BK BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
SENIOR SECONDARY CO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL

MID-TERM EXAMINATION 2023-24

CHEMISTRY (043)

B K BIRLA CENTRE FOR EDUCATION
(Sarala Birla Group of Schools)

INDIAN PUBLIC SCHOOLS' CONFERENCE

Class : XII

Date : 09/10/23

Admission No:

MARKING SCHEME

Duration : **3 Hrs**

Max. Marks : **70**

Roll No. :

1. (c) $x < z < y$
2. (d) $K_4[Fe(CN)_6]$
3. (b) Electrons move into the cathode
4. (a) Anode to cathode externally
5. (c) Mercury cell
6. (d) $\Delta G° < 0$

7. (a) rate determining step

8. (c) is independent of initial concentration

9. (d) + 7

10. (d) Mn^{2+}

11. (c) Potassium trioxalato aluminate (III)

12. (b) 6

13. (a)

14. (a)

15. (b)

16. (d)

17. Aquatic species need dissolved oxygen for breathing. As solubility of gases decreases with increase of temperature, less oxygen is available in summer in the lake. Hence the aquatic species feel more comfortable in winter (low temperature) when the solubility of oxygen is higher.

18. (a) 3F **1**   (b) 2F 1

19 . (a) 4 times 1 (b) ¼ times 1

                    OR

   Only definition statement in each case

20. fully filled orbital and configuration and vanderwaal forces week   2

21. Write the formulas for the following coordination compounds: 2
    (a) $[Co(NH_3)_4]Cl_3$
    (b) $K_2[Ni(CN)_4]$

22. **Osmosis :** The net spontaneous flow of the solvent molecules from the solvent to the solution or from a less concentrated solution to a more concentrated solution through a semipermeable membrane is called osmosis.

Osmotic pressure : The minimum excess pressure that has to be applied on the solution to prevent the entry of the solvent into the solution through the semipermeable membrane is called the osmotic pressure.

The osmotic pressure method has the advantage that it uses molarities instead of molalities and it can be measured at room temperature.

Henry's law : Henry's law states that "The partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution ", Applications of Henry's law :

To increase the solubility of CO_2 in soft drinks and soda water, the bottle is sealed under high pressure.

To avoid a dangerous medical condition called bends, scuba divers use oxygen diluted with less soluble helium gas.

23. applying Nerst equation Ecell= E°Cell – 0.059/n log Oxidised/reduced 1/2

E^0cell = 1.14V 1/2 Ecell =1.44 V1/2 calculation 1.5

24. **Conductivity:** Conductivity of a solution is defined as the conductance of a solution of 1 cm length and having 1 sq. cm as the area of cross-section. It is represented by K.
Its unit is S cm^{-1}
Molar conductivity : Molar conductivity of a solution at a dilution V is the conductance of all the ions produced from one mole of the electrolyte dissolved in V cm^3 of the solution when the electrodes are 1 cm apart and the area of the electrodes is so large that the whole of the solution is contained between them. It is represented by Λ_m.
Its unit is S cm^2 mol^{-1}
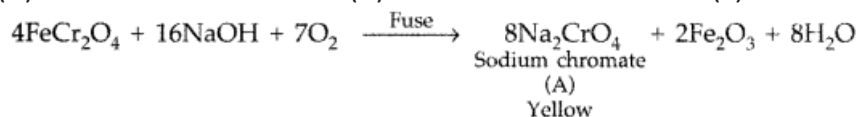Conductivity and molar conductivity of electrolytes increase with increasing temperature.

25. **Order of reaction:** The sum of powers of the concentration of the reactants in the rate law expression is called the order of that chemical reaction.
r = K[A]^x[B]^y Order = x + y
(i) Zero order
(ii) Second order
26. The chromite ore $FeCr_2O_4$ on fusion with NaOH in presence of air, forms a yellow coloured compound
(A) i.e. Sodium chromate.   (B) Sodium dichromate and (c) Potassium dichromate.

$$4FeCr_2O_4 + 16NaOH + 7O_2 \xrightarrow{\text{Fuse}} 8Na_2CrO_4 + 2Fe_2O_3 + 8H_2O$$
$$\underset{\substack{\text{Sodium chromate} \\ \text{(A)} \\ \text{Yellow}}}{}$$

Sodium chromate (A) upon acidification with dilute sulphuric acid gives Sodium dichromate (B).

$$2Na_2CrO_4 + H_2SO_4 \longrightarrow \underset{\substack{\text{Sodium dichromate} \\ \text{(B)}}}{Na_2Cr_2O_7} + Na_2SO_4 + H_2O$$
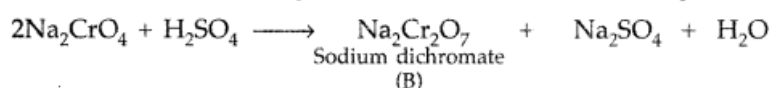
27. Hybridisation Sp^{3}d^2 Octahedral   Paramagnetic high spin outer orbital complex   3

28. (a) dsp2 and sp3 hybridisation

   (b) BaCl2 test

29 (i)   (c) triamminebromidochloridonitroplatinum (IV) chloride
   (ii) **(**b) tetracarbonylnickel(0)
   (iii) (d) diamminetetraaquacobalt(III) chloride.

(iv) (d) diamminetriaquachromium(III) chloride.

30. (i) Order 3 Rate = K $[A]^1[B]^2$

(ii) Rate constant K= rate/$[A]^1[B]^2$ put the value A and B

31. (a) **Corrosion:** Corrosion is defined as the deterioration of a substance because of its reaction with its environment. Corrosion is an electrochemical phenomenon. At a particular spot of an object made of iron, oxidation takes place and that spot behaves as anode and the reaction is

At Anode : $2Fe \rightarrow 2Fe^{+2} + 4e^-$

Electrons released at anodic spot move through the metal and go to another spot on the metal and reduce oxygen in presence of H^+. This spot behaves as cathode

At Cathode : $O_2 + 4H^+ + 4e-$

Overall reaction : $2Fe + O_2 + 4H^+ \rightarrow 2Fe^{+2} + 2H_2O$

(b) Statement and example 1,1

   OR

(a) Lead storage battery is used in inverters.

  At Anode:

  $Pb(s) + SO^{2-}4(aq) \rightarrow PbSO_4 (s) + 2e^-$

  At Cathode:

  $PbO_2(s) + SO^{2-}4(aq) + 4H^+ (aq) + 2e^- \rightarrow PbSO_4 (s) + 2H_2O$

(b)

Quantity of electricity passed

$= (5A) \times (20 \times 60 \, sec.) = 6000C$

$Ni^{2+} + 2e^- \longrightarrow Ni$

Thus, 2F, *i.e.*, $2 \times 96500C$ of charge deposit

$= 1$ mole of $Ni = 58 \cdot 7 \, g$

$\therefore$ 6000 C of charge will deposite

$$= \frac{58 \cdot 7 \times 6000}{2 \times 96500} = 1 \cdot 825 \, g \text{ of } Ni.$$

32(a)

According to formula : $\log \dfrac{k_2}{k_1} = \dfrac{E_a}{2.303R} \left[\dfrac{T_2 - T_1}{T_1 T_2} \right]$

or $\log \dfrac{2.39 \times 10^{-7}}{2.15 \times 10^{-8}} = \dfrac{E_a}{2.303 \times 8.314} \left[\dfrac{700 - 650}{700 \times 650} \right]$

or $\log 1.111 \times 10 = \dfrac{E_a}{19.147} \left[\dfrac{50}{455000} \right]$

or $\log 1.111 + \log 10 = \dfrac{E_a}{19.147} \times \dfrac{50}{455000}$

or $0.0457 + 1 = \dfrac{E_a}{19.147} \times \dfrac{1}{9100}$

or $E_a = 1.0457 \times 19.147 \times 9100$

$\therefore$ $E_a = 1,82,200.36 \, J = \mathbf{182.20 \, KJ}$

(b) any two point of differences

                OR

Answer:

(a) (i) Differential rate equation :

dxdt = rate = K $[A]^1 [B]^2$

(ii) Rate, r_1 = K $[A]^1[B]^2$ .... (i)

When concentration of B is increased three times then

Rate, r_2 = K $[A]^1 [3B]^2$ ....(ii)

Dividing equation (ii) by (i) we get

$r_2 = 9r_1$ rate increases by n*ne times.

(iii) When concentration of both A and B are doubled, then

r_3 = K $[2A]^1 [2B]^2$ .... (iii)

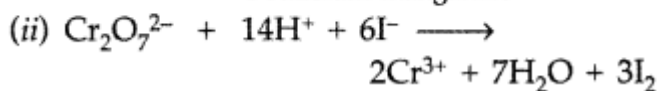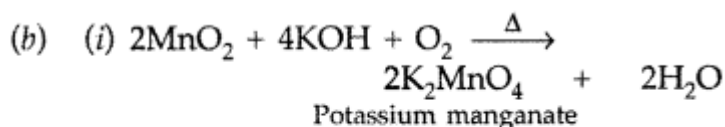Dividing equation {Hi) by (t), we get

$r_3 = 8r_1$

Hence rate increases by eight times.

(b) The number of reacting species (atoms, ions or molecules) taking part in an elementary reaction is called Molecularity of a reaction.

33. (a) (i) Because oxygen stabilizes the highest oxidation state (+7 of Mn) even more than fluorine i.e., +4 since oxygen has the ability to form multiple bonds with metal atoms.

(ii) Cr^{2+} exists in the d^4 system and is easily oxidized to Cr^{3+} by losing one electron which has the stable d^3/t_{2g} orbital configuration. So, Cr^{2+} is a strong reducing agent.

(iii) Cu^{2+} has the configuration $3d^9$ with one unpaired electron which gets excited in the visible region to impart its colour while Zn^{2+} has $3d^{10}$ configuration without any unpaired electron so no d – d transition possible and hence colourless.

(b) (i) $2MnO_2 + 4KOH + O_2 \xrightarrow{\Delta}$
$$2K_2MnO_4 \quad + \quad 2H_2O$$
Potassium manganate

(ii) $Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow$
$$2Cr^{3+} + 7H_2O + 3I_2$$

OR

(a) Account for the following

(i) Zinc in its common oxidation state of +2 has completely filled d-orbitals. Hence it is considered as non-transition elements.

(ii) Because of smaller size of their ions, high ionic charge and availability of vacant d-orbitals, transition metals from a large number of complexes.

(iii) The large positive E° value for Mn^{3+} | Mn^{2+} shows that Mn^{2+} is much more stable than Mn^{3+} due to stable half filled configuration ($3d^5$). Therefore the 3rd ionization energy of Mn will be very high and Mn^{3+} is unstable and can be easily reduced to Mn^{2+}. E° value for Fe^{3+} | Fe^{2+} is positive but small i.e. Fe^{3+} can also be reduced to Fe^{2+} but less easily. Thus Fe^{3+} is more stable than Mn^{3+}.

(b) Account for the following :

(i) The large positive E° value for Mn^{3+} | Mn^{2+} shows that Mn^{2+} is much more stable than Mn^{3+} due to stable half filled configuration ($3d^5$). Therefore the 3rd ionization energy of Mn will be very high and Mn^{3+} is unstable and can be easily reduced to Mn^{2+}. E° value for Fe^{3+} | Fe^{2+} is positive but small i.e. Fe^{3+} can also be reduced to Fe^{2+} but less easily. Thus Fe^{3+} is more stable than Mn^{3+}.

(ii) to acquire t_{2g}^3 configuration.

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