

1. The difference between electron gain enthalpies will be maximum between :

[2023 (06 Apr Shift 1)]

- (1) Ne and F
- (2) Ar and F
- (3) Ne and Cl
- (4) Ar and Cl

2. Match List I with List II

List I Oxide		List II Type of bond	
A	N ₂ O ₄	I	1 N = O bond
B	NO ₂	II	1 N - O - N bond
C	N ₂ O ₅	III	1 N - N bond
D	N ₂ O	IV	1 N = N / N ≡ N bond

Choose the correct answer from the options given below :

[2023 (06 Apr Shift 1)]

- (1) A - III, B - I, C - II, D - IV
- (2) A - II, B - IV, C - III, D - I
- (3) A - III, B - I, C - IV, D - II
- (4) A - II, B - I, C - III, D - IV

3. Match List-I with .

List-I Name of reaction		List-II Reagent used	
A	Hell-Volhard Zelinsky reaction	I	NaOH + I ₂
B	Iodoform reaction	II	(i) CrO ₂ Cl ₂ , CS ₂ (ii) H ₂ O
C	Etard reaction	III	(i) Br ₂ / red phosphorus (ii) H ₂ O
D	Gatterman-Koch reaction	IV	CO, HCl, anhyd. AlCl ₃

Choose the correct answer from the options given below:

[2023 (06 Apr Shift 1)]

- (1) A → III; B → I; C → II; D → IV
- (2) A → I; B → II; C → III; D → IV
- (3) A → III; B → II; C → I; D → IV
- (4) A → III; B → I; C → IV; D → II

4. XeF₄ reacts with SbF₅ to form [XeF_m]ⁿ⁺ [SbF_y]²⁻ m + n + y + z = ?.

[2023 (08 Apr Shift 1)]

5. The ratio of sigma and π bonds present in pyrophosphoric acid is

[2023 (08 Apr Shift 2)]

6. The difference in the oxidation state of Xe between the oxidised product of Xe formed on complete hydrolysis of XeF₄ and XeF₄ is

[2023 (10 Apr Shift 2)]

7. Given below are two statements :
- Statement-I : Methane and steam passed over a heated Ni catalyst produces hydrogen gas.
Statement-II : Sodium nitrite reacts with NH_4Cl to give H_2O , N_2 and NaCl .
- In the light of the above statements, choose the most appropriate answer from the options given below :

[2023 (11 Apr Shift 1)]

- (1) Statement I is incorrect but Statement II is correct
- (2) Both the statements I and II are incorrect
- (3) Statement I is correct but Statement II is incorrect
- (4) Both the statements I and II are correct

8. Given below are two statements, one is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A: A solution of the product obtained by heating a mole of glycine with a mole of chlorine in presence of red phosphorous generates chiral carbon atom.

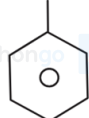
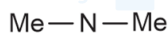
Reason R: A molecule with 2 chiral carbons is always optically active.

In the light of above statements, chose the correct answer from the options given below:

[2023 (11 Apr Shift 2)]

- (1) **A** is true but **R** is false
 - (2) Both **A** and **R** are true but **R** is the correct explanation of **A**
 - (3) **A** is false but **R** is true
 - (4) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**
9. One mole of P_4 reacts with 8 moles of SOCl_2 to give 4 moles of A, x mole of SO_2 and 2 moles of B. A, B and x respectively are
- [2023 (11 Apr Shift 2)]
- (1) POCl_3 , S_2Cl_2 and 2
 - (2) PCl_3 , S_2Cl_2 and 4
 - (3) PCl_3 , S_2Cl_2 and 2
 - (4) POCl_3 , S_2Cl_2 and 4

10. The incorrect statement regarding the reaction given below is



'A'

[2023 (12 Apr Shift 1)]

- (1) The product 'B' formed in the above reaction is p-nitroso compound at low temperature
- (2) 'B' is N-nitroso ammonium compound
- (3) The reaction occurs at low temperature
- (4) The electrophile involved in the reaction is NO^+

11. The incorrect statement from the following for borazine is:

[2023 (13 Apr Shift 1)]

- (1) It contains banana bonds
- (2) It can react with water
- (3) It is a cyclic compound
- (4) It has electronic delocalization

12. The correct group of halide ions which can be oxidised by oxygen in acidic medium is

[2023 (13 Apr Shift 2)]

- (1) Br^- and I^- only
- (2) Br^- only
- (3) I^- only
- (4) Cl^- , Br^- and I^- only

13. The number of P – O – P bonds in $\text{H}_4\text{P}_2\text{O}_7$, $(\text{HPO}_3)_3$, and P_4O_{10} are respectively

[2023 (15 Apr Shift 1)]

(1) 0, 3, 6

(2) 0, 3, 4

(3) 1, 2, 4

(4) 1, 3, 6

ANSWER KEYS

1. (3) 2. (1) 3. (1) 4. (11) 5. (6) 6. (2) 7. (4) 8. (1)
9. (2) 10. (2) 11. (1) 12. (3) 13. (4)

1. (3)

Electron gain enthalpy is defined as the amount of energy released when an electron is added to an isolated gaseous atom. During the addition of an electron, energy can either be released or absorbed. Electron gain enthalpy decreases down the group because as we move down the group, the size of an element increases, and the effective nuclear charge decreases. Due to this, the incoming electron will experience less attraction. Thus, electron gain enthalpy decreases as we move down the group.

$$\Delta H_{\text{eg}} \text{ for chlorine} = -349 \text{ kJ mole}^{-1}$$

$$\Delta H_{\text{eg}} \text{ for Neon} = +116 \text{ kJ mole}^{-1}$$

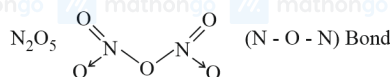
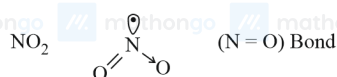
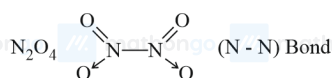
$$\Delta H_{\text{eg}} \text{ for Argon} = +96 \text{ kJmol}^{-1}$$

$$\Delta H_{\text{eg}} \text{ for fluorine} = -333 \text{ kJ mol}^{-1}$$

2. (1)

The coplanarity of N_2O_4 results from a delicate balance of the repulsive forces, which favour the skew structure, and of the effects of bonding which favour the planar structure.

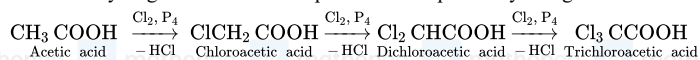
NO_2 is a bent molecule. The N_2O_5 molecule is a trigonal planar molecule. N_2O has a linear, unsymmetrical structure that may be thought of as a hybrid of two resonance forms.



3. (1)

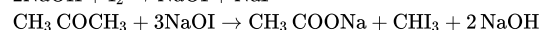
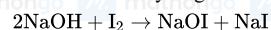
(A) Hell-Volhard-Zelinsky reaction:

Carboxylic acid react with chlorine or bromine in the presence of phosphorus to give α -halogenated carboxylic acids. The halogenation continues till all the hydrogen atom in the α -position are replaced by halogen atoms. This reaction is called HVZ (Hell-Volhard-Zelinsky) reaction.



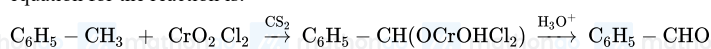
(B) Iodoform reaction:

The Iodoform reaction is a chemical reaction where an iodoform (CHI_3) is produced by the full iodination of a methyl ketone (RCOCH_3 , where R can be either a hydrogen atom, an alkyl or an aryl group) in the presence of a base.



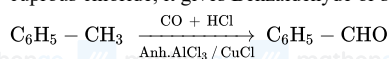
(C) Etard reaction:

In Etard reaction, chromyl chloride oxidises methyl group to a chromium complex, which on hydrolysis gives corresponding Benzaldehyde. The equation for the reaction is:



(D) Gatterman-Koch reaction

When benzene or its derivative is treated with carbon monoxide and hydrogen chloride in the presence of anhydrous aluminium chloride or cuprous chloride, it gives Benzaldehyde or substituted Benzaldehyde. The equation for the reaction is:



4. (11)

Xenon tetrafluoride (XeF_4) is square planar and acts as a fluoride donor with SbF_5 . XeF_4 changes to the cation $[\text{XeF}_3]^+$ and SbF_5 changes to the anion $[\text{SbF}_6]^-$.



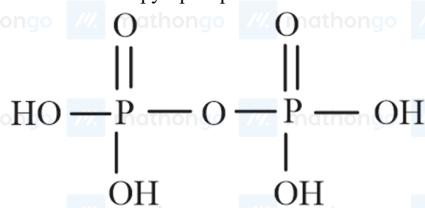
$$m = 3, n = 1, y = 6, z = 1$$

5. (6)

To determine the ratio of sigma and pi bonds in pyrophosphoric acid, we first need to understand the molecular structure of the compound.

Pyrophosphoric acid has the chemical formula $\text{H}_4\text{P}_2\text{O}_7$. The molecule contains two phosphorus atoms, seven oxygen atoms, and four hydrogen atoms.

The structure of pyrophosphoric acid is

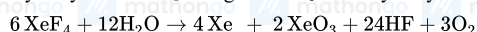


It contains total 12 sigma bonds and 2 pi bonds. So

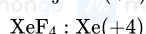
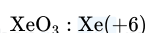
$$\frac{\text{No. of } \sigma \text{ bonds}}{\text{No. of } \pi \text{ bonds}} = \frac{12}{2} = 6 : 1$$

6. (2)

Hydrolysis of XeF_4 will give XeO_3 . This hydrolysis reaction is a redox reaction. This redox reaction is an example of disproportionation reaction.



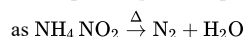
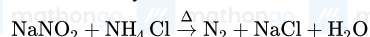
The oxidation states of Xenon in the reactant and product is



Hence, the difference in oxidation state is 2.

7. (4)

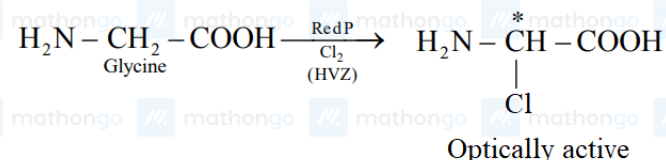
In steam-methane reforming, methane reacts with steam under 3–25 bar pressure in the presence of a nickel catalyst to produce hydrogen, carbon monoxide, and a relatively small amount of carbon dioxide. Steam reforming is endothermic, that is, heat must be supplied to the process for the reaction to proceed.



Hence, both the statements are correct.

8. (1)

When glycine is treated with chlorine in presence of red phosphorus, HVZ reaction takes place i.e., substitution of chlorine takes place at alpha carbon.



A molecule with two chiral carbons is not always optically active. Suppose the following compound is having two chiral carbons but optically inactive due to internal compensation of optical rotation.



9. (2)

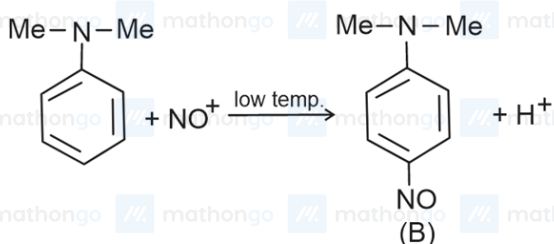
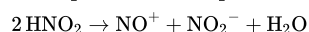
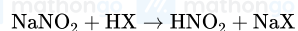
Thionyl chloride reacts with white phosphorus to produce phosphorus trichloride. The other side products in this reaction are sulphur dioxide and Sulphur monochloride.



Hence A = PCl_3 , x = 4, B = $\text{S}_2 \text{Cl}_2$

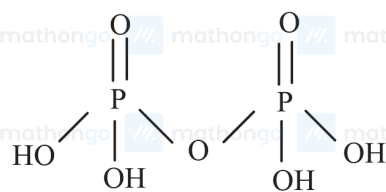
10. (2)

Nitrous acid is produced when sodium nitrate is reacted with acid. The nitrous acid can produce nitrosonium ion as electrophile. The tertiary amine given undergoes electrophilic substitution reaction with electrophile. The para substituted product is formed as major product.

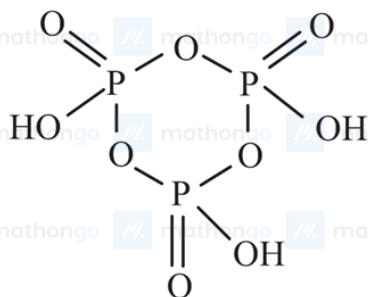


∴ Statement (2) is incorrect

13. (4) In $\text{H}_4\text{P}_2\text{O}_7$, each phosphorus undergo sp^3 hybridisation. It has one P-O-P linkage in it.

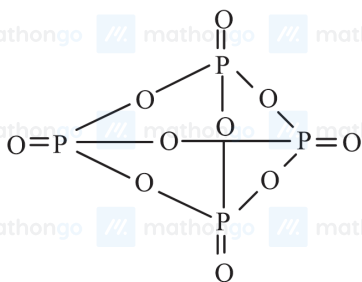


$(\text{HPO}_3)_2$



In $(\text{HPO}_3)_3$, each phosphorus undergo sp^3 hybridisation. It has three P-O-P linkages in it.

P_4O_{10}



In P_4O_{10} , each phosphorus undergo sp^3 hybridisation. It has six P-O-P linkages in it.