CHEMISTRY

JEE (MAIN AND ADVANCED) CHEMISTRY

REDOX REACTONS

Solved Problem

1. Steam is passed over hot coke to give water gas. Which substance set as reductant?

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2. Hydrogen peroxide linerates iodine from acidified potassium iodide. Identify the oxidation reaction.

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3. In the neutralisation between sulphuric acid and potash, identify spectator ions.

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4. What is the net redoc reaction between maganese dioxide from hydrochloric acid ?

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5. What is the oxidation state of chromium in potassium dichromate?

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6. Write the oxidation numbers of 'Cr' in $CrO_3Cr_3O_3$ and CrO_3.

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7. Can oxygen exhibit positive oxidation numbers in its compounds?

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8. What is oxidation states of (a) Br in Br_3O_8 (b) C in C_3O_2 , (c) 8 in $S_4O_6^{2-}$

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9. Write the oxidation number of oxygen in (a) O_3, (b) MgO, (c) H_2O_2, (D) KO_2 and (e) OF_2

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10. Calculate the oxidation number of sulphur in H_2SO_3 and in $H_2S_2O_8$

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11. Write the oxidation number of constituent atoms in chromium peroxide.

12. Oxidation number of the metal ion in the compound $\left[CO(NH_3)_5Cl\right]Cl_2$ is $+3$. Calculate the oxidation number of the complex ion.

13. What is the oxidation number of iron in the brown ring complex compound?

14. Mention whether each of the following conversion involves oxidation or reduction.

a) $HCl \rightarrow HOCl$, b) $KMnO_4 \rightarrow K_2MnO_4$ and c) $HNO_3 \rightarrow NaNO_3$

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15. Write the oxidation number of Hg in amalgam.

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16. One mole of AO_2^- is oxidised to A^{n+} in acidic solutions by 0.4 mole of permanganate. Calculate the value of n in A^{n+}.

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17. One mole of hydrazine loses 10 moles of electrons. If all the nitrogen content is present in the product, what is the oxidation number of

nitrogen in the product?

18. Is the decomposition of magnesite a redox reaction ?

19. Name the halogen that does not undergo disproportionation. Write the reason.

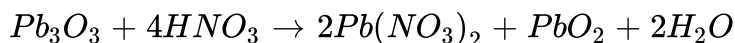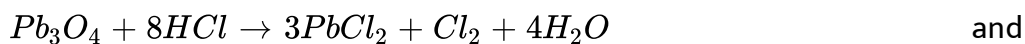**20.** Reaction between hydrogen sulphide and sulphurdioxide gives sulphur. Which type of redox reaction is this?

21. Among $ClO^-, ClO_2^-, ClO_3^-, ClO_4^-$ which one cannot disproportionate and why ?

22. Why do the following reactions proceed differently?

$$Pb_3O_4 + 8HCl \rightarrow 3PbCl_2 + Cl_2 + 4H_2O \qquad \text{and}$$

$$Pb_3O_3 + 4HNO_3 \rightarrow 2Pb(NO_3)_2 + PbO_2 + 2H_2O$$

23. How many electrons and protons are present in the balanced half equation? $NO_2^- \rightarrow NO$

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25. H_2O_2 reduces chlorine to chloride. Write the coefficients of all substances in the equation.

26. How many electrons are transferred in the oxidation of nitrite by hydrogen peroxide?

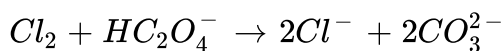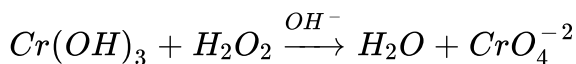**27.** What is the ratio of coefficients of caustic soda and zinc metal in the reaction between zinc and NaOH?

28. What will be the coefficients of water and proton, if the following equation is balaned in acidic medium

$$Cl_2 + HC_2O_4^- \rightarrow 2Cl^- + 2CO_3^{2-}$$

29. How many moles of OH^- are present in the balanced equation?

$$Cr(OH)_3 + H_2O_2 \xrightarrow{OH^-} H_2O + CrO_4^{-2}$$

30. $xKI + yH_2SO_4 \rightarrow I_2 + SO_2 + KHSO_4$. In the above balanced equation, what are x and y?

31. How are active metals extracted from their cations ?

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32. Fluorine can not be obtained from fluoride by chemical methods. Why ?

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33. 100 grams of each P_4O_6 and $KMnO_4^-$ were mixed in hydrochloric acid solution to from H_3PO_4 and $MnCl_2$. Which reagent is left unreacted and how much of it is left ?

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Exercise 4 1 1

1. What are redox reaction ? Give two suitable examples.

2. Write the role of electrons in oxidation and reduction.

3. What is an oxidising agent ? Give examples.

4. What is a reducing agent ? Give examples.

5. Comment on the net chemical change in a reaction.

6. What are spectator ions ? Give examples.

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7. Identify oxidation, reduction, oxidant and reductant in the reaction between permanganate and hydrogen peroxide in acidic solutions.

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Exercise 4 1 2

1. What is oxidation number ? Write notation.

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2. What are different oxidation number of oxygen in its compounds ? Write examples.

3. What are the oxidation number of nitrogen in (a) HCl, (b) NaH, (c) H_2O_2 and (d) PdH

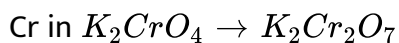**4.** Calculate the oxidation number of iron in (a) FeO, (b) Fe_2O_3 and (c) Fe_3O_4.

5. What are the different oxidation numbers exhibited by chlorine in its compounds ? Why -1 state is more common for chlorine when it reacts with metals ?
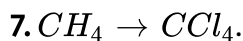
6. Find the change in oxidation numbers in the following conversion :

Cr in $K_2CrO_4 \rightarrow K_2Cr_2O_7$

7. $CH_4 \rightarrow CCl_4$.

In the above conversion what happens to the oxidation number of carbon

8. Write different oxidation numbers exhibited by nitrogen in its compounds.

9. Explain the different types of redox reactions.

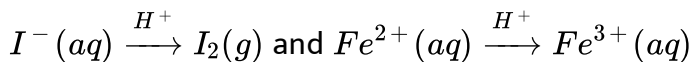**10.** What are disproportionate reactions? Give example.

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11. What is comproportionation ?

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Exercise 4 1 3

1. Balance the conversions :

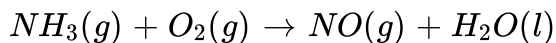$$I^-(aq) \xrightarrow{H^+} I_2(g) \text{ and } Fe^{2+}(aq) \xrightarrow{H^+} Fe^{3+}(aq)$$

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2. Balance the half equation $Br_2 \rightarrow BrO_3^- + Br^-$ by ion-electron method.

3. Balance the following equation by electron transfer method.

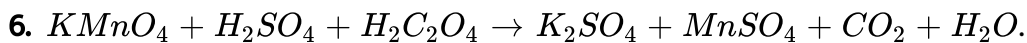$$NH_3(g) + O_2(g) \rightarrow NO(g) + H_2O(l)$$

4. Balance the following equation by oxidation number method.

$$NaOH + Cl_2 \rightarrow NaCl + NaClO_3 + H_2O$$

5. Divide the following equation

$$Cr_2O_7^{2-} + NO_2^- \xrightarrow{H^+} Cr^{3+} + NO_3^-$$ into two half reaction and balance.

6. $KMnO_4 + H_2SO_4 + H_2C_2O_4 \rightarrow K_2SO_4 + MnSO_4 + CO_2 + H_2O.$
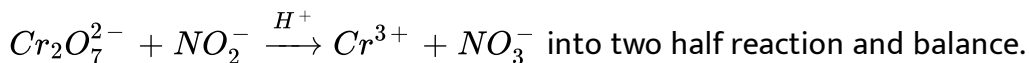
Balance this equation.

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7. Balance the equation :

$$SO_2 + Na_2CrO_4 + H_2SO_4 \rightarrow Na_2SO_4 + Cr_2(SO_4)_3 + H_2O$$
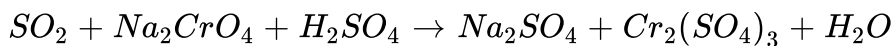
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8. Balance by ion-electron method :

$$C_2O_4^{2-} + MnO_4^- \xrightarrow{H^+} Mn^{2+} + CO_2$$
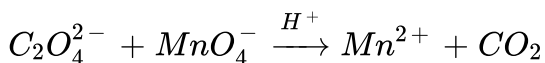
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9. $C + HNO_3(aq) \rightarrow NO_2 + CO_2 + H_2O(l).$ Balance this equation.
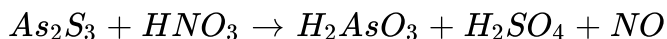
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10. Balance the equation :

$$As_2S_3 + HNO_3 \rightarrow H_2AsO_3 + H_2SO_4 + NO$$

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11. Gold dissolves in a 1:3 mixture of HNO_3 and HCl called aquaregia. If the product $HAuCl_4$, NO_2 and H_2O, write the equation and balance.

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Exercise 4 1 4

1. Write examples of extraction of metals using reducing agents.

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2. Mention the chemical principles in electrolysis.

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3. Discuss the concept used in the generation of electricity by performing a chemical reaction.

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Questions For Descriptive Answers

1. How are no electron transfer reactions different from redox reactions ?

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2. Oxidation or reduction capacity of a substance depends upon the other reagent involved in a reaction. Illustrate.

3. Distinguish between molecular and ionic equations.

4. Oxidation and reaction are complimetary reactions. Substantiate.

5. HNO_3 acts as oxidant, but HNO_2 usually acts as reductant. Explain.

6. What is the oxidation state of N in $(N_2H_5)SO_4$?

7. What are the oxidation numbers iodine atoms in KI_3 ?

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8. What are the oxidation of Cr in CrO_3 and Ti in H_2TiO_4 ?

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9. Write the average oxidation number of (a) N in NaN_3, (b) Fe in FeS_2 and (c) O in KO_2.

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10. Calculate the oxidation number of iron in (a) pentacarbonyl and (b) potassium ferrocyanide.

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11. Distinguish between disproportionation reactions and comproportionation reactions.

12. Find our the ratio of coefficients of metals. $Al^M nO_2 \rightarrow Al_2O_3 + Mn$.

13. How many moles of $KMnO_4$ are required to liberate one gram mole of oxygen from H_2O_2 in acid medium ?

14. $NaOH + S \rightarrow Na_2S_5 + Na_2S_2O_3 + H_2O$

Balance the above reaction and find the mole coefficients of the reactants.

15. Permaganate oxidises aqueous iodide to iodine and itself is reduced to manganese dioxide. How many moles of iodine is liberated with one mole of permanganate ?

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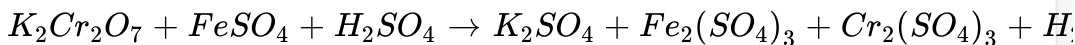**16.** $xKClO_3 \rightarrow yKCl + zKClO_4$. What are x and z ?

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17. One gram atom of aluminium can reduce how many moles of chromic oxide?

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18. What is the mole coefficient of H_2SO_4 in the balanced equation.

$$K_2Cr_2O_7 + FeSO_4 + H_2SO_4 \rightarrow K_2SO_4 + Fe_2(SO_4)_3 + Cr_2(SO_4)_3 + H_2$$

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19. $Cu + HNO_3 \rightarrow NO + Cu(NO_3)_2 + H_2O$. Write the ionic equation

and balance.

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20. $K_2Cr_2O_7 + HCl \rightarrow KCl + CrCl_3 + Cl_2 + H_2O$. How many moles

of HCl reacts with one mole of $K_2Cr_2O_7$?

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21. $S_2O_3^{2-} + MnO_4^- + H_2O \rightarrow MnO_2 + S_2O_4^{2-} + OH^-$. What are

the coefficients of $S_2O_3^{2-}$ and MnO_4^- in the balance equation ?

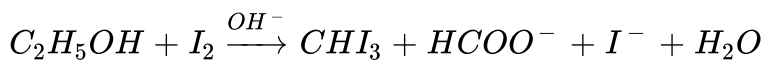**22.** How many moles of chlorine are obtained when one mole of $K_2Cr_2O_7$ reacts with excess hydrochloric acid ?

23. $Cr_2O_7^{2-} + C_2H_4O \xrightarrow{H^+} Cr^{3+} + C_2H_4O_2$. How many H^+ ions are in the balance equation ?

24. How many moles of OH^- are involved in the balanced equation ?

$C_2H_5OH + I_2 \xrightarrow{OH^-} CHI_3 + HCOO^- + I^- + H_2O$

25. Explain the principle of a redox reaction used in the construction of galvanic cell ?

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26. Why electrolysis is important for the extraction of reactive elements ?

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27. What redox changes are present in iodometry ?

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