1. The oxidation state of V in $Rb_4 Na[H V_{10} O_{28}]$ is
(a) + 2 (b) + 5 (c) – 2 (d) – 5

2. When an alkaline solution of K_2CrO_4 is treated with 3% H_2O_2 solution, red brown paramagnetic peroxochromate is obtained as per following equation.

$2K_2CrO_4 + 7H_2O_2 + 2KOH \rightarrow 2\ K_3CrO_8 + 8\ H_2O$

The equivalent weight of K_2CrO_4 for above transformation must be (assuming M is the molar mass of K_2CrO_4)
(a) $\frac{M}{16}$ (b) M (c) $\frac{M}{12}$ (d) $\frac{M}{2}$

3. In which of the following reaction (s) H_2SO_4 does not act as an acid as well as an oxidant?
(a) $C_{12}H_{22}O_{11} \xrightarrow[-11H_2O]{H_2SO_4(Conc.)} 12\ C$
(b) $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$
(c) $Cu + 2H_2SO_4 \longrightarrow CuSO_4 + SO_2 + 2H_2O$
(d) $NaHCO_3 + H_2SO_4 \longrightarrow NaHSO_4 + H_2O + CO_2$

4. Which of the following is not oxidation & reduction reaction ?
(a) $VO^{2+} \longrightarrow V_2O_3$ (b) $Na \longrightarrow Na^+$
(c) $CrO_4^{2-} \longrightarrow Cr_2O_7^{2-}$ (d) $Zn^{2+} \longrightarrow Zn$

5. What mass of N_2H_4 can be oxidised to N_2 by 24 gm of K_2CrO_4 which is reduced to $Cr(OH)_4^-$?
(a) 2.969 gm (b) 5.25 gm (c) 9.08 gm (d) 29.69 gm

6. Which is not a redox reaction ?
(a) $BaO_2 + H_2SO_4 \rightarrow BaSO_4 + H_2O_2$
(b) $2BaO + O_2 \rightarrow 2BaO_2$
(c) $4KClO_3 \rightarrow 4KClO_2 + 2O_2$
(d) $SO_2 + 2H_2S \rightarrow 2H_2O + 3S$

7. A compound contains atoms X, Y, Z. The oxidation number of X is +2, Y is +5, and Z is –2. The possible formula of the compound is -
(a) XY_1Z_2 (b) $Y_2(XZ_3)_2$ (c) $X_3(YZ_4)_2$ (d) $X_3(Y_4Z)_2$

8. The reaction, $3ClO^-(aq) \rightarrow ClO_3^-(aq) + 2Cl^-(aq)$ is an example of -
(a) Oxidation reaction (b) Reduction reaction
(c) Disproportionation reaction (d) Decomposition reaction

9. Equivalent weight of N_2 in the change
$N_2 \rightarrow NH_3$ is -
(a) 28/6 (b) 28 (c) 28/2 (d) 28/3

10. Which is the reducing agent in the reaction,
$8H^+ + 4NO_3^- + 6Cl^- + Sn(s) \rightarrow SnCl_6^{2-} + 4NO_2 + 4H_2O$?
(a) Sn (s) (b) Cl^- (c) NO_3^- (d) NO_2 (g)

11. Equivalent weight of S in SO_3^{2-} is (S = 32) -
(a) 6 (b) 8 (c) 9 (d) 4

12. Which of the following process represents disproportionation ?
(a) $Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$
(b) $3I_2 + 6OH^- \rightarrow IO_3^- + 5I^- + 3H_2O$
(c) $Cl_2 + I_2 \rightarrow 2ICl$
(d) $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

13. A metallic oxide contains 60% of the metal. The equivalent mass of the metal is -
(a) 12 (b) 24 (c) 48 (d) 72

14. What would happen when a solution of potassium chromate is treated with an excess of dilute HNO_3?
(a) $Cr_2O_7^{2-}$ and H_2O are formed
(b) CrO_4^{2-} is reduced to +3 state of Cr
(c) CrO_4^{2-} is oxidized to +7 state of Cr
(d) Cr^{3+} and $Cr_2O_7^{2-}$ are formed

15. For the redox reaction,

$$MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$$

the correct coefficients of the reactants for the balanced reaction are respectively

$MnO_4^-, C_2O_4^-, H^+$:
(a) 2, 5, 16 (b) 16, 3, 12 (c) 15, 16, 12 (d) 2, 16, 5

16. Which of the following statements is correct regarding redox reactions?
(a) An increase in oxidation number of an element is called reduction.
(b) A decrease in oxidation number of an element is called oxidation.
(c) A reagent which lowers the oxidation number of an element in a given substance is reductant.
(d) A reagent which increases the oxidation number of an element in a given substance is reductant.

17. Which of the following are the common oxidizing agents used in redox titrations?
(a) $K_2Cr_2O_7, KMnO_4$, Iodine
(b) $FeSO_4, KMnO_4$, Sodium thiosulphate
(c) Oxalic acid, $KMnO_4, CuSO_4$
(d) Mohr's salt, KI, sodium sulphate.

18. Which of the following colour changes shown during redox titrations is not correct?
(a) $Cr_2O_7^{2-}$ oxidises the indicator diphenylamine to produce blue colour showing end point.
(b) Iodine formed by oxidation of I^- ions gives blue colour with starch showing end point.
(c) $KMnO_4$ in the form of MnO_4^- ions gives pink colour showing end point.
(d) Thisulphate ions $(S_2O_3^{2-})$ give blue colour showing end point.

19. What will be the products of electrolysis of an aqueous solution of $AgNO_3$ with silver electrodes?
(a) Ag from Ag anode dissolves while Ag^+ from solution gets deposited on cathode.
(b) Ag is liberated at cathode and O_2 is liberated at anode.
(c) Ag at cathode and nitric acid at anode is liberated.
(d) No reaction takes place.

20. Given $E^o_{Ag^+/Ag} = +0.80V; E^o_{Cu^{2+}/Cu} = +0.34V;$
$E^o_{Fe^{3+}Fe^{2+}} = +0.76V; E^o_{Ce^{4+}/Ce^{3+}} = +1.60V$
Which of the following statements is not correct?
(a) Fe^{3+} does not oxidize Ce^{3+}
(b) Cu reduces Ag^+ to Ag.

(c) Ag will reduce Cu^{2+} to Cu.

(d) Fe^{3+} reduces Cu^{2+} to Cu.

21. The more positive the value of E^o the greater is the tendency of the species to get reduced Using the standard electrode potential of redoxx couples given below find out shich of the following is the strongest oxidizing agent.

E^o values:, $Fe^{3+}/Fe^{2+} = +0.77; I_{2(s)}/I^- = +0.54;$

$Cu^{2+}Cu = +0.34; Ag^+/Ag = +0.80\,V$

(a) Fe^{3+} (b) $I_{2(s)}$ (c) Cu^{2+} (d) Ag^+

22. Using the standard electrode potential, find out the pair between which redox reaction is not feasible.

E^o values: $Fe^{3+}/Fe^{2+} = +0.77; I_2/I^- = +0.54;$

$Cu^{2+}/Cu = +0.34; Ag^+/Ag = +0.80\,V$

(a) Fe^{3+} and I^- (b) Ag^+ and Cu

(c) Fe^{3+} and Cu (d) Ag and Fe^{3+}

23. The oxidation number of an element in a compound is evaluated on the basis of certain rules. Which of the following rules is not correct in this respect?

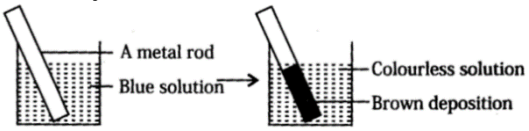
(a) The oxidation number of hydrogen is always + 1

(b) The algebraic sum of all the oxdidation numbers in a compound is zero.

(c) An element in the free or the uncombined state bears oxidation number zero.

(d) In all its compounds, the oxidation number of fluorine is – 1.

24. A redox reaction is shown in the diagrams. Identify the reaction.



(a) $Zn_{(s)} + Cu^{2+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$

(b) $Cu_{(s)} + 2Ag^{+}_{(aq)} \rightarrow Cu^{2+}_{(aq)} + 2Ag_{(s)}$

(c) $2Ag_{(s)} + Cu^{2+}_{(aq)} \rightarrow 2Ag^{+}_{(aq)} + Cu_{(s)}$

(d) $Cu_{(s)} + Zn^{2+}_{(aq)} \rightarrow Cu^{2+}_{(aq)} + Zn_{(s)}$

25. Match the compounds given in column I with oxidation states of carbon given in column II and mark the appropriate choice.

	Column I		**Column II**
(A)	$C_6H_{12}O_6$	(i)	+3
(B)	$CHCl_3$	(ii)	-3
(C)	CH_3CH_3	(iii)	+2
(D)	$(COOH)_2$	(iv)	0

(a) (A) → (iv), (B) → (iii), (C) → (ii), (D) → (i)

(b) (A) → (i), (B) → (ii), (C) → (iii), (D) → (iv)

(c) (A) → (ii),(B) → (iii),(C) → (iv), (D) → (i)

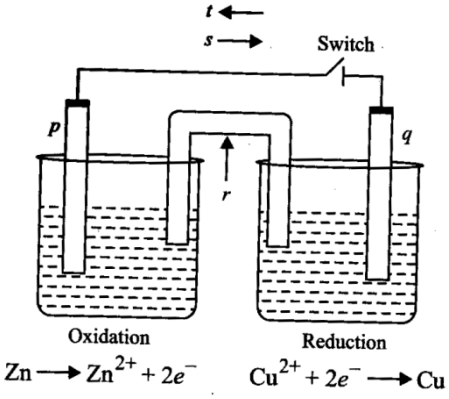
(d) (A) → (iii), (B) → (ii), (C) → (i), (D) → (iv)

26. A compound contains atoms X, Y and Z. The oxdidation number of X is +2, Y is +5 nad Z is -2 The possible formula of the compound is.

(a) XYZ_2 (b) $Y_2(XZ_3)_2$

(c) $X_3(YZ_4)_2$ (d) $X_2(Y_4Z)_2$

27. Given below is the set up for daniell cell. Label p, q, r, s, t in the given figure.



	p	q	r	s	T
(a)	Anode	Cathode	Salt bridge	Electron flow	Current flow
(b)	Cathode	Anode	Salt bridge	Current flow	Electron Flow
(c)	Anode	Cathode	Salt bridge	Current flow	Electron flow
(d)	Cathode	Anode	Salt bridge	Ions flow	Electron flow

28. The E^o values of redox complex of halogens are given. Based on these values mark the correct statement.

$E^o_{I_2/I^-} = +0.54V, E^o_{Br_2/Br^-} = +1.08V;$

$E^o_{Cl_2/Cl^-} = +1.36V,$

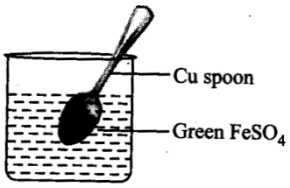
(a) Chlorine can displace bromine and iodine from their satl solutions.

(b) Chlorine can only displace iodine from its salt solution.

(c) Bromine can displace chlorine from its salt solution.

(d) Iodine can displace chlorine and bromine from their salt solutions.

29. If a spoon of copper metal is placed in a solution of $FeSO_4$ what will be the correct observation?



(a) Copper is dissolved in $FeSO_4$ to give brown deposit.

(b) No reaction takes place.

(c) Iron is deposited on copper spoon.

(d) Both copper and iron are precipitated.

30. The largest oxidation number exhibited by an element depends on its outer electronic configuration. With which of the following outer electronic configuration. With which of the following outer electronic configurations the element will exhibit largest oxidation number?

(a) $3d^1 4s^2$ (b) $3d^3 4s^2$ (c) $3d^5 4s^1$ (d) $3d^5 4s^2$

1. (b)

The oxidation state of Rb = +1 (Since it is alkali metals)

Let oxidation state of V = x

$\therefore \quad 4\times1+1+1+10x+28\times(-2)=0$

or $\quad 6+10x-56=0$ or $10x-50=0$ or $x=5$

$\therefore$ The oxidation state of V = +5

2. (b)

Oxidation of Cr in K_3CrO_8 = V

$Cr^{+6} \rightarrow Cr^{+5}$

Equivalent mass = $\frac{M}{1}$

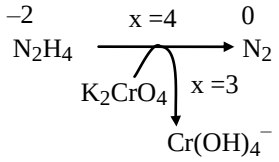
3. (a)

$C_{12}^{0}H_{22}O_{11} \rightarrow 12C^{0}$

4. (c)

O.N. of Cr remain unchanged.

5. (a)



Moles of K_2CrO_4 reacted = $\frac{24}{194}$ moles.

4 moles of K_2CrO_4 reacts with 3 mole of N_2H_4

$\therefore \quad \frac{24}{194}$ moles of K_2CrO_4 reacts with

$\frac{3}{4}\times\frac{24}{194}$ moles of N_2H_4

$\therefore$ amount of N_2H_4 reacted = $\frac{3}{4}\times\frac{24}{194}$ moles

$= \frac{3}{4}\times\frac{24}{194}\times 32$ gm = 2.969 gm

6. (a)

Ox. No. of each element on two sides is same.

7. (c)

Sum of oxidation no. of atoms in it is zero.

8. (c)

Cl atom is oxidized ($Cl^{1+} \rightarrow Cl^{5+} + 4e$) as well as Cl atom is reduced ($Cl^{1+} + 2e \rightarrow Cl^{-}$). Such reactions are called auto redox or disproportionation reactions.

9. (a)

$6e + N_2^0 \rightarrow 2N^{3-}$

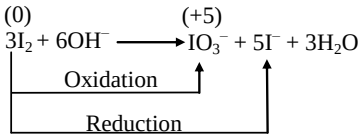
10. (a)

$Sn^0 \rightarrow Sn^{4+} + 4e$

11. (b)

Eq. wt. of S = $\frac{\text{Atomic wt. of S}}{\text{O. No. of S}} = \frac{32}{4} = 8$

12. (b)



13. (a)

Eq. mass of a metal in its oxide

$= \frac{\text{wt. of metal in oxide}}{\text{wt. of O in oxide}} \times 8$

$= \frac{60}{40} \times 8 = 12$

14. (a)

$2CrO_4^{2-} \underset{OH^-}{\overset{2H^+}{\rightleftharpoons}} Cr_2O_7^{2-} + H_2O$

Yellow Orange

15. (a)

$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow$

$2Mn^{2+} + 10CO_2 + 8H_2O$

16. (c): A reagent which lowers the oxidation number of an element in a given substance is reducing agent or reductnt.

17. (a): $K_2Cr_2O_7, KMnO_4$ and iodine are used as oxidizing agents for redox titrations.

18. (d): Thiosulphate ions do not act as indicator and do not indicate end point by change in colour.

19. (a): $AgNO_3 \rightarrow Ag^+ + NO_3^-$ (aqueous solution)

At cathode: $Ag^+_{(aq)} + e^- \rightarrow Ag : E^o = +0.80V$

$2H_2O_{(l)} + 2e^- \rightarrow H_2 + 2OH^-; E^o = -0.83V$

Since reduction potential of Ag^+ is higher than H_2O, Ag^+ anode:

$Ag \rightarrow Ag^+_{(aq)} + e^-; E^o = -0.80V$

$2H_2O \rightarrow O_2 + 4H^+ + 4e^-; E^o = -1.23V$

Since oxidation potential of Ag is higher than H_2O, Ag of silver anode is oxidised. The oxidation potential of NO_3^- is lower than H_2O.

20. (c): Since Ag has higher reduction potential than Cu, Ag will not reduce Cu^{2+} to Cu. Cu can reduce Ag^+ to Ag.

21. (d): Strongest oxidizing agent means it has greater tendency to get reduced. Thus, Ag^+ having more positive E^o value, is the strongest oxidizing agent.

22. (d): For the reaction,

$2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2$

$E^o_{cell} = E^o_{Fe^{3+}/Fe^{2+}} - E^o_{I_2/I^-}$

$= 0.77 - (0.54) = +0.23V$

Here, E^o_{cell} is + ve so, the reaction is feasible. For the reaction,

$Cu + 2Ag^+ \rightarrow Cu^{2+} + 2Ag$

$E^o_{cell} = E^o_{Ag^+/Ag} - E^o_{Cu^{2+}/Cu}$

$= 0.80 - (0.34) = +0.46V$

Here , E^o_{cell} is + ve so, the reaction is feasible. For the reaction,

$2Fe^{3+} + Cu \rightarrow 2Fe^{2+} + Cu^{2+}$

$E^o_{cell} = E^o_{Fe^{3+}/Fe^{2+}} - E^o_{Cu^{2+}/Cu}$

$= 0.77 - (0.80) = -0.03V$

Here, E^o_{cell} is negative so, the reaction is not feasible.

23. (a): Oxidation number of hydrogen may be + 1 or – 1 or 0. For example, in HX it is +1, in hydrides (MH) it is -1 and in H_2 it is 0.

24. (a): Zinc rod dipped in blue copper sulphate solution is oxidised to Zn^{2+} and Cu^{2+} are reduced to Cu and get deposited on zinc rod.

25. (a): $C_6H_{12}O_6 : 6x + 12 + (-12) = 0 \Rightarrow x = 0$

$CHCl_3 : x + 1 + (-3) = 0 \Rightarrow x = +2$

$CH_3CH_3; x + 3 + x + 3 = 0 \Rightarrow x = -3$

$(COOH)_2 : x + x + (-4 \times 2) + (+2) = 0 \Rightarrow x = +3$

26. (c): Sum of the oxidation numbers of atoms in it, is zero.

27. (a): (p) At anode: oxidation takes place.
(q) At cathode: reduction takes place.
(r) Salt bridge for migration of ions.
(s) Electrons flow from anode to cathode.
(t) Current flows from cathode to anode.

28. (a): Since chlorine has higher reduction potential than bromine and iodine so it can displace them from their salt solutions.

$2NaI + Cl_2 \rightarrow 2NaCl + I_2$

$2NaBr + Cl_2 \rightarrow 2NaCl + Br_2$

29. (b): Since reduction potential of copper is higher than iron it does not get oxidised and no reaction takes place.

30. (d): $3d^1 4s^2$ will exhibit +3, $3d^3 4s^2 = 5, 3d^5 4s^1 = +6$ and $3d^5 4s^2 = 7$ oxidation number.