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_2CI_2,

(iv) N in $(NH_4)SO_4$

(v)P in Na_3PO_4

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2. Calculate the oxidation number of

(i) N in NO_3^-,

(ii) P in $H_3P_2O_7^-$,

(iii) C in CO_3^{2-},

(iv)Cl in ClO_4^-

(v)Cr in Cr_2^{2-}

(vi) Mn in MnO_4^-

(vii) Fe in $\left[Fe(CN)_6\right]^4$

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

a.

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

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

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4. Balance the equation

$$Mg + HNO_3 \rightarrow Mg(NO_3)_2 + N_2O + H_2O$$

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5. Which of the following are correct about the reaction,

$$FeS_2 + O_2 \rightarrow Fe_2O_3 + SO_2$$

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

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7. Balance the equation

$$As_2(s) + NO_3^-(aq) + H^+(aq) \rightarrow AsO_+(4)^{3-}(aq) + S(s)NO(g) + H_2O$$

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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. If $10.0mL$ of hypo solution $(Na_2S_2O_3.5H_2)$ is decolorized by $15mL$ of $M/40$ iodine solution , then the concentration of hypo solution is $\_\_\_\_gdm^{-3}$.

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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 stadnard EMF of the cell?

(c) Which electrode will be positive?

(d) How will the cell be represented?

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14. Thehalf cel reactions with their oxidation potentials are

(a) $\text{Pb(s)} - 2e^- \rightarrow Pb^{2+}(aq), E^\circ_{\text{oxi}} = +0.13V$ (b)

$Ag(s) - e^- \rightarrow Ag^+(aq), E^\circ_{\text{oxi}} = 0.80V$

Write the cell reaction and calculate its emf.

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15. Predict whether zinc and silver react with 1 M suphuric acid to give out hydrogen or not given that h standard potentials of zinc and silver are -0.76 vold 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 $E^{\circ}_{Cu^{-2}/Cu} = +0.34$ volt

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Problems For Practice

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

(i) $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$

(ii) $H_2S(g) + O_2(g) \rightarrow 2S(s) + 2H_2O(l)$

(iii)$CH_2 = CH_2(g) + H_2(g) \rightarrow H_3C - CH_3(g)$

(iv)$HgO(s) \rightarrow 2Hg(l) + O_2(g)$

(v)$Mg(s) + S(s) \rightarrow MgS(s)$

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2. Using electron

transfer concept

identify the oxidant and reductant in the following redox reaction

(a) $Zn(s) + 2H^+(sq) \rightarrow Zn^2(aq) + H_2(g)$

(b)

$2[Fe(CN_3)]^{4-}(aq) + H_2O_2(aq) + 2H^+(aq) \rightarrow 2\left[Fe(CN)_6\right]^{3-} - (aq) +$

(c)

$2\left[Fe(CN)_6\right]^{3-}(aq) + 2OH^-(aq) + H_2O(aq) \rightarrow 2\left[Fe(CN)_6\right]^4 + (aq) +$

(d)

$BrO_3^-(aq) + F_2(g) + 2OH^- + 2OH^-(aq) \rightarrow BrO_4^-(aq) + H_2O(l)$

(e)$2NaCI_3(Aq) + L_2(aq) \rightarrow 2NaIO_3 \rightarrow 2NaIO_3(aq) + CI_2(aq)$

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3. Write the half reaction for the following redox reaction

$(a) 2Fe^{3+}(aq) + 2I^{-}(aq) \rightarrow 2Fe^{2+}(aq) + I_2(aq)$

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

(iii) $Al(s) + 3Ag^{+} \rightarrow Al^{+3}(aq) + 3Ag(s)$

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

(a) $2K(s) + CI_2(g) \rightarrow KCI(s)$

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

$(i) SiH_4, BH_3, BF_3, S_2O_3^{2-}, BrO_4^{-}$ and HPO_4^{2-} $(ii) PbSO_4, U_2O_7^{2-}, CrO_4^{2-}$

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6. Determine the oxidation numbr of C in the following : $C_2H_6, C_4H_{10}, CO, cO_2$ and HCO_3^-

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7. Determine the oxidtion number of O in the following : $OF_2, Na_2O_2, Na_2O, KO_2, KO_2, KO_3$ and O_2F_2

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8. Find out the oxidation number of CI in HCI , HCIO, ClO_4^- and ClO_2

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9. Find out the oxidation number of suphur 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 $LiAIH_4$

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11. Determine the change in OgtN of S in H_2s and SO_2 in the following reaction

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

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12. What is the oxidation number of S in S_2Cl_2

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13. Balance the equation

$As_2(s) + NO_3^-(aq) + H^+(aq) \rightarrow AsO_+(4)^{3-}(aq) + S(s)NO(g) + H_2O$

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

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15. Balance the following redox reaction

(i) $SnO_2 + C \rightarrow Sn + CO$

(ii)$Fe_3O_4 + C \rightarrow Fe + CO$

$(iii) I_2 + HNO_3 \rightarrow HIO_3 + NO_2 + H_2O$

(iv)$6FeSO_4 + 2HNO_3 + H_2SO_4 \rightarrow Fe_2(SO_4)_3 + NO + H_2O$

(v)$Fe + HNO_3 \rightarrow Fe(NO_3)_2 + NH_4NO_3 + H_2O$

(vi)$Sb + HNO_3 \rightarrow H_3SbO_4 + NO_2 + H_2O$

$(vii) Hg + HNO_3 \rightarrow Hg_2(NO_3)_2 + NO + H_2O$

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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 aicdic 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 $Na_2S_2O_3.xH_2O$ 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 ot 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 use for the same titration ?

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

(i) what is the cell reaction ?

(ii) what will be the standsard 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:

$Cu(s)ICu^{2+}(aq)IIAg^+(aq)Iag(S)$

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

$(GivenE^\circ\_(Cu^{2+}/Cu) = +0.34V, E^\circ\_(Ag^+/Ag) = +0.80V)$

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28. Write the half reaction for the following redox reaction

$(a) 2Fe^{3+}(aq) + 2I^-(aq) \rightarrow 2Fe^{2+}(aq) + I_2(aq)$

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

(iii) $Al(s) + 3Ag^+ \rightarrow Al^{+3}(aq) + 3Ag(s)$

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29. The standard EMF of the cell : Ni$|Ni^{2+}$ | $|Cu^{2+}|Cu$ is 0.59 volt The standsard elctrode potential (reduction potential of copper electrode is 0.34 volt . Calculate the standsard electrode potential of nickel electrode

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

$Ag|Ag^+(1M)||Cu^{2+}(1M)|Cu, E^\circ = -0.46$ volt

$Zn|Zn^{2+}(1M)||Cu^{2+}(1M)|Cu, E^\circ = +1.10$ volt

Calculate the emf of the cell :

$Zn|Zn^{2+}(1M)||Ag^+(1M)|Ag$

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31. The standard reduction potentials of two half cells $Al^{3+}(aq) \mid Al$and $Mg^{2+}(aq) \mid Mg$ 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, $E^0_{Cu^{2+}|Cu}$= 0.34volt , $E^0_{Pb^{2+}|Pb}$ = -0.13 volt, $E^0_{Fe^{2+}|Fe}$ = -0.44 volt

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

$E^\circ_{Zn^{+2}/Zn} = -0.76V$ and $E^\circ_{Cu^{+2}/Cu} = 0.34V$

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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 AgNO3 solution? Given that $E^0_{Cu^{2+}|Cu}$ = + 0.34 volt and $E^0_{Ag^+|Ag}$ = 0.80 volt

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

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Curiosity Question

1. Useually ina 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 in Sn^{2+} This is titrated with a dichromate solution containing 2.5 of $K_2Cr_2O_7$ in 0.50 litre A 0.40 g sample of the ore required 10.0 cm^3 of titrant to reach equivalence point calculate the percentage of tin in the ore (k=39.1, Cr = 52 Sn =11.87)

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2. A particular acid rain water water contains sulphite $\left(SO_3^{2-}\right)$ ions if a 25.0 cm^3 sample of this water requires cm^3 of 0.02 M $KMnO_4$ solution for titeation 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 dissolvedin 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 oxidisied sample of green vitrion $(FeSO_4.7H_2O)$ per litre

required 20.0 cm^3 mL of 0.01 M potassium dichromate solution for oxidiation in aidic 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 was treated with excess of KI soluiton in acidic medium and the liberated iodine required 10.0 cm^3 of 0.01 M thiosuphte solutoin find out the concentratin 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?

A. (a)NaCl$H_2SO_4 \rightarrow NaHSO_4 + HCI$

B. $2PCI_5 + H_2SO_{45} \rightarrow 2POCI_3 + 2HCI + SO_2CI_2$

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

D. $Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 \rightarrow rCaSO_4 + 2H_2O$

Answer: c

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

A. $Na_2S_4O_6 > H_2S_2O_7 > Na_2S_2O_3 > S_8$

B. $H_2SO_4 > S_{23}H_2S > H_2S_2O_8$

C. $SO_2^+ > SO_{45}^{2-} > SO_3^{2-} > HSO_4^-$

D. $H_2SO_5 hy H_2SO_3 > SCI_2 > H_2S$

Answer: d

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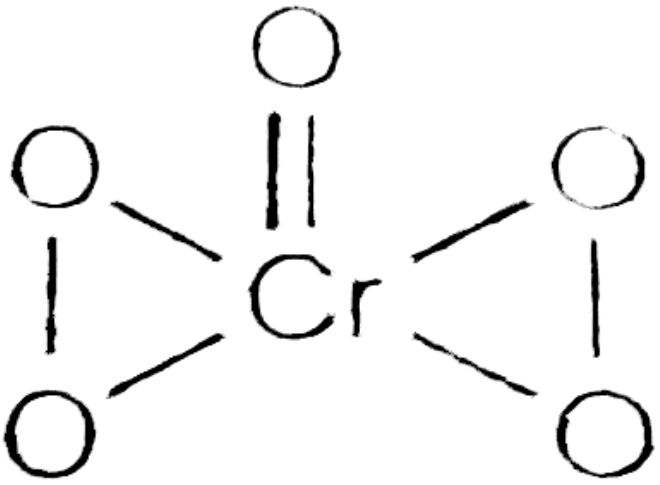
4. CrO_4 has structure as shown



The oxidation number of chromium in the above compound is

A. 4

B. 5

C. 6

D. 10

Answer: c

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

A. disproportination rection

B. neutralizatin reaction

C. double decomposition reaction

D. pyrolytic reaction

Answer: a

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

A. 4,3,1,5

B. 4,1,4

C. 3,2,3

D. 2,1,2

Answer: c

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7. In the chemical reaction,

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

$x, y,$ and z are

A. 1,3,1

B. 4,1,4

C. 3,2,3

D. 2,1,2

Answer: a

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

$xCI_2 + 6OH^- \rightarrow CIO_3^3 \rightarrow CIO_3^- + yCI^- + 3H_2O$ are

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

A. hydrogen is easiest ot oxidize

B. this electrode potential is assumed to be zero

C. hydrogen atom has oly one electron

D. hydrogen is the lighest element

Answer: b

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10. If the half cel reactions are given as

(i) $Fe^{2+}(Aq) + 2e^- \rightarrow Fe(s), E^\circ = -0.44V$

(ii) $2H^+(sq) + \frac{1}{2}O_2(g) + 2e^- \rightarrow H_2O(l) E^\circ = +1.23V$

The E° for the reaction

$Fe(s) + 2H^+ + \frac{1}{2}O_2(g) \rightarrow Fe^{2+}(aq) + H_2O(l)$ will be

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 is .....and the element which has been reduced is .....

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2. The compound $Yba_2Cu_3O_7$ 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 S in $Na_2S_4O_6$ is

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

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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 eelctrode and normal hydrogen electrode zinc electrode acts as .....

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8. Salt bridge maintains .....in the solution of two half cells

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

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10. The electroysis of molten sodium hydride liberates .....at the .....and .....at the .....

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Conceptual Question

1. What is the name of the reaction $2CH_3CH_2CH_2SH \rightarrow CH_3CH_2CH_2 - S - S - CH_2CH_2CH_3$

Whether condensation, oxidation ,reduction or polymerization

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2. Write the following redox reactions using half equations:

a. $Zn(s) + PbCl_2(aq) \rightarrow Pb(s) + ZnCl_2(aq).$

b. $2Fe^{3+}(aq) + 2I^{\ominus}(aq) \rightarrow I_2(aq) + 2Fe^{2+}(aq)$

c. $2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$

d. $Mg(s) + Cl_2(g) \rightarrow MgCl_2(s)$

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

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3. Photosynthesis involves the following overall reaction

$$6CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{sunlight}} C_6H_{12}O_6 + 6O_2$$

Identify the species oxidised and the species reduced

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4. Chlorine dioxide (CIO_2) is used to kill bacteria in mett soft drinks and dariy products being an unsatble compund it can be synthesized by the following reaction

$$CI_2 + NaCIO_2 \rightarrow 2CIO_2 + 2NaCI$$

Identify the substacne oxidised and reduced

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5. What is the maximum nad 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 CI atoms in bleaching powder $CaOCI_2$

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

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12. An iron rod is immersed in a solution containing $1.0MNiSO_4$ and $1.0MZnSO_4$ 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 : $E^0_{Zn^{2+}|Zn}$ = -0.76 volt and ,$E^0_{Fe^{2+}|Fe}$ = -0.44 volt and $E^0_{Ni^{2+}|Ni}$= -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 T^- ions what reaction will occur if

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

?

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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 an 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 HCI solutoin and on passing hydrogen gas through god 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: $E^{0}_{Cu^{2+}|Cu}$ = + 0.34 volt and $E^{0}_{Ag^{2+}|Ag}$ = 0.80 volt and $E^{0}_{Au^{2+}|Au}$ = +1.50 volt

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

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

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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Ncert Questions And Exercises With Answers

1. Identify the species undergoing oxidation and reduction.

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

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

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

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

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3. Using stock notation represetn the following comoounds : $HauCI_2, TI_2, FeO, F_2, CuI, CuO, MnO$ and MnO_2

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4. Justify that the reaction : $2Cu_2O(s) + Cu_2(s) \rightarrow 6Cu(s) + SO_2(g)$ is a redox rection 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 disporoportionation reaction and why ?

ClO^-, ClO_2^-, ClO_3^- and ClO_4^-

Also write reaction for each of the species that disproportinates

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6. Classify the following redox reactions:

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

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

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

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

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7. Why following two reaction proceed differently?

$Pb_3O_4 + 8HCl \rightarrow 3PbCl_2 + Cl_2 + 4H_2O$

and

$$Pb_3O_4 + 4HNO_3 \rightarrow 2Pb(NO_3)_2 + PbO_2 + 2H_2O$$

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8. Balance the net equtation fro th reaction of potassium dichromate (VI), $K_2Cr_2O_7$, with sodium sulphite, Na_2SO_3, in an acid solution to give chromium (III) ion and and sulphate ion.

Strategy : Follow the seven -step proceduce , one step at a time.

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

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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 elements in each of the following species:

a. NaH_2PO_4

b. $NaH\underline{S}O_4$

c. $H_4\underline{P_2}O_7$

d. $K_2\underline{Mn}O_4$

e. $\underline{Ca}O_2$

f. $Na\underline{B}H_4$

g. $H_2\underline{S_2}O_7$

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

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

(a) KI_3

(b) $H_2S_4O_6$

(c)Fe_3O_4

(d) CH_3CH_2OH

(e)CH_3COOH

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3. Justify that the following reaction are redox reactions:

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

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

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

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

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

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

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

Justify that this reaction is a redox reaction.

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5. Calculate the O.N of sulphur, chromium and nitrogen in H_2SO_5, CrO_5 and NO^-3 ion Suggest structure of these compounds.Account for the fallacy if any.

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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 following reactions:

(i) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$,

$\Delta H = = -X_1 Kjmol^{-1}$

(ii) $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l), \Delta H = -X_2 Kjmol^{-1}$

(iii) $CO_2(g) + H_2(g) \rightarrow CO(g) + H_2O(l)$,

$\Delta H = -X_3 KJmol^{-1}$

(iv) $C_2H_2(g) + \frac{5}{2}O_2(g) \rightarrow 2CO_2(g) + H_2O(l)$,

$\Delta H = +X_4 KJmol^{-1}$

Enthanlpy of formation of $H_2O(l)$ is

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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:

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

b.

$HCHO(l) + 2\left[Ag(NH_3)_3\right]^{\oplus} + 3\overset{\Theta}{O}H(aq) \rightarrow 2Ag(s) + HCOO^{\Theta}(aq) + 4N$

c.

$HCHO(l) + 2Cu^{2+}(aq) + 5\overset{\Theta}{O}H(aq) \rightarrow Cu_2O(s) + HCOO^{\Theta}(aq) + 3H_2O$

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

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

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14. Consider the reaction:

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

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

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

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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?

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

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

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17. Consider the reactions:

a.

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

b.

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

c.

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

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

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

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

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

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

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

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

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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.

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

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

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

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

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

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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 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:

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

b. $Ag^{\oplus}(aq)$ and $Cu(s)$

c. $Fe^{3+}(aq)$ and $Br^{c-}(aq)$

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

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

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

a. An aqueous solution of $AgNO_3$ with silver electrodes.

b. An aqeous solution of $AgNO_3$ with platinum electrodes,

c. A dilute solution of H_2SSO_4 with platinum electrodes.

d. 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 AI,Cu,Fe,Mg and Zn

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29. Given standard electrode potentials

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

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

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

Arrange these metals in their increasing order of reducing power.

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30. Depict the galvanic in whiCHM the reaction :

$Zn(s) + 2Ag^{\oplus}(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$ takes place.

Further show :

$a.$ WhiCHM of the electrode is negatively CHMarged ?

$b.$ The carriers of the current in the cell.

$c.$ Individual reaction at eaCHM electrode.

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

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

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

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

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

Answer:

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

E^θ values: $Fe^{3+}/Fe^{2+} = +0.77$

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

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

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

E° 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^θ 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

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

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

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

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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 ?

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

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

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

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

Answer:

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

A. NH_2OH

B. NH_4NO_3

C. N_2H_4

D. N_3H

Answer:

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

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

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

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

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

Answer:

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

A. $3d^14s^2$

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

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

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

Answer:

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10. Identifity disporportionation reaction

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

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

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

D. $2NO_2 + 2OH^{-1} \rightarrow NO_2^- + NO_3^- + H_2O$

Answer:

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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 Ansers Hints And Solution Ii

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

$2KCIO_3 \rightarrow 2KCI + 3O_2$

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 relation to the following reaction.

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$

A. Zinc is acting as an oxidant

B. Chlorine is acting as a reductant

C. Hydrogen ion is acting as an oxidant

D. Zinc is acting as a reductant

Answer:

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

A. $3s^1$

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

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

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

Answer:

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

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

A. Phosphorus 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 when connected to standard hydrogen electrode?

(a) Al^{3+}/Al	$E^{\Theta} = -1{\cdot}66$
(b) Fe^{2+}/Fe	$E^{\Theta} = -0{\cdot}44$
(c) Cu^{2+}/Cu	$E^{\Theta} = +0{\cdot}34$
(d) $2\,F^{-}\,(aq)/F_2\,(g)$	$E^{\Theta} = +2{\cdot}87$

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Short Answer Question

1. The reaction $Cl_2(g) + 20H^-(aq) \rightarrow ClO^-(aq) + Cl^-(aq) + H_2O(l)$ 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

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

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

Why do these compounds differ n their reactivity?

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

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5. write balanced chemical equation for the following reaction

(i) permanaganate ion $\left(MnO_4^-\right)$ reacts with suphur dioxide gas in acidic medium to produce Mn^{2+} and hydrogen suphate ion (balance by ion electron method)

(ii) reaction of liquid hydrazine (N_2H_4) with chlorate ion $\left(ClO_3^-\right)$ in basic medium produces nitric oxide gas and chloride ion in gaseous state

(iii) dichlorine hetaoxide (Cl_2O_7) in gaseoius state combines with an aqueous solution of hydrogen peroxide in acidic medium to give chlorite ion $\left(ClO_2^-\right)$and oxygen gas

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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 suphur atom in the following compounds

A. $Na_2S_2O_3$

B. $Na_2S_4O_6$

C. Na_2SO_3

D. Na_2SO_4

Answer:

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8. Balance the following equations by the oxidation number method

A. $Fe^{2+} + H^{+} + Cr_2O_7^{2} \rightarrow Cr^{3} + Fe^{3+} + H_2O$

B. $I_2 + NO_3^{-} \rightarrow NO_2 + IO_3^{-}$

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

D. $MnO_2 + C_2O_4^{2-} \rightarrow Mn^{2} + CO_2$

Answer:

View Text Solution

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

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

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

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

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

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

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10. Balance the following ionic equations

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

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

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

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

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

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

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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 ture and r is the correct explantion of a

B. both a and r are ture but r is not the correct xplanatio of a

C. a is true but r is flase

D. both a nad r are flase

Answer:

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

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

A. both a and r are ture and r is the correct explantion of a

B. both a and r are ture but r is not the correct xplanatio of a

C. a is true but r is flase

D. both a nad r are flase

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 ture and r is the correct explantion of a

B. both a and r are ture but r is not the correct xplanatio of a

C. a is true but r is flase

D. both a nad r are flase

Answer:

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

Reson (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 ture and r is the correct explantion of a

B. both a and r are ture but r is not the correct xplanatio of a

C. a is true but r is flase

D. both a nad r are flase

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. Defin the terms oxidising agent and reducing agents according to the electronic conept give one example in each case

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19. Taking a suitable example, explain that oxidation and reduction take place side by side.

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20. What happens when a strip o zinc is dipped in a copper sulphate solution ?

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21. What are half reaction ? Explain with examples

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

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

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24. H_2S acts only as a reducing agent while SO_2 acts as an oxidising as well as a reducing agent. Why?

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25. H_2O_2 acts as reductant as well as oxidant explain

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26. Explain the difference between valence and oxidation number

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

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28. Discus the following redox reaction (i) combination reaction (ii) decomposition reaction (iii) displacement reaction (iv) disproportionatoin reaction

Give one example in each case

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29. FRACTIONAL OXIDATION NUMBER

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30. Startin with the correctly balanced half rection write the overall ionic reaction in the following changes

(i) chloride ion is oxidised to CI_2 by MnO_4^- (in acid solution)

(ii) Nitrous acid (HNO_2) reduces MnO_4^- (in acid solution)

(iii) Nitrous acid (HNO_2) oxidises $I^- \rightarrow I_2$ (in acid solutoin)

(iv) chlorate ion $\left(CIO_3^-\right)$ oxidises $Mn^{2+} \rightarrow MnO_2$ (s) (in acid solution)

(v) chromite ion $\left(CrO_3^-\right)$ is oxidised by H_2O_2 (in strongly basic medium)

also find out the change in the oxidatoin number of the underline atoms

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

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

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

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34. Discuss the application of redox reaction

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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)

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

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

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

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

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3. Why does fluorine not show disportionation reaction ?

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4. Write redox couples involved in the reaction (i) to (iv) given below in the question

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

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

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

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

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

$NaClO_4, NaClO_3, NaClO, KClO_2, Cl_2O_7, ClO_3, Cl_2O, NaCl, Cl_2, ClO_2$

.

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

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8. Explain the term : (i) oxidation (ii) reduction (iii) oxidsing agent and (iv) reducing agent in terms of oxidation number give two example in each case to illustrate your answer

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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 choride from gaseous sodium and gaseous chlorine is a redox reaction

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4. Define oxidising and reducing agents in terms of electrons

Watch Video Solution

5. what is the oxidation number of (i) C in CH_2O (i) Pt in $[Pt(C_2H_4)CI_3]^-$

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6. The oxidation state of Ni in $\left[Ni(CO)_4\right]$ 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 oxid and magnesium nitride point out the oxidising and reducing agents

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10. In the reaction $MnO_2 + 4HCI \rightarrow MnCI_2 + CI_2 + 2H_2O$ 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 form the solution of their salts AI,Cu,Fe, Mg,Ag and Zn

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

$Na^+(aq) + E^- \rightarrow Na(s) E^\circ = -2.71V$

$2H_2O(l) + 2E^- \rightarrow H_2(g) + 2OH^\circ(aq) E^\circ = -0.83V$

Which reaction takes place preferentially and why ?

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17. $2M(s) + H_2SO_4(aq) \rightarrow M_2SO_4(aq) + H_2(g)$

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

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

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19. Define EMF of the cell

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20. What is a redox couple

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21. Can we use KCI as electrolyte in the salt bride of the cell $Cu(s)|Cu^{2+}(aq)||Ag^{+}(aq)|Ag(s)$?

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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 thisolphate is treated with dilute hydrochlorixc acid sulphut dioxide gas is evolved along with simultaneous deposition of elemental sulhur what does this reaction indicate about the oxidation number of the two suplhur atoms ? Also write the structure of thiossulphate ion

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3. Consider the following two decomposition reaction

(i) $2H_2O \rightarrow 2H_2 + O_2 (ii) CaCO_3 \rightarrow Ca + CO_2$

Which of the two is a redox rection ? 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 introamolecular

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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 $X^-, Y^- \text{ and } Z^-$ 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 elemnt B ? Explain

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

$A + H_2SO_4 \rightarrow ASO_4 + H_2$, $ACI_2 + C \rightarrow \mathbb{C}I_2 + A$

$ECI_2 + C \rightarrow$ NO reaction , $2BCI + D \rightarrow DCI_2 + 2B$

$H_2SO_4 + D \rightarrow$ NO reaction

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

(i) $A + B^+ \rightarrow A^+ + B, (ii) B + D^+ \rightarrow B^+ + D$

(iii) $B + C^+ \rightarrow B^+ + C, (iv) C^+ + D \rightarrow$ NO reaction

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

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

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10. A mixture of $FeCI_2$ and $SnCI_2$ can exist togethr but that of $FeCI_3$ and $SnCI_3$ cannot explain why ?

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11. If the moleucar wt of $Na_2S_2O_3$ and I_2 are M_1 and M_2 respectivly then what will be the equivalent wt of $Na_2S_2O_3$ and I_2 in the following reaction

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

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12. In the disproportionation reaction,

$$3HClO_3 \rightarrow HClO_4 + ClI_2 + 2O_2 + H_2O$$

What is the equivalent mass of the oxidising agnet ?

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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 $1.100g$ sample of copper ore is dissolved and the $Cu_{(aq.)}^{2+}$ is treated with excess KI. The liberated I_2 requires $12.12mL$ of $0.10MNa_2S_2O_3$ solution for titration. What is $\%$ copper by mass 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 thosulphate 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 $Cr(SO_4)_3$ 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 sates 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 in 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_2CI_2 in NaOH

Answer: b

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

A. HNO_3, NO, NH_4CI, N_2

B. HNO_3, NO, N_2, NH_4CI

C. HNO_{3,NH_4CI,O,N_2}

D. NO, HNO_3, NH_4cI, N_2

Answer: b

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

A. N_2H_4

B. NH_3

C. N_3H

D. NH_2OH

Answer: c

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6. Which is the strongest acid in the following ?

A. $HCIO_4$

B. H_2SO_{32}

C. H_2SO_4

D. $HCIO_3$

Answer: a

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

.

A. MnO_2FeCI

B. $MnO_4^- CrO_2CI_2$

C. $\left[Fe(CN)_6\right]^{3-}, COCI_4\Big]^-$

D. $[NiCI_4]^{2-}, [CoCI_4]^-$

Answer: b

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8. The number of electrons that are involved in the reduction of permanganate to managanes (II) salt managanate and managanese dioxide respecitvely are

A. 5,1,3

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 $\left[Co(H_2O)_5Cl\right]^{2+}$ 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 $\left[Fe(H_2O)_5NO\right]SO_4$ 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 temprature

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 CI in $CaOCI_2$ 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

$$O-\overset{\overset{O}{||}}{\underset{\underset{O}{||}}{S}}-S-S-\overset{\overset{O}{||}}{\underset{\underset{O}{||}}{S}}-O$$

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 pcroxy- monosulphuric acid (H_2SO_5) and peroxydisulphuric acid $(H_2S_2O_8)$ are respectively.

A. $+8$ and $+7$

B. $+3$ and $+3$

C. $+6$ and $+6$

D. $+4$ and $+6$

Answer: c

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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 Kl 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

A. $Cr_2(SO_4)_3$

B. CrO_4^{2-}

C. $Cr_2(SO_3)_3$

D. $CrSO_4$

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. CI

D. C

Answer: c

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

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

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

C. $CI_2(g) + 2KI(aq) \rightarrow 2KCI(Aq) + I_2(s)$

D. $Cr_2O_3(s) + 2AI(s) \rightarrow AI_2O_3(s) + 2cr$

Answer: b

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

A. $XeF_6 + H_2O \rightarrow XeO_2F_2 + 4Hf$

B. $XeF_6 + 2H_2O \rightarrow XeO_2F_2 + 4Hf$

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

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

Answer: c

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

A. oxidation reaction

B. reduction reaction

C. disproportionation reaction

D. decompostion reaction

Answer: c

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23. When CI_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 +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 reacation type, the oxidation states of phosphorus in phosphine and the other product are respectvely:

A. redox reaction ,-3 and -5

B. redox reaction , +3 and +5

C. 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_3CI

B. $CHCI_3$

C. CH_2CI_2

D. HCHO

Answer: a

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26. Hot concentrated sulpuric acis is a moderatly strong oxidizing agent. Which of the following reaction does not shwo oxidizing behaviour?

A. $Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2H_2O$

B. $S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$

C. $C + 2H_2SO_4 \rightarrow CO_2 + 2SO_2 + 2H_2O$

D. $CaF_2 +_2 SO_4 \rightarrow CaSO_4 + 2HF$

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 ?

A. H^+

B. MnO_4^-

C. Br^-

D. Mn^{2+}

Answer: c

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28. The standard readuction potential at 298 k for the followng half cell reaction are

$Zn^2 + 2e^- \rightarrow Zn(s), E^\circ = -0.7623V$

$Cr^{3+}(aq) + 3e^- \rightarrow Cr(s), E^\circ = -0.70v$

$2H^+(aq) + 2e^- \rightarrow H_2(g), E^\circ = 0.0V$

$F_2 + 2e^- \rightarrow 2f^-(aq) = 2.87V$

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. CI^{-}

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^{-}, cI^{-}, 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 functon as an oxidising as well as reducing agent ?

A. CI^-

B. CIO^-

C. CIO^-

D. MnO_4^-

Answer: c

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

A. $FeCI_3, SnCI_2$

B. $HgCI_2, SnCI_2$

C. $FeCI_2, SnCI_2$

D. $FeCI_3, KI$

Answer: c

Watch Video Solution

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

A. Y^-, Z^-, X^-

B. Z^-, X^-, Y^-

C. Y^-, X^-, Z^-

D. X^-, Z^-, Y^-

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 neutralization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by idometry, the equivalent weight of $K_2Cr_2O_7$ is

A. $(\text{molecular weight})/2$

B. $(\text{molecular weight})/6$

C. $(\text{molecular weight})/3$

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 moleucar wt of $Na_2S_2O_3$ and I_2 are M_1 and M_2 respectivly then what will be the equivalent wt of $Na_2S_2O_3$ and I_2 in the following reaction

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

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

The above equation balances when

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

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

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

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

Answer: d

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41. In the redox reactin

$xKMnO_4 + NH_3 \rightarrow yKNO_3 + MnO_2 + KOH + H_2O$

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 KMn_4 is treated with KI iodide ion is oxidised to

A. I_2

B. IO^-

C. IO_3^-

D. IO_4^-

Answer: c

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43. In the balanced chemical reaction,

$IO_3^- + aI^- + bH^+ \rightarrow cI_2 + dH_2O$

a,b,d 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,

$xUO^{2+} + Cr_2O_7^{2-} + yH^+ \rightarrow aUO_2^{2+} + zCr^{3+} + bH_2O$

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 :

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

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

A. 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

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

The correct coefficients of the reactants for the balanced reaction are

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 $1\text{mol of}KMnO_4$, 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 $1\text{mol of}KI$ 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 titraton of potassium dichromate solution with acidfied mohr salt solution using dmiethylamine as incdicator 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. Ceric ammonium suphate and potassium permanganate are used as oxidising agents in acidic medium of ferrous ammonium suphate to ferric sulphate the ratio of number of moles of cerium ammonium suphate requred of moles of cerium ammonium suphate rquired per mole of ferrous ammoniium suphate to the number of moles of $KMnO_4$ required per mole of ferrous ammonium suphate is

A. 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 rected 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. $FeSO_3$

B. FeC_2O_4

C. $Fe(NO_2)_2$

D. $FeSO_4$

Answer: d

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58. Zine can be coated on iron to produce galvanize3d iron but the reverse is not possible it is because

A. zinc is lighter than iron

B. zinc has lowr melting point than iron

C. zinc has lower negativ electrode point 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 oxidsed

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 $E_{Cr^{3+}/Cr^{\circ}} = -O \cdot 74V, E^{\circ}_{MnO_4^-/Mn^{2+}} = 1.51V$

$E^{\circ}_{Cr_2O_7^{2-}/Cr^{3+}}$ = 1.33V , $E^{\circ}_{Cl/Cl^-} = 1.36V$

Based on the given above , Strongest oxidising agent will be:

A. MnO_4^-

B. CI^-

C. Cr^{3+}

D. Mn^{2+}

Answer: a

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62. Using tha data given below is reducing potenial.

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

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

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

A. CI^-

B. Mn^{2+}

C. Cr

D. Cr^{3+}

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 stongest oxidizing agent is $\left[Fe(CN)_6\right]^{4-} \rightarrow \left[Fe(CN)_6\right]^{3-} + e^-, E^\circ = -0.35V$

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

A. Fe^{3+}

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

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

D. Fe^{2+}

Answer: a

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

$F_2(g) + 2e^- \rightarrow 2F^-(aq.),, E^\ominus = +2.87$

$Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq.),, E^\ominus = +1.36V$

$Br_2(g) + 2e^- \rightarrow 2Br^-(aq.),, E^\ominus = +1.09V$

$I_2(s) + 2e^- \rightarrow 2l^-(aq.),, E^\ominus = +0.54V$

The strongest oxidizing and reducing agents respectively are:

A. F_2 and I^-

B. Br_2 and CI^-

C. CI_2 and Br^-

D. CI_2 and I_2

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. $H_2Br_2, NaOH$

D. H_2 and O_2

Answer: c

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68. In the electrolysis of aqueous solutoin of copper suphate using copper stirps as anode and cathode the anode rection is

A. $Cu^{2+} + 2e^- \rightarrow Cu$

B. $Cu \rightarrow Cu^{2+} + 2e^-$

C. $2HO^- \rightarrow H_2 + 1/2O_2 + 2e^-$

D. $2HSO_4^- \rightarrow H_2S_2O_8 + 2e^-$

Answer: b

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

$Zn\left|Zn^{2+}\right|\left|Cu^{2+}\right|Cu$ and $Fe\left|Fe^{2+}\right|Cu^{2+}\mid Cu$ are connected in series what will be the net e.m.f of the cell at $25^{\circ}C$?

Give : $Zn^{2+}\mid Zn=-0.76V$

$Cu^{2+}\left|Cu=+0.34v, Fe^{2+}\right|Fe=-0.41V$

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, $2Ag^{+}+H_2\rightarrow 2Ag+2H^{+}$ 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 ?

A. $Cu + 2Ag^+(aq) \rightarrow Cu^{2+}(aq) + 2Ag$

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

C. $H_2 + Ni^{2+}(aq) \rightarrow 2H^+(aq) + Ni$

D. $Zn + 2H^+(aq) \rightarrow Zn^{2+}(aq) + H_2$

Answer: b

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74. Consider the redox reaction

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

A. $S_2O_3^{2-} + I_2 \rightarrow S_{45}O_6^{2} + 2I^{-}$

B. $S_2O_3^{2-}$ gets reduces to $S_4O_6^{2-}$

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

D. I_2 gets reduced to I^{-}

Answer: b,c

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

$2Cu_2O(s) + Cu_2S(s) \rightarrow 6Cu(s) + 5O_2(g)$

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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76. For the reaction : $I^- + ClO_3^- + H_2SO_4 \rightarrow Cl^- + HSO_4^- + I_2$

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

A. stoichiometric coefficient of HSO_4^- is 6

B. iodide is oxidized

C. suphur 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?

A. F_2

B. p_4

C. s_8

D. Br_2

Answer: b,c,d

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

A mole of hydrazine (N_2H_4) loses ten moles of electrons to form a new compound X assuming that all the nitrogen appears in the new compound what is the oxidation state of nitrogen in x ? (there is no change in the oxidation number of hydrogen in the reaction)

A. -1

B. -3

C. $+3$

D. $+5$

Answer: c

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80. The concept of oxidation number (O.N) is very important in under standing redox reaction s it helps to identify the oxidant / reductant in a redox reaction it also helps to (i) find oiut 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 umber of A is + 2 B is +5 and that of C is -2 the possible formula of the compund is

A. $A_3(BC_4)_2$

B. $A_3(B_4C)_2$

C. ABC_2

D. $A_3(BC_3)_2$

Answer: a

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

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

$XCu + YHNO_3 \rightarrow Cu(NO_3)_2 + NO + NO_2 + H_2O$

the coefficeents 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. For the reaction

$M^{x+} + MnO_4^{\ominus} \rightarrow MO_3^{\ominus} + Mn^{2+} + (1/2)O_2$

if $1\text{mol of} MnO_4^{\ominus}$ oxidises $1.67\text{mol of} M^{x+}$ to $MO_3^{\ominus}$, then the value of x in the reaction 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 hous-hold products. The effectiveness of bleach solution id often measured by iodometry.

Bleaching powder contains a salt of an oxoacid as one of its components. The anhydride of that oxoacid is:

A. CI_2O

B. CI_2O_7

C. CIO_2

D. CI_2O_6

Answer: a

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

$25mL$ of household bleach solution was mixed with $30mL$ of $0.50MKI$ and $10mL$ of $4N$ acetic acid. In the titration of the liberated iodine, $48mL$ of $0.25NNa_2S_2O_3$ 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 entires of Column I with appropiate 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

(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 ager

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 appropiate 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 ator
(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 appropiate 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)	$SnCI_2$	(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 entires of column II Each entry in column I may have one or more than one corret 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 entires of column II Each entry in column I may have one or more than one corret 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 displa
(B)	$2KClO_3 \rightarrow 2KCl + 3O_2$	(q)	Disproportionatio
(C)	$3Cl_2 + 6OH^- \rightarrow 5Cl^- + ClO_3^- + 3H_2O$	(r)	Decompostion rea
(D)	$Cl_2 + 2KI \rightarrow 2KCl + I_2$	(s)	Redox rection

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3. Match the entries of column I with appropriate entires of column II Each entry in column I may have one or more than one corret 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 p
(D)	Electrode connected to negative pole of the battery	(s)	positive po

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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 two types of sulphul atoms in $Na_2S_4O_6$ is.....

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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?

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

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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 iodin are liberated when 2 moles of potassium permanganate rect with potassium iodide?

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7. Reaction of Br_2 with Na_2CO_3 in aqueous solution gives sodium bromide and sodium bromate with evolution of gas. The number of sodium bromide molecules formed in the balanced chemical equation is :

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8. Consider the following list of reagent

$\text{Acidified}K_2Cr_2O_7$, $\text{alkaline}KMnO_4$, $CuSO_4$, H_2O_2, Cl_2, O_3, $FeCl_3$, HNO

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

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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 $K_2Cr_{21}O_7$ 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 corrrect 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 corrrect 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 $ClO^- \rightarrow ClO_3^- + 2cI^-$, CI atom is oxidised as well as reduced

A. Statement 1 is true statement 2 is true , statement 2 is a corrrect 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 decompostion reaction are redox reactions

Statement 2 H_2O on decompostion gives H_2 and O_2

A. Statement 1 is true statement 2 is true , statement 2 is a corrrect 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 $2CuCI \rightarrow CuCI_2 + Cu$ is a disprotionation reaction

Statement 2 all transitoin metals show disproportioination reactions

A. Statement 1 is true statement 2 is true , statement 2 is a corrrect 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. Satement 1 A solution of $FeSO_4$ can be stored in a copper vessel

Statement 2 $E^0 \text{of} Cu < E^0$ of Fe

A. Statement 1 is true statement 2 is true , statement 2 is a corrrect 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 corrrect 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 reasn 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 rects with HCI produce H_2 gas

Reason Fe is better reducing agent than H_2

A. If both assertion and reasn 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 reasn 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 reasn 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 decoloruize $KMnO_4$ solution

A. If both assertion and reasn 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 undrego disporportionation reaction

Reason Fluorine shows only 0 and -1 oxidation states

A. If both assertion and reasn 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 reasn 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 reasn 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 protential of Zn anode decreases and that of Cu increases.

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