FINAL JEE–MAIN EXAMINATION – APRIL, 2023

(Held On Thursday 06th April, 2023) **TIME : 9 : 00 AM to 12 : 00 NOON**

CHEMISTRY — TEST PAPER WITH SOLUTION

SECTION-A

61. A compound is formed by two elements X and Y. The element Y forms cubic close packed arrangement and those of element X occupy one third of the tetrahedral voids. What is the formula of the compound?

(1) X_2Y_3

(2) X_3Y

(3) X_3Y_2

(4) XY_3

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Y : CCP $\Rightarrow$ 4Y

X = 1/3 THV = 1/3 × 8 $\Rightarrow$ 8/3x

$\therefore$ Formula : $X_{8/3}Y_4$ or X_2Y_3

62. **Match List I with List II**

List I Element detected		List II Reagent used/ Product formed	
A	Nitrogen	I.	$Na_2[Fe(CN)_5 NO]$
B	Sulphur	II.	$AgNO_3$
C	Phosphorous	III.	$Fe_4[Fe(CN)_6]_3$
D	Halogen	IV.	$(NH_4)_2 MoO_4$

Choose the correct answer from the options given below:

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

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

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

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

Official Ans. by NTA (4)

Allen Ans. (4)

Nitrogen detection by lassaigne's method

$Na + C + N \rightarrow NaCN$

$6NaCN + FeSO_4 \rightarrow Na_4[Fe(CN)_6] + Na_2SO_4$

$Na_4[Fe(CN)_6] + Fe^{3+} \rightarrow Fe_4[Fe(CN)_6]_3$

(Prussian blue)

Sulphur detection by Sodium nitroprusside

$Na_2[Fe(CN)_5 NO] + Na_2S \rightarrow Na_4[Fe(CN)_5 NOS]$

[Purple]

Phosphorus detection by ammonium molybdate

$Na_3PO_4 + 3HNO_3 \rightarrow H_3PO_4 + 3NaNO_3$

$H_3PO_4 + 12(NH_4)_2 MoO_4 + 21HNO_3 \rightarrow$

$(NH_4)_3 PO_4.\ 12MoO_3 + 21NH_4NO_3 + 12H_2O$

(canary yellow)

Halogen give specific coloured ppt with $AgNO_3(aq)$

$NaCl + AgNO_3(aq) \rightarrow AgCl + NaNO_3$

(White)

$NaBr + AgNO_3(aq) \rightarrow AgBr + NaNO_3$

(Pale yellow)

$NaI + AgNO_3(aq) \rightarrow AgI + NaNO_3$

(Yellow)

63. The standard electrode potential of M^+/M in aqueous solution does not depend on

(1) Ionisation of a solid metal atom

(2) Sublimation of a solid metal

(3) Ionisation of a gaseous metal atom

(4) Hydration of a gaseous metal ion

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Factual

64. Polymer used in orlon is:

(1) Polyacrylonitrile

(2) Polyethene

(3) Polycarbonate

(4) Polyamide

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. $n\ CH_2 = \underset{\displaystyle CN}{\underset{|}{CH}}$ (Acrylonitrile) $\xrightarrow{\text{Polymerisation}}$ $\left[CH_2 - \underset{\displaystyle CN}{\underset{|}{CH}} \right]_n$

Polyacrylonitrile (Orlon)

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

(1) Ne and F

(2) Ne and Cl

(3) Ar and Cl

(4) Ar and F

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. Cl has the most negative ΔH_{eg} among all the elements and Ne has the most positive ΔH_{eg}.

66. **Match List I with List II**

	List I Enzymatic reaction		List II Enzyme
A	Sucrose → Glucose and Fructose	I.	Zymase
B	Glucose→ethyl alcohol and CO_2	II.	Pepsin
C	Starch → Maltose	III.	Invertase
D	Proteins → Amino acids	IV.	Diastase

Choose the correct answer from the options given below:

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

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

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

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

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. Factual

67. The possibility of photochemical smog formation is more at

(1) The places with healthy vegetation

(2) Himalayan villages in winter

(3) Marshy lands

(4) Industrial areas

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. Photochemical smog occurs in warm, dry and sunny climate. The main components come from the action of sunlight on unsaturated hydrocarbon and nitrogen oxides produced by automobiles and factories.

68. The setting time of Cement is increased by adding

(1) Clay

(2) Silica

(3) Limestone

(4) Gypsum

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. Factual

69. Given below are two statements: one is labelled as assertion and the other is labelled as reason .

Assertion: Loss of electron from hydrogen atom results in nucles of ~1.5×10^{-3} pm size.

Reason: Proton (H^+) always exists in combined form

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

(1) Both A and R are correct and R is the correct explanation of A

(2) A is correct but R is not correct

(3) A is not correct but R is correct

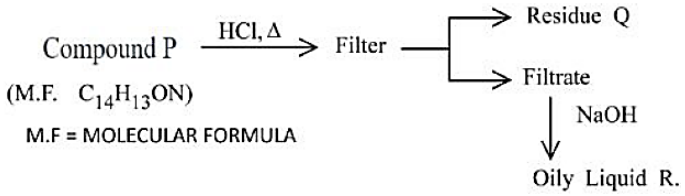
(4) Both A and R are correct but R is NOT the correct explanation of A.

Official Ans. by NTA (4)

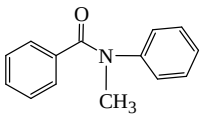
Allen Ans. (4)

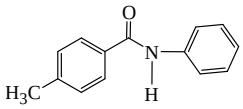
Sol. Factual

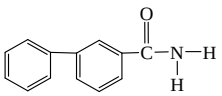
70.

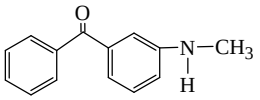


Compound P is neutral. Q gives effervescence with $NaHCO_3$ while R reacts with Hinsbergs reagent to give solid soluble in NaOH. Compound P is

(1) 

(2) 

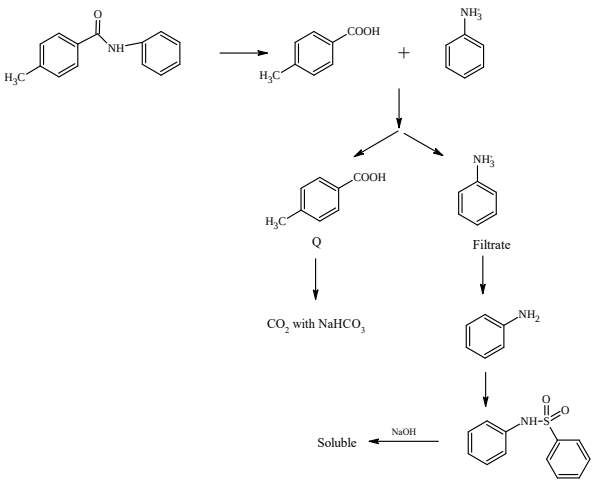
(3) 

(4) 

Official Ans. by NTA (2)

Allen Ans. (2)

Sol.



71. **Match List I with List II**

List I Name of reaction		List II Reagent used	
A	Hell-Volhard-Zelinsky reaction	I.	$NaOH + I_2$
B	Iodoform reaction	II.	(i) CrO_2Cl_2,CS_2(ii) H_2O
C	Etard reaction	III.	(i) Br_2/red phosphorus (ii) H_2O
D	Gatterman-Koch reaction	IV.	CO, HCl, anhyd. $A1C1_3$

Choose the correct answer from the options given below:

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

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

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

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

Official Ans. by NTA (4)

Allen Ans. (4)

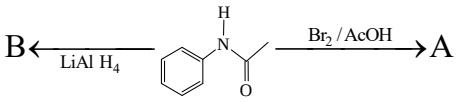
Sol. HVZ reactions = Br_2 / red P

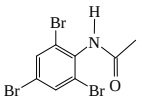
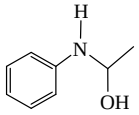
Iodoform reaction = $NaOH + I_2$

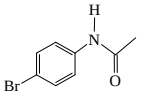
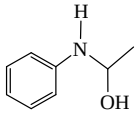
Etard reaction = (i) CrO_2Cl_2, CS_2(ii) H_2O

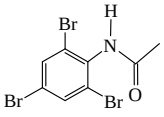
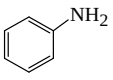
Gatterman-Koch Reaction = CO, HCl, Anhydrous, $AlCl_3$

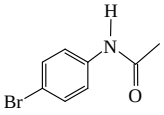
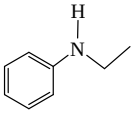
72. The major products A and B from the following reactions are:



(1) A =  B = 

(2) A =  B = 

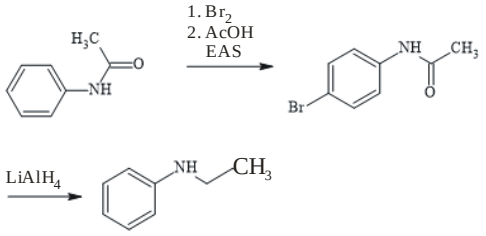
(3) A =  B = 

(4) A =  B = 

Official Ans. by NTA (4)

Allen Ans. (4)

Sol.



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

Assertion A: The spin only magnetic moment value for $[Fe(CN)_6]^{3-}$ is 1.74 BM, whereas for $[Fe(H_2O)_6]^{3+}$ is 5.92 BM.

Reason R : In both complexes, Fe is present in +3 oxidation state.

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

(1) Both A and R are true but R is NOT the correct explanation of A

(2) A is false but R is true

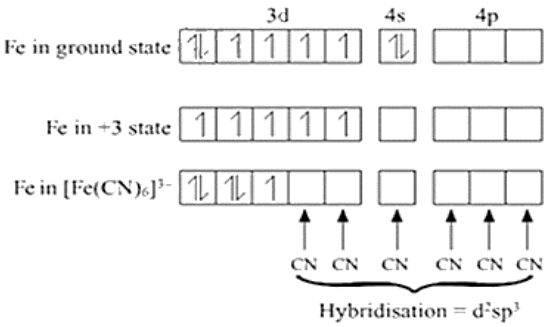
(3) A is true but R is false

(4) Both A and R are true and R is the correct explanation of A

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. $[Fe(CN)_6]^{3-}$



Unpaired electron = 1

$\mu = \sqrt{n(n+2)} = \sqrt{1\times 3} = 1.74$ B.M.

$[Fe(H_2O)_6]^{3+}$ No pairing because H_2O is WFL

Number of unpaired electrons = 5, μ = 5.92 BM

Assertion is true, Reason is true but not correct explanation.

74. **Match List I with List II**

List I Vitamin		List II Deficiency disease	
A	Vitamin A	I.	Beri-Beri
B	Thiamine	II.	Cheilosis
C	Ascorbic acid	III.	Xeropthalmia
D	Riboflavin	IV.	Scurvy

Choose the correct answer from the options given below:

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

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

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. Factual

75. Which of the following options are correct for the reaction

$2[Au(CN)_2]^-_{(aq)} + Zn(s) \rightarrow 2Au(s) + [Zn(CN)_4]^{2-}_{(aq)}$

A. Redox reaction

B. Displacement reaction

C. Decomposition reaction

D. Combination reaction

Choose the correct answer from the options given below:

(1) A and B only (2) A only

(3) C and D only (4) A and D only

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. $2\left[\overset{+1}{Au}(CN)_2\right]^- + \overset{0}{Z}n(s) \longrightarrow 2\overset{0}{Au} + \left[\overset{+2}{Zn}(CN)_4\right]^{-2}$

Zn displaced Au^+

Reduction and Oxidation both are taking place.

76. **Match List I with List II**

List I Oxide		List II Type of Bond	
A	N_2O_4	I.	1N = O bond
B	NO_2	II.	1N – O – N bond
C	N_2O_5	III.	1N – N bond
D	N_2O	IV.	1N = N / N ≡ N bond

Choose the correct answer from the options given below:

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

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

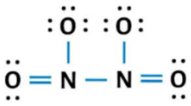
(3) A-III, B-I, C-IV, D-II

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

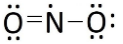
Official Ans. by NTA (4)

Allen Ans. (4)

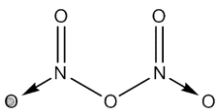
Sol. N_2O_4



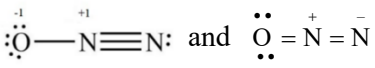
NO_2



N_2O_5



N_2O



77. Strong reducing and oxidizing agents among the following, respectively, are

(1) Ce^{4+} and Eu^{2+} (2) Ce^{4+} and Tb^{4+}

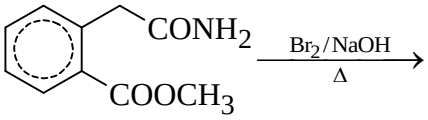
(3) Ce^{3+} and Ce^{4+} (4) Eu^{2+} and Ce^{4+}

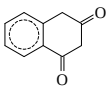
Official Ans. by NTA (4)

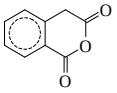
Allen Ans. (4)

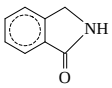
Sol. **Factual**

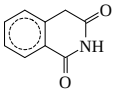
78. The major product formed in the following reaction is



(1) 

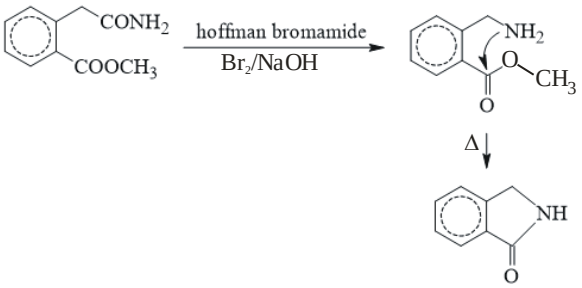
(2) 

(3) 

(4) 

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. 

79. For a concentrated solution of a weak electrolyte (K_{eq}= equilibrium constant) A_2B_3 of concentration 'c', the degree of dissociation "α' is

(1) $\left(\frac{K_{eq}}{108c^4}\right)^{\frac{1}{5}}$ (2) $\left(\frac{K_{eq}}{6c^5}\right)^{\frac{1}{5}}$

(3) $\left(\frac{K_{eq}}{5c^4}\right)^{\frac{1}{5}}$ (4) $\left(\frac{K_{eq}}{25c^2}\right)^{\frac{1}{5}}$

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. $A_2B_3(aq.) \rightleftharpoons 2A^{3+}_{(aq.)} + 3B^{2-}_{(aq)}$

$c(1-\alpha) \quad 2c\alpha \quad 3c\alpha$

$$K_{eq} = \frac{\left[A^{3+}\right]^2\left[B^{2-}\right]^3}{\left[A_2B_3\right]} = \frac{4c^2\alpha^2 \times 27c^3\alpha^3}{c(1-\alpha)}$$

$$K_{eq} == \frac{108c^5\alpha^5}{c} \quad \alpha = \left(\frac{K_{eq}}{108c^4}\right)^{\frac{1}{5}}$$

80. For the reaction:

$$RCH_2Br + I^- \xrightarrow[\text{major}]{\text{Acetone}} RCH_2I + Br^-$$

The correct statement is :

(1) The transition state formed in the above reaction is less polar than the localised anion.

(2) The reaction can occur in acetic acid also.

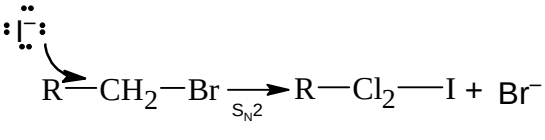
(3) The solvent used in the reaction solvates the ions formed in rate determining step.

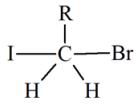
(4) Br^- can act as competing nucleophile.

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. This is finkelstein reaction



Transition state 

Clearly, the transition state is less polar than free anions. $Br^-$and I^-

Acetic acid is protic which does not support S_N2

Acetone does not solvate anion

Br^- gets precipitated and hence can not compete with I^-

So only (1)is correct

SECTION-B

81. The wavelength of an electron of kinetic energy 4.50×10^{-29}J is…… $\times 10^{-5}$ m. (Nearest integer)

Given : mass of electron is 9×10^{-31} kg, h =6.6×10^{-34} J s

Official Ans. by NTA (7)

Allen Ans. (7)

Sol. $\lambda_d = \frac{h}{mv} = \frac{h}{\sqrt{2mKE}} = \frac{6.6\times10^{-34}}{\sqrt{2\times9\times10^{-31}\times4.5\times10^{-29}}}$

$= \frac{6.6\times10^{-34}}{\sqrt{9^2\times10^{-60}}}$

$= \frac{6.6\times10^{-34}}{9\times10^{-30}} = \frac{6.6}{9}\times10^{-4}$

$= 7.3 \times 10^{-5}$ m

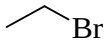
Therefore Ans = 7

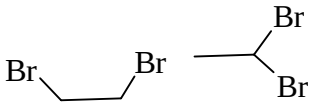
82. Number of bromo derivatives obtained on treating ethane with excess of Br_2, in diffused sunlight is…

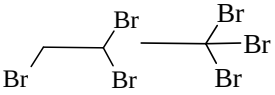
Official Ans. by NTA (9)

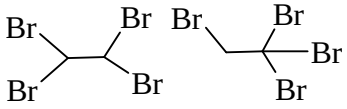
Allen Ans. (9)

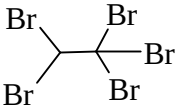
Sol. $CH_3 - CH_3 + Br_2$ (Excess) $\xrightarrow{h\nu}$

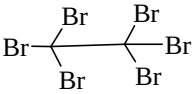
Monobromo 

Dibromo 

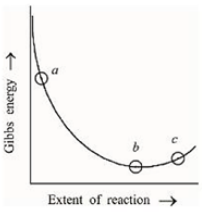
Tribromo 

Tretrabromo 

Pentabromo 

Hexabromo 

83. Consider the graph of Gibbs free energy G vs Extent of reaction. The number of statement/s from the following which are true with respect to points (a), (b) and (c) is……..



A. Reaction is spontaneous at (a) and (b)

B. Reaction is at equilibrium at point (b) and non-spontaneous at point (c)

C. Reaction is spontaneous at (a) and non-spontaneous at (c)

D. Reaction is non-spontaneous at (a) and (b)

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. For, Spontaneous process dG< 0

For, Equilibrium dG = 0

For, Nonspontaneous process dG > 0

∴ A Wrong

B Correct

C Correct

D Wrong

84. Mass of Urea (NH_2CONH_2) required to be dissolved in 1000 g of water to reduce the vapour pressure of water by 25% is……g. (Nearest integer)

Given: Molar mass of N. C. O and H are 14. 12. 16 and 1 2 mol^{-1} respectively.

Official Ans. by NTA (1111)

Allen Ans. (1111)

Sol. $$\frac{P^0 - P_s}{P_s} = \frac{n_{solute}}{n_{solvent}} = \frac{\frac{x}{60}}{\frac{1000}{18}} = \frac{P^0 - 0.75P^0}{0.75P^0}$$

$$\Rightarrow x = \frac{10000}{9} = 1111\,gm$$

Ans: 1111

85. The value of log K for the reaction A⇋ B at 298 K is ……. (Nearest integer)

Given: $\Delta H^0 = -54.07\ kJ\ mol^{-1}$

$\Delta S° = 10\ JK^{-1}\ mol^{-1}$

(Take 2.303 × 8.314 × 298 = 5705)

Official Ans. by NTA (10)

Allen Ans. (10)

Sol. $\Delta G^0 = \Delta H^0 - T\Delta S$

$\Rightarrow \Delta G^0 = (-54070 - 10 \times 298)$

Also, $\Delta G^0 = (-2.303\ RT \log K)$

$\Rightarrow (-54070 - 10 \times 298)$

$= (-2.303 \times 8.134 \times 298 \log K)$

$\Rightarrow \log K = 10$ Ans: 10

86. The number of species from the following which have square pyramidal structure is

PF_5, BrF_4^-, IF_5; BrF_5, $XeOF_4$, ICl_4^-

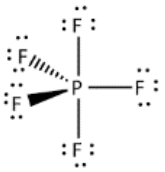
Official Ans. by NTA (3)

Allen Ans. (3)

Sol. PF_5

sp^3d (0 lone pair)

Trigonal bipyramidal



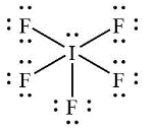
BrF_4^-,

sp^3d^2 (2 lone pair)

 square planar

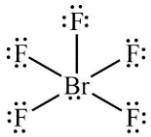
IF_5

sp^3d^2 (1 lone pair)

 square pyramidal

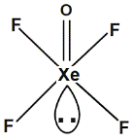
BrF_5

sp^3d^2 (1 lone pair)

 square pyramidal

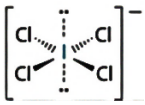
$XeOF_4$

sp^3d^2 (1 lone pair)

 square pyramidal

ICl_4^-

sp^3d^2 (2 lone pair)

 square planar

87. Number of ambidentate ligands in a representative metal complex $[M(en)(SCN)_4]$ is

[en = ethylenediamine]

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. $[M(en)(SCN)_4]$

$S = C = N^-$

Ambidentate ligand means two ligand site, so ambidentate ligand is SCN^-.

Ans: 4

88. For the adsorption of hydrogen on platinum, the activation energy is 30 kJ mol^{-1} and for the adsorption of hydrogen on nickel, the activation energy is 41.4 kJ mol^{-1}. The logarithm of the ratio of the rates of chemisorption on equal areas of the metals at 300 K is …… (Nearest integer)

Given: ln 10 = 2. 3 R = 8.3 JK^{-1} mol^{-1}

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. $K = Ae^{-\frac{E_a}{RT}}$

$K_1 = Ae^{-\frac{(E_a)_1}{RT}}$

$K_2 = Ae^{-\frac{(E_a)_2}{RT}}$

$\frac{K_2}{K_1} = e^{\frac{(E_a)_1-(E_a)_2}{RT}}$

$\log\frac{K_2}{K_1} = \frac{(E_a)_1-(E_a)_2}{2.3RT}$

$= \frac{(41.4-30)\times1000}{2.3\times8.3\times300} = 1.99$

Ans: 2

89. If 5 moles of $BaCl_2$ is mixed with 2 moles of Na_3PO_4, the maximum number of moles of $Ba_3(PO_4)_2$ formed is…….

(Nearest integer)

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. $3BaCl_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6NaCl$

5 2

Na_3PO_4 is limiting reagent.

2 mole Na_3PO_4 gives 1 mole of $Ba_3(PO_4)_2$

Ans: 1

90. In ammonium-phosphomolybdate, the oxidation state of Mo is $^{+}$……

Official Ans. by NTA (6)

Allen Ans. (6)

Sol. $(NH_4)_3PO_4.12MoO_3$

Let X = oxidation state of Mo in MoO_3

X + (–2) × 3 = 0

X = + 6

Ans: 6