# FINAL JEE–MAIN EXAMINATION – APRIL, 2023

(Held On Monday 10th April, 2023) TIME : 9 : 00 AM to 12 : 00 NOON

## CHEMISTRY

## TEST PAPER WITH SOLUTIONS

### SECTION-A

**61.** Using column chromatography, mixture of two compounds 'A' and 'B' was separated. 'A' eluted first, this indicates 'B' has

(1) low $R_f$, weaker adsorption

(2) high $R_f$, stronger adsorption

(3) high $R_f$, weaker adsorption

(4) low $R_f$, stronger adsorption

**Official Ans. by NTA (4)**

**Ans. (4)**

**Sol.** If any component eluted second then it means that its $R_f$ value is low and its adsorption is stronger

$$R_f = \frac{\text{distance covered by substance from base line}}{\text{total distance covered by solvent from base line}}$$

**62.** Prolonged heating is avoided during the preparation of ferrous ammonium sulphate to

(1) prevent oxidation

(2) prevent reduction

(3) prevent hydrolysis

(4) prevent breaking

**Official Ans. by NTA (1)**

**Ans. (1)**

**Sol.** Prolonged heating will cause oxidation of $Fe^{+2}$ to $Fe^{+3}$.

**63.** Lime reacts exothermally with water to give 'A' which has low solubility in water. Aqueous solution of 'A' is often used for the test of $CO_2$, a test in which insoluble B is formed. If B is further reacted with $CO_2$ then soluble compound is formed 'A' is

(1) Quick lime (2) Slaked lime

(3) Lime water (4) White lime

**Official Ans. by NTA (2)**

**Ans. (2)**

**Sol.** $CaO + H_2O \rightarrow \underset{\text{A (less soluble)}}{Ca(OH)_2}$

$Ca(OH)_2 + CO_2 \rightarrow \underset{\text{B (insoluble)}}{CaCO_3} + H_2O$

$\underset{\text{B}}{CaCO_3} + H_2O + CO_2 \rightarrow \underset{\text{Soluble}}{Ca(HCO_3)_2}$

**64.** The pair from the following pairs having both compounds with net non-zero dipole moment is

(1) Benzene, anisidine

(2) 1,4-Dichlorobenzene, 1,3-Dichlorobenzene

(3) $CH_2Cl_2$, $CHCl_3$

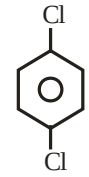
(4) cis-butene, trans-butene

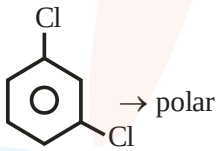
**Official Ans. by NTA (3)**

**Ans. (3)**

**Sol.** (1) Benzene → non polar

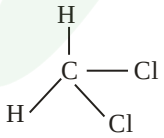
Anisidine → polar

(2)  → Non polar

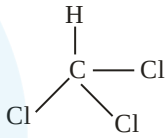


→ polar

**(3)** $CH_2Cl_2$, $\mu_{net} \neq 0$ polar



$CHCl_3$, $\mu_{net} \neq 0$ polar



(4)  ⇒ polar

 ⇒ non polar

**65.** Match List-I with List-II

| **List-I Industry** | **List-II Waste Generated** |
|---|---|
| (A) Steel plants | (I) Gypsum |
| (B) Thermal power plants | (II) Fly ash |
| (C) Fertilizer industries | (III) Slag |
| (D) Paper mils | (IV) Bio-degradable Wastes |

Choose the correct answer from the options given below:

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

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

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

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

**Official Ans. by NTA (1)**

**Ans. (1)**

**Sol.** Steel plant produces slag from blast furnace. Thermal power plant produces fly ash, Fertilizer industries produces gypsum. Paper mills produces bio degradable waste

**66.** Isomeric amines with molecular formula $C_8H_{11}N$ give the following tests

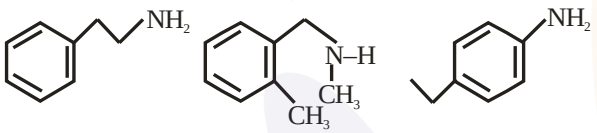
Isomer (P) $\Rightarrow$ Can be prepared by Gabriel phthalimide synthesis

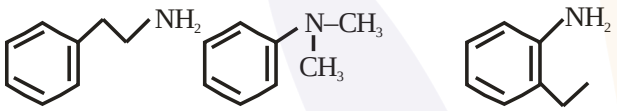
Isomer (Q) $\Rightarrow$ Reacts with Hinsberg's reagent to give solid insoluble in NaOH

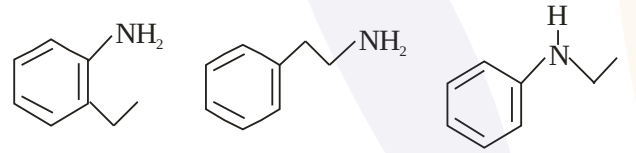
Isomer (R) $\Rightarrow$ Reacts with HONO followed by β-naphthol in NaOH to give red dye.

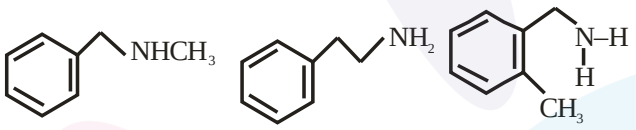
Isomers (P), (Q) and (R) respectively are

P Q R

(1) 

(2) 

(3) 

(4) 

**Official Ans. by NTA (1)**

**Ans. (1)**

**Sol.** (P) Gabriel phthalimide synthesis is used for the preparation of aliphatic primary amines. Aromatic primary amines cannot be prepared by this method.

(Q) 2°-amines reacts with Hinsberg's reagent to give solid insoluble in NaOH

(R) Aromatic primary amine react with nitrous acid at low temperature (273 – 298 K) to form diazonium salts, which form Red dye with β-Naphthol

**67.** Given below are two statements

Statement I : Aqueous solution of $K_2Cr_2O_7$ is preferred as a primary standard in volumetric analysis over $Na_2Cr_2O_7$ aqueous solution

Statement II : $K_2Cr_2O_7$ has a higher solubility in water than $Na_2Cr_2O_7$

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

(1) Both Statement I and Statement II are true

(2) Both Statement I and Statement II are false

(3) Both Statement I is true but Statement II is false

(4) Both Statement I is false but Statement II is true

**Official Ans. by NTA (3)**

**Ans. (3)**

**Sol. (1)** $K_2Cr_2O_7$ is used as primary standard. The concentration $Na_2Cr_2O_7$ changes in aq. solution.

**(2)** It is less soluble than $Na_2Cr_2O_7$.

**68.** The one that does not stabilize 2° and 3° structures of proteins is

(1) H-bonding (2) –S-S-linkage

(3) –O-O-linkage (4) van der Waals forces

**Official Ans. by NTA (3)**

**Ans. (3)**

**Sol.** 2° and 3° structure of proteins are stabilized by hydrogen bonding, disulphide linkages, Van der Waals force of attraction and electrostatic force of attraction.

**69.** Given below are two reactions, involved in the commercial production of dihydrogen ($H_2$).

The two reactions are carried out at temperature "$T_1$" and "$T_2$" respectively

$$C(s) + H_2O(g) \xrightarrow{T_1} CO(g) + H_2(g)$$

$$CO(g) + H_2O(g) \xrightarrow[\text{Catalyst}]{T_2} CO_2(g) + H_2(g)$$

The temperature $T_1$ and $T_2$ are correctly related as

(1) $T_1 > T_2$

(2) $T_1 = T_2$

(3) $T_1 = 100$ K, $T_2 = 1270$ K

(4) $T_1 < T_2$

**Official Ans. by NTA (1)**

**Ans. (1)**

**Sol.** $T_1 = 1270$ K $T_2 = 673$ K

$T_1 > T_2$ on the basis of data

**70.** Which of the following statements are correct?

(A) The $M^{3+}/M^{2+}$ reduction potential for iron is greater than manganese

(B) The higher oxidation states of first row d-block elements get stabilized by oxide ion.

(C) Aqueous solution of $Cr^{2+}$ can liberate hydrogen from dilute acid.

(D) Magnetic moment of $V^{2+}$ is observed between 4.4-5.2 BM

Choose the correct answer from the options given below:

(1) (B), (C) only (C), (D) only

(2) (A), (B), (D) only (A), (B) only

**Official Ans. by NTA (1)**

**Ans. (1)**

**Sol.** (A) The $M^{3+}/M^{2+}$ reduction potential for manganese is greater than iron

(B) $E^0_{Fe^{+3}/Fe^{+2}} = +0.77$

$E^0_{Mn^{+3}/Mn^{+2}} = +1.57$

(C) $E^0_{Cr^{+3}/Cr^{+2}} = -0.26$

$\therefore \quad Cr^{2\oplus} + H^{\oplus} \longrightarrow Cr^{3\oplus} + \frac{1}{2}H_2$

(D) $V^{2\oplus}$ = 3 unpaired electron

Magnetic Moment = 3.87 B.M

**71.** Which of the following is used as a stabilizer during the concentration of sulphide ores?

(1) Pine oils

(2) Xanthates

(3) Fatty acids

(4) Cresols

**Official Ans. by NTA (4)**

**Ans. (4)**

**Sol.** Cresol is used as stabilizer.

**72.** The octahedral diamagnetic low spin complex among the following is

(1) $[NiCl_4]^{2-}$

(2) $[CoCl_6]^{3-}$

(3) $[CoF_6]^{3-}$

(4) $[Co(NH_3)_6]^{3+}$

**Official Ans. by NTA (4)**

**Ans. (4)**

**Sol. (1)** Paramagnetic, High Spin & Tetrahedral

**(2)** Paramagnetic, High Spin & Octahedral

**(3)** Paramagnetic, High Spin & Octahedral

**(4)** Diamagnetic, Low Spin & Octahedral

$[Co(NH_3)_6]^{3+}$, CN = 6 (Octahedral)

$NH_3$ = SFL

$Co^{+3} = [Ar]3d^6$

Diamagnetic & Low spin complex

**73.** Given

(A) $2CO(g)+O_2(g) \rightarrow 2CO_2(g) \qquad \Delta H_1^{\theta} = -x\ kJ\ mol^{-1}$

(B) $C(graphite) + O_2(g) \rightarrow CO_2(g) \quad \Delta H_2^{\theta} = -y\ kJ\ mol^{-1}$

The $\Delta H^{\theta}$ for the reaction

$C(graphite) + \frac{1}{2}O_2(g) \rightarrow CO(g)$ is

(1) $\frac{x-2y}{2}$ (3) $\frac{x+2y}{2}$

(3) $\frac{2x-y}{2}$ (4) $2y - x$

**Official Ans. by NTA (1)**

**Ans. (1)**

**Sol.** Target equation

$C(graphite) + \frac{1}{2}O_{2(g)} \rightarrow CO_{(g)}$ .....(i) $\Delta H$

$C(graphite) + O_{2(g)} \rightarrow CO_{2(g)}$ .(ii) $\Delta H_1$ = - y kJ/mole

$CO_{2(g)} \rightarrow CO_{(g)} + \frac{1}{2}O_{2(g)}$ ...(iii) $\Delta H_2 = \frac{x}{2}$ kJ/mole

eq. (i) = eq.(ii) + eq (iii)

$\therefore \Delta H = \frac{x}{2} - y = \frac{x-2y}{2}$

**74.** The compound which does not exist is

(1) $NaO_2$

(2) $(NH_4)_2BeF_4$

(3) $BeH_2$

(4) $PbEt_4$

**Official Ans. by NTA (1)**

**Ans. (1)**

**Sol.** Sodium superoxide is not stable

**75.** Match List I with List II

| **List-I Polymer** | **List-II Type/Class** |
|---|---|
| (A) Nylon-2-Nylon-6 | (I) Thermosetting Polymer |
| (B) Buna-N | (II) Biodegradable polymer |
| (C) Urea-formaldehyde | (III) Synthetic rubber resin |
| (D) Dacron | (IV) Polyester |

Choose the correct answer from the options given below:

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

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

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

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

**Official Ans. by NTA (4)**

**Ans. (4)**

**Sol.**

(A) Nylon-2-nylon-6

Biodegradable polymer and polyamides (II)

(B) Buna-N → Butadiene acrylonitrile rubber → synthetic rubber (III)

(C) Urea-formaldehyde resin → Thermosetting polymer (I)

(D) Dacron → Polyester polymer of ethylene glycol and terephthalic acid (IV)

**76.** The number of molecules and moles in 2.8375 litres of $O_2$ at STP are respectively

(1) $7.527 \times 10^{22}$ and 0.250 mol

(2) $1.505 \times 10^{23}$ and 0.250 mol

(3) $7.527 \times 10^{23}$ and 0.125 mol

(4) $7.527 \times 10^{22}$ and 0.125 mol

**Official Ans. by NTA (4)**

**Ans. (4)**

**Sol.** Number of moles of $O_2 = \frac{2.8375}{22.7} = 0.125$

$\Rightarrow$ Number of molecules $= 0.125\ N_A$

$= 7.525 \times 10^{22}$

**77.** The enthalpy change for the adsorption process and micelle formation respectively are

(1) $\Delta H_{ads} < 0$ and $\Delta H_{mic} > 0$

(2) $\Delta H_{ads} < 0$ and $\Delta H_{mic} < 0$

(3) $\Delta H_{ads} > 0$ and $\Delta H_{mic} < 0$

(4) $\Delta H_{ads} > 0$ and $\Delta H_{mic} > 0$

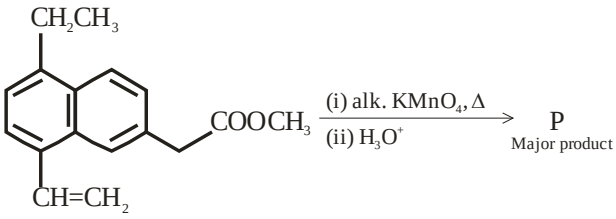
**Official Ans. by NTA (1)**

**Ans. (1)**

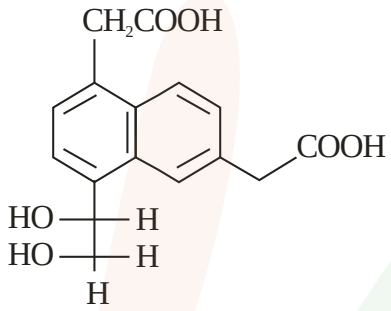
**Sol.** Adsorption is exothermic process due to decrease in surface energy

Micelle formation is endothermic

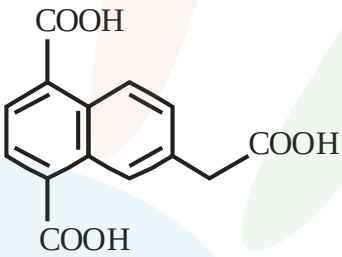
**78.** The major product 'P' formed in the given reaction is



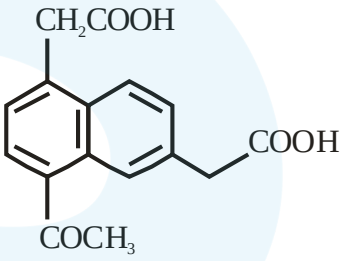

(1)



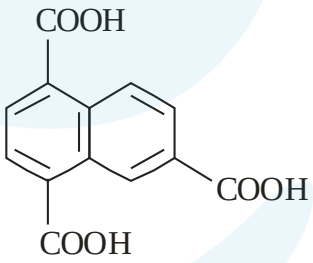

(2)




(3)




(4)

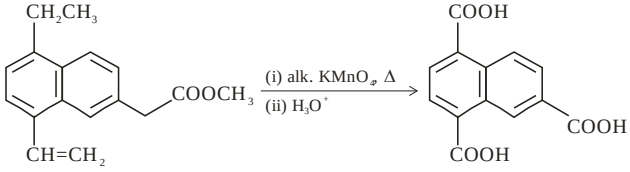



**Official Ans. by NTA (4)**

**Ans. (4)**

**Sol.**

$KMnO_4$ oxidises benzylic carbon containing atleast one α-hydrogen atom to –COOH.



**79.** Suitable reaction condition for preparation of Methyl phenyl ether is

(1) $Ph-Br,\ MeO^-Na^+$

(2) $PhO^-Na^+,\ MeOH$

(3) $PhO^-Na^+,\ MeBr$

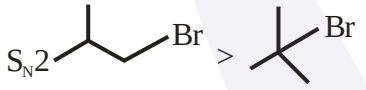
(4) Benzene, MeBr

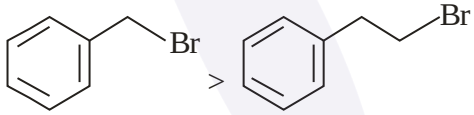
**Official Ans. by NTA (3)**

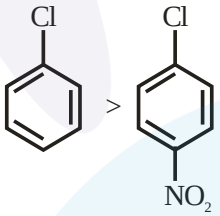
**Ans. (3)**

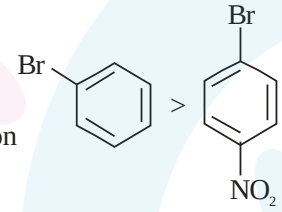
**Sol.** $PhO^-Na^+ + Me-Br \xrightarrow{S_N2} Ph-O-Me$

**80.** Identify the correct order of reactivity for the following pairs towards the respective mechanism

(A) $S_N2$ 

(B) $S_N1$ 

(C) Electrophilic substitution 

(D) Nucleophilic substitution 

Choose the correct answer from the options given below :

(1) (A), (B) and (D) only

(2) (A), (B), (C) and (D)

(3) (A), (C) and (D) only

(4) (B), (C) and (D) only

**Official Ans. by NTA (2)**

**Ans. (2)**

**Sol.**

All are correct

(A) $S_N2$ reaction decreases with increase in steric crowding.

(B) $S_N1$ reaction increases with stability of carbocation.

(C) EAS reaction decreases with decrease in electron density.

(D) Presence of electron withdrawing group at ortho and para-position to a halogen in haloarene increase nucleophilic aryl substitution.

## SECTION-B

**81.** The number of correct statement/s involving equilibria in physical process from the following is

(A) Equilibrium is possible only in a closed system at a given temperature

(B) Both the opposing processes occur at the same rate.

(C) When equilibrium is attained at a given temperature, the value of all its parameters became equal

(D) For dissolution of solids in liquids, the solubility is constant at a given temperature

**Official Ans. by NTA (3)**

**Ans. (3)**

**Sol.** (A) is correct

(B) for equilibrium $r_f = r_b$

$\Rightarrow$ (B) is correct

(C) at equilibrium the value of parameters become constant of a given temperature and not equal

$\Rightarrow$ (C) is incorrect

(D) for a given solid solute and a liquid solvent solubility depends upon temperature only

$\Rightarrow$ (D) is correct

**82.** The number of bent-shaped molecule/s from the following is _____

$N_3^-,\ NO_2^-, I_3^-, O_3, SO_2$

**Official Ans. by NTA (3)**

**Ans. (3)**

**Sol.** $N_3^-$ linear

$NO_2^-$ bent

$I_3^-$ linear

$O_3$ bent

$SO_2$ bent

**83.** A molecule undergoes two independent first order reactions whose respective half lives are 12 min and 3 min. If both the reactions are occurring then the time taken for the 50% consumption of the reactant is _____ min. (Nearest integer)

**Official Ans. by NTA (2)**

**Ans. (2)**

**Sol.** $\frac{1}{t_{1/2}} = \frac{1}{3} + \frac{1}{12} = \frac{4+1}{12} = \frac{5}{12}$

$t_{1/2} = \frac{12}{5}\text{min} = 2.4$

Ans. is 2

**84.** The number of incorrect statement/s about the black body from the following is _____

(A) Emit or absorb energy in the form of electromagnetic radiation

(B) Frequency distribution of the emitted radiation depends on temperature

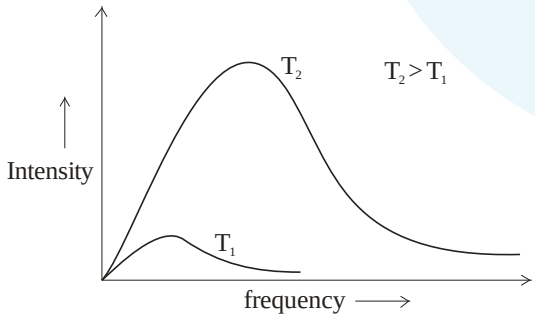
(C) At a given temperature, intensity vs frequency curve passes through a maximum value

(D) The maximum of the intensity vs frequency curve is at a higher frequency at higher temperature compared to that at lower temperature

**Official Ans. by NTA (0)**

**Ans. (0)**

**Sol.** A blackbody can emit and absorb all the wavelengths in electromagnetic spectrum $\Rightarrow$ (A) is correct




$\Rightarrow$ (B), (C), (D) correct

Ans (0)

**85.** In the following reactions, the total number of oxygen atoms in X and Y is _____

$Na_2O + H_2O \rightarrow 2X$

$Cl_2O_7 + H_2O \rightarrow 2Y$

**Official Ans. by NTA (5)**

**Ans. (5)**

**Sol.** $Na_2O + H_2O \rightarrow 2NaOH$

$Cl_2O_7 + H_2O \rightarrow 2HClO_4$

1 + 4 = 5

**86.** $FeO_4^{2-} \xrightarrow{+2.2\,V} Fe^{3+} \xrightarrow{+0.70\,V} Fe^{2+} \xrightarrow{-0.45V} Fe^0$

$E^{\theta}_{FeO_4^{2-}/Fe^{2+}}$ is x × $10^{-3}$ V. The value of x is _____

**Official Ans. by NTA (1825)**

**Ans. (1825)**

**Sol.**

$$FeO_4^{2-} \xrightarrow[n=3]{2.2V} Fe^{3+} \xrightarrow[n=1]{0.7V} Fe^{2+} \xrightarrow{-0.45V} Fe$$

E = ?

n = 4

$4 \times E = 3 \times 2.2 + 1 \times 0.7$

$E = \frac{7.3}{4} = 1.825\ V = 1825 \times 10^{-3}\ V$

**87.** If the degree of dissociation of aqueous solution of weak monobasic acid is determined to be 0.3, then the observed freezing point will be _____ % higher than the expected/theoretical freezing point. (Nearest integer)

**Official Ans. by NTA (30)**

**Ans. (30)**

**Sol.** i = 1 + α (for HA)

= 1.3

$$\%\ \text{increase} = \frac{(\Delta T_f)_{obs} - (\Delta T_f)_{cal}}{(\Delta T_f)_{cal}} \times 100$$

$$= \frac{K_f \times i \times m - K_f \times m}{K_f \times m} \times 100$$

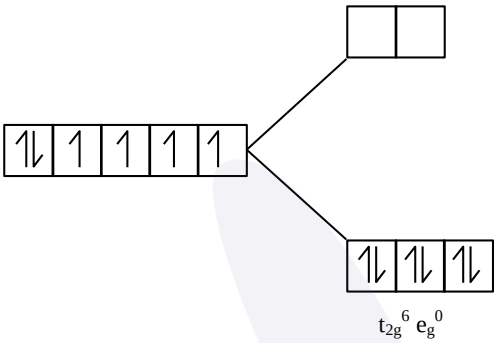
$$= \frac{i-1}{1} \times 100 = 30\%$$

**88.** In potassium ferrocyanide, there are ____ pairs of electrons in the $t_{2g}$ set of orbitals

**Official Ans. by NTA (3)**

**Ans. (3)**

**Sol.** $K_4[Fe(CN)_6]$




$Fe^{+2} = [Ar]3d^6$

$CN^-$ = SFL

$t_{2g}$ contain 6 electron so it become 3 pairs:-

**89.** At constant temperature a gas is at a pressure of 940.3 mm Hg. The pressure at which its volume decreases by 40% is _____ mm Hg.

(Nearest Integer)

**Official Ans. by NTA (1567)**

**Ans. (1567)**

**Sol.** $P_1V_1 = P_2V_2$

$940.3 \times 100 = P_2 \times 60$

$P_2 = 1567$ mm of Hg

**90.** The sum of lone pairs present on the central atom of the interhalogen $IF_5$ and $IF_7$ is _____

**Official Ans. by NTA (1)**

**Ans. (1)**

**Sol.** $IF_5$ = 1 lone pair

$IF_7$ = 0 lone pair

1+ 0 = 1