

Group-18 Elements: Noble Gases

SINGLE CORRECT CHOICE TYPE QUESTIONS

- Which of the following elements has the highest ionization energy?
(A) He
(B) Ne
(C) F
(D) H
- The most abundant inert gas element is
(A) Ne
(B) Ar
(C) He
(D) Xe
- Which of the following elements is used in cryoscopic study for superconductivity?
(A) Liquid bromine
(B) Mercury liquid
(C) Liquid nitrogen
(D) Liquid helium
- Which of the following properties does not increase from helium to xenon?
(A) Boiling point
(B) Atomic radius
(C) Rate of diffusion through glass
(D) None of these
- When XeO_3 reacts with XeOF_4 , the product formed is
(A) XeO_4
(B) XeO_2F_2
(C) XeOF_2
(D) XeO_3F_2

MULTIPLE CORRECT CHOICE TYPE QUESTIONS

- When liquid helium is cooled below the λ -point temperature, which of the following abrupt changes is/are observed in the properties?
(A) Increase in thermal conductivity
(B) The viscosity becomes zero
(C) It becomes a superconductor and shows zero electrical resistance.
(D) The liquid can flow up the sides of the vessel.
- Which of the following statements is/are true for XeOF_4 molecule?
(A) It is planar.
(B) It has a total of 15 lone pairs.
(C) It hydrolyses to produce XeO_3 .
(D) The shape is square pyramidal.
- Which of the following properties are a consequence of the small size of the noble gases?
(A) Clathrate compounds are not formed by helium.
(B) Rate of diffusion through glass is very high for helium.
(C) Extent of London force is the lowest for helium.
(D) Abundance in atmosphere is poor.
- Which of the following momentarily occurring species have fractional bond order?
(A) He_2^+
(B) HeH^+
(C) HeH^{2+}
(D) Ar_2^+
- How many of the following molecules have trigonal bipyramidal electronic geometry for their central atom?
(A) XeO_3F_2
(B) XeF_2
(C) XeF_4
(D) XeOF_2

COMPREHENSION TYPE QUESTIONS

Passage 1: For Questions 1 and 2

In 1962, Bartlett coined the new branch of chemistry of noble gas Xe and the first compound of Xe detected (wrongly) was $\text{Xe}^+[\text{MF}_6]^-$.

- What was the concept involved behind the idea that xenon can combine with other elements to form compounds when the experiment was started?
(A) IE_1 of Xe is close to that of O atom.
(B) IE_1 of Xe $\approx \text{IE}_1$ of O_2 molecule.
(C) ΔH_{eg1} of Xe $\approx \Delta H_{\text{eg1}}$ of O-atom.
(D) ΔH_{eg1} of Xe $\approx \Delta H_{\text{eg1}}$ of O_2 molecule.
- IE_1 of noble gases is in the order $\text{He} > \text{Ne} > \text{Ar} > \text{Kr} > \text{Xe} > \text{Rn}$. Accordingly, which of the following statements is correct?
(A) Rn should form compounds more easily than Xe.
(B) Kr should form compounds more easily than Xe.
(C) Rn and Kr both should form compounds with equal ease.
(D) None of the above prediction is correct.

Passage 2: For Questions 3 to 5

Xenon fluorides are very good oxidizing agent, fluorinating agents and also can act as F donors and F acceptors.

- When XeF_4 donates its fluoride to SbF_5 , then the states of hybridization of central atoms of cationic part and anionic part of the product formed are:
(A) sp^3d , sp^3d^2
(B) sp^3d^2 , sp^3d
(C) sp^3d , sp^3d
(D) sp^3d^2 , sp^3d^2
- XeO_4 is obtained when
(A) Xe reacts with O_2 directly.
(B) XeF_4 is hydrolyzed and disproportionated to give XeO_4 .
(C) XeF_6 is hydrolyzed in alkaline medium followed by treatment with conc. H_2SO_4 at low temperature.
(D) XeF_6 is hydrolyzed in neutral medium followed by reaction with O_2 .
- The state of hybridization in the Xe compound obtained in alkaline hydrolysis product of XeF_6 is
(A) sp^3d^2
(B) sp^3d^3
(C) d^2sp^3
(D) sp^3d

ASSERTION-REASONING TYPE QUESTIONS

In the following set of questions, a Statement I is given and a corresponding Statement II is given below it. Mark the correct answer as:

- (B) If both Statement I and Statement II are true but Statement II is not the correct explanation for Statement I
(C) If Statement I is true but Statement II is false.
(D) If Statement I is false and Statement II is true.

- Statement I:** Helium is used in preference to N_2 to dilute O_2 in the gas cylinder used by divers.

Statement II: Helium has lower solubility in blood as compared to N_2 ; thus minimising the risk of bend.

- Statement I:** In the adduct $[\text{XeF}_6 \cdot \text{AsF}_5]$, XeF_6 acts as fluoride donor.

Statement II: XeF_6 acts as a Lewis base.

- (A) If both Statement I and Statement II are true and Statement II is the correct explanation of Statement I.

- Statement I:** When Pt is fluorinated with XeF_2 , it is mixed with anhydrous HF.

Statement II: Reactivity of XeF_2 increases greatly due to the formation of XeF^+ .

- Statement I:** XeO_4 with oxidation state of Xe as +8 is formed, but XeF_8 does not form.

Statement II: Steric crowding is more for XeF_8 than in XeO_4 .

- Statement I:** The variable oxidation state of Xe is observed by jump of two units.

Statement II: The valence shell electronic configuration is $5s^25p^6$ and on excitation it always produces an even number of unpaired electrons.

INTEGER ANSWER TYPE QUESTIONS

The answer to each of the following is a non-negative integer.

- Find the number lone pairs in XeO_2F_2 .
- Find the number of d -orbitals used for bonding of XeOF_4 .
- When XeF_2 fluorinates Ph_2S , the product is $\text{Ph}_2\text{SF}_2 + \text{Xe}$. Find the difference in the number of d -orbitals involved in bonding of reactants to product.
- In the following reaction, find the difference in oxidation state of Xe in the underlined species (numerical value only).

$$2[\text{H XeO}_4]^- + 2\text{OH}^- \rightarrow [\text{XeO}_6]^{4-} + \text{Xe} + \text{O}_2 + 2\text{H}_2\text{O}$$
- Find the number of molecules that can form clathrate compounds from the following:
 $\text{O}_2, \text{Kr}, \text{SO}_2, \text{H}_2\text{S}, \text{Xe}, \text{Ar}, \text{MeCN}, \text{MeOH}$
- The maximum number of identical angles in $[\text{XeF}_8]^{2-}$ is ____.

MATRIX-MATCH TYPE QUESTIONS

In each of the following questions, statements are given in two columns, which have to be matched. The statements in Column I are labelled as (A), (B), (C) and (D), while those in Column II are labelled as (P), (Q), (R), (S) and (T). Any given statement in Column I can have correct matching with one or more statements in Column II.

1. Match the compounds with their properties.

| Column I | Column II |
|---------------------|--|
| (A) XeO_3 | (P) Powerful explosive. |
| (B) XeF_2 | (Q) Acts as fluoride donor. |
| (C) XeO_4 | (R) Central atom carries at least one lone pair. |
| (D) XeOF_4 | (S) It is formed by the reaction between XeO_3 and XeF_6 |
| | (T) It is formed by the reaction of Na_4XeO_6 with conc. H_2SO_4 at -9°C |

2. Match the compounds with their properties.

| Column I | Column II |
|------------------------------|---|
| (A) XeO_6^{4-} | (P) Central atom is sp^3d^2 hybridized. |
| (B) XeF_4 | (Q) On treatment with conc. H_2SO_4 produces XeO_4 . |
| (C) XeO_3 | (R) Only one lone pair is present on the central atom. |
| (D) XeO_2F_2 | (S) Central atom of the molecule has four surrounding atoms. |

ANSWERS

Single Correct Choice Type Questions

1. (A) 2. (B) 3. (D) 4. (C) 5. (B)

Multiple Correct Choice Type Questions

1. (A), (B), (C), (D) 2. (B), (C), (D) 3. (A), (B), (C) 4. (A), (C), (D) 5. (A), (B), (D)

Comprehension Type Questions

1. (B) 2. (A) 3. (A) 4. (C) 5. (A)

Assertion-Reasoning Type Questions

1. (A) 2. (C) 3. (A) 4. (A) 5. (A)

Integer Answer Type Questions

1. 11 2. 3 3. 0 4. 2 5. 8 6. 8

Matrix-Match Type Questions

1. (A) \rightarrow (P), (R)
 (B) \rightarrow (Q), (R)
 (C) \rightarrow (P), (T)
 (D) \rightarrow (R), (S)
2. (A) \rightarrow (P), (Q)
 (B) \rightarrow (P), (S)
 (C) \rightarrow (R)
 (D) \rightarrow (R), (S)