

# JEE Main 2020 Paper



**Date** : 6<sup>th</sup> September 2020

**Time** : 02 : 00 pm - 05 : 00 pm

**Subject** : Chemistry

**1.** Match the following :

**Test/Method**

- (i) Lucas Test
- (ii) Dumas method
- (iii) Kjeldahl's method
- (iv) Hinsberg Test

**Reagent**

- (a)  $C_6H_5SO_2Cl/aq. KOH$
- (b)  $HNO_3/AgNO_3$
- (c)  $CuO/CO_2$
- (d) Conc.  $HCl$  and  $ZnCl_2$
- (e)  $H_2SO_4$

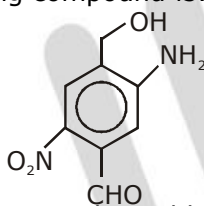
- (1) (i)-(d), (ii)-(c), (iii)-(e), (iv)-(a)
- (3) (i)-(b), (ii)-(d), (iii)-(e), (iv)-(a)

- (2) (i)-(b), (ii)-(a), (iii)-(c), (iv)-(d)
- (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-hydroxymethyl nitrobenzene
- (4) 5-amino-4-hydroxymethyl-2-nitro benzaldehyde

**Sol.**

**4**

**3.** For the Given Cell;



Change in Gibbs energy ( $\Delta G$ ) 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**

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

$$\Delta G = - nFE$$

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

$$\log \left[ \frac{C_1}{C_2} \right] < 0$$

$$C_1 < C_2$$

$$C_2 = \sqrt{2}C_1$$

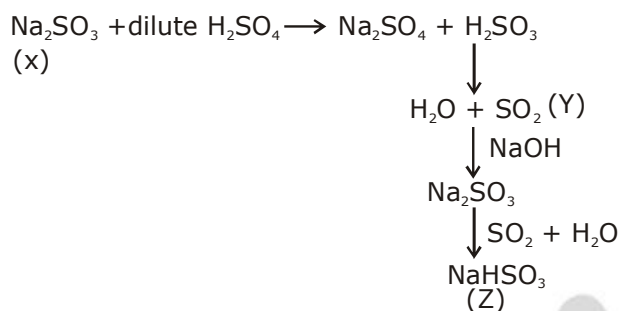
# JEE Main 2020 Paper



4. Reaction of an inorganic sulphite X with dilute  $\text{H}_2\text{SO}_4$  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, respectively, are :

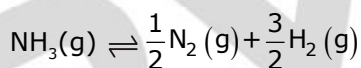
- |  |  |
|--|--|
| (1) $\text{SO}_2$ and $\text{NaHSO}_3$         | (2) S and $\text{Na}_2\text{SO}_3$     |
| (3) $\text{SO}_2$ and $\text{Na}_2\text{SO}_3$ | (4) $\text{SO}_3$ and $\text{NaHSO}_3$ |

**Sol. 1**



Ans. (1) Y =  $\text{SO}_2$   
 Z =  $\text{NaHSO}_3$

5. The value of  $K_c$  is 64 at 800 K for the reaction  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$   
 The value of  $K_c$  for the following reaction is :



- |         |       |         |          |
|---------|-------|---------|----------|
| (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 :

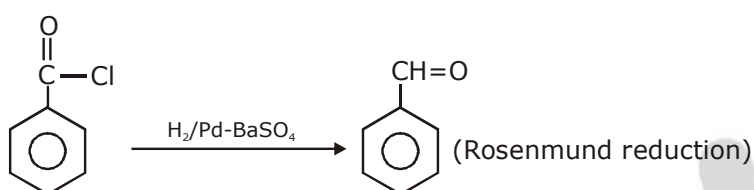
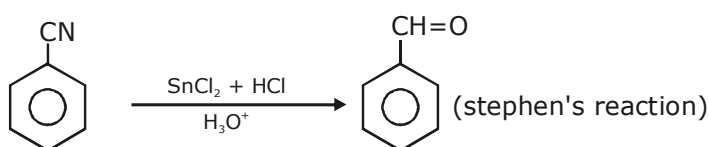
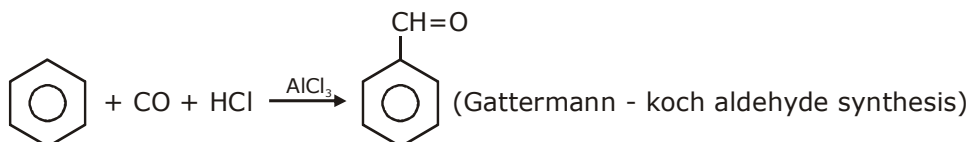
- | Item - I               | Item - II  |
|------------------------|--|
| (I) Benzene            | (P) HCl and $\text{SnCl}_2 \cdot \text{H}_3\text{O}^+$ |
| (II) Benzonitrile      | (Q) $\text{H}_2$ , Pd- $\text{BaSO}_4$ , and quinoline |
| (III) Benzoyl Chloride | (R) CO, HCl and $\text{AlCl}_3$                        |

- |   |
|---|
| (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) |

# JEE Main 2020 Paper



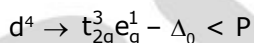
**Sol. 1**



**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)  $t_{2g}^4 e_g^0$  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**



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

- | Item - I           | Item - II                          |
|--------------------|------------------------------------|
| (a) Natural rubber | (I) 1,3-butadiene + styrene        |
| (b) Neoprene       | (II) 1,3-butadiene + acrylonitrile |
| (c) Buna-N         | (III) Chloroprene                  |
| (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

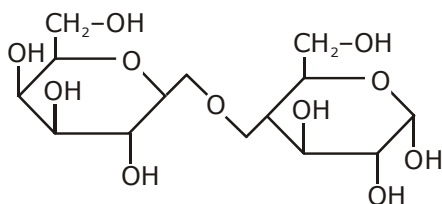
**9.** Which one of the following statement is not true ?

- (1) Lactose contains  $\alpha$ -glycosidic 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  $\beta$ -glycosidic linkage between  $C_1$  of galactose and  $C_4$  of glucose.

# JEE Main 2020 Paper



Structure of Lactose

- 10.** The element that can be refined by distillation is :
- |          |             |
|----------|-------------|
| (1) tin  | (2) gallium |
| (3) zinc | (4) nickel  |

**Sol. 3**  
Zinc → 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) <sub>2</sub>	(A)	Casts of statues
(II)	NaCl	(B)	White wash
(III)	CaSO <sub>4</sub> · $\frac{1}{2}$ H <sub>2</sub> O	(C)	Antacid
(IV)	CaCO <sub>3</sub>	(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)<sub>2</sub> → used in white wash due to its disinfectant nature  
 (ii) CaCO<sub>3</sub> → it used as an Antacid

(iii) CaSO<sub>4</sub> ·  $\frac{1}{2}$  H<sub>2</sub>O → Formaking casts of statues and busts

(iii) Preparation of wasing soda (sodium carbonate)

(1)  $2\text{NH}_3 + \text{H}_2\text{O} + \text{CO}_2 \longrightarrow (\text{NH}_4)_2\text{CO}_3$   
 (2)  $(\text{NH}_4)_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2 \longrightarrow 2\text{NH}_4\text{HCO}_3$   
 (3)  $\text{NH}_4\text{HCO}_3 + \text{NaCl} \longrightarrow \text{NH}_4\text{Cl} + \text{NaHCO}_3$   
 (4)  $2\text{NaHCO}_3 \longrightarrow \text{Na}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O}$

Ans. (3)

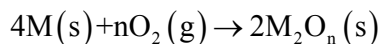
- 12.** Mischmetal is an alloy consisting mainly of :
- |                                    |                                    |
|------------------------------------|------------------------------------|
| (1) lanthanoid and actinoid metals | (2) lanthanoid metals              |
| (3) actinoid metals                | (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

# JEE Main 2020 Paper



13. For a reaction,



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.

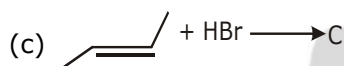
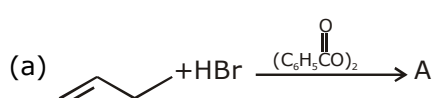
Sol. 1

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G = -ve \text{ (stable oxide)}$$

$$\Delta G = +ve \text{ (unstable oxide)}$$

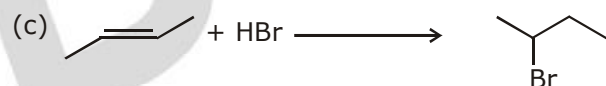
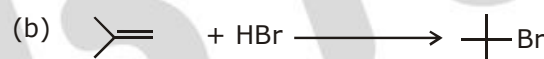
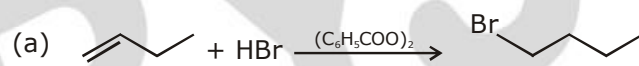
14. The increasing order of the boiling points of the major products A, B and C of the following reaction will be :



- (1) A < B < C
- (3) A < C < B

- (2) C < A < B
- (4) B < C < A

Sol. 4



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

15. The average molar mass of chlorine is 35.5g mol<sup>-1</sup>. The ratio of <sup>35</sup>Cl to <sup>37</sup>Cl in naturally occurring chlorine is close to :

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

Sol. 2

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

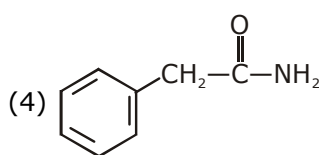
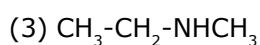
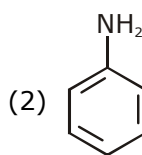
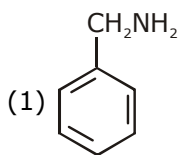
$$1.5y = -0.5x$$

$$x/y = 3/1$$

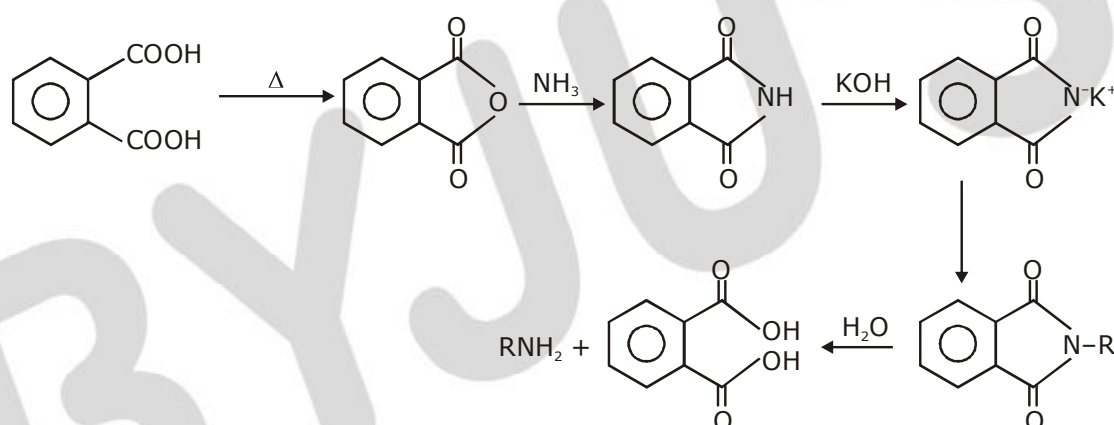
# JEE Main 2020 Paper



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



**Sol. 1**



In this reaction, the alkyl halide should be  $\text{CH}_2\text{-Cl}$ , which can give  $\text{S}_{\text{N}}2$  reaction easily.

17. The reaction of NO with  $\text{N}_2\text{O}_4$  at 250 K gives:
- (1)  $\text{N}_2\text{O}$  (2)  $\text{NO}_2$   
 (3)  $\text{N}_2\text{O}_5$  (4)  $\text{N}_2\text{O}_3$

**Sol. 4**



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 =  $100\text{g mol}^{-1}$ ; B =  $200\text{g mol}^{-1}$ ; C =  $10,000\text{g mol}^{-1}$ ]
- (1)  $\text{A} > \text{C} > \text{B}$  (2)  $\text{B} > \text{C} > \text{A}$   
 (3)  $\text{C} > \text{B} > \text{A}$  (4)  $\text{A} > \text{B} > \text{C}$

# JEE Main 2020 Paper



**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 electrolysis 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)<sub>2</sub> solution using Ni electrodes.

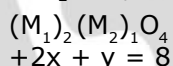
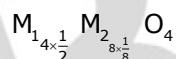
**Sol. 4**

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

**20.** A crystal is made up of metal iron 'M<sub>1</sub>' and 'M<sub>2</sub>' and oxide ions. Oxide ions form a ccp lattice structure. The cation 'M<sub>1</sub>' occupies 50% of octahedral voids and the cation 'M<sub>2</sub>' occupies 12.5% of tetrahedral voids of oxide lattice. The oxidation number of 'M<sub>1</sub>' and 'M<sub>2</sub>' are, respectively :

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

**Sol. 1**



$$+2x + y = 8$$

$$x = +2$$

$$y = +4$$

**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 initial pressure is 0.04 atm, is ..... × 10<sup>-4</sup>g. (log 3=0.4771)

**Sol. 48**

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

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

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

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

$$x/m = 3 \times (4 \times 10^{-2})^2 = 48 \times 10^{-4}g$$

## JEE Main 2020 Paper



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

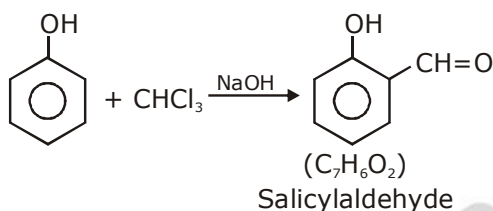
**Sol. 101**

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%**



$$\text{mass of Salicylaldehyde} = 12 \times 7 + 6 \times 1 + 16 \times 2 = 122$$

$$\text{mass of carbon} = 12 \times 7 = 84$$

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

**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<sup>-1</sup>) of the reaction is..... [Take; R = 8.314 J mol<sup>-1</sup> K<sup>-1</sup> In 3.555 = 1.268]

**Sol.**  $K_{40^\circ\text{C}} = K; K_{30^\circ\text{C}} = \frac{K}{3.555}$

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

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

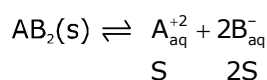
$$E_a = 99980.7 \text{ J/mol.}$$

$$E_a = 99.98 \text{ kJ/mol.}$$

$$E_a = 100 \text{ kJ/mol.}$$

**25.** If the solubility product of AB<sub>2</sub> is 3.20 × 10<sup>-11</sup> M<sup>3</sup>, then the solubility of AB<sub>2</sub> in pure water is ..... × 10<sup>-4</sup> mol L<sup>-1</sup> [Assuming that neither kind of ion reacts with water].

**Sol. 2**



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

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