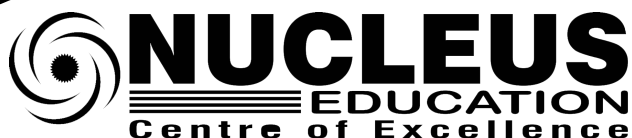


**NURTURE**

# IIT CHEMISTRY

ORGANIC CHEMISTRY

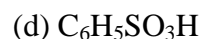
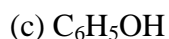
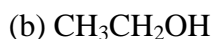
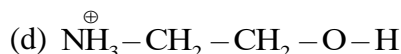
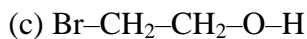
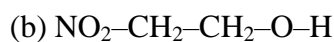
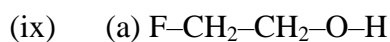
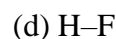
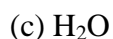
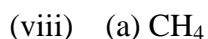
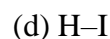
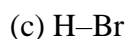
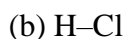
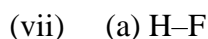
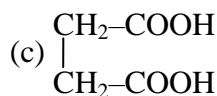
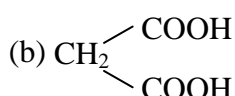
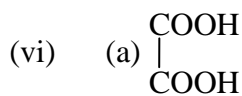
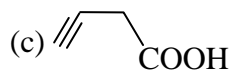
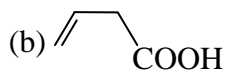
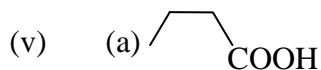
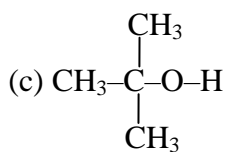
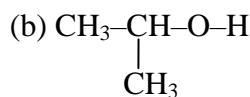
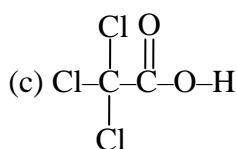
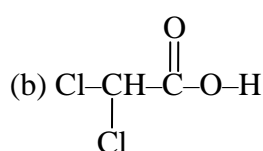
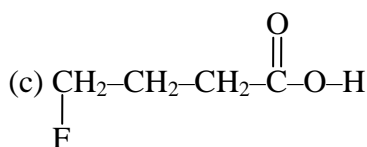
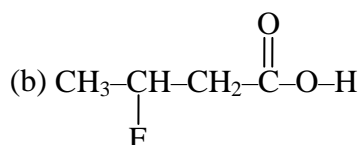
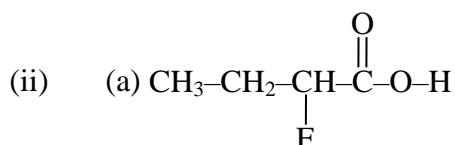
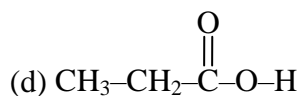
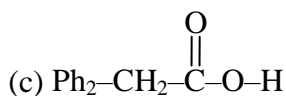
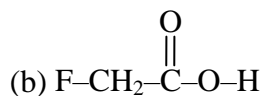
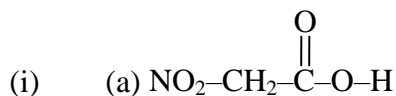
ACID & BASES



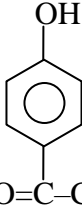
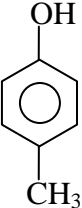
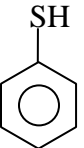
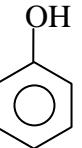
unacademy

## EXERCISE # I

1. Write correct order of acidic strength of following compounds:



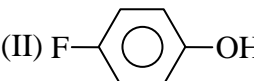
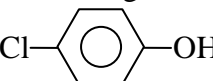
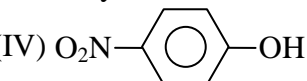
2. Among the following pairs, which compound is stronger acid?

- (a)  $\text{CH}_3\text{CH}_3$  or  $\text{BrCH}_2\text{NO}_2$
- (b)  $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$  or  $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2\text{CN}$
- (c)  or 
- (d)  or 

3. Which of the following would you predict to be the stronger acid?

- (a) Benzoic acid or para-nitrobenzoic acid
- (b)  $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{OH}$  or  $\text{CH}_3-\text{CH}=\text{CH}-\text{OH}$
- (c)  $\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_2-\text{OH}$  or  $\text{CH}_3-\text{CH}=\text{CH}-\text{OH}$




4. Arrange the given phenol & its derivative in their decreasing order of acidity:

- (I)  $\text{C}_6\text{H}_5-\text{OH}$  (II)  (III)  (IV) 

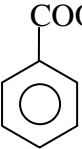
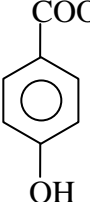
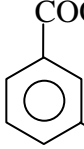
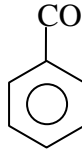
Select the correct answer from the given code:

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

5. Which one of the following is the most acidic?

- (A)  (B)  (C)  (D)  $\text{CH}_2=\text{CH}-\text{CH}_3$

6. Which of the following is weakest acid?

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

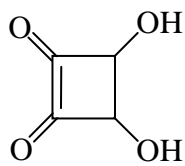
7. Arrange pH of the given compounds in decreasing order:

- (1) Phenol (2) Ethyl alcohol (3) Formic acid (4) Benzoic acid
- (A)  $1 > 2 > 3 > 4$  (B)  $2 > 1 > 4 > 3$  (C)  $3 > 2 > 4 > 1$  (D)  $4 > 3 > 1 > 2$

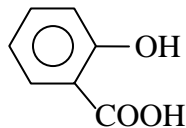
8. Arrange acidity of given compounds in decreasing order:

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

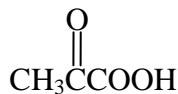
9. Which of the following compounds on reaction with  $\text{NaHCO}_3$  gives  $\text{CO}_2$  gas?



I



II



III

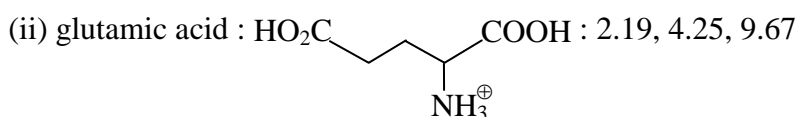
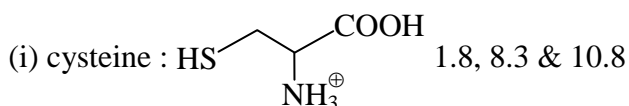
(A) I, II and III

(B) I and III

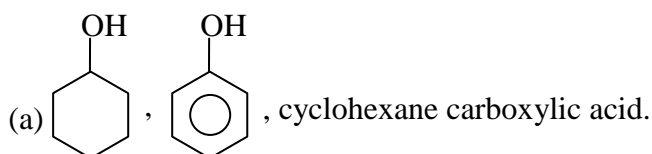
(C) II and III

(D) I and II

10. Which  $\text{pK}_a$  belong to the given functional group in case of following amino acids :



11. Arrange the following sets of compounds according to increasing  $\text{pK}_a$  ( $= -\log K_a$ )



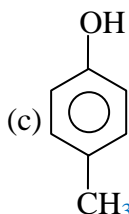
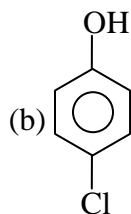
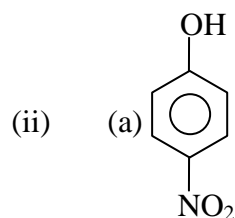
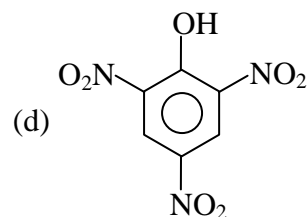
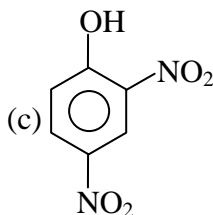
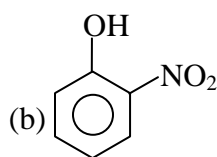
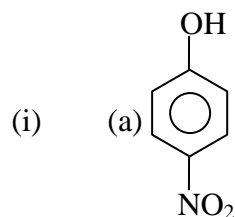
(b) 1-butyne, 1-butene, butane

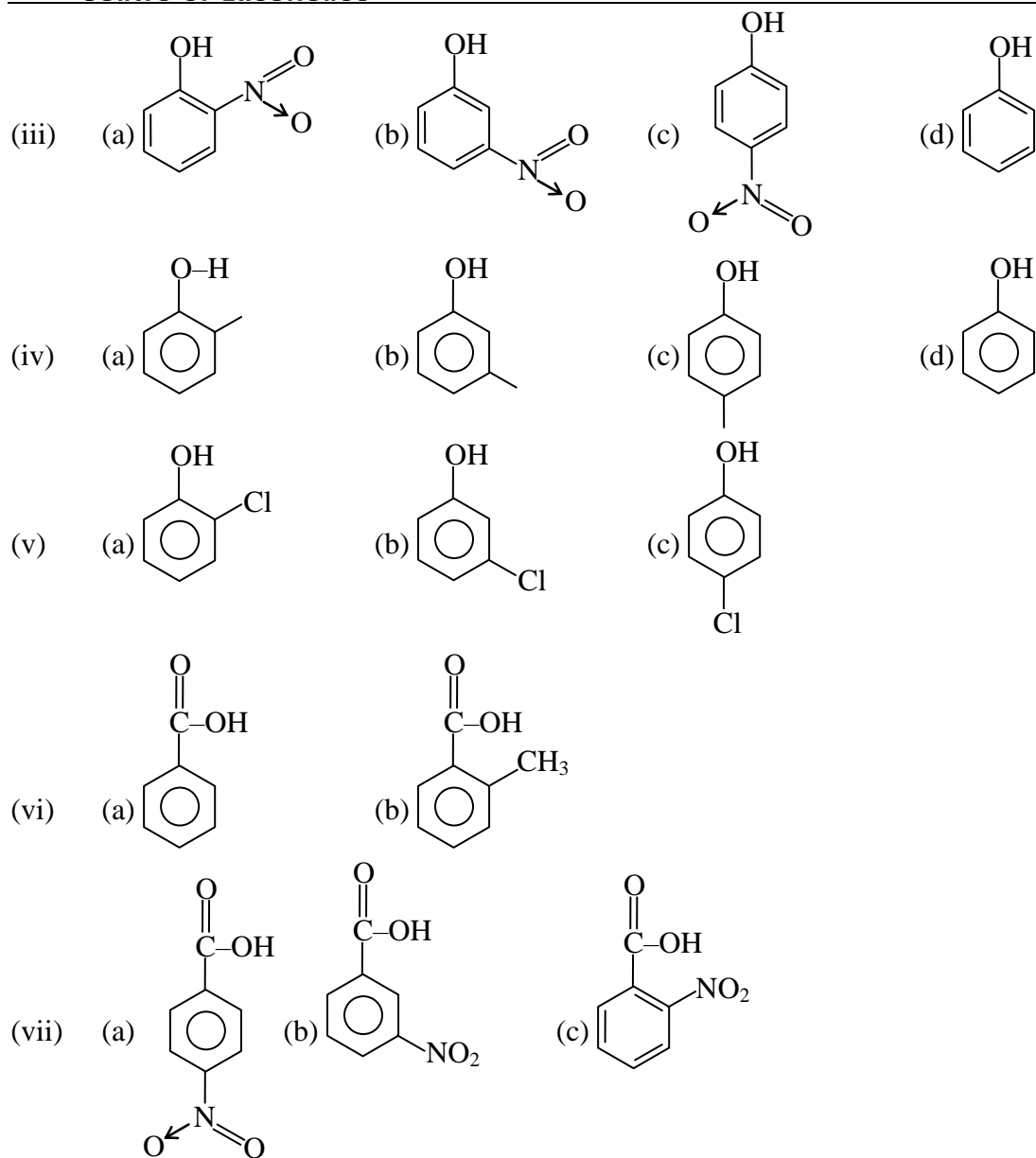
(c) Propanoic acid, 3-bromopropanoic acid, 2-nitropropanoic acid

(d) Phenol, o-nitrophenol, o-cresol

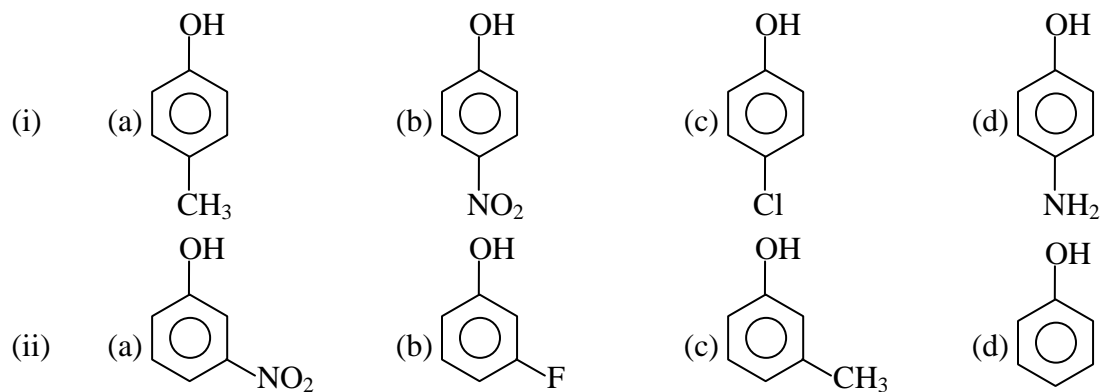
(e) Hexylamine, aniline, methylamine

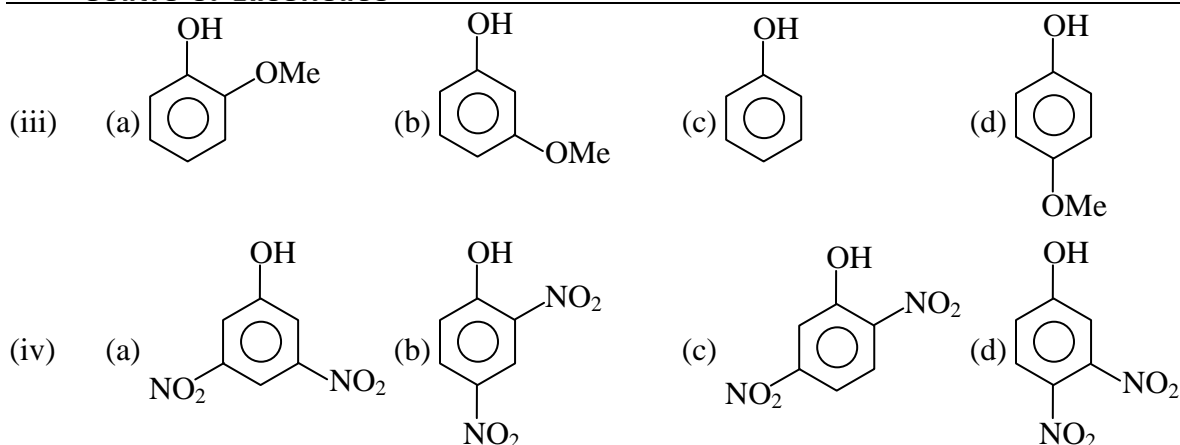
12. Write correct order of acidic strength of following compounds:





13. Select the strongest acid in each of the following sets :





14. The strongest acid is:

- (A) HF (B)  $\text{CH}_3\text{CO}_2\text{H}$  (C)  $\text{HF} + \text{SbF}_5$  (D)  $\text{H}_2\text{S}$

15. The weakest acid (does not show acidic character) is:

- (A)  $\text{HC} \equiv \text{CH}$  (B)  $\text{CH}_2 = \text{CH}_2$  (C)  $\text{Me}_3\text{CH}$  (D)  $\text{Ph}_3\text{CH}$

16. Select correct order regarding acidic strength of given compounds :

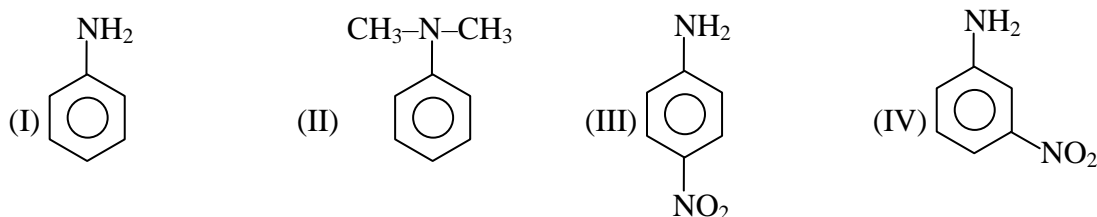
- (1) o-methylbenzoic acid (2) m-methylbenzoic acid  
(3) p-methylbenzoic acid (4) benzoic acid  
(A)  $1 > 2 > 3 > 4$  (B)  $4 > 3 > 2 > 1$  (C)  $1 > 4 > 2 > 3$  (D)  $3 > 2 > 4 > 1$

### Paragraph for Question 17 to 18

The most important condition for resonance to occur is that the involved atoms in resonating structure must be coplanar or nearly coplanar for maximum delocalisation. If this condition does not fulfil, involved orbitals cannot be parallel- to each other and as a consequence delocalisation cannot occur. Bulky groups present on adjacent atoms inhibit the planarity of atoms involved in resonance. This phenomenon is known as steric inhibition of resonance. Steric inhibition of resonance has profound effect on

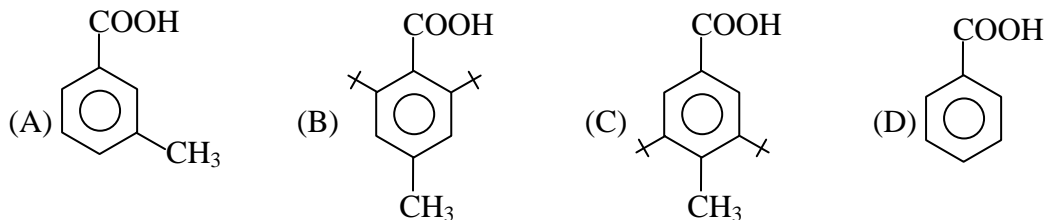
- (1) Physical properties (2) Acidity and basicity (3) Reactivity of organic compounds

17. Arrange the following in the increasing order of basicity :

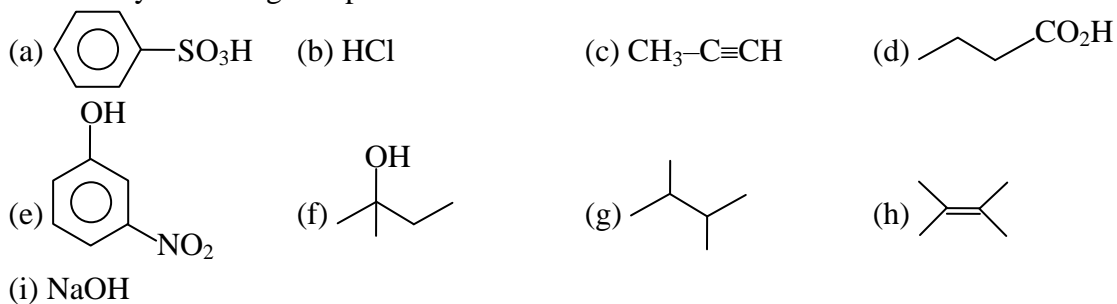


- (A)  $\text{I} > \text{II} > \text{III} > \text{IV}$  (B)  $\text{IV} > \text{III} > \text{II} > \text{I}$  (C)  $\text{II} > \text{I} > \text{IV} > \text{III}$  (D)  $\text{I} > \text{IV} > \text{III} > \text{II}$

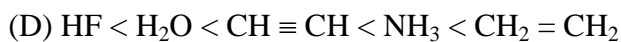
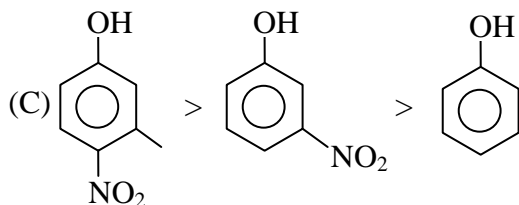
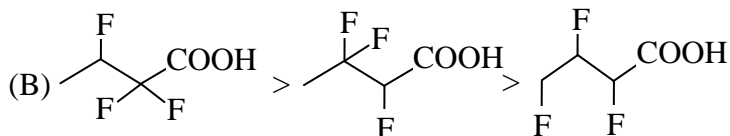
18. Which of the following is most acidic :



19. How many following compounds are more acidic than water ?



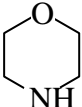

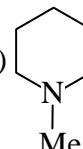
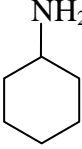
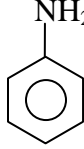
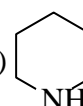
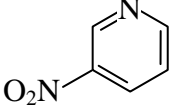
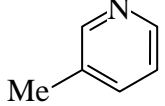
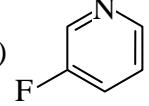
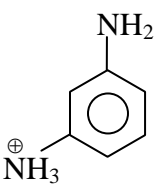
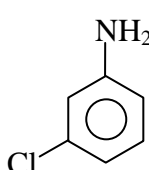
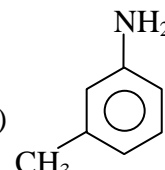
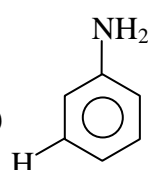
20. How many of the following are incorrect order of  $\text{pK}_a$ .



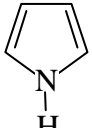
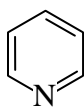
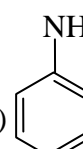
## EXERCISE # II

1. Write increasing order of basic strength of following compounds/species :

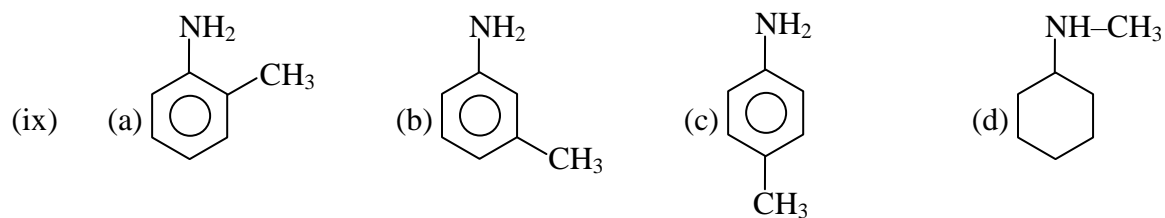
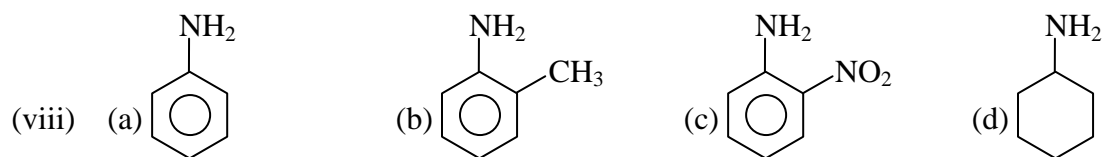
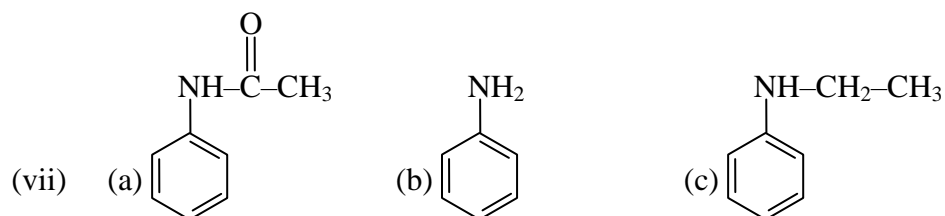
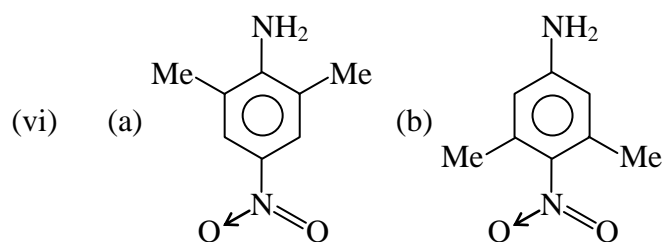
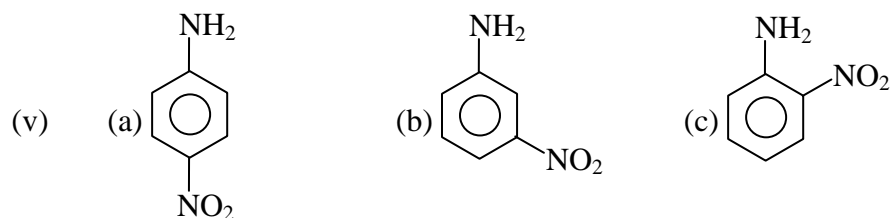
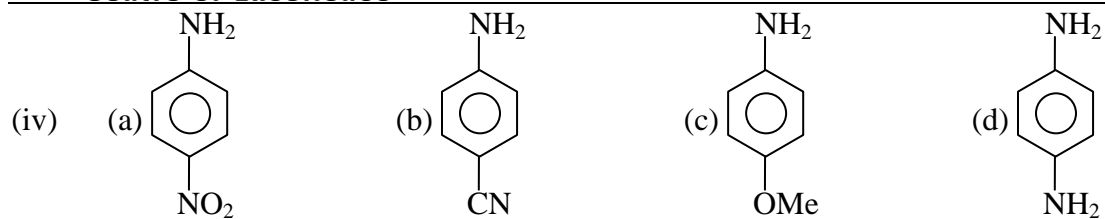
- (i) (a)  $\text{CH}_3^-$  (b)  $\text{NH}_2^-$  (c)  $\text{OH}^-$  (d)  $\text{F}^-$   
 (ii) (a)  $\text{F}^-$  (b)  $\text{Cl}^-$  (c)  $\text{Br}^-$  (d)  $\text{I}^-$   
 (iii) (a)  $\text{NH}_3$  (b)  $\text{MeNH}_2$  (c)  $\text{Me}_2\text{NH}$  (d)  $\text{Me}_3\text{N}$  (in  $\text{H}_2\text{O}$ )  
 (iv) (a)  $\text{NH}_3$  (b)  $\text{MeNH}_2$  (c)  $\text{Me}_2\text{NH}$  (d)  $\text{Me}_3\text{N}$  (Gas phase)  
 (v) (a)  $\text{R}-\text{NH}_2$  (b)  $\text{Ph}-\text{NH}_2$  (c)  $\text{R}-\text{C}(=\text{O})-\text{NH}_2$

- (vi) (a)  (b)  (c)   
 (vii) (a)  (b)  (c)   
 (viii) (a)  (b)  (c)   
 (ix) (a)  (b)  (c)  (d) 

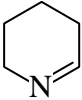
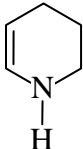
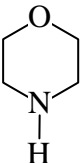
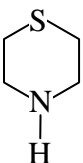
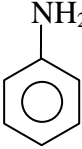
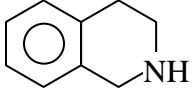
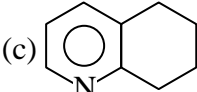
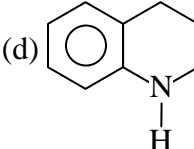
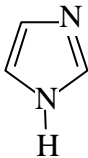
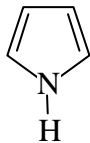
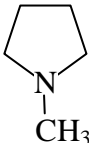
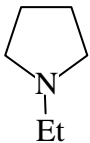
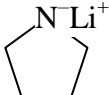
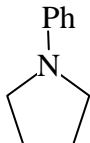
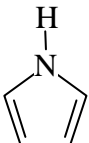
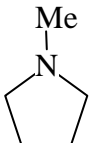
2. Write increasing order of basic strength of following:

- (i) (a)  $\text{CH}_3-\text{CH}_2-\text{NH}_2$  (b)  $\text{CH}_3-\text{CH}_2=\text{NH}$  (c)  $\text{CH}_3-\text{C}\equiv\text{N}$   
 (ii) (a)  $\text{CH}_3-\text{C}(=\text{O})-\text{NH}_2$  (b)  $\text{CH}_3-\text{CH}_2-\text{NH}_2$  (c)  $\text{CH}_3-\text{C}(=\text{NH})-\text{NH}_2$  (d)  $\text{NH}_2-\text{C}(=\text{NH})-\text{NH}_2$   
 (iii) (a)  (b)  (c) 

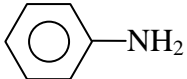
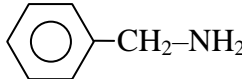
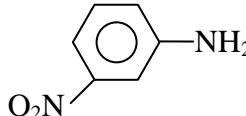
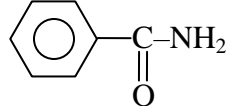




3. Select the strongest base in following compound:

- (i) (a)  (b)  (c)  (d) 
- (ii) (a)  (b)  (c)  (d) 
- (iii) (a)  (b)  (c)  (d) 
- (iv) (a)  (b)  (c)  (d) 

4. Arrange the following compound in decreasing order of their basicity.

- (i) (a)  $\text{H}_2\text{C}=\text{CHNa}$  (b)  $\text{CH}_3\text{CH}_2\text{Na}$  (c)  $\text{CH}_3\text{CH}_2\text{ONa}$  (d)  $\text{HC}\equiv\text{CNa}$
- (ii) (a)  (b)  (c)  (d) 
- (iii) (a)  $\text{HO}^-$  (b)  $\text{NH}_3$  (c)  $\text{H}_2\text{O}$  (d)  $\text{HSO}_4^-$

5. Consider the following bases:

(I) o-nitroaniline (II) m-nitroaniline (III) p-nitroaniline

The decreasing order of basicity is:

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

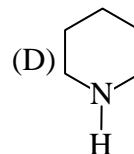
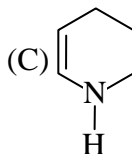
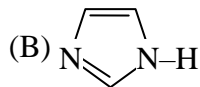
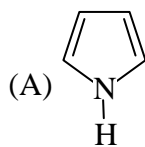
6. Consider the basicity of the following aromatic amines:

(I) aniline (II) p-nitroaniline (III) p-methoxyaniline (IV) p-methylaniline

The correct order of decreasing basicity is:

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

7. Which one of the following is least basic in character?



8. In each of the following pair of compounds, which is more basic ?

(a)  $\text{CH}_3\text{NH}_2$  or  $\text{CF}_3\text{NH}_2$

(b)  $\text{CH}_3\text{CONH}_2$  or  $\text{H}_2\text{N}-\text{C}(=\text{NH})-\text{NH}_2$

(c)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$  or  $\text{CH}_3\text{CN}$

(d)  $\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2$  or 2,6-dimethyl-N,N-dimethylaniline

9. Choose the member of each of the following pairs of compounds that is likely to be the weaker base.

(a)  $\text{H}_2\text{O}$  or  $\text{H}_3\text{O}^+$

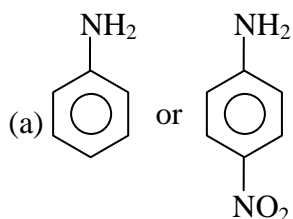
(b)  $\text{Cl}^-$ ,  $\text{SH}^-$

(c)  $\text{F}^-$ ,  $\text{OH}^-$ ,  $\text{NH}_2^-$ ,  $\text{CH}_3^-$

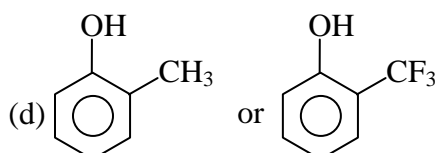
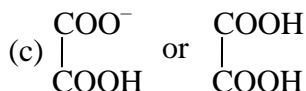
(d)  $\text{HF}$ ,  $\text{H}_2\text{O}$ ,  $\text{NH}_3$

(e)  $\text{OH}^-$ ,  $\text{SH}^-$ ,  $\text{SeH}^-$

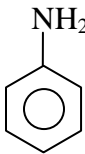
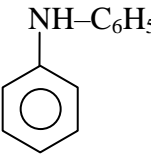
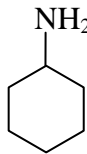
10. Which compound in given pair is the weaker base?



(b)  $\text{CH}_2=\text{CH}-\text{CH}=\text{CH}-\text{CH}_2^-$  or  $\text{CH}_2=\text{CH}-\text{CH}_2^-$



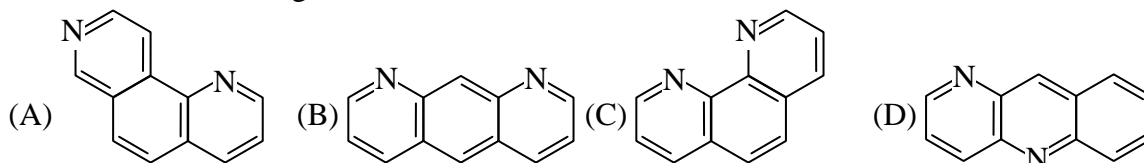
11. Arrange the basic strength of the following compounds.

- |  |   |  |
|--|---|--|
| (a) $\text{OH}^-$<br>(i)   | $\text{CH}_3\text{COO}^-$<br>(ii)   | $\text{Cl}^-$<br>(iii)   |
| (b) $\text{CH}\equiv\text{C}^-$<br>(i)   | $\text{CH}_2=\text{CH}^-$<br>(ii)   | $\text{CH}_3\text{CH}_2^-$<br>(iii)  |
| (c) $\text{CH}_2=\text{CHCH}_2\text{NH}_2$<br>(i)  | $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$<br>(ii)                                    | $\text{CH}\equiv\text{C}-\text{CH}_2\text{NH}_2$<br>(iii)                                    |
| (d) <br>(i) | <br>(ii) | <br>(iii) |

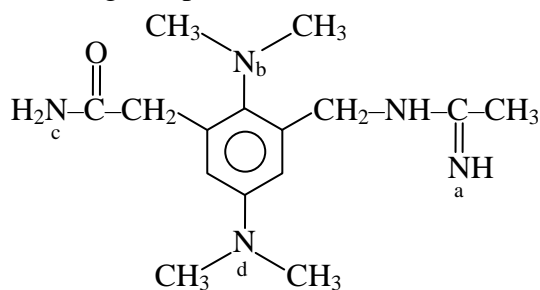
12. Arrange the following compounds in order of increasing basicity.

- (a)  $\text{CH}_3\text{NH}_2$ ,  $\text{CH}_3\text{NH}_3^+$ ,  $\text{CH}_3\text{NH}^-$       (b)  $\text{CH}_3\text{O}^-$ ,  $\text{CH}_3\text{NH}^-$ ,  $\text{CH}_3\text{CH}_2^-$

13. Which of the following is most basic :

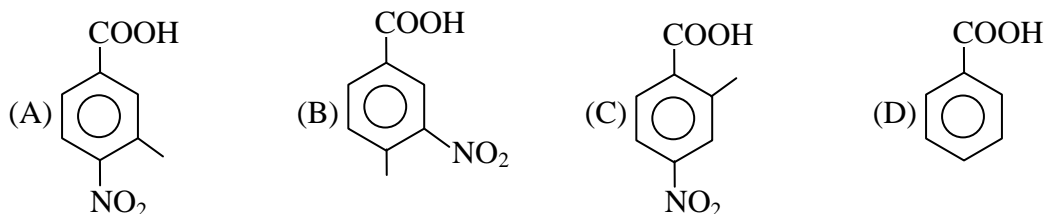


14. Basicity order of N in following compound is :

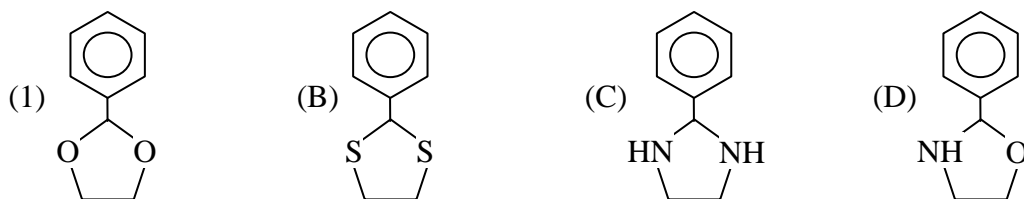


- (A)  $b > d > a > c$       (B)  $a > b > d > c$       (C)  $a > b > c > d$       (D)  $a > c > b > d$

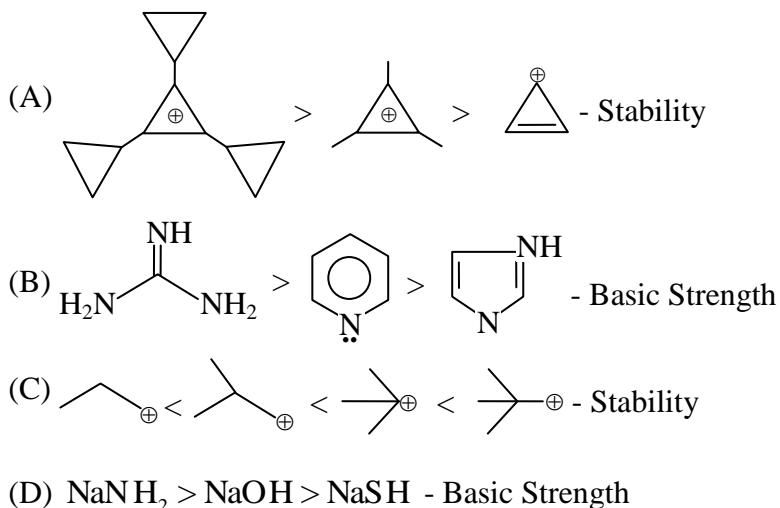
15. Which of the following possess highest basic conjugate base?



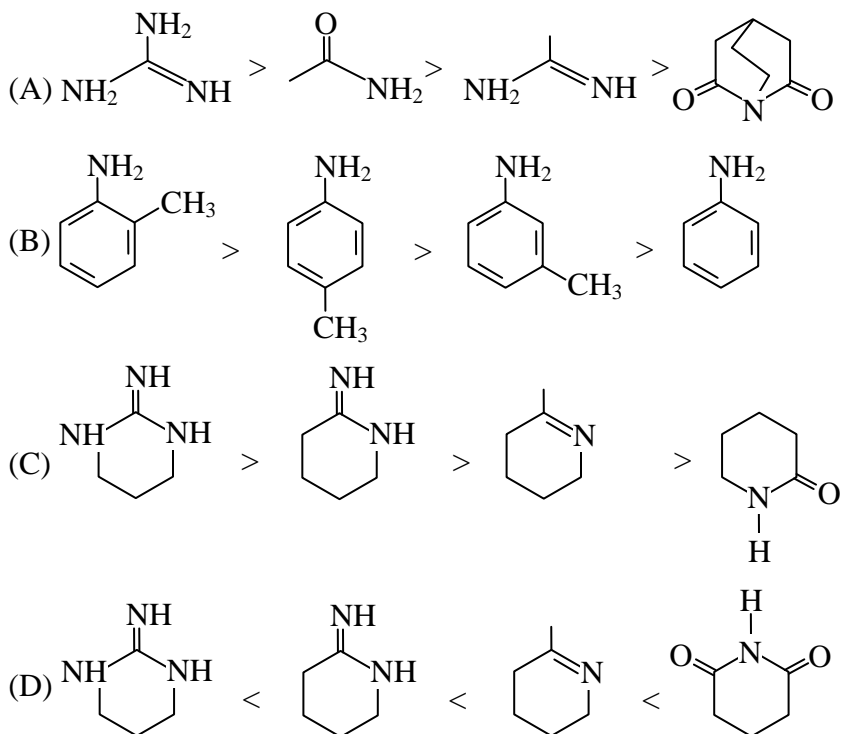
16. Which of the following compound has least  $pK_b$  value :



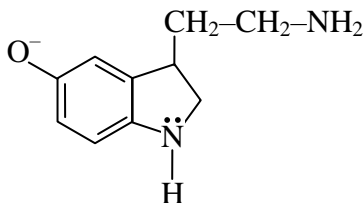
17. Which of the following order(s) is(are) correct.



18. Which one of the following option is correct regarding basic strength:

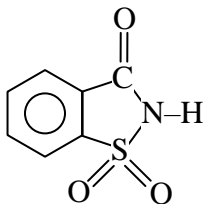


19. The conjugate base of serotonin (used as tranquilisers) is given as follows:

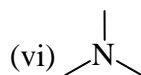
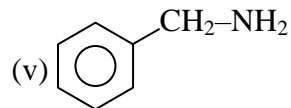
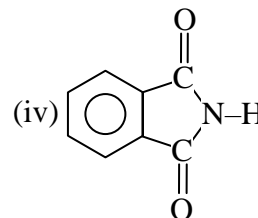
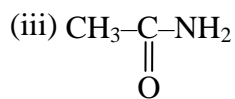
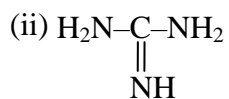
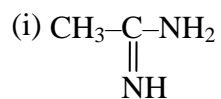


How many basic groups present in given compound?

20. The structure of saccharin is given as follows :

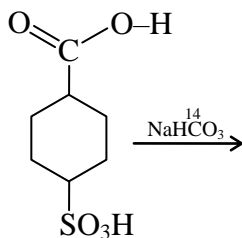


How many following compounds are more basic than saccharin ?



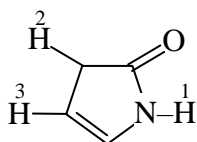
### EXERCISE # III

1. In given reaction Gas liberated is/are



- (A)  $\text{CO}_2$  &  $\text{SO}_3$       (B)  $\text{SO}_3$  &  $^{14}\text{CO}_2$       (C)  $^{14}\text{CO}_2$  only      (D)  $\text{SO}_2$  only

2. Arrange marked atom in decreasing order of acidic strength :

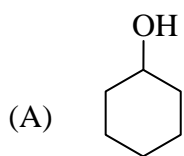


- (A)  $1 > 2 > 3$       (B)  $3 > 2 > 1$       (C)  $2 > 1 > 3$       (D)  $2 > 3 > 1$

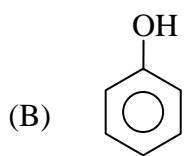
- 3.

**Column-I**

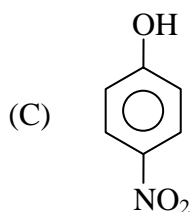
**Column-II**



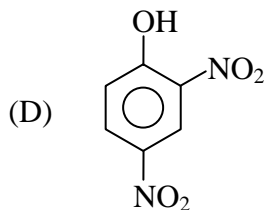
(P) React with NaOH



(Q) React with  $\text{NaHCO}_3$



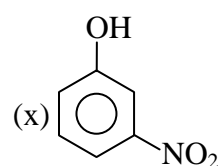
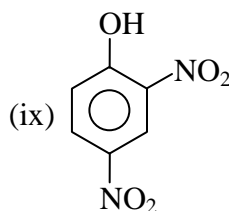
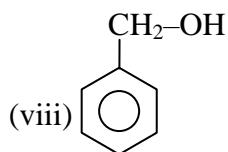
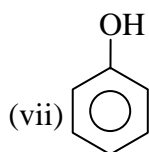
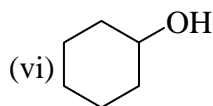
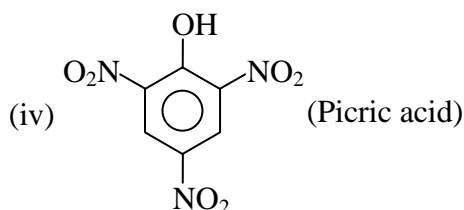
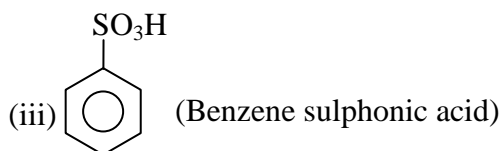
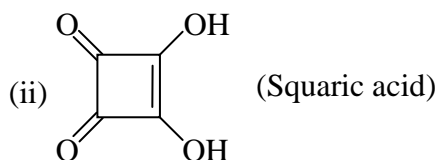
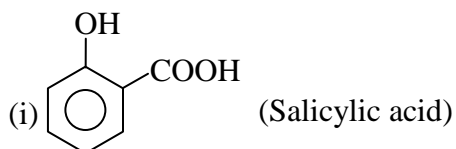
(R) React with NaH



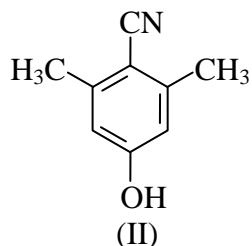
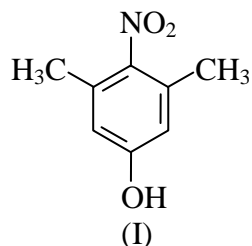
(S) React with Na

(T) React with  $\text{NaNH}_2$

4. Compounds which can give effervescences with  $\text{NaHCO}_3$  are :



5. **Statement-1** : For the given two compounds-I is more acidic than compounds-II.



and

**Statement-2** : Due to presence of  $-\text{CH}_3$  group at ortho positions to  $-\text{NO}_2$  ; the plane of  $-\text{NO}_2$  deviates, w.r.t plane of ring.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

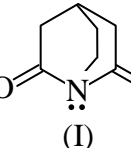
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

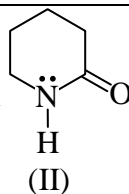
(C) Statement-1 is True, Statement-2 is False.

(D) Statement-1 is False, Statement-2 is True.



6.

**Statement 1 :**  is more basic than



and

**Statement 2 :** Lone pair electrons on nitrogen in compound (I) does not participate in resonance.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(C) Statement-1 is True, Statement-2 is False.

(D) Statement-1 is False, Statement-2 is True.

7. Match Column-I with Column-II.

**Column-I (Facts)**

**Column-II (Reasons)**

(A) Guanidine is proton sponge



(P) 3 equivalent structures of conjugate acid

(B) Carbanion stability  $\text{CCl}_3^- > \text{CF}_3^-$

(Q) Due to s-character of central atoms

(C) Alkyne is more acidic than alkene

(R) Due to d-orbital resonance

(D) Acidity:  < 

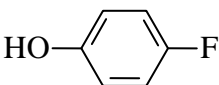
(S) Due to formation of aromatic anion

(T) Stability of conjugate base due to more number of equivalent resonating structure

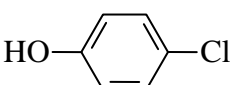
8. Match Column-I with Column-II.

**Column-I (Compounds)**

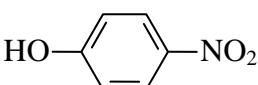
**Column-II (pK<sub>a</sub>)**

(A) 

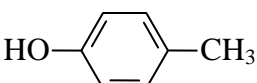
(P) 7.15

(B) 

(Q) 10.14

(C) 

(R) 9.98

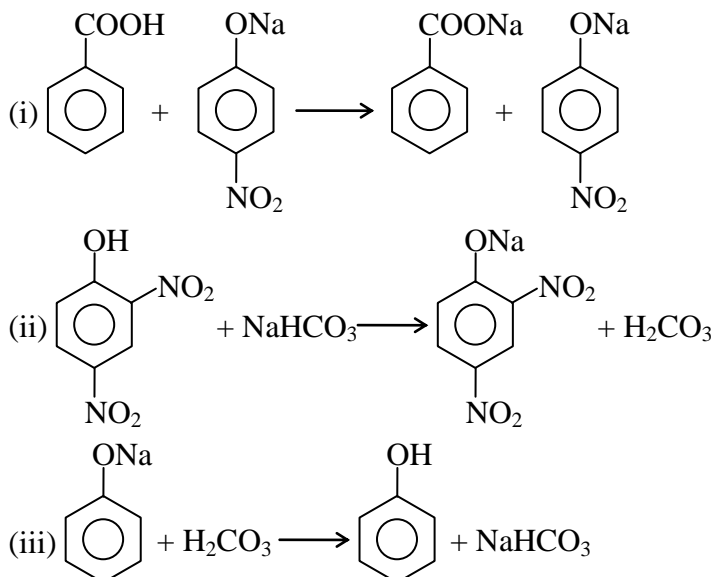
(D) 

(S) 9.38

(T) pK<sub>a</sub> is more than phenol

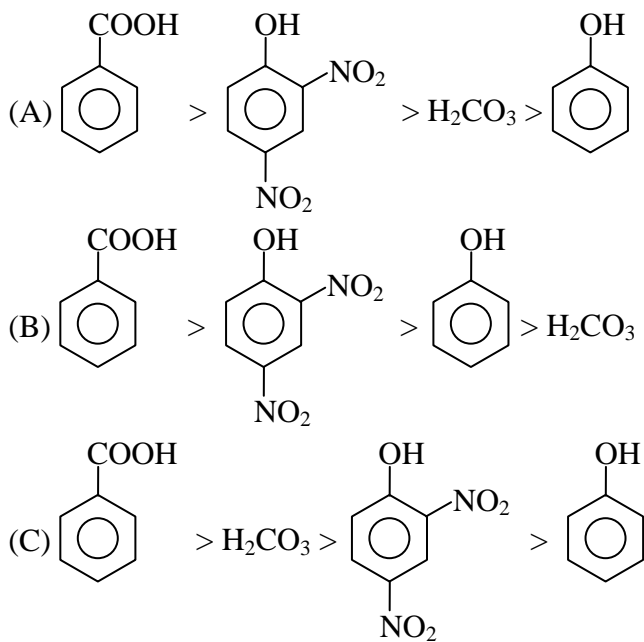
(Comprehension) (Q.9 to Q.11)

Observe the following reaction which are feasible:

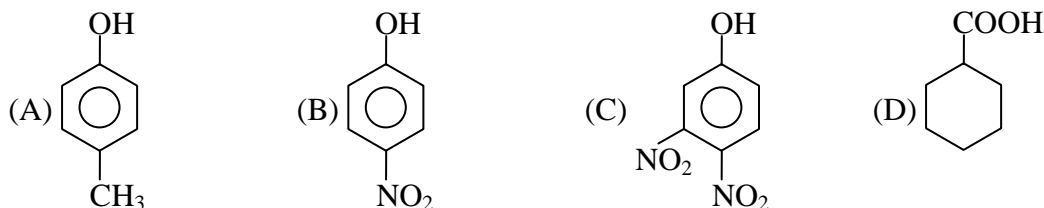


Answer the following question :

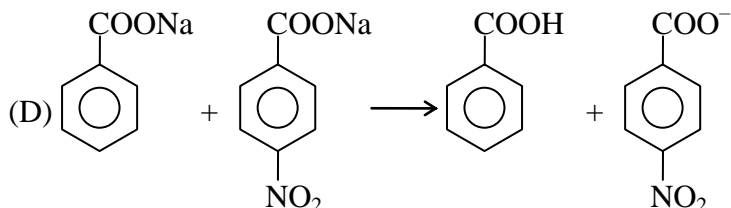
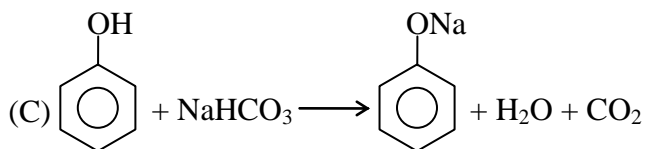
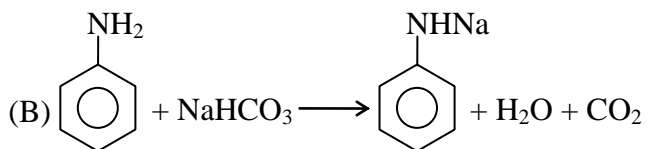
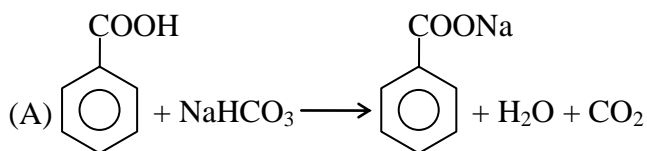
9. Which of the following is the correct order of acidic strength?



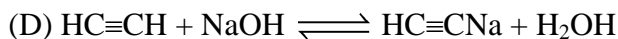
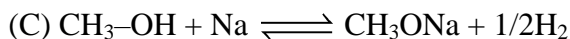
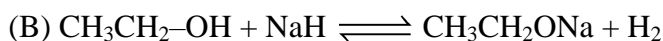
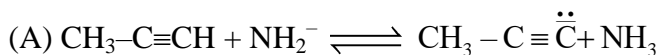
10. Which of the following compound does not react with  $\text{NaHCO}_3$



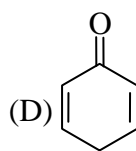
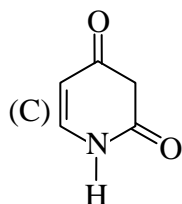
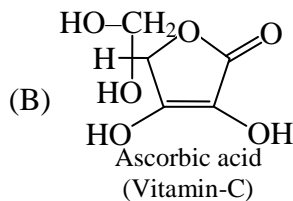
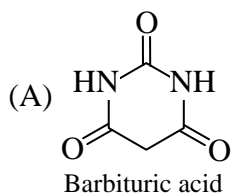
11. Identify the feasible reactions



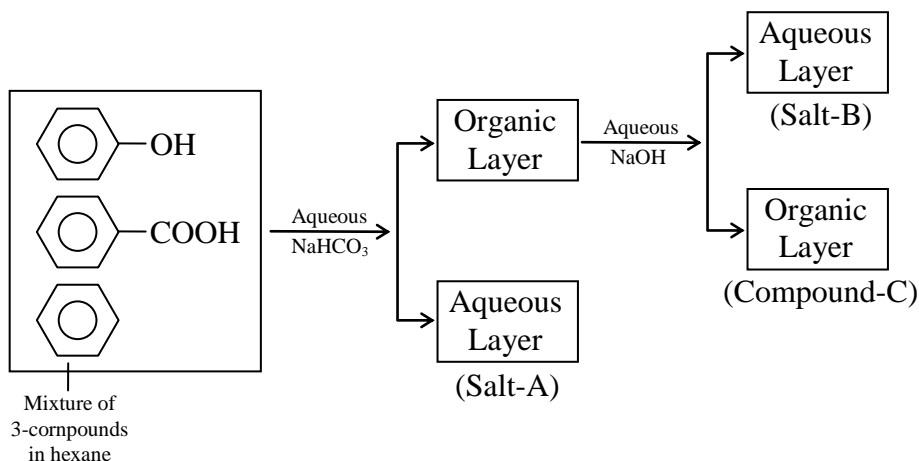
12. Identify the non-feasible reaction



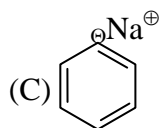
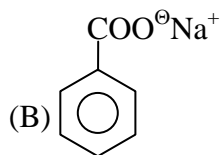
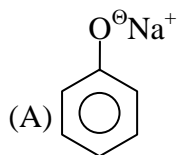
13. Select the number of compounds in which deprotonation gives aromatic anion :



Paragraph for Questions 14 and 15

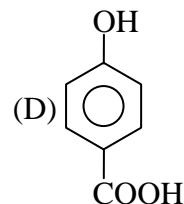
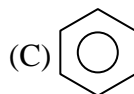
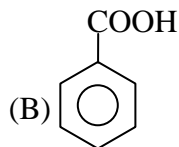
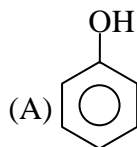


14. Identify salt 'A' ?

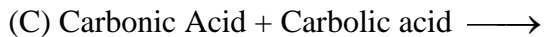
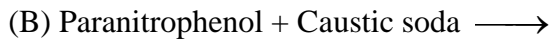


(D) All of these

15. Identify compound 'C' ?

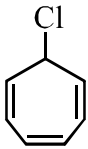

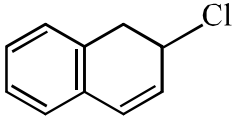
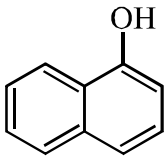


16. Which of the following reactions is/are feasible in forward direction.

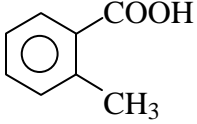
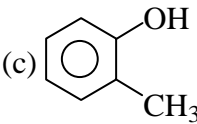
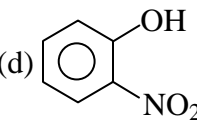
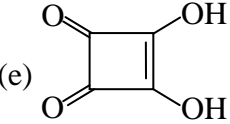
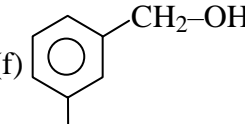
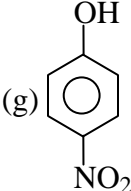
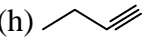
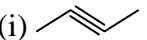
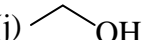


Answer Q.17, Q.18 and Q.19 by appropriately matching the information given in the three columns of the following table.

Column 1, 2 and 3 contain starting materials, reagents and resonating structure of product involving monoion only.

Column-I	Column-II	Column-III
(I) 	(i) Aq. NaOH	(P) 5
(II) 	(ii) $\text{AlCl}_3$	(Q) 7
(III) 	(iii) NaH	(R) 6
(IV) 	(iv) $\text{SbCl}_5$	(S) 10

17. Which of the following represent CORRECT combination ?  
 (A) (III) (iv) (R)      (B) (I) (ii) (P)      (C) (II) (iii) (Q)      (D) (IV) (iii) (S)
18. Which of the following CORRECT combination represent equivalent resonating structures ?  
 (A) (I) (ii) (R)      (B) (III) (iv) (Q)      (C) (II) (iii) (P)      (D) (IV) (i) (S)
19. Which of the following represent INCORRECT combination ?  
 (A) (I) (iv) (R)      (B) (III) (ii) (Q)      (C) (IV) (i) (S)      (D) (II) (iii) (P)

20. (a)  $\text{H}_3\text{C}-\text{SO}_3\text{H}$       (b)       (c)       (d) 
- (e)       (f)       (g)       (h) 
- (i)       (j) 

In above given compounds if

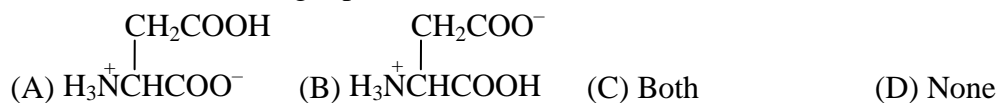
(i) Total number of compounds which gives  $\text{CO}_2(\uparrow)$  on reacting with  $\text{NaHCO}_3 = \text{A}$

(ii) Total number of compounds which are soluble in aq. NaOH are = B

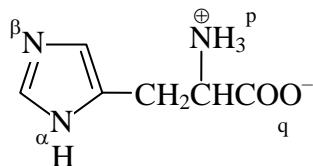
Then what would be the value of  $\text{B}^{\text{A}}$

## EXERCISE-IV

1. Which of the following dipolar structure of the amino acid is considered more correct?

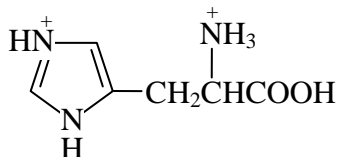


2. Which of the nitrogen of histidine is first protonated?

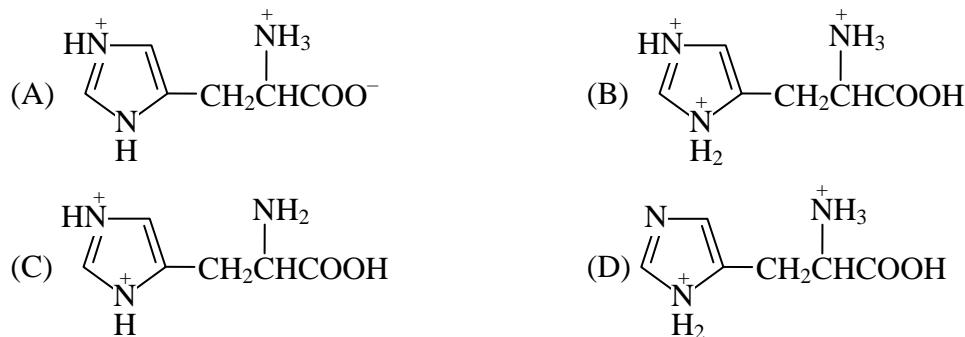


- (A)  $\alpha$  (B)  $\beta$  (C) p (D) q

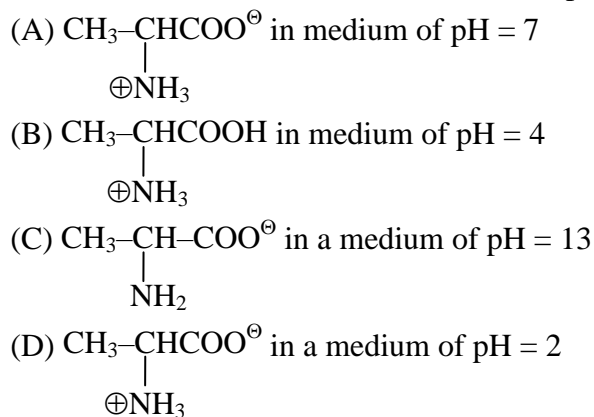
3. Histidine, a heterocyclic amino acid has following structure at  $\text{pH} < 1.82$ ,



At  $\text{pH} > 1.82$  it should have which structure?



4. Alanine forms Zwitter ion which exists as ( $\text{pK}_a$  for two acids is 4.62 and 9.13) :



5. In aqueous solution at pH = 7, glycine is present as :  
(A)  $\text{H}_3\text{N}^+\text{CH}_2\text{COO}^-$  (B)  $\text{H}_3\text{N}^+\text{CH}_2\text{COOH}$  (C)  $\text{H}_2\text{NCH}_2\text{COO}^-$  (D) All of these
6. In aqueous solution, the basic character of amino acids is due to :  
(A)  $-\text{NH}_2$  group (B)  $-\text{NH}_3^+$  group (C)  $-\text{COOH}$  group (D)  $-\text{COO}^-$  group

7.  $\text{NH}_2$   
|  
 $^-\text{OOCCHCH}_2\text{COO}^- \xrightleftharpoons{\text{H}^+} \text{product}$   
Product in the above reaction is :

- (A)  $\text{NH}_2$   
|  
 $\text{HOOCCHCH}_2\text{COOH}$  (B)  $\text{NH}_2$   
|  
 $\text{HOOCCHCH}_2\text{COO}^-$   
(C)  $\text{NH}_3^+$   
|  
 $^-\text{OOCCHCH}_2\text{COO}^-$  (D) Any of the three

8. The principle species present in the solution of lysine  $\text{H}_2\text{N}(\text{CH}_2)_4\text{CHCOOH}$  at pH 9 is:  
(Given  $\text{pK}_a$  are 4.2, 8.1, 9.8)

- (A)  $\text{NH}_3^+$   
|  
 $\text{H}_3\text{N}^+(\text{CH}_2)_4\text{CHCOOH}$  (B)  $\text{NH}_2$   
|  
 $\text{H}_3\text{N}^+(\text{CH}_2)_4\text{CHCOO}^-$   
(C)  $\text{NH}_3^+$   
|  
 $\text{H}_2\text{N}(\text{CH}_2)_4\text{CHCOO}^-$  (D)  $\text{NH}_3^+$   
|  
 $\text{H}_3\text{N}^+(\text{CH}_2)_4\text{CHCOO}^-$

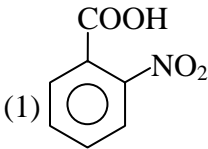
9. At, pH = 7, following amino acid predominantly exist as:  
(Given  $\text{pK}_a$  are 2.2, 4.3, 8.9)

- $\text{HOOC}-\text{CH}_2-\text{CH}(\text{COOH})-\text{NH}_3^+$
- (A)  $\text{HOOC}-\text{CH}_2-\text{CH}(\text{COO}^-)-\text{NH}_3^+$  (C)  $^-\text{OOC}-\text{CH}_2-\text{CH}(\text{COO}^-)-\text{NH}_2$   
(B)  $^-\text{OOC}-\text{CH}_2-\text{CH}(\text{COOH})-\text{NH}_3^+$  (D)  $^-\text{OOC}-\text{CH}_2-\text{CH}(\text{COO}^-)-\text{NH}_3^+$

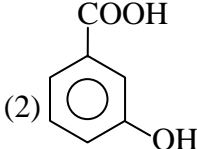
10. Which of the following compounds forms anion at pH=7 dominantly?  
(A) Benzene sulphonic acid (B) Carboic acid  
(C) Cinnamic acid (D) Picric acid

**EXERCISE # V (JEE MAIN)**

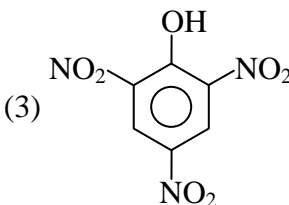
- Picric acid is – [AIEEE-2002]



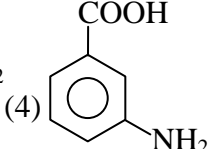
(1)



(2)



(3)



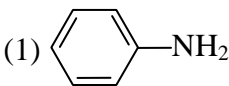
(4)
- Which of the following species acts both as bronsted acid & base - [AIEEE-2002]

(1)  $\text{NH}_3$                       (2)  $\text{HO}^-$                       (3)  $\text{HSO}_4^\ominus$                       (4) 1 and 3 both
- The correct order of increasing basic nature for the bases  $\text{NH}_3$ ,  $\text{CH}_3\text{NH}_2$  and  $(\text{CH}_3)_2\text{NH}$  is- [AIEEE-2003]

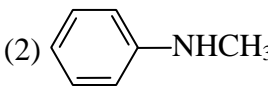
(1)  $\text{CH}_3\text{NH}_2 < \text{NH}_3 < (\text{CH}_3)_2\text{NH}$                       (2)  $(\text{CH}_3)_2\text{NH}_2 < \text{NH}_3 < \text{CH}_3\text{NH}_2$   
 (3)  $\text{NH}_3 < \text{CH}_3\text{NH}_2 < (\text{CH}_3)_2\text{NH}$                       (4)  $\text{CH}_3\text{NH}_2 < (\text{CH}_3)_2\text{NH} < \text{NH}_3$
- Consider the acidity of the carboxylic acids- [AIEEE-2004]

(i)  $\text{PhCOOH}$                       (ii)  $\text{o-NO}_2\text{C}_6\text{H}_4\text{COOH}$   
 (iii)  $\text{p-NO}_2\text{C}_6\text{H}_4\text{COOH}$                       (iv)  $\text{m-NO}_2\text{C}_6\text{H}_4\text{COOH}$   
 which of the following is the correct order of acidity-

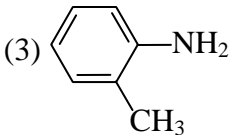
(1)  $\text{i} > \text{ii} > \text{iii} > \text{iv}$                       (2)  $\text{ii} > \text{iv} > \text{iii} > \text{i}$                       (3)  $\text{ii} > \text{iv} > \text{i} > \text{iii}$                       (4)  $\text{ii} > \text{iii} > \text{iv} > \text{i}$
- Which of the following is the strongest base – [AIEEE-2004]



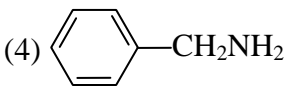
(1)



(2)



(3)



(4)
- Among the following acids which has the lowest  $\text{pK}_a$  value- [AIEEE-2005]

(1)  $\text{CH}_3\text{CH}_2\text{COOH}$                       (2)  $(\text{CH}_3)_2\text{CHCOOH}$                       (3)  $\text{HCOOH}$                       (4)  $\text{CH}_3\text{COOH}$
- Amongst the following the most basic compound is- [AIEEE-2005]

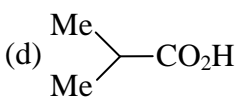
(1) p-nitro aniline                      (2) Acetanilide                      (3) Aniline                      (4) Benzylamine
- What is the conjugate base of  $\text{OH}^-$ ? [AIEEE-2005]

(1)  $\text{H}_2\text{O}$                       (2)  $\text{O}_2$                       (3)  $\text{O}^{2-}$                       (4)  $\text{O}^-$
- Among the following acids which has the lowest  $\text{pK}_a$  value? [AIEEE-2005]

(1)  $\text{HCOOH}$                       (2)  $\text{CH}_3\text{COOH}$                       (3)  $\text{CH}_3\text{CH}_2\text{COOH}$                       (4)  $(\text{CH}_3)_2\text{CH-COOH}$



10. The correct order of increasing acid strength of the compounds is: [AIEEE-2006]

- (a)  $\text{CH}_3\text{CO}_2\text{H}$       (b)  $\text{MeOCH}_2\text{CO}_2\text{H}$       (c)  $\text{CF}_3\text{CO}_2\text{H}$       (d) 
- (1)  $d < a < c < b$       (2)  $d < a < b < c$       (3)  $a < d < c < b$       (4)  $b < d < a < c$

11. Which one of the following is strongest base in aqueous solution? [AIEEE-2010]

- (1) Trimethylamine      (2) Aniline      (3) Dimethylamine      (4) Methylamine

12. The correct order of increasing basicity of the given conjugated base ( $\text{R}=\text{CH}_3$ ) is : [AIEEE-2010]

- (1)  $\text{RCOO}^- < \text{HC} \equiv \text{C}^- < \text{NH}_2^- < \text{R}^-$       (2)  $\text{RCOO}^- < \text{HC} \equiv \text{C}^- < \text{R}^- < \text{NH}_2^-$   
(3)  $\text{R}^- < \text{HC} \equiv \text{C}^- < \text{RCOO}^- < \text{NH}_2^-$       (4)  $\text{RCOO}^- < \text{NH}_2^- < \text{HC} \equiv \text{C}^- < \text{R}^-$

13. The strongest acid amongst the following compounds is ? [AIEEE-2011]

- (1)  $\text{CH}_3\text{CH}_2\text{CH}(\text{Cl})\text{CO}_2\text{H}$       (2)  $\text{ClCH}_2\text{CH}_2\text{CH}_2\text{CCOOH}$   
(3)  $\text{CH}_3\text{COOH}$       (4)  $\text{HCOOH}$

14. The correct order of acid strength of the following compounds: [AIEEE-2011]

- A. Phenol      B. p-Cresol      C. m-Nitrophenol      D. p-Nitrophenol  
(1)  $C > B > A > D$       (B)  $D > C > A > B$       (C)  $B > D > A > C$       (D)  $A > B > D > C$

15. In the following compounds: [JEE(Main)-2012]



the order of basicity is as follows:

- (1)  $\text{IV} > \text{III} > \text{II} > \text{I}$       (2)  $\text{II} > \text{III} > \text{I} > \text{IV}$       (3)  $\text{I} > \text{III} > \text{II} > \text{IV}$       (4)  $\text{III} > \text{I} > \text{II} > \text{IV}$

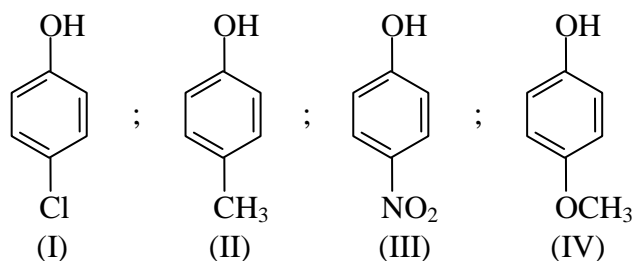
16. The most basic compound among the following is : [JEE(Main)-2012]

- (1) Acetanilide      (2) Benzylamine      (3) p-Nitro aniline      (4) Aniline

17. The order of basicity of amines in gaseous state is : [JEE(Main)-2013]

- (1)  $3^\circ > 2^\circ > \text{NH}_3 > 1^\circ$       (2)  $1^\circ > 2^\circ > 3^\circ > \text{NH}_3$   
(3)  $\text{NH}_3 > 1^\circ > 2^\circ > 3^\circ$       (4)  $3^\circ > 2^\circ > 1^\circ > \text{NH}_3$

18. Arrange the following compounds in order of decreasing acidity : [JEE(Main)-2013]



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

19. The conjugate base of hydrazoic acid is : [JEE(Main)-2014]

- (1)  $\text{NH}_3^-$     (2)  $\text{N}_3^-$     (3)  $\text{N}_2^-$     (4)  $\text{N}^{3-}$

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

[JEE(Main)-2014]

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

21. Considering the basic strength of amines in aqueous solution, which one has the smallest  $\text{pK}_b$  value? [JEE(Main)-2014]

- (1)  $(\text{CH}_3)_3\text{N}$     (2)  $\text{C}_6\text{H}_5\text{NH}_2$     (3)  $(\text{CH}_3)_2\text{NH}$     (4)  $\text{CH}_3\text{NH}_2$

22. Among the following oxoacids, the correct decreasing order of acid strength is : [JEE(Main)-2014]

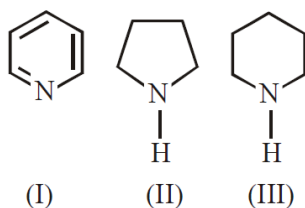
- (1)  $\text{HClO}_4 > \text{HClO}_3 > \text{HClO}_2 > \text{HOCl}$   
(2)  $\text{HClO}_2 > \text{HClO}_4 > \text{HClO}_3 > \text{HOCl}$   
(3)  $\text{HOCl} > \text{HClO}_2 > \text{HClO}_3 > \text{HClO}_4$   
(4)  $\text{HClO}_4 > \text{HOCl} > \text{HClO}_2 > \text{HClO}_3$

23. The correct decreasing order for acid strength is [JEE(Main)-2019]

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

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

[JEE(Main)-2019]



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

25. Which amongst the following is the strongest acid ?

[JEE(Main)-2019]

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

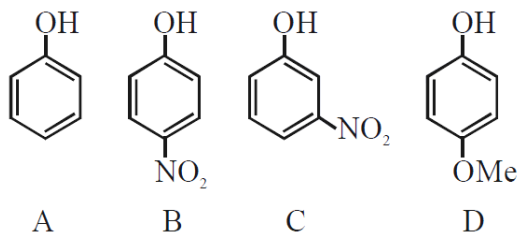
26. The increasing basicity order of the following compounds is :

[JEE(Main)-2019]

- (A)  $\text{CH}_3\text{CH}_2\text{NH}_2$                       (B)  $\text{CH}_3\text{CH}_2\text{NHCH}_2\text{CH}_3$   
(C)  $\text{H}_3\text{C}-\text{N}(\text{CH}_3)_2$                       (D)  $\text{Ph}-\text{N}(\text{CH}_3)_2$   
(1) (D) < (C) < (B) < (A)                      (2) (A) < (B) < (D) < (C)  
(3) (A) < (B) < (C) < (D)                      (4) (D) < (C) < (A) < (B)

27. The increasing order of the  $\text{pK}_a$  values of the following compounds is :

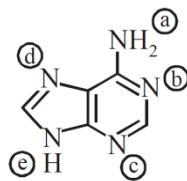
[JEE(Main)-2019]



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

28. In the following compound,

[JEE(Main)-2019]



the favourable site/s for protonation is/are :-

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

29. The correct order for acid strength of compounds

[JEE(Main)-2019]

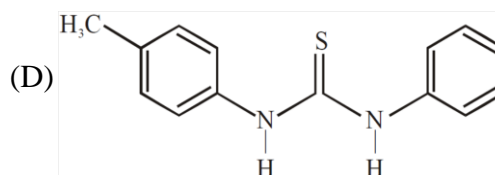
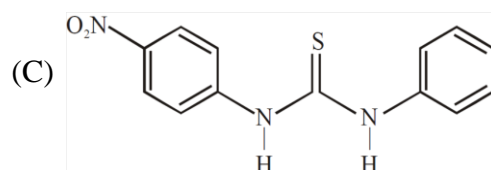
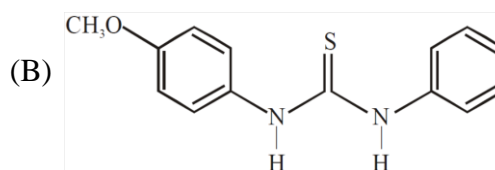
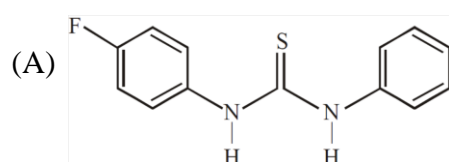


is as follows :

- (1)  $\text{CH}\equiv\text{CH} > \text{CH}_2=\text{CH}_2 > \text{CH}_3-\text{C}\equiv\text{CH}$
- (2)  $\text{HC}\equiv\text{CH} > \text{CH}_3-\text{C}\equiv\text{CH} > \text{CH}_2=\text{CH}_2$
- (3)  $\text{CH}_3-\text{C}\equiv\text{CH} > \text{CH}_2=\text{CH}_2 > \text{HC}\equiv\text{CH}$
- (4)  $\text{CH}_3-\text{C}\equiv\text{CH} > \text{CH}\equiv\text{CH} > \text{CH}_2=\text{CH}_2$

30. The increasing order of the  $\text{pK}_b$  of the following compound is:

[JEE(Main)-2019]



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

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

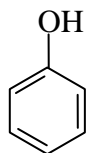
31. In the following compounds, the decreasing order of basic strength will be : [JEE(Main)-2019]

- (1)  $(\text{C}_2\text{H}_5)_2\text{NH} > \text{C}_2\text{H}_5\text{NH}_2 > \text{NH}_3$
- (2)  $\text{NH}_3 > \text{C}_2\text{H}_5\text{NH}_2 > (\text{C}_2\text{H}_5)_2\text{NH}$
- (3)  $(\text{C}_2\text{H}_5)_2\text{NH} > \text{NH}_3 > \text{C}_2\text{H}_5\text{NH}_2$
- (4)  $\text{C}_2\text{H}_5\text{NH}_2 > \text{NH}_3 > (\text{C}_2\text{H}_5)_2\text{NH}$

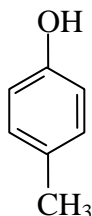
**EXERCISE # VI (JEE ADVANCE)**

1. In the following compounds

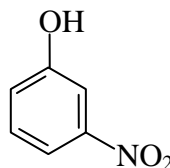
[IIT-JEE-1996]



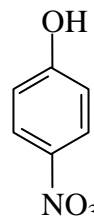
(I)



(II)



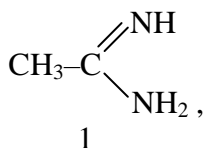
(III)



(IV)

The order of acidity is-

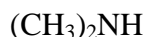
- (A) III > IV > I > II (B) I > IV > III > II (C) II > I > III > IV (D) IV > III > I > II
2. Although phenoxide ion has more number of resonating structures than benzoate ion, benzoic acid is a stronger acid than phenol. Why ? [IIT-JEE-1997]
3. Amongst the following, the most basic compound is: [IIT-JEE-2000]
- (A)  $C_6H_5NH_2$  (B)  $p\text{-NO}_2\text{-C}_6\text{H}_4\text{NH}_2$   
(C)  $m\text{-NO}_2\text{-C}_6\text{H}_4\text{NH}_2$  (D)  $C_6H_5CH_2NH_2$
4. The correct order of basicities of the following compounds is : [IIT-JEE-2001]



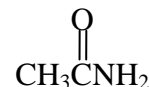
1



2



3



4

- (A) 2 > 1 > 3 > 4 (B) 1 > 3 > 2 > 4 (C) 3 > 1 > 2 > 4 (D) 1 > 2 > 3 > 4
5. **Statement-I** : p-Hydroxybenzoic acid has a lower boiling point than o-hydroxybenzoic acid. **Because**  
**Statement-II** : o-Hydroxybenzoic acid has intramolecular hydrogen bonding. [IIT-JEE-2003]
- (A) Statement-I is True, Statement-II is True; Statement-II is a correct explanation for Statement-I  
(B) Statement-I is True, Statement-II is True; Statement-II is NOT a correct explanation for Statement-I  
(C) Statement-I is True, Statement-II is False.  
(D) Statement-I is False, Statement-II is True.
6. Match  $K_a$  values with suitable acid : [IIT-JEE-2003]

$K_a$

(A)  $3.3 \times 10^{-5}$

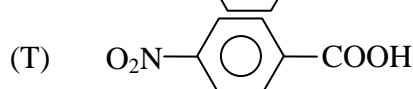
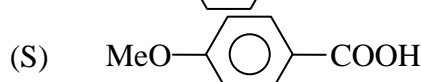
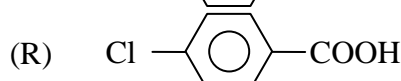
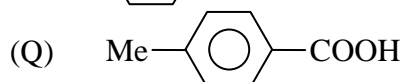
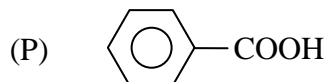
(B)  $4.2 \times 10^{-5}$

(C)  $6.3 \times 10^{-5}$

(D)  $6.4 \times 10^{-5}$

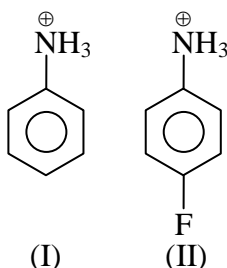
(E)  $30.6 \times 10^{-5}$

**Acid**

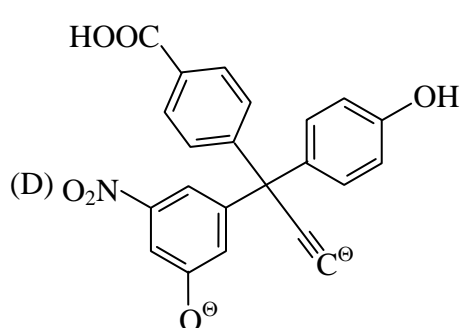
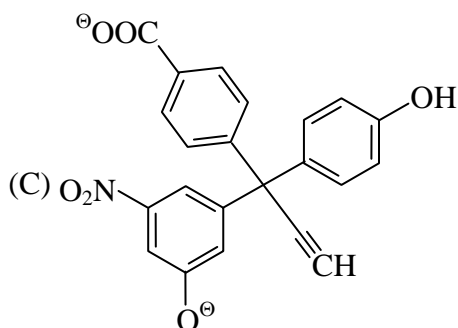
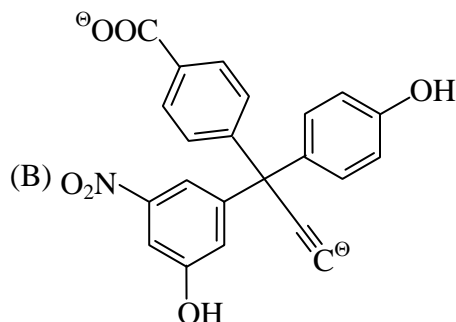
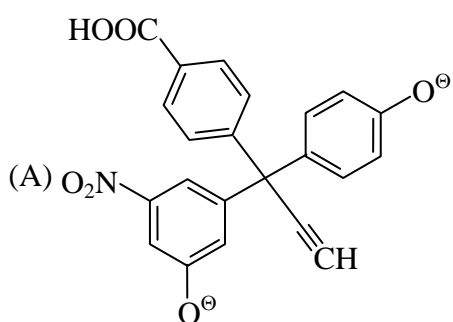


7. (a) Which of the following is more acidic and why ?

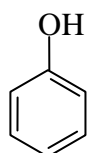
[IIT-JEE-2004]



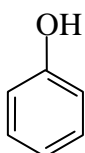
8.  $\xrightarrow{2\text{Moles NaNH}_2}$  A. The product (A) will be: [IIT-JEE-2007]



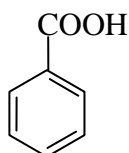
9. The correct acidity order of the following is :



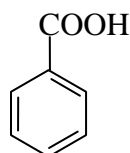
(I)



(II)



(III)



(IV)

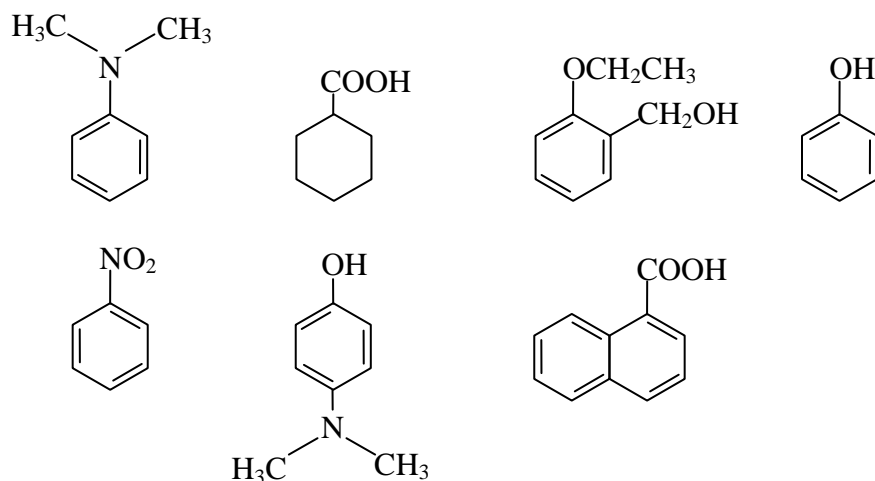
(A) (III) > (IV) > (II) > (I)

(B) (IV) > (III) > (I) > (II)

(C) (III) > (II) > (I) > (IV)

(D) (II) > (III) > (IV) > (I)

10. Amongst the following, the number of compounds soluble in aqueous NaOH is: [IIT-JEE-2010]



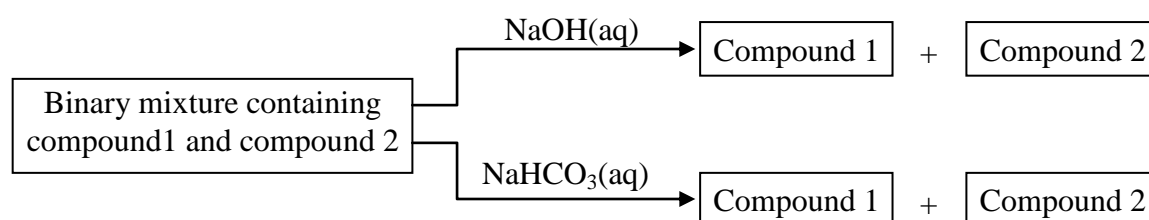
11. Among the following compounds, the most acidic is: [IIT-JEE-2011]

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

12. The carboxyl functional group ( $-\text{COOH}$ ) is present in – [IIT-JEE-2012]

- (A) picric acid (B) barbituric acid (C) ascorbic acid (D) aspirin

13. Identify the binary mixtures(s) that can be separated into the individual compounds, by differential extraction, as shown in the given scheme – [IIT-JEE-2012]



- (A)  $\text{C}_6\text{H}_5\text{OH}$  and  $\text{C}_6\text{H}_5\text{COOH}$  (B)  $\text{C}_6\text{H}_5\text{COOH}$  and  $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$   
(C)  $\text{C}_6\text{H}_5\text{CH}_2$  and  $\text{C}_6\text{H}_5\text{OH}$  (D)  $\text{C}_6\text{H}_5\text{CH}_2$  and  $\text{C}_6\text{H}_5\text{CH}_2\text{COOH}$

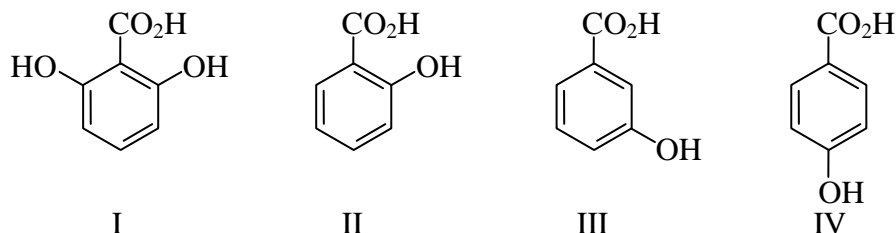
14. The compound that does NOT liberate  $\text{CO}_2$ , on treatment with aqueous sodium bicarbonate solution, is – [JEE-ADVANCE-2013]

- (A) Benzoic acid (B) Benzenesulphonic acid  
(C) Salicylic acid (D) Cabolic acid (phenol)

15. Hydrogen bonding plays a central role in the following phenomena [JEE-ADVANCE-2013]

- (A) Ice floats in water
- (B) Higher Lewis basicity of primary amines than tertiary amines in aqueous solution
- (C) Formic acid is more acidic than acetic acid
- (D) Dimerisation of acetic acid in benzene

16. The correct order of acidity for the following compounds is : [JEE-ADVANCED-2016]



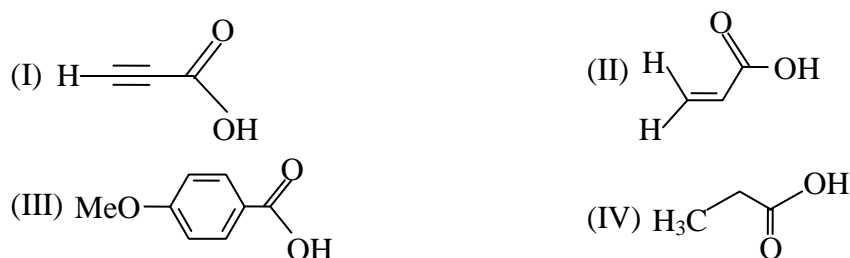
- (A) I > II > III > IV    (B) III > I > II > IV    (C) III > IV > II > I    (D) I > III > IV > II

17. The order of basicity among the following compounds is [JEE-ADVANCED-2017]



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

18. The correct order of acid strength of the following carboxylic acids is: [JEE-ADVANCED-2019]

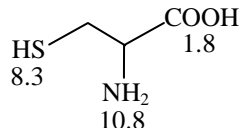
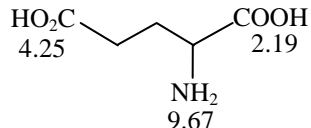


- (A) I > II > III > IV    (B) I > III > II > IV    (C) II > I > IV > III    (D) III > II > I > IV



## ANSWER KEY

### EXERCISE # I

- $a > b > c > d$ ,
  - $a > b > c$ ,
  - $c > b > a$ ,
  - $a > b > c$ ,
  - $c > b > a$ ,
  - $a > b > c$ ,
  - $d > c > b > a$ ,
  - $d > c > b > a$
  - $d > b > a > c$
  - $d > a > c > b$
- 2; (b) 2; (c) 1; (d) 1
- 2; (b) 2; (c) 2
- (C)
- (B)
- (B)
- (B)
- (A)
- (A)
- cysteine : 
  - glutamic acid : 
- $3 < 2 < 1$ ; (b)  $1 < 2 < 3$ ; (c)  $3 < 2 < 1$ ; (d)  $2 < 1 < 3$ ; (e)  $2 < 3 < 1$
- $d > c > a > b$ ,
  - $a > b > c$ ,
  - $c > a > b > d$ ,
  - $d > b > c > a$ ,
  - $a > b > c$ ,
  - $b > a$
  - $c > a > b$
- b, (ii) a, (iii) b, (iv) b
- (C)
- (C)
- (C)
- (C)
- (C)
- (B)
- (4)
- (C)

### EXERCISE # II

- $a > b > c > d$ ,
  - $a > b > c > d$ ,
  - $c > b > d > a$ ,
  - $a < b < c < d$ ,
  - $a > b > c$ ,
  - $a > b > c$ ,
  - $c > a > b$ ,
  - $b > c > a$ ,
  - $c > d > b > a$
- $a > b > c$ ,
  - $d > c > b > a$ ,
  - $b > c > a$ ,
  - $d > c > b > a$ ,
  - $b > a > c$ ,
  - $b < a$ ,
  - $c > b > a$ ,
  - $c < b < a < d$
  - $a < b < c < d$
- d, (ii) b, (iii) a, (iv) a
- $b > a > d > c$ ,
  - $b > a > c > d$ ,
  - $a > b > c > d$
- (A)
- (A)
- (A)
- i, (b) ii, (c) i, (d) ii
- 2; (b) 1; (c) 2; (d) 2
- 2; (b) 1; (c) 1; (d) 1; (e) 3
- $1 > 2 > 3$ ; (b)  $1 < 2 < 3$ ; (c)  $3 < 1 < 2$ ; (d)  $2 < 1 < 3$
- $2 < 1 < 3$ ; (b)  $1 < 2 < 3$
- (C)
- (B)
- (D)
- (C)
- (A,D)
- (C)
- (3)
- (6)

### EXERCISE # III

1. (C)                      2. (C)
3. (A)→R, S, T; (B)→P, R, S, T; (C)→P, Q, R, S, T; (D)→P, Q, R, S, T
4. (i), (ii) (iii) (iv), (v) (ix)                      5. (D)                      6. (A)
7. (A)→P; (B)→R; (C)→Q; (D)→S,T    8. (A)→R ; (B)→S; (C)→P ; (D)→Q,T
9. (A)                      10. (A)                      11. (A, D)                      12. (D)
13. (A, B, C, D)    14. (B)                      15. (C)                      16. (A,B)                      17. (D)
18. (C)                      19. (A)                      20. (2401)

### EXERCISE # IV

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

### EXERCISE # V (JEE-MAIN)

1. (3)    2. (4)    3. (3)    4. (4)    5. (4)    6. (3)    7. (4)
8. (3)    9. (1)    10. (2)    11. (3)    12. (1)    13. (1)    14. (2)
15. (3)    16. (2)    17. (4)    18. (3)    19. (2)    20. (3)    21. (3)
22. (1)    23. (1)    24. (4)    25. (4)    26. (4)    27. (3)    28. (4)
29. (4)    30. (3)    31. (1)

### EXERCISE # VI (JEE-ADVANCE)

1. (D)                      2. Benzoate has equivalent resonating structures                      3. (D)
4. (B)                      5. (D)                      6.  $A \rightarrow (S); B \rightarrow (Q); C \rightarrow (P); D \rightarrow (R); E \rightarrow (T)$
7. (II is most acidic)    8. (C)                      9. (A)                      10. (4)    11. (C)
12. (D)                      13. (B, D)                      14. (D)                      15. (A, B, D)
16. (A)                      17. (B)                      18. (A)

