# FACT/DEFINITION TYPE QUESTIONS

- **1.** Group 2 elements are called alkaline earth metals why? Choose the correct reason(s).
  - (i) Hydroxides formed by group 2 elements are alkaline in nature.
  - (ii) Their metal oxides are found in the earth's crust.
  - (iii) Their oxides are alkaline in nature
  - (iv) Group 2 elements react with alkalies.
  - (a) (i) and (ii) (b) (ii) and (iv)
  - (c) (i), (ii) and (iii) (d) (ii) and (iii)
- 2. Which of the following alkali metal is highly radioactive?
  - (a) Rubidium (b) Caesium
  - (c) Francium (d) Both (a) and (c)
- Which of the following are found in biological fluids Na<sup>+</sup>, Mg<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup>, Sr<sup>2+</sup>, Li<sup>+</sup> and Ba<sup>2+</sup>
  - (a)  $Mg^{2+}$ ,  $Ca^{2+}$ , and  $Sr^{2+}$
  - (b) Na<sup>2</sup> +and K<sup>+</sup>
  - (c) Na<sup>+</sup>, K<sup>+</sup>, Mg<sup>2+</sup>and Ca<sup>2+</sup>
  - (d)  $Sr^+$ , Li and  $Ba^{2+}$
- 4. Which of the following statements is not correct for alkali metals?
  - (a) Alkali metals are the most electropositive metals.
  - (b) Alkali metals exist in free state in nature.
  - (c) These metals have the largest size in a particular period of the periodic table.
  - (d) Both (b) and (c)
- 5. Which of the following has largest size?
  - (a) Na (b)  $Na^+$
  - (c) Na<sup>-</sup> (d) Can't be predicted
- 6. Ionization potential of Na would be numerically the same as
  - (a) electron affinity of  $Na^+$
  - (b) electronegativity of Na<sup>+</sup>
  - (c) electron affinity of He
  - (d) ionization potential of Mg
- 7. Which one of the following properties of alkali metals increases in magnitude as the atomic number rises ?
  - (a) Ionic radius (b) Melting point
  - (c) Electronegativity (d) First ionization energy.

8. Which of the following has density greater than water?

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- (a) Li (b) Na
- (c) K (d) Rb
- **9.** The elements of group 1 provide a colour to the flame of Bunsen burner due to
  - (a) low ionization potential
  - (b) low melting point
  - (c) softness
  - (d) presence of one electron in the outermost orbit
- **10.** The metal that produces red-violet colour in the non-luminous flame is
  - (a) Ba (b) Ag
  - (c) Rb (d) Pb
- **11.** The alkali metals have low melting point. Which of the following alkali metal is expected to melt if the room temperature rises to 30°C?
  - (a) Na (b) K
  - (c) Rb (d) Cs
- 12. In the case of the alkali metals
  - (a) the cation is less stable than the atom
  - (b) the cation is smaller than the atom
  - (c) the cation and the atom have about the same size
  - (d) the cation is larger than the atom
- 13. Which of the following is not correct?

(a) 
$$2\text{Li}_2\text{O} \xrightarrow{\text{heat}} \text{Li}_2\text{O}_2 + 2\text{Li}$$

(b)  $2K_2O \xrightarrow{heat} K_2O_2 + 2K$ 

(c) 
$$2Na_2O \xrightarrow{heat} Na_2O_2 + 2Na_2O_2$$

(d) 
$$2Rb_2O \xrightarrow{heat}{673K} Rb_2O_2 + 2Rb$$

- 14. The element which on burning in air gives peroxide is
  - (a) lithium (b) sodium
  - (c) rubidium (d) caesium

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15.	Which one of the alkali metals, forms only, the normal oxide,	26.	Na metal is stored in
	$M_2O$ on heating in air ?		(a) C H (b) kerosene
	(a) Rb (b) K		(a) $C_6 H_6$ (b) kerösene
	(c) Li (d) Na		(c) alcohol (d) toluene
16.	Which of the following is used as a source of oxygen in	27.	Which of the following metal is used along with lithium
	space capsules, submarines and breathing masks ?		to make the alloy named 'white metal' ?
	(a) $Li_2O$ (b) $Na_2O_2$		(a) Nickel (b) Aluminium
			(c) Silver (d) Lead
	$ \begin{array}{c} (c)  KO_2 \\ \hline \end{array} \qquad (d)  K_2O_2 \\ \hline \end{array} $	28.	Which of the following metal is used as a coolant in
17.	The ionic mobility of alkali metal ions in aqueous solution is		breeder nuclear reactors?
	$\begin{array}{c} \text{maximum for} \\ \text{(a)}  \mathbf{L}^{+} \\ \end{array} $		(a) Potassium (b) Sodium
	(a) $L^+$ (b) $Na^+$		(c) Caesium (d) Rubidium
10	(c) K (d) KD For an aquicous solution under an electric field which of	29.	Which is most basic in character ?
18.	For an aqueous solution under an electric field which of the following have lowest mobility?		(a) CsOH (b) KOH
	(a) $Li^+$ (b) $Na^+$		(c) NaOH (d) LiOH
	$ \begin{array}{c} (a) & L \\ (c) & K^+ \\ \end{array} \qquad \qquad$	30.	Which compound will show the highest lattice energy?
10	Which of the following pairs of substances would give		(a) RbF (b) CsF
17.	same gaseous product on reaction with water?		(c) NaF (d) KF
	(a) Na and Na <sub>2</sub> O <sub>2</sub> (b) Ca and CaH <sub>2</sub>	31.	In crystals which one of the following ionic compounds
	(c) Ca and CaO (d) Ba and BaO <sub>2</sub>		would you expect maximum distance between centres of
20.	Which is the most basic of the following?		cations and anions?
	(a) No $(h)$ (b) $B_{2}(h)$		(a) LiF (b) CsF
	(a) $\operatorname{Na}_2 O$ (b) $\operatorname{BaO}$		(c) CsI (d) LiI
	(c) $As_2O_3$ (d) $Al_2O_3$	32.	Among LiI, NaI, KI, the one which is more ionic and more
21.	Which hydride is most stable		soluble in water is
	(a) NaH (b) KH		(a) KI (b) NaI
	(c) CsH (d) LiH		(c) LiI (d) None of these
22.	The most stable compound is	33.	The products obtained on heating LiNO <sub>2</sub> will be
	(a) LiF (b) LiCl		(a) $\text{Li} O + \text{NO} + O$ (b) $\text{Li} N + O$
	(c) LiBr (d) LiI		$(a) = E_2 O + F(O_2 + O_2) = (b) = E_{13} F(F + O_2)$
23.	Which of the following represents a correct sequence of		(c) $\text{Li}_2\text{O} + \text{NO} + \text{O}_2$ (d) $\text{LiNO}_3 + \text{O}_2$
	reducing power of the following elements?	34.	On heating anhydrous Na <sub>2</sub> CO <sub>3</sub> ,is evolved
	(a) $L_1 > C_S > Rb$ (b) $Rb > C_S > L_1$		(a) $CO_2$ (b) water vapour
•	(c) $Cs > Li > Rb$ (d) $Li > Rb > Cs$		(c) CO (d) no gas
24.	What is the colour of solution of alkali metals in liquid	35.	Complete the following two reactions.
	(a) Propze (b) Plue		(i) $4\text{LiNO}_2 \rightarrow x + \text{O}_2$
	(a) Green (d) Violet		(ii) $2NaNO_2 \rightarrow v + O_2$
25	The alkali metals dissolve in liquid ammonia giving deen		(a) $x = \text{LiNO}_2$ , $y = \text{NaNO}_2$
23.	blue solution The solution is x In concentrated		(b) $x = \text{Li}_2 O + NO_2$ $y = \text{Na}_2 O + NO_2$
	solution, the blue colour changes to $y$ and becomes		(c) $x = Li_2 O + NO_2$ , $y = NaNO_2$
			(d) $r = LiNO_{2}, v = Na_{2}O + NO_{2}$
	(a) $x = paramagnetic$ $y = colourless$	36	Which of the following does not illustrate the anomalous
	z = diamagnetic	50.	properties of lithium?
	(b) $x = \text{diamagnetic}$ $y = \text{colourless}$		(a) The melting point and hoiling point of Li are
	z = paramagnetic		comparatively high
	(c) $x = \text{paramagnetic}$ $y = \text{bronze}$		(b) Li is much softer than the other groun I metals
	z = diamagnetic		(c) Li forms a nitride Li. N unlike group I metals
	(d) $x = paramagnetic$ $y = black$		(d) The join of Li and its compounds are more bessiles

z = diamagnetic

(d) The ion of Li and its compounds are more heavily hydrated than those of the rest of the group

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37.	<ul> <li>Why lithium react less vigorously with water than other alkali metals?</li> <li>(a) Lithium has most negative E<sup>◦</sup> value</li> <li>(b) Lithium has small size and very high hydration</li> </ul>	45.	<ul> <li>Which of the following is/are present as impurity in crude sodium chloride, obtained by crystallisation of brine solution?</li> <li>(i) Sodium sulphate (ii) Calcium chloride</li> <li>(iii) Magnesium chloride (iv) Potassium chloride</li> </ul>	
38.	<ul> <li>energy.</li> <li>(c) Lithium has least negative E<sup>⊖</sup> value</li> <li>(d) Both (a) and (b)</li> <li>Identify the correct statement</li> </ul>	46.	<ul> <li>(a) (i), (ii) and (iv)</li> <li>(b) (ii) and (iii)</li> <li>(c) (iii) and (iv)</li> <li>(d) (i), (ii) and (iii)</li> <li>Which is manufactured by electrolysis of fused NaCl ?</li> </ul>	
	<ul> <li>(a) Elemental sodium can be prepared and isolated by electrolysing an aqueous solution of sodium chloride</li> <li>(b) Elemental sodium is a strong oxidising agent</li> <li>(c) Elemental sodium is insoluble in ammonia</li> </ul>	47.	<ul> <li>(a) NaOH</li> <li>(b) Na</li> <li>(c) NaClO</li> <li>(d) NaClO<sub>3</sub>.</li> <li>Baking soda is</li> <li>(a) NaHCO<sub>3</sub></li> <li>(b) K<sub>2</sub>CO<sub>3</sub></li> <li>(c) NaClO<sub>3</sub></li> </ul>	
39.	(d) Elemental sodium is easily oxidisedWashing soda has formula(a) $Na_2CO_3.7H_2O$ (b) $Na_2CO_3.10H_2O$ (c) $Na_2CO_3.3H_2O$ (d) $Na_2CO_3$	48.	(c) $Na_2CO_3$ (d) NaOH Baking powder contains : (a) $NaHCO_3$ , $Ca(H_2PO_2)_2$ and starch (b) $NaHCO_3$ , $Ca(H_2PO_2)_2$ (c) $NaHCO_3$ , starch	
40.	The process associated with sodium carbonate manufactureis known as(a) Chamber(b) Haber(c) LeBlanc(d) Castner	49.	<ul> <li>(d) NaHCO<sub>3</sub></li> <li>Which of the following is the most abundant ion within cell fluids?</li> <li>(a) Sodium ions</li> <li>(b) Potassium ions</li> <li>(c) Calcium ions</li> <li>(d) None of these</li> </ul>	
41.	<ul> <li>In Solvay ammonia process, sodium bicarbonate is precipitate due to</li> <li>(a) presence of NH<sub>3</sub></li> <li>(b) reaction with CO<sub>2</sub></li> <li>(c) reaction with brine solution</li> </ul>	50. 51.	Which of the following is non-metallic? (a) B (b) Be (c) Mg (d) Al Electronic configuration of calcium atom may be written as (a) $[Ne], 4p^2$ (b) $[Ar], 4s^2$ (c) $[Ne], 4s^2$ (d) $[Ar], 4p^2$	
42.	<ul> <li>(d) reaction with NaOH</li> <li>Sodium carbonate is manufactured by Solvay process. The products which can be recycled are</li> <li>(a) CO<sub>2</sub> and NH<sub>3</sub></li> <li>(b) CO<sub>2</sub> and NH<sub>4</sub>Cl</li> </ul>	52. 53.	The outer electronic configuration of alkaline earth metal is (a) $ns^2$ (b) $ns^1$ (c) $np^6$ (d) $nd^{10}$ Which of the following atoms will have the smallest size?	
43.	(c) NaCl and CaO (d) CaCl <sub>2</sub> and CaO. How NH <sub>3</sub> is recovered in Solvay process? (a) By reaction of NH <sub>4</sub> Cl and Ca(OH) <sub>2</sub> (b) By reaction of NH <sub>4</sub> Cl and Ca(OH) <sub>2</sub>	54.	<ul> <li>(a) Mg</li> <li>(b) Na</li> <li>(c) Be</li> <li>(d) Li</li> <li>The first ionization energy of magnesium is lower than the first ionization energy of</li> </ul>	

- (b) By reaction of  $NH_4HCO_3$  and NaCl
- (c) By reaction of  $(NH_4)_2CO_3$  with  $H_2O$
- (d) By any of the above
- 44. Why Solvay process cannot be extended to the manufacture of potassium carbonate?
  - (a) Ammonium hydrogen carbonate does not react with potassium chloride.
  - (b) Potassium hydrogen carbonate is too soluble to be precipitated by the addition of ammonium hydrogencarbonate to a saturated solution of potassium chloride.
  - (c) Ammonium carbonate is precipitated out instead of potassium hydrogen carbonate on reaction of ammonium hydrogen carbonate with potassium chloride
  - (d) None of the above

(c) Calcium (d) Beryllium Which of the following relations is correct with respect to 55. first (I) and second (II) ionization potentials of sodium and magnesium?

(b) Sodium

(a)  $I_{Mg} = II_{Na}$ (b)  $I_{Mg} < II_{Na}$ 

(c)  $I_{Na} > I_{Mg}$ (d)  $II_{Na} > II_{Mg}$ 

- 56. The first ionization energies of alkaline earth metals are higher than those of alkali metals. This is because
  - (a) there is no change in the nuclear charge
  - (b) there is decrease in the nuclear charge of alkaline earth metals
  - (c) there is increase in the nuclear charge of alkaline earth metals
  - (d) none of these

(a) Lithium

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	<b>TT</b> 71	. 1 . 6.4 . 6.11		
57.	which of the following has maximum ionization energy			
	(a)	$Ba \longrightarrow Ba^+ + e^-$	(b)	$Be \longrightarrow Be^+ + e^-$
	(c)	$Ca \longrightarrow Ca^{2+} + 2e^{-}$	(d)	$Mg \longrightarrow Mg^{2+} + 2e^{-}$
58.	The most electropositive amongst the alkaline earth metals			st the alkaline earth metals
	is			
	(a)	beryllium	(b)	magnesium
	(c)	calcium	(d)	barium
59.	Alk	aline earth metals are n	ot foi	und free in nature because
	(a)	their thermal instabilit	v	
	(b)	their low melting point	ts	
	(c)	their high boiling poin	ts	
	(d)	their greater chemical	reacti	ivity
60.	A fi	rework gives out crims	on cc	bloured light. It contains a
	salt	of		C
	(a)	Ca	(b)	Na
	(c)	Sr	(d)	Ba
61.	Foll	lowing are colours sh	own	by some alkaline earth
	met	als in flame test. Wh	ich o	of the following are not
	cori	ectly matched?		
		Metal	Col	our
	(i)	Calcium	App	ole green
	(ii)	Strontium	Crir	nson
	(111)	Barium	Bric	ck red
	(a)	(i) and (iii)	(b)	(1) only
	(c)	(11) only	(d)	(11) and (111)
62.	which one of the following properties of alkali metals			
	inci	) Ionic radius (b) Melting point		
	(a)	Flastron agotivity	(D) (d)	First ionization on array
()	$(\mathbf{c})$	Electronegativity	(u)	First ionization energy
03.	be n	nost reactive, chemicall	nts w y?	filen one do you expect to
	(a)	Mg	(b)	Ca
	(c)	Sr	(d)	Ba
64.	In t	he reaction $Mg + H_2O$	$\rightarrow \lambda$	$X + H_2$ ; X is
		(steam)	)	2
	(a)	MgO	(b)	Mg(OH) <sub>2</sub>
	(c)	MgH <sub>2</sub>	(d)	None of these
65.	The	metals A and B form oxi	ide bu	t B also forms nitride when
	botł	h burn in air. The A and	B are	
	(a)	Cs, K	(b)	Mg, Ca
	(c)	Li, Na	(d)	K, Mg
66.	Wh	ich of the following is t	he be	est method for preparation
	$\frac{1}{2}$	$Ser_2?$	C.	
	(a)	Thermal descent	<sup>r</sup> 2	(NIL) DoF
	(D)	Pagetian of Demistric	JII OÎ	$(1 n n_4)_2 \text{Ber}_4$
	(c) Reaction of Be with HF			

(d) All of the above are equally effective

	67.	Arr	ange the following of	compour	nds in order of increasing
		SOIL		(``)	Q F
		(1)	MgF <sub>2</sub>	(11)	CaF <sub>2</sub> ,
		(III)	$\operatorname{BaF}_2$	<b>(</b> )	
		(a)	(1) < (11) < (111)	(b)	(11) < (1) < (111)
		(c)	(11)<(11)<(11)	(d)	(111) < (11) < (1)
	68.	Alk	aline earth metals are	•	
		(a)	reducing agent	(b)	amphoteric
		(c)	dehydrating agent	(d)	oxidizing agent
	69.	The	e oxidation state show	vn by alk	caline earth metals is
		(a)	+2	(b)	+1,+2
		(c)	-2	(d)	-1,-2
	70.	Wh	ich one of the follow	ing is th	e most soluble in water?
		(a)	Mg(OH) <sub>2</sub>	(b)	Sr(OH) <sub>2</sub>
		(c)	Ca(OH) <sub>2</sub>	(d)	$Ba(OH)_2$
	71.	Wh	ich of the following	alkaline	earth metal hydroxides is
		am	ohoteric in character		-
		(a)	Be(OH) <sub>2</sub>	(b)	Ca(OH) <sub>2</sub>
		(c)	Sr(OH) <sub>2</sub>	(d)	Ba(OH) <sub>2</sub>
	72.	Oft	he metals Be, Mg, Ca	and Sr o	f group 2 A. In the periodic
		tabl	e the least ionic chlo	ride wou	ald be formed by
		(a)	Be	(b)	Mg
		(c)	Ca	(d)	Sr
	73.	The	order of solubility of	fsulphat	es of alkaline earth metals
		in v	vater is	1	
		(a)	Be > Mg > Ca > Sr >	>Ba	
		(b)	Mg > Be >> Ba > Ca	a > Sr	
		(c)	Be > Ca > Mg > Ba	>> Sr	
		(d)	Mg > Ca > Ba >> B	e>Sr	
	74.	The	solubilities of carbon	ates decr	ease down the magnesium
		gro	up due to a decrease	in	
		(a)	hydration energies	of cation	ns
		(b)	inter-ionic attraction	n	
		(c)	entropy of solution	formatio	on
		(d)	lattice energies of s	olids	
	75	The	correct order of incr	easing th	permal stability of K.CO.
		Mg	$CO_3$ , $CaCO_3$ and $BeO_3$	$CO_3$ is	ierniar statisticy of the 2003;
		(a)	BeCO <sub>3</sub> < MgCO <sub>3</sub> <	CaCO <sub>3</sub>	$< K_2 CO_3$
		(b)	MgCO <sub>3</sub> < BeCO <sub>3</sub> <	CaCO	$< K_2 CO_3$
		(c)	$K_2CO_2 < MgCO_2 <$	CaCO <sub>2</sub>	< BeCO <sub>2</sub>
		(d)	$BeCO_2 < MgCO_2 <$	K <sub>2</sub> CO <sub>2</sub>	$< CaCO_2$
	76.	Inv	which of the following	1g the h	vdration energy is higher
		tha	n the lattice energy?	3 <b>e</b> II	,
		(a)	MgSO₄	(b)	RaSO <sub>4</sub>
		(c)	SrSO <sub>4</sub>	(d)	BaSO
	77.	Wh	ich of the following:	alkaline	earth metal sulphates has
	•	hvd	ration enthalpy high	er than t	the lattice enthalpy?
nyuration entitalpy higher than the lattice enthal					

(a) $CaSO_4$ (b)	b) $BeSO_2$	4
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(c)  $BaSO_4$  (d)  $SrSO_4$ 

# THE s-BLOCK ELEMENTS

78.	Beryllium shows diagona Which of the following sin (a) Be forms beryllates an (b) Be(OH) <sub>2</sub> like Al(OH)	I relationship with aluminium. nilarity is incorrect ? nd Al forms aluminates a is basic.	<ul> <li>90. For a good quality cement what should be the ratio of following:</li> <li>I. Silica to alumina</li> <li>II. CaO to the total of oxides of SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub> and Fe<sub>2</sub>O</li> </ul>
	(c) Be like Al is rendered	1 passive by HNO <sub>2</sub> .	(a) $I = 2.5 \text{ to } 4$
79.	(d) $Be_2C$ like $Al_4C_3$ yield The substance <b>not</b> likely to (a) gypsum	ds methane on hydrolysis. o contain CaCO <sub>3</sub> is (b) sea shells	<ul> <li>II = Greater than 2</li> <li>(b) I = Nearly 4</li> <li>II = Less than 2</li> </ul>
80.	<ul><li>(c) dolomite</li><li>Plaster of Paris is</li></ul>	(d) a marble statue	(c) $I = 2.5$ II = Closer to 2 (d) $I = 2.5 to 4$
	(a) $CaSO_4.2H_2O$	(b) $CaSO_4.H_2O$	(d) $I = 2.5 \text{ to } 4$ II = Closer to 2
	(c) $CaSO_4 \cdot \frac{1}{2}H_2O$	(d) $CaSO_4.4H_2O$	<ul> <li>91. Calcitonin and parathyroid hormone regulate concentration of which of the following element in plasma?</li> <li>(a) Calcium (b) Magnesium</li> </ul>
81.	Gypsum on heating at 120	– 130°C gives	(c) Sodium (d) Potassium
	(a) anhydrous salt	(b) hemihydrate	<b>92.</b> Which of the following metal is found in green colourin
	(c) monohydrate	(d) dihydrate	pigment chlorophyll of plants?
82.	Plaster of Paris on makir	ng paste with little water sets to	(a) Fe (b) Mg
	(a) $CaSO$	(b) $C_{3}SO_{1}/2HO_{2}$	(c) Na (d) Al
	(a) $CaSO_4$ (c) $CaSO_4$ H <sub>2</sub> O	(d) $CaSO_4.1/2H_2O$	STATEMENT TYPE QUESTIONS
83.	The chemical which is use	d for plastering the broken bones	
	is	1 0	93. Select the correct statements $(2 - C)^{+1}$
	(a) $(CaSO_4)_2H_2O$	(b) $MgSO_4.7H_2O$	(i) CS <sup>-</sup> is more nightly hydrated that the other alkali meta
	(c) $\text{FeSO}_4$ . $7\text{H}_2\text{O}$	(d) $CuSO_4$ . $5H_2O$	(ii) Among the alkali metals Li Na K and Rb lithium ha
84.	Dead burn plaster is		the highest melting point
	(a) $CaSO_4.2H_2O$	(b) $MgSO_4$ . $7H_2O$	(iii) Among the alkali metals only lithium forms a stabl
07	(c) $CaSO_4 \cdot \frac{1}{2} H_2O$	(d) $CaSO_4$	nitride by direct combination with nitrogen
85.	The formula for calcium ch (a) $G_{2}(C O_{1})$	$\frac{1}{10} = C_{-1}(C_{10})$	(a) (i), (ii) and (iii) (b) (i) and (ii)
	(a) $Ca(CIO_4)_2$	(b) $Ca(CIO_3)_2$ (d) $Ca(CIO_3)_2$	(c) (i) and (iii) (d) (ii) and (iii)
86	(c) $CaCIO_2$ Bone ash contains	(u) $Ca(CIO_2)_2$	<b>94.</b> Which of the following sequence of T and F is correct fo
00.	(a) $CaO$	(b) CaSO.	alkall metals ? Here I represents True and F represent
	(c) $Ca_2(PO_4)_2$	(d) $Ca(H_2PO_4)_2$	(i) Alkali metal hydrides are jonic solids with high
87.	Mortar is a mixture of	() (2 4/2	melting point.
	(a) $CaCO_3$ , sand and wat	ter	(ii) All alkali halides are ionic in nature.
	(b) slaked lime and water		(iii) Li is the least powerful reducing agent and Na is th
	(c) slaked lime, sand and	water	most powerful reducing agent.
	(d) CaCO <sub>3</sub> and CaO		(a) TTT (b) TFT
88.	Which gas is released w	then CaCO <sub>3</sub> reacts with dilute	(c) FIF (d) IFF
	HCI?	(h) CO	<b>y5.</b> which of the following statement(s) is/are correct regarding $L_1$ , CO, and Na, CO ?
	(a) $\Pi_2$	$\begin{array}{c} (0) & CO_2 \\ (d) & CI \end{array}$	(i) Sodium salt evolve $CO_2$ at higher temperature
80	Setting of comment is an	$(u)  Cl_2$	(i) Polarization of Na <sup>+</sup> is lesser than that of L i <sup>+</sup>
57.	(a) exothermic reaction		(a) Both statements (i) and (ii) are correct
	(b) endothermic reaction		(b) Both statements (i) and (ii) are incorrect
	(c) neither endothermic r	nor exothermic	(c) Statement (ii) is correct explanation for statement (i)

(d) example of neutralisation reaction

(d) Statement (i) is correct explanation for statement (ii)

- 96. Which of the following sequence of T and F is correct for given statements?
  - The alkali metal hydroxides are the strongest of all (i) bases.
  - (ii) All alkali metal halides have high negative enthalpies of formation.
  - (iii) The stability of the carbonates and hydrogen carbonates of alkali metals decrease with increase in electropositive character down the group.
  - (iv) Only LiHCO<sub>3</sub> exist as solid.
  - (a) TTFF (b) TTTT
  - (c) FTFT (d) TFFT
- 97. Which of the following statement(s) is/are correct?
  - The atomic and ionic radii of alkaline earth metals are (i) smaller than those of the corresponding alkali metals in the same periods.
  - (ii) Second ionisation enthalpies of the alkaline earth metals are smaller than those of the corresponding alkali metals.
  - (iii) Compounds of alkaline earth metals are more extensively hydrated than those of alkali metals
  - (a) (i) and (ii) (b) (ii) and (iii)
  - (c) (i) and (iii) (d) (i), (ii) and (iii)
- 98. Which of the following statements are correct ?
  - (i) Copper beryllium alloys are used in the preparation of high strength springs
  - (ii) Metallic beryllium is used for making window X-ray tubes.
  - (iii) Magnesium powder is used in incendiary bombs and singnals.
  - (iv) Barium is used in treatment of cancer.
  - (a) (i), (ii) and (iv) (b) (i) and (iii)
  - (c) (i), (ii) and (iii) (d) (i), (ii), (iii) and (iv)
- 99. Which of the following is/are not characteristic property(ies) of alkaline earth metals ?
  - All alkaline earth metal oxides are basic in nature and (i) forms sparingly soluble hydroxides with water.
  - (ii) The hydrated chlorides, bromides and iodies of Ca, Sr and Ba on heating undergoes hydrolysis while corresponding hydrated halides of Be and Mg on heating undergo dehydration.
  - (iii) Nitrates of alkaline earth metals decompose on heating as below
    - $2M(NO_3)_2 \rightarrow 2MO + 4NO_2 + O_2$
  - (b) (ii) only (a) (i) only
  - (c) (i) and (iii) (d) (i) and (ii)
- 100. Which of the following statement(s) is/are correct regarding Al and Be?
  - (i) Both of these react with alkali.
  - (ii) There is diagonal relationship among these elements.
  - (a) Both (i) and (ii) (b) Only(i)
  - (c) Only(ii) (d) Neither (i) nor (ii)

# MATCHING TYPE QUESTIONS

<b>101.</b> Match the columns
-------------------------------

Column-1		Column-I	Column-II		
	(All	kali metal)	(Co	lour imparted to an oxidizing flame)	
	(A)	Cs	(p)	Yellow	
	(B)	Rb	(q)	Blue	
	(C)	Κ	(r)	Violet	
	(D)	Na	(s)	Red violet	
	<b>(E)</b>	Li	(t)	Crimson red	
	(a)	A – (q), B – (s), C –	(r), I	D - (p), E - (t)	
	(b)	A – (s), B – (q), C –	(r), I	D - (p), E - (t)	
	(c)	A - (t), B - (r), C - (t)	(s), C	0 - (p), E - (q)	
	(d)	A - (q), B - (p), C -	(r), l	D - (p), E - (t)	

# **102.** Match the columns

	Column-I		Column-II
	(Metal)	(Ox	ide formed on burning)
(A)	Caesium	(p)	Superoxide
(B)	Lithium	(q)	Peroxide
(C)	Sodium	(r)	Monoxide
(a)	A – (q), B – (p), C –	(r)	
(b)	A – (r), B – (q), C –	(p)	
(c)	A - (p), B - (r), C -	(q)	
(d)	A - (q), B - (r), C -	(p)	

103. Match the columns. Here Column-I shows the names of the metals used with lithium to make useful alloys and Column-II shows the uses of these alloys

Column-II

engines.

Column-II

(Uses)

(p) In fire extinguisher

(q) In manufacture of

NaOH and Na<sub>2</sub>CO<sub>3</sub>

(r)

glass, soap, borax

and caustic soda.

(s) In petroleum refining

In preparation of  $Na_2O_2$ ,

Column	- <b>I</b>
A 1	

- (A) Aluminium (p) Armour plates (B) Magnesium (q) Aircraft parts Bearings for motor (r)
- (C) Lead
- (a) A (q), B (p), C (r)
- (b) A (q), B (r), C (p)
- (c) A (p), B (q), C (r)
- (d) A (p), B (r), C (q)
- **104.** Match the columns.

# Column-I

# (Sodium compound)

- (A) Sodium carbonate
- (B) Sodium chloride
- (C) Sodium hydroxide
- (D) Sodium hydrogen carbonate
- (a) A (q), B (r), C (s), D (p)
- (b) A (s), B (q), C (r), D (p)
- (c) A (p), B (s), C (r), D (q)
- (d) A (s), B (r), C (p), D (q)

105. Match the columns

- Column-I Column-II (A) Quick lime (p) Ca(OH)<sub>2</sub>
- (B) Slaked lime (q) CaO
- (C) Bleaching powder (r)  $Ca(OCl)_2$
- (D) Plaster of Paris (s)  $CaSO_4$ .  $H_2O$
- (a) A-(p), B-(q), C-(r), D-(s)
- (b) A-(s), B-(r), C-(q), D-(p)
- (c) A-(q), B-(p), C-(r), D-(s)
- (d) A-(q), B-(p), C-(s), D-(r)

#### **106.** Match the columns

- (A) Quick lime (p) Setting fractured bones
- (B) Plaster of Paris (q) A constituent of chewing gum
- (C) Slaked lime (r) Manufacture of bleaching powder
- (D) Limestone (s) Manufacture of dyestuffs
- (a) A-(p), B-(s), C-(q), D-(r)
- (b) A-(s), B-(p), C-(r), D-(q)
- (c) A-(q), B-(r), C-(p), D-(s)
- (d) A-(r), B-(q), C-(s), D-(p)

# ASSERTION-REASON TYPE QUESTIONS

**Directions :** Each of these questions contain two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

- (a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.
- (b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion
- (c) Assertion is correct, reason is incorrect
- (d) Assertion is incorrect, reason is correct.
- 107. Assertion: Lithium salts are mostly hydrated.Reason : The hydration enthalpy of alkali metal ions decreases with increase in ionic sizes.
- **108.** Assertion : Lithium carbonate is not so stable to heat. Reason : Lithium being very small in size polarizes large

 $CO_3^{2-}$  ion leading to the formation of more stable Li<sub>2</sub>O and CO<sub>2</sub>

**109.** Assertion : Compounds of beryllium is largely covalent and get hydrolysed easily.

**Reason :** This is due to high value of ionisation potential and small size of Be.

**110.** Assertion : Radium is most abundant *s*-block element.**Reason :** *s*-block elements are non-radioactive in nature.

# **CRITICAL THINKING TYPE QUESTIONS**

- **111.** The melting point of lithium (181°C) is just double the melting point of sodium (98°C) because
  - (a) down the group, the hydration energy decreases
  - (b) down the group, the ionization energy decreases
  - (c) down the group the cohesive energy decreases
  - (d) None of these
- **112.** Li has the maximum value of ionisation potential among alkali metals i.e. lithium has the minimum tendency to ionise to give LI<sup>+</sup> ion. Thus, in aq. solution lithium is
  - (a) strongest reducing agent
  - (b) poorest reducing agent
  - (c) strongest oxidising agent
  - (d) poorest oxidising agent
- **113.** Lithium is strongest reducing agent among alkali metals due to which of the following factor?
  - (a) Ionization energy (b) Electron affinity
  - (c) Hydration energy (d) Lattice energy
- 114. Which of the following statements is incorrect?
  - (a) Alkali metal hydroxide are hygroscopic
  - (b) Dissolution of alkali metal hydroxide is endothermic
  - (c) Aqueous solution of alkali metal hydroxides are strongly basic
  - (d) Alkali metal hydroxides form ionic crystals
- **115.** Which of the following on thermal decomposition yields a basic as well as acidic oxide ?
  - (a) NaNO<sub>3</sub> (b) KClO<sub>3</sub>
  - (c)  $CaCO_3$  (d)  $NH_4NO_3$
- **116.** Which one of the following on hydrolysis, gives the corresponding metallic hydroxide, H<sub>2</sub>O<sub>2</sub> and O<sub>2</sub>?
  - (a)  $Li_2O$  (b)  $Na_2O_2$
  - (c)  $NaO_2$  (d)  $Na_2O$
- 117. Which of the following oxides of potassium is not known?
  - (a)  $K_2O$  (b)  $K_2O_4$
  - (c)  $KO_3$  (d)  $K_2O_3$
- **118.** Suppose an element is kept in air chamber, than air content was evaluated after sometime, oxygen and nitrogen content was found to be low comparitively. The given element will be
  - (a) Li (b) Rb
  - (c) Na (d) K
- **119.** Suppose metal react with the oxygen to form oxide, than aqueous solution of this oxide when added to a solution of HI, solution turn yellowish brown in colour. This compound is
  - (a)  $Na_2O$  (b)  $Li_2O$
  - (c) NaOH (d)  $Na_2O_2$
- **120.** Which of the following salt of lithium is most soluble in organic solvent ?
  - (a) LiF (b) LiCl
  - (c) LiBr (d) LiI

- **121.** Arrange the following in increasing order of their melting point ?
  - (A) LiCl, (B) NaCl, (C) KCl
  - (a) A < B < C (b) B < A < C
- (c)  $C \le A \le B$  (d)  $A \le B = C$ **122.** The raw materials in Solvay Process are
  - (a)  $Na_2CO_3$ ,  $CaCO_3$  and  $NH_3$
  - (b)  $Na_2SO_4$ , CaCO<sub>3</sub> and  $NH_3$
  - (c) NaCl,  $NH_3$  and  $CaCO_3$
  - (d) NaOH, CaO and NH<sub>3</sub>.
- **123.** Compared with the alkaline earth metals, the alkali metals exhibit
  - (a) smaller ionic radii (b) highest boiling points
  - (c) greater hardness (d) lower ionization energies.
- **124.** Property of the alkaline earth metals that increases with their atomic number is
  - (a) solubility of their hydroxides in water
  - (b) solubility of their sulphates in water
  - (c) ionization energy
  - (d) electronegativity
- **125.** Which one of the following does not react with water even under red hot condition?
  - (a) Na (b) Be
  - (c) Ca (d) K
- **126.** Magnesium burns in  $CO_2$  to form
  - (a) MgO+C (b) MgO+CO
  - (c)  $MgCO_3$  (d)  $MgO_3$
- **127.** Arrange the following in increasing order of their solubility? MgCO<sub>3</sub>(A), CaCO<sub>3</sub>(B), SrCO<sub>3</sub>(C), Na<sub>2</sub>CO<sub>3</sub>(D)

(a) A < B < C < D(b) A < C < B < D(c) C < A < B < D(d) C < B < A < D

- **128.** Which of the following will precipitate first when aqueous solution containing sulphate ions are added?
  - (a)  $Mg^{2+}$  (b)  $Ca^{2+}$
  - (c)  $Sr^{2+}$  (d)  $Ba^{2+}$
- **129.** If the fluoride salts of group 2 metals are dissolved in water, than which of the following will show high solubility?
  - (a)  $BaF_2$  (b)  $RbF_2$
  - (c)  $CaF_2$  (d)  $BeF_2$
- **130.** Aqueous solution of group 2 is precipitated by adding  $Na_2CO_3$ , then this precipitate is tested on flame, no light in visible region is observed, this element can be
  - (a) Ba (b) Mg
  - (c) Ca (d) Sr
- 131. Which of the following statement is false?
  - (a) Strontium decomposes water readily than beryllium
  - (b) Barium carbonate melts at a higher temperature than calcium carbonate
  - (c) Barium hydroxide is more soluble in water than magnesium hydroxide
  - (d) Beryllium hydroxide is more basic than barium hydroxide.
- **132.** Bleaching powder is obtained by the interaction of chlorine with
  - (a) dil. solution of  $Ca(OH)_2$
  - (b) dry CaO
  - (c) conc. solution of Ca(OH)<sub>2</sub>
  - (d) dry slaked lime

# HINTS AND SOLUTIONS

# FACT/DEFINITION TYPE QUESTIONS

- 1. (c) Group 2 elements are called alkaline earth metals as their oxides and hydroxides are alkaline in nature and these metal oxides are found in the earth's crust.
- 2. (c) Francium is highly radioactive.
- **3.** (c) Monovalent sodium and potassium ions and divalent magnesium and calcium ions are found in large proportions in biological fluids.
- 4. (b) Alkali metals readily lose electron to give monovalent  $M^+$  ion. Hence they are never found in free state in nature.
- 5. (c) A cation is always much smaller than the corresponding atom, whereas an anion is always larger than the corresponding atom.

Hence, correct order of the size is

 $Na^->Na>Na^+$ 

- 6. (a)  $Na \rightarrow Na^+ + e^-$ ; IE of Na = +ve  $Na^+ + e^- \rightarrow Na$ ; E.A. of  $Na^+ = -ve$ Both are equal but opposite in nature
- (a) Within a group, ionic radius increases with increase in atomic number. The melting points decrease down the group due to weakening of metallic bond. The electronegativity and the 1<sup>st</sup> ionization energy also decreases down the group.
- **8.** (d) Li, Na, K are lighter than water but Rb is heavier than water.
- 9. (a)
- 10. (c) Alkali metals have large size. When they are heated in the flame of Bunsen burner, the electrons present in the valence shell move from lower energy level to higher energy level by absorption of heat from the flame. When they come back to the ground state, they emit the extra energy in the form of visible light to provide colour to the flame.
- 11. (d)
- 12. (b) Gp 1 metals form cations M<sup>+</sup> by loss of electron from outermost shell. Electronic configuration of Gp 1 metals is ns<sup>1</sup>. When the outer electron is removed to give a positive ion, the size decreases because the outermost shell is completely removed. After removal of an electron, the positive charge of the nucleus is greater on the remaining electrons so that each of the remaining electrons are attracted more strongly towards the nucleus. This further reduces the size.
- 13. (a) Lithium does not form peroxide.
- 14. (b) Sodium metal on burning in air gives sodium peroxide.

15. (c) All the alkali metals when heated with oxygen form different types of oxides for example lithium forms lithium oxide (Li<sub>2</sub>O), sodium forms sodium peroxide  $(Na_2O_2)$ , while K, Rb and Cs form their respective superoxides.

$$2\mathrm{Li} + \frac{1}{2}\mathrm{O}_2 \to \mathrm{Li}_2\mathrm{O}$$

16. (c) Because  $KO_2$  not only provides  $O_2$  but also removes  $1CO_2$  as follows

$$4\text{KO}_2 + 2\text{CO}_2 \rightarrow 2\text{K}_2\text{CO}_3 + 3\text{O}_2$$
$$4\text{KO}_2 + 4\text{CO}_2 + 2\text{H}_2\text{O} \rightarrow \text{KHCO}_3 + 3\text{O}_2$$

- 17. (d) Smaller the size of cation higher is its hydration energy and lesser is its ionic mobility hence the correct order is  $Li^+ < Na^+ < K^+ < Rb^+$
- (a) In aqueous solution because of high charge density of Li<sup>+</sup> it is heavily hydrated, therefore due to its extensive hydration which increases its size to highest the mobility of Li<sup>+</sup> ion will be lowest.
- **19.** (b) Both Ca and CaH<sub>2</sub> produce  $H_2$  gas with water.

$$Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2 \uparrow$$

 $CaH_2 + 2H_2O \longrightarrow Ca(OH)_2 + 2H_2 \uparrow$ 

- 20. (a)
- **21.** (d) The basic character and stability of hydrides decrease down the group.
- 22. (a) For a given metal, order of stability of halides is MF > MCl > MBr > MI
- 23. (a) A reducing agent is a substance which can loose electron and hence a reducing agent should have low ionisation energy. Now since ionisation energy decreases from Li to Cs, the reducing property should increase from Li to Cs. The only exception to this is lithium. This is because the net process of converting an atom to an ion takes place in 3 steps.

(i)  $M(s) \rightarrow M(g)$   $\Delta H =$  Sublimation energy (ii)  $M(g) \rightarrow M^+(g) + e^ \Delta H =$  Ionisation energy (iii)  $M^+(g)+H_2O \rightarrow M^+(aq) \Delta H =$  Hydration energy The large amount of energy liberated in hydration of Li (because of its small size) makes the overall  $\Delta H$ negative. This accounts for the higher oxidation potential of lithium i.e., its high reducing power.

- 24. (b) The alkali metals dissolve in liquid ammonia giving deep blue solution.
- 25. (c) x = paramagnetic y = bronzez = diamagnetic
- 26. (b) Na reacts violently and may catch fire on exposure to moisture (air + water). So it is always stored in kerosene. Na reacts with alcohol to produce  $H_2$ .

27. Lithium with lead is used to make white metal. (d) 28. **(b)** Liquid sodium is used as a coolant in fast breeder nuclear reactors. 29. (a) Since the ionization energies of alkali metals decrease down the group, the ionic character and consequently basic property of their hydroxides increases in the same order, i.e. from LiOH to CsOH. With the same anion, smaller the size of the cation, 30. (c) higher is the lattice energy. The correct order of size of cations is - $Na^+ < K^+ < Rb^+ < Cs^+$ 

Hence, the lattice energy of NaF will be maximum. i.e., NaF.

- (c) As  $Cs^+$  ion has larger size than  $Li^+$  and  $I^-$  has larger 31. size than F<sup>-</sup>, therefore maximum distance between centres of cations and anions is in CsI.
- Larger cation  $(K^+)$  develops less polarisation in anion 32. (a) and thus KI has more ionic nature and more soluble in water
- 33. (a)  $4\text{LiNO}_3 \rightarrow 2\text{Li}_2\text{O} + 4\text{NO}_2 + \text{O}_2$
- (d) Anhydrous form of  $Na_2CO_3$  does not decompose on 34. heating even to redness. It is a amorphous powder called soda ash.
- (c)  $4\text{LiNO}_3 \rightarrow 2\text{Li}_2\text{O} + 4\text{NO}_2 + \text{O}_2$ 2 NaNO<sub>3</sub>  $\rightarrow 2\text{NaNO}_2 + \text{O}_2$ 35.
- 36. (b) Li is much softer than the other group I metals. Actually Li is harder then other alkali metals.
- (b) Lithium although has most negative  $E^{\Theta}$  value reacts 37. less vigorously with water than other alkali metals due to its small size and very high hydration energy.
- (d) Elemental sodium is easily oxidised (has low I.P.) and 38. acts as reductant.
- Washing soda is Na<sub>2</sub>CO<sub>3</sub>.10 H<sub>2</sub>O. 39. **(b)**
- 40. (c)
- $NH_4HCO_3 + NaCl \longrightarrow NaHCO_3 \downarrow + NH_4Cl$ 41. (c) Brine Sod. bicarbonat eppt
- 42. CO<sub>2</sub> and NH<sub>3</sub> formed are reused (See Solvay process) **(a)**
- NH<sub>3</sub> is recovered when the solution containing **43**. **(a)**  $NH_4Cl$  is treated with Ca(OH)<sub>2</sub>

$$2NH_4Cl + Ca(OH)_2 \rightarrow 2NH_3 + CaCl_2 + H_2C$$

- 44. **(b)**
- Sodium sulphate, calcium chloride and magnesium 45. (d) chloride are present as impurities in crude sodium chloride.
- (b) Na metal is manufactured by electrolysis of fused NaCl 46. by two methods.
  - (i) Castner's process
  - (ii) Down's process

In both the above processes electrolysis of fused sodium chloride produces Na at cathode.

$$2 \text{NaOH} \Longrightarrow 2 \text{Na}^+ + \text{OH}^-$$

at cathode  $2Na^+ + 2e^- \longrightarrow 2Na$ at anode  $4OH^- \longrightarrow 2H_2O + O_2 + 4e$ 

- 47. NaHCO<sub>3</sub> (baking soda) is one of the major constituents **(a)** of baking powder.
- **48.** Baking powder has starch, NaHCO<sub>3</sub> and Ca(H<sub>2</sub>PO<sub>2</sub>)<sub>2</sub>. **(a)**
- Potassium ions are the most abundant cations within 49. **(b)** cell fluids.
- 50. Metallic character decreases, as we go to the right **(a)** side in a period and increases when we move downwards in a group.

**51.** (b) Ca (20) = 
$$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 = [Ar], 4s^2$$

- 52. **(a)**
- 53. (c) Within a period, the size decreases from left to right, i.e., Na > Mg > Li > Be. Atomic size increases down the group.
- 54. (d)
- 55. The IInd ionisation potential of Na is higher than Mg (d) because it requires more energy to remove an electron from a saturated shell or stable (fully filled) orbital.

$$11^{\text{Na}} \longrightarrow 1s^{2}, 2s^{2} 2p^{6}, 3s^{1} \xrightarrow{I}$$

$$1s^{2}, 2s^{2} 2p^{6}, 3s^{0} \xrightarrow{\text{II}}$$

$$1s^{2}, 2s^{2} 2p^{5}, 3s^{0}$$

$$12^{\text{Mg}} \longrightarrow 1s^{2}, 2s^{2} 2p^{6}, 3s^{2} \xrightarrow{I}$$

$$1s^{2}, 2s^{2} 2p^{6}, 3s^{1} \xrightarrow{\text{II}} 1s^{2}, 2s^{2} 2p^{6}, 3s^{0}$$

Here Na-I < Mg-I and Na-II > Mg-II.

56. (c) As we go from grp I element to grp II element in a period, an extra electron is added in same shell which results in increase in nuclear charge due to which force of attraction by the nucleus increases and hence ionic radii decreases and consequently I.E. increases.

- Calcium gives brick red colour and barium gives 61. (a) apple green colour in flame test.
- 62. Within a group, ionic radius increases with increase in (a) atomic number. The melting points decrease down the group due to weakning of metallic bond. The electronegativity and the 1st ionization energy also decreases down the group.
- Barium is most electropostive element among those **63**. (d) given. Hence it is most reactive.
- **64**. (a) Mg(OH)<sub>2</sub> is not formed because of poor solubility of MgO in H<sub>2</sub>O.
- 65. (d) K and Mg, both form oxides

$$K + O_2 \rightarrow KO_2$$
;  $2Mg + O_2 \rightarrow 2MgO$ 

Mg form nitride also  $3Mg + N_2 \rightarrow Mg_3N_2$ K does not form nitride.

- 66. **(b)** Thermal decomposition of  $(NH_4)_2BeF_4$  is the best method for preparation of BeF<sub>2</sub>.
- $BaF_2 > MgF_2 > CaF_2$ 67. **(b)**
- Alkaline earth metals have a fairly strong tendency to **68**. (a) lose their outermost electrons due to which they act as reducing agent.

- 69. (a)
- 70. (d) For a compoud to be soluble, the hydration energy must exceed lattice energy. For Gp.II hydroxides  $(Mg(OH)_2, Sr(OH)_2, Ca(OH)_2, Ba(OH)_2, lattice energy decrease more rapidly than the hydration energy & so their solubility increases down the group. Ba(OH)_2 > Sr(OH)_2 > Ca(OH)_2 > Mg(OH)_2$
- **71.** (a)  $Be(OH)_2$  is amphoteric while  $Ca(OH)_2$ ,  $Sr(OH)_2$  and  $Ba(OH)_2$  are all basic.
- 72. (a) Because of small atomic size and high I.E. Be forms covalent chloride.
- 73. (a)
- 74. (a) As we move down the group, the lattice energies of carbonates remain approximately the same. However the hydration energies of the metal cation decreases from Be<sup>++</sup> to Ba<sup>++</sup>, hence the solubilities of carbonates of the alkaline earth metal decrease down the group mainly due to decreasing hydration energies of the cations from Be<sup>++</sup> to Ba<sup>++</sup>.
- **75.** (a) As the basicity of metal hydroxides increases down the group from Be to Ba, the thermal stability of their carbonates also increases in the same order. Further group 1 compounds are more thermally stable than group 2 because their hydroxide are much basic than group 2 hydroxides therefore, the order of thermal stability is

 $BeCO_3 < MgCO_3 < CaCO_3 < K_2CO_3.$ 

76. (a) In alkaline earth metals ionic size increases down the group. The lattice energy remains constant because sulphate ion is so large, so that small change in cationic sizes do not make any difference. On moving down the group the degree of hydration of metal ions decreases very much leading to decrease in solubility

$$\therefore$$
 BeSO<sub>4</sub> > MgSO<sub>4</sub> > CaSO<sub>4</sub> > SrSO<sub>4</sub> > BaSO<sub>4</sub>

77. (b)  $Be^{2+}$  is very small, hence its hydration enthalpy is greater than its lattice enthalpy

**78.** (b) The  $Be(OH)_2$  and  $Al(OH)_3$  are amphoteric in nature.

- **79.** (a) Gypsum is  $CaSO_4.2H_2O$
- **80.** (c) Chemically plaster of Paris is  $CaSO_4$ .1/2H<sub>2</sub>O.

**81.** (b) 
$$\operatorname{CaSO}_4 \cdot 2\operatorname{H}_2O \xrightarrow{120^{\circ}C} \operatorname{CaSO}_4 \cdot \frac{1}{2}\operatorname{H}_2O$$

Plaster of Paris is hemihydrate.

82. (d) Plaster of Paris (CaSO<sub>4</sub>  $\cdot \frac{1}{2}$  H<sub>2</sub>O) on making paste with little water sets to a hard mass due to formation of gypsum (CaSO<sub>4</sub>.2H<sub>2</sub>O).

$$CaSO_4 \cdot \frac{1}{2}H_2O + \frac{3}{2}H_2O \rightarrow CaSO_4 \cdot 2H_2O + Heat$$

Plaster of Paris Gypsum

83. (a)  $(CaSO_4)_2$ .H<sub>2</sub>O – Plaster of paris is used for plastering the broken bones.

84. (d) 85. (d) 86. (c) 87. (c)

- 88. (b)  $CaCO_3 + 2HCl \longrightarrow 2CaCl_2 + H_2O + CO_2$
- 89. (a) During setting of cement, silicates and aluminates of calcium are hydrated. Hydration is an exothermic process. Therefore setting of cement is exothermic process.
- **90.** (d) 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.
- **91.** (a) The calcium concentration in plasma is regulated at about 100 mgL<sup>-1</sup>. It is maintained by two hormones: calcitonin and parathyroid hormone.
- 92. (b)

### STATEMENT TYPE QUESTIONS

- 93. (d) Amongst alkali metal Li ions are highly hydrated.
- 94. (d) Lithium halides are some what covalent in nature. Li is the most powerful reducing agent and Na is the least powerful reducing agent.
- 95. (c)
- **96.** (a) For statement (iii), stability of the carbonates and hydrogen carbonates of alkali metals increases with increase in electropositive character down the group. Hydrogen carbonate of lithium does not exist as a solid.
- 97. (d) All the given statements are correct.
- 98. (c) Radium is used in treatment of cancer.
- 99. (d) All alkaline earth metal oxides except BeO are basic in nature. BeO is amphoteric in nature. Hydrated halides of Ca, Sr and Ba on heating undergo dehydration while corresponding hydrated halides of Be and Mg on heating suffer hydrolysis.

100. (a)

#### MATCHING TYPE QUESTIONS

#### 101. (a)

- **102.** (c)  $Cs + O_2 \rightarrow CsO_2$  (Superoxide)  $4Li + O_2 \rightarrow 2Li_2O$  (Oxide)  $2Na + O_2 \rightarrow Na_2O_2$  (Peroxide)
- 103. (a) Lithium metal is used to make useful alloys, for example with lead to make 'white metal' bearings for motor engines, with aluminium to make aircraft parts, and with magnesium to make armour plates.
- 104. (a) 105. (c)
- 106. (b) Quick lime is used for the manufacture of dyestuffs. Plaster of Paris is used for setting of fractured bones. Slaked lime is used for the manufacture of bleaching powder.

Limestone is a constituent of chewing gum.

# **ASSERTION-REASON TYPE QUESTIONS**

- 107. (a) Li<sup>+</sup> has maximum degree of hydration among other alkali metals.
- 108. (a) Lithium carbonate is unstable to heat; lithium being very small in size polarises a large  $CO_3^{2-}$  ion leading to the formation of more stable Li<sub>2</sub>O and CO<sub>2</sub>.
- 109. (a) Because of high value of ionisation enthalpy and small size it forms compound which are highly covalent in nature, hence, it get hydrolysed easily.
- Both assertion and reason are false. 110. (d) Radium is the rarest of all s-block elements comprising only 10<sup>-10</sup> percent of igneous rocks. Francium (s-block member) is radioactive; its long lived isotope <sup>223</sup>Fr ahs a half life of only 21 minutes.

#### CRITICAL THINKING TYPE QUESTIONS

- **111.** (c) The atom becomes larger on descending the group, so the bonds becomes weaker (metallic bond), the cohesive force/energy decreases and accordingly melting point also decreases.
- 112. (a) The ionisation potential value of lithium is maximum among alkali metals i.e., its tendency to ionise to give Li<sup>+</sup> ions should be the minimum i.e. Li should be the poorest reducing agent. But, lithium is the strongest reducing agent in aq. solution. This is due to the largest value of hydration energy of Li<sup>+</sup> ions.
- **113.** (c) Li due to highest hydration energy among the alkali metals is the strongest reducing agent.
- **114.** (b) During the dissolution of alkali metal hydrides energy is released in large amount, i.e., it is exothermic in nature.
- 115. (c) Calcium carbonate on thermal decomposition gives CaO (Basic oxide) and CO<sub>2</sub> (Acidic oxide)

 $CaCO_3 \xrightarrow{\Delta} CaO + CO_2^{\uparrow}$ Basic oxide Acidic oxide **116.** (c)  $2NaO_2 + 2H_2O \rightarrow 2NaOH + H_2O_2 + O$ 

- 117. (b)  $O_4^{2-}$  ion is not possible and  $K_2O_4$  is unknown.
- 118. (a) All the given elements react with oxygen to form oxides but only Li also react with nitrogen to form Li<sub>2</sub>N.
- 119. (d) (a) and (b) forms corresponding hydroxides (NaOH and LiOH) in aqueous solution

 $M_2O + H_2O \longrightarrow 2M^+ + 2OH^-$  (M = Na or Li)

Therefore reaction of HI with (a), (b) and (c) is simply a neutralization reaction, while aqueous solution of (d) form  $H_2O_2$  which act as oxidizing agent, hence convert Iodide to Iodine( I2).

$$Na_2O_2 + 2H_2O \longrightarrow 2Na^+ + 2OH^- + H_2O_2$$

- LiI is more soluble as the degree of covalent character 120. (d) is high due to larger size of anion i.e., iodide ion by greater polarization of lithium cation.
- 121. (a)
- **122.** (c) NaCl (brine),  $NH_3$  and  $CO_2$  are raw materials. CaCO<sub>3</sub> is source of  $CO_2$ .
- 123. (d) Because of larger size and smaller nuclear charge, alkali metals have low ionization potential relative to alkaline earth metals.
- 124. (a) Lattice energy decreases more rapidly than hydration energy for alkaline earth metal hydroxides. On moving down a group: solubility of their hydroxides increases.
- $2Na + 2H_2O \longrightarrow 2NaOH + H_2 \uparrow$ 125. (b)

$$2K + 2H_2O \longrightarrow 2KOH + H_2 \uparrow$$

All alkali metals decompose water with the evolution of hydrogen.

 $Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2 \uparrow$ 

$$Sr + 2H_2O \longrightarrow Sr(OH)_2 + H_2 \uparrow$$

 $Be + 2H_2O \longrightarrow No reaction$ 

Ca, Sr, Ba and Ra decompose cold water readily with evolution of hydrogen. Mg decomposes boiling water but Be is not attacked by water even at high temperatures as its oxidation potential is lower than the other members.

- Mg burns in  $CO_2$  to give MgO and C. 126. (a)
- 127. (d) Group1 carbonates are more soluble than group 2 which are sparingly soluble, and also in case of group 2, down the group the solubility of carbonates decreases.
- **128.** (d) Down the group solubility of sulphate decreases. Thus Ba<sup>2+</sup> ions will precipitate out most easily.
- BeF<sub>2</sub> is highly soluble in water due to the high 129. (a) hydration enthalpy of the small  $Be^{2+}$  ion.
- 130. (b) Electrons in Mg due to its small size are tightly bound so they cannot be excited by the flame.
- 131. (d) Be(OH)<sub>2</sub> is amphoteric, but the hydroxides of other alkaline earth metals are basic. The basic strength increases gradually.
- 132. (d) When cold calcium hydroxide reacts with chlorine, then bleaching powder is obtained.

 $3Ca(OH)_2 + 2Cl_2$ slaked lim e

$$\longrightarrow$$
 Ca(OCl)<sub>2</sub>.Ca(OH)<sub>2</sub>.CaCl<sub>2</sub>.2H<sub>2</sub>O  
Bleaching powder