Redox Reactions

Question1

5g of NaOH was dissolved in deionized water to prepare a 450 mL stock solution. What volume (in mL) of this solution would be required to prepare 500 mL of 0.1M solution?
Given : Molar Mass of Na, O and H is 23, 16 and 1 $gmol^{-1}$ respectively
[24-Jan-2023 Shift 1]

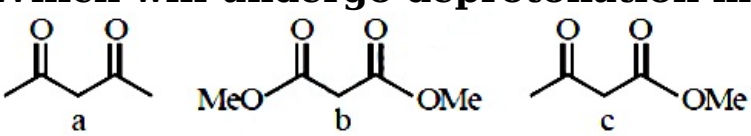
Answer: 180

Solution:

$$M = \frac{5}{40} \times \frac{1000}{450}$$
$$M_1V_1 = M_2V_2$$
$$\left(\frac{5}{40} \times \frac{1000}{450} \right) \times V_1 = 0.1 \times 500$$
$$V_1 = 180$$

Question2

Which will undergo deprotonation most readily in basic medium?



[24-Jan-2023 Shift 2]

Options:

A. a only

B. c only

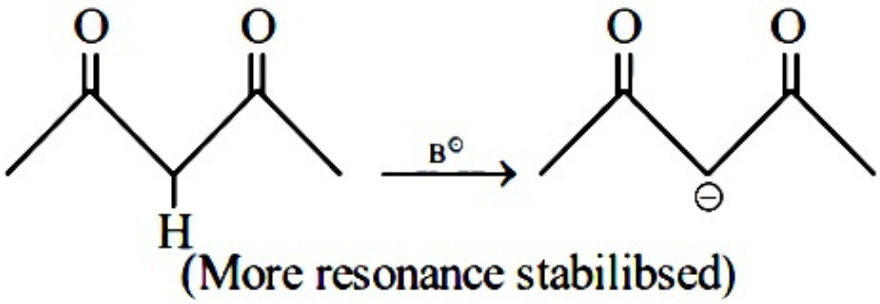
C. Both a and c

D. b only

Answer: A

Solution:

Most easily deprotonation



(More resonance stabilibsed)

Question3

The density of a monobasic strong acid (Molar mass 24.2g mol) is 1.21 kg L. The volume of its solution required for the complete neutralization of 25 mL of 0.24M NaOH is _____ x 10^{-2} mL (Nearest integer)
[25-Jan-2023 Shift 1]

Answer: 12

Solution:

millimole of NaOH = 0.24×25
$\therefore$ millimole of acid $= 0.24 \times 25$
$\Rightarrow$ mass of acid $= 0.24 \times 25 \times 24.2$ mg
for pure acid,

$V = \frac{w}{d}$; (d = 1.21 kg / L = 1.21g / ml)

$\therefore V = \frac{0.24 \times 25 \times 24.2}{1.12} \times 10^{-3}$

$= 120 \times 10^{-3}$ ml
$= 12 \times 10^{-2}$ ml

Question4

An indicator ' X ' is used for studying the effect of variation in concentration of iodide on the rate of reaction of iodide ion with H_2O_2 at room temp. The indicator ' X ' forms blue colored complex with compound ' A ' present in the solution. The indicator ' X ' and compound ' A ' respectively are
[29-Jan-2023 Shift 2]

Options:

A. Starch and iodine

B. Methyl orange and H_2O_2

C. Starch and H_2O_2

D. Methyl orange and iodine

Answer: A

Solution:

$I^- + H_2O_2 \rightarrow \underset{(A)}{I_2} + H_2O$

$I_2 + \underset{(Indicator)}{Starch} \rightarrow Blue$

Question5

The volume of HCl, containing $73gL^{-1}$, required to completely neutralise NaOH obtained by reacting 0.69g of metallic sodium with water, is _____ mL. (Nearest Integer)
(Given : molar Masses of Na, Cl, O, H are 23, 35.5, 16 and $1gmol^{-1}$ respectively)
[29-Jan-2023 Shift 2]

Answer: 15

Solution:

Mole of Na $= \frac{0.69}{23} = 3 \times 10^{-2}$

$Na + H_2O \rightarrow NaOH + \frac{1}{2}H_2$

By using POAC
Moles of NaOH $= 3 \times 10^{-2}$
NaOH reacts with HCl
No. of equivalent of NaOH = No. of equivalent of HCl

$3 \times 10^{-2} \times 1 = \frac{73}{36.5} \times V(\text{ in L}) \times 1$

$V = 1.5 \times 10^{-2}L$
Volume of HCl = 15 ml.

Question6

The number of electrons involved in the reduction of permanganate to manganese dioxide in acidic medium is _____.
[30-Jan-2023 Shift 1]

Answer: 3

Solution:

$MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$

Question7

$KMnO_4$ oxidises I^- in acidic and neutral/faintly alkaline solution, respectively to
[30-Jan-2023 Shift 2]

Options:

A. $I_2 \& IO_3^-$

B. $IO_3^- \& I_2$

C. $IO_3^- \& IO_3^-$

D. $I_2 \& I_2$

Answer: A

Solution:

In acidic medium
$2MnO_4^- + 10I^- + 16H^+ \rightarrow 2Mn^{2+} + 5I_2 + 8H_2O$
In neutral/faintly alkaline solution
$2MnO_4^- + I^- + H_2O \rightarrow 2MnO_2 + 2OH^- + IO_3^-$

Question8

25 mL of an aqueous solution of KCl was found to require 20 mL of 1M $AgNO_3$ solution when titrated using K_2CrO_4 as an indicator. What is the depression in freezing point of KCl solution of the given concentration? _____ (Nearest integer).
(Given : $K_f = 2.0 K\,kg\,mol^{-1}$)
Assume
1) 100% ionization and
2) density of the aqueous solution as $1 gmL^{-1}$
[1-Feb-2023 Shift 1]

Answer: 3

Solution:

At equivalence point, mmole of KCl = mmole of $AgNO_3$ = 20 mmole
Volume of solution = 25 ml
Mass of solution = 25 gm
Mass of solvent
= 25 - mass of solute
$= 25 - [20 \times 10^{-3} \times 74.5]$
= 23.51 gm

$$\text{Molality of KCl} = \frac{\text{mole of KCl}}{\text{mass of solvent in kg}}$$

$$= \frac{20 \times 10^{-3}}{23.51 \times 10^{-3}} = 0.85$$

i of KCl = 2(100% ionisation)
$\Delta T_f = i \times K_f \times m$
$= 2 \times 2 \times 0.85$
= 3.4
$\simeq 3$

Question9

Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : An aqueous solution of KOH when for volumetric analysis, its concentration should be checked before the use.
Reason (R) : On aging, KOH solution absorbs atmospheric CO_2.
In the light of the above statements, choose the correct answer from the options given below.
[1-Feb-2023 Shift 2]

Options:

A. (A) is not correct but (R) is correct

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

C. Both (A) and (R) are correct and (R) is the correct explanation of (A)

D. (A) is correct but (R) is not correct

Answer: C

Solution:

Solution:
KOH absorb CO_2
So its concentration should be checked.

Question10

Which of the following options are correct for the reaction
$2[Au(CN)_2]^-_{(aq)} + Zn(s) \rightarrow 2Au(s) + [Zn(CN)_4]^{2-}_{(aq)}$
A. Redox reaction
B. Displacement reaction
C. Decomposition reaction
D. Combination reaction
Choose the correct answer from the options given below:
[6-Apr-2023 shift 1]

Options:

A. A and B only

B. A only

C. C and D only

D. A and D only

Answer: A

Solution:

$2\left[\overset{+1}{Au}(CN)_2\right]^- + \overset{0}{Zn}(s) \rightarrow 2\overset{0}{Au} + \left[\overset{+2}{Zn}(CN)_4\right]^{-2}$
Zn displaced Au^+
Reduction and Oxidation both are taking place.

Question11

Strong reducing and oxidizing agents among the following, respectively, are
[6-Apr-2023 shift 1]

Options:

A. Ce^{4+} and Eu^{2+}

B. Ce^{4+} and Tb^{4+}

C. Ce^{3+} and Ce^{4+}

D. Eu^{2+} and Ce^{4+}

Answer: D

Solution:

Solution:

Question12

During the reaction of permanganate with thiosulphate, the change in oxidation of manganese occurs by value of 3 . Identify which of the below medium will favour the reaction.
[6-Apr-2023 shift 2]

Options:

A. aqueous acidic

B. aqueous neutral

C. both aqueous acidic and neutral

D. both aqueous acidic and faintly alkaline.

Answer: B

Solution:

Solution:
In neutral or weakly alkaline solution oxidation state of Mn changes by 3 unit
$\overset{+7}{MnO_4}^{-1} \rightarrow \overset{+4}{MnO_2}$

Question13

The volume of 0.02M aqueous HBr required to neutralize 10.0 mL of 0.01M aqueous $Ba(OH)_2$ is (Assume complete neutralization)
[6-Apr-2023 shift 2]

Options:

A. 2.5 mL

B. 5.0 mL

C. 10.0 mL

D. 7.5 mL

Answer: C

Solution:

$N_1v_1 = N_2v_2$
$\Rightarrow 0.02v_1 = 0.02 \times 10$
$\Rightarrow v_1 = 10\,ml$

Question14

$2IO_3^- + xI^- + 12H^+ \rightarrow 6I_2 + 6H_2O$
What is the value of x ?
[8-Apr-2023 shift 1]

Options:

A. 12

B. 10

C. 2

D. 6

Answer: B

Solution:

n factor of $IO_3^-$and I^-in the given redox reaction are 5 and 1 respectively. Therefore, IO_3^-will always react in the molar ratio 1 : 5 to get I_2.
$IO_3^- + 6H^+ + 5I^- \rightarrow 3I_2 + 3H_2O$
To get 6 molar I_2, multiple equation by 2
$2IO_3^- + 12H^+ + 10I^- \rightarrow 6I_2 + 6H_2O$
So, x = 10

Question15

Given below are two statement :
Statement I : In redox titration, the indicators used are sensitive to change in pH of the solution.
Statement II : In acid-base titration, the indicators used are sensitive to change in oxidation potential.
In the light of the above statement, choose the most appropriate answer from the options given below
[8-Apr-2023 shift 2]

Options:

A. Both statement I and Statement II are incorrect

B. Statement I is incorrect but Statement II is correct

C. Statement I is correct but Statement II is incorrect

D. Both Statement I and Statement II are correct

Answer: A

Solution:

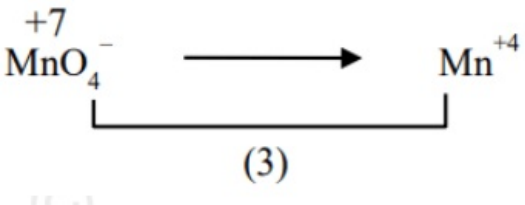
Solution:
Fact

Question16

In alkaline medium, the reduction of permanganate anion involves a gain of _____ electrons.
[10-Apr-2023 shift 2]

Answer: 3

Solution:



Question17

$KMnO_4$ is titrated with ferrous ammonium sulphate hexahydrate in presence of dilute H_2SO_4. Number of water molecules produced for 2 molecules of $KMnO_4$ is _____.
[13-Apr-2023 shift 1]

Answer: 68

Solution:

Solution:
$2KMnO_4 + 8H_2SO_4 + 10\,FeSO\,F_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O \rightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 10(NH_4)_2SO_4 + 68H_2O$
On the basis of above equation, 68 molecules of water will be produced from 2 molecules of $KMnO_4$.

Question18

20 mL of calcium hydroxide was consumed when it was reacted with 10 mL of unknown solution of H_2SO_4. Also 20 mL standard solution of 0.5 MHCl containing 2 drops of phenolphthalein was titrated with calcium hydroxide, the mixture showed pink colour when burette

displayed the value of 35.5 mL whereas the burette showed 25.5 mL initially. The concentration of H_2SO_4 is _____ M.(Nearest integer)
[13-Apr-2023 shift 1]

Answer: 1

Solution:

miliequivalent of $Ca(OH)_2$ = miliequivalent of H_2SO_4
$M_1 \times 2 \times 20 = M_2 \times 2 \times 10$
$2M_1 = M_2$
miliequivalent of HCl = miliequivalent of $Ca(OH)_2$
$20 \times 0.5 = 10 \times M_1 \times 2$
$M_1 = 0.5M$
Concentration of $H_2SO_4 = M_2 = 2M_1$
$= 2 \times 0.5$
$= 1M$

Question19

See the following chemical reaction:
$Cr_2O_7^{2-} + XH^+ + 6Fe^{2+} \rightarrow YCr^{3+} + 6Fe^{3+} + ZH_2O$
The sum of X, Y and Z is _____
[13-Apr-2023 shift 2]

Answer: 23

Solution:

Solution:
$Cr_2O_7^{2-} + 14H^+ + 6Fe^{2+} \rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$
x = 14
y = 2
z = 7
Hence (x + y + z) = 14 + 2 + 7 = 23

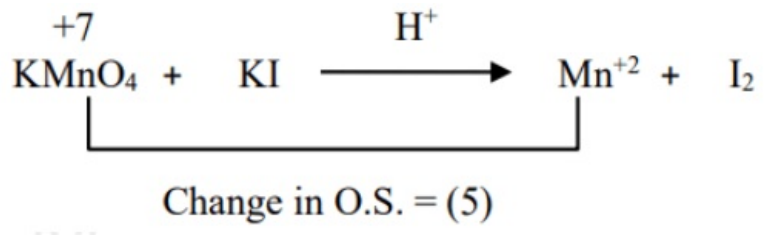
Question20

The total change in the oxidation state of manganese involved in the reaction of $KMnO_4$ and potassium iodide in the acidic medium is _____.
[15-Apr-2023 shift 1]

Answer: 5

Solution:

Solution:



Question21

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R
Assertion A : Physical properties of isotopes of hydrogen are different.
Reason : Mass difference between isotopes of hydrogen is very large.
In the light of the above statements, choose the correct answer from the options given below:
[10-Apr-2023 shift 2]

Options:

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

B. A is false but R is true

C. A is true but R is false

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

Answer: D

Solution:

Solution:
The Physical properties of isotope of Hydrogen are different due to Large mass difference

---

Question22

A 0.166g sample of an organic compound was digested with conc. H_2SO_4 and then distilled with NaOH. The ammonia gas evolved was passed through 50.0 mL of 0.5NH_2SO_4. The used acid required 30.0 mL of 0.25N NaOH for complete neutralization. The mass percentage of nitrogen in the organic compound is

[24-Jun-2022-Shift-1]

Answer: 63

Solution:

Solution:

Millimoles of used acid $= \frac{30 \times 0.25}{2}$

Millimoles of $NH_3 = 30 \times 0.25 = 7.5$

Mass % of nitrogen $= \frac{7.5}{0.166} \times 10^{-3} \times 14 \times 100 \simeq 63\%$

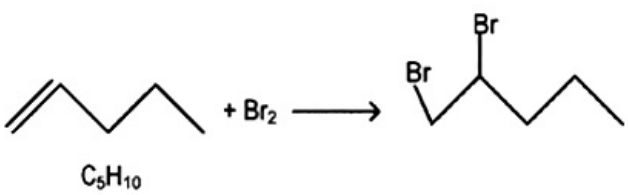
Question23

Number of grams of bromine that will completely react with 5.0g of pent-1-ene is $\times 10^{-2}$g. (Atomic mass of Br = 80g / mol) [Nearest Integer]
[25-Jun-2022-Shift-1]

Answer: 1143

Solution:

Solution:



Molar mass of $C_5H_{10} = 12 \times 5 + 10 = 70\,gm$

Given mass of $C_5H_{10} = 5\,gm$

$\therefore$ Moles of $C_5H_{10} = \frac{5}{70}$

From reaction,
1 mole of C_5H_{10} reacts with 1 mole of Br_2

$\therefore \frac{5}{70}$ moles of C_5H_{10} reacts with $\frac{5}{70}$ moles of Br_2

$\therefore$ Reacted $Br_2 = \frac{5}{70} \times 160\,gm$

$= 11.428\,gm$

$= 1142.8 \times 10^{-2}\,gm$

$\simeq 1143 \times 10^{-2}\,gm$

Question24

The neutralization occurs when 10 mL of 0.1M acid 'A' is allowed to react with 30 mL of 0.05M base $M(OH)_2$. The basicity of the acid ' A ' is [M is a metal]
[25-Jun-2022-Shift-2]

Answer: 3

Solution:

$$\underset{\substack{0.1M\\10ml}}{\text{Acid}} + \underset{\substack{M(OH)_2\\0.05M\\30\,ml}}{\text{Base}} \longrightarrow \text{Salt} + H_2O$$

at equivalence point equivalent of acid = equivalent of base
$0.1 \times 10 \times n = 30 \times 0.05 \times 2$
$n = 3$

Question25

Which one of the following is an example of disproportionation reaction?
[26-Jun-2022-Shift-2]

Options:

A. $3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$

B. $MnO_4^- + 4H^+ + 4e^- \rightarrow MnO_2 + 2H_2O$

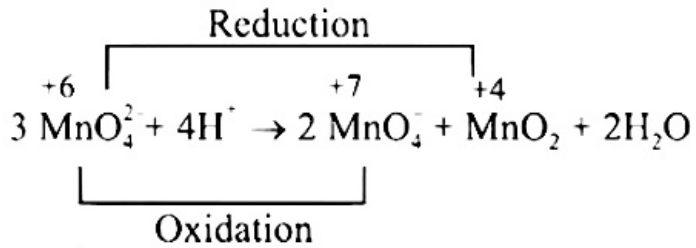
C. $10I^- + 2MnO_4^- + 16H^+ \rightarrow 2Mn^{2+} + 8H_2O + 5I_2$

D. $8MnO_4^- + 3S_2O_3^{2-} + H_2O \rightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$

Answer: A

Solution:

Solution:



MnO_4^{2-} is an intermediate oxidation state and is converted into compounds having higher and lower oxidation states.

Question26

A 2.0g sample containing MnO_2 is treated with HCl liberating Cl_2. The Cl_2 gas is passed into a solution of KI and 60.0 mL of 0.1 M $Na_2S_2O_3$ is required to titrate the liberated iodine. The percentage of MnO_2 in the sample is ____ (Nearest integer)
[Atomic masses (in u)
Mn = 55; Cl = 35.5; O = 16, I = 127, Na = 23, K = 39, S = 32]
[28-Jun-2022-Shift-1]

Answer: 13

Solution:

First Step :
$MnO_2 + 4\,HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$
Here 1 mol of MnO_2 produce 1 mol of Cl_2
$\therefore$ Mole ratio of $n_{M_{nO_2}} : n_{Cl_2} = 1 : 1$
Second Step :
$Cl_2 + 2\,Kl \rightarrow 2\,KCl + I_2$
Here, 1 mol of Cl_2 produce 1 mol of I_2
Mole ratio of $n_{Cl_2} : n_{I_2} = 1 : 1$
Third Step :
$I_2 + 2Na_2S_2O_3 \rightarrow 2\,Nal + Na_2S_2O_3$
1 mol of I_2 react with 2 mol of $Na_2S_2O_3$
Mole ratio of $n_{I_2} : n_{N_2S_2O_3} = 1 : 2$
Given $Na_2S_2O_3$ is 60 mL of 0.1M
$\therefore$ Number of moles of $Na_2S_2O_3$
$= V(\text{ in L}) \times M \text{ (Molarity)}$
$= \frac{60}{1000} \times 0.1$
$= 0.006\,\text{mol}$
$\therefore$ Number of moles of I_2
$= \frac{1}{2}(0.006)$
$= 0.003$
$\therefore$ Moles of $MnO_2 = 0.003$ (as mole ratio of MnO_2 and $Cl_2 = 1 : 1$)
Molar mass of $MnO_2 = 55 + 32 = 87$
$\therefore$ Mass of $MnO_2 = 0.003 \times 87 = 0.261\,\text{gm}$
Given $MnO_2 = 2g$
$\therefore\%$ of $MnO_2 = \frac{0.261}{2} \times 100 = 13\%$

Question27

0.01 M $KMnO_4$ solution was added to 20.0 mL of 0.05M Mohr s salt solution through a burette. The initial reading of 50 mL burette is zero. The volume of $KMnO_4$ solution left in the burette after the end point is _____mL. (nearest integer)

[28-Jun-2022-Shift-2]

Answer: 30

Solution:

Meq of oxidizing agent = Meq of reducing agent
$(M \times V \times n_F)_{KMnO_4} = (M \times V \times n_F)_{Mohr's\ salt}$
$0.01 \times 20 \times 5 = 0.05 \times V \times 1$
Volume required $= 20\,ml$
Since initial volume of $KMnO_4$ in burette is $50\,ml$.
Hence volume of $KMnO_4$ left in the burette after end point is $30\,ml$.

Question28

For the reaction given below:
$CoCl_3 \cdot xNH_3 + AgNO_3(aq) \rightarrow$
If two equivalents of AgCl precipitate out, then the value of x will be_____
[29-Jun-2022-Shift-2]

Answer: 5

Solution:

$CoCl_3 \cdot xNH_3 + AgNO_3 \rightarrow \underset{2\,mol}{AgCl}\downarrow$
$[Co(NH_3)_5\,Cl]Cl_2 + AgNO_3 \rightarrow \underset{2\,mol}{AgCl}\downarrow$
$x = 5$

Question29

SO_2Cl_2 on reaction with excess of water results into acidic mixture
$SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$
16 moles of NaOH is required for the complete neutralisation of the resultant acidic mixture. The number of moles of SO_2Cl_2 used is:
[25-Jul-2022-Shift-1]

Options:

A. 16

B. 8

C. 4

D. 2

Answer: C

Solution:

$SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2\,HCl$
Moles of NaOH required for complete neutralization of resultant acidic mixture = 16 moles
And 1 mole of SO_2Cl_2 produced 4 moles of H^+.
$\therefore$ Moles of SO_2Cl_2 used will be $= \frac{16}{4} = 4$ moles

---

Question30

In base vs. acid titration, at the end point methyl orange is present as [25-Jul-2022-Shift-2]

Options:

A. quinonoid form

B. heterocyclic form

C. phenolic form

D. benzenoid form

Answer: A

Solution:

Solution:

Question31

Which of the given reactions is not an example of disproportionation reaction? [26-Jul-2022-Shift-1]

Options:

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

B. $2NO_2 + H_2O \rightarrow HNO_3 + HNO_2$

C. $MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$

D. $3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$

Answer: C

Solution:

Solution:
$2NO_2 + H_2O \rightarrow HNO_3^{+5} + HNO_2^{+3}$: Disproportionation
$MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$: reduction
$3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2^{+4} + 2H_2O$: Disproportionation

---

Question32

The dark purple colour of $KMnO_4$ disappears in the titration with oxalic acid in acidic medium. The overall change in the oxidation number of manganese in the reaction is :
[26-Jul-2022-Shift-1]

Options:

A. 5

B. 1

C. 7

D. 2

Answer: A

Solution:

Solution:
In acidic medium,
$MnO_4^- \rightarrow Mn^{+2}$
change in ox. no. = 5

Question33

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A: Phenolphthalein is a pH dependent indicator, remains colourless in acidic solution and gives pink colour in basic medium.
Reason R: Phenolphthalein is a weak acid. It doesn't dissociate in basic medium.
In the light of the above statements, choose the most appropriate answer from the options given below.
[26-Jul-2022-Shift-2]

Options:

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

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

C. A is true but R is false.

D. A is false but R is true.

Answer: C

Solution:

Solution:
Phenolphthalein is a pH dependent indicator. It is a weak acid which is colourless in the acidic solution but gives pink colour in basic medium. The pink colour is due to its conjugate form. Therefore, assertion (A) is true but Reason (R) is false.
Phenolphthalein dissociate in basic medium
$HPh(aq) \rightleftharpoons H^+ + Ph^-$
(colourless) (Pink)

Question34

20 mL of 0.02M hypo solution is used for the titration of 10 mL of copper sulphate solution, in the presence of excess of KI using starch as an indicator. The molarity of Cu^{2+} is found to be _____ $\times 10^{-2}$M [nearest integer]
Given :$2Cu^{2+} + 4I^- \rightarrow Cu_2I_2 + I_2$
$I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$
[26-Jul-2022-Shift-2]

Answer: 4

Solution:

Solution:
$2Cu^{2+} + 4I^- \rightarrow Cu_2I_2 + I_2$
$I_2 + S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$
Milliequivalents of hypo solution $= 0.02 \times 20 = 0.4$
Milliequivalents of Cu^{2+} in 10 mL solution =
Milliequivalents of I_2 = Milliequivalents of hypo $= 0.4$
Millimoles of Cu^{2+} ions in 10 mL = 0.4
Molarity of Cu^{2+} ions $= \frac{0.4}{10} = 0.04M$
$= 4 \times 10^{-2}M$

Question35

20 mL of 0.02$M_2Cr_2O_7$ solution is used for the titration of 10 mL of Fe^{2+} solution in the acidic medium.
The molarity of Fe^{2+} solution is _____ $\times 10^{-2}$M. (Nearest Integer)
[27-Jul-2022-Shift-1]

Answer: 24

Solution:

Solution:
Eq. of $K_2Cr_2O_7$ = Eq. of Fe^{2+}
⇒ (Molarity × volume × n.f) of $K_2Cr_2O_7$ = (molarity × volume × n.f) of Fe^{2+} ⇒0.02 × 20 × 6 = M × 10 × 1 ⇒M = 0.24
⇒ Molarity = 24×10^{-2}

Question36

Given below are two statements :
One is labelled as Assertion A and the other is labelled as Reason R
Assertion A : Permanganate titrations are not performed in presence of hydrochloric acid.
Reason R : Chlorine is formed as a consequence of oxidation of hydrochloric acid.
In the light of the above statements, choose the correct answer from the options given below
[28-Jul-2022-Shift-2]

Options:

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

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

C. A is true but R is false

D. A is false but R is true

Answer: A

Solution:

Solution:
$2KMnO_4 + 16\,HCl \rightarrow 2MnCl_2 + 2\,KCl + 8H_2O + Cl_2$
HCl is not used in the process of titration because it reacts with the ($KMnO_4$) that is used in the process and gets oxidized.

Question37

2L of 0.2M H_2SO_4 is reacted with 2L of 0.1M NaOH solution, the molarity of the resulting product Na_2SO_4 in the solution is _____ millimolar. (Nearest integer)
[28-Jul-2022-Shift-2]

Answer: 25

Solution:

$$H_2SO_4 + 2\,NaOH \rightarrow Na_2SO_4 + 2H_2O$$
$0.4\,mol \quad 0.2\,mol \quad -$
$0.3\,mol \quad - \quad 0.1\,mol$

Molarity of Na_2SO_4 is $\frac{0.1}{4} = 0.025M$
$= 25\,mM$

Question38

A compound ' X ' is a weak acid and it exhibits colour change at pH close to the equivalence point during neutralization of NaOH with CH_3COOH. Compound ' X ' exists in ionized form in basic medium. The compound ' X ' is
[29-Jul-2022-Shift-2]

Options:

A. methyl orange

B. methyl red

C. phenolphthalein

D. erichrome Black T

Answer: C

Solution:

Solution:
Phenolphthalein is weak acid give colour in basic medium.

Question39

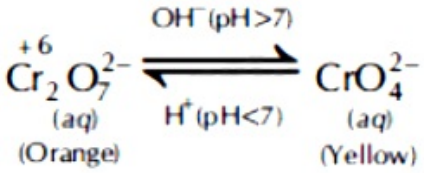
Dichromate ion is treated with base, the oxidation number of Cr in the product formed is ..... .

[26 Feb 2021 Shift 1]

Answer: 6

Solution:

In basic medium dichromate ion ($Cr_2O_7^{2-}$)
changes in chromate ion (CrO_4^{2-}). Oxidation state of Cr in CrO_4^{2-} is +6.
$\Rightarrow CrO_4^{2-} = x + 4(-2) = -2$ or $x = +6$
Dichromate and chromate equilibrium depends on pH of the medium as



Question40

Which of the following equation depicts the oxidising nature of H_2O_2 ? [25 Feb 2021 Shift 1]

Options:

A. $KIO_4 + H_2O_2 \longrightarrow KIO_3 + H_2O + O_2$

B. $I_2 + H_2O_2 + 2OH^- \longrightarrow 2I^- + 2H_2O + O_2$

C. $2I^- + H_2O_2 + 2H^+ \longrightarrow I_2 + 2H_2O$

D. $Cl_2 + H_2O_2 \longrightarrow 2HCl + O_2$

Answer: C

Solution:

Solution:
Oxidation involves increase in oxidation number and reduction involves decrease in oxidation number.
$2I^- + 2H^+ + \overset{1}{H_2O_2} \longrightarrow \overset{1}{I_2} + 2\overset{+1\ -2}{H_2O_2}$
In this reaction, H_2O_2 oxidises I^- to I_2 and itself gets reduced to H_2O, so the reaction depicts oxidising nature of H_2O_2.
While in other reactions H_2O_2 does not oxidise KIO_4, I_2 and Cl_2.

Question41

In basic medium CrO_4^{2-} oxidises $S_2O_3^{2-}$ to form SO_4^{2-} and itself changes into $Cr(OH)_4^-$. The volume of 0.154M CrO_4^{2-} required to react

with 40mL of 0.25M $S_2O_3^{2-}$ is ..... mL
(Rounded off to the nearest integer).
[25 Feb 2021 Shift 1]

Answer: 173

Solution:

Given, Molarity of $CrO_4^{2-}(M_1) = 0.154M$
Molarity of $S_2O_3^{2-}(M_2) = 0.25M$
Volume of $S_2O_3^{2-}(V_2) = 40mL$
Volume of $CrO_4^{2-}(V_1) =$? $CrO_4 + S_2O_3 \longrightarrow SO_4^{2-} + Cr(OH)_4^{+6}$
Gram equivalent of CrO_4^{2-} = Gram equivalent of $S_2O_3^{2-}$
$N_1V_1 = N_2V_2$
Normality = Molarity $\times$ n factor
n for Cr = 6 − 3 = 3
n for S $\Rightarrow S_2O_3^{2-} \longrightarrow 2SO_4^{2-} + 8e^-$
= 8
$0.154 \times 3 \times V_1 = 0.25 \times 40 \times 8$
$V_1 = 173mL$

Question42

The reaction of sulphur in alkaline medium is given below:
S_8 (s) + aOH^-(aq) →bS^{2-} (aq) +c$S_2O_3^{2-}$ (aq) +d H_2O(l)
The values of 'a' is ____. (Integer answer)
[24feb2021shift1]

Answer: 12

Solution:

Solution:
$16e^- + S_8^- \longrightarrow 8S^{2-}$
$12H_2O + S_8 \longrightarrow 4S_2O_3^{2-} + 24H^+ + 16e^-$
$2S_8 + 12H_2O \longrightarrow 8S^{2-} + 4S_2O_3^{2-} + 24H^+$
For balancing in basic medium add OH^- equal to H^+.
$2S_8 + 12H_2O + 24OH^- \longrightarrow 8S^{2-} + 4S_2O_8^{2-} + 24H_2O$
$2S_8 + 24OH^- \longrightarrow 8S^{2-} + 4S_2O_8^{2-} + 12H_2O$
$S_8 + 12OH^- \longrightarrow 4S^{2-} + 2S_2O_8^{2-} + 6H_2O$
∴a = 12.

Question43

In basic medium, H_2O_2 exhibits which of the following reactions ?

A. $Mn^{2+} \rightarrow Mn^{4+}$

B. $I_2 \rightarrow I^-$

C. $PbS \rightarrow PbSO_4$

Choose the most appropriate answer from the options given below.
[18 Mar 2021 Shift 2]

Options:

A. A and C

B. Only A

C. B Only

D. A and B

Answer: D

Solution:

Solution:
In basic medium, oxidising action of H_2O_2
$Mn^{2+} + H_2O_2 \longrightarrow Mn^{4+} + 2OH^-$
In basic medium, reducing action of H_2O_2
$I_2 + H_2O_2 + 2OH^- \longrightarrow 2I^- + 2H_2O + O_2$
In acidic medium, oxidising action of H_2O_2
$PbS(s) + 4H_2O_2(aq) \longrightarrow PbSO_4(s) + 4H_2O(l)$
Thus, in basic medium H_2O_2 exhibits reaction ' A ' and ' B '
Hence, correct option is (d).

Question44

Given below are two statements.
Statement I Potassium permanganate on heating at 573K forms potassium manganate.
Statement II Both potassium permanganate and potassium manganate are tetrahedral and paramagnetic in nature. In the light of the above statements, choose the most appropriate answer from the options given below
[17 Mar 2021 Shift 1]

Options:

A. Statement I is true but statement II is false

B. Both statement I and statement II are true

C. Statement I is false but statement II is true

D. Both statement I and statement II are false

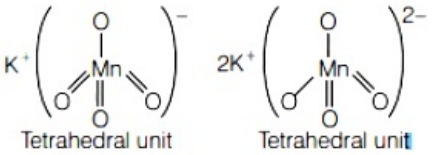
Answer: A

Solution:

Solution:
Potassium permanganate on heating at $573K$ forms potassium manganate.

$$\underset{\text{permanganate(Diamagnetic)}}{K\overset{+7}{M}nO_4} \xrightarrow{573K} \underset{\text{Potassium manganate Paramagnetic)}}{K_2\overset{+6}{M}nO_4} + MnO_2 + O_2$$

Both potassium permanganate and potassium manganate are tetrahedral.
Manganese has four sigma bonds forming tetrahedral structure.



$KMnO_4$; $+1 + x - 8 = 0$
$x = +7$
K_2MnO_4; $+2 + x - 8 = 0$
$x = +6$
So, Mn is present in $+7$ oxidation state in $KMnO_4$ and $+6$ oxidation state in K_2MnO_4.
$_{25}Mn = [Ar]4s^2 3d^5$
$Mn^{+7} = [Ar]4s^0 3d^0$ (Diamagnetic)
$Mn^{+6} = [Ar]4s^1$ (Paramagnetic)
So, potassium permanganate is diamagnetic and potassium manganate is paramagnetic.
Statement I is true but statement II is false.

Question45

$2MnO_4^- + bC_2O_4^{2-} + CH^+ \longrightarrow xMn^{2+} + yCO_2 + ZH_2O$ If the above equation is balanced with integer coefficients, the value of c is [16 Mar 2021 Shift 1]

Answer: 16

Solution:

Solution:
Balancing by half-reaction method

$$\underset{+7}{2MnO_4^-} + bC_2O_4^{2-} + cH^+ \longrightarrow x\underset{+2}{Mn^{+2}} + y\underset{+4}{CO_2} + ZH_2O$$

Step 1 Separate two half-reactions
Oxidation half (O.H.) $C_2O_4^{2-} \longrightarrow CO_2$
Reduction half (R.H.) $MnO_4^- \longrightarrow Mn^{2+}$
Step 2 Balance all the atoms except oxygen and 'H'.
O.H. $C_2O_4^{2-} \longrightarrow 2CO_2$
R.H. $MnO_4^- \longrightarrow Mn^{2+}$
Step 3 Balance 'O' by adding H_2O and ' H ' by adding H^+.
O.H. $C_2O_4^{2-} \longrightarrow 2CO_2$
R.H. $8H^+ + MnO_4^- \longrightarrow Mn^{2+} + 4H_2O$
Step 4 Balance charge by adding electron
O.H $C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^-$ R.H. $5e^- + 8H^+ + MnO_4^- \longrightarrow Mn^{2+} + 4H_2O$
Step 5 Balance electron by multiplying O.H. by '5' and R.H. by ' 2 '.
O.H. $5C_2O_4^{2-} \longrightarrow 10CO_2 + 10e^-$

R.H. $10e^- + 16H^+ + 2M\,nO_4^- \longrightarrow 2M\,n^{2+} + 8H_2O$
Step 6 Add both half-reaction
$16H^+ + 5C_2O_4^{2-} + 2M\,nO_4^- \longrightarrow 10CO_2 + 2M\,n^{2+} + 8H_2O$
So, c = 16

Question46

Identify the process in which change in the oxidation state is five : [25 Jul 2021 Shift 2]

Options:

A. $Cr_2O_7^{2-} \rightarrow 2Cr^{3+}$

B. $M\,nO_4^- \rightarrow M\,n^{2+}$

C. $CrO_4^{2-} \rightarrow Cr^{3+}$

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

Answer: B

Solution:

Solution:
$M\,nO_4^- + 5e \rightarrow M\,n^{2+}$

Question47

Cu^{2+} salt reacts with potassium iodide to give [20 Jul 2021 Shift 2]

Options:

A. Cu_2I_2

B. Cu_2I_3

C. CuI

D. $Cu(I_3)_2$

Answer: A

Solution:

Solution:
$2Cu^{+2} + 4I^- \rightarrow Cu_2I_2(s) + I_2$
$2Cu^{+2} + 3I^- \rightarrow 2CuI + I_2$

Question48

The species given below that does NOT show disproportionation reaction is :
[20 Jul 2021 Shift 1]

Options:

A. BrO_4^-

B. BrO^-

C. BrO_2^-

D. BrO_3^-

Answer: A

Solution:

Solution:
In $BrO_4^{\ominus}$, Br is in highest oxidation state (+7), So it cannot oxidise further hence it cannot show disproportionation reaction.

Question49

The sum of oxidation states of two silver ions in $[Ag(NH_3)_2][Ag(CN)_2]$ complex is …….. .
[1 Sep 2021 Shift 2]

Answer: 2

Solution:

Solution:
$[Ag(NH_3)_2][Ag(CN)_2]$ complex dissociates into $[Ag(NH_3)_2]^+$ and $[Ag(CN)\ ]$.
Oxidation of Ag in $[Ag(NH_3)_2]^+$
$Ag + 0 \times 2 = +1$
$Ag = +1$
Oxidation state of Ag in $[Ag(CN)_2]^-$
$Ag + (-1) \times 2 = -1$
$Ag - 2 = -1$
$\Rightarrow Ag = +1$
$\therefore$ Sum of oxidation states of two silver ions in $[Ag(NH_3)_2][Ag(CN)_2]$ complex is 2.

Question50

The compound that cannot act both as oxidising and reducing agent is: [Jan. 09, 2020(I)]

Options:

A. H_3PO_4

B. HNO_2

C. H_2SO_3

D. H_2O_2

Answer: A

Solution:

Solution:
In H_3PO_4 oxidation state of P is +5, which cannot be oxidised further to a higher oxidation state. Hence, it cannot act as reducing agent.

Question51

The redox reaction among the following is: [Jan. 07, 2020 (II)]

Options:

A. formation of ozone from atmospheric oxygen in the presence of sunlight

B. reaction of $[Co(H_2O)_6]Cl_3$ with $AgNO_3$

C. reaction of H_2SO_4 with NaOH

D. combination of dinitrogen with dioxygen at 2000K

Answer: D

Solution:

Solution:
$N_2 + O_2 \rightarrow 2NO$ (Redox reaction)
$3O_2 \rightarrow 2O_3$(Photochemical reaction)
$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$(Neutralisation reaction)
$[Co(H_2O)_6]Cl_3 + 3AgNO_3 \rightarrow [CO(H_2O)_6](NO_3)_3 + 3AgCl$ (Neutralisation reaction)

Question52

Oxidation number of potassium in K_2O, K_2O_2 and KO_2, respectively, is:

[Jan. 07, 2020 (I)]

Options:

A. +2, +1 and $+\frac{1}{2}$

B. +1, +1 and +1

C. +1, +4 and +2

D. +1, +2 and +4

Answer: B

Solution:

Solution:
$K_2O : 2x - 2 = 0 \Rightarrow x = +1$
$K_2O_2 : 2x - 2 = 0 \Rightarrow x = +1$
$KO_2 : x - 1 = 0 \Rightarrow x = +1$
Thus, potassium shows +1 state in all its oxides, superoxides and peroxides.

Question53

The oxidation states of iron atoms in compounds (A), (B) and (C), respectively, are x, y and z. The sum of x, y and z is _____.

$\underset{(A)}{Na_4[Fe(CN)_5(NOS)]}$

$\underset{(B)}{Na_4[FeO_4]}$

$\underset{(C)}{[Fe_2(CO)_9]}$

[NV, Sep. 02, 2020 (I)]

Answer: 6

Solution:

Solution:
The oxidation states of iron in these compounds will be -
In A, $x + 5(-1) + (-1) = -4 \Rightarrow x = +2$
In B, $y + 4(-2) = -4 \Rightarrow y = +4$
In C, $z = 0$
The sum of oxidation states will be $= 4 + 2 + 0 = 6$.

Question54

The oxidation states of transition metal atoms in $K_2Cr_2O_7$, $KMnO_4$ and K_2FeO_4, respectively, are x, y and z. The sum of x, y and z is _____,

[NV, Sep. 02, 2020 (II)]

Answer: 19

Solution:

Compound	Oxidation state oftransition element
(i) $K_2Cr_2O_7$	$x = +6$
(ii) $KMnO_4$	$y = +7$
(iii) K_2FeO_4	$z = +6$

So, (x + y + z) = 6 + 7 + 6 = 19

Question55

Consider the following equations :
$2Fe^{2+} + H_2O_2 \rightarrow xA + yB$
(in basic medium)
$2MnO_4^- + 6H^+ + 5H_2O_2 \rightarrow x'C + y'D + z'E$
(in acidic medium)
The sum of the stoichiometric coefficients x, y, x′, y′ and z′ for products A, B, C, D and E , respectively, is _____.
[NV, Sep. 04, 2020 (II)]

Answer: 19

Solution:

$2Fe^{2+} + H_2O_2 \longrightarrow 2Fe^{3+} + 2OH^-$
$2MnO_4^- + 6H^+ + 5H_2O_2 \longrightarrow 2Mn^{2+} + 8H_2O + 5O_2$
$\because x = 2, y = 2, x' = 2, y' = 8, z' = 5$
$\therefore x + y + x' + y' + z' = 19$

Question56

Consider the following reduction processes:

$Zn^{2+} + 2e \rightarrow Zn(s);\ E^\circ = -0.76V$
$Ca^{2+} + 2e^- \rightarrow Ca(s);\ E^\circ = -2.87V$
$Mg^{2+} + 2e^- \rightarrow Mg(s);\ E^\circ = -2.36V$
$Ni^{2+} + 2e^- \rightarrow Ni(s);\ E^\circ = -0.25V$
The reducing power of the metals increases in the order: [Jan.10,2019(I)]

Options:

A. Ca < Zn < Mg < Ni

B. Ni < Zn < Mg < Ca

C. Zn < Mg < Ni < Ca

D. Ca < Mg < Zn < Ni

Answer: B

Solution:

Solution:
Higher the oxidation potential, higher will be the reducing power. So, the order of reducing behaviour is:
Ca > Mg > Zn > Ni

Question57

In the reaction of oxalate with permanganate in acidic medium, the number of electrons involved in producing one molecule of CO_2 is: [Jan. 10,2019 (II)]

Options:

A. 1

B. 10

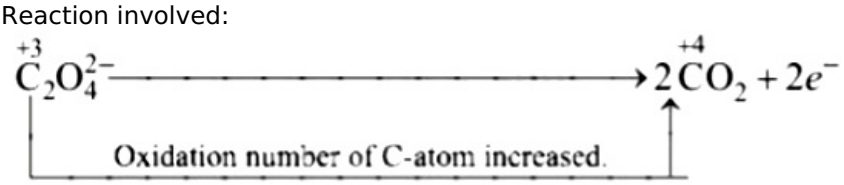
C. 2

D. 5

Answer: A

Solution:

Solution:
Reaction involved:



∴ The number of electrons involved in producing one mole of CO_2 is 1 .

Question58

An example of a disproportionation reaction is: [April 12, 2019(I)]

Options:

A. $2MnO_4^- + 10I^- + 16H^+ \rightarrow 2Mn^{2+} + 5I_2 + 8H_2O$

B. $2NaBr + Cl_2 \rightarrow 2NaCl + Br_2$

C. $2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$

D. $2CuBr \rightarrow CuBr_2 + Cu$

Answer: D

Solution:

Solution:

$\overset{+}{Cu}Br \longrightarrow \overset{0}{Cu} + \overset{2+}{Cu}Br_2$

It is an example of disproportionation reaction, as Cu undergoes both oxidation and reduction.

Question59

In order to oxidise a mixture of one mole of each of FeC_2O_4, $Fe_2(C_2O_4)_3$, $FeSO_4$ and $Fe_2(SO_4)_3$ in acidic medium, the number of moles of $KMnO_4$ required is : [April 8, 2019 (I)]

Options:

A. 2

B. 1

C. 3

D. 1.5

Answer: A

Solution:

Solution:

$MnO_4^- + 5e^- \longrightarrow Mn^{2+}$

(i) $FeC_2O_4 \longrightarrow Fe^{3+} + 2CO_2 + 3e^-$

1 mole of FeC_2O_4 reacts with $\frac{3}{5}$ mole of acidified $KMnO_4$

(ii) $Fe_2(C_2O_4)_3 \longrightarrow Fe^{3+} + CO_2 + 6e^-$

1 mole of $Fe_2(C_2O_4)_3$ reacts with $\frac{6}{5}$ moles of $KMnO_4$

(iii) $FeSO_4 \longrightarrow Fe^{3+} + e^-$

1 mole of $FeSO_4$ react with $\frac{1}{5}$ moles of $KMnO_4$

(iv) $Fe_2(SO_4)_3$ does not oxidise

$\therefore$ Total moles required $= \frac{3}{6} + \frac{6}{5} + \frac{1}{5} = 2$

Question60

Given:

$Co^{3+} + e^- \rightarrow Co^{2+}$; $E^\circ = +1.81V$

$Pb^{4+} + 2e^- \rightarrow Pb^{2+}$; $E^0 = +1.67V$

$Ce^{4+} + e^- \rightarrow Ce^{3+}$; $E^o = +1.61V$

$Bi^{3+} + 3e^- \rightarrow Bi$; $E^o = +0.20V$

oxidizing power of thespecies will increase in the order:

[April 12, 2019(I)]

Options:

A. $Ce^{4+} < Pb^{4+} < Bi^{3+} < Co^{3+}$

B. $Bi^{3+} < Ce^{4+} < Pb^{4+} < Co^{3+}$

C. $Co^{3+} < Ce^{4+} < Bi^{3+} < Pb^{4+}$

D. $Co^{3+} < Pb^{4+} < Ce^{4+} < Bi^{3+}$

Answer: B

Solution:

Solution:

Higher the reduction potential, higher will be oxidising power. So,

$Bi^{3+} < Ce^{4+} < Pb^{4+} < Co^{3+}$

Question61

Given that $E^oO_2 / H_2O = +1.23V$;

$E_{S_2O_8^{2-} / SO_4^{2-}} = 2.05V$

$E_{Br_2 / Br^\circ} = +1.09V$

$E_{Au^{3+} / Au}^\circ = +1.4V$

The strongest oxidising agent is:

[April 8, 2019 (I)]

Options:

A. Au^{3+}

B. O_2

C. $S_2O_g^{2-}$

D. Br_2

Answer: C

Solution:

Solution:
More positive is the reduction potential stronger is the oxidising agent. Reduction potential is maximum for $S_2O_8^{2-}$, therefore, it is the strongest oxidising agent amongst the given species.

Question62

The oxidation states of Cr in $[Cr(H_2O)_6]Cl_3$, $[Cr(C_6H_6)_2]$, and $K_2[Cr(CN)_2(O)_2(O_2)(NH_3)]$ respectively are : [2018]

Options:

A. +3, +4, and +6

B. +3, +2, and +4

C. +3, 0, and +6

D. +3, 0, and +4

Answer: C

Solution:

Solution:
$[Cr(H_2O)_6]Cl_3$
$\Rightarrow x + 6 \times 0 + (-1) \times 3 = 0$
$\Rightarrow x = +3$
$[Cr(C_6H_6)_2]$
$x + 2 \times 0 = 0; x = 0$
$K_2[Cr(CN)_2(O)_2(O_2)(NH_3)]$
[Here $(O)_2$, is OX O, $(2x - 2)$ and (O_2) is per OX O, $(1x - 2)$]
$2 \times 1 + x + 2 \times (-1) + 2 \times (-2) + (-2) + 0 = 0$
$x = +6$

Question63

Which of the following reactions is an example of a redox reaction? [2017]

Options:

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

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

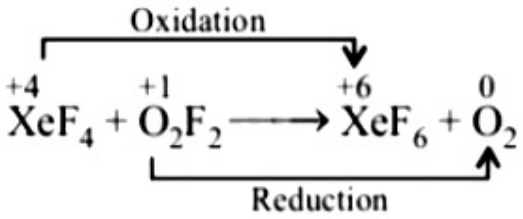
C. $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$

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

Answer: A

Solution:

In the reaction



Question64

In which of the following reactions, hydrogen peroxide acts as an oxidizing agent?
[Online April 8, 2017]

Options:

A. $HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$

B. $I_2 + H_2O_2 + 2OH^- \rightarrow 2I^- + 2H_2O + O_2$

C. $2MnO_4^- + 3H_2O_2 \rightarrow 2MnO_2 + 3O_2 + 2H_2O + 2OH^-$

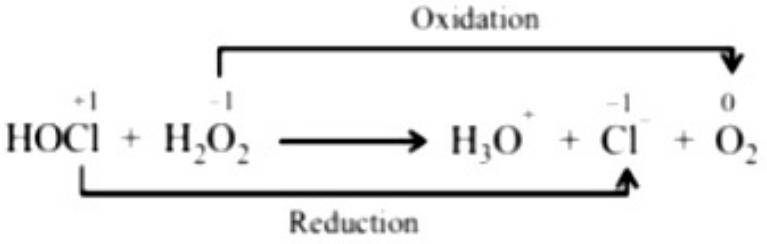
D. $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

Answer: D

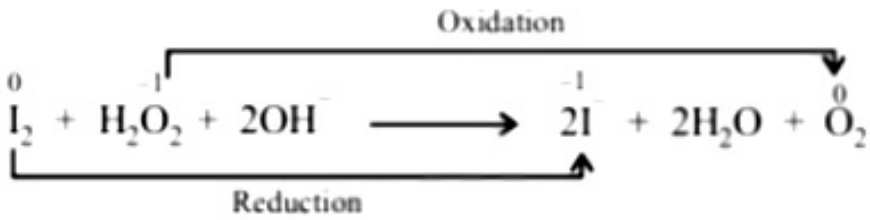
Solution:

Solution:

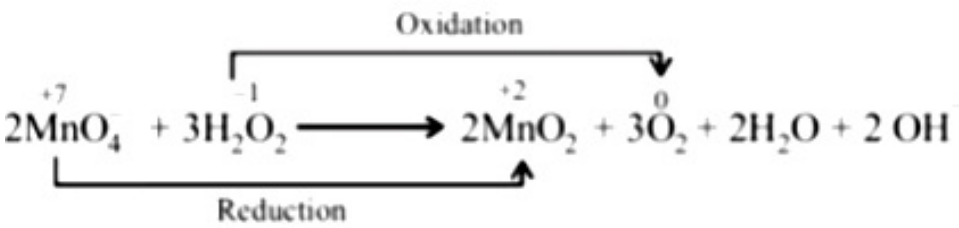
(a)



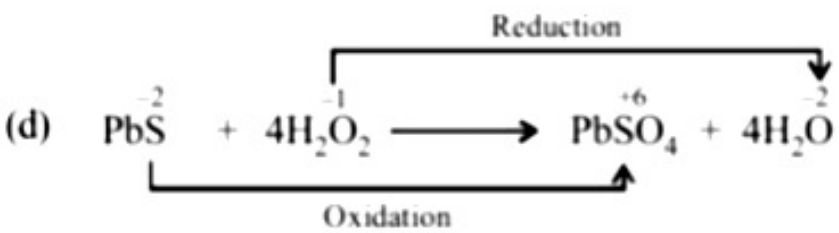
(b)



(c)



(d)



Notice that the oxidation state of oxygen goes from -1 on the H_2O_2 to -2 on the H_2O means H_2O_2 is being reduced. On the other hand the oxidation state of sulfur is going from -2 on the PbS to $+6$ on the $PbSO_4$. i.e Sulfur is being oxidised [74]

Question65

Copper becomes green when exposed to moist air for a long period. This is due to:
[Online April 12,2014]

Options:

A. the formation of a layer of cupric oxide on the surface of copper.

B. the formation of a layer of basic carbonate of copper on the surface of copper.

C. the formation of a layer of cupric hydroxide on the surface of copper.

D. the formation of basic copper sulphate layer on the surface of the metal.

Answer: B

Solution:

Copper when exposed to moist air having CO_2. It gets superficially coated with a green layer of basic carbonate $CuCO_3 . Cu(OH)_2$

Question66

Amongst the following, identify the species with an atom in +6 oxidation state:
[Online April 19,2014]

Options:

A. $[MnO_4]^-$

B. $[Cr(CN)_6]^{3-}$

C. Cr_2O_3

D. CrO_2Cl_2

Answer: D

Solution:

CrO_2Cl_2
Let O. No. of Cr = x
$\therefore x + 2(-2) + 2(-1) = 0$
$x - 4 - 2 = 0$
$\therefore x = +6$

Question67

How many electrons are involved in the following redox reaction?

$Cr_2O_7^{2-} + Fe^{2+} + C_2O_4^{2-} \rightarrow Cr^{3+} + Fe^{3+} + CO_2$(Unbalanced)
[Online April 19, 2014]

Options:

A. 3

B. 4

C. 6

D. 5

Answer: A

Solution:

The reaction given is
$Cr_2O_7^{2-} + Fe^{2+} + C_2O_4^{2-} \longrightarrow Cr^{3+} + Fe^{3+} + CO_2$
$Cr_2O_7^{2-} \longrightarrow 2Cr^{3+}$
On balancing
$14H^+ + Cr_2O_7^{2-} + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$ . . . (i)
$Fe^{2+} \longrightarrow Fe^{3+} + e^-$ . . . (ii)
$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^-$ . . . (iii)
On adding all three equations, we get
$Cr_2O_7^{2-} + Fe^{2+} + C_2O_4^{2-} + 14H^+ + 3e^-$
$\rightarrow 2Cr^{3+} + Fe^{3+} + 2CO_2 + 7H_2O$
Hence the total no. of electrons involved in the reaction = 3

Question68

Consider the reaction:
$H_2SO_3(aq) + Sn^{4+}(aq) + H_2O(1)$
$\rightarrow Sn^{2+}(aq) + HSO_4^-(aq) + 3H^+(aq)$Which of the following statements is correct?
[Online April 19, 2014]

Options:

A. Sn^{4+} is the oxidizing agent because it undergoes oxidation

B. Sn^{4+} is the reducing agent because it undergoes oxidation

C. H_2SO_3 is the reducing agent because it undergoes oxidation

D. H_2SO_3 is the reducing agent because it undergoes reduction

Answer: C

Solution:

Solution:
If an electronegative element is in its lowest possible oxidation state in a compound or in free state. It can function as a

powerful reducing agent. e.g. I^-

Question69

Oxidation state of sulphur in anions SO_3^{2-}, $S_2O_4^{2-}$ and $S_2O_6^{2-}$ increases in the orders :
[Online April 22, 2013]

Options:

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

B. $SO_6^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$

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

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

Answer: C

Solution:

In SO_3^{2-}
$x + 3(-2) = -2$; $x = +4$
In $S_2O_4^{2-}$
$2x + 4(-2) = -2$
$2x - 8 = -2$
$2x = 6$; $x = +3$
In $S_2O_6^{2-}$
$2x + 6(-2) = -2$
$2x = 10$; $x = +5$
hence the correct order is
$S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$

Question70

Given:
$X\,Na_2HAsO_3 + Y\,NaBrO_3 + Z\,HCl \rightarrow$
$NaBr + H_3AsO_4 + NaCl$
The values of X , Y and Z in the above redox reaction are respectively :
[Online April 9, 2013]

Options:

A. 2, 1, 2

B. 2, 1, 3

C. 3, 1, 6

D. 3, 1, 4

Answer: C

Solution:

Solution:
On balancing the given reaction, we find
$3Na_2HAsO_3 + NaBrO_3 + 6HCl \longrightarrow 6NaCl + 3H_3AsO_4 + NaBr$

Question71

Which one of the following cannot function as an oxidising agent? [Online April 25, 2013]

Options:

A. I^-

B. S(s)

C. NO_3^-(aq)

D. $Cr_2O_7^{2-}$

Answer: A

Solution:

Solution:
If an electronegative element is in its lowest possible oxidation state in a compound or in free state. It can function as a powerful reducing agent. e.g. I^-

---

Question72

In the following balanced reaction, $XMnO_4^- + YC_2O_4^{2-} + ZH^+ \rightleftharpoons XMn^{2+} + 2YCO_2 + \frac{Z}{2}H_2O$ values of X, Y and Z respectively are [Online May 12, 2012; 2013]

Options:

A. 2, 5, 16

B. 8, 2, 5

C. 5, 2, 16

D. 5, 8, 4

Answer: A

Solution:

(a) $X\,MnO_4^- + Y\,C_2O_4^{2-} + Z\,H^+ \rightleftharpoons X\,Mn^{+2} + 2Y\,CO_2 + \frac{Z}{2}H_2O$

First half reaction $MnO_4^- \longrightarrow Mn^{2+}$ .... (i)

On balancing

$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$..... (ii)

Second half reaction

$C_2O_4^{2-} \longrightarrow 2CO_2$ . . . . .(iii)

On balancing

$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^-$ ... (iv)

On multiplying eqn. (ii) by 5 and (iv) by 2 and then adding we get

$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

Question73

Which of the following chemical reactions depict the oxidizing behavior of H_2SO_4 ?

[2006]

Options:

A. $NaCl + H_2SO_4 \longrightarrow NaHSO_4 + HCl$

B. $2PCl_5 + H_2SO_4 \longrightarrow 2POCl_3 + 2HCl + SO_2Cl_2$

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

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

Answer: C

Solution:

Solution:

$\overset{-1}{2HI} + H_2\overset{+6}{S}O_4 \longrightarrow \overset{0}{I_2} + \overset{+4}{S}O_2 + 2H_2O$

in this reaction oxidation number of S is decreasing from + 6 to +4 hence undergoing reduction and for HI oxidation number of I is increasing from −1 to 0 hence underegoing oxidation, therefore H_2SO_4 is acting as oxidising agent.

Question74

Several blocks of magnesium are fixed to the bottom of a ship to

[2003]

Options:

A. make the ship lighter

B. prevent action of water and salt

C. prevent puncturing by under-sea rocks

D. keep away the sharks

Answer: B

Solution:

Magnesium provides cathodic protection and prevents rusting or corrosion.

Question75

Which of the following is a redox reaction? [2002]

Options:

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

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

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

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

Answer: D

Solution: