. The more positive the value of E^0, the greater is the tendency of the species to get reduced. Using the standard electrode potential of redox couples given below find out which of the following is the strongest oxidising agent.

E^0 values:

$Fe^{3+}/Fe^{2+} = +0.77, I_2(s)/I^- = +0.54,$

$Cu^{2+}/Cu = +0.34, Ag^+/A = 0.80V$

A. Fe^{3+}

B. $I_2(s)$

C. Cu^{2+}

D. Ag^+

Answer: D

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2. E^{θ} values of some redox couples are given below. On the basis of these values choose the correct option.

E^{θ} values: $Br_2/Br^- = +1.90$

$Ag^+/Ag(s) = +0.80$

$Cu^{2+}/Cu(s) = +0.34, I_2(s)/I^- = +0.54$

A. Cu will reduce Br^-

B. Cu will reduce Ag

C. Cu will reduce I^-

D. Cu will reduce Br_2

Answer: D

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3. Using the standard electrode potential, find out the pair between which redox reaction is not feasible. E° values :

$Fe^{3+}/Fe^{2+} = +0.77, I_2/I^- = +0.54V$

$Cu^{2+}/Cu = +0.34V, Ag^+/Ag = +0.80V$

A. Fe^{3+} and I^-

B. Ag^+ and Cu

C. Fe^{3+} and Cu

D. Ag and Fe^{3+}

Answer: D

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4. Thiosulphate reacts differently with iodine and bromine in the reaction given below

$2S_2O_3^{2-} \rightarrow S_4O_6^{2-} + 2I^-$

$S_2O_3^{2-} + 2Br_2 + 5H_2O \rightarrow 2SO_4^{2-} + 2Br^- + 10H^+$

Which of the following statements justifies the above dual behaviour of thiosulphate?

A. Bromine is a stronger oxidant than iodine.

B. Bromine is a weaker oxidant than iodine.

C. Thiosulphate undergoes oxidation by bromine and reduction by iodine in these reactions.

D. Bromine undergoes oxidation and iodine undergoes reduction in these reactions.

Answer: A

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5. The oxidation number of an element in a compound is evaluated on the basis of certain rules. Which of the following rules is not correct in this respect?

A. The oxidation number of hydrogen is always +1.

B. The algebraic sum of all the oxidation numbers in a compound is zero.

C. An element in the free or the uncombined state bears oxidation number zero.

D. In all its compounds, the oxidation number of fluorine is -1.

Answer: A

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6. In which of the following compounds an element exhibits two different oxidation states ?

A. NH_2OH

B. NH_4NO_3

C. N_2H_4

D. N_3H

Answer: B

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7. Which of the following arrangements represent increaseing oxidation number of the central atom?

A. $CrO_2^-, ClO_3^-, CrO_4^{2-}, MnO_4^-$

B. $ClO_3^- CrO_4^{2-}, MnO_4^-, CrO_2^-$

C. $CrO_2^-, ClO_3^-, MnO_4^-, CrO_4^{2-}$

D. $CrO_4^{2-}. MnO_4^-, CrO_2^-, ClO_3^-$

Answer: A

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8. The largest oxidation number exhibited by an element depends on its outer electronic configuration. With which of the following outer electronic configurations the element will exhibit largest oxidation number?

A. $3d^1 4s^2$

B. $3d^3 4s^2$

C. $3d^5 4s^1$

D. $3d^5 4s^2$

Answer: D

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9. Identify the disproportionation reaction.

A. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

B. $CH_4 + 4Cl_2 \rightarrow \quad CCl_4 + 4HCl$

C. $2F_2 + 2OH^- \rightarrow 2F^- + OF_2 + H_2O$

D. $2NO_2 + 2OH^- \rightarrow NO_2^- + NO_3^- + H_2O$

Answer: D

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10. Which of the following elements does not show disproportionation tendency?

A. Cl

B. Br

C. F

D. I

Answer: C

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Ncert File Solved Ncert Exemplar Problems Multiple Choice Questions Type Ii

1. Which of the following statement (s) is /are not true about the following decomposition reaction.

$2KClO_3 \rightarrow 2KCl + 3O_2$

A. Potassium is undergoing oxidation

B. Chlorine is undergoing oxidation

C. Oxygen is reduced

D. None of species are undergoing oxidation or reduction

Answer: A::B::C::D

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2. Identify the correct statement (s) in reflection to the following reaction :

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

A. Zinc is acting as an oxidant

B. Chlorine is acting as a reluctant

C. Hydrogen ion is acting as an oxidant

D. Zinc is acting as a reluctant

Answer: C::D

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3. The exhibition of various oxidation states by an element is also related to the outer orbital electornic configuration of its atom. Atom(s) having which of the following outermost electronic confjigurations will exhibit more than one oxidation state in its compounds

A. $3s^{-1}$

B. $3d^{1}4s^{2}$

C. $3d^{2}4s^{2}$

D. $3s^{2}3p^{3}$

Answer: B::C::D

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4. Identify the correct statements with reference to the given reaction

$$P_4 + 3OH^- + 3H_2O \rightarrow PH_3 + 3H_2PO_2^-$$

A. Phosphorus undergoing reduction only

B. Phosphorus in undergoing oxidation only

C. Phosphorus is undergoing oxidation as well as reduction.

D. Hydrogen is undergoing neither oxidation nor reduction

Answer: C::D

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5. Which of the following electrodes will act as anodes, when connected to Standard Hydrogen Electrode ?

A. Al/Al^{3+} $E^\circ = -1.66V$

B. Fe/Fe^{2+} $E^\circ = -0.44V$

C. Cu/Cu^{2+} $E^\circ = -0.34V$

D. $F_2(g)2F^-(aq) \quad E^\circ = +2.87V$

Answer: A::B

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Ncert File Solved Ncert Exemplar Problems Short Answer Questions

1. The reaction $CI_2(g) + 2OH^-(aq) \rightarrow CIO^-(aq) + CI^-(aq) + H_2O(l)$ represents the process of bleaching . Identify and name the species that bleaches . the substances due to oxidising action .

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2. MnO_4^{2-} undergoes disproportionation reaction in acidic medium but MnO_4^- does not . Give reason .

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3. PbO and PbO_2 react with HCl according to following chemical equations

$2PbO + 4HCl \rightarrow 2PbCl_2 + 2H_2O$

$PbO_2 + 4HCl \rightarrow PbCl_2 + Cl_2 + 2H_2O$

Why do these compounds differ n their reactivity?

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4. Nitric acid is an oxidising agent and reacts with PbO but it does not react with PbO_2. Explain why?

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5. Write balanced chemical equations for the following reactions :

(i) Permanganate ion $\left(MnO_4^-\right)$ reacts with sulphur dioxide gas in acidic medium to produce Mn^{2+} and hydrogen sulphate ion (Balance by ion electron method)

(ii) Reaction of liquid hydrazine (N_2H_4) with chlorate ion $\left(ClO_3^-\right)$ in basic medium produces nitric oxide gas and chloride ion in gaseous state. (Balance by oxidation number method)

(iii) Dichlorine heptaoxide (Cl_2O_7) in gaseous state combines with an aqueous solution of hydrogen peroxide in acidic medium to give chlorite ion $\left(ClO_2^-\right)$ and oxygen gas , (Balance by ion electron method)

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6. Calculate the oxidation number of phosphorus in the following species.

(a) HPO_3^{2-} (b)PO_4^{3-}

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7. Calculate the oxidation number of each sulphur atom in the following compounds.

(a) $Na_2S_2O_3$ (b)$Na_2S_4O_6$ (c)Na_2SO_3 (d)Na_2SO_4

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8. Balance the following equations by the oxidaiton number method .

(i) $Fe^{2+} + H^+ + Cr_2O_7^{2-} \rightarrow Cr^{3+} + Fe^{3+} + H_2O$

(ii) $I_2 + NO_3^- \rightarrow NO_2 + IO_3^-$

(iii) $I_2 + S_2O_3^{2-} \rightarrow I^- + S_4O_6^{2-}$

(iv) $MnO_2 + C_2O_4^{2-} \rightarrow Mn^{2+} + CO_2$

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9. Identify the redox reaction out of the following reacitons and identify the oxidising and reducing agents in them.

(a) $3HCl(aq) + HNO_3(aq) \rightarrow Cl_2(g) + NOCl(g) + 2H_2O(l)$

(b) $HgCl_2(aq) + 2KI(aq) \rightarrow HgI_2(s) + 2KCl(aq)$

(c) $Fe_2O_3(s) + 3CO(g) \xrightarrow{\Delta} 2Fe(s) + 3CO_2(g)$

(d) $PCl_2(l) + 3H_2O(l) \rightarrow 3HCl(aq) + H_2PO_3(aq)$

(e) $4NH_3(aq) + 3O_2(g) \rightarrow 2N_2(g) + 6H_2O(g)$

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10. Balance the following ionic equations

(i) $Cr_2O_7^{2-} + H^+I^- \rightarrow Cr^{3+} + I_2 + H_2O$

(ii) $Cr_2O_7^{2-} + Fe^{2+} + H^+ \rightarrow Cr^{3+} + Fe^{3+} + H_2O$

(iii) $MnO_4^- + SO_3^{2-} + H^+ \rightarrow Mn^{2+} + SO_4^{2-} + SO_4^{2-} + H_2O$

(iv) $MnO_4^- + H^+ + Br^- \rightarrow Mn^{2+} + Br_2 + H_2O$

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Ncert File Solved Ncert Exemplar Problems Matching Type Questions

1. Match Column I with Column II for the oxidation states of the central atoms .

Column I	Column II
$(i) Cr_2O_7^{2-}$	$(a) +3$
$(ii) MnO_4^-$	$(b) +4$
$(iii) VO_3^-$	$(c) +5$
$(iv) FeF_6^{3-}$	$(e) +7$

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2. Match the items in Column I with relevant items in Column II

Column I	Column II
(i) Ions having positive charge	$(a)+7$
(ii) The sum of oxidation number of all atoms in a neutral molecule	$(b)-1$
(iii) Oxidation number of hydrogen ion(H^+)	$(c)+1$
(iv) Oxidation number of fluorine in NaF	$(d)0$
(v) Ions having negative charge	(e) Cation
	(f) Anion

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Ncert File Solved Ncert Exemplar Problems Assertion And Reason Type Questions

1. Assertion [A]: Among halogens fluorine is the best oxidant.

Reason (R): Fluorine is the most electronegative atom.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true but R is not the correct explanation of A

C. A is true but R is false.

D. Both A and R are false.

Answer: B

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2. Assertion (A) In the reaction between potassium permanganate and potassium iodide, permanganate ions acts as oxidising agent.

Reason (R) Oxidation state of manganese changes from +2 and +7 during the reaction.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true but R is not the correct explanation of A

C. A is true but R is false.

D. Both A and R are false.

Answer: C

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3. Assertion (A) : The decomposition of hydrogen peroxide to form water and oxygen is an example of disproportionation reaction.

Reason (R) : The oxygen of peroxide is in -1 oxidation state and it is converted to zero oxidation state in O_2 and -2 oxidation state in H_2O.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true but R is not the correct explanation of A

C. A is true but R is false.

D. Both A and R are false.

Answer: A

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4. Assertion (A) Redox couple is the combination of oxidised and reduced form of a substance involved in an oxidation or reduction half cell

Reason (R) In the representation $E^{\ominus}_{Fe^{-3+}/Fe^{2+}}$ and $E^{\ominus}_{Cu^{2+}/Cu}$, Fe^{3+}/Fe^{2+} and Cu^{2+}/Cu are redox couples

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true but R is not the correct explanation of A

C. A is true but R is false.

D. Both A and R are false.

Answer: B

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Ncert File Solved Ncert Exemplar Problems Long Answer Questions

1. Explain redox reaction on the basis of electron transfer. Given suitable examples.

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2. On the basis of standard electrode potential values, suggest which of the following reactions would take place ? (Consult the book for E° value)

(i) $Cu + Zn^{2+} \rightarrow Cu^{2+} + Zn$

(ii) $Mg + Fe^{2+} \rightarrow Mg^{2+} + Fe$

(iii) $Br_2 + 2Cl^- + 2Cl^- \rightarrow Cl_2 + 2Br^-$

(iv) $Fe + Cd^{2+} \rightarrow Cd + Fe^{2+}$

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3. Why does fluorine not shown disproportionation reaction?

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4. Write redox couples involved in the reactions (a) to (d) given in quesiton 34.

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5. Find out the oxidation number of chlorine in the following compounds and arrange them in increasing order of oxidation number of chlorine : $NaClO_4, NaClO_3, NaClO, KClO_2, Cl_2O_7, ClO_3, Cl_2O, NaCl, Cl_2, ClO_2$.

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6. Which method can be used to find out the strength of reductant /oxidant in a solution ? Explain with an example.

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Revision Exercies Passage Based Questions

1. Sulphur shows a large number of oxidation states in its compounds such as $H_2S, SO_2, H_2SO_3, Na_2S_2O_3, H_2SO_4, H_2S_2O_7, H_2S_2O_4$ and elemental S . In the reactions of sulphur compounds , the oxidation number of sulphur increases and decreases in different reactions and the

compounds act as reducing and oxidising agents.

(i) $H_2S + HNO_3 \rightarrow NO + S + H_2O$

(ii) $2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$

(iii) $H_2SO_4 + 2HBr \rightarrow 2H_2O + Br_2 + SO_2$

(iv) $S_8 + 12OH^- \rightarrow 4S^{2-} + 2S_2O_3^{2-} + 6H_2O$

What is the oxidation number of sulphur in H_2SO_3 and $H_2S_2O_4$?

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2. Sulphur shows a large number of oxidation states in its compounds such as $H_2S, SO_2, H_2SO_3, Na_2S_2O_3, H_2SO_4, H_2S_2O_7, H_2S_2O_4$ and elemental S . In the reactions of sulphur compounds , the oxidation number of sulphur increases and decreases in different reactions and the compounds act as reducing and oxidising agents.

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(iii) $H_2SO_4 + 2HBr \rightarrow 2H_2O + Br_2 + SO_2$

(iv) $S_8 + 12OH^- \rightarrow 4S^{2-} + 2S_2O_3^{2-} + 6H_2O$

Name the substance which gets (a) reduced and (b) oxidised in reaction (iii)

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3. Sulphur shows a large number of oxidation states in its compounds such as $H_2S, SO_2, H_2SO_3, Na_2S_2O_3, H_2SO_4, H_2S_2O_7, H_2S_2O_4$ and elemental S . In the reactions of sulphur compounds , the oxidation number of sulphur increases and decreases in different reactions and the compounds act as reducing and oxidising agents.

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(ii) $2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$

(iii) $H_2SO_4 + 2HBr \rightarrow 2H_2O + Br_2 + SO_2$

(iv) $S_8 + 12OH^- \rightarrow 4S^{2-} + 2S_2O_3^{2-} + 6H_2O$

What is the change in oxidation number of sulphur in reaction (ii)

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4. Sulphur shows a large number of oxidation states in its compounds such as $H_2S, SO_2, H_2SO_3, Na_2S_2O_3, H_2SO_4, H_2S_2O_7, H_2S_2O_4$ and elemental S . In the reactions of sulphur compounds , the oxidation number of sulphur increases and decreases in different reactions and the compounds act as reducing and oxidising agents.

(i) $H_2S + HNO_3 \rightarrow NO + S + H_2O$

(ii) $2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$

(iii) $H_2SO_4 + 2HBr \rightarrow 2H_2O + Br_2 + SO_2$

(iv) $S_8 + 12OH^- \rightarrow 4S^{2-} + 2S_2O_3^{2-} + 6H_2O$

Name the oxidising agent reducing agent in reaction (i)

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5. Sulphur shows a large number of oxidation states in its compounds such as $H_2S, SO_2, H_2SO_3, Na_2S_2O_3, H_2SO_4, H_2S_2O_7, H_2S_2O_4$ and elemental S . In the reactions of sulphur compounds , the oxidation number of sulphur increases and decreases in different reactions and the compounds act as reducing and oxidising agents.

(i) $H_2S + HNO_3 \rightarrow NO + S + H_2O$

(ii) $2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$

(iii) $H_2SO_4 + 2HBr \rightarrow 2H_2O + Br_2 + SO_2$

(iv) $S_8 + 12OH^- \rightarrow 4S^{2-} + 2S_2O_3^{2-} + 6H_2O$

What type of reaction is reaction (iv) ?

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6. Consider the following table of standard reduction potentials.

Reaction	$E^\circ(V)$
$A^{3+} + 2e^- \rightarrow A^+$	1.36
$B^{2+} + 2e^- \rightarrow B$	0.72
$C^{2+} + 2e^- \rightarrow C$	-0.28
$D^+ + e^- \rightarrow D$	-1.42

What substance is

(i) strongest oxidising agnet ?

(ii) strongest reducing agent ?

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7. Consider the following table of standard reduction potentials.

Reaction	$E^\circ(V)$
$A^{3+} + 2e^- \rightarrow A^+$	1.36
$B^{2+} + 2e^- \rightarrow B$	0.72
$C^{2+} + 2e^- \rightarrow C$	-0.28
$D^+ + e^- \rightarrow D$	-1.42

Which substance can be oxidised by B^{2+} ?

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8. Consider the following table of standard reduction potentials.

Reaction	$E^\circ(V)$
$A^{3+} + 2e^- \rightarrow A^+$	1.36
$B^{2+} + 2e^- \rightarrow B$	0.72
$C^{2+} + 2e^- \rightarrow C$	-0.28
$D^+ + e^- \rightarrow D$	-1.42

Which substance can be reduced by C ?

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9. Consider the following table of standard reduction potentials.

Reaction	$E^\circ(V)$
$A^{3+} + 2e^- \rightarrow A^+$	1.36
$B^{2+} + 2e^- \rightarrow B$	0.72
$C^{2+} + 2e^- \rightarrow C$	-0.28
$D^+ + e^- \rightarrow D$	-1.42

Writer a balanced chemical equation for the overall calculate E° for the reaction.

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10. Consider the following table of standard reduction potentials.

Reaction	$E^\circ(V)$
$A^{3+} + 2e^- \rightarrow A^+$	1.36
$B^{2+} + 2e^- \rightarrow B$	0.72
$C^{2+} + 2e^- \rightarrow C$	-0.28
$D^+ + e^- \rightarrow D$	-1.42

Which of the following reaction will occur ?

(i) $B^{2+} + C \rightarrow B + C^{2+}$

(ii) $C^{2+} + A \rightarrow C + A^{2+}$

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Revision Exercies True Or False Questions

1. Oxidation number of an element can be zero but valency is never zero.

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2. The decomposition of calcium carbonate to calcium oxide and carbon dioxide is a redox reaction .True/False

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3. The reaction : $Cr_2O_7^{2-} + H_2O \Leftrightarrow 2CrO_4^{2-} + 2H^+$ cannot be regarded as a redox reaction . True or False

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4. The oxidation number of each iron atom in Fe_3O_4 is same .

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5. The reaction : $V_2O_5 + 5Ca \rightarrow 2V + 5CaO$ is a metal displacement reaction.

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6. The oxidation number of carbon in CH_2Cl_2 is +4.

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Revision Exercies Fill In The Blanks Questions

1. Oxidant is a substance in which the oxidation number of one of the atoms .....and reductant is a substacne in which oxidation number of one of atoms .....

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2. When the oxidation number of an element is maximum , it can act only as .....

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3. The oxidation number of oxygen in sodium peroxide is .....

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4. In an electrochemical cell .....acts as the negatice pole while .....acts as the positive pole

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5. A compound in which oxidation number of oxygen is +2 is .....

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6. In an electrochemical cell , oxidation occurs at .....and reduction occurs at .....

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7. Stock notation of chromium trioxide is .....

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8. Oxidation number of N is ammonium sulphate is .....

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Revision Exercies Assertion Reason Questions

1. Assertion : Oxidation state of hydrogen in H_2O is +1 .

Reason : CaH_2 is metal hydride and for hydrides hydrogen is assigned

the oxidation state of - 1.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: a

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2. Assertion : Oxidation number of C in HCHO is zero.

Reason : Formaldehyde is a covalent compound.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: b

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3. Assertion : Oxygen has oxidation states of -2 in both O_2 and O_3.

Reason : Oxygen is assigned an oxidation state of - 2 in almost all its compounds.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: d

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4. Assertion : Oxidation number of phosphorus in P_4 is zero.

Reason : Phosphorus has oxidation state zero in all its compound .

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: c

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5. Assertion : Redox reactions are also called neutralisation reactions.

Reason : The number of electrons gained or lost in the reaction are balanced.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: d

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6. Assertion : $3ClO^- \rightarrow ClO_3^- + 2Cl^-$ is an example of dissociation reaction.

Reason : ClO^- gets oxidised as well as reduced.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: d

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7. Assertion : A substance which gets reduced can act as reducing agent.

Reason : As oxidising agent itself gets reduced.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: D

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8. Assertion : Copper sulphate solution is not stored in zinc vessel.

Reason : Zinc forms complex with copper sulphate .

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: c

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9. Assertion : The Daniell cell becomes dead after sometime.

Reason : Oxidation potential of zinc anode decreases and that of copper cathode increases.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: a

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10. Assertion : In iodometic titrations, starch is used as an indicator.

Reason : Starch is a polysaccharide.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: b

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Revision Exercies Very Short Answer Questions

1. What is the oxidation number of Mn in MnO_2 ?

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2. What is the average oxidation number of carbon in acetone (CH_3COCH_3) ?

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3. Can oxidation number be zero ? Illustrte .

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4. Will oxidation number increase or decrease in a reduction reaction ?

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5. What is the oxidation number of oxygen in H_2O_2 ?

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6. Calculate the oxidation number of lead in Pb_3O_4 ?

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7. Identify the oxidsing and reducing agent in the following reaction :

$3CuO + 2NH_3 \rightarrow 3Cu + N_2 + 2H_2O$

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8. Give an example of a compound in which the oxidation number is fractional.

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9. Calculate the oxidation number of phosphorous in $Mg_2P_2O_7$.

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10. Indicate the oxidizing and reducing agents in the following reaction :

$2Cu^{2+} + 4I^{-} \rightarrow 2CuI + I_2$

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11. Calculate the oxidation number of N in NO_3^- .

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12. The oxidation number of B is $Na_2B_4O_7$ is +3 . Is the statement correct ?

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13. What is the oxidation number of Cr in CrO_2Cl_2 ?

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14. Calculate the oxidation number of C in $C_6H_{12}O_6$.

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15. The reduction potentials are :

$Cl_2 + 2e^- = 2Cl^-$ $E^\circ = 1.36V$

$F_2 + 2e^- = 2F^-$ $E^\circ = 2.87V$

Which is a better oxidising agent?

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Revision Exercies Short Answer Questions

1. Define the terms : oxidation , reduction , oxidising agent and reducing agent according to electronic concept.

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2. Which of the following reaction is oxidation and which is reduction ?

$(i) \quad 2H_2O + 2e^- \longrightarrow 2OH^- + H_2$

$(ii) \quad Al \longrightarrow Al^{3+} + 3e^-$

$(iii) \quad Fe^{3+} \longrightarrow Fe^{2+} - e^-$

$(iv) \quad 2O^{2-} + C \longrightarrow CO_2 + 4e^-$

$(v) \quad Br^- \longrightarrow 1/2Br_2 + e^-$

$(vi) \quad 2H_2O - 4e^- \longrightarrow 4H^+ + O_2$

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3. In the following reaction , explain which reactant is oxidised and which is reduced . Give reasons for your answer :

$(i) \quad 2H_2S + SO_2 \longrightarrow 2H_2O + 3S$

$(ii) \quad MnO_2 + 4HCl \longrightarrow MnCl_2 + H_2O + Cl_2$

$(iii) \quad 2KI + Cl_2 \longrightarrow 2KCl + I_2$

$(iv) \quad CuO + CO \longrightarrow CO_2 + Cu$

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4. Calculate the oxidation number of :

(i) S in $Na_2S_2O_3$ (ii) Cl in $HClO_4$

(iii) Mn in MnO_2 (iv) Boron in $Na_2B_4O_7$

(v) Cr in $K_2Cr_2O_7$

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5. What is the oxidation number of S in the following ?

(i) SO_2 (ii) Na_2S_2 (iii) S^{2-}

(iv) CS_2 (v) S_2Cl_2

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6. Calculate the oxidation number of the underlined atom :

(i) $K\underline{Mn}O_4$ (ii) $\underline{P}_2O_5$ (iii) $\underline{Fe_2}O_3$ (iv) $\underline{Xe}OF_4$

(v) $\underline{S}_2O_3^{2-}$ (vi) $\underline{Cr}_2O_7^{2-}$.

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7. In the following reactions , lable the oxidising agent and the reducing agent :

(a) $MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$

(b) $PbS(s) + 4H_2O_2(aq) \rightarrow PBSO_4(s) + 4H_2O(l)$

(c) $2Al + 3F_2(g) \rightarrow 2AlF_3(s).$

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8. Arrange the following in the decreasing order of oxidation number of Mn :

(i) $KMnO_4$ (ii) MnO_2 (iii) Mn_2O_3

(iv) Mn (v) K_2MnO_4

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9. Consider the reaction :

$2HBr + Cl_2 \rightarrow 2HCl + Br_2$

Identify the substance

(i) getting reduced (ii) getting oxidised

(iii) acting as reducing agent

(iv) acting as oxidising agent .

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Revision Exercies Long Answer Questions

1. Balance the following equations using oxidation number method :

$$(i) \quad MnO_4^- + H^+ + Fe^{2+} \longrightarrow Mn^{2+} + Fe^{3+} + H_2O$$

$$(ii) \quad Zn + NO_3^- + H^+ \longrightarrow Zn^{2+} + H_2O$$

$$(iii) \quad H_2SO_3 + I_2 + H_2O \longrightarrow H_2SO_4 + HI$$

$$(iv) \quad HNO_3 + I_2 \longrightarrow HIO_3 + NO_2 + H_2O$$

$$(v) \quad MnO_4^- + H_2O_2 \longrightarrow MnO_4^{2-} + O_2$$

(in alkaline medium)

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2. Balance the following equations by oxidation number method :

$(i) \quad H_2S + HNO_3 \longrightarrow H_2O + NO + S$

$(ii) \quad NH_3 + O_3 \longrightarrow NO + H_2O$

$(iii) \quad Cu + HNO_3 \longrightarrow Cu(NO_3)_2 + NO + H_2O$

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3. Balance the following equations by ion electron (half reaction) method :

$(i) \quad H_2S + MnO_4^- + H^+ \longrightarrow S + Mn^{2+} + H_2O$

$(ii) \quad Cr_2O_7^{2-} + H^+ + Fe^{2+} \longrightarrow Cr^{3+} + Fe^{3+} + H_2O$

$(iii) \quad AsO_3^{3-} + IO_3^- \longrightarrow AsO_4^{3-} + I^-$

$(iv) \quad SnO_2 + C \longrightarrow Sn + CO$

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4. What is are redox reaction ? Discuss with examples . Give important applications of redox reactions ?

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5. Write shot notes on :

(a) Electrochemical series

(b) Redox titrations

(c) Abnorma oxidation number and structures of compounds .

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Higher Order Thinking Skills Advanced Level

1. While sulphate dioxide and hydrogen peroxide can act as oxidising as well as reducing agents in their reactions, ozone and nitric acid act only as oxidants. Why?

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2. Out of aluminium and silver vessel, which one will be more suitable to store 1 M HCl solution and why ?

$E^{\circ}_{Al^{3+}|Al} = -1.66V, E^{\circ}_{Ag^{+}|Ag} = +0.80V$

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3. Can Fe^{3+} oxidize Br^- to Br_2 at 1 M concentration ?

$E^\circ\left(Fe^{3+} \mid Fe^{2+}\right. = 0.77V$ and $E^\circ\left(Br \mid Br^-\right) = 1.09V$

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4. Is it sate to stir 1 M $AgNO_3$ solution with a copper spoon ? Given :

$E^\circ_{Ag^+ \mid Ag} = 0.80V, E^\circ_{Cu^{2+} \mid Cu} = 0.34V$

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5. Copper dissolves in dilute HNO_3 but not in dilute HCl. Explain.

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6. Element A will reduce the cation of element B $\left(B^{+}\right)$ but will not reduce the cation of element C $\left(C^{+}\right)$ Will element C reduce the cation of element B ? Explain .

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7. Why does an electrochemical cell stops working after some time ?

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8. (a) What is the maximum and minimum oxidation states of nitrogen in its compounds ? Given one example each .

(b) What is the oxidation number of N in each of the following ?

(i) NH_3 (ii) N_2H_4 (iii) HN_3 (iv) NO_2^- (v) N_2O (vi) HCN (vii) N_2 (viii) NH_2OH (ix) HNO_3 (x) NO_2.

(c) What is the oxidation state of hydrogen in each of the following ?

(i) H^+ (ii) H_2 (iii) $LiAlH_4$ (iv) HCl (v) LiH

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9. (a) Use the following reactions to arrange the elements A ,B, C and D in order of their redox reactivity :

(i) $A + B^+ \rightarrow A^+ + B$

(ii) $B + D^+ \rightarrow B^+ D$

(iii) $C^+ + D \rightarrow$ No reaction

(iv) $B + C^+ \rightarrow B^+ C$

(b) On the basis of above redox activity series predict which of the following reactions would you expect to occur.

(i) $A^+ C \rightarrow A + C^+$ (ii) $A^+ + D \rightarrow A + D^+$

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10. 40.05 mL of 1.0 M Ce^{4+} are required to titrate 20.0 mL of 1.0 M Sn^{2+} to Sn^{4+} . What is the oxidatin state of cerium in the reduction product ?

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11. 3.90×10^{-3} moles of a solution containing an ion A^{n+} require 2.34×10^{-3} moles of MnO_4^- for the oxidation of A^{n+} to AO_3^- in acidic medium . What is the value of n ?

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12. 15.0 mL of 0.05 M SeO_2 reacts with 30.6 mL of 0.1 M $CrSO_4$ solution . If during the reaction $CrSO_4$ gets oxidised to $Cr_2(SO_4)_3$ to what oxidation state does selenium get converted ?

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Competition File Objective Questions A Multiple Choice Questions

1. Reduction involves :

A. gain of electrons

B. addition of oxygen

C. increases in oxidation number

D. loss of electrons .

Answer: A

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2. Oxidation number of P in PO_4^{3-} ion is :

A. -3

B. $+7$

C. $+5$

D. $+3$

Answer: C

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3. Oxidation Number of Mn in $[MnO_4]^-$ is:

A. $+1$

B. -7

C. -1

D. $+7$

Answer: D

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4. Oxidation number of C in $CH_3OH, CH_2O, HCOOH$ and C_2H_2 is respectively :

A. $-2, 0, +2, -1$

B. $+2, 0, +2, -2$

C. $-2, 0, +2, 0$

D. $-2, -4, +2, -2$

Answer: A

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5. What is the oxidation state of S in Na_2S_2 ?

A. $+1$

B. -2

C. -1

D. 0

Answer: C

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6. Oxidation state of sulphur in Caro's acid is

A. $+8$

B. $+6$

C. $+5$

D. $+4$

Answer: B

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7. What is the oxidation state of sodium in sodium amalgam (Na/Hg)?

A. 0

B. $+1$

C. -1

D. $+2$

Answer: A

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8. In the reaction : $Cl_2 + 2OH^- \rightarrow OCl^- + Cl^- + H_2O$

A. OH^- is oxidising and Cl^- is reducing agent

B. Cl_2 is oxidising and OH^- is reducing agent

C. OH^- is both oxidising and reducing agent .

D. Cl_2 is both oxidising and reducing agent

Answer: D

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9. The oxidation states of S in $S_2O_8^{2-}$ is

A. $+2$

B. $+4$

C. $+6$

D. $+7$

Answer: C

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10. In which of the following compounds , the oxidation number of carbon is not zero ?

A. $C_{12}H_{22}O_{11}$

B. $HCHO$

C. CH_3CHO

D. CH_3COOH

Answer: C

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11. The oxidation states of V and Br in V $(BrO_2)_2$ are respectively

A. 2 and 2

B. 2 and 1

C. 4 and 2

D. 2 and 3

Answer: D

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12. The oxidation state of N in HN_3 is

A. $+3$

B. -3

C. $-1/3$

D. $+1/3$

Answer: C

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13. In which of the following S has highest oxidation state ?

A. $Na_2S_4O_6$

B. S_2Cl_2

C. S_8

D. H_2SO_4

Answer: D

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14. Which of the following rules for oxidation number is not correct?

A. The algebraic sum of all the oxidation numbers in a compound is zero .

B. An element in the free or the uncombined state bears oxidation numbers zero.

C. The oxidation number of hydrogen is always +1.

D. In all its compounds, the oxidation number of fluorine is -1.

Answer: C

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15. In the reaction :

$3CuO + 2NH_3 \rightarrow N_2 + 3H_2O + 3Cu$

the change of NH_3 to N_2 involve

A. Loss of 6 electrons per mol of N_2

B. Loss of 3 electrons per mol of N_2

C. Gain of 6 electrons per mol of N_2

D. Gain of 3 electrons per mol of N_2

Answer: A

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16. Which of the following statement is not correct ?

A. Oxidant is a substance which increases the oxidation number of other substance.

B. Reluctant is a substance which decreases the oxidation number of other substance.

C. The oxidation number of oxidant decreases.

D. In oxidation there is decreases in oxidation number .

Answer: D

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17. When phosphorus reacts with caustic soda, the products are PH_3 and NaH_2PO_2 This reaction is an example of:

A. oxidation

B. reduction

C. disproportionation

D. none of these

Answer: C

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18. Which of the following is not an example of redox reaction ?

A. $CuO + H_2 \rightarrow Cu + H_2O$

B. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

C. $2K + F_2 \rightarrow 2KF$

D. $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$

Answer: D

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19. The oxidation state of Cr in $Cr(CO)_6$ is

A. 0

B. $+2$

C. -2

D. $+6$

Answer: A

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20. Oxidation state of oxygen in H_2O_2 is

A. -1

B. $+2$

C. -2

D. $+1$

Answer: A

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21. The oxidation state of phosphorus in $Ba(H_2PO_2)_2$ is

A. $+3$

B. $+2$

C. $+1$

D. -1

Answer: C

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22. The oxidation number of S in S_8, S_2F_2 and H_2S respectively are :

A. $0, +1, -2$

B. $+2, +1, -2$

C. $0, +1, +2$

D. $+2, +1, -2$

Answer: A

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23. In the reaction :

$$3Br_2 + 6CO_3^{2-} + 3H_2O \rightarrow 5Br^- + BrO_3^- + 6HCO_3^-$$

A. Br_2 is oxidised and carbonate is reduced .

B. Bromine is reduced and water is oxisised.

C. Bromine is neither reduced nor oxidised .

D. Bromine is both reduced and oxidised.

Answer: D

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24. Oxidation state of Fe in Fe_3O_4 is

A. $+2$

B. $+3$

C. $+8/3$

D. $+2/3$

Answer: C

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25. In Br_3O_8 compound , oxidation number of bromine is

A. $16/13$

B. $26/3$

C. $24/3$

D. $16/3$

Answer: D

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26. Which is the best description of the behaviour of bromine in the reaction given below

$H_2O + Br_2 \rightarrow HOBr + HBr$

A. Proton acceptor only

B. Both oxidised and reduced

C. Oxidised only

D. Reduced only

Answer: B

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27. The oxidation number of H in $LiAlH_4$ is

A. -1

B. $+1$

C. 0

D. $+3$

Answer: A

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28. The oxidation states of sulphur in the anions SO_3^{2-}, $S_2O_4^{2-}$, and $S_2O_6^{2-}$ follow the order

A. $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$

B. $S_2O_3^{2-} < SO_4^{2-} < S_2O_6^{2-}$

C. $S_2O_4^{2-} < SO_6^{2-} < S_2O_3^{2-}$

D. $S_2O_6^{2-} < SO_4^{2-} < S_2O_3^{2-}$

Answer: A

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29. E° values of some redox couples are given below . On the basis of these values choose the correct option .

E° value : $Br_2 \mid Br^- = +1.90, Ag^+ \mid Ag(s) = +0.80$

$Cu^{2+} \mid Cu(s) = +0.34, I_2(s) \mid I^- = +0.54$

A. Cu will reduce Br^-

B. Cu will reduce Ag

C. Cu will reduce I^-

D. Cu will reduce Br_2

Answer: D

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30. The more positive the value of E^{θ}, the greater is the trendency of the species to get reduced. Using the standard electrode potential of redox couples given below find out which of the following is the strongest oxidising agent.

E^{θ} values: $Fe^{3+}/Fe^{2+} = +0.77$

$I_2(s)/I^- = +0.54,$

$Cu^{2+}/Cu = +0.34, Ag^+/A = 0.80V$

A. Fe^{3+}

B. $I_2(s)$

C. Cu^{2+}

D. Ag^+

Answer: D

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31. The coefficients x, y and z in the following balanced equation :

$xZn + yNO_3^- \rightarrow zZn^{2+} + NH_4^+$ (in basic medium) are

A. 4,1,4

B. 2,2,2

C. 4,2,4

D. 4,4,4

Answer: A

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32. Four colourless salt solutions are placed in separate test tubes and a strip of copper is dipped in each. Which solution finally turns blue?

A. NaCl

B. $AgNO_3$

C. $ZnSO_4$

D. $Cd(NO_3)_2$

Answer: B

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33. In a standard hydrogen electrode, the concentration of H^+ is

A. 0.1 M

B. 1 M

C. 10 M

D. Not fixed

Answer: B

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34. In a galvanic cell, which of the following statement is incorrect?

A. anode is negatively charged

B. cathode is positively charged

C. reduction occurs at anode

D. standard e.g. of the cells is always zero.

Answer: C

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35. For the redox reaction :

$$MnO_4^- + Fe^{2+} + H^+ \rightarrow Mn^{2+} + Fe^{3+} + H_2O$$

The correct coefficients of the reactants in the balanced reaction are :

	MnO_4^-	Fe^{2+}	H^+
A.	1	5	8
B.	2	5	8
C.	4	5	16
D.	2	5	16

Answer: A

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36. The standard reduction potential values of three metallic cation X, Y, Z are $0.52, \ -3.03$ and $-1.18V$ respectively. The order of reducing power to the corresponding metals is:

A. $Y > Z > X$

B. $X > Y > Z$

C. $Z > Y > X$

D. $Z > X > Y$

Answer: A

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37. A gas X at 1 atm is bubbled through a solution containing a mixture of 1M Y^- and 1M Z^- at $25^\circ C$. If the reduction potential of $Z > Y > X$, then

A. Y will oxidize X and not Z

B. Y will oxidise both X and Z

C. Y will reduce both X and Z.

D.

Answer: A

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38. Standard electrode potentials are

$Fe^{2+}/Fe, E^\circ = -0.44V$

$Fe^{3+}/Fe^{2+}, E^\circ = +0.77V$

If Fe^{3+}, Fe^{2+} and Fe block are kept together, then

A. Fe^{3+} increases

B. Fe^{3+} decreases

C. Fe^{2+}/Fe^{3+} remains unchanged

D. Fe^{2+} decreases

Answer: B

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39. For decolourization of 1 mole of $KMnO_4$, the moles of H_2O_2 required is

A. $1/2$

B. $3/2$

C. $5/2$

D. $7/2$

Answer: C

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Competition File Objective Questions B Multiple Choice Questions

1. Which of the following is a redox reaction?

A. $2CuSO_4 + 4KI \rightarrow Cu_2I_2 + 2K_2SO_4 + I_2$

B. $SO_2 + H_2O \rightarrow H_2SO_3$

C. $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$

D. $CuSO_4 + 4NH_3 \rightarrow \left[Cu(NH_3)_4\right]SO_4$

Answer: A

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2. Oxidation number of iodine in IO_3^-, IO_4^-, KI and I_2 respectively are

A. $-1, \ -1, 0, \ +1$

B. $+3, \ +5, \ +7, 0$

C. $+5, \ +7, \ -1, 0$

D. $-1, \ -5, \ -1, 0$

Answer: C

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3. In the balanced chemical reaction

$IO_3^{\ominus} + aI^{\ominus} + bH^{\ominus} \rightarrow cH_2O + dI_2$

a, b, c, and d, respectively, correspond to

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4. Number of moles of MnO_4^- required to oxidise one mole of ferrous oxalate completely in acidic medium will be

A. 0.6 moles

B. 0.4 moles

C. 7.5 moles

D. 0.2 moles

Answer: A

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5. On the basis of the folwing E° values, the strongest oxidizing agent is

$\left[Fe(CN)_6\right]_4^- \rightarrow \left[Fe(CN)_5\right]^{3-} + 3^-, E^{\circ} = -0.35V$

$Fe^{2+} \rightarrow Fe^{3+} + e^-: E^{\circ} = -0.77V.$

A. $\left[Fe(CN)_6\right]^{4-}$

B. Fe^{2+}

C. Fe^{3+}

D. $\left[Fe(CN)_6\right]^{3-}$

Answer: C

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6. In the redox reaction, $xKMnO_4 + NH_3 \rightarrow yKNO_3 + MnO_2 + MnO_2 + KOH + H_2O$, x and y are

A. x = 4, y = 6

B. x = 8, y = 6

C. x = 3, y = 8

D. x = 8, y = 3

Answer: D

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7. Which of the following have been arranged in decreasing of oxidation number of sulphur ?

A. $Na_2S_4O_6 > H_2S_2O_7 > Na_2S_2O_3 > S_8$

B. $H_2SO_4 > SO_2 > H_2S > H_2S_2O_8$

C. $SO_2^{2+} > SO_4^{2-} > SO_3^{2-} > HSO_4^-$

D. $H_2SO_5 > H_2SO_3 > SCl_2 > H_2S$

Answer: D

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8. The average oxidation state of sulphur in $Na_2S_4O_6$ is

A. $+2.5$

B. $+2$

C. $+3.0$

D. $+3.5$

Answer: A

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9. Standard electrode potential of three metal X, Y and Z are $-1.2V$, $+0.5V$ and $-3.0V$ respectively. The reducing power of these metals will be:

A. $Y > Z > X$

B. $Y > X > Z$

C. $Z > X > Y$

D. $X > Y > Z$

Answer: C

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10. In which of the following compounds,nitrogen exhibits highest oxidation state?

A. N_2H_4

B. NH_3

C. N_3H

D. NH_3OH

Answer: C

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11. A mixture of potassium chlorate, oxalic acid and sulphuric acid is heated. During the reaction which element undergoes maximum change in the oxidation number?

A. S

B. H

C. Cl

D. C

Answer: C

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12. In acidic medium, H_2O_2 changes $Cr_2O_7^{2-}$ to CrO_5 which has two $(-O-O-)$ bonds. Oxidation state of Cr in CrO_5 is

A. $+5$

B. $+3$

C. $+6$

D. -10

Answer: C

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13. Choose the disproportionation reaction among the following redox reactions.

A. $3Mg(s) + N_2(g) \rightarrow Mg_3N_2(s)$

B. $P_4(s) + 3NaOH(aq) + 3H_2O(l) \rightarrow PH_3(g) + 3NaH_2PO_2(aq)$

C. $Cl_2(g) + 2KI(aq) \rightarrow 2KCl(aq) + I_2(s)$

D. $Cr_2O_3(s) + 2Al(s) \rightarrow Al_2O_3(s) + 2Cr(s)$

Answer: B

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14. Which of the following processes does not involve oxidation of iron ?

A. Formation of $Fe(CO)_6$ from Fe

B. Liberation of H_2 from steam by iron at high temperature

C. Rusting of iron sheets

D. Decolourisation of blue $CuSO_4$ solution by iron

Answer: A

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15. Assuming complete ionization, same moles of which of the following compounds will require the least amount of acidified $KMnO_4$ for complete oxidation ?

A. FeC_2O_4

B. $Fe(NO_2)_2$

C. $FeSO_4$

D. $FeSO_3$

Answer: C

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16. For the redox reaction

$$MnO_4^{\ominus} + C_2O_4^{2-} + H^{\oplus} \rightarrow Mn^{2+} + CO_2 + H_2O$$

the correct coefficients of the reactions for the balanced reaction are

	MnO_4^-	$C_2O_4^{2-}$	H^+
A.	16	5	2

B. MnO_4^- $C_2O_4^{2-}$ H^+
2 5 16

C. MnO_4^- $C_2O_4^{2-}$ H^+
2 16 5

D. MnO_4^- $C_2O_4^{2-}$ H^+
5 16 2

Answer: B

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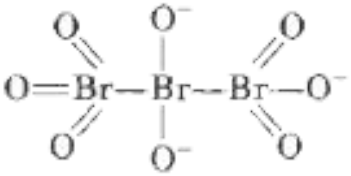
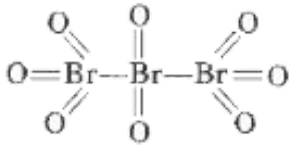
17. The correct structure of tribromooctaoxide.

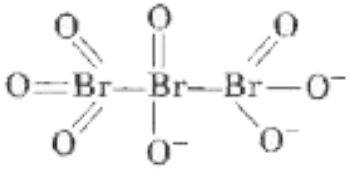
A.

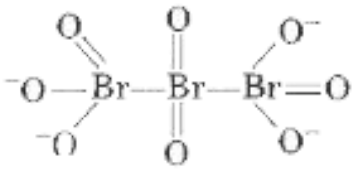


B.



C.





D.

Answer: B

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18. Which of the following reactions are disproportionation reactions?

$(A)\quad Cu^{+} \rightarrow Cu^{2+} + Cu$

$(B)\quad 3MnO_4^{2-} + 4H^{+} \rightarrow 2MnO_4^{-} + MnO_2 + 2H_2O$

$(C)\quad 2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$

$(D)\quad 2MnO_4^{-} + 3Mn^{2+} + 2H_2O \rightarrow 5MnO_2 + 4H^{+}$

A. (i) and (iv) only

B. (i) and (ii) only

C. (i),(ii) and (iii)

D. (i),(iii) and (iv)

Answer: B

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19. Consider the following E^o values :

$E^o \_ Fe^{3+} / FE^{2+} o = +0.77V$

$E_{Sn^{2+}/Sn} = -0.14V$

Under standard conditions the potential for reaction

$Sn(s) + 2Fe^{3+}(aq) \rightarrow 2Fe^{2+}(sq) + Sn^{2+}(aq)$ is.

A. 0.91 V

B. 0.140 V

C. 1.68 V

D. 0.63 V

Answer: A

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20. In a cell that utilizes the reactions.

$$Zn(s) + 2H^+(aq) \rightarrow Zn^{2+}(aq) + H_2(g)$$

addition of H_2SO_4 to cathode compartment, will

A. increase the E and shift equilibrium to the right

B. lower the E and shift equilibrium to the right

C. lower the E and shift equilibrium to the left

D. increase the E and shift equilibrium to the left

Answer: A

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21. $aK_2Cr_2O_7 + bKCl + cH_2SO_4 \rightarrow xCrO_2Cl_2 + yKHSO_4 + zH_2O$

The above equation balances when

A. $a = 2, b = 4, c = 6$ and $x = 2, y = 6, z = 3$

B. $a = 4, b = 2, c = 6$ and $x = 6, y = 2, z = 3$

C. $a = 6, b = 4, c = 2$ and $x = 6, y = 3, z = 2$

D. $a = 1, b = 4, c = 6$ and $x = 2, y = 6, z = 3$

Answer: D

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22. What products are expected from the desproprtionation reactin of hypochorous acid ?

A. $HClO$ and $HClO_4$

B. HCl and Cl_2O

C. HCl and $HClO_3$

D. $HClO_3$ and Cl_2O

Answer: C

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23. What is the oxidation number of carbonyl carbon in methanal ?

A. $+3$

B. $+2$

C. $+4$

D. 0

Answer: D

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24. The reaction $3ClO^{-}(aq) \rightarrow ClO_3^{-}(aq) + 2Cl^{-}(aq)$ is an example of :

A. oxidation reaction

B. reduction reaction

C. disproportionation reaction

D. decomposition reaction

Answer: C

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25. How many electrons are involved during the oxidation reaction of $KMnO_4$ in acidic medium ?

A. 1

B. 3

C. 5

D. 4

Answer: C

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26. For redox reaction

$$xMnO_4^- + yH_2C_2O_4 + ZH^+ \downarrow mMn^{2+} + nCO_2 + pH_2O$$

The value of x,y,m and n are:

A. 10,2,5,2

B. 2,5,2,10

C. 6,4,2,4

D. 3,5,2,10

Answer: B

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27. Iodine reacts with concentrateed HNO_3 to yield Y along with other products. The oxidation state of iodine in Y, is _____.

A. 7

B. 1

C. 5

D. 3

Answer: C

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28. The correct order of the oxidation states of nitrogen in NO, N_2O, NO_2 and N_2O_3 is :

A. $NO_2 < N_2O_3 < NO < N_2O$

B. $NO_2 < NO < N_2O_3 < N_2O$

C. $N_2O < N_2O_3 < NO < NO_2$

D. $N_2O < NO < N_2O_3 < NO_2$

Answer: D

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29. In order to oxidise a mixture of one mole of each of $FeC_2O_4, Fe_2(C_2O_4)_3, FeSO_4$ and $Fe_2(SO_4)_3$ in acidic medium , the number of mole of $KMnO_4$ required is

A. 2

B. 1

C. 3

D. 1.5

Answer: A

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30. In the reaction of oxalate with permanganate in acidic medium, the number of electrons involved in producing one molecule of CO_2 is

A. 10

B. 2

C. 1

D. 5

Answer: C

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31. For the electrochemical cell, $M|M^+||X^-|X$, $E^\circ_{M^+/M} = 0.44V$ and $E^\circ_{X/X^-} = 0.33V$. From this data we can deduce that :

A. $M + X \rightarrow M^+ + X^-$ is the spontaneous reaction

B. $M^+ + X^- \rightarrow M + X$ is the spontaneous reaction

C. $E^\circ_{\text{cell}} = 0.77V$

D. $E^\circ_{\text{cell}} = -0.77V$

Answer: B

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32. Standard electrode potential data are used for understanding the stability of an oxidant in a redox titration . Some half reactions and their standard potentials are given below :

$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l)$

$E^\circ = 1.51V$

$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6e^- \rightarrow 2Cr^{3+}(aq) + 7H_2O(l)$

$E^\circ = 1.38V$

$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq) \qquad E^\circ = 0.77V$

$Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq) \qquad E^\circ = 1.40V$

Identify the only incorrect statement regarding the quantitative estirnation of aqueous $Fe(NO_3)_2$.

A. MnO_4^- can be used in aqueous HCl

B. $Cr_2O_7^{2-}$ can be used in aqueous HCl

C. MnO_4^- can be used in aqueous H_2SO_4

D. $Cr_2O_7^{2-}$ can be used in aqueous H_2SO_4

Answer: A

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33. The pair of compounds having metals in their highest oxidation state is.

A. $MnO_2, FeCl_3$

B. MnO_4^-, CrO_2Cl_2

C. $\left[Fe(CN)_6\right]^{3-}, \left[Co(CN)_6\right]^{3-}$

D. $\left[NiCl_4\right]^{2-}, \left[CoCl_4\right]^{-}$

Answer: B

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34. Which ordering of compounds is according to the decreasing order of the oxidation state of nitrogen ?

A. HNO_3, NO, NH_4, Cl, N_2

B. HNO_3, NO, N_2, NH_4Cl

C. HNO_3, NH_4Cl, NO, N_2

D. NO, HNO_3, NH_4Cl, N_2

Answer: B

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Competition File Objective Questions C Multiple Choice Questions

1. Which of the following are redox reaction ?

A. $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$

B. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

C. $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

D. $KCN + AgCN \rightarrow K\left[Ag(CN)_2\right]$

Answer: B::C

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2. In which of the following the oxidation number of atom is/are correctly given ?

A. $C_6H_{12}O_6 : C = 0$

B. $Na_4\left[Fe(CN)_6\right] : Fe = +3$

C. $HCOOH : C = +4$

D. $HCHO : C = 0$

Answer: A::D

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3. Which of the following act both as an oxidising as well as reducing agent ?

A. HNO_3

B. H_2O_2

C. HNO_2

D. H_2S

Answer: B::C

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4. In which of the following the oxidation number of the underlined atom is maximum ?

A. $H_4\underline{P}_2O_7$

B. $K\underline{Al}(SO_4)_2.12H_2O$

C. $K_2\underline{Mn}O_4$

D. $Na_2\underline{S}O_3$

Answer: B::C

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5. Oxidation number of Cr in CrO_5 is same as of S in

A. H_2SO_5

B. $Na_2S_4O_6$

C. $Na_2S_2O_7$

D. H_2SO_3

Answer: A::C

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6. Which of the following statements are not correct for the following reaction :

$$2MnO_4^- + 6I^- + 4H_2O \rightarrow 2MnO_2 + 3I_2 + 8OH^-$$

A. Oxidation number of in MnO_4^- and MnO_2 are same

B. MnO_4^- acts as an oxidising agent

C. H_2O has been reduced

D. Oxidation number of iodide has increased from I^- to I_2.

Answer: B::D

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7. Which of the following statements are wrong ?

A. Reduction involves gain of electrons .

B. The oxidation number of reducing agent decreases.

C. Oxidising agent helps to increases the oxidation number of reducing agent.

D. Oxidation involves gain of electrons.

Answer: B::D

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8. Consider the redox reaction

$2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^{\ominus}$

A. $2S_2O_3^{2-}$ gets oxidised to $S_4O_6^{2-}$

B. I_2 gets oxidised to I^-

C. there is increase in oxidation number of iodine during the reaction

D. The total increase in oxidation number of shulphur is +1 during the reaction

Answer: A::D

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9. For the reaction :

$I^- + ClO_3^- + H_2SO_4 \rightarrow Cl^- + HSO_4^- + I_2$

The correct statement (s) in the balanced equation is/are

A. stoichiometic coefficient of HSO_4^- is 6

B. iodide is oxidised

C. sulphur is reduced

D. H_2O is one of the products.

Answer: A::B::D

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