CHEMISTRY

BOOKS - G.R. BATHLA & SONS CHEMISTRY (HINGLISH)

OXIDATION AND REDUCTION (REDOX REACTIONS)

Example

1. Write the following equation in ionic form.

$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$

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2. Represent the following equation in ionic form

$K_2Cr_2O_7 + 7H_2SO_4 + 6FeSO_4 = 3Fe(SO_4)_3 + Cr_2(SO_4)_3 + 7H_2O + K$

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3. Write the balanced ionic equation for the reaction of sodium bicarbonate with sulphuric acid

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4. Write the following ionic equation in the molecular form if the reactants are chlorides.

$2Fe^{3+} + Sn^{2+} \rightarrow 2Fe^{2+} + Sn^{4+}$

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5. Balance the following equations by an electron method.

$(a).\ FeCl_3 + H_2S \rightarrow FeCl_2 + HCl + S$

$(b).\ Cu + HNO_3 \rightarrow Cu(NO)_3 + NO + H_2O$

$(c).\ KI + Cl_2 \rightarrow KCl + I_2$

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6. What is the oxidation number of Mn in $KMnO_4$ and S in $Na_2S_2O_3$?

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7. The oxidation number of Cr in $K_2Cr_2O_7$ is

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8. What is the oxidation number of $Fe \text{in} K_4Fe(CN)_6$?

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9. Find the oxidation number of

(a) $S \text{in} SO_4^{2-}$ ion (b) $S \text{in} HSO_3^-$ ion

(c). Pt in $\left(PtCl_6^{2-}\right)$ ion (d). Mn in $(MnO_4)^-$ ion

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10. Which compound amongst the following gas the highest oxidation number of Mn?

$KMnO_4, K_2MnO_2, MnO_2$ and Mn_2O_3

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11. In the following reaction, identify the speech oxidised, the species reduced, the oxidising agent and reducing agent.

(a). $4HCl + MnO_2 = MnCl_2 + 2H_2O + Cl_2$

(b). $SnCl_2 + 2FeCl_3 = SnCl_4 + 2FeCl_2$

(c).$2H^+ + Mg = Mg^{2+} + H_2$

(d).$H_2SO_3 + 2H_2S = 3S + 2H_2O$

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12. Which of the following reactions is a redox reaction?

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

(b).$Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$

(c).$SO_2 + H_2O \rightarrow H_2SO_4$

(d).$2CuSO_4 + 4KI \rightarrow Cu_2I_2 + 2K_2SO_4 + I_2$

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13. Explain why HNO_3 acts only as oxidising agent while HNO_2 can act both as a reducing agent and an oxiding agent?

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14. Balance the following equation by the oxidatoin number method.

$Cu + HNO_3 \rightarrow Cu(NO_3)_2 + NO_2 + H_2O$

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15. Balance the following equation by oxidation number method:

$K_2Cr_2O_7 + FeSO_4 + H_2SO_4 = Cr_2(SO_4)_3 + Fe_2(SO_4) + K_2SO_4 + H_2C$

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16. Balance the following equation by oxidation number method

$$K_2Cr_2O_7 + HCl \rightarrow KCl + CrCl_3 + H_2O + Cl_2$$

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17. Balance the following equation by oxidation number method

$$NaIO_3 + NaHSO_3 \rightarrow Na_2SO_4 + NaHSO_4 + I_2 + H_2O$$

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18. Balance the followin equation by oxidation number method:

$$I_2 + NaOH \rightarrow NaIO_3 + NaI + H_2O$$

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19. Balance the following equation by oxidation number method

$PbS + H_2O_2 \rightarrow PbSO_4 + H_2O$

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20. Balance the following equation by oxidation number method

$Zn + HNO_3 \rightarrow Zn(NO_3)_2 + NH_4NO_3 + H_2$

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21. Balance the following equation by oxidation number method

$HgS + HCl + HNO_3 \rightarrow H_2HgCl_4 + NO + S + H_2O$

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22. Balance the following equation by oxidation number method.

$Cl_2 + IO_3^- + OH^- \rightarrow IO_4^- + Cl^- + H_2O$

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23. Balance the following equation by oxidation number method

$$Al + KMnO_4 + H_2SO_4 \rightarrow Al_2(SO_4)_3 + K_2SO_4 + MnSO_4 + H_2O$$

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24. Balance the following chemical equation

$$H_2O_2 + O_3 \rightarrow H_2O + O_2$$

Indicating the changes in oxidation number of oxygen, find the equivalent weight of H_2O_2 for this reaction

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Illustration

1. Oxidation state of S in SO_4^{2-}

A. $+6$

B. $+3$

C. $+2$

D. -2

Answer: A

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2. Arrange the following in the increasing order of oxidation state of Mn:

(i) Mn^{2+} (ii) MnO_2 (iii) $KMnO_4$ (iv) K_2MnO_4

A. $i > ii > iii > iv$

B. $i < ii < iv < iii$

C. $ii < iii < i < iv$

D. $iii < i < iv < ii$

Answer: B

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3. Which of the following has least oxidation state of Fe?

A. $K_3[FeO_4]$

B. $K_2[FeO_4]$

C. $FeSO_4.(NH_4)_2SO_4.6H_2O$

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

Answer: C

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4. Oxidation state of carbon in HCOOH will be:

A. $+1$

B. $+2$

C. -4

D. 0

Answer: B

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5. Oxidation states of chlorine in $HClO_4$ and $HClO_3$ are:

A. $+4,\ +3$

B. $+7+5$

C. $+3,\ +4$

D. $+5,\ +7$

Answer: B

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Practise Problems

1. Indicate which of the substance/ion in the following reactions is an oxidising agent and which is a reducing agent?

(i) $2FeCl + SnCl_2 \rightarrow 2FeCl_2 + SnCl_4$

(ii) $2Mg + SO_2 \rightarrow 2MgO + S$

(iii) $2SO_2 + O_2 \rightarrow 2SO_3$

(iv)$Ca + Cl_2 \rightarrow CaCl_2$

(v) $Sn^{2+} + 2Hg^{2+} \rightarrow Hg_2^{2+} + Sn^{4+}$

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

(vii)$2I^- + H_2O_2 \rightarrow 2OH^- + I_2$

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

(ix) $SO_2 + 2HNO_3 \rightarrow H_2SO_4 + 2NO_2$

(x) $SO_2 + Cl_2 + 2H_2O \rightarrow 2HCl + H_2SO_4$

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2. Which substance is oxidised and which substance/ion is reduced in the following reactions?

(i) $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

(ii) $H_2S + 2FeCl_3 \rightarrow 2FeCl_2 + 2HCl + S$

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

(iv) $SnCl_2 + 2FeCl_3 + \rightarrow SnCl_2 + 2FeCl_2$

(v) $2MnO_4^- + 16H^+ + 5CrO_4^{2-} \rightarrow 2Mn^{2+} + 8H_2O + 10CO_2$

(vi) $3N_2H_4 + 2BrO_3^- \rightarrow 3N_2 + 2Br^- + 6H_2O$

(vii) $Cl_2 + SO_3^{2-} + H_2O \rightarrow 2Cl^- + SO_4^{2-} + 2H^+$

(viii) $2I^- + Cl_2 \rightarrow 2Cl^- + I_2$

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3. Arrange the following in the order of

(a) Increasing oxidation number of iodine. I_2, HI, HIO_4, ICI

(b) Increasing oxidation number of cholorine Cl_2O_7, Cl_2O, HCl, CIF_3, Cl_2

(c) increasing oxidation number of nitrogen. NH_3, N_3H, N_2O, NO, N_2O_5

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(i) I in KIO_3

(ii) P in NaH_2PO_4

(iii) P in $P_2O_7^{4-}$

(iv) Fe in $[Fe(CN)_6]^{4-}$

(v) Ni in $[Ni(CN)_6]^{4-}$

(vi) S in $H_2S_2O_8$

(vii) N in NO_3^-

(viii) S in S_2Cl_2

(ix) P in $Mg_2P_2O_7$

(x) Cr in $K_2Cr_2O_7$

(xi) Mn in MnO_4^-

(xii) Pt in $[PtCl_6]^{2-}$

(xiii) P in PH_4^+

(xiv) C in $C_{12}H_{22}O_{11}$

(xv) Fe in $Na_2[Fe(CN)_5NO]$

(xvi) Cr in $(NH_4)_2Cr_2O_7$

(xvii) V in $Rb_4Na[HV_{10}O_{28}]$

(xviii) Xe in $BaXeO_6$

(xix) Cl in $Ca(ClO_2)_2$

4. (xx) Ni in $Ni(CO)_4$

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5. (a). Which compound among the following has the lowest oxidation number of Mn?

$KMnO_4, K_2MnO_4, MnO_2$ and Mn_2O_3

(b). Which compound among the following has the higest oxidation number of P?

PH_3, H_3PO_2, PCl_3 and H_3PO_4

(c). Which compound among the following has the highest oxidation number of chlorine ?

$HClO_4, HOCl, CIF_3, HCIO_3$ and HCl

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Short Answer

1. Balance the following equations by the ion electron method:

a. $MnO_4^{\ominus} + Cl^{\ominus} + H^{\oplus} \rightarrow Mn^{2+} + H_2O + Cl_2$

b. $Cr_2O_7^{2-} + I^{\ominus} + H^{\oplus} \rightarrow Cr^{3+} + H_2O + I_2$

c. $H^{\oplus} + SO_4^{2-} + I^{\ominus} \rightarrow H_2S + H_2O + I_2$

d. $MnO_4^{\ominus} + Fe^{2+} \rightarrow Mn^{2+} + Fe^{3+} + H_2O$

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(i) $CO + Fe_3O_4 \longrightarrow FeO + CO_2$

(ii) $H_2O_2 + ClO_2 + OH^- \longrightarrow Cl^- + O_2 + H_2O$

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

(iv) $Cr_2O_7^{2-} + HNO_2 + H^+ \longrightarrow Cr^{3+} + NO_3^- + H_2O$

(v) $KI + H_2SO_4 \longrightarrow K_2SO_4 + I_2 + SO_2 + H_2O$

(vi) $HgS + HI + HNO_3 \longrightarrow H_2HgI_4 + NO + S + H_2O$

2. (vii) $[Fe(CN)_6]^{3-} + N_2H_4 + OH^- \rightarrow [Fe(CN)_6]^{4-} + N_2 + H_2O$

[**Hint:** Two half reactions

$$\overset{+3}{[Fe(CN)_6]^{3-}} \longrightarrow \overset{+2}{[Fe(CN)_6]^{4-}}$$

(change in Ox.no. per Fe atom = −1)

$$\overset{-2}{N_2H_4} \longrightarrow \overset{0}{N_2}$$

(change in Ox.no. per N atom = + 2)

Total increase = 2 × (+2) = + 4

$$4[Fe(CN)_6]^{3-} + N_2H_4 \longrightarrow 4[Fe(CN)_6]^{4-} + N_2$$

$$[4Fe(CN)_6]^{3-} + N_2H_4 + 4OH^- \longrightarrow 4[Fe(CN)_6]^{4-} + N_2 + 4H_2O$$

(viii) $MnO_4^{2-} + H^+ \longrightarrow MnO_2 + MnO_4^- + H_2O$

[**Hint:**

$$\overset{VI}{MnO_4^{2-}} \longrightarrow \overset{IV}{MnO_2}$$

$$[\overset{VI}{MnO_4^{2-}} \longrightarrow \overset{VII}{MnO_4^-}] \times 2$$

$$3MnO_4^{2-} + 4H^+ \longrightarrow 2MnO_4^- + MnO_2 + 2H_2O]$$

(ix) $HNO_3 + Cu_2O \longrightarrow Cu(NO_3)_2 + NO + H_2O$

(x) $AuCl_4^- + Sn^{2+} + H^+ \longrightarrow Sn^{4+} + AuCl + HCl$

(xi) $S + OH^- \longrightarrow S^{2-} + S_2O_3^{2-}$

[Hint: $\overset{0}{S} \longrightarrow S^{2-}$ (decrease of 2)

$2\overset{0}{S} \longrightarrow S_2O_3^{2-}$ (increase of 2 per S atom)]

(xii) $NaClO_3 + KI + HCl \longrightarrow NaCl + KCl + I_2 + H_2O$

(xiii) $PbCrO_4 + H_2SO_4 + FeSO_4 \longrightarrow Fe_2(SO_4)_3 + PbSO_4 + Cr_2(SO_4)_3 + H_2O$

(xiv) $As + HNO_3 \longrightarrow H_3AsO_4 + NO_2 + H_2O$

(xv) $Fe_2(SO_4)_3 + H_2SO_3 + H_2O \longrightarrow FeSO_4 + H_2SO_4$

(xvi) $C_6H_{12}O_6 + H_2SO_4 \longrightarrow CO_2 + SO_2 + H_2O$

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(xvi) $C_6H_{12}O_6 + 12H_2SO_4 \longrightarrow 6CO_2 + 12SO_2 + 18H_2O$]

Balance the following equations:

(i) $Ca_3(PO_4)_2 + SiO_2 + C \longrightarrow CaSiO_3 + P_4 + CO$

(ii) $P_2H_4 \longrightarrow PH_3 + P_4H_2$

[Hint: $3 \times [P_2H_4 + 2H^+ + 2e \longrightarrow 2PH_3]$

$2P_2H_4 \longrightarrow P_4H_2 + 6H^+ + 6e$

$5P_2H_4 \longrightarrow 6PH_3 + P_4H_2$]

(iii) $Na_2HAsO_3 + KBrO_3 + HCl \longrightarrow NaCl + KBr + H_3AsO_4$

[Hint: $[HAsO_3^{2-} + H_2O \longrightarrow H_3AsO_4 + 2e] \times 3$

$BrO_3^- + 6H^+ + 6e \longrightarrow Br^- + 3H_2O$

$3HAsO_3^{2-} + BrO_3^- + 6H^+ + 3H_2O \longrightarrow 3H_3AsO_4 + Br^- + 3H_2O$

or $3Na_2HAsO_3 + KBrO_3 + 6HCl \longrightarrow 3H_3AsO_4 + KBr + 6NaCl$]

(iv) $FeS_2 + O_2 \longrightarrow Fe_2O_3 + SO_2$

[Hint: Both iron and sulphur in FeS_2 undergo a change oxidation state.

Increase

$\overset{+2\,-1}{FeS_2} \longrightarrow \overset{+3}{Fe} + \overset{+4}{2SO_2}$ Total increase = 10 + 1 = 11

Increase $5 \times 2 = 10$

$O_2^0 \longrightarrow 2O^{2-}$ Total decrease = $2 \times 2 = 4$]

3.

(v) $As_2S_5 + HNO_3 \longrightarrow H_3AsO_4 + H_2SO_4 + NO_2 + H_2O$

Increase $5 \times 8 = 40$

[Hint: $\overset{-2}{As_2S_5} + \overset{+5}{HNO_3} \longrightarrow \overset{+6}{H_2SO_4} + \overset{+4}{NO_2}$]

Decrease $1 \times 1 = 1$

(vi) $MnO + PbO_2 + HNO_3 \longrightarrow HMnO_4 + Pb(NO_3)_2 + H_2O$

(vii) $P + NaOH + H_2O \longrightarrow NaH_2PO_2 + PH_3$

Increase $1 \times 1 = 1$

[Hint: $\overset{0}{P} \longrightarrow \overset{+1}{NaH_2PO_2} + \overset{-3}{PH_3}$]

Decrease i × 3 = 3

(viii) $KClO_3 + H_2SO_4 \longrightarrow KHSO_4 + O_2 + ClO_2 + H_2O$

[Hint: $|ClO_3^- + 2H^+ + e \longrightarrow ClO_2 + H_2O| \times 2$

$2ClO_3^- \longrightarrow 2ClO_2 + O_2 + 2e$

$4ClO_3^- + 4H^+ \longrightarrow 4ClO_2 + O_2 + 2H_2O$

or $4KClO_3 + 4H_2SO_4 \longrightarrow 4KHSO_4 + 4ClO_2 + O_2 + 2H_2O$

(ix) $Ag + KCN + O_2 + H_2O \longrightarrow KAg(CN)_2 + KOH$

[Hint: $[Ag + 2CN^- \longrightarrow [Ag(CN)_2]^- + e] \times 4$

$O_2 + 2H_2O + 4e \longrightarrow 4OH^-$]

(x) $Ca(OCl)_2 + KI + HCl \longrightarrow CaCl_2 + I_2 + KCl + H_2O$

[Hint: $OCl^- + 2H^+ + 2e \longrightarrow Cl^- + H_2O$

$2I^- \longrightarrow I_2 + 2e$

$OCl^- + 2H^+ + 2I^- \longrightarrow Cl^- + I_2 + H_2O$

or $2OCl^- + 4H^+ \longrightarrow 2Cl^- + 2I_2 + 2H_2O]$

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4. Calculate the oxidation state of underlined

(a) Ba_2XeO_2 (b). $BaCl_2$ (c).$C_{12}H_{22}O_{11}$ (d) IF_7

(e) $Na\left[Fe(CN)_5NO\right]$ (f) RuO_4 (g) K_2TaF_7 (h) Na_2MO_4

$U_2O_7^{4-}$ (j) C is diamond.

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5. Calculate the oxidation state of vanadium in the following complex compound.

$Rb_4Na[HV_{10}O_{28}]$

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Level A

1. Oxidation is defined as:

A. loss of electrons

B. gain of electron

C. gain of protons

D. loss of protons

Answer: A

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2. A reducing agent is a substance Which can:

A. accept electrons

B. donate electrons

C. accept protons

D. donate protons

Answer: B

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3. A redox reaction is:

A. proton transfer reaction

B. ion combination reaction

C. a reaction in solution

D. electrons transfer reaction

Answer: D

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4. Which of the following is not a redox reaction?

A. Burning of candle

B. Rusting of iron

C. Dissolving a salt in water

D. Disssolving Zn in dil. H_2SO_4

Answer: C

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5. The reaction of $H_2S + H_2O_2 \rightarrow S + 2H_2O$ manifests

A. oxidising action of H_2O_2

B. reducing nature of H_2O_2

C. acidic nature H_2O_2

D. alkaline nature of H_2O_2

Answer: A

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6. The oxidation number of Fe in $K_4[Fe(CN))(6)]$ is

A. $+6$

B. $+4$

C. $+3$

D. $+2$

Answer: D

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7. In $Ni(CO)_4$ the oxidation state of Ni is:

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8. Pick the group which docs not on an a neutral oxide:

A. $NO_2, P_4O_{10}, Al_2O_3, NO$

B. MgO, N_2O_3, SO_3, N_2O

C. CO_2, SO_3, CaO, XeO_3

D. $CO, SiO_2, SnO_2, Na_2O_3$

Answer: C

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9. Magnesium reacts with acids producing hydrogen and correspondmg magnesmm salts. In such reactions Mg undergoes

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10. White P reacts with caustic soda, the products are PH_3 and NaH_2PO_2. This reaction is an example of:

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11. Which of the following reactions is not a redox reaction?

A. $Ag^+ + Cl^- \rightarrow AgCl$

B. $Zn(s) + Cu^{2+}(aq.) \rightarrow Zn^{2+} + Cu(s)$

C. $2Mg(s) + O_2(g) \rightarrow 2MgO$

D. $FeO + C \rightarrow Fe + CO$

Answer: A

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12. In this reaction $2Na_2S_2O_3 + I_2 = Na_2SO_4O_6 = 2NaI_2$ acts as:

A. reducing agent

B. oxidising agent

C. oxidising agent as well as reducing agent

D. None of these

Answer: B

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13. The most common oxidation explained as due to:

A. 2 electron in the outermost shell

B. 4 electron in the outermost shell

C. 6 electrons in the outermost shell

D. 8 electron in the outermost shell

Answer: C

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14. Select the compound in which chlorine shows oxidation state +7:

A. $HClO_4$

B. $HClO_3$

C. $HClO_3$

D. $HClO$

Answer: A

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15. HBr and HI can reduce sulphurie acid, HCI can reduced $KMnO_4$ and HF can reduce.....

A. H_2SO_4

B. $KMnO_4$

C. $K_2Cr_2O_7$

D. None of these

Answer: D

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16. One mole of N_2H_4 loses ten moles of electrons to form a new compound A. Assuming that all the nitrogen appears in the new compound, what is the oxidation state of nitrogen in A? (There is no change in the oxidation state of hydrogen.)

A. -1

B. -3

C. $+3$

D. $+5$

Answer: C

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17. The brown ring complex compound of iron is formulated as $\left[Fe(H_2O)_5(NO)\right]SO_4$. The oxidation state of iron is

A. $+1$

B. $+2$

C. $+3$

D. zero

Answer: B

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18. In which of the following compounds, iron has an oxidation state of+3?

A. $Fe(NO_3)_2$

B. FeC_2O_4

C. $\left[Fe(H_2O)_6\right]Cl$

D. $(NH_4)_2SO_4.\ FeSO_4.6H_2O$

Answer: C

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19. When $KMnO_4$ is reduced with oxalic acid in acidic solution, the oxidation number of Mn changes from

A. 7 to 2

B. 7 to 4

C. 7 to 6

D. 6 to 2

Answer: A

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20. In which of the following reactions the underlined substance is oxidised?

A. $3Mg + \underline{N}_2 \rightarrow Mg_3N_2$

B. $2KI + \underline{B}r_2 \rightarrow 2KBr + I_2$

C. $\underline{C}uO + H_2 \rightarrow Cu + H_2O$

D. $\underline{C}O + Cl_2 \rightarrow COCl_2$

Answer: D

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21. When tin(IV) chloride is treated with excess of conc., hydrochloric acid, the complex ion $(SnCl_6)^{2-}$ is formed. The oxidation state of tin in this complex ion is:

A. $+4$

B. zero

C. -2

D. -4

Answer: A

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22. In the following reaction

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

A. bromine is oxidised carbonate is reduced,

B. bromine is reduced, carbonate is oxidised

C. bromine in neither reduced nor oxidised

D. bromine is reduced as well as oxidised

Answer: D

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23. The oxidation state of phosphorus varies from:

A. $-1\text{to}+1$

B. $-3\text{to}+3$

C. $-3\text{to}+5$

D. $-5\text{to}+1$

Answer: C

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24. When SO_2 is passed through acidic solution of potassium dichromate, then chromium sulphate is formed. Change in valency of chronium is

A. $+4\text{to}+2$

B. $+6 \text{to} +3$

C. $+7 \text{to} +2$

D. $+5 \text{to} +3$

Answer: B

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25. Oxidation states of iodine vary from

A. $-1 \text{to} +1$

B. $-1 \text{to} +7$

C. $+3 \text{to} +5$

D. $-1 \text{to} +5$

Answer: B

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26. Oxidation number of fluorine in F_2O is:

A. $+1$

B. $+2$

C. -1

D. -2

Answer: C

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27. In that compounds $KMnO_4$ and $K_2Cr_2O_7$ the highest oxidation state the element:

A. potassium

B. chromium

C. oxygen

D. maganse

Answer: D

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28. $Cl_2 + H_2S \rightarrow 2HCl + S$,

In that above reaction oxidation state of chlorine changes from

A. zero to -1

B. 1 to zero

C. zero to 1

D. remains unchanged

Answer: A

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29. Carbon is in highest oxidation state in:

A. CH_3Cl

B. CCl_4

C. $CHCl_3$

D. CH_2Cl

Answer: B

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30. Addition of iron or zinc to copper sulphate cause, precipitation of copper owing to the:

A. reduction of Cu^{2+}

B. oxidation of Cu^{2+}

C. hydrolysis of $CuSO_4$

D. ionisationn of $CuSO_4$

Answer: A

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31. In a reaction

$$H_2O(\text{steam}) + C(\text{glowing}) = CO + H_2$$

A. H_2O Is the reducing agent

B. H_2O is the oxidising agent

C. carbon is the oxidising agent

D. oxidation reduction does no occur

Answer: B

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32. The oxidation number of C in $CH_4, CH_3CI, CH_2CI_2, CHCI_3 \text{and} \mathbb{C}I_4$ are respectively:

A. $+4, \ +2, 0, \ -2, \ -4$

B. $+2, \ +4, 0, \ -4, \ -2$

C. $-4, \ -2, 0, \ +2, \ +4$

D. $-2, \ -4, 0, \ +4, \ +2$

Answer: C

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33. Which of the following statements is correct

A. Oxidation of a substance is followed by reduction of another

B. Reduction of a substance is followed by oxidation of another

C. Oxidation and reduction are complementary reactions.

D. It is not necessary that both oxidation and reduction should take place in the same reaction

Answer: C

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34. Reduction never involves:

A. gain of electrons

B. decrease in oxidation number

C. loss of electrons

D. decrease in valency of electropositive component

Answer: C

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35. In which of the following reactions have the underlined substance been reduced?

A. $\underline{\text{Carbon monoxide}} + \text{copper oxide} \rightarrow \text{carbon dioxide} + \text{copper}$

B. $\underline{\text{copper oxide}} + \text{hydrochloric acid} \rightarrow \text{carbon dioxide} + \text{water}$

C. $\underline{\text{hydrogen}} + \text{iron oxide} \rightarrow \text{carbon chloride} + \text{water}$

D. $\underline{\text{steam}} + \text{iron} \rightarrow \text{iron oxide} + \text{hydrogen}$

Answer: D

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36. In which of the following reactions, the underlined element has decreased its oxidation number during the reaction?

A. $\underline{Fe} + CuSO_4 \rightarrow Cu + FeSO_4$

B. $\underline{H_2} + Cl_2 \rightarrow 2HCl$

C. $\underline{C} + H_2O \rightarrow CO + H_2$

D. $\underline{MnO_2} + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$

Answer: C

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37. Select the compound in which chlorine is assigned the oxidation number $+5$

A. $HClO_4$

B. $HClO_2$

C. $HClO_3$

D. HCl

Answer: B

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38. Phosphorus has the oxidation state $+3$ in

A. ortho phosphoric acid

B. phosphorus acid

C. meta phosphoric acid

D. pyrophophoric acid

Answer: B

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39. Oxidation number of P in PO_4^{3-}, of S in SO_4^{2-} and that of $Cr_2O_7^{2-}$ are respectively

A. $+3,\ +6$ and $+6$

B. $+5,\ +6$ and $+6$

C. $+3,\ +6$ and $+5$

D. $+5,\ +3$ and $+6$

Answer: B

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40. The highest oxidation state of Mn is shown by

A. K_2MnO_4

B. $KMnO_4$

C. MnO_2

D. Mn_2O_3

Answer: C

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41. Oxidation number of P in $Ba(H_2PO_2)_2$ is

A. $+3$

B. $+2$

C. $+1$

D. -1

Answer: B

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42. The oxidation states of the most electronegative elements in the products of the reaction between BaO_2 and H_2SO_4 are

A. 0 and -1

B. -1 and -2

C. -2 and 0

D. -2 and $+1$

Answer: D

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43. Following reaction describes the rusting of iron

$4Fe + 3O_2 \rightarrow 4Fe^{3+} + 6O^{2-}$

Which one of the following statements is incorrect?

A. It s redox reaction

B. Metallic iron is a reducing agent

C. Fe^{3+} is an oxidising agent

D. Metallic iron is reduced to Fe^{2+}

Answer: A

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44. In the reaction of sodium thiosulphate with 12 in aqueous medium the equivalent weight of sodium thiosulphatc is equal to

A. molar mass of sodium this sulphate

B. the average molar masses of $Na_2S_2O_3$ and I_2

C. half the molar mass of sodium this sulphate

D. twice of molar mass of sodium this sulphate

Answer: C

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45. The oxidation number of chlorine in HOCl is:

A. -1

B. zero

C. $+1$

D. $+2$

Answer: C

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46. In the reaction,

$Cl_2 + OH^- \rightarrow Cl^- + ClO_4^{-1} + H_2O$, chlorine is:

A. oxidised

B. reduced

C. oxidised as well as reduced

D. neither oxidised nor reduced

Answer: D

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47. The oxidation number of arsenic atom in H_3AsO_4 is :-

A. -1

B. -3

C. $+3$

D. $+5$

Answer: B

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48. In which one of the following reactions, hydrogen is acts as an oxidising agent ?

A. With iodine to give hydrogen iodide

B. With lithium to give lithium hydride

C. With nitrogen to give ammonia

D. With sulphur to give hydrogen sulphide

Answer: A

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49. For the redox reaction,

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

the correct coefficients of the reactants for the balanced reaction are

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50. The oxidation number of P in $Mg_2P_2O_7$ is

A. $+3$

B. $+2$

C. $+5$

D. -3

Answer: A

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51. The oxidation number of phosphorus in PO_4^{3-}, P_4O_{10}, and $P_2O_7^{4-}$ is

A. $+5$

B. $+3$

C. -3

D. $+2$

Answer: B

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52. The oxidation number of Cr in $K_2Cr_2O_7$ is

A. $+7$

B. $+6$

C. $+3$

D. $+2$

Answer: B

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53. Bromine reacts with hot aqueous alkali to give bromide and bromate. What is the change that is brought about in oxidation sate to bromine to bromate?

A. $-1\text{to}+5$

B. $0\text{to}+5$

C. $-1\text{to}+7$

D. None of these

Answer: B

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54. The oxidation number of S in $Na_2S_4O_6$ is

A. $+0.5$

B. 2.5

C. $+4$

D. $+6$

Answer: D

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55. The oxidation number of nitrogen in NO_3^- is:

A. -1

B. $+2$

C. $+3$

D. $+5$

Answer: B

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56. Oxygen has an oxidation state of +2 in

A. H_2O_2

B. OF_2

C. SO_2

D. H_2O

Answer: A

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57. When iron is rusted, it is

A. oxidised

B. reduced

C. evaporated

D. decomposed

Answer: D

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58. An element that never has a positive oxidation state in any of its compounds is

A. boron

B. oxygen

C. chlorine

D. fluorine

Answer: D

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59. Which of the following acids possesses oxidising, reducing, and complex forming properties ?

A. HNO_3

B. H_2SO_4

C. HCl

D. HNO_2

Answer: B

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60. Which substance is serving as a reducing agent in the following reaction?

$$14H^+ + Cr_2O_7^{2-} + 3Ni \rightarrow 2Cr^{3+} + 7H_2O + 3Ni^{2+}$$

A. H_2O

B. Ni

C. H^+

D. $Cr_2O_7^{2-}$

Answer: A

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61. The oxidation state of iodine in $H_4IO_6^-$ is:

A. $+7$

B. -1

C. $+5$

D. $+1$

Answer: C

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62. Oxidation number of N in NH_4NO_3 is:

A. -3

B. $+5$

C. -3 and $+5$

D. $+3$ and -5

Answer: A

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63. The missing tenn in the following equation is:

$2Fe^{3+} + Sn^{2+} \rightarrow 2Fe^{2+} + \ldots$

A. Sn^{4+}

B. Sn^{3+}

C. Sn^{2+}

D. Sn^{+}

Answer: C

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64. A compound contains atoms A, B and C. the oxidation number of A is $+2$, of B is $+5$ and of C is -2. The possible formula of the compound is

A. ABC_2

B. $B_2(AC_3)_2$

C. $A_3(BC_4)_2$

D. $A_3(B_4C)_2$

Answer: D

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65. The correct set of oxidation numbers of nitrogen in ammonium nitrate is:

A. $-3, +3$

B. $-1+1$

C. $+1, -1$

D. $-3, +5$

Answer: B

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66. In which of the following pairs. the oxidation states, of sulphuric and chromium are same?

A. SO_3^{2-}, CrO_4^{2-}

B. SO_3, CrO_4^{2-}

C. SO_2, CrO_4^{2-}

D. $SO_2, Cr_2O_7^{2-}$

Answer: C

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67. For the redox reaction. $HgCl_2 + SnCl_2 \rightarrow 2Hg + SnC1_{4+}$ the correct coefficients of reactants fur the balance equation are:

A. 1,1

B. 1,2

C. 2,2

D. 2,1

Answer: C

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68. Consider the following reaction:

$$6FeSO_4 + K_2Cr_2O_7 + 7H_2SO_4 \rightarrow 3Fe_2(SO_4)_2 + Cr_2(SO_4)_3 + K_2SO_4 +$$

How many electrons are involved in the aboYc redox reaction?

A. 9

B. 6

C. 3

D. 2

Answer: B

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69. In the reaction

$$8Al + 3Fe_3O_4 \rightarrow 4Al_2O_3 + 9Fe$$

the number of electrons transferred from the reductant to the oxidant is

A. 8

B. 4

C. 16

D. 24

Answer: D

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70. Which of the following examples does not represent disproportionation ?

A. $MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$

B. $2H_2O_2 \rightarrow 2H_2O + O_2$

C. $4KClO_3 \rightarrow 3KClO_4 + KCl$

D. $3Cl_2 + 6NaOH \rightarrow 5NaCl + NaClO_3 + 3H_2O$

Answer: A

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71. Why the following reaction is not possible?

A. Both $Cr_2O_7^{2-}$ and Fe^{3+} are reducing agents

B. Both $Cr_2O_7^{2-}$ and Fe^{3+} are oxidising agents

C. $Cr_2O_7^{2-}$ is a strong oxidsing agent while Fe^{3+} is a weak oxidising agent.

D. The solution is acidic in nature

Answer: B

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72. Which one of the following statements is not correct?

A. Oxidation number of S in $(NH_4)_2S_2O_8$ is +6

B. Oxidation number of Os in OsO_4 is +8

C. Oxidation number of S in H_2SO_5 is +8

D. Oxidation number of O in $KO_2$is $-\frac{1}{2}$

Answer: C

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73. The oxidant which cannot act as a reducing agent is

A. SO_2

B. NO_2

C. CO_2

D. ClO_2

Answer: C

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74. The coordination number and oxidation number of Cr in $K_3\left[Cr(C_2O_4)_3\right]$ are, respectively,

A. 4 and +2

B. 6 and +3

C. 3 and -3

D. 3 and 0

Answer: C

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75. Consider the following reaction:

$$P_4 + 3NaOH + 3H_2O \rightarrow 3NaH_2PO_2 + PH_3$$

In the above reaction,

1 . Phosphorus is oxidised.

2. Phosphorus is reduced.

Which of the above is/are correct?

[Hint: It is disproportionation in which phosphorus is oxidised as well as reduced.]

A. I only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Answer: C

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76. Which of the following reactions does not involve either oxidation or reduction ?

A. $VO^{2+} \rightarrow V_2O_3$

B. $Na \rightarrow Na^+$

C. $CrO_4^{2-} \rightarrow CrO_7^{2-}$

D. $Zn^{2+} \rightarrow Zn$

Answer: C

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77. It is found that V forms a double salt isomorphous with Mohr's salt. The oxidation number of V in this compound is:

A. $+3$

B. $+2$

C. $+4$

D. -4

Answer: B

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78. How many mole of electrons are involved in the reduction of one mole of MnO_4^- ion in alkaline medium to MnO_3^-

A. 2

B. 1

C. 3

D. 4

Answer: A

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79. The oxidation number of C in HNC is

A. $+2$

B. -3

C. $+3$

D. zero

Answer: A

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80. The oxidation number of Fe in $Fe_{0.94}O$ is

A. 200

B. 200/94

C. 94/200

D. None of these

Answer: B

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81. The oxidation number of Cl in $CaOCl_2$ is

A. -1 and $+1$

B. $+2$

C. -2

D. None of these

Answer: A

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82. The equivalent weight of FeC_2O_4 in the change

$FeC_2O_4 \rightarrow Fe^{3+} + CO_2$ is

A. M/3

B. M/6

C. M/2

D. M/1

Answer: D

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83. The oxidation number of sulphur in S_8, S_2F_2 and H_2S respectively are:

A. $0, +1$ and -2

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

C. $0, +1$ and $+2$

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

Answer: A

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

A. oxidation reaction

B. reduction reaction

C. disproportionation reaction

D. decomposition reaction

Answer: C

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85. The oxidation state of 'S' in H_2SO_4 is:

A. $+2$

B. $+4$

C. $+6$

D. $+7$

Answer: C

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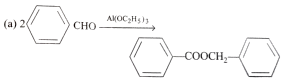
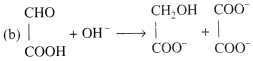
86. Which of the following is not a disproportionation reaction ?

A. 

B. 

C. $NaH + H_20 \rightarrow NaOH + H_2$

D. All of these

Answer: A

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87. Which of the following is a disproportionation reaction?

A. $Cu_2O + 2H^+ \rightarrow Cu + Cu^{2+} + H_2O$

B. $2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$

C. $CaCO_3 + 2H^+ \rightarrow Ca^{2+} + H_2O + CO_2$

D. $Cr_2O_7^{2-} + 2OH^- \rightarrow 2CrO_4^{2-} + H_2O$

Answer: A

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88. When $KMnO_4$ acts as an oxidising agnet and ultimetely from MnO_4^{2-}, MnO_2, Mn_2O_3, and Mn^{2+}, then the number of electrons transferred in each case, respectively, are

A. 4,3,1,5

B. 1,5,3,7

C. 1,3,4,5

D. 3,5,7,1

Answer: C

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89. which of the following is a redox reaction ?

A. $NaCl + KNO_3 \rightarrow NaNO_3 + KCl$

B. $CaC_2O_4 + 2HCl \rightarrow CaCl_2 + H_2C_2O_4$

C. $CaC_2O_4 + 2HCl \rightarrow CaCl_2 + H_2C_2O_4$

D. $Zn + 2AgCN \rightarrow 2Ag + Zn(CN)_2$

Answer: C

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90. For decolourisation of $1\text{mol of} KMnO_4$, the moles of H_2O_2 required is

A. $\frac{1}{2}$

B. $\frac{3}{2}$

C. $\frac{5}{2}$

D. $\frac{7}{2}$

Answer: C

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91. The reaction of $KMnO_4$ and HCI results in:

A. oxidation of Mn in $KMnO_4$ and production of Cl_2

B. reduction of Mn in $KMnO_4$ and production of H_2

C. oxidation of Mn in $KMnO_4$ and production of H_2

D. reduction of Mn in $KMnO_4$ and production of Cl_2

Answer: D

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92. Consider the following reaction,

$5H_2O_2 + ClO_2 + 2OH^- \rightarrow Cl^- + yO_2 + 6H_2O$

The reaction is balanced if:

A. x=5, y=2

B. x=2, y=5

C. x=4, y=10

D. x=5, y=5

Answer: B

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93. In the chemical reaction,

$Ag_2O + H_2O + 2e^- \rightarrow 2Ag + 2OH^-$

A. water is oxidised

B. electrons are reduced

C. silver is oxidised

D. silver is reduced

Answer: D

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94. The reaction, $2H_2O(l) \rightarrow 4H^+(aq.) + O_2(g) + 4^-$ is

A. a redox reaction

B. a hydrolysis reaction

C. a solvolysis reaction

D. an oscillatory reaction

Answer: A

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95. Which of the following molecules can act as an oxidating as well as a reducing agent?

A. H_2S

B. SO_3

C. H_2O_2

D. F_2

Answer: C

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96. Which of the following is not a reducing agent ?

A. SO_2

B. H_2O_2

C. CO_2

D. NO_2

Answer: C

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97. Equivalent mass of oxidizing agent in the reaction,

$SO_2 + 2H_2S \rightarrow 3S + 2H_2O$ is

A. 32

B. 64

C. 16

D. 8

Answer: C

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98. Among these, identify the species with an atom in $+6$ oxidation state:

.

A. MnO_4^-

B. $Cr(CN)_6^{2-}$

C. NiF_6^{2-}

D. CrO_2Cl_2

Answer: D

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99. On reduction of $KMnO_4$ by oxalic acid in acidic medium, the oxidation number of Mn. What is the magnitude of is change?

A. 7 to 2

B. 6 to 2

C. 5 to 2

D. 7 to 4

Answer: A

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100. The number of moles of $K_2Cr_2O_7$ reduced by $1mol$ of Sn^{2+} ions is

A. $\frac{1}{3}$

B. 3

C. $\frac{1}{6}$

D. 6

Answer: A

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101. In the standardization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by iodometry, th equivalent weight of K_2Cr_2O is

A. molecular weight /2

B. molecular weight /6

C. molecular weight /3

D. same as molecular weight

Answer: B

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102. In the balanced chemical reaction

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

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

A. 5,6,3,3

B. 5,3,6,3

C. 3,5,3,6

D. 5,6,5,5

Answer: A

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103. In alkaline medium CIO_2 oxidises to H_2O_2 and O_2 and itself gets reduced to Cl^-. How many moles of H_2O_2 are oxidised by 1 mole of ClO_2?

Hint: The balanced chemical equation is:

A. 1

B. 1.5

C. 2.5

D. 3.5

Answer: C

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104. The oxidation number of xenon in $XeOF_2$ is

A. zero

B. 2

C. 4

D. 3

Answer: C

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105. The oxidation number of cobalt in $K\left[Co(CO)_4\right)$ is

A. $+1$

B. $+3$

C. -1

D. -3

Answer: C

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106. The oxidation state of iodine in IPO_4 is

A. $+1$

B. $+3$

C. $+5$

D. $+7$

Answer: B

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107. Nitrogen forms a variety of compounds in all oxidation states ranging from:

A. $-3\text{to}+5$

B. $-3\text{to}+3$

C. $-3\text{to}+4$

D. $-3\text{to}+6$

Answer: A

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108. In alkaline medium, H_2O_2 reacts with Fe^{3+} and Mn^{2+} separately to give:

A. Fe^{4+} and Mn^{4+}

B. Fe^{2+} and Mn^{2+}

C. Fe^{2+} and Mn^{4+}

D. Fe^{4+} and Mn^{2+}

Answer: C

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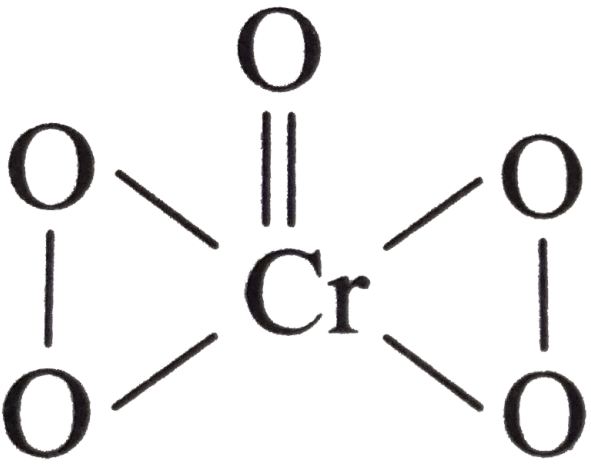
109. Compound CrO_5 has structure as shown



ltbtgt The oxidation number fo Cr in the above compound is .

A. $+4$

B. $+5$

C. $+6$

D. $+10$

Answer: C

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110. Which of the following chemical reactions depicts the oxidising behaviour of H_2SO_4?

A. $2HI + H_2SO_4 \rightarrow I_2 + SO_2 + 2H_2O$

B. $Ca(OH)_2 + H_2SO_4 \rightarrow NaHSO_4 + HCl$

C. $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$

D. $2PCl_5 + H_2SO_4 \rightarrow 2POCl_3 + 2HCl + SO_2Cl_2$

Answer: A

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111. The oxidation numbers of the sulphur atoms in pcroxy-monosulphuric acid (H_2SO_5) and peroxydisulphuric acid $(H_2S_2O_8)$ are respectively.

A. $+8$ and $+7$

B. $+3$ and $+3$

C. $+6$ and $+6$

D. $+4$ and $+6$

Answer: C

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112. 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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113. When hydrogen peroxide is added to acidified potassium dichromate, a blue colour is produced due to formation of :

A. CrO_3

B. Cr_2O_3

C. CrO_5

D. CrO_4^{2-}

Answer: C

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

A. 7.5 moles

B. 0.2 moles

C. 0.6 moles

D. 0.4 moles

Answer: D

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115. Oxidation number if 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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116. 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=3,Y=8

C. X=8,Y=6

D. X=8,Y=3

Answer: D

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

A. oxidation reaction

B. reduction reaction

C. disproportionation reaction

D. decomposition reacto

Answer: C

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118. Which of the following species does not show disproportionation reaction?

A. ClO^-

B. ClO_2^-

C. ClO_3^-

D. ClO_4^-

Answer: D

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119. Which of the following shows nitrogen with its increasing order of oxidation number.

A. $NO < N_2O < NO_2 < NO_3^- < NH_4^-$

B. $NH_4^- < N_2O < N_2O < N_3O^- < NO$

C. $NH_4^- < N_2O < NO < NO_2 < N_3O^-$

D. $NH_4^- < NO < N_2O < NO_2 < N_3O^-$

Answer: C

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120. Freshly prepared, bright blue coloured solution of sodium in liquid ammonia can be used to reduce the organic functional moieties. In this, the actual reducing species is

A. $\left[Na(NH_3)_n\right]^+$

B. $\left[H_2(NH_3)_n\right]$

C. $\left[NaNH_2(NH_3)_n\right]$

D. $\left[e(NH_3)_n\right]^+$

Answer: D

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121. The reaction of white phosphorus with aqueous $NaOH$ gives phosphine along with another phosphorus containing compound. The reacation type, the oxidation states of phosphorus in phosphine and the other product are respectvely:

A. redox reaction, -3 and -5

B. redox reaction, +3 and +5

C. disproportion reaction, -4 and +5

D. disproportion reaction, -3 and +5

Answer: D

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122. In the oxidation of sulphite to sulphate using pennanganate the number of protons consumed by each manganese center is:

A. 5

B. 2

C. 6

D. 3

Answer: B

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123. Which ordering of Compounds is according to the decreasing order of the oxidation state of nitrogen?

A. HNO_3, NO, NH_4Cl, 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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124. Consider the following reaction :

$$xMnO_4^- + yC_2O_4^{2-} + zH^+ \rightarrow xMn^{2+} + 2yCO_2 + \frac{z}{2}H_2O$$

The value of x, y and z in the reaction are, respectively.

A. 2,5 and 16

B. 5,2 and 8

C. 5,2 and 16

D. 2,5 and 8

Answer: A

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125. In which of the following reactions H_2O_2 acts as reducing agent?

(A) $H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$

(B) $H_2O_2 - 2e^- \rightarrow O_2 + 2H^+$

(C). $H_2O_2 + 2e^- \rightarrow 2OH^-$

(D) $H_2O_2 + 2OH^- - 2e^- \rightarrow O_2 + 2H_2O$

A. A,C

B. B,D

C. A,B

D. C,D

Answer: B

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126. In which of the following coordination compounds, the central metal iron is in zero oxidation state?

A. $\left[Fe(H_2O)_6\right]Cl_3$

B. $K_4\left[Fe(CN)_6\right]$

C. $\left[Fe(CO)_5\right]$

D. $\left[Fe(H_2O)_6\right]Cl_2$

Answer: C

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127. The pair in which phosphours atoms have a formed oxidation state of $+3$ is

A. Orthophosphorous and phyrophosphorous acids

B. Pyrophosphorous and hypophosphoric acids

C. Orthophosphorous and hypophosphoric acids

D. Phyrophosphorous and pyrophosphoric acids

Answer: A

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128. Which of the following reactions is an example of a redox reaction?

Hint: In above reaction. xenon is oxidised while oxygen is reduced i.e .. it is redox reaction.)

A. $XeF_4 + O_2F_2 \rightarrow XeF_6 + O_2$

B. $XeF_2 + PF_5 \rightarrow [XeF]^+ PF_6^-$

C. $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$

D. $XeF_6 + 2H_2O \rightarrow XeO_2F_2 + 4HF$

Answer: A

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129. The oxidation states of

Cr in $\left[Cr(H_2O)_6\right]Cl_3.$, $\left[Cr(C_6H_6)_2\right]$ and

$K_2\left[Cr(CN)_2(O_2)(NH_3)\right]$ respectively are

A. $+3,\ +2$ and $+4$

B. $+3, 0$ and $+6$

C. $+3, 0$ and $+4$

D. $+3,\ +4$ and $+6$

Answer: B

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130. In this reaction

ozone acts as:

A. an oxidisng agent

B. a reducing agent

C. a dehydrating agent

D. a hydrating agent

Answer: A

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131. For the reaction

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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Section B

1. Oxidation states of carbon atoms in diamond and graphite are.

A. $+2,\ +4$

B. $+4,\ +2$

C. $-4, 4$

D. zero,zero

Answer: D

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2. Oxidation state(s) of chlorine in $CaOCl_2$ (bleaching powder)

A. $+1 \text{ and } -1$

B. $1+ only$

C. -1 only

D. None of these

Answer: A

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3. Oxidation number of sulphur in S_8, S_2F_2 and H_2S are

A. $+2, 0, +2$

B. $0, +1, -2$

C. $-2, 0, +2$

D. $0, +1, +2$

Answer: B

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4. The reaction of $H_2S + H_2O_2 \rightarrow S + 2H_2O$ manifests

A. acidic nature of H_2O_2

B. reducing agent of H_2O_2

C. oxidising action of H_2O_2

D. alkaline nature of H_2O_2

Answer: C

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5. For redox reaction.

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

the reaction coefficients of the reactants for the balanced reaction are:

	MnO_4^-	$C_2O_4^{2-}$	H^+
(a)	2	5	16
(b)	16	3	12
(c)	15	16	12
(d)	2	16	5

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6. The number of moles of $K_2Cr_2O_7$ reduced by $1mol$ of Sn^{2+} ions is

A. $\frac{1}{3}$

B. $\frac{3}{2}$

C. $\frac{5}{2}$

D. $\frac{6}{5}$

Answer: A

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7. The$3ClO^-(aq.) \rightarrow ClO_3^-(aq.) + 2Cl^-(aq.)$ is an example of

A. reduction reaction

B. oxidation reaction

C. disportionation reaction

D. spallation reaction

Answer: C

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8. The oxidation state of S-atoms in Caro's and Marshall's acids are:

A. $+6,\ +6$

B. $+4,\ +6$

C. $+6,\ +6$

D. $+6,\ +4$

Answer: A

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9. Which among the following compounds have +6 state with the metal atoms?

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

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

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

D. CrO_2Cl_2

Answer: D

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10. The oxidation number of nitrogen atom in NH_4NO_3 are:

A. $+3,\ +3$

B. $+3,\ -3$

C. $-3,\ +5$

D. $-5,\ +3$

Answer: C

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11. In the chemical reaction,

$$K_2Cr_2O_7 + xH_2SO_4 + ySO_2 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + zH_2O$$

$x, y,$ and z are

A. $x = 1, y = 3, z = 1$

B. $x = 4, y = 1, z = 4$

C. $x = 3, y = 2, z = 1$

D. $x = 2, y = 2, z = 2$

Answer: A

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12. In which of the following pairs both members contain peroxy linkage?

A. $H_2S_2O_8, H_4P_2O_6$

B. $H_2SO_5, H_4P_2O_7$

C. H_2TiO_4, $H_4P_2O_8$

D. S_3O_9, P_2O_7

Answer: C

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13. Which of the following agents is the most oxidising?

A. O_3

B. $KMnO_4$

C. H_2O_2

D. $K_2Cr_2O_7$

Answer: A

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14. When methane is burnt in oxygen to produce CO_2 and H_2O. the oxidation number changes by:

A. -8

B. zero

C. $+8$

D. $+4$

Answer: C

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15. Which of the following has been arranged m order of increasing oxidation number of nitrogen?

A. $NH_3 < N_2O_5 < NO < N_2$

B. $NO_2^+, NO_3^- < NO_2^-, N_3^-$

C. $NH_4^+ < N_2H_4 < NH_2OH < N_2O$

D. $NO_2 < NaN_3 < NH_4^+ < N_2O$

Answer: C

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16. In the ethylene molecule the two carbon atoms have the oxidation numbers:

A. $-1, -1$

B. $-2, -2$

C. $-1, -2$

D. $+2, -2$

Answer: B

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17. In which of the following coordmation compounds do the transition metals have an oxidation number of +6?

A. $\left[Cr(H_2O)_4Cl_2\right]Cl.2H_2O$

B. $\left[Fe(CO)_5\right]$

C. $\left[(H_2O)_5Cr-O-Cr(H_2O)_5\right]^{4+}$

D. $K_2\left[Cr(CN)_2O_2(O_2)NH_3\right]$

Answer: D

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18. In the redox reaction

$$xMnO + yPbO_2 + zHNO_3 \rightarrow HMnO_4 + Pb(NO_3)_2 + H_2O$$

Find x , y and z.

A. x=2,y=5,z=10

B. x=2,y=7,z=8

C. x=2,y=5,z=8

D. x=2,y=5,z=5

Answer: A

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19. 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=3

C. x=8,y=6

D. x=3,y=8

Answer: B

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20. In a redox reaction:

$$xCH_3CH_2OH + yI_2 + zOH^- \rightarrow CHO_3 + HCO_2^- + I^- + H_2O$$

A. x=1,y=4,z=6

B. x=1,y=6,z=4

C. x=1,y=8,z=12

D. x=1,y=8,z=8

Answer: A

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21. The oxidation number of carboxylic carbon atom in CH_3COOH is

A. $+2$

B. $+4$

C. $+1$

D. $+3$

Answer: D

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22. Oxidation state of nitrogen is incorrectly given for:

Compound	Oxidation state
(a) $[Co(NH_3)_5Cl]Cl_2$	-3
(b) NH_2OH	-1
(c) $(N_2H_5)_2SO_4$	$+2$
(d) Mg_3N_2	-3

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23. Oxidation number of C in HNC is:

A. $+2$

B. -3

C. $+3$

D. zero

Answer: A

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24. Which of the following groups of molecules act both as oxidising agent as well as reducing agent?

A. $KMnO_4$. O_3, SO_3

B. $HClO_4$, HNO_2, H_2O_2

C. HNO_2, SO_2, H_2O_2

D. HNO_2, SO_2, H_2SO_4

Answer: C

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25. The oxidising state of molybdenum in its oxo complex species $\left[Mo_2O_4(C_2H_4)_2(H_2O)\right]^{2-}$ is

A. 2

B. 3

C. 4

D. 5

Answer: B

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26. The oxidant which cannot act as a reducing agent is

A. CO_2

B. NO_2

C. SO_2

D. ClO_2

Answer: A

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27. The coordination number and oxidation state of Cr in $K_3\left[Cr(C_2O_4)_3\right]$ an respectively

A. 3 and $+3$

B. 2 and 0

C. 6 and +3

D. 4 and +2

Answer: C

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28. The reaction,$P_4 + 3NaOH + 3H_2O \rightarrow 3NaH_2PO_2 + PH_3$ is an example of

A. disproportionation reaction

B. neutralisation reaction

C. double decomposition reaction

D. pyrolytic reaction

Answer: A

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29. Balance the following equation and choose the quantity which is the sum of the coefficients of and products:

$\ldots\ldots CS_2 + Cl_2 \rightarrow CCl_4 + S_2Cl_2$

A. 5

B. 3

C. 6

D. 2

Answer: D

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30. 6×10^{-3} mole $K_2Cr_2C_7$ reacts completely with 9×10^{-3} mole X^{n+} to give XO_3^- and Cr^{3+}. The value of n is :

A. 1

B. 2

C. 3

D. 5

Answer: A

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31. Hydrazine reacts with KIO_3 in presence of HCl as :

$N_2H_4 + IO_3^- + 2H^+ + Cl^- \rightarrow ICI + N_2 + 3H_2O$

The equivalent masses of N_2H_4 and KIO_3 respectively are :

A. 8,87

B. 8,35,6

C. 16,53,5

D. 8,53,5

Answer: D

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32. Hydrogen peroxide in its reaction with KIO_4 and NH_2OH respectively, it acting as a:

A. reducing agent, oxidising agent

B. reducing agent, reducing agent

C. oxidising agent, oxidising agent

D. oxidising agent, reducmg agent

Answer: A

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33. The order of the oxidation state of the phosphorus in $H_3PO_2, H_3PO_4, H_3PO_3$ and $H_4P_2O_6$ is

A. $H_3PO_4 > H_4P_2O_6 > H_3PO_3 > H_3PO_2$

B. $H_3PO_3 > H_3PO_2 > H_3PO_4 > H_4P_2O_6$

C. $H_3PO_2 > H_3PO_3 > H_4P_2O_6 > H_3PO_4$

D. $H_3PO_4 > H_3PO_2 > H_3PO_3 > H_4P_2O_6$

Answer: A

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34. Identify the reactions in which dichromatc acts as an oxidising reagents :

A. $Cr_2O_7^{2-} + 6Fe^{2+} + 14H^+ \rightarrow 6Fe^{3+} + 7H_2O$

B. $Cr_2O_7^{2-} + 2OH^- \rightarrow 2CrO_4^{2-} + H_2O$

C. $Cr_2O_7^{2-} + 6I^- + 14H^- \rightarrow 2Cr^{3+} + 3I_2 + 7H_2O$

D. $Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$

Answer: B

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35. Which of the following arc disproportionation reactions?

(A)

$2NO_2(g) + 2NaOH(aq.) \rightarrow NaNO_2(aq.) + NaNO_3(aq.) + H_2O(l)$

(B). $Cl_2(g)_2NaOH(aq.) \rightarrow NaOCl(aq.) + NaCl(aq.) + H_2O(l)$

(C).$3ClO^- \rightarrow 2Cl^- + ClO_3^-$

(D). $3Mg(s) + N_2(g) \rightarrow NaOCl(aq.) + NaCl(aq.) + H_2O(l)$

A. A,B,D

B. B,C,D

C. B,C

D. A,B,C

Answer: D

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Step Ii

1. The oxidation number of Cr is +6 in:

A. $FeCr_2O_4$

B. $KCrO_3Cl$

C. CrO_5

D. $\left[Cr(OH)_4\right]^-$

Answer: B::C

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2. The oxidation number of carbon is zero in

A. HCHO

B. CH_2Cl_2

C. $C_6H_{12}O_6$

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

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

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3. Which of the following has//have been arranged in order of decreasing oxidation number of sulphur?

A. $H_2S_2O_7 > Na_2S_4O_6 > Na_2S_2O_4 > S_8$

B. $SO^{2+} > SO_4^{2-} > SO_3^{2-} > HSO_4^-$

C. $H_2SO_5 > H_2SO_3 > SCl_2 > H_2S$

D. $H_2SO_4 > SO_2 > H_2S > H_2S_2O_8$

Answer: A::C

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4. Which among the following are auto redox reactions?

A. $P_4 + OH^- \rightarrow H_2PO_4^- + PH_3$

B. $S_2O_3^{2-} \rightarrow SO_4^{2-} + S$

C. $H_2O_2 \rightarrow H_2O + O_2$

D. $AgCl + NH_3 \rightarrow \left[Ag(NH_3)_2\right]Cl$

Answer: A::B::C

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5. Reduction of the metal centre in aqueous permanganate ion involves

A. 3 electrons in neutral medium

B. 5 electrons in neutral medium

C. 3 electrons in alkaline medium

D. 5 electrons in acidic medium

Answer: A::D

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6. 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. stoichiometric coefficient of HSO_4^- is 6

B. iodine si oxidised

C. sulphur is reduced

D. H_2O is one of the products

Answer: A::B::D

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7. Fe^{3+} is reduced to Fe^{2+} of NaOH

A. H_2O_2 is presence of NaOH

B. Na_2O_2 in water

C. H_2O_2 in presence of H_2SO_4

D. Na_2O_2 in presence of H_2SO_4

Answer: A::B

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Assertion Reason

1. Assertion (A): In aqueous solution, SO_2 reacts with H_2S liberating sulphur

Reason (R): SO_2 is an effective reducing agent.

A. If both (A) and (R) are correct, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If(A) is correct, but (R) is incorrect.

D. lf(A) is incorrect, but (R) is correct.

Answer: B

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2. (A) fluorine acts as a stronger reducing agent than oxygen.

(R) Fluorine is more electronegative.

A. If both (A) and (R) are correct, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If(A) is correct, but (R) is incorrect.

D. lf(A) is incorrect, but (R) is correct.

Answer: B

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3. Assertion (A): $PbCl_2$ is more stable than $PbCl_4$.

Reason (R): $PbCl_4$ is a powerful oxidising agent.

A. If both (A) and (R) are correct, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If(A) is correct, but (R) is incorrect.

D. If(A) is incorrect, but (R) is correct.

Answer: B

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4. (A) Among halogens fluorine is the most oxidising agent.

(R) fluorine is the most electronegative element.

A. If both (A) and (R) are correct, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If(A) is correct, but (R) is incorrect.

D. If(A) is incorrect, but (R) is correct.

Answer: B

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5. 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. If both (A) and (R) are correct, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If(A) is correct, but (R) is incorrect.

D. lf(A) is incorrect, but (R) is correct.

Answer: C

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6. (A) Identification of cathode and anode is done with the help of thermometer.

(R) Higher is the value of reduction potential. greater would be its reducing power.

A. If both (A) and (R) are true. and (R) is the correct explanation of (A).

B. If both (A) und (R) are true, but (R) is not the correct explanation of (A).

C. lf (A) and (R) is false.

D. lf (A) and (R)are both false.

Answer: D

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7. (A) Zinc reacts with H_2SO_4 to give H_2 gas but copper does not.

(R) Zinc has higher reduction potential than copper.

A. If both (A) and (R) are true. and (R) is the correct explanation of (A).

B. If both (A) und (R) are true, but (R) is not the correct explanation of (A).

C. lf (A) and (R) is false.

D. lf (A) and (R)are both false.

Answer: C

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8. (A) Absolute electrode potential can be easily measured by using vacuum tube voltmeter.

(R) Oxidation or reduction cannot take place alone,

A. If both (A) and (R) are true. and (R) is the correct explanation of (A).

B. If both (A) und (R) are true, but (R) is not the correct explanation of (A).

C. lf (A) and (R) is false.

D. lf (A) and (R)are both false.

Answer: D

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9. Assertion (A): SO_2 and Cl_2 are both bleaching agents.

Reason (R): Both are reducing agents.

A. If both (A) and (R) are true. and (R) is the correct explanation of (A).

B. If both (A) und (R) are true, but (R) is not the correct explanation of (A).

C. If (A) and (R) is false.

D. If (A) and (R)are both false.

Answer: C

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10. Assertion (A): H_2O_2 acts only as an oxidising agnet.

$H_2O_2 \rightarrow H_2O + O$

Reason (R): All peroxides behave as oxidising agnets only.

A. If both (A) and (R) are true. and (R) is the correct explanation of (A).

B. If both (A) und (R) are true, but (R) is not the correct explanation of (A).

C. If (A) and (R) is false.

D. If (A) and (R)are both false.

Answer: D

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11. (A) $HClO_4$ is stronger acid than $HClO_3$.

(R) Oxidation state of Cl in $HClO_4$ is +VII and in $HClO_3$, it is+V.

A. If both (A) and (R) are true. and (R) is the correct explanation of (A).

B. If both (A) und (R) are true, but (R) is not the correct explanation of (A).

C. If (A) and (R) is false.

D. If (A) and (R)are both false.

Answer: B

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12. (A) Oxidation number of Ni in $Ni(C0)_4$ is taken zero.

(R) The oxidation number of CO has been taken to be zero.

A. If both (A) and (R) are true. and (R) is the correct explanation of (A).

B. If both (A) und (R) are true, but (R) is not the correct explanation of (A).

C. lf (A) and (R) is false.

D. lf (A) and (R)are both false.

Answer: A

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13. (A) Oxidation state of 'H' is +1 in CuH_2 and $is - 1 in CaH_2$

(R) Ca is stronger electropositive than hydrogen.

A. If both (A) and (R) are true. and (R) is the correct explanation of (A).

B. If both (A) und (R) are true, but (R) is not the correct explanation of (A).

C. lf (A) and (R) is false.

D. lf (A) and (R)are both false.

Answer: A

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14. (A) Iodine shows oxidation state of +1 and +3 in the compounds ICI and IC3 respectively.

(R) Iodine coming below the halogens group and Br in the halogen group of elements in the periodic table shows a higher degree of electron,positive nature.

A. If both (A) and (R) are true. and (R) is the correct explanation of (A).

B. If both (A) und (R) are true, but (R) is not the correct explanation of (A).

C. lf (A) and (R) is false.

D. lf (A) and (R)are both false.

Answer: A

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Matrix Matching

1. Match the Column-I with Column II:

Column-I (Compound)		Column-II (Oxidation state)	
(a)	CrO_5	(p)	+6
(b)	H_2SO_4	(q)	+1
(c)	$CaOCl_2$	(r)	−1
(d)	$(CH_3)_2SO$	(s)	0

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2. Match the Column-I with Column II:

Column-I (Redox process)		Column-II (*n*-factor for underlined species)	
(a)	$\underline{As_2S_3} \rightarrow AsO_3^- + SO_4^{2-}$	(p)	28
(b)	$\underline{I_2} \rightarrow I^- + IO_3^-$	(q)	4/3
(c)	$\underline{H_3PO_2} \rightarrow PH_3 + 2H_3PO_3$	(r)	1
(d)	$H_3PO_2 + NaOH \rightarrow NaH_2PO_2 + H_2O$	(s)	5/3

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3. Match the Column-I with Column II:

Column-I (Compound)		Column-II (Oxidation state of nitrogen)
(a)	Mg_3N_2	(p) -1
(b)	NO	(q) $+2$
(c)	$(N_2H_5)_2SO_4$	(r) -2
(d)	NH_2OH	(s) -3

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4. Match the Column-I with Column II:

Column-I (Compound)		Column-II (Oxidation state of)
(a)	CrO_5	(p) Oxygen is -2
(b)	$Na_2S_2O_3$	(q) Oxygen is -1
(c)	H_2SO_5	(r) Sulphur is $+6$
(d)	$H_2S_2O_7$	(s) Sulphur is $+2$

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5. Match the Column-I with Column II:

Column-I	Column-II
(a) $(NH_4)_2Cr_2O_7 \rightarrow N_2 + Cr_2O_3 + 4H_2O$	(p) Intermolecular redox reaction
(b) $PbO_2 + H_2O \rightarrow PbO + H_2O_2$	(q) Disproportionation
(c) $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$	(r) Intramolecular redox reaction
(d) $Cl_2 + 2OH^- \rightarrow ClO^- + Cl^- + H_2O$	(s) Metal displacement

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6. Match the list-I with List II and select the correct answer from the given codes:

List-I (Compound)	List-II (Oxidation state of nitrogen)
A. N_2O_5	(i) -2
B. NaN_3	(ii) $+5$
C. NO	(iii) $-1/3$
D. N_2H_4	(iv) $+2$

Codes:	A	B	C	D
(a)	(ii)	(iii)	(iv)	(i)
(b)	(i)	(ii)	(iii)	(iv)
(c)	(iv)	(i)	(ii)	(iii)
(d)	(iii)	(i)	(iv)	(ii)

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Integer Type

1. Find the oxidation number of Mn in the product of alkaline oxidative fusion of MnO_2.

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2. How many peroxy links are there in CrO_5

There are two peroxy links in this molecule.

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3. How many moles of electrons are involved in the conversion of 1 mol $Cr_2O_7^{2-}$ into Cr^{3+} ion?

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

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4. In the following reaction hydrazine is oxidized N_2

$N_2H_4 + OH^- \rightarrow N_2 + H_2O + e$ The equivalent weight of N_2H_4 (hydrazine) is:

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5. Nitrobenzene $(C_6H_5NO_2)$ can be reduced to aniline $(C_6H_5NH_2)$ by electrolytic reduction, the equivalent mass of nitrobenzene will be equal to $\frac{\text{Molecular mass}}{n}$. The value of n is:

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6. How many sulphur atoms in $Na_2S_4O_6$ have zero oxidation state?

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7. 6×10^{-3} mole $K_2Cr_2C_7$ reacts completely with 9×10^{-3} mole X^{n+} to give XO_3^- and Cr^{3+}. The value of n is :

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8. The sum of oxidation number of nitrogen in NH_4NO_3 is:

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9. The value of n in the molecular formula $Be_nAl_2Si_6O_{18}$ is:

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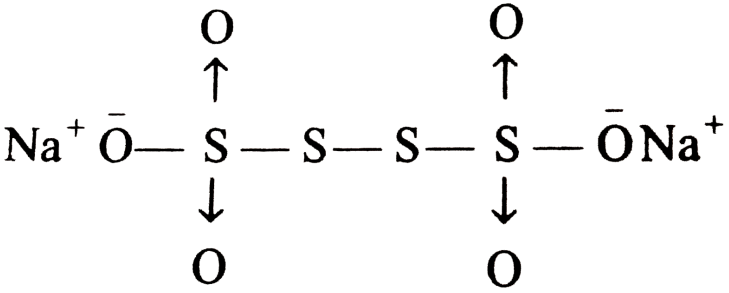
10. The difference in the oxidation numbers of the two types of sulphur atoms in $Na_2S_4O_6$ is:



Oxidation number of sulphur atom involved in coordinate bond formation is (+5) and that of middle sulphur atom is zero. Hence the difference in oxidation number of two types of sulphur aton will be (+5).]

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11. Consider the following list of reagent

Acidified$K_2Cr_2O_7$, alkaline$KMnO_4$, $CuSO_4$, H_2O_2, Cl_2, O_3, $FeCl_3$, HNO

The total number of reagents that can oxidise aqueous iodide iodine is

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Passage I

1. Valency and Oxidation number are different for an element. Valency of carbon is generally 4, however, the oxidation state may be $-4, -20, +2, -1$ etc. In the compounds containing carbon. hydrogen and oxygen the oxidation number of carbon can be calculated as

$$\text{Oxidation number of carbon} = \frac{2n_O - n_H}{n_C}$$

Where, n_H, n_O and n_C are number of respective atoms

Which of the following compounds have zero oxidation state at carbon

A. $C_6H_{12}O_6$

B. $HCOOH$

C. HCHO

D. CH_4

Answer: A::C

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2. Valency and Oxidation number are different for an element. Valency of carbon is generally 4, however, the oxidation state may be $-4, -20, +2, -1$ etc. In the compounds containing carbon. hydrogen and oxygen the oxidation number of carbon can be calculated as

$$\text{Oxidation number of carbon} = \frac{2n_O - n_H}{n_C}$$

Where, n_H, n_O and n_C are number of respective atoms

Which of the following oxides of carbon has fractional oxidation state?

A. Carbon monoxide

B. Carbon dioxide

C. Carbon suboxide

D. All of these

Answer: C

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3. The valancy of carbons is generally 4, but its oxidation state may be $-4,\ -2, 0,\ +2,\ -1$, etc. In the compounds containing C, H, and O, the oxidation number of C is calculated as

Oxidation number of $C = \dfrac{2n_O - n_H}{n_C}$

Where n_O, n_H and n_C are the numbers of oxygen, hydrogen, and carbons, atoms, respectively.

In which of the following compounds is the oxidation state of carbon is zero?

A. CH_4

B. CH_3OH

C. CH_2O

D. HCOOH

Answer: D

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4. Valency and Oxidation number are different for an element. Valency of carbon is generally 4, however, the oxidation state may be $-4,\ -20,\ +2,\ -1$ etc. In the compounds containing carbon. hydrogen and oxygen the oxidation number of carbon can be calculated as

$$\text{Oxidation number of carbon} = \frac{2n_O - n_H}{n_C}$$

Where, n_H, n_O and n_C are number of respective atoms

Oxidation state of carbon in diamond is:

A. zero

B. $+1$

C. -1

D. $+2$

Answer: A

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5. Valency and Oxidation number are different for an element. Valency of carbon is generally 4, however, the oxidation state may be $-4, -20, +2, -1$ etc. In the compounds containing carbon. hydrogen and oxygen the oxidation number of carbon can be calculated as

$$\text{Oxidation number of carbon} = \frac{2n_O - n_H}{n_C}$$

Where, n_H, n_O and n_C are number of respective atoms

In which of the following compounds, the valency of carbon is two?

A. Carbenes

B. Allenes

C. Alkenes

D. Ketenes

Answer: A

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6. Oxidation and reduction process involves the transaction of electrons. Loss of electrons is oxidation and the gain of electrons is reduction. It is thus obvious that in a redox reaction, the oxidant is reduced by accepting the electrons and the reductant is oxidised by losing electrons. The reactions in which a species disproportionates into two oxidation states (lower and higher) are called disproportionation reactions. In electrochemical cells, redox reaction is involved, i.e., oxidation takes place at anode and reduction at cathode.

The reaction $Cl_2 \rightarrow Cl^- + ClO_3^-$ is:

A. oxidation

B. reduction

C. disproportionation

D. neither oxidation nor reduction

Answer: C

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7. Oxidation and reduction process involves the transaction of electrons. Loss of electrons is oxidation and the gain of electrons is reduction. It is thus obvious that in a redox reaction, the oxidant is reduced by accepting the electrons and the reductant is oxidised by losing electrons. The reactions in which a species disproportionates into two oxidation states (lower and higher) are called disproportionation reactions. In electrochemical cells, redox reaction is involved, i.e., oxidation takes place at anode and reduction at cathode.

Select the correct statement:

A. oxidation takes place at anode in electrochemical cell

B. reduction take place at anode in electrolytic cell

C. oxidation takes place at anode n electrolytic cell

D. all are correct

Answer: A::B

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8. Oxidation and reduction process involves the transaction of electrons. Loss of electrons is oxidation and the gain of electrons is reduction. It is thus obvious that in a redox reaction, the oxidant is reduced by accepting the electrons and the reductant is oxidised by losing electrons. The reactions in which a species disproportionates into two oxidation states (lower and higher) are called disproportionation reactions. In electrochemical cells, redox reaction is involved, i.e., oxidation takes place at anode and reduction at cathode.

In the reaction:

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

A. I_2 is a reducing agent

B. I_2 is an oxidising agent

C. $S_2O_3^{2-}$ is a reducing agent

D. $S_2O_3^{2-}$ is an oxidising agent

Answer: B::C

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9. Oxidation and reduction process involves the transaction of electrons. Loss of electrons is oxidation and the gain of electrons is reduction. It is thus obvious that in a redox reaction, the oxidant is reduced by accepting the electrons and the reductant is oxidised by losing electrons. The reactions in which a species disproportionates into two oxidation states (lower and higher) are called disproportionation reactions. In electrochemical cells, redox reaction is involved, i.e., oxidation takes place at anode and reduction at cathode.

Detennine the change in oxidation number of sulphur in H_2S and SO_2 respectively in the following reaction:

$2H_2S + SO_2 \rightarrow 2H_2O + 3S$

A. 0,+2

B. $+2, \ -4$

C. $-2, \ +2$

D. $+4, 0$

Answer: B

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10. Oxidation and reduction process involves the transaction of electrons. Loss of electrons is oxidation and the gain of electrons is reduction. It is thus obvious that in a redox reaction, the oxidant is reduced by accepting the electrons and the reductant is oxidised by losing electrons. The reactions in which a species disproportionates into two oxidation states (lower and higher) are called disproportionation reactions. In electrochemical cells, redox reaction is involved, i.e., oxidation takes place at anode and reduction at cathode.

Which of the following reactions is/are correctly indicated?

	Oxidant		Reductant
a)	$HNO_3 + Cu$	$\longrightarrow$	$Cu^{2+} + NO_2$
b)	$2Zn + O_2$	$\longrightarrow$	ZnO
c)	$Cl_2 + 2Br^-$	$\longrightarrow$	$2Cl^- + Br_2$
d)	$4Cl_2 + CH_4$	$\longrightarrow$	$CCl_4 + 4HCl$

A. $HNO_3 + Cu \rightarrow Cu^{2+} + NO_2$

B. $2Zn + O_2 \rightarrow ZnO$

C. $Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$

D. $4Cl_2 + CH_4 \rightarrow CCl_4 + 4HCl$

Answer: A::C::D

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11. Redox reactions are of three types:

(i) Intermolernlar redox reactions.

(ii) Intramolecular redox reactions,

(iii) Auto redox reactions

OR

Disproportionation reactions.

Redox reactions are divided into two main types:

(i) Chemical redox reactions,

(ii) Electrochemical redox reactions which either produce or consume electricity

Oxidation and reduction process takes place in a reaction simultaneously.

Which of the following is a redox reaction?

A. $NaCl + KNO_3 \rightarrow NaNO_3 + KCl$

B. $CaC_2O_4 + 2HCl \rightarrow CaCl_2 + H_2C_2O_4$

C. $Mg(OH)_2 + 2NH_4Cl \rightarrow MgCl_2 + 2NH_4OH$

D. $Zn + 2AgCN \rightarrow 2Ag + Zn(CN)_2$

Answer: D

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12. Redox reactions are of three types:

(i) Intermolernlar redox reactions.

(ii) lntramolecular redox reactions,

(iii) Auto redox reactions

OR

Disproportionation reactions.

Redox reactions are divided into two main types:

(i) Chemical redox reactions,

(ii) Electrochemical redox reactions which either produce or consume

electricity

Oxidation and reduction process takes place in a reaction simultaneously.

Select the intramolccular redox reaction(s) among the following:

A. $2KClO_3 \rightarrow 2KCl + 3O_2$

B. $(NH_4)_2Cr_2O_7 \rightarrow N_2 + Cr_2O_3 + 4H_2O$

C. $Cl_2 \rightarrow Cl^- + ClO_3^-$

D. $NH_4NO_2 \rightarrow N_2 + 2H_2O$

Answer: A::B::D

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13. Redox reactions are of three types:

(i) Intermolernlar redox reactions.

(ii) Intramolecular redox reactions,

(iii) Auto redox reactions

OR

Disproportionation reactions.

Redox reactions are divided into two main types:

(i) Chemical redox reactions,

(ii) Electrochemical redox reactions which either produce or consume electricity

Oxidation and reduction process takes place in a reaction simultaneously.

In which of the following reactions, H_2O_2, acts as reducing?

A. $Cl_2 + H_2O_2 \rightarrow 2HCl + O_2$

B. $H_2O_2 + O_3 \rightarrow H_2O + 2O_2$

C. $HCHO + H_2O_2 \rightarrow HCOOH + H_2O$

D. $PbO_2 + H_2O_2 \rightarrow PbO + H_2O + O_2$

Answer: A::B::D

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14. Redox reactions are of three types:

(i) Intermolernlar redox reactions.

(ii) Intramolecular redox reactions,

(iii) Auto redox reactions

OR

Disproportionation reactions.

Redox reactions are divided into two main types:

(i) Chemical redox reactions,

(ii) Electrochemical redox reactions which either produce or consume electricity

Oxidation and reduction process takes place in a reaction simultaneously.

Which among the following acts as oxidising as well as reducing agent?

A. HNO_2

B. HNO_3

C. H_2SO_4

D. $KMnO_4$

Answer: A

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15. Redox reactions are of three types:

(i) Intermolernlar redox reactions.

(ii) lntramolecular redox reactions,

(iii) Auto redox reactions

OR

Disproportionation reactions.

Redox reactions are divided into two main types:

(i) Chemical redox reactions,

(ii) Electrochemical redox reactions which either produce or consume electricity

Oxidation and reduction process takes place in a reaction simultaneously.

The value of x in the following reaction,

$MnO_4 + 8H^+ + xe \rightarrow Mn^{2+} + 4H_2O$ is

A. 5

B. 10

C. 2

D. 3

Answer: A

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Self Assignment

1. In this reaction: $S_2O_8^{2-} + 2I^- \rightarrow 2SO_4^{2-} + I_2$

A. oxidation of iodide into iodine takes place

B. reduction of iodine into iodide takes place

C. both oxidation and reduction of iodine takes place

D. None of these

Answer: A

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2. The oxidation state of chromium in chromoium trioxide is:

A. $+3$

B. $+4$

C. $+5$

D. $+6$

Answer: D

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3. For the reaction between $KMnO_4$ and H_2O_2. The number of electrons transferred per mole of H_2O_2 is:

A. one

B. two

C. three

D. four

Answer: C

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4. In the ions equatio, $BrO_3^- + 6H^+ + xe^- \rightarrow Br^{3+} + 3H_2O$, the value of x is

A. 6

B. 2

C. 4

D. 3

Answer: B

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5. In $\left[Cr(O_2)(NH_3)_4H_2O\right]Cl_2$ oxidation number of Cr is +3 then oxygen will be the form:

A. dioxo

B. peroxo

C. superoxo

D. oxo

Answer: C

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6. In the reaction, $CrO_5 + SnCl_2 \rightarrow CrO_4^{2-} + SnCl_4$,the element undergoing oxidation and reduction respectively, are:

A. Cr,Sn

B. Sn,Cr

C. Sn,O

D. Cl,C

Answer: C

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7. Equivalent mass of $KMnO_4$ in acidic basic and netural are in the ratio, of:

A. $3:5:15$

B. $5:3:1$

C. $5:1:3$

D. $3:15:5$

Answer: D

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8. A compound of Xe and F is found to have 53.5% Xe. What is the oxidation number of Xe in this comound?

A. -4

B. 0

C. $+4$

D. $+6$

Answer: D

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9. Peroxide ions are present in

A. H_2O_2

B. BaO_2

C. OF_2

D. $H_2S_2O_8$

Answer: A::B::D

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10. The metals undergoing disproportion are:

A. Sn

B. Na

C. Cu

D. Ca

Answer: A::C

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11. The non-metals undergoing disportionation are:

A. P_4

B. Cl_2

C. I_2

D. H_2O_2

Answer: A::B::C

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12. Which of the following can act as oxidising as well as reducing agent?

A. O_2

B. HNO_3

C. SO_2

D. H_2O_2

Answer: C::D

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13. The compound that can work both as an oxidising as well as reducing agent is :

A. -1

B. $+1$

C. -2

D. $+2$

Answer: A::B

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14. The species that contain peroxide ions are:

A. KI

B. KI_3

C. I_2

D. H_2O_2

Answer: B::C::D

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15. Statement-1:Spector ions are the species that are present in the solution but do not part in the reaction

Because ltbr Statement-2: The phenomena of formation of H_2O_2 by the oxidation of H_2O is known as auto-oxdation

A. PbO_2

B. H_2O_2

C. SrO_2

D. BaO_2

Answer: B::C::D

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16. Statement-1: Spectator ions are the species that are presetnt in the solution but do not take part in the reaction.

Because

Statement-2: The phenomena of formation of H_2O_2 by the oxidation of H_2O is known as auto-oxidation.

Hint: $Zn + 2H^+ + 2Cl^- \rightarrow Zn^{2+} + 2Cl^- + 2Cl^- + H_2$. Here Cl^- ion is spectator ion.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. Statement-1 is true, statement-1

D. Statement-1 is false, statement-2 is false

Answer: B

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17. Statement-1: Oxidation number of carbon in HCN is +2.

Because

Statement-2: Carbon always shows an oxidation state of +4.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-2

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-2

C. Statement-1 is true, statement-2

D. Statement-1 is false, statement-2 is false

Answer: C

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18. Statement-I: Bromide ion nets as a reducing agent in the reaction,

$$2MnO_4^- + Br^- + H_2O \rightarrow 2MnO_2 + BrO_3^- + 2OH^-$$

Because

Statment-2: Oxidation number of bromine increases from -1 to+ 5.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-3

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-3

C. Statement-1 is true, statement-3

D. Statement-1 is false, statement-2 is false

Answer: A

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19. Statement-1: Oxidation number of carbon in HCHO is zero.

Because

Statement-2: HCHO is a covalent organic compound.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-4

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-4

C. Statement-1 is true, statement-4

D. Statement-1 is false, statement-2 is false

Answer: B

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20. Matche the Column-I with Column-II

Column-I (Chemical species)	Column-II (Oxidation number of sulphur)
(a) S	(p) + 6
(b) H_2S	(q) + 1
(c) S_2Cl_2	(r) 0
(d) $H_2S_2O_8$	(s) – 2

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21. Matche the Column-I with Column-II

Column-I (Compound)	Column-II (Oxidation state of sulphur)
(a) Sulphurus acid (H_2SO_3)	(p) +5
(b) Peroxy mono sulphuric acid (H_2SO_5)	(q) +3
(c) Dithionic acid ($H_2S_2O_6$)	(r) +6
(d) Dithionous acid ($H_2S_2O_4$)	(s) +4

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22. Matche the Column-I with Column-II

	Column-I	Column-II
(a)	$O_2^- \longrightarrow O_2 + O_2^{2-}$	(p) Redox reaction
(b)	$CrO_4^{2-} + H^+ \longrightarrow$	(q) One of the products has trigonal planar structure
(c)	$MnO_4^- + NO_2^- + H^+ \longrightarrow$	(r) Dimeric bridged tetrahedral metal ion
(d)	$NO_3^- + H_2SO_4 + Fe^{2+} \rightarrow$	(s) Disproportionation

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Section V

1. How many oxyanions among the following show disproportionation?

$ClO^-, ClO_2^-, ClO_3^-, ClO_4^-$

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2. The oxidation state of phosphorus in PO_4^{3-}, P_4O_{10} and $P_2O_7^{4-}$ is

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3. Oxidation state of phosphorus in cyclotrimetaphosphoric acid is

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