CHEMISTRY
JEE-MAIN (July-Attempt) 6 SEPTEMBER (Shift-2) Paper

SECTION - A

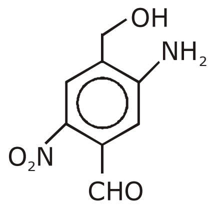
1. Match the following :

Test/Method	**Reagent**
(i) Lucas Test	(a) $C_6H_5SO_2Cl$/aq. KOH
(ii) Dumas method	(b) $HNO_3/AgNO_3$
(iii) kjeldjhl's method	(c) CuO/CO_2
(iv) Hinsberg Test	(d) Conc. HCl and $ZnCl_2$
	(e) H_2SO_4

(1) (i)-(d),(ii)-(c),(iii)-(e),(iv)-(a)
(2) (i)-(b),(ii)-(a),(iii)-(c),(iv)-(d)
(3) (i)-(b),(ii)-(d),(iii)-(e),(iv)-(a)
(4) (i)-(d),(ii)-(c),(iii)-(b)-(iv)-(e)

Sol. **1**
By Theory

2. The IUPAC name of the following compound is:



(1) 2-nitro-4-hydroxymethyl-5-amino benzaldehyde
(2) 3-amino-4-hydroxymethyl-5-nitro benzaldehyde
(3) 4-amino-2-formyl-5-hydroxymehtyl nitrobenzene
(4) 5-amino-4-hydroxymethyl-2-nitro benzaldehyde

Sol. **4**

3. For the Given Cell;

$$Cu(s)|Cu^{2+}(C_1M)||Cu^{2+}(C_2M)|Cu(s)$$

Change in Gibbs energy (ΔG) is negative, if :

(1) $C_2 = \sqrt{2}C_1$
(2) $C_2 = \frac{C_1}{\sqrt{2}}$
(3) $C_1 = 2C_2$
(4) $C_1 = C_2$

Sol. **1**

$$E = 0 - \frac{0.059}{2}\log\left[\frac{C_1}{C_2}\right]$$

$\Delta G = -nFE$

$$= +nF \times \frac{RT}{nF} \times 2.303 \text{ Log}\left[\frac{C_1}{C_2}\right]$$

$$\text{Log}\left[\frac{C_1}{C_2}\right] < O$$

$C_1 < C_2$

$C_2 = \sqrt{2}C_1$

4. Reaction of an inorganic sulphite X with dilute H_2SO_4 generates compound Y. Reaction of Y with NaOH gives X. Further, the reaction of X with Y and water affords compound Z. Y and Z, repectively, are :

(1) SO_2 and $NaHSO_3$ (2) S and Na_2SO_3

(3) SO_2 and Na_2SO_3 (4) SO_3 and $NaHSO_3$

Sol. **1**

$$Na_2SO_3 + H_2SO_4 \longrightarrow Na_2SO_4 + H_2SO_3$$

$$H_2SO_3 \longrightarrow H_2O + SO_2 \ (Y)$$

$$SO_2 \xrightarrow{NaOH} Na_2SO_3$$

$$Na_2SO_3 \xrightarrow{SO_2 + H_2O} \underset{(Z)}{NaHSO_3}$$

Ans. (1) $Y = SO_2$

$Z = NaHSO_3$

5. The value of K_C is 64 at 800 K for the reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

The value of K_C for the following reaction is :

$$NH_3(g) \rightleftharpoons \frac{1}{2}N_2(g) + \frac{3}{2}H_2(g)$$

(1) 1/4 (2) 8 (3) 1/8 (4) 1/64

Sol. **3**

$K_C = (64)^{-1/2}$

$K_C = \frac{1}{8}$

6. The correct match between Item - I (Starting material) and Item - II (reagent) for the preparation of benzaldehyde is :

	Item - I	**Item - II**
(I)	Benzene	(P) HCl and $SnCl_2.H_3O^+$
(II)	Benzonitrile	(Q) H_2, Pd- $BaSO_4$, and quinoline
(III)	Benzoyl Chloride	(R) CO, HCl and $AlCl_3$

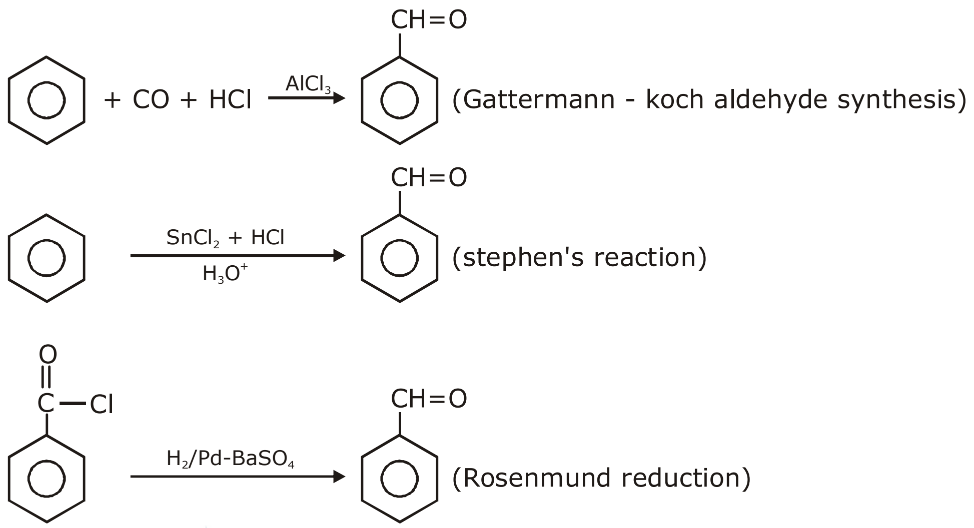
(1) (I) - (R), (II) - (P) and (III) - (Q)

(2) (I) - (P), (II) - (Q) and (III) - (R)

(3) (I) - (Q), (II) - (R) and (III) - (P)

(4) (I) - (R), (II) - (Q) and (III) - (P)

Sol. **1**



7. For a d^4 metal ion in an octahedral field, the correct electronic configuration is :

(1) $e_g^2 t_{2g}^2$ when $\Delta_o < P$ (2) $t_{2g}^4 e_g^o$ when $\Delta_o < P$

(3) $t_{2g}^3 e_g^1$ when $\Delta_o > P$ (4) $t_{2g}^3 e_g^1$ when $\Delta_o < P$

Sol. **4**

$d^4 \rightarrow t_{2g}^3 e_g^1 - \Delta_0 < P$

8. The correct match between Item - I and Item - II is :

Item - I		**Item - II**
(a)	Natural rubber	(I) 1,3-butadience + styrene
(b)	Neoprene	(II) 1,3-butadiene + acrylonitrile
(c)	Buna-N	(III) Chloropene
(d)	Buna-S	(IV) Isoprene

(1) (a) - (III), (b) - (IV), (c) - (I), (d) - (II)
(2) (a) - (IV), (b) - (III), (c) - (II), (d) - (I)
(3) (a) - (IV), (b) - (III), (c) - (I), (d) - (II)
(4) (a) - (III), (b) - (IV), (c) - (II), (d) - (I)

Sol. **2**

By Theory

9. Which one of the following statement is not true ?

(1) Lactose contains α-glycoside linkage between C_1 of galactose and C_4 of glucose.

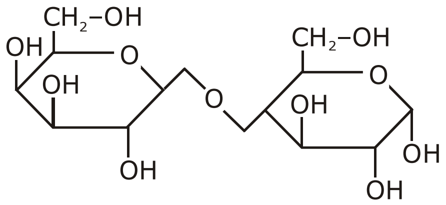
(2) Lactose is a reducing sugar and it gives Fehling's test.

(3) On acid hydrolysis, lactose gives one molecule of D(+)-glucose and one molecule of D(+)-galactose.

(4) Lactose($C_{11}H_{22}O_{11}$) is a disaccharide and it contains 8 hydroxyl groups.

Sol. **1**

Lactose contains β-glycosidic linkage between C_1 of galactose and C_4 of glucose.



10. The element that can be refined by distillation is :

(1) tin (2) gallium

(3) zinc (4) nickel

Sol. **3**

Zinc $\rightarrow$ Refined by distillation

11. Match the following compounds (Column-I) with their uses (Column-II) :

S. No.	**Column – I**	**S. No.**	**Column – II**
(I)	$Ca(OH)_2$	(A)	Casts of statues
(II)	NaCl	(B)	White wash
(III)	$CaSO_4.\frac{1}{2}H_2O$	(C)	Antacid
(IV)	$CaCO_3$	(D)	Washing soda preparation

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

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

Sol. **3**

(i) $Ca(OH)_2 \rightarrow$ used in white wash due to its disinfectant nature

(ii) $CaCO_3 \rightarrow$ it used as an Antacid

(iii) $CaSO_4 . \frac{1}{2} H_2O \rightarrow$ Formaking casts of statues and busts

(iii) Preparation of wasing soda (sodium carbonate)

(1) $2NH_3 + H_2O + CO_2 \longrightarrow (NH_4)_2CO_3$

(2) $(NH_4)_2CO_3 + H_2O + CO_2 \longrightarrow 2NH_4HCO_3$

(3) $NH_4HCO_3 + NaCl \longrightarrow NH_4Cl + NaHCO_3$

(4) $2NaHCO_3 \longrightarrow Na_2CO_3 + CO_2 + H_2O$

Ans. (3)

12. Mischmetal is an alloy consisting mainly of :

(1) lanthanoid and actinoid metals
(2) lanthanoid metals
(3) actinoid metals
(4) actinoid and transition metals

Sol. **2**

Misch metal - well known alloy is mischmetal which consists of Lanthanoid metal (~ 95%) and iron (~ 5%) and Traces of S, C, Ca and Al

13. For a reaction,

$$4M(s)+nO_2(g)\rightarrow 2M_2O_n(s)$$

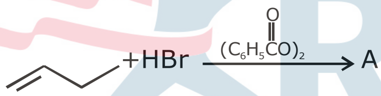
the free energy change is plotted as a function of temperature. The temperature below which the oxide is stable could be inferred from the plot as the point at which :

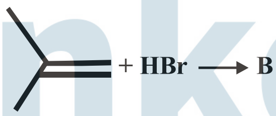
(1) the free energy change shows a change from negative to positive value.
(2) the slope changes from positive to zero
(3) the slope changes from positive to negative.
(4) the slope changes from negative to positive.

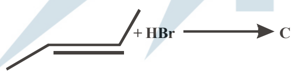
Sol. **1**

$\Delta G = \Delta H - T\Delta S$
$\Delta G = -ve$ (stable oxide)
$\Delta G = +ve$ (unstable oxide)

14. The increasing order of the boiling points of the major products A,B and C of the following reaction will be :

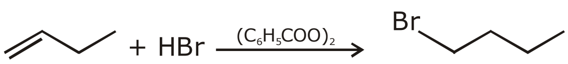
(a) 

(b) 

(c) 

(1) A < B < C
(2) C < A < B
(3) A < C < B
(4) B < C < A

Sol. **4**

(a) 

(b) 

(c) 

$$B.P \propto \frac{1}{Branching}$$

15. The average molar mass of chlorine is 35.5g mol^{-1}. The ratio of ^{35}Cl to ^{37}Cl in naturally occurring chlorine is close to :

(1) 1 : 1 (2) 3 : 1

(3) 2 : 1 (4) 4 : 1

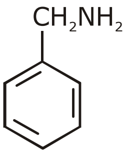
Sol. **2**

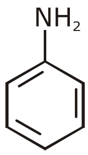
$$\frac{35x + 37y}{x + y} = 35.5$$

$1.5y = -0.5x$

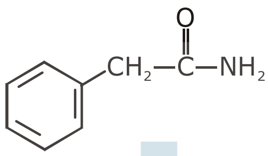
$x/y = 3/1$

16. which of the following compound can be prepared in good yield by Gabriel phthalimide synthesis ?

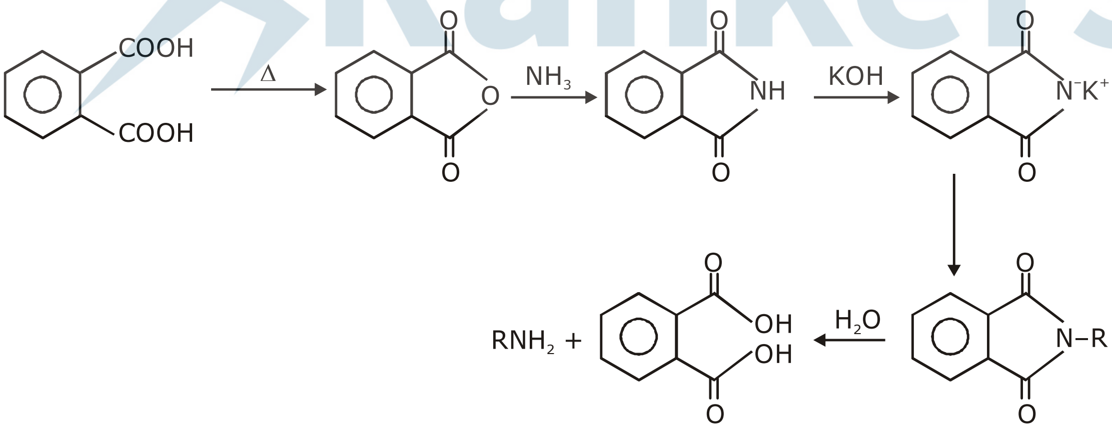
(1) 

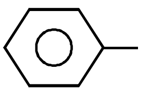
(2) 

(3) CH_3-CH_2-$NHCH_3$

(4) 

Sol. **1**



In this reaction, the alkyl halide should be  $CH_2 - Cl$, which can gives S_N2 reaction easily.

17. The reaction of NO with N_2O_4 at 250 K gives:

(1) N_2O (2) NO_2

(3) N_2O_5 (4) N_2O_3

Sol. **4**

$NO + N_2O_4 \xrightarrow{250k} N_2O_3$

18. A set of solution is prepared using 180g of water as a solvent and 10g of different non-volatile solutes A,B and C. The relative lowering of vapour pressure in the presence of these solutes are in the order [Given, molar mass of A = $100g\ mol^{-1}$ B = $200g\ mol^{-1}$; C = $10{,}000g\ mol^{-1}$]

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

(3) C > B > A (4) A > B > C

Sol. **4**

$RLVP_A = \frac{0.1}{10.1} = \frac{1}{101}$

$RLVP_B = \frac{0.05}{10.05} = \frac{1}{201}$

$RLVP_C = \frac{10^{-3}}{10} = 10^{-4}$

A > B > C

19. Dihydrogen of high purity (> 99.95%) is obtained through :

(1) the elecrolysis of acidified water using Pt electrodes.

(2) the reaction of Zn with dilute HCl

(3) the electrolysis of brine solution.

(4) the electrolysis of warm $Ba(OH)_2$ solution using Ni electrodes.

Sol. **4**

High purity (>99.95%) dihydrogen is obtained by electroloysing warm aqueous barium hydroxide solution between nickel electrodes

20. A crystal is made up of metal iron 'M_1' and 'M_2' and oxide ions. Oxide ions form a ccp lattice structure. The cation 'M_1' occupies 50% of octahedral voids and the cation 'M_2' occupies 12.5% of tetrahedral voids of oxide lattice. The oxidation number of 'M_1' and 'M_2' are, respectively :

(1) +2, +4 (2) +3, +1

(3) +4, +2 (4) +1,+3

Sol. **1**

$M_{1_{4\times\frac{1}{2}}}\ M_{2_{8\times\frac{1}{8}}}\ O_4$

$(M_1)_2(M_2)_1O_4$

$+2x + y = 8$

$x = +2$

$y = +4$

21. For Freundlich adsorption isotherm, a plot of log (x/m) (y-axis) and log p (x-axis) gives a straight line. The intercept and slope for the line is 0.4771 and 2, respectively. The mass of gas, adsorbed per gram of adsorbent if the intitial pressure is 0.04 atm, is ....$\times 10^{-4}$g. (log 3=0.4771)

Sol. **48**

$x/m = KP^{1/n}$

$\text{Log}(x/m) = \text{Log}(k) + \frac{1}{n}\log(P)$

$K = 3, \frac{1}{n} = 2 \Rightarrow n = \frac{1}{2}$

$x/m = 3(P)^{1/n}$

$x/m = 3 \times (4 \times 10^{-2})^2$

$= 48 \times 10^{-4}$g

22. The atomic number of Unnilunium is ....

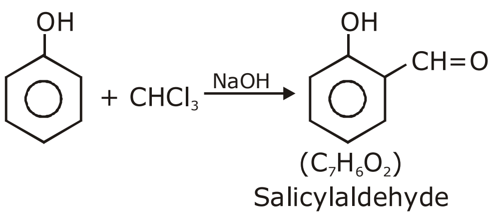
Sol. **101**

Fact

23. A solution of phenol in chloroform when treated with aqueous NaOH gives compound P as a major product. The mass percentage of carbon in P is .... (to the nearest integer)

(Atomic mass : C = 12;H = 1; O = 16)

Sol. **68.85%**



mass of Salicylaldehyde = 12 × 7 + 6 × 1 + 16 × 2 = 122

mass of carbon = 12 × 7 = 84

The mass % of carbon = $\frac{84}{122} \times 100 = 68.85\%$

24. The rate of a reaction decreased by 3.555 times when the temperature was changed from 40°C to 30°C.. The activation energy (in KJ mol^{-1}) of the reaction is......... [Take; R = 8.314 J mol^{-1} K^{-1} In 3.555 = 1.268]

Sol. $K_{40°C} = K; K_{30°C} = \frac{K}{3.555}$

$$\text{In}\ \{3.555\} = \frac{E_a}{R}\left\{\frac{1}{303} - \frac{1}{313}\right\}$$

$$E_a = \frac{1.268 \times 8.314 \times 313 \times 303}{10}$$

E_a = 99980.7 J/mol.

E_a = 99.98 kJ/mol.

E_a = 100 kJ/mol.

25. If the solubility product of AB_2 is 3.20×10^{-11} M^3, then the solubility of AB_2 in pure water is ....× 10^{-4} mol L^{-1} [Assuming that neither kind of ion reacts with water].

Sol. **2**

$$AB_2(s) \rightleftharpoons BA^{+2}_{aq} + 2B^{-}_{aq}$$

S 2S

$K_{sp} = 4s^3 = 32 \times 10^{-12}$

$S = 2 \times 10^{-4}$ mol/lit