INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 26

Total Marks : 67

Max. Time : 75 min.

Topic : s-block Elements

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1,2,4, 5,6,8 to 10, 12	(3 marks, 3 min.)	[27, 27]
Fill in the Blanks ('–1' negative marking) Q.3, Q.7,	(3 marks, 3 min.)	[6, 6]
True or False (no negative marking) Q.11	(2 marks, 2 min.)	[2, 2]
Match the Following (no negative marking) Q. 13	(8 marks, 10 min.)	[8, 10]
Subjective Questions ('–1' negative marking) Q.14 to Q.19	(4 marks, 5 min.)	[24, 30]

1. Which of the following statements is true for all the alkali metals ?
(A) Their nitrates decompose on heating to give the corresponding nitrites and oxygen.
(B) Their chlorides are deliquescent and crystallise as hydrates.
(C) They react with water to form hydroxide and hydrogen.
(D) They readily react with halogens to form ionic halides, M^+X^-.

2. Which of the following gives propyne on hydrolysis ?
(A) Al_4C_3 (B) Mg_2C_3 (C) B_4C (D) La_4C_3

3. **COMPLETE THE FOLLOWING REACTIONS :**

(i) $Na_2S + Na_2O_2 \longrightarrow$ (ii) $Na + O_2(excess) \xrightarrow{350^\circ C}$

(iii) $Na_2O_2 + CO \longrightarrow$; $Na_2O_2 + CO_2 \longrightarrow$ (iv) $Cr(OH)_3 + Na_2O_2 \longrightarrow$

(v) $MnSO_4 + Na_2O_2 \longrightarrow$ (vi) $Na_2O + NH_3 \longrightarrow$

(vii) $Na_2O_2 + H_2O \xrightarrow{Cold}$

4. Which of the following has the highest solubility in water ?
(A) LiOH (B) KOH (C) CsOH (D) RbOH

5. Which of the following compounds on thermal decomposition yields a basic as well as an acidic oxide ?
(A) $KClO_3$ (B) $NaNO_3$ (C) K_2CO_3 (D) $MgCO_3$

6. Which of the following reactions of potassium superoxide supply oxygen gas in the breathing equipments used in space and submarines ?
(1) reaction of superoxide with nitrogen in the exhaled air
(2) reaction of superoxide with moisture in the exhaled air
(3) reaction of superoxide with carbon dioxide in the exhaled air
(A) (1), (2) and (3) (B) (2) and (3) only (C) (2) only (D) (1) and (2) only

7. **COMPLETE THE FOLLOWING REACTIONS :**

(i) $NaOH + NO_2 \longrightarrow$; $NaOH + SO_3 \longrightarrow$

(ii) $NaOH$ (hot & conc.) $+ Br_2 \longrightarrow$; $NaOH$ (hot & conc.) $+ F_2 \longrightarrow$

(iii) $NaOH + S \longrightarrow$ **(iv)** $B + NaOH \longrightarrow$ **(v)** $NaOH + Si + H_2O \longrightarrow$

(vi) Reaction of NaOH with amphoteric oxides :
$PbO + NaOH \longrightarrow$; $PbO_2 + NaOH \longrightarrow$

(vii) Reaction of NaOH with amphoteric metals (e.g. Al, Pb, Sn, Zn etc.) :
$NaOH + H_2O + Al \longrightarrow$

(viii) Reaction of NaOH with salts of Cr, Ni, Fe, Mn, Cu etc., :
$CrCl_3 + NaOH \longrightarrow$; $CuCl_2 + NaOH \longrightarrow$

(ix) Reaction of NaOH with salts of Hg and Ag :
$HgCl_2 + NaOH \longrightarrow$; $Hg(OH)_2 \longrightarrow$
$AgNO_3 + NaOH \longrightarrow$; $AgOH \longrightarrow$

(x) $NaOH + CO \xrightarrow[5-10\,atm]{150-200^\circ C}$

8. A substance absorbs CO_2 and violently reacts with water. The substance is :
(A) $CaCO_3$ (B) CaO (C) H_2SO_4 (D) ZnO

9. HCl is added to following oxides. Which one would give H_2O_2?
(A) MnO_2 (B) PbO_2 (C) $BaO_2.8H_2O$ (D) NO_2

10. The pair of compounds which cannot exist together in solution is :
(A) $NaHCO_3$ and NaOH (B) Na_2CO_3 and $NaHCO_3$
(C) Na_2CO_3 and NaOH (D) $NaHCO_3$ and NaCl

11. **S_1 :** Plaster of paris is a hemihydrate of calcium sulphate obtained by heating the gypsum above 393 K.
S_2 : Sodium carbonate is used in water softening.
S_3 : The order of mobilities of the alkali metal ions in aqueous solutions is $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$.
(A) T T F (B) T T T (C) F T F (D) F F F

12. Chemical A is used for water softening to remove temporary hardness. A reacts with Na_2CO_3 to generate caustic soda. When CO_2 is bubbled through A, it turns cloudly. What is the chemical formula of A?
(A) $CaCO_3$ (B) CaO (C) $Ca(OH)_2$ (D) $Ca(HCO_3)_2$

13.

Column I	**Column II**
(A) $Na_2SO_4 + C + CaCO_3 \xrightarrow{\Delta}$	(P) One of the products has sp^2 hybridisation of central atom.
(B) $NaCl + NH_4HCO_3 \longrightarrow$	(Q) One of the products has sp^3 hybridisation of central atom:
(C) $Na_2CO_3 + Ca(OH)_2 \longrightarrow$	(R) One of the products is insoluble as precipitate.
(D) KOH + NO (2 : 4 by mole ratio)	(S) One of the products is a neutral oxide.

14. When gas (A) is passed through dry KOH at low temperature, a deep red coloured compound (B) and a gas (C) are obtained. The gas (A) on reaction with but–2-ene followed by treatment with Zn/H_2O yields acetaldehyde. Identify (A), (B) and (C).

15. Write down the balanced equation for the reaction when :
Carbon dioxide is passed through a suspension of lime stone in water.

16. Give reasons for the following :
Magnesium oxide is used for the lining of steel making furnace.

17. Work out the following using chemical equations :
Chlorination of calcium hydroxide produces bleaching powder.

18. Complete and balance the following reaction :
$Ca_5(PO_4)_3F + H_2SO_4 + H_2O \xrightarrow{Heat}$ ..... + $5CaSO_4.2H_2O$ +.....

19. When zeolite, which is hydrated sodium aluminium silicate, is treated with hard water, the sodium ions are exchanged with
(A) H^+ ions (B) Ca^{2+} ions (C) SO_4^{2-} ions (D) Mg^{2+} ions (E) OH^- ions

Answer Key

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1. (C) **2.** (B)

3. (i) $Na_2S + 4Na_2O_2 \longrightarrow Na_2SO_4 + 4Na_2O$. (ii) $2Na + O_2(excess) \xrightarrow{350^\circ C} Na_2O_2$.

(iii) $Na_2O_2 + CO \longrightarrow Na_2CO_3$; $2Na_2O_2 + 2CO_2 \longrightarrow 2Na_2CO_3 + O_2$.

(iv) $2Cr(OH)_3 + 3Na_2O_2 \longrightarrow 2Na_2CrO_4 + 2NaOH + 2H_2O$.

(v) $MnSO_4 + 2Na_2O_2 \longrightarrow Na_2MnO_4 + Na_2SO_4$.

(vi) $Na_2O + NH_3 \longrightarrow NaNH_2 + NaOH$ (vii) $Na_2O_2 + 2H_2O \xrightarrow{Cold} 2NaOH + H_2O_2$.

4. (C) **5.** (D) **6.** (B)

Hints & Solutions

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1. (A) $4\ LiNO_3 \longrightarrow 2Li_2O + 4NO_2 + O_2$

$2NaNO_3 \longrightarrow 2NaNO_2 + O_2$ (similar decomposition with the nitrates of K, Rb and Cs)

(B) Only LiCl is deliquescent and crystallises as a hydrate $LiCl.2H_2O$

(C) $2M + 2H_2O \longrightarrow 2M^+ + 2OH^- + H_2$ (M = an alkali metal)

(D) Halides of Li are covalent in nature.

3. (i) $Na_2S + 4Na_2O_2 \longrightarrow Na_2SO_4 + 4Na_2O$.

(ii) $2Na + O_2(excess)$ (आधिक्य) $\xrightarrow{350^\circ C} Na_2O_2$.

(iii) $Na_2O_2 + CO \longrightarrow Na_2CO_3$; $2Na_2O_2 + 2CO_2 \longrightarrow 2Na_2CO_3 + O_2$.

(iv) $2Cr(OH)_3 + 3Na_2O_2 \longrightarrow 2Na_2CrO_4 + 2NaOH + 2H_2O$.

(v) $MnSO_4 + 2Na_2O_2 \longrightarrow Na_2MnO_4 + Na_2SO_4$.

(vi) $Na_2O + NH_3 \longrightarrow NaNH_2 + NaOH$

(vii) $Na_2O_2 + 2H_2O \xrightarrow{Cold} 2NaOH + H_2O_2$

5. $MgCO_3 \xrightarrow{\Delta} \underset{\text{(Basic)}}{MgO} + \underset{\text{(Acidic)}}{CO_2}$

6. (2) $KO_2 + 2H_2O \longrightarrow KOH + H_2O_2 + 1/2O_2$

(3) $4KO_2 + 2CO_2 \longrightarrow 2K_2CO_3 + 3O_2$

7. **(i)** $2NaOH + 2NO_2 \longrightarrow NaNO_2 + NaNO_3 + H_2O$; $2NaOH + SO_3 \longrightarrow Na_2SO_4 + H_2O$.

(ii) $6NaOH + 3Br_2 \longrightarrow 5NaBr + NaBrO_3 + 3H_2O$.

$4NaOH + 2F_2 \longrightarrow 4NaF + O_2 + 2H_2O$.

(iii) $6NaOH + 4S \longrightarrow 2Na_2S + Na_2S_2O_3 + 3H_2O$.

(iv) $2B + 6NaOH \longrightarrow 2Na_3BO_3 + 3H_2$

(v) $2NaOH + Si + H_2O \longrightarrow Na_2SiO_3 + 2H_2$.

(vi) $PbO + 2NaOH \longrightarrow Na_2PbO_2 + H_2O$; $PbO_2 + NaOH \longrightarrow Na_2PbO_3 + H_2O$.

(vii) $4NaOH + 2H_2O + 2Al \longrightarrow 2NaAlO_2 + 3H_2$.

(viii) Form insoluble hydroxides.

$CrCl_3 + 3NaOH \longrightarrow Cr(OH)_3 \downarrow$ (Green) + 3NaCl.

$CuCl_2 + 2NaOH \longrightarrow Cu(OH)_2 \downarrow$ (bule) + 2NaCl.

(ix) $HgCl_2 + 2NaOH \longrightarrow Hg(OH)_2 \downarrow + 2NaCl$; $Hg(OH)_2 \longrightarrow HgO \downarrow$ (yellow or brown) + H_2O.

$2AgNO_3 + 2NaOH \longrightarrow 2AgOH \downarrow + 2NaNO_3$; $2AgOH \longrightarrow Ag_2O \downarrow$ (black) + H_2O.

(x) $NaOH + CO \xrightarrow[5-10\,atm]{150-200^\circ C} HCOONa$.

8. $CaO + H_2O \xrightarrow{\text{Hissing sound}} Ca(OH)_2 + \text{Heat}$

$CaO + CO_2 \longrightarrow CaCO_3$

9. $BaO_2.8H_2O + 2HCl \longrightarrow BaCl_2 + H_2O_2 + 8H_2O$.

10. Since $NaHCO_3$ is an acid salt of H_2CO_3. it reacts with NaOH to form Na_2CO_3 and H_2O.

$Na_2CO_3 + NaOH \rightarrow Na_2CO_3 + H_2O$.

11. **S_1 :** $(2\,CaSO_4.2H_2O) \xrightarrow{393K} 2\,(CaSO_4).H_2O + 3H_2O$; above 393 K dead burnt plaster is obtained.

S_2 : $Ca^{2+} + Na_2CO_3 \longrightarrow CaCO_3 \downarrow + 2Na^+$

S_3 : $Li^+ < Na^+ < K^+ < Kb^+ < Cs^+$

Bigger hydrated ion moves slower in aqueous solution.

13. **(A → P, Q, R) ; (B → P,Q,R) ; (C → P,Q) ; (D → P,Q,S)**

(A) $NaSO_4 + C + CaCO_3 \longrightarrow Na_2CO_3(sp^2) + CaSO_4(sp^3)\downarrow$ (White)

(B) $NaCl + NH_4.HCO_3 \longrightarrow NaHCO_3(sp^2)\downarrow$ (White) + $NH_4Cl(sp^3)$

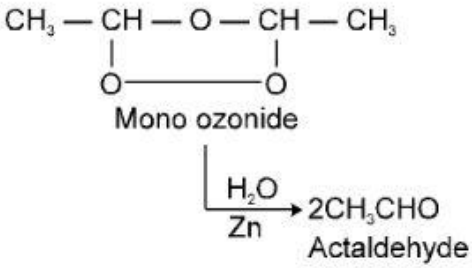
(C) $Na_2CO_3 + Ca(OH)_2 \longrightarrow Ca\,CO_3(sp^2)\downarrow$ (White) + NaOH

(D) $2KOH + 4NO \longrightarrow 2KNO_2(sp^2) + N_2O + H_2O(sp^3)$

If $4\,KOH + 6NO \longrightarrow 4KNO_2 + N_2 + 2H_2O$

14. The gas (A) on treatment with but 2–ene followed by treatment with Zn/H_2O yields acetaldehyde and thus (A) is ozone

(i) $O_3 + CH_3 - CH = CH - CH_3 \longrightarrow$



(ii) $5O_3 + 2KOH \longrightarrow 2KO_3$(Deep red) $+ H_2O_{(g)} + 5O_2$
(A) Potassium ozonide (B) (C)

15. $CaCO_3 + CO_2 + H_2O \rightarrow Ca(HCO_3)_2$ (calcium bicarbonate).

16. MgO is used for the lining of steel making furnace because it acts as basic flux and facilitates the removal of acidic impurities of Si, P and S from steel through slag formation.

17. $3\ Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2.\ Ca(OH)_2.CaCl_2.2H_2O$
Bleaching powder
(a mixture of $Ca(OCl)_2$ and basic chloride)

18. $Ca_5(PO_4)_3F + 5H_2SO_4 + 10H_2O \xrightarrow{\Delta} 3H_3PO_4 + 5CaSO_4.2H_2O + HF$

19. $Na_2Al_2Si_2O_8 . xH_2O + Ca^{2+} \rightarrow CaAl_2Si_2O_8 . xH_2O + 2Na^+$
$Na_2Al_2Si_2O_8 . xH_2O + Mg^{2+} \rightarrow MgAl_2Si_2O_8 . xH_2O + 2Na^+$