1. Given : $XNa_2HAsO_3 + YNaBrO_3 + ZHCl \rightarrow NaBr + H_3AsO_4 + NaCl$
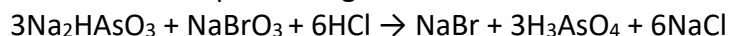**The values of X, Y and Z in the above redox reaction are respectively :**
 (1) 2, 1, 3
(2) 3, 1, 6
(3) 2, 1, 2
(4) 3, 1, 4

Solution:
The balanced equation is given below.
$3Na_2HAsO_3 + NaBrO_3 + 6HCl \rightarrow NaBr + 3H_3AsO_4 + 6NaCl$
The value of X, Y and Z are 3, 1 and 6 respectively.

Hence option (2) is the answer.

2. An alkali is titrated against an acid with methyl orange as an indicator, which of the following is a correct combination?
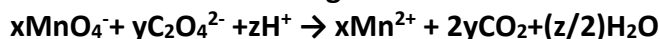
	Base	Acid	Endpoint
1	strong	strong	Pinkish red to yellow
2	weak	strong	Yellow to pinkish-red
3	strong	strong	Pink to colourless
4	weak	strong	Colourless to pink

Solution:
When methyl orange is added to a weak base solution, the solution becomes yellow. When the solution is titrated with a strong acid, after the endpoint, the solution is acidic. So the solution becomes pinkish red.

Hence option (2) is the answer.
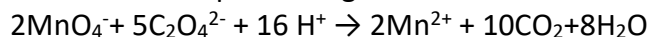
3. Consider the following reaction:
$xMnO_4^- + yC_2O_4^{2-} + zH^+ \rightarrow xMn^{2+} + 2yCO_2 + (z/2)H_2O$
The values of x, y and z in the reaction are respectively :-
(1) 5, 2 and 16
(2) 2, 5 and 8
(3) 2, 5 and 16
(4) 5, 2 and 8

Solution:
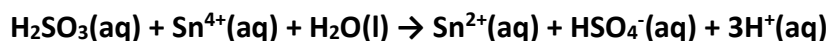The balanced equation is given below.
$2MnO_4^- + 5C_2O_4^{2-} + 16 H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$
The values of x, y and z are 2, 5 and 16, respectively.
Hence option (3) is the answer.

4. Consider the reaction
$H_2SO_3(aq) + Sn^{4+}(aq) + H_2O(l) \rightarrow Sn^{2+}(aq) + HSO_4^-(aq) + 3H^+(aq)$
Which of the following statements is correct?
(1) H_2SO_3 is the reducing agent because it undergoes oxidation
(2) H_2SO_3 is the reducing agent because it undergoes reduction
(3) Sn^{4+} is the reducing agent because it undergoes oxidation
(4) Sn^{4+} is the oxidizing agent because it undergoes oxidation

Solution:
Oxidation is the loss of electrons during a reaction by a molecule. In the given equation, H_2SO_3 is the reducing agent because it undergoes oxidation.

Hence option (1) is the answer.

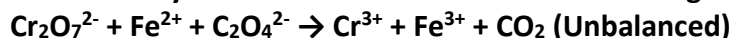**5. In which of the following reaction H_2O_2 acts as a reducing agent ?**
(1) $H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$
(2) $H_2O_2 - 2e^- \rightarrow O_2 + 2H^+$
(3) $H_2O_2 + 2e^- \rightarrow 2OH^-$
(4) $H_2O_2 + 2OH^- - 2e^- \rightarrow O_2 + 2H_2O$
(1) (1), (3)
(2) (2), (4)
(3) (1), (2)
(4) (3), (4)

Solution:
Reducing agent is an element or compound that loses an electron to an electron recipient in a redox chemical reaction. In (2) and (4) , H_2O_2 acts as a reducing agent.

Hence option (2) is the answer.

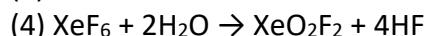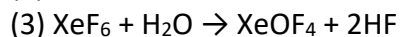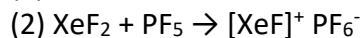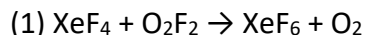**6. How many electrons are involved in the following redox reaction?**
$Cr_2O_7^{2-} + Fe^{2+} + C_2O_4^{2-} \rightarrow Cr^{3+} + Fe^{3+} + CO_2$ (Unbalanced)
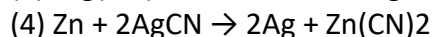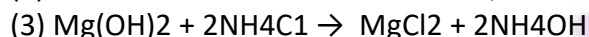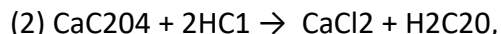(1) 3
(2) 4
(3) 5
(4) 6

Solution:
A redox reaction is any chemical reaction in which the oxidation number of a molecule, atom, or ion changes by gaining or losing an electron. Chromium and iron are involved in the reaction which is oxidised and reduced. So, a total of 6 electrons are involved in this redox reaction.
Hence option (4) is the answer.

7. Which of the following reactions is an example of a redox reaction ?
(1) $XeF_4 + O_2F_2 \rightarrow XeF_6 + O_2$
(2) $XeF_2 + PF_5 \rightarrow [XeF]^+ PF_6^-$
(3) $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$
(4) $XeF_6 + 2H_2O \rightarrow XeO_2F_2 + 4HF$

Solution:
In equation (1) Xe undergoes oxidation and oxygen undergoes reduction.
Hence option (1) is the answer.

8. Which of the following is a redox reaction ?
(1) $NaCl + KNO_3 \rightarrow NaNO_3 + KCl$
(2) $CaC_2O_4 + 2HCl \rightarrow CaCl_2 + H_2C_2O_,$
(3) $Mg(OH)_2 + 2NH_4Cl \rightarrow MgCl_2 + 2NH_4OH$
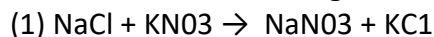(4) $Zn + 2AgCN \rightarrow 2Ag + Zn(CN)_2$

Solution:
A redox reaction is any chemical reaction in which the oxidation number of a molecule, atom, or ion changes by gaining or losing an electron. The oxidation state shows a change only in a reaction between zinc and cyanide.
Hence option (4) is the answer.

9. When $KMnO_4$ acts as an oxidising agent and ultimately forms [MnO_4^{2-}, MnO_2, Mn_2O_3 and Mn^{+2}. Then the number of electrons trans-ferred in each case respectively is
(1) 4, 3, 1, 5
(2) 1, 5, 3, 7
(3) 1,3, 4, 5
(4) 3, 5, 7,1
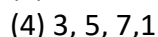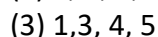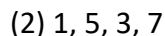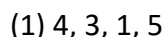
Solution:
The oxidation number of Mn in $KMnO_4$, MnO_4^{2-}, MnO_2, Mn_2O_3 and Mn^{+2} 7, 6, 4, 3 and 2 respectively. The number of electrons transferred corresponds to the change in the oxidation number. When $KMnO_4$ acts as an oxidising agent and ultimately forms MnO_4^{2-}, MnO_2, Mn_2O_3 and Mn^{+2}, then the number of electrons transferred in each case are 1,3,4,5 respectively.

Hence option (3) is the answer.

10. For the redox reaction: $Zn_{(s)} + Cu^{2+}$ (0.1 M)→ Zn^+ (1M) + $Cu_{(s)}$ taking place in a cell, E°cell is 1.10 volt. E_{cell} for the cell will be (2.303 RT / F = 0.0591)
(1) 2.14 V
(2) 1.80 V
(3) 1.07 V
(4) 0.82 V

Solution:
$E_{cell} = E^0_{cell} - (0.0591/n) \log(1/0.1)$
$E^0_{cell} = 1.10$ V
n = 2
$E_{cell} = 1.10 - (0.0591/2) \log(10)$
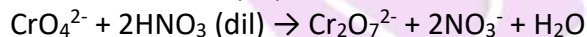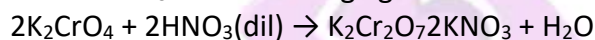= 1.10 - 0.0295
= 1.0705 V
Hence option (3) is the answer.

11. What would happen when a solution of potassium chromate is treated with an excess of dilute nitric acid?
(1) $Cr_2O_7^{2-}$ and H_2O are formed
(2) $Cr_2O_7^{2-}$ is reduced to +3 state of Cr
(3) $Cr_2O_7^{2-}$ is oxidises to +7 state of Cr
(4) Cr^{3+} and $Cr_2O_7^{2-}$ are formed

Solution:
Dilute HNO_3 is an oxidising agent.
$2K_2CrO_4 + 2HNO_3(dil) \rightarrow K_2Cr_2O_72KNO_3 + H_2O$
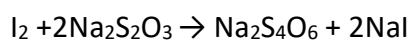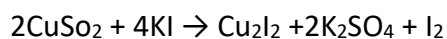$CrO_4^{2-} + 2HNO_3$ (dil) $\rightarrow Cr_2O_7^{2-} + 2NO_3^- + H_2O$
Hence option (1) is the answer.

12. Excess of KI reacts with $CuSO_4$ solution and then $Na_2S_2O_3$solution is added to it. Which of the statements is incorrect for this reaction?
(1) Cu_2I_2 is reduced
(2) Evolved I_2 is reduced
(3) $Na_2S_2O_3$is oxidized
(4) CuI_2 is formed

Solution:
$2CuSo_2 + 4KI \rightarrow Cu_2I_2 + 2K_2SO_4 + I_2$
$I_2 + 2Na_2S_2O_3 \rightarrow Na_2S_4O_6 + 2NaI$
Here statement (4) is incorrect.
Hence option (4) is the answer.

13. The highest electrical conductivity of the following aqueous solutions is of

(1) 1 M acetic acid

(2) 1 M chloroacetic acid

(3) 1 M fluoroacetic acid

(4) 1 M difluoroacetic acid

Solution:

More the acidity more will be the tendency to release protons. So lighter will be the electrical conductivity. Difluoroacetic acid will be the strongest acid because of the electron-withdrawing effect of two fluorine atoms so as it will show maximum electrical conductivity.

Hence option (4) is the answer.

14. Amount of oxalic acid present in a solution can be determined by its titration with KMnO$_4$ solution in the presence of H$_2$SO$_4$. The titration gives unsatisfactory result when carried out in the presence of HCl because HCl

(1) gets oxidised by oxalic acid to chlorine

(2) furnishes H$^+$ ions in addition to those from oxalic acid

(3) reduces permanganate to Mn^{2+}

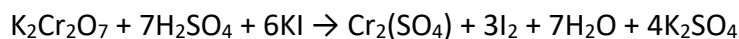(4) Oxidises oxalic acid to carbon dioxide and water

Solution:

HCl is a strong reducing agent. It reduces permanganate to Mn^{2+}.

Hence option (3) is the answer.

15. The oxidation state of chromium in the final product formed by the reaction between KI and acidified potassium dichromate solution is

(1) +4

(2) +6

(3) +2

(4) +3

Solution:

K$_2$Cr$_2$O$_7$ + 7H$_2$SO$_4$ + 6KI → Cr$_2$(SO$_4$) + 3I$_2$ + 7H$_2$O + 4K$_2$SO$_4$

Cr get reduced from +6 Oxidation state to +3 oxidation state.

Hence option (4) is the answer.