FINAL JEE–MAIN EXAMINATION – APRIL,2019

(Held On Friday 12ᵗʰ APRIL, 2019)   TIME : 2 : 30 PM To 5 : 30 PM

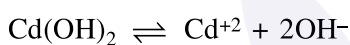| CHEMISTRY	TEST PAPER WITH ANSWER & SOLUTION

1. The molar solubility of $Cd(OH)_2$ is 1.84×10^{-5} M in water. The expected solubility of $Cd(OH)_2$ in a buffer solution of pH = 12 is :

(1) 6.23×10^{-11} M   (2) 1.84×10^{-9} M

(3) $\dfrac{2.49}{1.84} \times 10^{-9}$ M   (4) 2.49×10^{-10} M

Official Ans. by NTA (4)

Sol. $K_{sp} = 4\,(s)^3$

$= 4 \times (1.84 \times 10^{-5})^3$

$Cd(OH)_2 \rightleftharpoons Cd^{+2} + 2OH^-$

   S'   S' $(10^{-2} + S') \simeq 10^{-2}$

$S' \times (10^{-2})^2 = 4 \times (1.84 \times 10^{-5})^3$

$S' = 4 \times (1.84)^3 \times 10^{-11}$

$(S') = 2.491 \times 10^{-10}$ M

2. The correct statement is :

(1) leaching of bauxite using concentrated NaOH solution gives sodium aluminate and sodium silicate

(2) the blistered appearance of copper during the metallurgical process is due to the evolution of CO_2

(3) pig iron is obtained from cast iron

(4) the Hall-Heroult process is used for the production of aluminium and iron

Official Ans. by NTA (1)

Sol. (1) During leaching when bauxite is treated with concentrated NaOH, then sodium aluminate and sodium silicate is formed in the soluble form, whereas Fe_2O_3 is precipitated

(2) The blistered appearance of copper during the metallurgical process is due to the evolution of SO_2.

(3) Cast iron is obtained from pig iron.

(4) Hall-Heroult process is used for production of only aluminium.

3. Which one of the following is likely to give a precipitate with $AgNO_3$ solution ?

(1) $(CH_3)_3CCl$ (2) $CHCl_3$

(3) $CH_2=CH–Cl$ (4) CCl_4

Official Ans. by NTA (1)

Sol.
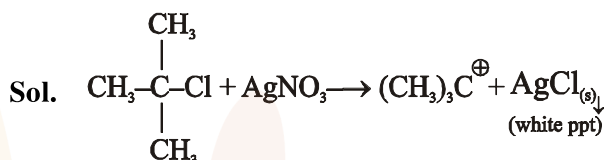
Reason :- Due to most stable carbocation formation tert-butyl chloride given the ppt immediately

4. The compound used in the treatment of lead poisoning is :

(1) EDTA   (2) Cis-platin

(3) D-penicillamine   (4) desferrioxime B

Official Ans. by NTA (1)

Sol. (1) EDTA (ethylene diamine tetra acetate) is used for lead poisoning

(2) Cis platin is used as a anti cancer drug

(3) D-penicillamine is used for copper poisoning

(4) desferrioxime B is used for iron poisoning

5. A solution is prepared by dissolving 0.6 g of urea (molar mass = 60 g mol^{-1}) and 1.8 g of glucose (molar mass = 180 g mol^{-1}) in 100 mL of water at 27°C. The osmotic pressure of the solution is :

(R = 0.08206 L atm K^{-1} mol^{-1})
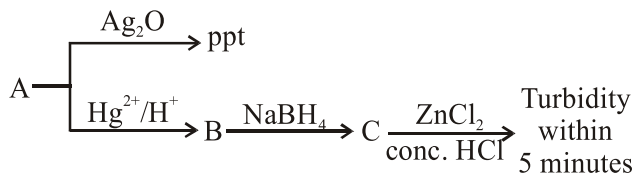
(1) 4.92 atm   (2) 1.64 atm

(3) 2.46 atm   (4) 8.2 atm

Official Ans. by NTA (1)

Sol. $\Pi = \dfrac{\left(\dfrac{0.6}{60} + \dfrac{1.8}{180}\right)}{0.1} \times 0.08206 \times 300$
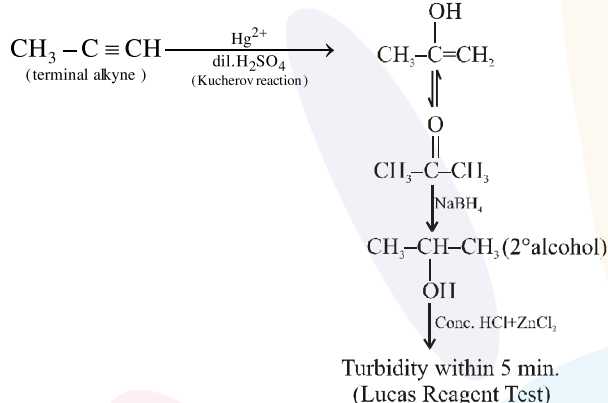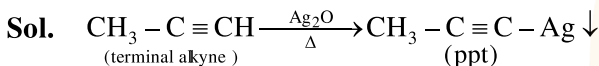
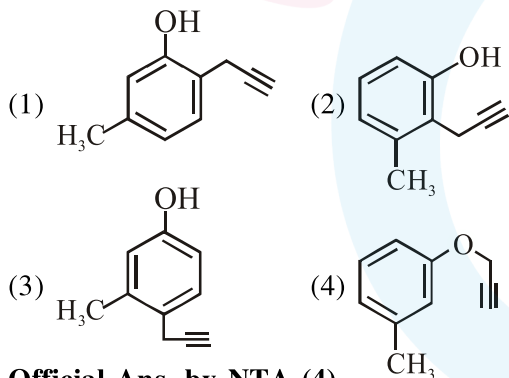$\Pi = 4.9236$ atm

6. Consider the following reactions :

$$A \begin{cases} \xrightarrow{Ag_2O} ppt \\ \xrightarrow{Hg^{2+}/H^+} B \xrightarrow{NaBH_4} C \xrightarrow[\text{conc. HCl}]{ZnCl_2} \text{Turbidity within 5 minutes} \end{cases}$$

'A' is :

(1) CH≡CH   (2) CH_3–C≡CH

(3) CH_2=CH_2 (4) CH_3–C≡C–CH_3

Official Ans. by NTA (2)

Sol.

$$CH_3 - C \equiv CH \xrightarrow[\text{(terminal alkyne)}]{Ag_2O / \Delta} CH_3 - C \equiv C - Ag \downarrow \text{ (ppt)}$$

$$CH_3 - C \equiv CH \xrightarrow[\substack{\text{dil.}H_2SO_4 \\ \text{(Kucherov reaction)}}]{Hg^{2+}} \underset{\text{(terminal alkyne)}}{CH_3 - C = CH_2} \begin{matrix} OH \\ | \end{matrix}$$

$$\Updownarrow$$

$$CH_3 - \overset{\overset{O}{\|}}{C} - CH_3$$

$$\downarrow NaBH_4$$

$$CH_3 - \underset{\underset{OH}{|}}{CH} - CH_3 \text{ (2° alcohol)}$$

$$\downarrow \text{Conc. HCl} + ZnCl_2$$

Turbidity within 5 min.
(Lucas Reagent Test)

7. What will be the major product when m-cresol is reacted with propargyl bromide (HC≡C–CH_2Br) in present of K_2CO_3 in acetone

(1) [structure: phenol with CH₃ and propargyl group, H₃C substituent]

(2) [structure: phenol with CH₃ and propargyl group]

(3) [structure: phenol with H₃C and propargyl group]

(4) [structure: O–propargyl ether with CH₃]

Official Ans. by NTA (4)

Sol.

[reaction mechanism: m-cresol + CH≡C–CH₂–Br $\xrightarrow[\text{Acetone}]{K_2CO_3}$ (SN²) → O–CH₂–C≡CH product]

[reaction: m-cresol $\xrightarrow[CO_3^{2-}]{\text{Base}}$ phenoxide, with CH₂–C≡CH / Br, SN² (Acetone) → O–CH₂–C≡CH product]
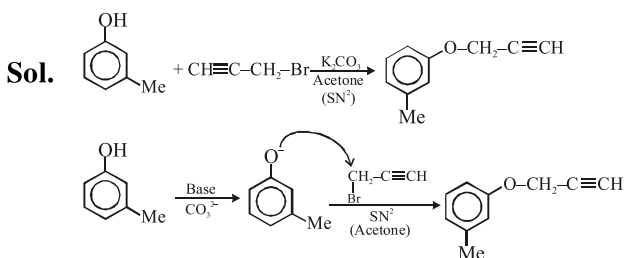
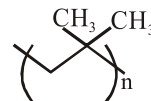**8.** The INCORRECT match in the following is :

(1) $\Delta G° < 0$, K < 1   (2) $\Delta G° = 0$, K = 1

(3) $\Delta G° > 0$, K < 1   (4) $\Delta G° < 0$, K > 1
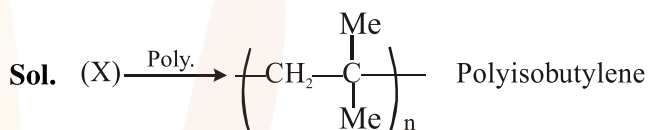
Official Ans. by NTA (1)

Sol. $\Delta G° = -RT \ln k$

if K < 1 ⇒ $\Delta G° > 0$
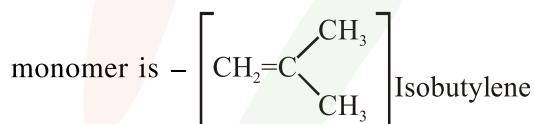
9. The correct name of the following polymer is:

$$\left[\overset{CH_3 \quad CH_3}{\underset{}{\diagup \diagdown}} \right]_n$$

(1) Polyisoprene   (2) Polytert-butylene

(3) Polyisobutane   (4) Polyisobutylene

Official Ans. by NTA (4)

Sol. (X) $\xrightarrow{Poly.}$ $\left(CH_2 - \underset{Me}{\overset{Me}{\underset{|}{\overset{|}{C}}}} \right)_n$ Polyisobutylene

As per the given structure of the polymer the

monomer is – $\left[CH_2 = \underset{CH_3}{\overset{CH_3}{\underset{\diagdown}{\overset{\diagup}{C}}}} \right]$ Isobutylene

10. Among the following, the energy of 2s orbital is lowest in :

(1) K   (2) Na   (3) Li   (4) H

Official Ans. by NTA (1)

Sol. In 'K', 2s orbital feel maximum attraction from nucleus (So having less energy) due to more Z_{eff}.

11. The primary pollutant that leads to photochemical smog is :

(1) sulphur dioxide   (2) acrolein

(3) ozone   (4) nitrogen oxides

Official Ans. by NTA (4)

Sol. Nitrogen oxides and hydrocarbons (unburnt fuel) are primary pollutant that leads to photochemical smog.

12. An 'Assertion' and a 'Reason' are given below. Choose the correct answer from the following options.

Assertion (A) : Vinyl halides do not undergo nucleophilic substitution easily.

Reason (R) : Even though the intermediate carbocation is stabilized by loosely held π-electrons, the cleavage is difficult becuase of strong bonding.

(1) Both (A) and (R) are wrong statements

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

(3) Both (A) and (R) are correct statements but (R) is not the correct explanation of (A)

(4) (A) is a correct statement but (R) is a wrong statement.

Official Ans. by NTA (4)

Sol. Vinyl halide $CH_2=CH–Cl$ do not undergo SN reaction

This is due to formation of highly unstable carbocation ($CH_2=\overset{\oplus}{CH}$) ; which cannot be delocalised by the π-electron, also C–Cl has double bond character because of resonance

Hence statement (2) is wrong.

13. The coordination numbers of Co and Al in $[Co(Cl)(en)_2]Cl$ and $K_3[Al(C_2O_4)_3]$, respectively, are :

(en=ethane-1,2-diamine)

(1) 3 and 3   (2) 6 and 6

(3) 5 and 6   (4) 5 and 3

Official Ans. by NTA (3)

Sol. en and $C_2O_4{}^{2-}$ are bidentate ligand. So coordination number of $[Co(Cl)(en)_2]Cl$ is 5 and $K_3[Al(C_2O_4)_3]$ is 6.
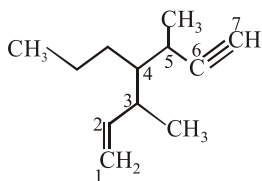
14. The IUPAC name of the following compound is :
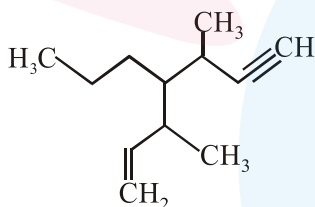
(1) 3,5-dimethyl-4-propylhept-6-en-1-yne

(2) 3-methyl-4-(3-methylprop-1-enyl)-1-heptyne

(3) 3-methyl-4-(1-methylprop-2-ynyl)-1-heptene

(4) 3,5-dimethyl-4-propylhept-1-en-6-yne

Official Ans. by NTA (4)

Sol.

3,5-Dimethyl-4-propylhept-1-en-6-yne

Longest carbon chain, including multiple bonds, and numbering starts from double bond.

15. Among the following, the INCORRECT statement about colloids is :

(1) They can scatter light

(2) They are larger than small molecules and have high molar mass

(3) The range of diameters of colloidal particles is between 1 and 1000 nm

(4) The osmotic pressure of a colloidal solution is of higher order than the true solution at the same concentration

Official Ans. by NTA (4)

Sol. Colligative properties of colloidal solution are smaller than true solution

**16.** In comparison to boron, berylium has :

(1) lesser nuclear charge and greater first ionisation enthalpy

(2) lesser nuclear charge and lesser first ionisation enthalpy

(3) greater nuclear charge and greater first ionisation enthalpy

(4) greater nuclear charge and lesser first ionisation enthalpy

Official Ans. by NTA (1)

Sol. In case of 'Be' electron remove from '2s' orbital while in case of 'B' electron remove from '2p' orbital. '2s' orbital have greater penetration effect then '2p' orbitals. So 'Be' having more I.E. then 'B'
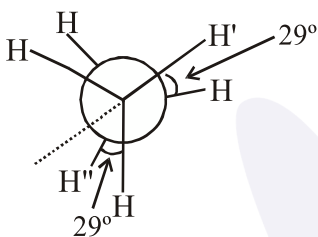
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17. In the following skew conformation of ethane, H'–C–C–H" dihedral angle is :
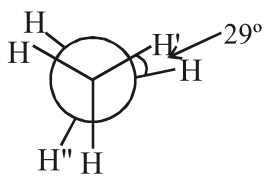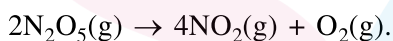

(1) 120° (2) 58°

(3) 149° (4) 151°

Official Ans. by NTA (3)

Sol.

H'–C–C–H"

Hence angle between

H'—C—C—H" is

(120° + 29°) = 149°

18. NO_2 required for a reaction is produced by the decomposition of N_2O_5 in CCl_4 as per the equation

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$.

The initial concentration of N_2O_5 is 3.00 mol L^{-1} and it is 2.75 mol L^{-1} after 30 minutes. The rate of formation of NO_2 is :

(1) 2.083×10^{-3} mol L^{-1} min^{-1}

(2) 4.167×10^{-3} mol L^{-1} min^{-1}

(3) 8.333×10^{-3} mol L^{-1} min^{-1}

(4) 1.667×10^{-2} mol L^{-1} min^{-1}

Official Ans. by NTA (4)

Sol. $2N_2O_5(g) \longrightarrow 4NO_2(g) + O_2(g)$
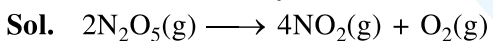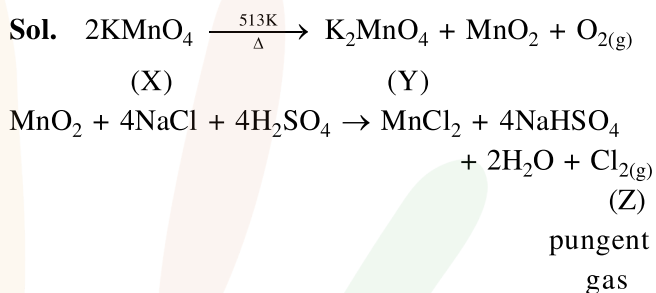
t=0 3.0M

t=30 2.75 M

$$\frac{-\Delta[N_2O_5]}{\Delta t} = \frac{0.25}{30}$$

$$\frac{1}{2} \times \frac{-\Delta[N_2O_5]}{\Delta t} = \frac{1}{4} \times \frac{\Delta[NO_2]}{\Delta t}$$

$$\frac{\Delta[NO_2]}{\Delta t} = \frac{0.25}{30} \times 2 = 1.66 \times 10^{-2} \text{ M/min}$$

19. Thermal decomposition of a Mn compound (X) at 513 K results in compound Y, MnO_2 and a gaseous product. MnO_2 reacts with NaCl and concentrated H_2SO_4 to give a pungent gas Z. X, Y and Z, respectively.

(1) K_2MnO_4, $KMnO_4$ and SO_2

(2) K_2MnO_4, $KMnO_4$ and Cl_2

(3) K_3MnO_4, K_2MnO_4 and Cl_2

(4) $KMnO_4$, K_2MnO_4 and Cl_2

Official Ans. by NTA (4)

Sol. $2KMnO_4 \xrightarrow[\Delta]{513K} K_2MnO_4 + MnO_2 + O_{2(g)}$

  (X) (Y)

$MnO_2 + 4NaCl + 4H_2SO_4 \rightarrow MnCl_2 + 4NaHSO_4$
$+ 2H_2O + Cl_{2(g)}$
(Z)
pungent
gas
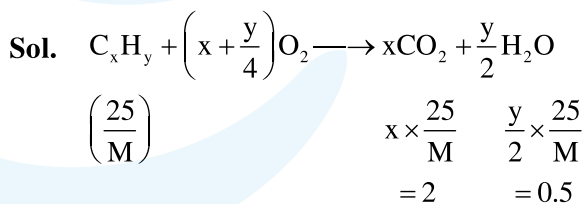
20. 25 g of an unknown hydrocarbon upon burning produces 88 g of CO_2 and 9 g of H_2O. This unknown hydrocarbon contains.

(1) 20g of carbon and 5 g of hydrogen

(2) 24g of carbon and 1 g of hydrogen

(3) 18g of carbon and 7 g of hydrogen

(4) 22g of carbon and 3 g of hydrogen

Official Ans. by NTA (2)

Sol. $C_xH_y + \left(x + \frac{y}{4}\right)O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$

$\left(\frac{25}{M}\right)$ $x \times \frac{25}{M}$ $\frac{y}{2} \times \frac{25}{M}$

        $= 2$ $= 0.5$

C $x \times \frac{25}{M} = 2$

H $y \times \frac{25}{M} = 1$

$C_{2y}H_y \equiv$ 24y gm C + y gm H

  or

  24 : 1 ratio by mass

21. Which of the given statements is INCORRECT about glycogen ?

(1) It is a straight chain polymer similar to amylose

(2) Only α-linkages are present in the molecule

(3) It is present in animal cells

(4) It is present in some yeast and fungi

Official Ans. by NTA (1)

Sol. Glycogen is an animal starch.
It consists of α-amylose and amylopectin. Amylopectin is branched chain polysaccharide Hence statement (1) is incorrect.

22. The C–C bond length is maximum in

(1) graphite   (2) C_{70}

(3) diamond   (4) C_{60}

Official Ans. by NTA (3)

Sol. In diamond C–C bond have only σ bond character while in case of graphite and fullerene (C_{60} and C_{70}) C–C bond contain double bond character. That's why diamond having maximum C–C bond length.

23. The temporary hardness of a water sample is due to compound X. Boiling this sample converts X to compound Y. X and Y, respectively, are :

(1) $Ca(HCO_3)_2$ and CaO

(2) $Mg(HCO_3)_2$ and $MgCO_3$

(3) $Mg(HCO_3)_2$ and $Mg(OH)_2$

(4) $Ca(HCO_3)_2$ and $Ca(OH)_2$

Official Ans. by NTA (3)

Sol. Temporary hardness is due to soluble $Mg(HCO_3)_2$ and $Ca(HCO_3)_2$

$Mg(HCO_3)_2 \xrightarrow{Boil} Mg(OH)_2 \downarrow + 2CO_2 \uparrow$

$Ca(HCO_3)_2 \xrightarrow{Boil} CaCO_3 \downarrow + H_2O + CO_2\uparrow$

24. The ratio of number of atoms present in a simple cubic, body centered cubic and face centered cubic structure are, respectively :

(1) 1 : 2 : 4   (2) 8 : 1 : 6

(3) 4 : 2 : 1   (4) 4 : 2 : 3
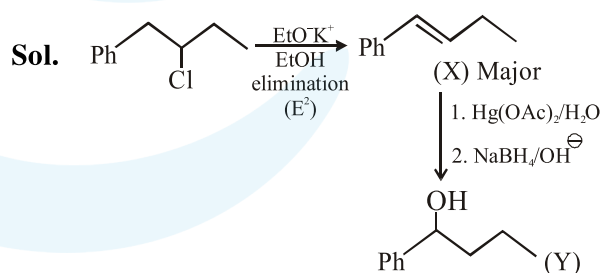
Official Ans. by NTA (1)

Sol. SC : BCC : FCC
 1 :   2 :   4

25. Heating of 2-chloro-1-phenylbutane with EtOK/EtOH gives X as the major product. Reaction of X with $Hg(OAc)_2/H_2O$ followed by $NaBH_4$ gives Y as the major product. Y is :
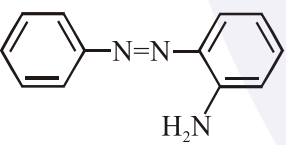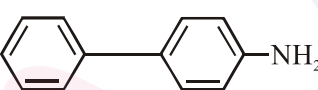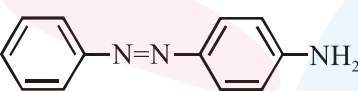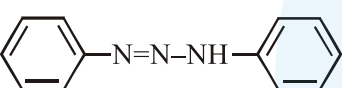

Official Ans. by NTA (4)

Sol.
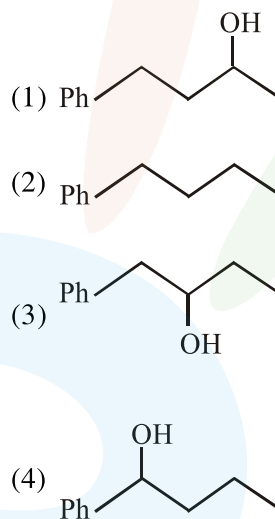
26. In which one of the following equilibria, $K_p \neq K_c$?

(1) $NO_2(g) + SO_2(g) \rightleftharpoons NO(g) + SO_3(g)$

(2) $2\,HI(g) \rightleftharpoons H_2(g) + I_2(g)$

(3) $2NO(g) \rightleftharpoons N_2(g) + O_2(g)$

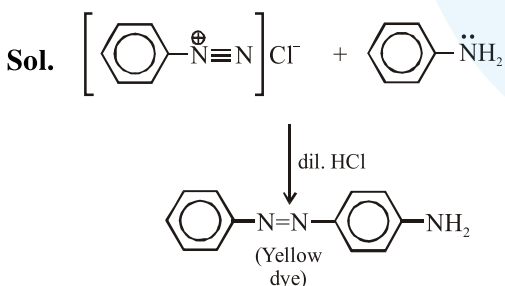(4) $2C(s) + O_2(g) \rightleftharpoons 2CO(g)$

Official Ans. by NTA (4)

Sol. if $\Delta n_g \neq 0$

$\quad K_p \neq K_c$

27. Benzene diazonium chloride on reaction with aniline in the presence of dilute hydrochloric acid gives :

(1)

(2)

(3)

(4)

Official Ans. by NTA (3)

Sol.

28. The decreasing order of electrical conductivity of the following aqueous solutions is :

0.1 M Formic acid (A),

0.1 M Acetic acid (B)

0.1 M Benzoic acid (C)

(1) C > B > A   (2) A > B > C

(3) A > C > B   (4) C > A > B
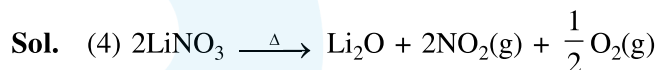
Official Ans. by NTA (3)

Sol. Order of acidic strength
A > C > B
Acidic strength $\uparrow$ $\Rightarrow$ degree of ionization $\uparrow$

29. The INCORRECT statement is :

(1) Lithium is least reactive with water among the alkali metals.

(2) LiCl crystallises from aqueous solution as $LiCl.2H_2O$.

(3) Lithium is the strongest reducing agent among the alkali metals.

(4) $LiNO_3$ decomposes on heating to give $LiNO_2$ and O_2.

Official Ans. by NTA (4)

Sol. (4) $2LiNO_3 \xrightarrow{\Delta} Li_2O + 2NO_2(g) + \dfrac{1}{2} O_2(g)$

30. The pair that has similar atomic radii is :

(1) Sc and Ni   (2) Ti and HF

(3) Mo and W   (4) Mn and Re

Official Ans. by NTA (3)

Sol. Mo and W has nearly similar atomic radius due to lanthanoid contraction.