PHYSICAL / INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 35

Total Marks : 50

Max. Time : 55 min.

Topic : p-block elements (Nitrogen and Oxygen family)

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.7	(3 marks, 3 min.)	[21, 21]
Multiple choice objective ('–1' negative marking) Q.8	(4 marks, 4 min.)	[4, 4]
True or False (no negative marking) Q.9	(2 marks, 2 min.)	[2, 2]
Assertion and Reason (no negative marking) Q. 10	(3 marks, 3 min.)	[3, 3]
Subjective Questions ('–1' negative marking) Q.11 to Q. 15	(4 marks, 5 min.)	[20, 25]

1. Heating of ammonium dichromate produes :

(A) NH_3, Cr_2O_3 and H_2O.
(B) N_2, Cr_2O_3 and H_2O.
(C) NO_2, CrO_3 and H_2O.
(D) N_2O, CrO_3 and H_2O.

2. **(a)** Which of the following oxides is amphoteric in nature ?

(A) N_2O_3 (B) P_2O_3 (C) Sb_2O_3 (D) Bi_2O_3

(b) Which of the following compounds does not give nitrogen on heating ?

(A) NaN_3 (B) $(NH_4)_2SO_4$ (C) NH_4NO_2 (D) NH_4ClO_4

3. Which of the following oxides of nitrogen is solid ?

(A) NO_2 (B) NO (C) N_2O (D) N_2O_5

4. Which of the following statement is correct ?

(A) Black phosphorus is thermodynamically most stable allotrope of phosphorus:
(B) One mole of calcium phosphide on reaction with excess water gives two moles of phosphine
(C) PbO_2 on treatment with concentrated HNO_3 produces NO_2 gas.
(D) (A) and (B) both

5. **(a)** One mole of calcium phosphide on reaction with dilute hydrochloric acid gives :

(A) Two moles of phosphine
(B) Two moles of phosphorus pentachloride
(C) One mole of phosphine
(D) One mole of phosphorus trichloride

(b) Ammonia can be dried by :

(A) conc. H_2SO_4 (B) P_4O_{10} (C) anhydrous $CaCl_2$ (D) none

6. For H_3PO_3 and H_3PO_4, the correct choice is:

(A) H_3PO_3 is stronger acid than H_3PO_4
(B) H_3PO_3 is dibasic and reducing.
(C) H_3PO_4 is tribasic and reducing
(D) (A) and (B) both

7. Which of the following statement (s) is/are incorrect ?

(A) Ammonia is oxidised to NO_2 by oxygen at 800°C in presence of a catalyst platinum.
(B) Nitric acid on standing slowly turns yellow.
(C) Colloidal sulphur is formed when H_2S gas is passed through nitric acid solution.
(D) N_2O_3 gas dissolves in water giving a pale blue solution.

8. Which of the following statement (s) is/are true ?

(A) Ammonia burns in air with a pale yellow flame.
(B) Calcium carbide reacts with nitrogen gas at 1100°C to form a fertilizer, nitrolim.
(C) All the elements of nitrogen family are polyatomic.
(D) The melting point of antimony is less than arsenic.

9. **True/False :**

(A) Dry ammonia gas can be obtained by passing it through a U-tube containing anhydrous calcium chloride.

(B) The brown ring test for nitrates depends on the ability of Fe^{2+} to reduce nitrates to nitric oxide which then reacts with Fe^{2+} to form a brown coloured complex.

(C) Metals like chromium, aluminimum dissolves in concentrated nitric acid (80%).

(A) F T F (B) T F T (C) F T T (D) T F F

10. **Statement-1 :** NO(s) is a neutral oxide, diamagnetic and is not an acid anhydride.

Statement-2 : NO as a ligand is a three electron donor and paramagnetic in gaseous state.

(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 True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

11. An orange solid (A) on heating gives a green residue (B), a colourless gas (C) and water vapour. The dry gas (C) on passing over heated magneisum gave a white solid (D). (D) on reaction with water gave a gas (E) which formed dense white fumes with HCl.

Identify (A) to (E) giving reactions.

12. **(a)** Why does the reactivity of nitrogen differ from phosphorus ?

(b) Nitrogen exists as diatomic molecule and phosphorus as P_4 . Why ?

(c) Explain why NH_3 is basic while BiH_3 is only feebly basic.

13. **(a)** What happens when ? CaO in water reacts with phosphorus (white).

(b) Give equations for the reactions of the following compound with water.

(a) AlN (b) P_4O_6

(c) What happens when carbon reacts with concentrated HNO_3.

14. **(a)** Why white phosphorus is kept in water ?

(b) Pure phosphine does not burn in air but impure sample of phosphine burns in air. Why ?

(c) What happens when solution of PH_3 in water is exposed to light ?

15. ***Integer Answer Type***

This question contains 3 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9.

(i) How many P-P single bonds are present in white phosphrus (P_4) molecule ?

(ii) In the disproportionation reaction of NaOH with one molecule of P_4, number of molecules of NaOH reacting are ..... .

(iii) The basicity of phosphorus acid (H_3PO_3) is

Answer Key

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1. (B) **2.** **(a)** (C) **(b)** (B) **3.** (D) **4.** (D)

5. **(a)** (A) **(b)** (D) **6.** (D) **7.** (A) **8.** (B,C,D) **9.** (A)

10. (B)

11. $(NH_4)_2\,Cr_2O_7 \longrightarrow N_2 + Cr_2O_3 + 4\,H_2O$
(A) (C) (B)

Orange solid

$N_2 + 3\,Mg \xrightarrow{\Delta} Mg_3N_2$ (D)
$Mg_3N_2 + 6\,H_2O \longrightarrow 3\,Mg(OH)_2 + 2\,NH_3$ (E)
$NH_3 + HCl \longrightarrow NH_4Cl$ (white fumes)

12. **(a)** (i) Nitrogen exists as a diatomic molecule with triple bond (high bond enthalpy), where as phosphorus form single bond as P–P.
(ii) Due to its small size, high electronegativity, high ionisation enthalpy and non–availability of d–orbitals.
(b) (i) Nitrogen → $p\pi$–$p\pi$ multiple bond (very high bond enthalpy).
(ii) In phosphorus their atomic orbitals are so large and diffuse that they cannot have effective over lapping.
(c) Basic character decreases down the group as size of atom increases and thus electron density decreases leading to decrease in electron donor capacity. Due to decrease in bond (E–H) dissociation enthalpy down the group may act as acid rather than a base.

13. **(a)** $3CaO + + 8P + 9H_2O \longrightarrow 3Ca(H_2PO_2)_2 + 2PH_3$
(b) (a) $AlN + 3H_2O \longrightarrow Al(OH)_3 + NH_3$
(b) $P_4O_6 + 6H_2O(cold) \longrightarrow 4H_3PO_3$
$P_4O_6 + 6H_2O\,(hot) \longrightarrow 3H_3PO_4 + PH_3$
(c) $C + 4\,HNO_3 \longrightarrow CO_2 + 4\,NO_2 + 2\,H_2O$

14. **(a)** Slow oxidation in air raises its temperature and when exceeds 30°c ignition tempt. catches fire
(b) Impure sample becomes inflammable owing to the presence of P_2H_4 or P_4 vapours.
$P_4 + 5O_2 \longrightarrow P_4O_{10}$
(c) $2PH_3 \xrightarrow{\text{decomposes}} 2P\,(red) + 3H_2$

15. **(i)** 6 **(ii)** 3 **(iii)** 2

Hints & Solutions

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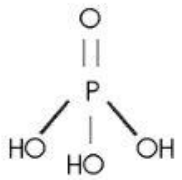
1. $(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2 + Cr_2O_3 + 4H_2O$

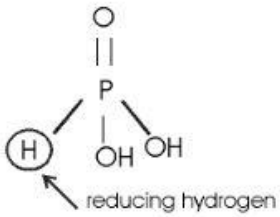
4. (C) oxygen gas is produced.

5. **(a)** $Ca_3P_2 + 6HCl \longrightarrow 3CaCl_2 + 2PH_3$ **(b)** $CaO + H_2O \longrightarrow Ca(OH)_2$

6.



(H_3PO_4)



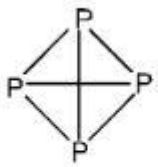
(H_3PO_3)

Strength of phosphorus oxy acid depends upon the number of OH groups per P = O group. It is the P = O group which induces polarisation and helps in the release of proton from-OH group. $H_3PO_3 > H_3P_4$

8. (A) Burns only in pure dioxygen gas.
(D) Avalability of electrons for metallic bonding ↓.

10. Both statement are correct but not correct explanation
NO solid is dimerised so diamagnetic O=N – N=O (s) but gasesous form is paramagnetic.

15. **(i)**



Six P–P single bonds are present.

(ii) $P_4 + 3NaOH + 3H_2O \longrightarrow PH_3 + 3NaH_2PO_2$