



CHEMISTRY

BOOKS - PRADEEP CHEMISTRY (HINGLISH)

REDOX REACTIONS

Sample Problem

1. Calculate the oxidation number of

(i) S in H_2S ,

(ii) C in CO_2

(iii) C in CH_2Cl_2 ,

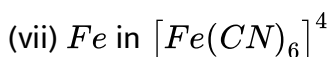
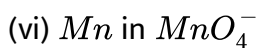
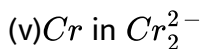
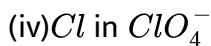
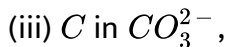
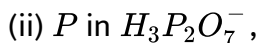
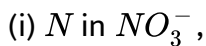
(iv) N in $(NH_4)SO_4$

(v) P in Na_3PO_4



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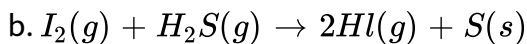
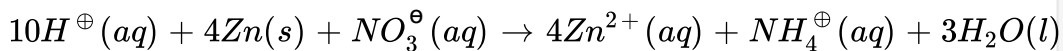
2. Calculate the oxidation number of



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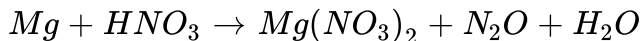
3. Identify the oxidant and reductant in the following reactions:

a.



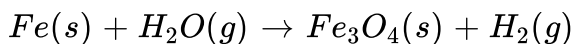
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4. Balance the equation



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5. Balance the following chemical equation:

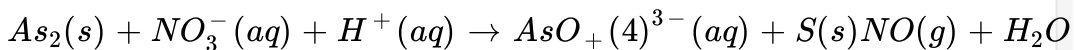


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6. Dichromate ion in aqueous acidic medium reacts with ferrous ion give ferric and chromium ions write the balanced chemical equation corresponding to the reaction

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7. Balance the equation



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8. In passing chlorine gas through a concentrated solution of alkali we get chloride and chlorate ions Obtain balanced chemical equation for this reaction.

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9. How many grams of potassium dichromate are required to oxidise 15.2 g of $FeSO_4$ in acidic medium?

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10. Determine the volume of $M/8KMnO_4$ solution required to react completely with 25.0 cm^3 of $M/4FeSO_4$ solution in acidic medium

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11. Calculate the concentration of hypo ($Na_2S_2O_3 \cdot 5H_2O$) solution in $g\ dm^{-3}$ if 10.0 mL of this solution decolourised 15 mL of $\frac{M}{40}$ iodine solution

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12. 0.5 g of an oxalate was dissolved in water and the solution made to 100 mL . On titration 10 mL of this solution required 15 mL of $\frac{N}{20}KMnO_4$. Calculate the percentage of oxalate in the sample .

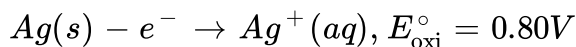
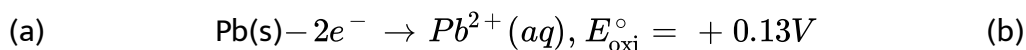
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13. A cell is prepared by dipping a copper rod in 1 M $CuSO_4$ solution and a nickel rod in 1 M $NiSO_4$ solution. The standard reduction potentials of copper electrode and nickel electrode are 0.34 volt and -0.25 volt respectively.

- (a) What will be the cell reaction?
- (b) What will be the standard EMF of the cell?
- (c) Which electrode will be positive?
- (d) How will the cell be represented?

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14. The half cell reactions with their oxidation potentials are



Write the cell reaction and calculate its emf.

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15. Predict whether zinc and silver react with 1 M sulphuric acid to give out hydrogen or not given that the standard potentials of zinc and silver are -0.76 volt and +0.80 volt respectively

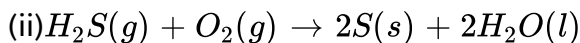
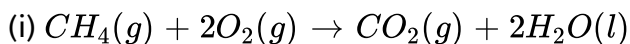
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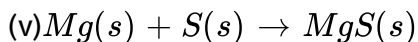
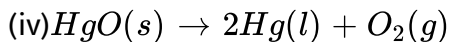
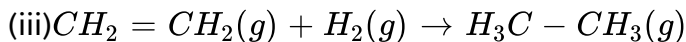
16. Can a solution of 1 M copper sulphate be stored in a vessel made of nickel metal? Given that $E_{Ni^{2+}/Ni} = -0.25$ volt and $E_{Cu^{2+}/Cu}^{\circ} = +0.34$ volt

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Problems For Practice

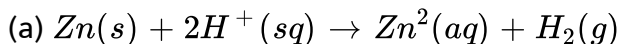
1. In the reaction given below identify the species undergoing oxidation and reduction :



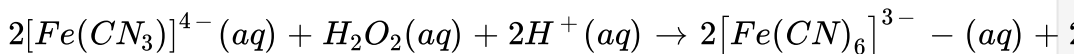


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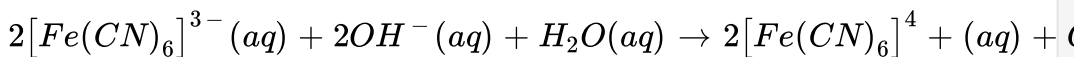
2. Using electron transfer concept identify the oxidant and reductant in the following redox reaction



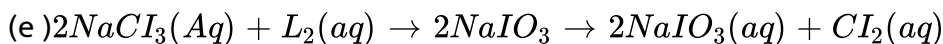
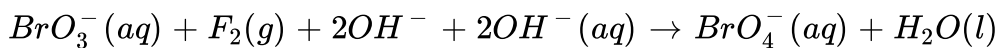
(b)



(c)

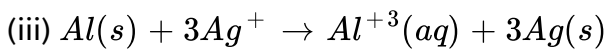
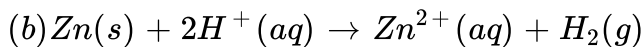
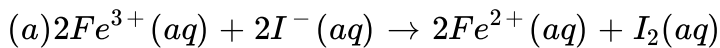


(d)



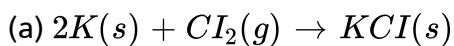
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3. Write the half reaction for the following redox reaction



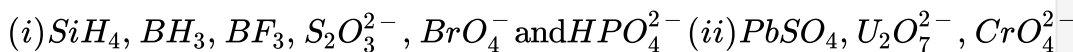
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4. Split the following redox reaction in to the oxidation and reduction half rections



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5. Find the oxidation number of the element in bold in the following speices



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6. Determine the oxidation number of C in the following :

C_2H_6 , C_4H_{10} , CO , CO_2 and HCO_3^-

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7. Determine the oxidation number of O in the following :

OF_2 , Na_2O_2 , Na_2O , KO_2 , KO_3 and O_2F_2

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8. Find out the oxidation number of Cl in HCl , $HClO$, ClO_4^- and ClO_2

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9. Find out the oxidation number of sulphur in the following species

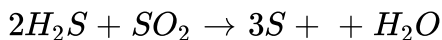
H_2SO_4 , $S_2O_4^{2-}$, $S_2O_7^{2-}$, HSO_3^- and HSO_4^-

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10. Determine the oxidation number of all the atoms in the following well known oxidants $KMnO_4$, $K_2Cr_2O_7$ and $LiAlH_4$

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11. Determine the change in OgtN of S in H_2S and SO_2 in the following reaction

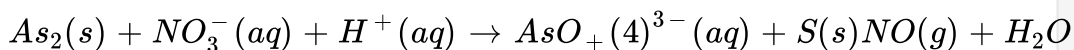


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12. What is the oxidation number of S in S_2Cl_2

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13. Balance the equation

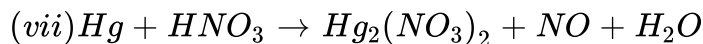
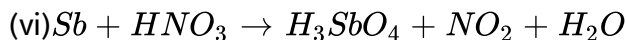
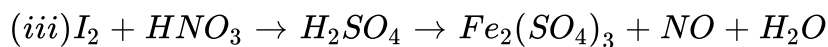
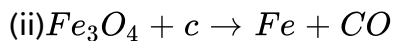
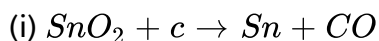


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14. (Associativity) Let $f: A \rightarrow B$, $g: B \rightarrow C$ and $h: C \rightarrow \cdot$. Then prove that $(h \circ g) \circ f = h \circ (g \circ f)$

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15. Balance the following redox reaction

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16. Calculate the volume of 0.05 M $KMnO_4$ solution required to oxidise completely 2.70 grams of oxalic acid ($H_2C_2O_4$) in acidic medium

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17. How many grams of $K_2Cr_2O_7$ are required to oxidize Fe^{2+} present in 15.2 g of $FeSO_4 \rightarrow Fe^{3+}$ if the reaction is carried out in an acidic medium ?

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18. 15.0 mL of 0.12 M $KMnO_4$ solution are required to oxidise 20.0 mL of $FeSO_4$ solution in acidic medium what is the concentration of $FeSO_4$ solution ?

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19. Calculate the percentage of oxalate ions in a given sample of oxalate salt 3.0 of which has been dissolve per litre of the solution 10 mL of the oxalate salt solution required 8 mL of 0.01 M $KMnO_4$ solution complete oxidation

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20. A solution of ferrous oxalate has been prepared by dissolving 3.6 g L^{-1} calculate the volume of 0.01 M $KMnO_4$ solution required for complete oxidation of 100 mL of ferrous oxalate solution in acidic medium

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21. Metallic tin in the presence of HCl is oxidized by $K_2Cr_2O_7$ to stannic chloride, $SnCl_4$. What volume of deci-normal dichromate solution would be reduced by 1 g of tin.

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22. How many millimoles of potassium dichromate is required to oxidise 24 ml of 0.5 M Mohr salt solution in acidic medium ?

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23. 2.48 g of $Na_2S_2O_3 \cdot xH_2O$ is dissolved per litre solution 20 ml of this solution required 10 ml 0.01 M iodine solution. What is value of x ?

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24. 50 mL of an aqueous solution of H_2O_2 was treated with an excess of KI solution and dilute H_2SO_4 . The liberated iodine required 20 mL 0.1 N $Na_2S_2O_3$ solution for complete interaction. Calculate the concentration of H_2O_2 in g/L.

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25. Both $Cr_2O_7^{2-}$ (aq) and MnO_4^- (aq) can be used to titrate Fe^{2+} (aq) if in a given titration 24.50 cm^3 0.1 M $Cr_2O_7^{2-}$ were used then what volume of 0.1 M MnO_4^- solution would have been used for the same titration ?

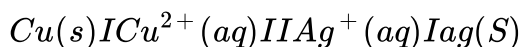
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26. A cell is prepared by dipping copper rod in 1M copper sulphate solution and zinc rod in 1M $ZnSO_4$ solution. The standard reduction potentials of copper and zinc are + 0.34 and -0.76 V respectively

- (i) what is the cell reaction ?
- (ii) what will be the standard electromotive force (EMF) of the cell ?
- (iii) which electrode will be positive ?
- (iv) How will the cell be represented ?

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27. A cell is set up between copper and silver electrodes as follows:

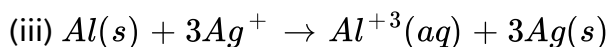
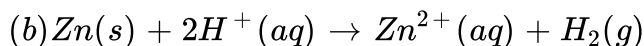
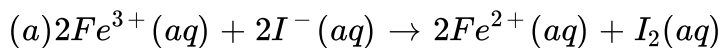


If the two half cells work under standard conditions, calculate the EMF of the cell

$$\text{(Given } E^\circ_{-}(\text{Cu}^{2+}/\text{Cu}) = +0.34\text{V, } E^\circ_{-}(\text{Ag}^{+}/\text{Ag}) = +0.80\text{V)}$$

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28. Write the half reaction for the following redox reaction



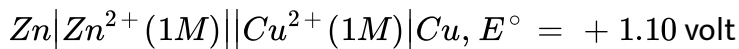
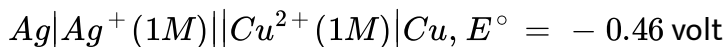
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29. The standard EMF of the cell : $\text{Ni}|\text{Ni}^{2+} || \text{Cu}^{2+}|\text{Cu}$

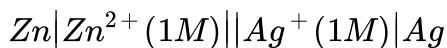
is 0.59 volt The standard electrode potential (reduction potential of copper electrode is 0.34 volt . Calculate the standard electrode potential of nickel electrode

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30. The emf (E°) of the following cells are :



Calculate the emf of the cell :



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31. The standard reduction potentials of two half cells $Al^{3+}(aq) | Al$ and $Mg^{2+}(aq) | Mg$ are $-1.66V$ and $-2.36V$ respectively. Calculate the standard cell potential. Write the cell reactions also.

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32. Calculate E° for the cell : $Al|Al^{3+}(1M)||Cu^{2+}(1M)|Cu$

Given : $E^\circ_{Al^{3+}/Al}$ and $E^\circ_{Cu^{2+}/Cu}$ as $-1.66 V$ and $+0.34 V$ respectively

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33. Predict reaction of 1N sulphuric acid with following metals : (i) copper (ii) lead (iii) iron Given, $E_{Cu^{2+}/Cu}^0 = 0.34\text{volt}$, $E_{Pb^{2+}/Pb}^0 = -0.13\text{ volt}$, $E_{Fe^{2+}/Fe}^0 = -0.44\text{ volt}$

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34. Can a solution of 1 M $ZnSO_4$ be stored in a vessel made of copper ?

Given that

$$E_{Zn^{2+}/Zn}^{\circ} = -0.76V \text{ and } E_{Cu^{2+}/Cu}^{\circ} = 0.34V$$

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35. Is it safe to stir 1M $AgNO_3$) solution with copper spoon? Given:

$$E^{\circ} Ag^{+} / ag = 0.80V, E^{\circ} Cu^{2+} / Cu^{2+} / Cu = 0.34V$$

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36. Can we use a copper vessel to store 1 M AgNO_3 solution? Given that

$$E_{\text{Cu}^{2+}|\text{Cu}}^0 = + 0.34 \text{ volt and } E_{\text{Ag}^+|\text{Ag}}^0 = 0.80 \text{ volt}$$

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

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Curiosity Question

1. Usually in a redox reaction one substance is oxidised and the other is reduced. Can you think of an inorganic compound which undergoes intramolecular redox reaction?

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2. Why does the electrochemical cell stop working after some time ?

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3. What would happen if no salt bridge is used in electrochemical cell ?

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Advanced Problems For Competitions

1. In an ore, the only oxidizable material is Sn^{2+} . This ore is titrated with a dichromate solution containing 2.5g of $K_2Cr_2O_7$ in 0.5litre. A 0.40g sample of the ore required $10.0cm^3$ of titrant to reach equivalence point. Calculate the percentage of tin in ore.

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2. A particular acid rain water contains sulphite (SO_3^{2-}) ions if a 25.0 cm^3 sample of this water requires cm^3 of 0.02 M KMnO_4 solution for titration what is the amount of SO_3^{2-} ions per litre in rain water?

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3. 0.144 g of pure FeC_2O_4 was dissolved in dilute H_2SO_4 and the solution was diluted to 100 ml . What volume in ml of 0.1 M KMnO_4 will be needed to oxidise FeC_2O_4 solution

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4. 25.0 cm^3 of a solution containing 15.0 g of a partially oxidised sample of green vitriol ($FeSO_4 \cdot 7H_2O$) per litre required 20.0 cm^3 mL of 0.01 M potassium dichromate solution for oxidation in acidic medium find out the percentage purity of the given sample of green vitriol

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5. 25.0 cm^3 of an aqueous solution of H_2O_2 was treated with excess of KI solution in acidic medium and the liberated iodine required 10.0 cm^3 of 0.01 M thiosulphate solution. Find out the concentration of H_2O_2 in grams per litre?

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Test Your Grip Multiple Choice Question

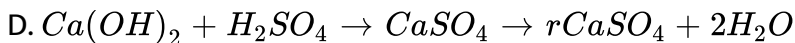
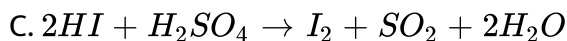
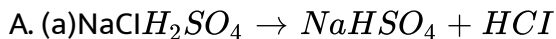
1. Bromine water reacts with SO_2 to form

- A. HBr and S
- B. H_2O and HBr
- C. S and H_2O
- D. H_2SO_4 and HBr

Answer: d

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

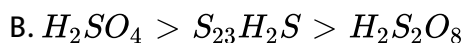
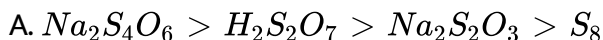


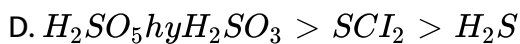
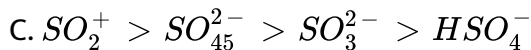
Answer: c



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





Answer: d

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

- A. disproportionation reaction
- B. neutralization reaction
- C. double decomposition reaction
- D. pyrolytic reaction

Answer: a

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5. When $KMnO_4$ acts as an oxidising agent and ultimately 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. 4,1,4

C. 3,2,3

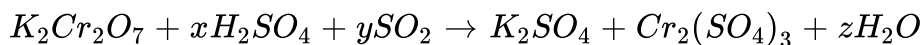
D. 2,1,2

Answer: c



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6. In the chemical reaction,



x , y , and z are

A. 1,3,1

B. 4,1,4

C. 3,2,3

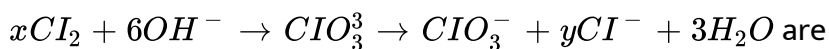
D. 2,1,2

Answer: a



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7. The values of x and y in the following redox reaction



A. x=2, y=4

B. x=5, y=3

C. x=3, y=5

D. x=4, y=2

Answer: b



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8. A standard hydrogen electrode has zero electrode potential because :

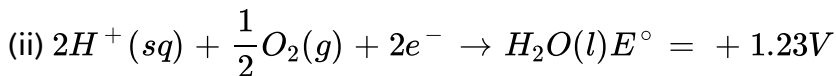
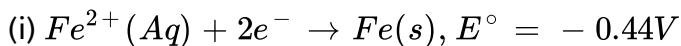
- A. hydrogen is easiest to oxidize
- B. this electrode potential is assumed to be zero
- C. hydrogen atom has only one electron
- D. hydrogen is the lightest element

Answer: b

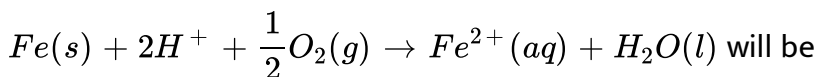


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9. If the half cell reactions are given as



The E° for the reaction



A. $1.67V$

B. $-1.67V$

C. $+0.79V$

D. $-0.79V$

Answer: b

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Fill In Th Blanks

1. In the reaction $2KClO_3 \rightarrow 2KCl + 3O_2$ the element which has been oxidised isand the element which has been reduced is

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2. The compound $Yb_a_2Cu_3O_7$ which shows super conductivity has copper in oxidation state _____. Assume that the rare earth element

yttrium is in its usual +3 oxidation state.

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3. The oxidation number of two S atoms in $Na_2S_2O_3$ areand

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4. Oxidant is a substance in which the oxidation number of one of the atomsand reductant is a substance in which oxidation number of one of atoms

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

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6. The compound in which oxygen number of oxygen is +2 is

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7. In an electrochemical cell consisting of zinc electrode and normal hydrogen electrode zinc electrode acts as

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8. Salt bridge maintainsin the solution of two half cells

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9. In an electrochemical cellacts as the negative pole whileacts as the positive pole

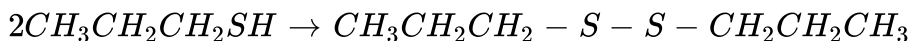
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10. The electrolysis of molten sodium hydride liberatesat theandat the

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Conceptual Question

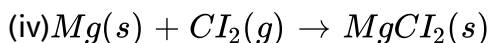
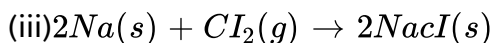
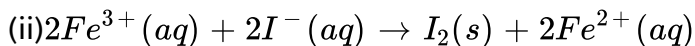
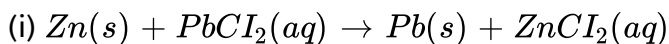
1. What is the name of the reaction

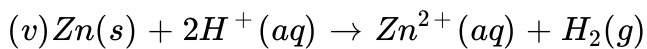


Whether condensation, oxidation, reduction or polymerization

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2. Write the following redox reactions using half equations



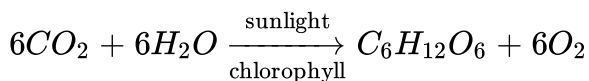


In each of the reactions given above mention

(a) Which reactant is oxidized ? to what ? (b) which reactant is the oxidiser ? (c) which reactant is reduced ? To what ? (d) which reactant is the reducer?

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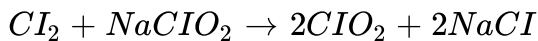
3. Photosynthesis involves the following overall reaction



Identify the species oxidised and the species reduced

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4. Chlorine dioxide (ClO_2) is used to kill bacteria in soft drinks and dairy products being an unstable compound it can be synthesized by the following reaction



Identify the substance oxidised and reduced

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5. What is the maximum and minimum oxidation states for Na Mg Al Sn and Mn?

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6. What are the maximum and minimum oxidation numbers of N, S and Cl ?

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7. Nitric acid acts as an oxidising agent while nitrous acid can act both as an oxidising as well as reducing agent ?

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8. How does Cu_2O acts as both oxidant and reductant ? Explain with proper reaction showing the change of oxidation number in each example

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

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10. Find out the oxidation numbers of (i) S atoms in $Na_2S_2O_3$ and Cl atoms in bleaching powder $CaOCl_2$

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11. Find out the oxidation states of two types of Fe atoms in $Fe_4[Fe(CN)_6]_3$ and rewrite the formula in stock notation form

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12. An iron rod is immersed in a solution containing $1.0M NiSO_4$ and $1.0M ZnSO_4$. Predict giving reasons which of the following reactions is likely to proceed?

(i) Fe reduces Zn^{2+} ions,

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

Given : $E_{Zn^{2+} | Zn}^0 = -0.76$ volt and $E_{Fe^{2+} | Fe}^0 = -0.44$ volt and $E_{Ni^{2+} | Ni}^0 = -0.25$ V

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



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14. I_2 and Br_2 are added to a solution containing Br^- and I^- ions what reaction will occur if



?



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15. The oxides of Cl, Br and I are well known. They have various composition. The oxides are thermally unstable and dangerously explosive. They react with alkali. The bromine oxides are thermally more stable than chlorine oxides. The structure of halogen oxides is explained on the basis of VSEPR theory.

The hydrides of chlorine, bromine and iodine can be made by direct synthesis as they are well strongly fuming become increasingly more powerful reducing agents. Halogens also form oxoacids of the form HOX , HXO_2 , HXO_3 and HXO_4 The acidic character of oxoacids

and halogen oxides decreases from 'Cl' to 'I', however it increases with increase in oxidation number of halogen in them.

Which of the following does not dimerise?

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16. Copper dissolves in dilute Nitric acid but not in dilute HCl . Why?

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17. The standard electrode potential corresponding to the reaction $Au^{3+}(aq) + 3e^{-} \rightarrow Au(s)$ is 1.50 V predict if gold can be dissolved in 1M HCl solution and on passing hydrogen gas through gold salt solution metallic gold will be precipitated or not

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18. Is it possible to store:

- (i) Copper sulphate solution in a zinc vessel?
- (ii) Copper sulphate solution in a silver vessel?
- (iii) Copper sulphate solution in a gold vessel?

Given: $E_{Cu^{2+} | Cu}^0 = + 0.34$ volt and $E_{Ag^{2+} | Ag}^0 = 0.80$ volt and $E_{Au^{2+} | Au}^0 = +1.50$ volt

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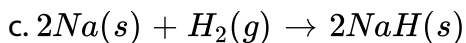
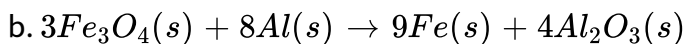
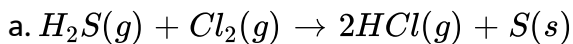
19. The standard electrode potentials at 298 K are given below:

$E_{Zn^{2+} | Zn}^0 = -0.76$ volt and $E_{Fe^{2+} | Fe}^0 = -0.44$ volt, $E_{H^+ | H_2}^0 = -0.0$ volt

Which of the two electrodes should be combined to form a cell having highest EMF? Identify the cathode and the anode and write the cell reaction. Also mention the direction of flow of electrons in the external as well as the internal circuit.

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1. Identify the species undergoing oxidation and reduction.



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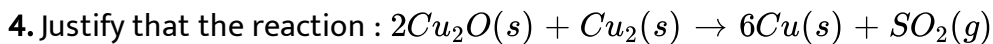
2. Justify that the reaction : $2Na(s) + H_2(g) \rightarrow 2NaH(s)$ is a redox reaction

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3. Using stock notation represent the following compounds :

$HgCl_2$, Tl_2 , FeO , F_2 , CuI , CuO , MnO and MnO_2

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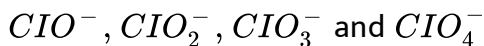


is a redox reaction identify the species oxidised / reduced which acts as an oxidant and which acts as a reductant



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5. Which of the following species do not show disproportionation reaction and why ?

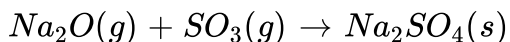


Also write reaction for each of the species that disproportionates

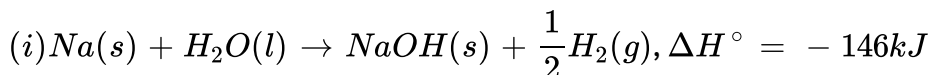


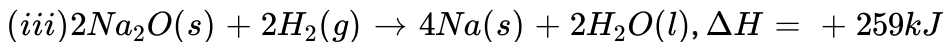
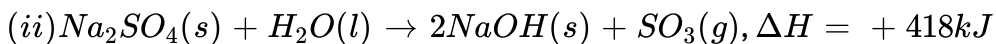
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6. Calculate ΔH° for the reaction



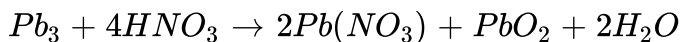
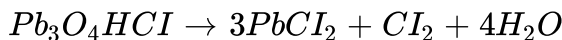
Given the following





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7. Why do the following reaction proceed differently?



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8. Write the net ionic equation for the reaction of potassium dichromate

(VI) $K_2Cr_2O_7$ with sodium sulphite Na_2SO_3 in acid solution to give chromium (III) ion and sulphate ion

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9. Permanganate ion reacts with bromide ion in basic medium to give manganese dioxide and bromate ion write the balanced chemical equation for the reaction

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10. Permanganate (VII) ion, in basic solution oxidize iodide ion I^- to produce molecular iodine I_2 and manganese (IV) oxide MnO_2 . Write a balanced ionic equation to represent this redox reaction.

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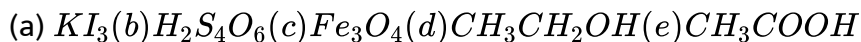
Ncert Exercise

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

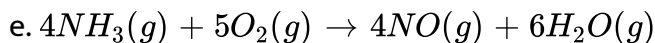
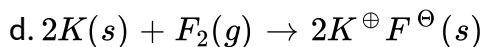
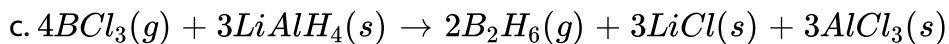
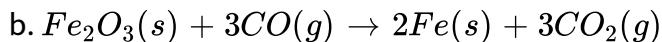
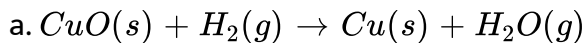
NaH_2PO_4 (a) $NaHSO_4$ (b) $H_4P_2O_7$ (c) K_2MnO_4 (d) CO_2 (e) $NaBH_4$ (f) H_2S_2

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

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3. Justify that the following reaction are redox reactions:

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

$H_2O(s) + F_2(g) \rightarrow HF(g) + HOF(g)$ justify that this reaction is a redox reaction

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5. Calculate the oxidation number of sulphur chromium and nitrogen in

H_2SO_5 , CrO_5 and suggest structure of these three compounds count for the fallacy

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6. Write formulas for the following compounds

(a) Mercury (II) chloride

(b) Nickel (II) sulphate

(c) Tin (IV) oxide

(d) Thallium (I) sulphate

(e) Iron (III) sulphate

(f) Chromium (III) oxide

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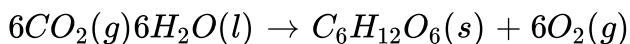
7. Suggest a list of the substances where carbon can exhibit oxidation states from -4 to $+4$ and nitrogen from -3 to $+5$.

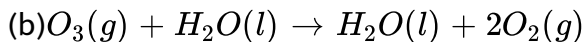
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8. While sulphate dioxide and hydrogen peroxide can act as oxidising as well as reducing agents in their reactions, ozone and nitric acid act only as oxidants. Why?

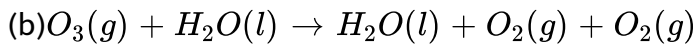
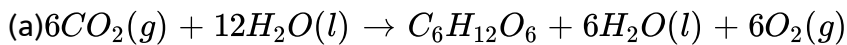
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9. Consider the reaction : (a)





Why it is more appropriate to write these reactions as :



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

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

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11. Whenever a reaction between an oxidising agent and a reducing agent is carried out, a compound of lower oxidation state is formed if the reducing agent is in excess and a compound of higher oxidation state is formed if the oxidising agent is in excess. Justify this statement giving three illustrations.



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12. How do you count for the following observations ?

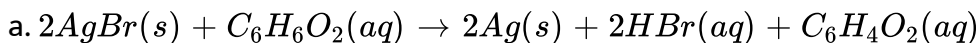
(a) Though alkaline potassium permanganate and acidic potassium permanganate both are used as oxidants, yet in the manufacture of benzoic acid from toluene we use alcoholic potassium permanganate as an oxidant. Why ? Write a balanced redox equation for the reaction.

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

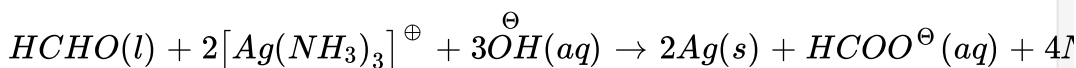


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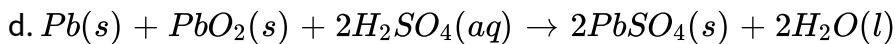
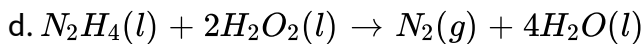
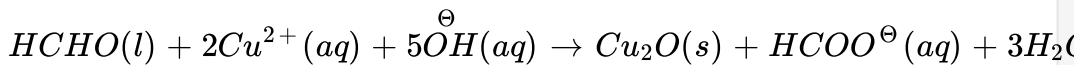
13. Identify the substance oxidised substance reduced, oxidising agent, and reducing agent for each of the following reactions:



b.

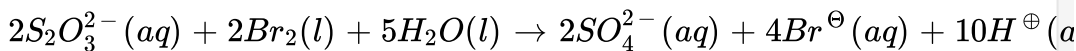
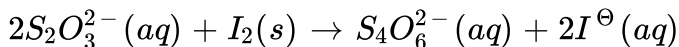


c.



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14. Consider the reaction:



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

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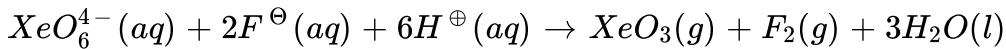
15. Justify giving reaction that among halogens, fluorine is the best oxidant and among hydrohalic compounds, hydroiodic acid is the best reductant.





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16. Why does the following reaction occur?



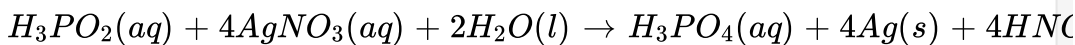
What conclusion about the compound Na_4XeO_6 (of which XeO_6^{4-} is a part) can be drawn from the reaction?



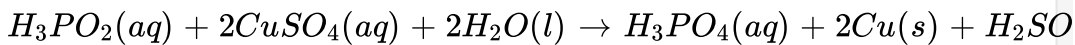
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17. Consider the reactions:

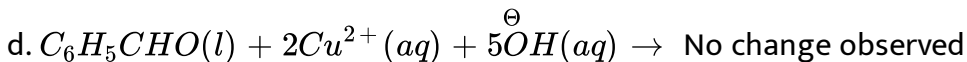
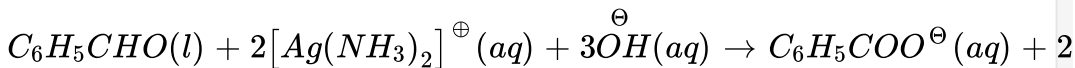
a.



b.



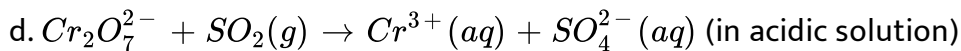
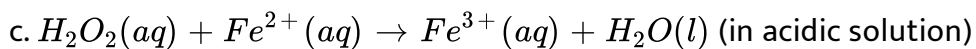
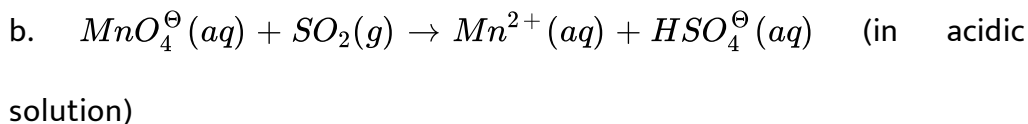
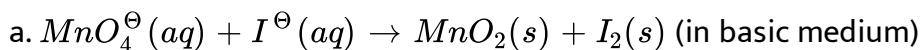
c.



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

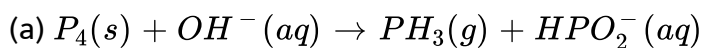
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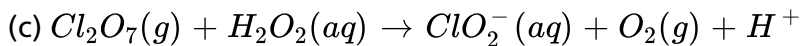
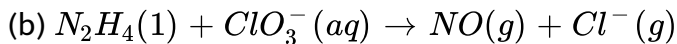
18. Balance the following redox reactions by ion electron method:



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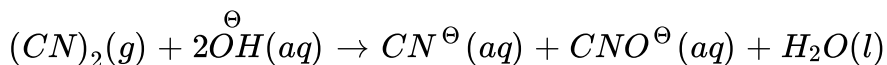
19. Balance the following equations in basic medium by ion-electron method and oxidation number methods and identify the oxidising agent and the reducing agent.





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



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

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22. Consider the elements:

Cs , Ne , I and F

- a. Identify the element that exhibits only negative oxidation state.
- b. Identify the element that exhibits only positive oxidation state.
- c. Identify the element that exhibits both positive and negative oxidation states.
- d. Identify the element which exhibits neither the negative nor does the positive oxidation state.

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

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

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

reaction.

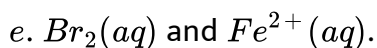
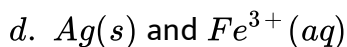
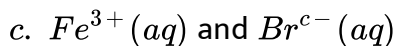
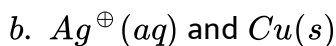
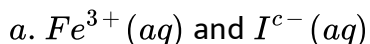
b. Select three metals that can show disproportionation reaction.

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

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26. Using the standard electrode potentials given in Table, predict if the reaction between the following is feasible:





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27. Predict the products of electrolysis in each of the following :

- An aqueous solution of $AgNO_3$ with silver electrodes.
- An aqueous solution of $AgNO_3$ with platinum electrodes,
- A dilute solution of H_2SO_4 with platinum electrodes.
- An aqueous solution of $CuCl_2$ with platinum electrodes.



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28. Arrange the following metals in the order in which they displace each other from the solution of their salts Al, Cu, Fe, Mg and Zn

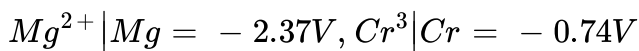


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29. Given standard electrode potentials

$$K^{\oplus} | K = -2.93V, Ag^{\oplus} | Ag = 0.80V,$$

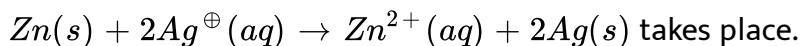
$$Hg^{2+} | Hg = 0.79V$$



Arrange these metals in their increasing order of reducing power.

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30. Depict the galvanic cell in which the reaction :



Further show :

- Which electrode is negatively charged?
- The carriers of the current in the cell.
- Individual reaction at each electrode.

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Ncert Exemplar Problems With Answers Hints And Solution I

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

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2. The more positive the value of E° the greater is the tendency of the species to get reduced using the standard electrode potential of redox couples given below find out which of the following is the strongest oxidising agent

$$E^\circ \text{ values: } \frac{F^{3+}}{Fe^{2+}} = + 0.77,$$

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

$$\frac{Ag^+}{Ag(s)} = + 0.80, Cu^{2+} / Cu(s) = + 0.34$$

$$\frac{I_s}{(I)^-} = + 0.54$$

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

$$E^\circ \text{ values : } B \frac{r_2}{B} r^- = 1.09$$

$$Ag^+ / Ag(s) = + 0.80, Cu^{2+} / Cu(s) = + 0.34$$

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

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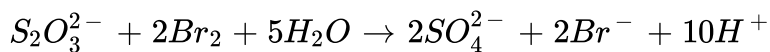
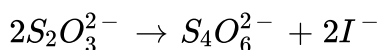
4. Using the standard electrode potential, find out the pair between which redox reaction is not feasible.

$$E^\theta \text{ values: } Fe^{3+} / Fe^{2+} = 0.77, I_2 / I^- = + 0.54,$$

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

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



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

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

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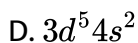
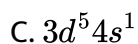
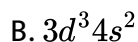
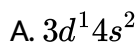
7. In which of the following compounds, an element exhibits two different oxidation states?

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8. Which of the following arrangements represent increasing oxidation number of the central atom?

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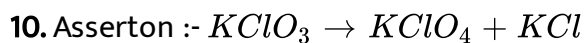
9. The largest oxidation number exhibited by an element depends on its outer electronic configuration. With which of the following outer electronic configurations the element will exhibit largest oxidation number ?



Answer:



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This is a disproportionation type reaction.

Reason :- The reaction in which one substance oxidise or reduce is known as disproportionation reaction.



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

A. Cl

B. Br

C. F

D. I

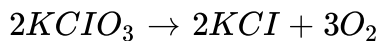
Answer:



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Ncert Exemplar Problems With Answers Hints And Solution li

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



- A. Potassium is undergoing oxidation
- B. Chlorine is undergoing oxidation
- C. Oxygen is reduced
- D. None of the species are undergoing oxidation or reduction

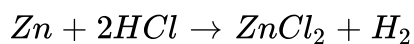
Answer:



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

:



- A. Zinc is acting as an oxidant
- B. Chlorine is acting as a reluctant
- C. Hydrogen ion is acting as an oxidant

D. Zinc is acting as a reluctant

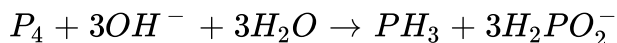
Answer:

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

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



A. Phosphorus is undergoing reduction only

B. Phosphorus is undergoing oxidation only

C. Phosphorus is undergoing oxidation as well as reduction

D. Hydrogen is undergoing neither oxidation nor reduction

Answer:

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

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Short Answer Question

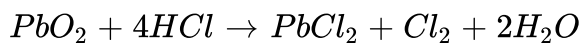
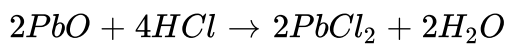
1. The reaction $Cl_2(g) + 2OH^-(aq) \rightarrow ClO^-(aq) + Cl^-(aq) + H_2O(l)$ represents the process of bleaching. Identify and name the species that bleaches the substances due to its oxidising action.

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

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



Why do these compounds differ in their reactivity?

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

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5. When potassium permanganate, $KMnO_4$, is added to an acidified solution of oxalic acid, $H_2C_2O_4$, the products are CO_2 gas and Mn^{2+} ions. What is the reducing agent in this reaction?

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

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

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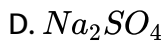
7. Calculate the oxidation number of each sulphur atom in the following compounds.

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

A. $Na_2S_2O_3$

B. $Na_2S_4O_6$

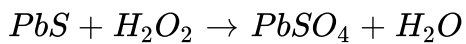
C. Na_2SO_3



Answer:

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8. Balance the following equation by oxidation number method



A.

B.

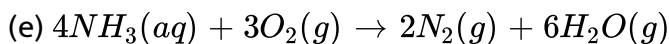
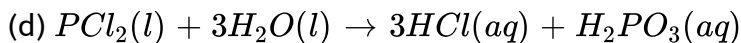
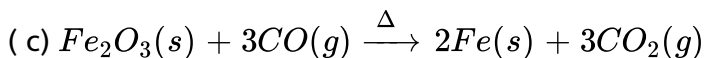
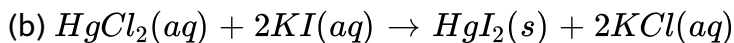
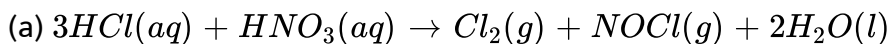
C.

D.

Answer:

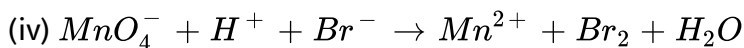
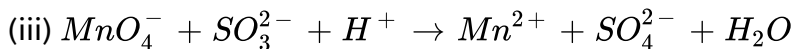
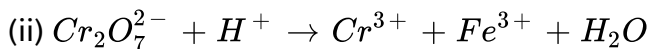
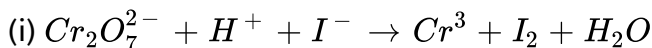
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9. Identify the redox reaction out of the following reactions and identify the oxidising and reducing agents in them.



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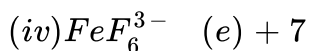
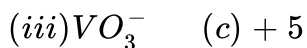
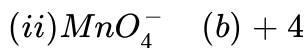
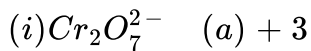
10. Balance the following ionic equations



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

Column I Column II



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

Column I

Column II

(i) Ions having positive charge (a) + 7

(ii) The sum of oxidation number of all atoms in a neutral molecule (b) - 1

(iii) Oxidation number of hydrogen ion (H^+) (c) + 1

(iv) Oxidation number of fluorine in NaF (d) 0

(v) Ions having negative charge (e) Cation

(f) Anion



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

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

A. both a and r are true and r is the correct explanation of a

B. both a and r are true but r is not the correct explanation of a

C. a is true but r is false

D. both a and r are false

Answer:



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

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

A. both a and r are true and r is the correct explanation of a

B. both a and r are true but r is not the correct explanation of a

C. a is true but r is false

D. both a and r are false

Answer:

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

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

A. both a and r are true and r is the correct explanation of a

B. both a and r are true but r is not the correct explanation of a

C. a is true but r is false

D. both a and r are false

Answer:

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

Reason (R) : In the represent $E_{Fe^{3+}/Fe^{2+}}$ and $E_{Fe^{3+}/Fe^{2+}} Fe^{3+}/Fe^{2+}$ and Cu^{2+}/Cu are redox couples

- A. both a and r are true and r is the correct explanation of a
- B. both a and r are true but r is not the correct explanation of a
- C. a is true but r is false
- D. both a and r are false

Answer:



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17. Explain the term : oxidation and reduction in terms of electronic give example in each case

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18. Define the terms oxidising agent and reducing agents according to the electronic concept give one example in each case

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19. Oxidation and Reduction Reactions

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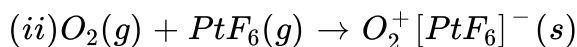
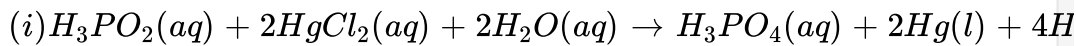
20. If an iron rod is dipped in $CuSO_4$ solution

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21. What are half reaction ? Explain with examples

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22. In the following redox reaction identify the oxidising agent and the reducing agent



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23. Define oxidation and reduction in terms of oxidation give examples in each case to illustrate your answer

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24. Define oxidising and reducing agents in terms of oxidation number cite two examples in each case to support your answer

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25. H_2S acts only as reducing agent while SO_2 can act both as a reducing agent and as an oxidising agent. How will you account for it ?

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26. H_2O_2 acts as reductant as well as oxidant explain

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27. Explain the difference between valency and oxidation number

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28. Discuss briefly types of redox reaction give one example in each case

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29. Discuss the following redox reaction (i) combination reaction (ii) decomposition reaction (iii) displacement reaction (iv) disproportionation reaction

Give one example in each case

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30. Comment upon the statement paradox of fractional oxidation number

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31. In a titration, H_2O_2 is oxidised to O_2 by MnO_4^- . 24 mL of 0.1M H_2O_2 requires 16 mL of 0.1M MnO_4^- solution. Hence MnO_4^- changes to :

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32. What is an electrochemical series ? How can this be used to explain the oxidising and reducing abilities of elements

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33. Arrange the following metals in increasing order of reactivity which one will be the strongest reduce agent and which is the weakest ? Mg, Na, Ag ,Cu,Zn

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34. Draw a neat labelled diagram of an animal cell.

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35. Write the functions of salt bridge in an electrochemical cell.

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36. Discuss the application of redox reactio

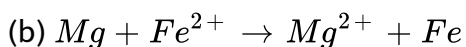
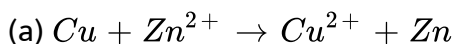
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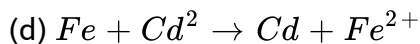
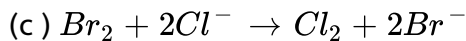
Long Answer Question

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

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





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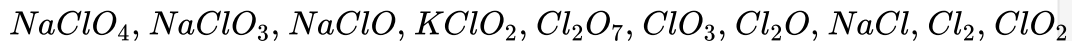
3. Why does fluorine not show disproportionation reaction ?

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

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5. Find out the oxidation number of chlorine in the following compounds and arrange them in increasing order of oxidation number of chlorine.



Which oxidation state is not present in any of the above compounds?

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

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7. Explain the terms : (i) oxidatio (ii) reduction (iii) oxidising agent and (iv) reducing agent in terms of electrons give two example in each to justify your answer

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8. Briefly discuss some redox reaction occuring in aqueous solution

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9. Define oxidation number how does it differ from valency ? Write the general rules of assigning oxidation number to various atoms in ions and molecules

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10. What is electrochemical series ? How does it help in predicting whether a particular redox reaction is feasible in a given direction or not.

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Very Short Answer Question

1. Define oxidation and reduction according to electronic concept.

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2. What is a redox reaction give one example

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3. Show that the formation of sodium chloride from gaseous sodium and gaseous chlorine is a redox reaction

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4. Define oxidising and reducing agents in terms of electrons

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5. what is the oxidation number of (i) C in CH_2O (ii) Pt in $[Pt(C_2H_4)Cl_3]^-$

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6. The oxidation state of Ni in $[Ni(CO)_4]$ is

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

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8. Define oxidation and reduction according to the oxidation number.

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9. When magnesium ribbon is burnt in air two products are formed magnesium oxide and magnesium nitride point out the oxidising and reducing agents

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10. In the reaction $MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$ which species is oxidised

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11. Define disproportionation reaction. Give one example.

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12. The standard electrode potentials of few metals are give below

Al (-1.66 v), Cu(+0.34V), Li(-3.05 v), Ag(+0.80 v) and Zn (-0.76) V

Which of these will behave as the strongest oxidising agent and which as the strongest reducing agent ?

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

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

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15. Arrange the following metal in which they displace each other from the solution of their salts Al,Cu,Fe, Mg,Ag and Zn

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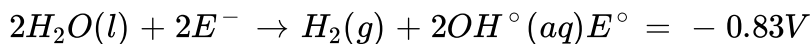
16. Give anodic and cathodic reaction occurring during electrolysis of acidified water





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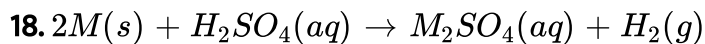
17. The following two reaction can occur during electrolysis of aqueous sodium chloride solution



Which reaction takes place preferentially and why ?



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Give the representation of the cell which involves the above redox reaction



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19. A cell is constructed using Cu^{2+} / Cu and Al^{3+} / Al electrode what is the net cell reaction



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20. Define EMF of the cell



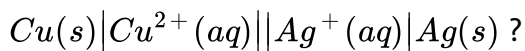
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21. What is a redox couple



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22. Can we use KCl as electrolyte in the salt bridge of the cell



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Question

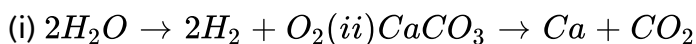
1. Draw the structure of chromium pentoxide and predict the oxidation number of chromium in it

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2. When sodium tetrathionate is treated with dilute hydrochloric acid sulphur dioxide gas is evolved along with simultaneous deposition of elemental sulphur what does this reaction indicate about the oxidation number of the two sulphur atoms ? Also write the structure of tetrathionate ion

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3. Consider the following two decomposition reaction



Which of the two is a redox reaction ? Explain

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4. Ammonium dichromate upon heating decomposes to give nitrogen gas and chromium oxide is it a redox reaction ?

If so what is the type of the redox whether inter or intramolecular

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5. Small quantities of compounds TX, TY and TZ are put into separate test tubes containing X, Y and Z solutions. TX does not react with any of these. TY reacts with both X and Z. TZ reacts only with X. The decreasing order of ease of oxidation of the anions X^- , Y^- and Z^- is

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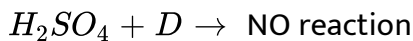
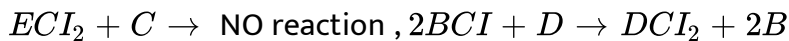
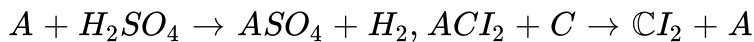
6. If the half reaction $A + E^- \rightarrow A^-$ moves in the backward reaction what does half reaction mean

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7. Element A reduces cation of element B but does not reduce the cation of element C. Will element C reduce the cation of element B? Explain

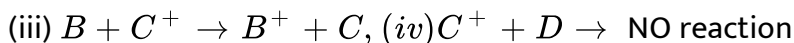
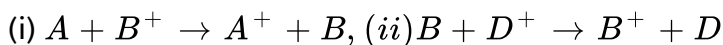
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8. Arrange A, B, C, D, E and H in order of increasing electrode potential in the electrochemical series if



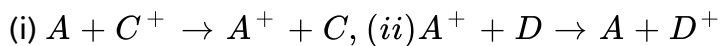
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9. (a) Arrange A, B, C and D in order of increasing electrode potential in the electrochemical series if



(b) on the basis of the above data predict which of the following reaction

will occur

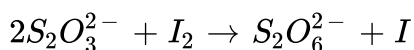


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10. A mixture of $FeCl_2$ and $SnCl_2$ can exist together but that of $FeCl_3$ and $SnCl_3$ cannot explain why?

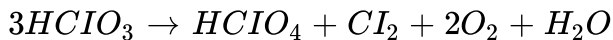
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11. If the molecular mass of $Na_2S_2O_3$ and I_2 are M_1 and M_2 respectively, then what will be the equivalent mass of $Na_2S_2O_3$ and I_2 in the following reaction



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12. In the disproportionation reaction,



What is the equivalent mass of the oxidising agent ?

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13. Amount of oxalic acid present in a solution can be determined by its titration with KMnO_4 solution in presence of H_2SO_4 but not in presence of HCl ? Explain why ?

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Problems

1. A 0.276 g impure sample of copper ore is dissolved and Cu^{2+} is titrated with KI solution. I_2 liberated required 40 mL of 0.1 M $\text{Na}_2\text{S}_2\text{O}_3$ solution for titration. What is the % of impurities in the ore ?



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2. An aqueous solution containing 0.10 g KIO_3 (formula weight = 214.0) was treated with an excess of KI solution the solution was acidified with HCl. The liberated I_2 consumed 45.0 mL of thiosulphate solution to decolourise the blue starch-iodine complex. Calculate the molarity of the sodium thiosulphate solution.



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3. 2.68×10^{-3} moles of solution containing anion A^{n+} require 1.61×10^{-3} moles of MnO_4^- for oxidation of A^{n+} to AO_3^- in acidic medium. What is the value of n ?



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4. 12.53 cm^3 of 0.51 M SeO_2 reacts exactly with 25.5 cm^3 of 0.1 M $CrSO_4$ which is oxidised to $Cr(SO_4)_3$. To what oxidation state is the selenium

converted during the reaction ?

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Multiple Choice Question

1. Oxidation state of P in $H_4P_2O_5$, $H_4P_2O_6$, $H_4P_2O_7$ are respectively

A. +3, +5, +4

B. +5, +3, +4

C. +5, +4, +3

D. +3, +4, +5

Answer: d

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2. The oxidation states of iodine in HIO_4 , H_3IO_5 and H_5IO_6 are respectively :

A. +1, +3, +7

B. +7 + 7 + 3

C. +7 + 7 + 7

D. +7 + 5 + 3

Answer: c



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3. Identify the cases(s) where there is change in oxidation number.

A. Acidified solution of CrO_4^{2-}

B. SO_2 gas bubbled through an acidic solution of $Cr_2O_7^{2-}$

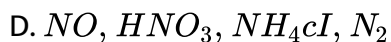
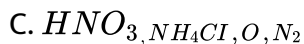
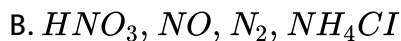
C. alkaline solution of CrO_4^{2-}

D. aqueous solution of CrO_2Cl_2 in NaOH

Answer: b

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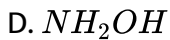
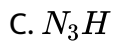
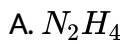
4. The correct order of N-compounds in its decreasing order of oxidation states is



Answer: b

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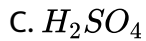
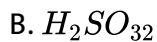
5. In which of the following compounds, nitrogen exhibits highest oxidation state?



Answer: c

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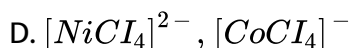
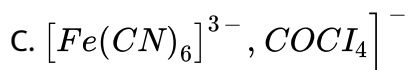
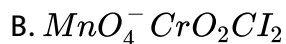
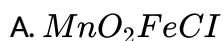
6. Which is the strongest acid in the following ?



Answer: a

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



Answer: b



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8. The number of electrons that are involved in the reduction of permanganate to manganese (II) salt, manganese dioxide and manganese dioxide respectively are



B. 5,3,1

C. 2,7,1

D. 5,2,3

Answer: a



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9. A metal ion M^{3+} loses three electrons, its oxidation number will be

A. +3

B. +6

C. 0

D. -3

Answer: b



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10. The oxidate state of Co in $[Co(H_2O)_5Cl]^{2+}$ is

A. +2

B. +3

C. +1

D. +4

Answer: b



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11. Which of the following statements is correct

A. oxidation number of Fe in $[Fe(H_2O)_5NO]SO_4$ is +1

B. oxidation number of sodium in sodium amalgam is -1

C. oxidation state of carbon in HCN is +4

D. All statement are correct

Answer: a

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

- A. formation of $Fe(CO)_5$ from Fe
- B. Liberation of H_2 from steam by iron at high temperature
- C. rusting of iron sheets
- D. decolourisation of blue $CuSO_4$ solution by iron

Answer: a

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13. Oxidation state of each Cl in $CaOCl_2$ is / are

- A. 0

B. +1

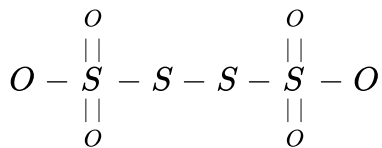
C. -1

D. +1, -1

Answer: d

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14. The oxidation states of S atom in $S_4O_6^{2-}$ from left to right respectively are



A. +6, 0, 0, +6

B. +3, +1, +1, +3

C. +5, 0, 0, +5

D. +4, +1, +1, +4

Answer: c

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15. The oxidation numbers of the sulphur atoms in peroxy- 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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16. In acidic medium, H_2O_2 changes $Cr_2O_7^{2-}$ to CrO_5 which has two (-O-O-) bonds. Oxidation state of Cr in CrO_5 is

A. +5

B. +3

C. +6

D. -10

Answer: c



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17. The oxidation state of chromium in the final product formed by the reaction between KI and acidified potassium dichromate solution is :

A. +3

B. +2

C. +6

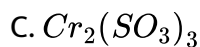
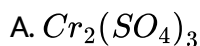
D. +4

Answer: a

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18. Acidified $K_2Cr_2O_7$ solution turns green when Na_2SO_3 is added to it.

This is due to the formation of



Answer: a

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

A. S

B. H

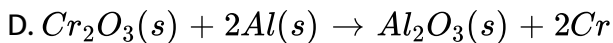
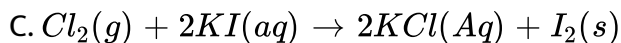
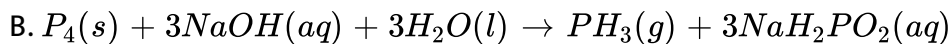
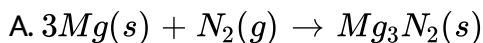
C. Cl

D. C

Answer: c

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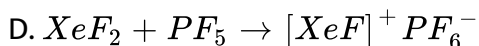
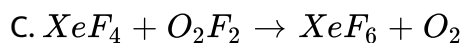
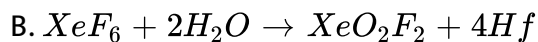
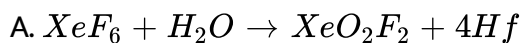
20. Choose the disproportionation reaction among the following redox reactions.



Answer: b

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21. Which of the following is an example of redox reaction ?



Answer: c

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22. 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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23. When Cl_2 gas reacts with hot and concentrated sodium hydroxide solution, the oxidation number of chlorine changes from:

A. zero to +1 and zero to -5

B. zero to -1 and zero to +5

C. zero to -1 and zero to +3

D. zero to +1 and zero to -3

Answer: b

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

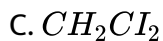
- A. redox reaction , -3 and -5
- B. redox reaction , +3 and +5
- C. disproportionation reaction , -3 and +1
- D. disproportionation reaction , -3 and +3

Answer: c

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25. In which of the following compounds, carbon exhibits a valency of four but oxidation state of -2 ?

- A. CH_3Cl

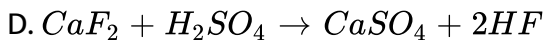
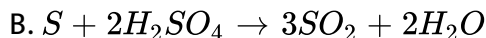


Answer: a

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26. Hot concentrated sulphuric acid is a moderately strong oxidizing agent.

Which of the following reactions does not show oxidizing behaviour?

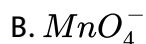


Answer: d

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27. In the redox reaction

$MnO_4^- + 8H^+ + Br^- \rightarrow Mn^{2+} + 4H_2O + 5/2Br_2$ which one is the reducing agent ?

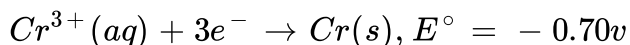
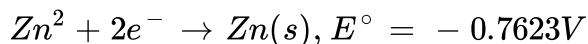


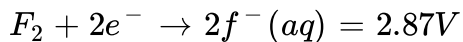
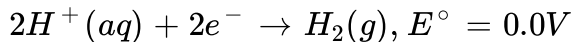
Answer: c



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28. The standard reduction potential at 298 K for the following half cell reaction are





which of the following is the strongest reducing agent

A. Cr (s)

B. Zn(g)

C. $H_2(g)$

D. $F_2(g)$

Answer: b



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29. Given $E^\circ_{Cl_2/Cl^-} = 1.36V$, $E^\circ_{Cr^{3+}/Cr} = -0.74V$

$E^\circ_{Cr_2O_7^{2-}/Cr^{3+}} = 1.33V$, $E^\circ_{MnO_4^-/Mn^{2+}} = 1.51V$

Among the following, the strongest reducing agent is

A. Cr^{3+}

B. Cl^-

C. Cr

D. Mn^{2+}

Answer: c



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30. Which of the following is a set of reducing agents ?

A. HNO_3 , Fe^{2+} , f_2

B. F^- , Cl^- , MnO_4^-

C. I^- , Na , Fe^{2+}

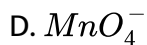
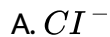
D. $Cr_2O_7^{2-}$, CrO_4^{2-} , Na

Answer: c



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31. Which of the following species can function as an oxidising as well as reducing agent ?

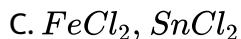
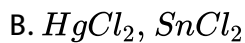
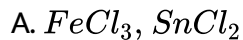


Answer: c



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32. The pair of compounds that can exist together is:

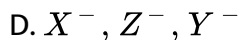
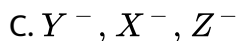
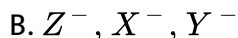
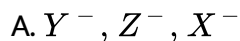


Answer: c



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33. Small quantities of compounds TX, TY and TZ are put into separate test tubes containing X, Y and Z solutions. TX does not react with any of these. TY reacts with both X and Z. TZ reacts only with X. The decreasing order of ease of oxidation of the anions X^- , Y^- and Z^- is



Answer: a



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34. Which of these will not be oxidised by ozone

A. KI

B. $FeSO_4$

C. $KMnO_4$

D. K_2MnO_4

Answer: c



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35. When acidified $K_2Cr_2O_7$ solution is added to Sn^{2+} salts then Sn^{2+} changes to

A. Sn

B. Sn^{3+}

C. Sn^{4+}

D. Sn^+

Answer: c

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36. In the standardization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by iodometry, the equivalent weight of $K_2Cr_2O_7$ is

- A. (molecular weight) / 2
- B. (molecular weight) / 6
- C. (molecular weight) / 3
- D. same as molecular weight

Answer: B

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37. The equivalent mass of potassium permanganate in alkaline medium is

- A. molar mass / 5
- B. molar mass / 3
- C. molar mass / 2
- D. molar mass itself

Answer: b

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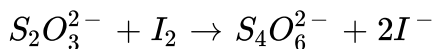
38. 21 Mol of $FeSO_2$ (atomic weight of Fe is 55.84 g mol^{-1}) is oxidized to $Fe_2(SO_4)_3$ calculate the equivalent weight of ferrous ion

- A. 55.84
- B. 27.92
- C. 18.61
- D. 111.68

Answer: a

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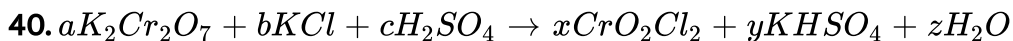
39. If the molecular wt of $Na_2S_2O_3$ and I_2 are M_1 and M_2 respectively then what will be the equivalent wt of $Na_2S_2O_3$ and I_2 in the following reaction



- A. M_1M_2
- B. $M_1M_2/2$
- C. $2M_1, M_2$
- D. $M_1, 2M_2$

Answer: b

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The above equation balances when

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

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

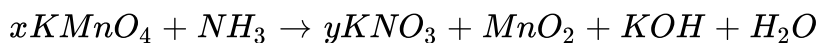
C. $a=6, b=4, c=2$ and $x=6, y=3, z=2$

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

Answer: d

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41. In the redox reaction



A. $x=4, y=6$

B. $x=3, y=8$

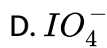
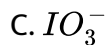
C. $x=8, y=6$

D. $x=8, y=3$

Answer: d

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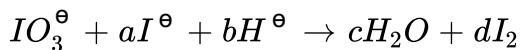
42. $KMnO_4$ acts as an oxidising agent in alkaline medium when alkaline $KMnO_4$ is treated with KI iodide ion is oxidised to



Answer: c

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43. In the balanced chemical reaction



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

A. 5,6,3,3

B. 5,3,6,3

C. 3,5,3,6

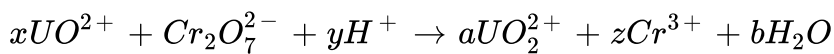
D. 5,6,5,5

Answer: a



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44. In the following redox reaction,



the value of coefficients x,y and z respectively, are

A. 3,8,2

B. 3,8,7

C. 3,2,4

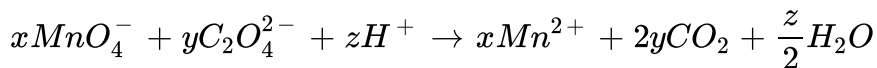
D. 3,1,8

Answer: a



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45. Consider the following reaction :



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

A. 5,2 and 8

B. 5,2 and 16

C. 2,5 and 8

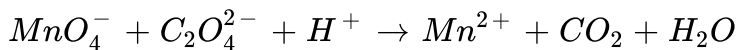
D. 2,5 and 16

Answer: d



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46. For the redox reaction



The correct coefficients of the reactants for the balanced reaction are

A. 16 5 2

B. 2 5 16

C. 2 16 5

D. 5 16 2

Answer: b



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47. In aqueous alkaline solution two electron reduction of HO_2^- gives

A. HO^-

B. H_2O

C. O_2

D. O_2^-

Answer: a

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48. For decolourisation of 1mol of $KMnO_4$, the moles of H_2O_2 required is

A. $1/2$

B. $3/21$

C. $5/2$

D. $7/2$

Answer: c

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49. The number of moles of $KMnO_4$ reduced by 1mol of KI in alkaline medium is

- A. one
- B. two
- C. five
- D. one fifth

Answer: b



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50. The number of moles of $KMnO_4$ needed to react with one mole of SO_3^{2-} in acidic solution is

- A. $4/5$
- B. $2/5$
- C. 1

D. 3/5

Answer: b

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51. Consider the titration of potassium dichromate solution with acidified Mohr salt solution using dimethylamine as indicator. The number of moles of Mohr salt required per mole of dichromate

A. 3

B. 4

C. 5

D. 6

Answer: d

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52. 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: c



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53. 3.92g of ferrous ammonium sulphate crystals are dissolved in 100ml of water, 20ml of this solution requires 18ml of $KMnO_4$ during titration for complete oxidation. The weight of $KMnO_4$ present in one litre of the solution is

A. 34.76 g

B. 12.38 g

C. 1.23 g

D. 3.476 g

Answer: d



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54. MnO_4^- ions are reduced in acidic conditions to Mn^{2+} ions whereas they are reduced in neutral condition to MnO_2 . The oxidation of 25 mL of a solution x containing Fe^{2+} ions required in acidic condition 20 mL of a solution y containing MnO_4^- ions. What value of solution y would be required to oxidize 25 mL of solution x containing Fe^{2+} ions in neutral condition ?

A. 11.4 ml

B. 12.0 ml

C. 33.3 ml

D. 35.0 ml

Answer: c



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55. Stannous sulphate ($SnSO_4$) and potassium permanganate are used as oxidising agents in acidic medium for oxidation of ferrous ammonium sulphate to ferric sulphate. The ration of number of moles of stannous sulphate required per mole of ferrous ammonium sulphate to the number of moles of $KMnO_4$ required per mole of ferrous ammonium sulphate, is:

- A. 2.5
- B. 0.2
- C. 0.6
- D. 2

Answer: a



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56. How many mL of 0.125 M Cr^{3+} must be reacted with 12.00 mL of 0.200 M MnO_4^- if the redox products are $Cr_2O_7^{2-}$ and Mn^{2+} ?

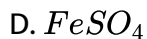
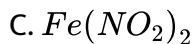
- A. 8 mL
- B. 16 mL
- C. 24 mL
- D. 32 mL

Answer: d

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

- A. $FeSO_3$



Answer: d

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58. Zinc can be coated on iron to produce galvanized iron but the reverse is not possible it is because

A. zinc is lighter than iron

B. zinc has lower melting point than iron

C. zinc has lower negative electrode potential than iron

D. zinc has higher negative electrode potential than iron

Answer: d

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59. If a half cell $A + E^- \rightarrow A^-$ has a large negative potential it follows that

- A. a is easily reduced
- B. a is readily oxidised
- C. A^- is readily reduced
- D. A^- is readily oxidised

Answer: d



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

- A. y will oxidize x but not z

B. y will oxidise both x and z

C. y will oxidise z but not x

D. y will reduce both x and z

Answer: a

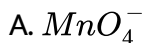
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61. Given

$$E_{Cr^{3+}/Cr}^0 = -0.74V, E_{MnO_4^-/Mn^{2+}}^0 = 1.51V$$

$$E_{Cr_2O_7^{2-}/Cr^{3+}}^0 = 1.33V, E_{Cl_2/Cl^-}^0 = 1.36V$$

Based on the data given above, strongest oxidising agent will be:



Answer: a

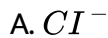
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62. Using the data given below is reducing potential.

$$E_{Cr_2O_7^{2-} / Cr^{3+}}^{\circ} = 1.33 \text{ V}, E_{Cl_2 / Cl^{-}}^{\circ} = 1.36 \text{ V}$$

$$E_{MnO_4^{-} / Mn^{2+}}^{\circ} = 1.51 \text{ V}, E_{Cr^{3+} / Cr}^{\circ} = -0.74 \text{ V}$$

find out which of the following is the strongest oxidising agent.



Answer: c

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63. Standard electrode potentials are

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

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

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

- A. increase in Fe^{3+}
- B. decrease in Fe^{3+}
- C. Fe^{2+} / Fe^{3+} remains unchanged
- D. Fe^{2+} decreases

Answer: b



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

A. $X > Y > Z$

B. $Y > Z > X$

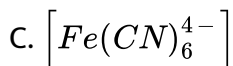
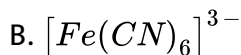
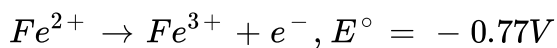
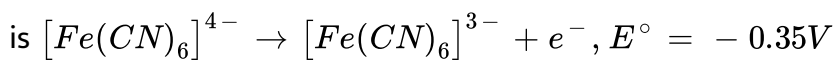
C. $Y > X > Z$

D. $Z > X > Y$

Answer: d

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65. On the basis of the following E° values, the strongest oxidizing agent

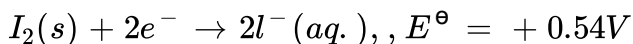
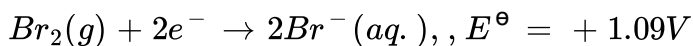
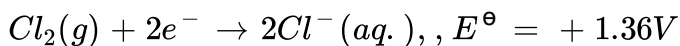
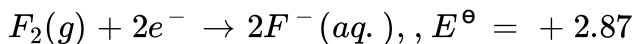


Answer: a

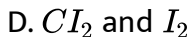
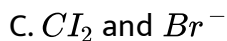
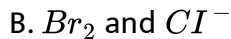
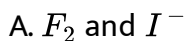


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66. Standard reduction potentials of the half reactions are given below:



The strongest oxidizing and reducing agents respectively are:



Answer: a



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67. The products formed when an aqueous solution of $NaBr$ is electrolysed in a cell having inert electrodes are :

A. Na and Br_2

B. Na and O_2

C. H_2 , Br_2 , $NaOH$

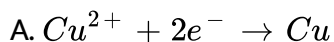
D. H_2 and O_2

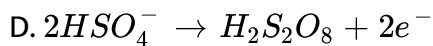
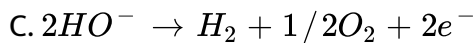
Answer: c



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68. In the electrolysis of aqueous solution of copper sulphate using copper strips as anode and cathode the anode reaction is





Answer: b

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69. Which of the following statement is / are true for an electrochemical cell ?

A. oxidation occurs at the anode only

B. reduction occurs at the anode only

C. oxidation occurs at both the anode and cathode

D. reduction occurs at both the anode and cathode

Answer: a

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70. Consider the following relations for emf of a electrochemical cell

(i) emf of cell = (Oxidation potential of anode)-(Reduction potential of cathode)

(ii) emf of cell = (Oxidation potential of anode)+(Reduction potential of cathode)

(iii) emf of cell = (Reduction potential of anode)+(Reduction potential of cathode)

(iv) emf of cell = (Oxidation potential of anode)-(Oxidation potential of cathode)

Which of the above realtions are correct?

A. (iii) and (i)

B. (i) and (ii)

C. (iii) and (iv)

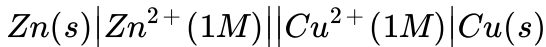
D. (ii) and (iv)

Answer: d



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71. For a standard cell



Write the electrode reaction and cell reaction. Also find the e.m.f. of cell if

?

$$E_{\text{Zn}^{2+} | \text{Zn}}^{\circ} = -0.76 \text{ V},$$

$$E_{\text{Cu}^{2+} | \text{Cu}}^{\circ} = +0.34 \text{ V}.$$

A. $+1.85V$

B. $-1.85V$

C. $+0.83V$

D. $-0.83V$

Answer: a



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72. The emf of the cell involving the following reaction,

$2\text{Ag}^+ + \text{H}_2 \rightarrow 2\text{Ag} + 2\text{H}^+$ is 0.80 volt. The standard oxidation

potential of silver electrode is:-

A. -0.80 volt

B. 0.80 volt

C. 0.40 volt

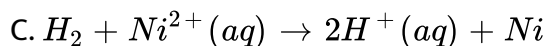
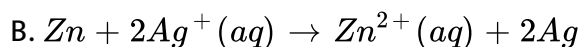
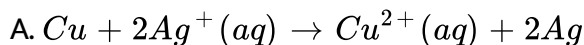
D. -0.40 volt

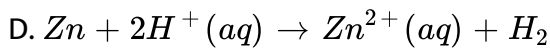
Answer: a



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73. The oxidation potentials of Zn, Cu, Ag, H_2 and Ni are 0.76 , -0.34 , 0.80 , 0 and 0.25 volt respectively. Which of the following reactions will provide maximum voltage ?

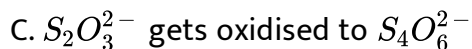
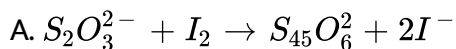
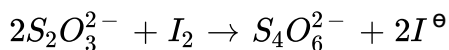




Answer: b

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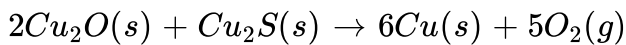
74. Consider the redox reaction



Answer: b,c

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75. Which of the following statements about the following reaction is / are Wrong?



A. Both Cu_2O and Cu_2S are reduced

B. Cu_2S is the oxidant

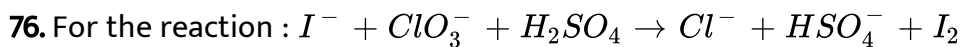
C. Cu_2S is the oxidant

D. only Cu_2O is reduced

Answer: b,c,d



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

A. stoichiometric coefficient of HSO_4^- is 6

B. iodide is oxidized

C. sulphur is reduced

D. H_2O is one of the products

Answer: a,b,d

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

A. HNO_2

B. H_2O_2

C. H_2S

D. SO_2

Answer: a,b,d

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78. Which of the following substances undergo(s) disproportionation reactions under basic medium?



Answer: b,c,d



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79. A 2.5 mol of hydrazine N_2H_4 loses 25 mole of electrons is being converted to a new compound X. Assuming that all of the nitrogen appears in the new compound, what is the oxidation state of nitrogen in compound X ?



B. -3

C. $+3$

D. $+5$

Answer: c



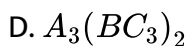
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80. The concept of oxidation number (O.N) is very important in understanding redox reactions it helps to identify the oxidant / reductant in a redox reaction it also helps to (i) find out the possible molecular formula of any neutral compound and (ii) to balance redox reaction

A compound contains atoms of three elements A b and c if the oxidation number of A is $+2$ B is $+5$ and that of C is -2 the possible formula of the compound is

A. $A_3(BC_4)_2$

B. $A_3(B_4C)_2$



Answer: a



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81. The concept of oxidation number (O.N) is very important in understanding redox reactions it helps to identify the oxidant / reductant in a redox reaction it also helps to (i) find out the possible molecular formula of any neutral compound and (ii) to balance redox reaction

when copper is treated with a certain concentration of nitric acid oxide and nitrogen dioxide are liberated in equal volume according to the equation



the coefficients of x and y are

A. 2 and 3

B. 2 and 6

C. 1 and 3

D. 3 and 8

Answer: b



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82. The concept of oxidation number (O.N) is very important in understanding redox reactions it helps to identify the oxidant / reductant in a redox reaction it also helps to (i) find out the possible molecular formula of any neutral compound and (ii) to balance redox reaction

A compound contains atoms of three elements A, B and C. If the oxidation number of A is +2, B is +5 and that of C is -2, the possible formula of the compound is

A. 5

B. 3

C. 2

D. 1

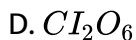
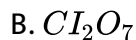
Answer: c

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83. Bleaching powder and bleach solution are produced on a large scale and used in several household products. The effectiveness of bleach solution is often measured by iodometry.

Bleaching powder contains a salt of an oxoacid as one of its components.

The anhydride of that oxoacid is:



Answer: a

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84. Bleaching powder and bleach solution are produced on a large scale and used in several household products. The effectiveness of bleach solution is often measured by iodometry.

25 mL of household bleach solution was mixed with 30 mL of 0.50 M KI and 10 mL of 4 N acetic acid. In the titration of the liberated iodine, 48 mL of 0.25 N $\text{Na}_2\text{S}_2\text{O}_3$ was used to reach the end point. The molarity of the household bleach solution is :

- A. 0.48 M
- B. 0.96 M
- C. 0.24 M
- D. 0.24 M

Answer: c



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Matching Type Question

1. Match the entieres of Column I with appropriate entieres of column II and choose the correct option out of the four option (a) ,(b) ,(c) (d) given at the end of each question

column I

- (A) Device in which chemical energy is converted into electrocal energy
- (B) Device which keeps electrical neutrality in two half reactions in an el
- (C) A process in which electric energy is used to bring about decompostic
- (D) Process which involves reactions between oxidising and reducing agen

A. A-r,B-s,C-p,D-q

B. A-r,B-s,c-q,D-p

C. A-s,B-p,C-r,D-q

D. A-p,B-r,c-s,D-q

Answer: a



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2. Match the entires of Column I with appropriate entires of column II and choose the correct option out of the four option (a) ,(b) ,(c) (d) given at the end of each question

column I (Compound)	column II (Oxidation numbers of S atom)
(A) Na_2S_2	(p) +6
(B) $Na_2S_2O_3$	(q) -1 - 1
(C) $Na_2S(2)O_7$	(r) +6 + 6
(D) H_2SO_4	(s) -2 + 4

A. A-r,B-p,C-s,D-q

B. A-p,B-s,c-q,D-r

C. A-q,B-s,c-r,D-p

D. A-s,B-r,c-p,D-q

Answer: c



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3. Match the entires of Column I with appropriate entires of column II and choose the correct option out of the four option (a) ,(b) ,(c) (d) given at

the end of each question

column I

column II

- (A) $KMnO_4$ (p) used in salt bridge
(B) $SnCl_2$ (q) used as an oxidising agent
(C) $ZnSO_4$ (r) used as a reducing agent
(D) K_2SO_4 (s) used as electrolyte in daniell cell

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Matrix Match Type Question

1. Match the entries of column I with appropriate entries of column II

Each entry in column I may have one or more than one correct option from column II if the correct matches are A-p,s, B-r,C-p,q,D-s then the correctly bubbled 4×4 matrix should be as follows:

column I

- (A) Metal which reacts with dilute acids to give H_2 gas (p)
(B) Metal whose container can be used to store conc HNO_3 (q)
(C) Metal which is used as an electrode in daniell cell (r)
(D) Metal which does not react with dilute acids to give H_2 gas (s)

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2. Match the entries of column I with appropriate entries of column II

Each entry in column I may have one or more than one correct option from column II if the correct matches are A-p,s, B-r,C-p,q,D-s then the correctly bubbled 4×4 matrix should be as follows:

column I	column II
(A) $CuSO_4 + Zn \rightarrow Cu + ZnSO_4$	(p) None metal displacement
(B) $2KClO_3 \rightarrow 2KCl + 3O_2$	(q) Disproportionation
(C) $3Cl_2 + 6OH^- \rightarrow 5Cl^- + ClO_3^- + 3H_2O$	(r) Decomposition reaction
(D) $Cl_2 + 2KI \rightarrow 2KCl + I_2$	(s) Redox reaction

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3. Match the entries of column I with appropriate entries of column II

Each entry in column I may have one or more than one correct option from column II if the correct matches are A-p,s, B-r,C-p,q,D-s then the correctly bubbled 4×4 matrix should be as follows:

column I	column II
(A) Electrode on which reduction occurs	(p) Anode
(B) Electrode on which oxidation occurs	(q) Cathode
(C) Electrode connected to positive pole of the battery	(r) Negative pole
(D) Electrode connected to negative pole of the battery	(s) positive pole

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Integer Type Question

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

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2. Among the following, the number of elements showing only one non-zero oxidation state is:

O, Cl, F, N, P, Sn, Tl, Na, Ti

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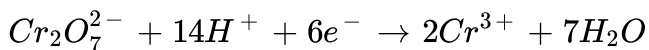
3. The difference in the oxidation numbers of the two types of sulphur atoms in $Na_2S_4O_6$ is

0	1	2	3	4	5	6	7	8	9
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4. How many moles of electrons are involved in the conversion of 1 mol

$Cr_2O_7^{2-}$ into Cr^{3+} ion?



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5. The oxidation number of Mn in the product of alkaline oxidative fusion of MnO_2 is

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6. How many moles of iodine are liberated when 2 moles of potassium permanganate react with potassium iodide?

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7. Reaction of Br_2 with Na_2CO_3 in aqueous solution gives sodium bromide bromate with evolution of CO_2 gas. The number of sodium

bromide molecules involved in the balanced chemical equation is:

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8. 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_3

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

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Numerical Value Type Question

1. How many grams of potassium dichromate are required to oxidise 20.0 g of Fe^{2+} in $FeSO_4$ to Fe^{3+} if the reaction is carried out in an acidic medium ? (Molar mass of $K_2Cr_2O_7$ and $FeSO_4$) are 294 and 152 respectively

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Assertion Reason Type Question

1. Statement 1 Silver can be precipitated by adding zinc powder to $AgNO_3$ solution

Statement 2 $ZnSO_4$ solution can be stirred with a silver spoon

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

Answer: b



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2. Statement 1 $HNOO_2$ acts both as an oxidising as well as reducing agent

Statement 2 The O.N of N can increase above +3 and can also decrease below +3

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 2 is false

D. Statement 1 is false statement 2 is true

Answer: a



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3. Statement 1 a substance which gets reduced can act as an oxidising agent

Statement 2 In the reaction $3 \text{ClO}^- \rightarrow \text{ClO}_3^- + 2\text{Cl}^-$, Cl atom is oxidised as well as reduced

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

Answer: b



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4. Statement 1 all decomposition reaction are redox reactions

Statement 2 H_2O on decomposition gives H_2 and O_2

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 2 is false

D. Statement 1 is false statement 2 is true

Answer: d

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5. Statement 1 $2CuCl \rightarrow CuCl_2 + Cu$ is a disproportionation reaction

Statement 2 all transition metals show disproportionation reactions

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

Answer: c

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6. Statement 1 A solution of $FeSO_4$ can be stored in a copper vessel

Statement 2 E^0 of $Cu < E^0$ of Fe

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

Answer: c

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7. Statement 1 Copper liberates hydrogen from a dilute solution of hydrochloric acid

Statement 2 E° of Cu is higher than of H_2

- 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 2 is false

D. Statement 1 is false statement 2 is true

Answer: d

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8. Statement 1 The electrochemical cell stops working after sometime

Statement 2 The electrode potential of both the electrodes becomes zero

- A. If both assertion and reason are true and reason is the true explanation of the assertion
- B. If both assertion and reason are true but reason is not the true explanation of the assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false

Answer: c

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9. Assertion Fe reacts with HCl produce H_2 gas

Reason Fe is better reducing agent than H_2

- A. If both assertion and reason are true and reason is the true explanation of the assertion
- B. If both assertion and reason are true but reason is not the true explanation of the assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false

Answer: a



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10. Assertion: Sulphur dioxide and chlorine are bleaching agents.

Reason: Both are reducing agents.

- A. If both assertion and reason are true and reason is the true explanation of the assertion
- B. If both assertion and reason are true but reason is not the true explanation of the assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false

Answer: c

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

Reason : Zinc forms complex with $CuSO_4$.

- A. If both assertion and reason are true and reason is the true explanation of the assertion

- B. If both assertion and reason are true but reason is not the true explanation of the assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false

Answer: c

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12. Assertion Fe_3O_4 contains iron atoms in two different oxidation number

Reason Fe^{2+} ions decolorize $KMnO_4$ solution

- A. If both assertion and reason are true and reason is the true explanation of the assertion
- B. If both assertion and reason are true but reason is not the true explanation of the assertion
- C. If assertion is true but reason is false

D. If both assertion and reason are false

Answer: b

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13. Assertion F_2 does not undergo disproportionation reaction

Reason Fluorine shows only 0 and -1 oxidation states

- A. If both assertion and reason are true and reason is the true explanation of the assertion
- B. If both assertion and reason are true but reason is not the true explanation of the assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false

Answer: d

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14. Assertion : In the iodometric titration, starch is used as an indicator.

Reason : Starch is a polysaccharide.

A. If both assertion and reason are true and reason is the true explanation of the assertion

B. If both assertion and reason are true but reason is not the true explanation of the assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false

Answer: b



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15. Assertion (A): For a Daniell cell :

$Zn|Zn^{2+}||Cu^{2+}|Cu$ with $E_{cell} = 1.1V$, the application of opposite potential greater than $1.1V$ results into the flow of electron from cathod

to anode. Reason (R): Zn is deposited at anode and Cu is dissolved at cathode

- A. If both assertion and reason are true and reason is the true explanation of the assertion
- B. If both assertion and reason are true but reason is not the true explanation of the assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false

Answer: a

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16. Assertion (A): The Daniell cell becomes dead after sometimes.

Reason (R): The oxidation potential of Zn anode decreases and that of Cu increases.

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