CHEMISTRY
JEE-MAIN (July-Attempt) 27 July
(Shift-1) Paper

SECTION –A

1. Which one of the following statements is **NOT** correct?

(1) The dissolved oxygen concentration below 6 ppm inhibits fish growth

(2) Eutrophication indicates that water body is polluted

(3) Eutrophication leads to increase in the oxygen level in water

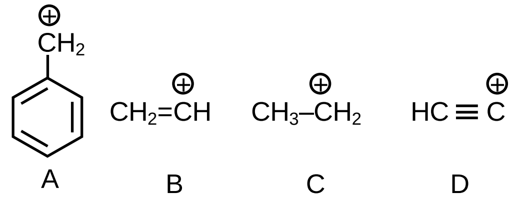
(4) Eutrophication leads to anaerobic conditions

Sol. (3)

Eutrophication leads to decrease in oxygen level of water.

3rd statement is incorrect

2.



The correct order of stability of given carbocation is :

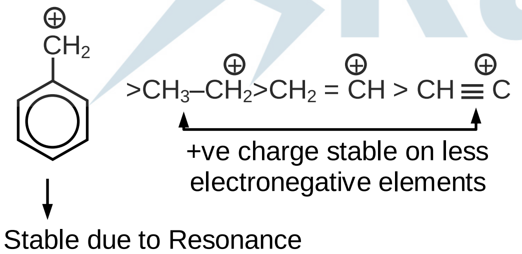
(1) C > A > D > B

(2) D > B > C > A

(3) A > C > B > D

(4) D > B > A > C

Sol. (3)



3. Given below are two statements: One is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A : Lithium halides are some what covalent in nature.

Reason R : Lithium possess high polarization capability.

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

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

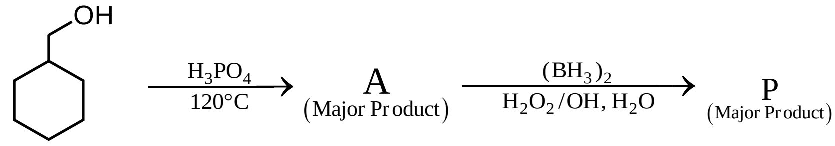
(2) **A** is true but **R** is false

(3) **A** is false but **R** is true

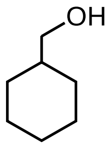
(4) Both **A** and **R** are true and **R** is the correct explanation of **A**

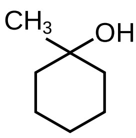
Sol. (4)

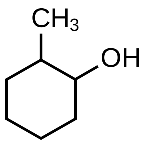
Lithium due to small size has very high polarization capability and thus increases covalent nature in Halides.

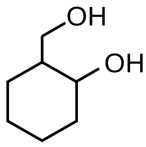
4. 

Consider the above reaction and identify the product P :

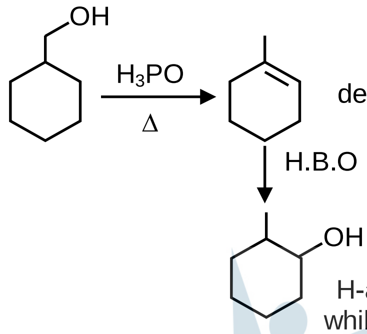
(1) 

(2) 

(3) 

(4) 

Sol. **(3)**



dehedration of alcohol by E^1 Rxn

H-attached at more hindard site while OH attached at less hindard site in H.B.O. Reaction

(Anti – markownikov addition)

5. The statement that is INCORRECT about Ellingham diagram is :
(1) Provides idea about the reaction rate.
(2) provides idea about free energy change.
(3) Provide idea about reduction of metal oxide.
(4) Provides idea about changes in the phase during the reaction.

Sol. **(1)**
Ellingham diagram is a plot between $\Delta G°$ and T and does not give any information regarding rate of reaction

6. For a reaction of order n, the unit of the rate constant is :
(1) $mol^{1-n}\ L^{1-n}\ s^{-1}$
(2) $mol^{1-n}\ L^{n-1}\ s^{-1}$
(3) $mol^{1-n}\ L^{1-n}\ s$
(4) $mol^{1-n}\ L^{2n}\ s^{-1}$

Sol. **(2)**
Rate = $k[A]^n$
comparing units

$$\frac{\left(\frac{mol}{\ell}\right)}{sec} = k\left(\frac{mol}{\ell}\right)^n$$

$$\Rightarrow k = mol^{(1-n)}\ell^{(n-1)}s^{-1}$$

7. The product obtained from the electrolytic oxidation of acidified sulphate solution, is:
(1) HO_2SOSO_2H
(2) HO_3SOOSO_3H
(3) HSO_4^-
(4) HO_3SOSO_3H

Sol. **(2)**
anode : $2SO_4^{-2}(aq) \rightarrow (S_2O_8)^{-2} + 2e^-$
Cathode : $2H^2 + 2e^- \rightarrow H_2(g)$
Electrolysis of concentrated solution of acidified sulphate solution yields $H_2S_2O_8$.

8. Presence of which reagent will affect the reversibility of the following reaction, and change it to a irreversible reaction:

$$CH_4 + I_2 \underset{\text{Reversible}}{\overset{hv}{\rightleftharpoons}} CH_3 - I + HI$$

(1) HOCl
(2) LiquidNH_3
(3) diluteHNO_2
(4) Concentrated HIO_3

Sol. **(4)**
Iodination of alkane is reversible reaction.
It can be irreversible in the presence of strong oxidising agent like conc. HNO_3 or conc. HIO_3

9. Match List-I with List-II :

	List – I	**List – II**
(a)	NaOH	(i) Acidic
(b)	$Be(OH)_2$	(ii) Basic
(c)	$Ca(OH)_2$	(iii) Amphoteric
(d)	$B(OH)_3$	
(e)	$Al(OH)_3$	

Choose the most appropriate answer from the option given below :
(1) (a)-(ii), (b)-(ii), (c)-(iii), (d)-(ii), (e)-(iii)
(2) (a)-(ii), (b)-(iii), (c)-(ii), (d)-(i), (e)-(iii)
(3) (a)-(ii), (b)-(ii), (c)-(iii), (d)-(i), (e)-(iii)
(4) (a)-(ii), (b)-(i), (c)-(ii), (d)-(iii), (e)-(iii)

Sol. **(2)**

$NaOH \longrightarrow$ Basic

$Be(OH)_2 \longrightarrow$ Amphoteric

$Ca(OH)_2 \longrightarrow$ Basic

$B(OH)_3 \longrightarrow$ Acidic

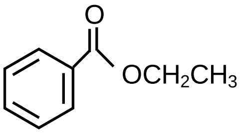
$Al(OH)_3 \longrightarrow$ Amphoteric

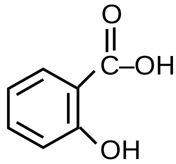
10. Given below are two statements:

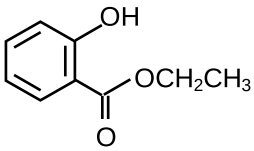
Statement I : Aniline is less basic than acetamide.
Statement II : In aniline, the lone pair of electrons on nitrogen atom is delocalised over benzene ring due to resonance and hence less available to a proton.
Choose the **most appropriate** option;
(1) Both statement I and statement II are true.
(2) Both statement I and statement II are false.
(3) Statement I is true but statement II is false.
(4) Statement I is false but statement II is true.

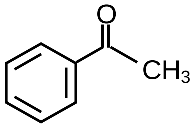
Sol. **(4)**
Explanation :- aniline is more basic than acetamide because in acetamide, lone pair of nitrogen is delocalized to more electronegative element oxygen.
In Aniline lone pair of nitrogen delocalised over benzene ring.

11. Which one of the following compounds will give orange precipitate when treated with 2, 4-dinitrophenyl hydrazine?

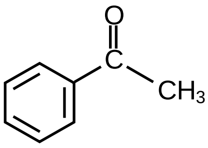
(1) 

(2) 

(3) 

(4) 

Sol. **(4)**



Explanation $\Rightarrow$ 2–4–D.N.P test is used for carbonyl compound (aldehyde & ketone)

12. Staggered and eclipsed conformers of ethane are:

(1) Enantiomers (2) Rotamers
(3) Mirror images (4) Polymers

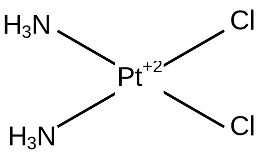
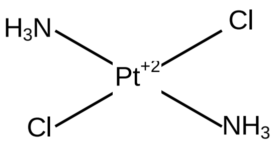
Sol. **(2)**

Staggered and eclipsed conformers of ethane also known as rotamers

13. The number of geometrical isomers found in the metal complexes$[PtCl_2(NH_3)_2]$, $[Ni(CO)_4]$, $[Ru(H_2O)_3Cl_3]$ and $[CoCl_2(NH_3)_4]^+$ respectively, are :

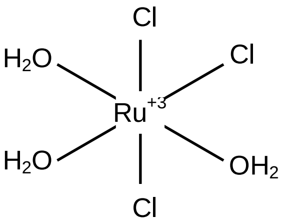
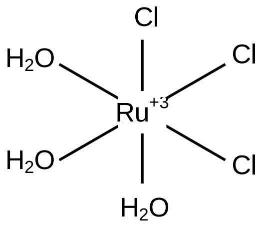
(1) 1, 1, 1, 1 (2) 2, 1, 2, 2
(3) 2, 1, 2, 1 (4) 2, 0, 2, 2

Sol. **(NTA-2)**
Motion-4

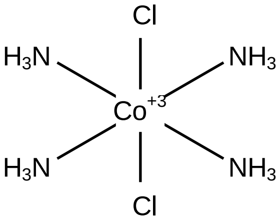
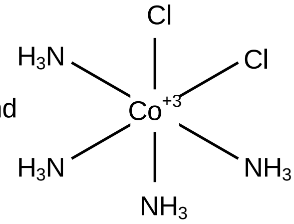
 and  2 Geometrical isomers

$[Ni(CO)_4]$ $\rightarrow$ All ligands are same Zero Geometrical isomers

$[Ru(H_2O)_3Cl_3]$

 and  2 Geometrical isomers

$[CoCl_2(NH_3)_4]^+$

 and  2 Geometrical isomers

14. The parameters of the unit cell of a substance are a = = 2.5, b = 3.0, c = 4.0, α= 90°, β= 120° γ=90°. The crystal system of the substance is :

(1) Orthorhombic
(2) Triclinic
(3) Hexagonal
(4) Monoclinic

Sol. **(4)**

$a \neq b \neq c$ and $\alpha = \gamma = 90° \neq \beta$

are parameters of monoclinic unit cell.

15. Given below are two statements:

Statement I : Rutherford's gold foil experiment cannot explain the line spectrum of hydrogen atom.

Statement II : Bohr'smodel of hydrogen atom contradicts Heisenberg's uncertainty principle.

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

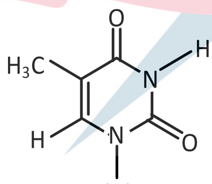
(1) Statement I is false but statement II is true.
(2) Both statement I and statement II are false.
(3) Statement I is true but statement II is false.
(4) Both statement I and statement II are true.

Sol. **(4)**

Rutherford's gold foil experiment only proved that electrons are held towards nucleus by electrostatic forces of attraction and move in circular orbits with very high speeds.

Bohr's model gave exact formula for simultaneous calculation of speed & distance of electron from the nucleus, something which was deemed impossible according to Heisenberg.

16.



(A)

The compound 'A' is a complementary base of ______ in DNA stands.

(1) Cytosine
(2) Adenine
(3) Guanine
(4) Uracil

Sol. **(2)**

Given structure is Thymine and Thymine being paired with adenine.

17. The oxidation states of 'P' in $H_4P_2O_7$, $H_4P_2O_5$and $H_4P_2O_6$, respectively, are:

(1) 5, 3 and 4
(2) 6, 4 and 5
(3) 5, 4 and 3
(4) 7, 5 and 6

Sol. **(1)**

Oxidation state of P in $H_4P_2O_7$, $H_4P_2O_5$ and $H_4P_2O_6$ is 5, 3 & 4 respectively

$H_4P_2O_7$

$2x + 4 (+1) + 7 (-2) = 0$

$x = +5$

$H_4\underline{P_2}O_5$

$2x + 4(+1) + 5(-2) = 0$

$x = +3$

$H_4\underline{P_2}O_6$

$2x + 4(+1) + 6(-2) = 0$

$x = +4$

18. Which one among the following chemical tests is used to distinguish monosaccharide from disaccharide?

(1) Barfoed test (2) Seliwanoff's test

(3) Tollen's test (4) Iodine test

Sol. **(1)**

Barford test is used for distinguish mono-saccharide from disaccharide

19. Match List-I with List-II :

List – I (Drug)	**List – II (Class of Drug)**
(a)Furacin	(i) Antibiotic
(b)Arsphenamine	(ii) Tranquilizers
(c)Dimetone	(iii) Antiseptic
(d)Valium	(iv) Synthetic antihistamines

Choose the **most appropriate** match :

(1) (a)-(iii), (b)-(iv), (c)-(ii),(d)-(i)

(2) (a)-(i), (b)-(iii), (c)-(iv),(d)-(ii)

(3) (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)

(4) (a)-(iii), (b)-(i), (c)-(iv),(d)-(ii)

Sol. **(4)**

$\longrightarrow$ furacine acts as Antiseptic

$\longrightarrow$ Arsphenamine also known as salvarsan acts as antibiotic

$\longrightarrow$ Dimetone is synthetic histamine

$\longrightarrow$ valium is a Tranqulizer

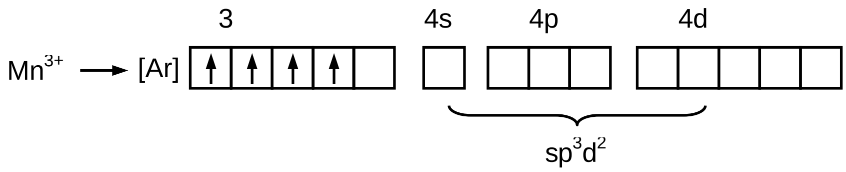
20. The type of hybridisation and magnetic property of the complex $[MnCl_6]^{3-}$, respectively, are :

(1) d^2sp^3 and paramagnetic (2) d^2sp^3 and diamagnetic

(3) sp^3d^2 and paramagnetic (4) sp^3d^2 and diamagnetic

Sol. **(3)**

$[MnCl_6]^{3-}$



Paramagnetic and having 4 unpaired electrons.

SECTION –B

1. In gaseous triethyl amine the "–C–N–C–" bond angle is ______________ degree.

Sol. **180**

In gaseous triethyl amine the "–C–N–C–" bond angle is 108 degree.

2. The density of NaOH solution is $1.2 gcm^{-3}$.The molality of this solution is __________ m. (Round off to the NearestInteger)

[Use:Atomicmasses:Na:23.0u O : 16.0u H : 1.0 u, Density of H_2O : 1.0 g cm^{-3}]

Sol. **5**

Consider 1ℓ solution

mass of solution = (1.2 × 1000)g

= 1200 gm

Neglecting volume of NaOH

Mass of water = 1000 gm

$\Rightarrow$ Mass of NaOH = (1200 – 1000)gm

= 200 gm

$\Rightarrow$ Moles of NaOH = $\frac{200g}{50g/mol}$ = 5 mol

$\Rightarrow$ molality = $\frac{5\,mol}{1\,kg}$ = 5 m

3. $PCl_5 \rightleftharpoons PCl_3 + Cl_3$ $K_c = 1.844$

3.0 moles of PCl_5 is introduced in a 1 L closed reaction vessel at 380 K. The number of moles of PCl_5 at equilibrium is ________________ $\times 10^{-3}$. (Round off to the Nearest Integer)

Sol. **NTA-1400, MOTION-1396**

$PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ $K_2 = 1.844$

t = 0 3 moles

t = ∞ x x

$$\Rightarrow \frac{[PCl_3][Cl_2]}{[PCl_5]} = \frac{x^2}{3-x} = 1.844$$

$\Rightarrow$ $x^2 + 1.844 - 5.532 = 0$

$$\Rightarrow x = \frac{-1.844 + \sqrt{(1.844)^2 + 4\times 5.532}}{2}$$

$\cong$ 1.604

$\Rightarrow$ Moles of PCl_5 = 3 – 1.604 $\cong$ 1.396

4. For water at 100°C and 1bar,

$\Delta_{vap}H - \Delta_{vap}U$=______$\times 10^2$ J mol^{-1}. (Round off to the NearestInteger)

[Use : R=8.31 J mol^{-1} K^{-1}]

[Assume volume of $H_2O(l)$ is much smaller than volume of $H_2O(g)$. Assume $H_2O(g)$ treated as an ideal gas]

Sol. **31**

$H_2O_{(\ell)} \rightleftharpoons H_2O_{(V)}$

$\Delta H = \Delta U + \Delta n_g RT$

for 1 mole waters;

$\Delta n_g = 1$

$\therefore \Delta n_g RT$ = 1 mol × 8.31 J/mol-k × 373 K

= 3099.63 J $\cong$ 31 × 10^2J

5. The difference between bond orders of CO and NO is $NO^{\oplus}$ is $\frac{x}{2}$ where x = ______________.

(Round off to the Nearest Integer)

Sol. **0**

Bond order of CO = 3

Bond order of NO^{+}= 3

Difference = 0 = $\frac{x}{2}$

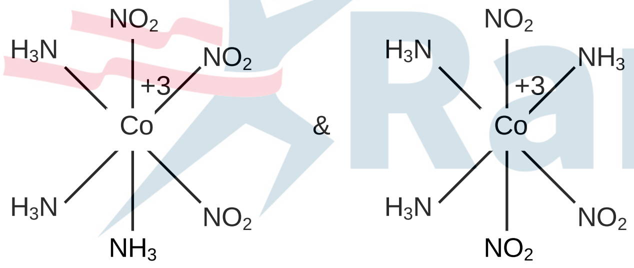
x = 0

6. The number of geometrical isomers possible in triamminetrinitrocobalt (III) is X and in trioxalatochromate (III) is Y. Then the value of X +Y is _____________.

Sol. **2**

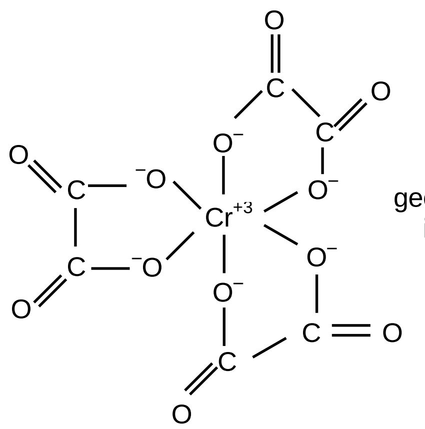
Triamminetrinitrocobalt(III) $\rightarrow$ $[Co(NO_2)_3(NH_3)_3]$

trioxalatochromate(III) ion $\rightarrow$ $[Cr(C_2O_4)_3]^{3-}[Co(NO_2)_3(NH_3)_3]$



Two geometrical isomers (X)

$[Cr(C_2O_4)_3]^{3-}$



Zero geometrical isomer (Y)

X + Y = 2 + 0 = 2.0

7. CO_2 gas adsorbs on charcoal following Freundlich adsorption isotherm. For a given amount of charcoal, the mass of CO_2 adsorbed becomes 64 times when the pressure of CO_2 is doubled. The value of n in the Freundlich isotherm equation is ___________ × 10^{-2}. (Round off to the Nearest Integer)

Sol. **17**

Freundlich isotherm. ;

$$\frac{x}{m} = k.p^{\frac{1}{n}}$$

Substituting values;

$$\left(\frac{64}{1}\right) = (2)^{\frac{1}{n}} \Rightarrow n = \frac{1}{6} = 0.166$$

$\cong 17 \times 10^{-2}$

8. 1.46 g of a biopolymer dissolved in a 100 mL water at 300 K exerted an osmotic pressure of 2.42×10^{-3}bar.
The molar mass of the biopolymer is ______ × 10^4 g mol^{-1} . (Round off to the Nearest Integer)

[Use : R = 0.083 L bar mol^{-1} K^{-1}]

Sol. **15**

π = CRT ; π = osmotic pressure
C = molarity
T = Temperature of solution

let the molar mass be M gm / mol

$$2.42 \times 10^{-3} \text{ bar} = \frac{\left(\frac{1.46g}{Mgm/mol}\right)}{0.1\ell} \times \left(\frac{0.083\ell - bar}{mol - K}\right) \times (300K)$$

$\Rightarrow$ M = 15.02×10^4 g/mol

9. An organic compound is subjected to chlorination to get compound A using 5.0g of chlorine. When 0.5 g of compound A is reacted with $AgNO_3$ [Carius Method], the percentage of chlorine in compound A is ____________ when it forms 0.3849 gof AgCl. (Round off to the Nearest Integer)
(Atomic masses of Ag and Cl are 107.87 and 35.5 respectively)

Sol. **19**

$n_{c\ell}$ in compound = $n_{AgCl} = \frac{0.3849g}{(107.87 + 35.5)}$ g/mol

$\Rightarrow$ mass of chlorine = n_{Cl} × 35.5 = 0.0953 gm

$\Rightarrow$ % wt of chlorine = $\frac{0.0953}{0.5} \times 100$

= 19.06 %

10. The conductivity of a weak acid HA of concentration 0.001 mol L^{-1} is 2.0 × 10^{-5} S cm^{-1}. If Λ_m° (HA) =190 S $cm^2 mol^{-1}$, the ionization constant (K_a) of HA is equal to

__________ × 10^{-6}. (Round off to the Nearest Integer)

Sol. **12**

$$\wedge_m = 1000 \times \frac{\kappa}{M}$$

$$= 1000 \times \frac{2\times10^{-5}}{0.001} = 20 \text{ S cm}^2 \text{ mol}^{-1}$$

$$\Rightarrow \alpha = \frac{\wedge_m}{\wedge_m^{\infty}} = \frac{20}{190} = \left(\frac{2}{19}\right)$$

$HA \rightleftharpoons H^+ + A^-$

0.001 (1 − α) 0.001α 0.001 α

$$\Rightarrow \quad k_a = 0.001\left(\frac{\alpha^2}{1-\alpha}\right) = \frac{0.001\times\left(\frac{2}{19}\right)^2}{1-\left(\frac{2}{19}\right)}$$

$= 12.3 \times 10^{-6}$