1. The setting time of Cement is increased by adding
[2023 (06 Apr Shift 1)]
(1) Clay
(2) Silica
(3) Gypsum
(4) Limestone

2. Ion having highest hydration enthalpy among the given alkaline earth metal ions is:
[2023 (06 Apr Shift 2)]
(1) Be^{2+}
(2) Sr^{2+}
(3) Ba^{2+}
(4) Ca^{2+}

3. Given below are two statements :
Statement I : Lithium and Magnesium do not form superoxide
Statement II : The ionic radius of Li^{+} is larger than ionic radius of Mg^{2+} In the light of the above statements, choose the most appropriate answer from the questions given below :
In the light of the above statements, choose the most appropriate answer from the questions given below :
[2023 (08 Apr Shift 1)]
(1) Statement I is incorrect but Statement II is correct
(2) Statement I is correct but Statement II is incorrect
(3) Both statement I and Statement II are incorrect
(4) Both Statement I and Statement II are correct

4. What is the purpose of adding gypsum to cement?
[2023 (08 Apr Shift 1)]
(1) To facilitate the hydration of cement
(2) To slow down the process of setting
(3) To give a hard mass
(4) To speed up the process of setting

5. For a good quality cement, the ratio of lime to the total of the oxides of Si, Al and Fe should be as close as to
[2023 (08 Apr Shift 2)]
(1) 4
(2) 1
(3) 2
(4) 3

6. Given below are two statements: One is labelled as
Assertion $\mathbf{A}$ and the other is labelled as Reason $\mathbf{R}$
Assertion $\mathbf{A}$: Sodium is about 30 times as abundant as potassium in the oceans.
Reason $\mathbf{R}$: Potassium is bigger in size than sodium.
In the light of the above statements, choose the correct answer from the options given below
[2023 (08 Apr Shift 2)]
(1) Both $\mathbf{A}$ and $\mathbf{R}$ are true and $\mathbf{R}$ is the correct explanation of $\mathbf{A}$
(2) $\mathbf{A}$ is true but $\mathbf{R}$ is false
(3) Both $\mathbf{A}$ and $\mathbf{R}$ are true but $\mathbf{R}$ is NOT the correct explanation of $\mathbf{A}$
(4) Both $\mathbf{A}$ and $\mathbf{R}$ are false

7. Lime reacts exothermally with water to give 'A' which has low solubility in water. Aqueous solution of 'A' is often used for the test of CO_2, a test in which insoluble B is formed. If B is further reacted with CO_2 then soluble compound is formed. 'A' is
[2023 (10 Apr Shift 1)]
(1) Quick lime
(2) Slaked lime
(3) White lime
(4) Lime water

8. In the following reaction, the total number of oxygen atoms in X and Y is_____

$Na_2O + H_2O \rightarrow 2X$

$Cl_2O_7 + H_2O \rightarrow 2Y$

[2023 (10 Apr Shift 1)]

9. Number of water molecules in washing soda and soda ash respectively are :

[2023 (10 Apr Shift 2)]

(1) 1 and 10

(2) 10 and 1

(3) 10 and 0

(4) 1 and 0

10. Match List-I with List-II:

	List-I		List-II
A.	K	I.	Thermonuclear reactions
B.	KCI	II.	Fertilizer
C.	KOH	III.	Sodium potassium pump
D.	Li	IV.	Absorbent of CO_2

[2023 (11 Apr Shift 1)]

(1) A(III), B(II), C(IV), D(I)

(2) A(III), B(IV), C(II), D(I)

(3) A(IV), B(I), C(III), D(II)

(4) A(IV), B(III), C(I), D(II)

11. Alkali metal from the following with least melting point is

[2023 (11 Apr Shift 2)]

(1) Cs

(2) Rb

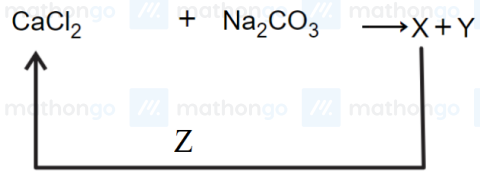
(3) Na

(4) K

12. $Mg(NO_3)_2 . XH_2O$ and $Ba(NO_3)_2 . YH_2O$, represent formula of the crystalline forms of nitrate salts. Sum of X and Y is.....

[2023 (11 Apr Shift 2)]

13. In the given reaction cycle



X, Y and Z respectively are

[2023 (12 Apr Shift 1)]

(1) $X - CaCO_3,\ Y - NaCl,\ Z - KCl$

(2) $X - CaCO_3,\ Y - NaCl,\ Z - HCl$

(3) $X - CaO,\ Y - NaCl + CO_2,\ Z - NaCl$

(4) $X - CaO,\ Y - NaCl + CO_2,\ Z - KCl$

14. The density of alkali metals is in the order

[2023 (12 Apr Shift 1)]

(1) $K < Cs < Na < Rb$

(2) $Na < Rb < K < Cs$

(3) $Na < K < Cs < Rb$

(4) $K < Na < Rb < Cs$

15. $Be(OH)_2$ reacts with $Sr(OH)_2$ to yield an ionic salt. Choose the incorrect option related to this reaction from the following

[2023 (13 Apr Shift 1)]

(1) Both Sr and Be elements are present in the ionic salt

(2) Beis tetrahedrally coordinated in the ionic salt

(3) The element Be is present in the cationic part of the ionic salt

(4) The reaction is an example of acid-base neutralization reaction

16. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:

Assertion (A) : $BeCl_2$ and $MgCl_2$ produce characteristic flame

Reason (R) : The excitation energy is high in $BeCl_2$ and $MgCl_2$

In the light of the above statements, choose the correct answer from the options given below:

[2023 (15 Apr Shift 1)]

(1) (A) is true but (R) is false

(2) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

(3) Both ((A) and (R) are true and (R) is the correct explanation of (A)

(4) (A) is false but (R) is true

ANSWER KEYS

1. (3)	**2.** (1)	**3.** (4)	**4.** (2)	**5.** (3)	**6.** (3)	**7.** (2)	**8.** (5)
9. (3)	**10.** (1)	**11.** (1)	**12.** (6)	**13.** (2)	**14.** (4)	**15.** (3)	**16.** (4)

1. (3)

Cement or Portland cement mainly contains oxides of calcium, silicon, aluminium, and iron. When water is mixed with cement, the oxides get hydrated, and cement sets extremely fast. To control the setting time of cement, gypsum is added to it, which increases the setting time of cement.

2. (1)

Smaller the size of the cation, more the hydration of ion, hence the more values of the hydration enthalpies. Now, as the down the group the size increases so the hydration enthalpies decreases, hence as the increasing order of the size of the ions is as follows:

$Be^{2+} < Mg^{2+} < Ca^{2+} < Sr^{2+} < Ba^{2+}$

and reverse of this order is true for the hydration enthalpies.

$Be^{2+} > Mg^{2+} > Ca^{2+} > Sr^{2+} > Ba^{2+}$

3. (4)

The values of ionic radii of $Li^{+} = 0.74$ Åand $Mg^{+2} = 0.72$ Å respectively. Thus, the lithium ion with $+1$ charge is only marginally larger than the magnesium ion having a charge of $+2$.

The superoxide releases the most energy when formed, the superoxide is preferentially formed for the larger metals where the more complex anions are not polarised. So, Li and Mg do not form superoxides.

Therefore both the given options were correct.

4. (2)

When mixed with water the setting of cement takes place to give a hard mass. The is due to the hydration of molecules of the constituents and their rearrangement. Gypsum is $CaSO_4.2H_2O$. The purpose of adding gypsum is only to slow down the process of setting of the cement so that it gets sufficiently hardened.

5. (3)

Cement is made by strongly heating a mixture of lime stone and clay in a rotatory kiln. Lime stone and clay are finely powdered, and a little water is added. For a good quality cement, the ratio of silica (SiO_2) to alumina (Al_2O_3) should be between 2.5 and 4 and the ratio of lime (CaO) to the total of the oxides of silicon (SiO_2) aluminium (Al_2O_3) and iron (Fe_2O_3) should be as close as possible to 2. If lime is in excess, the cement cracks during setting. On the other hand, if lime is less than the required, the cement is weak in strength. Therefore, a proper composition of cement must be maintained to get cement of good quality.

6. (3)

Sodium is indeed about 30 times more abundant than potassium in seawater. This is because sodium is more soluble in water than potassium, and is therefore more readily dissolved from rocks and minerals into seawater.

Potassium is bigger than sodium in size as atomic number of potassium is more than sodium and Potassium has one additional electron shell compared to sodium, which means that its atomic radius is larger.

So Both **A** and **R** are true but **R** is NOT the correct explanation of **A**

7. (2)

$\underset{\text{Lime}}{CaO} \xrightarrow{\text{Limited water}} Ca(OH)_2$

The process is known as slaking of lime and the product is slaked lime. It is an exothermic process.

$Ca(OH)_2$ aq solution is known as lime water and used for test of CO_2.

$Ca(OH)_2(aq) \xrightarrow{CO_2} CaCO_3$

$CaCO_3 + CO_2(\text{excess}) + H_2O \rightarrow Ca(HCO_3)_2$

Milkiness is due to the formation of calcium carbonate and disappearance of milkiness is due to the formation of calcium bicarbonate.

8. (5)

Let's first balance the two given chemical equations:

$Na_2O + H_2O \longrightarrow 2\,NaOH(X)$

In this equation, there are two NaOH molecules, so the total number of oxygen atoms in the products is 1.

$Cl_2O_7 + H_2O \longrightarrow 2\,HClO_4(Y)$

In this equation, there are two $HClO_4$ molecules, so the total number of oxygen atoms in the products is 4.

So X has one O and Y has four O.

9. (3)

The chemical formula for washing soda is $Na_2CO_3.10H_2O$, which means that each molecule of washing soda contains 10 water molecules.

The chemical formula for soda ash is Na_2CO_3, which does not contain any water molecules.

Therefore, there are 10 water molecules in washing soda and 0 water molecules in soda ash.

10. (1)

Lithium can indeed participate in thermonuclear reactions, specifically in certain fusion reactions.

The movement of K^+ ions (potassium ions) is indeed involved in the functioning of the sodium-potassium pump.

KOH (potassium hydroxide) can act as an absorbent of carbon dioxide. This property is primarily due to the alkaline nature of KOH.

KCl (potassium chloride) is commonly used as a fertilizer in agriculture due to its high potassium content.

So option A is correct.

11. (1)

On moving down the group in alkali metals, the melting point generally decreases.

As you move down the alkali metal group (Group 1 of the periodic table), the atomic size or atomic radius increases. This increase in atomic size leads to a decrease in the strength of metallic bonds between the alkali metal atoms. Weaker metallic bonding results in lower melting points because less energy is required to overcome these weaker bonds and convert the solid metal into a liquid state.

Element	M. P. (K)
Na	371
K	336
Rb	312
Cs	302

12. (6)

Magnesium nitrate crystallises with six molecules of water, whereas barium nitrate is anhydrous salts.

The hydrated form of magnesium nitrate is $Mg(NO_3)_2.6H_2O$ and anhydrous salt of barium nitrate is $Ba(NO_3)_2$ respectively

$\therefore\ x = 6,\ y = 0$

13. (2)

When calcium chloride reacts with sodium carbonate, a double replacement reaction takes place. The products of this reaction are calcium carbonate and sodium chloride.$CaCl_2 + Na_2CO_3 \rightarrow \underset{(X)}{CaCO_3} + 2\,\underset{(Y)}{NaCl}$

To Obtain Calcium chloride from Calcium carbonate we need to react calcium carbonate with Hydro chloric acid.

$\underset{(X)}{CaCO_3} + 2\,\underset{(Z)}{HCl} \rightarrow CaCl_2 + CO_2(g) + H_2O(l)$

$\therefore$ (X) $CaCO_3$

(Y) NaCl

(Z) HCl

14. (4) As we down in a group then its size increases and also volume of the atom increases as the number of electrons and protons increases. But the increase in mass is greater than that of increase in volume so the density which is defined as mass per unit volume will increase generally. Density of alkali metals increases down the group except potassium. Therefore, correct order of density of given alkali metals is $K < Na < Rb < Cs$

15. (3)

$Be(OH)_2$ has amphoteric nature. $Sr(OH)_2$ has basic nature. These two compounds undergo acid-base reaction to get salt,

$Be(OH)_2 + Sr(OH)_2 \longrightarrow Sr^{+2}[Be(OH)_4]^{-2}$

As Be is present in anionic part.

16. (4)

In Be and Mg, the electrons are strongly bound. The energy required to excite these electrons is very high. Therefore, when the electron reverts back to its original position, the energy released does not fall in the visible region. Hence, no colour in the flame is seen.