Stoichiometry - II

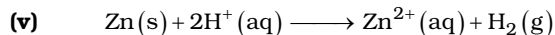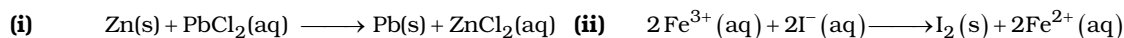| Date Planned : __ / __ / __	Daily Tutorial Sheet	Expected Duration : 90 Min
Actual Date of Attempt : __ / __ / __	Level-0	Exact Duration :_____

Very Short Answer Type (1 Mark)

1. Write the cell reaction and calculate the standard E° of the cell: $Zn | Zn^{2+}(1M) || Cd^{2+}(1M) | Cd$

Given $E°_{Zn|Zn^{2+}} = 0.763\,volt$, $E°_{Cd|Cd^{2+}} = 0.403\,volt$,

2. The e.m.f. (E°) of the following cells are

$Ag | Ag^{+}(1M) || Cu^{2+}(1M) | Cu; E° = -0.46V$, $Zn | Zn^{2+}(1M) || Cu^{2+}(1M) | Cu : E° = +1.10V$

Calculate the e.m.f. of the cell $Zn | Zn^{2+}(1M) || Ag^{+}(1M) | Ag$

3. The standard reduction potentials of two half cells $Al^{3+}(aq) | Al$ and $Mg^{2+}(aq) | Mg$ are $-1.66\,V$ and $-2.36\,V$ respectively. Calculate the standard cell potential. Write the cell reactions also.

4. Calculate standard potential of cell $(E°_{cell})$ by using $E°_{Al^{3+}|Al}$ and $E°_{Cu^{2+}|Cu}$ as $-1.66V$ and $+0.34V$ respectively.

5. Predict reaction of 1N sulphuric acid with following metals : **(i)** copper **(ii)** lead **(iii)** iron

Given $E°_{cu^{2+}|Cu} = 0.34\,volt$; $E°_{Pb^{2+}|Pb} = -0.13\,volt$; $E°_{Fe^{2+}|Fe} = -0.44\,volt$

6. Can a solution of 1 M $ZnSO_4$ be stored in a vessel made of copper ?

(Given that $E°_{Zn|Zn^{2+}} = +0.76\,volt$, and $E°_{Cu^{2+}|Cu} = 0.34\,volt$)

Short Answer Type-I (2 Marks)

7. Is it safe to stir 1 M $AgNO_3$ solution with a copper spoon ?

(Given $E°_{Ag^{+}|Ag} = 0.80\,volt$ and $E°_{Cu|Cu^{2+}} = -0.34V$. Explain)

8. Can we use a copper vessel to store 1 M $AgNO_3$ solution? Given that

$E°_{Cu^{2+}|Cu} = +0.34\,V$ and $E°_{Ag^{+}|Ag} = +0.80\,V$

9. Why blue colour of copper sulphate solution gets discharged when zinc rod is dipped in it ?

(Given $E°_{Cu^{2+}|Cu} = 0.34\,V$ and $E°_{Zn|Zn^{2+}} = 0.76\,V$)

10. What are the maximum and minimum oxidation numbers of N, S and Cl ?

11. Nitric acid acts only as an oxidizing agent while nitrous acid acts both as an oxidizing as well as a reducing agent. Why ?

12. Can the reaction, $Cr_2O_7^{2-} + H_2O \rightleftharpoons 2CrO_4^{2-} + 2H^{+}$ be regarded as a redox reaction ?

13. Write the following redox reactions using half equations.

(i) $Zn(s) + PbCl_2(aq) \longrightarrow Pb(s) + ZnCl_2(aq)$ **(ii)** $2Fe^{3+}(aq) + 2I^-(aq) \longrightarrow I_2(s) + 2Fe^{2+}(aq)$

(iii) $2Na(s) + Cl_2(g) \longrightarrow 2NaCl(s)$ **(iv)** $Mg(s) + Cl_2(g) \longrightarrow MgCl_2(s)$

(v) $Zn(s) + 2H^+(aq) \longrightarrow Zn^{2+}(aq) + H_2(g)$

Short Answer Type-II (3 Marks)

14. The standard electrode potentials at 298 K are given below:

$E^\circ_{Zn^{2+}|Zn} = -0.76V$, $E^\circ_{Fe^{2+}|Fe} = -0.44V$, $E^\circ_{H^+|H_2} = 0.0V$ and $E^\circ_{Cu^{2+}|Cu} = +0.34V$.

Which of the two electrodes should be combined to form a cell having highest EMF? Identify the cathode and the anode and write the cell reaction. Also mention the direction of flow of electrons in the external as well as the internal circuit.

15. An iron rod is immersed in a solution containing 1.0 M $NiSO_4$ and 1.0 M $ZnSO_4$. Predict giving reasons which of the following reactions is likely to proceed ?

(i) Fe reduces Zn^{2+} ions,

(ii) Iron reduces Ni^{2+} ions.

Given : $E^\circ_{Zn^{2+}|Zn} = -0.76V$, $E^\circ_{Fe^{2+}|Fe} = -0.44V$ and $E^\circ_{Ni^{2+}|Ni} = -0.25V$

16. The standard electrode potential of four metallic elements (A, B, C and D) are + 0.80, –0.76, + 0.12 and +0.34 V respectively. Arrange them in order of decreasing electropositive character.

17. I_2 and Br_2 are added to a solution containing Br^- and I^- ions. What reaction will occur if,

$I_2 + 2e^- \longrightarrow 2I^-$; $E^\circ = +0.54V$ and $Br_2 + 2e^- \longrightarrow 2Br^-$; $E^\circ = +1.09\,V$?
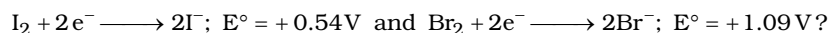
18. Is it possible to store:

(i) Copper sulphate solution in a zinc vessel?

(ii) Copper sulphate solution in a silver vessel?

(iii) Copper sulphate solution in a gold vessel?

Given: $E^\circ_{Cu^{2+}|Cu} = +0.34V$; $E^\circ_{Ag^+|Ag} = +0.80V$ and $E^\circ_{Au^{3+}|Au} = +1.50\,V$

19. How does Cu_2O act as both oxidant and reductant? Explain with proper reactions showing the change of oxidation numbers in each example.

Long Answer Type (5 Marks)

20. Permanganate ion reacts with bromide ion in basic medium to give manganese dioxide and bromate ion. Write the balanced chemical equation for the reaction.

21. Permanganate (VII) ion, in basic solution oxidize iodide ion I^- to produce molecular iodine (I_2) and manganese (IV) oxide (MnO_2). Write a balanced ionic equation to represent this redox reaction.

22. What are the oxidation numbers of the underlined elements in each of the following and how do you rationalize your result?

(a) K<u>I</u>₃ **(b)** H₂<u>S</u>₄O₆ **(c)** <u>Fe</u>₃O₄ **(d)** <u>C</u>H₃<u>C</u>H₂OH **(e)** CH₃<u>C</u>OOH
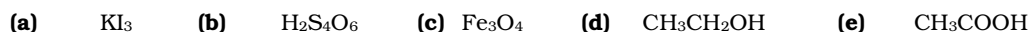
23. The compound AgF_2 is unstable. However, if formed, the compound acts as a very strong oxidizing agent. Why ?

24. How do you count for the following observations ?

    (a) Though alkaline potassium permanganate and acidic potassium permanganate both are used as oxidants, yet in the manufacture of benzoic acid from toluene we use alcoholic potassium permanganate as an oxidant. Why? Write a balanced redox equation for the reaction.

    (b) When concentrated sulphuric acid is added to an inorganic mixture containing chloride, we get pungent smelling gas HCl, but if the mixture contains bromide then we get red vapour of bromine. Why?

25. Given the standard electrode potentials, $K^+ | K = -2.93\,V$, $Ag^+ | Ag = 0.80\,V$, $Hg_2^{2+} | Hg = 0.79\,V$, $Mg^{2+} | Mg = -2.37\,V$, $Cr^{3+} | Cr = -0.74\,V$. Arrange these metals in increasing order of their reducing power.