JEE Main Archive	DTS-1

1.(D) Be forms water soluble $BeSO_4$, water insoluble $Be(OH)_2$ and BeO. $Be(OH)_2$ is soluble in NaOH giving sodium beryllate Na_2BeO_2.

2.(A) $4KO_2 + 2CO_2 \rightarrow 2K_2CO_3 + 3O_2$

3.(B) Magnesium on account of its lightness, great affinity for oxygen and toughness is used in ship. Being a lighter element, magnesium makes the ship lighter when it is fixed to the bottom of the ship.

4.(B) Water develops interlocking needle-like crystals of hydrated silicates. The reactions involved are the hydration of calcium aluminates and calcium silicates which change into their colloidal gels. At the same time, some calcium hydroxide and aluminium hydroxides are formed as precipitates due to hydrolysis. Calcium hydroxide binds the particles of calcium silicate together while aluminium hydroxide fills the interstices rendering the mass impervious.

5.(B) The stability of the carbonates of the alkaline earth metals increases on moving down the group. The solubility of carbonate of metals in water is generally low. However they dissolve in water containing CO_2 yielding bicarbonates, and this solubility decreases on going down in a group with the increase in stability of carbonates of metals, and decrease in hydration energy of the cations.

6.(B) The composition of gypsum is $CaSO_4 \cdot 2H_2O$. It does not have $CaCO_3$.

7.(A) Beryllium has the valency $+2$ while aluminium exhibits its valency as $+3$.

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

9.(B) The alkali metal ion exist as hydrated ions $M^+(H_2O)_n$ in the aqueous solution. The degree of hydration, decrease with ionic size as we go down the group. Hence Li^+ ion is mostly hydrated e.g. $[Li(H_2O)_6]^+$. Since the mobility of ions is inversely proportional to the size of the their hydrated ions, hence the increasing order of ionic mobility is $Li^+ < Na^+ < K^+ < Rb^+$.

10.(B) Moving from left to right in a period, the ionic radii decrease due to increase in effective nuclear charge as the additional electrons are added to the same shell. However from top to bottom the ionic radii increase with increasing atomic number and presence of additional shells.

Also Li and Mg are diagonally relates and hence the order is $Na^+ > Li^+ > Mg^{2+} > Be^{2+}$.

11.(B) $CaCO_3 \xrightarrow{\Delta} \underset{\substack{\text{metal oxide}\\\text{(basic)}}}{CaO} + \underset{\substack{\text{non-metal oxide}\\\text{(acidic)}}}{CO_2}$

12.(C) Among all the metals, only Ca is a s-block metal, which is highly electropositive and cannot be obtained by electrolysis of an aqueous solution of its salt.

13.(D) Release of electron is known as reduction. So, H_2O_2 acts as reducing agent when it releases electrons.
Here, in reaction (II) and (IV), H_2O_2 releases two electron, hence reaction (II) and (IV) are known as reduction.
In reaction (I) and (III), two electrons are being added, so (I) and (III) represents oxidation.

14.(B) As we move down the group, size of metal increases. Be has lower size while SO_4^{2-} has bigger size, that's why $BeSO_4$ breaks easily and lattice energy become smaller but due to lower size of Be, water molecules are gathered around and hence hydration energy increases. On the other hand, rest of metals, i.e. Ca, Ba, Sr have bigger size and that's why lattice energy is greater than hydration energy.

15.(D) Hydrogen gas is flammable.