

P Block Elements Chemistry Questions with Solutions

Q1. Why do noble gases have low boiling points?

Answer: Noble gases are mono-atomic gases. They do not have intermolecular forces and have very weak London dispersion forces. Thus, they have low boiling points.

Q2. Why is white phosphorus more reactive than red phosphorus?

Answer: White phosphorus is more reactive than red phosphorus due to the presence of angle strain in it. The angle is 60° instead of the 109.5° seen in standard tetrahedral geometry. Red Phosphorus forms a chain-like polymeric network of tetrahedral units bonded covalently and thus is more stable and less reactive than white phosphorus.

Q3. Determine the oxidation number of Phosphorus in H_3PO_2 molecule.

Answer: The oxidation number of phosphorus in H_3PO_2 is calculated as shown below:

Oxidation number of Hydrogen is: 1

Oxidation number of Oxygen is: -2

Let Oxidation number of phosphorus be x.

$$1(3) + x + 2(-2) = 0$$

$$3 + x - 4 = 0$$

$$x = +1.$$

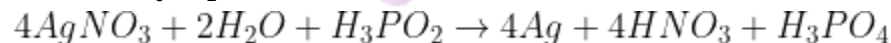
Therefore, the oxidation number of phosphorus is +1 in H_3PO_2 .

Q4. What is the structure of the XeF_2 molecule?

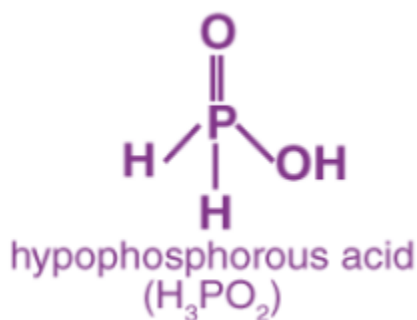
Answer: The structure of the XeF_2 molecule is given below.

Q5. Explain the reducing behaviour of H_3PO_2 by a reaction.

Answer: H_3PO_2 reduces silver nitrate to elemental silver as shown in the reaction below.

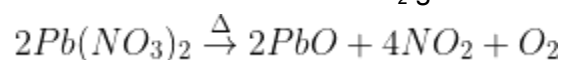


Greater the number of P-H bonds, the greater the reducing power of oxyacids of Phosphorus. H_3PO_2 has 2 P-H bonds, thus it acts as a strong reducing agent and itself gets oxidized to +5 oxidation state.



Q6. Identify the gas released on heating $\text{Pb}(\text{NO}_3)_2$.

Answer: A brown colored NO_2 gas is released when lead nitrate is heated.



Q7. Choose the correct statement

- (a) HCl is a weaker acid than HF
- (b) On going down group 17, boiling point increases
- (c) Cl has lower electron affinity than F
- (d) Cl_2 has lower dissociation energy than F_2

Answer: (b)

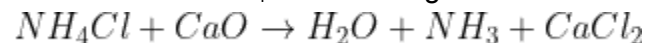
Reason: On going down the group, the size of halogens increases. Due to increase in size, van der Waals forces of attraction also increase, leading to an increase in boiling points.

Q8. Which molecule given below does not produce nitrogen on heating?

- (a) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$
- (b) $\text{NH}_4\text{Cl} + \text{NaNO}_2$
- (c) $\text{NH}_4\text{Cl} + \text{CaO}$
- (d) $\text{Ba}(\text{N}_3)_2$

Answer: (c)

The reaction of $\text{NH}_4\text{Cl} + \text{CaO}$ is given below:



Q9. Which chemical depletes the ozone layer?

- (a) Sulfur
- (b) Hydrogen
- (c) Nitrogen
- (d) Chlorofluorocarbons (CFCs)

Answer: (d)

CFCs are harmful chemicals responsible for warming the lower layer of the atmosphere causing global warming and they also deplete the ozone layer which protects the earth from harmful UV-rays of the sun.

Q10. Which catalyst is used in the contact process for the production of sulfuric acid?

- (a) V_2O_5
- (b) Al_2O_3
- (c) SO_3
- (d) Fe_2O_3

Answer: (a) V_2O_5 increases the rate of the reaction and also reduces the need for high temperatures.

Q11. Why is phosphorus relatively reactive compared to nitrogen?

Answer: Nitrogen is less reactive than Phosphorus because nitrogen has a triple bond and phosphorus has a single bond. It requires a higher amount of energy to break the bonds of nitrogen and thus they are chemically inert.

Q12. Match the following items of column 1 with column 2 and choose the correct answer:

Column 1	Column 2
1) Sulfur	A) Tear gas
2) Sulphuric acid	B) Storage batteries
3) Chlorine gas	C) Chalcogen
4) Trichloronitromethane	D) Highest electron gain enthalpy

Answer:

Column 1	Column 2
1) Sulfur	C) Chalcogen
2) Sulphuric acid	B) Storage batteries
3) Chlorine gas	D) Highest electron gain enthalpy
4) Trichloronitromethane	A) Tear gas

Q13. Match the following items of column 1 with column 2 and choose the correct answer:

Column 1 (Molecule)	Column 2 (Bond angle in degrees)
1) NH_3	a) 109.5
2) H_2O	b) 180

3) CH ₄	c) 104.5
4) CO ₂	d) 107

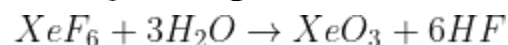
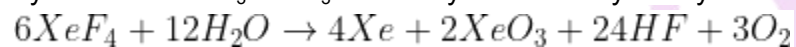
Answer:

Column 1 (Molecule)	Column 2 (Bond angle in degrees)
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2) H ₂ O	b) 104.5
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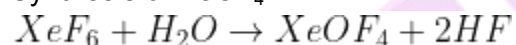
Q14. Write the preparation methods of XeO₃ and XeOF₄

Answer:

Synthesis of XeO₃: XeO₃ can be synthesized by 2 ways-



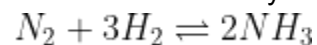
Synthesis of XeOF₄:



Q15. Explain the industrial preparation of Ammonia.

Answer:

Ammonia is produced in large quantities industrially using a process called Haber's process. In this process, atmospheric nitrogen is combined with hydrogen reversibly to form ammonia. Iron is used as a catalyst and molybdenum is used as a promoter for this reaction. It is carried out under high pressure (200 atm - 400 atm) and high temperature (500° C). It is a highly efficient process and gives 98% conversion efficiency. The reaction is given below:



Practise Questions on P block elements

Q1. What are group 15 elements collectively called?

- a) Chalcogens
- b) Pnictogens
- c) Halogens
- d) Icosagens

Answer: (b)

Q2. What is the trend in ionic radii for $\text{As}^{(3+)}$, $\text{Bi}^{(3+)}$ and $\text{Sb}^{(3+)}$

Answer: Ionic radii increases down the group. Therefore the order is $\text{Bi}^{3+} > \text{Sb}^{3+} > \text{As}^{3+}$

Q3. What are the relative acidic strengths of HCl, HBr, HF and HI?

Answer: HF is the weakest acid compared to the other three due to strong 2p-1s orbital overlap. Down the group, size of halogen atoms increases and thus orbital overlap decreases. This increases the acidic strength. Thus acidic strength follow the trend $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$

Q4. What is the chemical formula of oleum?

- a) H_2SO_5
- b) $\text{H}_3\text{S}_2\text{O}_6$
- c) $\text{H}_2\text{S}_2\text{O}_7$
- d) $\text{H}_2\text{S}_2\text{O}_8$

Answer: (c)

Q5. Write the electronic configuration of oxygen, nitrogen and sulphur

Answer: The electronic configuration of oxygen is: $1s^2 2s^2 2p^4$

The electronic configuration of nitrogen is: $1s^2 2s^2 2p^3$

The electronic configuration of sulphur is: $1s^2 2s^2 2p^6 3s^2 3p^4$