DPP - Daily Practice Problems

Date : | **Start Time :** | **End Time :**

CHEMISTRY CC10

SYLLABUS : The s-Block Elements

Max. Marks : 120 **Marking Scheme :** (+ 4) for correct & (–1) for incorrect **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. Alkali metals are generally extracted by
(a) reduction methods
(b) double decomposition methods
(c) displacement methods
(d) electrolytic methods

2. Which of the following represents a correct sequence of reducing power of the following elements?
(a) Li > Cs > Rb
(b) Rb > Cs > Li
(c) Cs > Li > Rb
(d) Li > Rb > Cs

3. Strongest bond is in between
(a) CsF
(b) NaCl
(c) Both (a) and (b)
(d) None of above

4. A metal salt solution forms a yellow precipitate with potassium chromate in acetic acid, a white precipitate with dil H_2SO_4, but gives no precipitate with NaCl. The metal salt solution will consist of
(a) $PbCO_3$ (b) $BaCO_3$
(c) $MgCO_3$ (d) $CaCO_3$

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ

5. Which of the following has lowest thermal stability ?

(a) Li_2CO_3 (b) Na_2CO_3

(c) K_2CO_3 (d) Rb_2CO_3

6. The first (IE_1) and second (IE_2) ionisation energies (kJ/mol) of a few elements designated by Roman numerals are given below. Which of these would be an alkali metal?

		IE_1	IE_2
(a)	I	2372	5251
(b)	II	520	7300
(c)	III	900	1760
(d)	IV	16803	380

7. The solubilities of carbonates decrease down the magnesium group due to a decrease in

(a) hydration energies of cations

(b) inter-ionic attraction

(c) entropy of solution formation

(d) lattice energies of solids

8. KO_2 (potassium super oxide) is used in oxygen cylinders in space and submarines because it

(a) absorbs CO_2 and increases O_2 content

(b) eliminates moisture

(c) absorbs CO_2

(d) produces ozone.

9. Which one of the following salts does not impart colour to the flame ?

(a) KI (b) LiCl

(c) $CaCl_2$ (d) $MgCl_2$

10. Amongst LiCl, RbCl, $BeCl_2$ and $MgCl_2$ the compounds with the greatest and least ionic character respectively are :

(a) LiCl and RbCl (b) $MgCl_2$ and $BeCl_2$

(c) RbCl and $BeCl_2$ (d) RbCl and $MgCl_2$

11. Which of the following statements about Na_2O_2 is not correct?

(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

12. All of the following substances react with water. The pair that gives the same gaseous product is

(a) K and KO_2

(b) Na and Na_2O_2

(c) Ca and CaH_2

(d) Ba and BaO_2

13. Which is not correctly matched?

(1) Basic strength $Cs_2O < Rb_2O < K_2O < Na_2O < Li_2O$ of oxides

(2) Stability of $Na_2O_2 < K_2O_2 < Rb_2O_2 < Cs_2O_2$ peroxides

(3) Stability of $LiHCO_3 < NaHCO_3 < KHCO_3$ bicarbonates $< RbHCO_3 < CsHCO_3$

(4) Melting point NaF < NaCl < NaBr < NaI

(a) 1 and 4

(b) 1 and 3

(c) 1 and 2

(d) 2 and 3

14. If NaOH is added to an aqueous solution of Zn^{2+} ions, a white precipitate appears and on adding excess NaOH, the precipitate dissolves. In this solution zinc exists in the :

(a) both in cationic and anionic parts

(b) there is no zinc left in the solution

(c) cationic part

(d) anionic part.

RESPONSE GRID					
	5. ⓐⓑⓒⓓ	**6.** ⓐⓑⓒⓓ	**7.** ⓐⓑⓒⓓ	**8.** ⓐⓑⓒⓓ	**9.** ⓐⓑⓒⓓ
	10. ⓐⓑⓒⓓ	**11.** ⓐⓑⓒⓓ	**12.** ⓐⓑⓒⓓ	**13.** ⓐⓑⓒⓓ	**14.** ⓐⓑⓒⓓ

15. The compound A on heating gives a colourless gas and a residue that is dissolved in water to obtain B. Excess of CO_2 is bubbled through aqueous solution of B, C is formed which is recovered in the solid form. Solid C on gentle heating gives back A. The compound is

(a) $CaSO_4.2H_2O$ (b) $CaCO_3$

(c) Na_2CO_3 (d) K_2CO_3

16. In Castner-Kellner cell for production of sodium hydroxide:

(a) Brine is electrolyzed with Pt electrodes

(b) Brine is electrolyzed using graphite electrodes

(c) Molten sodium chloride is electrolysed

(d) Sodium amalgam is formed at mercury cathode

17. A metal X 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

(a) $Mg(NO_3)_2$ (b) Mg_3N_2

(c) NH_3 (d) MgO

18. The metals A and B form oxide but B also forms nitride when both burn in air. The A and B are

(a) Cs, K (b) Mg, Ca

(c) Li, Na (d) K, Mg

19. 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

20. Which of the following are arranged in increasing order of solubilities?

(a) $CaCO_3 < KHCO_3 < NaHCO_3$

(b) $NaHCO_3 < KHCO_3 < CaCO_3$

(c) $KHCO_3 < NaHCO_3 < CaCO_3$

(d) $CaCO_3 < NaHCO_3 < KHCO_3$

21. For a good quality cement what should be the ratio of following :

I. Silica to alumina

II. CaO to the total of oxides of SiO_2, Al_2O_3 and Fe_2O_3

(a) I = 2.5 to 4
II = Greater than 2

(b) I = Nearly 4
II = Less than 2

(c) I = 2.5
II = Closer to 2

(d) I = 2.5 to 4
II = Closer to 2

22. Which one of the following does not react with water even under red hot condition?

(a) Na (b) Be

(c) Ca (d) K

23. Which of the following are found in biological fluids Na^+, Mg^{2+}, Ca^{2+}, K^+, Sr^{2+}, Li^+ and Ba^{2+}

(a) Mg^{2+}, Ca^{2+}, and Sr^{2+}

(b) Na^{2+} and K^+

(c) Na^+, K^+, Mg^{2+} and Ca^{2+}

(d) Sr^+, Li and Ba^{2+}

24. 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)

RESPONSE GRID					
	15. ⓐⓑⓒⓓ	**16.** ⓐⓑⓒⓓ	**17.** ⓐⓑⓒⓓ	**18.** ⓐⓑⓒⓓ	**19.** ⓐⓑⓒⓓ
	20. ⓐⓑⓒⓓ	**21.** ⓐⓑⓒⓓ	**22.** ⓐⓑⓒⓓ	**23.** ⓐⓑⓒⓓ	**24.** ⓐⓑⓒⓓ

25. Which one of the following alkaline earth metal sulphates has its hydration enthalpy greater than its lattice enthalpy ?

(a) $BaSO_4$ (b) $SrSO_4$

(c) $CaSO_4$ (d) $BeSO_4$

26. The metallic sodium disolves in liquid ammonia to form a deep blue coloured solution. The deep blue colour is due to formation of:

(a) solvated electron, $e(NH_3)_x^-$

(b) solvated atomic sodium, $Na(NH_3)_y$

(c) $(Na^+ + Na^-)$

(d) $NaNH_2 + H_2$

27. A firework gives out crimson coloured light. It contains a salt of

(a) Ca (b) Na

(c) Sr (d) Ba

28. Magnesium wire burns in the atmosphere of CO_2 because

(a) Magnesium acts as an oxidising agent

(b) Magnesium has 2 electrons in the outermost orbit.

(c) Magnesium acts as a reducing agent and removes oxygen from CO_2

(d) None of these

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

(a) -2.55 eV (b) -5.1 eV

(c) -10.2 eV (d) $+2.55$ eV

30. Stability of the species Li_2, Li_2^- and Li_2^+ increases in the order of :

(a) $Li_2 < Li_2^+ < Li_2^-$ (b) $Li_2^- < Li_2^+ < Li_2$

(c) $Li_2 < Li_2^- < Li_2^+$ (d) $Li_2^- < Li_2 < Li_2^+$

RESPONSE GRID	**25.** ⓐⓑⓒⓓ **26.** ⓐⓑⓒⓓ **27.** ⓐⓑⓒⓓ **28.** ⓐⓑⓒⓓ **29.** ⓐⓑⓒⓓ **30.** ⓐⓑⓒⓓ

DAILY PRACTICE PROBLEM DPP CHAPTERWISE 10 - CHEMISTRY			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	37	Qualifying Score	56
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

1. **(d)** Alkali metals are highly electropositive and thus highly reducing .Therefore reduction , double decomposition and displacement methods for their extraction are not suitable .Only electrolytic methods are useful for their extraction.

2. **(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) $M(s) \rightarrow M(g)$ ΔH = Sublimation energy

(ii) $M(g) \rightarrow M^+(g) + e^-$ ΔH = Ionisation energy

(iii) $M^+(g)+H_2O \rightarrow M^+(aq)$ ΔH = Hydration energy

The large amount of energy liberated in hydration of Li (because of its small size) makes the overall ΔH negative. This accounts for the higher oxidation potential of lithium i.e., its high reducing power.

3. **(a)** According to Fajan rules, ionic character increases with increase in size of the cation and decrease in size of the anion. Thus, CsF has higher ionic character than NaCl and hence bond in CsF is stronger than in NaCl.

4. **(b)** $BaCO_3$ forms a yellow ppt of barium chromate. $BaCO_3$ forms a white precipitate of $BaSO_4$. $BaCl_2$ is soluble in water.

5. **(a)** The weaker the base, the less stable is its carbonate. Since LiOH is the weakest base, hence Li_2CO_3 has the lowest thermal stability.

6. **(b)** As outermost electronic configuration of alkali metals is ns^1 and also their size are largest in their respective periods so their 1st I.E will be lowest among the given options. As second electron is to be removed from complete shell or noble gas core, so the IInd I.E. must be highest among the given options. So, option (b) is correct choice.

7. **(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^{++} to Ba^{++}, 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^{++} to Ba^{++}.

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

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 remove carbon dioxide.

9. **(d)** Halides of group I and II impart characteristic colour to the flame due to low IE of the central atom. However, ionization energy of Be and Mg atoms is high due to their small size, hence they can't be excited to higher levels by Bunsen burner flame. Thus, their halides don't impart colour to flame

10. **(c)** According to Fajan's rule,

Size of cation $\propto$ Ionic character.

Recall that size of metal (ion) increases while going down the group, and decreases on crossing the periods from left to right. Thus Rb^+ (group I) is largest and Be^{2+} (group II) is smallest in size. Hence RbCl has greatest, and $BeCl_2$ has lowest ionic character.

11. **(d)** Na_2O_2 is peroxide of sodium not super oxide. The formula of sodium superoxide is NaO_2.

12. **(c)** Ca and CaH_2 both react with H_2O to form H_2 gas,

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

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

whereas K gives H_2 while KO_2 gives O_2 and H_2O_2

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

$$2KO_2 + 2H_2O \longrightarrow 2KOH + O_2 + H_2O_2$$

Similarly, Na gives H_2 while Na_2O_2 gives H_2O_2

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2$$

$$Na_2O_2 + 2H_2O \longrightarrow 2NaOH + H_2O_2$$

Likewise Ba gives H_2 while BaO_2 gives H_2O_2

$$Ba + 2H_2O \longrightarrow Ba(OH)_2 + H_2$$

$$BaO_2 + 2H_2O \longrightarrow Ba(OH)_2 + H_2O_2$$

13. **(a)** Basic strength of the oxides increase in the order $Li_2O < Na_2O < K_2O < Rb_2O < Cs_2O$. The increase in basic strength is due to the decrease in I.E. and increase in electropositive character.

The melting points of the halides decrease in the order NaF > NaCl > NaBr > NaI, as the size of the halide ion increases. The decrease in melting point is due to increase in the covalent character with increase in the size of anion according to Fajan's rule.

14. **(d)** $$Zn^{++} + 2NaOH \longrightarrow Zn(OH)_2 + 2Na^+$$

$$Zn(OH)_2 + 2NaOH \longrightarrow Na_2ZnO_2 + 2H_2O$$

$$Na_2ZnO_2 \longrightarrow 2Na^+ + (ZnO_2)^{2-}$$

15. **(b)** $$\underset{A}{CaCO_{3(s)}} \xrightarrow{\Delta} \underset{\text{colourless}}{CO_{2(g)}} \uparrow + \underset{B}{CaO_{(s)}}$$

$$\underset{B}{CaO_{(s)}} + H_2O \longrightarrow Ca(OH)_{2(aq)}$$

$$Ca(OH)_2 + 2CO_2 \longrightarrow \underset{C}{Ca(HCO_3)_{2(aq)}}$$

$$Ca(HCO_3)_{2(s)} \longrightarrow \underset{A}{CaCO_{3(s)}} + CO_{2(g)} + H_2O_{(g)}$$

$\therefore$ Correct choice : (b)

16. **(d)** In Castner Kellner cell, sodium amalgam is formed at mercury cathode.

17. **(b)** $$\underset{X}{3Mg} + N_2 \xrightarrow{\Delta} \underset{Y}{Mg_3N_2};$$

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

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

18. **(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.

19. **(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.

20. **(d)** Lesser the lattice energy, more will be the solubility in H_2O.

21. **(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.

22. **(b)** $2Na + 2H_2O \longrightarrow 2NaOH + H_2 \uparrow$

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

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.

23. **(c)** Monovalent sodium and potassium ions and divalent magnesium and calcium ions are found in large proportions in biological fluids.

24. **(b)** Alkali metals readily lose electron to give monovalent M^+ ion. Hence they are never found in free state in nature.

25. **(d)** 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 size does not make any difference. On moving down the group the degree of hydration of metal ions decreases very much leading to decrease in solubility.

$\therefore$ $BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4 > BaSO_4$

26. **(a)** The alkali metals dissolve in liquid ammonia without evolution of hydrogen. The metal loses electrons and combine with ammonia molecule.

$M \longrightarrow M^+$ (in liquid ammonia) $+ e^-$ (ammoniated)

$M + (x+y)NH_3 \rightarrow [M(NH_3)_x]^+ + \underset{\text{Solvated electron}}{e^-(NH_3)_y}$

It is ammoniated electron which is responsible for colour.

27. **(c)**

28. **(c)** Mg is more reducing in nature than carbon

$CO_2 + 2Mg \rightarrow 2MgO + C$

29. **(b)** $\because$ For $Na \longrightarrow Na^+ + e^-$ $\quad IE_1 = 5.1$ eV

$\therefore$ For $Na^+ + e^- \longrightarrow Na$ $\quad EF = -5.1$ eV

(because the reaction is reverse)

30. **(b)** $Li_2 = \sigma 1s^2\, \sigma^* 1s^2\, \sigma 2s^2$

$\therefore$ Bond order $= \frac{1}{2}(4 - 2) = 1$

$Li_2^+ = \sigma 1s^2\, \sigma^* 1s^2\, \sigma 2s^1$

B.O. $= \frac{1}{2}(3 - 2) = 0.5$

$Li_2^- = \sigma 1s^2\, \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^1$

B.O. $= \frac{1}{2}(4 - 3) = 0.5$

The bond order of Li_2^+ and Li_2^- is same but Li_2^+ is more stable than Li_2^- because Li_2^+ is smaller in size and has 2 electrons in antibonding orbitals whereas Li_2^- has 3 electrons in antibonding orbitals. Hence Li_2^+ is more stable than Li_2^-.