Miscellaneous Exercise Question Bank

1.(A) $Mg(HCO_3)_2 \xrightarrow{\Delta} Mg(OH)_2 + H_2O + CO_2$

2.(A) milk of magnesia is $Mg(OH)_2$.

3.(C) Ammoniated electrons are responsible for reducing character.

4.(C) KO_2 absorbs CO_2

$4KO_2 + 2CO_2 \longrightarrow 2K_2CO_3 + 3O_2$

5.(D) All are correct

$\underset{\text{(oxide)}}{Li_2O} + H_2O \longrightarrow LiOH$

$\underset{\text{(peroxide)}}{Na_2O_2} + H_2O \longrightarrow NaOH + H_2O_2$

$\underset{\text{(Superoxide)}}{KO_2} + H_2O \longrightarrow KOH + H_2O_2 + O_2$

6.(D) Element having atomic number 43 is Tc. It belongs to group VII. Group 7, 8 and 9 do not from hydrides.

7.(B) Due to maximum covalent character

8.(C) Interstitial hydrides cannot be used as rocket propellants because they are capable of storing only 2% by weight hydrogen.

9.(C) $\underset{\text{microcosmic salt}}{NaNH_4HPO_4} \xrightarrow{\Delta} NH_3 + H_2O + NaPO_3$

Coloured bead is formed due to $NaPO_3$

10.(ABC) NaOH is hygroscopic and absorbs moisture

11..(ABCD) $BeCl_2$ and $AlCl_3$ are lewis acids due to Vacant orbital.

Both $BeCl_2$ and $AlCl_3$ exist in the form of dimer to overcome electron deficiency.

Be and Al Hydroxides are amphoteric so they are soluble in acid as well as Base.

12..(C) Be and Al show resemblance due to similar charge/size ratio

13.(CD) $NaHCO_3 + NaOH \longrightarrow Na_2CO_3 + H_2O + CO_2$

$NaOH + NaH_2PO_4 \longrightarrow Na_2HPO_4 + H_2O$

So it cannot exist together

14.(C) $Ba + Cl_2 \longrightarrow \underset{\text{(soluble)}}{BaCl_2}$

$BaSO_4$ it insoluble and white in colour

$BaSO_4$ with ZnS from lithopone i.e. $BaSO_4 \cdot ZnS$

15.(ABC) $Mg(OH)_2$, $Al(OH)_3$ and $NaHCO_3$ are used as antacid as they can neutralise the excess acid produced in stomach.

16.(C) EDTA forms complex with Mg^{2+} and Ca^{2+} and hence used in its estimation.

17.(A) $KNO_3 \xrightarrow{\Delta} KNO_2 + O_2$ **18.(A)** $LiAlH_4$ exist as Li^+ and AlH_4^-

19.(CD) Only Ca carbide reacts with water to form acetylene.
Oxide of Be is amphoteric and CaO is basic.

20.(ABD) SiC is covalent

21.(AB) $H_2S_2O_8 + H_2O \longrightarrow 2H_2SO_4 + H_2O_2$

$H_2SO_5 + H_2O \longrightarrow H_2SO_4 + H_2O_2$

22.(ACD) Ortho and para hydrogens are nuclear spin isomers.

23.(BD) $CaH_2 \xrightarrow{H_2O} Ca(OH)_2 + H_2$

$Ca \xrightarrow{H_2O} Ca(OH)_2 + H_2$

24.(D) KNO_3 is used in the manufacture of gupowder.
KO_2 is used as an air purifier in submarines because it absorbs CO_2 gas and librates O_2 gas.
KOH is used in eudiometry as CO_2 & SO_2 absorber.

25.(A) Wavelength of violet colour is less and highly Energetic.

26.(C) $Be(OH)_2$ is amphoteric in nature as it reacts with both acid as well as bases.

27.(D) Solubility of hydroxides of alkaline earth metals increases down the group.

28.(ABC) $BeCl_2$ in vapour phase exist as polymer. Hybrid state of Be in polymeric form of $BeCl_2$ is sp^3.

29.(A) Li_2CO_3 has the least thermal stability.
Thermal stability of carbonates of group-1 increases down the group.

30.(D) In group 1 (Alkali metals), Li reacts with air forming oxide and nitride. Na forms oxide and peroxide. K, Cs, Rb forms oxide, peroxide and superoxide.

31.(C) $Mg_2C_3 + H_2O \longrightarrow Mg(OH)_2 + C_3H_4$

32.(B) The hydration energy of Mg^{2+} is more than that of Na^+ due to high charge density.

33.(D) H_2O_2 is thermally unstable and it decomposes easily

$H_2O_2(\ell) \longrightarrow H_2O(\ell) + \frac{1}{2}O_2(g)$

Its decomposition is catalysed by alkali metals present in traces in the glass of the vessel.

34.(A) $\xleftarrow[\text{Solubility}]{LiI > LiBr > LiCl > LiF}$

35.(C) $CsBr_3$ contains Cs^+ and Br_3^- ions

36.(B) CaC_2 exists as Ca^{2+} and C_2^{2-}

C_2^{2-} has two pi bonds and one sigma bond. (Refer MOT)

37.(AB) Highly pure dilute solution of Na in liq. NH_3 shows blue colouration due to solvated electrons. It is a good conductor of electricity due to the presence of solvated ions and electrons.

38.(D) Solubility of bicarbonates of group-1 increases down the group

39.(A) The complex formation tendency of alkaline earth metals decreases down the group because atomic size increases and zeff. decreases.

40.(ABCD) In $CuSO_4 \cdot 5H_2O$, 4 water molecules are bonded to Cu^{2+} by covalent bonding and 5th water molecule is bonded by hydrogen bonding.

41.(A) $CaSO_4 \xleftarrow[\Delta]{205^\circ} CaSO_4 \cdot 2H_2O \xrightarrow{\Delta,\ 120^\circ C} CaSO_4 \cdot \frac{1}{2}H_2O$

42.(B)
- $BeSO_4$ is water soluble sulphate
- $Be(OH)_2$ is insoluble
- BeO is amphoteric

43.(B) Basicity of oxide of Alkaline Earth Metals increases down the group.

44.(A) KO_2 is paramagnetic.

45.(A) Second ionization energy of Alkali Metal is very high as compared to alkaline Earth Metals.
After losing 1 electron, the alkali Metals attain Noble gas configuration and become highly stable. Thus second IE. of Alkali Metal is very high.

46.(D) Size of aq. Li is very large due to high hydration energy. Due to large size it is a poor conductor of electricity.

47.(C) Learn as a fact

48.(A) This is due to intermolecular hydrogen bonding in liquid and solid phases.

49.(A) Mg can form complexes due to high Zeff and presence of Vacant orbitals

50.(A) $CaNH + 2H_2O \longrightarrow Ca(OH)_2 + \underset{(B)}{NH_3(g)}$

$2NH_3 + 3CaOCl_2 \longrightarrow \underset{(C)}{N_2(g)} + 3CaCl_2 + 3H_2O$

$\underset{(C)}{N_2(g)} + 3Mg \longrightarrow \underset{(D)}{Mg_3N_2}$

$\underset{(D)}{Mg_3N_2} + 6H_2O \longrightarrow 3Mg(OH)_2 + \underset{(B)}{2NH_3}$

51.(C) $Na_2O + H_2O \longrightarrow 2NaOH$

$Cs_2O_2 + 2H_2O \longrightarrow 2CsOH + H_2O_2$

$Na_2O_2 + 2H_2O \longrightarrow 2NaOH + H_2O_2$

$2KO_2 + 2H_2O \longrightarrow 2NaOH + H_2O_2 + O_2$

52.(CD) Na_2CO_3 does not decompose on heating. $NaNO_3$ gives $NaNO_2$ on heating.

53.(ABC) K_2CO_3 cannot be prepared by Solvay process similar to Na_2CO_3 because $KHCO_3$ is more soluble.

54.(ABC) Alkali metal hydrides are ionic

55.(ABCD) Smaller cations form covalent and polymeric hydrides. Higher electro positive metals form ionic hydrides.

56.(B) Plaster of Paris hardens by utilising water.

57.(C) $NaCl + H_2O + SO_2 + O_2 \longrightarrow NaHSO_3$

58.(C) $Be(OH)_2$ as well as BeO being amphoteric reacts with NaOH solution to form $[Be(OH)_4]^{2-}$

59.(BCD) $NaHCO_3 + NaOH \longrightarrow Na_2CO_3 + H_2O$

$NaHCO_3 + NaH \longrightarrow Na_2CO_3 + H_2$

$NaHCO_3 + HCl \longrightarrow NaCl + H_2O$

60.(AD) $BeC_2 + H_2O \longrightarrow Be(OH)_2 + C_2H_2$

C_2H_2 decolourise Br_2 water

$Al_4C_3 + H_2O \longrightarrow Al(OH)_3 + CH_4$

CH_4 does not decolourise bromine water

$Mg_2C_3 + H_2O \longrightarrow Mg(OH)_3 + C_3H_4$

C_3H_4(Propyne) decolourise Br_2 water

61.(A) $LiNO_3 \xrightarrow{\Delta} Li_2O + NO_2 + O_2$

62.(CD) $CaCO_3 \xrightarrow{\Delta} \underset{\text{Basic oxide}}{CaO} + \underset{\text{(Acidic oxide)}}{CO_2}$; $LiNO_3 \longrightarrow \underset{\text{(Basic oxide)}}{Li_2O} + \underset{\text{(Acidic oxide)}}{NO_2} + O_2$

63.(A) Basic nature of oxide $\propto$ metallic character

64.(B) Down the group size increases and therefore, attraction between valence shell electron and nucleus decreases and thus ionisation energy decreases.

65.(D) **(B)** Smaller cation and higher charge attracts more number of water molecules

(C) Periodic property

(D) Except Li^+, due to bigger size they have low hydration enthalpies. Hence except lithium, all alkali metal halides do not form hydrated salts.

66.(A) S_1 : Li^+ being smaller has high polarising power and I^- being larger has high polarisability. So it is most covalent among alkali metal halides according to Fajan's rule. S_2 : The IE_1 of potassium atom is less then sodium atom.

S_3 : The presence of transition metals like iron and other impurities catalyses the decomposition of deep blue solution forming amide and librating H_2.

S_4 : Two opposing tendencies exist. With greater charge and smaller size of cation, lattice energy increases which tends to increase the melting point ; while increase is covalent character causes a decrease in melting point. Hence, no unique generalised trend may be stated for melting points.

67.(B) All alkali metals hydrides are ionic in nature and react with water according to the reaction ;

$NaH + H_2O \longrightarrow NaOH + H_2$

68.(C) $Mg_3N_2 + 6H_2O \longrightarrow 3Mg(OH)_2 + 2NH_3$

69.(D) True statement. CsI, because of bigger cation (Cs^+) and bigger anion (I^-), has smaller hydration enthalpy. As a result, it does not exceed its lattice energy ; so CsI is insoluble in water.

70.(B) Baking powder used to make cake is a mixture of starch, $NaHCO_3$ and $Ca(H_2PO_4)_2$. The function of $Ca(H_2PO_4)_2$ is that being acidic in nature it gives CO_2 when moistened with $NaHCO_3$.

71.(B) **(A)** $Na_2O + H_2O \longrightarrow 2NaOH$

(B) $2Na/Hg + 2H_2O(\text{Castner - Kellner cell}) \longrightarrow 2NaOH + 2Hg + H_2$

(C) $Na_2O_2 + 2H_2O \longrightarrow 2NaOH + H_2O_2$

(D) $Na_2CO_3 + 2H_2O \rightleftharpoons 2NaOH + H_2CO_3$

72.(B) $Ba(NO_3)_2 + H_2SO_4 \longrightarrow BaSO_4 + HNO_3$

$BaSO_4$ is insoluble and gets separated

73.(B) S_1 : Because of the formation of an oxide film on their surface.

S_2 : Due to the formation of metal ion clusters.

S_3 : As the basicity (i.e. electropositive character) of alkaline earth metals increases, their reactivity towards water increases

S_4 : Oxides and hydroxides of alkaline earth metals are less ionic and basic. This is due to increased nuclear charge and smaller size

74.(AC) **(A)** $CaCO_3 + H_2O + CO_2 \longrightarrow Ca(HCO_3)_2$ soluble.

(B) Sodium is more basic (i.e. more ionic) in nature ; so Na_2CO_3 is thermally stable towards heat. It does not decompose to give Na_2O and CO_2

(C) Li is least basic (i.e. more covalent) in nature ; so Li_2CO_3 is thermally unstable.

(D) Presence of $CaCl_2$ or $CaSO_4$ in water causes permanent hardness. Temporary hardness of water is due to the presence of bicarbonates of Ca^{2+} and Mg^{2+}.

75.(B) Efflorescence is the property of spontaneous loss of water by a hydrated salt.

76.(C) $S_1 : (2CaSO_4 \cdot 2H_2O) \xrightarrow{393K} 2(CaSO_4) \cdot H_2O + 3H_2O;$ above 393K dead burnt plaster is obtained.

$S_2 : Ca^{2+} + Na_2CO_3 \longrightarrow CaCO_3 \downarrow + 2Na^{2+}$

$S_3 : Li^+ < Na^+ < K^+ < Kb^+ < Cs^+$

Bigger hydrated ion moves slower in aqueous solution.

77.(C) **(A)** $4LiNO_3 \longrightarrow 2Li_2O + 4NO_2 + O_2$

$2NaNO_3 \longrightarrow 2NaNO_2 + O_2$ (similar decomposition with the nitrates of K, Rb and Cs)

(B) Only LiCl is deliquescent and crystallises as a hydrate $LiCl \cdot 2H_2O$

(C) $2M + 2H_2O \longrightarrow 2M^+ + 2OH^- + H_2$ (M = an alkali metal)

(D) Halides of Li are covalent in nature.

78.(C) When sodium and potassium reacts with water, the heat evolved causes them to melt, giving a larger area of contact with water lithium on the other hand, does not melt under these condition and thus reacts more slowly.

79.(A) $2\underset{\text{Gypsum}}{\left[CaSO_4 \cdot 2H_2O\right]} \longrightarrow \underset{\text{Plaster of paris}}{2CaSO_4 \cdot H_2O}$ (calcium sulphate hemihydrate) $+ 3H_2O$

80.(B) In solvay process NH_3, CO_2 and $NaCl$ solution participate but H_2SO_4 does not.

81.(D) Lithium is the strongest reducing agent among the alkali metals.

82.(A) Cesium is used in photoelectric cells as it is most electropositive element due to its low ionisation energy.

83.(A) Superoxides of Alkali metals are paramagnetic due to presence of 1 unpaired electron in O_2^- (Refer MOT)

84.(A) Be, due to its high IE does not impart colour to the flame.

85.(A) Be and Al show diagonal relationship due to similar charge/size ratio

86.(C) Beryllium halides are covalent in character.

87.(A) $BeCl_2$ fumes in moist air because of formation of HCl. $BeCl_2 + H_2O \longrightarrow Be(OH)_2 + 2HCl$

88.(A) $MgCO_3(aq) + CO_2 \longrightarrow Mg(HCO_3)_2$

89.(A) $\underset{\text{lime water}}{Ca(OH)_2} + CO_2 \longrightarrow \underset{\text{(milky)}}{CaCO_3} \xrightarrow{CO_2} \underset{\text{milkiness disappears}}{Ca(HCO_3)_2}$

90.(A) H_2O_2 is unstable compound, so it is stored in waxy coated vessels. If it is stored in glass bottle alkali oxides present in glass catalyse the decomposition of H_2O_2.

91.(A) Hydrogen peroxide shows bleaching action by oxidation. $H_2O_2 \longrightarrow H_2O + (O)$

92.(A) H_2O_2 is non linear molecule with open book structure. In H_2O_2 each oxygen undergoes sp^3 hybridisation, and each oxygen has angular geometry.

93. Conductivity is due to the presence of ammoniated electrons and ammoniated cations. On increasing temperature conductivity decreases because solution conducts electricity like a metallic conductor.

94. $CaSO_4 \cdot 2H_2O \longrightarrow CaSO_4 \cdot \frac{1}{2}H_2O + \frac{3}{2}H_2O$. 6 milli moles give 9 milli moles of steam.

95. K^+, Rb^+ and Cs^+ are larger cations which stabilize O_2^- (superoxide) the larger anion. Thus when MO_2 is formed, the lattice is stabilized hence its formation is preferred to oxides and peroxides.

96.(3) $BeCl_2, BeH_2, NaHCO_3$

97.(4) Li, Mg, Ca, Sr

98.(4) Only $NaHCO_3, KHCO_3, RbHCO_3, CsHCO_3$ are present in solid form.

99.(3) Zn, Na, K

Metals which are more reactive than hydrogen can displace hydrogen from acid.

100.(B)

1.	$NaNO_3$	(Chile salt peter)	**2.**	$Na_2B_4O_7 \cdot 10H_2O$	(Borax)
3.	$NaHCO_3$	(Baking soda)	**4.**	$Na_2CO_3 \cdot 10H_2O$	(Washing soda)