CHEMISTRY
JEE-MAIN (January-Attempt) 11 January (Shift-2) Paper

SECTION - A

1. The hydride that is NOT electron deficient is :

(A) AlH_3 (B) GaH_3 (C) SiH_4 (D) B_2H_6

Sol. **C**

(1) B_2H_6 : Electron deficient
(2) AlH_3 : Electron deficient
(3) SiH_4 : Electron precise
(4) GaH_3 : Electron deficient

2. The reaction,
$MgO(s) + C(s) \rightarrow Mg(s) + CO(g)$, for which $\Delta_rH^o = +491.1$ kJ mol^{-1} and $\Delta_rS^o = 198.0$ JK^{-1} mol^{-1}, is not feasible at 298 K. Temperature above which reaction will be feasible is :

(A) 1890.0 K (B)2040.5 K (C) 2480.3 K (D) 2380.5 K

Sol. **C**

$$T_{eq} = \frac{\Delta H}{\Delta S}$$

$$= \frac{491.1 \times 1000}{198}$$

= 2480.3 K

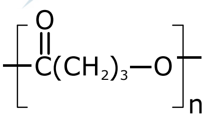
3. The higher concentration of which gas in air can cause stiffness of flower buds ?

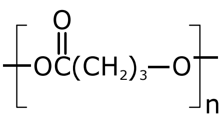
(A) SO_2 (B) NO_2 (C) CO_2 (D) CO

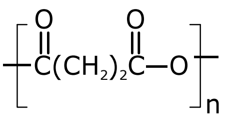
Sol. **A**

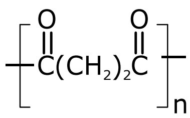
Due to acid rain in plants high concentration of SO_2 makes the flower buds stiff and makes them fall.

4. The homopolymer formed from 4-hydroxybutanoic acid is :

(A) 

(B) 

(C) 

(D) 

Sol. **A**

It is a formation of polyester

5. Taj Mahal is being slowly disfigured and discoloured. This is primarily due to :

(A) acid rain (B) global warming (C) soil pollution (D) water pollution

Sol. **A**

Taj mahal is slowely disfigured and discoloured due to acid rain.

6. The reaction that does NOT define calcination is :

(A) $CaCO_3 . MgCO_3 \xrightarrow{\Delta} CaO + MgO + 2CO_2$

(B) $Fe_2O_3 . XH_2O \xrightarrow{\Delta} Fe_2O_3 + XH_2O$

(C) $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

(D) $2\ Cu_2S + 3\ O_2 \xrightarrow{\Delta} 2Cu_2O + 2SO_2$

Sol. **D**

Calcinatin in carried out for carbonates and oxide ores in absence of oxygen. Roasting is carried out mainly for sulphide ores in presence of excess of oxygen.

7. For the equilibrium,

$2\ H_2O \rightleftharpoons = H_3O^+ + OH^-$, the value of ΔG^o at 298 K is approximately :

(A) 100 kJ mol^{-1} (B) -80 kJ mol^{-1} (C) -100 kJ mol^{-1} (D) 80 kJ mol^{-1}

Sol. **D**

$2H_2O = H_3O + OH-\ K = 10^{-14}$

$\Delta G^0 = RT\ \ell n\ K$

$= \frac{-8.314}{1000} \times 298 \times \ell n 10^{-14}$

= 80 Kj/Mole

8. Among the colloids cheese (C), Milk (M) and smoke (S), the correct combination of the dispersed phase and dispersion medium, respectively is :

(A) C : solid in liquid; M : solid is liquid ;
S : solid in gas

(B) C : liquid in solid ; M : liquid in liquid :
S : solid in gas

(C) C : liquid in solid ; M : liquid in solid ;
S : solid in gas

(D) C : solid in liquid ; M : liquid in liquid ;
S : gas in solid

Sol. **B**

	Dispersed Phase	**Dispersion Medium**
Cheese	Liquid	Solid
Milk	Liquid	Liquid
Smoke	Solid	Gas

9. The de Broglie wavelength (λ) associated with a photoelectron varies with the frequency (ν) of the incident radiation as, [ν_0 is threshold frequency] :

(A) $\lambda \propto \frac{1}{(\nu - \nu_0)^{\frac{3}{2}}}$

(B) $\lambda \propto \frac{1}{(\nu - \nu_0)}$

(C) $\lambda \propto \frac{1}{(\nu - \nu_0)^{\frac{1}{4}}}$

(D) $\lambda \propto \frac{1}{(\nu - \nu_0)^{\frac{1}{2}}}$

Sol. **D**

For electron

$\lambda_{DB} = \frac{\lambda}{\sqrt{2mK.E.}}$ (de broglie wavelength)

By photoelectric effect

$h\nu = h\nu_0 + KE$

$KE = h\nu - h\nu_0$

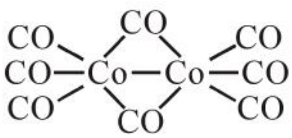
$$\lambda_{DB} = \frac{h}{\sqrt{2m \times (h\nu - h\nu_0)}}$$

$$\lambda_{DB} \propto \frac{1}{(\nu - \nu_0)^{1/2}}$$

10. The number of bridging CO ligand(s) and Co—Co bond(s) in $Co_2(Co)_8$, respectively are :

(A) 2 and 1 (B) 0 and 2 (C) 4 and 0 (D) 2 and 0

Sol. **A**



Bridging CO are and Co – Co bond is 1.

11. Match the following items in column I with the corresponding items in column II

	Column I		ColumnII
(i)	$Na_2CO_3.10H_2O$	(A)	Portland cement ingredient
(ii)	$Mg(HCO_3)_2$	(B)	Castner-Kellner process
(iii)	NaOH	(C)	Solvay process
(iv)	$Ca_3Al_2O_6$	(D)	Temporary hardness

(A) (i) → (D) ; (ii) → (A) ; (iii) → (B) ; (iv) → (C)

(B) (i) → (B) ; (ii) → (C) ; (iii) → (A) ; (iv) → (D)

(C) (i) → (C) ; (ii) → (B) ; (iii) → (D) ; (iv) → (A)

(D) (i) → (C) ; (ii) → (D) ; (iii) → (B) ; (iv) → (A)

Sol. **D**

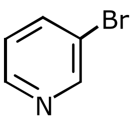
$Na_2CO_3.10H_2O$ → Solvay process

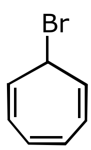
$Mg(HCO_3)_2$ → Temporary hardness

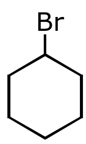
NaOH → Castner-kellner cell

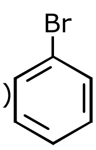
$Ca_3Al_2O_6$ → Portland cement

12. Which of the following compounds will produce a precipitate with $AgNO_3$?

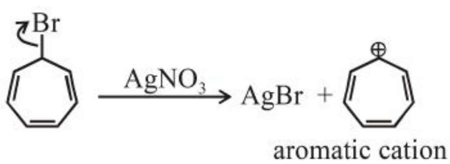
(A) 

(B) 

(C) 

(D) 

Sol. **B**



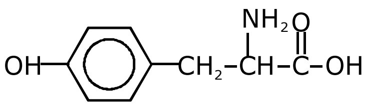
as it can produce aromatic cation so will produce precipitate with $AgNO_3$.

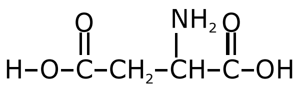
13. The correct match between Item I and Item II is :

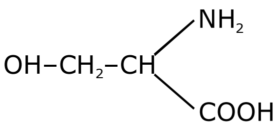
	Item I	**Item II**
(A)	Ester test	(P) Tyr
(B)	Carbylamine test	(Q) Asp
(C)	Phthalein dye test	(R) Ser
		(S) Lys

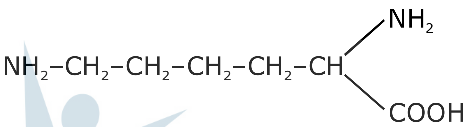
(A) (A) → (Q) ; (B) → (S) ; (C) → (R)
(B) (A) → (R) ; (B) → (S) ; (C) → (Q)
(C) (A) → (R) ; (B) → (Q) ; (C) → (P)
(D) (A) → (Q) ; (B) → (S) ; (C) → (P)

Sol. **D**

(P) Tyrosine Tyr 

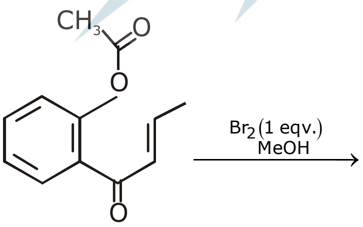
(Q) Aspartic ASP Acid 

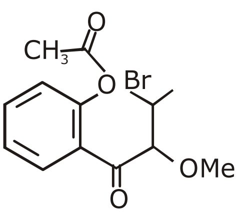
(R) Serine Ser 

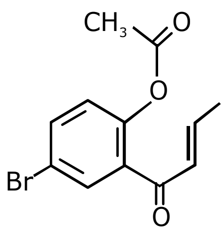
(S) Lysine 

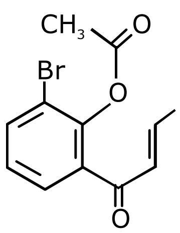
(A)	Ester test	(Q) Aspartic acid (Acidic amino acid)
(B)	Carbylamine	(S) Lysine [NH_2 group present]
(C)	Phthalein dye	(P) Tyrosine {Phenolic group present}

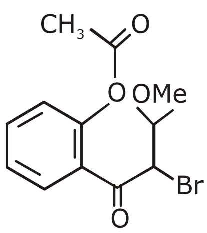
14. the major product obtained in the following conversion is :



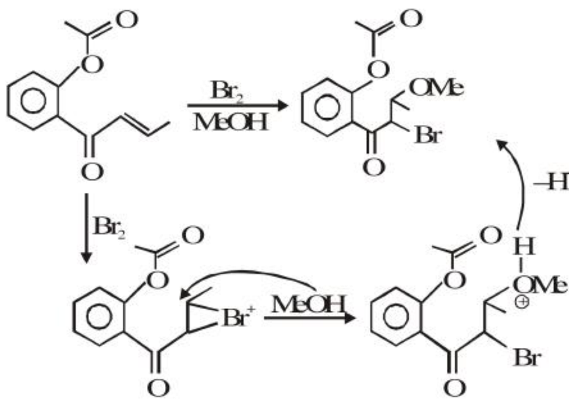
(A) 

(B) 

(C) 

(D) 

Sol. **D**



15. A compound 'X' on treatment with Br_2/NaOH, provided C_3H_9N, which gives positive carbylamine test. Compound 'X' is :

(A) $CH_3CON(CH_3)_2$
(B) $CH_3CH_2COCH_2NH_2$
(C) $CH_3CH_2CH_2CONH_2$
(D) $CH_3COCH_2NHCH_3$

Sol. **C**

$$[X] \xrightarrow[\text{NaoH}]{Br_2} C_3H_9N \xrightarrow[\text{KOH}]{CHCl_3} CH_3CH_2CH_2{-}NC$$

Hoff mann's Bromaide degradation — Carbylamine Reaction

Thus [X] must be aride with oen carbon more than is amine

Thus [X] is $CH_3CH_2CH_2CONH_2$

16. The correct option with respect to the Pauling electronegativity values of the elemetns is :

(A) Si < Al (B) Te > Se (C) P > S (D) Ga < Ge

Sol. **D**

B C
Al Si

Ga<Ge

Along the period electronegativity increases

17. 25 ml of the given HCl solution requires 30 mL of 0.1 M sodium carbonate solution. What is the volume of this HCl solution required to titrate 30 mL of 0.2 M aqueous NaOH solution ?

(A) 75 mL (B) 50 mL (C) 25 mL (D) 12.5 mL

Sol. **C**

HCl with Na_2CO_3

Eq. of HCl = Eq. of Na_2CO_3

$$\frac{25}{1000} \times M \times 1 = \frac{30}{1000} \times 0.1 \times 2$$

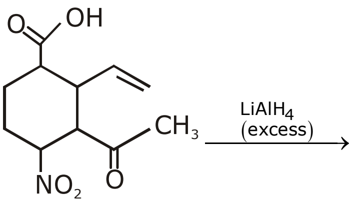
$$M = \frac{6}{25} M$$

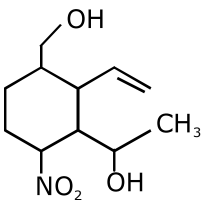
Eq of HCl = Eq. of NaOH

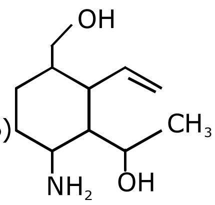
$$\frac{6}{25} \times 1 \times \frac{V}{1000} = \frac{30}{1000} \times 0.2 \times 1$$

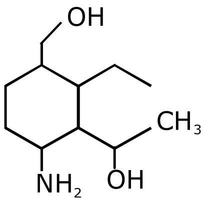
V = 25 ml

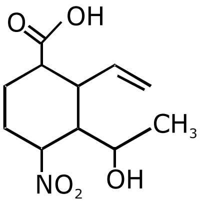
18. The major product obtained in the following reaction is :



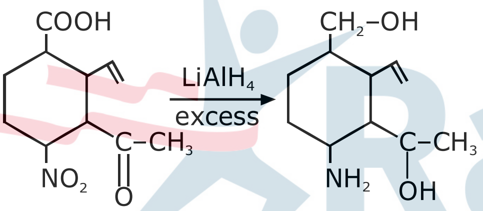
(A) 

(B) 

(C) 

(D) 

Sol. **B**

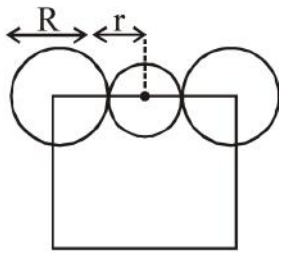


$LiAlH_4$ will not affect C=C in this compound.

19. The radius of the largest sphere which fits properly at the centre of the edge of a body centred cubic unit cell is : (Edge length is represented by 'a')

(A) 0.067 a (B) 0.047 a (C) 0.027 a (D) 0.134 a

Sol. **A**



a = 2(R + r)

$\frac{a}{2} = (R + r)$ ...(1)

$a\sqrt{3} = 4R$ ...(2)

using (1) & (2)

$\frac{a}{2} = \frac{a\sqrt{3}}{4} = r$

$a\left(\frac{2-\sqrt{3}}{4}\right) = r$

r = 0.067a

20. The reaction $2X \rightarrow B$ is a zeroth order reaction. If the initial concentration of X is 0.2 M, the half-life is 6 h. When the initial concentration of X is 0.5 M, the time required to reach its final concentration of 0.2 M will be :

(A) 12.0 h (B) 9.0 h (C) 7.2 h (D) 18.0 h

Sol. **D**

For zero order

$[A_0]-[A_t] = kt$

$0.2 - 0.1 = k\times6$

$k = \frac{1}{60} M/hr$

and $0.5-0.2 = \frac{1}{60}\times t$

t = 18 hrs.

21. The standard reaction Gibbs energy for a chemical reaction at an absolute temperature T is given by

$\Delta_r G^o = A - BT$

Where A and B are non-zero constants. Which of the following is **TRUE** about this reaction ?

(A) Exothermic if B < 0

(B) Exothermic if A > 0 and B < 0

(C) Endothermic if A > 0

(D) Endothermic if A < 0 and B > 0

Sol. **C**

Theory

22. K_2HgI_4 is 40% ionised in aqueous solution. The value of its van't Hoff factor (i) is

(A) 2.0 (B) 1.8 (C) 2.2 (D) 1.6

Sol. **B**

For $K2[HgI_4]$

i $= 1 + 0.4\,(3 - 1)$

$= 1.8$

23. The correct match between item I and item II is :-

Item I		Item II	
(A)	Allosteric effect	(P)	Molecule binding to the active site of enzyme
(B)	Competitive inhibitor	(Q)	Molecule crucial for communication in the body
(C)	Receptor	(R)	Molecule binding to a site other than the active site of enzyme
(D)	Poison	(S)	Molecule binding to the enzyme covalently

(A) (A) → (P) ; (B) → (R) ; (C) → (Q) ; (D) → (S)

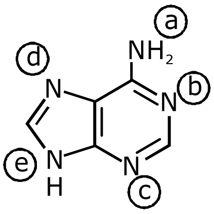
(B) (A) → (P) ; (B) → (R) ; (C) → (S) ; (D) → (Q)

(C) (A) → (R) ; (B) → (P) ; (C) → (S) ; (D) → (Q)

(D) (A) → (R) ; (B) → (P) ; (C) → (Q) ; (D) → (S)

Sol. **D**

24. In the following compound,



The favourable site/s for protonation is/are :

(A) a and e (B) a

(C) b, c and d (D) a and d

Sol. **C**

Localised lone pair e^-.

25. Given the equilibrium constant ;

K_C of the reaction :

$Cu(s) + 2Ag^+(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s)$ is

10×10^{15}, calculate the E^o_{cell} of this reaction at 298 K

$\left[2.303\frac{RT}{F} \text{ at } 298\text{ K} = 0.059\text{V}\right]$

(A) 0.04736 V (B) 0.4736 V

(C) 0.4736 mV (D) 0.04736 mV

Sol. **B**

$$E_{cell} = E^0_{cell} - \frac{0.059}{n}\log Q$$

At equilibrium

$$E_{cell} = \frac{0.059}{n}\log 10^{16}$$

$= 0.059 \times 8$

$= 0.472$ V

26. The coordination number of Th in $K_4[Th(C_2O_4)_4(OH_2)_2]$ is :

$\left(C_2O_4^{2-} = \text{oxalato}\right)$

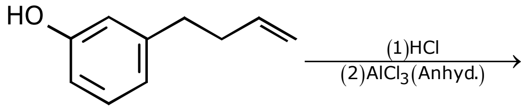
(A) 10 (B) 8 (C) 6 (D) 14

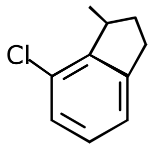
Sol. **A**

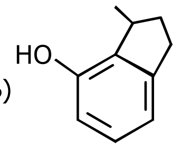
$C_2O_4^{2-}$ (oxalato) : bidentate

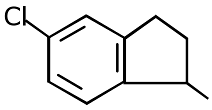
H_2O (aqua) : Monodentate

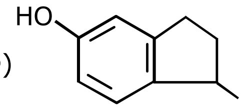
27. The major product of the following reaction is :



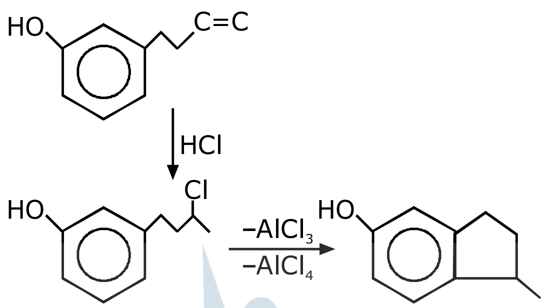
(A) 

(B) 

(C) 

(D) 

Sol. **D**



28. $\underline{A} \xrightarrow{4KOH,O_2} 2\underline{B} + 2H_2O$
(Green)

$3\underline{B} \xrightarrow{4\,HCl} 2\underline{C} + MnO_2 + 2H_2O$
(Purple)

$2\underline{C} \xrightarrow{H_2O,KI} 2\underline{A} + 2\,KOH + \underline{D}$

In the above sequence of reactions, A and D, respectively, are :

(A) KI and $KMnO_4$ (B) MnO_2 and KIO_3
(C) KI and K_2MnO_4 (D) KIO_3 and MnO_2

Sol. **B**

$MnO_2(A) \xrightarrow{4KOH,O_2} 2K_2MnO_4(B) + 2H_2O$
(Green)

$3K_2MnO_4(B) \xrightarrow{4HCL} 2K_2MnO_4(C) + 2H_2O$
(Purple)

$3K_2MnO_4(C) \xrightarrow{H_2O,KI} 2MnO_2(A) + 2KOH + KIO_3(D)$

$A \rightarrow MnO_2$
$D \rightarrow KIO_3$

29. The relative stability of +1 oxidation state of group 13 elements follows the order :

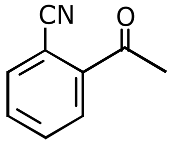
(A) Al <Ga < In < Tl (B) Ga < Al < In < Tl
(C) Tl < In < Ga < Al (D) Al < Ga <Tl < In

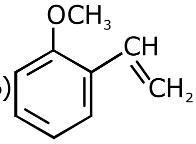
Sol. **A**

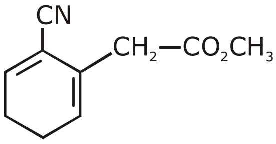
Due to inert pair effect as we move down the group in 13th group lower oxidation state becomes more stable.

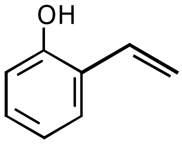
Al<Ga<In<Tℓ

30. Which of the following compounds reacts with ethylmagnesium bromide and also decolourizes bromine water solution:

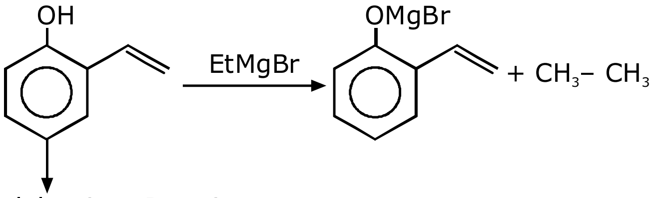
(A) 

(B) 

(C) 

(D) 

Sol. **C, D**



declolourizes Bromine water