The S-Block Elements

Question1

The number of alkali metal(s), from Li, K, Cs, Rb having ionization enthalpy greater than 400 kJ mol^{-1} and forming stable super oxide is _____.
[31-Jan-2023 Shift 2]

Answer: 2

Solution:

K, Rb and Cs form stable super oxides but Cs has ionisation enthalpy less than 400 kJ.

Question2

Order of Covalent bond;
A. KF > KI; LiF > KF
B. KF < KI; LiF > KF
C. $SnCl_4$ > $SnCl_2$; CuCl > NaCl
D. LiF > KF; CuCl < NaCl
E. KF < KI; CuCl > NaCl
[24-Jan-2023 Shift 1]

Options:

A. C, E only

B. B, C only

C. B, C, E only

D. A, B only

Answer: C

Solution:

According to Fajan's Rule,
A. KF > KI − False; LiF > KF - True
B. KF < KI - True; LiF > KF - True
C. $SnCl_4$ > $SnCl_2$ − True; CuCl > NaCl − True

D. LiF > KF - True; CuCl < NaCl− False
E. KF < KI− True; CuCl > NaCl− True

Question3

Choose the correct answer from the options given below :

	LIST I		LIST II
A.	Chlorophyll	I.	Na_2CO_3
B.	Soda ash	II.	$CaSO_4$
C.	Dentistry, Ornamental work	III	Mg^{2+}
D.	Used in white washing	IV.	$Ca(OH)_2$

[24-Jan-2023 Shift 1]

Options:

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

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

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

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

Answer: A

Solution:

Chlorophyll : Mg^{+2} complex
Soda ash : Na_2CO_3
Dentistry, Ornamental work: $CaSO_4$
Used in white washing : $Ca(OH)_2$

Question4

Identify the correct statements about alkali metals.
A. The order of standard reduction potential (M^+ | M) for alkali metal ions is Na > Rb > Li.
B. CsI is highly soluble in water.
C. Lithium carbonate is highly stable to heat.
D. Potassium dissolved in concentrated liquid ammonia is blue in colour and paramagnetic.
E. All the alkali metal hydrides are ionic solids. Choose the correct answer from the options given below
[24-Jan-2023 Shift 2]

Options:

A. A, B, D only

B. C and E only

C. A and E only

D. A, B and E only

Answer: C

Solution:

(1) Na > Cs > Li− true { If considered with sign } The low solubility of CsI is due to smaller hydration enthalpy of it's two ions
Li_2CO_3 is highly stable to heat - false
In Conc. NH_3, K formed blue solution - true
All the alkali metal hydrides are ionic solid (True).

Question5

Compound A reacts with NH_4Cl and forms a compound B. Compound B reacts with H_2O and excess of CO_2 to form compound C which on passing through or reaction with saturated NaCl solution forms sodium hydrogen carbonate. Compound A. B and C, are respectively. [25-Jan-2023 Shift 1]

Options:

A. $CaCl_2$, NH_3, NH_4HCO_3

B. $CaCl_2$, NH_4^+, $(NH_4)_2CO_3$

C. $Ca(OH)_2$, NH_3, NH_4HCO_3

D. $Ca(OH)_2$, NH_4^+, $(NH_4)_2CO_3$

Answer: C

Solution:

$$\underset{(A)}{Ca(OH)_2} + 2NH_4Cl \longrightarrow \underset{(B)}{2NH_3} + CaCl_2 + 2H_2O$$

$$\underset{(B)}{NH_3} + H_2O + \underset{(exc)}{CO_2} \longrightarrow \underset{(C)}{NH_4HCO_3}$$

$$\underset{(C)}{NH_4HCO_3} + NaCl \longrightarrow NaHCO_3 \downarrow + NH_4Cl$$

Question6

Choose the correct answer from the options given below:

List I Elements	List II 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: [25-Jan-2023 Shift 1]

Options:

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

Answer: C

Solution:

Solution:

Elements	Colour in flame test
K	Violet
Ca	Brick Red
Sr	Crimson Red
Ba	Apple Green

Question7

Which one among the following metals is the weakest reducing agent ? [25-Jan-2023 Shift 2]

Options:

A. K

B. Rb

C. Na

D. Li

Answer: C

Solution:

Sodium have lowest oxidation potential in alkali metals. Hence it is weakest reducing agent among alkali metals.

Question8

Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R
Assertion A :- The alkali metals and their salts impart characteristic colour to reducing flame.
Reason R :- Alkali metals can be detected using flame tests.
In the light of the above statements, choose the most appropriate answer form the options given below
[25-Jan-2023 Shift 2]

Options:

A. Both A and R are correct but R is NOT the correct explanation of A.

B. A is correct but R is not correct.

C. A is not correct but R is correct

D. Both A and R are correct and R is the correct explanation of A.

Answer: C

Solution:

The alkali metals and their salts impart characteristic colour to oxidizing flame.

Question9

The correct order of hydration enthalpies is
(A) K^+
(B) Rb^+
(C) Mg^{2+}
(D) Cs^+
(E) Ca^{2+}
Choose the correct answer from the options given below:
[29-Jan-2023 Shift 1]

Options:

A. C > A > E > B > D

B. E > C > A > B > D

C. C > E > A > D > B

D. C > E > A > B >D

Answer: D

Solution:

Solution:
Hydration enthalpies:
(i) $K^+ > Rb^+ > Cs^+$: (A)> (B) > (D)
(ii) $Mg^{+2} > Ca^{+2}$: (C) > (E)
Option (D)
(C) > (E) > (A) > (B) > (D)

Question10

The magnetic behaviour of Li_2O, Na_2O_2 and KO_2, respectively, are [29-Jan-2023 Shift 1]

Options:

A. diamagnetic, paramagnetic and diamagnetic

B. paramagnetic, paramagnetic and diamagnetic

C. paramagnetic, diamagnetic and paramagnetic

D. diamagnetic, diamagnetic and paramagnetic

Answer: D

Solution:

$Li_2O \rightarrow O^{2-} \rightarrow$ diamagnetic
$Na_2O_2 \rightarrow O_2^{2-} \rightarrow$ diamagnetic
$KO_2 \rightarrow O_2^{-} \rightarrow$ paramagnetic

Question11

On heating, $LiNO_3$ gives how many compounds among the following? Li_2O, N_2, O_2, $LiNO_2$, NO_2 [29-Jan-2023 Shift 2]

Answer: 3

Solution:

$2\,\mathrm{Li\,NO_3} \xrightarrow{\Delta} \mathrm{Li_2\,O} + 2\mathrm{NO_2} + \frac{1}{2}\mathrm{O_2}$

Hence three products $\mathrm{Li_2O}$, $\mathrm{NO_2}$ and $\mathrm{O_2}$

Question12

The alkaline earth metal sulphate(s) which are readily soluble in water is/are:

(A) $\mathrm{BeSO_4}$

(B) $\mathrm{MgSO_4}$

(C) $\mathrm{CaSO_4}$

(D) $\mathrm{SrSO_4}$

(E) $\mathrm{BaSO_4}$

Choose the correct answer from the options given below:
[30-Jan-2023 Shift 1]

Options:

A. A only

B. B only

C. A and B

D. B and C

Answer: C

Solution:

Solution:
Due to high hydration energy $\mathrm{Be^{2+}}$ and $\mathrm{Mg^{2+}}$, $\mathrm{BeSO_4}$ and $\mathrm{MgSO_4}$ are readily soluble in water.

Question13

Which of the following reaction is correct?
[30-Jan-2023 Shift 2]

Options:

A. $2\mathrm{LiNO_3} \xrightarrow{\Delta} 2\mathrm{LiNO_2} + \mathrm{O_2}$

B. $4\mathrm{LiNO_3} \xrightarrow{\Delta} 2\mathrm{Li_2O} + 2\mathrm{N_2O_4} + \mathrm{O_2}$

C. $4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 4NO_2 + O_2$

D. $2LiNO_3 \xrightarrow{\Delta} 2\,Li + 2NO_2 + O_2$

Answer: C

Solution:

Solution:
$4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 4NO_2 + O_2$

Question14

Chlorides of which metal are soluble in organic solvents: [30-Jan-2023 Shift 2]

Options:

A. Ca

B. Mg

C. K

D. Be

Answer: D

Solution:

Solution:
$BeCl_2$ having covalent nature is soluble in organic solvent.

Question15

The element playing significant role in neuromuscular function and interneuronal transmission is: [31-Jan-2023 Shift 2]

Options:

A. Be

B. Ca

C. Li

D. Mg

Answer: B

Solution:

Solution:
Calcium plays important role in neuromuscular function, interneuronal transmission, cell membrane etc.

Question16

Choose the correct statement(s):
A. Beryllium oxide is purely acidic in nature.
B. Beryllium carbonate is kept in the atmosphere of CO_2.
C. Beryllium sulphate is readily soluble in water.
D. Beryllium shows anomalous behavior.
Choose the correct answer from the options given below:
[1-Feb-2023 Shift 1]

Options:

A. A, B and C only

B. B,C and D only

C. A and B only

D. A only

Answer: B

Solution:

Solution:
A. Beryllium oxide is amphoteric in nature.
B. Beryllium carbonate is kept in the atmosphere of CO_2 because it is thermally less stable.
C. Beryllium sulphate is readily soluble in water due to high degree of hydration.
D. Beryllium shows anomalous behaviour due to small size, high ionization energy and high value of φ (polarising power).

Question17

Match List I with List II

List I	List II
A. Slaked lime	I. $NaOH$
B. Dead burnt plaster	II. $Na_2CO_3 \cdot 10H_2O$
C. Caustic soda	III. $Na_2CO_3 \cdot 10H_2O$
D. Washing soda	IV. $CaSO_4$

Choose the correct answer form the options given below:

[1-Feb-2023 Shift 1]

Options:

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

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

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

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

Answer: C

Solution:

Solution:
From S-block NCERT

Question18

Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : Gypsum is used for making fireproof wall boards.
Reason (R) : Gypsum is unstable at high temperatures.
In the light of the above statements, choose the correct answer from the options given below :
[1-Feb-2023 Shift 2]

Options:

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

B. (A) is correct but (R) is not correct.

C. (A) is not correct but (R) is correct.

D. Both (A) and (R) are correct and (R) is the correct explanation of (A).

Answer: A

Solution:

Solution:
(Gypsum is used for making fireproof wall boards.

Question19

The setting time of Cement is increased by adding
[6-Apr-2023 shift 1]

Options:

A. Clay

B. Silica

C. Limestone

D. Gypsum

Answer: D

Solution:

Solution:

Question20

Ion having highest hydration enthalpy among the given alkaline earth metal ions is:-
[6-Apr-2023 shift 2]

Options:

A. Be^{2+}

B. Ba^{2+}

C. Sr^{2+}

D. Ca^{2+}

Answer: A

Solution:

Hydration enthalpy $\propto \frac{1}{\text{size}}$

Down the group as size increases hydration enthalpy decreases

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

Question21

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 options given below:
[8-Apr-2023 shift 1]

Options:

A. Statement I is correct but Statement II is incorrect

B. Statement I is incorrect but Statement II is correct

C. Both statement I and Statement II are correct

D. Both statement I and Statement II are incorrect

Answer: C

Solution:

Due to small in size Li and Mg do not from superoxide.
$Li^{+} \geq Mg^{+2}$ - radius
$2e^{-}10e^{-}$
Due to diagonal relationship.

Question22

What is the purpose of adding gypsum to cement? [8-Apr-2023 shift 1]

Options:

A. To give a hard mass

B. To speed up the process of setting

C. To facilitate the hydration of cement

D. To slow down the process of setting

Answer: D

Solution:

Solution:
$CaSO_4 \cdot 2H_2O$ Gypsum
To slow down the process of setting.
Gypsum is added to control the 'setting of cement'. If not added, the cement will set immediately after mixing of water leaving no time the concrete placing.

Question23

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 [8-Apr-2023 shift 2]

Options:

A. 2

B. 1

C. 3

D. 4

Answer: A

Solution:

$$\frac{\%CaO}{\%SiO_2 + \%Al_2O_3 + \%Fe_2O_3} = 1.9 - 2.1$$

Option (1) is correct.

Question24

Given below are two statements : One is labelled as Assertion A and other is labelled as Reason R
Assertion A : Sodium is about 30 times as abundant as potassium in the oceans.
Reason R : Potassium is bigger in size than sodium.
In the light of the above statements, choose the correct answer from the options given below
[8-Apr-2023 shift 2]

Options:

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. A is false but R is true

D. Both A and R are true and R is the correct explanation of A

Answer: A

Solution:

Solution:
Due to bigger size of potassium, it forms more efficient lattices as compared to sodium with silicates. The abundance of sodium in ocean is more due to the more soluble nature of salt of sodium as compared to potassium salts.

Question25

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
[10-Apr-2023 shift 1]

Options:

A. Quick lime

B. Slaked lime

C. White lime

D. Lime water

Answer: B

Solution:

$CaO + H_2O \rightarrow Ca(OH)_2$
A(less soluble)
$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$
B(insoluble)
$(CaCO_3) + H_2O + CO_2 \rightarrow (Ca(HCO_3)_2)$
B Soluble

Question26

In the following reactions, the total number of oxygen atoms in X and Y is _____

$Na_2O + H_2O \rightarrow 2X$

$Cl_2O_7 + H_2O \rightarrow 2Y$

[10-Apr-2023 shift 1]

Answer: 5

Solution:

$Na_2O + H_2O \rightarrow 2\,NaOH$
$Cl_2O_7 + H_2O \rightarrow 2HClO_4$
1 + 4 = 5

Question27

Number of water molecules in washing soda and soda ash respectively are:
[10-Apr-2023 shift 2]

Options:

A. 1 and 0

B. 1 and 10

C. 10 and 0

D. 10 and 1

Answer: C

Solution:

Washing Soda $\rightarrow Na_2CO_3 \cdot 10H_2O$
0.2
Soda Ash $\rightarrow Na_2CO_3$
No. of water = 10 + 0 = (10)

Question28

Match list I with list II:

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

Choose the correct answer from the options given below: [11-Apr-2023 shift 1]

Options:

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

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

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

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

Answer: C

Solution:

K^+-Sodium-Potassium Pump
KCl-Fertiliser
KOH− absorber of CO_2
Li - used in thermonuclear reactions

Question29

Alkali metal from the following with least melting point is: [11-Apr-2023 shift 2]

Options:

A. K

B. Cs

C. Rb

D. Na

Answer: B

Solution:

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

Question30

$Mg(NO_3)_2 XH_2O$ and $Ba(NO_3)_2 YH_2O$, represent formula of the crystalline forms of nitrate salts. Sum of X and Y is _____ [11-Apr-2023 shift 2]

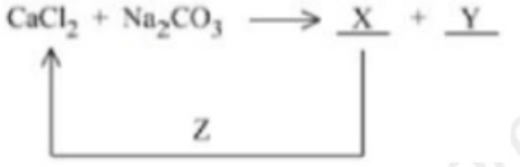
Answer: 6

Solution:

$Mg(NO_3)_2 \cdot 6H_2O$ is a hydrated salt whereas $Ba(NO_3)_2$ is a anhydrous salt.
$\therefore x + y = 6$

Question31

In the given reaction cycle



X, Y and Z respectively are [12-Apr-2023 shift 1]

Options:

A. $X - CaO, Y - NaCl + CO_2, Z - NaCl$

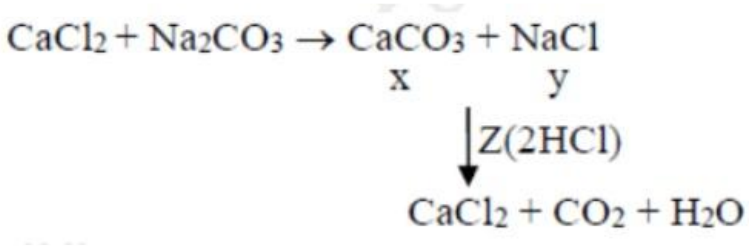
B. $X - CaCO_3, Y - NaCl, Z - HCl$

C. X − CaO_3, Y − NaCl, Z − KCl

D. X − CaO, Y − NaCl + CO_2, Z − KCl

Answer: B

Solution:



Question32

The density of alkali metals metals is in the order
[12-Apr-2023 shift 1]

Options:

A. Na < K < Cs < Rb

B. K < Na < Rb < Cs

C. Na < Rb < K < Cs

D. K < Cs < Na < Rb

Answer: B

Solution:

K < Na < Rb < Cs

D = $\frac{\text{Mass}}{\text{volume}}$ → generally do min ant

Potasium have extra volume due to presence at vaccant 3d.

Question33

$Be(OH)_2$ reacts with $Sr(OH)_2$ to yield an ionic salt. Choose the incorrect option related to this reaction from the following :
[13-Apr-2023 shift 1]

Options:

A. Be is tetrahedrally coordinated in the ionic salt.

B. The reaction is an example of acid - base neutralization reaction.

C. The element Be is present in the cationic part of the ionic salt.

D. Both Sr and Be elements are present in the ionic salt.

Answer: C

Solution:

$Be(OH)_2$ is amphoteric in nature.
$Sr(OH)_2$ is basic in nature.
These two undergo acid - base reaction to form a salt.
$Be(OH)_2 + Sr(OH)_2 \rightarrow \underset{(salt)}{Sr[Be(OH)_4]}$

Question34

Given below are two statements: One is labeled 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 statement, choose the correct answer from the options given below:
[15-Apr-2023 shift 1]

Options:

A. (A) is False but (R) is true

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

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

D. (A) is true but (R) is fasle

Answer: A

Solution:

Solution:
Be and mg have abnormally small size when compared to other alkali metals. Due to this, electrons in the atom are tightly hold and thus, they have high Ionisation energy. Hence, Be and mg donot undergo transition and don't impart characteristic colour to the flame.

Question35

Which of the following statements are correct?
(A) Both LiCl and $MgCl_2$ are soluble in ethanol.
(B) The oxides Li_2O and MgO combine with excess of oxygen to give superoxide.
(C) LiF is less soluble in water than other alkali metal fluorides.

(D) Li_2O is more soluble in water than other alkali metal oxides.

Choose the most appropriate answer from the options given below : [24-Jun-2022-Shift-1]

Options:

A. (A) and (C) only

B. (A), (C) and (D) only

C. (B) and (C) only

D. (A) and (D) only

Answer: A

Solution:

(A) Both LiCl and $MgCl_2$ are soluble in ethanol
(B) Li and Mg do not form superoxide
(C) LiF has high lattice energy
(D) Li_2O is least soluble in water than another alkali metal oxides

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Question36

Which one of the following compounds is used as a chemical in certain type of fire extinguishers? [24-Jun-2022-Shift-2]

Options:

A. Baking soda

B. Soda ash

C. Washing soda

D. Caustic soda

Answer: A

Solution:

Solution:
Baking soda ($NaHCO_3$) is used in certain type of fire extinguishers because it decomposes at high temperature to produce CO_2 which extinguishes fire

$$2NaHCO_3(s) \xrightarrow{\Delta} Na_2CO_3(s) + H_2O \uparrow + CO_2 \uparrow$$

Question37

In the flame test of a mixture of salts, a green flame with blue centre

was observed. Which one of the following cations may be present? [24-Jun-2022-Shift-2]

Options:

A. Cu^{2+}

B. Sr^{2+}

C. Ba^{2+}

D. Ca^{2+}

Answer: A

Solution:

Cupric salts give green flame with blue centre. The colour of other salts are
Sr^{2+} Crimson red
Ca^{2+} Brick red
Ba^{2+} Green

Question38

Which one of the following alkaline earth metal ions has the highest ionic mobility in its aqueous solution? [25-Jun-2022-Shift-1]

Options:

A. Be^{2+}

B. Mg^{2+}

C. Ca^{2+}

D. Sr^{2+}

Answer: D

Solution:

In aqueous solution, the ionic mobility is inversely proportional to the charge density on the ion. Hence Sr^{2+} has highest ionic mobility in water.

Question39

The correct order of melting point is : [26-Jun-2022-Shift-1]

Options:

A. Be > Mg > Ca > Sr

B. Sr > Ca > Mg > Be

C. Be > Ca > Mg > Sr

D. Be > Ca > Sr > Mg

Answer: D

Solution:

MP details
Be 1560K
Mg 924K
Ca 1124K
Sr 1062K

Question40

s-block element which cannot be qualitatively confirmed by the flame test is
[26-Jun-2022-Shift-2]

Options:

A. Li

B. Na

C. Rb

D. Be

Answer: D

Solution:

Solution:
Beryllium does not give flame test because of its small size and high ionization energy the energy of flame is not sufficient to excite the electrons to higher energy level.

Question41

Addition of H_2SO_4 to BaO_2 produces:
[27-Jun-2022-Shift-1]

Options:

A. BaO, SO_2 and H_2O

B. $BaHSO_4$ and O_2

C. $BaSO_4$, H_2 and O_2

D. $BaSO_4$ and H_2O_2

Answer: D

Solution:

Solution:
$BaO_2 \cdot 8H_2O + H_2SO_4 \rightarrow BaSO_4 + H_2O_2 + H_2O$
This is a common method to prepare hydrogenperoxide

Question42

$BeCl_2$ reacts with $LiAlH_4$ to give:
[27-Jun-2022-Shift-1]

Options:

A. $Be + Li[AlCl_4] + H_2$

B. $Be + AlH_3 + LiCl + HCl$

C. $BeH_2 + LiCl + AlCl_3$

D. $BeH_2 + Li[AlCl_4]$

Answer: C

Solution:

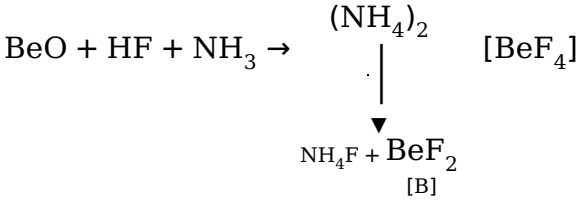
Solution:
$2BeCl_2 + LiAlH_4 \rightarrow 2BeH_2 + LiCl + AlCl_3$
The above reaction using $LiAlH_4$ is an important preparation method for production of hydrides.

Question43

BeO reacts with HF in presence of ammonia to give [A] which on thermal decomposition produces [B] and ammonium fluoride. Oxidation state of Be in [A] is___
[27-Jun-2022-Shift-2]

Answer: 2

Solution:



Question44

Choose the most appropriate answer from the options given below :

	List-I (Metal)		List-II (Emitted light wavelength (nm))
(A)	Li	(I)	670.8
(B)	Na	(II)	589.2
(C)	Rb	(III)	780.0
(D)	Cs	(IV)	455.5

[29-Jun-2022-Shift-1]

Options:

A. (A) − (I), (B) − (I I), (C) − (I I I), (D) − (I V)

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

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

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

Answer: A

Solution:

Solution:

Metal	Li	Na	K	Rb	Cs
Colour	Crimson red	Yellow	Violet	Red Violet	Blue
λ / nm	670.8	589.2	766.5	780.0	455.5

Question45

Amongst baking soda, caustic soda and washing soda, carbonate anion is present in
[29-Jun-2022-Shift-2]

Options:

A. washing soda only.

B. washing soda and caustic soda only.

C. washing soda and baking soda only.

D. baking soda, caustic soda and washing soda.

Answer: A

Solution:

Solution:
Baking soda $\rightarrow NaHCO_3$
Washing soda $\rightarrow Na_2CO_3 \cdot 10H_2O$
Caustic soda $\rightarrow NaOH$
CO_3^{-2} ion is present only in washing soda.

Question46

Choose the correct order of density of the alkali meals: [25-Jul-2022-Shift-1]

Options:

A. Li < K < N a < Rb < Cs

B. Li < N a < K < Rb < CS

C. Cs < Rb < K < N a < Li

D. Li < N a < K < C s <Rb

Answer: B

Solution:

Solution:

Question47

The correct order of density is [25-Jul-2022-Shift-2]

Options:

A. Be > M g > Ca > Sr

B. Sr > Ca > M g > Be

C. Sr > Be > M g > Ca

D. Be > Sr > M g > Ca

Answer: C

Solution:

Density of Sr = 2.63g / cm^3
Density of Be = 1.84g / cm^3
Density of Mg = 1.74g / cm^3
Density of Ca = 1.55g / cm^3

Question48

Which of the following can be used to prevent the decomposition of H_2O_2 ?
[26-Jul-2022-Shift-1]

Options:

A. Urea

B. Formaldehyde

C. Formic acid

D. Ethanol

Answer: A

Solution:

Solution:
Urea is used as a stabilizer for the storage of H_2O_2.

Question49

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A : LiF is sparingly soluble in water.
Reason R: The ionic radius of Li^+ion is smallest among its group members, hence has least hydration enthalpy.
In the light of the above statements, choose the most appropriate answer from the options given below.
[26-Jul-2022-Shift-2]

Options:

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true but R is NOT the correct explanation of A.

C. A is true but R is false.

D. A is false but R is true .

Answer: C

Solution:

Solution:
LiF is sparingly soluble in water.
The low solubility of LiF in water is due to its high lattice enthalpy (Since $Li^+$and $F^-$are small in size). Also, due to small size of Li^+, its hydration enthalpy is high.
Hence, Assertion is true but Reason is false

Question50

An element A of group 1 shows similarity to an element B belonging to group 2 . If A has maximum hydration enthalpy in group 1 then B is : [27-Jul-2022-Shift-2]

Options:

A. Mg

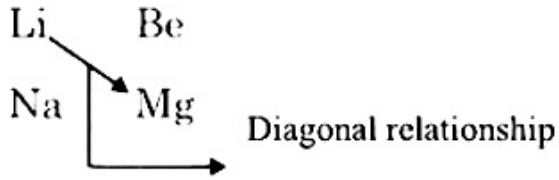
B. Be

C. Ca

D. Sr

Answer: A

Solution:



Li^+→ Maximum hydration enthalpy in group 1 due to small size.
So ' B ' is Mg.

Question51

Which of the following statement is incorrect? [28-Jul-2022-Shift-1]

Options:

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

B. KO_2 is paramagnetic.

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

D. Sodium metal has higher density than potassium metal.

Answer: A

Solution:

Solution:
Low solubility of LiF in water is due to the fact that though $Li^+$is having high hydration enthalpy but it has higher lattice enthalpy when present in LiF. Due to higher lattice enthalpy its solubility is less.

Question52

The products obtained during treatment of hard water using Clark's method are:
[28-Jul-2022-Shift-2]

Options:

A. $CaCO_3$ and $MgCO_3$

B. $Ca(OH)_2$ and $Mg(OH)_2$

C. $CaCO_3$ and $Mg(OH)_2$

D. $Ca(OH)_2$ and $MgCO_3$

Answer: C

Solution:

In Clark's method lime water is used
$Ca(HCO_3)_2 + 2\,Ca(OH)_2 \rightarrow 2CaCO_3 + 2H_2O$
$Mg(HCO_3)_2 + 2\,Ca(OH)_2 \rightarrow 2CaCO_3 + Mg(OH)_2 + 2H_2O$

Question53

Statement I: An alloy of lithium and magnesium is used to make aircraft plates.
Statement II : The magnesium ions are important for cell-membrane integrity.
In the light the above statements, choose the correct answer from the options given below
[28-Jul-2022-Shift-2]

Options:

A. Both Statement I and Statement II are true

B. Both Statement I and Statement II are false

C. Statement I is true but Statement II is false

D. Statement I is false but Statement II is true

Answer: B

Solution:

Solution:
Alloy of Li and Mg is used to make armour plates and not aircraft plates.
Calcium plays important roles in neuromuscular function, interneuronal transmission and cell membrane integrity .

Question54

Lithium nitrate and sodium nitrate, when heated separately, respectively, give:
[29-Jul-2022-Shift-1]

Options:

A. $LiNO_2$ and $NaNO_2$

B. Li_2O and Na_2O

C. Li_2O and $NaNO_2$

D. $LiNO_2$ and Na_2O

Answer: C

Solution:

Solution:
Li_2O, $NaNO_2$
As per NCERT lithium nitrate when heated gives lithium oxide, Li_2O. Whereas other alkali metal nitrates decompose to give the corresponding nitrite.
$4LiNO_3 \longrightarrow 2Li_2O + 4NO_2 + O_2$
$2NaNO_3 \longrightarrow 2NaNO_2 + O_2$
However, the decomposition product of $NaNO_3$ is temperature dependent process as shown in the below reaction.
$NaNO_3 \xrightarrow[500^{\circ}C]{\Delta} NaNO_2(s) + \frac{1}{2}O_2(g)$
$\Delta\downarrow, 800^{\circ}C$
$Na_2O(s) + N_2(g) + O_2(g)$
As the temperature is not mentioned, we can go by the answer. (C)

Question55

Portland cement contains ' X ' to enhance the setting time. What is ' X '?
[29-Jul-2022-Shift-2]

Options:

A. $CaSO_4 \cdot \frac{1}{2}H_2O$

B. $CaSO_4 \cdot 2H_2O$

C. $CaSO_4$

D. $CaCO_3$

Answer: B

Solution:

Solution:
Gypsum ($CaSO_4 \cdot 2H_2O$) is used to enhance setting time in portland cement.

Question56

Match List-I with List-II

	List-I		List-II
A.	Sodium carbonate	(i)	Deacon
B.	Titanium	(ii)	Castner-Kellner
C.	Chlorine	(iii)	van-Arkel
D.	Sodium hydroxide	(iv)	Solvay

Choose the correct answer form the options given below. [26 Feb 2021 Shift 2]

Options:

A. (A-iv), (B-iii), (C-i), (D-ii)

B. (A-i), (B-iii), (C-iv), (D-ii)

C. (A-iv), (B-i), (C-ii), (D-iii)

D. (A-iii), (B-ini), (C-i), (D-iv)

Answer: A

Solution:

(A) Sodium carbonate is manufactured by Solvay process ⇒ (iv) of List-ll.
Solvay process's reactions are as follows
In Solvay's process, first ammonia (NH_3) reacts with CO_2 and H_2O to give ammonium bicarbonate (NH_4HCO_3).
This bicarbonate react with $NaCl$ to give sodium bicarbonate ($NaHCO_3$) along with ammonium chloride (NH_4Cl).
At last, $NaHCO_3$ is heated to form sodium carbonate as major product.
$NH_3 + CO_2 + H_2O \longrightarrow NH_4HCO_3$

$$NH_4HCO_3 + \underset{\text{(Brine)}}{NaCl} \longrightarrow NaHCO_3 \downarrow + NH_4Cl$$

$$2NaHCO_3 \xrightarrow{\Delta_2} \underset{\text{Sodium carbonate}}{Na_2CO_3} + CO_2 + H_2O$$

(B) Titanium is purified by van-Arkel method ⇒ (iii) of List-II

van-Arkel method

$$\text{Crude titanium} \xrightarrow[I_2]{780K} TiI_4(g) \xrightarrow{1800K} \underset{\text{(Pure)}}{Ti} + 2I_2$$

(C) Chlorine is manufactured by Deacon process ⇒ (i) of List-II.

Deacon process

$$4HCl(g) + \underset{\text{[Air]}}{O_2(g)} \xrightarrow[723K]{CuCl_2 \text{ (catalyst)}} \underset{\text{Chlorine gas}}{2Cl_2} + 2H_2O(g)$$

(D) Sodium hydroxide is manufactured by Castner-Kellner cell ⇒ (ii) of List-II.

Castner-Kellner cell reaction

Electrolyte used is brine, saturated $NaCl$ solution. Cathode (Hg) :

$$Na^+ + e^- \longrightarrow Na \xrightarrow{Hg} Na/Hg$$

Anode (carbon) : $Cl^- + e^- \longrightarrow \frac{1}{2}Cl_2 \uparrow$

$$2Na/Hg + 2H_2O \longrightarrow \underset{\text{Sodium hydroxide}}{2NaOH} + 2Hg + H_2 \uparrow$$

Question57

Match List-I with List-II.

List-I(Salt)	List-II (Flame colour wavelength)
A. *LiCl*	1. 455.5*nm*
B. *NaCl*	2. 670.8*nm*
C. *RbCl*	3. 780.0*nm*
D. *CsCl*	4. 589.2*nm*

Choose the correct answer from the options given below.
[24 Feb 2021 Shift 2]

Options:

A. (A-4), (B-2), (C-3), (D-1)

B. (A-2), (B-1), (C-4), (D-3)

C. (A-1), (B-4), (C-2), (D-3)

D. (A-2), (B-4), (C-3), (D-1)

Answer: D

Solution:

Solution:

Alkali metal	Colour (Flame)	$\lambda(nm)$
Li	Crimson red	670.8
Na	Yellow	589.2
Rb	Red, violet	780.0
Cs	Blue	455.5

Alkali metals have very low value of ionisation energy as compared to other metals. So, alkali metals easily get excited and impart colour to flame.
Hence, Rb is most excited and having high value of wavelength in all alkali metals.

Question58

The correct set from the following in which both pairs are in correct order of melting point is
[24 Feb 2021 Shift 2]

Options:

A. $LiF > LiCl$, $MgO > NaCl$

B. $LiCl > LiF$, $NaCl > MgO$

C. $LiF > LiCl$, $NaCl > MgO$

D. $LiCl > LiF$, $MgO > NaCl$

Answer: A

Solution:

Solution:
Correct option is (a) i.e. $LiF > LiCl$; $MgO > NaCl$. Melting point is directly proportional to lattice energy. Lattice energy is the energy required to separate a mole of an ionic solid into gaseous ions. It depends upon charge of ions and size of ions.

$$M.P \propto L.E \propto \frac{\text{Charge}}{\text{Size}}$$

$Li \rightarrow +1$ $Li \rightarrow +1$
$F = -1$ $Cl \rightarrow -1$
Both LiF and LiCl having same charge, so melting point will depend on size.
Larger the size of anion, lesser the lattice energy and hence, melting point order is $LiF > LiCl$.
Similarly, $MgONaCl$
$Mg \rightarrow 2+$ $Na \rightarrow 1+$
$O \rightarrow 2-$ $Cl \rightarrow 1-$
MgO having $+2$ charge which is greater than $NaCl$ $(+1)$ charge.
So, greater the charge on the ions greater will be lattice energy and hence, melting point order is $MgO > NaCl$.

Question59

Number of amphoteric compound among the following is
(A) BeO
(B) BaO

(C) $Be(OH)_2$
(D) $Sr(OH)_2$
[24 Feb 2021 Shift 1]

Answer: 2

Solution:

Solution:
BeO and $Be(OH)_2$ are amphoteric in nature while BaO and $Sr(OH)_2$ are basic in nature.

Question60

The ionic radius of Na^+ions is 1.02Å. The ionic radii (in Å) of Mg^{2+} and Al^{3+}, respectively, are
[18 Mar 2021 Shift 1]

Options:

A. 1.05 and 0.99

B. 0.72 and 0.54

C. 0.85 and 0.99

D. 0.68 and 0.72

Answer: B

Solution:

Solution:
For iso-electronic system, radius is inversely proportional to the $Z_{eff.}$. The effective nuclear charge (Z_{eff}) is net positive charge, experienced by an electron in a multi-electron atom.

$$\underset{Z=11}{Na^+} \quad \underset{Z=12}{Mg^{2+}} \quad \underset{Z=13}{Al^{3+}}$$

(10 electrons in each)

(Z = atomic number)
We know that, more is the positive charge on an ion, smaller will be its ionic radii. Whereas more is the negative charge on an ion more will be its ionic radii.
So, order of ionic size
$Na^+ > Mg^{2+} > Al^{3+}$
Ionic radii of$Na^+(1.02\,\mathring{A}) > Mg^{2+}(0.72\,\mathring{A}) > Al^{3+}(0.54\,\mathring{A})$

Question61

The correct order of conductivity of ions in water is
[17 Mar 2021 Shift 1]

Options:

A. $Na^+ > K^+ > Rb^+ > Cs^+$

B. $Cs^+ > Rb^+ > K^+ > Na^+$

C. $K^+ > Na^+ > Cs^+ > Rb^+$

D. $Rb^+ > Na^+ > K^+ > Li^+$

Answer: B

Solution:

Solution:
Correct order of conductivity of ions in water is
$Cs^+ > Rb^+ > K^+ > Na^+$
$Cs^+(aq)$ has lower hydrated radius so its electrical conductivity is higher.
Extent of hydration depends on charge density on the ion.
As the size of gaseous ion decreases, it get more hydrated in water and hence, the size of aqueous ion increases. When this bulky ion move in solution, it experience greater resistance and hence lower conductivity.
Size of gaseous ion: $Cs^+ > Rb^+ > K^+ > Na^+$
Size of aqueous ion: $Cs^+ < Rb^+ < K^+ < Na^+$
Conductivity: $Cs^+ > Rb^+ > K^+ > Na^+$

Question62

Match List-I with List-II.

List-I	List-II
(A) $Ca(OCl)_2$	(i) Antacid
(B) $CaSO_4 \cdot \frac{1}{2}H_2O$	(ii) Cement
(C) CaO	(iii) Bleach
(D) $CaCO_3$	(iv) Plaster of Paris

Choose the most appropriate answer from the options given below. [18 Mar 2021 Shift 1]

Options:

A. A - 1, B - 4, C - 2, D - 3

B. A - 3, B - 2, C - 4, D - 1

C. A - 3, B - 4, C - 2, D - 1

D. A - 3, B - 2, C - 1, D - 4

Answer: C

Solution:

A. $Ca(OCl)_2$→ Bleaching powder
B. $CaSO_4 - 1/2H_2O$→ Plaster of Paris
C. CaO→ is major component of cement
D. $CaCO_3$→ used as an antacid
Correct match is (A-iii), (B-iv), (C-ii), (D-i).

Question63

Match List-I with List-II.

List-I	List-II
(A) $Ca(OCl)_2$	(i) Antacid
(B) $CaSO_4 \cdot \frac{1}{2}H_2O$	(ii) Cement
(C) CaO	(iii) Bleach
(D) $CaCO_3$	(iv) Plaster of Paris

Choose the most appropriate answer from the options given below. [18 Mar 2021 Shift 1]

Options:

A. A - 1, B - 4, C - 2, D - 3

B. A - 3, B - 2, C - 4, D - 1

C. A - 3, B - 4, C - 2, D - 1

D. A - 3, B - 2, C - 1, D - 4

Answer: C

Solution:

A. $Ca(OCl)_2$→ Bleaching powder
B. $CaSO_4 - 1/2H_2O$→ Plaster of Paris
C. CaO→ is major component of cement
D. $CaCO_3$→ used as an antacid
Correct match is (A-iii), (B-iv), (C-ii), (D-i).

Question64

One of the by-products formed during the recovery of NH_3 from solvay process is [17 Mar 2021 Shift 2]

Options:

A. $Ca(OH)_2$

B. $NaHCO_3$

C. $CaCl_2$

D. NH_4Cl

Answer: C

Solution:

Solution:
$CaCl_2$ is one of the by-products formed during the recovery of NH_3 from Solvay process. Ammonia required for the process can be prepared by heating ammonium chloride with calcium hydroxide.
$2NH_4Cl + Ca(OH)_2 \longrightarrow 2NH_3 + CaCl_2 + H_2O$
Hence, the only by-product of the reaction is calcium chloride.

Question65

Given below are two statements.
Statement I Both $CaCl_2 \cdot 6H_2O$ and $MgCl_2 \cdot 8H_2O$ undergo dehydration on heating.
Statement II BeO is amphoteric, whereas the oxides of other elements in the same group are acidic.
In the light of the above statements, choose the correct answer from the options given below.
[16 Mar 2021 Shift 1]

Options:

A. Statement I is false but statement II is true

B. Both statement I and statement II are false

C. Both statement I and statement II are true

D. Statement I is true but statement II is false

Answer: B

Solution:

Solution:
The dehydration of hydrated chlorides, bromides and iodides of Ca, Sr, Ba is possible but hydrated halides of Be and Mg on heating suffer hydrolysis due to their small size or high charge density.
$$CaCl_2 \cdot 6H_2O \xrightarrow{\Delta} \underset{\text{Anhydrous}}{CaCl_2} + 6H_2O$$
$$MgCl_2 \cdot 8H_2O \xrightarrow{\Delta} MgO + 7H_2O + 2HCl$$
$MgCl_2$ can be made anhydrous by heating in presence of dry HCl.
$$MgCl_2 \cdot 6H_2O \xrightarrow[\text{Dry HCl(g)}]{\Delta\ \text{(Calcination)}} MgCl_2 + 8H_2O$$
Hence, on heating $CaCl_2 \cdot 6H_2O$ undergoes dehydration but $MgCl_2 \cdot 8H_2O$ does not.
Metal oxides are generally basic. In alkaline earth metal BeO is amphoteric and shows anomalous behaviour while other

oxides are basic.
So, both statement I and statement II are false.

Question66

Match List - I with List II :

	List - I		List - II
(a)	Li	(i)	photoelectric cell
(b)	Na	(ii)	absorbent of CO_2
(c)	K	(iii)	coolant in fast breeder nuclear reactor
(d)	Cs	(iv)	treatment of cancer
		(v)	bearings for motor engines

Choose the correct answer from the options given below : [27 Jul 2021 Shift 2]

Options:

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

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

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

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

Answer: D

Solution:

Solution:
Li makes alloy with Lead to make white metal bearings for motor engines
Liquid Na metal is used as coolant in fast breeder nuclear reactor
K is a very absorbent of CO_2
Cs is used in making photoelectric cel

Question67

Match List - I with List - II :

	List-I (Drug)		List-II (Class of Drug)
(a)	NaOH	(i)	Acidic
(b)	$Be(OH)_3$	(ii)	Basic
(c)	$Ca(OH)_3$	(iii)	Amphoteric
(d)	$B(OH)_3$		
(e)	$Al(OH)_3$		

Choose the most appropriate answer from the options given below [27 Jul 2021 Shift 1]

Options:

A. (a)-(ii), (b)-(ii), (c)-(iii), (d)-(ii), (e)-(iii)

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

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

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

Answer: B

Solution:

N aOH → Basic
$Be(OH)_2$ → Amphoteric
$Ca(OH)_2$ → Basic
$B(OH)_3$ → Acidic
$Al(OH)_3$ → Amphoteric

Question68

Given below are two statements : One is labelled as Assertion A and the other labelled as Reason R.
Assertion A : Lithium halides are some what covalent in nature.
Reason R : Lithium possess high polarisation capability.
In the light of the above statements, choose the most appropriate answer from the options given below:
[27 Jul 2021 Shift 1]

Options:

A. A is true but R is false

B. A is false but R is true

C. Both A and R are true but R is NOT the correct explanation of A

D. Both A and R are true and R is the correct explanation of A

Answer: D

Solution:

Solution:
Lithium due to small size has very high polarization capability and thus increases covalent nature in Halides.

Question69

Match List I with List II :

	List-I Elements		List-IIProperties
(a)	Li	(i)	Poor water solubility of I^- salt
(b)	Na	(ii)	Most abundant element in cell fluid
(c)	K	(iii)	Bicarbonate salt used in fire extinguisher
(d)	Cs	(iv)	Carbonate salt decomposeseasily on heating

Choose the correct answer from the options given below :
[25 Jul 2021 Shift 2]

Options:

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

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

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

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

Answer: A

Solution:

Solution:
(a) C_sI salt is poor water soluble due to it's low hydration energy
(b) $NaHCO_3$ is used in fire extinguisher
(c) K is most abundant element in cell fluid
(d) Li_2CO_3 decomposes easily due to high covalent character caused by small size Li^+cation.

Question70

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:
[20 Jul 2021 Shift 1]

Options:

A. Mg

B. Na

C. Ca

D. K

Answer: D

Solution:

(A) $2Mg + O_2 \rightarrow 2MgO$ (Diamagnetic)
(B) $2Na + O_2 \rightarrow Na_2O$ (Diamagnetic)
$2Na + \underset{\text{(excess)}}{O_2} \rightarrow Na_2O_2$ (Diamagnetic)
(C) $2Ca + O_2 \rightarrow 2CaO$ (Diamagnetic)
$Ca + O_2 \rightarrow CaO_2$ (Diamagnetic)
(D) $K + \underset{\text{(excess)}}{O_2} \rightarrow KO_2$ (Paramagnetic)

Question71

Match List-I with List-II

List-I (Elements)	List-II (Properties)
(a) Ba	(i) Organic solvent soluble compounds
(b) Ca	(ii) Outer electronic configuration $6s^2$
(c) Li	(iii) Oxalate insoluble in water
(d) Na	(iv) Formation of very strong monoacidic base

Choose the correct answer from the options given below :
[22 Jul 2021 Shift 2]

Options:

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

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

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

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

Answer: A

Solution:

(a) 'Ba' having outer electronic configuration $6s^2$ -
. (b) CaC_2O_4 is water insoluble
(c) 'Li' is soluble in organic solvents
(d) NaOH is strong Monoacidic base among given.

Question72

Given below are two statements : One is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) Lithium salts are hydrated.
Reason (R) Lithium has higher polarising power than other alkali metal group members.
In the light of the above statements, choose the most appropriate answer from the options given below
[31 Aug 2021 Shift 2]

Options:

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

B. (A) is true but (R) is not true

C. (A) is false but (R) is true.

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

Answer: A

Solution:

Solution:
Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
Lithium ions have smaller size as compared to other ions of the group.
Hence, it has greater value of charge to radius ratio and polarising power.
Among alkali metals ions, Li has smallest size due to which it can easily polarise water molecule. LiCl contains 2 water molecules per mole. However, due to bigger size of other alkali metals, they cannot easily polarise water molecules.

Question73

Choose the correct statement from the following. [27 Aug 2021 Shift 2]

Options:

A. The standard enthalpy of formation for alkali metal bromide becomes less negative on descending the group.

B. The low solubility of Csl in water is due to its high lattice enthalpy.

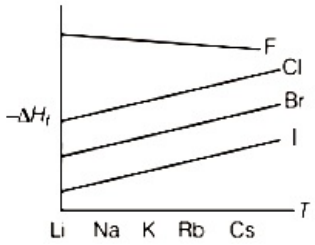
C. Among the alkali metal halides, LiF is least soluble in water.

D. LiF has least negative standard enthalpy of formation among alkali metal fluorides.

Answer: C

Solution:

The ΔH_f of alkali metal halides is shown through this graph.



This graph shows that formation of metal halide is negative, i.e. energy is released during the formation of metal halides.
(A)

$$\begin{matrix} M-F \\ M-Cl \\ M-Br \\ M-I \end{matrix} \downarrow$$

On moving down the group, the size of halogens increase which results in the lengthening of bond, making the bond weaker. Therefore, ΔH_f is less negative on moving down the group as the stability of metal halide decreases down the group.

(B)

$$\begin{matrix} Li-X \\ Na-X \\ K-X \\ Rb-X \end{matrix} \downarrow$$

On moving down the group, the electropositivity of metal increases making the attraction between the oppositely charged ions even stronger, thus increasing the strength of bond. Increase in strength is more than the weakness produced due to lengthening of bond because of increase in size of metal ions down the group. This makes ΔH_f more negative on moving down the group. Option (a) is incorrect, due to reason produced in (B).

Option (b) is incorrect. As CsI has $Cs^{\oplus}$ and $I^{\ominus}$ an constituent ions and both the ions are larger in size. The lattice enthalpy is not so high as shown in graph. But it has low solubility due to less hydration energy released when hydration of larger ions takes place. Option (c) is correct. As LiF has highest lattice enthalpy as shown in graph. This is due to the size of ions that is smallest in their respective groups. Smaller is the size, shorter is the bond length and stronger is the bond. The energy required is break the bond and release the constituents ions is more than the energy released in the hydration of ions. So, LiF is least soluble in water. Option (d) is incorrect. LiF has most negative enthalpy in all metal fluorides as shown in graph.

Question74

The ratio of number of water molecules in Mohr's salt and potash alum is ..... $\times 10^{-1}$.(Integer answer)
[26 Aug 2021 Shift 1]

Answer: 2.5

Solution:

Formula for Mohr's salt is $(NH_4)_2Fe(SO_4)_2.6H_2O$.
$\therefore$ Number of water molecule in Mohr' salt $= 6$.
Formula for potash alum is $K_2SO_4Al_2(SO_4)_3.24H_2O$.
$\therefore$ Number of water molecules in potash alum is 12.
$\therefore$ Ratio of water molecules in Mohr's salt and potash alum is

$$\frac{6}{24} = \frac{1}{-4} = 2.5 \times 10^{-1}$$

Question75

The major component/ingredient of Portland cement is
[31 Aug 2021 Shift 1]

Options:

A. tricalcium aluminate

B. tricalcium silicate

C. dicalcium aluminate

D. dicalcium silicate

Answer: B

Solution:

The major component of Portland cement is tricalcium silicate (51%, $3\,CaO\,.\,SiO_2$).
Hence, correct option is (b).

Question76

The number of water molecules in gypsum, dead burnt plaster and plaster of Paris, respectively are
[27 Aug 2021 Shift 1]

Options:

A. 2,0 and 1

B. 0.5, 0 and 2

C. 5,0 and 0.5

D. 2,0 and 0.5

Answer: D

Solution:

Solution:
The chemical formula of gypsum $-CaSO_4.2H_2O$, dead burnt plaster $-CaSO_4$ and plaster of Paris $-CaSO_4\,.\,\frac{1}{2}H_2O$.
So, number of water molecules in gypsum, dead burnt plaster and plaster of Paris are 2, 0 and 0.5 respectively.

Question77

Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) Barium carbonate is insoluble in water and is highly stable.
Reason (R) The thermal stability of the carbonates increases with increasing cationic size.
[26 Aug 2021 Shift 2]

Options:

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

B. (A) is true but (R) is false.

C. Both (A) and (R) are true and (R) is not the true explanation of (A).

D. (A) is false but (R) is true.

Answer: A

Solution:

Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
Stability of group-2 metal carbonates increases as we move down the group because large cations are stabilised by large anion and vice- . Carbonates being a large anion is stabilised by larger cations.

$$BeCO_3 \quad MgCO_3 \quad CaCO_3 \quad SrCO_3 \quad BaCO_3 \xrightarrow[\text{Stability increases}]{}$$

Solubility in water decreases as we move down the group because of decrease in hydration energy of cations.

Question78

What are the products formed in sequence when excess of CO_2 is passed in slaked lime?
[26 Aug 2021 Shift 1]

Options:

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

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

C. CaO, $Ca(HCO_3)_2$

D. CaO, $CaCO_3$

Answer: B

Solution:

When excess of CO_2 passes through slaked lime $[Ca(OH)_2]$, the calcium carbonate ($CaCO_3$) and calcium hydrogen carbonate $Ca(HCO_3)_2$ will be formed as follows

$$\underset{\text{Slaked lime}}{Ca(OH)_2} + CO_2 \rightarrow \underset{\text{Calcium carbonate(Milky)}}{CaCO_3\downarrow} + H_2O$$

$$CaCO_3 + CO_2 + H_2O \rightarrow \underset{\text{Calcium hydrogen carbonate}}{Ca(HCO_3)_2}$$

Question79

The conversion of hydroxyapatite occurs due to presence of F^- ions in water. The correct formula of hydroxyapatite is
[26 Aug 2021 Shift 1]

Options:

A. $[3Ca_3(PO_4)_2\, Ca(OH)_2]$

B. $[3\, Ca(OH)_2\, CaF_2]$

C. $[Ca_3(PO_4)_2 CaF_2]$

D. $[3Ca_3(PO_4)_2CaF_2]$

Answer: A

Solution:

The correct formula for hydroxyapatite is $3[Ca_3(PO_4)_2\,Ca(OH)_2]$. The presence of F^- ions on enamel make the enamel much harder as hydroxyapatite $[3Ca_3(PO_4)_2\,Ca(OH)_2]$ converts into fluoroapatite $[3Ca_3(PO_4)_2CaF_2]$.

Question80

Among the statements (A) − (D), the correct ones are:
(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.
[Jan. 09,2020 (II)]

Options:

A. (A), (B) and (D) only

B. (A), (C) and (D) only

C. (B) and (D) only

D. (A) and (D) only

Answer: B

Solution:

Solution:
LiCl is soluble in pyridine.

Question81

A metal (A) on heating in nitrogen gas gives compound B. B on treatment with H_2O gives a colourless gas which when passed through $CuSO_4$ solution gives a dark blue violet coloured solution. A and B respectively, are:
[Jan. 08,2020 (II)]

Options:

A. Na and $NaNO_3$

B. Na and Na_3N

C. Mg and Mg_3N_2

D. Mg and $Mg(NO_3)_2$

Answer: C

Solution:

$$\underset{(A)}{3Mg} + N_2 \longrightarrow \underset{(B)}{Mg_3N_2} \xrightarrow{H_2O} 3Mg(OH)_2 + 2NH_3$$

$$4NH_3 + CuSO_4 \longrightarrow \underset{\text{(Dark blue coloured)}}{[Cu(NH_3)_4]SO_4}$$

Question82

When gypsum is heated to 393K, it forms: [Jan. 08, 2020(I)]

Options:

A. Anhydrous $CaSO_4$

B. $CaSO_4.5H_2O$

C. $CaSO_4 \cdot 0.5H_2O$

D. Dead burnt plaster

Answer: C

Solution:

Solution:
Gypsum on heating to 393K forms plaster of Paris.

$$CaSO_4 \cdot 2H_2O \xrightarrow{393K} CaSO_4 \cdot 0.5H_2O + 1.5H_2O$$

Question83

On combustion of Li, Na and K in excess of air, the major oxides formed, respectively, are: [Sep. 04, 2020(I)]

Options:

A. Li_2O_2, Na_2O_2 and K_2O_2

B. Li_2O, Na_2O_2 and KO_2

C. Li_2O, Na_2O and K_2O_2

D. Li_2O, Na_2O_2 and K_2O

Answer: B

Solution:

On heating in excess air Li form oxide sodium form peroxide while K , Rb, Cs form superoxide.

Question84

The metal mainly used in devising photoelectric cells is:
[Sep. 02, 2020(1)]

Options:

A. Na

B. Li

C. Rb

D. Cs

Answer: D

Solution:

Solution:
Cesium has lowest ionisation enthalpy and hence it shows photoelectric effect to the maximum extent. So, it is used in photo electric cell.

Question85

Two elements A and B have similar chemical properties. They don't form solid hydrogencarbonates, but react with nitrogen to form nitrides. A and B, respectively, are:
[Sep. 02, 2020 (II)]

Options:

A. Na and Rb

B. Na and Ca

C. Cs and Ba

D. Li and Mg

Answer: D

Solution:

Li and Mg do not form solid bicarbonate, but react with N_2 to give nitrides.

$6Li + N_2 \xrightarrow{\Delta} 2Li_3N$

$3Mg + N_2 \xrightarrow{\Delta} Mg_3N_2$

Question86

Among the sulphates of alkaline earth metals, the solubilities of $BeSO_4$ and $MgSO_4$ in water, respectively, are:
[Sep. 06, 2020 (I)]

Options:

A. poor and poor

B. high and poor

C. high and high

D. poor and high

Answer: C

Solution:

Solution:
$BeSO_4$ and $MgSO_4$ are readily soluble in water due to greater hydration enthalpies of Be^{2+} and Mg^{2+} ions, dominate over their lattice enthalpies and therefore their sulphates are highly soluble.

Question87

An alkaline earth metal 'M' readily forms water soluble sulphate and water insoluble hydroxide. Its oxide MO is very stable to heat and does not have rock-salt structure. M is :
[Sep. 04, 2020 (II)]

Options:

A. Sr

B. Ca

C. Mg

D. Be

Answer: D

Solution:

Solubility of $BeSO_4$ is highest among the given metal sulphates
$BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4 > BaSO_4$
Solubility order for hydroxide is
$Be(OH)_2 < Mg(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < Ba(OH)_2$
Thus $BeSO_4$ is soluble and $Be(OH)_2$ is insoluble. BeO does not form rock salt like structure.
In the solid state, it adopts the hexagonal neurtzite structure form while in the vapour phase, it is present as discrete diatomic covalent molecules.

Question88

Match the following compounds (Column-I) with their uses (Column-II):

Column-I	Column-II
(I) $Ca(OH)_2$	(A) casts of statutes
(II) $NaCl$	(B) white wash
(III) $CaSO_4 \frac{1}{2}H_2O$	(C) antacid
(IV) $CaCO_3$	(D) washing soda preparation

[Sep.06, 2020 (II)]

Options:

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

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

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

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

Answer: B

Solution:

(I) $Ca(OH)_2$ is used in white wash.
(II) $NaCl$ is used in preparation of washing soda (Na_2CO_3).
(III) $CaSO_4 \cdot \frac{1}{2}H_2O$ is used for making casts of statues.
(IV) $CaCO_3$ is used as an antacid.

Question89

A metal on combustion in excess of air forms X. X upon hydrolysis with water yields H_2O_2 and O_2 along with another product. The metal is: [Jan. 12,2019(I)]

Options:

A. Na

B. Rb

C. M g

D. Li

Answer: B

Solution:

$$Rb \xrightarrow{O_2(excess)} RbO_2$$

$$2RbO_2 + 2H_2O \longrightarrow 2RbOH + H_2O_2 + O_2$$

Question90

The correct statement(s) among I to III with respect to potassium ions that are abundant within the cell fluids is/are:
I. They activate many enzymes
II. They participate in the oxidation of glucose to produce ATP
III. Along with sodium ions, they are responsible for the transmission of nerve signals
[Jan. 12, 2019 (II)]

Options:

A. I and II only

B. I and III only

C. I, II and III

D. III only

Answer: C

Solution:

Solution:
K^+ ions are the most abundant cations within cell fluids, where they activate many enzymes, participate in the oxidation of glucose to form ATP and, along with sodium ions, they are responsible for the transmission of nerve signals.

Question91

The metal that forms nitride by reacting directly with N_2 of air, is:
[Jan. 9, 2019 (II)]

Options:

A. K

B. L

C. Rb

D. Cs

Answer: B

Solution:

Solution:
Amongst the given alkali metals, only lithium can react with N_2 in air to form lithium nitride.

Question92

The amphoteric hydroxide is:
[Jan .11, 2019(I)]

Options:

A. $Be(OH)_2$

B. $Ca(OH)_2$

C. $Mg(OH)_2$

D. $Sr(OH)_2$

Answer: A

Solution:

Solution:
$Be(OH)_2$ is amphoteric in nature.

Question93

The metal used for making X-ray tube window is:
[Jan. 10, 2019(I)]

Options:

A. Mg

B. Na

C. Be

D. Ca

Answer: C

Solution:

Solution:
Be is transparent to X-rays, so it is used in making X-ray tube windows.

Question94

The alkaline earth metal nitrate that does not crystallise with water molecules, is:
[Jan. 9, 2019 (I)]

Options:

A. $Mg(NO_3)_2$

B. $Sr(NO_3)_2$

C. $Ca(NO_3)_2$

D. $Ba(NO_3)_2$

Answer: D

Solution:

Solution:
The chances of formation of hydrate decreases with the decrease in the charge density down the group. This is why, $Ba(NO_3)_2$ does not crystallise with water molecules.

Question95

Match the following items in column I with the correspond- ing items in column II.

Column-I	Column-II
(i) $Na_2CO_3 \cdot 10H_2O$	(A) Portland cement ingredient
(ii) $Mg(HCO_3)_2$	(B) Castner-Kellner process
(iii) $NaOH$	(C) Solvay process
(iv) $Ca_2Al_2O_6$	(D) Temporary hardness

[Jan. 11, 2019 (II)]

Options:

A. (i) → (B); (ii) → (C); (iii) → (A); (iv) → (D)

B. (i) → (C); (ii) → (B); (iii) → (D); (iv) → (A)

C. (i) → (D); (ii) → (A); (iii) → (B); (iv) → (C)

D. (i) → (C); (ii) →(D); (iii) → (B); (iv) → (A)

Answer: D

Solution:

(i) $Na_2CO_3 \cdot 10H_2O$→ Solvay process
(ii) $Mg(HCO_3)_2$→ Temporary hardness
(iii) NaOH → Castner-Kellner process
(iv) $Ca_3Al_2O_6$→ Portland cement

Question96

The correct order of hydration enthalpies of alkali metal ions is : [April 8,2019(I)]

Options:

A. $Li^+ > Na^+ > K^+ > Cs^+ > Rb^+$

B. $Na^+ > Li^+ > K^+ > Rb^+ > Cs^+$

C. $Na^+ > Li^+ > K^+ > Cs^+ > Rb^+$

D. $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$

Answer: D

Solution:

Solution:
Hydration energy is inversely proportional to the size of ion.
$Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$ Size
$Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$ Hydration energy

Question97

The INCORRECT statement is: [April 12,2019(II)]

Options:

A. Lithium is the strongest reducing agentamong the alkalimetals.

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 $LiCl \cdot 2H_2O$.

Answer: C

Solution:

Lithium nitrate decomposes into its oxide on heating.

$$4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 4NO_2 + O_2$$

Question98

A hydrated solid X on heating initially gives a monohydrated compound Y. Y upon heating above 373K leads to an anhydrous white powder Z . X and Z , respectively, are:
[April 10, 2019 (II)]

Options:

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.

Answer: A

Solution:

$$Na_2CO_3 \cdot 10H_2O \longrightarrow \underset{(X)}{Na_2CO_3 \cdot H_2O} + 9H_2O$$

$$\underset{(Y)}{Na_2CO_3 \cdot H_2O} \longrightarrow \underset{(Z)}{Na_2CO_3} + H_2O$$

X = Washing soda
Z = Soda ash

Question99

The correct sequence of thermal stability of the following carbonates is :
[April 12, 2019 (I)]

Options:

A. $BaCO_3 < CaCO_3 < SrCO_3 < MgCO_3$

B. $MgCO_3 < CaCO_3 < SrCO_3 < BaCO_3$

C. $MgCO_3 < SrCO_3 < CaCO_3 < BaCO_3$

D. $BaCO_3 < SrCO_3 < CaCO_3 < MgCO_3$

Answer: B

Solution:

Solution:
Thermal stability of alkaline earth metal carbonates increases down the group.
$MgCO_3 < CaCO_3 < SrCO_3 < BaCO_3$

Question100

The alloy used in the construction of aircrafts is :
←
[April 10, 2019 (I)]

Options:

A. $Mg - Al$

B. $Mg - Zn$

C. $Mg - Sn$

D. $Mg - Mn$

Answer: A

Solution:

Solution:
In manufacturing of aircraft an alloy of Mg and Al called magnalium is used due to its light weight and high strength.

Question101

Magnesium powder burns in air to give:
[April 9, 2019 (I)]

Options:

A. $Mg(NO_3)_2$ and Mg_3N_2

B. MgO and Mg_3N_2

C. MgO only

D. MgO and $Mg(NO_3)_2$

Answer: B

Solution:

Mg burns in air and produces a mixture of nitride and oxide.

Question102

The structures of beryllium chloride in the solid state and vapour phase, respectively, are:
[April 9,2019 (II)]

Options:

A. chain and chain

B. dimeric and dimeric

C. chain and dimeric

D. dimeric and chain

Answer: C

Solution:

Solution:
$BeCl_2$ in vapour phase exists as dimer (below $1200K$ temperature) whereas, in solid state $BeCl_2$ has chain structure.

Question103

The covalent alkaline earth metal halide ($X = Cl, Br, I$) is :
[April 8, 2019 (II)]

Options:

A. MgX_2

B. CaX_2

C. BeX_2

D. SrX_2

Answer: C

Solution:

Solution:
According to Fajan's rule, greater the polarising power of cation greater would be the covalent character. Since, Be^{2+} has maximum polarising power among given cations. Therefore, BeX_2 would be most covalent alkaline earth metal halides among the given halides.

Question104

Lithium aluminium hydride reacts with silicon tetrachloride to form: [Online April 15, 2018 (II)]

Options:

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

Answer: B

Solution:

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

Question105

Which one of the following is an oxide? [Online April 9, 2017]

Options:

A. KO_2

B. BaO_2

C. SiO_2

D. CsO_2

Answer: C

Solution:

Compound	Nature
KO_2	Superoxide
BaO_2	Peroxide
SiO_2	Oxide
CsO_2	Superoxide

Question106

The main oxides formed on combustion of Li, N a and K in excess of air are, respectively:
[2016]

Options:

A. Li_2O_2, Na_2O_2 and KO_2

B. Li_2O, Na_2O_2 and KO_2

C. L_2O, Na_2O and KO_2

D. LiO_2, Na_2O_2 and K_2O

Answer: B

Solution:

$4Li + O_2 \rightarrow 2Li_2O$ Lithium monoxide
$2Na + O_2 \rightarrow Na_2O_2$ Sodium peroxide
$K + O_2 \rightarrow KO_2$ Potassium superoxide

Question107

The correct order of the solubility of alkaline-earth metal sulphates in water is :
[Online April 9, 2016]

Options:

A. Mg > Ca > Sr > Ba

B. Mg > Sr > Ca > Ba

C. Mg < Ca < Sr < Ba

D. Mg < Sr < Ca < Ba

Answer: A

Solution:

The solubility of sulphates of alkaline earth metals decreases as we move down the group from Be to Ba due to the reason that 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. However the hydration energy decreases from Be to Ba apprciably as the size of the cation increase down the group. Hence, the solubility of sulphates of alkaline earth metal decrease down the group mainly due to decreasing hydration energy from Be to Ba. Thus the order will be
$Mg > Ca > Sr > Ba$

Question108

The commercial name for calcium oxide is : [Online April 10, 2016]

Options:

A. Quick lime

B. Milk of lime

C. Slaked lime

D. Limestone

Answer: A

Solution:

Solution:
Quick lime is commercial name of CaO.

Question109

Which of the alkaline earth metal halides given below is essentially covalent in nature ? [Online April 11, 2015]

Options:

A. $SrCl_2$

B. $CaCl_2$

C. $BaCl_2$

D. $MgCl_2$

Answer: D

Solution:

Covalent character increases, when the cation has small size and high charge density.
Among all these, Mg^{2+} size is smallest, so $MgCl_2$ tends to be more covalent in nature.

Question110

Which one of the following alkaline earth metal sulphates has its hydration enthalpy greater than its lattice enthalpy? [2015]

Options:

A. $BaSO_4$

B. $SrSO_4$

C. $CaSO_4$

D. $BeSO_4$

Answer: D

Solution:

Solution:
$BeSO_4$ has its hydration enthalpy greater than its lattice enthalpy.

Question111

The correct order of thermal stability of hydroxides is: [Online April 10, 2015]

Options:

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

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

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

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

Answer: C

Solution:

Solution:
The amount of heating required depends on the extent of polarisation. More polarization required less energy. The smaller the positive ion is, the higher the charge density, and the greater effect it will have on the hydroxide ion. As the positive ions get larger down the group, they affect on the hydroxide ions. Therefore, the hydroxides become more thermally stable down the group.

Question112

Which of the following statements about Na_2O_2 is not correct? [Online April 11, 2014]

Options:

A. It is diamagnetic in nature

B. It is derivative of H_2O_2

C. Na_2O_2 oxidises Cr^{3+} to CrO_4^{2-} in acid medium.

D. It is the super oxide of sodium

Answer: D

Solution:

Solution:
Na_2O_2 is the peroxide of sodium not super oxide. The formula of sodium superoxide is NaO_2.

Question113

The first ionisation potential of Na is 5.1eV . The value of electron gain enthalpy of Na^+ will be [2013]

Options:

A. $-2.55eV$

B. $-5.1eV$

C. $-10.2eV$

D. $+2.55eV$

Answer: B

Solution:

$\because$ For $Na \longrightarrow Na^+ + e^- \quad IE_1 = 5.1eV$
$\therefore$ For $Na^+ + e^- \longrightarrow NaEF = -5.1eV$
(because the reaction is reverse)

Question114

The solubility order for alkali metal fluoride in water is:

[Online April 22,2013]

Options:

A. $LiF < RbF < KF < NaF$

B. $RbF < KF < NaF < LiF$

C. $LiF > NaF > KF > RbF$

D. $LiF < NaF < KF < RbF$

Answer: D

Solution:

Higher the lattice enthalpy, lower will be solubility i.e., lattice enthalpy $\propto \frac{1}{\text{solubility}}$

Since the lattice enthalpy of alkali metals follow the order
$Li > Na > K > Rb$
Hence the correct order of solubility is
$LiF < NaF < KF < RbF$

Question115

A metal ´M´ on heating in nitrogen gas gives ' Y´ . ´Y´ on treatment with H_2O gives a colourless gas which when passed through $CuSO_4$ solution gives a blue colour. ' Y´ is
[Online May 12, 2012]

Options:

A. NH_3

B. $Mg(NO_3)_2$

C. Mg_3N_2

D. MgO

Answer: C

Solution:

$$\underset{M}{3Mg} + N_2 \longrightarrow \underset{Y}{Mg_3N_2}$$

$$\underset{Y}{Mg_3N_2} + 6H_2O \longrightarrow 3Mg(OH)_2 + \underset{\text{colourless}}{2NH_3}\uparrow$$

$$CuSO_4 + 4NH_3 \longrightarrow \underset{\text{Blue complex}}{[Cu(NH_3)_4]SO_4}$$

Question116

Which one of the following will react most vigorously with water? [Online May 19,2012]

Options:

A. L

B. K

C. Rb

D. Na

Answer: C

Solution:

Solution:
Reactivity with water increases on moving down the Group from Li to Cs as Li < N a < K < Rb < Cs. This is due to increase in electropositive character. Hence Rb reacts most vigorously with water.

Question117

Fire extinguishers contain H_2SO_4 and which one of the following? [Online May 26, 2012]

Options:

A. $NaHCO_3$ and Na_2CO_3

B. Na_2CO_3

C. $NaHCO_3$

D. $CaCO_3$

Answer: A

Solution:

Solution:
Fire extinguishers contain a mixture of Na_2CO_3, $NaHCO_3$ and H_2SO_4

Question118

Which of the following on thermal decomposition yields a basic as well as acidic oxide? [2012]

Options:

A. $NaNO_3$

B. $KClO_3$

C. $CaCO_3$

D. NH_4NO_3

Answer: C

Solution:

Solution:

Question119

What is the best description of the change that occurs when $Na_2O(s)$ is dissolved in water ? [2011RS]

Options:

A. Oxide ion accepts sharing a pair of electrons

B. Oxide ion donates a pair of electrons

C. Oxidation number of oxygen increases

D. Oxidation number of sodium decreases

Answer: B

Solution:

$$\underset{\text{Base}}{O^{2-}} + \underset{\text{Acid}}{H_2O} \longrightarrow \underset{\text{Conjugate base}}{OH^-} + \underset{\text{Conjugate acid}}{OH^-}$$

Question120

The products obtained on heating $LiNO_3$ will be: [2011RS]

Options:

A. $Li_2O + NO_2 + O_2$

B. $Li_3N + O_2$

C. $Li_2O + NO + O_2$

D. $LiNO_3 + O_2$

Answer: A

Solution:

Hint: Lithium, nitrogen and oxygen combine to form a compound which can be called as lithium nitrate. Lithium nitrate on heating forms multiple products which includes the formation of alkali oxide, oxygen and nitrogen dioxide. The alkali oxide formed in this reaction is lithium oxide.
The atoms in the periodic table combine with other atoms and form molecules attached through different bonds. Lithium is an electropositive element and also a metal, nitrogen and oxygen are non-metallic. These three atoms combine to form a chemical compound called lithium nitrate.
The molecular formula of lithium nitrate is $LiNO_3$, as it has elements other than oxygen and hydrogen. It can be considered as an inorganic compound.
Inorganic compounds upon heating give multiple products. The products formed on heating lithium nitrate are alkali oxide, oxygen and nitrogen dioxide. The alkali can be a metal that belongs to the alkali earth metals. Here, the alkali metal is lithium.
The chemical reaction involved can be written as:
$4LiNO_3 \rightarrow 2Li_2O + 4NO_2 + O_2$
Thus, the products are lithium oxide (Li_2O), oxygen (O_2) and nitrogen dioxide (NO_2).

Question121

The ionic mobility of alkali metal ions in aqueous solution is maximum for
[2006]

Options:

A. Li^+

B. Na^+

C. K^+

D. Rb^+

Answer: D

Solution:

Solution:
Smaller the size of cation, higher is its hydration energy and greater is its ionic mobility, hence the correct order is
$Li^+ < Na^+ < K^+ < Rb^+$

Question122

Based on lattice energy and other considerations, which one of the following alkali metal chloride is expected to have the highest melting point?
[2005, Online May 7, 2012]

Options:

A. NaCl

B. KCl

C. LiCl

D. RbCl

Answer: A

Solution:

Despite the fact that $LiCl$ has higher lattice energy than $NaCl$.
$LiCl$ has lower melting point because of its covalent nature. Also as we go down the group's lattice energy generally decreases as size of alkali metal atom increases (lattice energy $\propto$ melting point of alkali metal halide). Thus, $NaCl$ is expected to lave maximum melting point in the alkali chloride.

Question123

One mole of magnesium nitride on reaction with an excess of water gives
[2004]

Options:

A. two moles of ammonia

B. one mole of nitric acid

C. one mole of ammonia

D. two moles of nitric acid

Answer: A

Solution:

$$Mg_3N_2 + 6H_2O \rightleftharpoons 3Mg(OH)_2 + 2NH_3$$

Question124

The solubility of carbonates decreases down the magnesium group due to a decrease in
[2003]

Options:

A. hydration energy of cations

B. inter-ionic attraction

C. entropy of solution formation

D. lattice energy of solids

Answer: A

Solution:

As we move down the group, the lattice energy of carbonates remains approximately the same. However, the hydration energy of the metal cations decrease from Be^{2+} to Ba^{2+}, hence the solubility of carbonates of the alkaline earth metals decreases down the group mainly due to decreasing hydration energy of the cations from Be^{2+} to Ba^{2+}

Question125

Which one of the following processes will produce hard water ? [2003]

Options:

A. Saturation of water with $MgCO_3$

B. Saturation of water with $CaSO_4$

C. Addition of Na_2SO_4 to water

D. Saturation of water with $CaCO_3$

Answer: B

Solution:

Solution:
Permanent hardness of water is due to chlorides and sulphates of calcium and magnesium i.e $CaCl_2$, $CaSO_4$, $MgCl_2$ and $MgSO_4$

Question126

The substance not likely to contain $CaCO_3$ is [2003]

Options:

A. calcined gypsum

B. sea shells

C. dolomite

D. a marble statue

Answer: A

Solution:

Gypsum is $CaSO_4 \cdot 2H_2O$

Question127

In curing cement plasters water is sprinkled from time to time. This helps in [2003]

Options:

A. developing interlocking needle-like crystals of hydrated silicates

B. hydrating sand and gravel mixed with cement

C. converting sand into silicic acid

D. keeping it cool

Answer: A

Solution:

Solution:
Setting of cement is exothermic process which devel- ops interlocking crystals of hydrated silicates.

Question128

The metallic sodium dissolves in liquid ammonia to form a deep blue coloured solution. The deep blue colour is due to formation of: [2002]

Options:

A. solvated electron, $e(NH_3)_x^-$

B. solvated atomic sodium, $Na(NH_3)_y$

C. $(Na^+ + Na^-)$

D. $NaNH_2 + H_2$

Answer: A

Solution:

Solution:
The alkali metals dissolve in liquid ammonia without evolution of hydrogen. The metal loses electrons and com- bine with ammonia molecule.
$M \longrightarrow M^+$ (in liquid ammonia) $+e^-$ (ammoniated)
$M + (x+y)NH_3 \rightarrow [M(NH_3)_x]^+ + e^-(NH_3)_y$ Solvated electron
It is ammoniated electron which is responsible for colour.

Question129

KO_2 (potassium super oxide) is used in oxygen cylinders in space and submarines because it
[2002]

Options:

A. absorbs CO_2 and increases O_2 content

B. eliminates moisture

C. absorbs CO_2

D. produces ozone.

Answer: A

Solution:

Solution:
$2KO_2 + 2H_2O \rightarrow 2KOH + H_2O_2 + O_2$.
KO_2 is used as an oxidising agent. It is used as air purifier in space capsules, submarines and breathing masks as it produces oxygen and removes carbon dioxide.

Question130

A metal M readily forms its sulphate MSO_4 which is water soluble. It forms its oxide MO which becomes inert on heating. It forms an insoluble hyroxide $M(OH)_2$ which is soluble in NaOH solution. Then M is
[2002]

Options:

A. Mg

B. Ba

C. Ca

D. Be

Answer: D

Solution:

Sulphates of alkaline earth metals are sparingly soluble or almost not soluble in water whereas $BeSO_4$ is soluble in water due to high degree of solvation. $Be(OH)_2$ is insoluble in water but soluble in NaOH.
$BeO + 2NaOH \longrightarrow Na_2BeO_2 + H_2O$