CHEMISTRY

BOOKS - CENGAGE CHEMISTRY (HINGLISH)

P-BLOCK GROUP 15 ELEMENTS - THE NITROGEN FAMILY

Illustration

1. (a) Though nitrogen exhibits $+5$ oxidation state, it does not form pentahalide. Give reason.

(b) PH_3 has lower boiling point than NH_3. Why ?

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2. (a) PF_5 is known, but NF_5 is not. Why ?

(b) The experimentally determined $N-F$ bond length in NF_3 is greater

than the sum of single convalent radii of N and F.

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3. (a) Why elemental phosphorous does not exist as P_2 like N_2 ?

(b) NCl_3 gets easily hydrolysed, while NF_3 does not. Why ?

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4. (a) Can PCl_5 act as an oxidising as well as reducing agent ?

(b) Phosphorous does not form phosphorous pentaiodide. Why ?

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5. (a) Write the reaction of the thermal decomposition of sodium azide.

(b) Why does NH_3 act as a Lewis base ?

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6. (a) A bottle of liquor ammonia should be cooled before opening. Give reason.

(b) Why conc. H_2SO_4, anhydrous $CaCl_2$ and P_4O_{10} cannot be used as dehydrating agents for ammonia.

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7. (a) Why does NO_2 dimerise ?

(b) In what way can it be proved that PH_3 is basic in nature ?

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8. (a) A tetratomic molecule (A) on reaction with nitrogen (I) oxide, produces two substances (B) and (C) is a dehydrating agent while substance (C) is a diatomic gas which shows almost inert behaviour. Identify (A), (B) and (C).

(b) Why red phosphorous is denser and chemically less reactive than

while phosphorous ?

(c) Why nitrous oxide supports combustion better than air ?

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9. (a) What is the role of phosphorous pentoxide in the preparation of N_2O_5 ?

(b) Phosphine is prepared in an inert atmosphere of CO_2. Why ?

(c) Red phosphorous is used for making matches. Why ?

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10. (a) Nitric oxide turns brown in air. Why ?

(b) Copper dissolves in HNO_3 but not in HCl. Why ?

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11. Calculate the number of moles of Cu and HNO_3 to give NO and NO_2 in the $(2:1)$ molar ratio.

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12. (a) Why does PCl_3 fume in moisture ?

(b) Are all the five bonds in PCl_5 molecule equivalent ? Justify your answer.

(c) How do you account for the reducing behaviour of H_3PO_2 on the basic of its structure ?

(d) Give the disproportional reaction of H_3PO_3.

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Solved Example

1. An aqueous of a gas (X) shows the following reactions :

(a) It turns red litmus blue.

(b) When added in excess to a copper sulphate solution, a deep blue coloured solution is obtained.

(c) On addition to $FeCl_3$ solution, a brownish precipitate is formed, which is solution in HNO_3.

Identify (X) and give an explanation for step (a), (b) and (c).

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2. A colourless inorganic salt (A) decomposes completely at about $250^\circ C$ to give only two products (B) and (C), leaving no residue. The oxide (C) is a liquid at room temperature and neutral to litmus paper while the gas (B) is a neutral oxide. White phosphorous burns in excess of (B) to produce a strong white dehydrating agent. Write balanced equations for the reactions involved in this process.

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3. Identify (A) to (E).

(a) An inorganic iodide (A) on heating with a solution of KOH gives a

gas (B) and the solution of a compound (C).

(b) The gas (B) on ignition air gives a compound (D) and water.

(C) Copper sulphate is reduced to the metal on passing (B) through the solution.

(d) A precipitate of the compound (E) is formed on reaction of (C) with copper sulphate solution.

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4. Gradual addition of KI solution to $Bi(NO_3)_3$ solution initially produces a dark brown precipitate which dissolves in excess of KI to give a clear yellow solution. Write chemical equation for the above reactions.

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5. A certain element is a metalloid that forms an acidic oxide, E_2O_5. Indentify the element.

(b) N_2 makes up about $79\,\%$ of the atmosphere, why do not animals use the more abundant N_2 instead of O_2 for the biological processes ?

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6. A translucent white waxy solid (A) on heating in an inert atmosphere is converted into its allotropic form (B). (A) on reaction with very dilute KOH liberates a highly poisonous gas (C), having rotten smell. With excess of chlorine, (C) forms (A) which hydrolyses to compound (E). Indentify (A) to (E).

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7. An orange solid (A) on heating gave a green residue (B), colourless gas (C) and water vapour. The dry gas (C) on passing over heated magnesium gave a white solid (D). (D) on reaction with water have a gas (E) which formed dense white fumes with HCl. Indentify (A) to (E) and give the reactions.

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Concept Application Exercises 2 1 Subjective

1. Burning magnesium continues to burn in nitric oxide, while burning sulphur is extinguised. Give reason.

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2. Why pure PH_3 does not burn in air but impure sample does ?

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3. Why nitrogen is inert at room temperature ?

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4. Why BiH_3 is strongest reducing agent amongst group 15 hydrides ?

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5. Why nitrogen trihalide cannot be oxidised to pentahalide whereas phosphorous trihaldes can be oxidised to pentahalide ?

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6. NO is paramagnetic, while $NO^{\oplus}$ is diamagnetic.

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7. Which of the following acts as reducing agent and why ? H_3PO_3 or H_3PO_4.

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8. Nitrogen is a gas, while other members of group 15 are solids. Why ?

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9. Why commercial HNO_3 is generally yellow in colour ?

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10. Nitric acid acts as an oxidising agent while nitrous acid can act both as an oxidising as well as reducing agent ?

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11. Which is more basic and why ? NF_3 or NH_3.

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12. What is the chemistry of Holme's signal ?

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13. Write complete balanced reactions for the following :

(a) Red phosphorous reacts with iodine in presence of water.

(b) White phosphrous is boiled with a strong solution of $NaOH$ in an inert atmosphere.

(c) Phosphorous reacts with conc. HNO_3 to give H_3PO_4.

(d) Iodine reacts with concentrated nitric acid.

(e) Orthophosphoric acid is heated with nitric acid and ammonium molybdate.

(f) Disodium hydrogen phosphate is added to ammonical solution of magnesium sulphate.

(g) Magnesium is burnt in air and the product is treated with water.

(h) Phosphine is passed through $AgNO_3$ solution.

(i) A mixture of air and ammonia is passed over heated platinum gauze.

(j) Gold is treated with aqua regia.

(k) Water is added to calcium phosphide.

(l) Calcium phosphate is heated with a mixture of sand and carbon.

(m) Phosphorous reacts with nitric acid to give equimolar ratio of nitric oxide and nitrogen dioxide.

(n) Zinc is treated the very dilute nitric acid.

(o) Phosphine is treated with an acidified $CuSO_4$ solution.

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14. Describe the action of heat on the following compounds :

(a) Ammonium nitrate

(b) Ammonium nitrite

(c) Ammonium chloride.

(d) Ammonium dichromate

(e) Orthophosphoric acid

(f) Phosphrous acid

(g) Hypophosphorous acid

(h) Copper nitrate.

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15. Concentrated nitric acid can be stored in aluminium container. Give reason.

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16. Why calcuim cyanamide can be used as a fertiliser ?

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17. Describe being odd electron molecule, NO is colourless. Explain.

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18. Give reason : Urea is better nitrogenous fertiliser than ammonium sulphate.

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19. Mg_3N_2 on reaction with water gives off NH_3, but $MgCl_2$ on reaction with water does not give HCl at room temperature.

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20. Oxides of nitrogen have open chain structures while those of phosphorous have closed chain or cage structures. Why ?

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21. Illustrate, how copper gives different products on reaction with HNO_3.

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22. Give the names of formulae of the compounds described below :

(a) A compound of N, H and O which on heating gives laughing gas.

(b) A compound of N, H and O which on heating gives nitrogen gas.

(c) A compound of Ca, P and O which is found in bones.

(d) A compound of N and H which is used as refrigerant.

(e) A compound of N and H which behaves like an acid.

(f) A compound of N and H which is used as a rocket fuel.

(g) A compound of N, H, S and O which is used as a fertiliser.

(h) A compound of N, H, S and O which is used for making oximes.

(i) Two neutral oxides of nitrogen.

(j) The oxyacid of phosphorus is used for the preparation of HBr and HI from bromides and iodides respectively.

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Concept Application Exercises 2 1 Objective

1. White phosphorus on reaction with lime water gives calcium salt of an acid (A) along with a gas (X). Which of the following is correct ?

A. (A) on heating gives (X) and O_2

B. The bond angle in (X) is less than that in case of ammonia.

C. (A) is a disbasic acid.

D. (X) is more basic than ammonia.

Answer: B

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2. One mole of H_3PO_3 on reaction with excess of $NaOH$ gives :

A. One mole of Na_2HPO_3

B. Two moles of $Na_2H_2PO_3$

C. Two moles of Na_2HPO_3

D. One mole of Na_3PO_3

Answer: A

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3. If O_2 is removed from the formula of anhydride of HNO_2, then the formula of the resulting compound satisfies which of the following properties ?

A. It produces tears in eyes.

B. It supports combustion

C. It is paramagnetic

D. It cannot react with red hot copper.

Answer: B

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4. Which of the following is correct :

A. N_2O is a laughing gas and is angular in shape.

B. NO_2 is a sweet smelling and is angular in shape.

C. NO is a colourless gas and acidic in nature.

D. NO_2 on reaction with $NaOH$ gives a mixture of two salts.

Answer: D

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5. The compound is covalent in gaseous state but ionic in solid state is.

A. PCl_5

B. PCl_3

C. CCl_4

D. NH_3

Answer: A

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6. The equivalent weight of phosphoric acid (H_3PO_4) in the reaction $NaOH + H_3PO_4 \rightarrow NaH_2PO_4 + H_2O$ is

A. 25

B. 49

C. 59

D. 98

Answer: D

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7. The oxyacid of phosphorous in which phosphorus has lowest oxidation state is.

A. Hypophosphorus acid

B. Orthophosphoric acid

C. Pyrophosphoric acid

D. Metaphosphoric acid.

Answer: A

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8. Which is/are correct statements about P_4O_6 and P_4O_{10} :

A. In P_4O_6 each P is joined to three O and in P_4O_{10} each P is linked to four O atoms.

B. Both (a) and (b) form oxoacids H_3PO_3 and H_3PO_4 respectively.

C. Both (a) and (b)

D. None

Answer: C

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9. Blue liquid which is formed at $-30^\circ C$ by mixing of two gases is.

A. N_2O

B. N_2O_4

C. N_2O_3

D. N_2O_5

Answer: C

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10. Complete and balance the following reactions :

(i) $P_4O_{10} + PCl_5 \rightarrow$ ___

(ii) $NH_3 + NaOCl \rightarrow$ ____ $+ NaCl + H_2O$

(iii) $Ca(PO_4)_3 + 4H_3PO_4 \rightarrow$ ____

(iv) $AgCl + NH_4OH \rightarrow$ _____ $+$ ____

(v) $Pb(NO_3)_2 \xrightarrow{\Delta} PbO +$ ___ $+$ ____

(vi) $Mg + HNO_3 \rightarrow$ ____ $+$ ____.

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Exercises Linked Comprehension

1. NH_3 has got pyramidal structure. By replacement of H atom it forms $(CH_3)_3N$ and $(SiH_3)_3N$ molecules which are found to have different geometries.

Which is the correct relation of bond angles ?

A. $NH_3 > (CH_3)_3N > (SiH_3)_3N$

B. $(SiH_3)_3N > (CH_3)_3N > NH_3$

C. $NH_3 > (SiH_3)_3N > (CH_3)_3N$

D. $(CH_3)_3N > (SiH_3)_3N > NH_3$

Answer: B

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2. NH_3 has got pyramidal structure. By replacement of H atom it forms $(CH_3)_3N$ and $(SiH_3)_3N$ molecules which are found to have different geometries.

Shape of $(SiH_3)_3N$ with respect to N is.

A. Pyramidal

B. T-shaped

C. Trigonal planar

D. Tetrahedral

Answer: C

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3. NH_3 has got pyramidal structure. By replacement of H atom it forms $(CH_3)_3N$ and $(SiH_3)_3N$ molecules which are found to have different geometries.

Which of the following has highest basic character ?

A. NH_3

B. $(CH_3)_2NH$

C. $(CH_3)_3N$

D. $(SiH_3)_3N$

Answer: B

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4. Solid N_2O_5 exists as $NO_2^{\oplus}NO_3^{\ominus}$ and hence is called nitronium nitrate.

The gas which is acidic in nature is.

A. NO

B. N_2O

C. NO_2

D. Both (a) and (b)

Answer: C

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5. Solid N_2O_5 exists as $NO_2^{\oplus}NO_3^{\ominus}$ and hence is called nitronium nitrate.

Which of the following statement is correct for the oxides of nitrogen ?

A. Dinitrogen trioxide dissolves in potassium hydroxide forming potassium nitrate.

B. Aqueous solution of nitrogen dioxide behaves both as a reducing agent and as an oxidising agent.

C. NO_2 is non-planar.

D. Nitrous oxide is fairly soluble in cold water and turns blue litmus red.

Answer: B

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6. Solid N_2O_5 exists as $NO_2^{\oplus}NO_3^{\ominus}$ and hence is called nitronium nitrate. Choose the incorrect statement.

A. NO_2 molecule is angular with $N-O$ distance equal to intermediate distance between a single and a double bond.

B. In N_2O_4 the $N-N$ bond length is longer than the usual $N-N$ single bond distance.

C. N_2O is a linear molecule and has a small dipole moment.

D. None of these

Answer: D

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7. PCl_5 has trigonal pyramidal geometry with sp^3d hybridisation in gases and liquid state but in solid state it exist as ionic compound.

The hyridisation of P and shape of $POCl_3$ are.

A. sp^3, tetrahedral

B. sp^3d, distorted tetrahedral

C. sp^3d, square planar

D. sp^3, pyramidal

Answer: A

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8. PCl_5 has trigonal pyramidal geometry with sp^3d hybridisation in gases and liquid state but in solid state it exist as ionic compound.

In presence of small amount of water, PCl_5 hydrolysis to form.

A. PCl_3

B. H_3PO_3

C. $POCl_3$

D. $POCl$

Answer: C

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9. PCl_5 has trigonal pyramidal geometry with sp^3d hybridisation in gases and liquid state but in solid state it exist as ionic compound.

In crystalline state PCl_5 exists as.

A. $[PCl_3]^{2+} + 2Cl^{\ominus}$

B. $[PCl_4)^{\oplus}[PCl_6]^{\ominus}$

C. $[PCl_4]^{\oplus}Cl^{\ominus}$

D. $[PCl_6]^{\oplus}[PCl_4)^{\ominus}$

Answer: C

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10. PCl_5 has trigonal pyramidal geometry with sp^3d hybridisation in gases and liquid state but in solid state it exist as ionic compound.

What is the hybridisation state of cation part of solid PCl_5 ?

A. sp^3d^2

B. sp^3d

C. sp^3

D. sp^2

Answer: C

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11. The pronounced change from non-metallic behaviour and also increase in the basicity of oxides from nitrogen to bismuth in group 15 is principally due to incresing size of the atoms. The ionisation potential of nitrogen is very high on account of its small size. However, ionisation potential decreases regularly on descending the group.

Which one of the following is a strongest base ?

A. PH_3

B. SbH_3

C. AsH_3

D. NH_3

Answer: D

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12. The pronounced change from non-metallic behaviour and also increase in the basicity of oxides from nitrogen to bismuth in group 15 is principally due to incresing size of the atoms. The ionisation potential of nitrogen is very high on account of its small size. However, ionisation potential decreases regularly on descending the group.

Among the trihalides of nitrogen, which one is least basic ?

A. NF_3

B. NI_3

C. NBr_3

D. NCl_3

Answer: A

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13. The pronounced change from non-metallic behaviour and also increase in the basicity of oxides from nitrogen to bismuth in group 15 is principally due to incresing size of the atoms. The ionisation potential of nitrogen is very high on account of its small size. However, ionisation potential decreases regularly on descending the group.

Which one of the following fluorides does not exist ?

A. NF_5

B. SbF_5

C. AsF_5

D. PF_5

Answer: A

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14. The pronounced change from non-metallic behaviour and also increase in the basicity of oxides from nitrogen to bismuth in group 15 is principally due to incresing size of the atoms. The ionisation potential of nitrogen is very high on account of its small size. However, ionisation potential decreases regularly on descending the group.

Which of the following oxides is most acidic ?

A. Bi_2O_3

B. P_2O_3

C. As_2O_3

D. Sb_2O_3

Answer: B

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15. The pronounced change from non-metallic behaviour and also increase in the basicity of oxides from nitrogen to bismuth in group 15 is

principally due to incresing size of the atoms. The ionisation potential of nitrogen is very high on account of its small size. However, ionisation potential decreases regularly on descending the group.

The most unstable hydride is.

A. NH_3

B. SbH_3

C. BiH_3

D. PH_3

Answer: C

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16. The pronounced change from non-metallic behaviour and also increase in the basicity of oxides from nitrogen to bismuth in group 15 is principally due to incresing size of the atoms. The ionisation potential of nitrogen is very high on account of its small size. However, ionisation potential decreases regularly on descending the group.

In all the group 15 elements, the number of unpaired electrons in the valence shell is.

A. 2

B. 3

C. 4

D. 5

Answer: B

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17. The pronounced change from non-metallic behaviour and also increase in the basicity of oxides from nitrogen to bismuth in group 15 is principally due to increasing size of the atoms. The ionisation potential of nitrogen is very high on account of its small size. However, ionisation potential decreases regularly on descending the group.

Which trihalide is most ionic among the following ?

A. NCl_3

B. PCl_3

C. BiF_3

D. SbF_3

Answer: C

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18. Phosphorus forms a number of oxoacids which differ in their structures and oxidation state of phosphorus. All the acids contain phosphorus atom//atoms linked tetrahedrally to four other atoms or groups. Each of them has at least one $P = O$ or $P \rightarrow O$ unit and one $P - OH$ unit. The OH group is ionisable but H atom linked directly to P is non-ionisabl. Structures of all the acids are considered to be derived either from phosphorus acid or phosphoric acid.

Which one is monobasic acid ?

A. H_3PO_2

B. H_3PO_3

C. H_3PO_4

D. H_3PO_5

Answer: A

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19. Phosphorus forms a number of oxoacids which differ in their structures and oxidation state of phosphorus. All the acids contain phosphorus atom//atoms linked tetrahedrally to four other atoms or groups. Each of them has at least one $P = O$ or $P \to O$ unit and one $P - OH$ unit. The OH group is ionisable but H atom linked directly to P is non-ionisabl. Structures of all the acids are considered to be derived either from phosphorus acid or phosphoric acid.

Which one has $+3$ oxidation state ?

A. H_3PO_4

B. H_3PO_3

C. $H_4P_2O_7$

D. $H_4P_2O_6$

Answer: B

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20. Phosphorus forms a number of oxoacids which differ in their structures and oxidation state of phosphorus. All the acids contain phosphorus atom//atoms linked tetrahedrally to four other atoms or groups. Each of them has at least one $P=O$ or $P \rightarrow O$ unit and one $P-OH$ unit. The OH group is ionisable but H atom linked directly to P is non-ionisabl. Structures of all the acids are considered to be derived either from phosphorus acid or phosphoric acid.

The acid which forms two series of salts is.

A. H_3PO_4

B. H_3PO_3

C. HPO_3

D. H_3PO_2

Answer: B

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21. Phosphorus forms a number of oxoacids which differ in their structures and oxidation state of phosphorus. All the acids contain phosphorus atom//atoms linked tetrahedrally to four other atoms or groups. Each of them has at least one $P=O$ or $P \rightarrow O$ unit and one $P-OH$ unit. The OH group is ionisable but H atom linked directly to P is non-ionisabl. Structures of all the acids are considered to be derived either from phosphorus acid or phosphoric acid.

Which of the following is a cycle oxoacid ?

A. $H_4P_2O_7$

B. $H_4P_2O_6$

C. $H_3P_3O_9$

D. $H_5P_5O_{15}$

Answer: C

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22. Phosphorus forms a number of oxoacids which differ in their structures and oxidation state of phosphorus. All the acids contain phosphorus atom//atoms linked tetrahedrally to four other atoms or groups. Each of them has at least one $P = O$ or $P \to O$ unit and one $P - OH$ unit. The OH group is ionisable but H atom linked directly to P is non-ionisabl. Structures of all the acids are considered to be derived either from phosphorus acid or phosphoric acid.

The number of or $P = O$ and $P - O - H$ bonds in H_3PO_4 are.

A. $3, 1$

B. $2, 2$

C. $1, 2$

D. $1, 3$

Answer: D

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Exercises Multiple Correct

1. White phosphorus has.

A. Six $P-P$ single bonds

B. Four $P-P$ single bonds

C. Four lone pairs of electrons

D. $P-P-P$ angle of 60°.

Answer: A::C::D

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2. The metals which produce hydrogen only with very dilute nitric acid are.

A. Zn

B. Cu

C. Mg

D. Mn

Answer: C::D

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3. Which elements of group 15 are metalloids ?

A. N

B. As

C. Sb

D. Bi

Answer: B::C

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4. Which of the following substances are used as fertilisers ?

A. Nitrolim

B. Urea

C. Superphosphate of lime

D. Phosphorite mineral

Answer: A::B::C

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5. Which of the following form oxychiorides as precipitate on hydrolysis ?

A. $BiCl_3$

B. $SbCl_3$

C. CCl_4

D. $PbCl_2$

Answer: A::B

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6. Which of the elements show allotropy ?

A. B

B. P

C. As

D. Bi

Answer: B::C

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7. Which of the following reactions can evolve phosphine ?

A. White $P + Ca(OH)_2 \rightarrow$

B. $AlP + H_2O \rightarrow$

C. $H_3PO_4 \xrightarrow{Heat}$

D. $PH_4I + NaOH \rightarrow .$

Answer: A::B::D

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8. The nitrogen oxide (s) that contain (s) $N - N$ bonds (s) is (are).

A. N_2O

B. N_2O_3

C. N_2O_4

D. N_2O_5

Answer: A::B::C

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9. A solution of colourless salt on boiling with excess $NaOH$ produces a non-flammable gas. The gas evolution ceases after sometime upon addition of Zn dust to the same solution, the gas evolution restarts. The colourless salt (s) is (are).

A. NH_4NO_3

B. NH_4NO_2

C. NH_4Cl

D. $(NH_4)_2SO_4$

Answer: A::B

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10. Ammonia is.

A. Lewis base

B. Polar solvent

C. Non-polar

D. Paramagnetic

Answer: A::B

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11. Bonds present in N_2O_5 are.

A. Covalent

B. Coordinate

C. Ionic

D. Metallic

Answer: A::B

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12. Which of the group 15 elelments are non-metallic ?

A. N

B. P

C. As

D. Sb

Answer: A::B

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Exercises Single Correct

1. Boiling/melting points of the following hydrides follow in order.

A. $SbH_3 > AsH_3 > PH_3 < NH_3$

B. $SbH_3 > AsH_3 > PH_3 > NH_3$

C. $SbH_3 > AsH_3 < PH_3 < NH_3$

D. $SbH_3 < AsH_3 < PH_3 < NH_3$

Answer: A

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2. Anomalous behaviour of nitrogen is due to.

A. Small size and high EN

B. Non-ability of d-orbitals in valence shell

C. Ease of multiple bond formation

D. All

Answer: D

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3. Of the following the most acidic is.

A. H_3PO_4

B. H_3AsO_4

C. H_3SbO_4

D. H_3BiO_4

Answer: A

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4. The mixed anhydride of nitrous and nitric acid is.

A. N_2O

B. NO_2

C. NO

D. N_2O_5

Answer: B

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5. The compound of nitrogen which is supporter of combustion and is called laughing gas is.

A. N_2O

B. NO_2

C. N_2O_5

D. N_2O_4

Answer: A

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6. Copper reacts with dil. HNO_3 to form a nitrate and

A. NO_2

B. NO

C. N_2O_3

D. N_2O_5

Answer: B

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7. Conc. HNO_3 stains and wool yellow because.

A. The skin and wool is burned by acid

B. Nitro cellulose is formed

C. The proteins are converted into xanthoproteins.

D. The water is removed by acid.

Answer: C

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8. Nitrogen sequioxide is.

A. N_2O_3

B. N_2O_4

C. N_2O_5

D. N_2O

Answer: A

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9. Conc. HNO_3 stains wood yellow because.

A. The wood is burned by acid

B. Nitrocellulose is formed

C. The proteins are converted into xanthoproteins.

D. The water is removed by acid.

Answer: B

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10. When silver nitrate is heated, the product are

A. Oxygen and metal nitrate

B. Nitrogen dioxide, O_2 and metallic oxide.

C. Nitrogen dioxide. O_2 and metal

D. Nitrogen dioxide and metal oxide.

Answer: C

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11. The strongest acid is

A. HNO_2

B. HNO_3

C. $H_2N_2O_2$

D. $HONS$

Answer: B

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12. Which is strongest base

A. NH_3

B. PH_3

C. AsH_3

D. SbH_3

Answer: A

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13. In which of the following states nitric oxide is paramagnetic.

A. Solid

B. Liquid

C. Gaseous

D. It is diamagnetic in all the three states

Answer: C

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14. Which of the following is coloured ?

A. NO

B. N_2O

C. NO_2

D. NH_3

Answer: C

Watch Video Solution

15. The three electron bond is present in the structure of

A. N_2O

B. NO

C. N_2O_3

D. N_2O_5

Answer: B

Watch Video Solution

16. NO is purified by

A. Absorption in $(NH_4)_2SO_4$ solution

B. Passing into conc. H_2SO_4

C. Absorbing in $FeSO_4$ solution

D. Electrolysis method.

Answer: C

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17. Which of the following combines with Fe^{2+} ions to form brown complex ?

A. NO

B. N_2O

C. N_2O_3

D. N_2O_5

Answer: A

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18. Nitrogen reacts with calcium and carbon or when N_2 gas is passed over heated calcium carbide (at $1070K$) it gives___ which is an important fertiliser marketed under the name Nitrolium.

A. Calcium nitrate

B. Calcium cyanide

C. Calcium cvanamide

D. Calcium nitride

Answer: C

Watch Video Solution

19. NH_3 has pyramidal structure with HNH bond angle of 107° it forms complexes with cation which of the following does not form complex with NH_3 ?

A. $Ag^{\oplus}$

B. Cu^{2+}

C. Cd^{2+}

D. Pb^{2+}

Answer: D

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20. NH_3 is a Lewis base and is used for cooling in refrigeration is dried over quick lime has higher melting and boiling points as compared to other hydrides of the group due to.

A. Coordinate bond

B. Hydrogen bonding

C. Strong ionic bonding

D. All

Answer: B

Watch Video Solution

21. Catalytic oxidation of NH_3 (passing a mixture of NH_3 and air over heated Pt gauge) gives.

A. NO

B. N_2O

C. N_2O_3

D. N_2O_5

Answer: A

Watch Video Solution

22. Ordinary strong solution of HCl, HNO_3 and H_2SO_4 contains roughly.

A. $1/5$, $2/3$ and $3/3$ fractions of pure acid and water respectively

B. $2/3$, $1/5$ and $3/3$ fractions of pure acid and water respectively

C. $2/3$, $3/3$ and $1/5$ fractions of pure acid and water respectively

D. None

Answer: A

View Text Solution

23. Dilute HNO_3 cannot be concentrated beyond 68% by boiling because.

A. On boiling HNO_3 is decomposed

B. On boiling HNO_3 produces a large amount of heat which is uncontrollable.

C. It forms a constant boiling mixture with H_2O boiling ar $394K$.

D. It can be concentrated beyond $68\ \%$ by stream distillation.

Answer: C

Watch Video Solution

24. Fuming HNO_3 (containing $98\ \%$ of HNO_3) is obtained.

A. By distilling $68\ \%\ HNO_3$ with conc. H_2SO_4.

B. By distilling $68\ \%\ HNO_3$ under reduced pressure

C. By steam distillation of $68\ \%\ HNO_3$.

D. By distillation $68\ \%\ HNO_3$ with P_4O_{10}.

Answer: A

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25. Yellow colour of HNO_3 is due to the presence of NO_2 is removed by

A. Boiling the acid

B. Adding Mg powder

C. Passing NH_3 through acid

D. Passing air through warn acid.

Answer: D

Watch Video Solution

26. Which of the following form maximum $P - H$ bonds.

A. H_3PO_2

B. H_3PO_4

C. H_3PO_3

D. $H_4P_2O_7$

Answer: A

Watch Video Solution

27. Scheel's green, formerly used as a green pigment for colouring wall paper is.

A. Sodium arsenite (Na_3AsO_3)

B. Cupric arsenite $(CuHAsO_3)$

C. Silver arsenite (Ag_3AsO_3)

D. None

Answer: A

View Text Solution

28. PCl_5 in solid state exists as.

A. PCl_5

B. $PCl_4^{\oplus}$

C. PCl_6

D. $PCl_4^{\oplus} PCl_6^{\ominus}$

Answer: D

Watch Video Solution

29. Graham's salt used for softening of water and other alkalis used for cleaning sinks, drains and floors is

A. $(NaPO_3)_n$

B. $(KPO_3)_n$

C. Na_3PO_4

D. K_3PO_4

Answer: A

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30. Hypophosphorous acid is

A. A tribasic acid

B. A dibaic acid

C. A monobasic acid

D. Neutral

Answer: C

Watch Video Solution

31. Nitrolim is

A. $CaCN_2$

B. $CaCN_2 + C$

C. CaC_2

D. $CaCN_2 + CaC_2$

Answer: D

Watch Video Solution

32. Nitrochalk is

A. CAN

B. $CaNCN$

C. $(NH_4)_2SO_4$

D. $Ca(NO_3)_2 . CaO$

Answer: A

View Text Solution

33. Group 15 elements are commonly known as.

A. Halogens

B. Chalcogens

C. Pnicogens

D. Normal elements

Answer: C

View Text Solution

34. Paris green was used as a pigment due to unique light green colour but now-a-days it is used as an insecticide. It is prepared by boiling verdigris (basic acetate of copper). Arsenious oxide and acetic acid together. It is

A. $(CH_3COO)_2Cu.3Cu(AsO_2)_2$

B. Curpric acetoarsenite

C. $Cu_4(CH_3COO)_2(AsO_2)_2$

D. All

Answer: A

Watch Video Solution

35. Tartar emetic (potassium antimony tartrate) is used as an emitic in small does while larger does are poisnous. It is used for the treatment of Kala-azar and such other tropical diseases. It is formed when antimonytrioxide (Sb_4O_6) is treated with potassium hydrogen tartrate. It is.

A. **a.** $\begin{array}{l}\text{CH(OH) COO (SbO)}\\ |\\ \text{CH(OH) COOK}\end{array}$

B. **b.** $\begin{array}{l}\text{CH(OH) COO (Sb)}\\ |\\ \text{CH(OH) COOK}\end{array}$

C. **c.** $\begin{array}{l}\text{CH(OH) COO } (Sb_2O_3)\\ |\\ \text{CH(OH) COOK}\end{array}$

d. $\begin{array}{l} CH(OH)\ COO\ (SbO_3) \\ | \\ CH(OH)\ COOK \end{array}$

D.

Answer: A

Watch Video Solution

36. Which of the following halide does not hydrolyse

A. $SbCl_3$

B. $AsCl_3$

C. PCl_3

D. NF_3

Answer: D

Watch Video Solution

37. Witting reagent is used for the synthesis of alkenes from ketone in organic chemistry. The Witting reagent is.

A. $(Ph_3P) = CH_2$ Triphenyl phosphine methylene

B. $(Ph_3P) = O$ Triphenyl phosphine oxide

C. $(Ph_3P)CH_3Br$

D. Ph_3P

Answer: A

Watch Video Solution

38. Pernitric acid is

A. HNO_2

B. HNO_3

C. HNO_4

D. HNO

Answer: C

View Text Solution

39. Nitrates of all metals are

A. Unstable

B. Coloured

C. Insoluble in water

D. Soluble in water

Answer: D

Watch Video Solution

40. Following tests are shown by

(i) Decolourisation of acidified soln. of $KMnO_4$

(ii) Liberation of I_2 from an acidified soln. of KI

(iii) On treatment with dil HCl, brown fumes of NO_2 which turns $FeSO_4$ soln. black.

A. Nitrites

B. Nitrates

C. Both (a) and (b)

D. Neither (a) nor (b)

Answer: A

Watch Video Solution

41. Which of the following acids possesses oxidising, reducing, and complex forming properties ?

A. HNO_3

B. HNO_2

C. H_2SO_4

D. HCl

Answer: B

Watch Video Solution

42. Acidic hydride of nitrogen is

A. NH_3

B. N_3H

C. N_2H_4

D. N_2H_2

Answer: B

Watch Video Solution

43. Among the trihalides of nitrogen, which is the least basic ?

A. NF_3

B. NCl_3

C. NBr_3

D. NI_3

Answer: A

Watch Video Solution

44. PCl_5 exists but NCl_5 does not because :

A. NCl_5 is unstable

B. Nitrogen has no vacant orbitals

C. Nitrogen atom is much smaller

D. Nitrogen is highly inert

Answer: B

Watch Video Solution

45. PCl_5 and PH_3 exist but PH_5 does not because

A. PH_5 is unstable

B. Phosphorous has no vacant orbitals

C. Phosphorous exists as P_4

D. EN of hydrogen is less as compared to chlorine to excite electron from p orbital to d orbital for bond formation.

Answer: D

Watch Video Solution

46. The structure of phosphide ion is smaller to that of

A. Nitride ion

B. Chloride ion

C. Fluoride ion

D. Sodium ion

Answer: B

Watch Video Solution

47. Calcium phosphide is used in smoke screen because it.

A. Burns to form soot

B. Gives phosphine which catches fire to give needed smoke

C. Immediately catches fire in air

D. Is a gas which brings tears in the eyes

Answer: B

Watch Video Solution

48. Holme's signals produce burning gases which serve as a signal to the approaching ships contains.

A. A mixture of Ca_3P_2 and CaC_2

B. A mixture of Ca_3P_2 and KOH

C. A mixture of CaC_2 and KOH

D. A mixture of CaP_2, CaC_2 and KOH.

Answer: A

Watch Video Solution

49. Among the following the strongest acid is

A. H_3PO_2

B. H_3PO_3

C. H_3PO_4

D. $H_4P_2O_7$

Answer: D

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50. Basicity of H_3PO_4 and H_3PO_3 are

A. $3, 3$

B. $3, 2$

C. $2, 3$

D. $2, 2$

Answer: B

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51. Phosphoric acid is syrupy in nature due to hydrogen bonding. Each molecule of H_3PO_4 is surrounded by

A. $4-H-bonds$

B. $5-H-bonds$

C. $2-H-bonds$

D. Infinite-H-bonds

Answer: A

Watch Video Solution

52. PCl_3, P_4O_6 and P_4O_{10}, PCl_5 on hydrolysis gives respectivey.

A. H_3PO_3 and H_3PO_4

B. H_3PO_4 and H_3PO_3

C. $(HPO_3)_n$ and $H_4P_2O_7$

D. $H_4P_2O_7$ and $(HPO_3)_n$

Answer: A

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53. If phosphorous acid is allowed to react with sufficient quantity of KOH, the product obtained is.

A. K_3PO_3

B. KH_2PO_3

C. K_2HPO_3

D. $KHPO_3$

Answer: C

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54. Which one of the following pairs is obtained on heating ammonium dichromate ?

A. N_2 and H_2O

B. N_2O and H_2O

C. NO and H_2O

D. NO and NO_2

Answer: A

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55. By mixing ammonium chloride to potassium nitrite and heating, we get

A. Ammonium nitrate

B. $KNH_4(NO_3)_2$

C. Nitrogen

D. Nitrogen dioxide

Answer: C

Watch Video Solution

56. In salt which on heating gives a mixture of two gases is

A. $NaNO_3$

B. KNO_3

C. $Pb(NO_3)_2$

D. NH_4NO_3

Answer: A

Watch Video Solution

57. Ammonia is not used

A. In anaesthesia

B. In medicine

C. In cold storages

D. For preparation of artificial silk

Answer: A

Watch Video Solution

58. Which one of the following is used for drying of ammonia ?

A. $conc.\ H_2SO_4$

B. CaO

C. P_2O_5

D. Anhydrous $CaCl_2$

Answer: B

Watch Video Solution

59. Phosphorus is kept in

A. Kerosene

B. Alcohol

C. Water

D. Ammonal

Answer: C

Watch Video Solution

60. It is recommended that ammonia bottles be opened after cooling in ice for sometime. This is because

A. It brings tears to eyes

B. It has high vapour pressure

C. It is corrosive liquid

D. It is mild explosive

Answer: B

View Text Solution

61. Silver chloride dissolves in excess of NH_4OH. The cation present in solution is.

A. $[Ag(NH_3)]^{\oplus}$

B. $\left[Ag(NH_3)_4\right]^{\oplus}$

C. $\left[Ag(NH_3)_2\right]^{\oplus}$

D. $\left[Ag(NH_3)_6\right]^{\oplus}$

Answer: C

Watch Video Solution

62. When NH_4OH is added to copper sulphate solution, blue colour is obtained due to formation of

A. $Cu(NH_3)_4SO_4$

B. $Cu(NH_3SO_4)_2$

C. $Cu(OH)_2$

D. CuO

Answer: A

Watch Video Solution

63. A certain element is forms a solid oxide which dissolves in water to form an acidic solution. The element is

A. Na

B. Mg

C. S

D. P

Answer: D

Watch Video Solution

64. A colourless gas X forms a brown coloured gas when mixed with air. The gas X is

A. N_2O

B. NO

C. NH_3

D. NO_2

Answer: B

Watch Video Solution

65. The number of $P-O-P$ and $P-OH$ bonds present respectively in pyrophosphoric acid molecule are

A. $2, 3$

B. $1, 8$

C. $1, 4$

D. $1, 2$

Answer: C

Watch Video Solution

66. When ammonia is heated with CO_2 under pressure, the product is

A. $(NH_4)_2CO_3$

B. NH_2CONH_2

C. NH_2COONH_4

D. NH_4HCO_3

Answer: B

Watch Video Solution

67. Phosphorus is used in

A. Rubber industry

B. Cement industry

C. Photography

D. Match industry

Answer: D

Watch Video Solution

68. When phosphine is bubbled through a solution of nitrate ___ is precipitated.

A. Silver

B. Silver phosphide

C. Silver oxide

D. None of these

Answer: B

Watch Video Solution

69. When orthophosphoric acid is heated at $240^{\circ}C$, the main product formed is.

A. H_3PO_3

B. H_3PO_2

C. HPO_3

D. $H_4P_2O_7$

Answer: D

Watch Video Solution

70. Complete manure is that which supplies

A. S, K and N

B. N, K and P

C. S and N

D. S, N and P

Answer: B

View Text Solution

71. Industrial preparation of nitric acid by Ostwald's process involves.

A. Oxidation of NH_3

B. Reduction of NH_3

C. Hydrogenation of NH_3

D. Hydrolysis of NH_3

Answer: A

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72. When treated with nitric acid which of the following liberates hydrogen ?

A. Zinc

B. Copper

C. Magnesium

D. Mercury

Answer: C

Watch Video Solution

73. concentrared nitric acid oxidises cane sugar to

A. CO_2 and H_2O

B. CO and H_2O

C. CO, CO_2 and H_2O

D. Oxalic acid and water

Answer: D

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74. White P reacts with caustic soda, the products are PH_3 and NaH_2PO_2. This reaction is an example of:

A. Oxidation

B. Reduction

C. Neutralisation

D. Disproportionation

Answer: D

Watch Video Solution

75. White phosphorus may be removed from red phosphorus by

A. Sublimation

B. Distillation

C. Dissolving in CS_2

D. Heating in air

Answer: C

Watch Video Solution

76. Which one of the acids is a dibasic acid ?

A. H_3PO_3

B. H_3PO_2

C. HPO_3

D. H_3PO_4

Answer: A

Watch Video Solution

77. Which one of the following can be used as an anaesthetic?

A. NH_3

B. N_2O

C. NO

D. NO_2

Answer: B

Watch Video Solution

78. The catalyst used in the manufacture of ammonia by Haber process is

A. Pt

B. Fe

C. Mo

D. V_2O_5

Answer: B

Watch Video Solution

79. The catalyst used in the manufacture of NO by Ostwald's process is

A. Pt

B. Fe

C. Mo

D. Cu

Answer: A

Watch Video Solution

80. Which of the following properties of white phosphorus are shared by red phosphorus ?

A. It phosphorescences in air

B. It burns when heated in air

C. It dissolves in CS_2

D. It reacts with $NaOH$ to give PH_3

Answer: B

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81. The number of $P-O-P$ bridge in the structure of phosphorous pentoxide and phosphorus trioxide are respectively

A. $5, 5$

B. $5, 6$

C. $6, 6$

D. $6, 5$

Answer: C

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82. Nitrogen molecule is chemically less active because of its

A. Small dissociation enegry

B. High dissociation energy

C. High electronegativity

D. Stable electronic configuration

Answer: B

Watch Video Solution

83. Addition of conc. HNO_3 to conc. H_2SO_4 gives

A. SO_4^{2-}

B. SO_3

C. $NO_3^{\ominus}$

D. $NO_2^{\oplus}$

Answer: D

Watch Video Solution

84. The reaction between $NH_2^{\ominus}$ and N_2O gives

A. NO

B. N_2O_5

C. NH_2NH_2

D. $N_3^{\ominus}$

Answer: D

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85. Red phosphorus is less reactive than yellow phosphorus because

A. Its colour is red

B. It is highly polymerised

C. It is tetratomic

D. It is hard

Answer: B

Watch Video Solution

86. Aqua regia is

A. $Conc.\ HNO_3 + 2conc.\ HCl$

B. $Conc.\ HNO_3 + 3conc.\ HCl$

C. $Conc.\ HNO_3 + NO_2$

D. $Conc.\ HNO_3 + conc.\ H_2SO_4$

Answer: B

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87. The number of steps, in which orthophosphoric acid is ionised, are

A. 1

B. 2

C. 3

D. 4

Answer: C

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88. Phosphorous is usually extracted from

A. Phosphorite

B. Apatite

C. Chlorapatite

D. Triphylite

Answer: A

View Text Solution

89. PCl_5 is kept in well stopered bottles because

A. It is highly volatile

B. It reacts readily with moisture

C. It reacts with oxygen

D. It is explosive

Answer: B

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90. The BCl_3 is a polar molecule whereas NCl_3 is pyramidal because

A. $N - Cl$ bond is more covalent than $B - Cl$ bond

B. $B - Cl$ bond is more polar than $N - Cl$ bond

C. Nitrogen atom is smaller than boron

D. BCl_3 has no lone pair but NCl_3 has a lone pair of electron.

Answer: D

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91. N_2 forms NCl_3 whereas P can form both PCl_3 and PCl_5. Why ?

A. P has d-orbitals which can be used for bonding but N does not have.

B. N atom is larger than P in size

C. P is more reactive towards Cl than N

D. None of the above

Answer: A

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92. $Cl - P - Cl$ bond angles in PCl_5 molecule are

A. 120° and 90°

B. 60° and 90°

C. 60° and 120°

D. 120° and 30°

Answer: A

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93. Hyarolysis of NCl_3 gives NH_3 and X. Which of the following is X ?

A. $HClO_4$

B. $HClO_3$

C. $HOCl$

D. $HClO_2$

Answer: C

Watch Video Solution

94. Chlorine reacts with excess of ammonia to form.

A. NH_4Cl

B. $N_2 + HCl$

C. $N_2 + NH_4Cl$

D. $N_2 + NCl_3$

Answer: C

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95. The following are some statements related to group 15 hydrides.

(i) Reducing property increases from NH_3 to BiH_3

(ii) Tendency to donate lone pair decreases from NH_3 to BiH_3

(iii) Thermal stability of hydrides decreases from NH_3 to BiH_3

(iv) Bond angle decreases from NH_3 to BiH_3.

A. (i), (ii), (iii) and (iv)

B. (i), (iii) and (iv)

C. (i), (ii) and (iv)

D. (i) and (iv)

Answer: A

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96. The atomicity of phosphorus is X and the $P-P-P$ bond angle is Y. What are X and Y ?

A. $X=4, Y=90^{\circ}$

B. $X=4, Y=60^{\circ}$

C. $X=3, Y=120^{\circ}$

D. $X=2, Y=180^{\circ}$

Answer: B

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97. The reaction of P with X leads selectively to P_4O_6. X is

A. A dry O_2

B. A mixture of O_2 and N_2

C. Moist O_2

D. O_2 in presence of aqueous $NaOH$

Answer: B

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98. Atoms in P_4 molecule of white phosphorus are arranged regularly in the followinf way :

A. At the corners of a cube

B. At the corners of an octahedron

C. At the corners of a tetrahedron

D. At the centre and corners of a tetrahedron.

Answer: C

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99. Phosphine, acetylene and ammonia can be formed by treating water with

A. Mg_3P_2, Al_4Cl_3, Li_3N

B. Ca_3P_2, CaC_2, Mg_3N_2

C. Ca_3P_2, CaC_2, $CaCN_2$

D. Ca_3P_2, Mg_2C, NH_4NO_3

Answer: B

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100. The cyanide ion CN and N_2 are isoelectronic, but in contrast to CN^-, N_2 is chemically inert, because of

A. Low bond energy

B. Absence of bond polarity

C. Unsymmetrical electron distribution

D. Presence of more number of electrons in bonding orbitals.

Answer: B

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101. Nitrogen forms N_2 but phosphorous when forms P_2 gets readily converted into P_4 because

A. Triple bond is present between phosphorus atoms

B. $p\pi - p\pi$ bonding is weak

C. $p\pi - p\pi$ bonding is strong

D. Multiple bond is formed easily.

Answer: B

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102. In NO_3^- ion, the number of bond pair and lone pair of electrons on nitrogen atom are:

A. $2, 2$

B. $3, 1$

C. $1, 3$

D. $4, 0$

Answer: D

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103. Blue liquid which is formed at $-30^{\circ} C$ by mixing of two gases is.

A. N_2O_3

B. N_2O

C. N_2O_4

D. N_2O_5

Answer: A

Watch Video Solution

104. The element which forms oxides in all oxidation states $+1$ to $+5$ is.

A. N

B. P

C. As

D. Sb

Answer: A

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Exercises Integer

1. Nitrogen forms how many oxides

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2. How many lone pairs are present in nitrogen molecule ?

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3. In group 15 elements, the number of unpaired electrons in valence shell is___.

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4. How many $P-O-P$ bonds are present in P_4O_8 ?

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5. In solid PCl_5 molecule, how many $P-Cl$ bonds are present in the cation ?

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6. What is the basicity of pyrophosphoric acid ?

Watch Video Solution

7. How many $\sigma - bonds$ are present in N_2O_3 ?

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8. When excess of ammonia and chlorine react, nitrogen and ammonium chloride are formed. Write the balanced equation and find out how manty ammonium chloride molecules are involved in the balanced equation ?

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9. What is the atomicit of phosphorous ?

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10. How many $N - O(\sigma)$ bonds are present in N_2O_5 ?

Watch Video Solution

11. In P_4O_{10}, how many oxygen atoms are bonded to each phosphorous atoms ?

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12. How many unpaired electrons are present in NO molecule ?

Watch Video Solution

13. The number of vacant orbitals in the valence shell of phosphorous is ____.

Watch Video Solution

14. How many hydrogen bonds are formed by each H_3PO_4 molecule ?

Watch Video Solution

15. On hydrolysis, of calcium phosphide, how many moles of phosphine are formed ?

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16. How many lone pairs are present in white phosphorous ?

Watch Video Solution

17. How many bridging oxygen atom are present in P_4O_{10} ?

Watch Video Solution

18. How many moles of H_3PO_4 are obtained on hydrolysis of one mole of P_4O_8.

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Watch Video Solution

19. On hydrolysis of magnesium nitrate, how many moles of ammonia are produced ?

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20. How many electrons are present in the valence shell of P in PCl_3 ?

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Exercises Fill In The Blanks

1. When phosphine is bubbled through a solution of nitrate ___ is precipitated.

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2. The most non-metallic element in group 15 is ____.

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3. The group 15 element having maximum tendency to form multiple bond is ___ .

Watch Video Solution

4. The most explosive halide of N is ____ .

Watch Video Solution

5. PCl_3 react will water to give ____ and ____ .

Watch Video Solution

6. The most metallic element group 15 is _____ .

Watch Video Solution

7. Aqueous solution of ammonia consists of

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8. Ammonia has much higher boiling point than phosphine due to _____ .

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9. $BiCl_3$ on hydrolysis forms a white precipitate of _____.

Watch Video Solution

10. Phosphorous normally exhibits a covalency of _____ and ____ .

Watch Video Solution

11. The $P-P-P$ bond angle in white phosphorous is _____ .

Watch Video Solution

12. The number of hydroxyl groups in pyrophosphric acid is _____ .

Watch Video Solution

13. The basicity of phosphoric acid is _____ .

Watch Video Solution

14. The number of vacant orbitals in the valence shell of phosphorous is ____.

Watch Video Solution

15. NF_3 is ____ Lewis base as compared to NH_3.

Watch Video Solution

Exercises True False

1. Atomicity of nitrogen is four.

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2. Antimony does not show allotropy.

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3. Both red and white phosphorous are soluble in CS_2.

Watch Video Solution

4. Mixture used in Holme's signal is CaC_2 and Ca_3N_2.

Watch Video Solution

5. PH_3 is less basic than NH_3.

Watch Video Solution

6. In white phosphorous $\angle PPP = 90^\circ$.

Watch Video Solution

7. The solid oxide of nitrogen is N_2O.

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8. PCl_3 has pyramidal shape.

Watch Video Solution

9. The lightning bolts in the atmosphere causes the formation of nitric oxide.

Watch Video Solution

10. Ammonia acts as a Lewis base due to the presence of lone pair of electrons on N-atom.

Watch Video Solution

11. Nitrogen is an inert molecule due to low bond dissociation enthalpy.

Watch Video Solution

12. PCl_5 behaves as a Lewis acid.

Watch Video Solution

13. NCl_3 is a stable compound.

Watch Video Solution

14. N_2O is used as an anesthetic in dental surgery.

View Text Solution

15. NO_2 is a mixed anhydride.

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16. N_2O_3 is known as laughing gas.

Watch Video Solution

17. Yellow phosphorous is polymeric in nature.

Watch Video Solution

18. Phosphorous does not show oxidation state of $+4$.

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19. CAN is hygroscope so its pellets are coated with calcuin silicate so as to product with calcium silicate so as to product from mixture.

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20. Graham's salt is $(NaPO_3)_n$ and is used in softening of hard water.

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Exercises Archives Linked Comprehension

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

Which of the following statement is correct ?

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 adundant in earth's crust.

D. Oxidation of nitrates is possible in soil.

Answer: C

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

A. Between NH_3 and PH_3, NH_3 is a better electron donar 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 donar because the lone pair of electrons occupies sp^3-orbital and is more directional.

C. Between NH_3 and OH_3, NH_3, is a better electron donar 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 donar because the lone pair of electrons occupies spherical s-orbital and is less directional.

Answer: C

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

White phosphorous on reaction with $NaOH$ gives PH_3 as one of the products. This is a.

A. dimerisation reaction

B. disproportionation reaction

C. condensation reaction

D. precipitation reaction.

Answer: B

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Exercises Archives Multiple Correct

1. Nitrogen (I) oxide is product by

A. thermal decomposition of ammonium nitrate

B. disproportionation of N_2O_4

C. thermal decomposition of ammonia nitrate

D. interaction of hydroxylamine and nitrous acid.

Answer: A::D

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2. White phosphorus (P_4) has

A. Six $P-P$ single bonds

B. Four $P-P$ single bonds

C. Four lone pairs of electrons

D. PPP "angle" of 60°

Answer: A::C::D

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3. Ammonia , on reaction with hypochlorite anion, can form

A. NO

B. NH_4Cl

C. N_2H_4

D. HNO_2

Answer: C

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4. The nirogen oxide (s) that contains $N-N$ bonds is/are

A. N_2O

B. N_2O_3

C. N_2O_4

D. N_2O_5

Answer: A::B::C

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Exercises Archives Single Correct

1. Which of the following statement is incorrect ?

A. NO is heavier than O_2

B. The formula of heavy water in D_2O.

C. Nitrogen diffuses faster than oxygen through an orifice.

D. NH_3 can be used as a refrigerant.

Answer: A

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2. Ammonia gas can be dried by

A. $conc.\ H_2SO_4$

B. P_2O_5

C. $CaCl_2$

D. quick lime

Answer: D

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3. A gas that cannot be collected over water is.

A. N_2

B. O_2

C. SO_2

D. PH_3

Answer: C

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4. Bonds present in N_2O_5 are.

A. only ionic

B. covalent and coordinate

C. only covalent

D. covalent and ionic

Answer: B

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5. Which of the following oxides of nitrogen is a coloured gas ?

A. N_2O

B. NO

C. NH_3

D. NO_2

Answer: D

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6. Among the trihalides of nitrogen, which is the least basic ?

A. NF_3

B. NCl_3

C. NBr_3

D. NI_3

Answer: A

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7. Which of the following is the strongest base ?

A. AsH_3

B. NH_3

C. PH_3

D. SbH_3

Answer: B

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8. The number of $P-O-P$ bonds in cyclic metaphosphoric acid is.

A. zero

B. two

C. three

D. four

Answer: C

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9. Which is the most thermodynamically stable allotropic form of phosphorus ?

A. red

B. white

C. black

D. yellow

Answer: C

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10. Blue liquid which is formed at $-30^{\circ}C$ by mixing of two gases is.

A. N_2O

B. N_2O_3

C. N_2O_4

D. N_2O_5

Answer: B

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11. The reaction of P with X leads selectively to P_4O_6. X is

A. dry O_2

B. A mixture of O_2 and N_2

C. Moist O_2

D. O_2 in presence of aqueous $NaOH$

Answer: B

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12. Extra pure N_2 can be obtained by heating

A. $NH_3 with CuO$

B. NH_4NO_3

C. $(NH_4)_2Cr_2O_7$

D. $Ba(N_3)_2$

Answer: D

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13. The reaction of white phosphorous with aqueous $NaOH$ gives phosphine along with another phosphorous containing compound. The reason type , the oxidation state of phosphorous in phosphine and in the other products are, respectively,

A. redox reaction , -3 and -5

B. redox reaction , $+3$ and $+5$

C. disproportionation reaction , -3 and $+5$

D. Disproportionation reaction , -3 and $+3$.

Answer: C

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14. Which ordering of compounds is according to the decreasing order of the oxidation state of nitrogen ?

A. HNO_3, NO, NH_4Cl, N_2

B. HNO_3, NO, N_2, NH_4Cl

C. HNO_3, NH_4Cl, NO, N_2

D. NO, HNO_3, NH_4Cl, N_2

Answer: B

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15. Concentrated HNO_3, upon long standing, turns yellow-brown due to the formation of

A. NO

B. NO_2

C. N_2O

D. N_2O_4

Answer: B

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16. Which of the following properties is not shown by NO ?

A. It combines with oxygen to form nitrogen dioxide.

B. It's bond order is 2.5

C. It is diamagnetic in gaseous state

D. It is a neutral oxide.

Answer: C

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17. The product formed in the reaction of $SOCl_2$ (thionyl chloride) with white phosphorous is.

A. PCl_3

B. SO_2Cl_2

C. SCl_2

D. $POCl_3$

Answer: A

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Exercises Archives Assertion Reasoning

1. Although PF_5, PCl_5 and PBr_5 are known, the pentahalides of nitrogen have not been observed.

Phosphorous has lower electronegativity than nitrogen.

A. Assertion (A) is true , Reason (R) is also true , Reason (R) is the correct explanation for Assertion (A).

B. Assertion (A) is true , Reason (R) is true , Reason (R) is not the correct explanation for Assertion (A).

C. Assertion (A) is true , Reason (R) is false.

D. Assertion (A) is false , Reason (R) is true.

Answer: B

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2. HNO_3 is a stronger acid than HNO_2

In HNO_2, there are two nitrogen to oxygen bonds, whereas in HNO_2 there is only one.

A. Assertion (A) is true , Reason (R) is also true , Reason (R) is the correct explanation for Assertion (A).

B. Assertion (A) is true , Reason (R) is true , Reason (R) is not the correct explanation for Assertion (A).

C. Assertion (A) is true , Reason (R) is false.

D. Assertion (A) is false , Reason (R) is true.

Answer: A

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Exercises Archives Interger

1. What is the total number of diprotic acid among the following ?

$H_3PO_4, H_2SO_4, H_3, PO_3, H_2CO_3, H_2S_2O_7, H_3BO_3, H_3PO_2, H_2CrO_4, H$

.

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2. Among the following , the number of compounds that can react with PCl_5 to give $POCl_3$ is.

$O_2, CO_2, SO_2, H_2O, H_2SO_4, P_4O_{10}$.

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Exercises Archives Fill In The Blanks

1. ____phosphorus is reactive because of its highly strained tetrahedral structure.

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2. The basicity of phosphorus acid (H_3PO_3) is _____ .

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3. In P_4O_{10}, the number of oxygen atoms bonded to each phosphorus atom is _____ .

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Exercises Archives True False

1. The $H-H-H$ bond angle in NH_3 is greater than the $H-As-H$ bond angle in AsH_3.

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2. Nitric oxide, though an odd electron molecule, is diamagenetic in liquid state.

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Exercises Archives Subjective

1. Write the balanced equation involved in the preparation of

(a) bleaching powder from slaked lime

(b) nitric oxide from nitric acid

(c) chlorine from sodium chloride.

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2. Explan the following in not more than two sentances :

(i) Concentrated HNO_3 turns yellow in sunlight.

(ii) Bleaching powder loses its bleaching property when it is kept in an open bottle for a long lime.

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3. Give the structural formula for the following :

(i) Phosphorous acid, H_3PO_3

(ii) Pyrophosphoric acid, $H_4P_2O_7$.

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4. Explain why 'orthophosphoric acid, H_3PO_4, is tribasic but phosphorus acid, H_3PO_3, is dibasic'.

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5. Write the resonance structure of nitrous oxide.

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6. (i) Write the balanced equations for the reactions when ammonium sulphate is heated with a mixture of nitric oxide and nitrogen dioxide.

(ii) Aqueous ammonia is added dropwise to a solution of copper sulphate till is in excess.

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7. Write balanced equations for the following :

(i) Phosphorus is reacted with boiling aqueous solution of sodium hydroxide in an inert atmosphere.

(ii) Dilute nitric acid is slowly reacted with metallic tin.

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8. Explain the following in one or two sentances only :

"Orthophosphorous acid is not a tribasic acid".

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9. Give balanced equations for the following :

Phosphorous reacts with nitric acid to give equimolar ratio of nitric oxide and nitrogen dioxide.

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10. Write the balanced chemical equations when hypophosphorus acid is heated.

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11. Explain the following

(i) H_3PO_3 is a dibasic acid.

(ii) Phosphine has lower boiling point than ammonia.

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12. Write balanced equation for

(i) The preparation of phosphine from CaO and white phosphorus.

(ii) The preparation of ammonium sulphate from gypsum, ammonia and carbon dioxide.

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13. Write two resonance structure of N_2O that satisfy the octet rule.

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14. Write balanced chemical equations for the following :

(i) Sodium nitrite is produced by absorbing the oxides of nitrogen in aqueous solution of washing soda.

(ii) Nitrogen is obtained in the reaction of aqueous ammonia with potassium permanganate.

(iii) Elemental phosphorus reacts with $conc.\ HNO_3$ to give phosphoric acid.

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15. Arrange the following as stated :

Increasing order of the extent of hydrolysis :

$CCl_4, MgCl_2, AlCl_3, PCl_3, PCl_5, SiCl_4.$

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16. Give reason in one or two sentences.

"Ammonium chloride is acidic in liquid ammonia solvent".

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17. Complete and balance the following chemical reactions : Red phosphorus is reacted with iodine in the presence of water of form H_3PO_3 and HI.

$2P + 3I_2 + 6H_2O \rightarrow$.

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18. Identify the compounds A and B.

$PCl_5 + SO_2A + B \rightarrow$.

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19. Complete and balance the following reactions.

$Ca_5(PO_4)_3F + H_2SO_4 + H_2O \xrightarrow{Heat}$.

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20. Account for the following :

(i)The experimentally determined $N - F$ bond length in NF_3 is greater than the sum of the single bond covalent radii of N and F.

(ii) Mg_3N_2 when reacted with water gives NH_3 but HCl is not obtained from $MgCl_2$ on reaction with water at room temperature.

(iii) $(SiH_3)_3N$ is a weaker base than $(CH_3)_3N$.

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21. Draw the structure of P_4O_{10} and identify the number of single and double $P - O$ bonds.

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22. A soluble compound of a poisonous element M, when heated with Zn/H_2SO_4, gives a colourless and extremely poisonous gaseous compound N, which of passing through a heated tube gives a silvery mirror of element M. Indentify M and N.

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23. Reaction of phosphoric acid with $Ca_5(PO_4)_3F$ yields a fertiliser 'triple superphosphate'. Represent the same through balanced chemical equations.

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24. Complete and balance the following equation :

$P_4O_{10} + PCl_5 \rightarrow .$

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25. In the following equation :

$A + 2B + H_2O \rightarrow C + 2D$

$A = HNO_2, B = H_2SO_3, C = NH_2OH$

Identify D. Draw the structure of A, B, C and D.

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26. Give reason, why elemental nitrogen exists as a diatomic molecule, whereas elemental phosphorus is a tetratomic molecule.

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27. Write the balanced equations for the reactions of the following compounds with H_2O.

(i) $CaNCN$

(ii) NCl_3.

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28. How many grams of CaO are required to neutralise $852g$ of P_4O_{10} ?

Draw the structure of P_4O_{10}.

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