DPP - Daily Practice Problems

Name : Date :

Start Time : End Time :

CHEMISTRY 17

SYLLABUS : *s*-Block Elements-1 (Alkali Metals)

Max. Marks : 120 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The 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.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE choice is correct.

Q.1 As compared to potassium, sodium has

(a) Lower electronegativity

(b) Higher ionization potential

(c) Greater atomic radius

(d) Lower melting point

Q.2 Which of the following statement is correct regarding alkali metals?

(a) Cation is less stable than the atom

(b) Cation is smaller than the atom

(c) Size of cation and atom is the same

(d) Cation is greater in size than the atom

Q.3 A mixture of $CaCl_2$ and KF is added to sodium chloride

(a) To increase the conductivity of NaCl

(b) To decrease the melting point of NaCl

(c) To supress the degree of dissociation of NaCl

(d) To decrease the volatility of NaCl

Q.4 Na_2CO_3 can be manufactured by Solvay's process but K_2CO_3 cannot be prepared because

(a) K_2CO_3 is more soluble

(b) K_2CO_3 is less soluble

(c) $KHCO_3$ is more soluble than $NaHCO_3$

(d) $KHCO_3$ is less soluble than $NaHCO_3$

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

Space for Rough Work

Q.5 Which of the following does not illustrate the anomalous properties of lithium?
(a) The melting point and boiling point of Li are comparatively high
(b) Li is much softer than the other group I metals
(c) Li forms a nitride Li_3N unlike group I metal
(d) The ion of Li and its compounds are more heavily hydrated than those of the rest of the group

Q.6 KF combines with HF to form KHF_2. The compound contains the species
(a) K^+, F^- and H^+ (b) K^+, F^- and HF
(c) K^+ and $[HF_2]^-$ (d) $[KHF]^+$ and F^-

Q.7 Sodium thiosulphate is used in photography
(a) To convert metallic silver into silver salt
(b) AgBr grain is reduced to non-metallic silver
(c) To remove reduced silver
(d) To remove undecomposed AgBr in the form of $Na_3[Ag(S_2O_3)_2]$ (a complex salt)

Q.8 Which of the following is correct?
(a) All carbonates are soluble in water
(b) Carbonates of Na, K and NH_4 are soluble in water
(c) Carbonates of Ca, Sr, Ba are soluble in water
(d) All carbonates are insoluble

Q.9 On dissolving moderate amount of sodium metal in liquid NH_3 at low temperature, which one of the following does not occur?
(a) Blue coloured solution is obtained
(b) Na^+ ions are formed in the solution
(c) Liquid NH_3 becomes good conductor of electricity
(d) Liquid ammonia remains diamagnetic

Q.10 A substance X is a compound of an element of group IA, the substance X gives a violet colour in flame test, X is
(a) LiCl (b) NaCl
(c) KCl (d) None

Q.11 Sodium gives blue colour with NH_3 solution, this blue colour is due to
(a) Ammoniated $Na^{\oplus}$ (b) Ammoniated $Na^{\bullet}$
(c) Ammoniated e^- (d) Na^+/Na^- pair

Q.12 Photoelectric effect is maximum in
(a) Cs (b) Na
(c) K (d) Li

Q.13 The ionic mobility of alkali metal ions in aqeous solution is maximum for
(a) K^+ (b) Rb^+
(c) Li^+ (d) Na^+

Q.14 In certain matters lithium differs from other alkali metals, the main reason for this is
(a) Small size of Li atom and Li^+ ion
(b) Extremely high electropositivity of Li
(c) Greater hardness of Li
(d) Hydration of Li^+ ion

Q.15 Tincal is
(a) $Na_2CO_3.10H_2O$ (b) $NaNO_3$
(c) NaCl (d) $Na_2B_4O_7.10H_2O$

Q.16 Which of the following chemicals, in addition to water, are used for the manufacture of Na_2CO_3 by Solvay process?
(a) NaCl, CO and NH_3 (b) NaCl, CO_2 and NH_3
(c) NaCl, NH_4Cl and CO_2 (d) $NaHCO_3$, CO and NH_3

Q.17 The reactivity of the alkali metal sodium with water, is made use of
(a) In drying of alcohols
(b) In drying of benzene
(c) In drying of ammonia solution
(d) As a general drying agent

Q.18 The elements of group IA provide a colour to the flame of Bunson burner due to
(a) Low ionization potential
(b) Low melting point
(c) Softness
(d) Presence of one electron in the outermost orbit

Q.19 The property of hydrogen which distinguishes it from other alkali metal is
(a) Its electropositive character
(b) Its affinity for non-metals
(c) Its reducing character
(d) Its non-metallic character

RESPONSE GRID					
	5. ⓐⓑⓒⓓ	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ
	10. ⓐⓑⓒⓓ	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ
	15. ⓐⓑⓒⓓ	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ

Space for Rough Work

Q.20 The process of industrial manufacturing of sodium carbonate is known as
(a) Castner process
(b) Haber's process
(c) Le-blanc process
(d) Chamber process

Q.21 The correct formula of hypo is
(a) $Na_2S_2O_3.5H_2O$ (b) Na_2SO_4
(c) $Na_2S_2O_3.4H_2O$ (d) $Na_2S_2O_3.3H_2O$

DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes :
(a) 1, 2 and 3 are correct
(b) 1 and 2 are correct
(c) 2 and 4 are correct
(d) 1 and 3 are correct

Q.22 Which of the following statement are correct?
(1) Lithium hydride is a useful source of hydrogen
(2) Li^+ ion is readily hydrated in water and Cs^+ is least hydrated
(3) All lithium salts are hydrated but no caesium salt is hydrated
(4) The ionic nature of hydrides decreases from Li to Cs

Q.23 Highly pure dilute solution of sodium in liquid ammonia –
(1) shows blue colour
(2) exhibits electrical conductivity
(3) produces sodium amide
(4) produces hydrogen gas

Q.24 The compound(s) formed upon combustion of sodium metal in excess air is (are)
(1) Na_2O_2 (2) Na_2O
(3) NaO_2 (4) NaOH

DIRECTIONS (Q.25-Q.27) : Read the passage given below and answer the questions that follows :

The elements of group 1 describe, more clearly than any other group of elements, the effects of increasing the size of atoms or ions on the physical and chemical properties. The chemical and physical properties of the elements are closely related to their electronic structures and sizes. These metals are highly electropositive and thus form very strong bases, and have quite stable oxo-salts. In the manufacturing of sodium hydroxide, chlorine and sodium carbonate, sodium chloride is used as a starting material.

25. The following compounds have been arranged in the order of their increasing thermal stabilities. Identify the correct order,
K_2CO_3 (I), Na_2CO_3 (II), Rb_2CO_3 (III), Li_2CO_3 (IV)
(a) I < II < III < IV
(b) IV < II < III < I
(c) IV < II < I < III
(d) II < IV < III < I

26. Highly pure solution of sodium in liquid ammonia at –33°C (select correct statement) :
(a) is bad conductor of electricity.
(b) produces solvated ions responsible for electrical conductivity.
(c) shows copper - bronze colour.
(d) instantly produces sodium amide with liberation of hydrogen gas.

27. Which of the product is not correctly matched with its manufacture process?
(a) Sodium hydroxide - Castner Kellner method.
(b) Chlorine - Leblanc process.
(c) Potassium carbonate - Solvay process.
(d) Ammonia - Haber's process.

RESPONSE GRID					
	20. ⓐⓑⓒⓓ	**21.** ⓐⓑⓒⓓ	**22.** ⓐⓑⓒⓓ	**23.** ⓐⓑⓒⓓ	**24.** ⓐⓑⓒⓓ
	25. ⓐⓑⓒⓓ	**26.** ⓐⓑⓒⓓ	**27.** ⓐⓑⓒⓓ		

Space for Rough Work

DIRECTIONS (Q. 28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(c) Statement - 1 is False, Statement-2 is True.

(d) Statement - 1 is True, Statement-2 is False.

28. **Statement 1 :** Potassium and cacsium are used in photoelectric cells.
Statement 2 : Potassium and caesium emit electrons on exposure to light.

29. **Statement 1 :** LiCl is predominantly a covalent compound.
Statement 2 : Electronegativity difference between Li and Cl is too small.

30. **Statement 1 :** The alkali metals can form ionic hydrides which contain the hydride ion.
Statement 2 : The alkali metals have low electronegativity, their hydrides conduct electricity when fused and liberate hydrogen at the anode.

RESPONSE GRID	28. ⓐ ⓑ ⓒ ⓓ	29. ⓐ ⓑ ⓒ ⓓ	30. ⓐ ⓑ ⓒ ⓓ

DAILY PRACTICE PROBLEM SHEET 17 - CHEMISTRY			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	36	Qualifying Score	60
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

DAILY PRACTICE PROBLEMS

CHEMISTRY SOLUTIONS

(17)

(1) **(b)**

Element	Na	K
IE1	496	419
IE2	4562	3051

Sodium has higher I.E. because of smaller atomic size and hence greater nuclear attraction.

(2) **(b)** After removal of an electron the effective nuclear charge per electron increases hence the size decreases.

(3) **(b)** NaCl melts at 1074 K and it is difficult to attain and maintain this high temperature. The addition of $CaCl_2$ and KF lowers the melting point of NaCl to 850-875 K.

(4) **(c)** $NaHCO_3$ is sparingly soluble in water. When CO_2 is passed through ammoniated brine, $NaHCO_3$ gets precipitated. However, $KHCO_3$ is fairly soluble in water. When CO_2 is passed through ammoniated KCl solution, $KHCO_3$ does not get precipitated.

(5) **(b)** Actually Li is harder than other alkali metals.

(6) **(c)** $KF + HF \rightarrow KHF_2$ i.e., $K^+ + HF_2^-$

(7) **(a)** Sodium thiosulphate is a reducing agent which converts metallic silver into silver salt.

(8) **(b)** Na_2CO_3, K_2CO_3 and $(NH_4)_2CO_3$ are soluble in water because hydration energy is more than lattice energy.

(9) **(d)** Due to free electrons, liquid ammonia becomes paramagnetic.

(10) **(c)** On heating an alkali metal or its salt especially chloride (due to its more volatile nature in flame), the electrons are excited easily to higher energy levels by absorbing energy. When these excited electrons return to ground state, they emit extra energy in form of radiations which fall in visible region, thus imparting colour to the flame.

M-Cl	LiCl	NaCl	KCl
Colour	Crimson	Yellow	Violet

(11) **(c)** $M + (x + y)NH_3 \rightarrow [M(NH_3)_x]^+ + [e(NH_3)_y]^-$

The ammoniated e^- absorbs energy in the visible region of light and thus imparts blue colour to solution.

(12) **(a)** Group I element are so highly electropositive that they emit electrons even when exposed to light (photoelectric effect) and this character increases on moving down the group from lithium towards cacsium because as we go down the group, size increases and hence, the release of e^- becomes easier.

(13) **(b)** In aqueous solution, Li^+ is most highly hydrated due to its small size. As a result, its mobility is less. As size increases from Li^+ to Rb^+, hydration decreases and hence mobility increases. So, Rb^+ has the maximum mobility in water.

(14) **(a)** Small atomic and ionic size leads to high electronegativity and hydration energy. Thus electropositivity will be less.

(15) **(d)** **(16)** **(b)** **(17)** **(b)**

(18) **(a)** Due to low I.E., the e^- of alkali metals gets excited to higher energy level and when they come back to the ground state, they emit energy in the visible region of the spectrum thus imparting colour to the flame.

(19) **(d)** **(20)** **(c)** **(21)** **(a)**

(22) **(a)** $LiH + H_2O \rightarrow LiOH + H_2$

The hydration decreases from Li to Cs. So all the salts of lithium are hydrated and no cacsium salt is hydrated because Cs^+ is least hydrated.

The ionic nature of hydrides increases from Li to Cs.

(23) **(b)** $M + (x + y)\,NH_3 \rightarrow [M(NH_3)_x]^+ + [e(NH_3)_y]^-$

Blue colour of the solution is due to ammoniated electrons; and good conductor of electricity is because of both ammoniated cations and ammoniated electrons.

(24) **(b)** $4Na + O_2\,(\text{limited}) \xrightarrow{\Delta} 2Na_2O$

$2Na + O_2\,(\text{excess}) \xrightarrow{\Delta} Na_2O_2$

(25)(c), (26)(b), (27)(c).

The thermal stabilities of carbonates increase down the group due to increase in metallic character i.e. electropositive character. Further bigger cation stabilises bigger anion through crystal lattice energy effects.

$M + (x + y)\,NH_3 \longrightarrow [M(NH_3)_x]^+ + [e(NH_3)_y]^-$

Sodium carbonate is prepared by Solvay process not potassium carbonate, as $KHCO_3$ is quite soluble in water.

(28) **(a)** K and Cs emit electrons on exposure of light due to their large size and hence low ionization potential due to which very less energy is needed to emit the electron.

(29) **(d)** Due to high polarizing power of Li^+, LiCl is a covalent compound.

(30) **(a)**