CHAPTER



- 1. In KO<sub>2</sub>, the nature of oxygen species and the oxidation state of oxygen atom are, respectively
  - (a) superoxide and -1/2 (b) oxide and -2
  - (c) peroxide and -1/2 (d) superoxide and -1.

(Online 2018)

- 2. Both lithium and magnesium display several similar properties due to the diagonal relationship, however, the one which is incorrect, is
  - (a) both form nitrides
  - (b) nitrates of both Li and Mg yield  $NO_2$  and  $O_2$  on heating
  - (c) both form basic carbonates
  - (d) both form soluble bicarbonates. (2017)
- 3. Which of the following atoms has the highest first ionization energy?

(a) Rb (b) Na (c) K (d) Sc (2016)

- 4. The main oxides formed on combustion of Li, Na and K in excess of air are, respectively
  - (a)  $\text{Li}_2\text{O}$ ,  $\text{Na}_2\text{O}$  and  $\text{KO}_2$  (b)  $\text{LiO}_2$ ,  $\text{Na}_2\text{O}_2$  and  $\text{K}_2\text{O}$
  - (c)  $\text{Li}_2\text{O}_2$ ,  $\text{Na}_2\text{O}_2$  and  $\text{KO}_2$  (d)  $\text{Li}_2\text{O}$ ,  $\text{Na}_2\text{O}_2$  and  $\text{KO}_2$

- 5. The correct order of the solubility of alkaline earth metal sulphates in water is
  - (a) Mg > Ca > Sr > Ba (b) Mg > Sr > Ca > Ba
  - (c) Mg < Ca < Sr < Ba (d) Mg < Sr < Ca < Ba(Online 2016)
- 6. The commercial name for calcium oxide is
  - (a) quick lime (b) milk of lime
  - (c) slaked lime (d) limestone.

(Online 2016)

- 7. Which one of the following alkaline earth metal sulphates has its hydration enthalpy greater than its lattice enthalpy?
  (a) BaSO<sub>4</sub>
  (b) SrSO<sub>4</sub>
  (c) CaSO<sub>4</sub>
  (d) BeSO<sub>4</sub>
  (2015)
- 8. The correct order of thermal stability of hydroxides is
  - (a)  $Ba(OH)_2 < Sr(OH)_2 < Ca(OH)_2 < Mg(OH)_2$
  - (b)  $Ba(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < Mg(OH)_2$
  - (c)  $Mg(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < Ba(OH)_2$
  - (d)  $Mg(OH)_2 < Sr(OH)_2 < Ca(OH)_2 < Ba(OH)_2$

(Online 2015)

- 9. Which of the alkaline earth metal halides given below is essentially covalent in nature?
  - (a)  $MgCl_2$  (b)  $BeCl_2$ (c)  $SrCl_2$  (d)  $CaCl_2$ 
    - (Online 2015)
- 10. The metal that can not be obtained by electrolysis of an aqueous solution of its salt is
  (a) Cr
  (b) Ag
  (c) Ca
  (d) Cu
  (2014)
- 11. Which of the following on thermal decomposition yields a basic as well as an acidic oxide?
  (a) KClO<sub>3</sub> (b) CaCO<sub>3</sub> (c) NH<sub>4</sub>NO<sub>3</sub> (d) NaNO<sub>3</sub>
- 12. The set representing the correct order of ionic radius is (a)  $Li^+ > Be^{2+} > Na^+ > Mg^{2+}$ 
  - (b)  $Na^+ > Li^+ > Mg^{2+} > Be^{2+}$
  - (c)  $Li^+ > Na^+ > Mg^{2+} > Be^{2+}$
  - (d)  $Mg^{2+} > Be^{2+} > Li^+ > Na^+$  (2009)
- **13.** The ionic mobility of alkali metal ions in aqueous solution is maximum for

(a) 
$$K^+$$
 (b)  $Rb^+$  (c)  $Li^+$  (d)  $Na^+$  (2006)

- 14. Beryllium and aluminium exhibit many properties which are similar. But, the two elements differ in
  - (a) exhibiting maximum covalency in compounds
  - (b) forming polymeric hydrides
  - (c) forming covalent halides
  - (d) exhibiting amphoteric nature in their oxides.

(2004)

(2012)

- **15.** One mole of magnesium nitride on the reaction with an excess of water gives
  - (a) one mole of ammonia (b) one mole of nitric acid
  - (c) two moles of ammonia (d) two moles of nitric acid.

(2004)

- 16. Several blocks of magnesium are fixed to the bottom of a ship
  - (a) keep away the sharks

to

- (b) make the ship lighter
- (c) prevent action of water and salt
- (d) prevent puncturing by under-sea rocks. (2003)

- 17. In curing cement plasters water is sprinkled from time to time. This helps in
  - (a) keeping it cool
  - (b) developing interlocking needle-like crystals of hydrated silicates
  - (c) hydrating sand and gravel mixed with cement
  - (d) converting sand into silicic acid. (2003)
- **18.** The solubilities of carbonates decrease down the magnesium group due to a decrease in
  - (a) lattice energies of solids
  - (b) hydration energies of cations
  - (c) inter-ionic attraction
  - (d) entropy of solution formation. (2003)

- 19. The substance not likely to contain CaCO<sub>3</sub> is
  - (a) a marble statue (b) calcined gypsum
  - (c) sea shells (d) dolomite. (2003)
- **20.** A metal *M* readily forms its sulphate  $MSO_4$  which is watersoluble. It forms its oxide *MO* which becomes inert on heating. It forms an insoluble hydroxide  $M(OH)_2$  which is soluble in NaOH solution. Then *M* is (a) Mg (b) Ba (c) Ca (d) Be.

(2002)

- **21.**  $KO_2$  (potassium super oxide) is used in oxygen cylinders in space and submarines because it
  - (a) absorbs  $CO_2$  and increases  $O_2$  content
  - (b) eliminates moisture
  - (c) absorbs  $CO_2$  (d) produces ozone. (2002)

ANSWER KEY												
1.	(a)	<b>2.</b> (c)	<b>3.</b> (d)	<b>4.</b> (d)	<b>5.</b> (a)	<b>6.</b> (a)	7. (d)	<b>8.</b> (c)	<b>9.</b> (b)	10. (c)	11. (b)	12. (b)
13.	(b)	<b>14.</b> (a)	15. (c)	<b>16.</b> (b)	17. (b)	<b>18.</b> (b)	<b>19.</b> (b)	<b>20.</b> (d)	<b>21.</b> (a)			



1. (a) : KO<sub>2</sub> is potassium superoxide. The oxidation state of O-atom =  $-\frac{1}{2}$ 

2. (c) : Due to diagonal relationship, both Li and Mg display some similar properties, but in the case of carbonates, Mg can form basic carbonates such as  $3MgCO_3.Mg(OH)_2.3H_2O$ . In contrast, Li only form typical carbonate  $Li_2CO_3$  as other alkali metals. It does not form any basic carbonate having both carbonate and hydroxide ions.

**3.** (d) : Rb, Na and K belong to group 1 which on losing one electron attain noble gas configuration and thus, have low value of ionisation energies. On the other hand, Sc with electronic configuration [Ar]  $3d^{1}4s^{2}$  loses its electron from 4*s*-orbital thus, it does not achieve that much stable configuration as in group 1 elements. Hence, it shows higher first ionisation energy.

4. (d): Li + 
$$O_2 \longrightarrow Li_2O_{Normal oxide}$$
  
 $2Na + O_2 \longrightarrow Na_2O_2_{Peroxide}$   
 $K + O_2 \longrightarrow KO_2_{Superoxide}$   
i. (a): Understeen an  $2n$ 

5. (a) : Hydration energy  $\propto \frac{1}{\text{size}}$ 

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:. Solubility order of group 2 elements, sulphates in water is  $MgSO_4 > CaSO_4 > SrSO_4 > BaSO_4$ .

6. (a) : Quick lime is the commercial name of calcium oxide.
7. (d) : Be<sup>2+</sup> being smaller in size has maximum hydration enthalpy which exceeds its lattice enthalpy.

8. (c) : The correct order of thermal stability is

 $Mg(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < Ba(OH)_2$ .

Down the group the size of cation increases and larger cation can better stabilize the polyatomic anion.

**9.** (b) : According to Fajans rule, smaller the size of the cation greater is the covalent character.

10. (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.

**11.** (b):  $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$ Metal oxide Non-metal oxide (basic) (acidic) **12.** (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 related and hence the order is

$$Na^+ > Li^+ > Mg^{2+} > Be^{2+}.$$

13. (b) : The alkali metal ion exist as hydrated ions  $M^+(H_2O)_n$  in the aqueous solution. The degree of hydration, decreases 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 :  $Li^+ < Na^+ < K^+ < Rb^+$ 

• 14. (a) : Beryllium has the valency +2 while aluminium exhibits its valency as +3.

15. (c) :  $Mg_3N_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3$ 

16. (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.

**17.** (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.

18. (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.

**19.** (b) : The composition of gypsum is  $CaSO_4 \cdot 2H_2O$ . It does not have  $CaCO_3$ .

**20.** (d) : Be forms water soluble  $BeSO_4$ , water insoluble  $Be(OH)_2$  and BeO.  $Be(OH)_2$  is insoluble in NaOH giving sodium beryllate Na<sub>2</sub>BeO<sub>2</sub>.

**21.** (a) :  $4KO_2 + 2CO_2 \rightarrow 2K_2CO_3 + 3O_2$ 

