

Redox Reactions

Question 1.

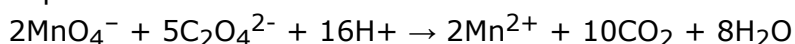
KMnO₄ reacts with oxalic acid according to the equation $2\text{MnO}_4^- + 5\text{C}_2\text{O}_4^{2-} + 16\text{H}^+ \rightarrow 2\text{Mn}^{2+} + 10\text{CO}_2 + 8\text{H}_2\text{O}$ Here 20 mL of 0.1 M KMnO₄ is equivalent to

- (a) 50 mL of 0.5 M C₂H₂O₄
- (b) 20 mL of 0.1 M C₂H₂O₄
- (c) 20 mL of 0.5 M C₂H₂O₄
- (d) 50 mL of 0.1 M C₂H₂O₄

▼ Answer

Answer: (d) 50 mL of 0.1 M C₂H₂O₄

Explanation:



Therefore, 2 moles of MnO₄⁻ equivalent to 5 moles of C₂O₄²⁻

20 mL of 0.1 M KMnO₄ = 2 moles of KMnO₄

Also, 50 mL of 0.1 M C₂H₂O₄ equivalent to 5 mol of C₂O₄²⁻

Therefore, these are equivalent.

Question 2.

Which of the following is a redox reaction?

- (a) $\text{NaCl} + \text{KNO}_3 \rightarrow \text{NaNO}_3 + \text{KCl}$
- (b) $\text{Mg}(\text{OH})_2 + 2\text{NH}_4\text{Cl} \rightarrow \text{MgCl}_2 + 2\text{NH}_4\text{OH}$
- (c) $\text{CaC}_2\text{O}_4 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{C}_2\text{O}_4$
- (d) $2\text{Zn} + 2\text{AgCN} \rightarrow 2\text{Ag} + \text{Zn}(\text{CN})_2$

▼ Answer

Answer: (d) $2\text{Zn} + 2\text{AgCN} \rightarrow 2\text{Ag} + \text{Zn}(\text{CN})_2$

Explanation:

In all the three reaction there is no change in the oxidation states. These are simple ionic reactions.

But in $2\text{Zn} + 2\text{AgCN} \rightarrow 2\text{Ag} + \text{Zn}(\text{CN})_2$ there is a change in oxidation state. Ag gains electrons and Zn lose electrons therefore it is a redox reaction.

Question 3.

The reduction potential values of M, N and O are +2.46 V, -1.13 V, -3.13 V respectively. Which of the following orders is correct regarding their reducing property?

- (a) $\text{O} > \text{N} > \text{M}$
- (b) $\text{M} > \text{O} > \text{N}$
- (c) $\text{M} > \text{N} > \text{O}$
- (d) $\text{O} > \text{M} > \text{N}$

▼ Answer

Answer: (d) $\text{O} > \text{M} > \text{N}$

Explanation:

Given Reduction Potential:

$\text{M} \rightarrow +2.46\text{V}$

$\text{N} \rightarrow +1.13\text{V}$

$\text{O} \rightarrow -3.13\text{V}$

We know that the electrode which has more reduction potential is a good oxidizing agent and has

least reducing power.

While the electrode which has less reduction potential, it has more reducing power.

Therefore, Order of reducing power is: $-O > M > N$

Question 4.

Which of the following processes does not involve either oxidation or reduction?

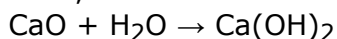
- (a) Formation of slaked lime from quick lime
- (b) Heating Mercuric Oxide
- (c) Formation of Manganese Chloride from Manganese oxide
- (d) Formation of Zinc from Zinc blende

▼ Answer

Answer: (a) Formation of slaked lime from quick lime

Explanation:

Here, in this reaction



Oxidation number doesn't change so it's not a redox reaction.

Question 5.

The number of moles of KMnO_4 reduced by one mole of KI in alkaline medium is

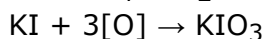
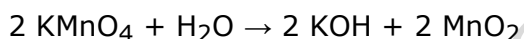
- (a) One
- (b) Two
- (c) Five
- (d) One fifth.

▼ Answer

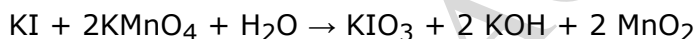
Answer: (b) Two

Explanation:

In alkaline medium the reduction of KMnO_4 with KI will take place as



Hence the overall reaction is



So, one mole of KI will reduce two moles of KMnO_4

Question 6.

What is known as Autooxidation?

- (a) Formation of H_2O by the oxidation of H_2O_2 .
- (b) Formation of H_2O_2 by the oxidation of H_2O .
- (c) Both (1) and (2) are true
- (d) None of the above

▼ Answer

Answer: (b) Formation of H_2O_2 by the oxidation of H_2O .

Explanation:

Autooxidation is any oxidation that occurs in presence of oxygen. The term is usually used to describe the degradation of organic compounds in air (as a source of oxygen). Autooxidation produces hydroperoxides and cyclic organic peroxides. These species can react further to form many products. The process is relevant to many phenomena including aging, paint, and spoilage of foods, degradation of petrochemicals, and the industrial production of chemicals. Autooxidation is important because it is a useful reaction for converting compounds to oxygenated derivatives, and also because it occurs in situations where it is not desired (as in the destructive cracking of the

rubber in automobile tires or in rancidification). Water automatically gets oxidised to hydrogen peroxide.

Question 7.

Which of the following statements regarding sulphur is incorrect ?

- (a) S_2 molecule is paramagnetic.
- (b) The vapour at 200°C consists mostly of S_8 rings.
- (c) At 600°C the gas mainly consists of S_2 molecules.
- (d) The oxidation state of sulphur is never less than +4 in its compounds.

▼ Answer

Answer: (d) The oxidation state of sulphur is never less than +4 in its compounds.

Explanation:

Oxidation state of oxygen family

Oxygen shows -2, +2 and -1

Oxidation states other elements show +2, +4 and +6 oxidation states

In H_2S , the oxidation state of S is -2. Oxidation state of S lie between -2 to +6.

Option 1)

S_2 molecule is paramagnetic.

This option is incorrect.

Option 2)

The vapour at 200°C consists mostly of S_8 rings.

This option is incorrect.

Option 3)

At 600°C the gas mainly consists of S_2 molecules.

This option is incorrect.

Option 4)

The oxidation state of sulphur is never less than +4 in its compounds.

This option is correct.

Question 8.

The oxidation number of Xe in $BaXeO_6$ is

- (a) 8
- (b) 6
- (c) 4
- (d) 10

▼ Answer

Answer: (d) 10

Explanation:

Oxidation state of Ba in general = +2 and of O = -2

Applying formula, Sum of total oxidation state of all atoms = Overall charge on the compound.

Let oxidation state of Xe in $BaXeO_6$ be x.

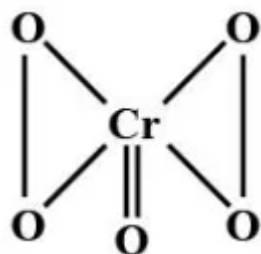
$$2 + x + 6(-2) = 0,$$

$$x = 10$$

But oxidation state 10 is not possible for Xe. In this case the oxidation state of Xe is equal to maximum possible oxidation state for Xe = +8.

Question 9.

CrO_5 has structure as shown, The oxidation number of chromium in the compound is?



- (a) +10
- (b) +6
- (c) +4
- (d) +5

▼ Answer

Answer: (b) +6

Explanation:

From the above structure we can observe that 4 oxygen atoms are linked by peroxide linkage. So their oxidation state is -1 as in peroxide.

One oxygen atom is attached normally so its oxidation state is -2. So oxidation state of Cr is $x + 4(-1) + (-2) = 0$, $x = +6$

Question 10.

Pure water is bad conductor of electricity because

- (a) It has high boiling point
- (b) It is almost unionised
- (c) Its molecules are associated with H- bonds
- (d) Its pH is 7 at 25°C

▼ Answer

Answer: (b) It is almost unionised

Explanation:

Distilled water is a poor conductor of electricity because it does not contain any dissolved salts in it which can provide it ions to conduct electricity. Impurities in water get ionised to conduct electricity. Hence pure water cannot conduct electricity.

Question 11.

The oxidation process involves

- (a) Increase in oxidation number
- (b) Decrease in oxidation number
- (c) No change in oxidation number
- (d) none of the above

▼ Answer

Answer: (a) Increase in oxidation number

Explanation:

Oxidation process Involves:-

Addition of O_2 or electronegative element

Removal of H/ electropositive element

Loss of electrons

Increase in oxidation number

Question 12.

The ionic mobility of alkali metal ions in aqueous solution is maximum for

- (a) Li^+

- (b) Na^+
- (c) K^+
- (d) Rb^+

▼ Answer

Answer: (d) Rb^+

Explanation:

The smaller is the ion, the more is hydration, the larger is size, lesser is the mobility.

Question 13.

Pure water is bad conductor of electricity because

- (a) It has high boiling point
- (b) It is almost unionised
- (c) Its molecules are associated with H- bonds
- (d) Its pH is 7 at 25°C

▼ Answer

Answer: (b) It is almost unionised

Explanation:

Distilled water is a poor conductor of electricity because it does not contain any dissolved salts in it which can provide it ions to conduct electricity.

Impurities in water get ionised to conduct electricity. Hence pure water cannot conduct electricity.

Question 14.

The oxidation number of Fe in $\text{K}_4[\text{Fe}(\text{CN})_6]$ is

- (a) 3
- (b) 4
- (c) 2
- (d) Zero

▼ Answer

Answer: (c) 2

Explanation:

The oxidation number of Fe in $\text{K}_4[\text{Fe}(\text{CN})_6]$ can be calculated as follows,

Oxidation state of K = 1, CN = -1.

Let Oxidation state of Fe be x. so

$$4(+1) + x + 6(-1) = 0$$

Hence $x = +2$

Question 15.

A standard hydrogen electrode has zero electrode potential because

- (a) Hydrogen is easiest to oxidise
- (b) This electrode potential is assumed to be zero
- (c) Hydrogen atom has only one electron
- (d) Hydrogen is the lightest element

▼ Answer

Answer: (b) This electrode potential is assumed to be zero

Explanation:

The electrode potential of a standard hydrogen electrode is arbitrarily assumed to be zero.

Question 16.

Burning of lime to give calcium oxide and carbon dioxide is

- (a) An Oxidation Process
- (b) A Reduction Process
- (c) Disproportionation
- (d) Decomposition.

▼ Answer

Answer: (d) Decomposition.

Explanation:

Lime water formula is Calcium hydroxide (Ca(OH)_2)

Ca(OH)_2 in the presence of excess heat gives calcium oxide (CaO), Carbon dioxide (CO_2), and water (H_2O).

In this process excess of heat is given and lime water breaks down in different compounds, therefore it undergoes Thermal decomposition reaction.

Question 17.

The colourless solution of silver nitrate slowly turns blue on adding copper chips to it because of

- (a) Dissolution of Copper
- (b) Oxidation of $\text{Ag}^+ \rightarrow \text{Ag}$
- (c) Reduction of Cu^{2+} ions
- (d) Oxidation of Cu atoms.

▼ Answer

Answer: (d) Oxidation of Cu atoms.

Explanation:

When copper turnings are added to silver nitrate solution, the solution becomes brown in color after sometime because copper is more reactive than silver so it displaces silver from silver nitrate solution and forms copper nitrate solution.

Question 18.

The oxidation number of carbon in CH_2Cl_2 is

- (a) 0
- (b) +2
- (c) +3
- (d) +5

▼ Answer

Answer: (a) 0

Explanation:

The oxidation state of carbon in dichloromethane as x.

Also the charges on H and Cl are +1 and -1 respectively.

Therefore, $\text{CH}_2\text{Cl}_2 \rightarrow x + 2(+1) + 2(-1) = 0$

$\Rightarrow x = 0$

Question 19.

The oxidation state of I in IPO_4 is

- (a) +1
- (b) +3
- (c) +5
- (d) +7

▼ Answer

Answer: (b) +3

Explanation:

Let oxidation state of iodine be x .

$$x - 3 = 0, x = +3,$$

Because PO_4^{3-} has combined oxidation number -3 .

$$\text{Therefore, } x - 3 = 0$$

$$\therefore x = +3$$

Thus oxidation state of iodine is +3.

Question 20.

The relationship between electrode potentials and concentrations of the substances involved in half cell reaction is given by

- (a) Habers process
- (b) Hess Law
- (c) Nernst Equation
- (d) None of the Above

▼ Answer

Answer: (c) Nernst Equation

Explanation:

The relationship between electrode potentials and concentrations of the substances involved in half cell reaction is given by Nernst Equation.

$$E = E^\circ - (2.303RT)/(nF) \log[M^{n+}]/[M]$$

Where

E = cell potential (V) under specific conditions

E° = cell potential at standard-state conditions

R = ideal gas constant = $8.314 \text{ J/mol}^\circ\text{K}$

T = temperature (kelvin), which is generally 25°C (298 K)

n = number of moles of electrons transferred in the balanced equation

F = Faradays constant, the charge on a mole of electrons = $95,484.56 \text{ C/mol}$

$[M]$ and $[M^{n+}]$ are molar concentrations of element and its cation resp.
