Compounds of s-Block

(1) Na_2O_2 (sodium peroxide)

Prep: $Na + O_2 \xrightarrow{excess} Na_2O_2$

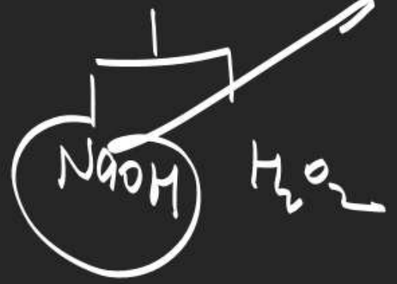
Pale yellow colour

Chemical reactions

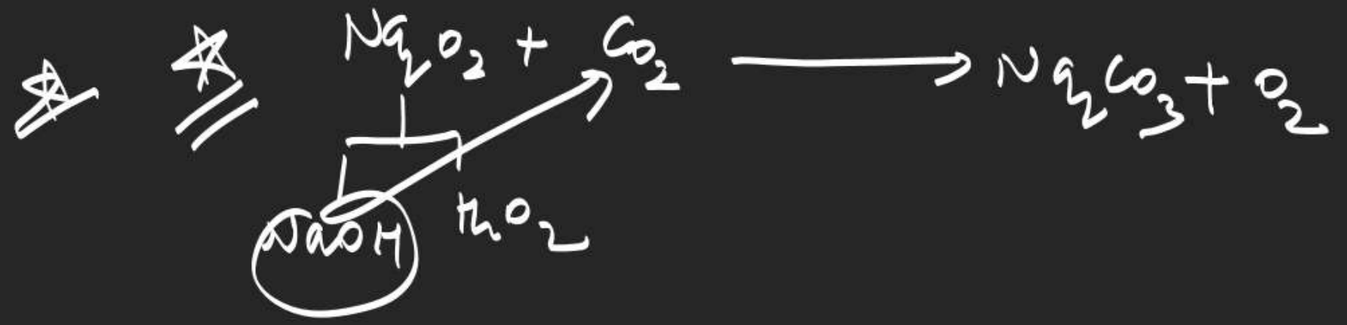
$$Na_2O_2 + H^+-O\bar{H} \xrightarrow[0^\circ C]{\text{ice cold}} NaOH + H_2O_2$$

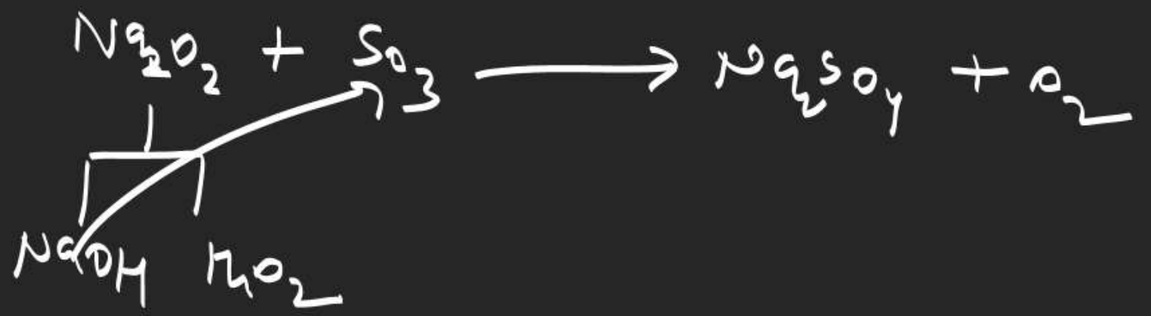
$$Na_2O_2 + H^+-O\bar{H} \xrightarrow[\text{temp.}]{\text{room}} NaOH + O_2$$

$$Na_2O_2 + H_2SO_4 \xrightarrow{0^\circ C} Na_2SO_4 + H_2O_2$$



$$Na_2O_2 + H_2SO_4 \xrightarrow[\text{temp.}]{\text{room}} Na_2SO_4 + O_2$$





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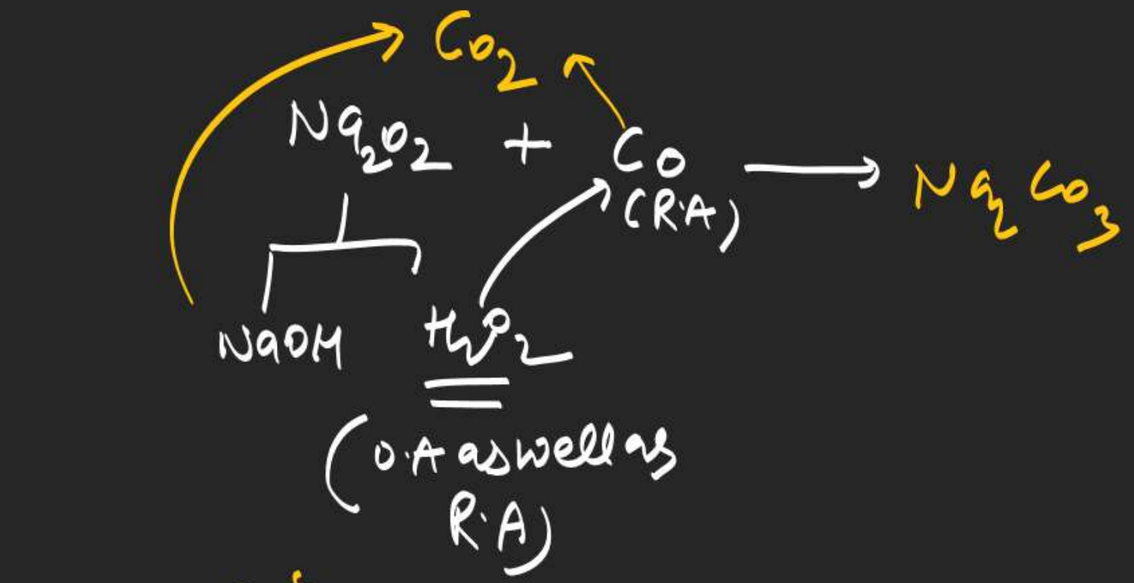

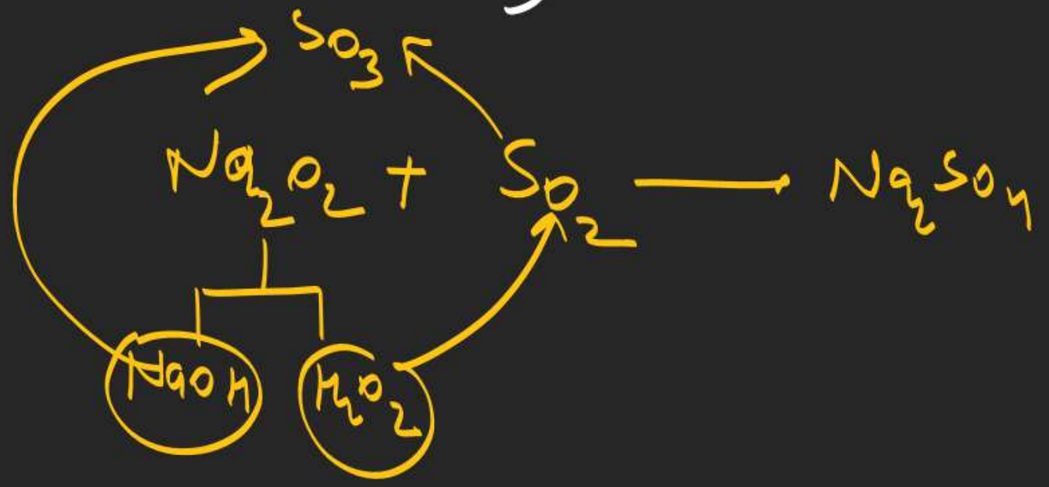

any

$NH_3 + O_2 \longrightarrow N_2$

except

$NH_3 + O_2 \longrightarrow NO$

$N_2O_2 + NH_3 \longrightarrow N_2 + NaOH$

N_2O_2 : NaOH

NH_3 : H_2O_2

Solvay process [Prep. of Na_2CO_3]

$$\underset{\text{(g)}}{NH_3} + \underset{\text{(g)}}{CO_2} + \underset{\text{(l)}}{H_2O} \longrightarrow (NH_4)_2CO_3$$

$$(NH_4)_2CO_3 + \underset{\text{(excess)}}{CO_2} \longrightarrow NH_4HCO_3$$

$$NH_4HCO_3 + \underline{NaCl} \longrightarrow \underset{\text{(Sparingly soluble)}}{NaHCO_3} + \underline{NH_4Cl}$$

Soluble

$$NaHCO_3 \xrightarrow{\Delta} \underline{Na_2CO_3} + CO_2\uparrow + H_2O\uparrow$$

Castner-Kellner cell [Prop. NaOH]

Electrolysis of brine solution using Hg-cathod.

$$NaCl \longrightarrow Na^+ + Cl^-$$

$$Na^+ + e^- \xrightarrow{Hg.} \underbrace{Na-Hg}_{\text{amalgam (alloy)}}$$

$$Na-Hg + H^+ - O^- H \longrightarrow \boxed{NaOH} + Hg + H_2$$

Imp. Reactions

$K_2O + H^+-\bar{O}H \longrightarrow KOH$

$K_2O_2 + H^+-\bar{O}H \longrightarrow KOH + H_2O_2$

$KO_2 + H^+-\bar{O}H \longrightarrow KOH + H_2O_2 + O_2$

Superoxide

KO_2 — it absorb CO_2 and produce — O_2

$KO_2 + H-OH \longrightarrow KOH + H_2O_2 + O_2$

Leblanc's Method (Prep. of Na_2CO_3 and K_2CO_3)

$$NaCl + Conc.H_2SO_4 \longrightarrow NaHSO_4 + HCl$$

$$NaHSO_4 + Conc.H_2SO_4 \longrightarrow Na_2SO_4$$
(Salt Cake)

$$Na_2SO_4 + C \longrightarrow Na_2S + CO\uparrow$$

$$Na_2S + CaCO_3 \longrightarrow Na_2CO_3 + CaS$$

Sorel cement ⇒ it is paste of MgO and $MgCl_2$ and it is used in dental filling

Mortar is mix. of $Ca(OH)_2$ slaked lime 1 part and 3 part sand

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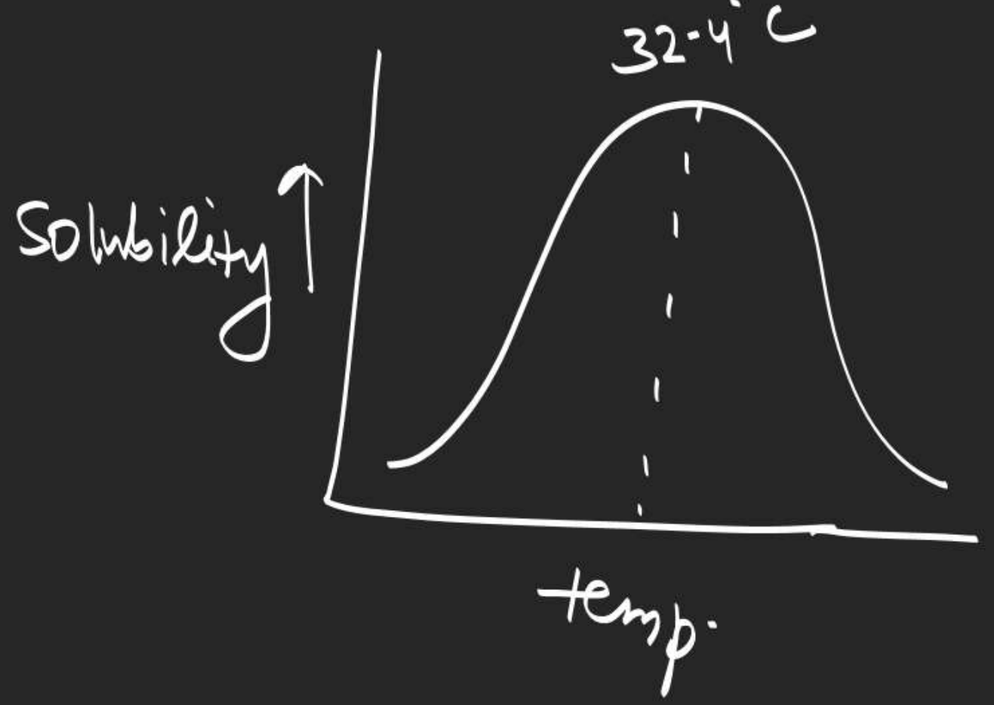
$Na_2SO_4 \cdot 10H_2O$ [Glabuer salt)



$$NH_4Cl + Ca(OH)_2 \longrightarrow \underline{\underline{CaCl_2}} + \underline{\underline{NH_3}}$$

$CaCl_2 \rightarrow$ it is prep. by solvay process as by product.

que Why K_2CO_3 is not produced by Solvay process

$KHCO_3 \Rightarrow$ soluble

s-Block

1. Which one of the following alkaline earth metal sulphates has its hydration enthalpy greater than its lattice enthalpy? [JEE(Main)-2015]

(A) $CaSO_4$ (B) $BeSO_4$ (C) $BaSO_4$ (D) $SrSO_4$

Solubility

no of Polyatomic anion $\geq$ no of cation

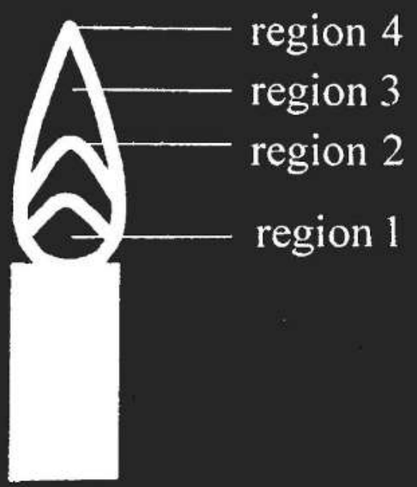
then solubility ↓

H.E > L.E then soluble

$BeSO_4$ > $SrSO_4$ > $BaSO_4$

s-Block

2. The hottest region of Bunsen flame shown in the figure below is [JEE(Main)-2016]



(Salt only

(A) region 2 (B) region 3 (C) region 4 (D) region 1

s-Block

3. Lithium aluminium hydride reacts with silicon tetrachloride to form:

[Main-2018(Online)]

(A) $LiCl, AlH_3$ and SiH_4

(B) $LiCl, AlCl_3$ and SiH_4

(C) $LiH, AlCl_3$ and $SiCl_2$

(D) LiH, AlH_3 and SiH_4

$LiAlH_4 + SiCl_4 \longrightarrow SiH_4 + LiCl + AlCl_3$

Nishant Jindal

s-Block

4. The alkaline earth metal nitrate that does not crystallise with water molecules is :

[2019]

(A) $Sr(NO_3)_2$

(B) $Mg(NO_3)_2$

(C) $Ca(NO_3)_2$

(D) $Ba(NO_3)_2$

s-Block

5. The metal that forms nitride by reacting directly with N_2 of air is : [2019]

(A) Li (B) Cs (C) Rb (D) K

$$Li + N_2 \longrightarrow Li_3N \xrightarrow{H^+ \cdot OH} LiOH + NH_3$$

$$\downarrow \Delta$$

$$Li + N_2$$

$$M + N_2 \longrightarrow \times$$

$(Na, K, Rb)(s)$

6. The metal used for making X-ray tube window is : [2019]

(A) Ca (B) Na (C) Mg (D) Be

s-Block

7. Sodium metal on dissolution in liquid ammonia gives a deep blue solution due to the formation of: [2019]

(A) ammoniated electrons

(B) sodamide

(C) sodium ion-ammonia complex

(D) sodium-ammonia complex

s-Block

8. The amphoteric hydroxide is: [2019]

(A) $Ca(OH)_2$ (B) $Mg(OH)_2$ (C) $Be(OH)_2$ (D) $Sr(OH)_2$

Pb Zn Be Al Ga Sn (Sc^{+3})

all the hydroxide and oxides are Amphoteric

V_2O_5 As_2O_3 Sb_2O_3

s-Block

9. Match the following items in column I with the corresponding items in column II.

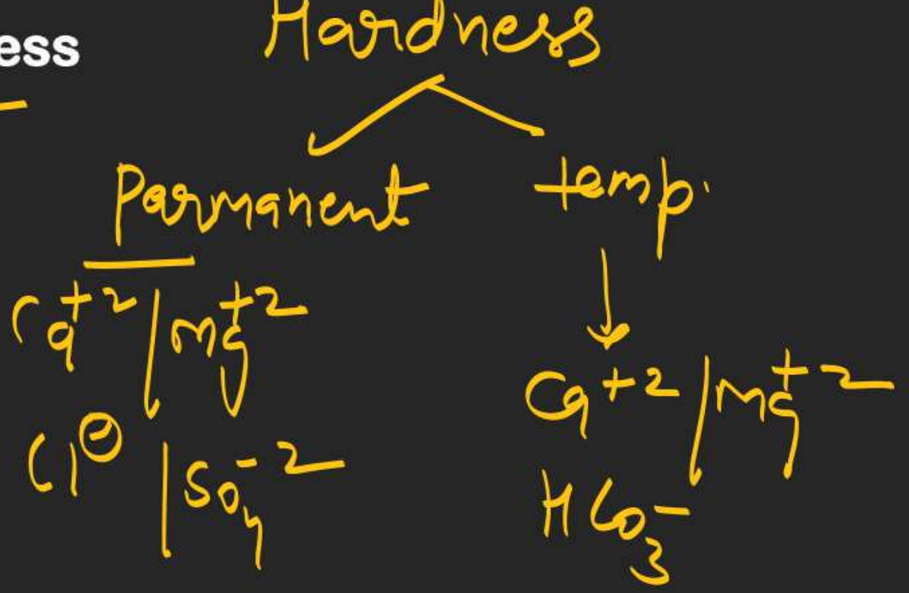
Column I	Column II
(i) $Na_2CO_3 \cdot 10H_2O$	(P) Portland cement ingredient
(ii) $Mg(HCO_3)_2$	(Q) Castner-Kellner process
(iii) $NaOH$	(R) Solvay process
(iv) $Ca_3Al_2O_6$	(S) Temporary hardness

(A) (i) $-$(Q); (ii) $-$(R); (iii) $-$(P); (iv) $-$(S)

(B) (i) $-$(S); (ii) $-$(P); (iii) $-$(Q); (iv) $-$(R)

(C) (i) $-$(R); (ii) $-$(Q); (iii) $-$(S); (iv) $-$(P)

(D) (i) $-$(R); (ii) $-$(S); (iii) $-$(Q); (iv) $-$(P)



10. A metal on combustion in excess air forms X, X upon hydrolysis with water yields H_2O_2 and O_2 along with another product. The metal is : [2019]

(A) Li (B) Rb (C) Na (D) Mg

$$Li + O_2 \longrightarrow Li_2O \xrightarrow[O_2]{excess} X$$

$$Na + O_2 \longrightarrow Na_2O \xrightarrow[O_2]{excess} Na_2O_2 \xrightarrow[O_2]{excess} X$$

$$\underset{(K|Rb|Cs)}{M} + O_2 \longrightarrow M_2O \xrightarrow[O_2]{excess} M_2O_2 \xrightarrow[O_2]{excess} MO_2$$

$$MO_2 + H^+OH^- \longrightarrow MOH + H_2O_2 + O_2$$

11. The correct order of hydration enthalpies of alkali metal ions is : [2019]

(A) $Li^+ > Na^+ > K^+ > Cs^+ > Rb^+$

(B) $Na^+ > Li^+ > K^+ > Rb^+ > Cs^+$

(C) $Na^+ > Li^+ > K^+ > Cs^+ > Rb^+$

(D) $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$

s-Block

12. A hydrated solid X on heating initially gives a monohydrated compound Y. Y upon heating above $373\ K$ leads to an anhydrous white powder Z. X and Z, respectively, are : [2019]

(A) Washing soda and soda ash

(B) Baking soda and dead burnt plaster.

(C) Washing soda and dead burnt plaster.

(D) Baking soda and soda ash.

$Na_2CO_3 \cdot 10H_2O \xrightarrow{\Delta} Na_2CO_3 \cdot H_2O \longrightarrow Na_2CO_3$

Washing soda (soda ash)

s-Block

13. The INCORRECT statement is : [2019]

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

(B) Lithium is least reactive with water among the alkali metals.

(C) $LiNO_3$ decomposes on heating to give $LiNO_2$ and O_2.

(D) LiCl crystallises from aqueous solution as $LiCl \cdot 2H_2O$.

$$LiNO_3 \longrightarrow Li_2O + NO_2 + O_2$$

$$MNO_3 \xrightarrow{500^\circ C} MNO_2 + O_2$$

$$MNO_2 \xrightarrow{800^\circ C} M_2O + N_2$$

(Na|K|Rb|(s))

14. $NaOH + Cl_2 \longrightarrow A +$ other products Hot & conc. [2020]

$Ca(OH)_2 + Cl_2 \longrightarrow B +$ other products Cold & dil.

A & B are respectively

(A) $NaClO_3, Ca(OCl)_2$

(B) $NaClO_3, Ca(ClO_3)_2$

(C) $NaCl, Ca(ClO_3)_2$

(D) $NaClO, Ca(ClO_3)_2$

s-Block

15. Two elements A and B have similar chemical properties. They don't form solid hydrogen carbonates, but react with nitrogen to form nitrides. A and B, respectively, are [2020]

(A) Li and Mg

(B) Cs and Ba

(C) Na and Rb

(D) Na and Ca

$LiHCO_3$

s-Block

16. Among the statements (a) – (d), the correct ones are : [2020]

(a) Lithium has the highest hydration enthalpy among the alkali metals.

(b) Lithium chloride is insoluble in pyridine.

(c) Lithium cannot form ethynide upon its reaction with ethyne.

(d) Both lithium and magnesium react slowly with H_2O.

(A) (a), (b) and (d) only

(B) (b) and (c) only

(C) (a) and (d) only

(D) (a), (c) and (d) only

LiCl → high ϕ — so covalent

s-Block

17. Among the sulphates of alkaline earth metals, the solubilities of $BeSO_4$ and $MgSO_4$ in water, respectively, are [2020]

(A) poor and poor
(B) poor and high
(C) high and poor
(D) high and high

$BeSO_4$ > $BaSO_4$

s-Block

18. Match List-I with List-II [2021]

List- I (Salt)	List-II (Flame colour wavelength)
(a) $LiCl$	(i) $455.5\ nm$
(b) $NaCl$	(ii) $970.8\ nm$
(c) $RbCl$	(iii) $780.0\ nm$
(d) $CsCl$	(iv) $589.2\ nm$

Choose the correct answer from the options given below :

(A) (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)

(B) (a) - (ii), (b) - (iv), (c) - (iii), (d) - (i)

(C) (a) - (iv), (b) - (ii), (c) - (iii), (d) - (i)

(D) (a) - (i), (b) - (iv), (c) - (ii), (d) - (iii)

s-Block

19. The Correct set from the following in which both pairs are in correct order of melting point is [2021]

(A) $LiF > LiCl; NaCl > MgO$

(B) $LiF > LiCl; MgO > NaCl$

(C) $LiCl > LiF; NaCl > MgO$

(D) $LiCl > LiF; MgO > NaCl$

20. Given below are two statements: [2021]

One is labelled as Assertion A and the other labelled as reason R

Assertion A : During the boiling of water having temporary hardness, $Mg(HCO_3)_2$ is converted to $MgCO_3$

Reason R : The solubility product of $Mg(OH)_2$ is greater than that of $MgCO_3$. In the light of the above statements, choose the most appropriate answer from the options given below:

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

(B) A is true but R is false

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

(D) A is false and R is also false

s-Block

21. Match list-I with list-II : [2021]

List-I	List-II
(a) Be	(i) Treatment of cancer
(b) Mg	(ii) Extraction of metals
(c) Ca	(iii) Incendiary bombs and signals
(d) Ra	(iv) Windows of X-ray tubes
	(v) Bearings for motor engines.

Choose the most appropriate answer the option given below:

(A) a - iv, b-iii, c-i,d – ii

(B) a – iv, b – iii, c – ii, d – i

(C) a – iii, b – iv, c – v, d – ii

(D) a – iii, b – iv, c – ii, d – v

s-Block

22. A s-block element (M) reacts with oxygen to form an oxide of the formula MO_2. The oxide is pale yellow in colour and paramagnetic. The element (M) is:

[2021]

(A) Mg (B) Na (C) Ca (D) K

s-Block

23. Given below are two statements [2021]

Statement I : None of the alkaline earth metal hydroxides dissolve in alkali.

Statement II : Solubility of alkaline earth metal hydroxides in water increases down the group. In the light of the above statements, choose the most appropriate answer from the options given below

(A) Statement I is comect but Statement II is incorrect.

(B) Statement I is incorrect but Statement II is correct.

(C) Statement I and Statement II both are incorrect.

(D) Statement I and Statement II both are correct.

s-Block

24. What are the products formed in sequence when excess of CO_2 is passed in slaked lime? [2021]

(A) $Ca(HCO_3)_2, CaCO_3$

(B) $CaCO_3, Ca(HCO_3)_2$

(C) $CaO, Ca(HCO_3)_2$

(D) $CaO, CaCO_3$

$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3$$

$$CaCO_3 + CO_2 \longrightarrow Ca(HCO_3)_2$$

s-Block

25. Choose the correct order of density of the alkali metals : [2022]

(A) Li < K < Na < Rb < Cs

(B) Li < Na < K < Rb < Cs

(C) Cs < Rb < K < Na < Li

(D) Li < Na < K < Cs < Rb

26. Lithium nitrate and sodium nitrate, when heated separately, respectively, give : [2022]

(A) $LiNO_2$ and $NaNO_2$

(B) Li_2O and Na_2O

(C) Li_2O and $NaNO_2$

(D) $LiNO_2$ and Na_2O

s-Block

27. Which of the following statement is incorrect? [2022]

(A) Low solubility of LiF in water is due to its small hydration enthalpy.

(B) KO_2 is paramagnetic. due to high L.E

(C) Solution of sodium in liquid ammonia is conducting in nature.

(D) Sodium metal has higher density than potassium metal

K^+ O_2^- $D_{Na} > D_K$

s-Block

28. Portland cement contains ' X ' to enhance the setting time. What is ' X '? [2022]

(A) $CaSO_4 \cdot \frac{1}{2}H_2O$

(B) $CaSO_4 \cdot 2H_2O$

(C) $CaSO_4$

(D) $CaCO_3$

s-Block

29. Match List I with List II [2023]

List I		List II	
Elements		Colour imparted to the flame	
A	K	I	Brick Red
B	Ca	II	Violet
C	Sr	III	Apple Green
D	Ba	IV	Crimson Red

Choose the correct answer from the options given below:

(A) A-II, B-I, C-III. D-IV

(B) A-II, B-IV, C-I. D-III

(C) A-II, B-I, C-IV. D-III

(D) A-IV, B-III, C-II. D-I