# Aromatic compounds, Arly Halides (Haloarenes)

## EXERCISES

#### ELEMENTARY



Q.2 (2) 10.5 gram carbon Per hydrogen

$$C = \frac{10.5}{12} \Rightarrow \frac{7}{8}$$
$$H = \frac{1}{1} = 1$$
$$C_{7}H_{8}$$

**Q.3** (3)

Q.4

Q.5

(3)CH<sub>2</sub>-CH<sub>3</sub>

Benzylic carbon has 2 hydrogen ethyl benzene. (1)



Q.6 (2) Rate of electrophilic substitution reaction  $\propto$  Stability of arenium ion.

Q.7

(3)



Isotopic effect is not operate because removal of proton is not R.D.S So isotopic benzen having equal rate for E.S.R. with respect to benzen  $K_{n,n} = K_{n,n} = K_{n,n}$ 

$$K_{C_6H_6} = K_{C_6D_6} = K_{C_6T_6}$$

**Q.8** (4)

$$\underbrace{\bigcirc}^{E^+} \xrightarrow{E^+} \to \sigma \text{ complex wheland}$$

intermediate benzenium cation.

**Q.9** (4)

**Q.10** (4)

 $\mathrm{CH}_3$  group in toluene is 0, p-position direction activator.

**Q.11** (1)

$$CO + HCl \longrightarrow \begin{bmatrix} H \\ Cl \end{bmatrix} = O in Gattermann Koch$$

reaction. (formylating agent).

**Q.12** (2)

**Q.13** (4)



4 (3)

Aromatic and aliphatic alcohols can be distinguished by  ${\rm FeCl}_3$  test.

**Q.15** (1)

Benzaldehyde and formaldehyde give Cannizzaro reaction.

#### **JEE-MAIN OBJECTIVE QUESTIONS** (B)

Q.1

contain 10  $\pi$  electrons [Aromatic species] thus most stable.

Q.2 (2)



(Quasi Aromatic Compound) (2)

2SbCl<sub>5</sub>  $2SbCl_6^{\ominus}$ 

(Quasi Aromatic Compound)



CH3

CH,-

-Q–ÖH,



This is electrophilic sub. reaction.

Q.9 (4)

Q.8







/ Wheeland inter Mediate

Q.10 (2)Anhydrous AlCl<sub>3</sub> \_\_\_\_\_ is best reagent for friedel craft Halogenation.

Q.11 (B)





Q.3



Q.5







Q.7 (3) Benzoic acid & acetone (4) Phenol & acetone (4)





Rate of electrophilic substitution  $\infty$  Stability of arenium ion.

**Q.18** (3)

(1)

Decreasing reactivity order for bromination (E.S.R.)



**Q.19** (B)

 $-\text{CCl}_3, -\text{NO}_2, -\text{CHO} \longrightarrow \text{Meta directing group}$  $- \text{O}^{\ominus} \longrightarrow \text{ortho} / \text{Para directing}$ (4)

(i) (i) (i) (i) (i) (i) (i) (i) (i) (i)

thus reactivity order towards electrophilic substitution reaction is iii > iv > i > ii

Q.21 (1) Flect

Electro releasing order of  $OH > CH_3 > Br > NO_2$ .

**Q.22** (4)



2, 4, 6 Tribromophenol.

**Q.23** (3)

In alkylation of benzene polyalkylated products are formed.

Q.16







**Sulphonation**:



Acetylation :



**Formylation** :



**Q.26** (3)

Reactivity towards electrophile  $\infty$  Electron releasing group.

Q.27 (1) Reactivity towards bromination  $\infty$  Stability of arenium

ion. Reactivity towards bromination  $\infty$  Stability of arenium

**Q.28** (4)



**Q.29** (3)



 $- \text{OCH}_3$  is ortho-para directing

**Q.30** (4)



**Q.31** (2) In sulphonation  $SO_3$  is electrophile species.

**Q.32** (2)



#### **Q.33** (4)

In vinyl chloride lone pair of Cl atom take part in conjugation so partial double bond character between C– Cl bond.



Increasing order of rate of reaction with Br<sub>2</sub>/AlBr<sub>3</sub>

III < I < II < IV



This is Meta directing group

#### Q.46 (2)



Reactivity order for E.S.R.  $\longrightarrow a > b > c > d$ 

Q.47 (1)

> In meta xylene both CH<sub>3</sub> groups increases electron density at same carbons.

Q.48 (1)



Q.49 (3)



-CH<sub>3</sub> group is ortho/para directing. One product is optained.



 $-\dot{O}CH_3$  is ortho-para directing and more electron density at ortho/para position.

#### Q.51 (3)

Correct reactivity order for E.S.R.



Q.52 (2)Orientation decided by more activating - OH group.

#### Q.53 (1)

Orientation decided by more activating - OH group [ + M effect ].



 $\Rightarrow$  do no show Friedel crafts reaction

Q.55 (2)

$$\begin{array}{c} & & & & \\ & & & \\ \hline & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\$$

- 
$$CH_3 \longrightarrow$$
 Weakly activating group









Trichloro ethane. (DDT)

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It is nucleophillic aromatic substitution reaction.

Q.73 (4)  $S_N^2$  Ar is obtained.

**Q.74** (4)

Q.75

(Nucleophilic aromatic Substitution Reaction) (3)



**Q.76** (1)



**Q.77** (2)



**Q.78** (2)



**Q.79** (1)

 $\odot CH_2$ 

Single carbene  $\rightarrow$  two non bonding electron are present in one sp<sup>2</sup> hybridized orbital.



**Q.80** (3)

Two non bonding electron are present in different orbital so triplet carbene having sp hybridized.



**Q.81** (4)

Secondary amine are not gives. Carbylamine reaction/ isocyanide test.

**Q.82** (1)

Sec. amine does not gives Hoffmann'scarbyl amine test.





**Q.86** (2)  $NH_4HS$  is selective reducing agent.

**Q.87** (4)





**Q.89** (2)

Q.88







(4) Amongst the following the moderately activating group is-

$$Ph-NH_{2} \xrightarrow{HNO_{2}} PhN_{2}Cl \xrightarrow{HF} Ph-F$$

**Q.92** (4)

C







**Q.93** (3)







**Q.95** (2)









Br<sub>2</sub>/Fe

\_ Br-





Q.19 (B)



**Q.20** (C)





**Q.21** (A)

















**Q.25** (B)









Q.49



**Q.50** (A)





Phenol prefer coupling in Basic medium.

#### Q.52 (B)

Aniline prefer coupling in acidic medium .

#### Q.53 (A)

The electron-attracting -  $NO_2$  stabilizes ring A. of 1nitronaphthalene to oxidation, and ring B is oxidized to form 3-nitrophthalic acid. By orbital overlap, -

 $NH_2$  releases electron density, making ring A more susceptible to oxidation, and  $\alpha$ -naphthylamine is oxidized to phthalic acid.







Q.55 (D) Q.56 (C)



**Q.57** (B)

$$Ph - \frac{O}{IL}_{14} - CHN_2 \xrightarrow{Ag_2O}_{-N_2} Ph - CH = C^{14}_{C} = O$$

$$\downarrow H_2O$$

$$Ph - CH_2 - \frac{C^{14}_{C}}{C} - OH$$

$$\downarrow H_2O$$

Q.58 (C)



#### **Q.59** (A)



Q.60 (C)



**Q.61** (A)



Q.62 (C)

**Q.63** (B)



#### JEE-ADVANCED

#### MCQ/COMPREHENSION/COLUMN MATCHING

**Q.1** (ABD)





 $4 \pi e^{-}$ , antiaromatic



10  $\pi$  e<sup>-</sup>, aromatic

#### Q.2 (ABCD)

Aromatic  $\rightarrow$  planar, cyclic , (4n+2)  $\pi e^{\varTheta}$  , complete conjugation

Antiaromatic  $\rightarrow$  planar, cyclic , (4n)  $\pi e^{\Theta}$  , complete conjugation

Non aromatic– cyclic structure with non-planar geometry with any hybridization

#### Q.3 (ABC)

Aromatic  $\rightarrow$  planar, cyclic , (4n+2)  $\pi e^{\Theta}$  , complete conjugation

#### Q.4 (AC)

Aromatic  $\rightarrow$  planar, cyclic , (4n+2)  $\pi e^{\varTheta}$  , complete conjugation

Q.5 (BCD)

(A) 
$$\bigwedge_{\text{double bond character}} Cl + AgNO_3 \longrightarrow No. Reaction$$

(B) 
$$H_3CO \longrightarrow CH_2 - CI + AgNO_3 \longrightarrow$$

$$H_3CO \longrightarrow CH_2 - CH + AgNO_3$$
  
Resonance stabilised

carbocation

$$(C) \bigotimes_{i=1}^{O} C - CI + AgNO_{3} \longrightarrow \bigotimes_{i=1}^{O} AgO_{3} \xrightarrow{\oplus} AgCl$$

Stable due to backbonding

(D)  $CH_3 - CH = CH - CH_2 - Cl + AgNO_3 \longrightarrow$   $CH_3 - CH = CH - CH_2 \stackrel{\bigoplus}{NO_3} + AgCl \downarrow$ Stable carbocation due to resonance.

(ABC)

 $\overline{O}$ 

Q.7



 $O - CH_2 - CH = CH - CH_3$ 

O L - CHO + HCHO

 $(\bigcirc NH_2 \longrightarrow NaNO_2/HCI \longrightarrow (\bigcirc N_2^+CI)$ 



Q.10 (AC)

Q.9

(ABD)



**Q.11** (AB)



Q.12 (AC) Q.13 (CD) Q.14 (ABC)



Br C-CH<sub>3</sub>

Q.15 (ABC)



**Q.8** (AC)



 $\bigcup_{i=1}^{I} CH CH = CH_2 \xrightarrow{(i) O_3} (ii)H_2O/Zn$ 

decreasing electron density in benzene ring. So attack of  $NO_2^{\oplus}$  at meta poistion.

#### Q.16 (ABC)



,**Q.17** (AB)

Reactivity order for E.S.R.





Q.18



both are ortho-para directing group because increasing electron density at ortho/para position.



Q.20 (BC)

They are activating groups.

#### Q.21 (ABCD)









Q.22 (BCD)









#### Q.23 (AB)



Q.24 (CD)





Q.25 (ABCD\_







(D)







Q.27 (ACD)











**Comprehension # 1 (Q. No. 28 to 30) Q.28** (D)



 $CH_2$ 

|| 0







(43 to 45)

S Br

NaNO<sub>2</sub>/HCI

NaNO<sub>2</sub>/Cu<sup>+</sup>

ОН

0 II





- Seconary amide does not gives Hoffmann bromamide
  - III NH, Br, + KOH

Comprehension # 10 (Q. No. 54 to 57)

- 56  $H_2SO_4$ , BF<sub>3</sub>, SO<sub>3</sub> reagent are acid and used in Beackmann rearrangment. When  $OH^{\ominus}$  is base.
- 57 Migration of alkyl group or formation of carbocation is R.D.S. step. in Beckmann rearrangement.

**Q.58** 
$$A \longrightarrow r, s; B \longrightarrow r; C \longrightarrow q, s; D \longrightarrow p, s$$

Aromatic  $\rightarrow$  planar, cyclic , (4n+2)  $\pi e^{\Theta}$  , complete conjugation

Antiaromatic  $\rightarrow$  planar, cyclic , (4n)  $\pi e^{\Theta}$  , complete conjugation

Non aromatic- cyclic structure with non-planar geometry with any hybridization

**Q.59** (A) - PR, (B) - PR, (C) - PR, (D) - PS (A) -  $CH_2 - CH_3$  Ortho - Para directing and Activating group.

(B)  $\overrightarrow{O}$  - S - CH<sub>3</sub> Ortho - Para directing group or activating group

(C)  $- \stackrel{O}{NH} - \stackrel{II}{C} - CH_3$  Ortho - Para directing goup or activating group (D)  $- \stackrel{S}{S} - CH_3$  Ortho - Para directing or  $\stackrel{II}{I}$  Ortho - Para directing or

deactivating group.

Q.60 (A) → q, r; (B) → q, s; (C) → p. r; (D) → q, s
(A) -CH=CHCOOH is deactivating due to -I of - COOH group, but o,p-directing due to stability of carbocation.

(B)  $-CCl_3$  is electron withdrawing group due to -I nature.

(C) –OH is electron donating due to +m ;  $-NO_2$  is electron withdrawing due to -m.

 $\textbf{Q.61} \quad \ (A)\text{-} PR; (B) \text{-} PR \text{;} (C) \text{-} P,R; (D) \text{-} P,R$ 



Ortho / para director, Activating group



Ortho / para director, Activating group







Ortho / para director, Activating group







Ortho / para director, activating group



Meta director, deactivating group









(C)



(D)



**Q.64** (A) 
$$\rightarrow$$
 s, (B)  $\rightarrow$  q, (C)  $\rightarrow$  p, (D)  $\rightarrow$  r









$$\label{eq:Q.65} {(A)-p,q,r}\,;\, (B)-s\,;\,\, (C)-q,r,s:(D)\;q$$











**Q.68** (A) - Q,S; (B) - P,R; (C) - R; (D) - P (A)





**Q.69** (A) 
$$-q$$
; (B)  $-p$ ; (C)  $-s$ ; (D)  $-r$ 























(Beckmann Rearrangement)





Q.71 (A) - P ; (B) - P; (C) - Q; (D) - R, S СНО + CHCl<sub>3</sub>/ KOH -







- (A) P S; (B) P, R; (C) P, Q; (D) T **Q.72** 
  - $+ CO + HCI \xrightarrow{AICI_3} Ph CHO$ (A) GatterMannKoch reaction

(B) Ph - C = N + 
$$\xrightarrow{SnCl_2/HCl}$$
 Ph-CHO  
H<sub>2</sub>O

Stephen reduction



 $A \rightarrow S; B \rightarrow Q; C \rightarrow P; D \rightarrow R$ Q.73









 $Ph-CH_2-COONa \xrightarrow{CaO} Ph-CH_3$  Toluene

Ph COON 
$$a \xrightarrow{+ CaO} Ph-H$$
 Benzene

$$Ph-Cl \xrightarrow{2Na} Ph-Ph Diphenyl$$

$$C_{_{6}}H_{_{6}} \xrightarrow{O_{_{3}},Zn} H_{_{2}O} \xrightarrow{CHO} HO Glyoxal$$



o, m, p isomer of toluidines will give toluene with NaNO<sub>2</sub>/HCl followed by  $H_3PO_2$  treatment.



•NH<sub>2</sub>

 $H_2SO_4$ (B) Br Br

(C)

OH

HNO<sub>2</sub>

intramolecular H-Bonding

OH

ĊН

Ñ,Cl<sup>⊕</sup> H<sub>3</sub>PO<sub>2</sub> As a reagent used because other are strong reducing agent

(4)



(C)



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#### $\mathbf{Q.5}\left(\mathbf{A}\right)$



This is example of Ulman reaction which gives product like Wurtz reaction.

**Q.6**(B)



Q.7

(A)





Q.8

(A)





### JEE-MAINS PREVIOUS YEAR'S

**Q.1** (2)



In first step ketonic group is reduced by Clemenssen reduction, in second step aromatisation takes place.







Q.6

(2)



Sandmayer reaction



Gattermann reaction



Fittig reaction

(D)  $2C_2H_5Cl \xrightarrow{Na/Dry ether} Wurtz reaction$ 

$$C_{6}H_{5}NO_{2} \xrightarrow{Sn + HCl} "A" \xrightarrow{C_{6}H_{3}N_{2}Cl} H^{\oplus} \xrightarrow{P} (Yellow coloured compound)$$
(4)

08

Q.10 (2)

**Q.11** (1)

# JEE-ADVANCED

# PREVIOUS YEAR'S

Q.1 Ans.



(C)

Q.2 (C) R (minor) (B,D) (D) **S** (major)





**Q.4** (A, B, C)



O, P-directing due to its powerful +M effect. With I<sub>2</sub> only A is substituted, since -I is large, steric inhibition by large  $-CMe_3$  group forbids substitution at B or C.

–Br and –Cl become progessively more reactive, due to –

(a) increasing electrophilic nature of  $X^{\oplus}$  (not mentioned is any option).

(b) Smaller size most sterically hindered loaction is B which is substituted only by –Cl.

### **Q.5** (D)

In dye test, phenolic -OH is converted to  $-O^{\circ}$ , which activates the ring towards EAS. This is possible only in alkaline solution. Hence (D).

Q.6 (C) P:















Hence the answer is (C)

**Note :** Verifying any two can easily give you the answer complete details are given for reference & understanding.





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**Q.8** (B)



**Q.9** (A)



Q.10 (BCD)







# Comprehension # 2 (Q. No. 12 to 13)

Q.1 2 (B)



(B) Process involved in  $Q \rightarrow R$  reaction is alkylation. Process involved in  $R \rightarrow S$  reaction is alkylation.



**Q.13** 



Scheme 2 :







(Aromatic)

**Ans.** (2,4)





Q.17 [18]





aniline = M.wt. of  $C_6 NH_7$ = 72 + 7 + 14 = 93 density of P = 1 gm ml<sup>-1</sup> 9.3 ml of P = 9.3 gm P

$$=\frac{9.3}{9.3}=0.1$$
 mole P

Q.18

The mole ratio  $PhNH_2$ :  $PhN_2^+$ :

so the mole of Q formed will be 0.1 mole and extent of reaction is 100% but if it is 75% yield.

Then amount of Q =  $01. \times \frac{75}{100} = 0.075 \text{ mol}$ The molecular formula of Q =  $C_{16}H_{12}ON_2$ so M.wt. of Q =  $16 \times 12 + 12 \times 1 + 16 + 2 \times 14$ = 192 + 12 + 16 + 28= 248 gmso amount of Q =  $248 \times 0.075$ = 18.6 gm

# Carboxylic Acids and It's Derivatives and Nitrogen Containing Compounds(Amines)

## EXERCISES

#### ELEMENTARY

#### Preparation of carboxylic acid and their derivative

**Q.1** (3)

Formic acid can not be prepared by grignard's reagent. Higher acids are prepared by the reaction of  $CO_2$  on grignard's reagent

$$\overset{\delta^{-}}{\operatorname{R}} \overset{\delta_{+}}{\operatorname{Mg}} X + \overset{\delta_{+}}{\operatorname{C}} \qquad \begin{array}{c} O\delta & - \\ O\delta & - \end{array} \xrightarrow{\operatorname{R}} \operatorname{R} - \operatorname{C} - O\operatorname{Mg} X \xrightarrow{\operatorname{H.OH}} \\ \overset{H.OH}{\underset{O}{\longrightarrow}} \end{array}$$

$$R - C = OH + Mg(OH)X$$

 $\sim$ 

**Q.2** (4)

 $CH_{3} - C \xrightarrow{} OH + NH_{3} \longrightarrow CH_{3} - CH_{3} \xrightarrow{} A CH_{3}C = N$ 

**Q.3** (1)

 $CO_2 + C_3H_7MgBr - \frac{Hydrc}{C_3H_7COOH} + Mg < \frac{Br}{OH}$ Butanoic acid

**Q.4** (2)

CO<sub>2</sub> adds to Grignard's reagent to yield acids.

$$CO_2 \xrightarrow{CH_3MgI} CH_3COOMgI \xrightarrow{H.OH} Hg \swarrow I$$

Q.5 (4) Acidity decreases with the decrease in Q electronegativity of halogen *i.e.*,

 $FCH_2COOH > ClCH_2COOH > BrCH_2COOH$ 

**Q.6** (1)

**Q.7** (2)

**Q.8** (2)



**Q.9** (4)

 $RCOOH \xrightarrow{\text{LiAlH}_4} RCH_2OH$ 

- **Q.10** (2)  $CH_3COCl \xrightarrow{\text{LiAlH}_4} CH_3CH_2OH + HCl$
- **Q.11** (1) In this reaction  $\alpha$ -*H* is replaced by chlorine
- **Q.12** (2)

$$CH_2 = CH - COOH - LiAH_2 \rightarrow CH - CH_2OH + H_2O$$

**Q.13** (3)



**Q.14** (1)

When succinic acid is heated it forms. Succinic anhydride

$$\begin{array}{c} CH_2COOH \\ \downarrow \\ CH_2COOH \\ Succinic acid \end{array} \xrightarrow{\Delta} \begin{array}{c} CH_2CO \\ \downarrow \\ CH_2CO \\ Succinic anhydride \end{array} O$$

**Q.15** (4)

Amide group represent by the formula -CONH<sub>2</sub>

**Q.16** (1)

 $pK_a \uparrow$  least acidic, acidic strength

$$\bigvee_{\mathbf{H}_{a}} OH < NC \bigvee_{\mathbf{OH}} OH < NO_{2} \bigvee_{\mathbf{OH}} OH < HO_{3} \bigvee_{\mathbf{OH}} OH$$
max PK<sub>a</sub>

**Q.17** (4)

 $CHF_2$  – COOH . Difluoroacetic acid is strongest because presence of two F atoms increases its acidic nature.

$$CH_{3}CH_{2}CONH_{2} \xrightarrow[Propionamide]{Br_{2}/KOH} CH_{3}CH_{2}NH_{2}$$

$$\xrightarrow{Propionamide} CH_{3}CH_{2}NH_{2}$$

$$\xrightarrow{Hofmann bromamide}_{reaction} CH_{3}CH_{2}NH_{2}$$

Q.19 (1)

$$Me \xrightarrow[Me]{} CH - C - NH_2 \xrightarrow[Br_2]{} Me \xrightarrow[Me]{} CH - NH_2$$
  
+ NaBr + Na<sub>2</sub>CO<sub>3</sub>

Q.20 (3)  

$$2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$$
  
 $2CH_3COOH + 2Na \rightarrow 2CH_3COONa + H_2$ 

#### Q.21 (1)

It is picric acid because it has three  $-NO_2$  group are arranged which are ortho and para position

#### Q.22 (2)

-COOH and -OH group form the hydrogen bond by which they have high boiling point. -COOH group show strong hydrogen bonding so it form dimer and have more boiling point than -OH group. While -CHO group do not form hydrogen bond. Thus the reactivity order are as 3 > 1 > 2.

Q.23 (3)  

$$CH_3 - N \equiv C \xrightarrow{\text{LiAlH}_4} CH_3 - NH - C$$
  
(Sec. A min e)

Isocyanide on reduction gives secondary amine.

 $-CH_3$ 

Q.24 (4)

$$\begin{array}{c} CH_{3}-CH_{2}-COOH \xrightarrow{SOCl_{2}} C_{2}H_{5}-C-CI \\ [A] & O & [B] \\ Propanoyl chloride \\ & & \downarrow NH_{3} \\ C_{2}H_{5}-NH_{2} \xleftarrow{KOH}{Br_{2}} C_{2}H_{5}-C-NH_{2} \\ [D] & O & [C] \\ Ethylamine & Propanamide \end{array}$$

Q.25 (3)

Q.26 (2)This reaction is used for preparation of primary aliphatic amines.

Q.28 (3)  
Test G Group  
(I) Iodoform test  

$$CH_3-C-\&CH_3-CH-OH$$
  
(II) Victor mayer test  $1^\circ, 2^\circ \& 3^\circ$  alcohol  
(III) Carbyl amine test Primary amine

Q.29 (3)

$$(I) \bigcirc H = NH_{3} \longrightarrow \bigcirc H_{2} \longrightarrow (I) \longrightarrow (I)$$

 $P \quad h \quad C \quad O \quad - \quad O \quad -$ (IV) $\text{COPh+NH}_3 \rightarrow \text{PhCONH}_2 + \text{PhCOOH}$ 

Q.30 (4)

> Tertiary amine does not react with nitrous acid because in it  $\alpha$ -H atom is absent.

Q.31 (3) Hinsberg Test Q.32 (4)

$$NH_{2}$$
+ Bromine water  $\rightarrow$ 
excess
$$Br$$

$$H_{2}$$
Br
$$Br$$

$$Br$$

$$Br$$

Q.33 (1)

$$C_6H_5 - NH_2 + CHCl_3 + 3KOH \rightarrow$$

 $C_6H_5NC + 3KCl + 3H_2O$ Phenyl Isocyanide

Q.36 (2)

$$0 \leftarrow N = 0 \quad 0 \leftarrow N = 0: \quad 0 \leftarrow N - 0: \quad 0 \leftarrow$$

Presence of  $-NO_2$  group decreases electron density at *o*- and *p*- positions. Hence, incoming electrophile goes to m position. Therefore it is m-directing group.

#### **Q.37** (2)

Carboxylic Acid and Its Derivatives Amines (Nitrogen Containing Compounds)



Q.38 (2)

**Q.39** (1)

NSR [Aryl halide]  $\propto \frac{-M}{+M}$ 

**Q.40** (1)

**Q.41** (1)

$$CH_2 - C \equiv N$$
 Nucleophile  
Electrophile

**Q.42** (1)

Electron – density will be maximum at this position.

**Q.43** (3)

$$\bigcap_{\mathsf{NH}_2} \rightarrow \mathsf{No} \text{ resonance, more availability of cone}$$

– pair.

### JEE-MAIN OBJECTIVE QUESTIONS

#### Q.1 (D)

Treatment of sodium salt of phenol with  $CO_2$  under pressure bring about substitution of the carbonyl group –COOH, for the hydrogen of the ring. This is called as Kolbe's reaction



Sodium salt of phenol

Sodium salicylate



**Q.2** (3)

$$\begin{array}{c} O \\ \parallel \\ CH_3 - C - H \xrightarrow[]{\theta \in H} \\ \xrightarrow[]{\theta \in H} \\ \xrightarrow[]{\theta \in H} \\ \end{array}$$

$$CH_{3} \xrightarrow{\overset{}{-}C - H} \xrightarrow{\overset{H_{2}O/H^{\oplus}}{\Delta}} CH_{3} \xrightarrow{\overset{}{-}C - H} \xrightarrow{\overset{}{-}H} COOH (R/S)$$

**Q.3** (4)

$$CH_{3}I \xrightarrow{Mg} CH_{3}MgI \xrightarrow{Dry} CH_{3} - C - OH$$

$$\xrightarrow{CO_{2}} CH_{2} - COOH$$

$$\downarrow CI$$

**Q.4** (3)

$$\begin{array}{c} \underset{H_{3}CC}{H_{3}CC} \xrightarrow[O]{H_{CN}} CH_{3} \xrightarrow[-C]{CN} CH_{3}CH \xrightarrow[O]{COOH} OH \\ \underset{Acetaklehy de}{} Lactic acid \end{array}$$
**Q.5** (4)

$$\begin{array}{c} CH_{3} \\ \bigcirc \\ OH \end{array} \xrightarrow{CHCl_{3}} \\ KOH \end{array} \xrightarrow{CH_{3}} \\ OH \end{array} \xrightarrow{CHO} \xrightarrow{HCN} \\ OH \end{array}$$



**Q.6** (1)

$$\begin{array}{ccc} C_{2}H_{2} & \xrightarrow{H_{2}SO_{4} \text{ dil.}} & CH_{3}CHI & \xrightarrow{[0]} & CH_{3}-COOH \\ & \xrightarrow{NaOH} & CH_{3}COONa & \xrightarrow{NaOH} & CH_{4} \end{array}$$



**Q.7** (4)



**Q.8** (1)

**Q.9** (4)



 $C_2H_5OH \xrightarrow{[0]} CH_3COOH$ .

Q.11 (2)  

$$CH_3COOH + CH_3 - Mg - X \rightarrow CH_3 - CH_3$$

**Q.12** (1)



Q.13 (C)  $CH_3CH_3 \xleftarrow{\text{Red P}}_{HI} CH_3-COOH \xrightarrow{\text{LiAlH}_4} CH_3-CH_2OH$  $CH_3CH_3 \xleftarrow{\text{LAH}} CH_3CH_2CI \xrightarrow{\text{KOH}} CH_3CH_2OH$ 

**Q.14** (2)

Q.15

RCOOAg  $\xrightarrow{Br_2/\Lambda}$  R-Br  $\downarrow$ R<sup>-</sup>  $\longrightarrow$  Intermediate 1° carbanion  $\rightarrow$  most stable  $\Rightarrow$  reactivity  $\uparrow$ (1)

$$\begin{array}{c} O & OMgBr \\ CH_3C - OCH_3 \xrightarrow{PhMgBr} CH_3 - \stackrel{I}{C} - OCH_3 \\ & \stackrel{PhMgBr}{\longrightarrow} CH_3 - \stackrel{I}{C} - OCH_3 \end{array}$$

$$\xrightarrow{O} OMgBr \\ \xrightarrow{-MgBr(OCH_3)} CH_3 - \stackrel{||}{C} - Ph \xrightarrow{PhMgBr} CH_3 - \stackrel{|}{C} - Ph \\ \xrightarrow{PhMgBr} Ph$$

 $\xrightarrow{H^{+}} CH_{3}\overset{|}{C} - Ph$   $\xrightarrow{Ph}$ 1,1-diphenylethanol

Q.16 (1)  
O  
R 
$$\rightarrow -\overset{||}{C} - OH \longrightarrow \text{less +I & less steric lindrance}}$$
  
more reactive.  
CH<sub>3</sub> - CH - CH<sub>2</sub> - COOH > CH<sub>3</sub> - CH - COOH >  
CH<sub>3</sub>  
CH<sub>3</sub>  
CH<sub>3</sub>  
CH<sub>3</sub>  
CH<sub>3</sub>  
CH<sub>3</sub> - C - COOH > (CH<sub>3</sub>CH<sub>2</sub>)<sub>3</sub>C-COOH  
 $\overset{||}{C}$ H<sub>3</sub>  
Q.17 (1)  
CH<sub>3</sub>COOH  $\xrightarrow{\text{Cl}_2/\text{red P}}$  CH<sub>2</sub> - COOH  
 $\overset{||}{C}$ H<sub>2</sub>  
 $\xrightarrow{\text{NH}_3}$  CH<sub>2</sub> - COOH

НÖ -CH2-OH (A) 0 || OCH₃ OH OCH₃ CH<sub>2</sub> CH<sub>3</sub>OH ĆН ĊH

**Q.23** (1)  

$$CH_3$$
-COOH  $\xrightarrow{Br_2/red P} CH_2$ -COOH  $\xrightarrow{NaCN}$   
 $Br$ 

Q.21

Q.22

Q.24

Q.25

D

(C)

$$\begin{array}{c} \mathrm{CH}_{2}-\mathrm{COOH} & \xrightarrow{\mathrm{H}_{2}\mathrm{O}/\mathrm{H}^{+}} & \mathrm{CH}_{2}-\mathrm{COOH} \\ | \\ \mathrm{CN} & | \\ \mathrm{COOH} \\ \end{array}$$

CI

Q.18 (4)

$$C_6H_5COOCH_3 \xrightarrow{\text{LiAlH}_4} OH + CH_3OH$$

Q.19 (2)  $R COOH + PCl_5 \rightarrow R COCl + POCl_3 + HCl \xrightarrow{KCN}$  $RCOCN + KCl \xrightarrow{2H_2O} RCOCOOH + 2NH_3$  $\xrightarrow{\text{Clemenson reduction}} \text{RCH}_2\text{COOH} + \text{H}_2\text{O}$ Zn-Hg/Conc. HCl 2)

$$CH_{3} - \bigcup_{Ester}^{||} - OC_{2}H_{5} + C_{2}H_{5}MgBr \rightarrow OC_{2}H_{5}$$

$$CH_{3} \xrightarrow{\mid} C \xrightarrow{-Mg(OC_{2}H_{5})Br} CH_{3} \xrightarrow{-C} OH_{3} \xrightarrow{-C} OH_{3}$$

$$\begin{array}{c} C_2H_5 \\ \xrightarrow{C_2H_5M_gBr} & CH_3 & - \begin{array}{c} & - OMgBr & -\underline{Mg(OH)Br} \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ \end{array} \right)$$

$$\begin{array}{c} C_2H_5\\ H_3C-\overset{\scriptstyle |}{C}-OH\\ \overset{\scriptstyle |}{C}_2H_5\end{array} 3^\circ \text{ alcohol} \end{array}$$

Br at 
$$\alpha$$
-carbon  
(A)  
CH<sub>3</sub>-COOH  $\xrightarrow{Br_2/red P}$  CH<sub>2</sub>-COOH  $\xrightarrow{NaCN}$   
Br  
CH<sub>2</sub>-COOH  $\xrightarrow{H_2O/H^+}$  CH<sub>2</sub>-COOH

$$\begin{array}{c} | \\ CN \\ \underline{ \ \ } \\ COOH \end{array}$$

$$\begin{pmatrix} H-C-O \\ \parallel \\ O \end{pmatrix}_2 Ca \xrightarrow{\Delta} HCHO \xrightarrow{NaOH}_{Cannizaro reaction}$$

$$CH_3OH + HCOONa \xrightarrow{\Delta}_{360^{\circ}C} H-C-O-CH_3$$

$$\parallel \\ O$$

**Q.36** (1)



**Q.33** (4)

 $\begin{array}{l} CH_{3}CH_{2}COOH(aq) + \underset{sod. \ bicarbonate}{NaHCO_{3}(aq)} \rightarrow \\ CH_{3}CH_{2}COONa + CO_{2} + H_{2}O \end{array}$ 

Q.34 (3)
 Presence of methyl group decreases the acidic character of acetic acid due to positive inductive effect (+I).

### **Q.35** (3)

 $CH_3 - CH_2 - CCl_2 - COOH$ ;  $\alpha, \alpha$ -dichloro butanoic acid is most acidic. Hence it will easily loose  $H^+$ ions in solution

#### **Q.44** (1)



Q.45 (D)



(2)  $C_2H_5-NH_2+HNO_2 \rightarrow C_2H_5OH+N_2+H_2O$  [Alcohol]  $C_2H_5-NH_2+C_6H_5CHO \rightarrow C_2H_5-N=CH-C_6H_5+H_2O$ [Shifts base]  $\mathrm{C_2H_5NH_2} + \mathrm{NOCl} \rightarrow \mathrm{C_2H_5Cl} + \mathrm{N_2} + \mathrm{H_2O}$ 

$$C_2H_3NH_2+C_6H_3SO_2CI \rightarrow C_2H_5NH_3-C_6H_3$$

Q.48 (2)

$$A \xrightarrow{\text{SnC}_2} B \xrightarrow{\text{NaNO}_2 + HC} C \xrightarrow{\text{H}_2O} C_6 H_5 OH$$



Q.49 (1)Q.50 (3)



Since aniline is more reactive forwards ESR and in polar solvent [water] concentration of E<sup>⊕</sup>[Br<sup>+</sup>] is also in good yield so Br<sup>⊕</sup> will attack on all o & p position of molecule.

(3)

Q.53 (1)

$$C_{2}H_{3}MgBr \xrightarrow{C-CN} C_{2}H_{3}CN \xrightarrow{H,O^{\oplus}} C_{2}H_{3}-COOH$$

$$[A] \xrightarrow{[A]} C_{2}H_{3}-COH$$

$$[B]$$

$$CH_{3}-C_{2}-CH_{3}\xrightarrow{\underline{l}} CH_{3}+Ag \longrightarrow CHECH$$

$$CH_{3}-CONA$$

$$[Y]$$

$$C_{6}H_{3}NH_{2}\xrightarrow{NaNO_{2}} C_{6}H_{5}N_{2}O^{\oplus} \xrightarrow{CaCN} C_{6}H_{5}CN$$

$$[P] \xrightarrow{[Q]}$$

$$[Q]$$

$$NauBOH$$

C HCH, NH, R]

Benzyl amine

Q.54 (3) (A) Ammonical AgNO<sub>3</sub> [Tollen's reagent]

$$\begin{array}{c} (B) HIO_4 > C & C + HIO_4 & C + C \\ I & I & I \\ OH & OH \\ Vicinal alcohol & O \end{array} \\ \end{array} \\ \begin{array}{c} (B) HIO_4 > C + C \\ I & I \\ O & O \\ O \\ O \\ \end{array} \\ \end{array}$$

(C) Alk. KMnO<sub>4</sub> [1% alk. cold dil.]  $\rightarrow$  Bayer's reagent  $\rightarrow$  Test of unsaturated  $(D)R-NH_2+CHCl_3+NaOH\rightarrow R-N\equiv C+3KCl+3H_2O$ 

Q.55 (4)

(a) >C=NH-R structure will be Shiff's Base.



[Yellow - Dve]



Q.56 (2)

$$R - C \equiv N \xrightarrow[Nitrile]{Reduction} R - CH_2 - NH_2$$

$$R - C \equiv N \xrightarrow[1^{\circ} amine]{Hydrolysis} R - COOH + NH_3$$

 $R-CN+H_2O \xrightarrow{H_2O/H^+} RCOOH+NH_3$ It yield amine when reduced as - $\mathrm{R}-\mathrm{CN}+\mathrm{H}_2\rightarrow\mathrm{R}-\mathrm{CH}_2-\mathrm{NH}_2$ 

Q.58 (3)

$$C_{6}H_{5}NH_{2} \xrightarrow{NaNO_{2} / HCI} C_{6}H_{5}NC_{2}H_{5}NO_{2}H_{N2} + HCI$$

Q.59 (3)



( )

 $+ 3H_2O$ 

Carbylamine reaction.

Q.62 (4)

$$\begin{array}{rcl} CH_{3}CH_{2}NH & + & CH_{3}MgBr \longrightarrow CH_{3}CH - NHMgBr + CH_{2} \\ & | & \downarrow \\ & H & base \\ & \downarrow \\ & acid \end{array}$$

 $CHCl_3 + 3KOH \longrightarrow CH_3NC + 3KCl$ 

Q.63 (4)

$$R - NH_2 + CS_2 \xrightarrow{HgCl_2} R - SCH$$

Hoffmann mustrd oil reaction.

(4)Q.64

Q.65 (4)

Q.66 (3)

Q.67 (4)



Q.68 (3)



(2)Q.69

$$CH_{3}CN + CH_{3}MgI \rightarrow (CH_{3})_{2}CNMgI \xrightarrow{H_{2}O/H^{+}}_{(A)} \rightarrow (CH_{3})_{2}CNMgI \xrightarrow{H_{2}O/H^{+}}_{-NH_{3}}$$

 $CH_{3}COCH_{3}+Mg < OH_{I}$ 

#### **Q.70** (B)







- **Q.72** (2)
- **Q.73** (1)
- **Q.74** (1)
- **Q.75** (1)
- **Q.76** (1)
- **Q.77** (4) Allyl isocyanide.  $CH_2 = CH - CH_2 - N \equiv C$
- **Q.78** (2)

Q.79 (4) Order of basicity of ethyl amines.  $(C_2H_5)_2NH > (C_2H_5)_3N > C_2H_5NH_2 > NH_3 > C_6H_5NH_2$ Q.80 (2) JEE-ADVANCED OBJECTIVE QUESTIONS

**Q.1** (B)



**Q.2** (A)

$$\frac{1}{\sqrt{C^{+\delta} + Nu^{\Theta}}}$$

Acyl carbon shows addition elimination mechanism by attack of Nucleophilic.

- **Q.3** (B)
- **Q.4** (C)

Primary amines, secondary amines and ammonia all react rapidly with acid chlorides to form amides, This reaction takes place at room temperature and gives high yield.

**Q.5** (D)



Q.6 (C)



**Q.7** (C)



42

 $CH_{3}-(CH_{2})_{3}-NH-C$  Br S Br Br  $H-(CH_{2})_{3}-CH_{3}$   $H-(CH_$ 

Q.8

(A)

(I) 
$$CH_3 - C - O - C_6H_5$$
 Only Resonance

(II) 
$$CH_3 - \overset{O}{C} - O - \bigcirc$$
 no Resonance

(III) 
$$CH_3 - \overset{O}{C} - O - \overset{O}{\swarrow} - CH_3$$
 Resonance +  
+ I effect of  $CH_3$ 

(IV) 
$$CH_3 - \overset{O}{C} - O - \overset{O}{\swarrow} - CI$$
 Resonance +

Q.10 (A)

Reactivity order of saponification of esters  $1^{\circ}R > 2^{\circ}R > 3^{\circ}R$ 

#### **Q.11** (A)

(I) 
$$NO_2$$
 -COOC<sub>2</sub>H<sub>5</sub> is more reactive be-

cause of -M effect of -NO<sub>2</sub>

(II) 
$$NO_2 - O - C - CH_3$$
 is more reactive

because of -M effect of  $-NO_2 > -M$  effect ( $-OCH_3$ ) (III) 6 member ring is less reactive to 4 member ring.

**Q.12** (B)

 $\begin{array}{c} O\\ \parallel\\ CH_{3}OH+R\ COOH \longrightarrow CH_{3}OCR \ ; \ Reactivity \ order \ of \ esterification \ H>1^{\circ}R>2^{\circ}\ R>3^{\circ}\ R \end{array}$ 

Q.13 (C)

R-COOH 
$$\xrightarrow{\text{EtOH}, \text{H}_2\text{SO}_4}$$
 R-C-OEt (esterification)  
Thus X is (C)

Q.14 (C)



**Q.15** (B)



**Q.16** (B) Ease of esterification for alcohols  $\infty$  more acidic alcohols

$$\bigcirc H_{1} \xrightarrow{CH_{3}OH} H_{1} \xrightarrow{CH_{3}OH} H_{2} \xrightarrow{CH_{3}O} \xrightarrow{OH} H_{2} \xrightarrow{CH_{3}O} \xrightarrow{CH_{3}OH} H_{2} \xrightarrow{CH_{3}OH} \xrightarrow{CH_{3}OH} H_{2} \xrightarrow{CH_{3}OH} \xrightarrow{CH_{3}OH$$

Q.18 (C)











Q.20 (C)





**Q.22** (B)



Q.23 (A)  $\begin{array}{cccc}
0 & 0 & 0 \\
\parallel & \parallel \\
R & COC & R + R'NH_2 \longrightarrow R & VHr' + HOCR \\
Thus X=(A)
\end{array}$ 





Q.26 (C)



**Q.27** (B)



**Q.28** (A)



**Q.29** (D)





Q.30 (A)



Q.31 (C)



Q.32 (C)



Q.33 C





Q.37 (C)

(P) on hydrolysis gives propanedioic acid and methanol. Propanedioic acid on strong heating gives acetic acid which when reduced with Red P/HI gives ethane.

Q.38 (A)

$$\begin{array}{c} \text{COOH} \\ | \\ \text{CH}_2 - \text{CH}_2 - \text{C} - \text{H} & \underline{\qquad} \text{NaBH}_4 \rightarrow \\ \\ | \\ \text{O} \end{array}$$

$$\begin{array}{c} \mathsf{COOH} \\ | \\ \mathsf{CH}_2 - \mathsf{CH}_2 - \mathsf{CH}_2 - \mathsf{OH} \xrightarrow{aq. acid} \end{array}$$

Q.39 (A) Q.40 (A)

$$(CH_{3})_{3}C - COOH - \frac{NH_{3}}{\Delta} \rightarrow (CH_{3})_{3}C - C - NH_{2} \xrightarrow{KBrO} (CH_{3})_{3}C - NH_{2} \xrightarrow{HNO_{2}} (CH_{3})_{3}C - OH$$
**O.41** (C)

It is a hoffmann bromamide reaction 
$$CH_3 \qquad CH_3$$

$$PhCH_2 - CH_2 - CH_2 - H_2 \xrightarrow{Br_2/NaOH} PhCH_2 - CH_2 - CH_2 - NH_2$$

Q.42 (C)

$$\begin{array}{c} O \\ \parallel \\ \mathsf{NH}_2 - \overset{}{\mathsf{C}} - \mathsf{NH}_2 + 2\mathsf{OH} \xrightarrow{\Theta} \mathsf{HO} - \overset{}{\mathsf{C}} - \mathsf{OH} + 2\mathsf{NH}_2^{\Theta} \longrightarrow \mathsf{Na}_2\mathsf{CO}_3 + 2\mathsf{NH}_3 \end{array}$$



 $\operatorname{RCNH}_2 \xrightarrow{OH/Br_2} \operatorname{RNH}_2$ 

Q.34 (B)  $H_{3}C$  CH - CH  $CH_{3}$  produced by the all reaction.

Q.35 (D)

**Q.36** (B)

Q.44 (B)



**Q.45** (A)



$$\begin{array}{c} & | \\ CH_3 - CH_2 + Cl_2 + Ca (OH)_2 \longrightarrow HCCl_3 \\ (C) & Slaked \\ Q.47 & (C) & lime \end{array}$$

#### JEE-ADVANCED

#### MCQ/COMPREHENSION/COLUMN MATCHING

Q.1 (BD)  $CH_3 \xrightarrow{CH_3} CH_3 \xrightarrow{CH_3} CH_3$   $CH_3-C-Br \xrightarrow{Mg} CH_3-C-MgBr \xrightarrow{CO_2} H_3$   $CH_3-C-CH_3$  $CH_3 \xrightarrow{CH_3} CH_3-C-COOH$ 

**Q.2** (ABD)

Hydrolysis of acid derivative is an  $S_N^2$ Th reaction and the reactivity of acid derivatives towards  $S_N^2$ Th is



Q.3 (ACD)

Rate of esterification  $\propto$  Steric crowding

Q.4 (BCD)

It is Hoffmann bromamide reaction which is 100% intramolecular.

**Q.5** (CD)

(A) Surface area decrease, solubility increase, so a is wrong order.



In it, due to the presence of intramolecular H – bonding the solubility is decrease, so b is wrong order.





Its dipole moment is higher than II, then we say like dissolve like.

Q.6 (BD)

Q.7

Dipole moment of cis isomer > dipole moment of trans isomer and hence water solubility also of cis isomer is greater than trans isomer.

Comprehension-1 (Q. No. 7 to 9)

(B)  

$$CH_{3} \longrightarrow \overset{O}{C} \longrightarrow OH \longrightarrow H^{\oplus}$$

$$CH_{3} = \bigcirc_{C_{2}}^{O} \bigoplus_{OH_{2}} \xrightarrow{C_{2}H_{5}OH(\Delta^{\circ})}$$

$$(CH_3)_3 C - OH \longrightarrow$$

$$(CH_{3})_{3} C^{\oplus} + H_{2}O^{18} \xrightarrow{CH_{3}COOH}$$

$$O$$

$$II$$

$$(CH_{3})_{3} C - O - C - CH_{3}$$

$$(A)$$

Q.8





optically active

$$CH_{3} - COOH + Ph - C - OH - OH - C_{2}H_{5}$$

$$(3^{\circ}\& \text{ benzylic})$$

racemic mixture

**Q.9** (B)

Since (+) Octan-2-ol racemises on reaction with acetic acid, therefore it must have gone through an  $S_{N}1$  reaction i.e., type II reaction.

#### Comprehension-2 (Q. No. 10 to 12)

Q.10 (C)

$$\overset{\text{II}}{\text{II}}$$
 = C = CH<sub>2</sub> = COOH

 $\cap$ 

**Q.11** (D)

X is an anion and it has no acidic hydrogen.

Q.12 (D) any mono substituted benzene oxidises to benzoic acid. Comprehension-3 (Q. No. 13 to 15)

Q.13 (B)

Hoffmann rearrangement is only shown by 1° amide.

**Q.14** (D)

Rate of reaction in hoffmann rearrangement among difference amide depends on migratory aptitude of group in the amide.

Q.15 (B)

Hoffmann rearrangement is 100% intramolecular. one amide will give only one amine with  $Br_{\gamma}/OH^{\Theta}$ .

#### Comprehension-4 (Q. No. 16 to 18)

**Q.16** (A) This is a Hoffmann bromamide reaction in which  $Br_2/HO^-$  i.e. NaOBr is used.

**Q.17** (B)

In this reaction migration of alkyl or aryl group is rate determining step.

Q.18 (C)

This is a 100% intramolecular reaction and no cross product is formed.

Q.19 (A) - (s); (B) - (q, s); (C) - (p, s); (D) - (p, r, s)

- (A) It will be an acid base reaction.
- (B) it is an acid catalysed esterification.

(C) it is an acid catalysed hydrolysis.

(D) It is a base catalysed hydrolysis which is also known as saponification



#### NUMERICAL VALUE BASED

- Q.1 [2]  $CH_3COOCH_3 \xrightarrow{H^+} H_{2O} \rightarrow CH_3COOH + CH_3OH$ Q.2 [3]
- **Q.3** [2]

 $\begin{array}{c} \text{Cl} \\ \text{CH}_3\text{CH}_2\text{COOH} \xrightarrow{\text{Cl}_2} \text{H}_3\text{C} \xrightarrow{\text{CH}} \text{CH}_2\text{COOH} \xrightarrow{\text{Ak:KOH}} \text{CH}_2 = \text{CH} - \text{COOH or } \text{C}_3\text{H}_4\text{O}_2 \end{array}$ 

**Q.4** [6]

Dcarboxylation occurs via six membered transition state.

**Q.5** [1]

Hydroxide ion promotes only hydrolysis reaction. It can't promote trans esterification reactions as anion of the acid will be formed from ester. In acetaldehyde only alpha hydrogens are exchanged.

- **Q.6** [8]
  - (A)  $\Rightarrow$  Colour with cerric ammonium nitrate  $\Rightarrow$  Alcoholic group.



$$\xrightarrow{\text{KCN}} \text{H}_{2}\text{C} \xrightarrow{\text{CH}_{2}-\text{CN}} \text{CH}_{2}-\text{CN}$$
(C)
$$\xrightarrow{\text{Na}}_{C_{2}\text{H}_{5}\text{OH}} \text{H}_{2}\text{C} \xrightarrow{\text{CH}_{2}-\text{CH}_{2}-\text{NH}_{2}} \xrightarrow{\Lambda} \xrightarrow{\text{NH}} \text{NH}$$

(D)

Piperidine

**Q.7** [2]



Q.8 [3]

Three products can be formed namely 1,4,9 In Hofmann bromamide reaction there is intramolecular migration of alkyl or aryl groups so cross products are not formed.

**Q.9** [5]



Friedel craft acylation Iodoform reaction





$$\begin{array}{c} N-MgBr & O \\ \parallel \\ H_{3}C-CH_{2}-C-CH_{3} \xrightarrow{H_{3}O^{+}} H_{3}C-CH_{2}-C-CH_{3} \end{array}$$

**Q.3** (B)



**Q.4** (A)



No acidic hydrogen (insoluble in alkali)

**Q.5** (B)  
$$2CH_3COOH + 2Na \rightarrow 2CH_3COONa + H_2 \uparrow$$

Q.6 (A)  

$$-C-O-C-$$
; an hydride group.  
 $\parallel \qquad \parallel \\ O \qquad O$ 

**Q.7** (A)



more nucleophilic (localised lone pair)

$$(6) \bigcirc \underbrace{Cl_2}_{AlCl_2} \bigoplus \underbrace{O}_{THE_{\Delta}}^{Cl}$$

COOH

 $\langle \$ 



Q.10



#### **Q.11** [5]

Only primary amines can be prepared by this method. The second step involves  $S_N^2$  reaction. Therefore



and  $CH_2 = CH - X$  are not expected to give  $S_N^2$ .

**Q.12** [4]

The chemical reaction involved is as follows:

$$-NH_{2}+Cl-\overset{O}{\overset{\parallel}{C}}-CH_{3}\xrightarrow{-H}-NH-\overset{O}{\overset{\parallel}{C}}-CH_{3}$$

Net increase in mol. Mass on acylation of one  $-NH_2$ group = Mol. Mass of  $CH_3CO$  group -At. Mass of H = 43 - 1 = 42Actual increase in mol. Mass on acylation = 348 - 180 = 168no.  $CH_3CO$  group added = 168/42 = 4Hence the compound has  $4 - NH_2$  groups.

#### KVPY PREVIOUS YEAR'S

**Q.1** (A)

 $\begin{array}{c} H_{3}C-COOH \xrightarrow{CH_{3}CH_{2}NH_{2}} \\ H_{3}C-COO^{-}.\overset{+}{N}H_{3}-CH_{2}CH_{3} \rightarrow \\ H_{3}C-CO-NH-CH_{2}-CH_{3} \end{array}$ 

Q.9 (B) Q.12 (A)



This is example of wolfkishner reduction which converts.

C=O in  $C=H_2$  Group But do not reduce –COOH **Q.13** group.







(A) Esterification

(C)



Q.14 (B)







Q.11 (A)







Q.21 (B)



Benzene





Q.23 (A)



#### Q.24 (B)



Q.25. (A)

$$CH_{3} - C \equiv N \xrightarrow{Reduction} CH_{3} - CH_{2} - NH_{2}$$

$$\downarrow H_{3}O^{\dagger}(Hydrolysis)$$

$$CH_{3} - COOH$$

$$CH_3 - CN$$
 is common name  $\Rightarrow$  Acetonitrile

Q.26 (B)

$$CH_3 - CH + \underbrace{CH_1}_{Ph} + \underbrace{CH_2}_{Ph} + \underbrace{Br_2 + NaOH}_{Ph} + CH_3 - CH - NH_2$$

#### JEE MAINS PREVIOUS YEAR'S

**Q.1** (1)





2-Butanone forms oxime with  $NH_2OH$  but does not give Tollen's test.





According to the question the amine should be amine, in which one of the alkyl group should will, because it can be formed by

**Q.3** (2)



In acidic medium, aniline is converted into anilinium ion which is meta directing so meta product is formed in significant amount.

Q.4



Q.5 Q.6

(4)

In acidic medium, aniline is converted into anilinium ion which is meta directing

Alcohols give positive test with ceric ammonium nitrate and primary amines gives carbyl amine test with  $CHCl_3$ , KOH.

Only aliphatic amines can be prepared by Gabriel phthalimide synthesis.



Q.9

Q.10

Only aromatic Primary amines will gives Dye test. (1)



Q.17(4)



**Q.11** (2)

Q.12

- (2) HO-CH<sub>2</sub>-CH<sub>2</sub>-OH + HOOC-COOH  $\xrightarrow{210^{\circ}\text{C}}$ CH<sub>2</sub>=CH<sub>2</sub>
- **Q.13** (3)
  - (1)  $CH_3CN + DiBAL-H \longrightarrow CH_3CHO$ (acetaldehyde)
  - (2)  $CH_3CH_2OH + Cu$ , heat  $\longrightarrow CH_3CHO$ (acetaldehyde)
  - (3)  $CH_3CH_2OH + CrO_3, H_2SO_4 \longrightarrow CH_3COOH$ (acetic acid)
  - (4)  $CH_2 = CH_2 + O_2 \xrightarrow{Catalyst}{pd(II),Cu(II)in water} CH_3CHO$ (acetaldehyde)
- **Q.14** (1)

 $CH_{3}-C \equiv N \xrightarrow{(1)H_{2}O/H^{+}} CH_{3}COOH$   $\xrightarrow{(2)SOCl_{2}} CH_{3}COCl \xrightarrow{(3)H_{2},pd, BaSO_{4}} CH_{3}CHO$ 

Q.15 (3)



Q.16 (3)

 $\begin{array}{c} & \overset{CH_{3}}{\longrightarrow} & \overset{"A"}{\longrightarrow} & \overset{COOH}{\longrightarrow} \\ & \overset{OCH_{3}}{\longrightarrow} & \overset{OCH_{3}}{\longrightarrow} & \overset{OCH_{3}}{\longrightarrow} & \overset{COOH}{\longrightarrow} \\ & \overset{CH_{3}}{\longrightarrow} & \overset{H^{+}}{\longrightarrow} & \overset{OCH_{3}}{\longrightarrow} & \overset{COOH}{\longrightarrow} \end{array}$ 



% yield order  $\Rightarrow C > B > A$ 

#### Q.18 (4)

Hinsberg reagent (Benzene sulphonyl chloride) gives reaction product with  $1^{\circ}$  amine and it is soluble in dil. NaOH.



Q.19 (1)



 $R-NH_2 + Na_2CO_3 + 2NaBr + 2H_2O \longleftarrow$ Mechanism



Q.20 (3)



Q.21 (2)



#### Q.22 (1)

Primary amines react with Para Toluene sulfonyl chloride to form a precipitate that is soluble in NaOH. Secondary amines reacts with para toluene sulfonyl chloride to give a precipitate that is insoluble in NaOH. Tertiary amines do not react with para toluen.

#### Q.23 (4)

The process of cleavage of the C-X bond by Ammonia molecule is known as ammonolysis.

Ex : 
$$R-CH - Cl_2 + \ddot{N}H \xrightarrow{3} R-CH_2 - NH_2$$

Q.24 (4)



### Q.25 (2)

Hoffmann bromamide degradation reaction :



Carbylamine reaction





Q.27 (3)





Q.31 (3)

$$\bigvee_{\substack{R-NH-R + NaX + H_2O \\ 2^{\circ} \text{ amine} \\ R-X \downarrow \\ [R-N + R] X \xrightarrow{-NaOH} R_3N + NaX + H_2O \\ R \end{vmatrix}$$

So the purpose of NaOH in the above reactions in to remove acidic impurities.

Q.28 (3)

Q.33  
Q.33  

$$O$$
  
 $CH_2-C-CH_3$   
 $i) Br_2+NaOH$   
 $ii) H^2$   
 $Haloform Reaction$   
 $NH_3/\Delta$   
Q.36  
 $O$   
 $CH_2-C-OH$   
 $Haloform Reaction$   
 $NH_3/\Delta$   
Q.36  
 $Q.37$ 

- This reaction does not involve haffmann bromanide ⇒ degradation.
- Rest all options involve haffmann bromamide  $\Rightarrow$ degradation during the reaction of Br<sub>2</sub>+NaOH with amide.

Q.29 (3)

$$(A) = (A) = (A)$$

Q.30 (1)



$$Q.46 \quad [4]$$

$$N_2^+C\Gamma \qquad Q.47 \quad (1)$$

$$OCH_3 - CH_2 - OH \longrightarrow OCH_3 - CH_3 - CH_2 - OH \longrightarrow OCH_3 - CH_3 -$$

$$Ph-CH_{2}-NH_{2} \xrightarrow{CH_{3}-Br} Ph-CH_{2}-NH_{2}-HBr_{3}$$
$$-HBr_{3} \downarrow CH-Br$$

$$\begin{array}{c} \text{Ph-CH}_2\text{-N} \xrightarrow{\text{CH}_3} \text{CH}_3 \xrightarrow{\text{CH}-\text{Br}_3} \text{Ph-CH}_2\text{-N} \xrightarrow{\text{CH}_3} \\ \bigoplus \\ \text{CH}_3 \xrightarrow{\text{CH}-\text{Br}} \text{Ph-CH}_2\text{-N} \xrightarrow{\text{CH}_3} \end{array}$$

no of moles 
$$= 3$$

0.00

- (1) Q.37
- Q.38 (3) Q.39 (4)
- Q.40 (3)
  - (4)
- (1) (3)

#### Q.50 (2)







$$Ph - NH - C - CH_{3} \qquad (A)$$



#### **JEE-ADVANCED PREVIOUS YEAR'S**

Q.1 (A)







Q.3

In decarboxylation,  $\alpha$ -carbon acquires  $\delta$ - charge. Whenever  $\delta$ - charge is stabilized, decarboxylation becomes simple. In (B), it is stabilized by -m & -I of C = O, which is best amongst the options offered,



(A,C,D)Q.4







No. of –COOH group is '2'.

#### Comprehension (Q. No. 6 to 7)

- Q.6 (B)
- Q.7 (A) (6 & 7)





(Racemic Mixture)



#### Q.8

Allylic radical are more stable than alkyl radical, so when there is a possibility of formation of allyl radical, it will undergo fragmentation through formation of allyl radical, i.e. fragmentation produces stable radical.

On the basis of stability of radical, fragmentation can be done as





#### **Q.10** (A)



Comprehension (Q. No. 11 to 12)

- **Q.11** (A)
- **Q.12** (B)



Question Stem for Question Nos. 13 and 14

Q.13 [3. 57]

The value of **x** is 3Sn + 6HCl +



(72 + 8 + 35) + 14= 129 gm (molecular weight of organic salt) So to get 1.29 gm organic salt. We have to form 0.01 mole salt. So 0.01 mole nitrobenzene is required. 0.03 mole Sn is required. So the amount of nitrobenzene = 0.01 × 123 = 1.23 gm the amount of Sn required = 0.01 0 + 357 = 3.57 gm **Ans. 3.57 & 1.23** 





(72 + 8 + 35) + 14

= 129 gm (molecular weight of organic salt) So to get 1.29 gm organic salt. We have to form 0.01 mole salt. So 0.01 mole nitrobenzene is required. 0.03 mole Sn is required. So the amount of nitrobenzene =  $0.01 \times 123 = 1.23$  gm

the amount of Sn required =  $0.01 \times 357 = 3.57$  gm Ans. 3.57 & 1.23

# **Biomolecules**

## **EXERCISES**

ELEM Q.1	ENTARY (1)		CH <sub>3</sub> -CH-COOH
	All are optically active.		alanine ( $\alpha$ amino propionic acid)
Q.2	(3)	0.16	
Q.3	(3) Threose = $C_4 H_8 O_4$	Q.16	(3) Isoelectric point is a pH at which zwitter ions do not migrate towards any of the electrode.
Q.4	(2)	Q.17	(2)
Q.5	(3) Carbohydrates are hydrates of carbon. Their general	Q.18	(1)
	formula is $C_x(H_2O)_y$	Q.19	(1)
Q.6	(1)	Q.20	(3)
Q.7	(4)	Q.21	(4) The linkage in protein is a amide (Peptide) bond.
	CHO — 5 hydroxy groups		O    - C - NH -
	Н-С-ОН	Q.22	(4)
	OH-C-H 4 secondary and one primary alcoholic		
	H–C–OH H–C–OH —— I aldehyde group	Q.23 Q.24	(3) (4)
	CH <sub>2</sub> OH	-	Nitrogenbase + Sugar + Phosphate
Q.8	(4)	Q.25	(1)
Q.9	(2)		Adenine is a purine base common in both RNA and DNA
	$C_6H_{12}O + C_6H_{12}O \xrightarrow{\Delta} C_{12}H_{22}O_{11} + H_2O$	0.04	
	2 mono sacchanide di sacchanide	Q.26	(3)
Q.10	(1)	Q.27	(1)
Q.11	(2)	Q.28	(2)
	Sucrose is not a reducing sugar.	0.29	(1)
Q.12	(1)	Q.30	<ul><li>(4)</li><li>Zinc ions hold six insulin molecule to make it as</li></ul>
<b>Q.13</b>	(1)		hexamer
	Maltose is made up of 2 glucose molecules.	Q.31	(2)
Q.14	(4)		

**Q.15** (3)

JEE-M OBJE Q.1	AIN CTIVE QUESTIONS (3)
Q.2	(1)
Q.3	(1)
Q.4	(1)
Q.5	(C)
Q.6	(1)
Q.7 Q.8	<ul><li>(3)</li><li>(4)</li><li>The dipeptide is made of two amino acids they are alanine and glycine hence the name of dipeptide is alanylglycine. Hence</li></ul>
Q.9	(3) The force of attraction between the neighbouring peptide chains is hydrogen bonding.
Q.10	(1) Since in (1) the number of amino groups is more than that of carboxylic groups. Therefore it is basic.
Q.11	(2) (1) – amino acid is that in which – $NH_2$ group is present at $\alpha$ – carbon.
Q.12	(3)
Q.13	(4)
Q.14	(2)
Q.15	(4)
Q.16	(4)
Q.17	(1)
Q.18	(4)
Q.19	(4)
Q.20	(3)
Q.21	(2)
Q.22	(1)
Q.23	(1)

Q.25 (4)

```
Q.26
       (3)
```

The peptide linkage



	0 27	(2)
	0.27	(2)
	Q.20	(3)
urina	Q.2	(2)
Juing	0.31	(3)
	0.32	(2)
	Q.32	(2)
e than	Q.33	(4)
e thun	Q.34	(3)
•	Q.55	(2)
	Q.36	(4)
resent	Q.37	(1)
	0.38	(4)
	0.39	(4)
	0.40	(4)
	0.41	(3)
	Q.42	(3)
	Q.43	(4)
	Q.44	(2)
	Q.45	(3)
	Q.46	(1)
	Q.47	(1)
	Q.48	(4)
	Q.49	(D)
	Q.50	(2)
	Q.51	(2)
		Pentose sugar: Phosphoric acid, pyrimidines and
		purines
	0.52	(3)
	Q.53	(2)
	Q.54	(1)
	Q.55	(4)
	Q.56	(1)
	Q.57	(2)

(4)

Q.58

- **Q.59** (2)
- **Q.60** (1)
- **Q.61** (1)
- Q.62 (2)
- **Q.63** (1)

# JEE-ADVANCED

#### **OBJECTIVE QUESTIONS**

**Q.1** (A)

(A) is the Hawarth projection of  $\alpha$ -D-glucose it is also known as glucopyranose.

**Q.2** (D)



Galactose unit







Galactose (1 mole)



H<sub>2</sub>O (– MeOH)

Glucose (1 mole)

#### **Q.3** (B)

Spontaneous change in the optical rotation of an optically active substance is known as mutarotation.

#### **Q.4** (B)

Fructose reduces Fehling solution but sucrose does quantum not.

**Q.5** (B)

In osazone formation first phenyl hydrazine molecule forms hydrazone at C - 1 second phenyl hydrazine molecule Oxidises the second carbon to carbonyl and third phenyl hydrazine molecule forms hydroazone with C- 2.

#### Q.6 (C)

Glucose shows mutarotation.

#### **Q.7** (D)

In the formation of osazone C–1 and C–2 react with phenyl hydrazine to form phenyl hydrazone. If C–3, C–4, C–5 have same configuration the carbohydrates will form same osazone even if they differ in configuration at C–1 or C–2.

**Q.8** (B)

Q.9





 $T.S.I. = 2^{n-1} + 2^{P-1}$ 

even 
$$P = \frac{n+1}{2}$$

n = 0

T.S.I. =10 (8+2) mese optical active

61



**Q.11** (B)



**Q.12** (A)



Q.13 (C)



**Q.14** (B)





**Q.16** (D)



(non Reducing suger)

(C) Oligosaccharides  $\Rightarrow$  2–10 monosaccharide units are present.

#### Q.18 (C)

Q.17

non reducing sugar Sucrose (1,2-glycosidic linkage of  $\alpha$ -glucose,  $\beta$ -Dfrutose)

# **Q.19** (D)

Reducing sugar = fructose

- Q.20 (C) D-fructose  $\rightleftharpoons$  D glucose  $\rightleftharpoons$   $\alpha$ -D-glucose exist in 3 forms (Isomeric)
- **Q.21** (D)

$$H \xrightarrow{\text{CH}_2\text{OH}} H \xrightarrow{\text{OH}_2\text{OH}} H \xrightarrow{\text{OH}_$$

Q.22 (D) Surcrose – X (Anomeric –OH is absent) Maltose Lactose — Anomeric OH is present

Q.23 (D)



Q.25 (B) Since proline has 2° amino group.

$$CH_{3} - CH - COOH \xrightarrow{\text{LiAlH}_{4}} MH_{2}$$

$$CH_{3} - CH - COOH \xrightarrow{\text{LiAlH}_{4}} HP_{2}$$

$$CH_{3} - CH - CH_{2}OH \text{ . hence X is LiAlH}_{4}$$

Q.27 (B)

Aspartame is an artificial sweetener, III is incorrect statement aspartame is an ester derivative of a dipeptide, made by aspartic acid and phenylalanine.

Q.28 (B)

$$\begin{array}{c} \begin{array}{c} & \mathsf{O} & \mathsf{H} \\ & \mathsf{H} & \mathsf{I} & \vdots \\ \mathsf{OH}-\mathsf{C}-\mathsf{C}-\mathsf{NH}_2 \\ & \mathsf{I} \\ \mathsf{H}\mathsf{C}_3 \end{array} \begin{array}{c} \begin{array}{c} & \mathsf{O} & \mathsf{H} \\ & \ominus & \mathsf{II} & \mathsf{I} \\ & \Theta & \mathsf{II} \\ & \Theta & \mathsf{II} \\ & \Theta & \mathsf{II} & \mathsf{I} \\ & \Theta & \mathsf{II} \\ & \mathsf{II} \\$$

Q.29 (A)  $P^{Ka,} = 2.34$  $P^{Ka,} = 9.60$ 

$$P^{I}= \ \frac{P^{Ka}+P^{Ka_{2}}}{2}=\frac{2.34+9.60}{2}=\frac{11.94}{2}=5.92$$

Q.30 (D)  
Lactose 
$$\longrightarrow$$
 galactose and Glucose

Q.31 (D)

 $\begin{array}{c} Amino \\ \downarrow \\ NH_2gp \end{array} \begin{array}{c} Acid \\ \downarrow \\ COOHgp \end{array}$ 

So compound in which  $-NH_2gp \& -COOH gp$  both are present are known as amineacid.

Q.32 (C)



Q.33

(C)

$$Ph - CH = O \xrightarrow{HCN + KOH}$$

$$Ph - CH \xrightarrow{OH} \xrightarrow{PCI_{5}} Ph - CH \xrightarrow{CI} \xrightarrow{(i)NH_{3}} Ph - CH \xrightarrow{OH} - CH \xrightarrow{COH} OH$$

**Q.34** (A)

**Q.35** (A)

Starch is natural polymer of D-glucose

#### JEE-ADVANCED

#### MCQ/COMPREHENSION/COLUMN MATCHING

- Q.1 (BCD) Starch is the mixture of two polysaccharides -Amylose and amylopectine
- Q.2 (B, D) I is L-sugar whereas II & III is D-sugar.

Q.3 (ACD)

6 membered ring with oxygen making a center is pyranose form.

Q.4 (AC)

A is  $\alpha$  D-mannose and C is  $\beta$  -D-mannose

#### **Q.5** (ABCD)

Cabohydrate having different stereochemistry at C-1 are termed as Anomers, whereas when stereochemistry at any other carbon is different then those carbohydrates are known as epimers.

Q.8

Q.6 (ABCD)

Q.7 (ABD) Nylon-6 is a polyamide molecule.

$$[-\mathsf{NH}(-\mathsf{CH}_2)_5-\mathsf{C}-]_n$$
(A,B,C)

Same Osazone D-glucose D-Mannose D-fructose

**Q.9** (B,C)







- Q.10 (A,B,D) positive Tollens – Anomeric –OH
- Q.11 (CD) Glucose shows mutarotation, sucrose gives glucose and fructose on hydrolysis.
- Q.12 (AB) Sucrose and lactose are disaccharides. Comprehension # 1 (Q. No. 13 to 15)
- Q.13 (A\*)
- Q.14 (C\*)
- Q.15 (B\*)
   13 P<sup>Ka3</sup> value of side chain determines the nature of amino acid
- 14 For acidic amino acid.

$$P^{I} = \frac{P^{Ka_{1}} + P^{ka_{3}}}{2} = \frac{1.88 + 3.65}{2} = \frac{5.53}{2} = 2.77$$

**15** For basic amino acids

$$P^{I} = \frac{P^{Ka_{2}} + P^{ka_{3}}}{2} = \frac{8.95 + 10.53}{2} = \frac{19.48}{2} = 9.74$$

Comprehension # 2 (Q. No. 16 to 18)

Q.16 (B\*)

- **Q.17** (A\*)
- Q.18 (C\*)

16

17

 $C_6H_5CH_2$ -Br is highly reactive toward SN<sup>2</sup> in base, so all the – OH groups will be converted tto OCH<sub>2</sub>Ph groups.

Q is pentamethyl derivative, on hydrolysis only– $OCH_3$ 





C-5 oxygen is involved in cyclic hemiacetal

**18** TBDPSCl is regioselective for primary –OH groups in sugars

Comprehension # 3 (Q.19 to Q.21)

ЛH





L-glucose











**Q.23** (A) - q; (B) - p; (C) -s (D) - r

- (A) has one acetal linkage thus is a disaccharide.
- (B) has one amide linkage.

(C) has two amide linkages.



- Q.24 (A) -p,q,r,s; (B) -p,q,r; (C) -T; (D) -p, rColumn-I (A)  $\alpha$ -D-Glucose (P,Q,R,S)
  - $(\mathbf{n}) \quad (\mathbf{n}) \quad ($
  - (P) Undergoes osazone formation
  - (B)  $\beta$ -D-Glucose (P,Q,R,S)
  - (Q) On acethylation reaction with acetic

anhydride weight increase by 210



(R) It is reducing suger



(S) It is known as  $\alpha$ -D-Glucopyranose

**Q.25** (A) – p,s ; (B) – q,s ; (C) – r, s

#### NUMERICAL VALUE BASED

**Q.1** [9]  $(3)^2 = 9$ 

**Q.2** [9].

For each fragment of 400 unit =  $\frac{4000}{400} = 10$  fragments

Q.11

Q.12

Q.13

Q.14

Q.15

Q.10

So (10 - 1) = 9 glycosidic linkage cleaved.

are obtained of 400 unit length.

**Q.3** [3]

(i), (ii) and (iii) are true but (iv) is False because the glycosides are non-super impossible non-mirror images hence they are diastereomers.

#### **Q.4** [3]

Molecular weight of octapeptide is 516 g/mole. Total bonds to be hydrolysed (8 - 1) = 7. Total weight of H<sub>2</sub>O added =  $7 \times 18 = 126$  gm/mole Total weight of hydrolysed product = 126 + 516 = 642 gm.

Total weight of alanine in product =  $\frac{642 \times 41.59}{100}$  =

267 gm. Molecular weight of alanine = 89 g/mole.

Number of alanine unit =  $\frac{267}{89} = 3$ .

**Q.6** [32]

$$pI = \frac{2.19 + 4.25}{2} = 3.22$$
$$3.22 \times 10 = 32$$

**Q.8** [6]

$$pH_2 = \frac{pk_{a_1} + pk_{a_2}}{2} = \frac{2.34 + 9.66}{2} = 6$$
[3]

 $\begin{array}{ccc} C_{18}H_{32}O_{16}+2H_2O & \stackrel{H^+}{\longrightarrow} C_6H_{12}O_6+C_6H_{12}O_6+C_6H_{12}O_6\\ \text{Raffinose} & \text{Glu cose} & \text{Fructose} & \text{Galactose} \end{array}$ 

[4] CH<sub>2</sub>COCl —CH(OH) + 0 -CH<sub>3</sub> for every acetylation, CH-O -- Cmolecular mass by increases 42(12 + 16 + 14). $\therefore$  number of -OH groups =  $\frac{318-150}{42} = 4$ 4  $pI = \frac{pKa(\beta) + pKa(\gamma)}{2}$  $=\frac{-\log(10^{-5})+-\log(10^{-3})}{2}=4$ [2] [2] [6] [3]  $CH = NNHC_6H_5$ CHO СНОН CHOH H<sub>2</sub>NNHC<sub>6</sub>H<sub>5</sub> (CHOH)<sub>3</sub> (CHOH) CH<sub>2</sub>OH CH<sub>2</sub>OH  $CH = NNHC_6H_5$ 

$$\begin{array}{c} \text{CH} = \text{NNHC}_{6}\text{H}_{5} \\ \downarrow \\ \text{C} = \text{NNHC}_{6}\text{H}_{5} \\ \downarrow \\ \text{H}_{2}\text{NNHC}_{6}\text{H}_{5} \\ \text{(CHOH)}_{3} \\ \downarrow \\ \text{CH}_{2}\text{OH} \end{array}$$

Q.16

[8]

It gives octa acetyl derivative

**Q.17** [4]

A pentapeptide has fice amino acids joined by four **Q.4** peptide bonds.

Q.19 [2]

 $\sim$ 

 $\sim$ 

Q.20

$$\frac{pka_2 + pka_3}{2} = \frac{8+10}{2} = 9$$

Q.21 [5] Except III, all are less acidic than NO<sub>2</sub> CH<sub>2</sub>COOH

#### **KVPY**

#### **PREVIOUS YEAR'S**

**Q.1** (A)

CHO  
H 
$$\rightarrow$$
 OH  
HO  $\rightarrow$  H  
H  $\rightarrow$  OH  
H  $\rightarrow$  OH

**Q.2** (A)



**Q.3** (B)



#### (D)

Q.5

 $\begin{array}{ccc} \alpha \text{-D Glucose} & & & \\ \hline & & \\ \text{Structure} & & \\ \text{Glucose} & & \\ \hline & & \\ \end{array} \\ \begin{array}{c} \beta \text{-D Glucose} \\ 65\% \end{array}$ 



Q.6 (B)



**Q.7** (B)

Haemoglobin is oxygen carrier.

Q.8 (D)

Note glycine is achiral, therefore possible combinatuions are:

- (A) Valine serine glycine alanine
- (B) Serine valine glycine alanine
- (C) Valine glycine serine alanine
- (D) Serine glycine valine alanine

#### JEE MAIN

#### PREVIOUS YEAR'S

**Q.1** (3)

Seliwanoff's test is used to distinguish between carbohydrates and xanthoprotic test is used to distinguish proteins.

- **Q.2** (4)
  - (A) Sucrose  $\alpha$ -glucose and  $\beta$ -fructose
  - (B) Lactose  $\beta$ -galactose and  $\beta$ -glucose
  - (C) Maltose  $\alpha$ -glucose and  $\alpha$ -glucose

**Q.3** (1)

**Q.4** (1)





The linkage is between C-1 of Galactose and C-4 of Glucose.

- Q.5 (1)
   Hydrogen bond is responsible for the stacking of α Q.19
   helix structure of protein.
- Q.6 (4)

Q.7

Sucrose $H_2O$	glucose +	Fructose	Q.20
(Non reducing	(Reducing	(Reducing	0.21
sugar)	sugar)	sugar)	2.21
(3)			Q.22

#### Informative

#### OR

$$C_{12}H_{22}O_{11}+H_{2}O \xrightarrow{Invertase} C_{6}H_{12}O_{6} + C_{6}H_{12}O_{6}$$
  
Glucose Fructose

$$C_6H_{12}O_6 \xrightarrow{Zymase} 2C_6H_5OH + 2CO_2$$

#### Q.8 (2)

Fructose is a ketohexose.



#### Q.9 (3)

The secondary structure of protein includes two type :

(a)  $\alpha$ -Helix (b)  $\beta$ -pleated sheet In  $\alpha$ -Helix structure, the poly peptide chain is coil around due to presence of Intramolecular H-Bonding.

#### Q.10 (1)

Due to deficiency of Vitmain K causes increases in blood clotting time. **Note :** Vitamin K related to blood factor.

#### Q.11 (2)

Vitamin-A & Vitamin-D

- Q.12 (667) Q.13 (1)Q.14 (4)Q.15 (4) Q.16 (3) Q.17 (3) Q.18 (4) (4)20 (3)
- **Q.21** (4)
- Q.23 (2)

(4)

(2)

- Q.23 (2
- **Q.24** (1)

#### Q.25

Keratin, collagen and myosin are example of fibrous protein.

**Q.26** (3)

#### JEE-ADVANCED PREVIOUS YEAR'S

Q.1 (6)

Structure of melamine is as follows

Total no. of lone pairs of electron is '6'.

**Q.2** (B, C)

Specific rotation of D(+) glucose =  $+52^{\circ}$ Specific rotation of D(-) fructose =  $-92^{\circ}$ On adding equimolar mix of above two, the specific

rotation of invert sugar is 
$$\frac{+52-92}{2} = -20^{\circ}$$

**Q.3** (1,2,3,4) (1) **True**:



(2) **TRUE** : Six member hemiacetal on anomeric carbon gives  $\alpha$ -D glucose &  $\beta$ -D glucose.

(3) **TRUE** :  $C_{12}H_{22}O_{11} + H_2O$  <u>Invertase</u>  $C_6H_{12}O_6 + C_6H_{12}O_6$ Glucose Fructose (+) (-) (4) **TRUE** : Monosaccharide cannot be hydrolysed to

give polyhydroxy aldehydes and ketones

Q.4

(5)

$$|z_1| + |z_2| + |z_3| = 5$$



At pH = 2 
$$\dot{NH}_2$$
 and  $\ddot{NH}_2$  of Tyrosine and Lysine is  
+ve charged (+1 each)  
+2  $|z_1| = 2$   
At pH = 6  $\dot{NH}_2$  of Lysine (+1),  
COOH (-1) of glutamic acid,  
so because of dipolar ion exist  $|z_2|=0$   
At pH = 11 COOH of Glutamic acid (-1)  
COOH of Lysine (-1)  
OH of phenol (-1)  
 $|z_3| = 3$ 

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# Polymer

Eleme	ntary	Q.6	(1)	
Q.1	(1) It is present in the cell wall of plant.	-		
		0.7	(1)	
Q.2	(4)	C	Starch is polymer of $\alpha$ - D - glucose.	
0.1				
Q.3	(3) Debalite is thermosotting polymon It becomes	Q.8	(3)	
	bakefile is thermosetting polymer. It becomes		The monomer of Nylon - 66 are adipic acid and	
	infusible on heating and can not be remounded		hexamethylene diamine.	
0.4	(2)	Q.9	(1)	
<b>X</b>	Nylon-66 is manufactured by the condensation		Nylon - 66 has amide linkage.	
	polymerization of adipic acid and	0.10	(2)	
	hexamethylenediamine with the lose of $H_2O$ as	Q.10	(3) Propagation of pylon 66 is an axample of	
	steam		condensation polymer as it is formed by elimination	
	Steam		of H O molecules from hexamethylenediamine and	
Q.5	(2)		adipic acid.	
-			1	
Q.6	(4)	Q.11	(3)	
			melamine is 2,4,6-triamino -1,3,5-triazine	
Q.7	(2)			
	$n(CH_2 = CH - Cl) \rightarrow (-CH_2 - CH -)_n$	Q.12	(3)	
	Vinyl chloride Cl	0.13	(2)	
	(PVC)	Q.13	(2)	
Q.8	(4)	<b>Q.14</b>	(4)	
	Bakelite is a thermoseting plastic	•		
0.0	(2)	Q.15	(2)	
Q.9	(3)			
0.10	(1)	Q.16	(1)	
C	Caprolactam in a monomen of nylon 6 (poly	0.17	(1)	
	caprolactam)	Q.17	(1)	
		0.18	(3)	
Q.11	(1)	<b>Q</b>		
		Q.19	(3)	
	AIN CTIVE OUESTIONS	Q.20	(1)	
		Q.21	(3)	
Q.1	Plexiglass is poly methyl methacrylate (PMMA) it			
	is a homo polymer of methyl methacrylate	Q.22		
			Ziegler Natta Catalyst is $AI_2(C_2H_5)_6 + TiCI_4$	
Q.2	(2)	0.23	(2)	
		2.20	(2)	
Q.3	<b>3</b> (1)		JEE-ADVANCED	
0.4	$\langle A \rangle$	OBJE	CTIVE QUESTIONS	
Q.4	(4)	Q.1	(D)	
05	(2)		Final product shown in the reaction is natural rubber	
Q.3	(2)		(iso prene).	

**Q.2** (B)

Given polymer is formed by Urea and formaldehyde, hence is called Urea formaldehyde resine.

**Q.3** (A)



is 
$$CH_2 = C$$

Q.4 (B)



- Q.5 (B) Weakest intermolecular force = Natural Rubber
- **Q.6** (D)

All are free radical initiators and catalyse the free radical polymerisation.

#### JEE-ADVANCED

#### **COMPREHENSION/MATCHING**

(B)Bakelite is polymer of phenol and formaldehyde.The polymer formed by polymerisation of two monomers is called copolymer.

Q.2 (C)

Q.1

Cellulose is a natural biodegradable polymer.

- **Q.3** (B)
  - Neoprene  $-(CH_2 C = CH CH_2)_n$  is a polymer of  $CH_2 - C = CH = CH_2$  (chloroprene).
- Q.4 A–PS; B–QR; C–PS; D–QR Column-I Column-II (A) Terylene (P,S) (P) Condensation polymerisation
  - (B) Styrene (Q,R)

- (Q) Addition Polymerisation
- (C) Bakellite (P,S)
- (R) Homo Polymer
- (D) Teflon (Q,R)
- (S) CO-Polymer

Q.5 A-P, S; B-Q, R; C-P, S; D-Q,R Column-I Column-II (A) Nylone 66(P,S) (P) Condinsation polymerisation (B) styrene (Q,R) (Q) Addition polymerisation

- (C) Baketite (P,S)
- (R) Home polymer
- (D) Teflon (Q,R)
- (S) Co-polymer
- Q.6 A→s; B→r; C→q; D→p
  (A) Monomers of bakelite are : Phenol + formaldehyde.
  (B) Monomer of Polypropene is : Propene
  (C) Monomers of Glyptal are : Ethylene glycol + phthalic anhydride
  (D) Monomer of Nylon-6 is : ω caprolactum.
- **Q.7** (A)  $\rightarrow$  s; (B)  $\rightarrow$  r; (C)  $\rightarrow$  q; (D)  $\rightarrow$  (p)

#### NUMERCIAL VALUE BASED

 Q.1
 [3]

 Q.2
 [2]

 Q.3
 [4]

# KVPY

#### PREVIOUS YEAR'S

- Q.1 (A) Polyacetic acid is biodegradable polymer.
- Q.2 (A) Glycine (fact based)

# JEE-MAIN

## PREVIOUS YEAR'S

**Q.1** (3)



Q.2	(3)		
Q.3	(2) Buna-S is the co-polymer of buta-1,3-diene and styrene		$+ \mathrm{NH} - (\mathrm{CH}_2)_6 - \mathrm{NH} - \mathrm{C}_{-} (\mathrm{CH}_2)_4 - \mathrm{C}_{-}$
Q.4	(1)	Q.2	(A) <i>CH</i> <sub>3</sub> <i>CH</i> <sub>3</sub>
Q.5	(3)		$CH_2 = C - CH = CH_2 \xrightarrow{polymerisation} (CH_2 - C = CH - CH_2)_n$ (Hydrogenation)
Q.6	(2)		$CH_{3}$ $(CH_{2} - C = CH - CH_{2})_{n}$
Q.7	(1)		Ethylene-propylene copolymer
Q.8	(3)	Q.3	(B,D) A Natural rubber is polyisoprene containing cis alk-
Q.9	(2)		ene units P. Nylon 6 has amida linkaga [UN] (CU)
Q.10	(1)		<b>B.</b> Nyion-o has annue mikage $\pm HN - (CH_2)_5 - C \pm_n$
Q.11	(3)		C. Cellulose has only $\beta$ -D glucose units. D. $F_2C = CF_2 \xrightarrow{\text{Persulphate}} [CF_2 - CF_2]_n$
Q.12	<ul><li>(1)</li><li>Novalac is a linear polymer of [Ph–OH + HCHO]. So ester linkage not present.</li><li>So novalac is not a polyester.</li></ul>		

**Q.13** (2)

### JEE-ADVANCED PREVIOUS YEAR'S

Q.1 (ABCD)  
(C) NH<sub>2</sub>OC - (CH<sub>2</sub>)<sub>4</sub> - CONH<sub>2</sub> 
$$\xrightarrow{Br_2}_{NaOH/\Delta}$$
 NH<sub>2</sub> -  
(CH<sub>2</sub>)<sub>4</sub> - NH<sub>2</sub>  $\xrightarrow{HOOC-(CH_2)_4-COOH}_{\Delta}$   

$$\left[ \begin{array}{c} HOOC-(CH_2)_4 - COH \\ H - (CH_2)_4 - NH - C - (CH_2)_4 - C \\ H - C - (CH_2)_4 - C \\ H_2/Ni \\ \Delta \end{array} \right]$$
(D)  
NC - (CH<sub>2</sub>)<sub>4</sub> - CN  $\xrightarrow{H_2/Ni}_{\Delta}$  NH<sub>2</sub> - (CH<sub>2</sub>)<sub>6</sub> - NH<sub>2</sub>  
 $\xrightarrow{HOOC-(CH_2)_4-COH}_{\Delta}$
# **Chemistry in Everyday Life**

	EXERCISES	
JEE-MAIN	Q.25	(1)
<b>OBJECTIVE QUESTIONS</b>	Q.26	(2)
<b>Q.1</b> (3)	Q.27	(1)
<b>0.2</b> (3)	Q.28	(2)
<b>0 3</b> (1)	Q.29	(1)
	Q.30	(1)
Q.4 (4)	Q.31	(1)
<b>Q.5</b> (3)	0.32	(2)
<b>Q.6</b> (3)	0.32	
<b>Q.7</b> (2)	Q.33	(4)
<b>Q.8</b> (2)	Q.34	(1)
<b>0.9</b> (1)	Q.35	(3)
$\mathbf{O} 10  (1)$	Q.36	(1)
Q.10 (1)	Q.37	(2)
<b>Q.11</b> (1)		Soaps are sodium salts of long chain fatty carboxylic acids e.g. sodium oleate $C_{17}H_{23}COO^-$ Na <sup>+</sup> Similarly
<b>Q.12</b> (1)		sodium stearate is a soap of a saturated fatty acid
<b>Q.13</b> (1)		Soaps form micelle in which there is one hydropho-
<b>Q.14</b> (2)		bic part and another is hydrophillic part
<b>Q.15</b> (3)		Hydrophillic part
<b>0.16</b> (2)		Hydrophobic part
$\mathbf{O} 17  (3)$	Q.38	(4)
Q.17 (3)		The incorrect statemet is, "soaps work more efficiently in hard water than in soft water. Soaps actually do not
<b>Q.18</b> (3)		give foams in hard water due to formation of insoluble
<b>Q.19</b> (4)		with hard water containing impurities of Ca & Mg
<b>Q.20</b> (2)		carbonates and bicarbonates.
<b>Q.21</b> (4)	Q.39	(4) The incorrect statement is that LABS detergents are
<b>Q.22</b> (3)		not biodegradable. Actually all detergent are not bio-
<b>0.23</b> (4)		to human civilization.
Q.24 (3)		

#### **Q.40** (4)

The incorrect statement about detergent is that, fluorescers are the organic compounds which act as foaming agents. Actually fluorescers are optically whitening agents which cause the clothes white and impart whitening in it. These are also known as fluorescent brighteners. They are stilbine derivatives.

#### **Q.41** (4)

All statements are true.

# JEE-ADVANCED

#### MATCHING

- **Q.1** (A -q), (B -s), (C r), (D- p)
- **Q.2** (A-r), (B-s), (C-p), (D-q)

#### **KVPY**

# **PREVIOUS YEAR'S**

**Q.1** (C)

Q.2	(D)
	Cetyltrimethyl ammonium bromide is used for sanitizing
	agent.

# JEE-MAIN PREVIOUS YEAR'S

#### Q.10 Q.1 $a \rightarrow r$ ; $b \rightarrow q$ ; $c \rightarrow s$ ; $d \rightarrow p$ (a) Valium (iv) Tranquilizer 0.11 (b) Morphine (iii) Analgesisc (c) Norethindrone (i) Antifertility drug Q.12 (d) Vitamin B12 (ii) Pernicious anemia Q.13 Q.2 (1)Q.14 Q.3 (3)(A) Antifertility drug $\rightarrow$ (iii) Nor ethindrone Q.15 (B) Antibiotic $\rightarrow$ (iv) Salvarsan

(C) Tranquilizer  $\rightarrow$  (i) Meprobamate (D) Artificial sweetener  $\rightarrow$  (ii) Alitame A–iii, B-iv, C-i, D-ii

# **Q.4** (1)

- (a) Antacid : Cimetidine
- (b) Artifical Sweetener : Alitame
- (c) Antifertility : Novestrol
- (d) Tranquilizers : Valium

#### **Q.5** (2)

Artificial sweetner : Sucralose Antiseptic : Bithional Preservative : Sodium Benzoate Glyceryl ester of stearic acid : Synthetic detergent

# **Q.6** (4)

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The structure of Tyrosine amino acid is
COOH
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#### **Q.7** (3)

Q.8

0.9

(2)

(1)

(3)

(4)

(2)

(3)

(4)

(2)

Some durg do not bind to the Enzyme's active site. These bind to a different site of enzyme which called **allosteric site**. This binding of inhibitor at allosteric site changes the shape of the active site in such a way that substrate can not recognise it. Such inhibitor is known as **Non-competitive inhibitor**.

