



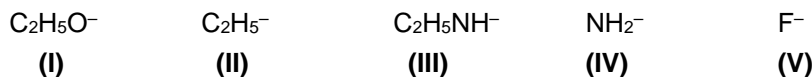
## Exercise-1

Marked questions are recommended for Revision.

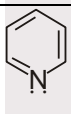
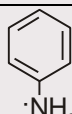

### PART - I : SUBJECTIVE QUESTIONS

#### Section (A) : Basic strength

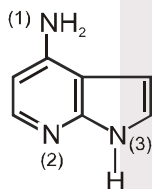
A-1. Compare the basic strength of the following compounds:



A-2. Compare the basic strength of the following compounds :

(a)	PhNH <sub>2</sub>	Ph <sub>2</sub> NH	Ph <sub>3</sub> N
(b)			
(c)	$CH_3-\underset{\text{Ph}}{\underset{ }{CH}}-NH_2$	$CH_3-CH_2-\underset{\text{Ph}}{\underset{ }{N}}H$	Ph-CH <sub>2</sub> -CH <sub>2</sub> -NH <sub>2</sub>

A-3. Which of the following group is most basic in the given compounds :

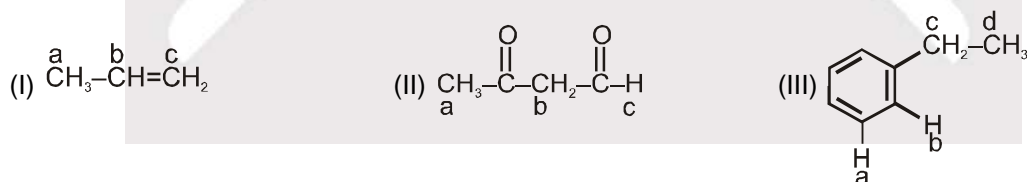


A-4. Which of the following is a stronger base ? Give reason to justify your answer.

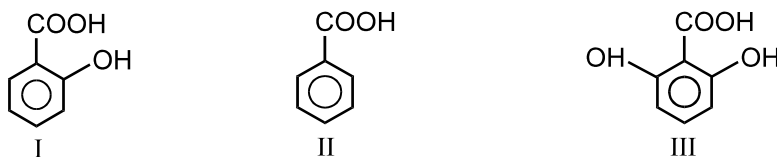


#### Section (B) : Acidic strength

B-1. Which 'H' atom is most acidic in the following compounds.



B-2. Arrange the following in decreasing order of acidity

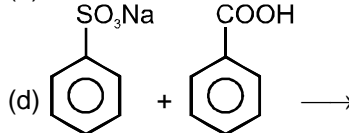
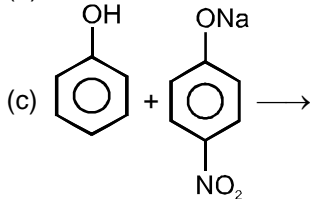
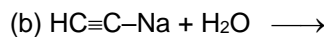
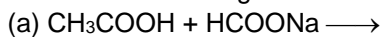


B-3. The given compound X =  is a strong acid. Justify this statement.

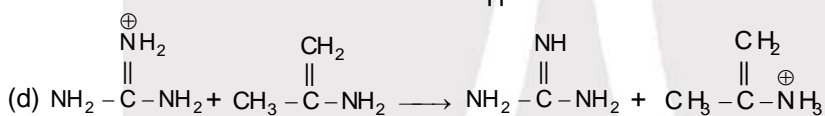
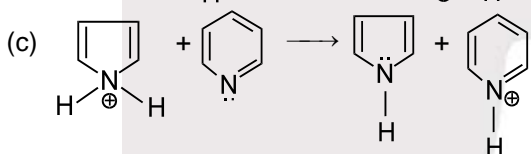
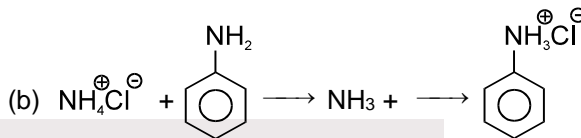
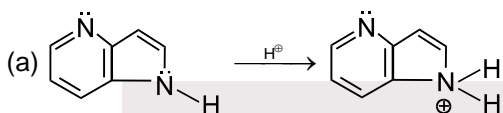


### Section (C) : Feasible reactions of acids and bases

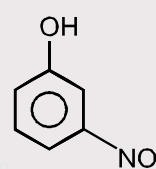
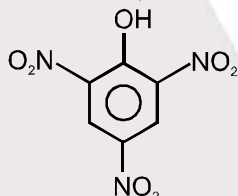
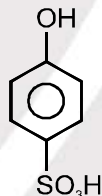
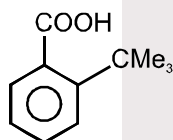
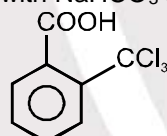
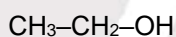
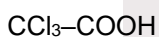
C-1. Which of the following reactions is/are feasible ?



C-2. Which of the following reaction is feasible?

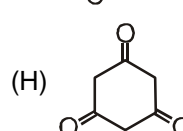
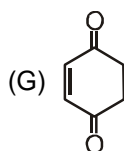
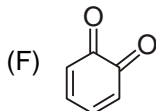
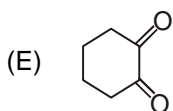
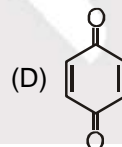
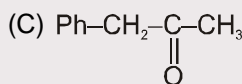
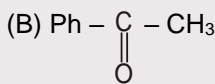
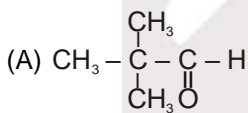


C-3. Which of the following acids (given below) react with  $\text{NaHCO}_3$  and liberate  $\text{CO}_2(\text{g})$  ?

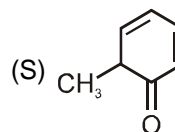
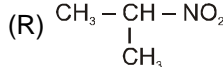
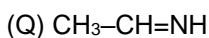
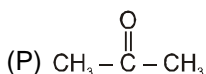


### Section (D) : Tautomerism

D-1. Which of the following compounds can exhibit tautomerism ?



D-2. Write the tautomers of the following compounds :



D-3. Monocarbonyl compounds have very small percentage enol form at equilibrium. Explain.



## PART - II : ONLY ONE OPTION CORRECT TYPE

### Section (A) : Basic strength

A-1. The correct basic strength order of following anions is :

- (A)  $\text{CH}_3\text{-CH}_2^- > \text{NH}_2^- > \text{CH}_2=\text{CH}^- > \text{CH}\equiv\text{C}^- > \text{HO}^- > \text{F}^-$   
 (B)  $\text{NH}_2^- > \text{CH}_3\text{-CH}_2^- > \text{CH}_2=\text{CH}^- > \text{CH}\equiv\text{C}^- > \text{F}^- > \text{HO}^-$   
 (C)  $\text{CH}_3\text{-CH}_2^- > \text{CH}_2=\text{CH}^- > \text{NH}_2^- > \text{CH}\equiv\text{C}^- > \text{HO}^- > \text{F}^-$   
 (D)  $\text{F}^- > \text{HO}^- > \text{CH}\equiv\text{C}^- > \text{CH}_2=\text{CH}^- > \text{NH}_2^- > \text{CH}_3\text{-CH}_2^-$

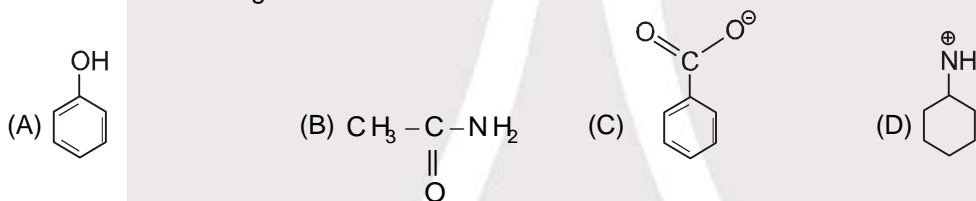
A-2. Which of the following shows the correct order of decreasing basicity in gas phase ?

- (A)  $(\text{CH}_3)_3\text{N} > (\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > \text{NH}_3$       (B)  $(\text{CH}_3)_2\text{NH} > (\text{CH}_3)_3\text{N} > \text{CH}_3\text{NH}_2 > \text{NH}_3$   
 (C)  $(\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > (\text{CH}_3)_3\text{N} > \text{NH}_3$       (D)  $(\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > \text{NH}_3 > (\text{CH}_3)_3\text{N}$

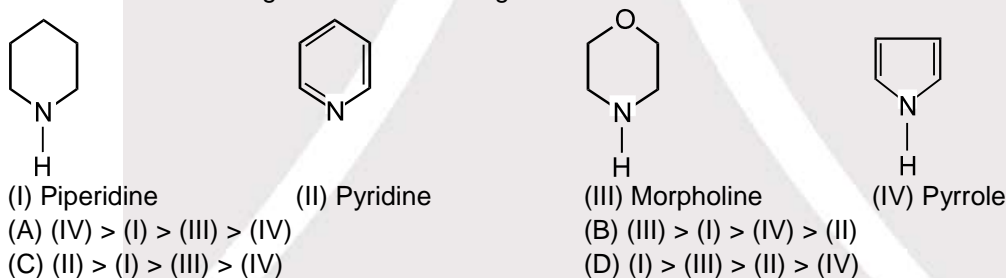
A-3. Find the order of basic strength. (If R = Me) ?

- (I)  $\text{R}_4\text{N}^+\text{OH}^-$       (II)  $\text{R}_3\text{N}$       (III)  $\text{R}_2\text{NH}$       (IV)  $\text{RNH}_2$   
 (A)  $\text{I} > \text{III} > \text{IV} > \text{II}$       (B)  $\text{IV} > \text{III} > \text{I} > \text{II}$       (C)  $\text{II} > \text{IV} > \text{III} > \text{I}$       (D)  $\text{II} > \text{IV} > \text{I} > \text{III}$

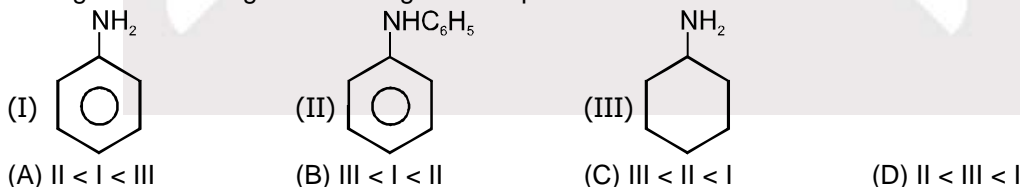
A-4. Which of the following cannot be a base?



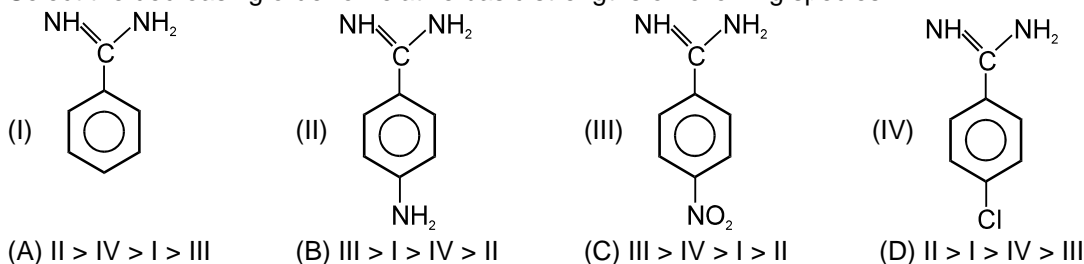
A-5. Select the basic strength order of following molecules ?



A-6. Arrange the following in increasing order of pKa value ?

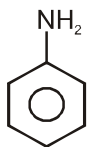


A-7. Select the decreasing order of relative basic strengths of following species :

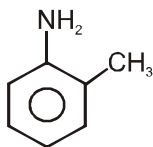




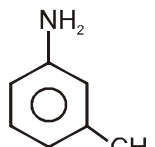
A-8. Select the basic strength order of following molecule :



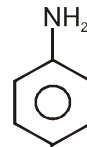
(I)



(II)



(III)



(IV)

(A) II &gt; III &gt; IV &gt; I

(B) II &gt; IV &gt; III &gt; I

(C) IV &gt; II &gt; III &gt; I

(D) IV &gt; III &gt; I &gt; II

### Section (B) : Acidic strength

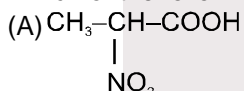
B-1. Among the following compounds, the strongest acid is :

(A)  $\text{HC} \equiv \text{CH}$ (B)  $\text{C}_6\text{H}_6$ (C)  $\text{C}_2\text{H}_6$ (D)  $\text{CH}_3\text{OH}$ 

B-2. Which of the following is not correct decreasing  $K_a$  order.

(A)  $\text{CH}_4 > \text{NH}_3 > \text{H}_2\text{O} > \text{HF}$ (B)  $\text{CH}_3\text{-OH} > \text{CH}_3\text{-NH}_2 > \text{CH}_3\text{-F} > \text{CH}_3\text{-CH}_3$ (C)  $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$ (D)  $\text{PhOH} > \text{H}_2\text{O} > \text{C}_2\text{H}_5\text{OH} > \text{CH}_3\text{-C}\equiv\text{CH}$ 

B-3. Which of the following acid has the smallest dissociation constant ?

(B)  $\text{O}_2\text{N-CH}_2\text{-CH}_2\text{-COOH}$ (C)  $\text{Cl-CH}_2\text{-CH}_2\text{-COOH}$ (D)  $\text{NC-CH}_2\text{-CH}_2\text{-COOH}$ 

B-4. Find the strongest acid among the following compounds is :

(A)  $\text{HOOC-(CH}_2)_2\text{-COOH}$ (B)  $\text{H}_3\text{N}^\oplus\text{-(CH}_2)_2\text{-COOH}$ (C)  $\text{F-(CH}_2)_2\text{-COOH}$ (D)  $\text{CH}_3\text{-(CH}_2)_2\text{-COOH}$ 

B-5. Which of the following option shows the correct order of decreasing acidity :

(A)  $\text{PhCO}_2\text{H} > \text{PhSO}_3\text{H} > \text{PhCH}_2\text{OH} > \text{PhOH}$ (B)  $\text{PhSO}_3\text{H} > \text{PhOH} > \text{PhCH}_2\text{OH} > \text{PhCO}_2\text{H}$ (C)  $\text{PhCO}_2\text{H} > \text{PhOH} > \text{PhCH}_2\text{OH} > \text{PhSO}_3\text{H}$ (D)  $\text{PhSO}_3\text{H} > \text{PhCO}_2\text{H} > \text{PhOH} > \text{PhCH}_2\text{OH}$ 

B-6. Arrange increasing order of acidic strength of following dibasic acids :

(I) oxalic acid,

(II) succinic acid,

(III) malonic acid,

(IV) adipic acid

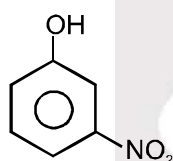
(A) III &lt; II &lt; I &lt; IV

(B) II &lt; III &gt; I &gt; IV

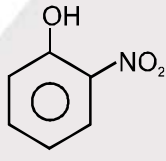
(C) I &gt; III &gt; II &gt; IV

(D) II &gt; I &gt; III &lt; IV

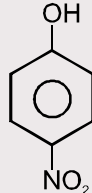
B-7.



I



II



III

Arrange above phenol in increasing order of  $\text{pK}_a$  value :

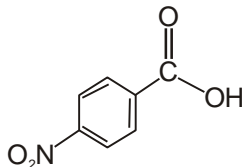
(A) I &lt; II &lt; III

(B) III &lt; I &lt; II

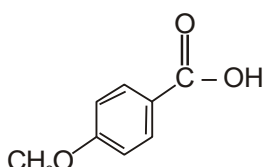
(C) III &lt; II &lt; I

(D) I &lt; III &lt; II

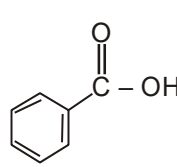
B-8. Order of  $K_a$  of following acids is :



I



II



III

(A) I &gt; II &gt; III

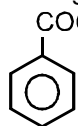
(B) II &gt; I &gt; III

(C) I &gt; III &gt; II

(D) III &gt; I &gt; II

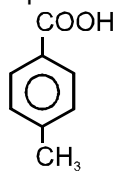


**B-9.** Arrange the following compounds in increasing order of their acidic strength.

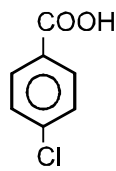


I

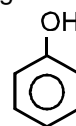
(A) IV < II < I < III



(B) I < II < III < IV



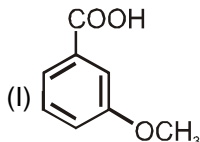
(C) IV < II < III < I



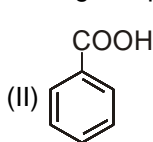
IV

(D) I < III < II < IV

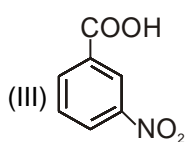
**B-10.** Find the order of  $K_a$  of following compounds :



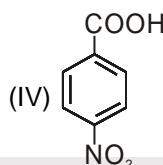
(I)



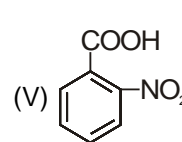
(II)



(III)



(IV)



(V)

(A) I < II < III < IV < V

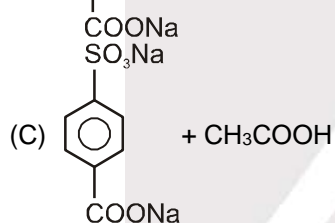
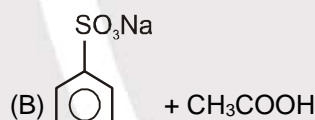
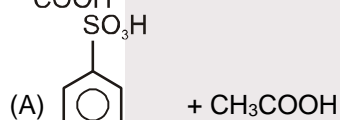
(B) IV < I < III < II < V

(C) III < II < I < IV < V

(D) II < I < III < IV < V

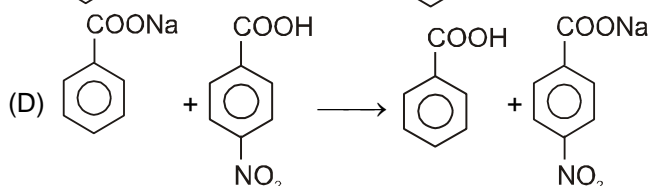
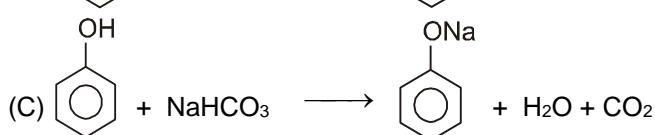
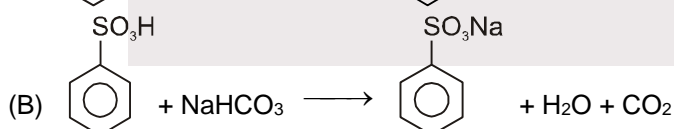
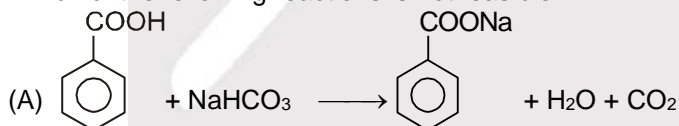
**Section (C) : Feasible reactions of acids and bases**

**C-1.**  $\xrightarrow{1 \text{ Mole of } \text{CH}_3\text{COONa}}$  ; The products will be :



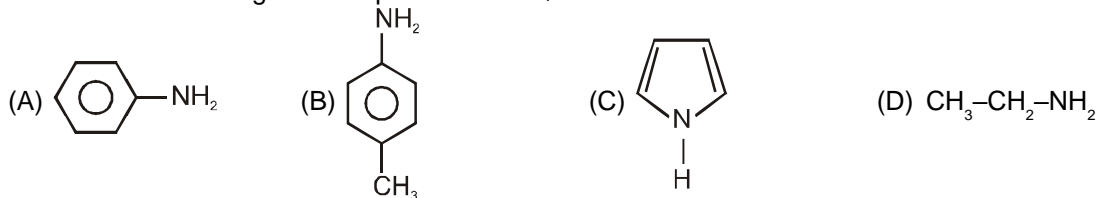
(D) Reaction is not feasible

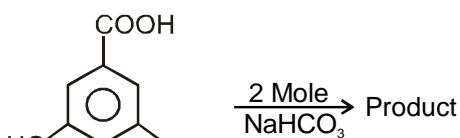
**C-2.** Which of the following reactions is not feasible ?





C-3. Which of the following will accept  $H^+$  from  $NH_4^+$  ion.



C-4. 



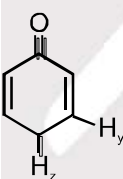
### Section (D) : Tautomerism

D-1. Keto-enol tautomerism does not observe in :



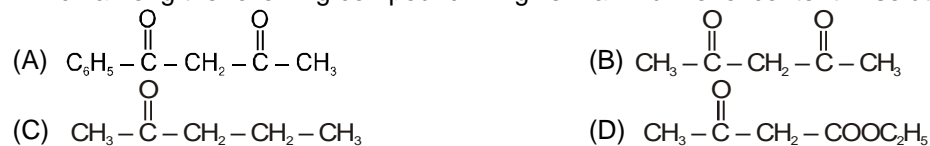
D-2. The enolic form of acetone contains :

- (A) 9  $\sigma$  bonds, 1  $\pi$  bond and 2 lone pairs (B) 8  $\sigma$  bond, 2  $\pi$  bond and 2 lone pairs  
 (C) 10  $\sigma$  bond, 1  $\pi$  bond and 1 lone pair (D) 9  $\sigma$  bond, 2  $\pi$  bond and 1 lone pair

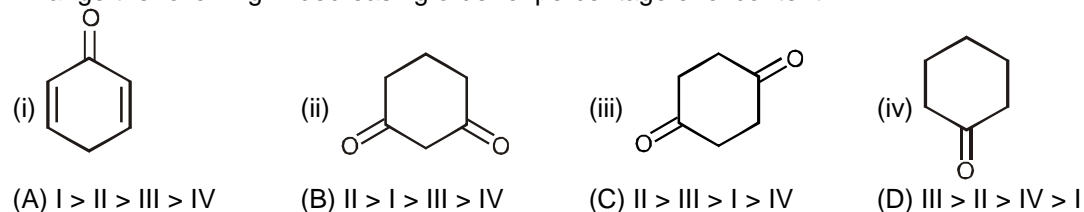
D-3. Molecule  can be enolised by which hydrogen ?

- (A)  $y-H$  (B)  $z-H$  (C) both (D) None of these

D-4. Which among the following compound will give maximum enol content in solution :



D-5. Arrange the following in decreasing order of percentage enol content.





## PART - III : MATCH THE COLUMN

1. Match the column :

	Column-I (Keto)		Column-II (% enol)
(A)	$\text{CH}_3 - \text{CH} = \text{O}$	(x)	95 %
(B)	$\text{Ph} - \overset{\text{O}}{\parallel}{\text{C}} - \text{CH}_2 - \overset{\text{O}}{\parallel}{\text{C}} - \text{Ph}$	(y)	76 %
(C)	$\text{CH}_3 - \overset{\text{O}}{\parallel}{\text{C}} - \text{CH}_2 - \overset{\text{O}}{\parallel}{\text{C}} - \text{OEt}$	(z)	0.0001 %
(D)	$\text{CH}_3 - \overset{\text{O}}{\parallel}{\text{C}} - \text{CH}_2 - \overset{\text{O}}{\parallel}{\text{C}} - \text{CH}_3$	(w)	7.2 %

2. Match the column :

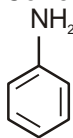
	Column-I		Column-II
(A)	$\text{NaHCO}_3$ will react with	(p)	
(B)	Na will react with	(q)	
(C)	NaOH will react with	(r)	
(D)	$\text{NaNH}_2$ will react with	(s)	

## Exercise-2

Marked questions are recommended for Revision.

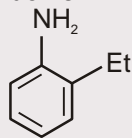
### PART - I : ONLY ONE OPTION CORRECT TYPE

1. Correct basic strength order is :



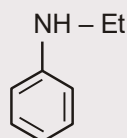
p

(A)  $r > q > p > s$



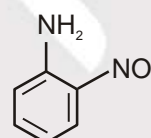
q

(B)  $r > p > q > s$



r

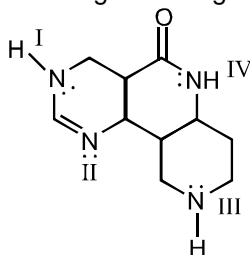
(C)  $q > r > p > s$



s

(D)  $r > q > s > p$

2. The order of basic strength of the given basic nitrogen atoms is :



(A)  $\text{III} > \text{II} > \text{I} > \text{IV}$

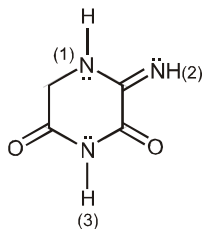
(B)  $\text{III} > \text{I} > \text{II} > \text{IV}$

(C)  $\text{I} > \text{III} > \text{II} > \text{IV}$

(D)  $\text{II} > \text{III} > \text{I} > \text{IV}$

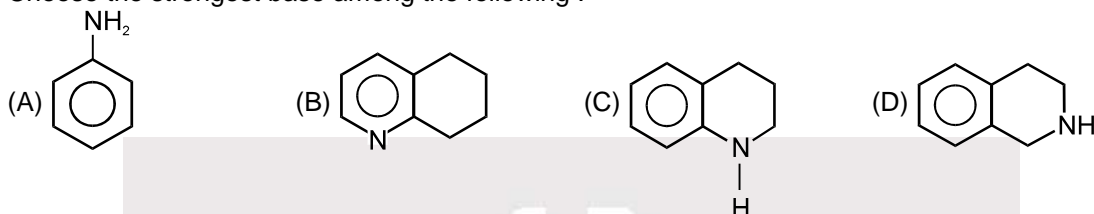


3. In the labelled N-atoms which is correct basic strength order :

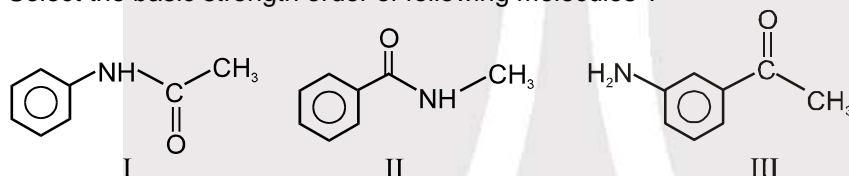


- (A)  $2 > 1 > 3$       (B)  $3 > 1 > 2$       (C)  $2 > 3 > 1$       (D) All are equally basic

4. Choose the strongest base among the following :

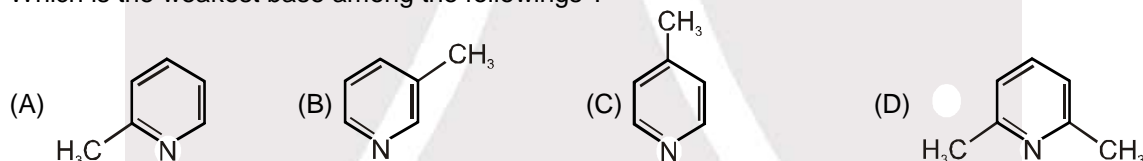


5. Select the basic strength order of following molecules ?

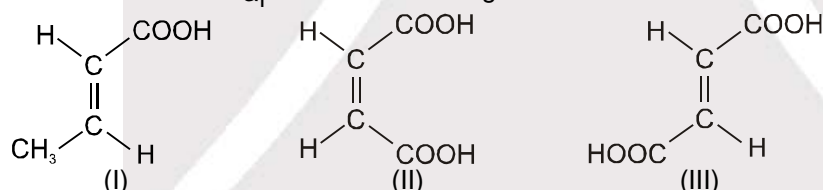


- (A)  $\text{III} > \text{II} > \text{I}$       (B)  $\text{II} > \text{III} > \text{I}$       (C)  $\text{I} > \text{III} > \text{II}$       (D)  $\text{III} > \text{I} > \text{II}$

6. Which is the weakest base among the followings ?



7. Write the order of  $K_{a1}$  values of following acids :



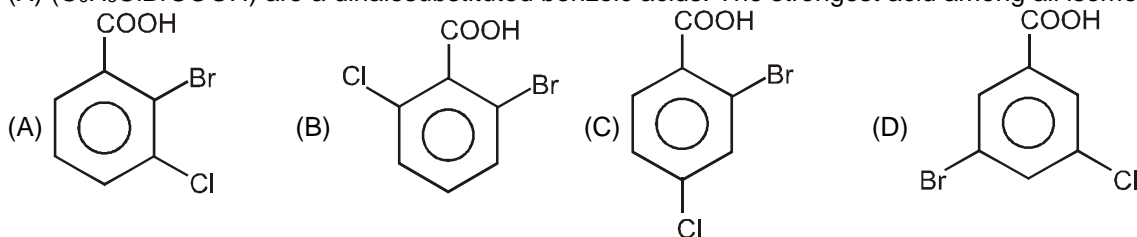
- (A)  $\text{II} > \text{III} > \text{I}$       (B)  $\text{I} > \text{III} > \text{II}$       (C)  $\text{III} > \text{II} > \text{I}$       (D)  $\text{II} > \text{I} > \text{III}$

8. The acid strength order is :



- (A)  $\text{I} > \text{IV} > \text{II} > \text{III}$       (B)  $\text{III} > \text{I} > \text{II} > \text{IV}$       (C)  $\text{II} > \text{III} > \text{I} > \text{IV}$       (D)  $\text{I} > \text{III} > \text{II} > \text{IV}$


9. (X) ( $\text{C}_6\text{H}_3\text{ClBrCOOH}$ ) are a dihalosubstituted benzoic acids. The strongest acid among all isomers is -







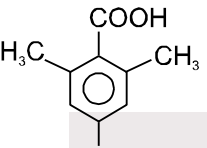
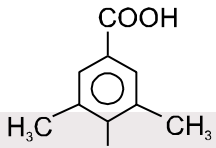
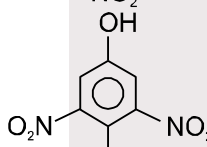
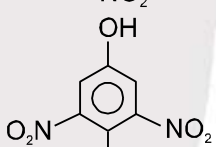
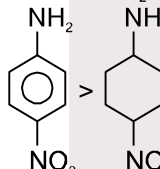

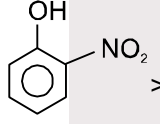
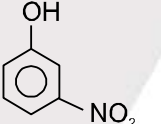
10. The order of acidity of the H-atoms underlined in the following compounds is in the order :

- (I) Ph-CH<sub>2</sub>-CH<sub>3</sub>      (II) Ph-CH=CH-CH<sub>3</sub>      (III) Ph-CH=CH<sub>2</sub>      (IV)   
 (A) IV>II>I>III      (B) II>IV>III>I      (C) III>IV>I>II      (D) I>III>II>IV

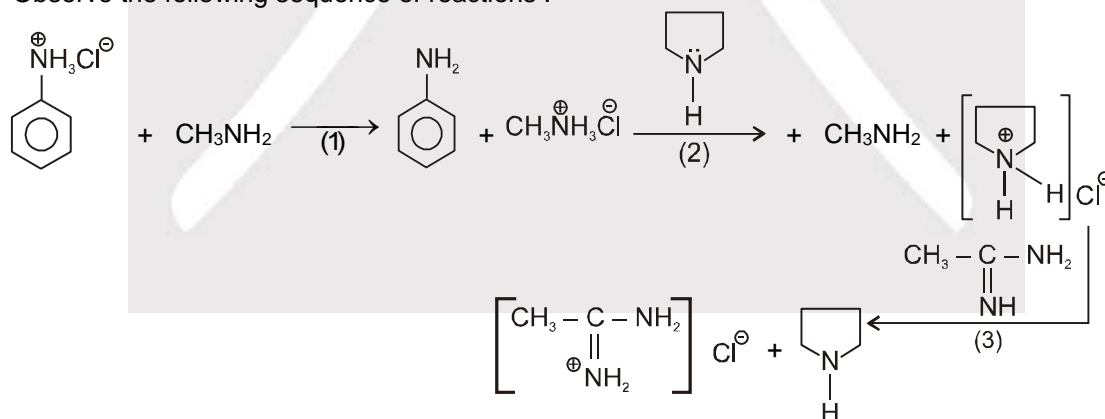
11. Most acidic hydrogen is present in :

- (A)       (B)       (C) (CH<sub>3</sub>CO)<sub>3</sub>CH      (D) (CH<sub>3</sub>)<sub>3</sub>COH

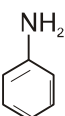
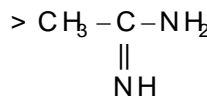
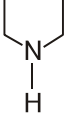
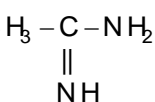
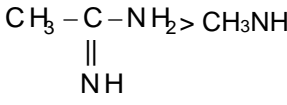


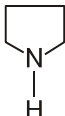
12. The correct orders are :

- (A)  >       Acid strength  
 (B)  >       Acid strength  
 (C)  >       Basic strength  
 (D)  >       Boiling point

13. Observe the following sequence of reactions :

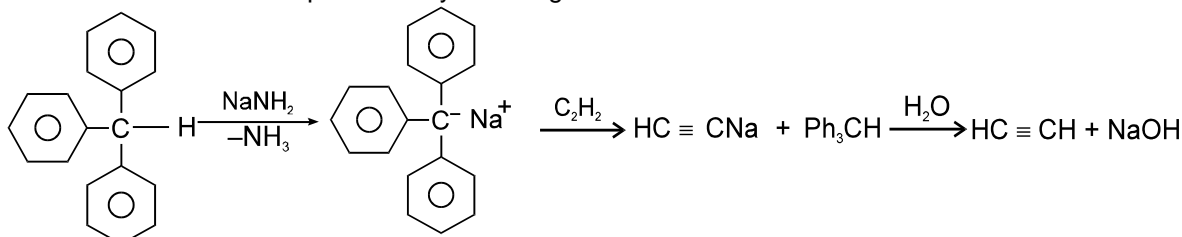


Select the correct option regarding the relative basic strength ( $K_b$ ) :

- (A)  >       (B)  >   
 (C)  >       (D)  > 

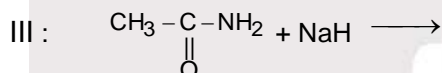
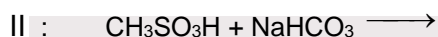
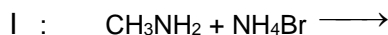


14. Order of  $K_a$  which can be predicted by following reaction is :



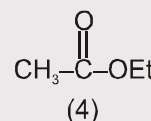
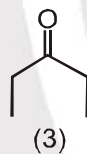
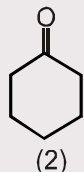
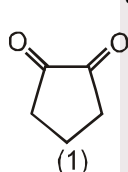
- (A)  $\text{NH}_3 > \text{Ph}_3\text{CH} > \text{C}_2\text{H}_2 > \text{H}_2\text{O}$  (B)  $\text{H}_2\text{O} > \text{HC}\equiv\text{CH} > \text{Ph}_3\text{CH} > \text{NH}_3$   
 (C)  $\text{HC}\equiv\text{CH} > \text{H}_2\text{O} > \text{Ph}_3\text{CH} > \text{NH}_3$  (D)  $\text{Ph}_3\text{CH} > \text{HC}\equiv\text{CH} > \text{H}_2\text{O} > \text{NH}_3$

15. The gases produced in the following reactions are respectively



- (A)  $\text{NH}_3, \text{NH}_3, \text{CO}_2$  (B)  $\text{NH}_3, \text{SO}_2, \text{H}_2$  (C)  $\text{NH}_3, \text{SO}_2, \text{NH}_3$  (D)  $\text{NH}_3, \text{CO}_2, \text{H}_2$

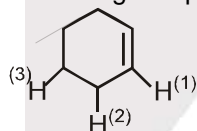
16. Decreasing order of enol content of the following compounds in liquid phase



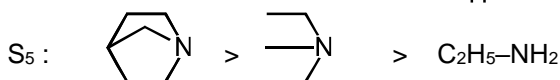
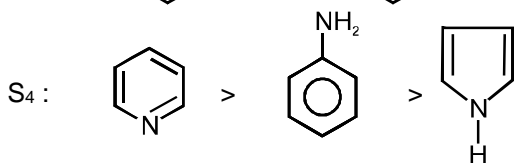
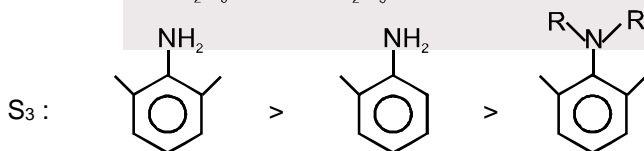
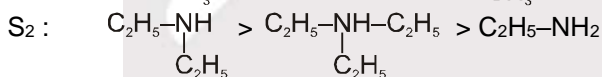
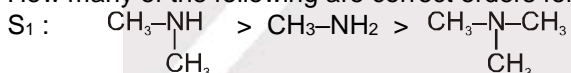
- (A)  $2 > 1 > 3 > 4$  (B)  $1 > 2 > 3 > 4$  (C)  $4 > 3 > 2 > 1$  (D)  $3 > 1 > 2 > 4$

## PART - II : SINGLE AND DOUBLE VALUE INTEGER TYPE

1. Consider following compound, which H-atom deprotonated first ?

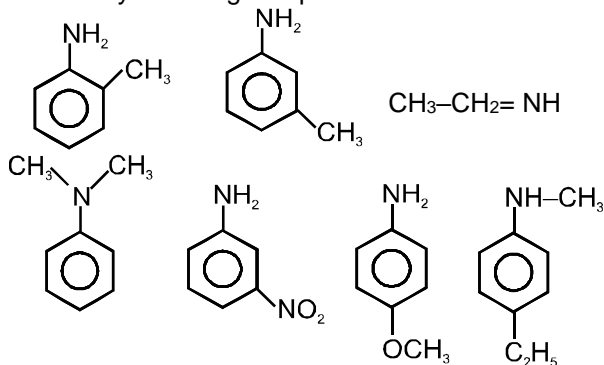


2. How many of the following are correct orders for Basic Strength :

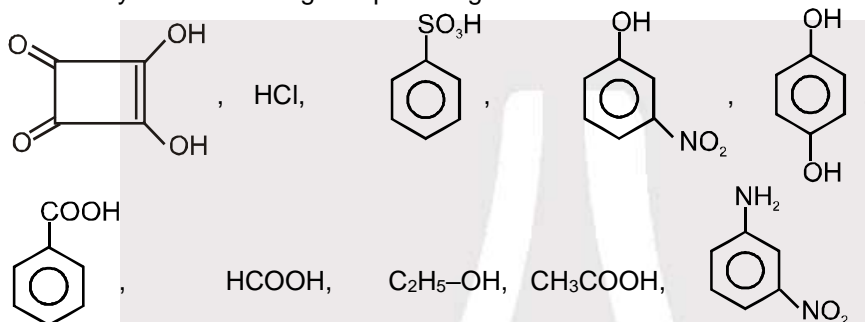




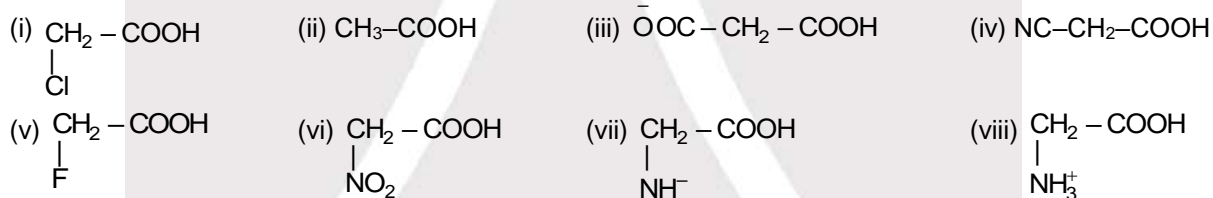
3. How many following compounds are more basic than aniline.



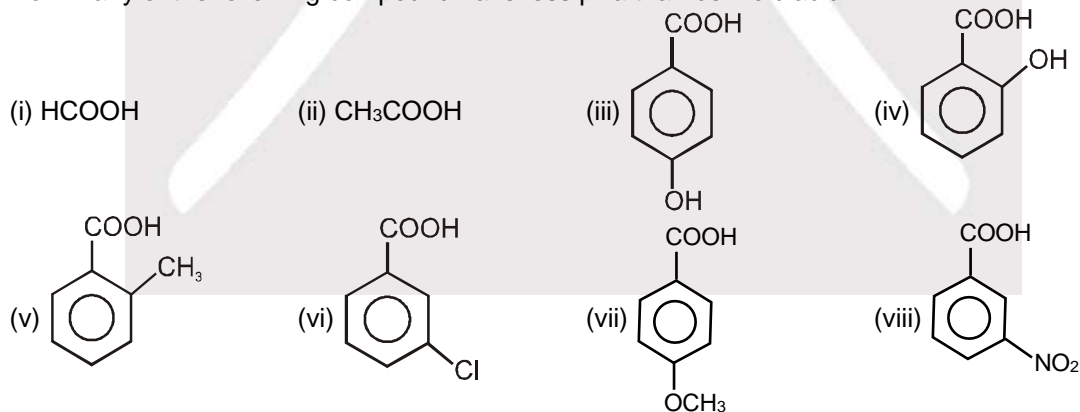
4. How many of the following compounds give  $\text{CO}_2$  on reaction with  $\text{NaHCO}_3$ .



5. How many of the following are more acidic than  $\text{HCOOH}$ .

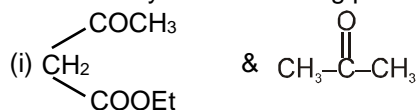


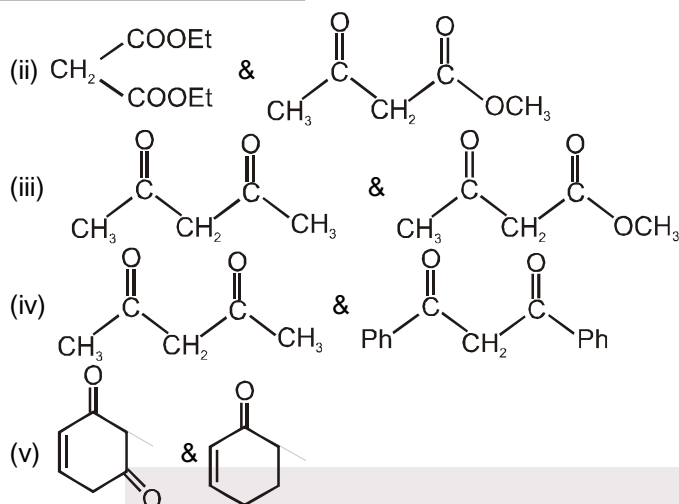
6. How many of the following compound have less pKa than benzoic acid :



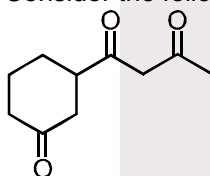
7. 90 g of acetic acid react with excess of  $\text{NaHCO}_3$  then what volume of  $\text{CO}_2$  will produce at S.T.P. Write your answer in terms of nearest integer.

8. In how many of the following pairs first will have higher enol content than second.



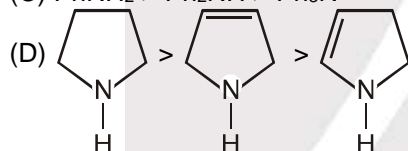
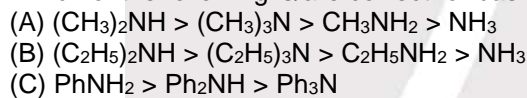


9. Consider the following compound and write number of enolizable H-atom

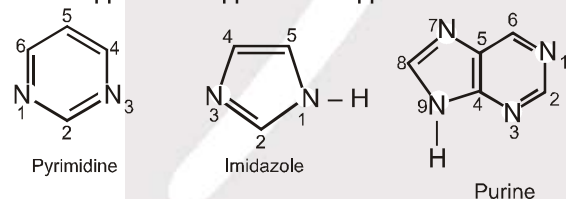


### PART - III : ONE OR MORE THAN ONE OPTIONS CORRECT TYPE

1. Which of the following is/are correct for basic strength :



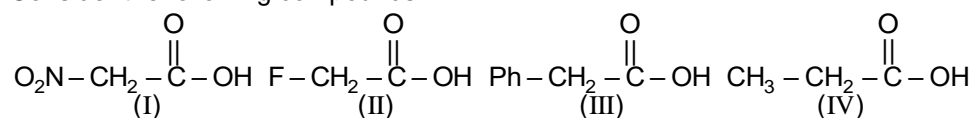
2.



Among the following which statement(s) is/are correct :

- (A) Both N of pyrimidine are same basic strength  
 (B) In imidazole protonation take places on N-3.  
 (C) In purine only one lone pair of N is delocalised.  
 (D) Pyrimidine, imidazole and purine all are aromatic.

3. Consider the following compounds

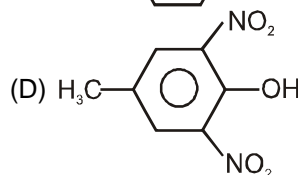
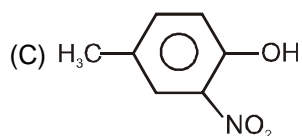
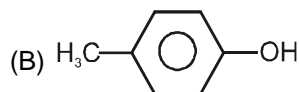
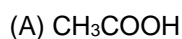


Which statement is/are correct :

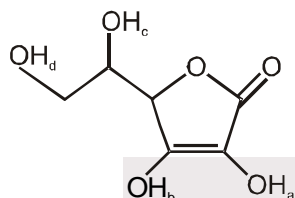
- (A) I > II > III > IV (Acidic strength order)  
 (B) I is most acidic because of -M effect of  $-\text{NO}_2$  group  
 (C) I is most acidic because of -I effect of  $-\text{NO}_2$  group  
 (D) IV is least acidic because of +I Effect.



4. Carboxylic acid is less acidic than :



5.



Observe the compound and choose correct statement :

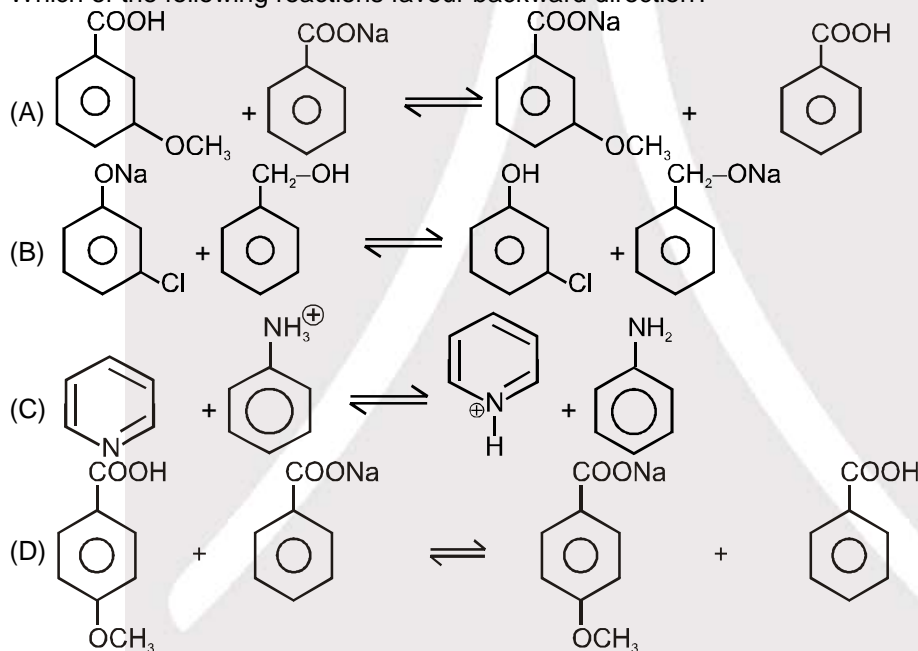
(A) It has carboxylic acid group

(B) It is Ascorbic acid

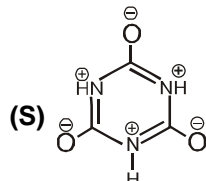
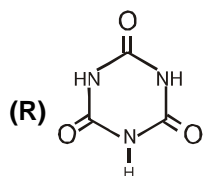
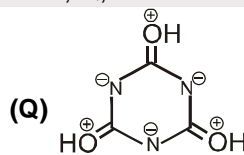
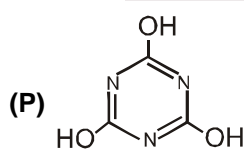
(C)  $\text{H}_b$  is most acidic Hydrogen atom

(D)  $\text{H}_a$  is least acidic Hydrogen atom

6. Which of the following reactions favour backward direction?



7. The **correct** statement(s) concerning the structures P, Q, R & S is/are



(A) Q & S are not resonating structures

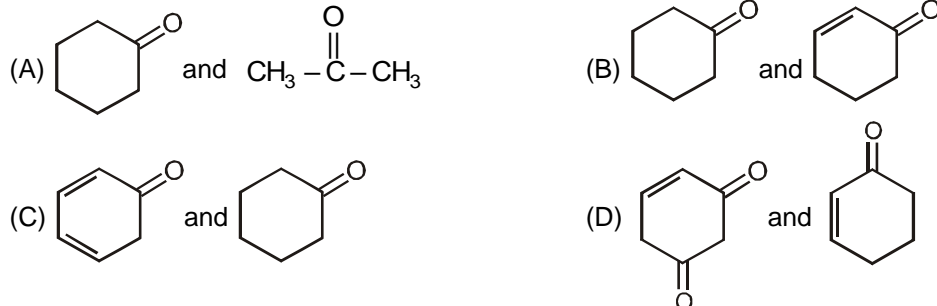
(B) R & S are resonating structures

(C) P & R are tautomers

(D) P & Q are resonating structures



8. Among the given pairs, in which pair second compound has less enol content :



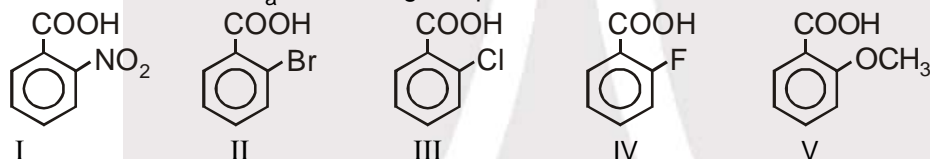
## PART - IV : COMPREHENSION

Read the following passage carefully and answer the questions.

### Comprehension # 1

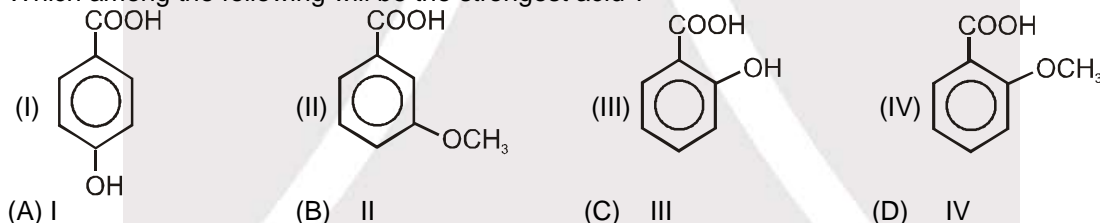
Ortho effect is a special type of effect that is shown by o-substituents. This ortho-effect operates at the benzoic acids irrespective of the polar type. Nearly all o-substituted benzoic acid are stronger than benzoic acid. Benzoic acid is a resonance stabilised and so the carboxyl group is coplanar with the ring. An o-substituent tends to prevent this coplanarity.

1. What is the order of  $K_a$  of following compounds ?



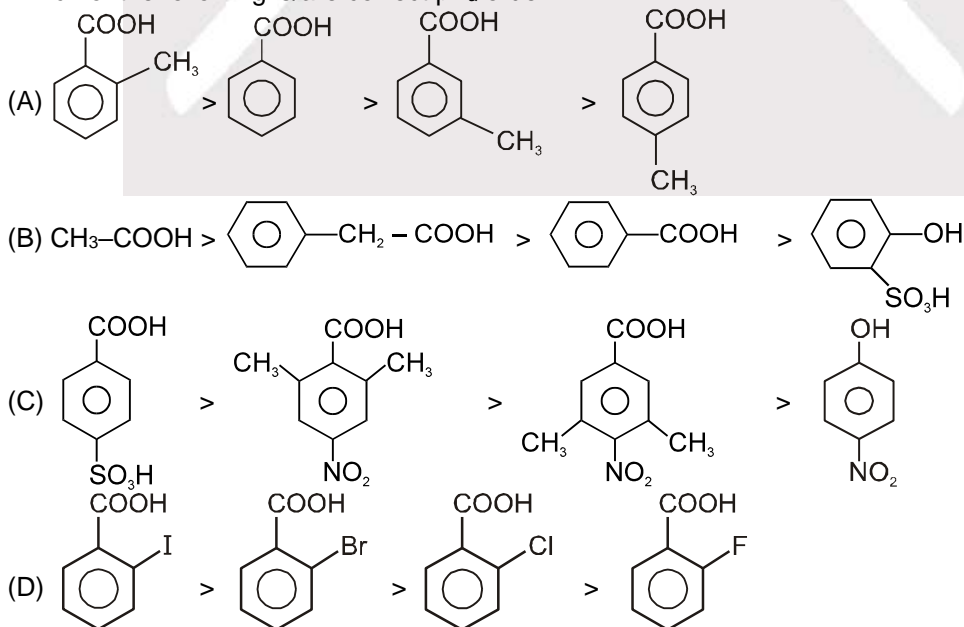
(A) I > II > III > IV > V    (B) II > I > III > IV > V    (C) V > IV > III > I > II    (D) III > II > I > V > IV

2. Which among the following will be the strongest acid ?



(A) I                      (B) II                      (C) III                      (D) IV

3. Which of the following is/are correct  $pK_a$  order ?





## Comprehension # 2

The lone pair of amines makes them basic. They react with acids to form acid-base salts. Amines are more basic than alcohols, ethers and water. When an amine is dissolved in water, an equilibrium is established, where water acts as an acid and transfer a proton to the amine. The basic strength of an amine can be measured by basicity constant  $K_b$ .

Arylamines are less basic than alkylamines because the lone pair of nitrogen is delocalised with the aromatic ring and are less available for donation.

Substituted arylamines can be either more basic or less basic than aniline, depending on the substituent. ERG substituents, such as  $-\text{CH}_3$ ,  $-\text{NH}_2$  and  $-\text{OCH}_3$  increases the basicity and EWG substituents, such as  $-\text{Cl}$ ,  $-\text{NO}_2$  and  $-\text{CN}$  decreases basicity. While  $\text{sp}^2$ -hybridized nitrogen atom in pyridine is less basic than the  $\text{sp}^3$ -hybridized nitrogen in an alkylamine.

4. Select the correct order of  $K_b$ .

- (A)  $\text{CH}_3\text{NH}_2 > \text{NaOH}$   
 (B) Pyridine  $> \text{CH}_3\text{-}\ddot{\text{N}}\text{-CH}_3$   
 (C) p-Methyl aniline  $>$  p-Chloroaniline  $>$  p-Amino acetophenone  
 (D) p-Bromoaniline  $>$  p-Nitroaniline  $>$  p-Amino benzaldehyde

5.  $\text{pK}_b$  order of the following compound is :

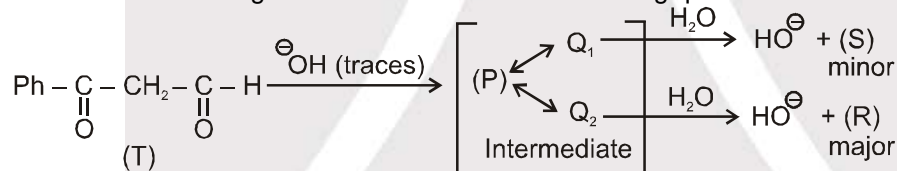
- (I)  $\text{NH}_2\text{OH}$  (II)  $\text{NH}_2\text{NH}_2$  (III)  $\text{NH}_3$  (IV)  $\text{H}_2\text{O}$   
 (A)  $\text{IV} > \text{I} > \text{II} > \text{III}$  (B)  $\text{III} > \text{II} > \text{I} > \text{IV}$  (C)  $\text{I} > \text{IV} > \text{II} > \text{III}$  (D)  $\text{III} > \text{I} > \text{II} > \text{IV}$

6. The most basic carbanion is :



## Comprehension # 3

Observe the following reaction and answer the following questions :



7. The product 'R' is :

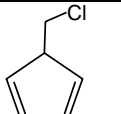
- (A)  $\text{Ph}-\overset{\text{OH}}{\underset{\text{OH}}{\text{C}}}=\overset{\text{OH}}{\underset{\text{OH}}{\text{C}}}-\text{H}$  (B)  $\text{Ph}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}=\overset{\text{OH}}{\underset{\text{OH}}{\text{C}}}-\text{H}$   
 (C)  $\text{Ph}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}=\overset{\text{OH}}{\underset{\text{OH}}{\text{C}}}-\text{H}$  (D)  $\text{Ph}-\overset{\text{OH}}{\underset{\text{OH}}{\text{C}}}=\text{CH}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$

8. The structure of  $\text{Q}_1$  is :

- (A)  $\text{Ph}-\overset{\text{O}^\ominus}{\parallel}{\text{C}}=\text{CH}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$  (B)  $\text{Ph}-\overset{\text{O}^\ominus}{\parallel}{\text{C}}=\text{C}=\overset{\text{O}^\ominus}{\parallel}{\text{C}}-\text{H}$   
 (C)  $\text{Ph}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}=\overset{\text{O}^\ominus}{\parallel}{\text{C}}-\text{H}$  (D)  $\text{Ph}-\overset{\text{O}}{\parallel}{\text{C}}-\overset{\ominus}{\text{C}}\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$

## Comprehension # 4

Answer 9, 10 and 11 by appropriately matching the information given in the three columns of the following table.

Column-1, 2 & 3 containing starting material, reaction condition & electronic effect / intermediate respectively.					
Column-1		Column-2		Column-3	
(I)		(i)	$\text{SbCl}_5$ or $\text{AlCl}_3(\text{Anhy.})$	(P)	Rearrangement



(II)		(ii)	Na	(Q)	Resonance
(III)		(iii)	H <sup>+</sup>	(R)	Hyperconjugation
(IV)		(iv)	NaOH	(S)	Carbocation intermediate

9. Which combination will give hydrogen gas ?  
 (A) (III) (iii) (P)      (B) (II) (ii) (R)      (C) (IV) (ii) (Q)      (D) (I) (iii) (P)
10. In which product formation is not possible ?  
 (A) (I) (ii) (Q)      (B) (II) (i) (R)      (C) (III) (ii) (Q)      (D) (IV) (i) (S)
11. In which amongs the following aromatic product will not form ?  
 (A) (I) (i) (P)      (B) (II) (i) (Q)      (C) (III) (iv) (Q)      (D) (IV) (ii) (Q)

## Exercise-3

\* Marked Questions may have more than one correct option.

### PART - I : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

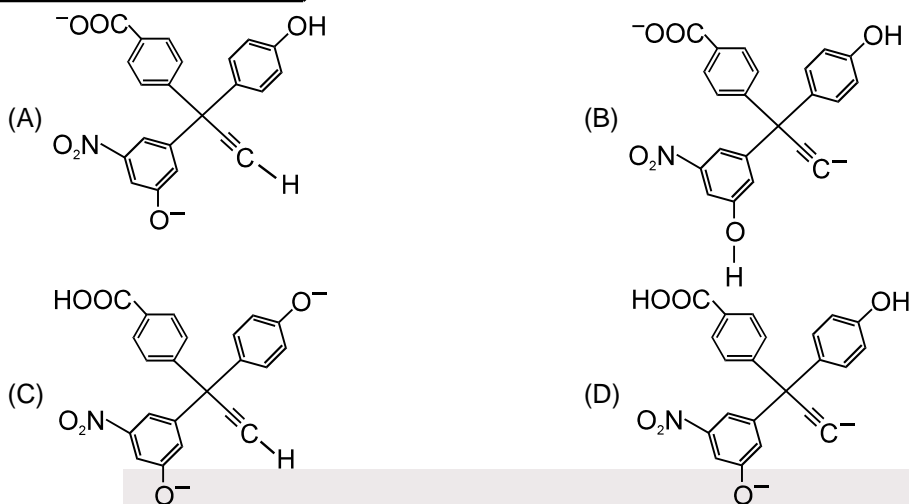
1. Which of the following acid has the lowest value of acid dissociation constant : [JEE-02(S), 3/90]  
 (A) CH<sub>3</sub>CHF<sub>2</sub>COOH      (B) FCH<sub>2</sub>CH<sub>2</sub>COOH      (C) BrCH<sub>2</sub>CH<sub>2</sub>COOH      (D) CH<sub>3</sub>CHBrCOOH
2. Match the K<sub>a</sub> values : [JEE-03(M), 2/60]

	Compounds		K <sub>a</sub>
(a)	Benzoic acid	(i)	3.3 × 10 <sup>-5</sup>
(b)		(ii)	6.3 × 10 <sup>-5</sup>
(d)		(iii)	30.6 × 10 <sup>-5</sup>
(e)		(iv)	6.4 × 10 <sup>-5</sup>
(f)		(v)	4.2 × 10 <sup>-5</sup>

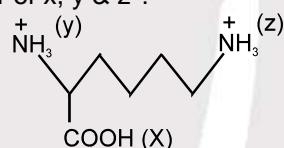
3. Compound A of molecular formula C<sub>9</sub>H<sub>7</sub>O<sub>2</sub>Cl exists in keto form and predominantly in enolic form 'B'. On oxidation with KMnO<sub>4</sub>'A' gives m-Chlorobenzoic acid. Identify 'A' and 'B'. [JEE(M)-03]

4.   
 2 moles NaNH<sub>2</sub> → A. The product A will be - [JEE-03(S), 3/84]



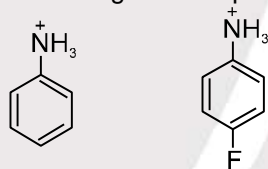


5. What is the acidity order of x, y & z ? [JEE-04(S), 3/84]



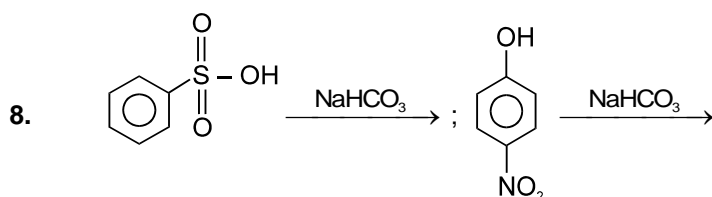
- (A)  $x > y > z$       (B)  $x > z > y$       (C)  $y > z > x$       (D)  $z > y > x$

6. Which one of the following two compounds is the stronger acid? Explain why? [JEE 2004, 4/60]



The products will be :

- (A) +  $\text{CH}_3\text{COONa}$
- (B) +  $\text{CH}_3\text{COOH}$
- (C) +  $\text{CH}_3\text{COOH}$
- (D) +  $\text{SO}_3$



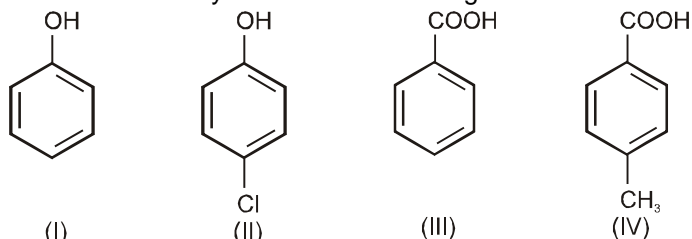
Benzenesulphonic acid and para nitrophenol react with  $\text{NaHCO}_3$  separately. The gases produced are respectively. [JEE-06, 3/184]

- (A)  $\text{SO}_2, \text{CO}_2$       (B)  $\text{SO}_2, \text{CO}$       (C)  $\text{SO}_2, \text{NO}_2$       (D)  $\text{CO}_2, \text{CO}_2$



[JEE-09, 3/160]

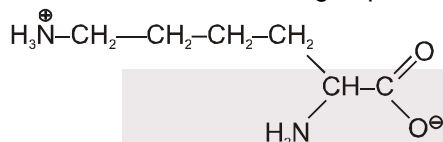
9. The correct acidity order of the following is :



- (I) (A) (III) > (IV) > (II) > (I) (B) (IV) > (III) > (I) > (II)  
 (C) (III) > (II) > (I) > (IV) (D) (II) > (III) > (IV) > (I)

10. The total number of basic groups in the following form of lysine is :

[JEE-10, 3/163]



11. Among the following compounds, the most acidic is :

[JEE-11, 3/180]

- (A) p-nitrophenol (B) p-hydroxybenzoic acid  
 (C) o-hydroxybenzoic acid (D) p-toluic acid

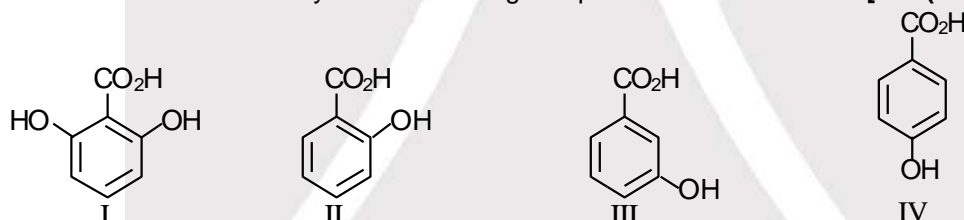
12. The compound that does **NOT** liberate  $\text{CO}_2$ , on treatment with aqueous sodium bicarbonate solution, is:

[JEE(Advanced) 2013, 2/120]

- (A) Benzoic acid (B) Benzenesulphonic acid  
 (C) Salicylic acid (D) Carboic acid (Phenol)

13. The correct order of acidity for the following compounds is

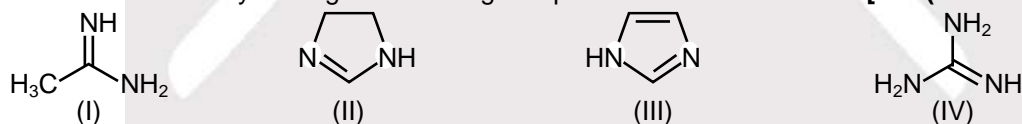
[JEE(Advanced) 2016, 3/124]



- (A) I > II > III > IV (B) III > I > II > IV (C) III > IV > II > I (D) I > III > IV > II

14. The order of basicity among the following compounds is

[JEE(Advanced) 2017, 3/122]



- (A) II > I > IV > III (B) I > IV > III > II (C) IV > II > III > I (D) IV > I > II > III

## PART - II : JEE (MAIN) / AIEEE ONLINE PROBLEMS (PREVIOUS YEARS)

1. Which one of the following statements is **not** correct ? [JEE(Main) 2014 Online (11-04-14), 4/120]

- (1) Alcohols are weaker acids than water.  
 (2) Acid strength of alcohols decreases in the following order  $\text{RCH}_2\text{OH} > \text{R}_2\text{CHOH} > \text{R}_3\text{COH}$ .  
 (3) Carbon-oxygen bond length in methanol,  $\text{CH}_3\text{OH}$  is shorter than that of C-O bond length in phenol.  
 (4) The bond angle  $\text{C}-\text{O}-\text{H}$  in methanol is  $108.9^\circ$ .

2. Which one of the following compounds will not be soluble in sodium bicarbonate ?

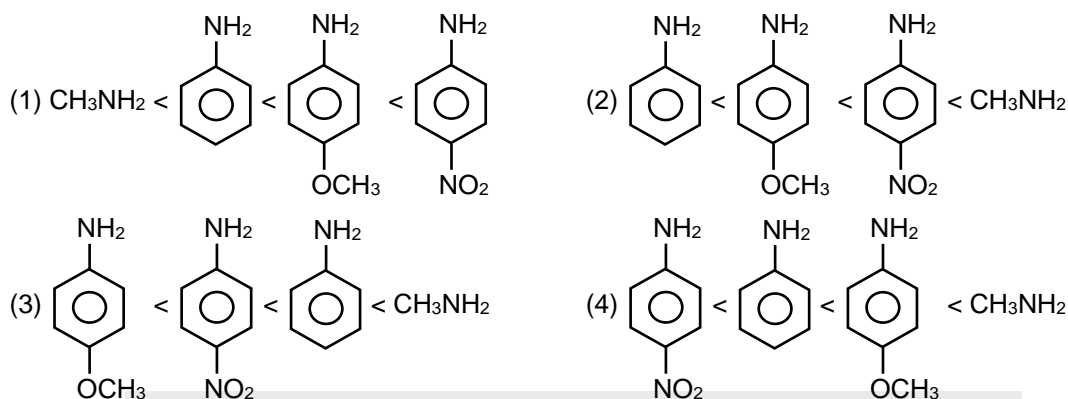
[JEE(Main) 2014 Online (19-04-14), 4/120]

- (1) 2,4,6-Trinitrophenol (2) Benzoic acid  
 (3) o-Nitrophenol (4) Benzene sulphonc acid



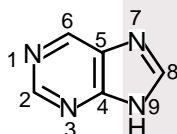
3. Arrange the following amines in the order of increasing basicity :

[JEE(Main) 2015 Online (10-04-15), 4/120]



4. The "N" which does not contribute to the basicity for the compound is :

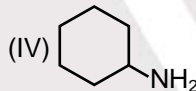
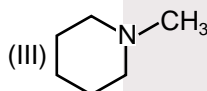
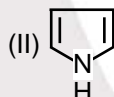
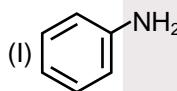
[JEE(Main) 2016 Online (10-04-16), 4/120]



- (1) N 7                      (2) N 1                      (3) N 9                      (4) N 3

5. Among the following compounds, the increasing order of their basic strength is :

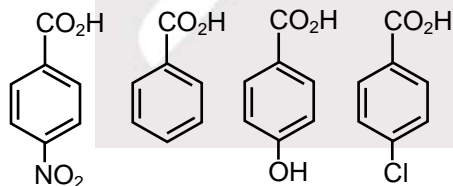
[JEE(Main) 2017 Online (09-04-17), 4/120]



- (1) (I) < (II) < (III) < (IV)  
 (2) (I) < (II) < (IV) < (III)  
 (3) (II) < (I) < (III) < (IV)  
 (4) (II) < (I) < (IV) < (III)

6. The increasing order of the acidity of the following carboxylic acids is :

[JEE(Main) 2018 Online (15-04-18), 4/120]



- (1) I < III < II < IV                      (2) IV < II < III < I                      (3) II < IV < III < I                      (4) III < II < IV < I

7. Which amongst the following is the strongest acid ?

[JEE(Main) 2019 Online (09-01-19), 4/120]

- (1)  $\text{CHBr}_3$                       (2)  $\text{CHCl}_3$                       (3)  $\text{CHI}_3$                       (4)  $\text{CH}(\text{CN})_3$

8. The correct decreasing order for acid strength is :

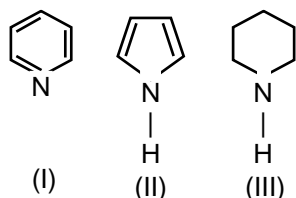
[JEE(Main) 2019 Online (09-01-19), 4/120]

- (1)  $\text{CNCH}_2\text{COOH} > \text{O}_2\text{NCH}_2\text{COOH} > \text{FCH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$   
 (2)  $\text{FCH}_2\text{COOH} > \text{NCCH}_2\text{COOH} > \text{NO}_2\text{CH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$   
 (3)  $\text{NO}_2\text{CH}_2\text{COOH} > \text{NCCH}_2\text{COOH} > \text{FCH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$   
 (4)  $\text{NO}_2\text{CH}_2\text{COOH} > \text{FCH}_2\text{COOH} > \text{CNCH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$



9. Arrange the following amines in the decreasing order of basicity :

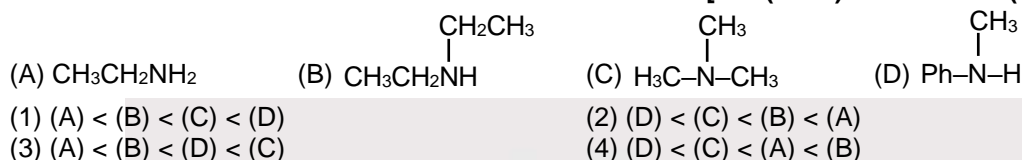
[JEE(Main) 2019 Online (09-01-19), 4/120]



- (1) I > III > II      (2) III > I > II      (3) III > II > I      (4) I > II > III

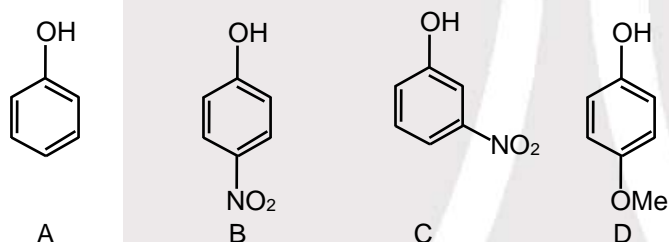
10. The increasing basicity order of the following compounds is:

[JEE(Main) 2019 Online (09-01-19), 4/120]



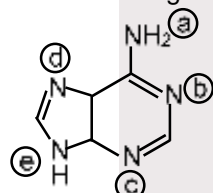
11. The increasing order of the pK<sub>a</sub> values of the following compounds is :

[JEE(Main) 2019 Online (10-01-19), 4/120]



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

12. In the following compound the favourable site/s for protonation is /are :



[JEE(Main) 2019 Online (11-01-19), 4/120]

- (1) (a) and (e)      (2) (a) and (d)      (3) (b), (c) and (d)      (4) (a)

13. The correct order of acid strength of compounds CH#CH, CH3-C#CH and CH2=CH2 is as follows :

[JEE(Main) 2019 Online (12-01-19), 4/120]

- (1) CH3-C#CH > CH#CH > CH2=CH2      (2) CH3-C#CH > CH2=CH2 > HC#CH  
 (3) HC#CH > CH3-C#CH > CH2=CH2      (4) CH#CH > CH2=CH2 > CH3-C#CH



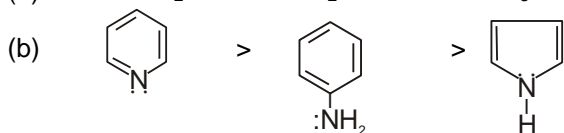
# Answers

## EXERCISE - 1

### PART - I

A-1. II > III > IV > I > V

A-2. (a)  $\text{PhNH}_2 > \text{Ph}_2\text{NH} > \text{Ph}_3\text{N}$



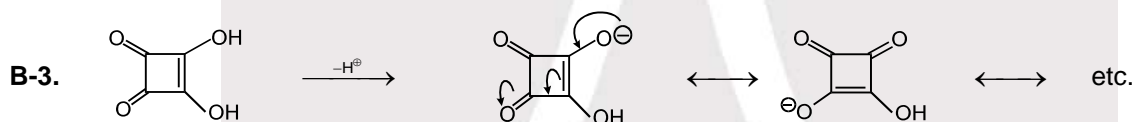
(c)  $\text{Ph-CH}_2\text{-CH}_2\text{-NH}_2 > \text{CH}_3\text{-CH(Ph)-NH}_2 > \text{CH}_3\text{-CH}_2\text{-NH(Ph)}$

A-3. 2

A-4. I is less basic than II because, in compound (I) the lone pair of electrons is involved in resonance but not in II.

B-1. I - a, II - b, III - c, (acidic strength  $\propto$  stability of conjugate base)

B-2. III > I > II (acidic strength  $\propto$  stability of conjugate base) In III conjugate base is highly stabilised by intra molecular H-bonding.



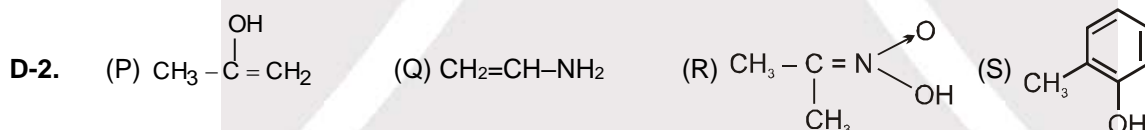
Its conjugate base (anion) is resonance stabilised like  $\text{RCOO}^-$  anion of carboxylic acid.

C-1. (a) Not feasible (b) Feasible (c) Not feasible (d) Not feasible

C-2. (c) Strong base accept  $\text{H}^+$  ions so this reaction is feasible.

C-3. (i, iii, iv, v, vi, vii)

D-1. B, C, E, G, H can show tautomerism.



D-3. In Monocarbonyl Keto form is more stable due to greater strength of the carbon-oxygen double bond as compared to the carbon carbon double bond.

### PART - II

A-1. (C) A-2. (A) A-3. (A) A-4. (D) A-5. (D)

A-6. (A) A-7. (D) A-8. (D) B-1. (D) B-2. (A)

B-3. (C) B-4. (B) B-5. (D) B-6. (C) B-7. (C)

B-8. (C) B-9. (A) B-10. (D) C-1. (B) C-2. (C)

C-3. (D) C-4. (C) D-1. (A) D-2. (A) D-3. (B)

D-4. (A) D-5. (A)

### PART - III

1. (A - z) ; (B - x) ; (C - w) ; (D - y)

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



## EXERCISE - 2

### PART - I

- |         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. (B)  | 2. (D)  | 3. (A)  | 4. (D)  | 5. (A)  |
| 6. (D)  | 7. (A)  | 8. (D)  | 9. (B)  | 10. (A) |
| 11. (C) | 12. (A) | 13. (C) | 14. (B) | 15. (D) |
| 15. (B) |         |         |         |         |

### PART - II

- |                                |                                                                           |                             |
|--------------------------------|---------------------------------------------------------------------------|-----------------------------|
| 1. 2                           | 2. 4 (S <sub>1</sub> , S <sub>2</sub> , S <sub>4</sub> , S <sub>5</sub> ) | 3. 5 (ii, iii, iv, vi, vii) |
| 4. 6 (i, ii, iii, vi, vii, ix) | 5. 5 (i, iv, v, vi, viii)                                                 | 6. 5 (i, iv, v, vi, viii)   |
| 7. 34                          | 8. 3                                                                      | 9. 10                       |

### PART - III

- |          |           |          |          |         |
|----------|-----------|----------|----------|---------|
| 1. (BCD) | 2. (ABCD) | 3. (ACD) | 4. (ACD) | 5. (BC) |
| 6. (BD)  | 7. (ABCD) | 8. (ACD) |          |         |

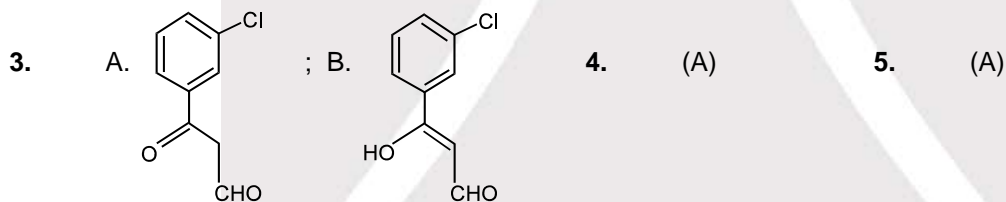
### PART - IV

- |         |        |        |        |         |
|---------|--------|--------|--------|---------|
| 1. (A)  | 2. (C) | 3. (B) | 4. (C) | 5. (A)  |
| 6. (D)  | 7. (D) | 8. (C) | 9. (C) | 10. (D) |
| 11. (A) |        |        |        |         |

## EXERCISE - 3

### PART - I

1. (C)      2. (a) – (ii) ; (b) – (iii) ; (c) – (iv) ; (d) – (i) ; (e) – (v)



4. (A)      5. (A)      6. 
7. (B)      8. (D)      9. (A)      10. 2      11. (C)
12. (D)      13. (A)      14. (D)

### PART - II

- |         |         |         |        |         |
|---------|---------|---------|--------|---------|
| 1. (3)  | 2. (3)  | 3. (4)  | 4. (3) | 5. (4)  |
| 6. (4)  | 7. (4)  | 8. (3)  | 9. (2) | 10. (4) |
| 11. (3) | 12. (3) | 13. (3) |        |         |