**ALVA’S PRE – UNIVERSITY COLLEGE, MOODBIDRI.**

**NEET / JEE CRASH COURSE – 2020**

**DEPARTMENT OF CHEMISTRY**

**TOPIC – REDOX & ELECTROCHEMISTRY**

**By – SD**

1. 0.1 M solution of an electrolyte Aplaced in a conductivity cell with electrodes 4 cm apart and each with area of cross - section equal to 2 sq.cm was found to have a resistance of 200 . The molar conductivity of the solution will be :

1) 25 2) 100 3) 0.25 4) 4000

**Ans : 2 k =  **

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**= 100 **

1. Given . The potential for the cell :

Cr|Cr3+ (0.1 M) || Fe2+ (0.01 M)|Fe is :

1) 0.26 V 2) 0.339 V 3) − 0.399 V 4) − 0.27 V

**Ans : 1 **

**= − 0.42 − (− 0.72) = 0.30 V**

**For the given cell, the net cell reaction is :**

**2Cr + 3Fe2+→ 3Fe + 2Cr3+**

**Nernst equation : **

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**= 0.30 + 0.01 log 10−4**

**= 0.30 − 0.04 = 0.26 V**

1. The hydrogen electrode is dipped in a solution of pH 3 at 25°C. The potential would be : (then value of 2.303 RT / F is 0.059 V)

1) 0.177 V 2) 0.87 V 3) 0.591 V 4) – 0.177 V

**Ans : 4 At pH = 3 [H]+ = 10-3 M**

**== - 0.177 V**

1. Which is the best description of the behavior of bromine in the reaction given below ?

H2O + Br2 → HOBr + HBr

1) Proton acceptor only. 2) Both oxidized and reduced.

3) Oxidized only. 4) Reduced only.

**Ans : 2 H2O + (0)Br2 → HO(+1)Br + H(-1)Br ; in this reaction the oxidation number of Br2 increases from zero (in Br2) to + 1 (in HOBr) and decreases from zero (in Br2) to - 1 (in HBr). Thus, Br2 is oxidised as well as reduced. Hence, it is a redox reaction.**

1. Hydrogen gas is not liberated when the following metal is added to dil. HCl :

1) Mg 2) Sn 3) Ag4) Zn

**Ans : 3 Highly reactive metal displaces hydrogen.**

1. When KMnO4 acts as an oxidizing agent and ultimately forms MnO4-2, MnO2, Mn2O3 and Mn+2,

then the number of electrons transferred in each case respectively is ……..

1) 3, 5, 7, 1 2) 1, 5, 3, 7 3) 1, 3, 4, 5 4) 4, 3, 1, 5

**Ans : 3**

1. How much charge is required to reduce (a) 1 mole of Al3+ to Al and (b) 1 mole  of Mn7+ to Mn2+respectively are ?

1) 3F, 5F 2)5F, 2F 3)2F, 2F 4)5F, 3F

**Ans : 1**

1. **The reduction reaction is :**

**Al3+ + 3e-  →  Al**

**Thus, 3 mole of electrons are needed to reduce 1 mole of Al3+,**

**Q = 3 × F   = 3 × 96500 = 289500 C**

**(b) The reduction is**

**Mn7+ + 5e- → Mn2+**

**Thus, 5 mole of electrons are needed to reduce 1 mole of Mn7+ to Mn2+,**

**Q = 5 × F   = 5 × 96500 = 48500 coulombs.**

1. In acidic medium, H2O2 changes Cr2O7 -2 to CrO5 which has two (— O — O —) bonds. Oxidation state of Cr in CrO5 is ….

1) +5 2) +3 3) +6 4) –10

**Ans : 3  has butterfly structure having two per oxo bonds.**

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**Per oxo oxygen has –1 oxidation state.**

**Let oxidation state of Cr be '' .**

1. Corrosion of iron is essentially an electrochemical phenomenon where the cell reactions are :

1) Fe is oxidised to Fe2+ and dissolved oxygen in water is reduced to OH–.

2) Fe is oxidised to Fe3+ and H2O is reduced to.

3) Fe is oxidised to Fe2+ and H2O is reduced to .

4) Fe is oxidised to Fe2+ and H2O is reduced to O2.

**Ans : 1 Fe is oxidised to Fe2+ and dissolved oxygen in water is reduced to OH–.**

1. In the disproportionation reaction 3HClO3 → HClO4 + Cl2 + 2O2 + H2O. The equivalent mass of the oxidizing agent (molar mass of HClO3 = 84.45) is ……….

1) 16.89 2) 32.22 3) 84.45 4) 28.15

**Ans : 1 HCl(+5)O3 → HCl(+7)O4 + Cl2(0) ; HCl(+5)O3 → Cl2(0) ; is the reduction reaction, so, HClO3 act as oxidizing agent and equivalent mass = = 16.89**

1. Four colourless salt solutions are placed in separate test tubes and a strip of copper is placed in each. Which solution finally turns blue ?

1) Pb(NO3)2 2) Zn(NO3)2 3) AgNO3 4)Cd(NO3)2

**Ans : 3 Copper is placed above silver in electrochemical series based on**

**reduction potential. So, copper will displace silver from silver nitrate solution.**

**Cu + 2 Ag NO3  Cu(NO3)2  + 2 Ag**

1. When the ion Cr2O7-2 acts as an oxidant in acidic aqueous solution the ion Cr+3 is formed. How many moles of Sn+2 would oxidized to Sn+4 by one mole of Cr2O7-2 ions ?

1) 2/3 2) 3/2 3) 2 4) 3

**Ans : 4 [(+6)Cr2O7-2 + 6e- → 2Cr+3] x 1**

**[Sn+2 → Sn+4 + 2e-] x 3**

1. Given standard electrode potentials ; K+/K = - 2.93 V, Ag+/Ag = 0.80V ,Hg2+/Hg = + 0.79V, Mg2+/Mg = - 2.37V, Cr3+/Cr = - 0.74V, which acts as a better oxidizing agent ?

1) Mg+2 2) Cr3+ 3) Ag+  4) K+

**Ans : 3 Higher the reduction potential value better will be the oxidizing agent.**

1. The oxidation state/s of Cl in CaOCl2 (bleaching powder) is/are :

1) + 1 only. 2) – l only. 3) + l and –l. 4) 0

**Ans : 3 Ca+2 (OCl-) Cl- Ox. St. of Cl are + l and – l.**

1. Resistance of a decinormal solution of a salt occupying a volume between Platinum electrodes

1.8 cm apart and 5.4 cm2 in area was found to be 32 ohm. Equivqlent conductivity of solution in

S cm2 eq-1 is :

1)104.1 S cm2 eq-1  2)10.41 S cm2 eq-1  3)1.041 S cm2 eq-1 4)1041.0 S cm2 eq-1

**Ans : 1 Applying, k = 1/R x l/a =1/32 x1.8/5.4 = 0.01041 S cm-1**

**We know, Λeq = k x1000/normality = 0.01041x1000/(1/10) = 104.1 S cm2 eq-1**

1. Which compound is zero valent metal complex ?

1) [Cu(NH3)4]SO4 2) [Pt(NH3)2­Cl2] 3) [Ni(CO)4] 4) K3[Fe(CN)6]

**Ans : 3 [Cu(NH3)4]SO4 => Cu = +2, [Pt(NH3)2­Cl2] => Pt = +2,**

**[Ni(CO)4] => Ni = 0, K3[Fe(CN)6] => Fe = +3**

1. A student made the following observation s in the laboratory.

(i) Clean Cu metal did not react with 1M Pb(NO3)2 solution.

(ii) Clean Pb metal dissolved in a 1M AgNO3 solution and crystals of Ag metal appeared.

(iii) Clean Ag metal did not react with 1M Cu(NO3)2 solution.

Order of decrease in reducing property of three metals is :

1) Cu, Pb, Ag 2) Cu, Ag, Pb 3) Pb, Cu, Ag. 4) Pb, Ag, Cu.

**Ans : 3 Pb, Cu, Ag.**

1. Equivalent weight of an acid may be expressed as :

1) eq. wt. = mol. wt / acidity. 2) eq. wt × mol. wt. = basicity

3) eq. wt. × basicity = mol. wt. 4) eq. wt. = basicity / mol. wt.

**Ans : 1 Eq. wt. = mol. wt / acidity.**

1. The molar ionic conductivities of NH4+ and OH- at infinite dilution are 72 and 198 ohm-1 cm2 respectively. The molar conductivity of a centinormal NH4OH solution at the same temperature is found to be 9 ohm-1cm2. The percentage dissociation of NH4OH at this concentration will be

1) 3.33% 2) 7.14% 3) 12.5% 4) 4.54%

**Ans : 1 Λm0(NH4OH) = Λ0 NH4+ + Λ0 OH- = 72 +198 = 270 ohm-1 cm2**

**α = Λ m /Λm0 = 9/270 = 1/30 = 3.33%**

1. Oxidation states of P in H4P2O5, H4P2O6, H4P2O7 are respectively :

1) +3, +5, +4 2) +5, +3, +4 3) +5, +4, +3 4) +3, +4, +5

**Ans : 4 +3, +4, +5**

1. The conductivity of 0.001028 mol L-1 acetic acid is 4.95 × 10-5 S cm-1. Calculate its dissociation constant if Λm0for acetic acid is 390.5 S cm2 mol-1 :

1) 1.78 x10-5 mol L-1 2) 1.87x10-5 mol L-1

3) 0.1 78 x10-5 mol L-1 4) 0.0178 x 10-5 mol L-1

**Ans : 1 Λm= k/C= 4.95 x 10-5 S cm-1/0.001023 mol L-1x(1000 cm3/L)**

**=48.38S cm2 mol-1 ;**

**α = Λm/ Λm0 = 48.38/395.5 = 0.1233 ;**

**k = Cα2/(l- α) = 0.001028 x (0.1233)2/0.8767 = 1.78x10-5 mol L-1**

1. Which of the following represents a disproportionation reaction ?

1) Cl2 + 2OH- → ClO- + Cl- + H2O 2) Cu2O + H+ → Cu + Cu2+ + OH-

3) 2HCuCl2 Cu + Cu+2 + 4Cl- + 2H+ 4) All the three above.

**Ans : 4 All the three above.**

1. A current 2.0 A passed for 5hrs through a molten metal salt deposits 22.2g of metal (at. wt = 177). The oxidation state of the metal salt is :

1) +1 2) +2 3) +3 4) +4

**Ans : 3 z = w/Q ; Emetal = = = 59.5**

**Ox. no of the metal =177/59.5 = +3**

1. The efficiency of a fuel cell is given by :

1) ∆G/∆S 2) ∆G/∆H 3) ∆S/∆G 4) ∆H/∆G

**Ans : 2 ∆G/∆H**

1. If molecular weight of Na2S2O3 and I2 are M1 and M2 respectively. Then, what will be the equivalent

weight of Na2S2O3 and I2 in the following reaction : 2S2O3-2 + I2 → S4O6-2 + 2I-

1) M1 and M2  2) M1 and M2 / 2 3) 2 M1 and M2 4)M1 and 2 M2

**Ans : 2 Na2(+2) S2 (-2) O3-2 + I 2 → (2.5)S4 (-2)O6-2 + 2 I-**

**Change in Ox. No. of Sulphur per mole = 0.5 x 2 = 1, so.**

**Eq. wt of Na2S2O3 = M.mass = M1**

**Change in Ox. No. of Iodine per mole = 1 x 2 = 2, so.**

**Eq. wt of I2 = M. mass / 2 = M2 /2**

1. How many Coulombs of electricity are required for the oxidation of one mol of water to oxygen ?

1) 1.93 X105 C 2) 9.65 X104 C 3) 19.3X105 C 4)1.93 X104 C

**Ans : 1 Charge on oxygen is -2**

**E0 = - nF = 2 X 96500 =193000**

**= 1.93X105 C**

1. In the reaction between SO2 and O3,the equivalent weight of ozone is ……

1) The same as its molecular weight. 2) Half the molecular weight.

3) One - third of the molecular eight. 4) One - fourth of the molecular weight.

**Ans : 2 S(+4)O2 + O3 → S(+6)O3 + O2 : this reaction involves 2 electron change.**

**So, equivalent weight = i.e., equivalent weight is half the molecular weight.**

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

Which of the following is strongest reducing agent ?

1) Zn 2) Cr 3) H 4) F2

**Ans : 1 Zn ; With increase in E0 value reducing character increases.**

1. In the reaction : S8 + 12 OH- → 4 S-2 + 2 S2O3-2 + 6 H2O : S has undergone oxidation and reduction.

Which of the following statement is true ?

1) In S-2, sulphur has been oxidized and in S2O3-2, sulphur has been reduced.

2) In S-2, sulphur has been reduced and in S2O3-2, sulphur has been oxidized.

3) In both S-2 and S2O3-2 sulphur has been oxidized.

4) In both S-2 and S2O3-2, sulphur has been reduced.

**Ans : 2 In S-2, sulphur has been reduced and in S2O3-2, sulphur has been oxidized.**

1. For a cell involving one electron E = 0.59V at 298 K, the equilibrium constant for the cell reaction is

[Given that 2.303/F = 0.059V at T 298K] :

1) 1.0 × 102 2) 1.0 × 105 3) 1.0 × 1010 4) 1.0 × 1030

**Ans : 3**

**At equilibrium Ecell=0**

**antilog 10 = 1x1010**

1. Which of the following has maximum number of unpaired electrons ?

1) Mg2+  2) Ti3+  3) V3+ 4) Fe2+

**A**ns **: 4 Fe2+**

1. The higher oxide of an element (E) has the formula EO3. Its hydride contains 2.47% hydrogen, the

element is :

1) Te 2) Se 3) S 4) Si

**Ans : 2 Since the element (E) forms a higher oxide with the formula , EO3, therefore, it must belong to group 16.**

**The hydrides of 16 group are H2S, H2Te, H2Se**

**% of hydrogen in H2S = **

**% of hydrogen in H2Se = **

**% of hydrogen in H2Te = **

**As such Si which lies in group 14 and would form SiO2 as the higher oxide stands rejected.**

1. Standard electrode potential of the three metals X, Y and Z are - 1.2V, + 0.5V and - 3.0V

respectively, the reducing powers of these metals will be :

1) Y > X > Z 2) Z > X > Y 3) X > Y > Z 4) Y > Z > X

**Ans : 2 Higher the reduction potential lesser is the reducing power. i.e.,**

**Z (-3.0) > X (-1.2) > Y (+0.5)**

1. Select the most basic oxide :

1) Mn2O7 2) MnO2 3) MnO 4) Mn2O3

**Ans : 3 MnO**

1. Red hot carbon will remove oxygen from the oxides XO & YO but not from ZO. Y will remove

oxygen from XO. Use this evidence to deduce the order of reactivity of the three metals X, Y and Z, putting the most reactive first :

1) X, Y, Z 2) Z, Y, X 3) Y, X, Z 4) Z, X, Y

**Ans : 2 Carbon is a powerful reducing agent which removes oxygen from X and Y but not from Z .Y is more reactive than X.**

1. Which of the following is isoelectronic with carbon atom ?

1) Na+ 2) Al3+ 3)O2─  4) N+

**Ans : 4 Number of electrons in carbon = 6**

**Number of electrons in N+ = 7 – 1 = 6**

1. A current of 3A was passed for 1 hour through an electrolyte solution of AxBy in water. If 2.977g of

A (atomic weight 106.4) was deposited at cathode and B was a monovalent ion, the formula of electrolyte was :

1) AB 2) A2B 3) AB3 4) AB4

**Ans : 4 W/Ew = It/96500 (Ay++ye- →A)**

**2.977/(106.4/y)=3x1x60x60/96500**

**Therefore y = 4, hence electrolyte is AB4.**

1. In which of the following species, the size of the first species is not more than the second ?

1) Na+, F─ 2) Fe2+, Fe3+ 3) Li, F 4) S, O

**Ans : 1** **Na+ and F─ are isoelectronic ions. Since amongst isoelectronic ions, the size of the anion is larger than that of the cation, therefore, Na+ < F─.**

1. A smuggler could not carry gold by depositing iron on the gold surface, because :

1) Gold has lower std. electrode potential than the iron.

2) Gold has higher std. electrode potential than iron.

3) Iron rusts. 4) Gold is denser.

**Ans : 2 Hence iron cannot be coated on gold.**

1. Identify the least stable ion amongst the following :

1) Li─ 2) Be─ 3)B─ 4) C─

**Ans : 2 Outer electronic configuration of the ions are Li─ (2s2 most stable), Be─ (2s2 2p1 least stable), B─ (2s2 2p2 stable) and C─ (2s2 2p3more stable). As Be─ is obtained from most stable Be (2s2 configuration) by adding one electron, it is least stable and always has the tendency to lose one electron to achieve 2s2 configuration.**

1. Among the one which is not used as a salt bridge in the construction of electrochemical cell :

1) KCl 2) NaCl 3) KNO3 4) NH4NO3

**Ans : 2 Anion and cation should have same mobility.**

1. Outermost shells of two elements X and Y have two and six electrons respectively. If they combine,

the expected formula of compound will be :

1) XY 2) X2Y 3) X2Y3 4) XY2

**Ans : 1 **

**Thus , XY**

1. If the Pb2+concentration is maintained at 1.0M. What is the [Cu2+] when the cell potential drops to

zero ?

E0cell = 0.473V

Pb/Pb2+(1.0M)// Cu2+(1.0 x 10-4)/Cu

1) 1x10-16 M 2) 1x1016 3) 1.0x10-14M 4) 1.0x 1014M

**Ans : 1 Cu2+ +Pb → Pb2++ Cu**

**E = E0-0.0591/2log[Pb2+]/[Cu2+]**

**0 = 0.473–0.0591/2log1/[Cu2+] log1/[Cu2+]=0.473x(2/0.0591) log1/[Cu2+] =16**

**[Cu2+] = 1x 10-16 M.**

1. The ionic conductance of the following cations at a given concentration is in the order :

1) Li+ < Na+ < K+< Rb+  2) Li+ > Na+ > K+ > Rb+

3) Li+ < Na+ > K+> Rb+ 4) Li+ = Na+ < K+ < Rb+

**Ans : 1 Alkali metal ions get hydrated in the order Li + > Na+> K +> Rb+**

**Hence their conductance is in the order of Li + < Na+< K +< Rb+**

1. The standard electrode potentials of f our metals A, B, C and D are –1.2 V, 0.6 V, 0.85 V and

– 0.76 V, respectively. The sequence of deposition of metals on applying potential is :

1) D, A, B, C 2) C, B, D, A 3) B, D, C, A 4) A, C, B, D

**Ans : 2 Higher the value of reduction potential more will be the ease of deposition.**

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