Redox Reactions

Question 1.
KMnO4 reacts with oxalic acid according to the equation $2MnO_4^- + 5C_2O_4^{2-} + 16H+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$ Here 20 mL of 0.1 M $KMnO_4$ is equivalent to
(a) 50 mL of 0.5 M $C_2H_2O_4$
(b) 20 mL of 0.1 M $C_2H_2O_4$
(c) 20 mL of 0.5 M $C_2H_2O_4$
(d) 50 mL of 0.1 M $C_2H_2O_4$

▼ Answer

Answer: (d) 50 mL of 0.1 M$C_2H_2O_4$
Explanation:
$2MnO_4^- + 5C_2O_4^{2-} + 16H+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$
Therefore, 2 moles of MNO_4^- equivalent to 5 moles of $C_2O_4^{2-}$
20 mL of 0.1 M $KMnO_4$ = 2 moles of $KMnO_4$
Also, 50 mL of 0.1 M $C_2H_2O_4$ equivalent to 5 mol of $C_2O_4^{2-}$
Therefore, these are equivalent.

Question 2.
Which of the following is a redox reaction?
(a) $NaCl + KNO_3 \rightarrow NaNO_3 + KCl$
(b) $Mg(OH)_2 + 2NH_4Cl \rightarrow MgCl_2 + 2NH_4OH$
(c) $CaC_2O_4 + 2HCl \rightarrow CaCl_2 + H_2C_2O_4$
(d) $2Zn + 2AgCN \rightarrow 2Ag + Zn(CN)_2$

▼ Answer

Answer: (d) $2Zn + 2AgCN \rightarrow 2Ag + Zn(CN)_2$
Explanation:
In all the three reaction there is no change in the oxidation states. These are simple ionic reactions.
But in $2Zn + 2AgCN \rightarrow 2Ag + Zn(CN)_2$ 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) O > N > M
(b) M > O > N
(c) M > N > O
(d) O > M > N

▼ Answer

Answer: (d) O > M > N
Explanation:
Given Reduction Potential:
$M \rightarrow +2.46V$
$N \rightarrow +1.13V$
$O \rightarrow -3.13V$
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
$CaO + H_2O \rightarrow Ca(OH)_2$
Oxidation number doesnt change so its 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 takes place as
$2\ KMnO_4 + H_2O \rightarrow 2\ KOH + 2\ MnO_2$
$KI + 3[O] \rightarrow KIO_3$
Hence the overall reaction is
$KI + 2KMnO_4 + H_2O \rightarrow KIO_3 + 2\ KOH + 2\ MnO_2$
So, one mole of KI will reduced 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:
Autoxidation 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). Autoxidation 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. Autoxidation 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

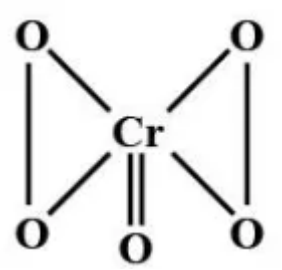
Answer: (d) The oxidation state of sulphur is never less than +4 in its compounds.
Explanation:
Oxidation state of oxygen family
Oxygen shows -2, +2 and -1
Oxidation states other elements show +2, +4 and +6 oxidation states
In H_2S, the oxidation state of S is -2. Oxidation state of S lie between -2 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 there 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 K_4 [Fe $(CN)_6$] is
(a) 3
(b) 4
(c) 2
(d) Zero

▼ Answer

Answer: (c) 2
Explanation:
The oxidation number of Fe in K_4 Fe $(CN)_6$ 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 $Ag^+ \rightarrow Ag$
(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 form copper nitrate solution.

Question 18.
The oxidation number of carbon in $CH_2\ Cl_2$ 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, $CH_2Cl_2 \rightarrow x + 2(+1) + 2(-1) = 0$
$\Rightarrow x = 0$

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.
Therefore, x − 3 = 0
∴ 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.
$E = E° - (2.303RT)/(nF) \log[M^{n+}]/[M]$
Where
E = cell potential (V) under specific conditions
E°= cell potential at standard-state conditions
R = ideal gas constant = 8.314 J/mol^{-k}
T = temperature (kelvin), which is generally 25C (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 C/mol
[M] and $[M^{n+}]$ are molar concentrations of element and its cation resp.
