Exercise-1

Marked questions are recommended for Revision.

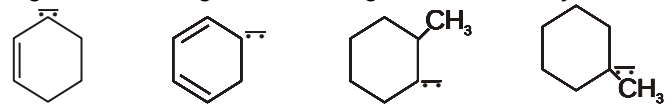
PART - I : SUBJECTIVE QUESTIONS

Section (A) : Carbanions

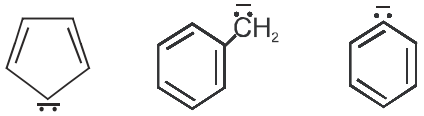
A-1. Arrange the following in decreasing order of stability.

(a)	$\overset{\ominus}{C}H_2-NO_2$, 1	$\overset{\ominus}{C}H_2-CHO$ 2	$CH\equiv\overset{\ominus}{C}$ 3
(b)	$CH_3-CH_2-CH_2-\overset{\ominus}{C}H_2$ 1	$CH_3-\overset{\ominus}{C}H-CH_2CH_3$ 2	$(CH_3)_2\overset{\ominus}{C}-CH_2CH_3$ 3

A-2. Arrange the following in decreasing order of stability

(a) 

1 2 3 4

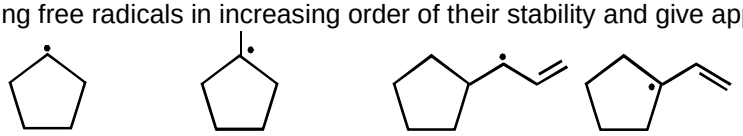
(b) 

1 2 3

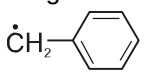
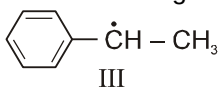
(c) $\overline{\underline{C}}Cl_3$ $\overline{\underline{C}}F_3$
1 2

Section (B) : Carbon free radicals

B-1. Rank the following free radicals in increasing order of their stability and give appropriate reasons.

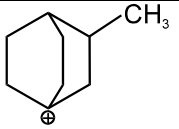
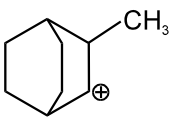
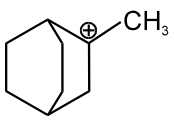
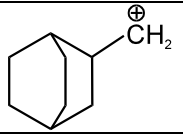

(I) (II) (III) (IV)

B-2. Arrange the following free radicals in decreasing order of stability :

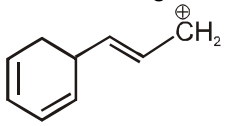
$CH_3-\dot{C}H_2$ I  II  III $\dot{C}H_3$ IV

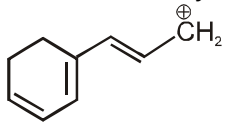
Section (C) : Carbocations

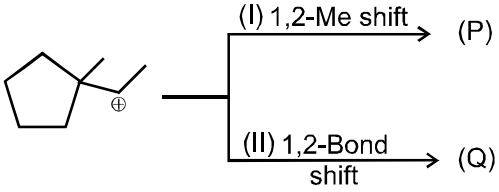
C-1. Arrange the following carbocations in decreasing order of their stability :

	(I)	(II)	(III)	(IV)
(P)	$CH_3-CH_2-\overset{\oplus}{C}H_2$	$CH_3-CH(F)-\overset{\oplus}{C}H_2$	$CH_3-CH(Br)-\overset{\oplus}{C}H_2$	$CH_3-CH(Cl)-\overset{\oplus}{C}H_2$
(Q)	$CH_3-\overset{\oplus}{C}H-C_2H_5$	$(CH_3)_2\overset{\oplus}{C}-CH_3$	$Ph-\overset{CH_3}{\overset{\oplus}{C}}-C_2H_5$	$Ph-\overset{Ph}{\overset{\oplus}{C}}-C_2H_5$
(R)				

C-2. Which of the following carbocation is more stable and why ?


(I)


(II)

C-3. 

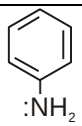
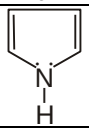
Draw the structures of P and Q.

Section (D) : Basic strength

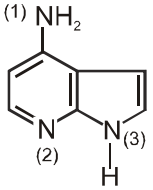
D-1. Compare the basic strength of the following compounds:

$C_2H_5O^-$	$C_2H_5^-$	$C_2H_5NH^-$	NH_2^-	F^-
(I)	**(II)**	**(III)**	**(IV)**	**(V)**

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

(a)	$PhNH_2$	Ph_2NH	Ph_3N
(b)			
(c)	$CH_3–\underset{\displaystyle Ph}{\underset{\vert}{CH}}–NH_2$	$CH_3–CH_2–\underset{\displaystyle Ph}{\underset{\vert}{\ddot{N}H}}$	$Ph–CH_2–CH_2–NH_2$

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

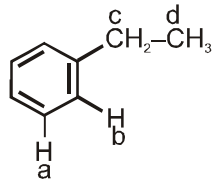


D-4. Which of the following is a stronger base ? Give reason to justify your answer.

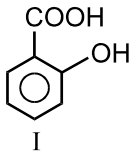
$CH_2 = CH – \ddot{N}H_2$ (I) $\qquad$ $CH_2 = \ddot{N} – CH_3$ (II)

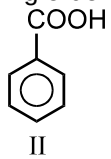
Section (E) : Acidic strength

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

(I) $\overset{a}{CH_3}–\overset{b}{CH}=\overset{c}{CH_2}$ $\qquad$ (II) $\overset{a}{CH_3}–\overset{\displaystyle O}{\overset{\Vert}{C}}–\overset{b}{CH_2}–\overset{\displaystyle O}{\overset{\Vert}{C}}–\overset{c}{H}$ $\qquad$ (III) 

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


I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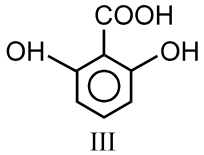
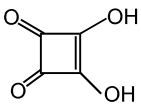

III

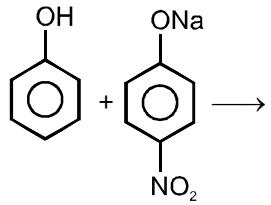
E-3. The given compound X =  is a strong acid. Justify this statement.

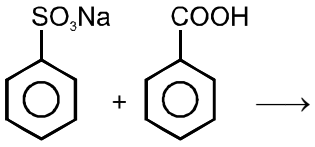
Section (F) : Feasible reactions of acids and bases

F-1. Which of the follwing reactions is/are feasible ?

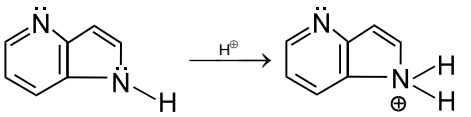
(a) $CH_3COOH + HCOONa \longrightarrow$

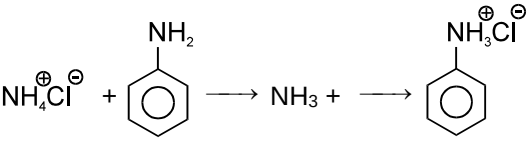
(b) $HC\equiv C-Na + H_2O \longrightarrow$

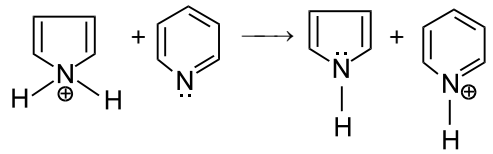
(c) 

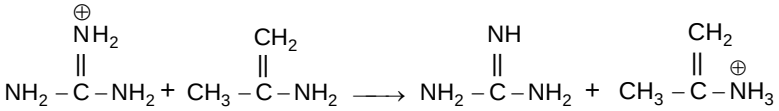
(d) 

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

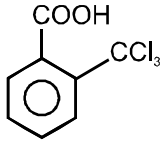
(a) 

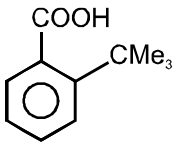
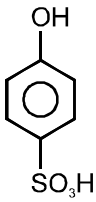
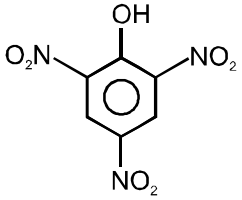
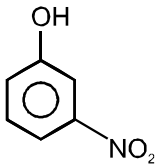
(b) 

(c) 

(d) 

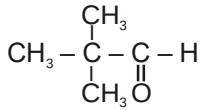
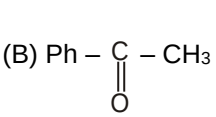
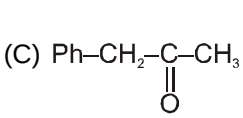
F-3. Which of the following acids (given below) react with $NaHCO_3$ and liberate $CO_2(g)$?

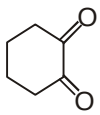
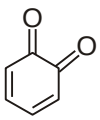
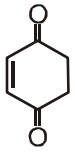
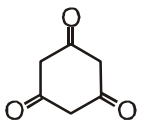
CCl_3-COOH $\quad$ CH_3-CH_2-OH $\quad$  $\quad$ HCl

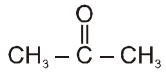
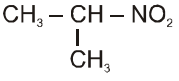
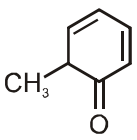
Section (G) : Tautomerism

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

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

(E)  (F)  (G)  (H) 

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

(P)  (Q) $CH_3-CH=NH$ (R)  (S) 

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

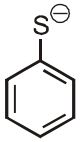
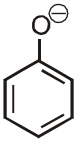
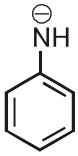
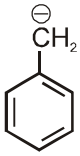
PART - II : ONLY ONE OPTION CORRECT TYPE

Section (A) : Carbanions

A-1. Which of the following is the least stable carbanion?

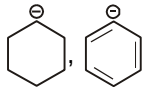
(A) $HC \equiv \overline{C}$ (B) $(C_6H_5)_3\overline{C}$ (C) $(CH_3)_3\overline{C}$ (D) $\overline{C}H_3$

A-2. The most stable anion is :

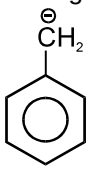
(A)  (B)  (C)  (D) 

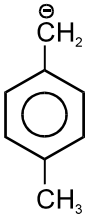
A-3. In which of the following pairs of carbanion the first one is more stable than second.

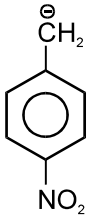
(A) $\overset{\ominus}{C}F_3$, $\overset{\ominus}{C}Cl_3$ (B) $HC \equiv \overset{\ominus}{C}$, $H_2C = \overset{\ominus}{C}H$

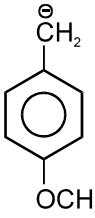
(C)  (D) $(CH_3)_3\overset{\ominus}{C}$, $H_3C - \overset{\ominus}{C}H_2$

A-4. Arrange the following carbanions in decreasing order of stability :


I

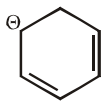
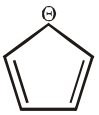
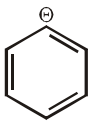
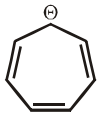

II


III

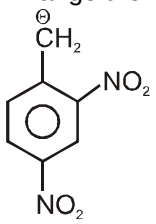

IV

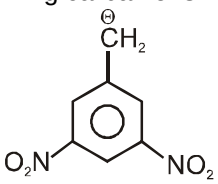
(A) III > I > IV > II (B) III > II > I > IV (C) I > III > II > IV (D) III > I > II > IV

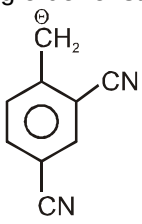
A-5. The most stable anion is :

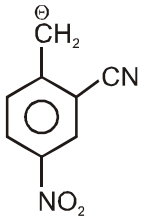
(A)  (B)  (C)  (D) 

A-6. Arrange the following carbanions in increasing order of stability :


I


II


III


IV

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

Section (B) : Carbon free radicals

B-1. Among the following, the paramagnetic species is :

(A) Free radical (B) Carbocation (C) Carbanion (D) All the three

B-2. The stability of given free radicals in decreasing order is :

(i) $CH_3-\dot{C}H_2$ (ii) $CH_3-\dot{C}H-CH_3$ (iii) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle \dot{C}}{|}}-CH_3$ (iv) $\dot{C}H_3$

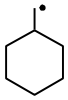
(A) iii > iv > i > ii (B) i > ii > iii > iv (C) iii > ii > iv > i (D) iii > ii > i > iv

B-3. Which of the following is the correct order of stability of free radicals ?

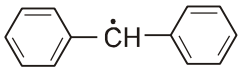
(A) benzyl > allyl > 2º > 1º (B) allyl > benzyl > 2º > 1º

(C) allyl > 2º > 1º >benzyl (D) benzyl > 2º > 1º > allyl

B-4. Most stable radical among the following is :

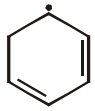
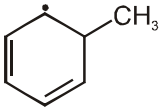
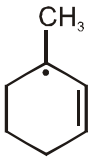
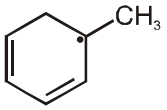
(A)  (B)  (C)  (D) 

B-5. Arrange the following radicals in decreasing order of their stability.

(I) $\dot{C}H_3$ (II) $CH_3-\dot{C}H_2$ (III)  (IV) 

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

B-6. Least stable radical among the following is :

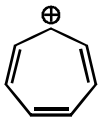
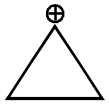
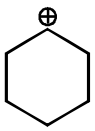
(A)  (B)  (C)  (D) 

Section (C) : Carbocations

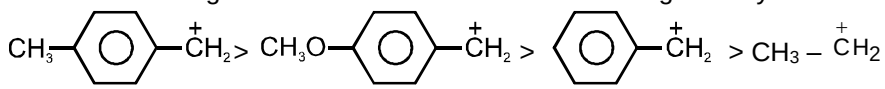
C-1. The most unstable carbocation is :

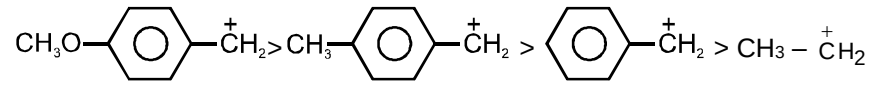
(A) $CH_3\overset{\oplus}{C}H_2$ (B) $Cl-CH_2-\overset{\oplus}{C}H_2$ (C) $\overset{\oplus}{C}H_2-CHO$ (D) $\overset{\oplus}{C}H_2-O-CH_3$

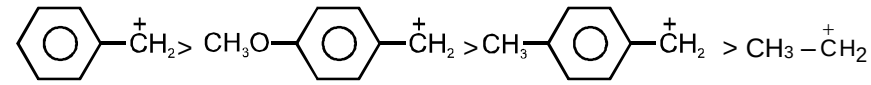
C-2. The most stable carbocation is :

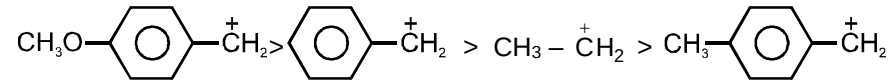
(A)  (B)  (C)  (D) 

C-3. Which of the following shows the correct order of decreasing stability ?

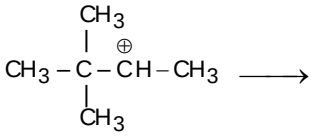
(A) 

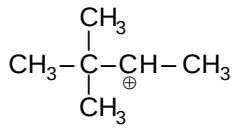
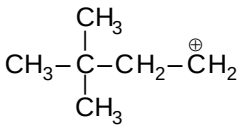
(B) 

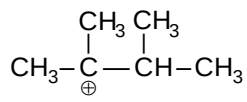
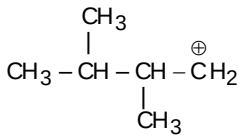
(C) 

(D) 

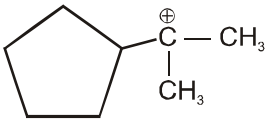
C-4. Which of the following is the rearranged more stable carbocation of the given species ?

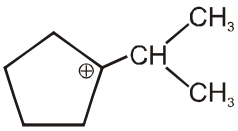
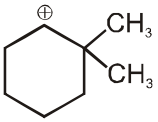
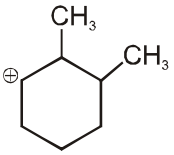
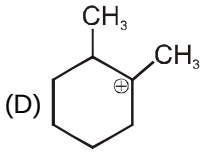


(A)  (B) 

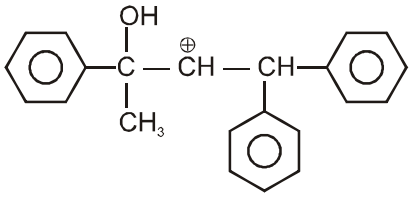
(C)  (D) 

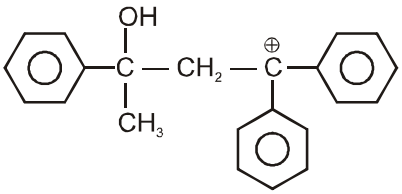
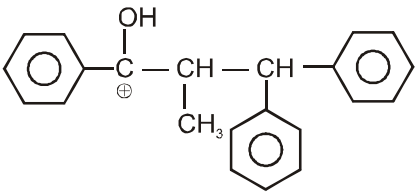
C-5. Most stable rearranged form of given carbocations is :

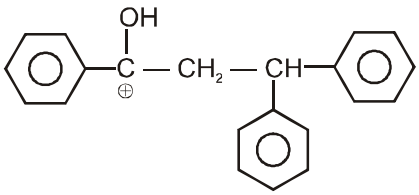
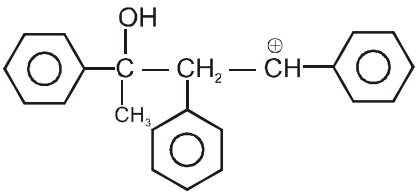


(A)  (B)  (C)  (D) 

C-6. Which of the following in the rearranged more stable carbocation of the given species?



(A)  (B) 

(C)  (D) 

Section (D) : Basic strength

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

(A) $CH_3\text{–}\overset{\ominus}{C}H_2 > \overset{\ominus}{N}H_2 > CH_2{=}\overset{\ominus}{C}H > CH{\equiv}\overset{\ominus}{C} > H\overset{\ominus}{O} > \overset{\ominus}{F}$

(B) $\overset{\ominus}{N}H_2 > CH_3\text{–}\overset{\ominus}{C}H_2 > CH_2{=}\overset{\ominus}{C}H > CH{\equiv}\overset{\ominus}{C} > \overset{\ominus}{F} > H\overset{\ominus}{O}$

(C) $CH_3\text{–}\overset{\ominus}{C}H_2 > CH_2{=}\overset{\ominus}{C}H > \overset{\ominus}{N}H_2 > CH{\equiv}\overset{\ominus}{C} > H\overset{\ominus}{O} > \overset{\ominus}{F}$

(D) $\overset{\ominus}{F} > H\overset{\ominus}{O} > CH{\equiv}\overset{\ominus}{C} > CH_2{=}\overset{\ominus}{C}H > \overset{\ominus}{N}H_2 > CH_3\text{–}\overset{\ominus}{C}H_2$

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

(A) $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2 > NH_3$ (B) $(CH_3)_2NH > (CH_3)_3N > CH_3NH_2 > NH_3$

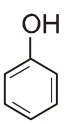
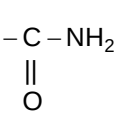
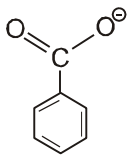
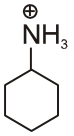
(C) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$ (D) $(CH_3)_2NH > CH_3NH_2 > NH_3 > (CH_3)_3N$

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

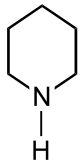
(I) $R_4N^+OH^-$ (II) R_3N (III) R_2NH (IV) RNH_2

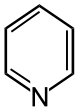
(A) I > III > IV > II (B) IV > III > I > II (C) II > IV > III > I (D) II > IV > I > III

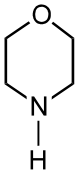
D-4. Which of the following cannot be a base?

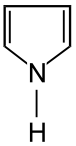
(A)  (B)  (C)  (D) 

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


(I) Piperidine

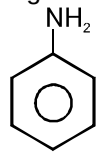

(II) Pyridine

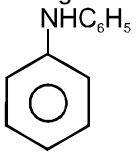

(III) Morpholine

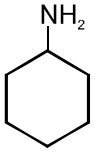

(IV) Pyrrole

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

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

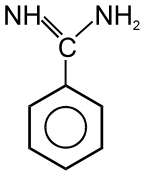
(I) 

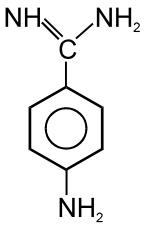
(II) 

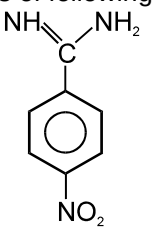
(III) 

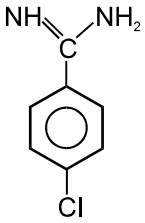
(A) II < I < III
(B) III < I < II
(C) III < II < I
(D) II < III < I

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

(I) 

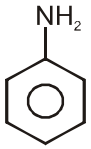
(II) 

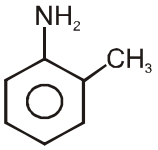
(III) 

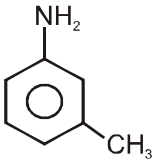
(IV) 

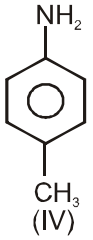
(A) II > IV > I > III
(B) III > I > IV > II
(C) III > IV > I > II
(D) II > I > IV > III

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


(I)


(II)


(III)


(IV)

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

Section (E) : Acidic strength

E-1. Among the following compounds, the strongest acid is :
(A) HC ≡ CH
(B) C_6H_6
(C) C_2H_6
(D) CH_3OH

E-2. Which of the following is not correct decreasing K_a order.
(A) $CH_4 > NH_3 > H_2O > HF$
(B) $CH_3–OH > CH_3–NH_2 > CH_3–F > CH_3–CH_3$
(C) HI > HBr > HCl > HF
(D) $PhOH > H_2O > C_2H_5OH > CH_3–C\equiv CH$

E-3. Which of the following acid has the smallest dissociation constant ?
(A) $CH_3–\underset{\displaystyle NO_2}{\underset{|}{CH}}–COOH$
(B) $O_2N–CH_2–CH_2–COOH$
(C) $Cl–CH_2–CH_2–COOH$
(D) $NC–CH_2–CH_2–COOH$

E-4. Find the strongest acid among the following compounds is :
(A) $HOOC–(CH_2)_2–COOH$
(B) $H_3N^{\oplus}–(CH_2)_2–COOH$
(C) $F–(CH_2)_2–COOH$
(D) $CH_3–(CH_2)_2–COOH$

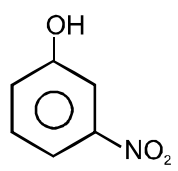
E-5. Which of the following option shows the correct order of decreasing acidity :
(A) $PhCO_2H > PhSO_3H > PhCH_2OH > PhOH$
(B) $PhSO_3H > PhOH > PhCH_2OH > PhCO_2H$
(C) $PhCO_2H > PhOH > PhCH_2OH > PhSO_3H$
(D) $PhSO_3H > PhCO_2H > PhOH > PhCH_2OH$

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

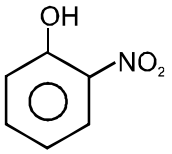
(I) oxalic acid, (II) succinic acid, (III) malonic acid, (IV) adipic acid

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

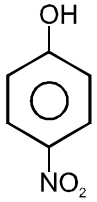
E-7.



I



II

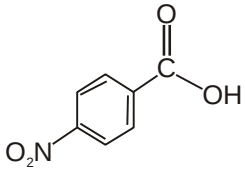


III

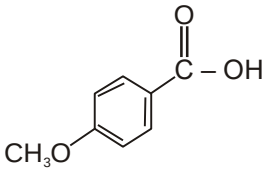
Arrange above phenol in increasing order of pK_a value :

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

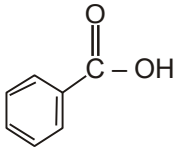
E-8. Order of K_a of following acids is :



I



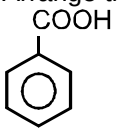
II



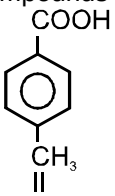
III

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

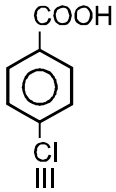
E-9. Arrange the following compounds in increasing order of their acidic strength.



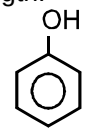
I



II



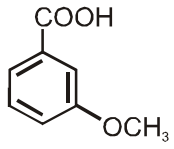
III

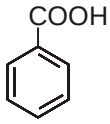


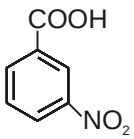
IV

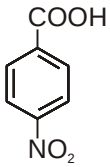
(A) IV < II < I < III (B) I < II < III < IV (C) IV < II < III < I (D) I < III < II < IV

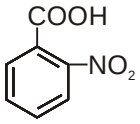
E-10. Find the order of K_a of following compounds :

(I) 

(II) 

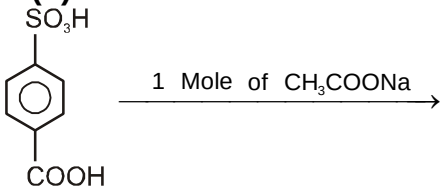
(III) 

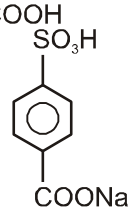
(IV) 

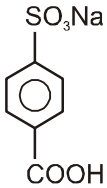
(V) 

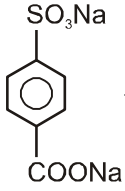
(A) I < II < III < IV < V (B) IV < I < III < II < V (C) III < II < I < IV < V (D) II < I < III < IV < V

Section (F) : Feasible reactions of acids and bases

F-1.  ; The products will be :

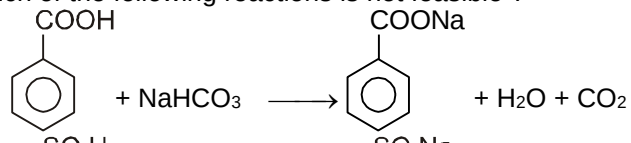
(A)  + CH_3COOH

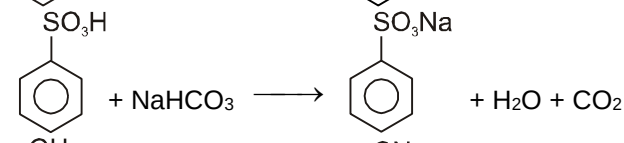
(B)  + CH_3COOH

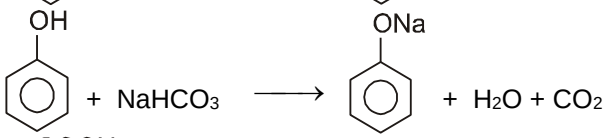
(C)  + CH_3COOH

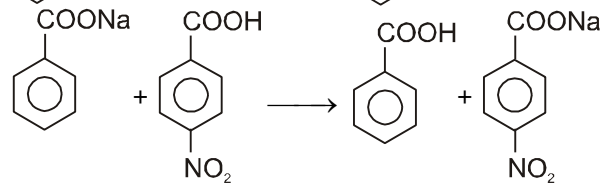
(D) Reaction is not feasible

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

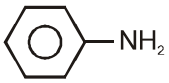
(A) 

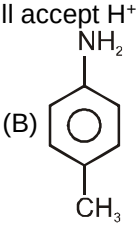
(B) 

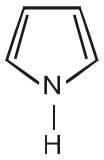
(C) 

(D) 

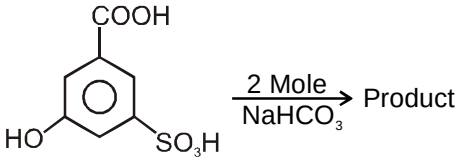
F-3. Which of the following will accept H^+ from NH_4^+ ion.

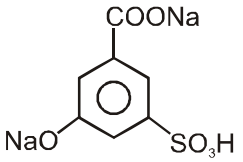
(A) 

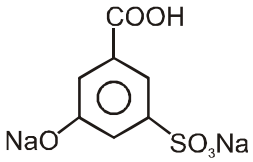
(B) 

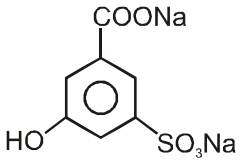
(C) 

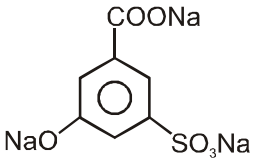
(D) $CH_3–CH_2–NH_2$

F-4. 

(A) 

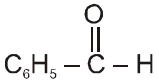
(B) 

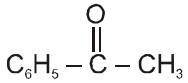
(C) 

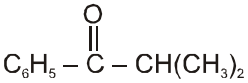
(D) 

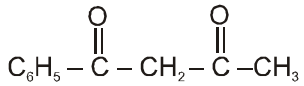
Section (G) : Tautomerism

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

(A) 

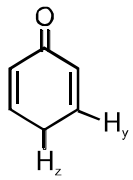
(B) 

(C) 

(D) 

G-2. The enolic form of acetone contains :

(A) 9 σ bonds, 1 π bond and 2 lone pairs
(B) 8 σ bond, 2 π bond and 2 lone pairs
(C) 10 σ bond, 1 π bond and 1 lone pair
(D) 9 σ bond, 2 π bond and 1 lone pair

G-3. Molecule 

can be enolised by which hydrogen ?

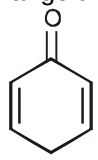
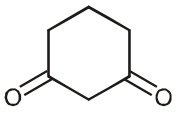
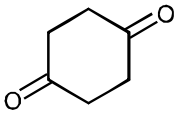
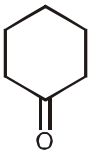
(A) y–H (B) z–H (C) both (D) None of these

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

(A) $C_6H_5-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$ (B) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

(C) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-CH_3$ (D) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-COOC_2H_5$

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

(i)  (ii)  (iii)  (iv) 

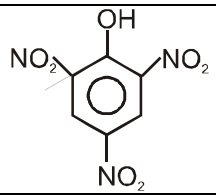
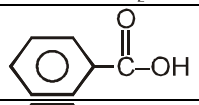
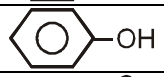
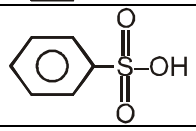
(A) I > II > III > IV (B) II > I > III > IV (C) II > III > I > IV (D) III > II > IV > I

PART - III : MATCH THE COLUMN

1. Match the column %

	Column-I (Keto)		**Column-II (% enol)**
(A)	$CH_3-CH=O$	(x)	95 %
(B)	$Ph-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-Ph$	(y)	76 %
(C)	$CH_3-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-OEt$	(z)	0.0001 %
(D)	$CH_3-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$	(w)	7.2 %

2. Match the column :

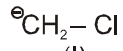
	Column-I		**Column-II**
(A)	$NaHCO_3$ will react with	(p)	
(B)	Na will react with	(q)	
(C)	NaOH will react with	(r)	
(D)	$NaNH_2$ will react with	(s)	

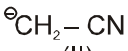
Exercise-2

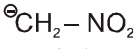
Marked questions are recommended for Revision.

PART - I : ONLY ONE OPTION CORRECT TYPE

1. Arrange the following carbanions in decreasing order of stability :


(I)

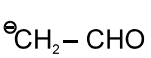

(II)

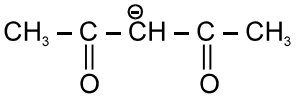

(III)

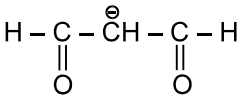

(IV)

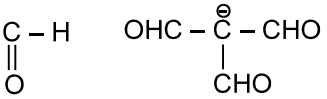
(A) III > II > IV > I (B) III > II > I > IV (C) III > I > II > IV (D) II > III > I > IV

2. Correct decreasing stability order of following carbanions :


I

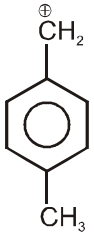

II

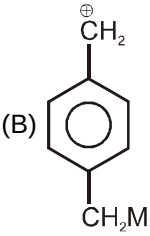

III

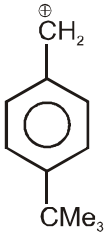

IV

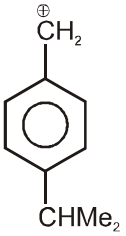
(A) III > IV > II > I (B) IV > II > III > I (C) IV > III > II > I (D) III > II > I > IV

3. Select the most stable intermediates :

(A) 

(B) 

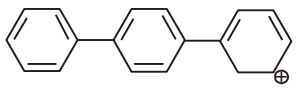
(C) 

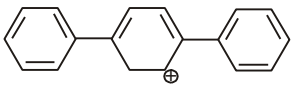
(D) 

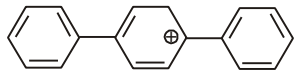
4. Which of the following is most stable carbocation?

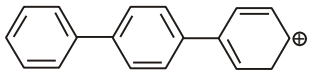
(A) $CH_3\overset{\oplus}{C}H_2$ (B) $CH_3\overset{\oplus}{C}=O$ (C) $CH_3-\overset{\oplus}{C}=NH$ (D) $CH_2=\overset{\oplus}{C}H$

5. The most stable carbocation is :

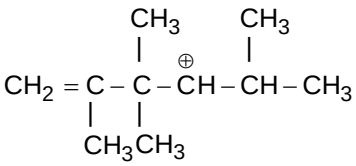
(A) 

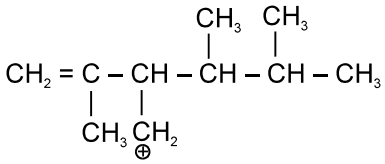
(B) 

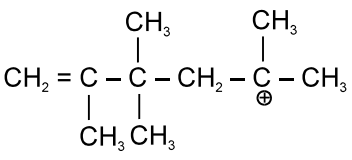
(C) 

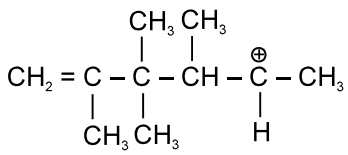
(D) 

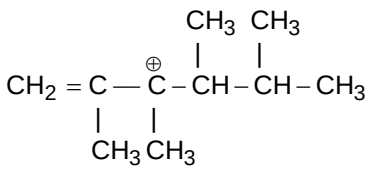
6. The following carbocation rearranges to



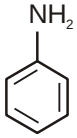
(A) 

(B) 

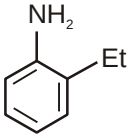
(C) 

(D) 

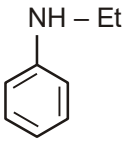
7. Correct basic strength order is :



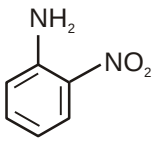
p



q



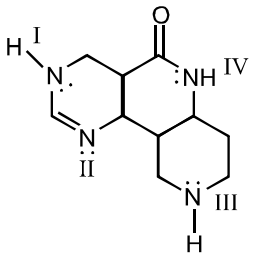
r



s

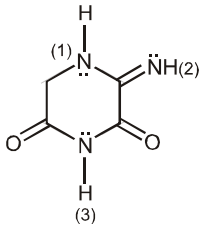
(A) r > q > p > s (B) r > p > q > s (C) q > r > p > s (D) r > q > s > p

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



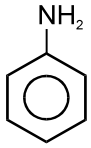
(A) III > II > I > IV (B) III > I > II > IV (C) I > III > II > IV (D) II > III > I > IV

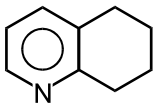
9. In the labelled N-atoms which is correct basic strength order :

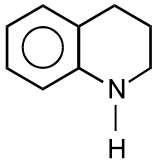


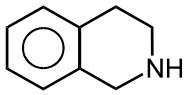
(A) 2 > 1 > 3 (B) 3 > 1 > 2 (C) 2 > 3 > 1 (D) All are equally basic

10. Choose the strongest base among the following :

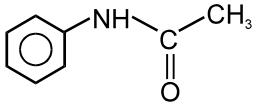
(A) 

(B) 

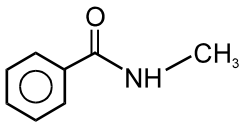
(C) 

(D) 

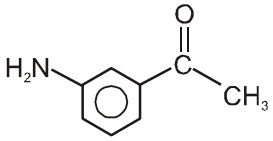
11. Select the basic strength order of following molecules ?



I



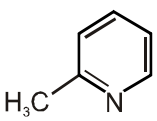
II

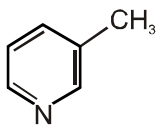


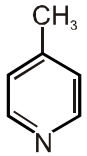
III

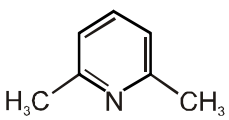
(A) III > II > I (B) II > III > I (C) I > III > II (D) III > I > II

12. Which is the weakest base among the followings ?

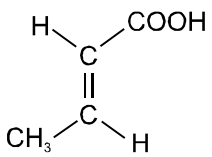
(A) 

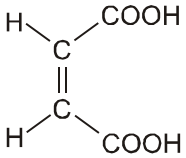
(B) 

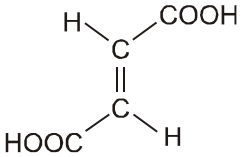
(C) 

(D) 

13. Write the order of K_{a_1} values of following acids :

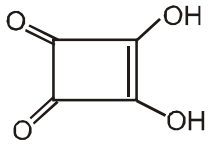

(I)

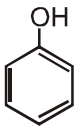

(II)

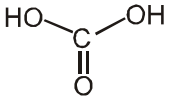

(III)

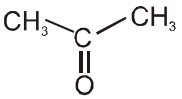
(A) II > III > I (B) I > III > II (C) III > II > I (D) II > I > III

14. The acid strength order is :


I

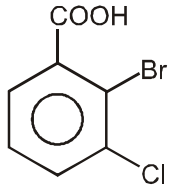

II

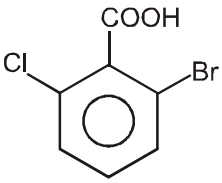

III

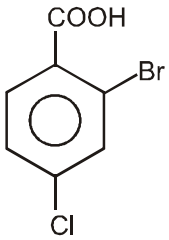

IV

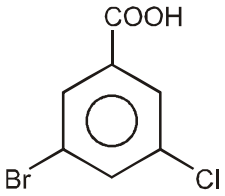
(A) I > IV > II > III (B) III > I > II > IV (C) II > III > I > IV (D) I > III > II > IV

15. (X) ($C_6H_3ClBrCOOH$) are a dihalosubstituted benzoic acids. The strongest acid among all isomers is -

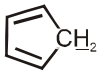
(A) 

(B) 

(C) 

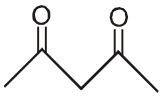
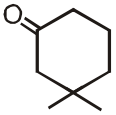
(D) 

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

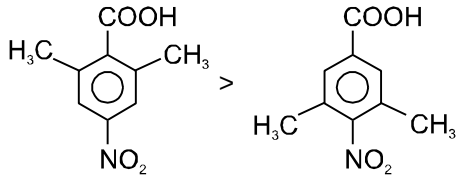
(I) Ph-C<u>H</u>$_2$-CH$_3$ (II) Ph–CH=CH–C<u>H</u>$_3$ (III) Ph-CH=C<u>H</u>$_2$ (IV) 

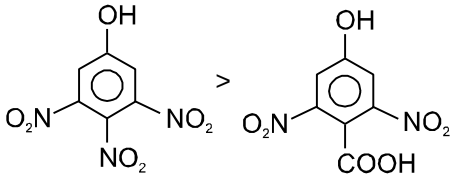
(A) IV>II>I>III (B) II>IV>III>I (C) III>IV>I>II (D) I>III>II>IV

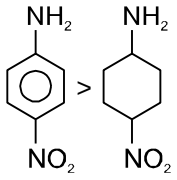
17. Most acidic hydrogen is present in :

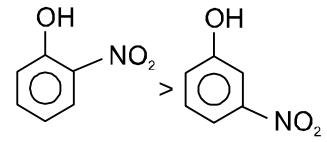
(A)  (B)  (C) $(CH_3CO)_3CH$ (D) $(CH_3)_3COH$

18. The correct orders are :

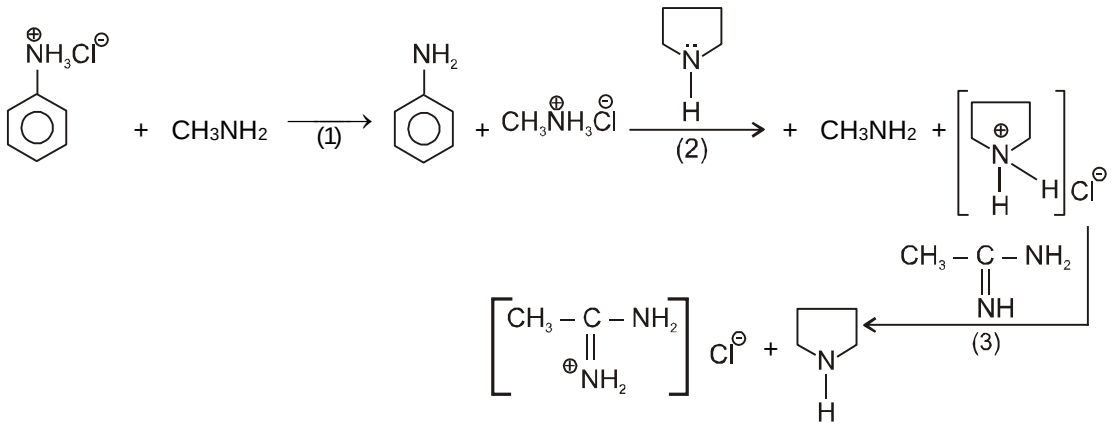
(A)  Acid strength

(B)  Acid strength

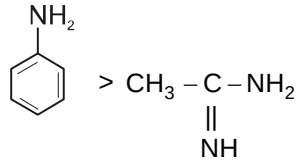
(C)  Basic strength

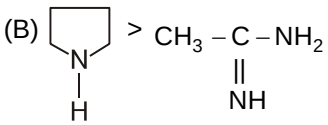
(D)  Boiling point

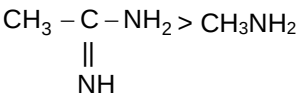
19. Observe the following sequence of reactions :

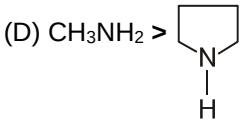


Select the correct option regarding the relative basic strength (K_b) :

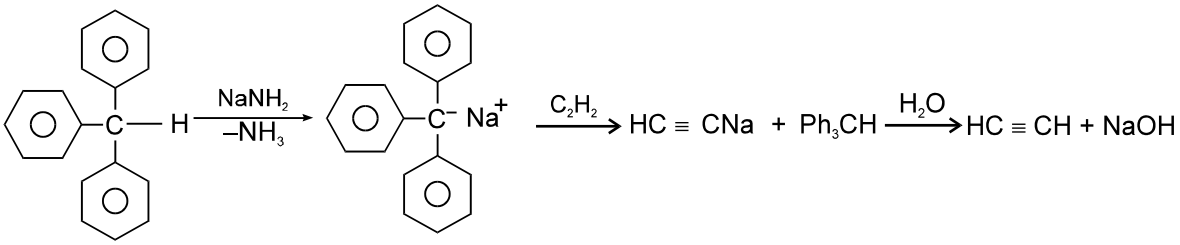
(A) 

(B) 

(C) 

(D) 

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



(A) $NH_3 > Ph_3CH > C_2H_2 > H_2O$ (B) $H_2O > HC{\equiv}CH > Ph_3CH > NH_3$

(C) $HC{\equiv}CH > H_2O > Ph_3CH > NH_3$ (D) $Ph_3CH > HC{\equiv}CH > H_2O > NH_3$

21. The gases produced in the following reactions are respectively

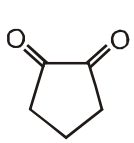
I : $CH_3NH_2 + NH_4Br \longrightarrow$

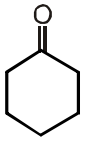
II : $CH_3SO_3H + NaHCO_3 \longrightarrow$

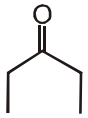
III : $CH_3-\underset{\underset{O}{\|}}{C}-NH_2 + NaH \longrightarrow$

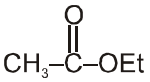
(A) NH_3, NH_3, CO_2 (B) NH_3, SO_2, H_2 (C) NH_3, SO_2, NH_3 (D) NH_3, CO_2, H_2

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


(1)


(2)


(3)

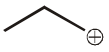

(4)

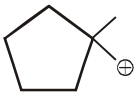
(A) 2 > 1 > 3 > 4 (B) 1 > 2 > 3 > 4 (C) 4 > 3 > 2 > 1 (D) 3 > 1 > 2 > 4

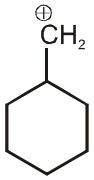
PART - II : SINGLE AND DOUBLE VALUE INTEGER TYPE

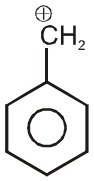
1. How many of the following carbocation can undergo rearrangement :

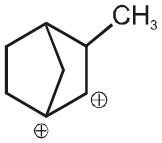
(a) 

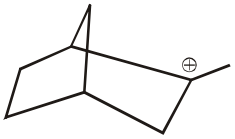
(b) 

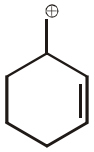
(c) 

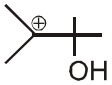
(d) 

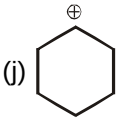
(e) 

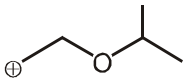
(f) 

(g) 

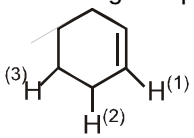
(h) 

(i) 

(j) 

(k) 

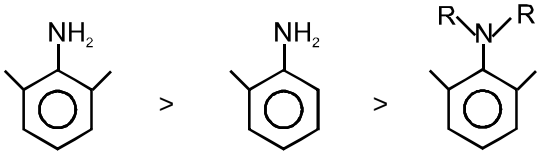
2. Consider following compound, which H-atom deprotonated first ?

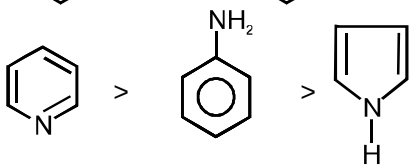


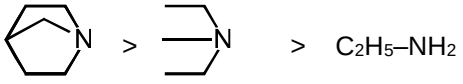
3. How many of the following are correct orders for Basic Strength :

S_1 : $CH_3–\underset{\displaystyle CH_3}{\overset{|}{NH}}$ > $CH_3–NH_2$ > $CH_3–\underset{\displaystyle CH_3}{\overset{|}{\underset{|}{N}}}–CH_3$

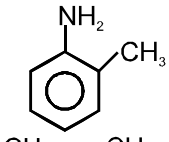
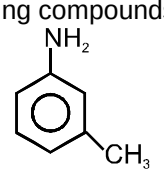
S_2 : $C_2H_5–\underset{\displaystyle C_2H_5}{\overset{|}{NH}}$ > $C_2H_5–\underset{\displaystyle C_2H_5}{\overset{|}{NH}}–C_2H_5$ > $C_2H_5–NH_2$

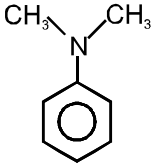
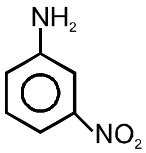
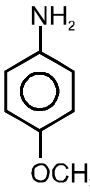
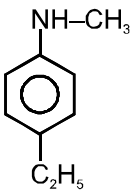
S_3 : 

S_4 : 

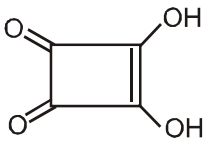
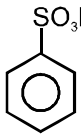
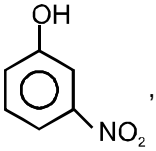
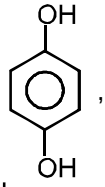
S_5 :  > $C_2H_5–NH_2$

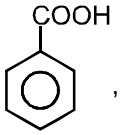
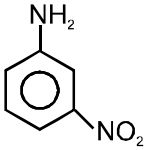
4. How many following compounds are more basic than aniline.



$CH_3–CH_2= NH$

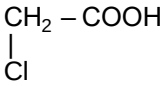
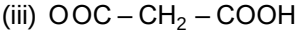





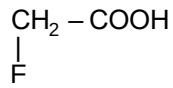
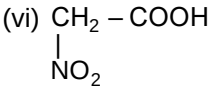
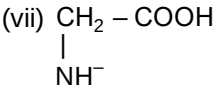
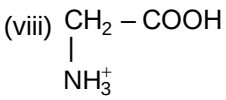
5. How many of the following compounds give CO_2 on reaction with $NaHCO_3$.


, HCl,

,

,

,

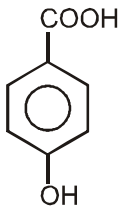
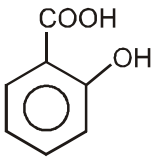

, HCOOH, $C_2H_5–OH$, CH_3COOH,


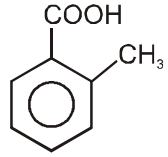
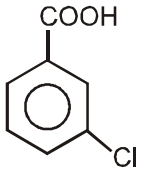
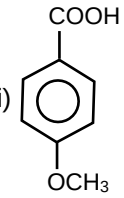
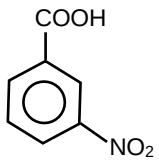
6. How many of the following are more acidic than HCOOH.

(i) 
(ii) $CH_3–COOH$
(iii) 
(iv) $NC–CH_2–COOH$

(v) 
(vi) 
(vii) 
(viii) 

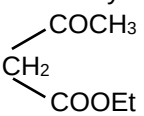
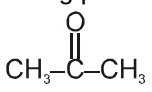
7. How many of the following compound have less pKa than benzoic acid :

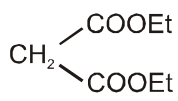
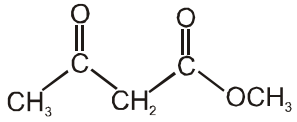
(i) HCOOH
(ii) CH_3COOH
(iii) 
(iv) 

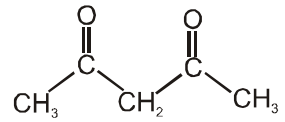
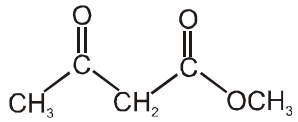
(v) 
(vi) 
(vii) 
(viii) 

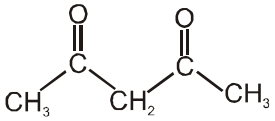
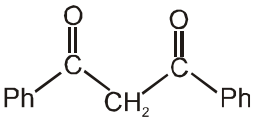
8. 90 g of acetic acid react with excess of $NaHCO_3$ then what volume of CO_2 will produce at S.T.P. Write your answer in terms of nearest integer.

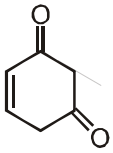
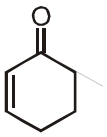
9. In how many of the following pairs first will have higher enol content than second.

(i) 
&


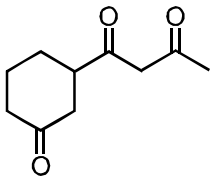
(ii) 
&


(iii)  & 

(iv)  & 

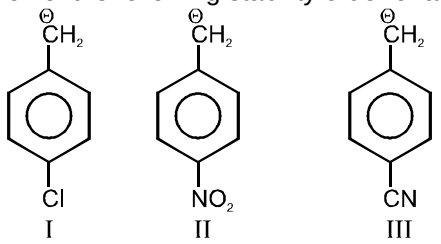
(v)  & 

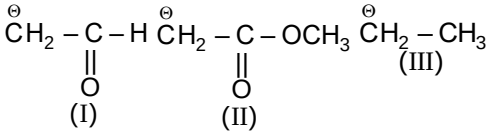
10. Consider the following compound and write number of enolizable H-atom

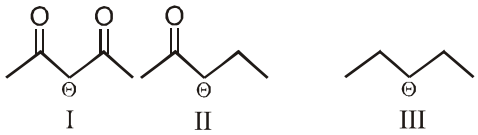


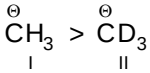
PART - III : ONE OR MORE THAN ONE OPTIONS CORRECT TYPE

1. Which of the following stability order of anions is/are correct :

(A)  II > III > I

(B)  I > II > III

(C)  I > II > III

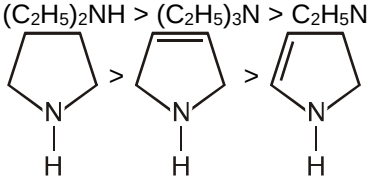
(D)  I > II

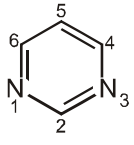
2. Which of the following is/are correct for basic strength :

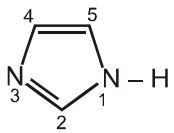
(A) $(CH_3)_2NH > (CH_3)_3N > CH_3NH_2 > NH_3$

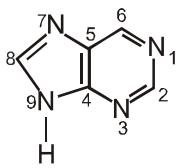
(B) $(C_2H_5)_2NH > (C_2H_5)_3N > C_2H_5NH_2 > NH_3$

(C) $PhNH_2 > Ph_2NH > Ph_3N$

(D) 

3. 
Pyrimidine


Imidazole


Purine

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

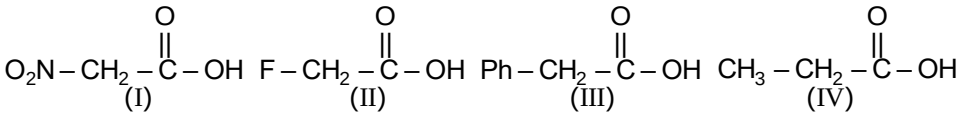
(A) Both N of pyrimidine are same basic strength

(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.

4. Consider the following compounds



(I) (II) (III) (IV)

Which statement is/are correct :

(A) I > II > III > IV (Acidic strength order)

(B) I is most acidic because of –M effect of $–NO_2$ group

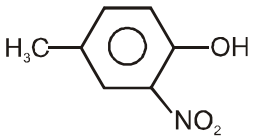
(C) I is most acidic because of –I effect of $–NO_2$ group

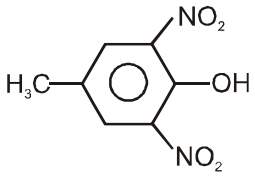
(D) IV is least acidic because of +I Effect.

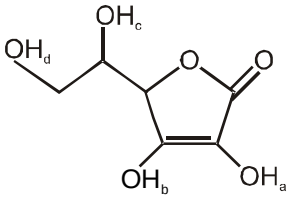
5. Carbolic acid is less acidic than :

(A) CH_3COOH

(B) 

(C) 

(D) 

6. 

Observe the compound and choose correct statement :

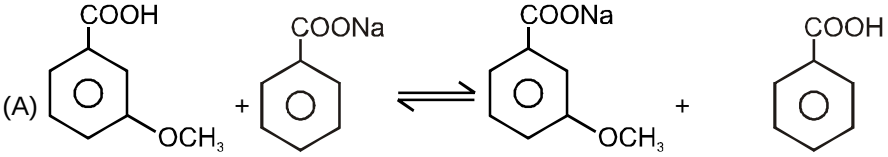
(A) It has carboxylic acid group

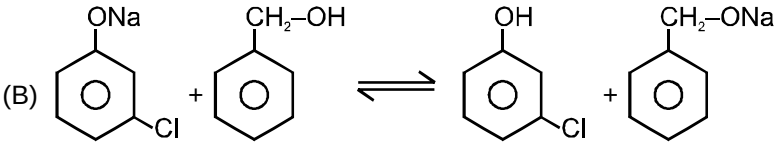
(B) It is Ascorbic acid

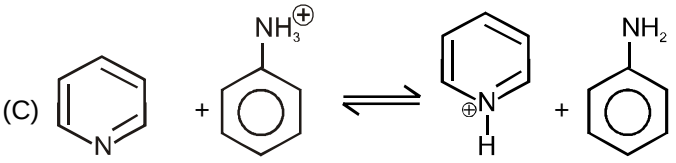
(C) H_b is most acidic Hydrogen atom

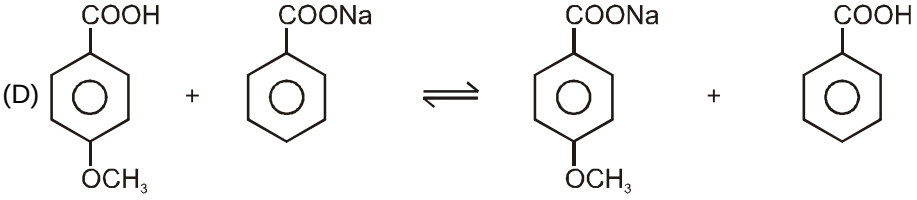
(D) H_a is least acidic Hydrogen atom

7. Which of the following reactions favour backward direction?

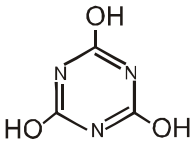
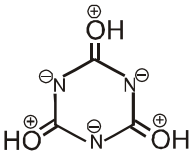
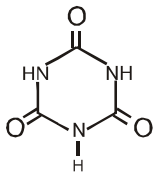
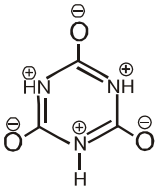
(A) 

(B) 

(C) 

(D) 

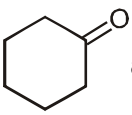
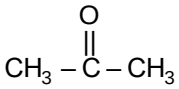
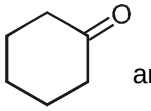
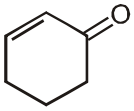
8. The **correct** statement(s) concerning the structures P, Q, R & S is/are

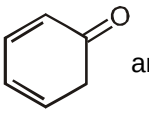
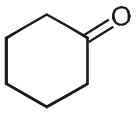
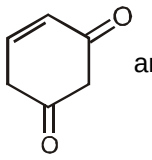
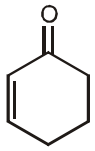
(P)  **(Q)**  **(R)**  **(S)** 

(A) Q & S are not resonating structures (B) R & S are resonating structures

(C) P & R are tautomers (D) P & Q are resonating structures

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

(A)  and  (B)  and 

(C)  and  (D)  and 

PART - IV : COMPREHENSION

Read the following passage carefully and answer the questions.

Comprehension # 1

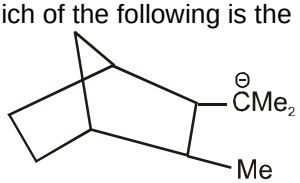
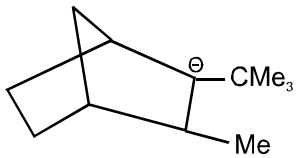
Reaction intermediates: Reaction intermediates are short lived species and are highly reactive. They are formed by heterolytic and homolytic bond fission. There are various types of reaction intermediates in which the most important are carbocation, carbanion and free radical.

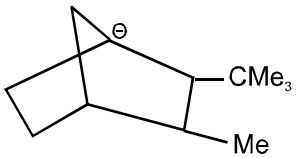
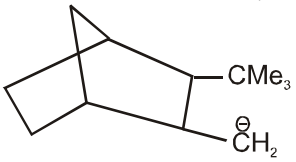
Carbocation is an organic species in which carbon have positive charge and six electrons in its outermost shell. The stability of carbocation can be increased by positive inductive effect, hyperconjugation and delocalisation. If α-atom with respect to carbocation has one or more lone pair of electrons then lone pair of electron strongly stabilises the carbocation due to octet completion.

Species in which carbon have negative charge is called carbanion. Carbanion carries three bond pairs and one lone pair. The stability of carbanion can be increased by negative inductive effect, negative mesomeric effect and delocalisation.

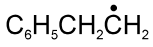
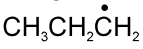
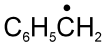
Free radical is a species which have seven electrons in its outermost shell. The stability of free radical can be increased by hyperconjugation and delocalisation.

1. Which of the following is the most stable carbanion intermediate ?

(A)  (B) 

(C)  (D) 

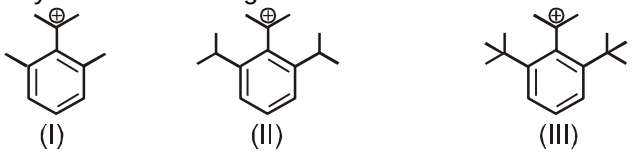
2. The stability order of following free radicals is :

I II III IV

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

3. The stability order of following carbocations is



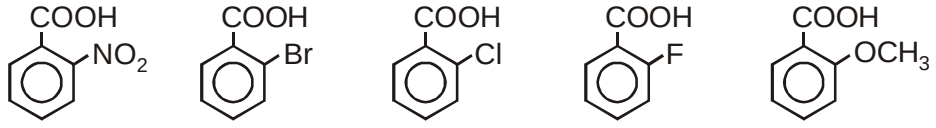
(I) (II) (III)

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

Comprehension # 2

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.

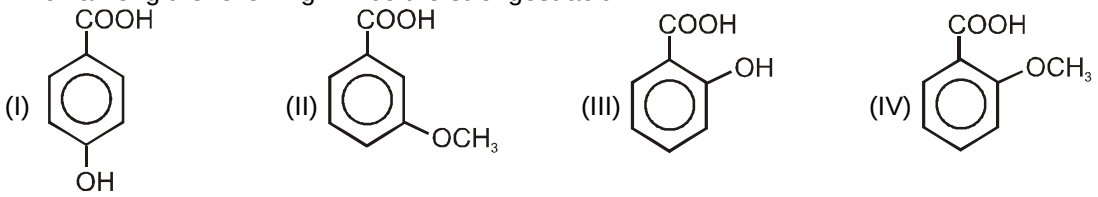
4. What is the order of K_a of following compounds ?



I II III IV V

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

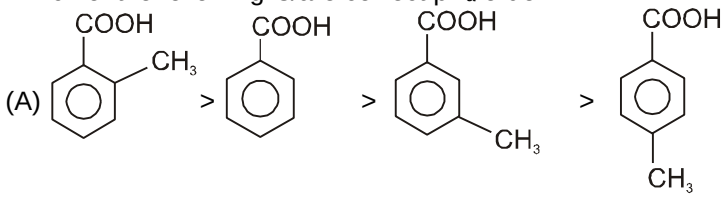
5. Which among the following will be the strongest acid ?



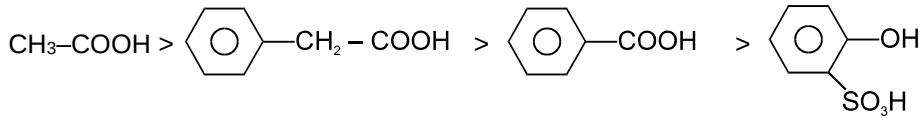
(I) (II) (III) (IV)

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

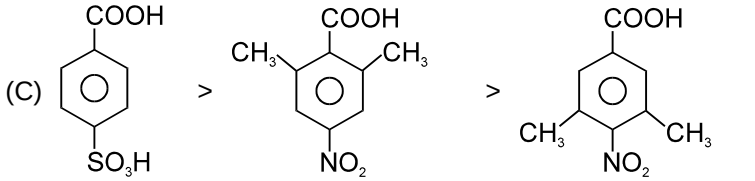
6. Which of the following is/are correct pK_a order ?



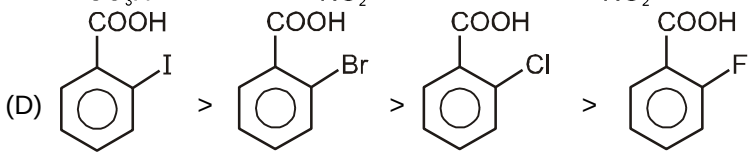
(A) >



(B) CH_3–COOH >



(C) > > >



(D) > > >

Comprehension # 3

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.

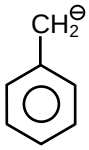
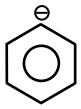
Arylamines are less basic than alkylamines because the lone pair of nitrogen is delocalised with the aromatic ring and are less available for donation.

Substituted arylamines can be either more basic or less basic than aniline, depending on the substitutent. ERG substituents, such as $–CH_3$, $–NH_2$ and $–OCH_3$ increases the basicity and EWG substituents, such as –Cl, $–NO_2$ and –CN decreases basicity. While sp^2-hybridized nitrogen atom in pyridine is less basic than the sp^3-hybridized nitrogen in an alkylamine.

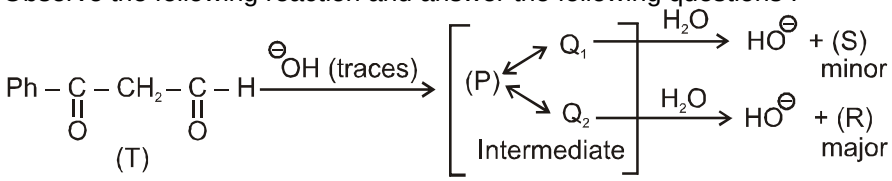
7. Select the correct order of K_b.
(A) CH_3NH_2 > NaOH
(B) Pyridine > $CH_3–\ddot{N}H–CH_3$
(C) p-Methyl aniline > p-Chloroaniline > p-Amino acetophenone
(D) p-Bromoaniline > p-Nitroaniline > p-Amino benzaldehyde

8. pK_b order of the following compound is :
(I) NH_2OH (II) NH_2NH_2 (III) NH_3 (IV) H_2O
(A) IV > I > II > III (B) III > II > I > IV (C) I > IV > II > III (D) III > I > II > IV

9. The most basic carbanion is :

(A)  (B) $CH\equiv C^{\ominus}$ (C)  (D) 

Comprehension # 4
Observe the following reaction and answer the following questions :



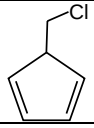
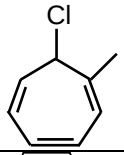
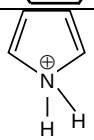
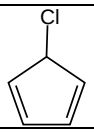
10. The product 'R' is **:**
(A) $Ph–\underset{\underset{OH}{|}}{C}=C=\underset{\underset{OH}{|}}{C}–H$ (B) $Ph–\underset{\underset{O}{||}}{C}–CH=\underset{\underset{OH}{|}}{C}–OH$
(C) $Ph–\underset{\underset{O}{||}}{C}–CH=\underset{\underset{OH}{|}}{C}–H$ (D) $Ph–\underset{\underset{OH}{|}}{C}=CH–\underset{\underset{O}{||}}{C}–H$

11. The structure of Q_1 is :
(A) $Ph–\underset{\underset{O^{\ominus}}{|}}{C}=CH–\underset{\underset{O}{||}}{C}–H$ (B) $Ph–\underset{\underset{O^{\ominus}}{|}}{C}=C=\underset{\underset{O^{\ominus}}{|}}{C}–H$
(C) $Ph–\underset{\underset{O}{||}}{C}–CH=\underset{\underset{O^{\ominus}}{|}}{C}–H$ (D) $Ph–\underset{\underset{O}{||}}{C}–\overset{\ominus}{C}H–\underset{\underset{O}{||}}{C}–H$

Comprehension # 5

Answer 12, 13 and 14 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)	$SbCl_5$ or $AlCl_{3(Anhy.)}$	(P)	Rearrangement
(II)		(ii)	Na	(Q)	Resonance
(III)		(iii)	H^+	(R)	Hyperconjugation
(IV)		(iv)	NaOH	(S)	Carbocation intermediate

12. Which combination will give hydrogen gas ?
(A) (III) (iii) (P) (B) (II) (ii) (R) (C) (IV) (ii) (Q) (D) (I) (iii) (P)

13. In which product formation is not possible ?
(A) (I) (ii) (Q) (B) (II) (i) (R) (C) (III) (ii) (Q) (D) (IV) (i) (S)

14. 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)

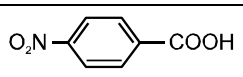
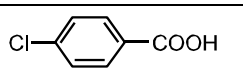
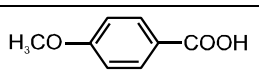
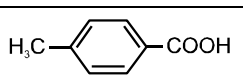
Exercise-3

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

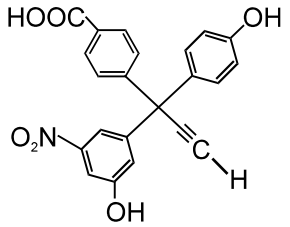
PART - I : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

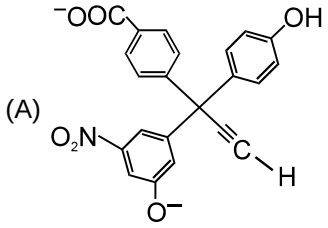
1. Which of the following acid has the lowest value of acid dissociation constant : **[JEE-02(S), 3/90]**
(A) $CH_3CHFCOOH$ (B) FCH_2CH_2COOH (C) $BrCH_2CH_2COOH$ (D) $CH_3CHBrCOOH$

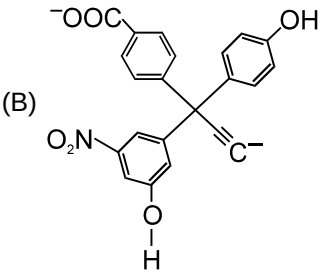
2. Match the K_a values : **[JEE-03(M), 2/60]**

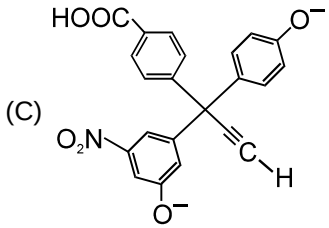
	Compounds		**K_a**
(a)	Benzoic acid	(i)	3.3×10^{-5}
(b)		(ii)	6.3×10^{-5}
(d)		(iii)	30.6×10^{-5}
(e)		(iv)	6.4×10^{-5}
(f)		(v)	4.2×10^{-5}

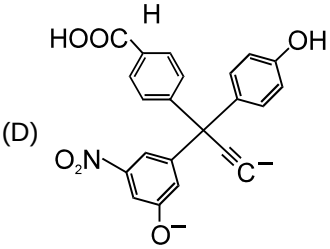
3. Compound A of molecular formula $C_9H_7O_2Cl$ exists in keto form and predominantly in enolic form 'B'. On oxidation with $KMnO_4$'A' gives m-Chlorobenzoic acid. Identify 'A' and 'B'. **[JEE(M)-03]**

4.  $\xrightarrow{2 \text{ moles } NaNH_2}$ A. The product A will be - **[JEE-03(S), 3/84]**

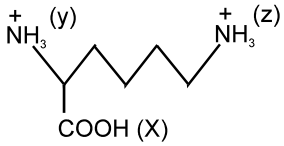
(A) 

(B) 

(C) 

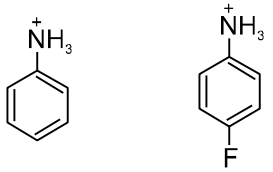
(D) 

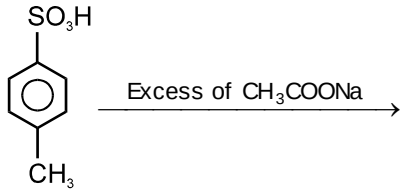
5. What is the acidity order of x, y & z ? **[JEE-04(S), 3/84]**



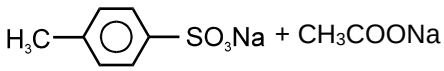
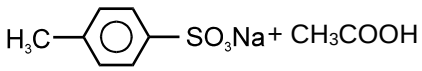
(A) x > y > z (B) x > z > y (C) y > z > x (D) z > y > x

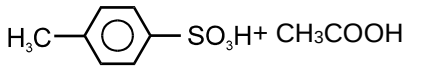
6. Which one of the following two compounds is the stronger acid? Explain why? **[JEE 2004, 4/60]**

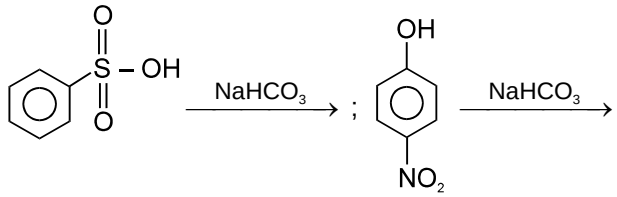


7.  **[JEE-05(S), 3/84]**

The products will be :

(A)  (B) 

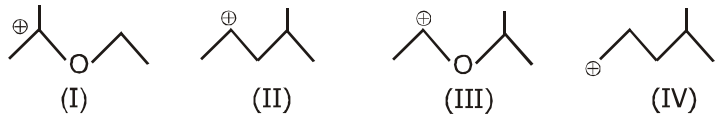
(C)  (D) 

8. 

Benzenesulphonic acid and para nitrophenol react with $NaHCO_3$ separately. The gases produced are respectively. **[JEE-06, 3/184]**

(A) SO_2, CO_2 (B) SO_2, CO (C) SO_2, NO_2 (D) CO_2, CO_2

9. The correct stability order for the following species is : **[JEE-08, 3/163]**

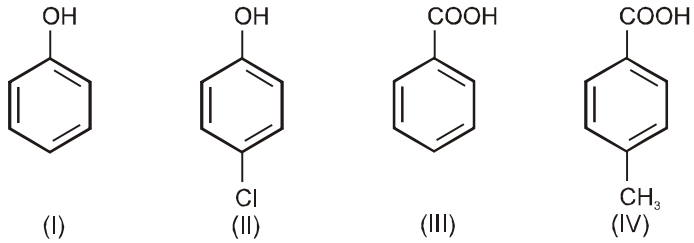


(I) (II) (III) (IV)

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

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

10. The correct acidity order of the following is : **[JEE-09, 3/160]**

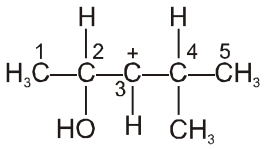


(I) (II) (III) (IV)

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

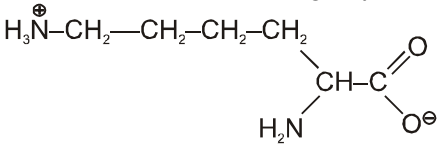
(C) (III) > (II) > (I) > (IV) (D) (II) > (III) > (IV) > (I)

11. In the following carbocation; H/CH_3 that is most likely to migrate to the positively charged carbon is **[JEE-09, 3/160]**



(A) CH_3 at C-4 (B) H at C-4 (C) CH_3 at C-2 (D) H at C-2

12. The total number of basic groups in the following form of lysine is : **[JEE-10, 3/163]**



13. 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

14. The carboxyl functional group (– COOH) is present in **[JEE-12,3/136]**

(A) picric acid (B) barbituric acid

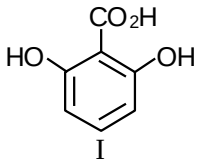
(C) ascorbic acid (D) aspirin

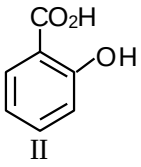
15. The compound that does **NOT** liberate CO_2, on treatment with aqueous sodium bicarbonate solution, is: **[JEE(Advanced) 2013, 2/120]**

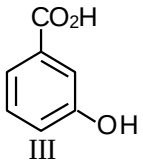
(A) Benzoic acid (B) Benzenesulphonic acid

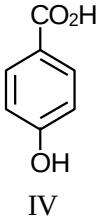
(C) Salicylic acid (D) Carbolic acid (Phenol)

16. The correct order of acidity for the following compounds is **[JEE(Advanced) 2016, 3/124]**


I

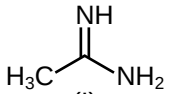

II

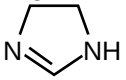

III

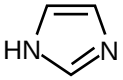

IV

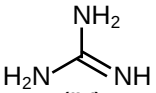
(A) I > II > III > IV (B) III > I > II > IV (C) III > IV > II > I (D) I > III > IV > II

17. The order of basicity among the following compounds is **[JEE(Advanced) 2017, 3/122]**


(I)


(II)


(III)


(IV)

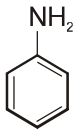
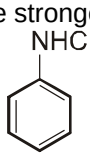
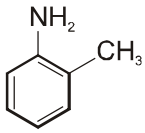
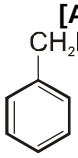
(A) II > I > IV > III (B) I > IV > III > II (C) IV > II > III > I (D) IV > I > II > III

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

1. The correct order of increasing basic nature for the bases NH_3, CH_3NH_2 and $(CH_3)_2NH$ is: **[AIEEE-2003, 3/225]**

(1) $CH_3NH_2 < NH_3 < (CH_3)_2NH$ (2) $(CH_3)_2NH < NH_3 < CH_3NH_2$
(3) $NH_3 < CH_3NH_2 < (CH_3)_2NH$ (4) $CH_3NH_2 < (CH_3)_2NH < NH_3$

2. Which of the following is the strongest base? **[AIEEE-2004, 3/225]**

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

3. Consider the acidity of the carboxylic acids : **[AIEEE-2004, 3/225]**

(i) PhCOOH (ii) o-$NO_2C_6H_4COOH$ (iii) p-$NO_2C_6H_4COOH$ (iv) m-$NO_2C_6H_4COOH$
(1) i > ii > iii > iv (2) ii > iii > iv > i (3) iii > ii > iv > i (4) ii > iv > iii > i

4. Among the following acid which has the lowest pK_a value ? **[AIEEE-2005, 3/225]**

(1) CH_3CH_2COOH (2) $(CH_3)_2CH–COOH$ (3) HCOOH (4) CH_3COOH

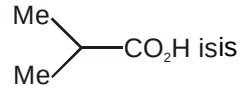
5. Amongst the following the most basic compound is **[AIEEE-2005, 3/225]**

(1) p-Nitroaniline (2) Acetanilide (3) Aniline (4) Benzylamine

6. The increasing order of stability of the following free radicals is : **[AIEEE-2006, 3/165]**

(1) $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C}$
(2) $(C_6H_5)_2\dot{C} < (C_6H_5)_2\dot{C}H < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$
(3) $(C_6H_5)_2H\dot{C} < (C_6H_5)_3\dot{C}H < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$
(4) $(CH_3)_2H\dot{C} < (CH_3)_3\dot{C} < (C_6H_5)_3\dot{C} < (C_6H_5)_2\dot{C}H$

7. The correct order of increasing acid strength of the compounds. **[AIEEE-2006, 3/165]**

(a) CH_3CO_2H (b) $MeOCH_2CO_2H$ (c) CF_3CO_2H (d) 

(1) b < d < a < c (2) d < a < c < b (3) d < a < b < c (4) a < d < c < b

8. Which one of the following is the strongest base in aqueous solution? **[AIEEE-2007, 3/120]**

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

9. Arrange the carbanions, $(CH_3)_3\overline{C}$, $\overline{C}Cl_3$, $(CH_3)_2\overline{C}H$, $C_6H_5\overline{C}H_2$ in order of their decreasing stability: **[AIEEE-2009, 4/144]**

(1) $(CH_3)_2\overline{C}H > \overline{C}Cl_3 > C_6H_5\overline{C}H_2 > (CH_3)_3\overline{C}$

(2) $\overline{C}Cl_3 > C_6H_5\overline{C}H_2 > (CH_3)_2\overline{C}H > (CH_3)_3\overline{C}$

(3) $(CH_3)_3\overline{C} > (CH_3)_2\overline{C}H > C_6H_5\overline{C}H_2 > \overline{C}Cl_3$

(4) $C_6H_5\overline{C}H_2 > \overline{C}Cl_3 > (CH_3)_3\overline{C} > (CH_3)_2\overline{C}H$

10. The correct order of increasing basicity of the given conjugate bases (R = CH_3) is: **[AIEEE-2010, 4/144]**

(1) $RCO\overline{O} < HC\equiv\overline{C} < \overline{R} < \overline{N}H_2$ (2) $\overline{R} < HC\equiv\overline{C} < RCO\overline{O} < \overline{N}H_2$

(3) $RCO\overline{O} < \overline{N}H_2 < HC\equiv\overline{C} < \overline{R}$ (4) $RCO\overline{O} < HC\equiv\overline{C} < \overline{N}H_2 < \overline{R}$

11. The strongest acid amongst the following compounds is : **[AIEEE-2011, 4/120]**

(1) CH_3COOH (2) HCOOH

(3) $CH_3CH_2CH(Cl)CO_2H$ (4) $ClCH_2CH_2CH_2COOH$

12. Identify the compound that exhibits tautomerism. **[AIEEE-2011, 4/120]**

(1) 2-Butene (2) Lactic acid (3) 2-Pentanone (4) Phenol

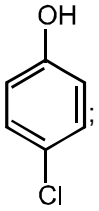
13. The correct order of acid strength of the following compounds: **[AIEEE-2011, 4/120]**

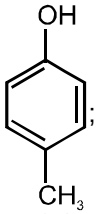
(A) Phenol (B) p-Cresol (C) m-Nitrophenol (D) p-Nitrophenol

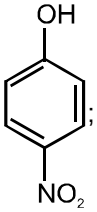
is :

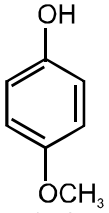
(1) D > C > A > B (2) B > D > A > C (3) A > B > D > C (4) C > B > A > D

14. Arrange the following compounds in order of decreasing acidity : **[JEE(Main)-2013, 4/120]**


(I)

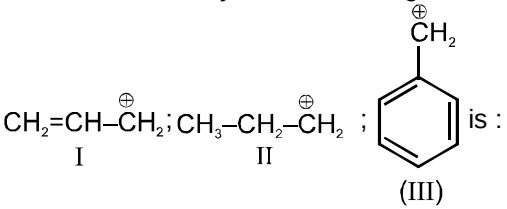

(II)


(III)


(IV)

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

15. The order of stability of the following carbocations : **[JEE(Main)-2013, 4/120]**


(III)

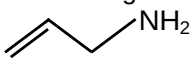
is :

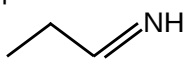
(1) III > II > I (2) II > III > I (3) I > II > III (4) III > I > II

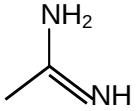
16. Considering the basic strength of amines in aqueous solution, which one has the smallest pK_b value? **[JEE(Main)-2014, 4/120]**

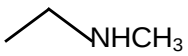
(1) $(CH_3)_2NH$ (2) CH_3NH_2 (3) $(CH_3)_3N$ (4) $C_6H_5NH_2$

17. The increasing order of basicity of the following compounds is : **[JEE(Main)-2018, 4/120]**

(a) 

(b) 

(c) 

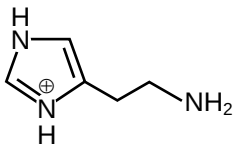
(d) 

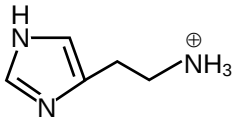
(1) (b) < (a) < (d) < (c) (2) (d) < (b) < (a) < (c)

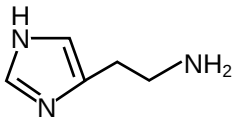
(3) (a) < (b) < (c) < (d) (4) (b) < (a) < (c) < (d)

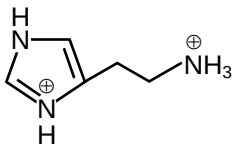
18. The predominant form of histamine present in human blood is (pK_a, Histidine = 6.0)

[JEE(Main)-2018, 4/120]

(1) 

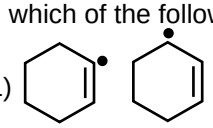
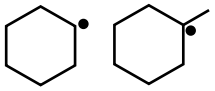
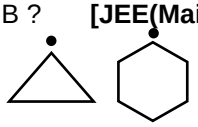
(2) 

(3) 

(4) 

JEE(MAIN) ONLINE PROBLEMS

1. In which of the following pairs A is more stable than B ? **[JEE(Main) 2014 Online (09-04-14), 4/120]**

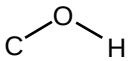
(1)  (2)  (3)  (4) $Ph_3C^{\bullet}$, $(CH_3)C^{\bullet}$

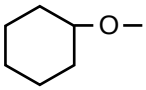
2. Which one of the following statements is **not** correct ? **[JEE(Main) 2014 Online (11-04-14), 4/120]**

(1) Alcohols are weaker acids than water.

(2) Acid strength of alcohols decreases in the following order $RCH_2OH > R_2CHOH > R_3COH$.

(3) Carbon-oxygen bond length in methanol, CH_3OH is shorter than that of C–O bond length in phenol.

(4) The bond angle  in methanol is 108.9º.

3. Which one of the following substituents at para-position is most effective in stabilizing the phenoixde  , ion? **[JEE(Main) 2014 Online (19-04-14), 4/120]**

(1) $-CH_3$ (2) $-OCH_3$ (3) $-COCH_3$ (4) $-CH_2OH$

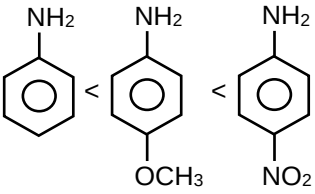
4. Which one of the following compounds will not be soluble in sodium bicarbonate ? **[JEE(Main) 2014 Online (19-04-14), 4/120]**

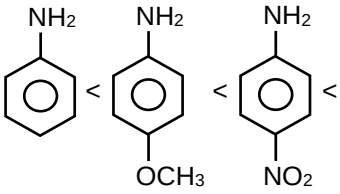
(1) 2,4,6-Trinitrophenol (2) Benzoic acid

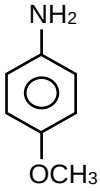
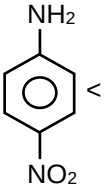
(3) o-Nitrophenol (4) Benzene sulphonic acid

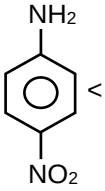
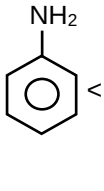
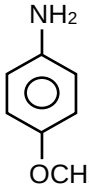
5. Arrange the following amines in the order of increasing basicity :

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

(1) CH_3NH_2 < 

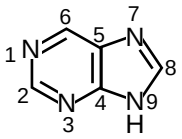
(2)  < CH_3NH_2

(3)  <  <  < CH_3NH_2

(4)  <  <  < CH_3NH_2

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

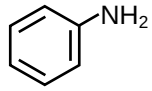
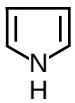
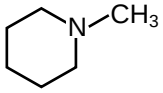
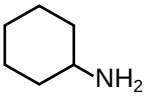
[JEE(Main) 2016 Online (10-04-16), 4/120]



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

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

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

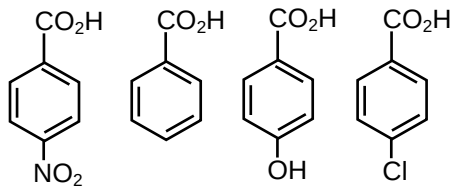
(I)  (II)  (III)  (IV) 

(1) (I) < (II) < (III) < (IV) (2) (I) < (II) < (IV) < (III)

(3) (II) < (I) < (III) < (IV) (4) (II) < (I) < (IV) < (III)

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

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



I II III IV

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

9. Which amongst the following is the strongest acid ? **[JEE(Main) 2019 Online (09-01-19), 4/120]**

(1) $CHBr_3$ (2) $CHCl_3$ (3) CHI_3 (4) $CH(CN)_3$

10. The correct decreasing order for acid strength is : **[JEE(Main) 2019 Online (09-01-19), 4/120]**

(1) $CNCH_2COOH > O_2NCH_2COOH > FCH_2COOH > ClCH_2COOH$

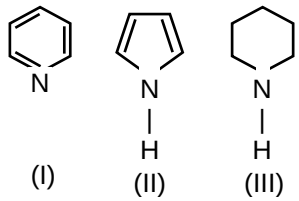
(2) $FCH_2COOH > NCCH_2COOH > NO_2CH_2COOH > ClCH_2COOH$

(3) $NO_2CH_2COOH > NCCH_2COOH > FCH_2COOH > ClCH_2COOH$

(4) $NO_2CH_2COOH > FCH_2COOH > CNCH_2COOH > ClCH_2COOH$

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

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



(I) (II) (III)

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

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

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

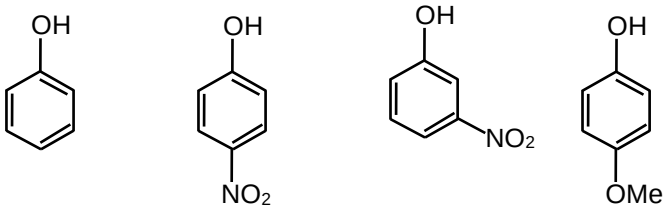
(A) $CH_3CH_2NH_2$ (B) $CH_3CH_2\underset{\displaystyle CH_2CH_3}{\underset{|}{N}}H$ (C) $H_3C-\underset{\displaystyle CH_3}{\underset{|}{N}}-CH_3$ (D) $Ph-\underset{\displaystyle CH_3}{\underset{|}{N}}-H$

(1) (A) < (B) < (C) < (D) (2) (D) < (C) < (B) < (A)

(3) (A) < (B) < (D) < (C) (4) (D) < (C) < (A) < (B)

13. The increasing order of the pK_a values of the following compounds is :

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



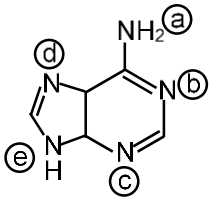
A B C D

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

14. Which of the following compounds will produce a precipitate with $AgNO_3$?

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

15. 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)

16. The correct order of acid strength of compounds CH≡CH, $CH_3-C\equiv CH$ and $CH_2=CH_2$ is as follows :

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

(1) $CH_3-C\equiv CH > CH\equiv CH > CH_2=CH_2$ (2) $CH_3-C\equiv CH > CH_2=CH_2 > HC\equiv CH$

(3) $HC\equiv CH > CH_3-C\equiv CH > CH_2=CH_2$ (4) $CH\equiv CH > CH_2=CH_2 > CH_3-C\equiv CH$

Answers

EXERCISE - 1

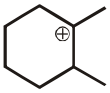
PART - I

A-1. (a) 1 > 2 > 3 ; (b) 1 > 2 > 3 **A-2.** (a) 2 > 1 > 3 > 4 ; (b) 1 > 2 > 3 ; (c) 1 > 2

B-1. Stability order : I < II < III < IV
IV is most stable being 3º and delocalised but III is 2º and delocalised.

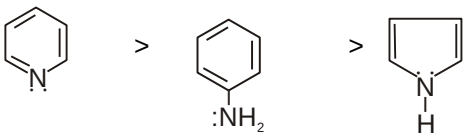
B-2. III > II > I > IV **C-1.** (P) I > III > IV > II ; (Q) IV > III > II > I ; (R) III > II > IV > I

C-2. (II) is more stable carbocation due to extented conjugation

C-3. (P) =  ; (Q) = 

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

D-2. (a) $PhNH_2$ > Ph_2NH > Ph_3N

(b) 

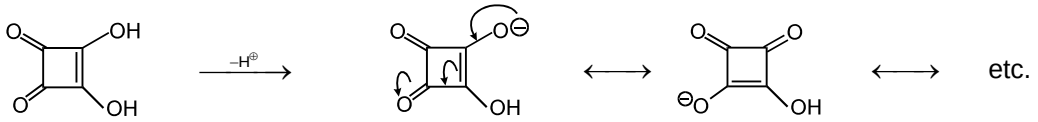
(c) $Ph–CH_2–CH_2–NH_2$ > $CH_3–\underset{\underset{Ph}{|}}{CH}–NH_2$ > $CH_3–CH_2–\underset{\underset{Ph}{|}}{\ddot{N}H}$

D-3. 2

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

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

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

E-3.  etc.

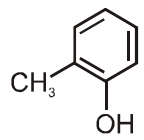
Its conjugate base (anion) is resonance stabilised like $RCOO^{\ominus}$ anion of carboxylic acid.

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

F-2. (c) Strong base accept H^+ ions so this reaction is feasible.

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

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

G-2. (P) $CH_3-\underset{\underset{OH}{|}}{C}=CH_2$ (Q) $CH_2=CH–NH_2$ (R) $CH_3-\underset{\underset{CH_3}{|}}{C}=N\overset{O}{\underset{OH}{\diagup}}$ (S) 

G-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.**	(B)	**A-4.**	(D)	**A-5.**	(B)
A-6.	(D)	**B-1.**	(A)	**B-2.**	(D)	**B-3.**	(A)	**B-4.**	(C)
B-5.	(B)	**B-6.**	(C)	**C-1.**	(C)	**C-2.**	(B)	**C-3.**	(B)
C-4.	(C)	**C-5.**	(D)	**C-6.**	(B)	**D-1.**	(C)	**D-2.**	(A)
D-3.	(A)	**D-4.**	(D)	**D-5.**	(D)	**D-6.**	(A)	**D-7.**	(D)
D-8.	(D)	**E-1.**	(D)	**E-2.**	(A)	**E-3.**	(C)	**E-4.**	(B)
E-5.	(D)	**E-6.**	(C)	**E-7.**	(C)	**E-8.**	(C)	**E-9.**	(A)
E-10.	(D)	**F-1.**	(B)	**F-2.**	(C)	**F-3.**	(D)	**F-4.**	(C)
G-1.	(A)	**G-2.**	(A)	**G-3.**	(B)	**G-4.**	(A)	**G-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.**	(C)	**3.**	(A)	**4.**	(C)	**5.**	(A)
6.	(D)	**7.**	(B)	**8.**	(D)	**9.**	(A)	**10.**	(D)
11.	(A)	**12.**	(D)	**13.**	(A)	**14.**	(D)	**15.**	(B)
16.	(A)	**17.**	(C)	**18.**	(A)	**19.**	(C)	**20.**	(B)
21.	(D)	**22.**	(B)						

PART - II

1.	7	**2.**	2	**3.**	4 (S_1, S_2, S_4, S_5)	**4.**	5 (ii, iii, iv, vi, vii)
5.	6 (i, ii, iii, vi, vii, ix)			**6.**	5 (i, iv, v, vi, viii)	**7.**	5 (i, iv, v, vi, viii)
8.	34	**9.**	3	**10.**	10		

PART - III

1.	(ABCD)	**2.**	(BCD)	**3.**	(ABCD)	**4.**	(ACD)	**5.**	(ACD)
6.	(BC)	**7.**	(BD)	**8.**	(ABCD)	**9.**	(ACD)		

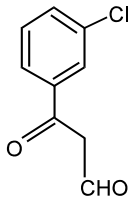
PART - IV

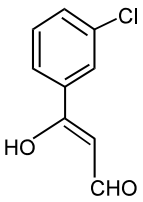
1.	(D)	**2.**	(D)	**3.**	(A)	**4.**	(A)	**5.**	(C)
6.	(B)	**7.**	(C)	**8.**	(A)	**9.**	(D)	**10.**	(D)
11.	(C)	**12.**	(C)	**13.**	(D)	**14.**	(A)		

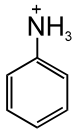
EXERCISE - 3

PART - I

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

3. A. 

; B. 

4. (A) **5.** (A) **6.** 

7. (B) **8.** (D) **9.** (D) **10.** (A) **11.** (D)

12. 2 **13.** (C) **14.** (D) **15.** (D) **16.** (A)

17. (D)

PART - II

JEE(MAIN) OFFLINE PROBLEMS

1. (3) **2.** (4) **3.** (2) **4.** (3) **5.** (4)

6. (1) **7.** (3) **8.** (1) **9.** (2) **10.** (4)

11. (3) **12.** (3) **13.** (1) **14.** (3) **15.** (4)

16. (1) **17.** (1) **18.** (2)

JEE(MAIN) ONLINE PROBLEMS

1. (4) **2.** (3) **3.** (3) **4.** (3) **5.** (4)

6. (3) **7.** (4) **8.** (4) **9.** (4) **10.** (3)

11. (2) **12.** (4) **13.** (3) **14.** (2) **15.** (3)

16. (3)