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CHEMISTRY

TARGET : JEE Advanced - 2023

CAPS – 12

p-block (Group 15-18)

1. Consider the following sequence of reaction.

$$Na + NH_3(g) \rightarrow [X] \xrightarrow{N_2O} [Y] \xrightarrow{Heat} \underset{Gas,Pure}{[Z]}$$

Identify [Z] gas:

(A) N_2 (B) NH_3 (C) O_2 (D) H_2

2. $A + H_2O \longrightarrow B + HCl$

$B + H_2O \longrightarrow C + HCl$

Compound (A), (B) and (C) can be respectively:

(A) PCl_5, $POCl_3$, H_3PO_3 (B) PCl_5, $POCl_3$, H_3PO_4

(C) $SOCl_2$, $POCl_3$, H_3PO_3 (D) PCl_3, $POCl_3$, H_3PO_4

3. Which of the following statements are correct about the reaction between the copper metal and dilute HNO_3?

(I) The principal reducing product is NO gas

(II) Cu metal is oxidized to $Cu^{2+}(aq)$ ion which is blue in colour.

(III) NO is paramagnetic and has one unpaired electron in antibonding molecular orbital

(IV) NO reacts with O_2 to produce NO_2 which is linear in shape

Choose the correct statements:

(A) I, II, III (B) I, III (C) II, IV (D) All the above

4. In which of the following reaction product does not contain 'Peroxy' linkage?

(A) $2OF \xrightarrow{Dimerisation}$ (B) $H_4P_2O_8 \xrightarrow{+H_2O}$

(C) $2Na \xrightarrow{excess\ O_2,\Delta}$ (D) None of these

5. Which of the following halides cannot be hydrolysed at room temperature?

I. TeF_6 II. SF_6 III. NCl_3 IV. NF_3

Choose the correct code:

(A) III and IV (B) I, II and III (C) I, II and IV (D) II and IV

6. By which of the following methods, H_2O_2 can't be synthesized?

(A) Lewis addition of ice cold H_2SO_4 on BaO_2

(B) Addition of ice cold H_2SO_4 on PbO_2

(C) Aerial oxidation of 2-ethyl anthraquinol

(D) Electrolysis of $(NH_4)_2SO_4$ at a high current density

7. Predict the correct product when Cl_2 passed through $H-\overset{18}{O}-\overset{18}{O}-H$ solution.

(A) $H^+ + Cl^- + O_2$ (both oxygen having 18) (B) HOCl and $HClO_2$ (all oxygen having 18)

(C) $HClO_4$ and HCl (all oxygen having 18) (D) Cl_2O and H_2O (all oxygen having 18)

8. $Cl_2(g) + Ba(OH)_2 \longrightarrow X(aq.) + BaCl_2 + H_2O$

$X + H_2SO_4 \longrightarrow Y + BaSO_4$

$Y \xrightarrow{\Delta,\ T>365K} Z + H_2O + O_2$

Y and Z are respectively:

(A) $HClO_4$, ClO_2 (B) $HClO_3$, ClO_2 (C) $HClO_3$, ClO_6 (D) $HClO_4$, Cl_2O_7

9. Which is incorrectly written?

(A) $I_4O_9 \rightleftharpoons I^{3+} + 3IO_3^-$ (B) $I_2O_4 \rightleftharpoons IO^+ + IO_3^-$

(C) $CsBr_3 \rightleftharpoons Cs^+ + Br_3^-$ (d) None of these

10. Most powerful reducing agent among the following is

(A) pyrophosphoric acid (B) hypophosphoric acid

(C) hypophosphorous acid (D) orthophosphorous acid

MULTIPLE CHOICE QUESTIONS

11. Which of the following statement is true about NO_2 and ClO_2?

(A) Both are paramagnetic

(B) Both have a bent structure

(C) On cooling, both undergoes dimerization

(D) In both oxides, the central atom has an oxidation state +4

12. Select the incorrect order.

(A) He > Ar > Kr > Ne > Xe – (abundance in air).

(B) He < Ne < Ar < Kr < Xe – (boiling point).

(C) $XeF_6 > XeF_4 > XeF_2$ – (melting point).

(D) $XeF_6 < XeF_4 < XeF_2$– (Xe – F bond length).

13. Consider the following reactions:

$$A_x + yB_z \xrightarrow{\text{limited supply of air}} \text{compound 'P'} \xrightarrow{+B_2 \text{ excess air}} \text{Compound 'Q'}$$

If atomic number of elements A and B are 15 and 8 respectively, then according to the given information the correct statement(s) is/are

(A) (B–A–B) bond angle in compound 'Q' > (B–A–B) bond angle in compound 'P'

(B) (A–B) bond length in compound 'Q' < (A–B) bond length in compound 'P'

(C) Value of x + y + z is 9

(D) Compound 'P' is P_2O_5 and compound 'Q' is P_4O_{10}.

14. In which of the following compound(s) terminal ($2C - 2e^-$) bond and bridge bonds are lying in same plane:

(A) I_2Cl_6 (B) Be_2H_4 (C) Solid $BeCl_2$ (D) Ga_2H_6

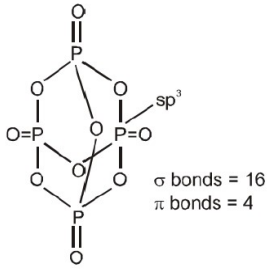
15. The compounds obtained by heating of orthophosphoric acid are:

(A) metaphosphoric acid (B) pyrophosphoric acid

(C) P_4O_6 (D) P_4O_{10}

COMPREHENSION # 1 (FOR Q.16 TO Q.18)

An inorganic iodide (A) on heating with a solution of KOH gives a gas (B) and a solution of a compound. The gas (B) on ignition in air gives a compound (C) and water. Compound (C) is :



16. Select the correct statement from the following for the gas (B).

(A) Its solution in water does not decompose in presence of light.

(B) It can be prepared by the alkaline hydrolysis of white phosphorus.

(C) It is non-inflammable owing to the presence of P_2H_4.

(D) It can act as oxidising agent.

17. The compound (C):

(A) has sp^3 hybridisation of central atom(s) (B) has sixteen sigma bonds.

(C) is used as a dehydrating agent (D) all of these

18. What is true about gas (B) and compound (C)?

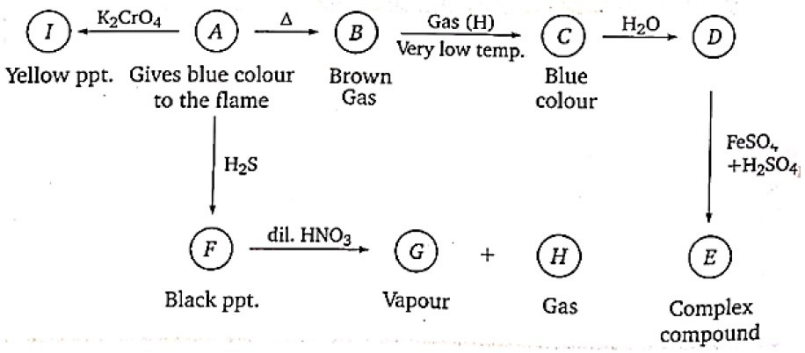
(A) The oxidation number of central atom of gas (B) is + IV

(B) The gas (B) produces a black precipitate of metallic silver with silver nitrate solution.

(C) Compound (C) dissolves in water forming an acid which with sodium hydroxide forms three series of salts.

(D) (b) and (c) both

COMPREHENSION #4 (Q.19 TO Q.20)



19. Compound (D) + I^- + $H^+ \rightarrow$ Gas

Evolved gas is similar to:

(A) Gas-B (B) Gas-G (C) Gas-H (D) None

20. Yellow ppt. of compound (I) is insoluble in:

(A) NaOH (B) CH_3COOH (C) dil. HNO_3 (D) none

NUMRIC ANSWER TYPE

21. Choose total number of correct reactions.

(i) When $CuSO_4$ solution reacts with NH_3, complex is formed.

(ii) When $CuSO_4$ solution react with PH_3, complex is formed.

(iii) $C_{12}H_{22}O_{11} \xrightarrow{\text{conc.}H_2SO_4} 2C + 11H_2O$

(iv) $NH_3 + Cl_2 \xrightarrow{\Delta} NCl_4Cl + N_2$

(v) $NH_3 + Cl_2 \xrightarrow{\Delta} NCl_3 + HCl$

(vi) $HNO_3 + P_4O_{10} \xrightarrow{\Delta} HPO_3 + N_2O_5$

(vii) $S + H_2SO_4 \xrightarrow{\Delta} SO_2 + H_2O$

(viii) $SbF_5 + XeF_4 \rightarrow [SbF_4]\,[XeF_5]$

(ix) $XeF_4 + O_2F_2 \rightarrow XeF_6 + O_2$

22. Consider the following orders:

(1) $H_2SO_4 > H_2SO_3$: Boiling point

(2) H_2O > HF: Extent of H-bond

(3) $H_2O > H_2O_2$: Strength of H-bond

(4) HF > HCl > HBr: Melting point

(5) para-dichlorobenzene > ortho-dichlorobenzene: Boiling point

(6) Ethylene glycol > Phenol: Viscosity

(7) 1, 3-Dichlorobenzene > 1, 3, 5-Trichlorobenzene: Strength of molecular force

(8) ortho-Hydroxy benzoic acid > para-Hydroxy benzoic acid: Solubility in water.

Then calculate value of $|x^2|$ (where 'x' is total number of correct orders.)

MATRIX MATCH TYPE

23. Match the reaction products listed in column–I with the particulars listed in column-II

Column–I	**Column–II**
(A) $XeF_2 + H_2O \longrightarrow$	(p) Redox reaction
(B) $XeF_4 + H_2O \longrightarrow$	(q) Disproportionation
(C) $XeF_6 + H_2O \longrightarrow$	(r) O_2 formation
(D) $XeO_3 + NaOH \longrightarrow$	(s) Xe formation
	(t) Etching glass

24. Match the Following:

Column-I	**Column-II**
(A) $P_4O_6 + H_2O(hot) \rightarrow$	(p) H_3PO_4
(B) $P_4 + NaOH \xrightarrow{\Delta}$	(q) PH_3
(C) $H_3PO_3 \xrightarrow{\Delta}$	(r) H_3PO_3
(D) $PH_4I + NaOH \rightarrow$	(s) $H_2PO_2^-$

(A) (A- p, q; B- q, s; C- p, q; D- s) (B) (A- p, q; B- q, s; C- p, q; D- q)

(C) (A- q, r; B- q; C- r, s; D- q) (D) (A- r, s; B- p, q; C- r; D- s)

25. Match the Following:

Column-I	**Column-II**
(A) Fluorine	(p) Affected by NaOH
(B) Chlorine	(q) Coloured
(C) Bromine	(r) Forming trihalide anion
(D) Iodine	(s) Forms only one oxo acid

(A) (A-p, q, s; B-p, q, r; C-p, q, r; D-p, q, r) (B) (A-p, q, r; B-p, s; C-p, q, r; D-p, q, r)

(C) (A-q, s; B-r; C-q, r, s; D-p, q, r) (D) (A-q, s; B-p, q, r; C-p, q, r; D-p, q, r)

26. Entries of Column-I are to be matched with entries of Column-II. Each entry of Column-I may have the matching with one or more than one entries of Column-II

Column-I	**Column-II**
(A) $POCl_3$	P. Oxyacid formed during hydrolysis undergoes Tautomeric change
(B) SOF_2	Q. Oxidation state of central atom does not change during hydrolysis
(C) $XeOF_4$	R. Complete as well as partial hydrolysis is possible
(D) $H_2S_2O_8$	S. Hydrolysed product reacts with glass
	T. Hybridization of central atom in the final product remains same as in the substrate on hydrolysis

(A) A $\rightarrow$ P, Q, R, T; B $\rightarrow$ P, S; C $\rightarrow$ P, Q, S; D $\rightarrow$ R, S, T

(B) A $\rightarrow$ Q, T; B $\rightarrow$ P, Q, S, T; C $\rightarrow$ Q, R, S; D $\rightarrow$ Q, R, T

(C) A $\rightarrow$ Q, R, S, T; B $\rightarrow$ R, S, T; C $\rightarrow$ Q, R, S; D $\rightarrow$ P, S, T

(D) A $\rightarrow$ R, S, T; B $\rightarrow$ P, Q; C $\rightarrow$ R, S; D $\rightarrow$ P, Q, R

SUBJECTIVE ANSWER TYPE

27. Colourless salt (A) + NaOH (excess) $\xrightarrow{\Delta}$ gas (B) giving white fumes with HCl + alkaline solution (C)

(C) + Zn $\longrightarrow$ gas (B)

(A) $\xrightarrow{\Delta}$ gas (D) + liquid (E)

D, E Both triatomic

Identify (A, B, C, D) and (E)