

EXERCISE - 1

- ① a e^- nuclei attraction $\uparrow$ ses due to Resonance
b $e^- - e^-$ repulsion $\downarrow$ ses
c Potential energy of the molecule $\downarrow$ ses

② a, c, d, g, j, l, & m are true about resonance or mesomerism.

③ a & c both are correct
Ex 2 B Q. 1

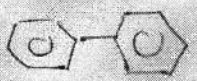
④ d
Ex 2 B Q. 2

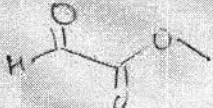
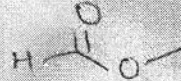
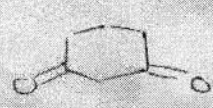
⑤ c
Ex 2 B Q. 3

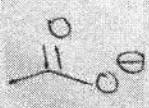
⑥ a & d only
Ex 2 B Q. 4

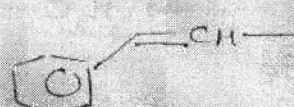
⑦ a, b, d, & g only
Ex 2 B Q. 5

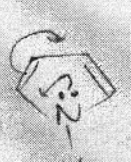
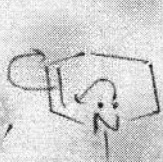
⑧ a, c & d
Ex 2 B Q. 6

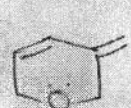
(9) ,  & $\text{H}-\text{C}(=\text{O})-\text{O}-$ are coplanar

(10) , ,  in these all atoms are not coplanar

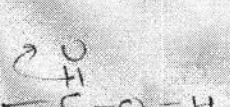
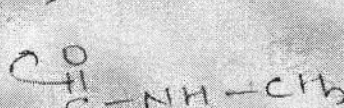
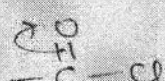
(11) , $-\text{NH}_3^+$ these group cannot participate in resonance

(12) $\text{H}_2\text{C}=\text{O}^+$, , $-\text{B}(\text{OH})_2$, $-\text{P}^+\text{Ph}_3$ can participate in resonance with other suitable gp.

(13) , , $\text{H}_2\text{C}=\text{CH}-\text{CH}_2^-$ lone pair involved in resonance

(14) , ,  l.p. of that atom not involved in resonance.

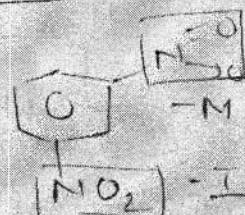
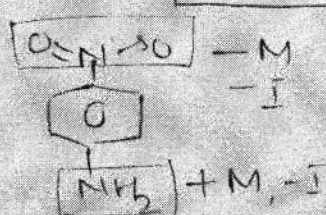
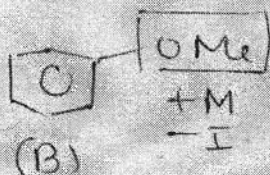
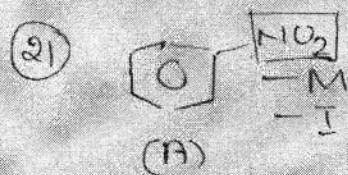
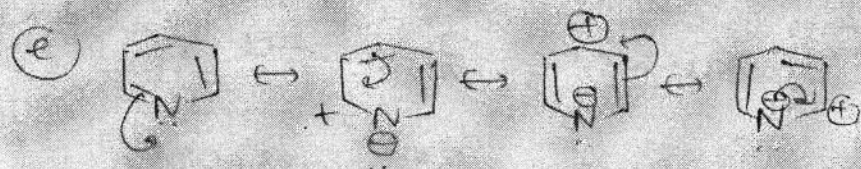
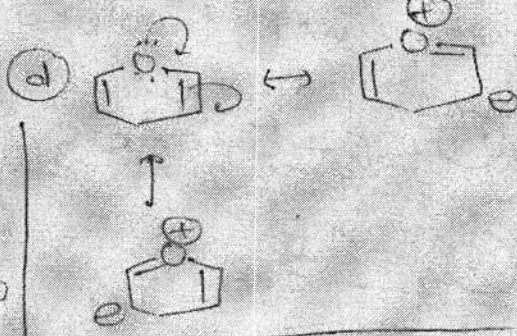
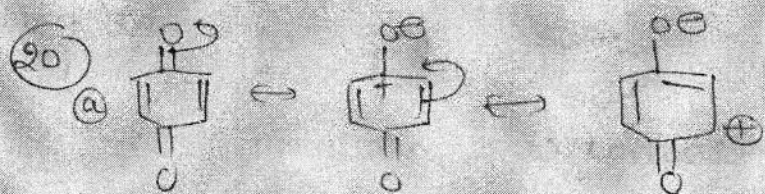
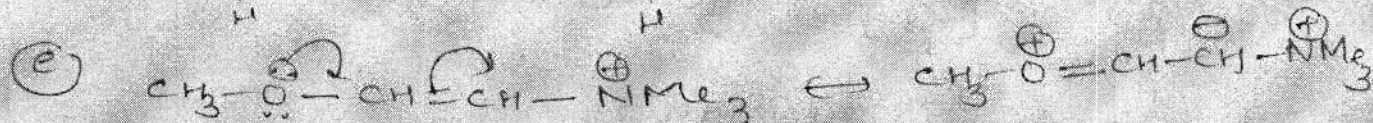
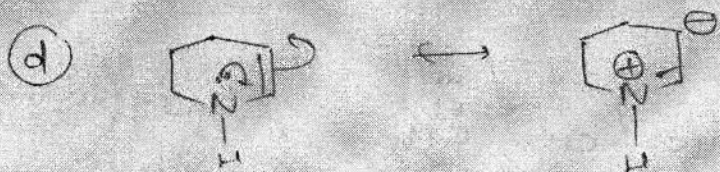
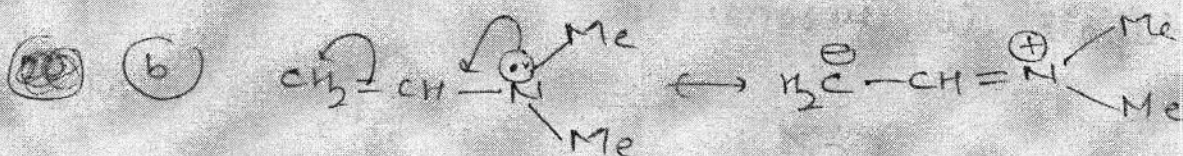
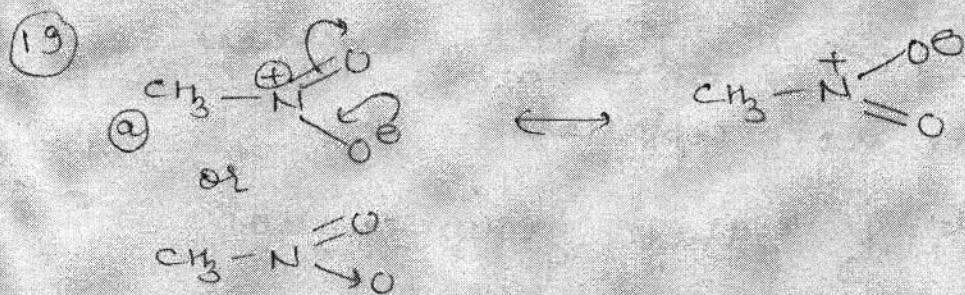
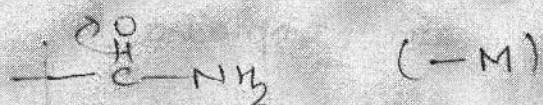
(15) $-\text{O}-\text{C}(=\text{O})-\text{CH}_3$, $-\text{NH}-\text{C}(=\text{O})-\text{CH}_3$ l.p. donating gp.

(16) , , , $-\text{C}\equiv\text{N}:$

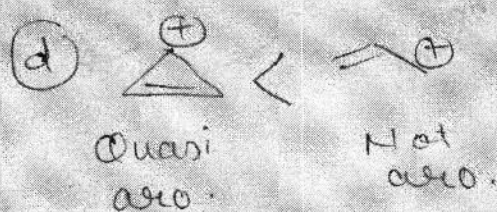
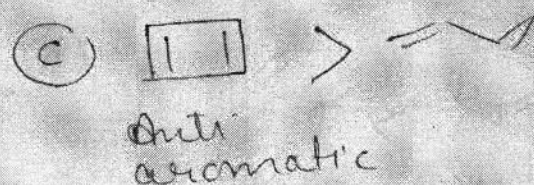
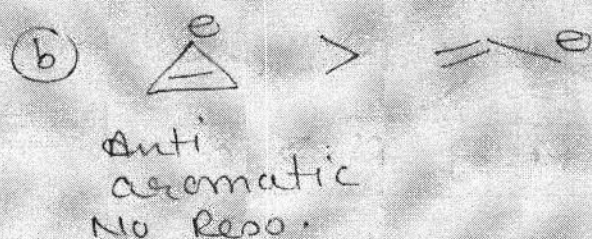
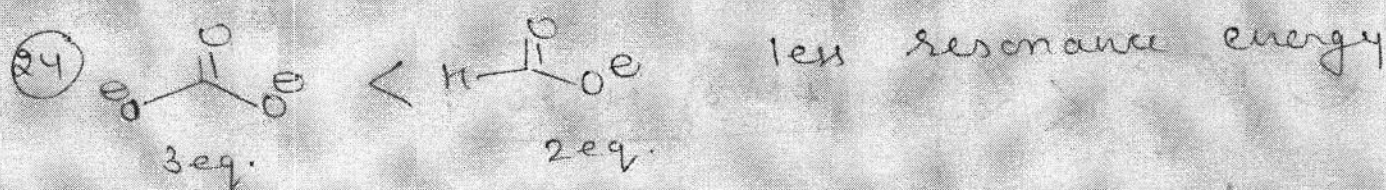
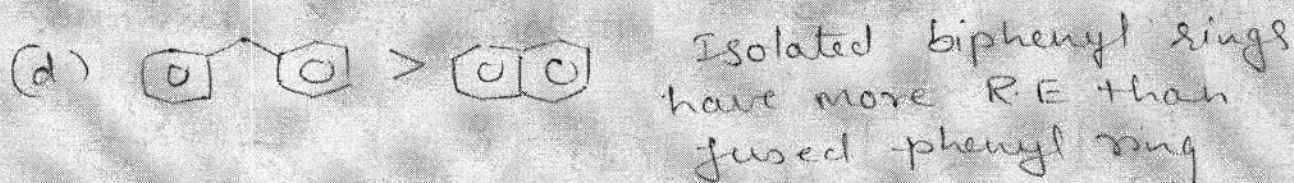
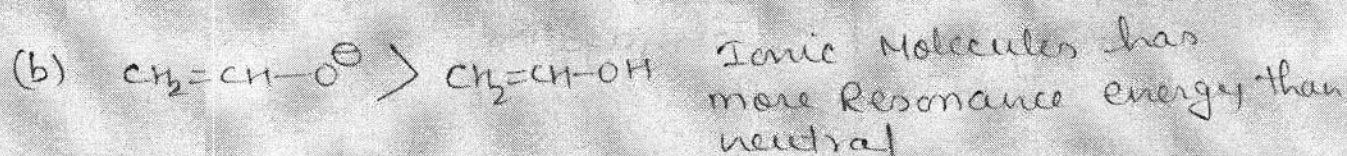
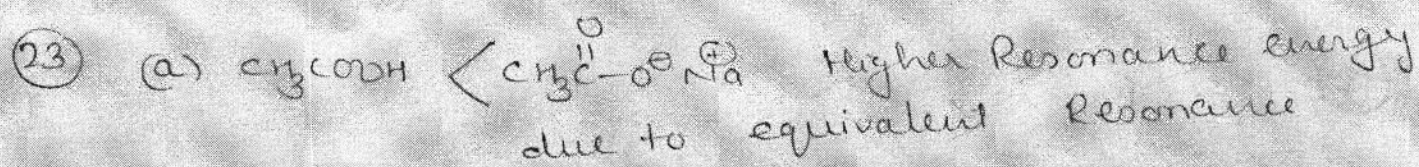
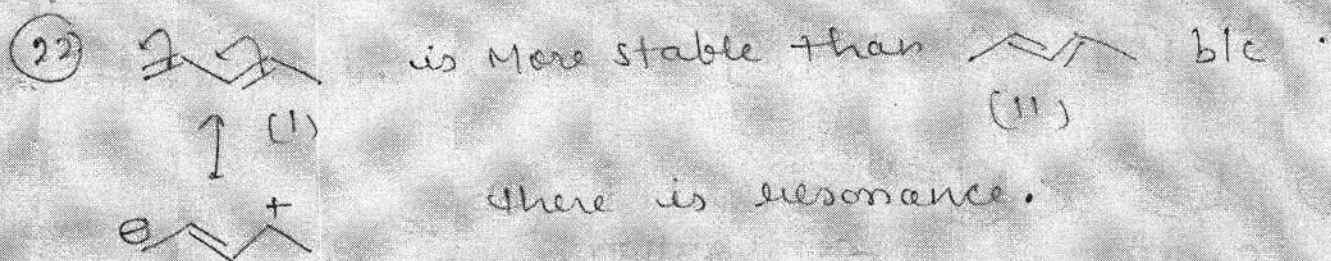
 electron withdrawing groups

(17) $-\text{N}=\text{O}$, $-\text{CH}=\text{CH}_2$, $-\text{N}=\text{NH}$ these group can either donate or withdraw a pair of e^- in resonance depending upon situation.

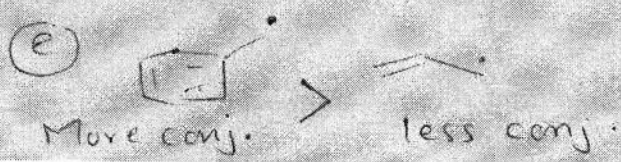
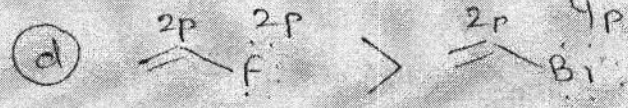
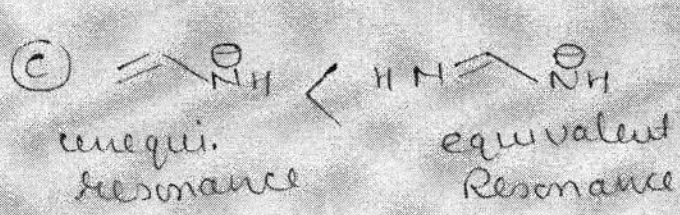
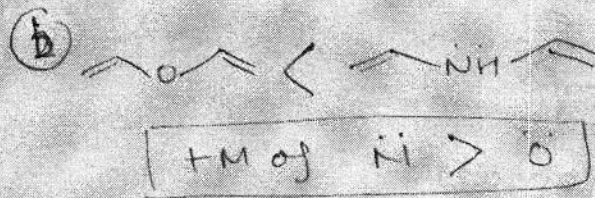
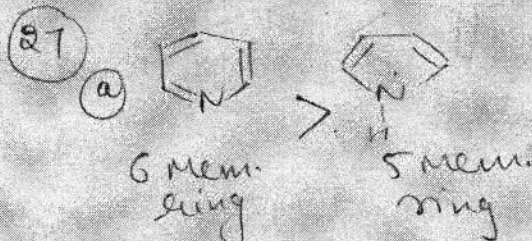
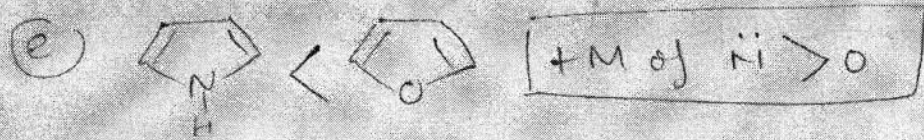
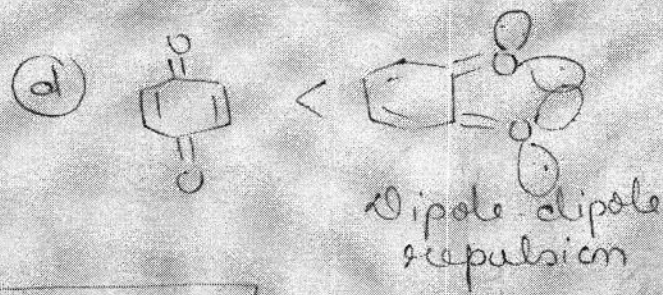
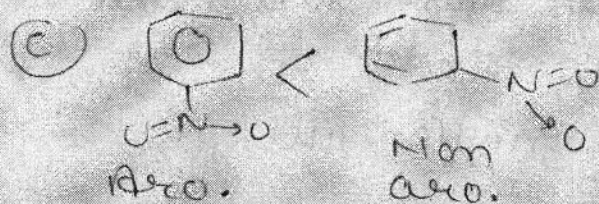
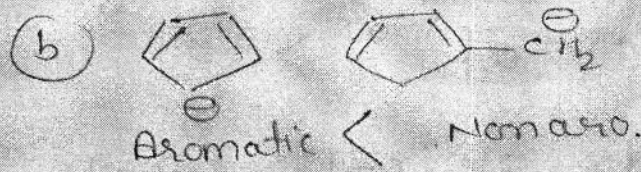
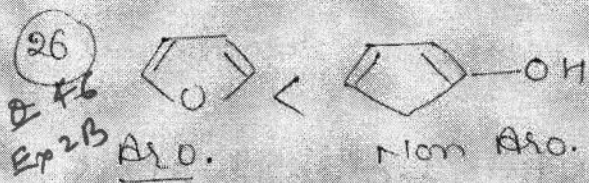
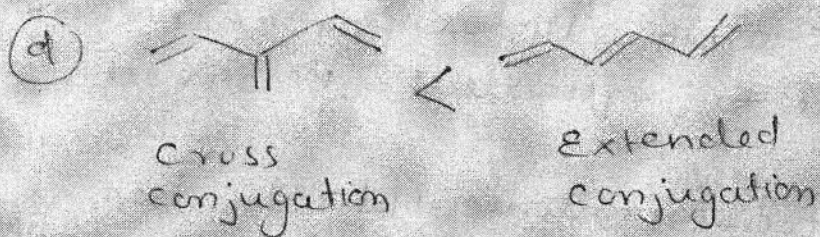
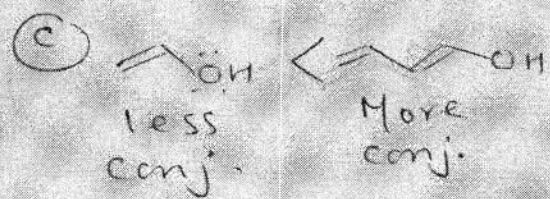
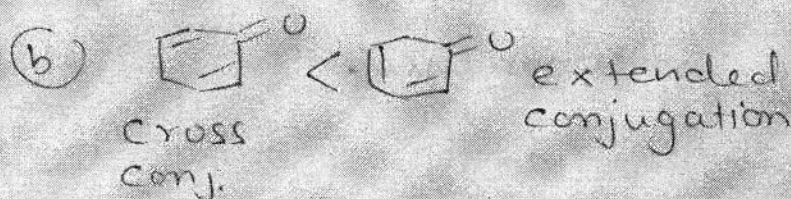
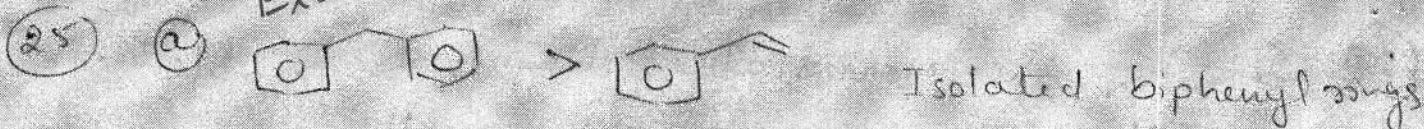
18) only withdraw a pair of e^-



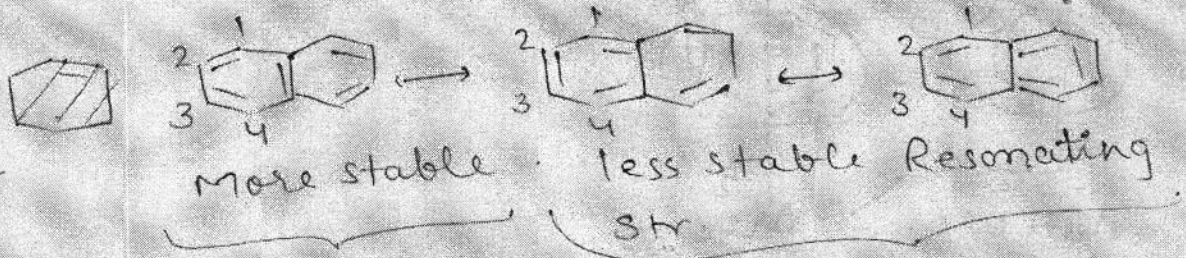
π e^- density in the ring $B > C > A > D$



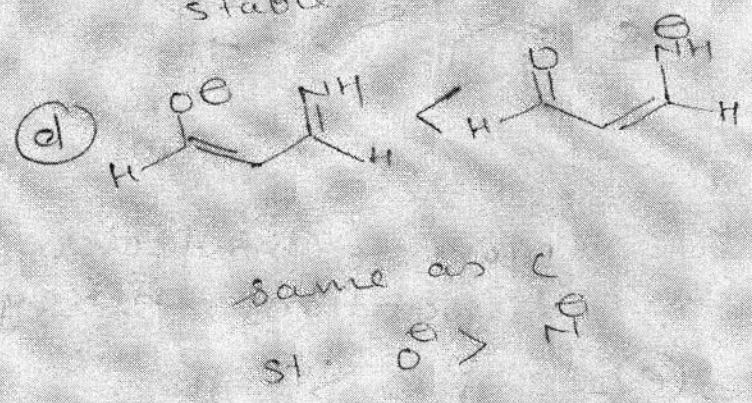
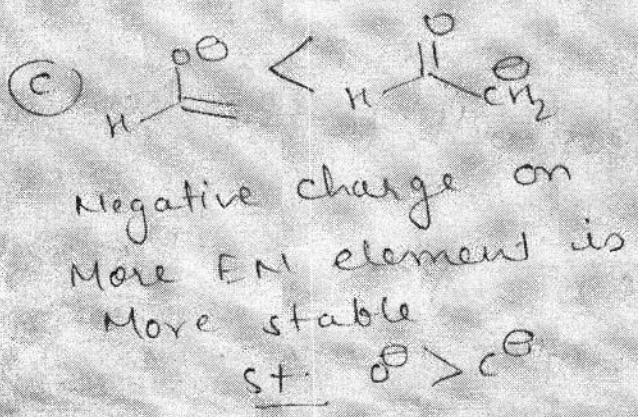
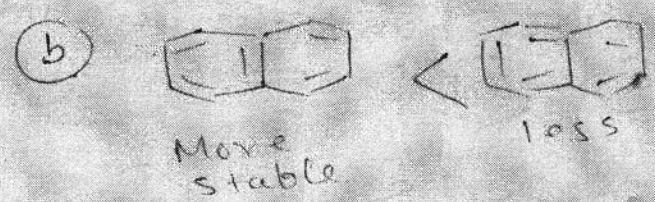
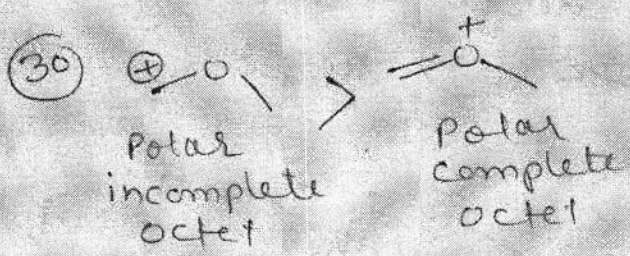
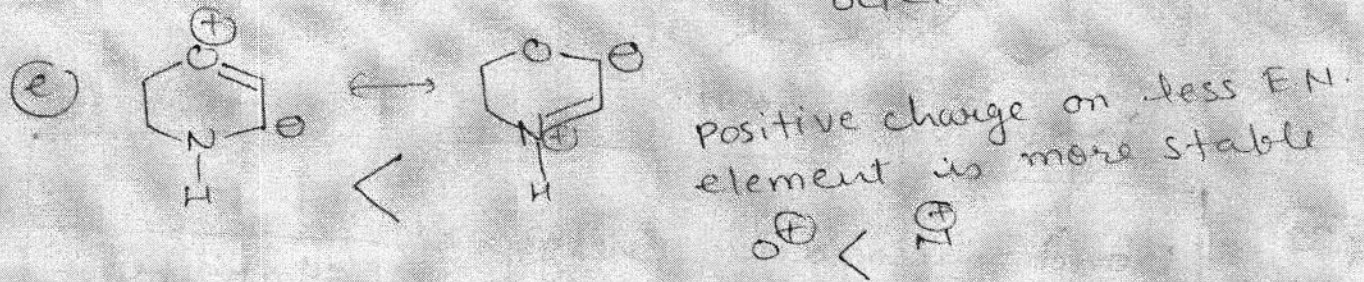
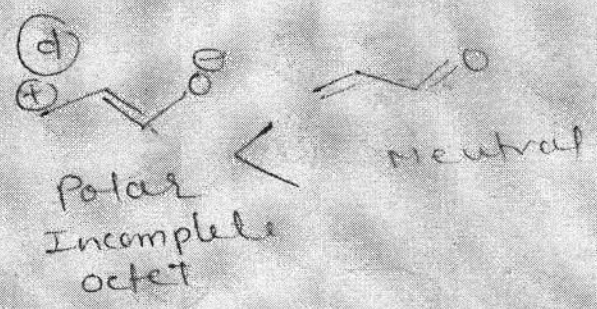
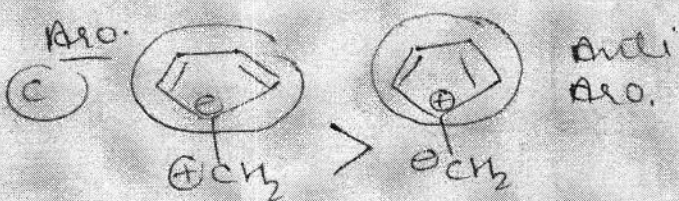
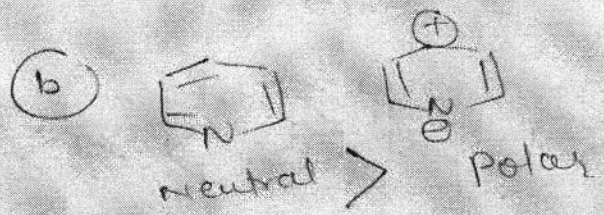
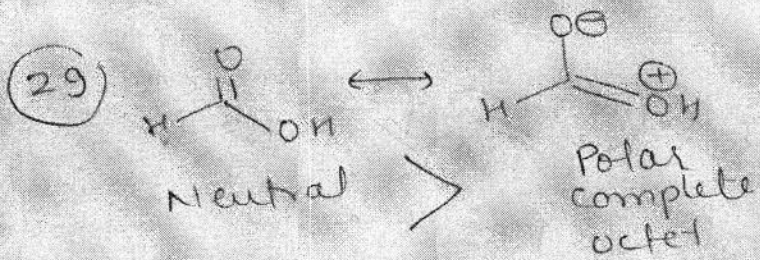
244
Ex 2B

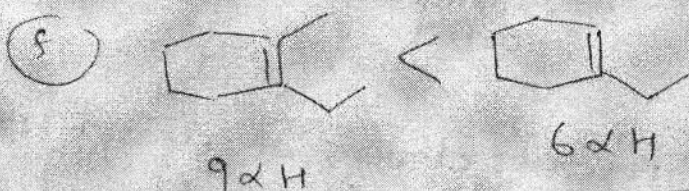
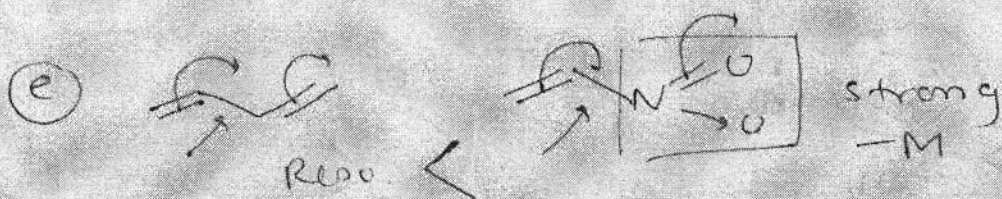
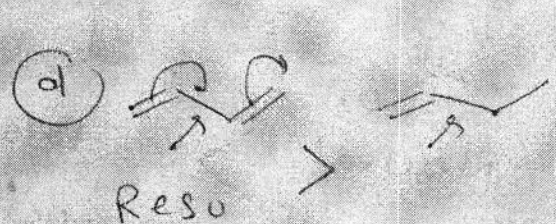
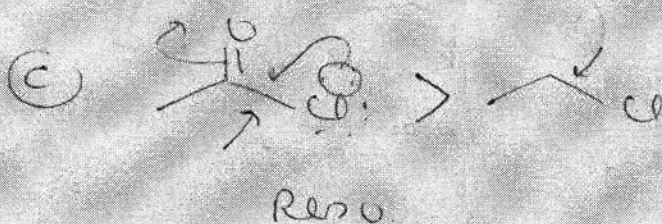
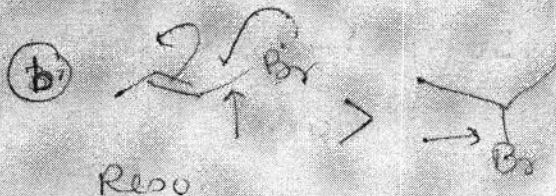
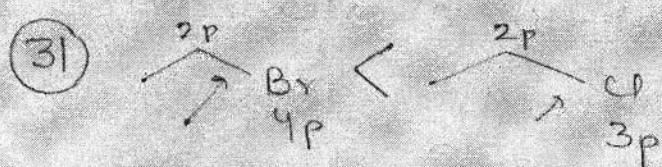
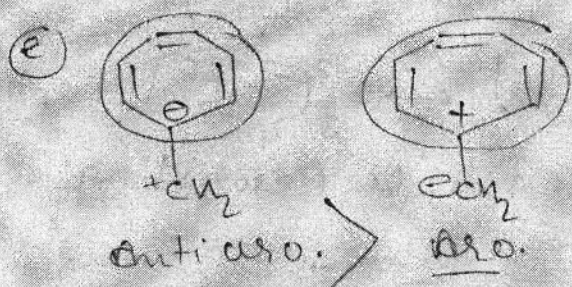


28
Q 65
Ex 4-A



So 1-2 & 3-4 bond is shorter than 2-3 bond



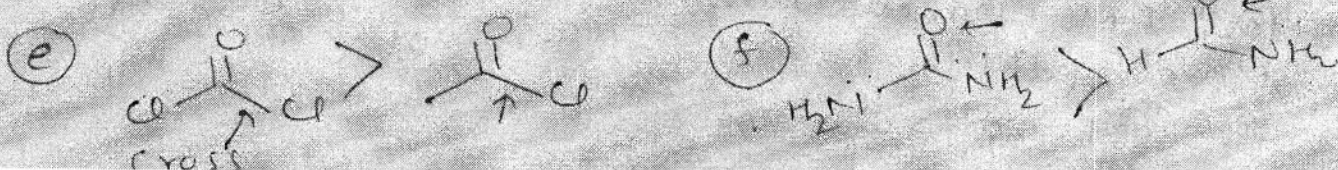


32) Bond dissociation Energy $\propto \frac{1}{\text{stability}}$

less bond dissociation Energy $\propto$ stability



More σ bond chr. less will be the bond dissociation energy.



33

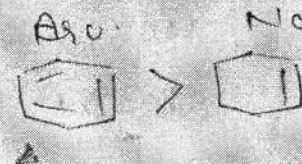
$\text{HOF} \propto \frac{1}{\text{stability}}$

a



Reso

b



A

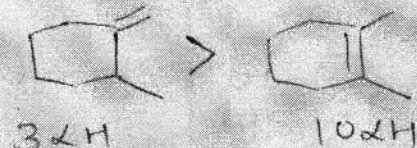
c



6xH

2xH

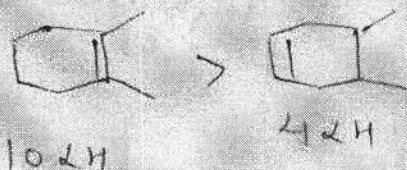
d



3xH

10xH

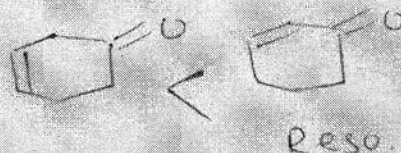
34



10xH

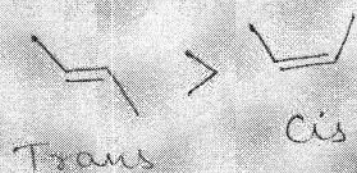
4xH

b



Reso

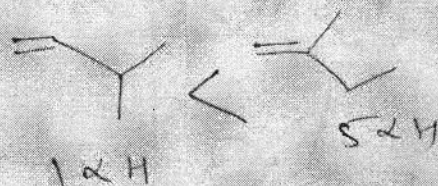
c



Trans

Cis

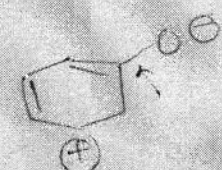
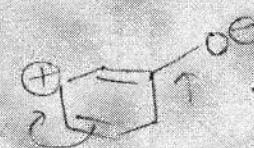
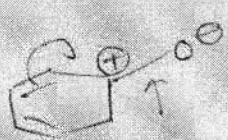
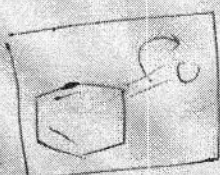
d



1xH

5xH

35

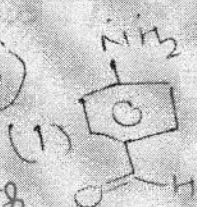


Q57

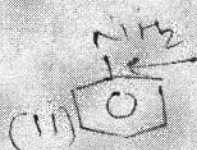
Ex 4-A

3 R.S. sigma bond char. in C-O bond

36



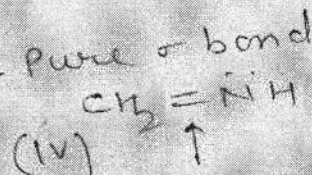
(I)



(II)



(III)



(IV)

Pure sigma bond
 $\text{CH}_2=\text{NH}$
Pure pi bond

3 R.S.

pi bond
char. b/w
C-N

Q58

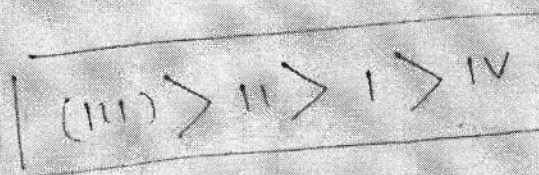
Ex 4-A

4 R.S.

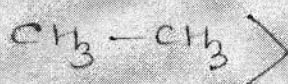
pi bond

char. in
between
C-N

So bond length.



37



Pure σ -bond



Hybrid ch.
1.39 Å

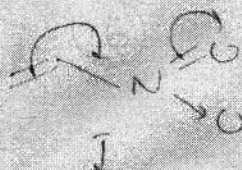
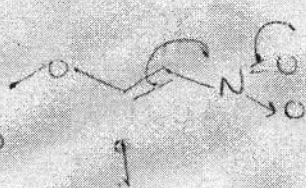


1.34 Å

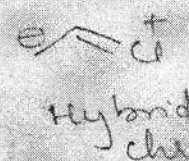
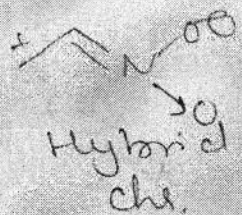
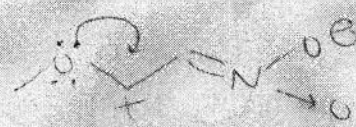


1.20 Å

38



Pure π -bond

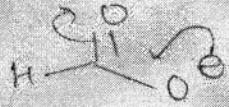


Hybrid ch.

I > II > III > IV

C-C bond length order

39

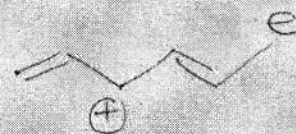


2 equivalent Resonating Str.

40



Q.24 Neutral
Ex. 4-A or Nonpolar



Polar incomplete octet

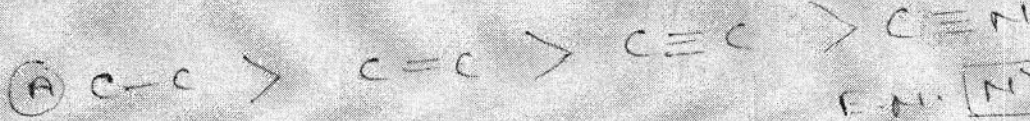


Polar incomplete octet

2° cation is more stable than 1° cation

I > II > III

41



E.N. [N > C]

(C)

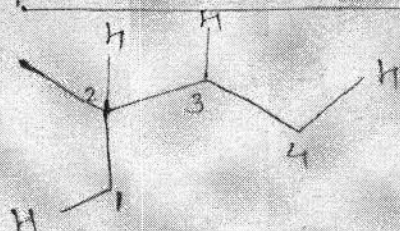


E.N. [O > N > C]

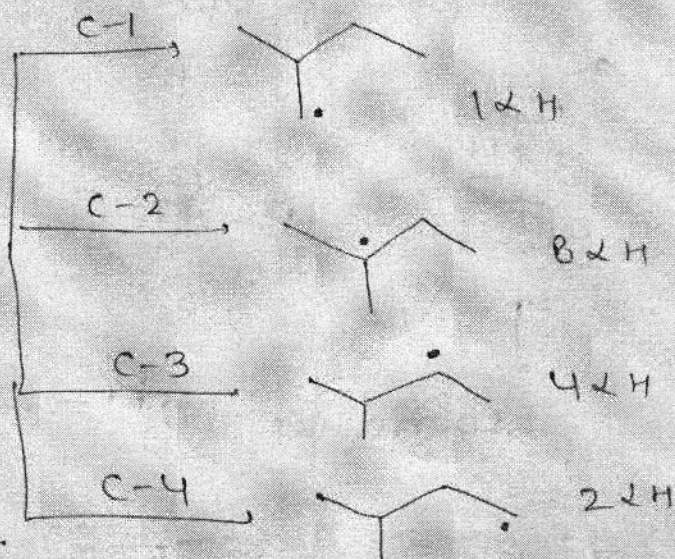
(E)



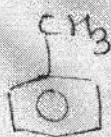
(42)

Bond dissociation Energy $\propto \frac{1}{\text{Stability of free radical}}$ Q66
Ex 4-A

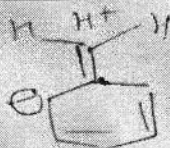
BDE order



EXERCISE - II

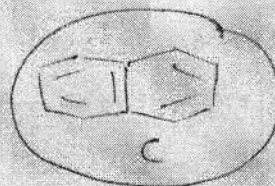
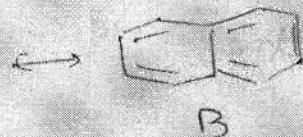
Q67
Ex 4-A

3xH



9 hyperconjugative str.

(2)

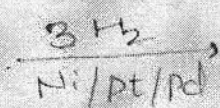


More stable

Q65

Ex 4-A

(3)



-49.8 Kcal/mole

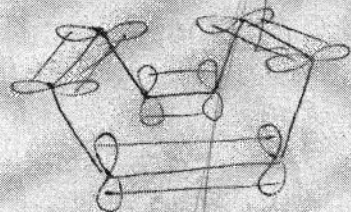
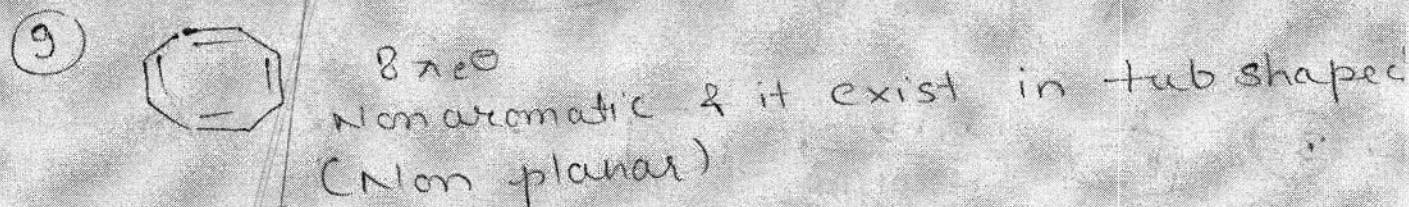
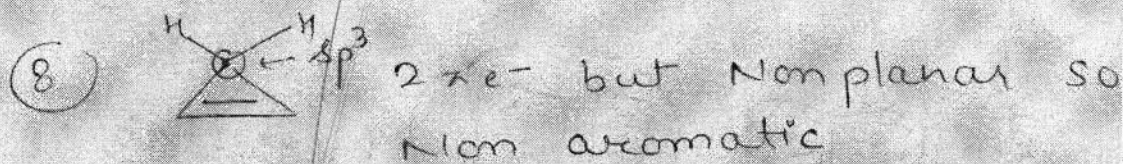
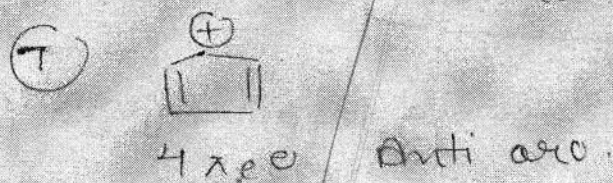
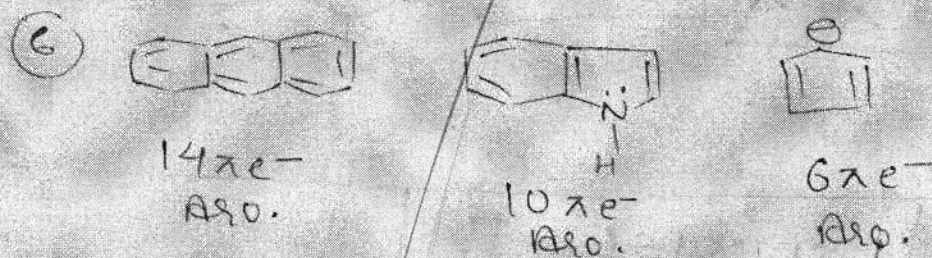
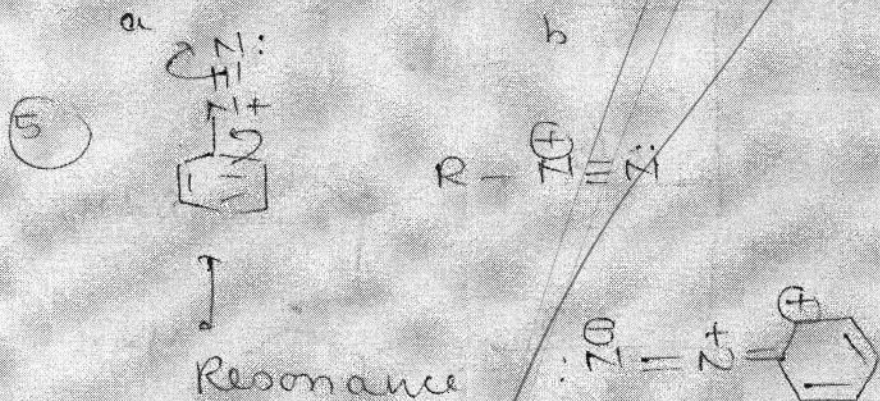
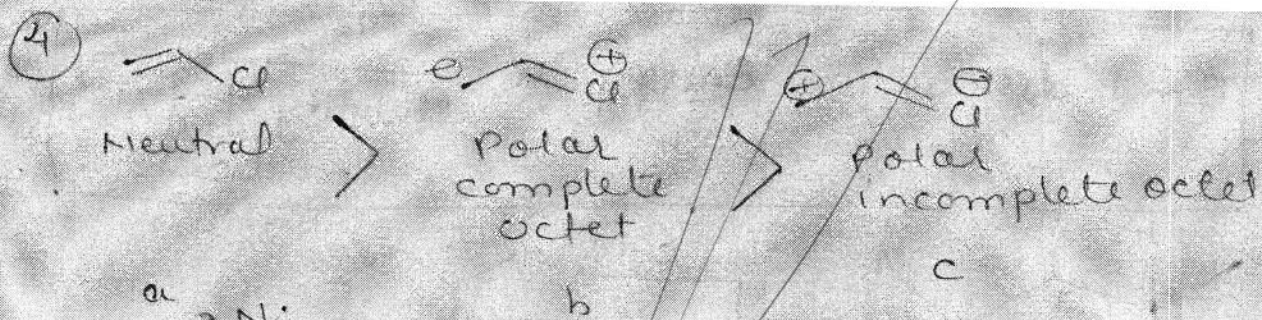
Q56

Ex 4-A

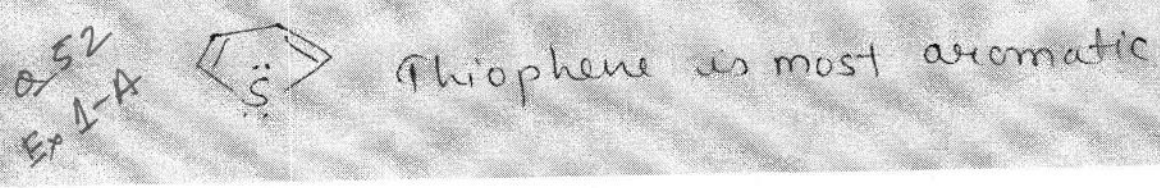
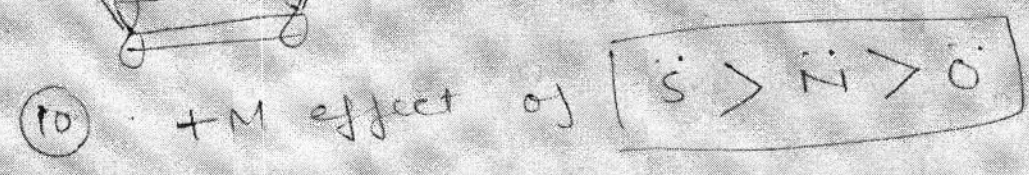
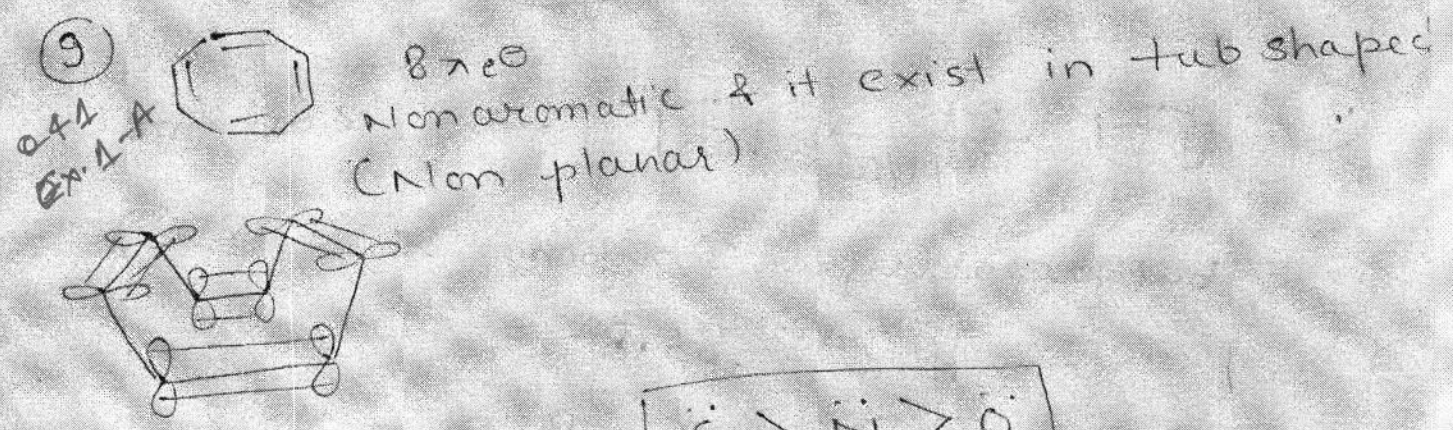
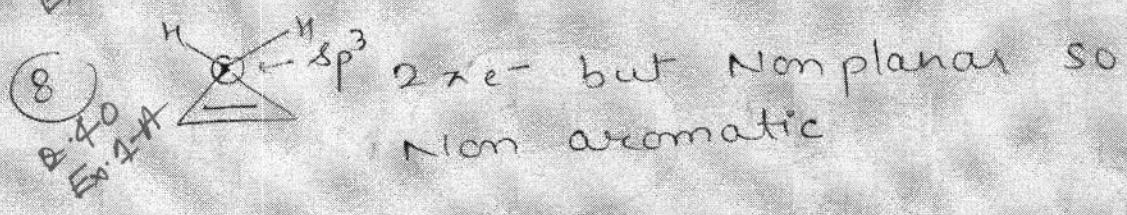
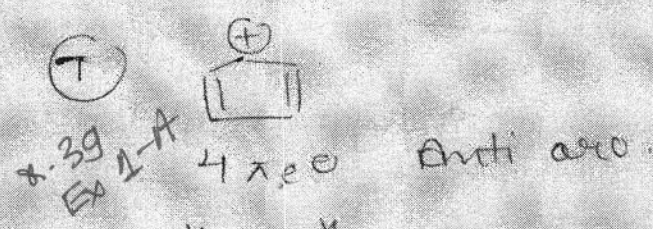
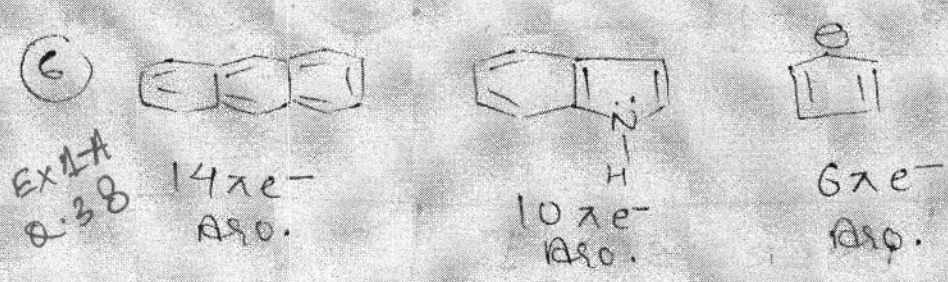
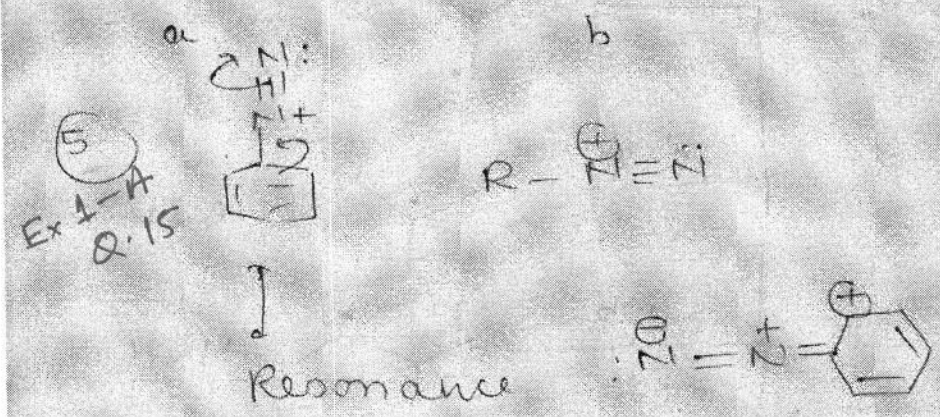
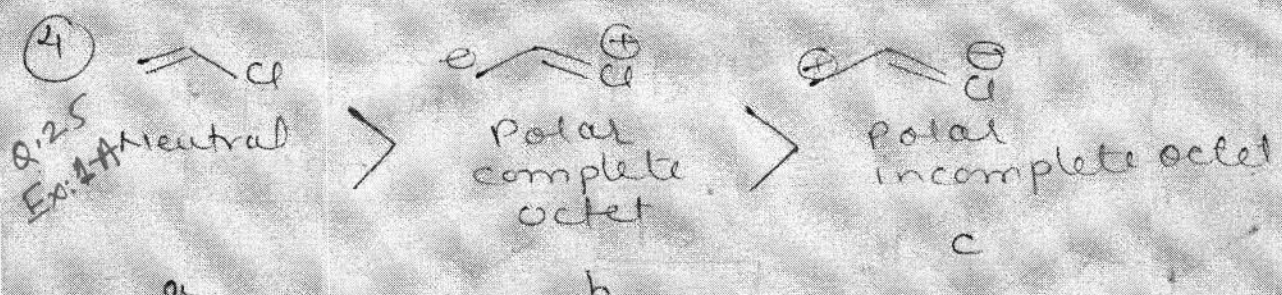
but actually

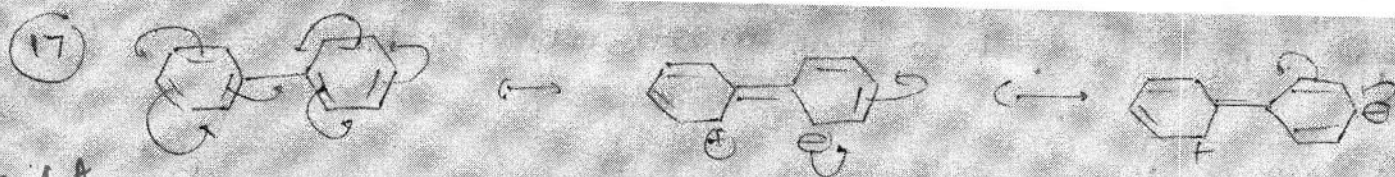
$$3 \pi \text{ bond} \times (-28.6) = -85.8$$

$$\text{Resonance energy} = 85.8 - 49.8 = 36 \text{ Kcal/mol}$$

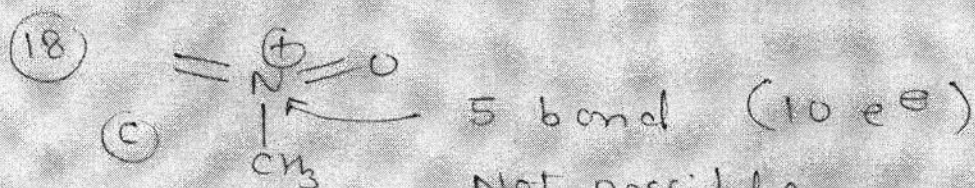


Thiophene is most aromatic



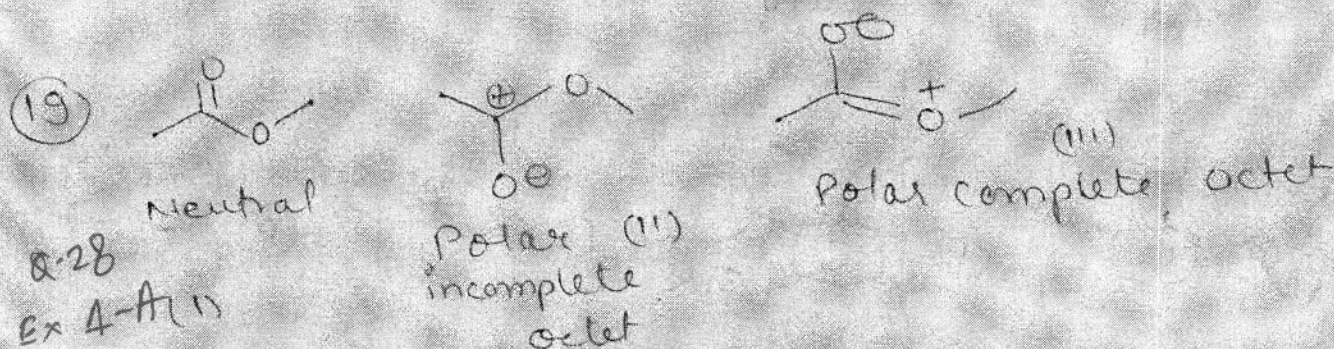


Ex 1-A
Q. 26
So Ans (D)



Not possible
2nd period element, max^m carry ~~only~~ 8 e⁻
not 10

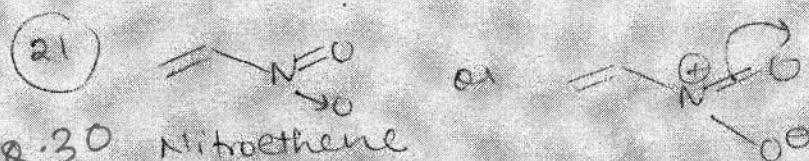
Q. 27
Ex-1-A



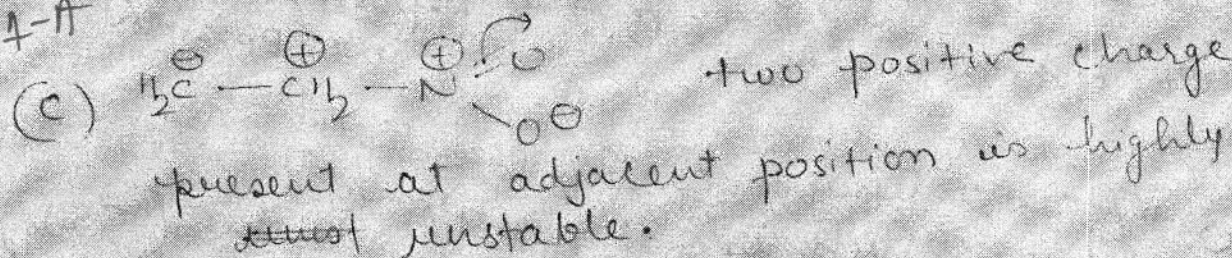
So (ii) is minor contributor



Q. 29
Ex-1-A
Not resonating str of diazomethane is 

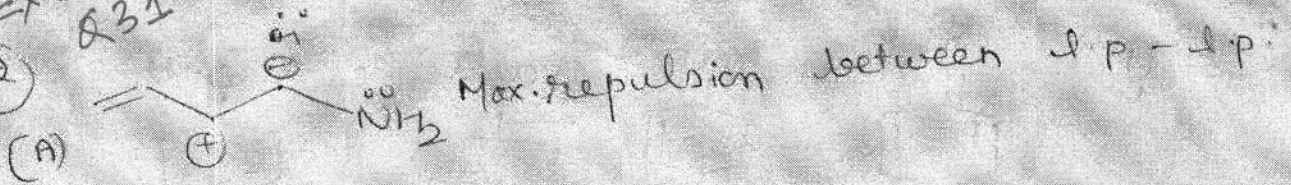


Q. 30 Nitroethene
Ex 4-A

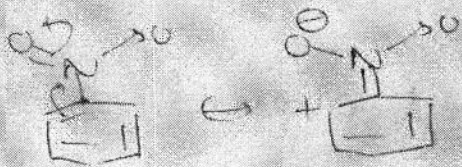


Ex 4-A
Q31

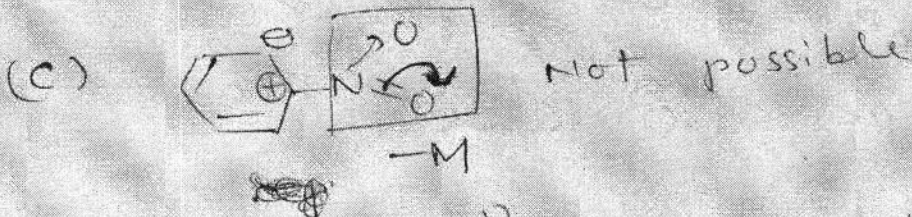
22



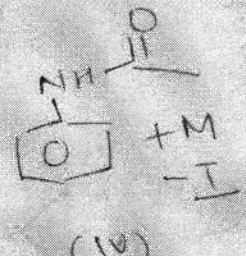
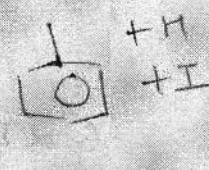
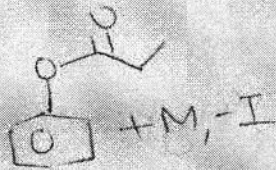
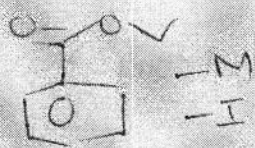
23



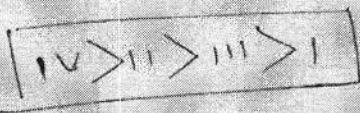
Q32 Ex 4-A Due to $-M$ effect of $-NO_2$ gp. positive charge move in phenyl ring not $\rightarrow$ ve charge



24



Q32
Ex 4-A



e^- density order in benzene ring

25

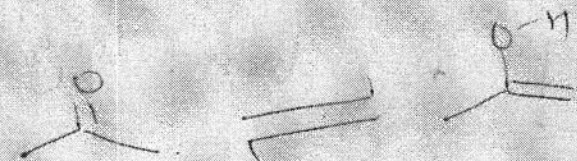
(B)



Positional isomers

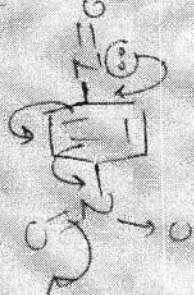
26

(A)

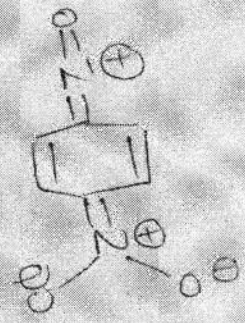


Tautomers

27



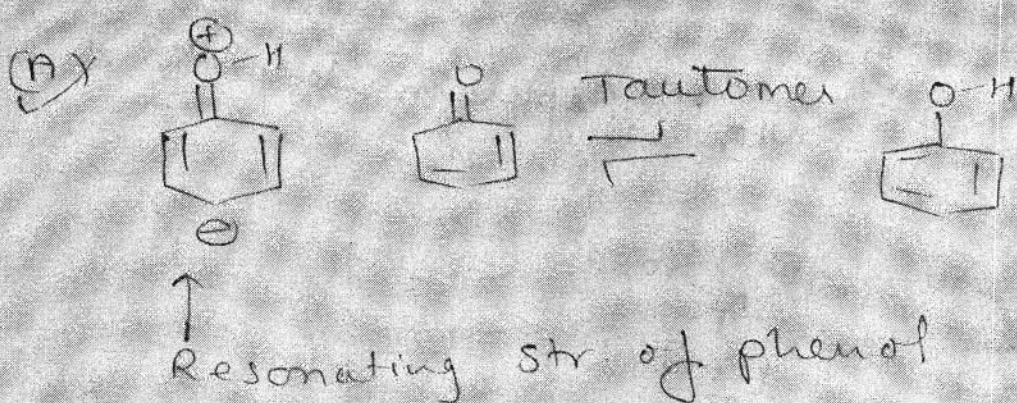
Ans (C)



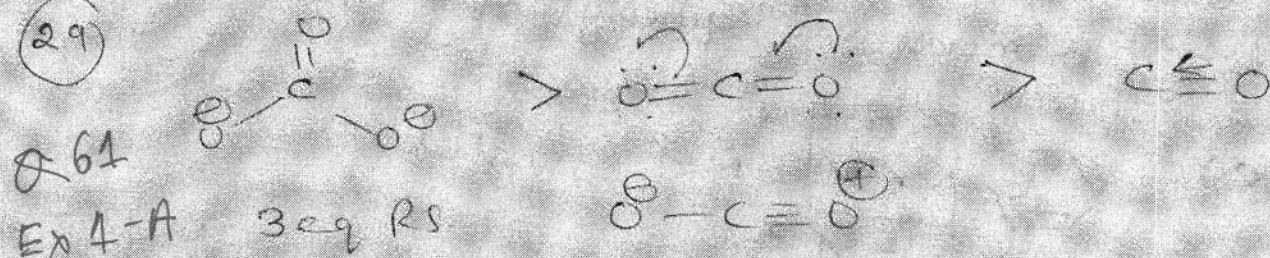
Polar complete octet

Q33
Ex 4-A

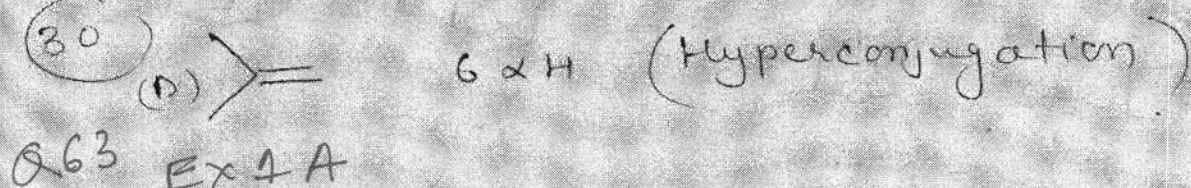
28



29



30

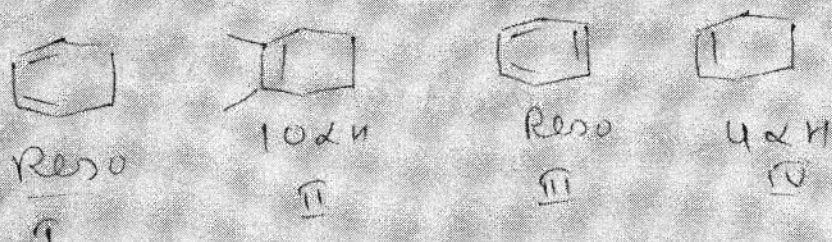


31

Resonance $>$ Hyperconjugation

Q64

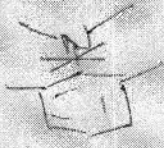
Ex 4 A



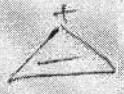
III $>$ I $>$ II $>$ IV

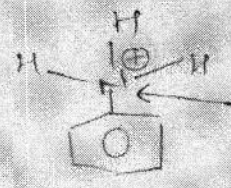
$C=C$ bond length order

Exercise - III

Q68 ① Ex 1-A (c)  SIR effect so N^- gp go out of the plane w.r.t. benzene ring

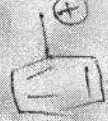
Q42 ② (a) $4n\pi$ e^- containing comp. must be cyclic & planar
Ex 1-A

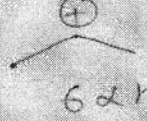
Q43 ③ Ex 1-A  $2\pi e^-$ follow Hückel Rule so aromatic

Q18 ④ Ex 1-A (b)  2^{nd} period element max. carry $8e^-$
So Resonance effect of the gp. is not present

⑤ (1)  $6\pi e^-$ aro

(2)  Non aro. less Reso.

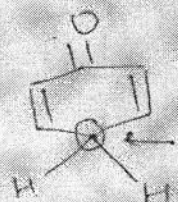
③  More Reso.

(4)  $6\pi e^-$

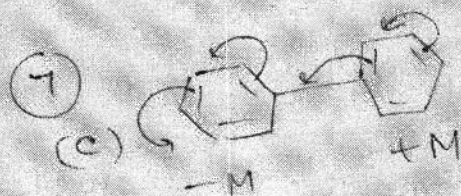
St. order

$1 > 3 > 2 > 4$

Q45 ⑥ Ex 1-A (d)

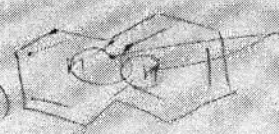


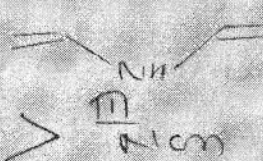
Nonplanar, Non aromatic
 sp^3 hybridized carbon

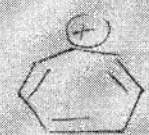


Q19 Ex 1-A

one ring is π -donor & another one is π -acceptor

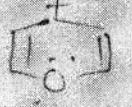
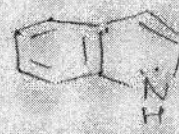
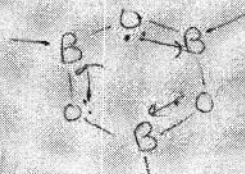
(8)  Due to repulsion it get nonplanar so nonaromatic
 (D) $[10\pi e^-]$ 246 Ex 4-A

(9)   
 2.55 Ex 4-A (I) > (II) less aro > III non aromatic
 More aro
 + M a) $[H] > 0$

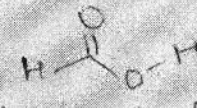
(10)  6 πe^- , follow Hückel Rule
 247 Ex 4-A Aromatic

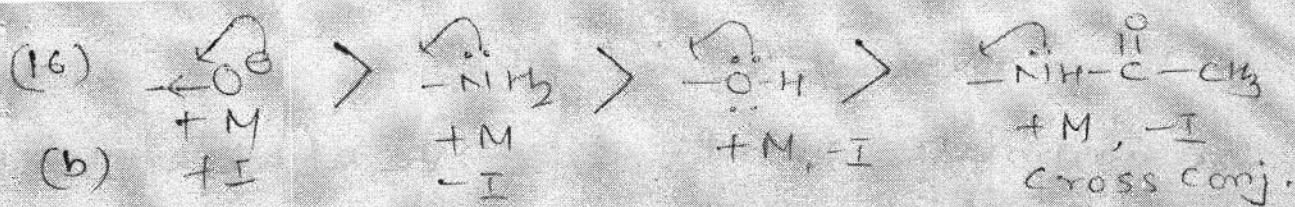
(11)  Due to resonance hybrid char. of bond length present between C_2-C_3 bond. (less than pure π bond)
 (c) Ex 4-A 2.62
 pure sigma bond & more than π bond

(12)  6 πe^-
 2.48 Ex 4-A Aromatic

(13) (a)  6 πe^- Aro
 Ex 4-A 2.49 (b)  10 πe^- Aro
 (c)  6 πe^- Aro

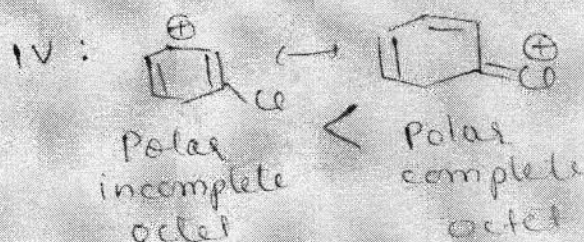
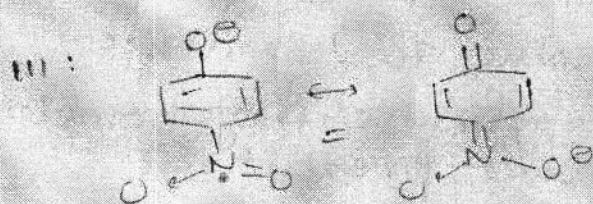
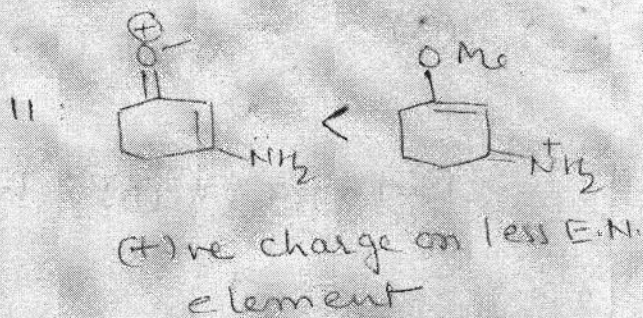
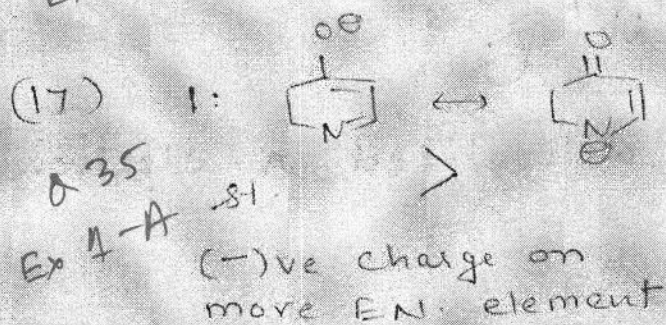
So ans (D)

(15)  Neutral
 2.34 Ex 4-A
 So St. order I > II > III > IV
 Polar complete octet > Polar Incomplete octet > Highly unstable

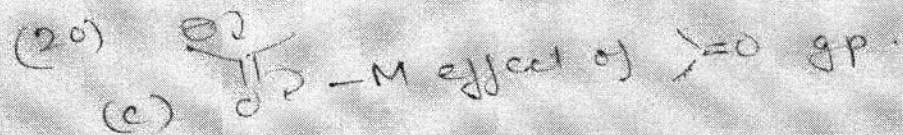
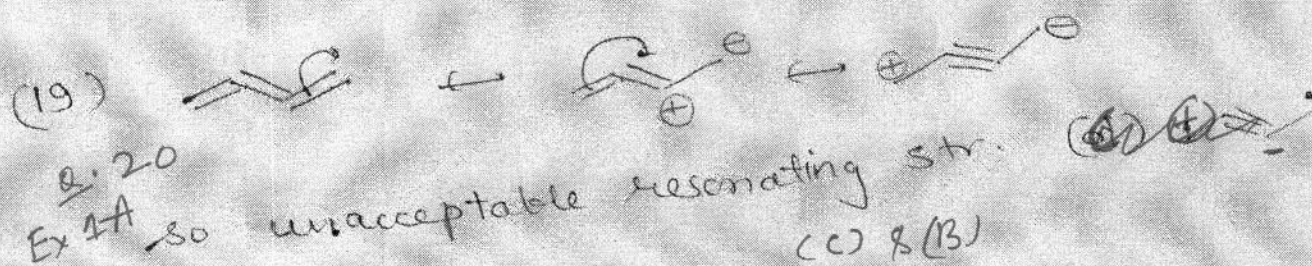
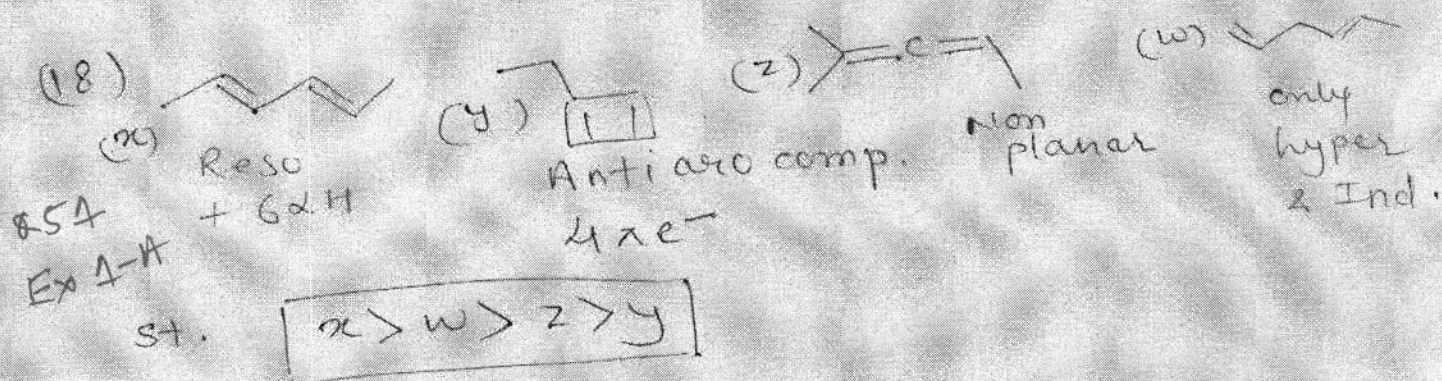


Q 23
Ex 4-A

E.N. diff



So ans (b) (II & IV)



Q 36
Ex 4-A

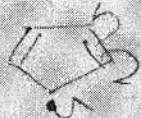
237 Ex 4A



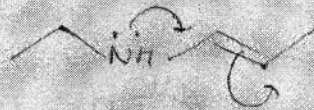
polar complete octet & (-)ve charge on more E.N. element

(22)

(a)



(b)

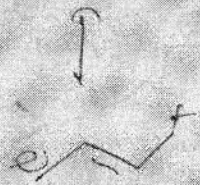


Q.21

Ex. 1A

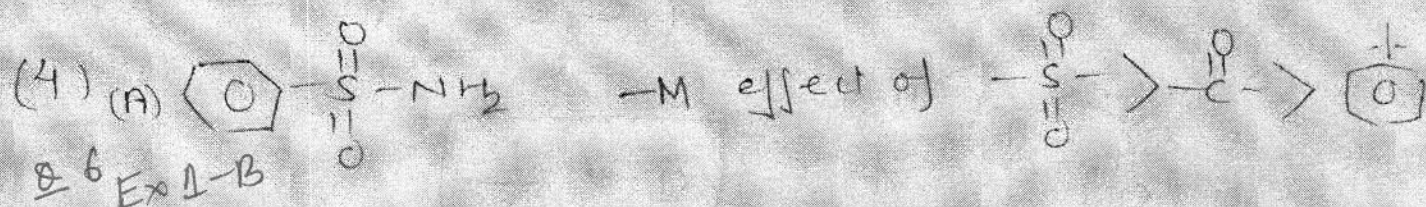
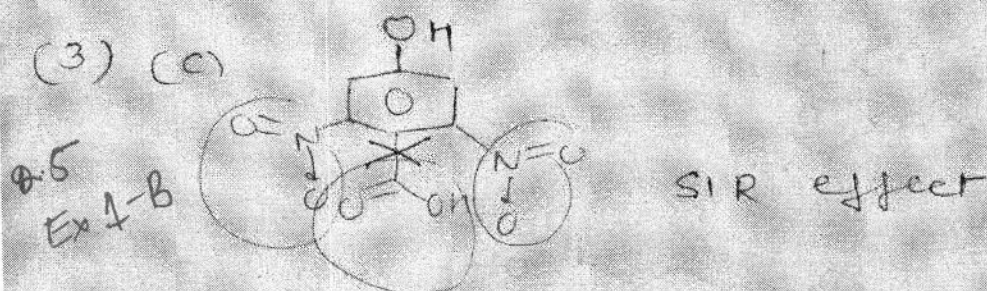
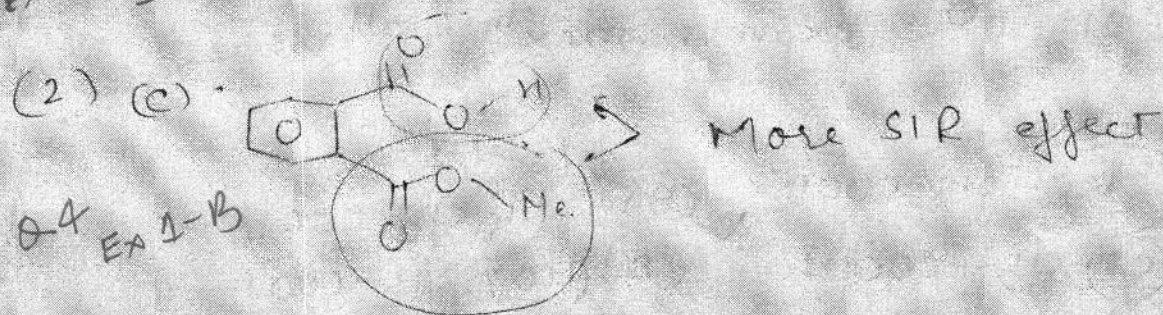
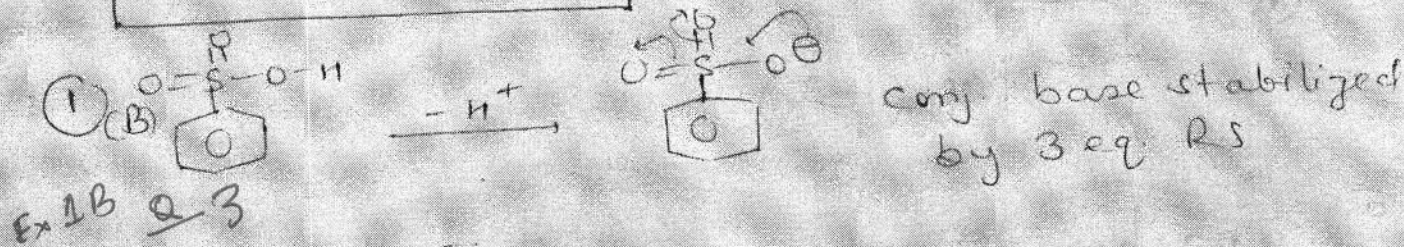
Both (a) & (b) have delocalized π -electrons

(23)



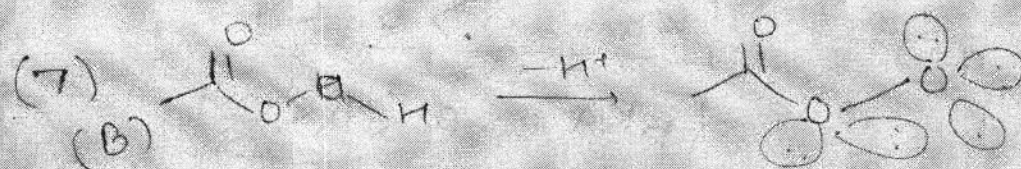
Due to resonance hybrid char. of bond length are present.

EXERCISE - IV



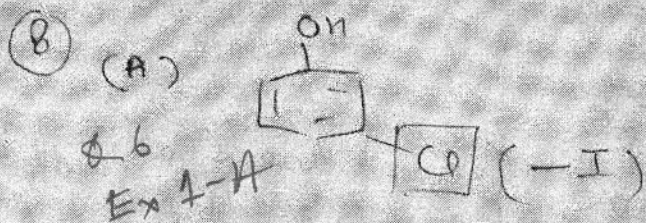
Q 4 order of K_a = B > A > C > D

Ex 1-A



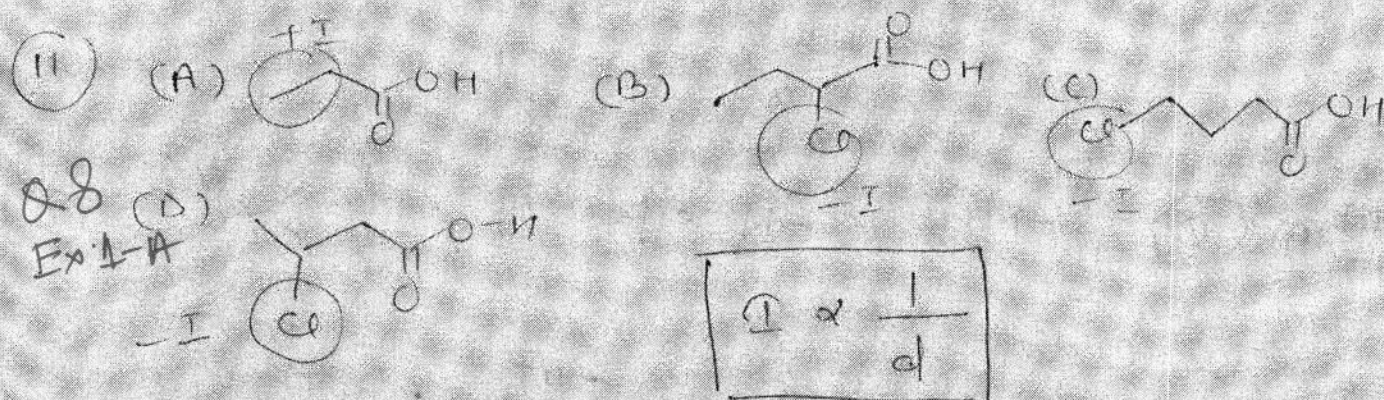
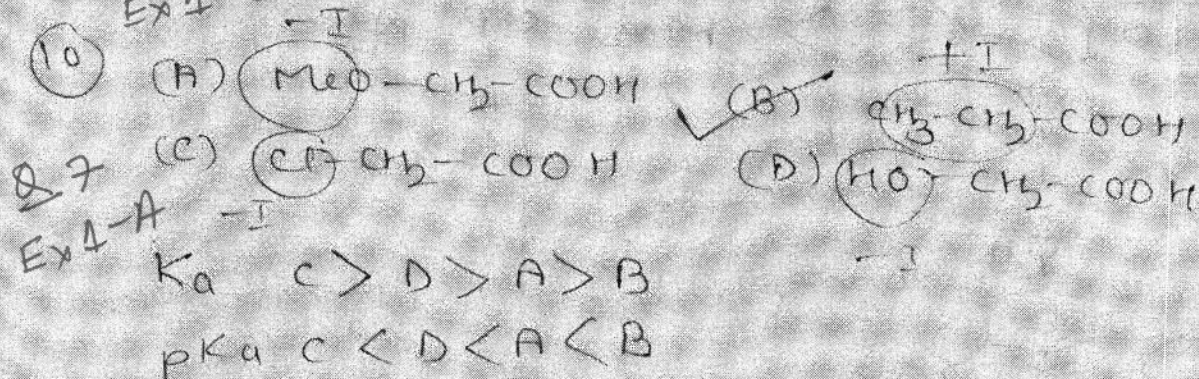
Q 5 Ex 1-A

unstable conj. base of per acid due to l.p. - l.p. repulsion

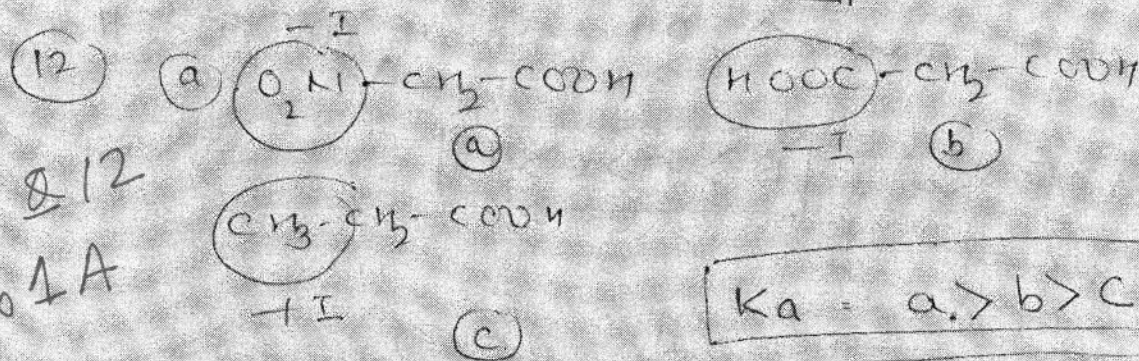


9 (B) CH_3O^- express max^m pH value

Q.9 Ex 4-B

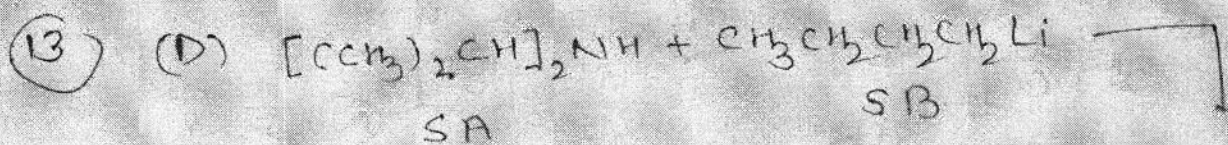


$K_a = b < d < c < a$

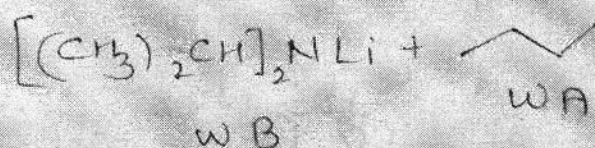


$K_a = a > b > c$

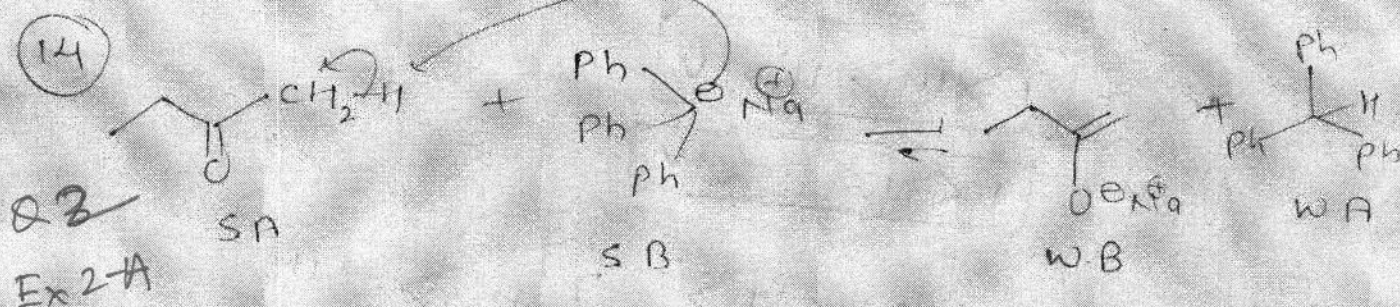
$pK_a = a < b < c$



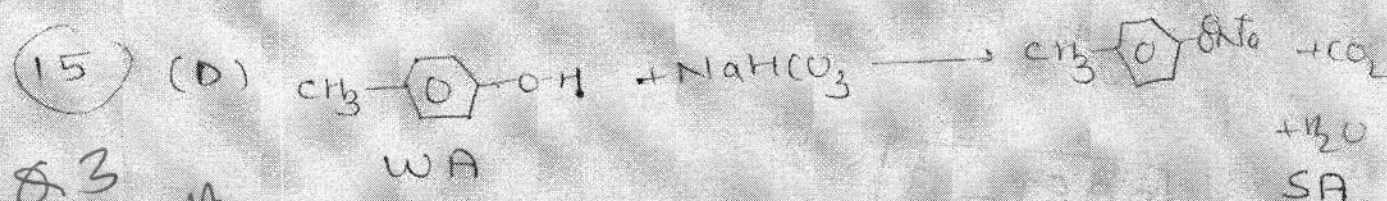
Q1
Ex 2A



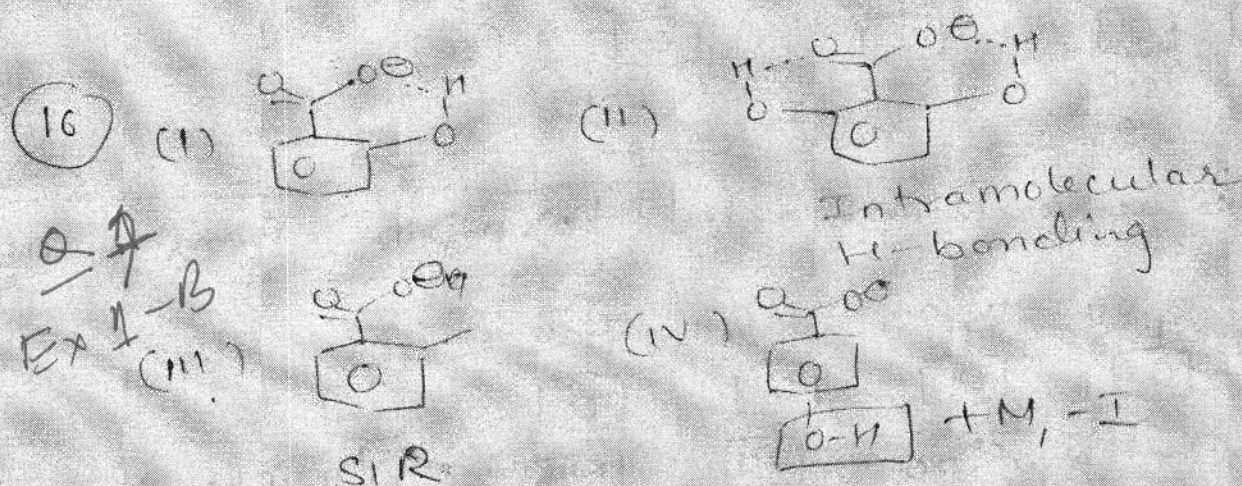
Rxn.
 so, favours to product form?



so Base is $(C_6H_5)_3CNa$



so Rxn. favours to reactant



so acidic strength order $K_a = [II > I > III > IV]$
 $pK_a = [II < I < III < IV]$

17

(I)



Move SIR

(II)



SIR -I

Ex 4-B

(III)



SIR

-M

(IV)



-I

-M, -I

$$K_a = I > III > II > IV$$

$$pK_a = I < III < II < IV$$

18



Q.24

EX 1-B

Electro negativity

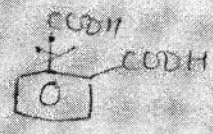
50% s char.

Reso

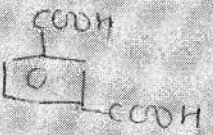
19

PART-B

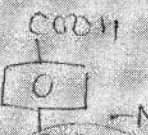
1



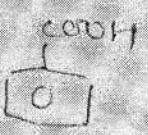
SIR



meta -I



p- -M

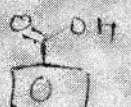


Benzoic acid

so acidic strength order

$$I > p- > m- > \text{Benzoic acid}$$

2



-M, -I



+M, -I



+M, -I

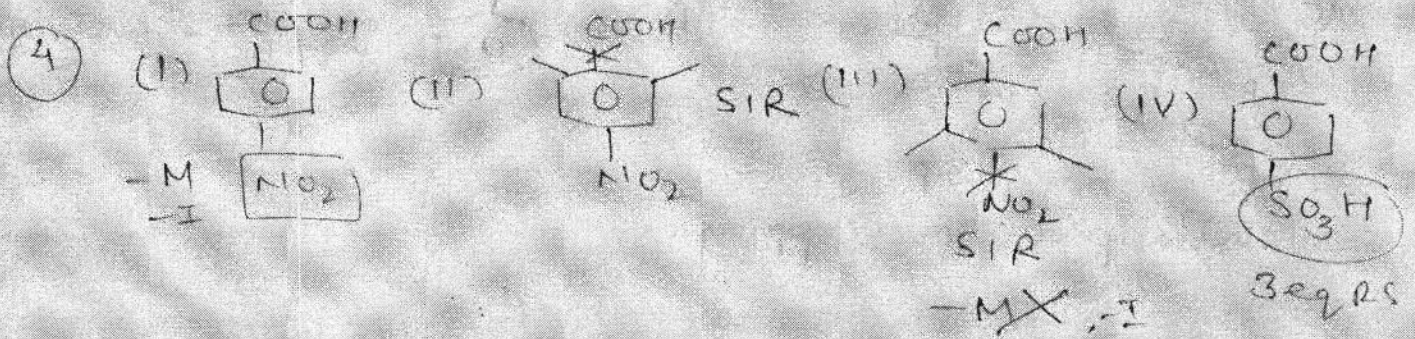
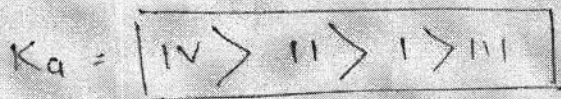
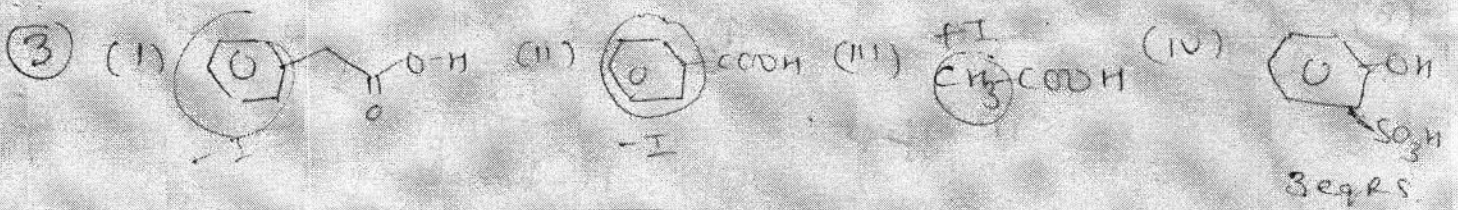


+M, -I

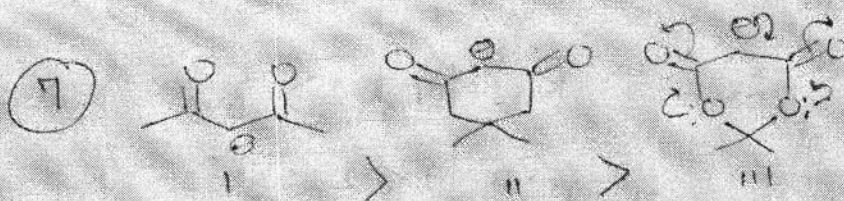
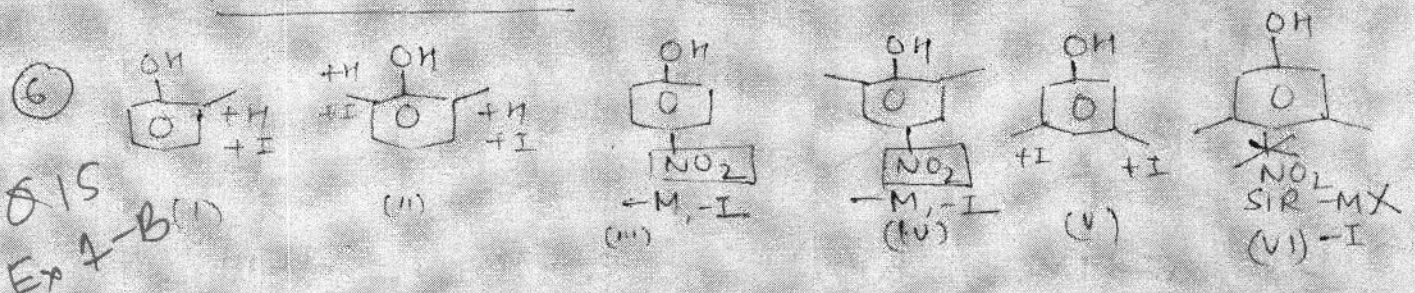
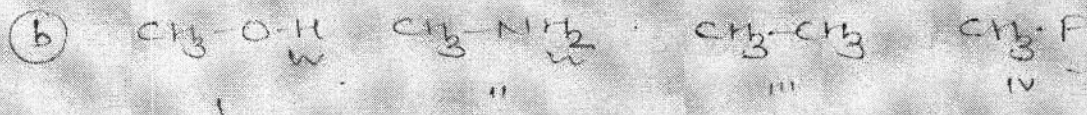
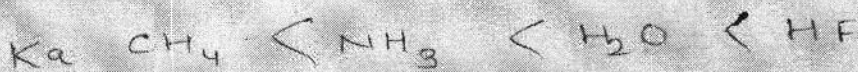


Phenol

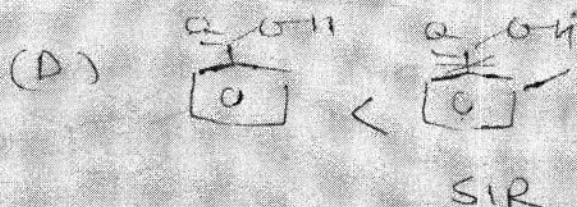
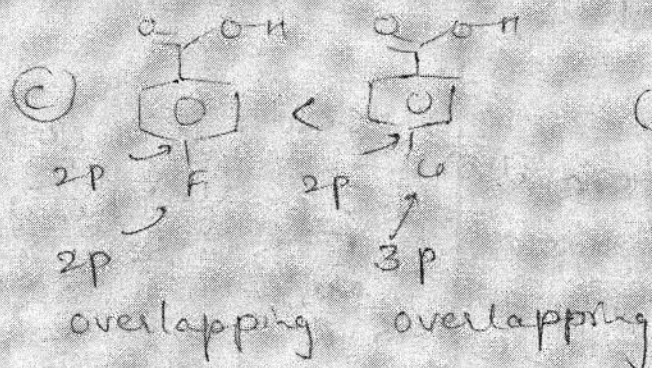
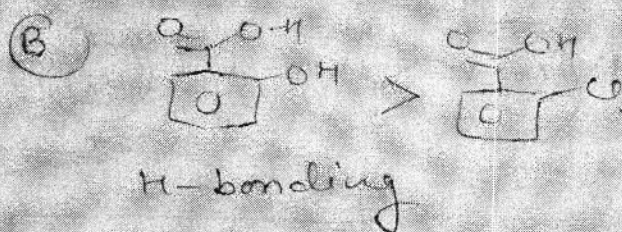
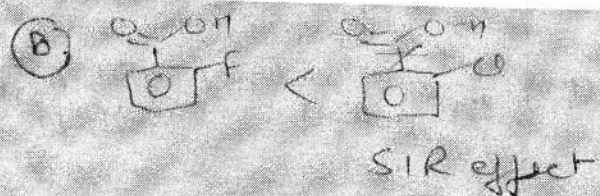
$$K_a = II > I > III > IV > V$$



⑤ (a) In Periodic table $L \rightarrow R$ $E_{\text{M}} \uparrow$ $K_a \uparrow$ res

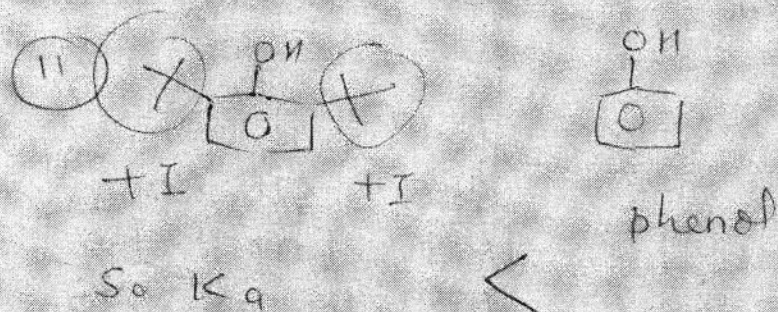


Due to cross conj.
 $K_a \downarrow$ res

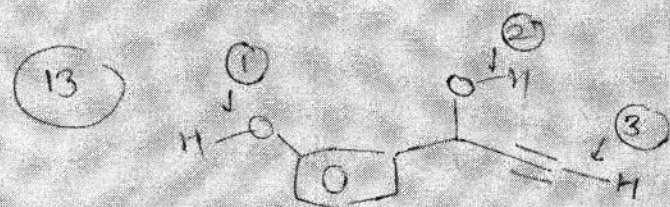


- (9)
 (a) + Due to cross conj
 (b) More H-bonding
 (c) -I of -Cl
 (d) Resonance

(10) Steric hinderance



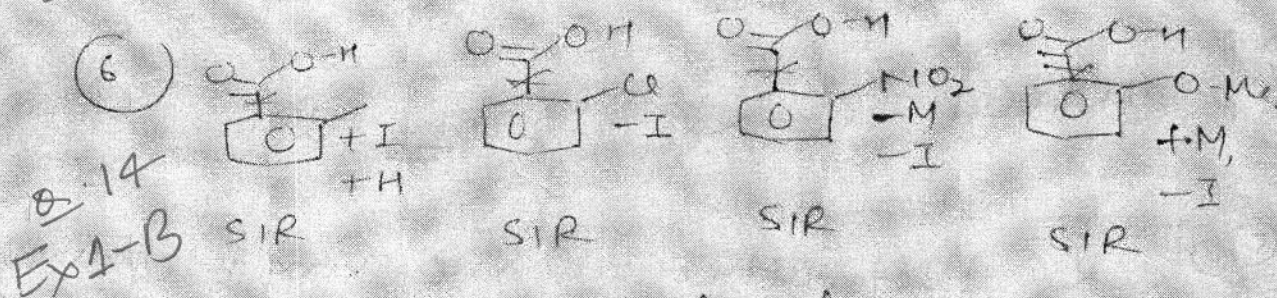
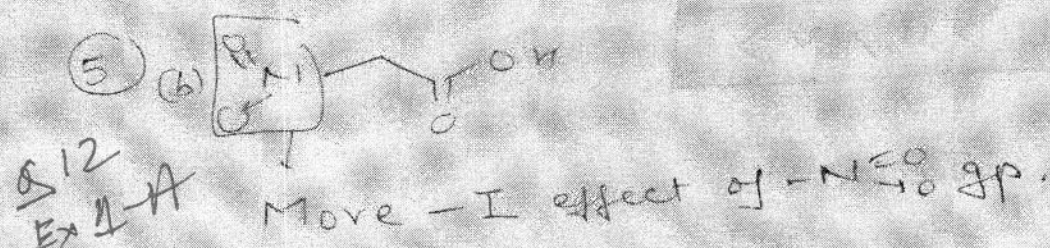
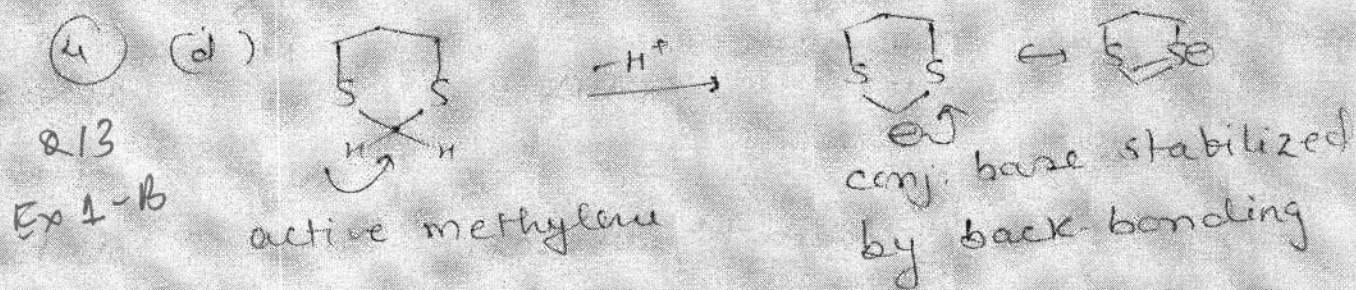
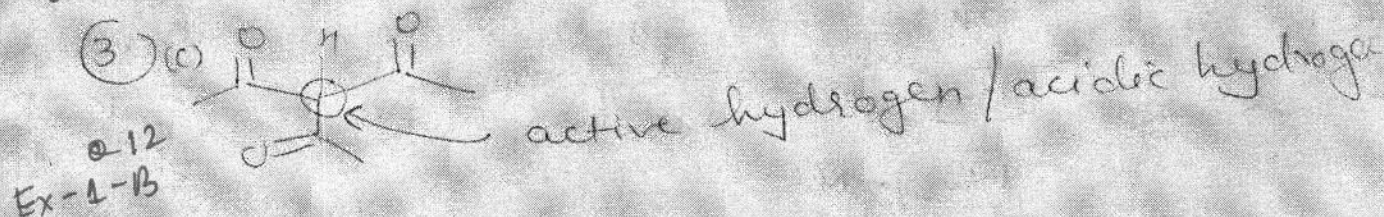
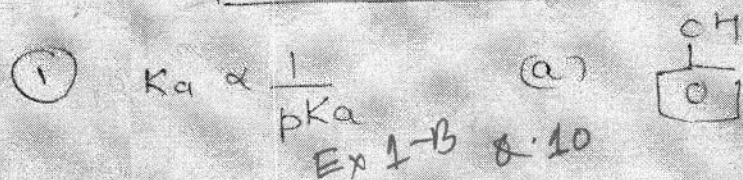
(12) a-IV, b-I, c-II, d-III



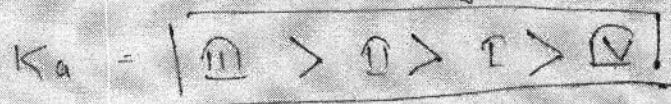
K_a : $1 > 2 > 3$

pK_a : $1 < 2 < 3$

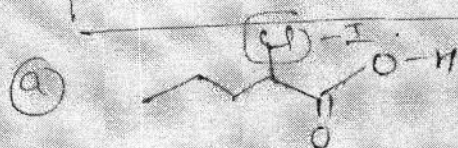
EXERCISE - V



so acidic strength order

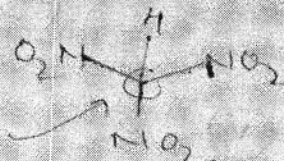
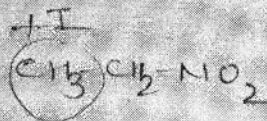


⑦ Inductive effect $\propto \frac{1}{\text{distance}}$



Q9 Ex 4-A

(8)



(1)

active methylene

(2)

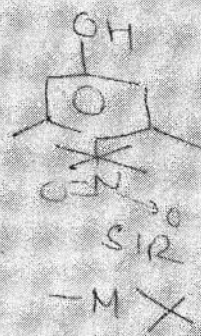
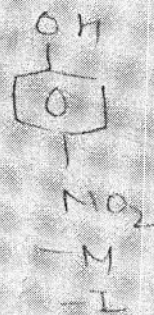
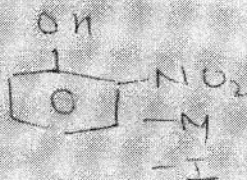
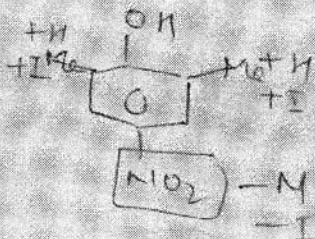
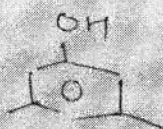
(3)

More active hydrogen

(4)

$$K_a = 4 > 2 > 1 > 3$$

(9)



Q15 Ex 4B

(i)

(ii)

(iii)

(iv)

(v)

So acidic strength order is

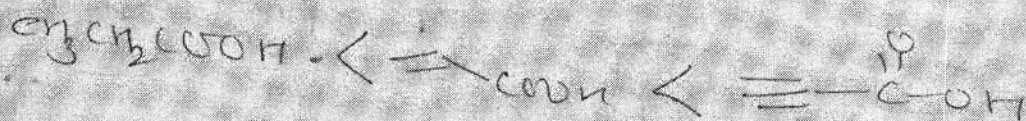
$$iv > iii > ii > v > i$$

(10)

$$K_a \propto -I \propto \frac{1}{+I}$$

Q10 Ex 4-A

(b)



stability of anion & strong w/-thdrawing gp.

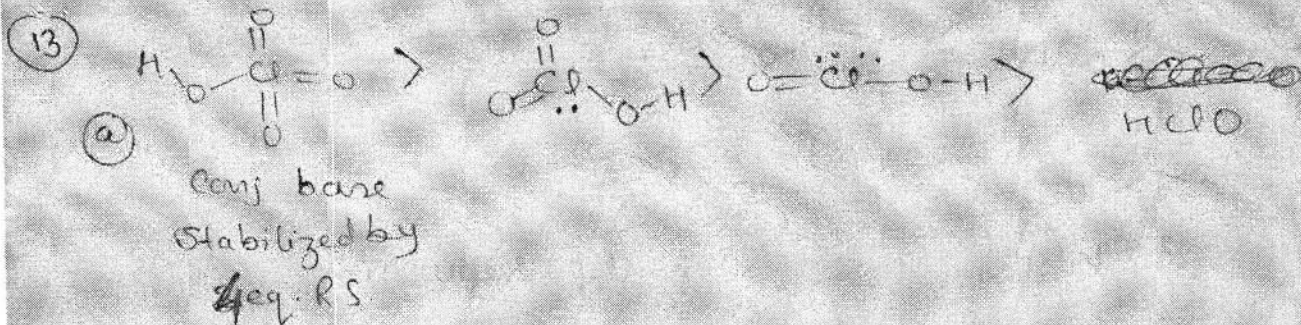
Q16 Ex 4-B

(12)

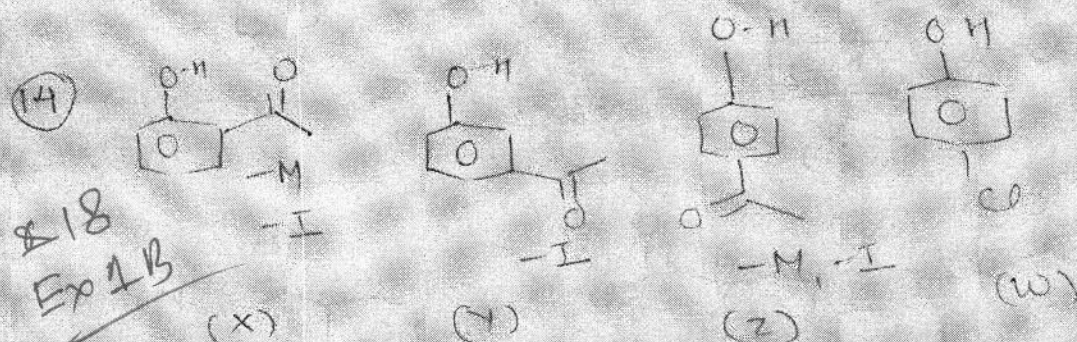
pH ↑, K_a ↓, K_b ↑

So ans is (b)

Q17 Ex 4-B

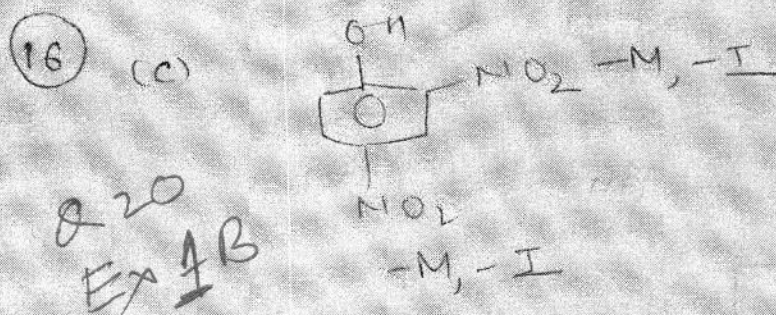
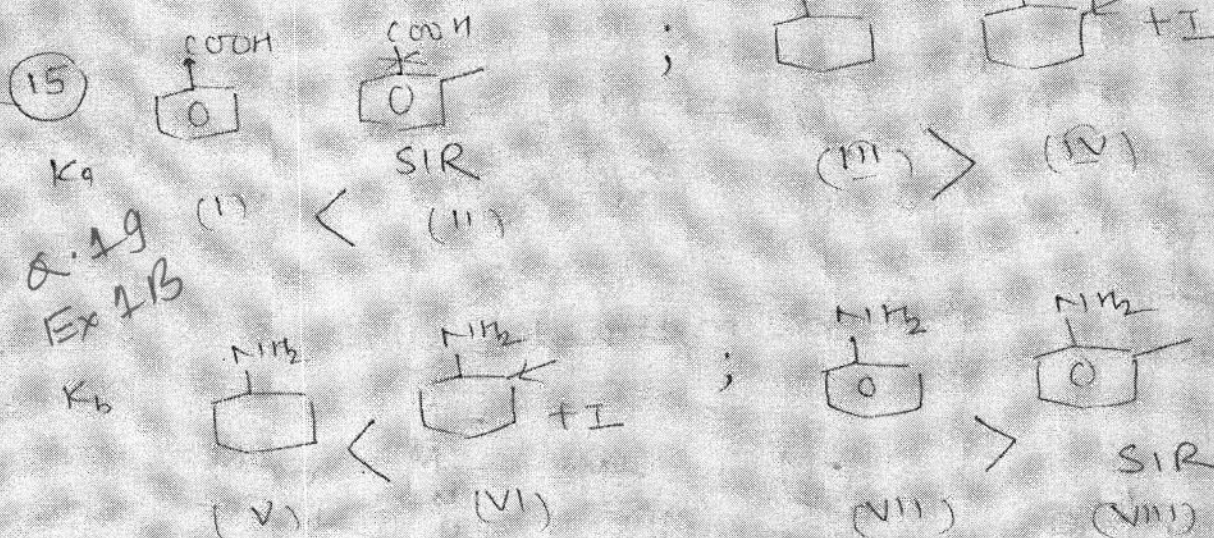


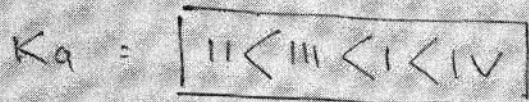
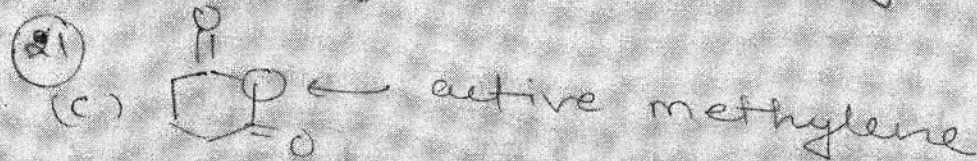
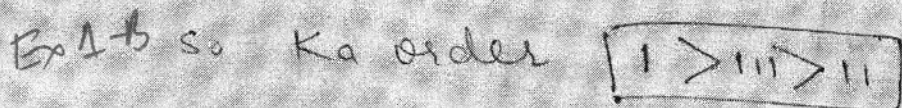
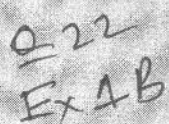
(c) size $\text{Cl} < \text{Br} < \text{I}$



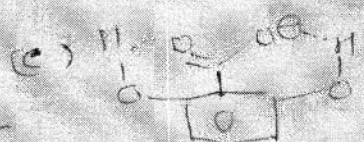
so acid strength order is

$$K_a = \boxed{x > z > y > w}$$





Q3



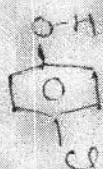
Q27

Ex 1-B

due to intramolecular H-bonding

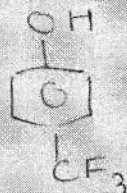
Q24

I.



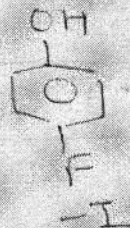
back bonding

II.



-H, -I

III.



-I

Q28

Ex 1-B

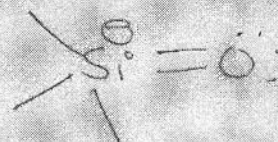
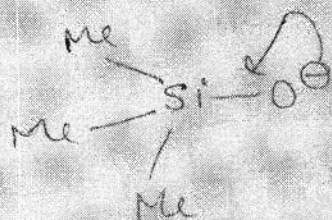
So Ka order :



(25) (b) Stabilized due to back bonding

Q29

Ex 1-B

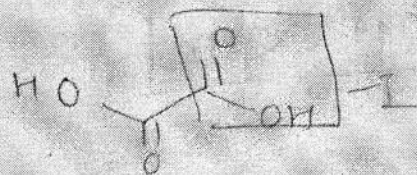


(26)

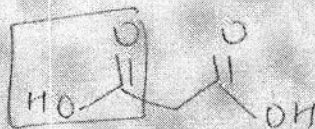
I.



II.

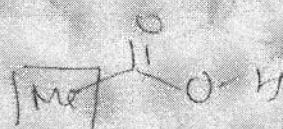


III.



-I

IV.



+I

Q21

Ex 1-A

So acidic strength order

