DPP - Daily Practice Problems

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

CHEMISTRY

CC18

SYLLABUS : The p-Block Elements (Group 15,16,17 and 18)

Max. Marks : 74 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 20 Questions divided into 5 sections.
  Section I has **6** MCQs with ONLY 1 Correct Option, **3** marks for each correct answer and **–1** for each incorrect answer.
  Section II has **4** MCQs with ONE or MORE THAN ONE Correct options.
  For each question, marks will be awarded in one of the following categories:
  Full marks: **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  Partial marks: **+1** For darkening a bubble corresponding to each correct option provided NO INCORRECT option is darkened.
  Zero marks: If none of the bubbles is darkened.
  Negative marks: **–2** In all other cases.
  Section III has **5** Single Digit Integer Answer Type Questions, **3** marks for each Correct Answer and 0 marks in all other cases.
  Section IV has Comprehension/Matching Cum-Comprehension Type Questions having **5** MCQs with ONLY ONE correct option, **3** marks for each Correct Answer and 0 marks in all other cases.
  Section V has **1** Matching Type Questions, **2** mark for the correct matching of each row and 0 marks in all other cases.
- You have to evaluate your Response Grids yourself with the help of Solutions.

Section I - Straight Objective Type

This section contains 5 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** is correct.

1. Excess of KI reacts with $CuSO_4$ solution and then $Na_2S_2O_3$ solution is added to it. Which of the statements is incorrect for this reaction ?

(a) $Na_2S_2O_3$ is oxidised (b) CuI_2 is formed

(c) Cu_2I_2 is formed (d) Evolved I_2 is reduced

2. Which of the following xenon-oxo compounds may not be obtained by hydrolysis of xenon fluorides?

(a) XeO_2F_2 (b) $XeOF_4$ (c) XeO_3 (d) XeO_4

3. A yellow metallic powder when burnt in a stream of fluorine produced a colourless, thermally stable and chemically inert gas 'X'. A gas 'Y', which is colourless and consists of the same elements as are present in gas 'X', is obtained by heating together sulphur dichloride and sodium fluoride. Gases 'X' and 'Y' respectively are

(a) SF_4 and SF_6 (b) SF_4 and S_2F_2

(c) SF_6 and SF_4 (d) None of these

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ

Space for Rough Work

4. If Cl_2 gas is passed into aqueous solution of KI containing some CCl_4 and the mixture is shaken then
   (a) upper layer becomes violet
   (b) lower layer becomes violet
   (c) homogenous violet layer is formed
   (d) None of these
5. The formation of $O_2^+[PtF_6]^-$ is the basis for the formation of xenon fluorides. This is because
   (a) O_2 and Xe have comparable sizes
   (b) both O_2 and Xe are gases
   (c) O_2 and Xe have comparable ionisation energies
   (d) Both (a) and (c)

Section II - Multiple Correct Answer Type

This section contains 4 multiple correct answer(s) type questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONE OR MORE** is/are correct.

6. Which of the following cannot be used as dehydrating agents for ammonia?
   (a) Conc. H_2SO_4 (b) anhydrous $CaCl_2$
   (c) P_4O_{10} (d) CaO
7. Sodium nitrate decomposes above 800° C to give
   (a) N_2 (b) O_2
   (c) NO_2 (d) Na_2O
8. Which of the following is/are correct for the characteristics indicated against each ?
   (a) $HClO < HClO_2 < HClO_3 < HClO_4$ (oxidising power)
   (b) $ClO_4^- < BrO_4^- < IO_4^-$ (oxidising power)
   (c) $ClO^- < BrO^- < IO^-$ (disproportionation)
   (d) $HClO < HClO_2 < HClO_3 < HClO_4$ (Acidic strength)
9. It is not suitable to add conc. H_2SO_4 to KI (s) for preparation of HI because
   (a) I^- (iodide ions) are oxidized to I_2
   (b) The product formed gets contaminated by compounds of sulphur.
   (c) Both the acids (i.e., H_2SO_4 and HI) are strong acids
   (d) H_2SO_4 is a strong acid and HI is a weak acid.

Section III - Integer Type

This section contains 5 questions. The answer to each of the questions is a single digit integer ranging from 0 to 9.

10. How many P–O–P bonds are present in P_4O_8?
11. Among the oxides given below, how many are acidic?
    CrO_3, Mn_2O_7, CuO, CO, SO_2
12. In the molecule ICl_3, how many lone pairs of electrons are associated with iodine?
13. How many $d\pi$–$p\pi$ bonds are there in XeO_4?
14. What is the total number of lone pair of electrons present in Xe in XeF_2?

RESPONSE GRID

4. ⓐⓑⓒⓓ 5. ⓐⓑⓒⓓ 6. ⓐⓑⓒⓓ 7. ⓐⓑⓒⓓ 8. ⓐⓑⓒⓓ
9. ⓐⓑⓒⓓ 10. ⓪①②③④⑤⑥⑦⑧⑨ 11. ⓪①②③④⑤⑥⑦⑧⑨
12. ⓪①②③④⑤⑥⑦⑧⑨ 13. ⓪①②③④⑤⑥⑦⑧⑨
14. ⓪①②③④⑤⑥⑦⑧⑨

Space for Rough Work

Section IV - Comprehension Type

Directions (Qs. 15-19) : Based upon the given paragraphs, 5 multiple choice questions have to be answered. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** is correct.

PARAGRAPH-1

Column I contains different acids & Column II & III contains their molecular formula and No. of σ & π bonds respectively

	Column I Compound		Column II Molecular Formula		Column III No. of σ and π bonds
(I)	Thiosulfuric acid	(i)	$H_2S_2O_6$	(P)	6 σ and 2π
(II)	Persulfuric acid	(ii)	$H_2S_2O_8$	(Q)	11 σ and 4π
(III)	Peroxydisulfuric acid	(iii)	H_2SO_5	(R)	9 σ and 4π
(IV)	Dithionic acid	(iv)	$H_2S_2O_3$	(S)	7 σ and 2π

15. Find appropriate combination for caro's acid

(a) (IV) (iii) (R) (b) (II) (iv) (P)

(c) (II) (iii) (S) (d) (I) (iii) (Q)

16. Find appropriate combination for marshall's acid

(a) (III) (i) (R) (b) (IV) (iii) (S)

(c) (I) (ii) (P) (d) (III) (ii) (Q)

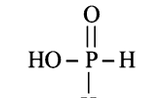
17. The only correct combination among the following is

(a) (I) (iv) (R) (b) (II) (iii) (Q)

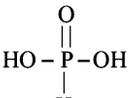
(c) (IV) (i) (R) (d) (III) (i) (S)

PARAGRAPH-2

In all the oxyacids of phosphorous, each phosphorous atom is in sp^3 hybrid state, i.e., it is tetrahedrally bonded to neighbouring four atoms. All these acids contain P – OH bonds, the hydrogen atom of which are ionisable imparting acidic nature to the compound. The *ous acids* (oxidation state of P = +1 or +3) also have P – H bonds in which hydrogens are not ionisable (P and hydrogen have nearly same electronegativity). The presence of P – H group in these acids imparts reducing properties. The structure of the various acids are drawn below (note that the tetrahedral shape of phosphorus is not shown only for convenience of representation).



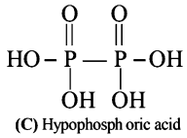
(A) Hypophosph orous acid



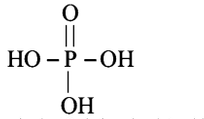
(B) Phosphorou s acid

RESPONSE GRID	15. ⓐⓑⓒⓓ	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ

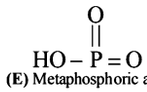
Space for Rough Work



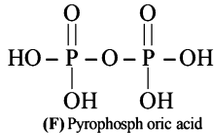
(C) Hypophosph oric acid



(D) Phosphoric (Orthphosph oric) acid



(E) Metaphosphoric acid



(F) Pyrophosph oric acid

18. Among the above acids, the acids having basicity 4 are :

(a) A & E (b) C & D

(c) C & F (d) D & F

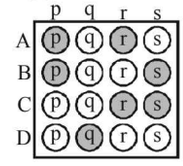
19. Metaphosphoric acid (E) can be prepared by heating

(a) D & F (b) C & F

(c) C & D (d) B, C & F

Section V - Matrix-Match Type

This section contains 1 question. It contains statements given in two columns, which have to be matched. Statements in column I are labelled as A, B, C and D whereas statements in column II are labelled as p, q, r and s. The answers to these questions have to be appropriately bubbled as illustrated in the following example. If the correct matches are A-p, A-r, B-p, B-s, C-r, C-s and D-q, then the correctly bubbled matrix will look like the following:



20.

Column I	Column II
(A) H_2S	p. decolourises acidified soln. of $KMnO_4$
(B) SO_2	q. Disproportionation reaction
(C) NO_2	r. Bleaching action
(D) HNO_2	s. V-shaped structure

RESPONSE GRID	**18.** ⓐⓑⓒⓓ **19.** ⓐⓑⓒⓓ **20. A -** ⓟⓠⓡⓢ; **B -** ⓟⓠⓡⓢ; **C -** ⓟⓠⓡⓢ; **D -** ⓟⓠⓡⓢ

DAILY PRACTICE PROBLEM DPP CHAPTERWISE 18 - CHEMISTRY			
Total Questions	20	Total Marks	74
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	24	Qualifying Score	35
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

1. (b) $\overset{-1}{4KI} + 2CuSO_4 \rightarrow \overset{0}{I_2} + Cu_2I_2 + 2K_2SO_4$

$\overset{0}{I_2} + 2Na_2\overset{2+}{S_2}O_3 \rightarrow Na_2\overset{+2.5}{S_4}O_6 + 2\overset{-1}{NaI}$

Thus, CuI_2 is not formed.

2. (d) $XeF_6 + H_2O \xrightarrow{\text{Partial}} XeOF_4 + 2HF$

$XeF_6 + 2H_2O \xrightarrow{\text{Partial}} XeO_2F_2 + 4HF$

$XeF_6 + 3H_2O \xrightarrow{\text{Complete}} XeO_3 + 6HF$

3. (c) $\underset{\text{(Yellow powder)}}{S} + 3F_2 \xrightarrow{\text{heat}} \underset{\text{'X'}}{SF_6}$

$3SCl_2 + 4NaF \xrightarrow{\text{heat}} \underset{\text{'Y'}}{SF_4} + S_2Cl_2 + 4NaCl$

[Note : SF_6 and SF_4 consist of sulphur and fluorine]

4. (b) $2KI + Cl_2 \rightarrow 2KCl + I_2$

$I_2 + CCl_4 \rightarrow$ Violet Colour

Note: The excess of Cl_2 should be avoided. The layer may become colourless due to conversion of I_2 to HIO_3

$I_2 + 5Cl_2 + 6H_2O \rightarrow 2HIO_3 + 10HCl$

In case of Br_2 : $Br_2 + 2H_2O + Cl_2 \rightarrow 2HBrO + 2HCl$

The layer test is based upon distribution law

5. (d) (i) The first ionization energy of xenon (1, 170 kJ mol^{-1}) is quite close to that of dioxygen (1,180 kJ mol^{-1}).
(ii) The molecular diameters of xenon and dioxygen are almost identical.
Based on the above similarities Barlett (who prepared $O_2^+[PtF_6]^-$ compound) suggested that since oxygen combines with PtF_6, so xenon should also form similar compound with PtF_6.

6. (a, b, c) Being a basic gas, ammonia will not get dehydrated by conc. H_2SO_4, anhydrous $CaCl_2$ and P_4O_{10} whereas it can directly react with them.

$H_2SO_4 + 2NH_3 \longrightarrow (NH_4)_2SO_4$;

$CaCl_2 + 8NH_3 \longrightarrow CaCl_2.8NH_3$;

$P_4O_{10} + 12NH_3 + 6H_2O \longrightarrow 4(NH_4)_3PO_4$

7. (a, b, d) Sodium nitrate on decomposition upto 500°C gives $NaNO_2$ and oxygen.

$2NaNO_3 \xrightarrow{\Delta} 2NaNO_2 + O_2\uparrow$

While at higher temperature (i.e. above to 800°C), $NaNO_2$ further decomposes into Na_2O, N_2 and O_2.

$2NaNO_2 \xrightarrow{800°C} Na_2O + 3/2O_2\uparrow + N_2\uparrow$

8. (b,d)

In case of oxy-acids of halogens, acidic strength increases with increase in number of oxygen atom. Thus the correct acidic strength is $HClO < HClO_2 < HClO_3 < HClO_4$.
For the given ions the correct order of oxidising power is $ClO_4^- < BrO_4^- < IO_4^-$

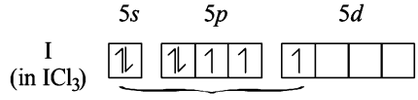
9. (a,b,c)

I^- is a strong reducing agent so it gets oxidised by H_2SO_4 (conc.) to I_2.
The products obtained by reduction of H_2SO_4 are SO_2, S and H_2S (compounds of sulphur) and so they act as contaminants for the product.

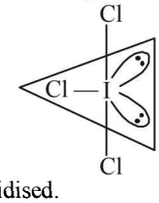
10. (6) There are 6 P–O–P bonds in P_4O_8.

11. (3) CrO_3, Mn_2O_7 and SO_2 are acidic oxides.

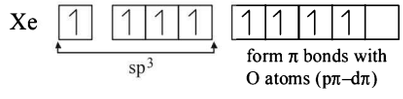
12. (2)



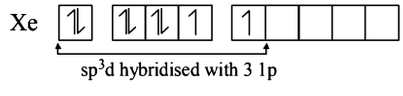
sp^3d with 2 1p



13. (4) XeO_4 is sp^3 hybridised.

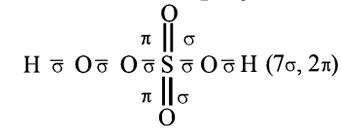


14. (3) In XeF_2

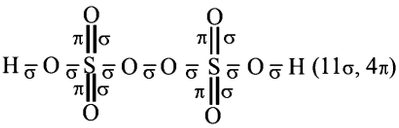


Hence, there are 3 1ps in Xe in XeF_2.

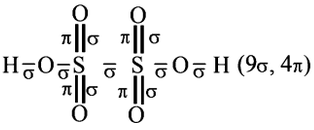
15. (c) Persulfuric acid (H_2SO_5) is also known as caro's acid



16. (d) Peroxydisulfuric acid ($H_2S_2O_8$) is also known as Marshall's acid



17. (c) Dithionic acid ($H_2S_2O_6$)



18. (c) The basicity is determined by the number of OH groups attached to the P atom.

19. (a) $\underset{\text{(D) ortho–}}{H_3PO_4} \xrightarrow{\Delta} \underset{\text{meta –}}{HPO_3} + H_2O;$

$\underset{\text{(F) pyro–}}{H_4P_2O_7} \xrightarrow{\Delta} 2\underset{\text{meta –}}{HPO_3} + H_2O$

20. A-p, s; B-p, q, r, s; C-p, s; D-p, s

A $\rightarrow$ H_2S decolourises acidified solution of $KMnO_4$

$$2KMnO_4 + 3H_2SO_4 + 5H_2S \longrightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5S$$

The shape of the H_2S molecule is similar to that of the water molecule i.e. V-shaped structure with bond length (H–S) 1.35Å and bond angle (H–S–H) 92.5° involving sp^3 hybridization of S atom.

B $\rightarrow$ SO_2 undergoes disproportionation (oxidation of two molecules of the same compound at the expense of the third which is reduced) reaction.

$$3SO_2 \xrightarrow{\text{Heat}} 2SO_3 + S$$

Decolourises $KMnO_4$

$$5SO_2 + 2KMnO_4 + 2H_2O \longrightarrow K_2SO_4 + 2MnSO_4 + 2H_2SO_4$$

Sulphur dioxide acts as bleaching agent in the following way :

In the presence of water, it is oxidised with the liberation of nascent hydrogen which reduces the colouring matter to colourless.

$$SO_2 + 2H_2O \longrightarrow H_2SO_4 + 2[H]$$

$$\text{Colouring matter} + 2[H] \underset{}{\overset{\text{air}}{\rightleftharpoons}} \text{Colourless compound}$$

Sulphur dioxide has a planar triangular (V-shaped) structure involving sp^2 hybridisation of the sulphur atom (sp^2 hybridisation occurs between $3s^2 3p_x^1$ and $3p_y^1$ electrons).

C $\rightarrow$ NO_2 undergoes decolourisation of $KMnO_4$

$$2KMnO_4 + 3H_2SO_4 + 10NO_2 + 2H_2O \longrightarrow K_2SO_4 + 2MnSO_4 + 10HNO_3$$

NO_2 molecule has angular structure (V-shape) with O–N–O bond angle of about 132° and N–O distance of about 1.19Å which is intermediate between a single and a double bond.

D $\rightarrow$ HNO_2 decolourises $KMnO_4$:

$$2KMnO_4 + 3H_2SO_4 + 5HNO_2 \longrightarrow K_2SO_4 + 2MnSO_4 + 3H_2O + 5HNO_3$$

X-ray and Raman spectral studies indicate an angular structure for nitrite ion (NO_2^-) with O–N–O angle of 132° and bond length (N–O) of 1.13 Å.