CHEMISTRY – MODULE 9 – SINGLE CHOICE SOLUTIONS

Hydrogen, S-block, Group 13, 14

1. Volume strength = 5.6 × N
2. $H_2O_2 + Cr_2O_4^{-2} + H^+ \rightarrow \underset{\text{Blue coloru}}{Cr_2O_5} + H_2O$
3. (b)

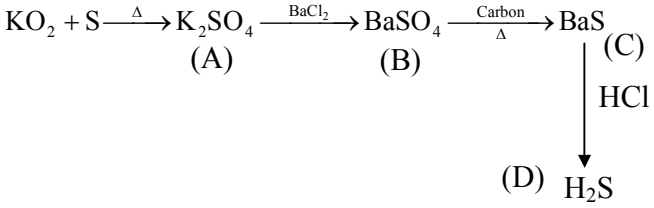
   $H_2SO_4 + PbO_2 \rightarrow PbSO_4 + \frac{1}{2}O_2 + H_2O$ [PbO_2 is not a peroxide]
4. (C). $3SO_2 + O_3 \rightarrow 3SO_3$
5. $\left[Cu(H_2O)_4\right]SO_4.H_2O$
6. Due to stronger hydrogen bonding in D_2O than H_2O
7. in aqueous solution because of high hydration energy of lithium is strong reducing agent but in vapour state, 'Li' is weak reducing agent.
8. Since the discharge potential of sodium is higher than that of hydrogen.
9. $Li, Mg \& Al$ can form nitrides which on hydrolysis form NH_3 $NH_3 + HCl \rightarrow NH_4Cl$ (white fumes).
10. Alkali metals dissolve in liquid ammonia giving deep blue solutions when dilute, due to the presence of ammoniated electrons in the solution
    $M + (x + y)\ NH_3 \rightarrow M^+(NH_3)_x + e^-\ (NH_3)_y$
11. $Na_2CO_3 + SO_2 \rightarrow Na_2SO_3 + CO_2$
12. It is a reason for the given fact.
13. The solubility of the carbonates and bicarbonates increases down the group due to lower lattice energies.
14. Oxides basic strength increases with increase in electopositivity
15. Sodium is reducing agent
16. (A)
    If the difference in size of cation and anion is large then hydration energy will be dominant.
17. because of low hydration energy of barium ion
18. r_- = radius of anion
    r_+ = radius of cation
    Lattice energy $\propto \frac{1}{(r_+ + r_-)^2} \approx \frac{1}{r_-^2}$, as $r_- >> r_+$
    SO_4^{2-} ion being common so lattice energy remains almost the same.
    Hydration energy $\propto \frac{1}{r_+^2} + \frac{1}{r_-^2} \approx \frac{1}{r_+^2}$
    Moving down the Group r_+ increases and hence hydration energy decreases.
19. Thermal stability of alkaline earth metal carbonates increases down the group.
    $BeCO_3 < MgCO_3 > CaCO_3 < SrCO_3 < BaCO_3$
20. $Ca_2B_6O_{11} + 11H_2O + 4SO_2 \rightarrow \underset{\text{(soluble)}}{2Ca(HSO_3)_2} + 6H_3BO_3$

21. Solubility of the hydroxides of alkaline earth metals increase as we move down the group. Since decrease in lattice energy is more than the hydration energy.

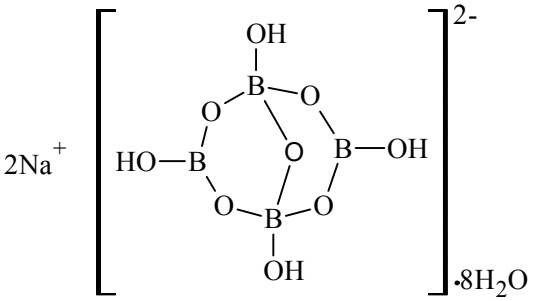
22. Basic strength of oxides order is
$Cs_2O > Rb_2O > K_2O > Na_2O > Li_2O$
For the same alkalimetal, the melting points decreases in the order
NaF > NaCl > NaBr > NaI

23. BeH_2 is covalent.

24. (A)



25.



26. $H_3BO_3 \xrightarrow{100^\circ C} HBO_2 \xrightarrow{160^\circ C} H_2B_4O_7 + H_2O$

$\downarrow$

$2B_2O_3 + H_2O$

27. When Cis – 1, 2 – diols are added to solutions the metaborate ion combines with them to form a stable complex. Thus metaborate is removed from solution which the reaction to proceed in the right side.

28. The general representation of alum is $X_2SO_4\ Y_2(SO_4)_3\ .\ 24H_2O$ where 'x' is monovalent cation and 'y' is trivalent cation.

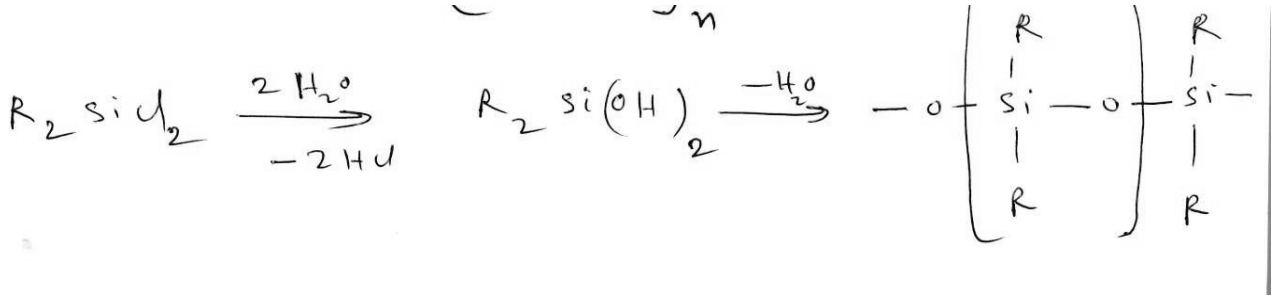
29. Aqueous solution of borax reacts with two moles of acid. This is because of formation of 2 mol each of $[B(OH)_4]^-$ and $B(OH)_3$ are formed in which only $[B(OH)_4]^-$ reacts with acid.

30. Due to ineffective shielding of valence electrons.

31. Diborane undergoes cleavage reactions with Lewis base (L) to give borane adducts (BH_3L)

32. In boric acid, planar BO_3^{-3} units are joined by hydrogen bonds to give a layer structure.

33. Two dimensional sheet structures are formed when three oxygen atoms of each $[SiO_4]^{4-}$ tetrahedral are shared.
34. Pb^{+4} is a stronger oxidising agent because, Pb^{+2} is more stable due to inert pair effect.
35. Two dimensional sheet structures are formed when three oxygen atoms of each $[SiO_4]^{4-}$ tetrahedral are shared.
36. $Si_3O_9^{-6}$ and $Si_6O_{18}^{-12}$
    Charge ratio 1 : 2
37. (A) Due to inert pair effect, Pb^{4+} is a strong oxidizer and hence readily get reduced to Pb^{2+}.
38. Depending upon the number of corners of the SiO_4 tetrahedra shared, various kinds of silicates are formed.
39. Sheet silicates are formed when sharing of 3 oxygen atoms by each tetrahedron and having the empirical formula $[(Si_2O_5)^{-2}]$
40.



CHEMISTRY – MODULE 9 – MULTIPLE CHOICE SOLUTIONS

Hydrogen, S-block, Group 13, 14

1. ABC
   $CHO + H_2 \rightarrow CH + H_2O$
   $2BCl_3 + 6H_2 \rightarrow B_2H_6 + 6HCl$
   $PdCl_2 + H_2 \rightarrow Pd + 2HCl$
2. The raw material used in Solvay's process are brine solution (aq. NaCl) NH_3 lime stone
3. MnO_2 is manganous dioxide.
4. acidic salts can react with bases.
5. Conceptual
6. superoxides are coloured and paramagnetic
   KO_2 – orange
   RbO_2 – brown
7. basic nature of alkalimetal hydroxides increases down the group alkali metal carbonates stability increases down the group.
8. $Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O$
   $ZnO + 2NaOH \longrightarrow Na_2ZnO_2 + H_2O$
   $SnO_2 + 2NaOH \longrightarrow Na_3SnO_3 + H_2O$
   $PbO_2 + 2NaOH \longrightarrow Na_2PbO_3 + H_2O$
9. solubility of hydroxides of alkaline earth metals increases from 'Be' to 'Ba'
10. except $LiHCO_3$ all the bicarbonates of alkali metals exists in solid state.
11. All these are facts
12. Basic berillium acetate, the oxidation state of berillium is +2 and it is a tetrahedral complex and show optical isomerism.
13. Borax on heating with conc. H_2SO_4 or HCl gives H_3BO_3 and H_3BO_3 on heating gives B_2O_3.
    B_2O_3 on reacting with sodium or magnesium like metals (reducing agents) give boron.
    $B_2O_3 + CuO \rightarrow Cu(BO_2)_2$
    Blue
14. Paste of lime in water is called milk of lime, while it's clear filtrate is known as lime water. Chemically either of these is calcium hydroxide.
15. (b), (c) and (d) Explanation : $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$
    $Cao + H_2O \rightarrow Ca(OH)_2$
16.

$$CaCO_3 \xrightarrow{\Delta} \underset{(A)}{CaO} + \underset{(B)}{CO_2}$$

$$\underset{(A)}{CaO} + H_2O \longrightarrow \underset{(C)}{Ca(OH)_2}$$

$$\underset{(C)}{Ca(OH)_2} + (B)CO_2 \longrightarrow \underset{(D)}{CaCO_3} + H_2O$$

$$\underset{(D)}{CaCO_3} + (B)CO_2 \xrightarrow{H_2O} \underset{(E)}{Ca(HCO_3)_2} \xrightarrow[BaCl_2]{Boil} \underset{(F)}{BaCO_3}$$

$$CaCO_3 \xrightarrow{\Delta} \underset{A}{CaO} + \underset{B_{(gas)}}{CO_2}$$

$$\underset{A}{CaO} + H_2O \rightarrow \underset{C}{Ca(OH)_2}$$

$$\underset{C}{Ca(OH)_2} + \underset{B}{CO_2} \rightarrow \underset{D}{CaCO_3} + H_2O$$

(white ppt)

$$\underset{D}{CaCO_3} \xrightarrow{\Delta} \underset{B_{(gas)}}{CO_2} + \underset{E}{Ca(HCO_3)_2} \xrightarrow[BaCl_2]{Boil} \underset{F}{BaCO_3}$$

17. ABC
B – $H_{(terminal)}$ bond length is 119 pm where as
B – $H_{(bridged)}$ bond length is 134 pm

18. $Be_2C + 4H_2O \rightarrow 2Be(OH)_2 + CH_4$
$Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_3 + 3CH_4$

19. $Na_2B_4O_7 + H_2SO_4 + 5H_2O \rightarrow 4H_3BO_3 + Na_2SO_4$
H_3BO_3 is a weak monobasic acid. It does not liberate H^+ ion but accepts OH^- ion and behaves as lewis acid.
$H_3BO_3 + H_2O \rightarrow B(OH)_4^- + H^+$

20.
$$B_2H_6 \xrightarrow{H_2O} H_3BO_3 + H_2$$
$$B_2H_6 \xrightarrow{Na} Na\,BH_4 \xrightarrow{H_2O} NaBO_2 + H_2$$
$$Al(OH)_3 \xrightarrow{3NaOH} Na_3AlO_3 + 3H_2O$$
$$B \xrightarrow[\Delta]{NaOH} Na_3BO_3 + H_2$$

21. borax when heated with NH_4Cl forms boron nitride.
22. Al^{3+} and Zn^{2+} does not respond to borox bead test.
23. All these are facts.
24. Silicates contains R_2 sio units. These are prepared by the hydrolysis of dialkyl dichloro silanes (or) by the hydrolysis of mono alkyl trichloro silanes.
25. All these are facts
26. feldspar is (potassium aluminium silicate, $KAlSi_3O_8$)
    Zeolite is (Sodium aluminium silicate, $Na_2Al_2Si_2O_8$. x H_2O)
27. The attack of water take place on vacant d-orbital of Si and forming a pentavalent intermediate with hybridization of sp^3d. Since the attack is S_N2 the asymmetrical silicon changes its configuration.
28. ABCD
29. Three oxygen atoms of tetrahedral are involved in sharing.
    $\left(Si_2O_5^{2-}\right)_n$ *and* $\left(AlSi_3O_{10}^{-5}\right)_n$
    Spodumene is a chain silicate

30. $[XeO_3F]^-$ has see saw shape (or) K shape.

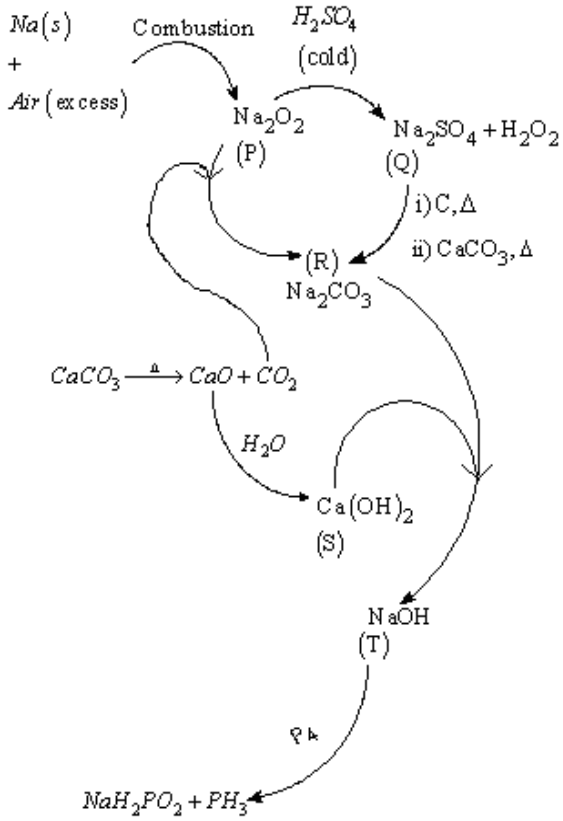
CHEMISTRY – MODULE 9 – PARAGRAPH TYPE SOLUTIONS

Hydrogen, S-block, Group 13, 14

1. $2KMnO_4 + 3H_2SO_4 + 5H_2O_2 \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$

2. $2KMnO_4 + 5H_2O_2 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$
   $K_2Cr_2O_7 + H_2SO_4 + 4H_2O_2 \rightarrow K_2SO_4 + 2CrO_5 + 5H_2O$

3. Given below

4. 

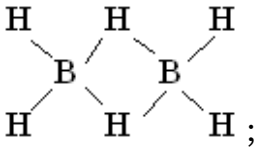
5. Held by hydrogen bonds
6. "Z" is non-planar
7. To prepare chain silicones dialkyl (or) diaryl silianes (R_2SiCl_2) and to prepare cross-linked silicones monoalkyl (or) monoaryl trichloro silanes are used.
8. alkyl/aryl halides treating with Si or $SiCl_4$ gies chlorosilanes.

CHEMISTRY – MODULE 9 – MATRIX MATCH SOLUTIONS

Hydrogen, S-block, Group 13, 14

1. (a – q), (b – r), (c – s), (d – p)

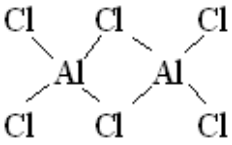
2. a→ p,r,s; b→ p,r,s; c→ p,r,s; d→q,t

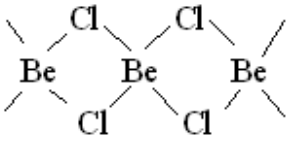


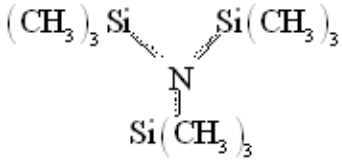
i) sp^3

ii) empty orbital participate in hybridization

iii) two types of bonds covalent & 2 electron and 3 centre bond

II) 

III) 

IV) 

3. Conceptual

CHEMISTRY – MODULE 9 – INTEGER TYPE SOLUTIONS

Hydrogen, S-block, Group 13, 14

1. Acid is $(HPO_3)_n$
2. Conceptual
3. $2Li_2CO_3 \xrightarrow{\Delta} 2Li_2O + 2CO_2$
   $2CaCO_3 \xrightarrow{\Delta} 2CaO + 2CO_2$
   $3Na_2CO_3 \xrightarrow{\Delta} X$
   Except Li_2CO_3 all alkali metal carbonates are thermally stable.
4. In alums two monovalent an two monovalent and two trivalent cations are present. So each cation is coordinated with six water molecules.
5. $SiO_2 + 6HF \longrightarrow H_2SiF_6 + 2H_2O$