DPP - Daily Practice Problems

Name : _____ Date : _____

Start Time : _____ End Time : _____

CHEMISTRY 40

SYLLABUS : *p*-Block Elements-III (Group-15) : Nitrogen Family

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 Which one of the following elements is most metallic ?

(a) P (b) As

(c) Sb (d) Bi

Q.2 White phosphorus (P_4) has

(a) Six P-P single bonds

(b) Four lone pair of electrons

(c) P-P-P angle of 60°

(d) All of these

Q.3 In Birkeland-Eyde process, the raw material used is

(a) Air (b) NH_3 (c) NO_2 (d) HNO_3

Q.4 Which of the following nitrates decomposes without leaving any solid residue ?

(a) Lead nitrate (b) Ammonium nitrate

(c) Silver nitrate (d) Sodium nitrate

Q.5 Phosphine is generally prepared in the laboratory

(a) By heating phosphorus in a current of hydrogen

(b) By heating white phosphorus with aqueous solution of caustic potash

(c) By decomposition of P_2H_4 at 110°C

(d) By heating red phosphorus with an aqueous solution of caustic soda

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ

Space for Rough Work

Q.6 Phosphorus is manufactured by heating in an electric furnace a mixture of

(a) Bone ash and coke

(b) Bone ash and silica

(c) Bone ash, silica and coke

(d) None of these

Q.7 Nitrous oxide

(a) Is a mixed oxide

(b) Is an acidic oxide

(c) Is highly soluble in hot water

(d) Supports the combustion of sulphur

Q.8 Which of the following acid exists in polymeric form?

(a) HPO_3 (b) $H_4P_2O_7$

(c) H_3PO_4 (d) None

Q.9 Of the following, the most acidic is

(a) As_2O_3 (b) P_2O_3

(c) Sb_2O_3 (d) Bi_2O_3

Q.10 Which of the following acid possesses oxidising. reducing and complex forming properties ?

(a) HNO_3 (b) H_2SO_4

(c) HCl (d) HNO_2

Q.11 In the reaction, $HNO_3 \cdot P_4O_{10} \cdot \cdots 4HPO_3 \cdot x$, the product x is

(a) N_2O_3 (b) N_2O_5

(c) NO_2 (d) H_2O

Q.12 Hypophosphorus acid is

(a) A tribasic acid (b) A dibasic acid

(c) A monobasic acid (d) Not acidic at all

Q.13 Blasting of TNT is done by mixing

(a) NH_4Cl (b) NH_4NO_3

(c) NH_4NO_2 (d) $(NH_4)_2SO_4$

Q.14 The number of hydroxyl groups in pyrophosphoric acid is

(a) 3 (b) 4 (c) 5 (d) 7

Q.15 Which one has the highest percentage of nitrogen?

(a) Urea (b) Ammonium sulphate

(c) Ammoniumnitrate (d) Calciumnitrate

Q.16 The number of P-O-P bridges in the structure of phosphorus pentoxide and phosphorus trioxide are respectively

(a) 6,6 (b) 5,5

(c) 5,6 (d) 6,5

Q.17 Which one of the following hydrides is least stable ?

(a) AsH_3 (b) SbH_3

(c) NH_3 (d) PH_3

Q.18 Atomic number of N is 7. The atomic number of IIIrd member of nitrogen family is

(a) 23 (b) 15 (c) 33 (d) 43

Q.19 Which of the following oxy acids of phosphorus is a reducing agent and monobasic?

(a) H_3PO_2 (b) H_3PO_3

(c) H_3PO_4 (d) $H_4P_2O_6$

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

Space for Rough Work

Q.20 Of the following which is paramagnetic and has three electron bond in its structure?

(a) N_2O (b) NO (c) N_2O_3 (d) N_2O_5

Q.21 When plants and animals decay, the organic nitrogen is converted into inorganic nitrogen.The inorganic nitrogen is in the form of

(a) ammonia (b) elements of nitrogen

(c) nitrates (d) nitrides

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 are true ?

(1) The melting point of antimony is less than arsenic.

(2) Calcium carbide reacts with nitrogen gas at 1100°C to form a fertilizer, nitrolim.

(3) Nearly all intermediate oxidation states of phosphorus disproportionate into +5 and – 3 both in alkali and acid.

(4) Boiling point of ammonia is greater than stibine.

Q.23 Which of the following orders are incorrect?

(1) $H_3PO_4 > H_3PO_3 > H_3PO_2$ (reducing character)

(2) $SbH_3 > NH_3 > AsH_3 > PH_3$ (reducing character)

(3) $NH_3 > PH_3 > AsH_3 > SbH_3$ (basicity)

(4) $N_2O < NO < N_2O_3 < N_2O_5$ (oxidation state of nitrogen atom)

Q.24 Which of the following statements are correct for nitrogen?

(1) It has a small size

(2) It does not readily react with O_2

(3) It is a typical non-metal

(4) *d*-orbitals are available for bonding

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

There are some deposits of nitrates and phosphates in earth's crust. Nitrates are more soluble in water. Nitrates are difficult to reduce under the laboratory conditions but microbes do it easily. Ammonia forms large number of complexes with transition metal ions. Hybridization easily explains the ease of sigma donation capability of NH_3 and PH_3. Phosphine is a flammable gas and is prepared from white phosphorus.

Q.25 Among the following, the correct statement is

(a) Phosphates have no biological significance in humans.

(b) Between nitrates and phosphates, phosphates are less abundant in earth's crust.

(c) Between nitrates and phosphates, nitrates are less abundant in earth's crust.

(d) Oxidation of nitrates is possible in soil.

Q.26 Among the following, the correct statement is

(a) Between NH_3 and PH_3, NH_3 is a better electron donor because the lone pair of electrons occupies spherical *s*-orbital and is less directional.

(b) Between NH_3 and PH_3, PH_3 is a better electron donor because the lone pair of electrons occupies sp^3 orbital and is more directional.

(c) Between NH_3 and PH_3, NH_3 is a better electron donor because the lone pair of electrons occupies sp^3 orbital and is more directional.

(d) Between NH_3 and PH_3, PH_3 is a better electron donor because the lone pair of electrons occupies spherical *s*-orbital and is less directional.

Q.27 White phosphorus on reaction with NaOH gives PH_3 as one of the products. This is a

(a) dimerization reaction

(b) disporportionation reaction

(c) condensation reaction

(d) precipitation reaction

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.

Q.28 Statement-1 : Nitrogen is unreactive at room temperatures but becomes reactive at elevated temperatures (on heating) or in presence of catalyst.

Statement-2 : In nitrogen molecule, there is extensive delocalization of electrons.

Q.29 Statement-1 : Liquid NH_3 is used for refrigeration.

Statement-2 : Liquid NH_3 quickly vaporises.

Q.30 Statement-1 : NO_3^- is planar while NH_3 is pyramidal.

Statement-2 : N in NO_3^- is sp^2 hybridized but in NH_3 it is sp^3-hybridized.

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

DAILY PRACTICE PROBLEM SHEET 40 - CHEMISTRY			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	32	Qualifying Score	52
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

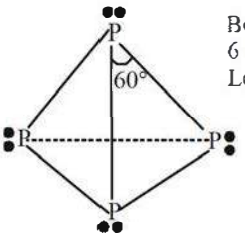
DAILY PRACTICE PROBLEMS

CHEMISTRY SOLUTIONS

40

1. **(d)** Metallic character increases down the group, Bi is most metallic.

2. **(d)** P_4 Molecule



Bond angle = 60°
6 P–P = Single Bond
Lone pair = 4

3. **(a)** Birkeland - Eyde process

Dinitrogen is prepared commercially from air by liquification and fractional distillation. When liquid air is allowed to distil, dinitrogen having lower b.pt (77 K) distils over first leaving behind liquid oxygen (b.pt 90K). World wide production of dinitrogen from liquid air is more than 50 million tonnes per year.

4. **(b)** $\underset{(s)}{NH_4NO_3} \xrightarrow{\Delta} 2H_2O\uparrow + N_2O\uparrow$

$\underset{(s)}{NaNO_3} \xrightarrow{\Delta} \underset{(s)}{NaNO_2} + \frac{1}{2}O_2\uparrow$

$2AgNO_3(s) \rightarrow 2Ag(s) + 2NO_2(g) + O_2(g)$
Lunar caustic

$2Pb(NO_3)_2 \rightarrow \underset{(s)}{2PbO} + 4NO_2\uparrow + O_2\uparrow$

5. **(b)** $\underset{\text{White}}{P_4} + 3NaOH + 3H_2O \rightarrow \underset{\text{Phosphine}}{PH_3} + 3NaH_2PO_2$

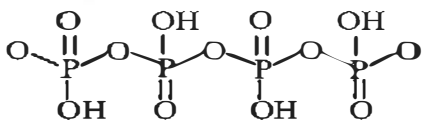
6. **(c)** $2Ca_3(PO_4)_2 + 6SiO_2 \xrightarrow{1770K} 6CaSiO_3 + P_4O_{10}$

$P_4O_{10} + 10C \xrightarrow{1770K} \underset{\text{White}}{P_4} + 10CO$

7. **(d)** N_2O is itself non- combustible but supports combustion.

$S + 2N_2O \rightarrow SO_2 + 2N_2$

8. **(a)** $(HPO_3)_n$, polymetaphosphoric acid.



9. **(b)** $\underbrace{N_2O_3 \quad P_2O_3 \quad As_2O_3}_{\text{Acidic oxides}} \quad \underbrace{Sb_2O_3}_{\text{Amphoteric}} \quad \underbrace{Bi_2O_3}_{\text{Basic}}$

Acidic character decreases down the group

10. **(d)** HNO_2 can be either reduced to nitric oxide (NO) or oxidised to nitric acid and hence it acts both as an oxidising as well as reducing agent.

$2HNO_2 \rightarrow 2NO + H_2O + [O]$

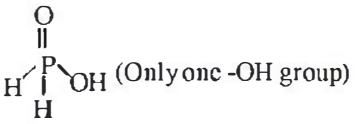
$HNO_2 + [O] \rightarrow HNO_3$

11. **(b)** We know that,

$4HNO_3 + P_4O_{10} \longrightarrow 4HPO_3 + 2N_2O_5$

The product is dinitrogen pentoxide (N_2O_5).

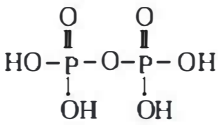
12. **(c)** H_3PO_2 is monobasic acid



(Only one -OH group)

13. **(b)** Blasting of TNT is done by mixing of NH_4NO_3.

14. **(b)** $H_4P_2O_7$



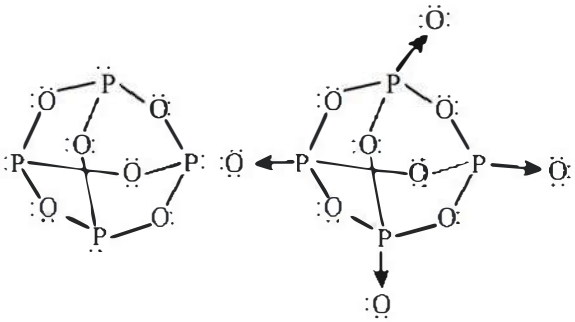
Tetrabasic

4-OH groups are present.

15. **(a)** NH_2CONH_2

$$\%\text{ of N} = \frac{\text{Mass of N}}{\text{Mass of compound}} \times 100 = \frac{28}{60} \times 100 = 46\%$$

16. **(a)**



P_4O_6 $\qquad$ P_4O_{10}

17. **(b)** $\xrightarrow{NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3}$

Stability decreases down the group because bond energy decreases down the group.

18. **(c)**

	I	II	III	IV	V
Element –	N	P	As	Sb	Bi
Atomic no.	7	15	33	51	83

19. **(a)** Hypophosphorous acid (H_3PO_2) is a monobasic acid which act as reducing agent. In this molecule, two P – H bonds are responsible for its reducing character and one –OH group is responsible for its monobasic acid character.

20. **(b)** The structure of NO is $\dot{\ddot{N}}=\bullet$. It is an odd electron molecule and is paramagnetic. It contains a three electron bond.

21. **(a)** The inorganic nitrogen exists in the form of ammonia, which may be lost as gas to the atmosphere, may be acted upon by nitrifying bacteria, or may be taken up directly by plants.

22. **(a)** (1) Availability of electrons for metallic bonding decreases on account of inert pair effect.

(2) $CaC_2 + N_2 \xrightarrow{1100°C} \underbrace{CaCN_2 + C}_{\text{nitrolim}}$

(3) Statement (3) is correct.

(4) SbH_3 has higher boiling point than NH_3 due to greater vander Waal's force of attraction.

23. **(b)** (1) As number of reducing hydrogen increases, the reducing character also increases. In H_3PO_4 there is no reducing hydrogen so it should be least reducing.

(2) As down the the group bond energy decreases, the removal of H becomes easier.

(3) Down the group availability of lone pair of electrons decreases as they are present in more concentrated s-orbital.

(4) $+1 < +2 < +3 < +5$

24. **(a)** $N_7 \rightarrow ls^2, 2s^2, 2p^3$

d-orbitals are absent in nitrogen.

25. **(c)** We know that phosphates have a biological significance in human, therefore statement (a) is not correct.

Since nitrates are more soluble in water so they are less abundant in earth's crust where as phosphates are less soluble in water and so they are more abundant in earth's crust. Thus statement (b) is False.

In nitrates (NO_3^-) nitrogen is in + 5 oxidation state which is the highest oxidation state exhibited by nitrogen. Because of this nitrates can not be oxidized (oxidation means increase in oxidation state). Hence statement (d) is not correct.

The correct answer is (c).

26. **(c)** In case of group 15 (nitrogen group), on moving down the group there occurs a decrease in bond angle of metal hydrides. This decrease in bond angle of metal hydrides of this group may be attributed to the increased *p*- character in the bond pair which results in more *s*- character in lone pair orbital.

The directional character is more for sp^3 hybrid orbital than a *s*- orbital.

Thus the correct answer is (c).

27. **(b)** The reaction between NaOH and white phosphorus (P_4) can be represented as follows:

$$\underset{\text{(white phosphorus)}}{P_4} + 3NaOH + 3H_2O \longrightarrow 3NaH_2PO_2 + \underset{\text{(Phosphine)}}{PH_3}$$

In this reaction phosphorus is oxidised as well as reduced so it is a disproportionation reaction.

$\therefore$ The correct answer is (b).

28. **(b)** On heating its outermost electron transite to next energy level by which it become more reactive.

29. **(a)** Liquid NH_3 is used for refrigeration is true and it is due to the fact that it vaporises quickly and for vaporisation it takes up heat and cool the refrigerator.

30. **(a)** Both statement-1 and statement-2 are true and statement-2 is the correct explanation of statement-1.