

General Organic Chemistry

EXERCISE - 1

- ①
- ① a e^- nuclei attraction \uparrow ses due to Resonance
 - ② b $e^- - e^-$ repulsion \downarrow ses
 - ③ d 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
- ④ d
- ⑤ c
- ⑥ a & d only
- ⑦ a, b, d, & g only
- ⑧ a, c & d

9 C1=CC=CC=C1, c1ccc(cc1)-c1ccccc1 & H-C(=O)-Cl are coplanar

10 H-C(=O)-O-CH3, H-C(=O)-O-CH3, O=C1CCCC1=O in these all atoms are not coplanar

11 [O-]C(=O)[O-], [NH3+] these group cannot participate in resonance

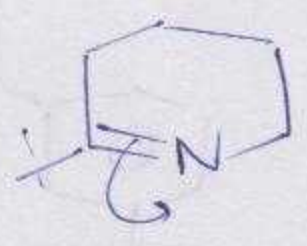
12 H2C=O+, c1ccccc1-CH=CH-, O=BH2, [P+](c1ccccc1)(c1ccccc1)c1ccccc1 can participate in resonance with other suitable gp.

13 C1=CN=C1, C1=CN=C1, H2C=CH-CH2- lone pair involved in resonance

14 C=C=O:, C=C#N:, C1=CC=CC=C1 l.p. of that atoms not involved in resonance.

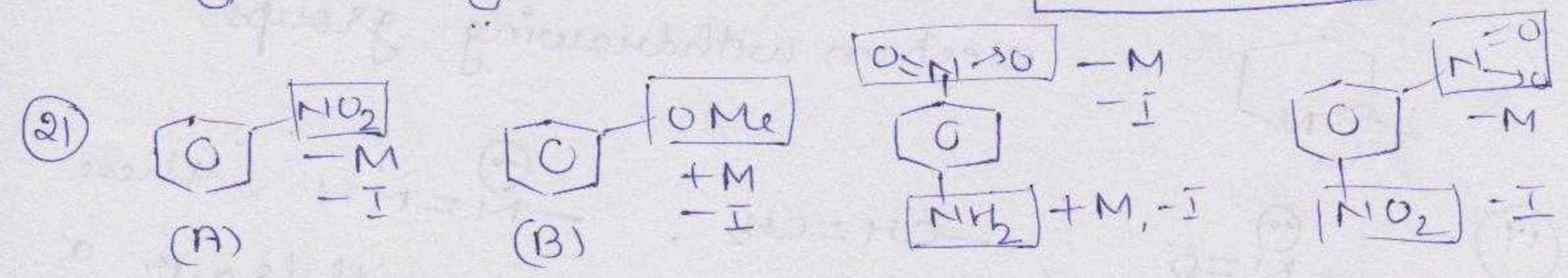
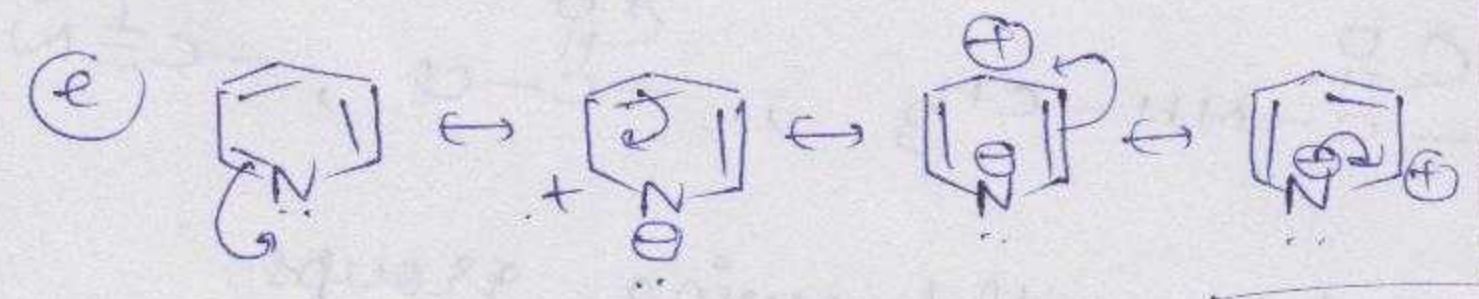
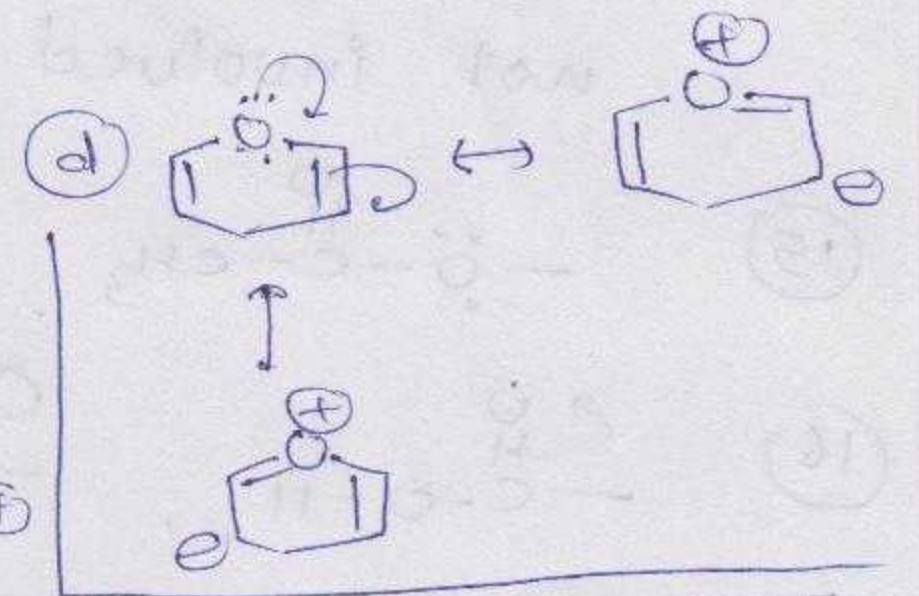
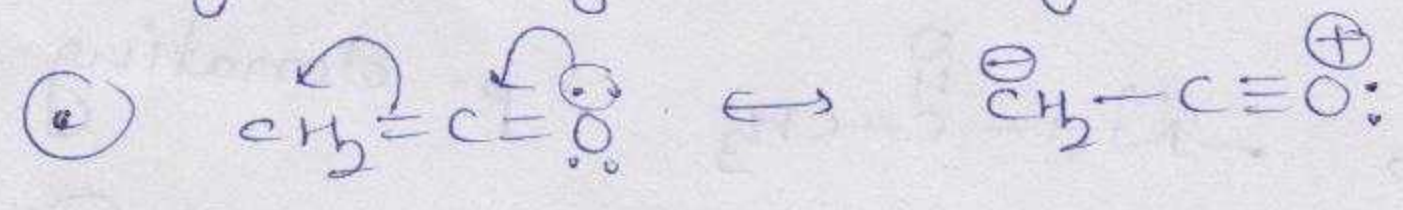
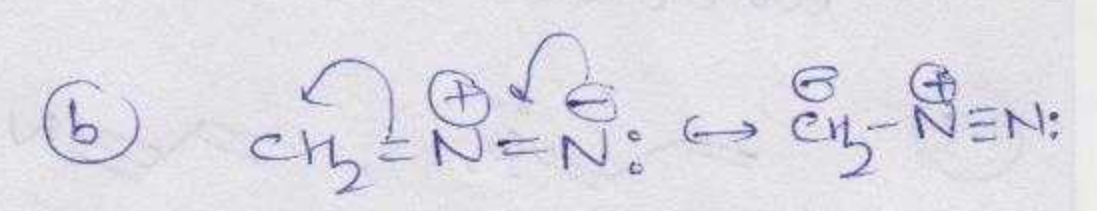
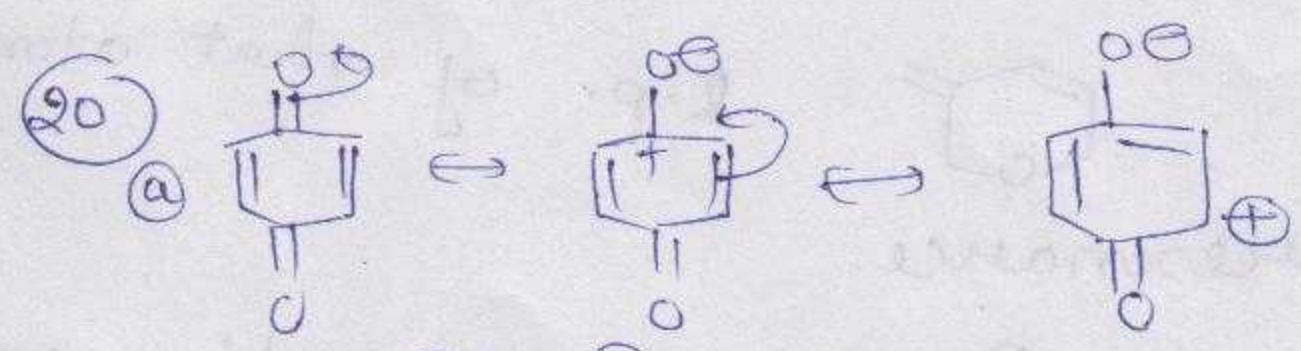
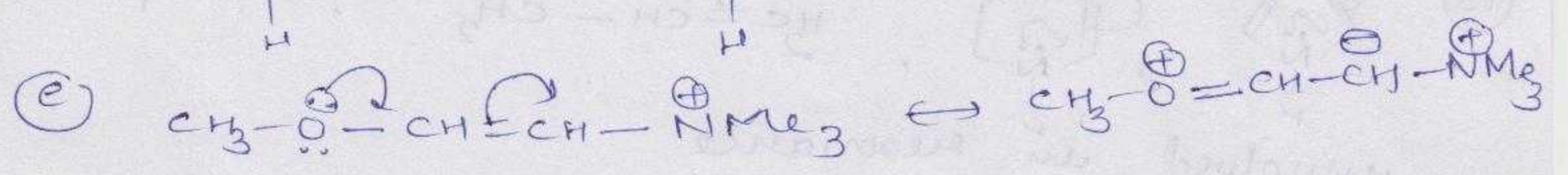
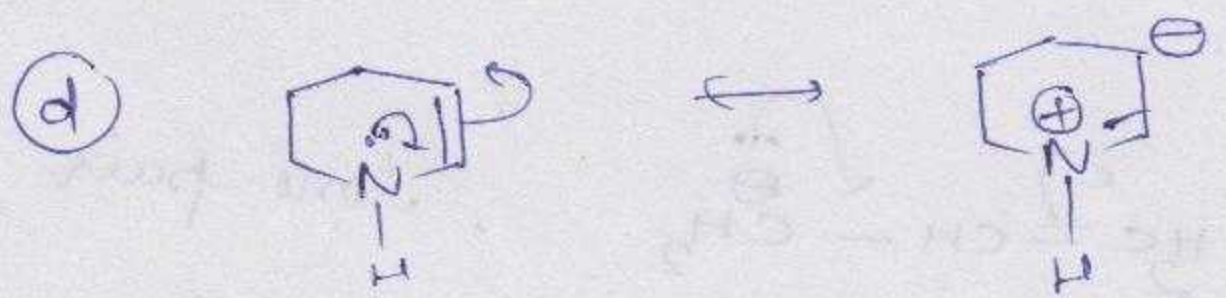
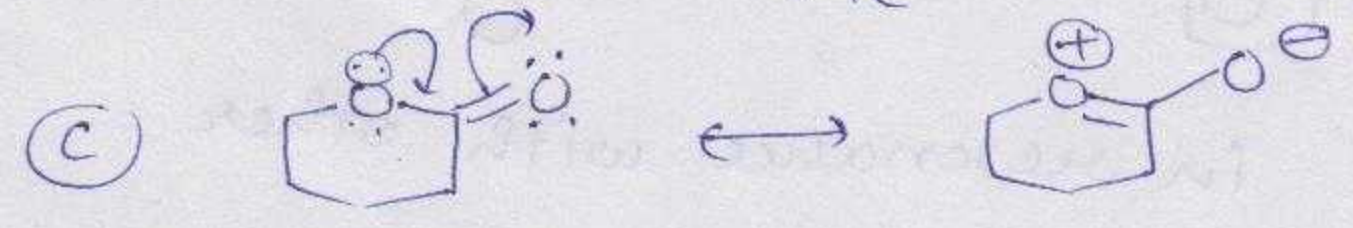
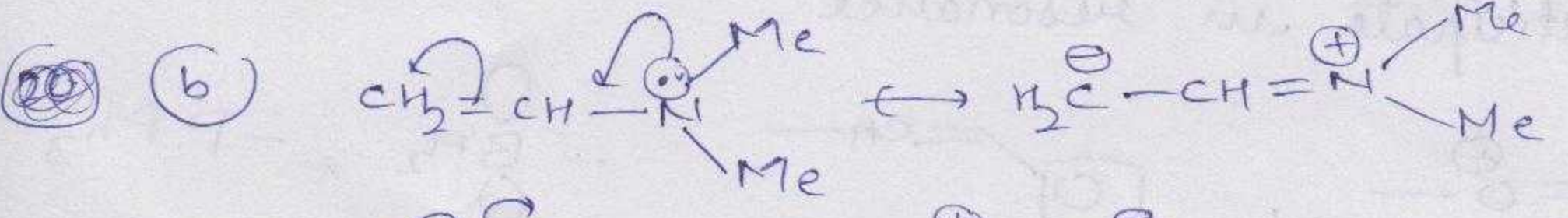
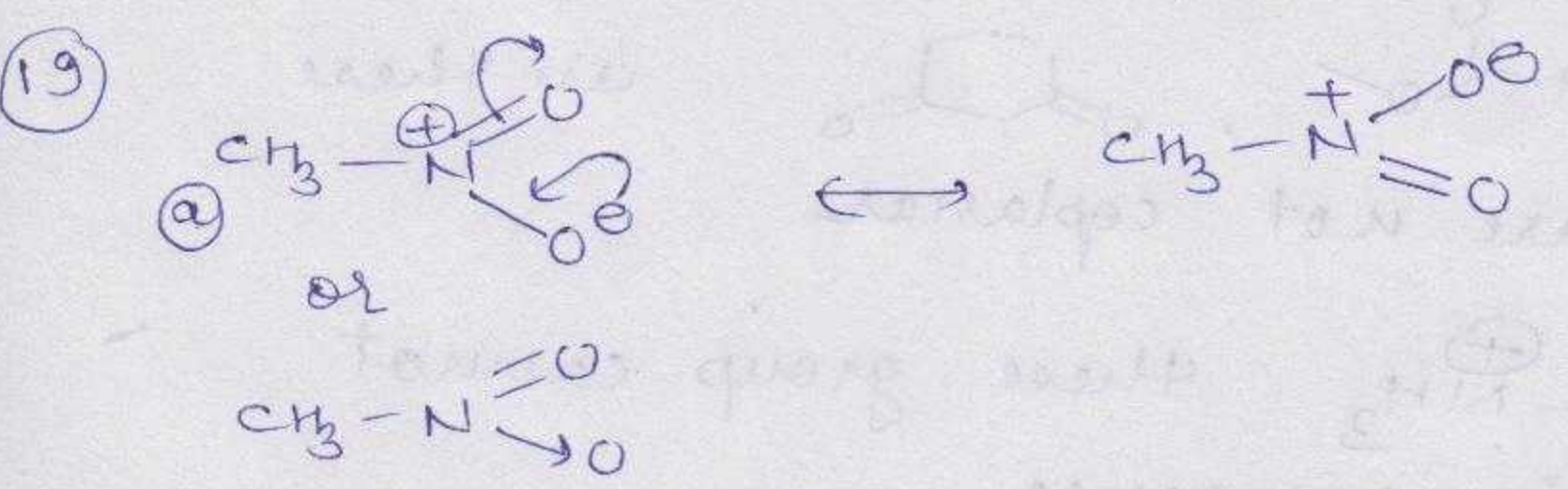
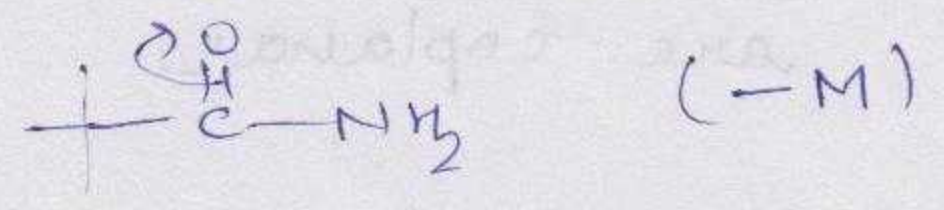
15 -O-C(=O)-CH3, -NH-C(=O)-CH3 l.p. donating gp.

16 -C(=O)-OH, -C(=O)-NH-CH3, -C(=O)-Cl, -C#N: electron withdrawing groups.

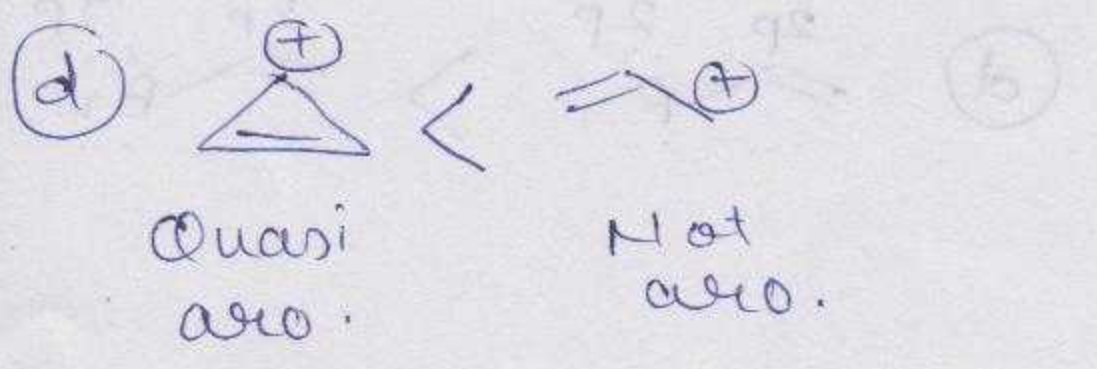
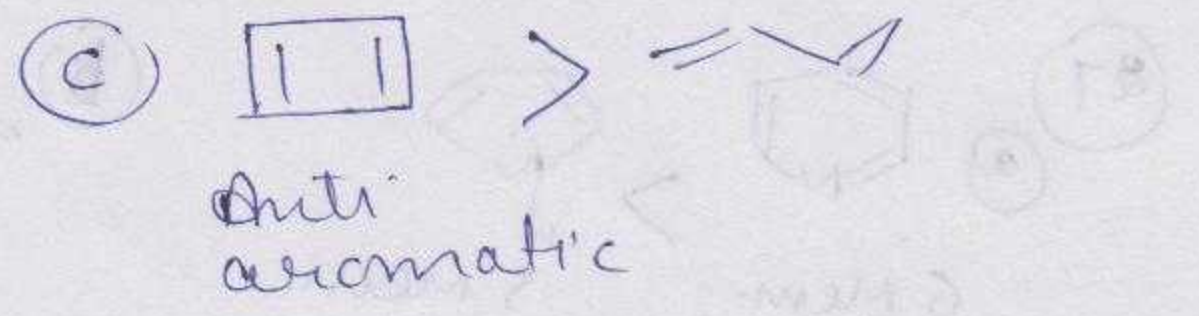
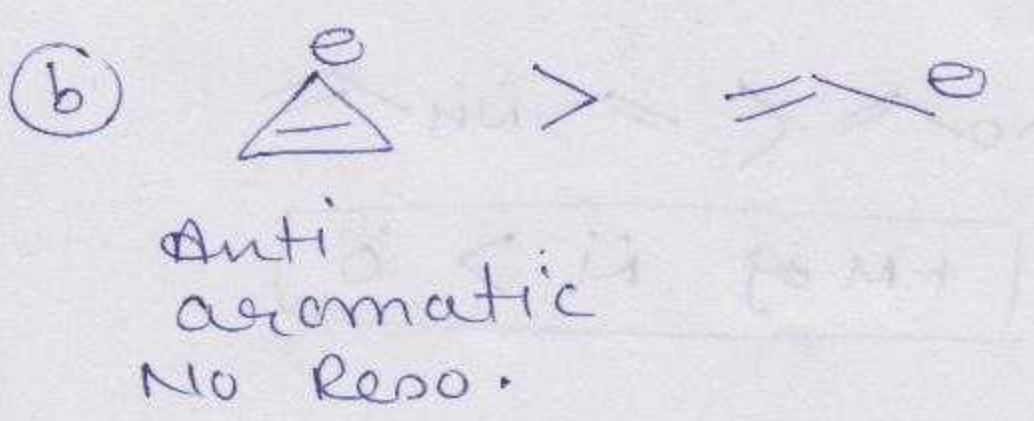
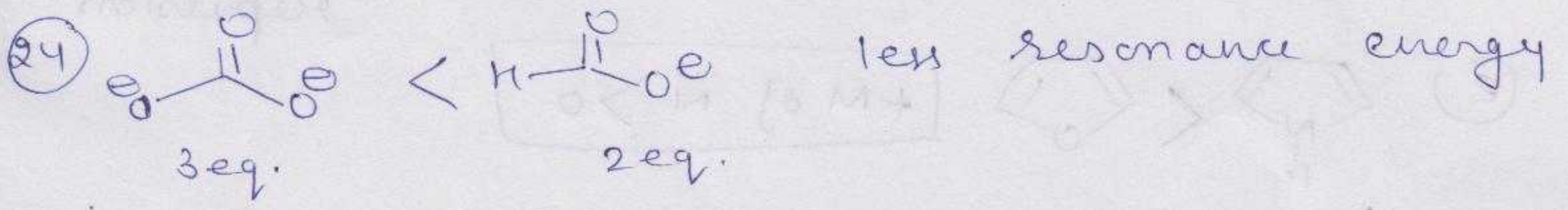
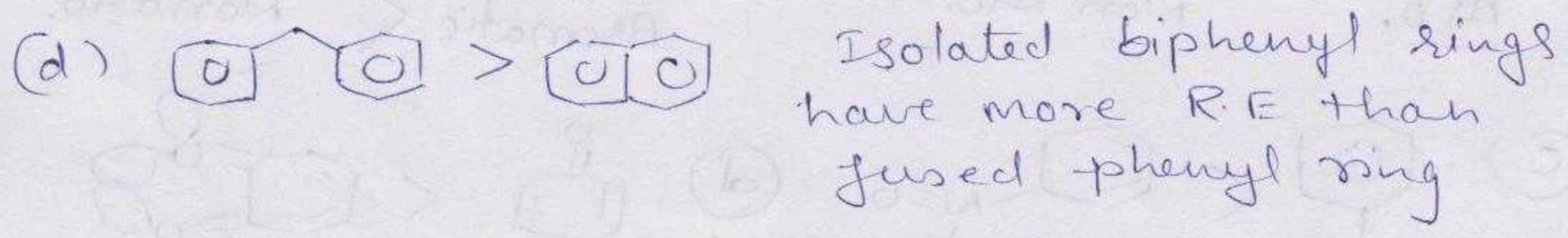
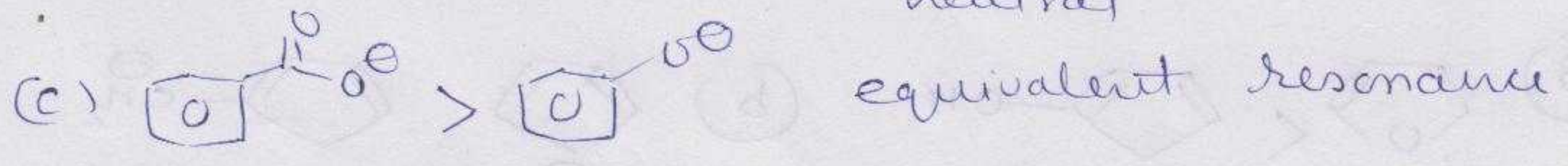
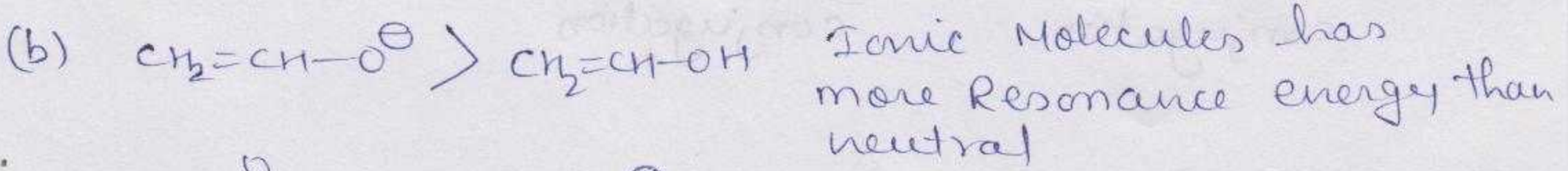
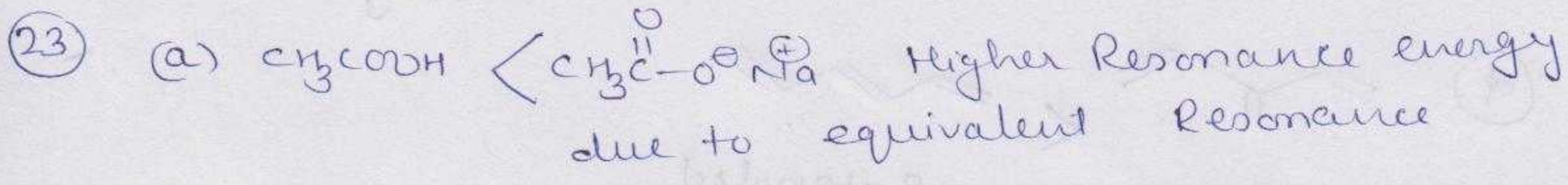
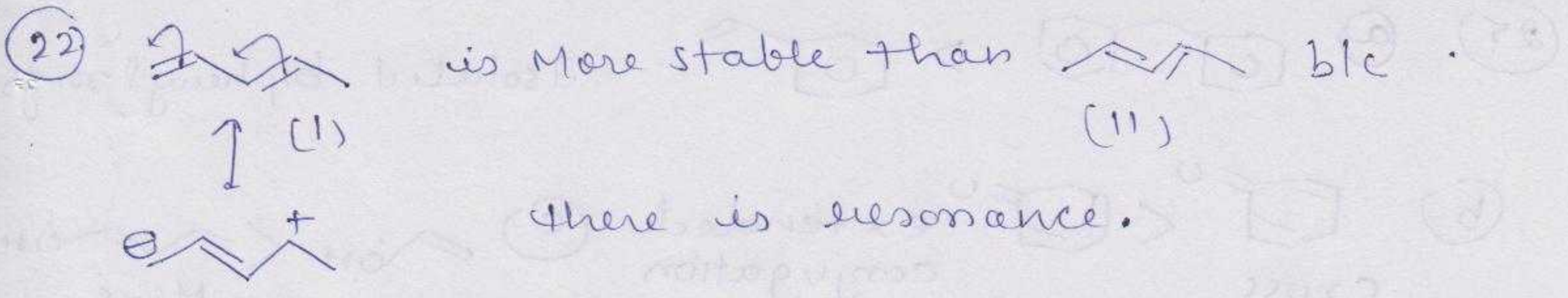


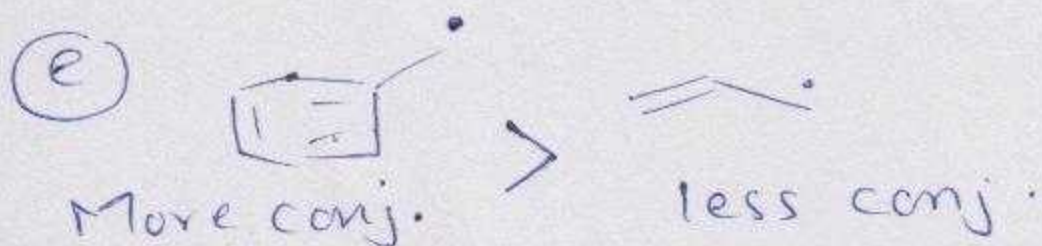
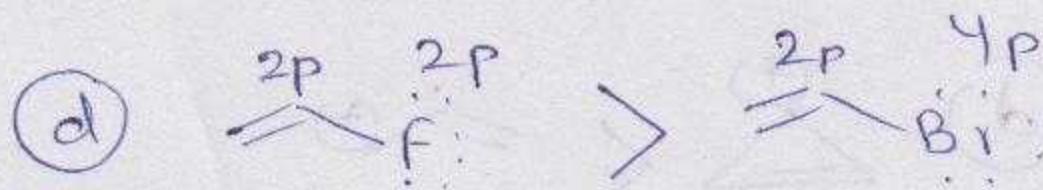
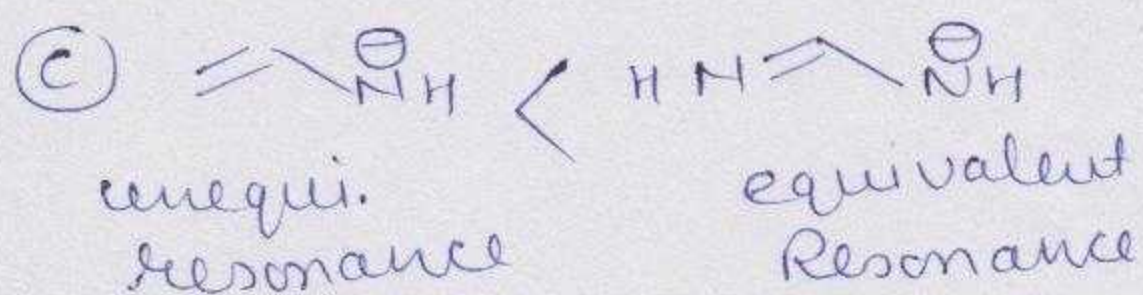
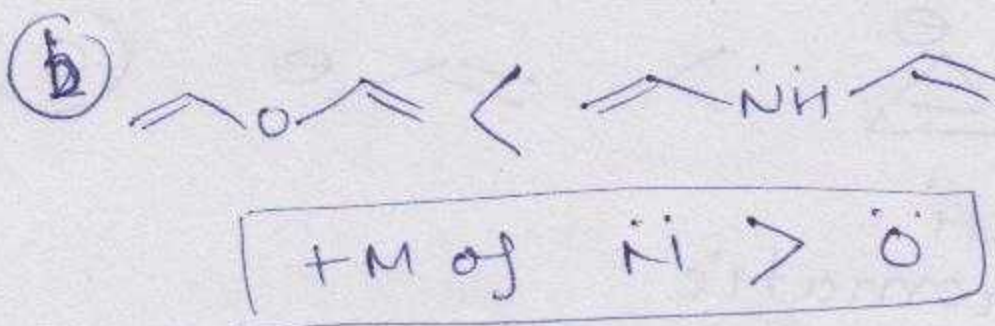
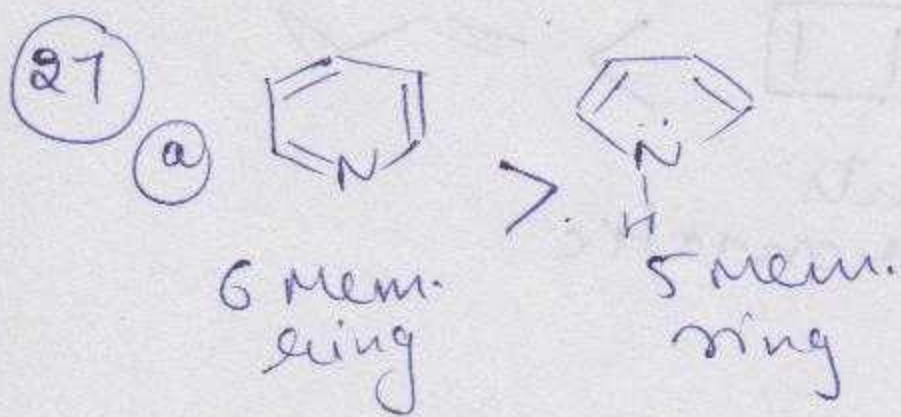
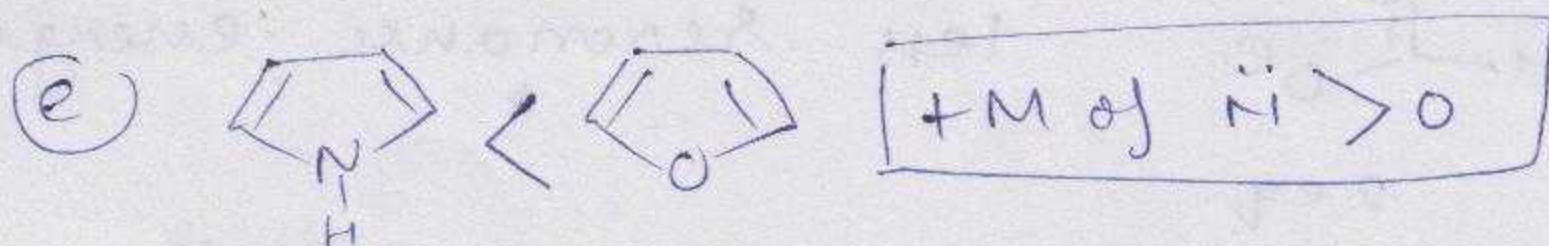
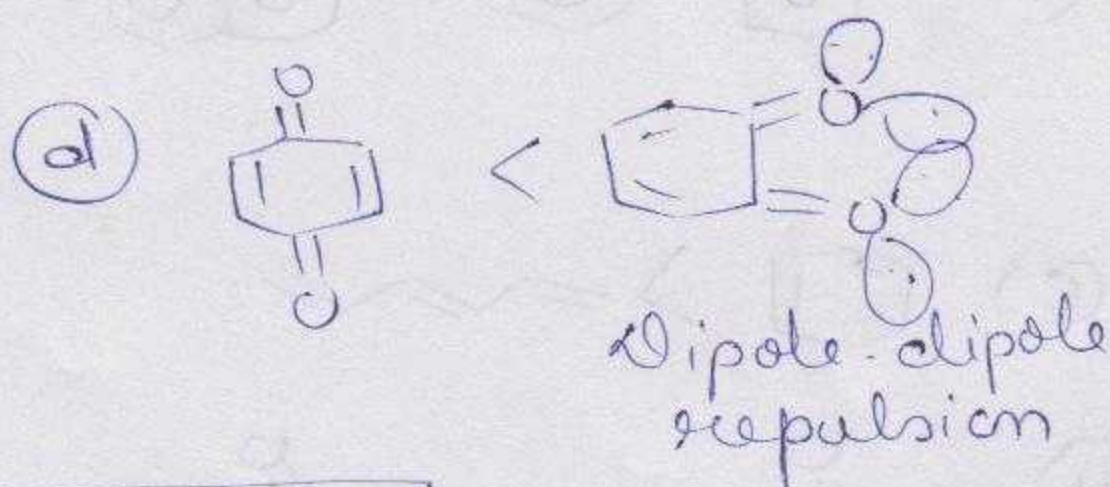
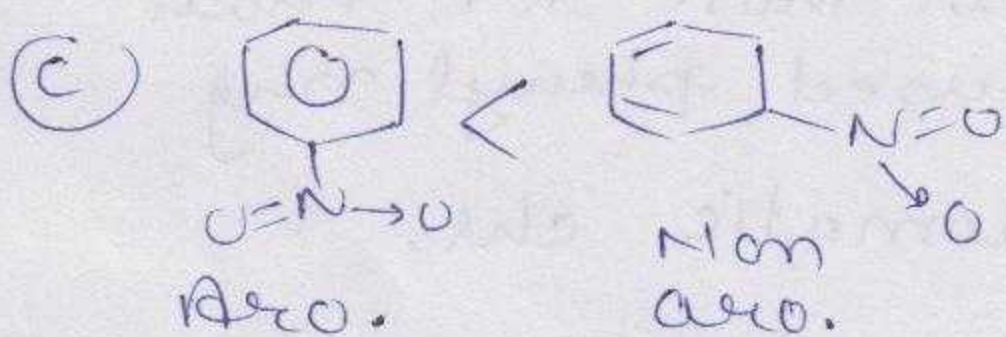
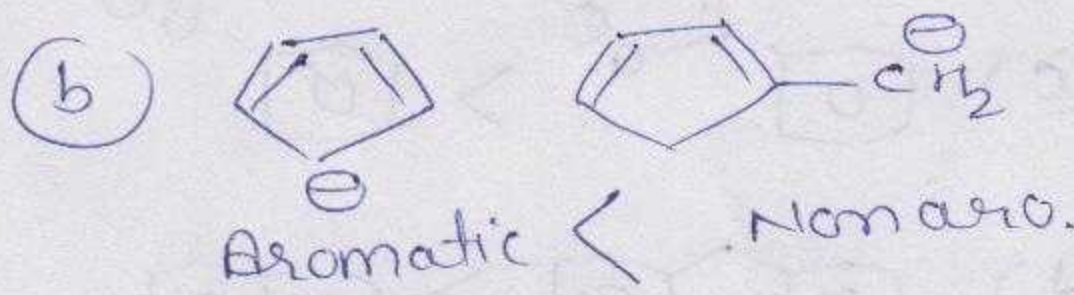
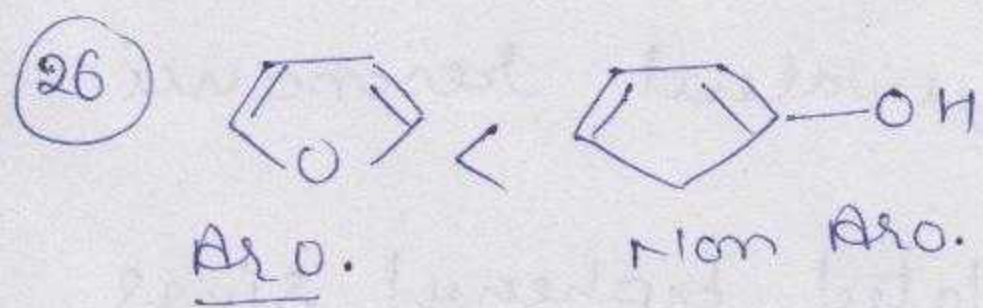
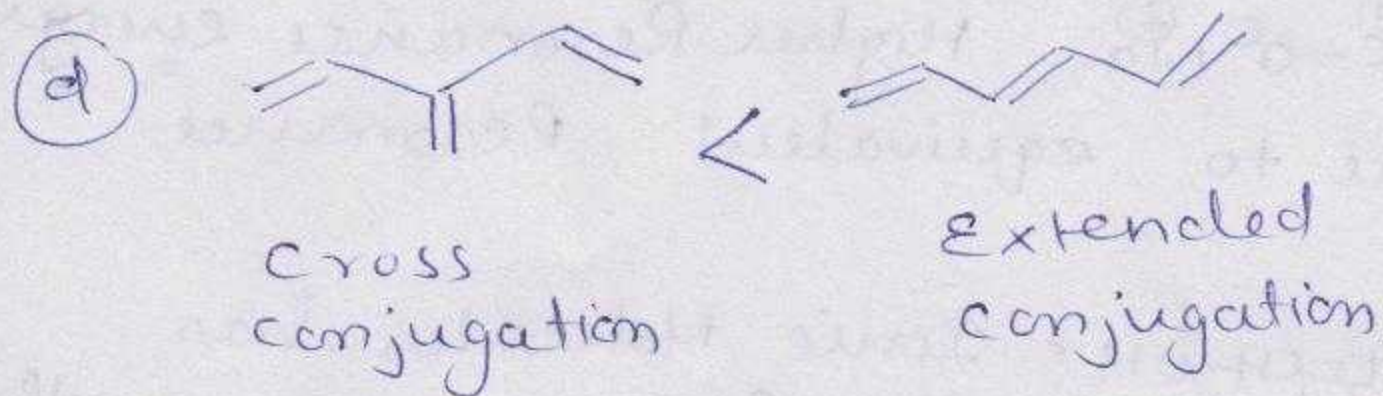
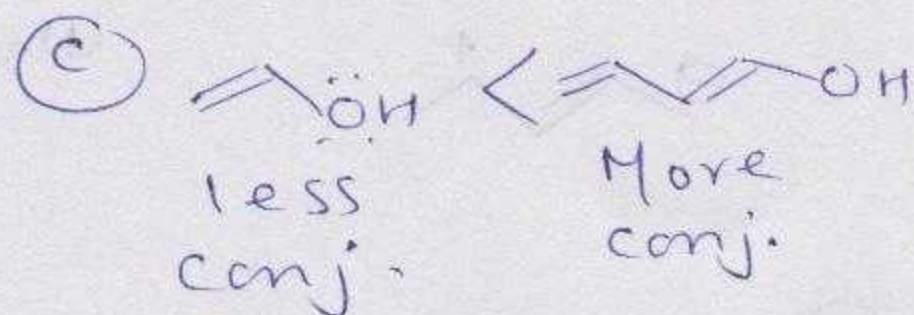
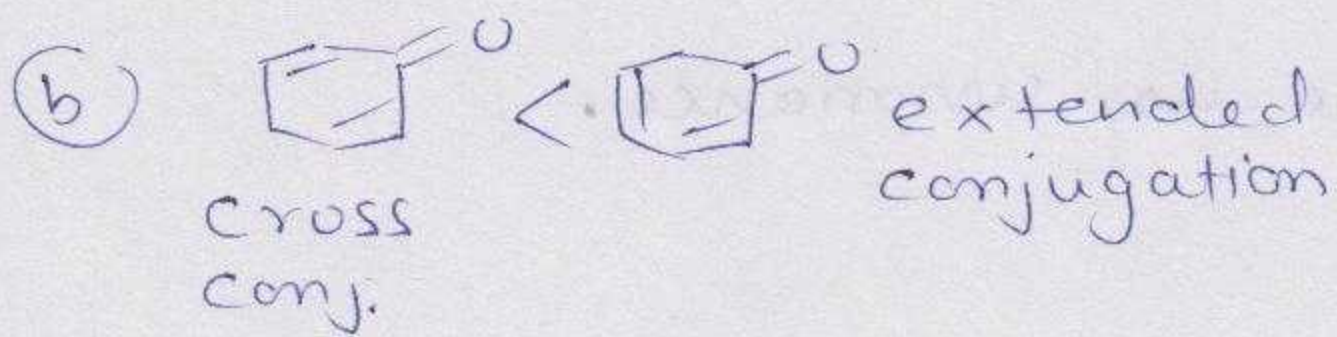
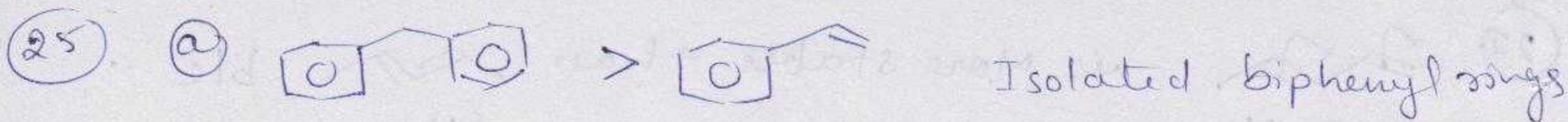
17 -N=O:, -CH=CH2, -N=NH these group can either donate or withdraw a pair of e^- in resonance depending upon situation.

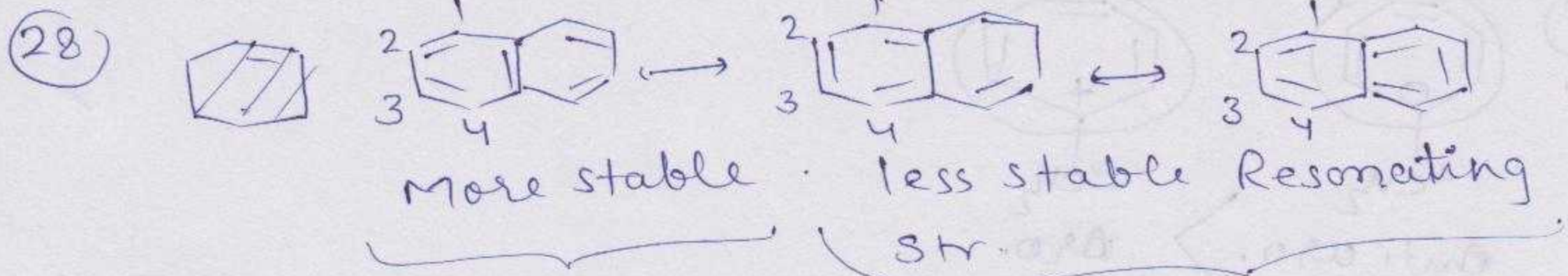
(18) only withdraw a pair of e^-



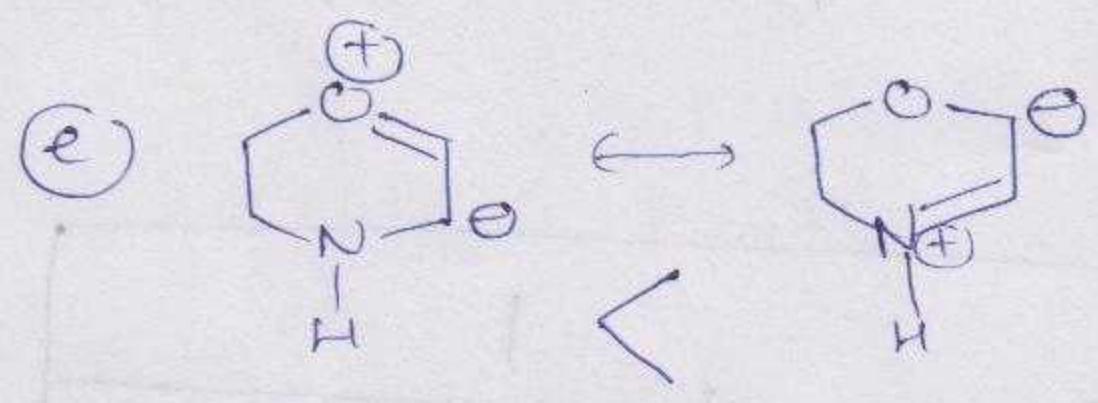
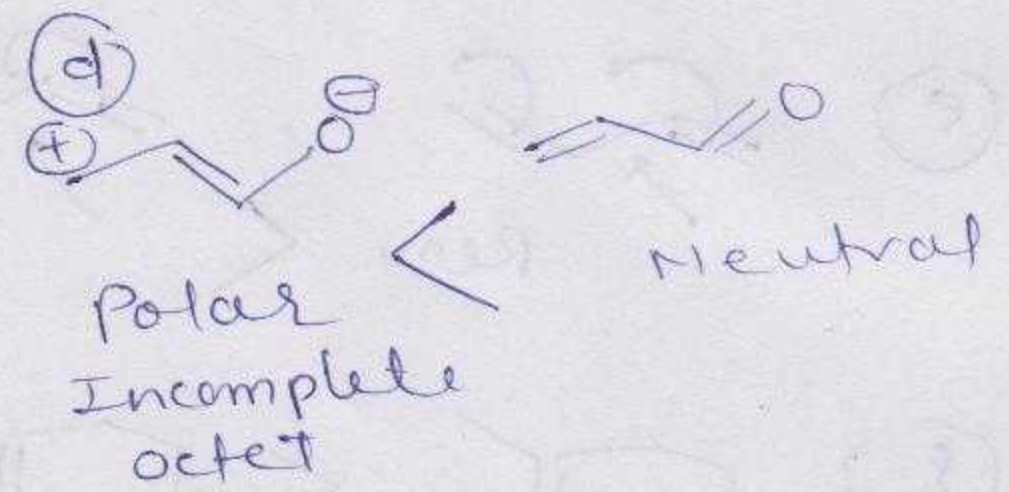
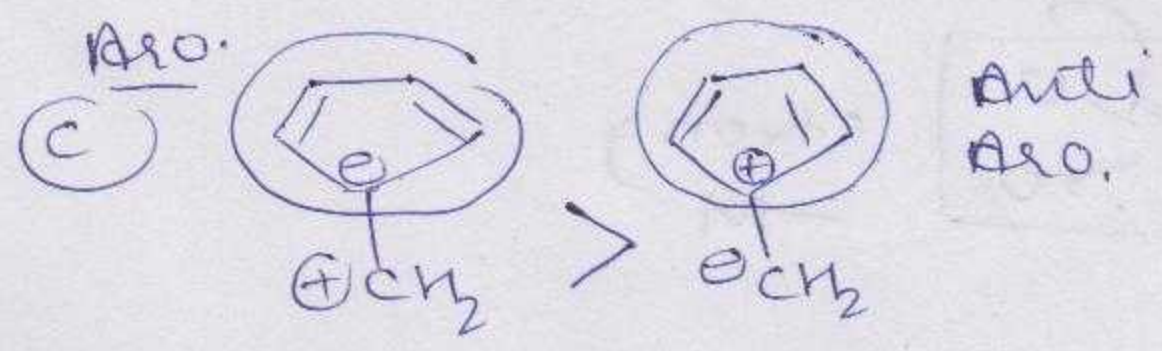
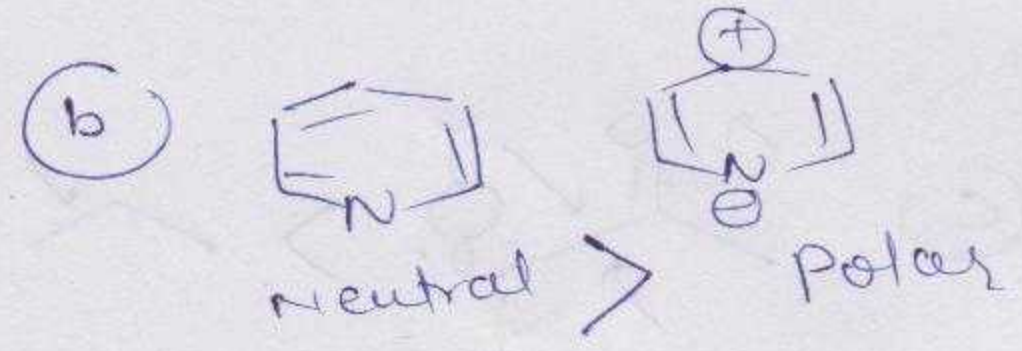
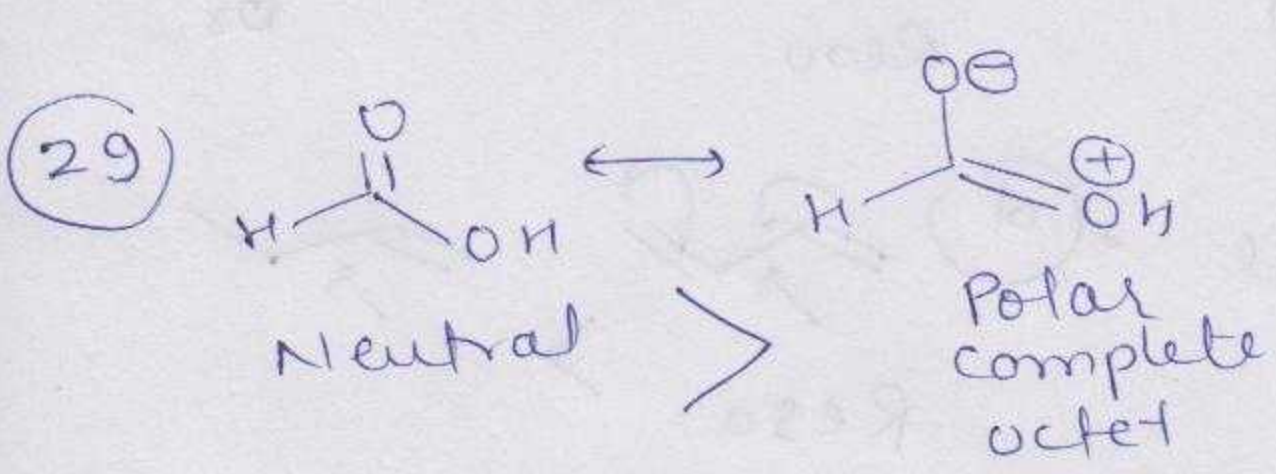
πe^- density in the ring $B > C > A > D$



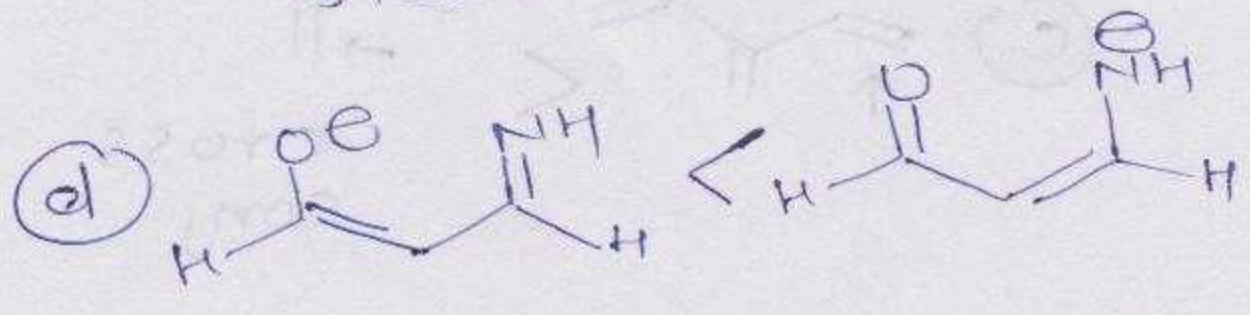
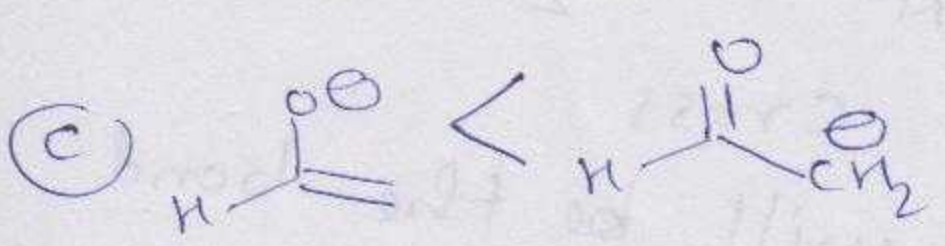
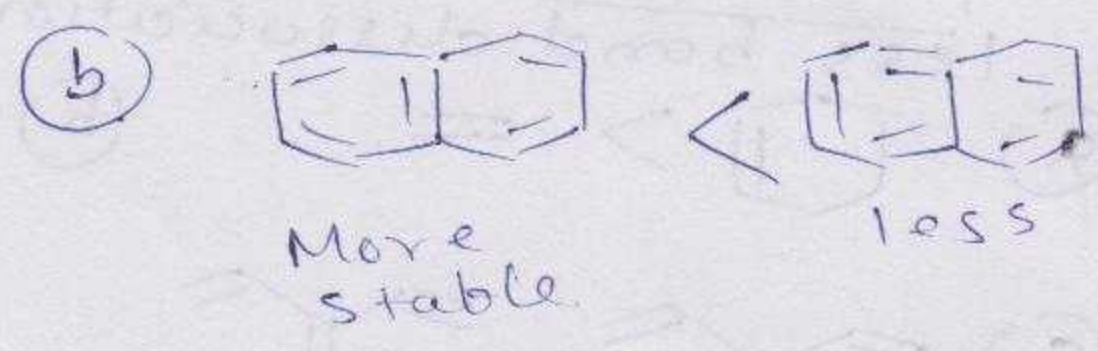
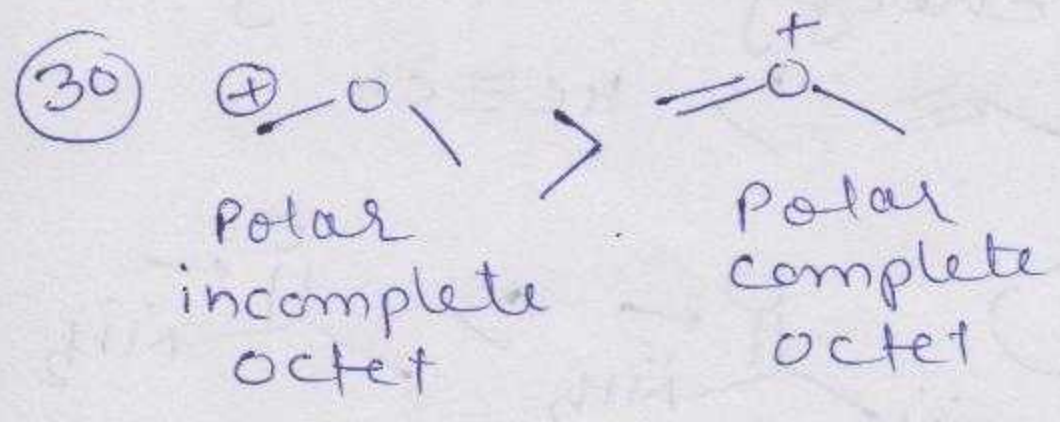




so 1-2 & 3-4 bond is shorter than 2-3 bond

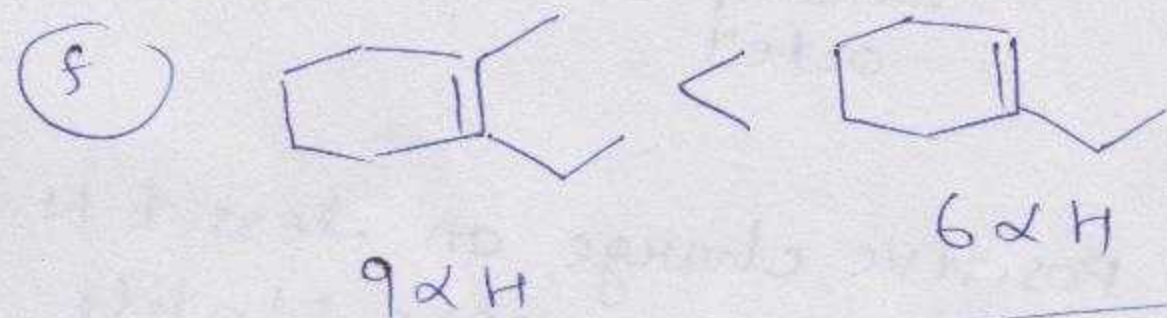
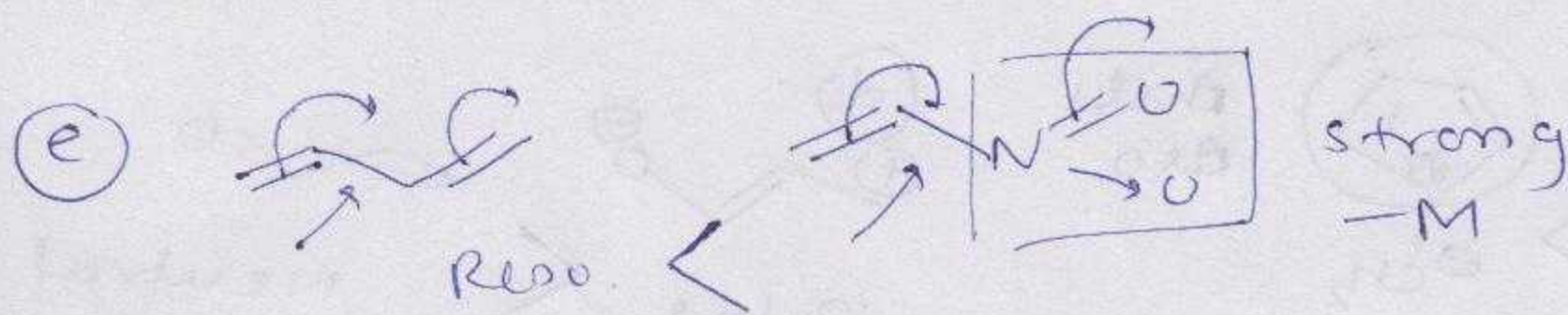
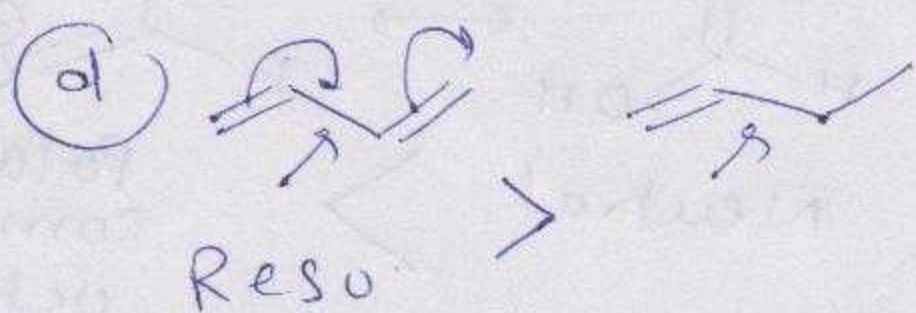
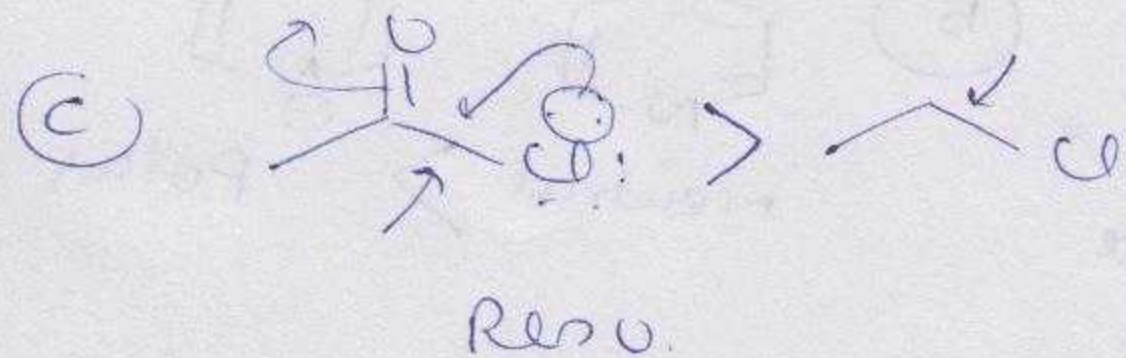
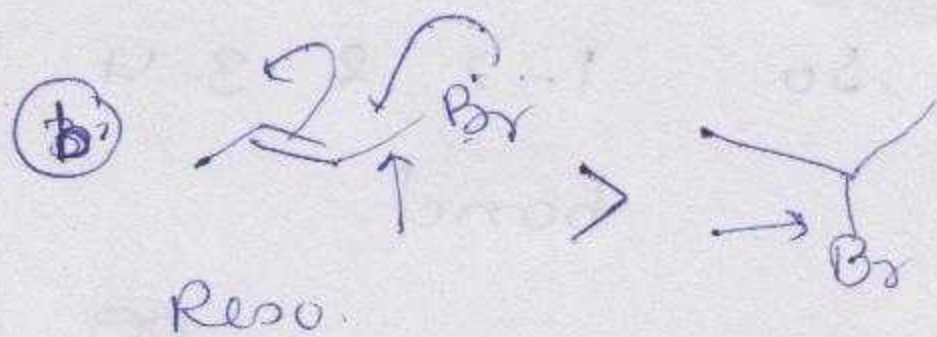
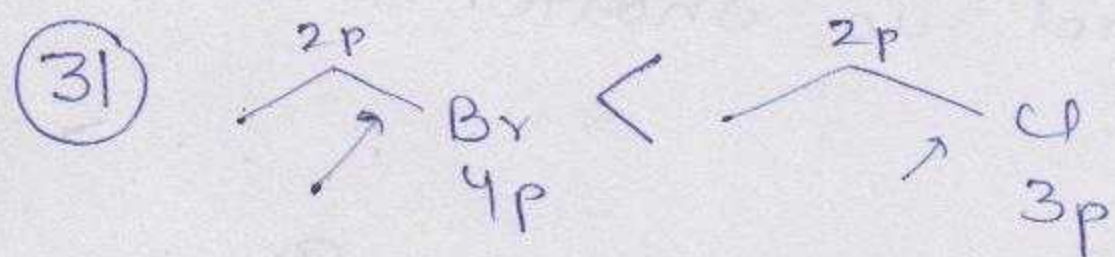
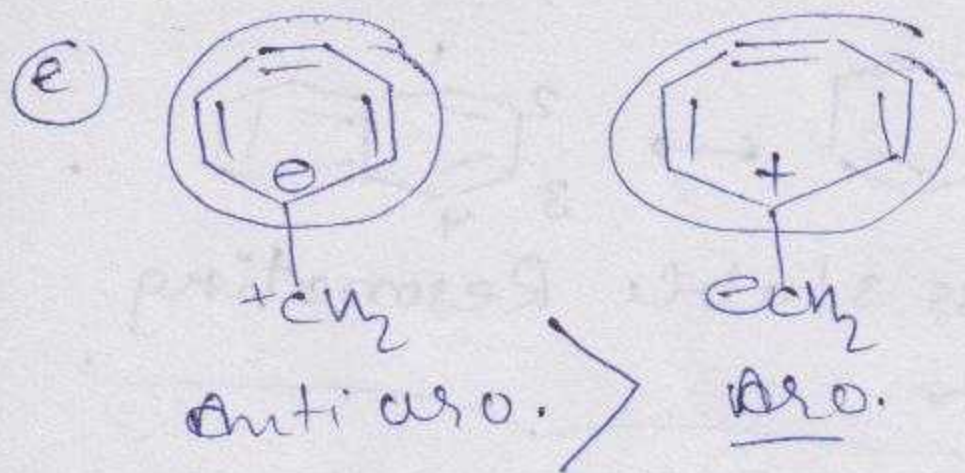


Positive charge on less E.N. element is more stable



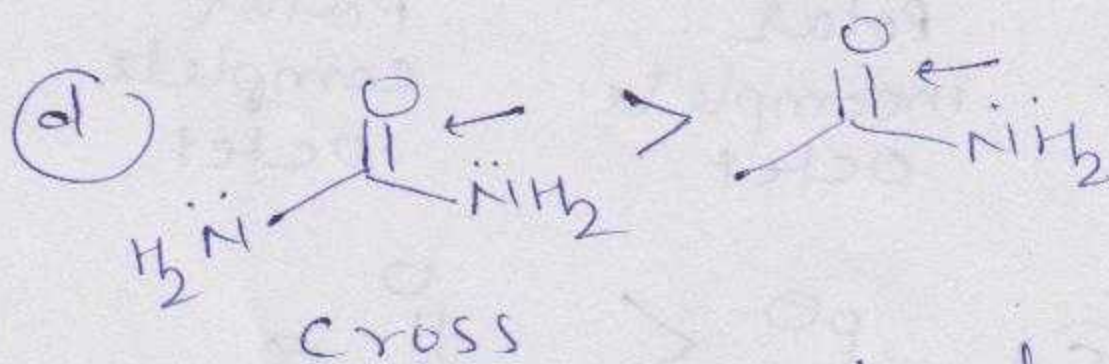
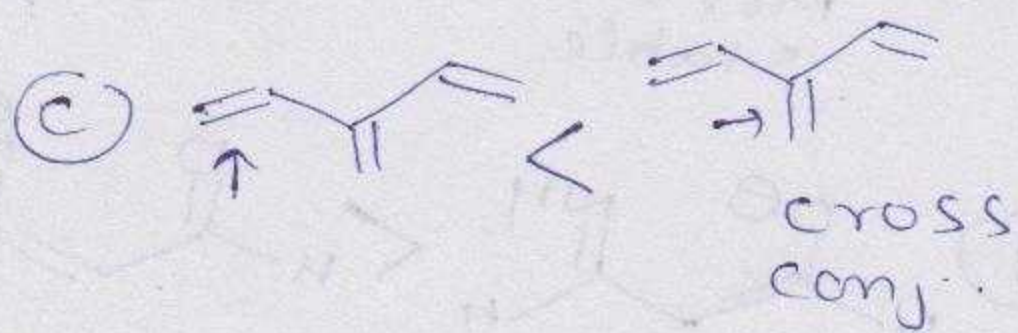
Negative charge on More EN element is More stable
 st. O- > C+

same as c
 st. O- > N+

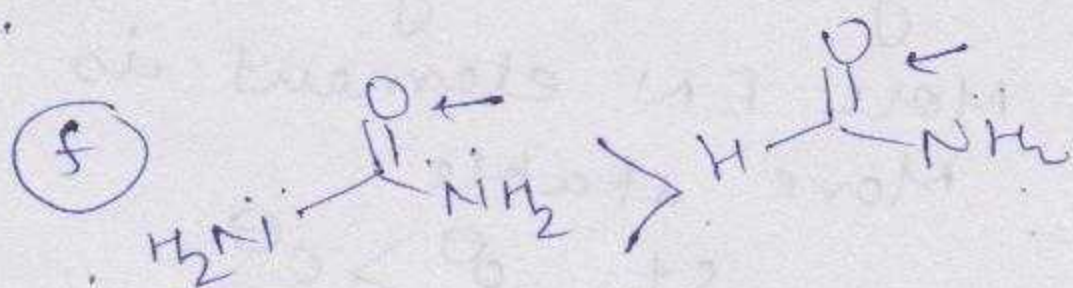
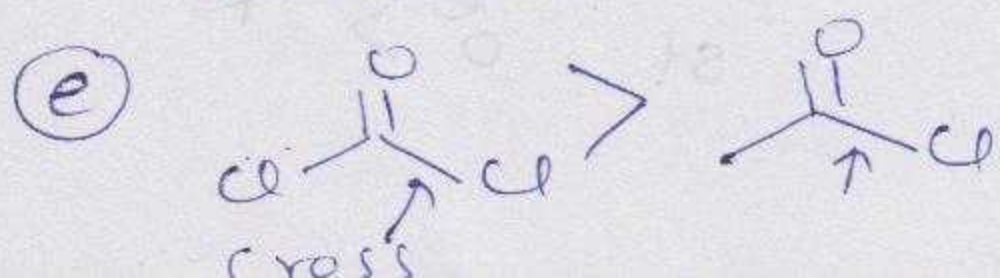


32) Bond dissociation Energy $\propto \frac{1}{\text{Stability}}$

less bond dissociation energy \propto stability

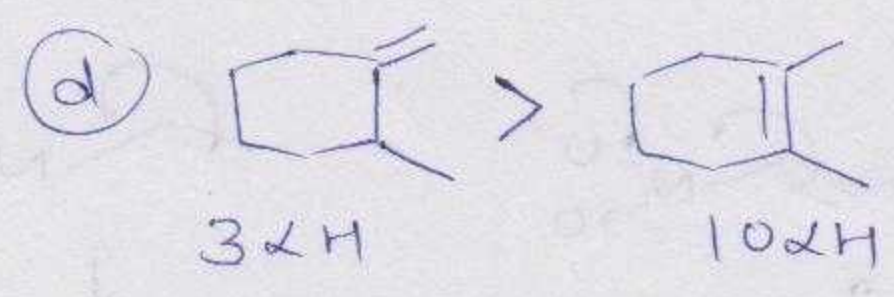
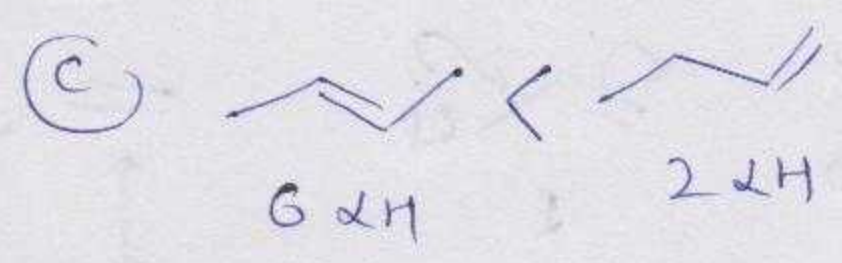
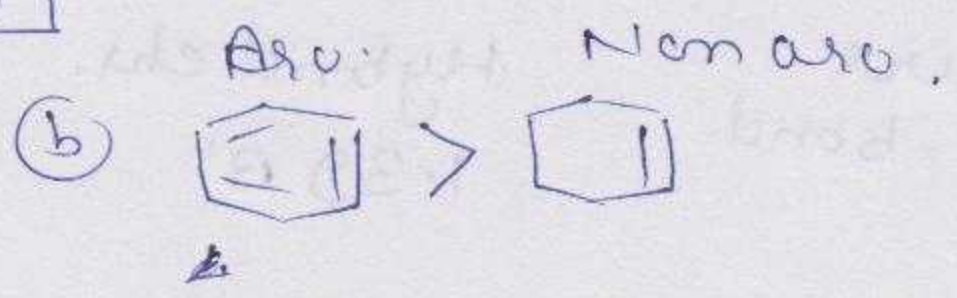


More σ bond char. less will be the bond dissociation energy.

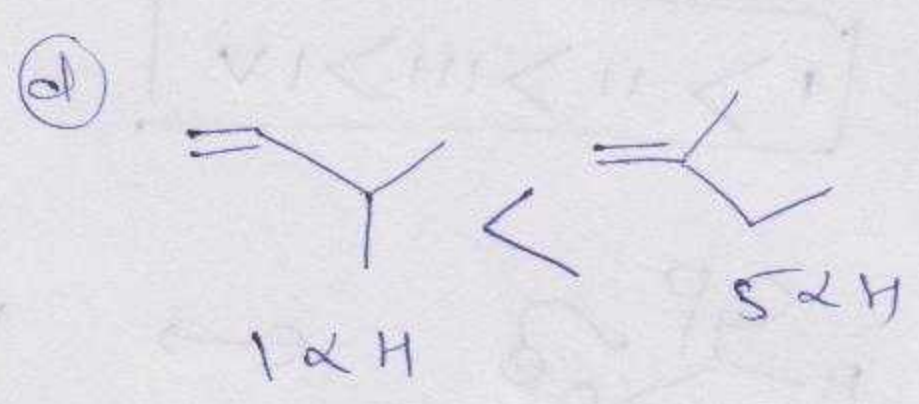
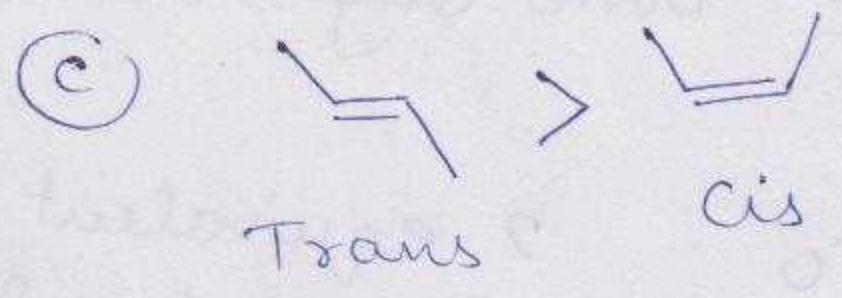
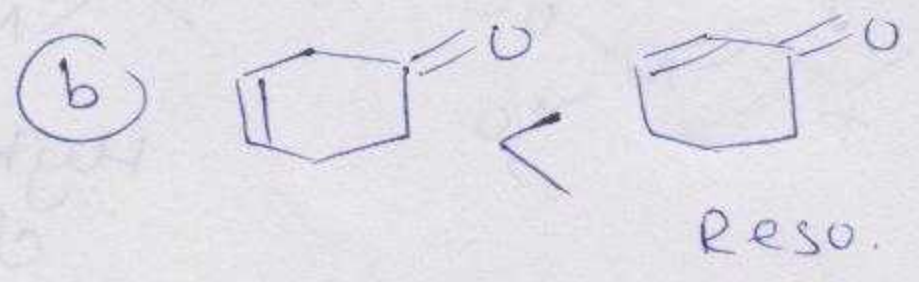
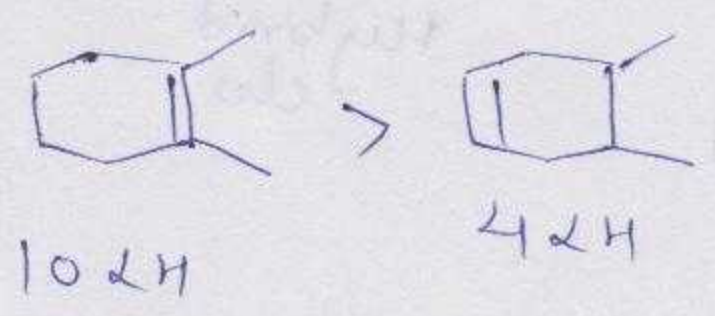


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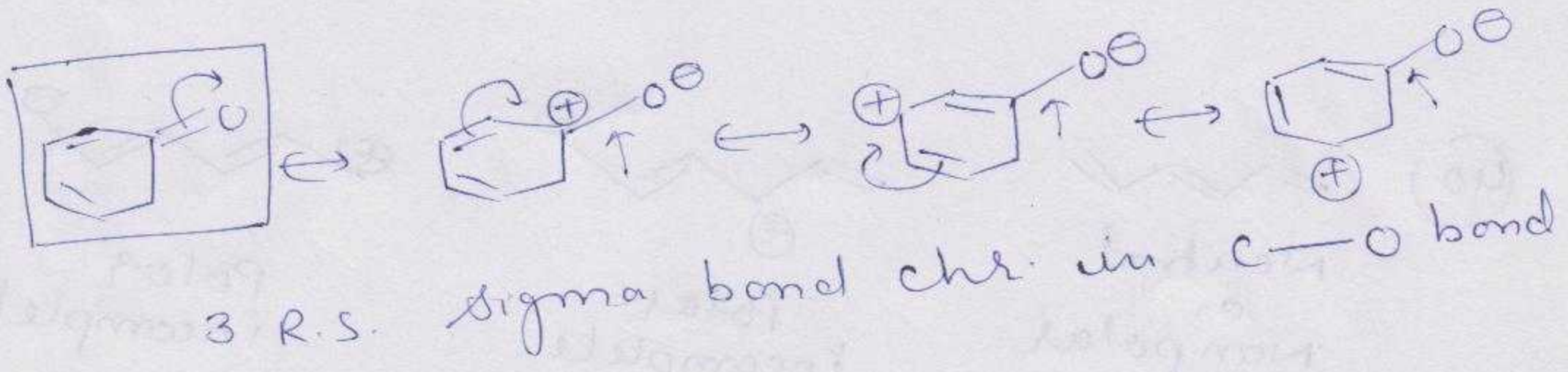
$HOH \propto \frac{1}{\text{stability}}$



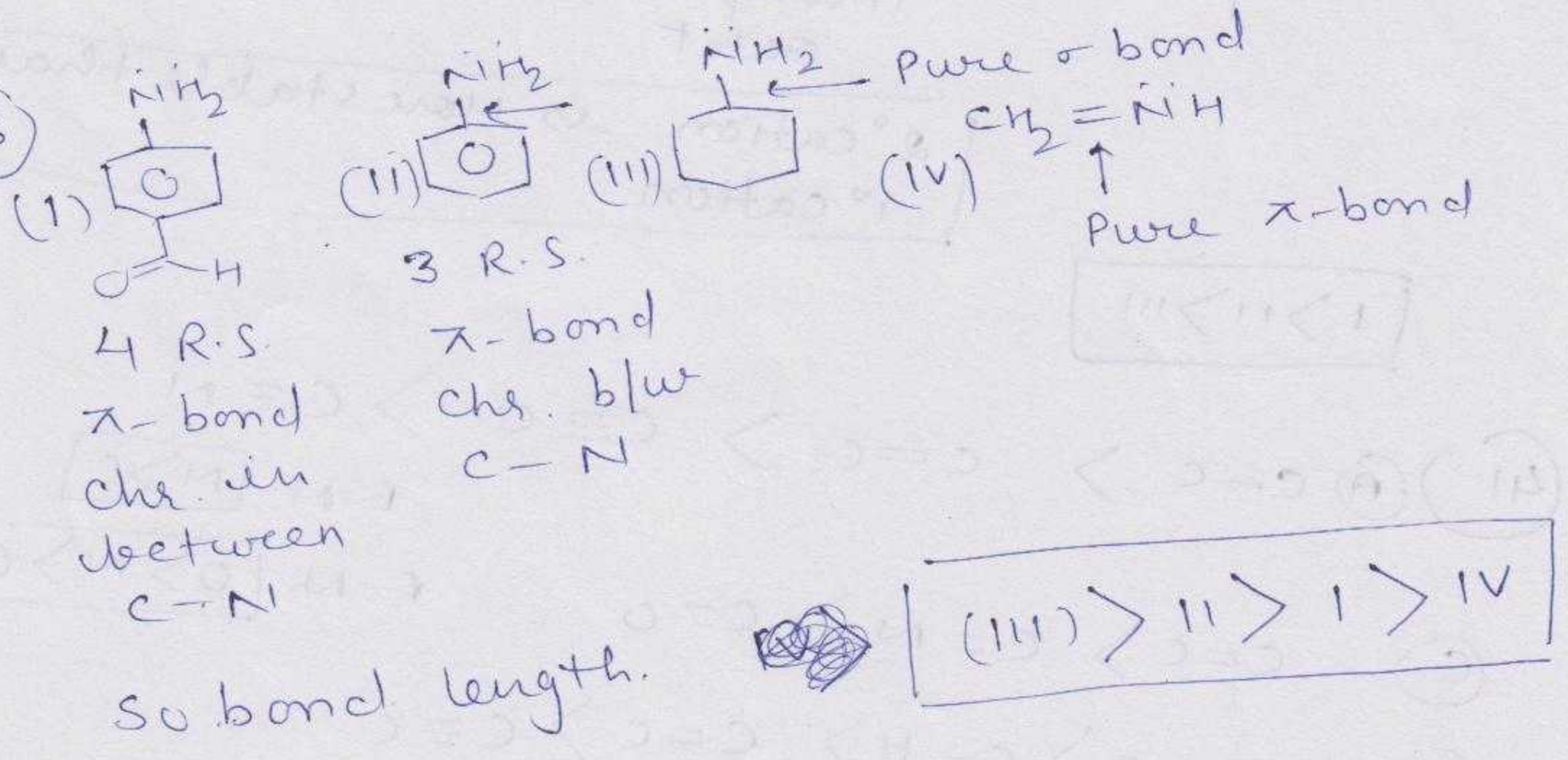
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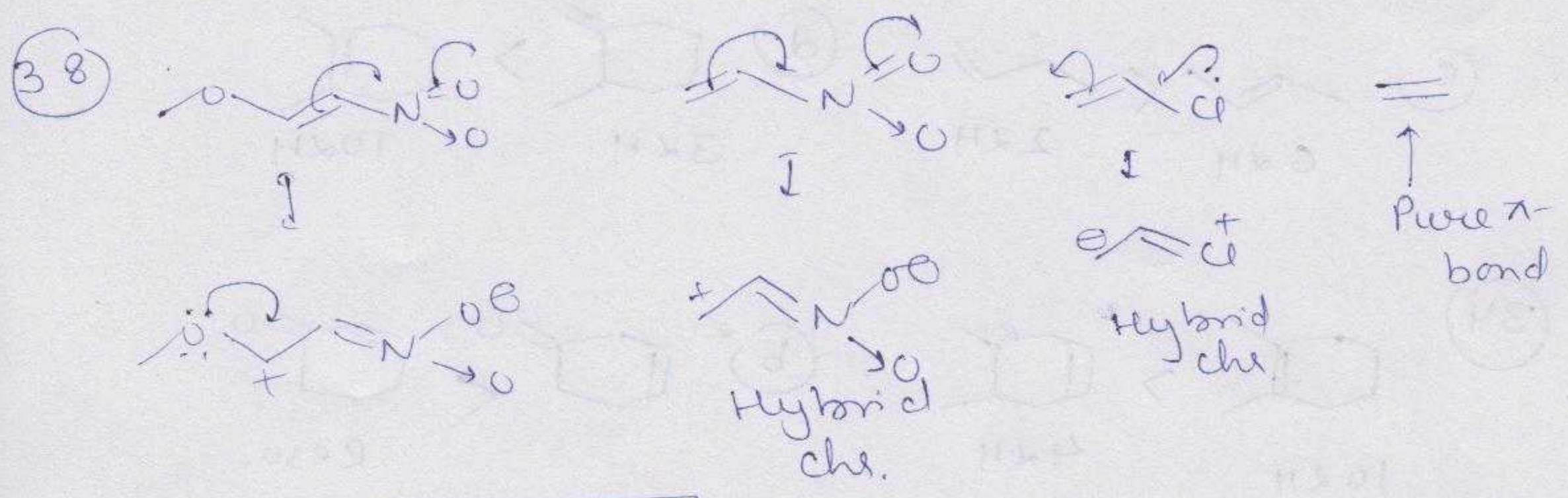
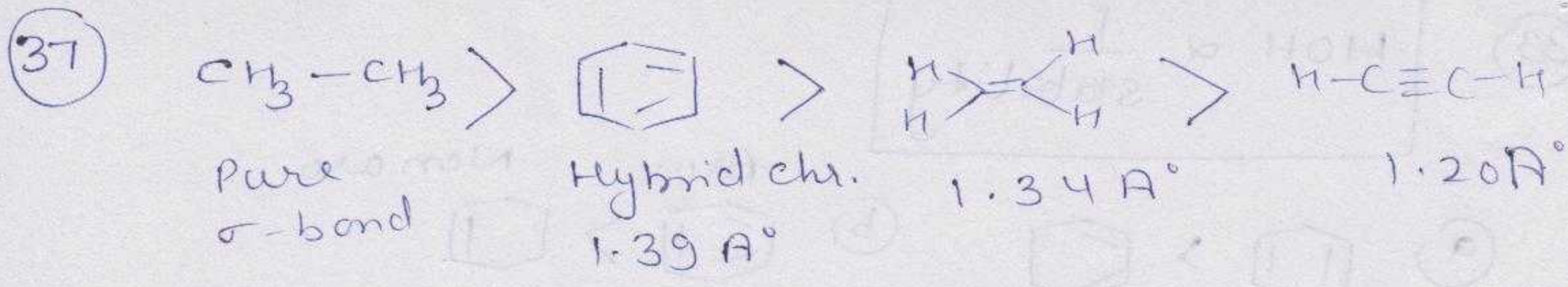


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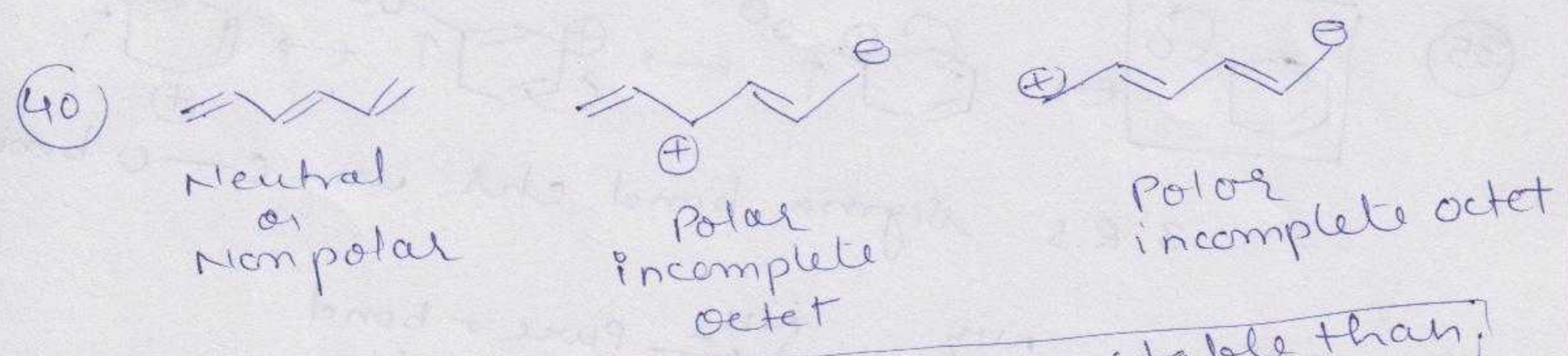
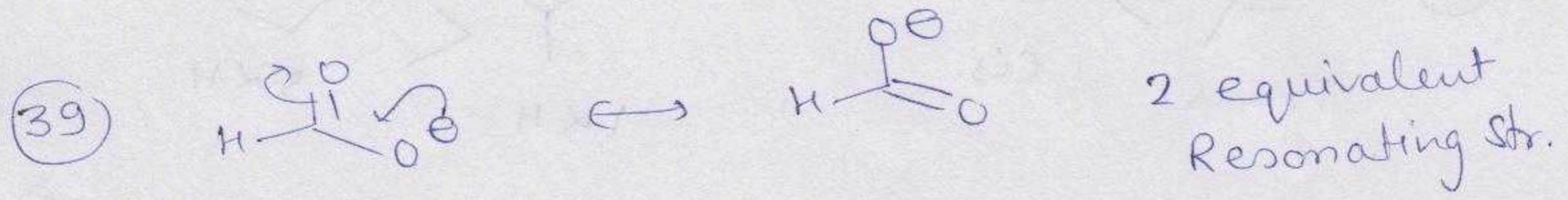


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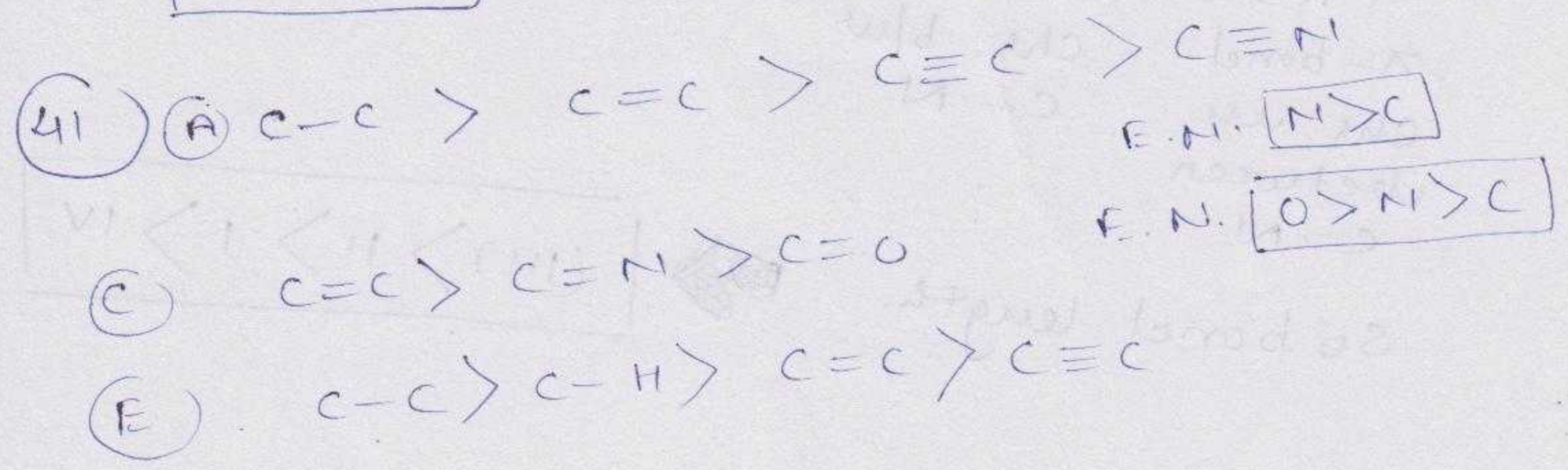


$I > II > III > IV$ C-C bond length order



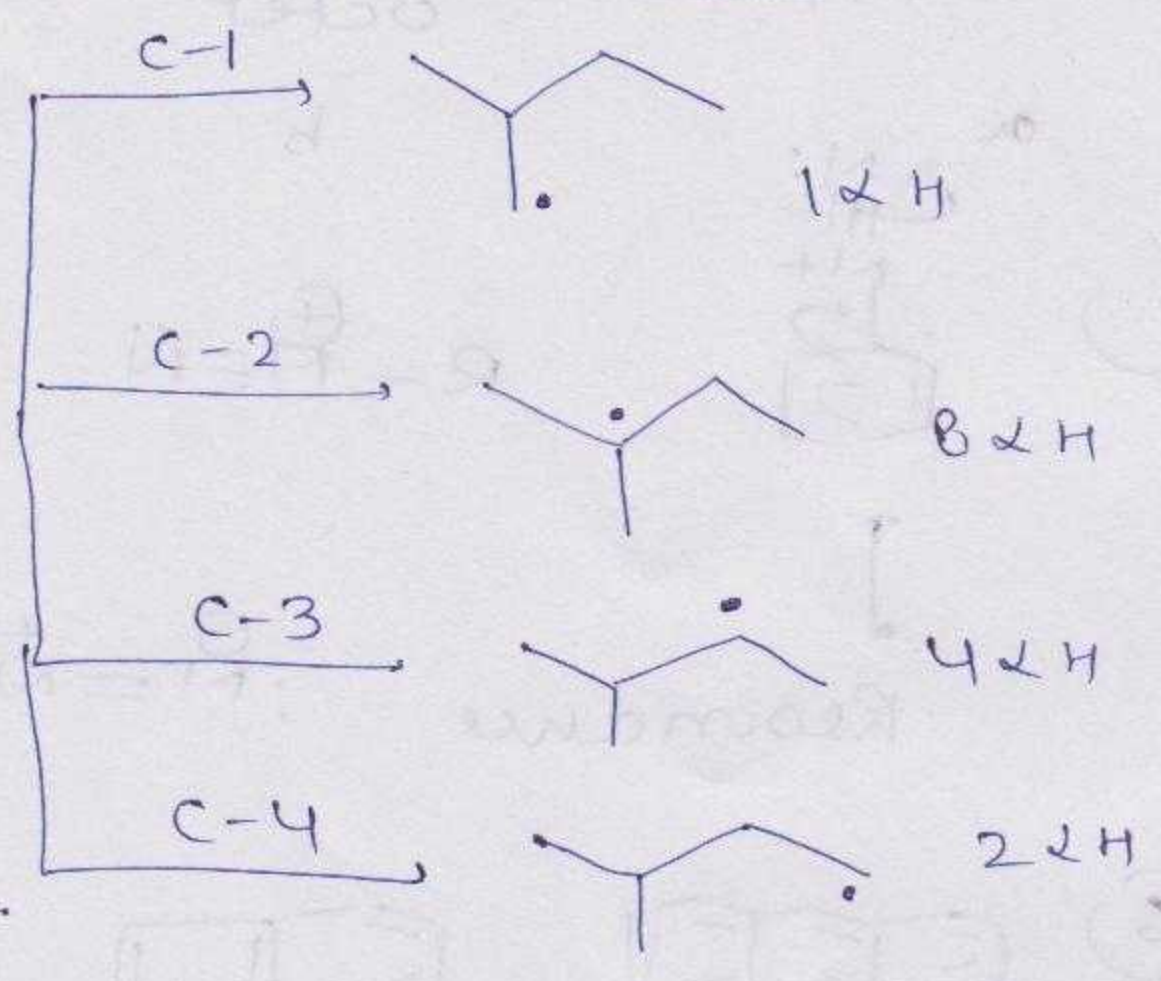
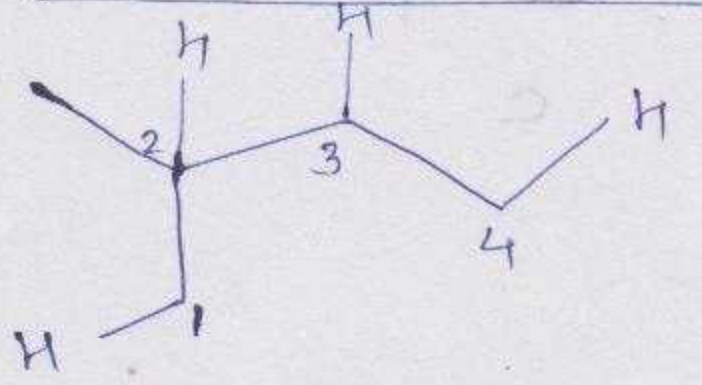
2° cation is more stable than 1° cation

$I > II > III$



42

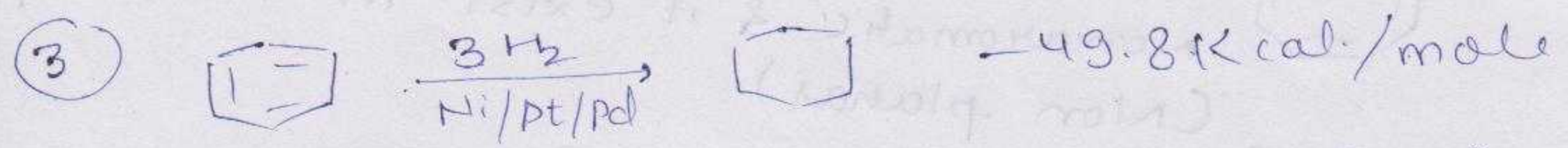
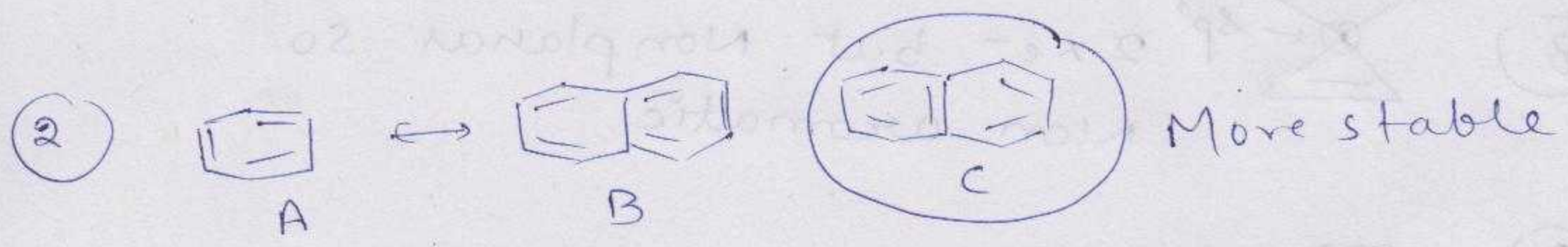
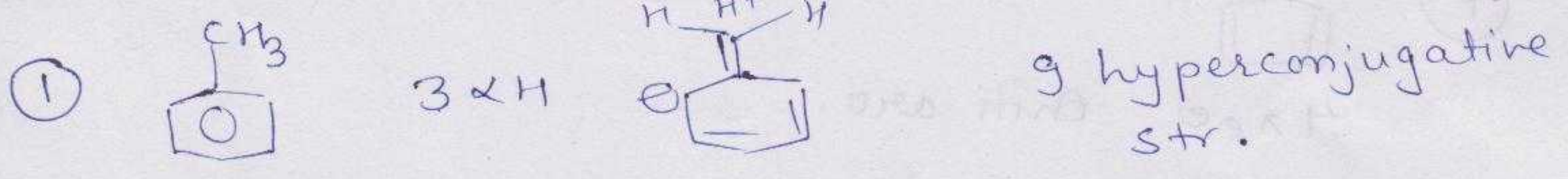
Bond dissociation Energy $\propto \frac{1}{\text{Stability of free radical}}$



BDE order

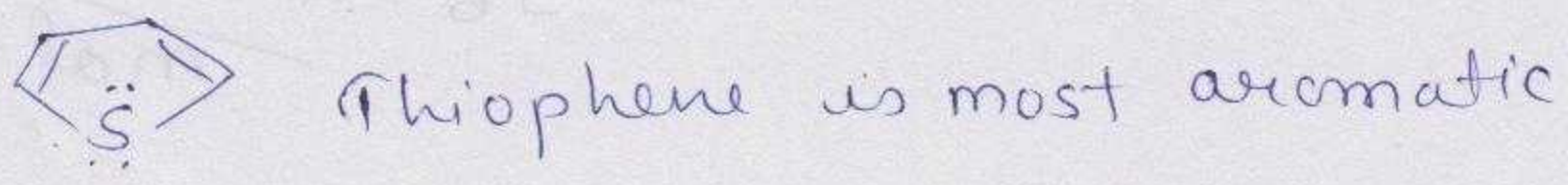
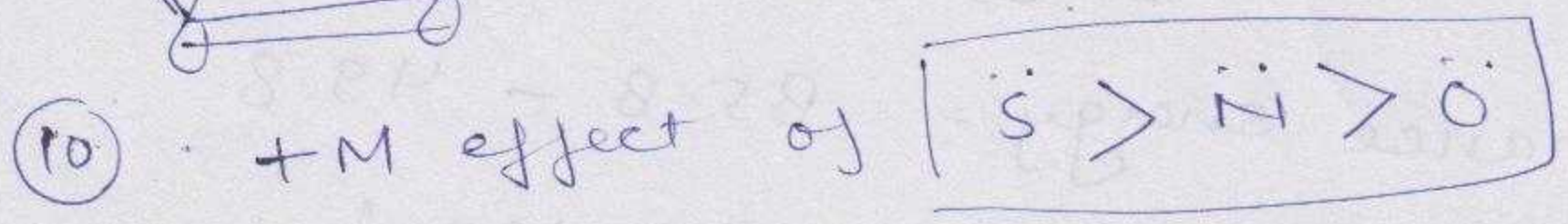
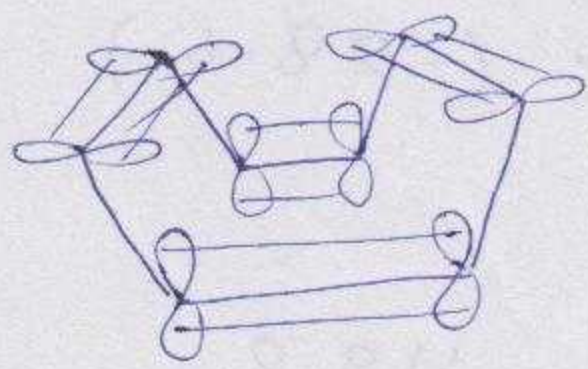
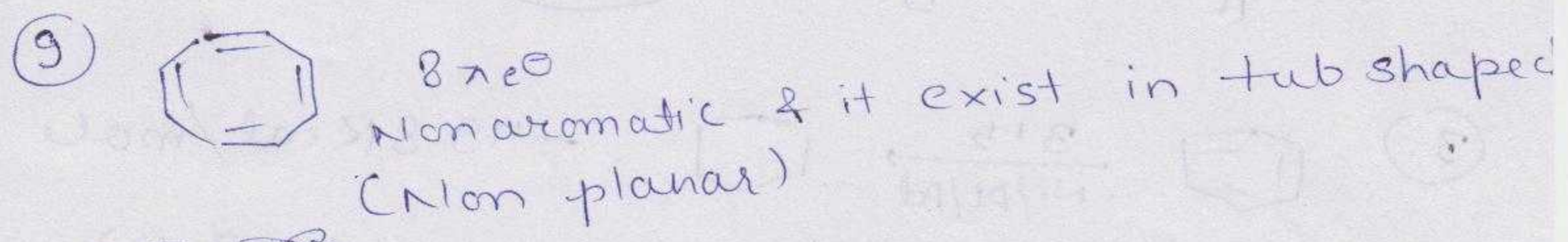
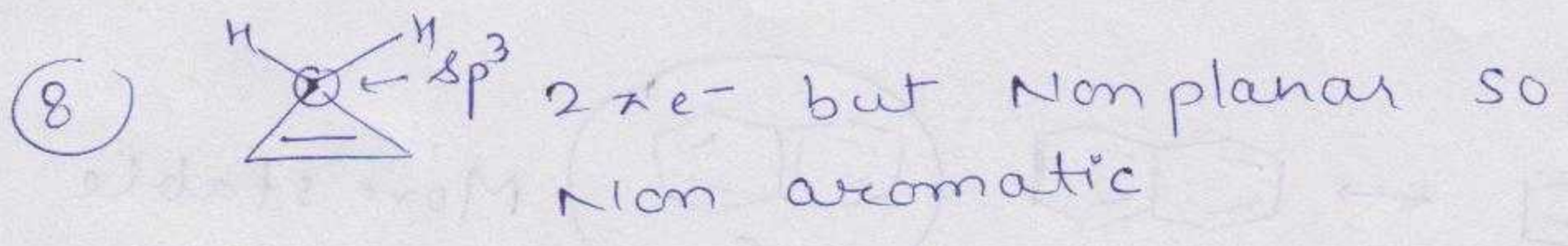
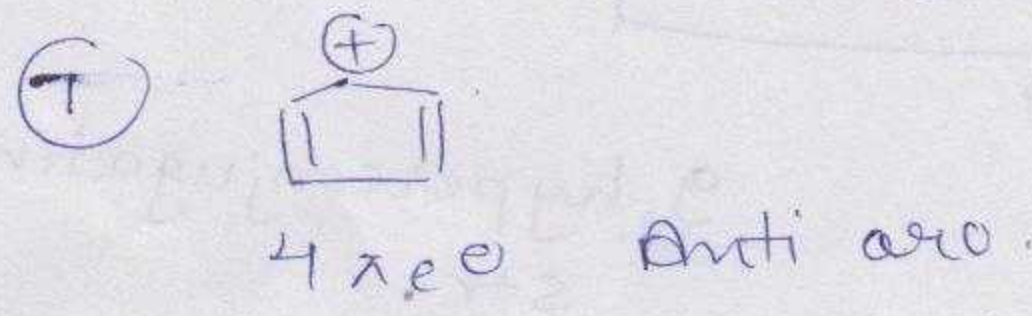
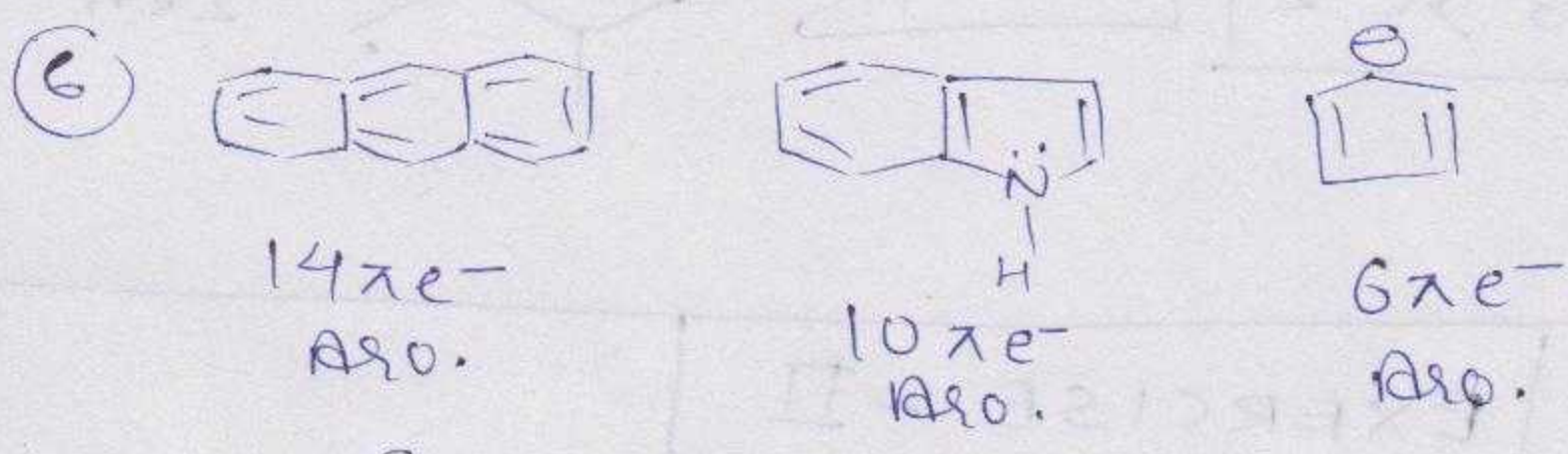
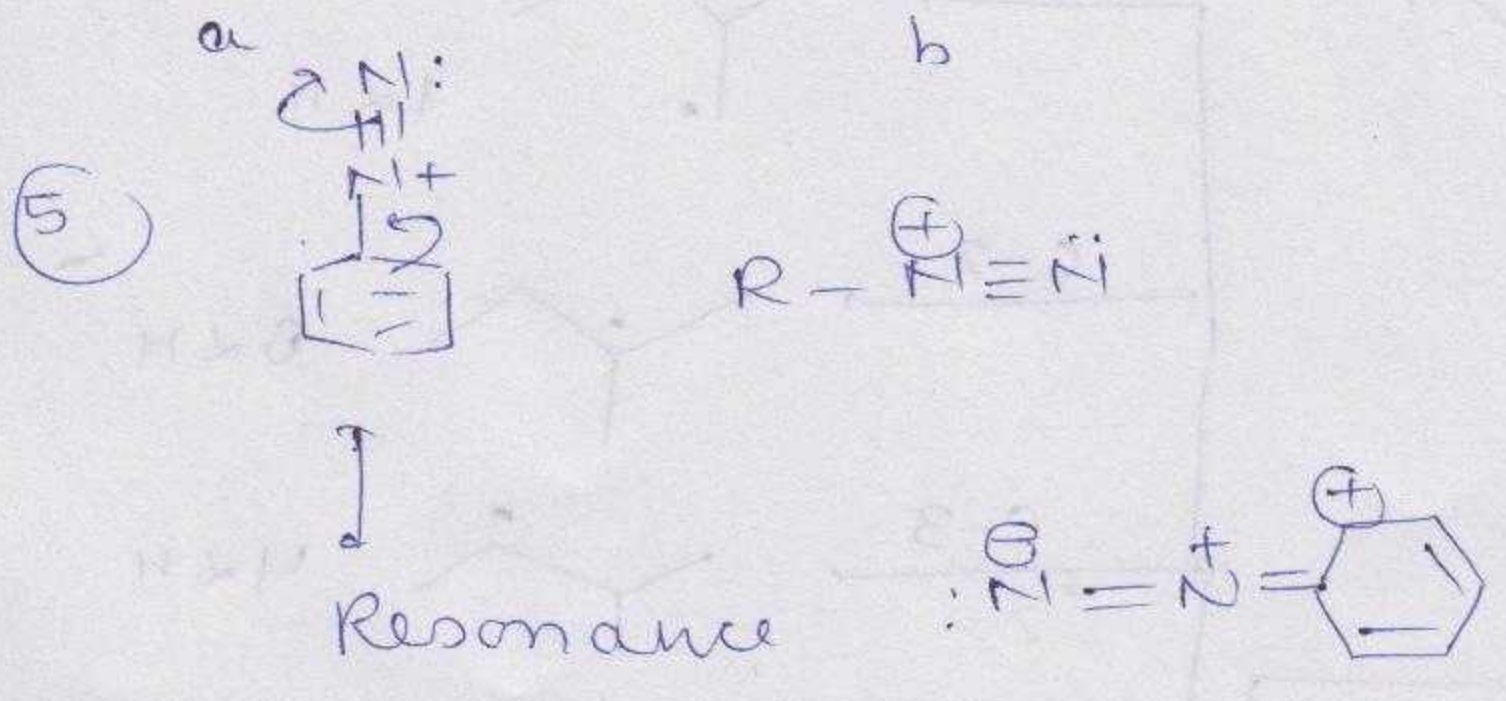
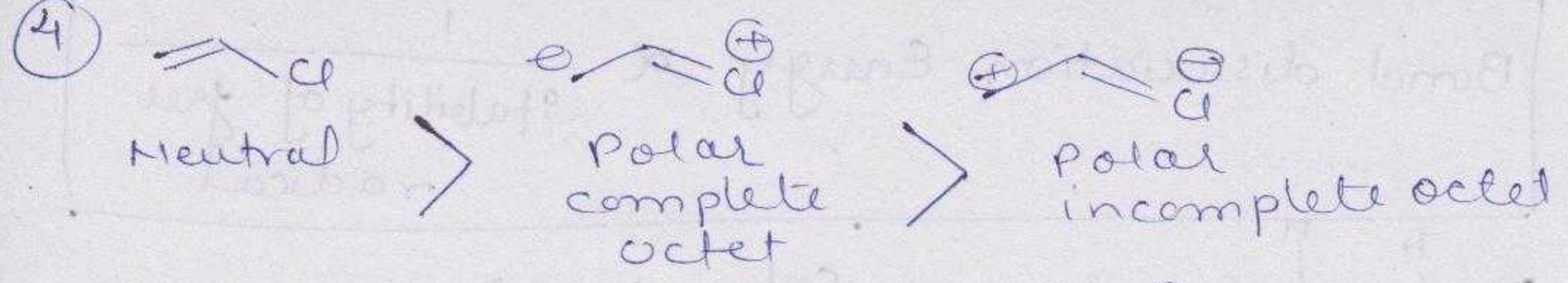
$$C-1 > C-4 > C-3 > C-2$$

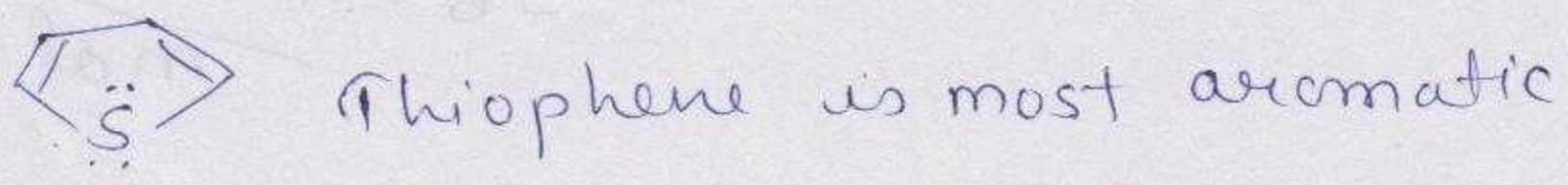
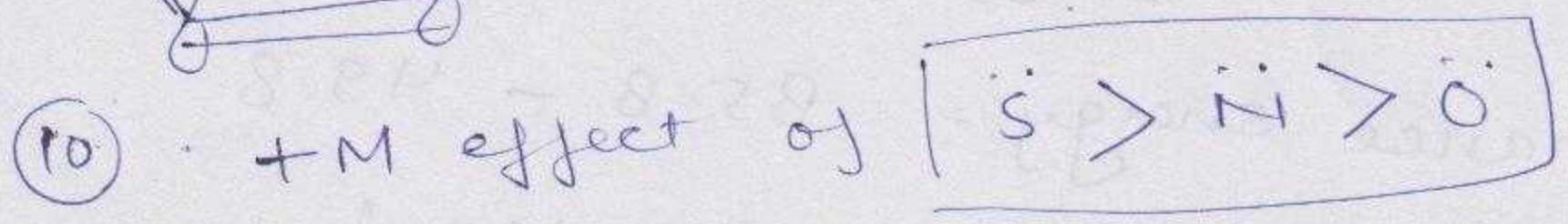
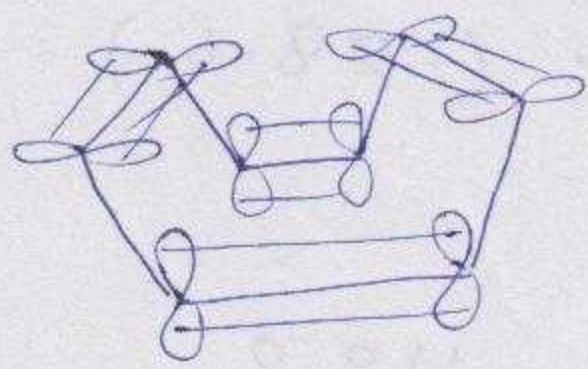
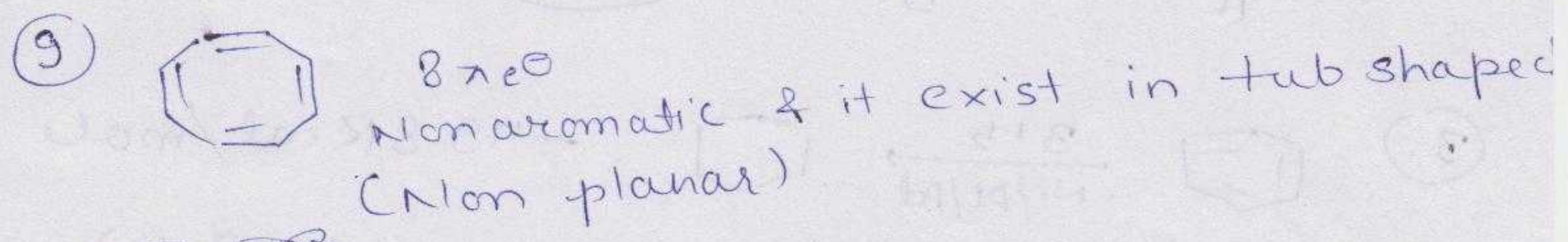
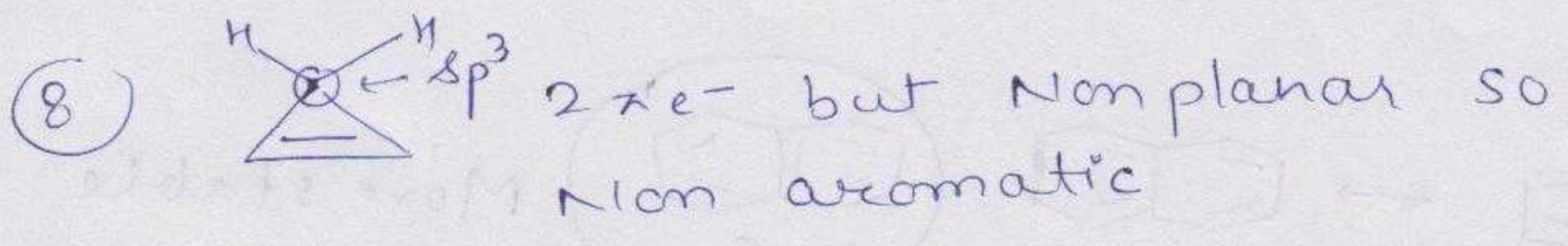
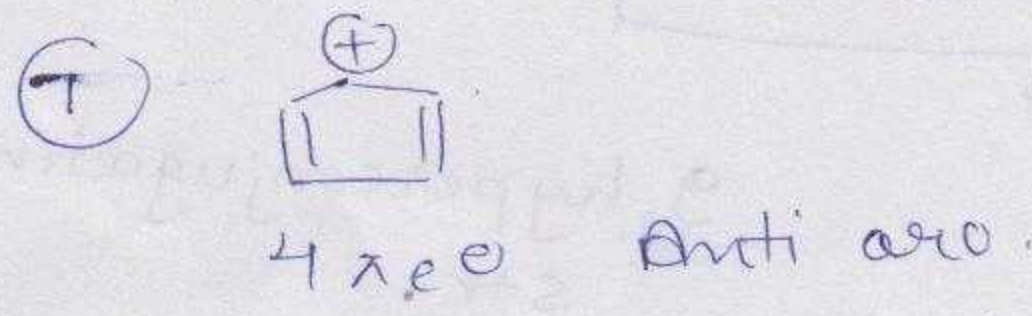
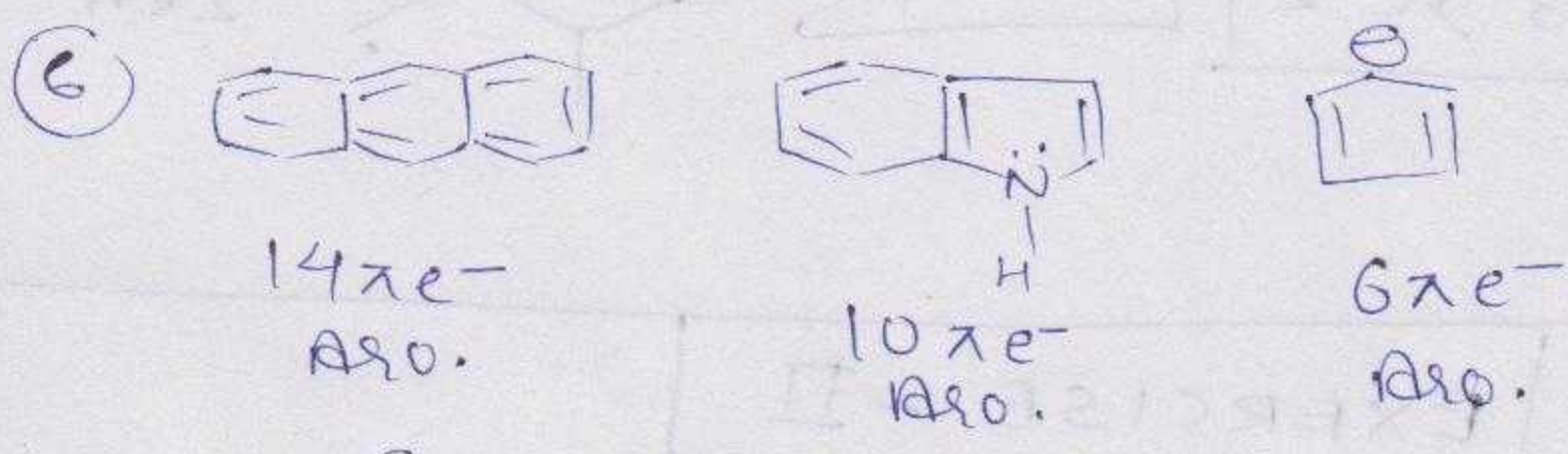
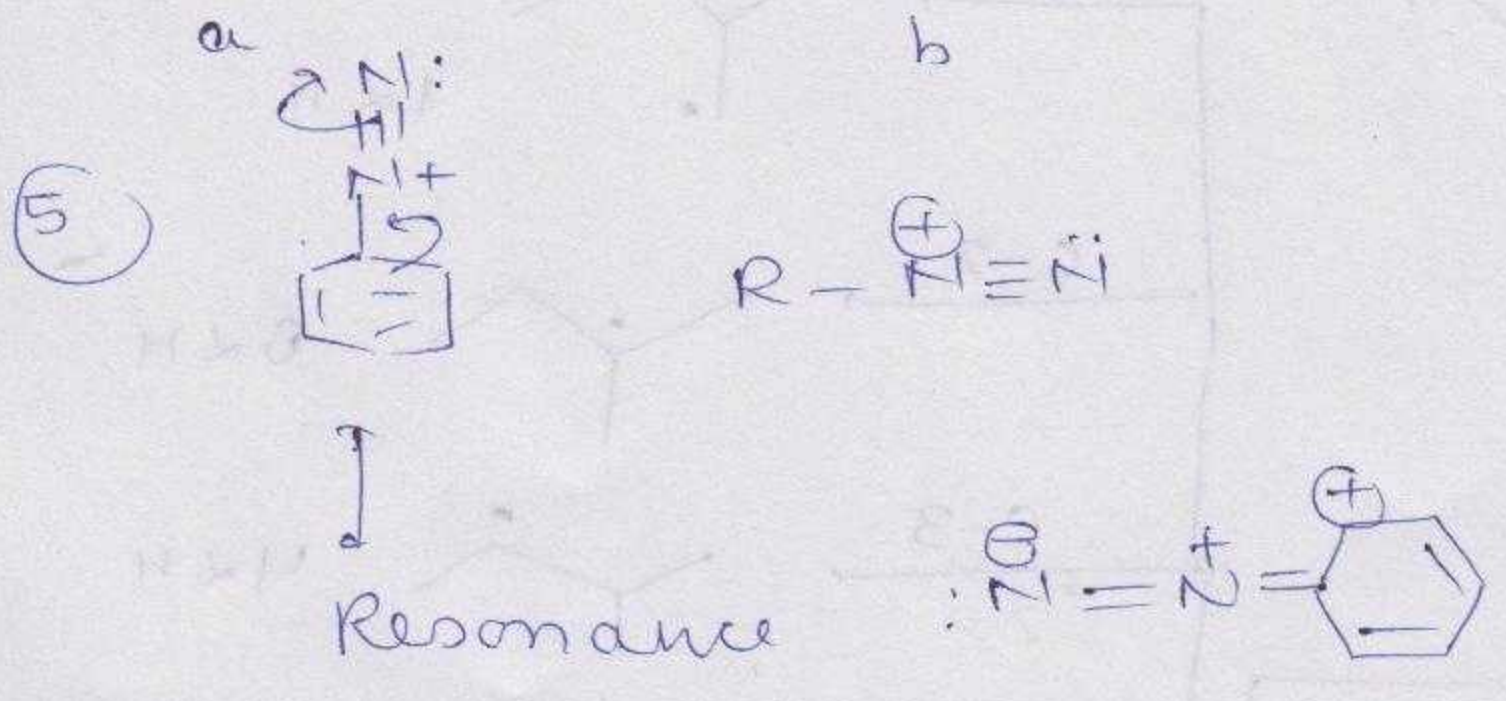
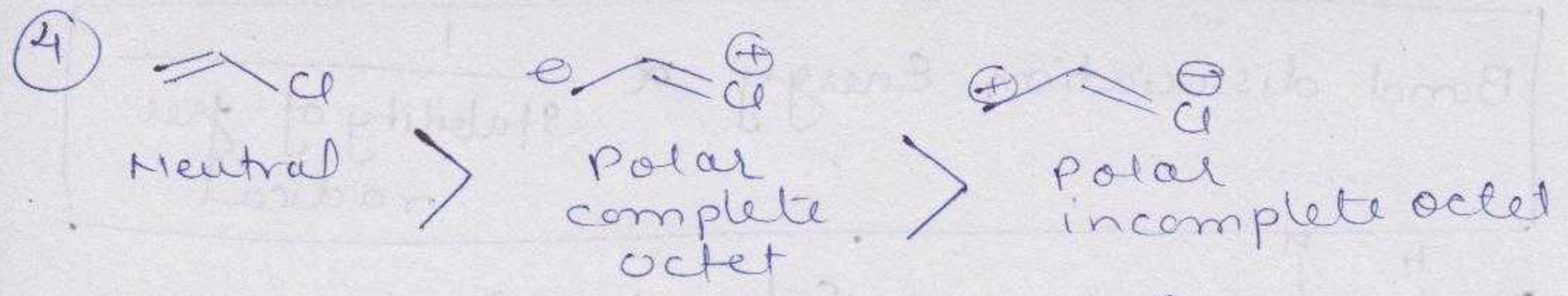
EXERCISE - II

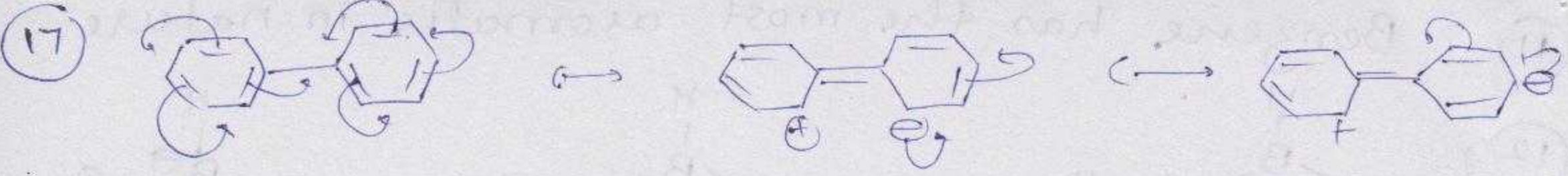


but actually 3 π bond $\times (-28.6)$
 $= -85.8$

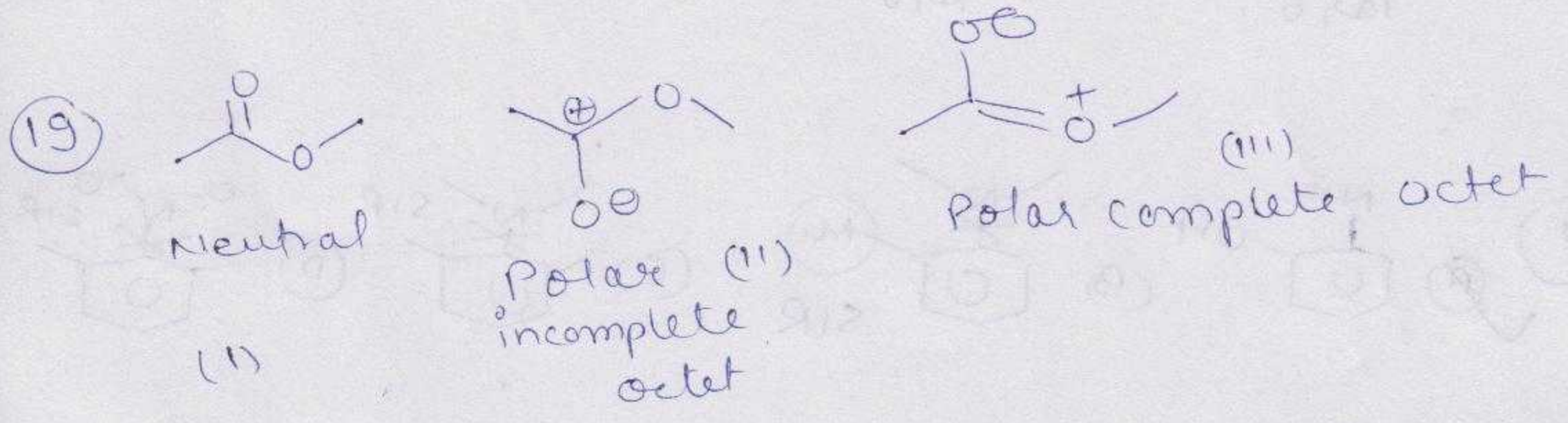
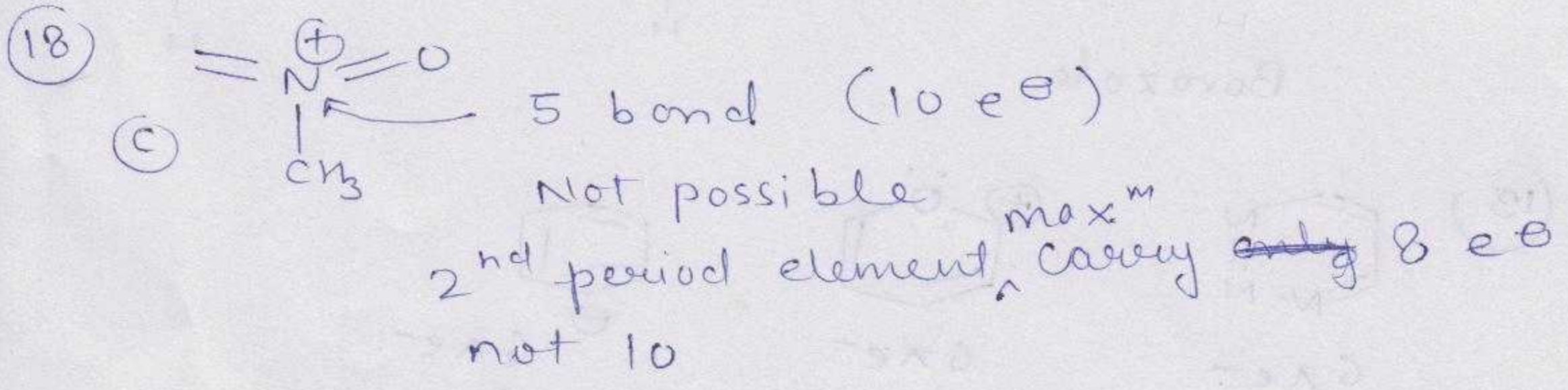
Resonance energy = $85.8 - 49.8$
 $= 36 \text{ Kcal/mol}$








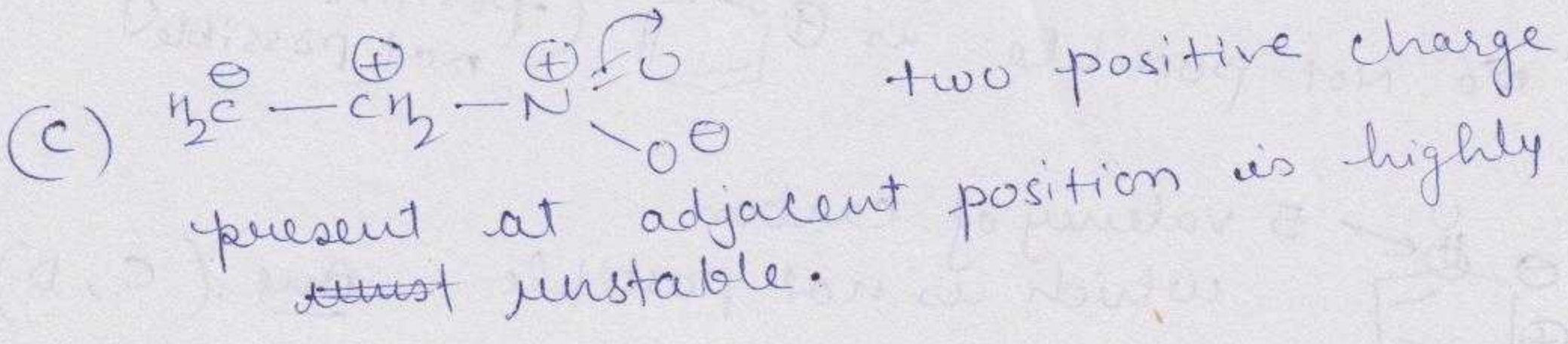
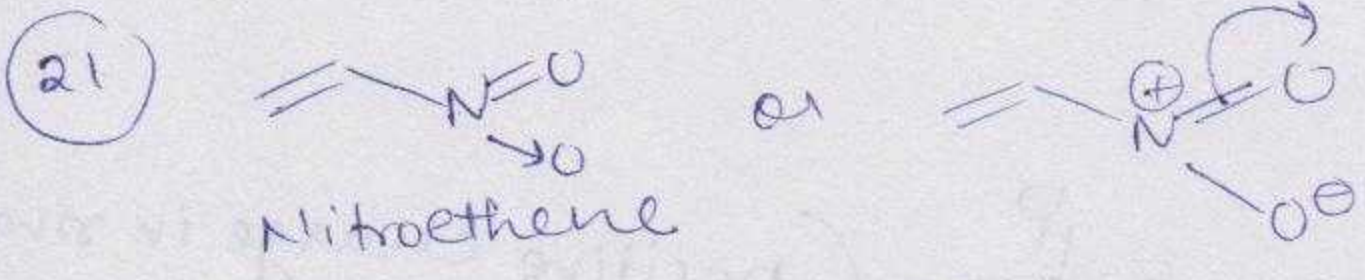
so Ans (D)

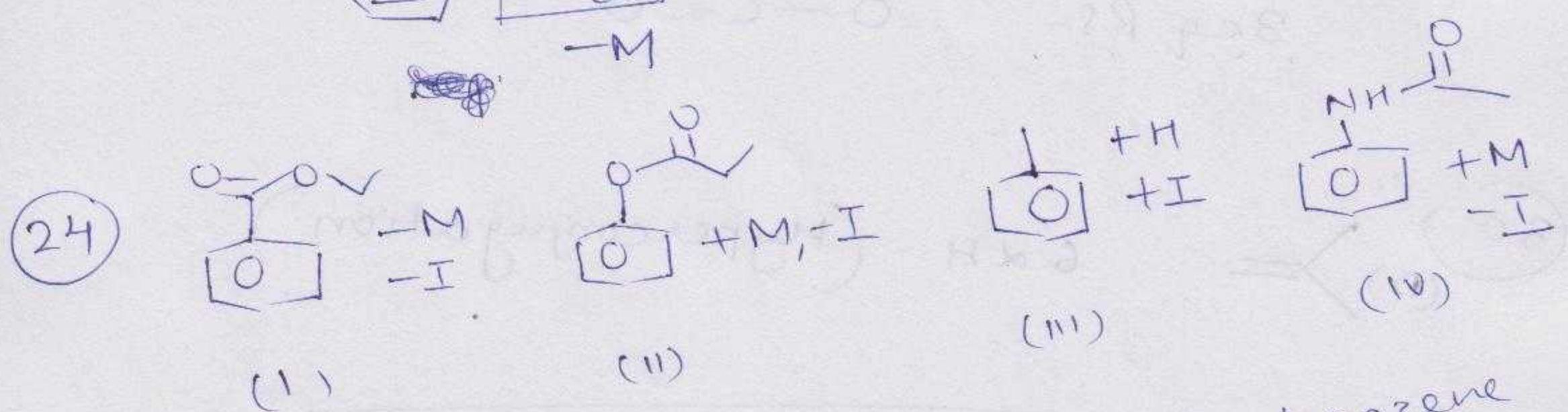
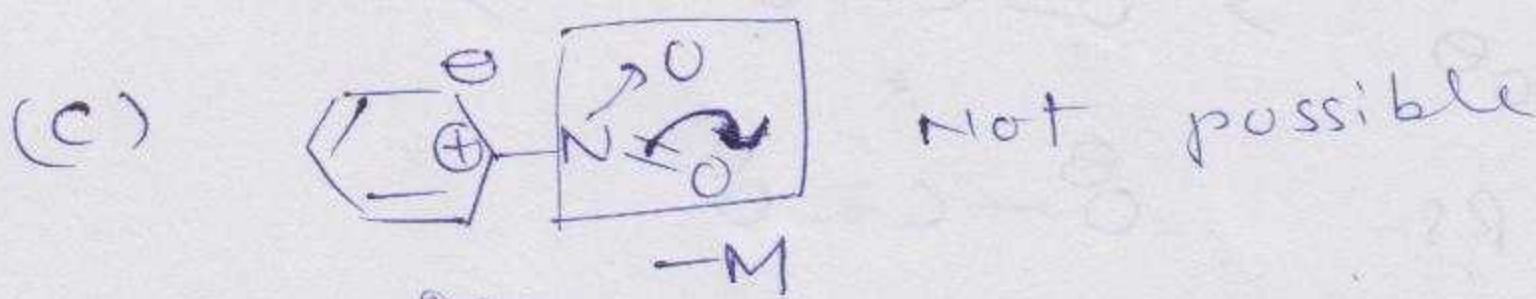
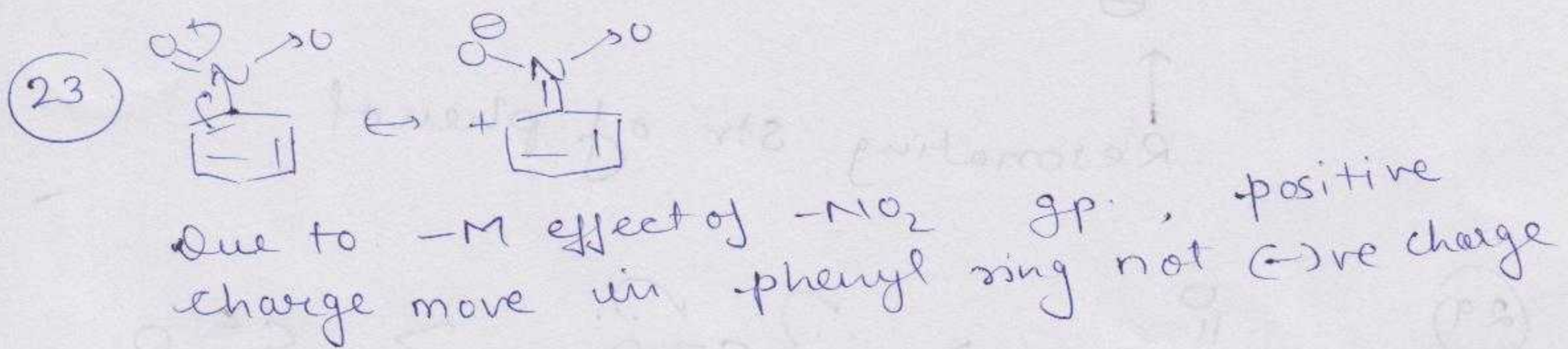
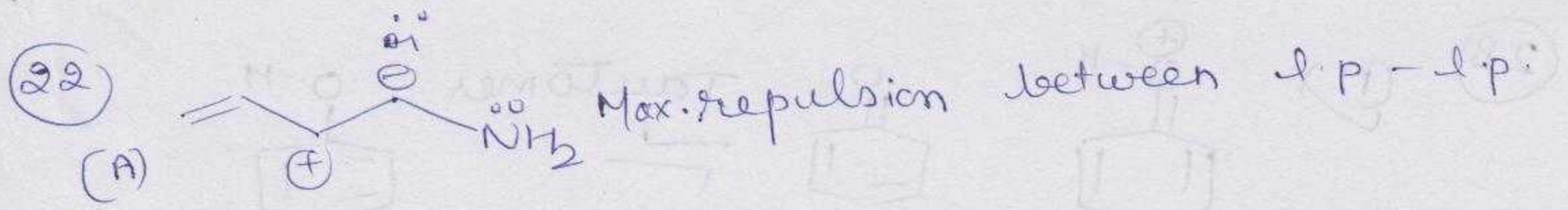


so (II) is minor contributor

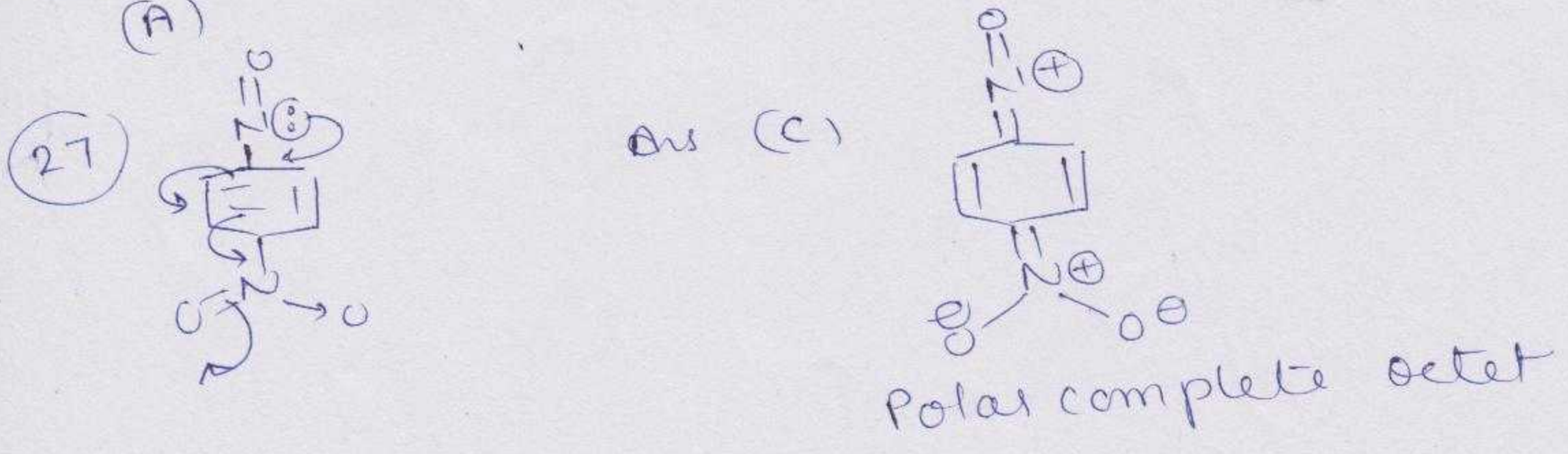
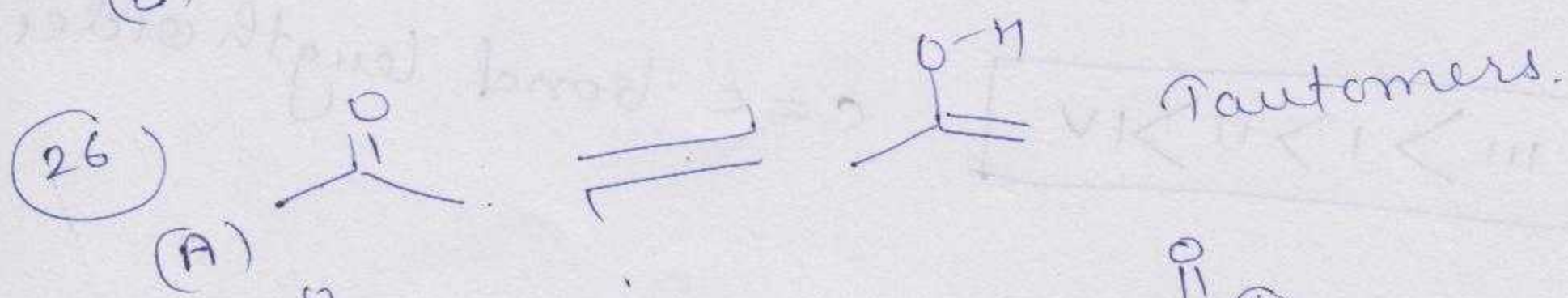
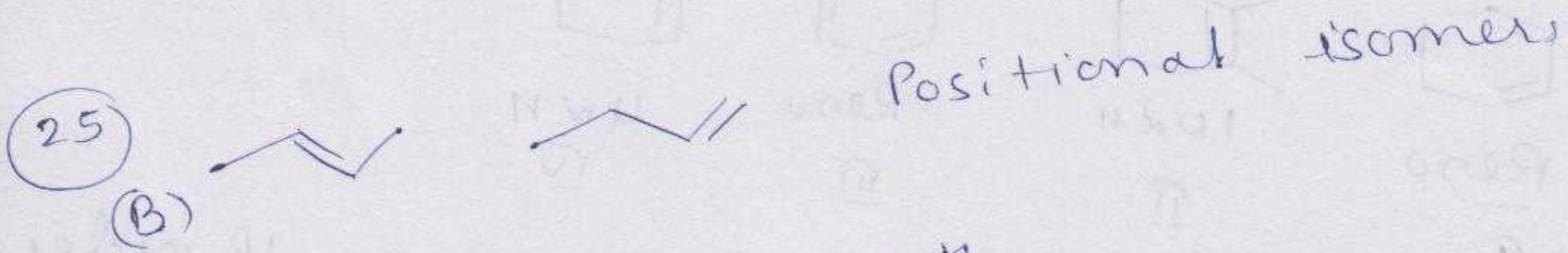


Not resonating str. of diazomethane is 
 (A)



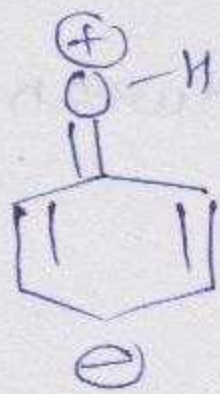


$IV > II > III > I$ e^- density order in benzene ring

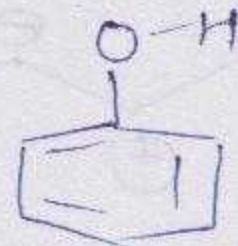


28

(A)

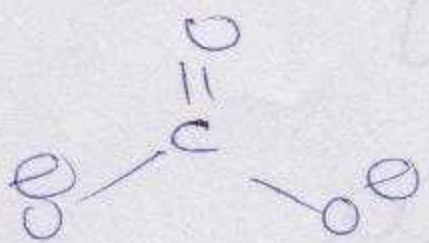


Tautomers



Resonating str. of phenol

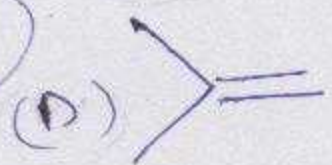
29



3 eq Rs.



30



6 α H (Hyperconjugation)

31

Resonance > Hyperconjugation



Reso

I



10 α H

II



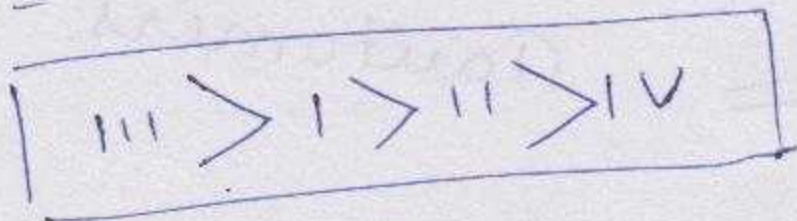
Reso

III



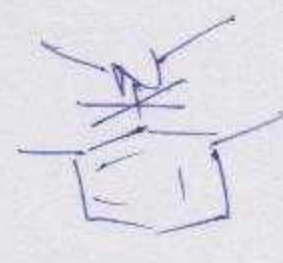
4 α H

IV




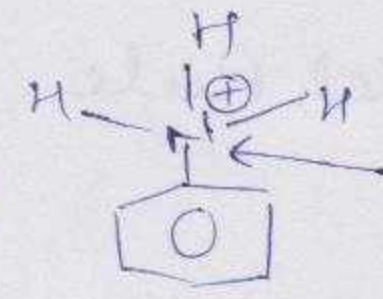
C=C bond length order.




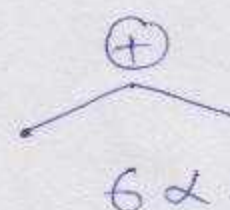
Exercise - III

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

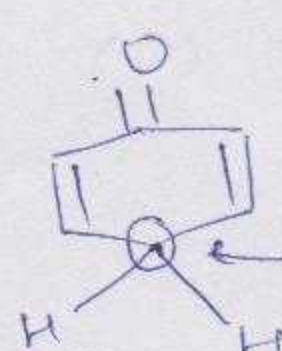
② (a) $4n\pi$ e^- containing comp. must be cyclic & planar

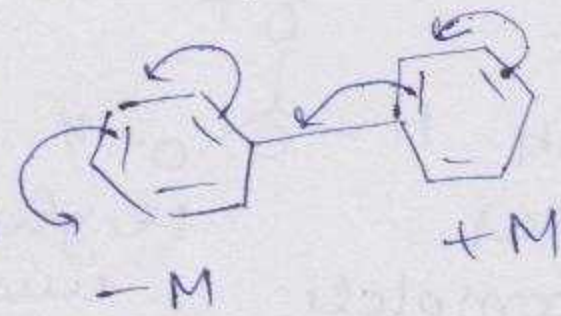
③  $2\pi e^-$ follow Huckel Rule so aromatic

④ (b)  2^{nd} period element max^m carry $8e^-$ so resonance effect of the gp. is not present

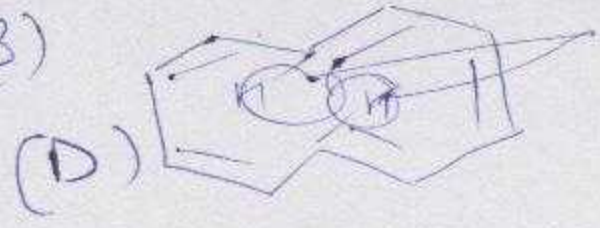
⑤ (1)  $6\pi e^-$ aro.
 (2)  Non aro. less Reso.
 (3)  More reso.
 (4)  $6\pi e^-$

st. order 1 > 3 > 2 > 4

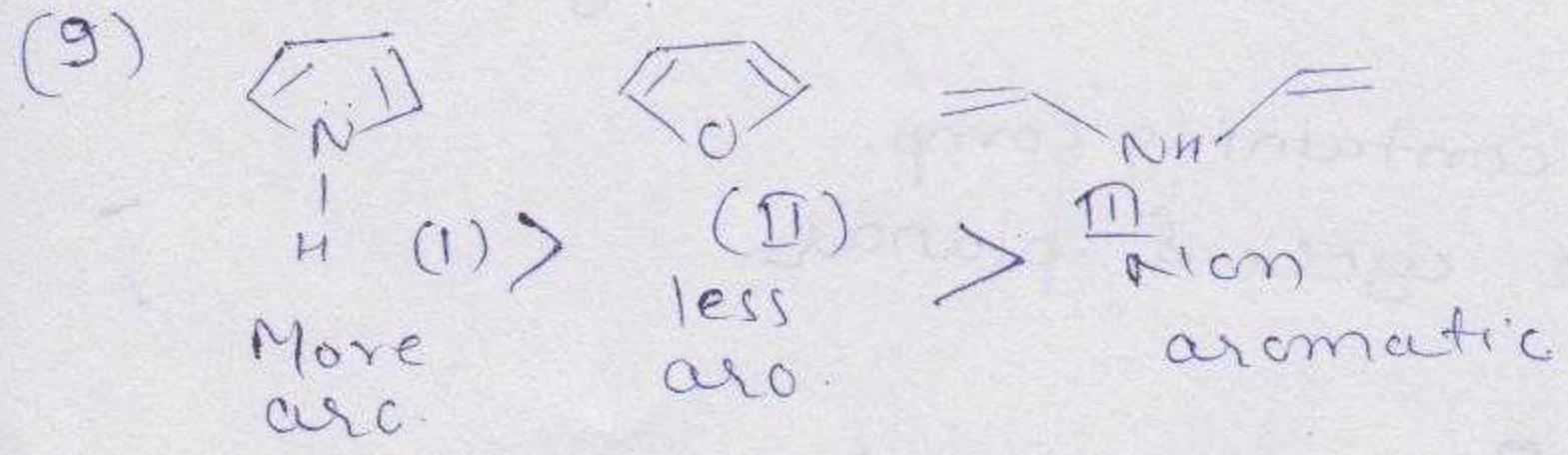
⑥ (d)  Nonplanar, Non aromatic sp^3 hybridized carbon

⑦ (c)  one ring is π -donor & another one is π -acceptor

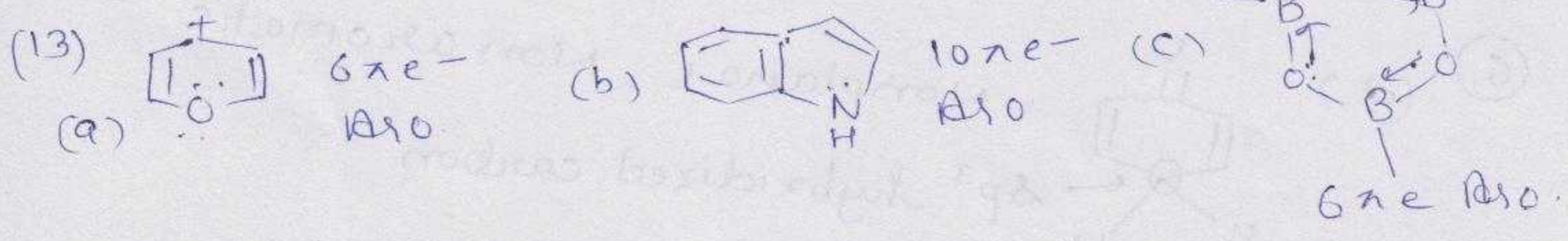
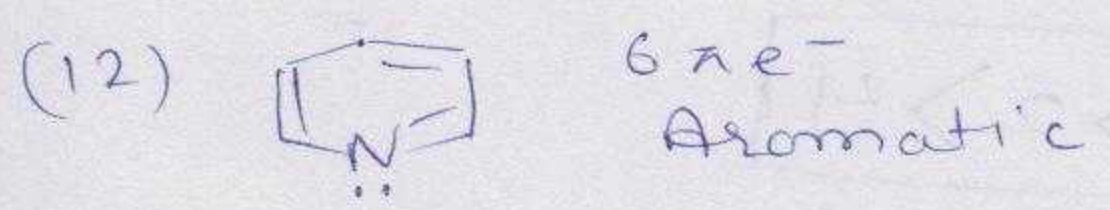
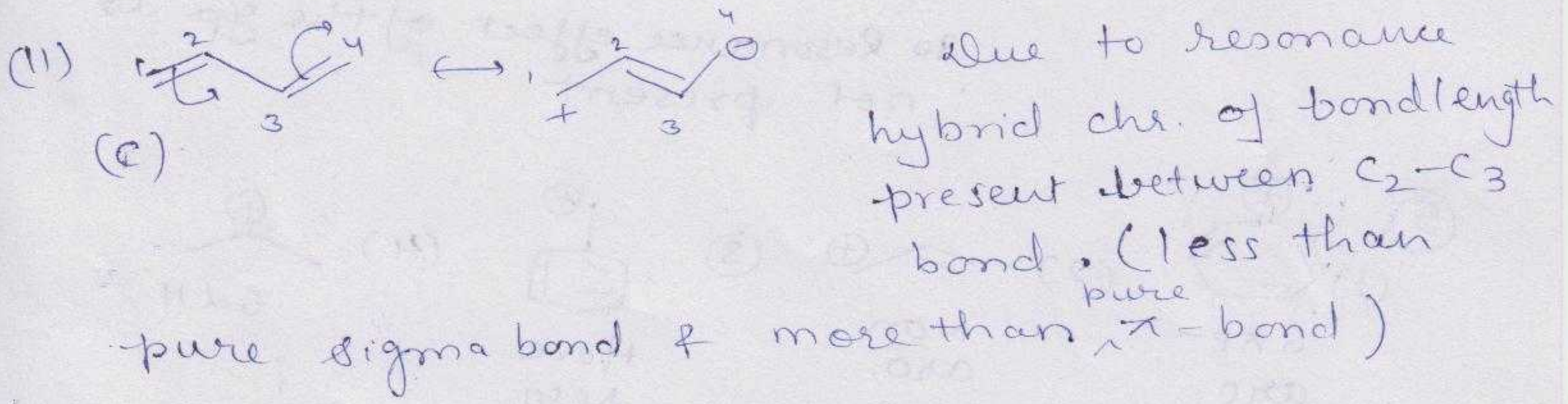
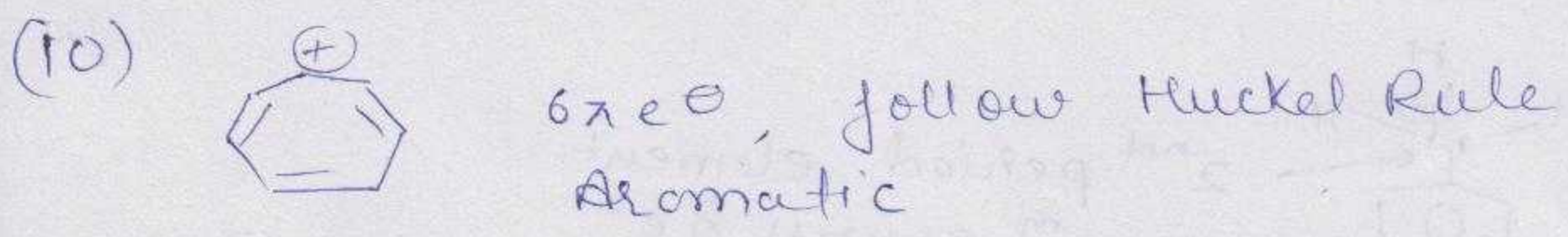
(8) Due to repulsion it get nonplanar so nonaromatic



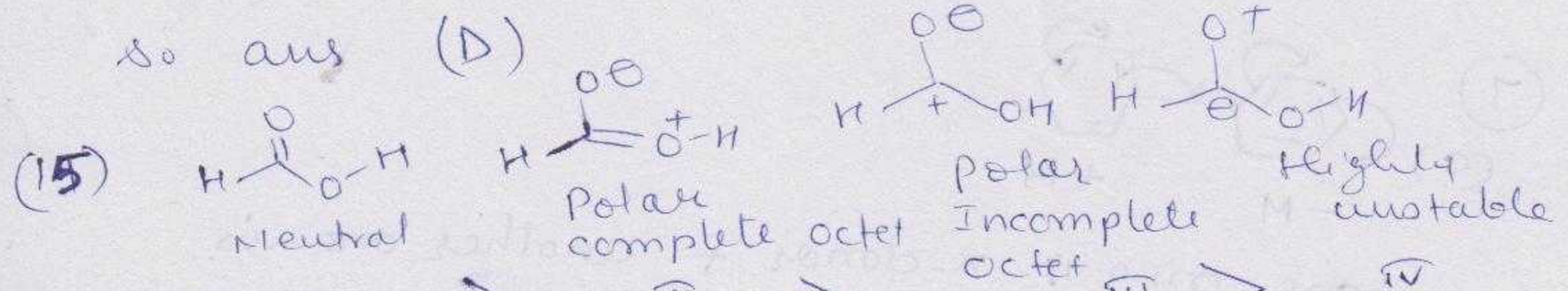
[10 πe^-]



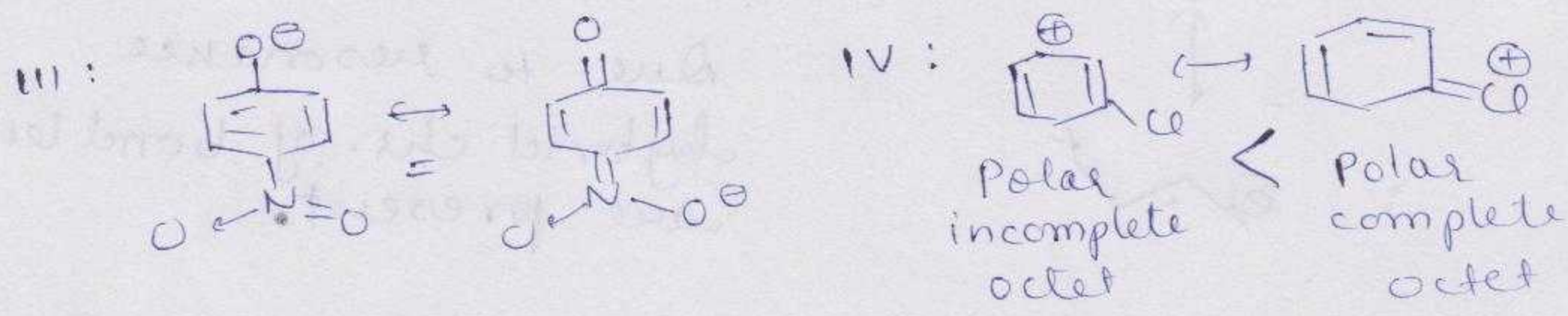
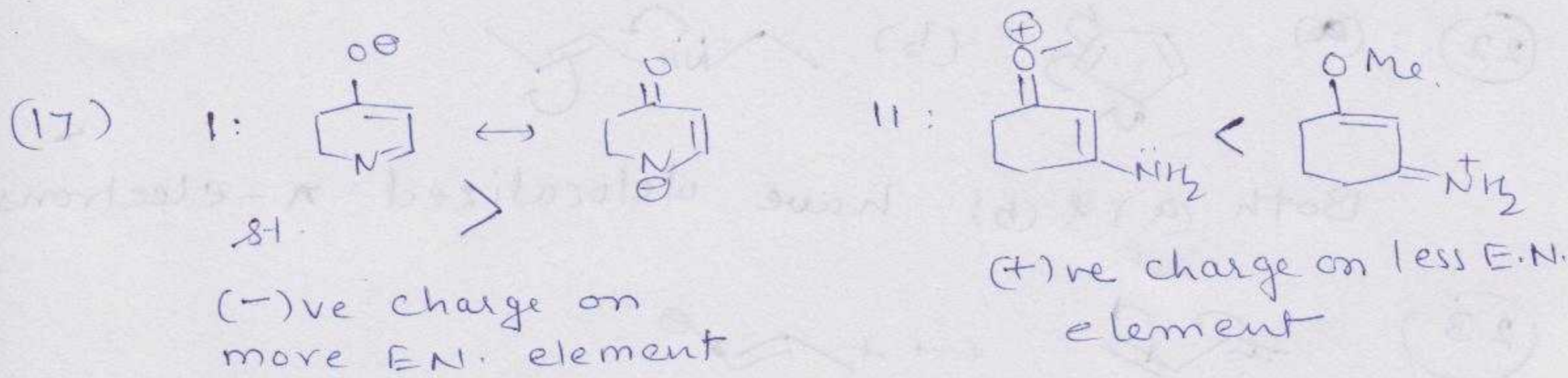
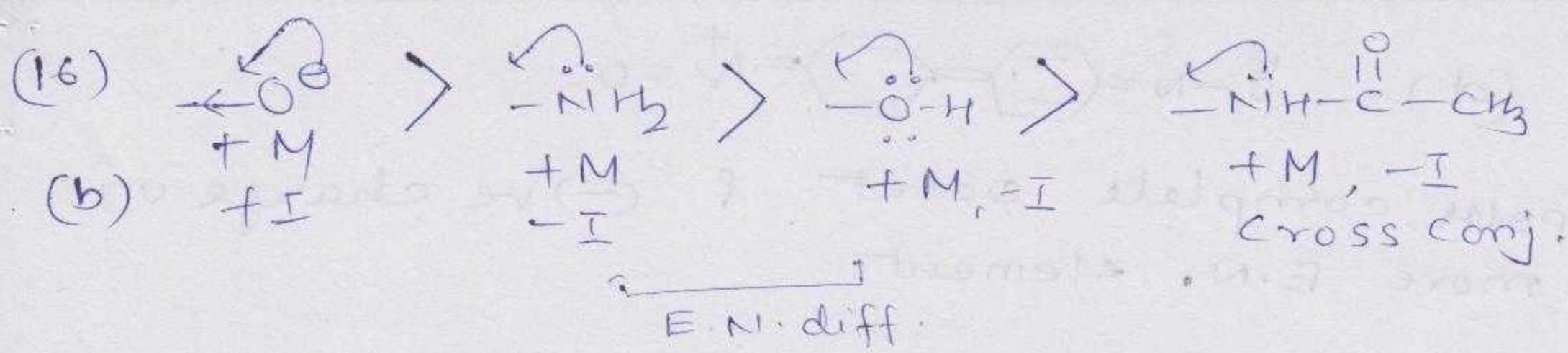
+M \Rightarrow [N > O]



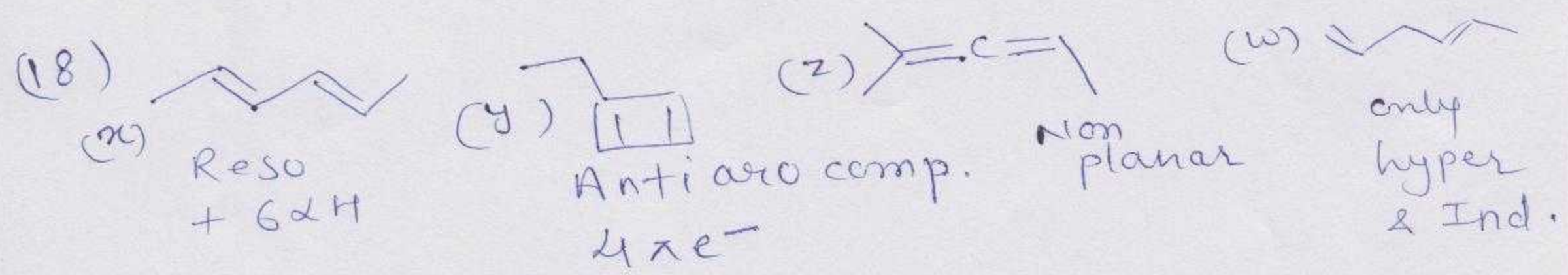
So ans (D)



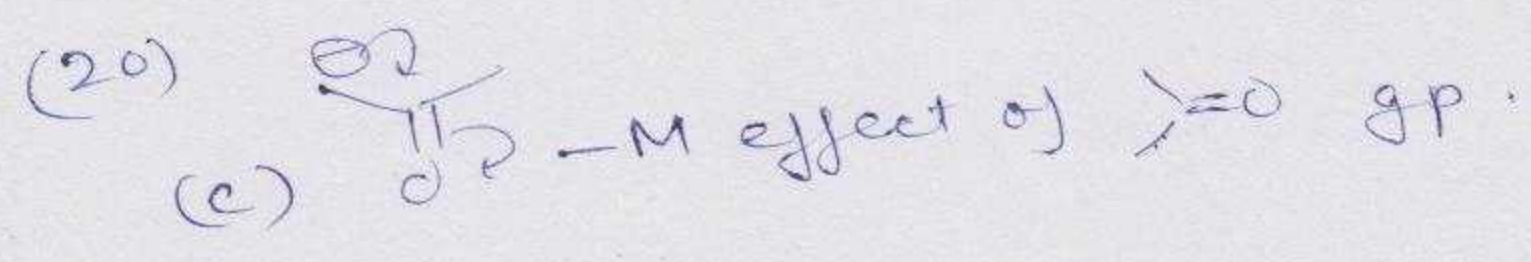
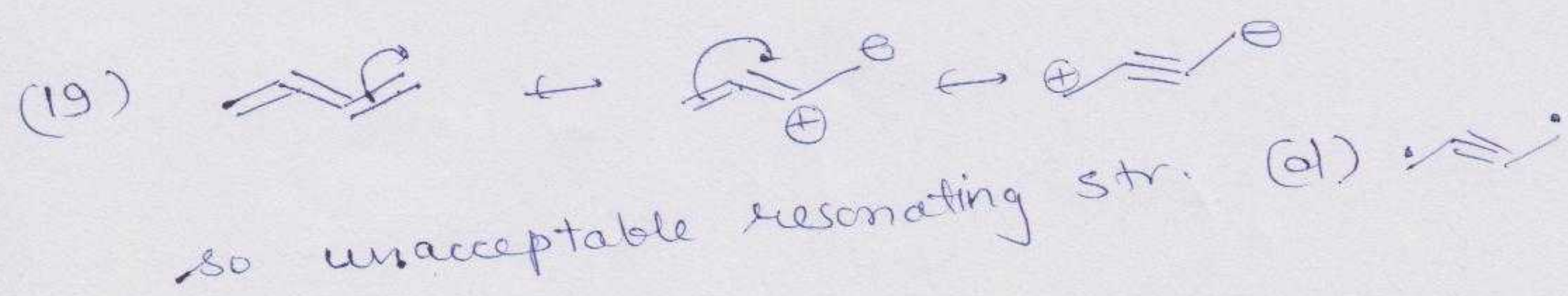
So st. order: I > II > III > IV

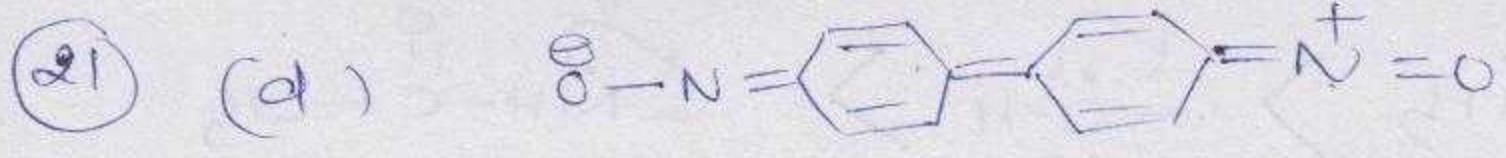


so ans (b) (II & IV)



st. $\alpha > w > z > y$

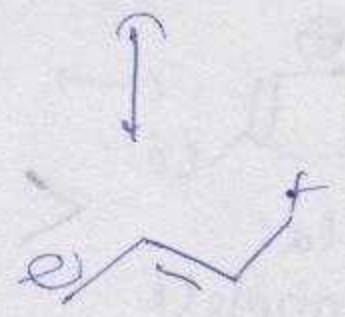




polar complete octet & (-)ve charge on more E.N. element

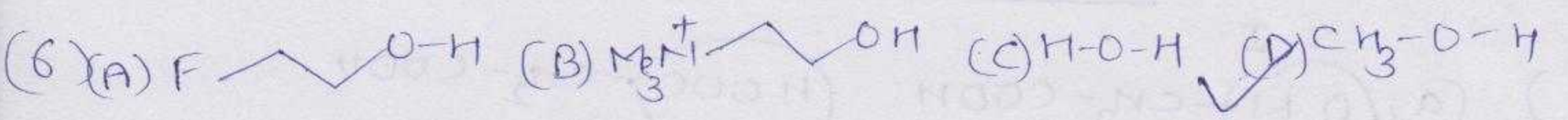
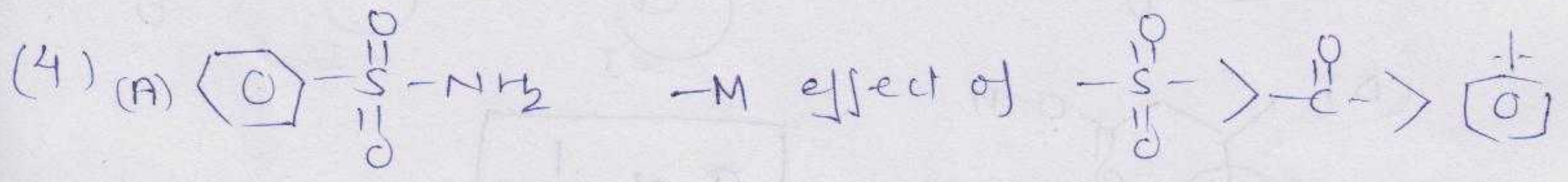
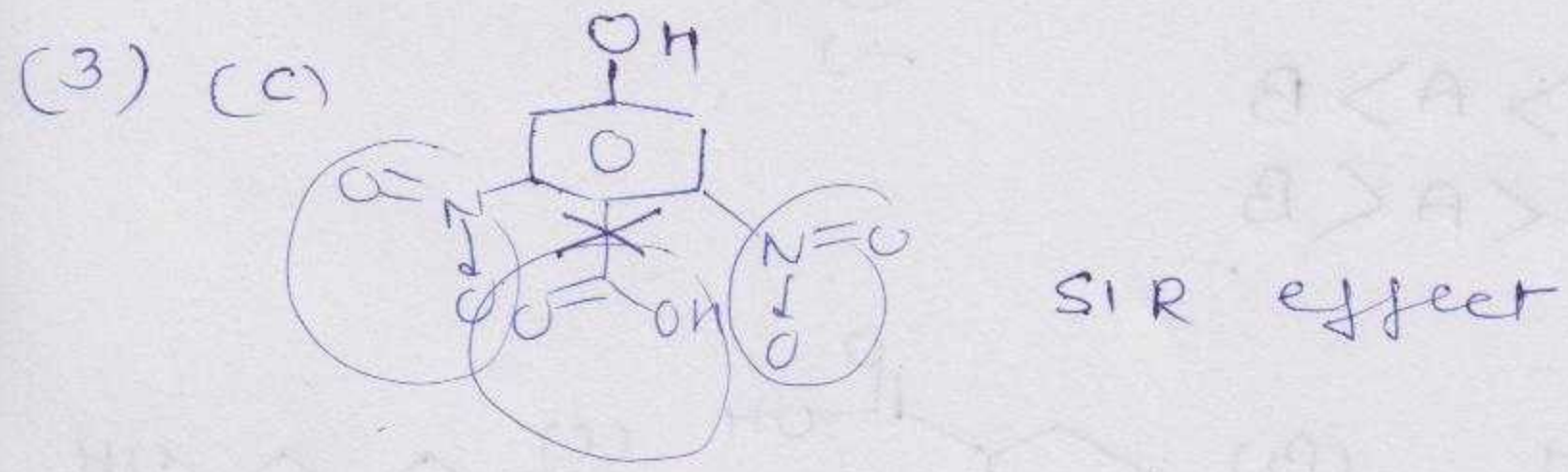
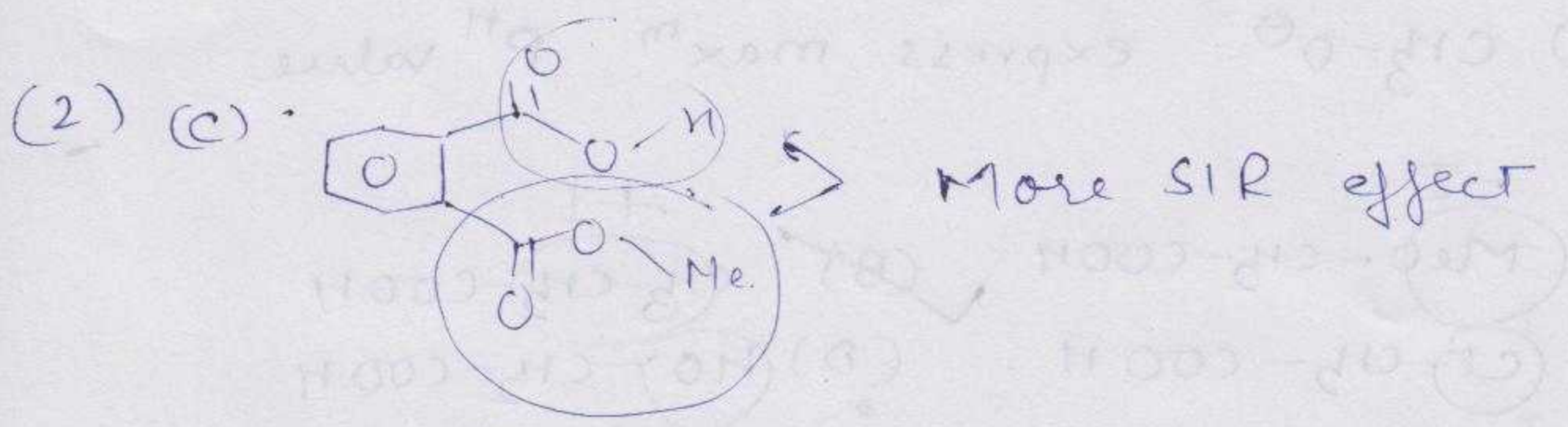
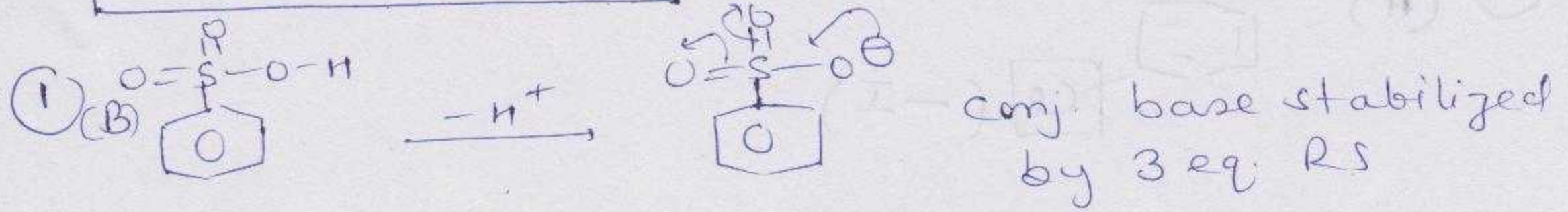


Both (a) & (b) have delocalized π -electrons

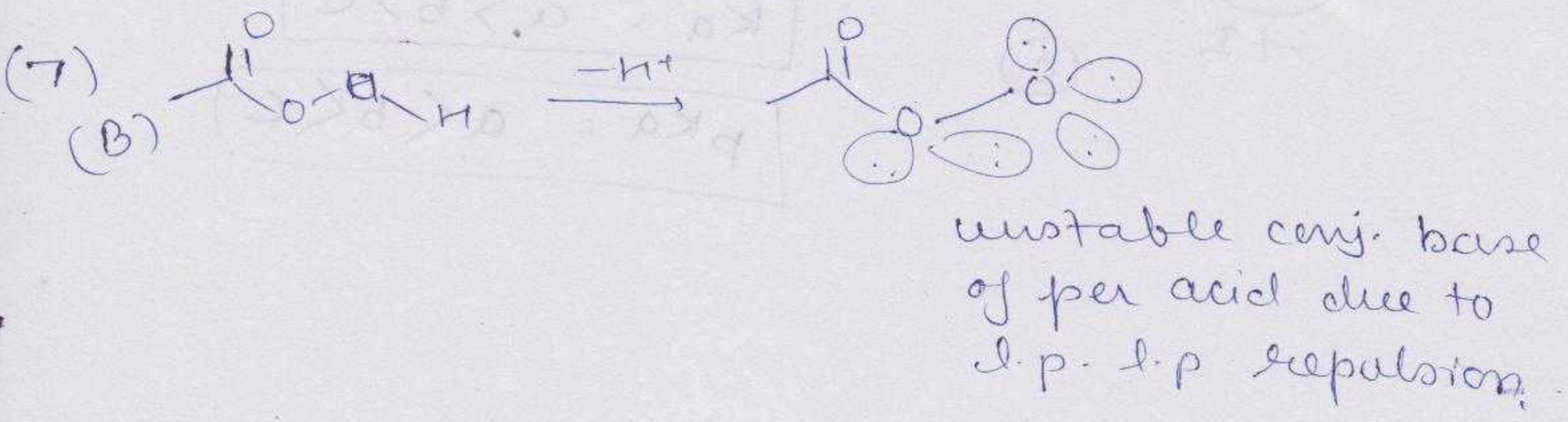


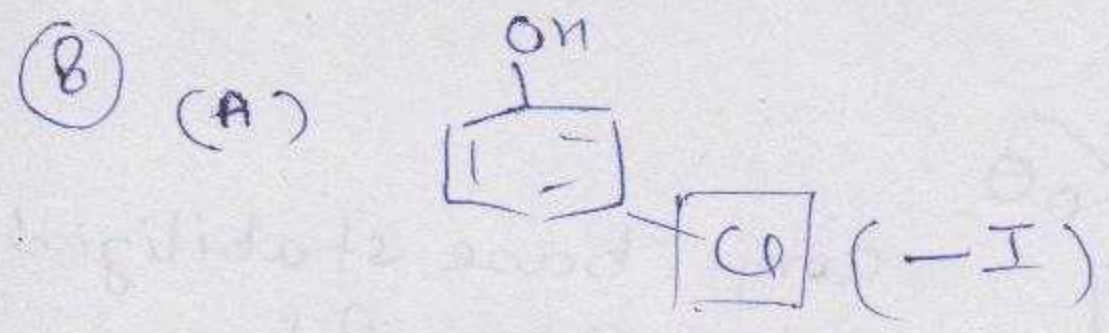
Due to resonance hybrid char. of bond length are present.

EXERCISE - IV

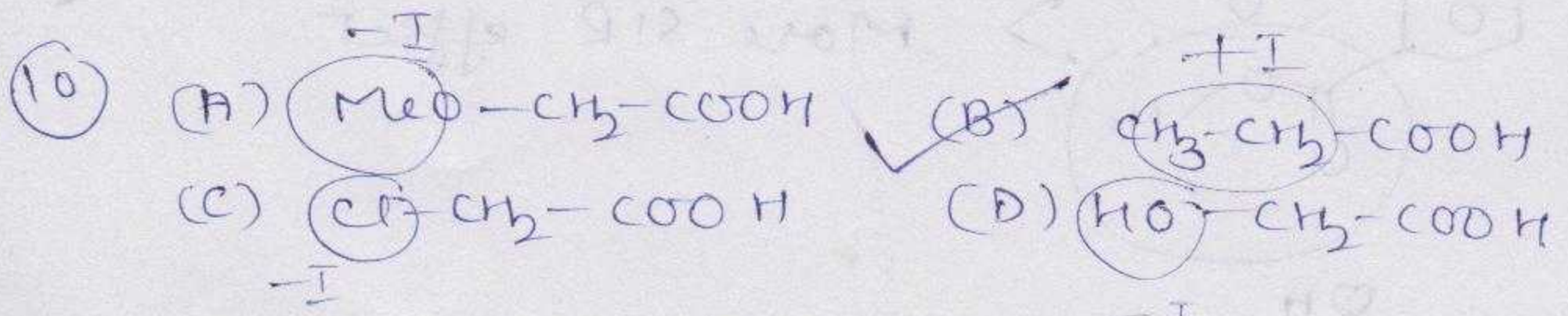


order of K_a = **B > A > C > D**

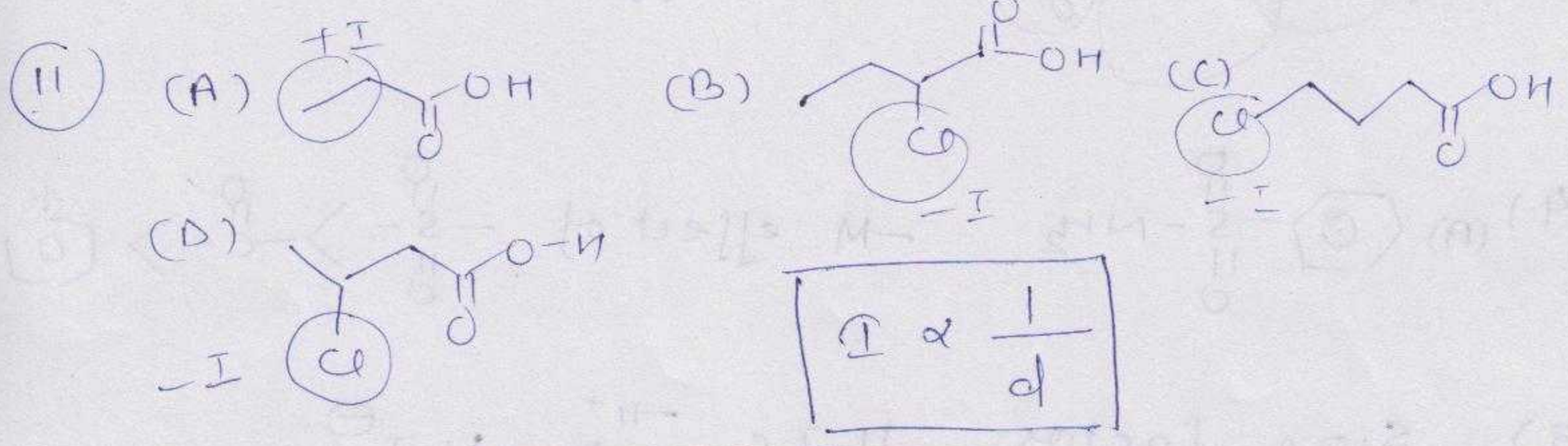




9 (B) CH3-O^- express max^m p^H value

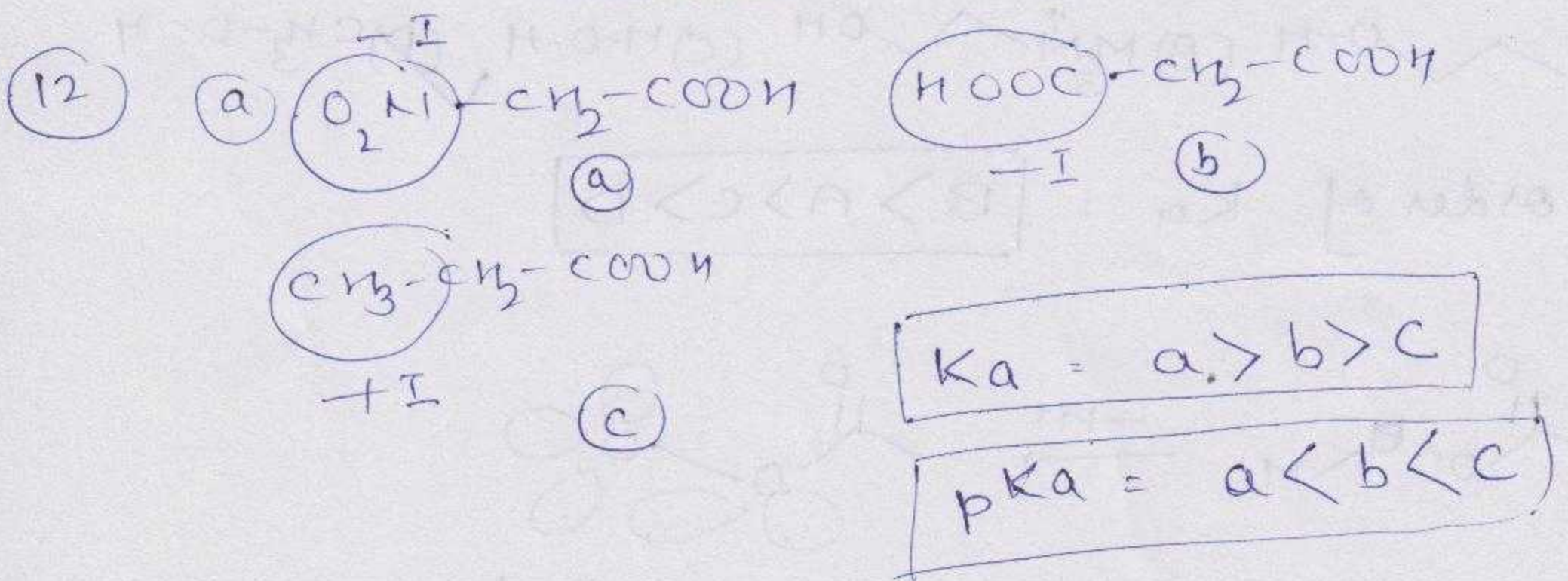


K_a C > D > A > B
 pK_a C < D < A < B



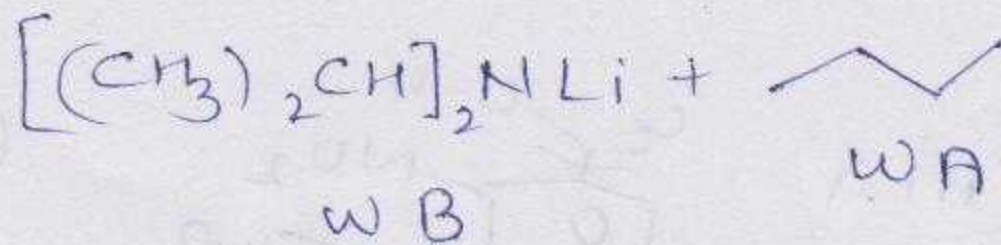
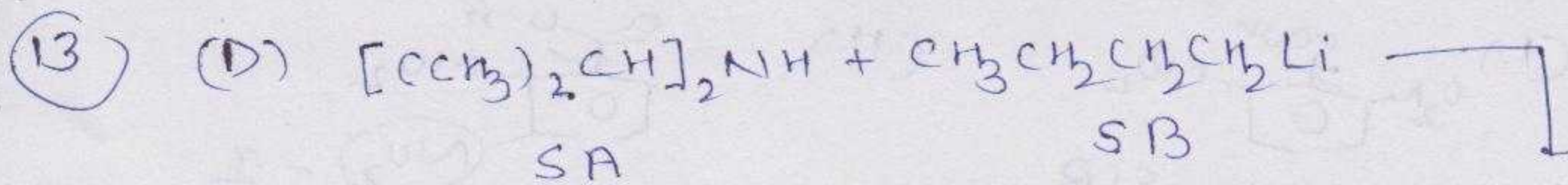
$$I \propto \frac{1}{d}$$

K_a = b < d < c < a

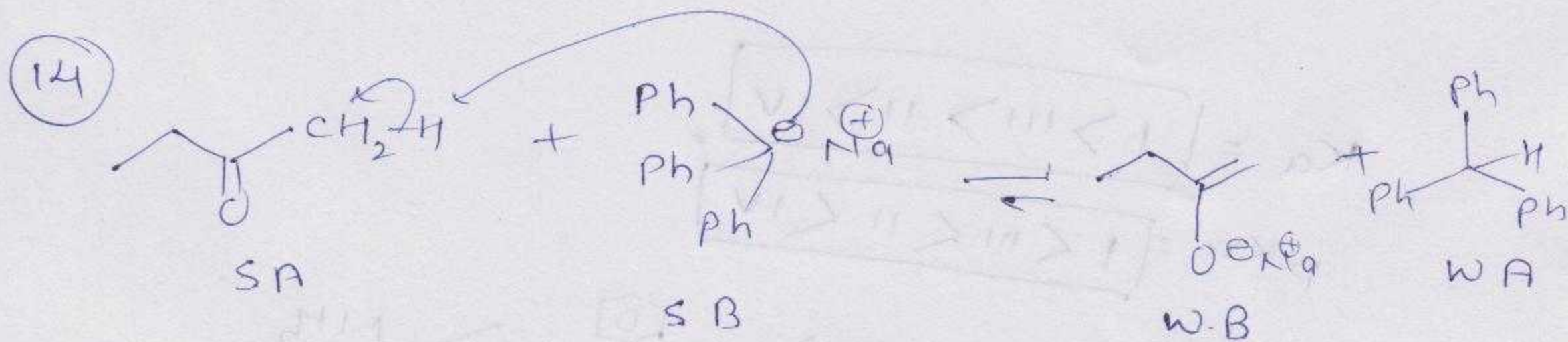


K_a = a > b > c

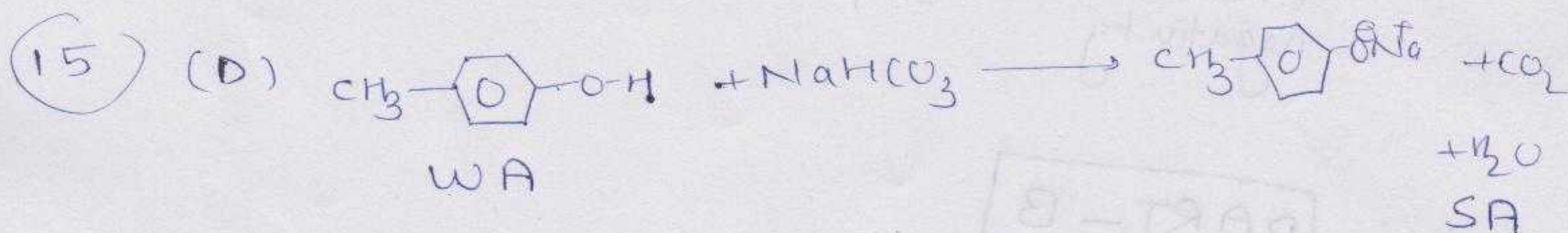
pK_a = a < b < c



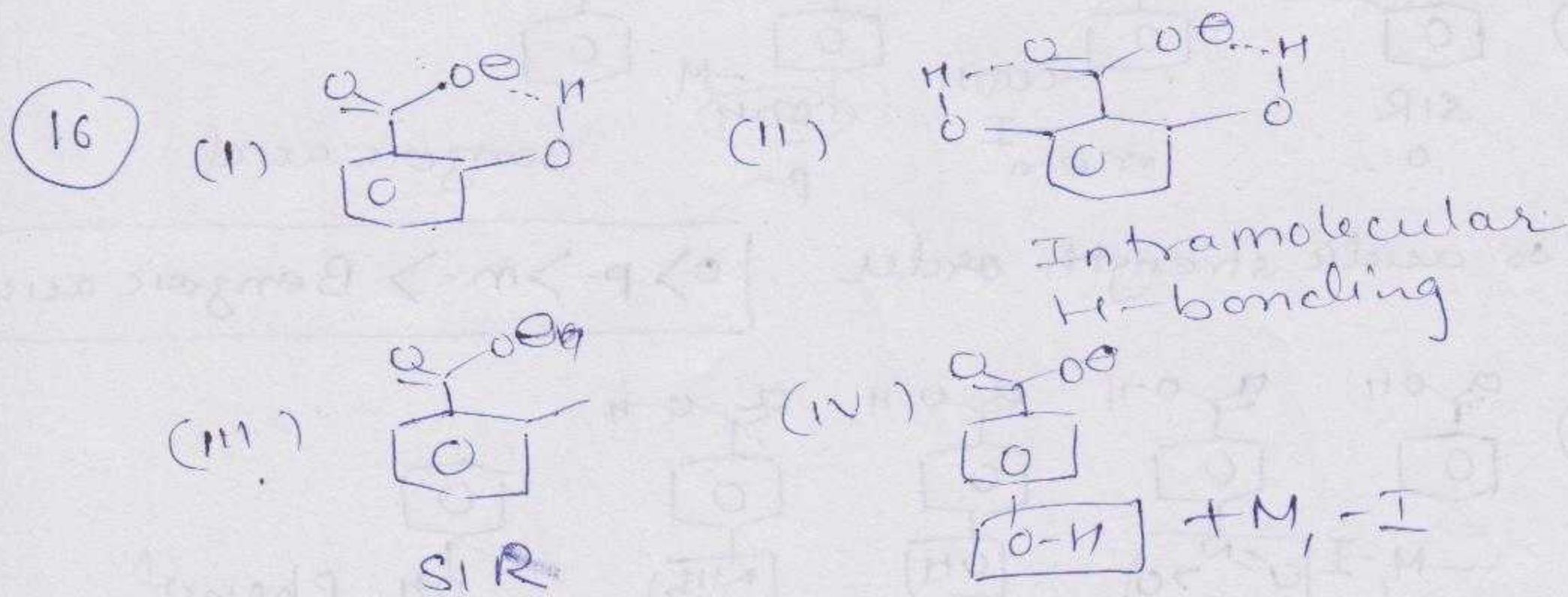
Rxn.
 so, favours to product form.



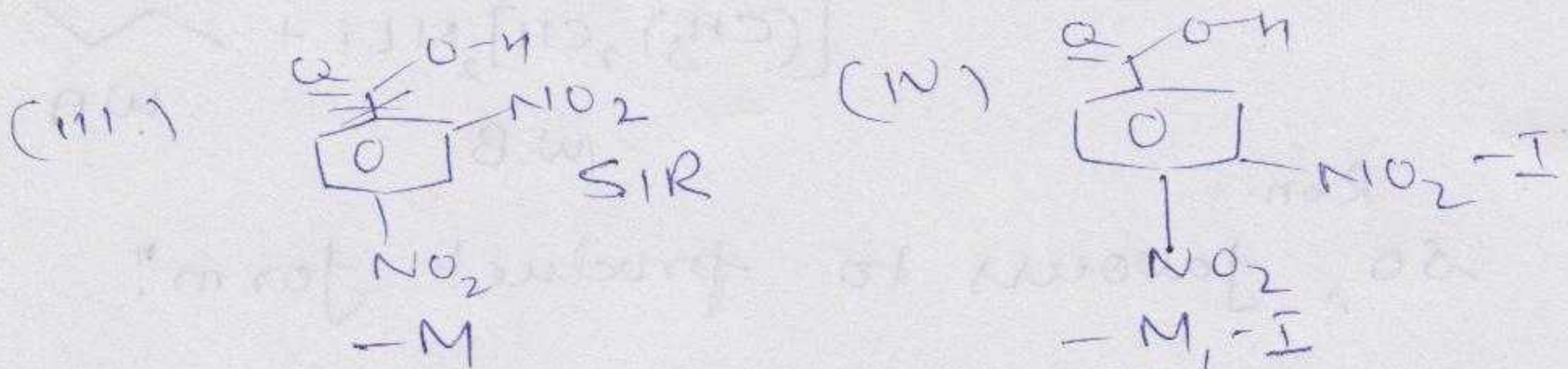
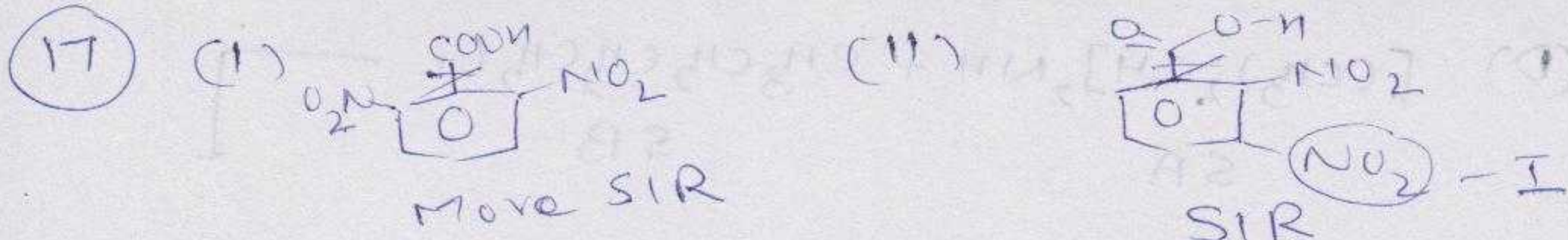
So Base is $(C_6H_5)_3CNa$



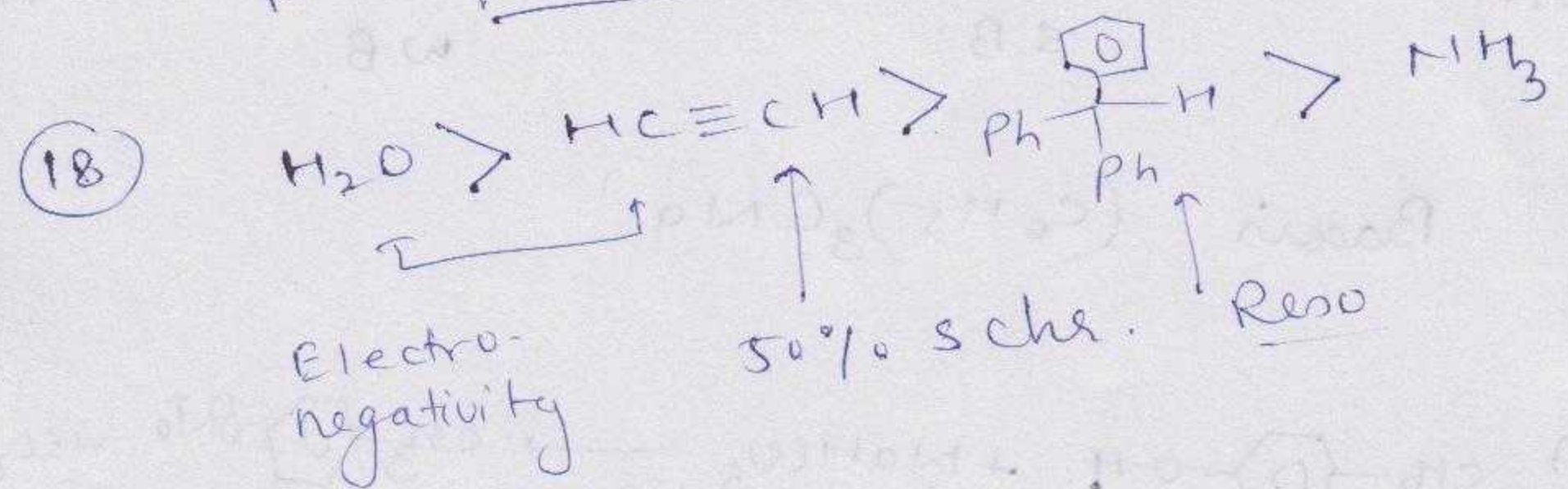
So Rxn. favours to reactant



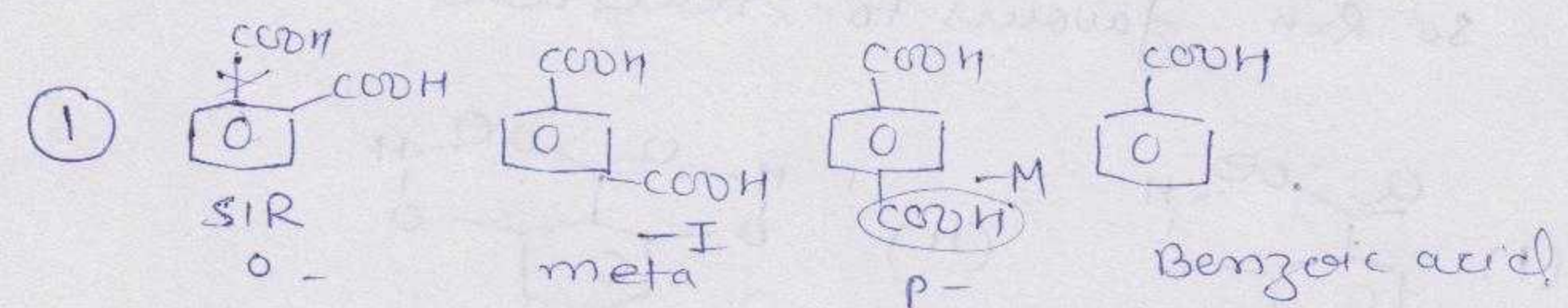
so acidic strength order $K_a = [II > I > III > IV]$
 $pK_a = [II < I < III < IV]$



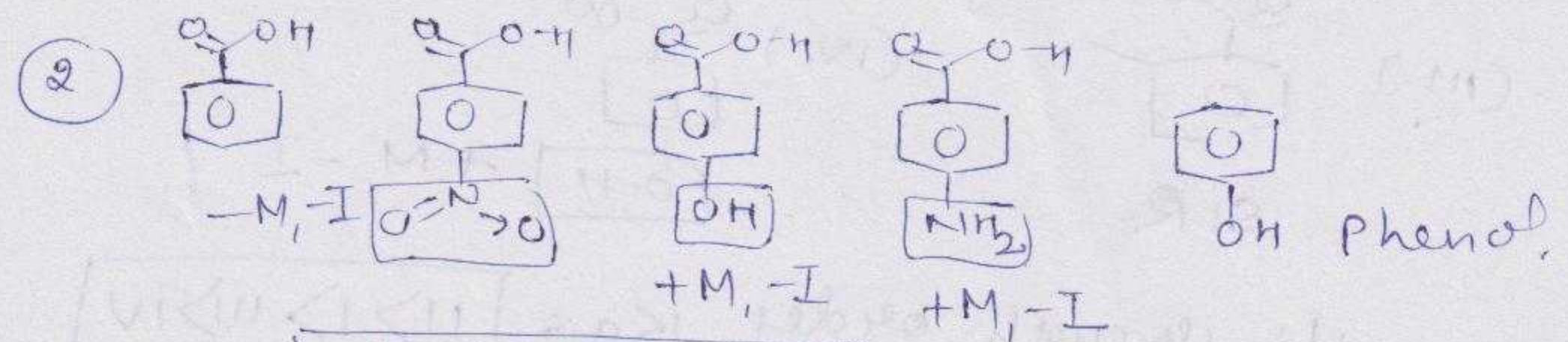
$K_a = I > III > II > IV$
 $pK_a = I < III < II < IV$



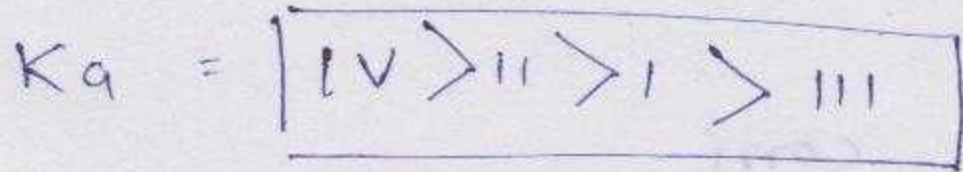
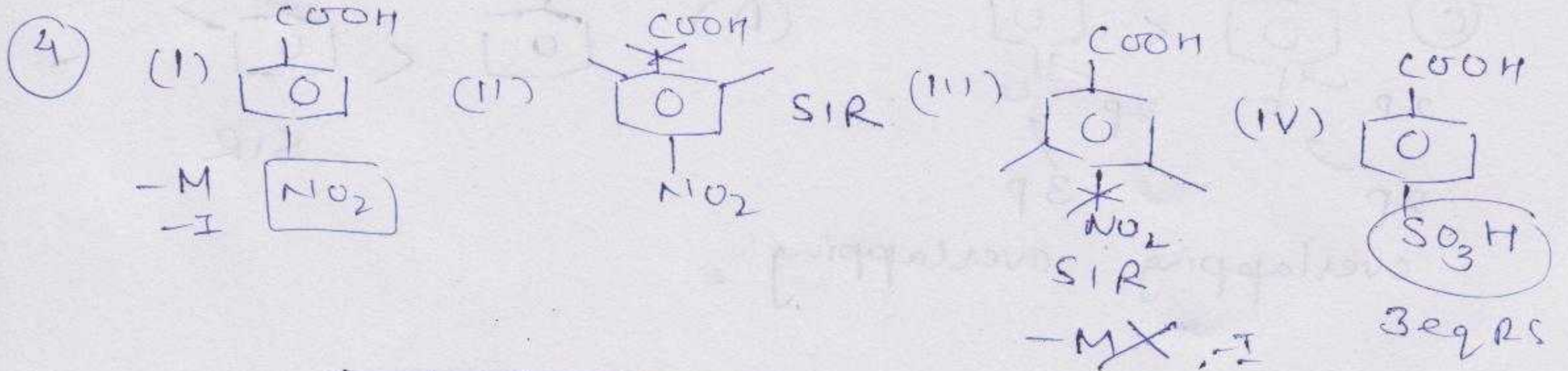
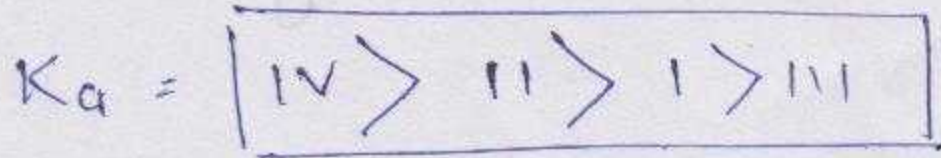
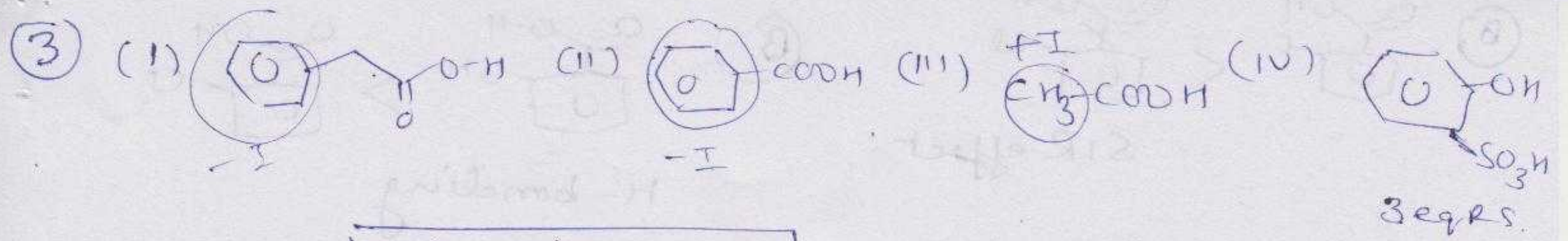
PART-B



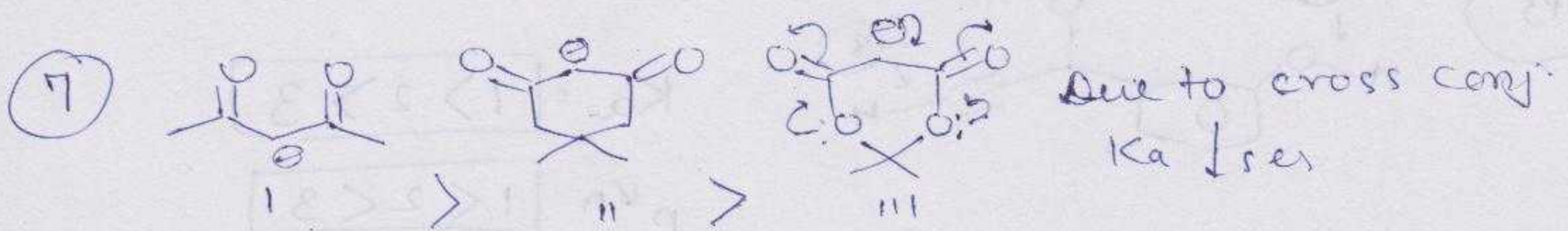
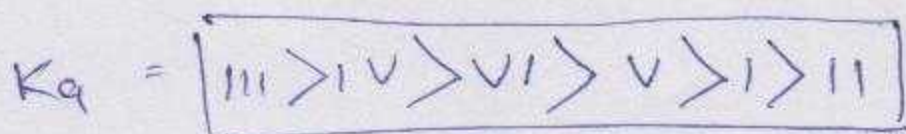
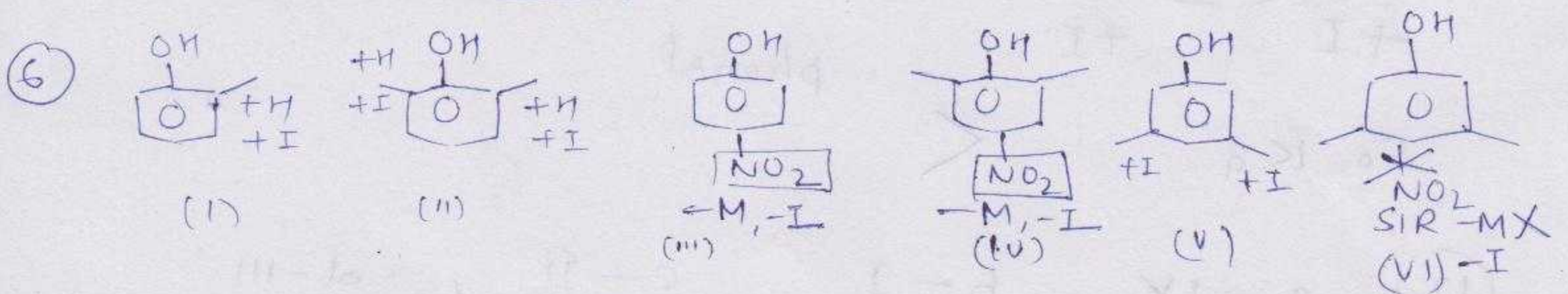
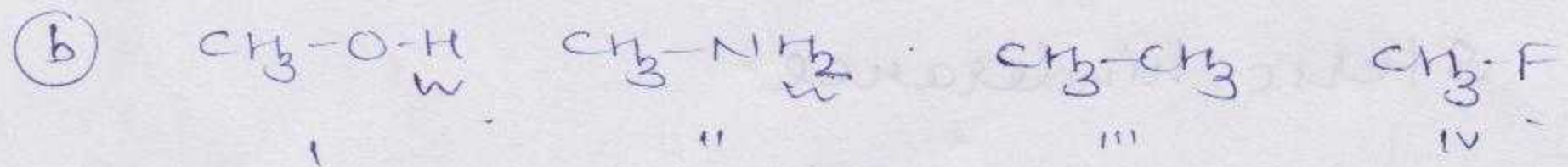
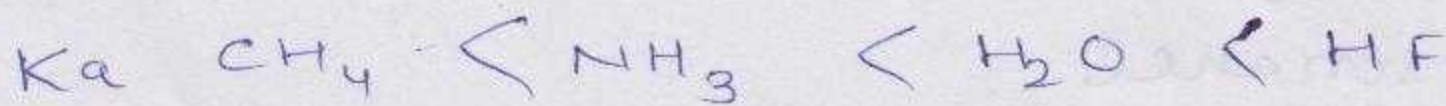
so acidic strength order $O > p- > m- > \text{Benzoic acid}$

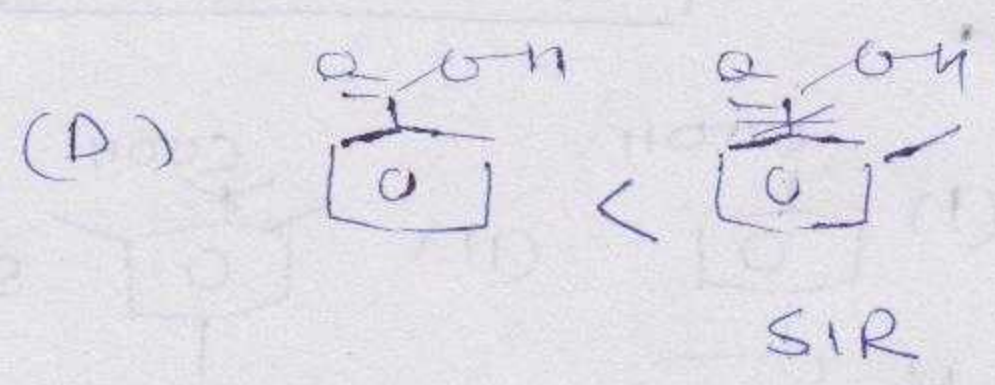
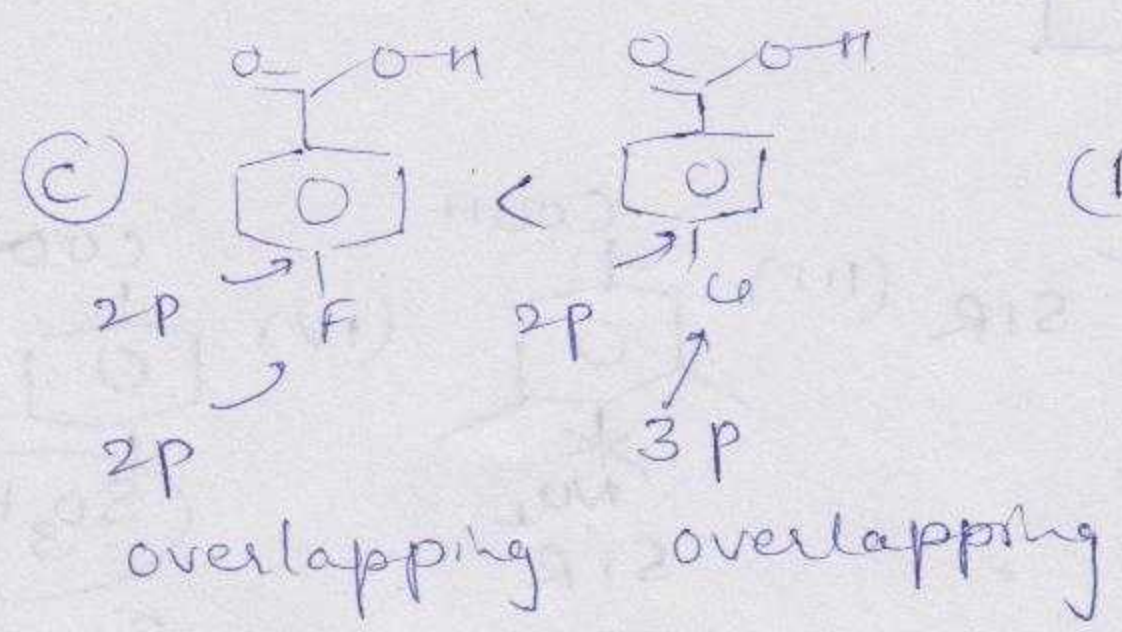
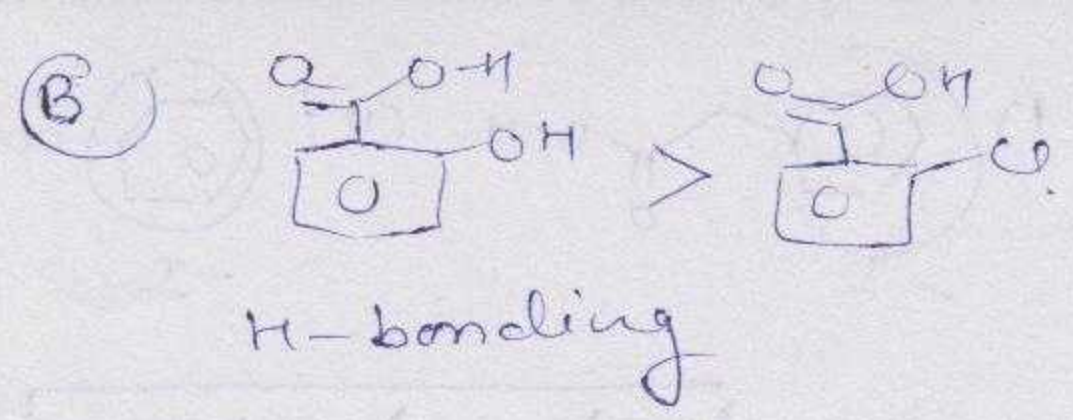
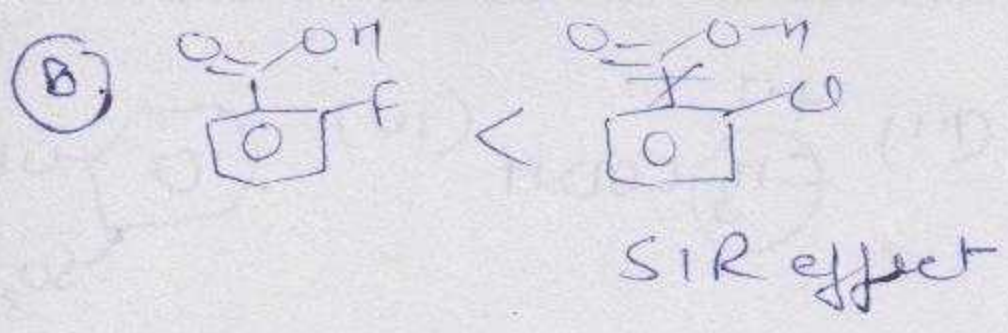


$K_a = II > I > III > IV > V$



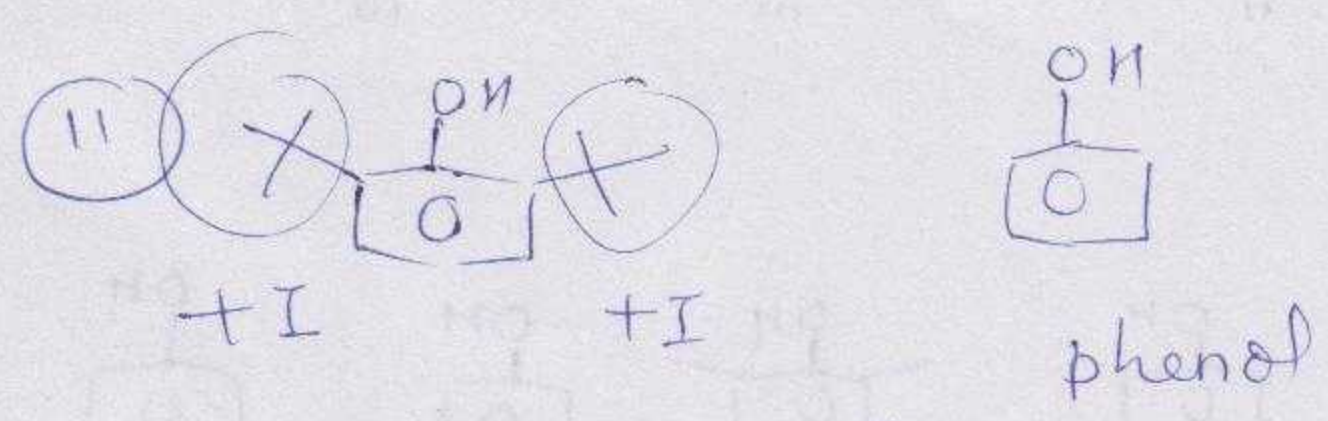
5 (a) In Periodic table $L \rightarrow R$ EN \uparrow $K_a \uparrow$





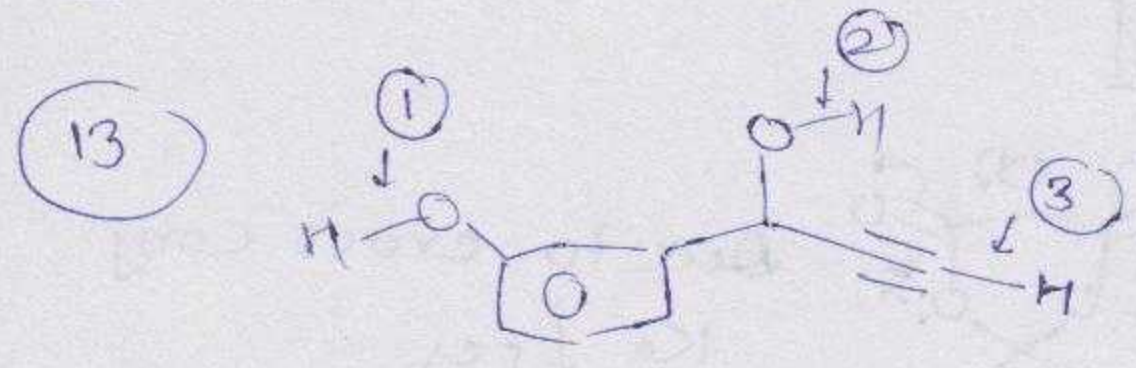
- (9) (a) + Due to cross conj
 (b) More H-bonding
 (c) -I of -Cl
 (d) Resonance

(10) Steric hinderance



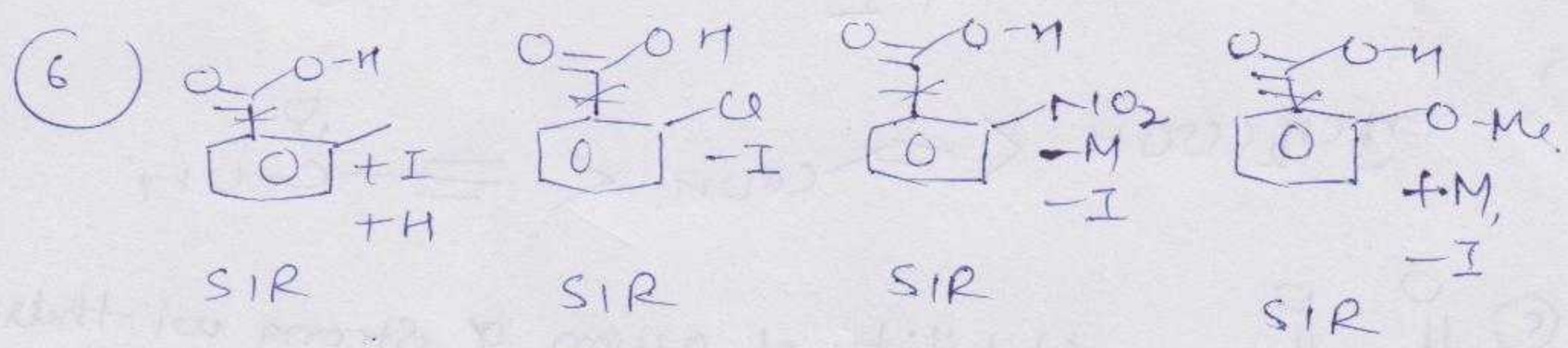
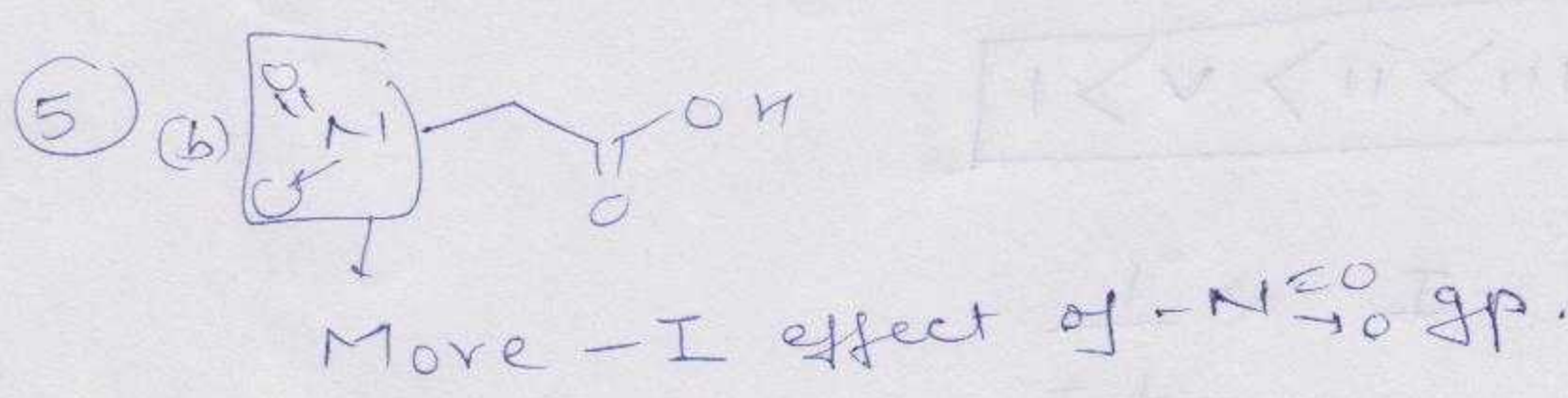
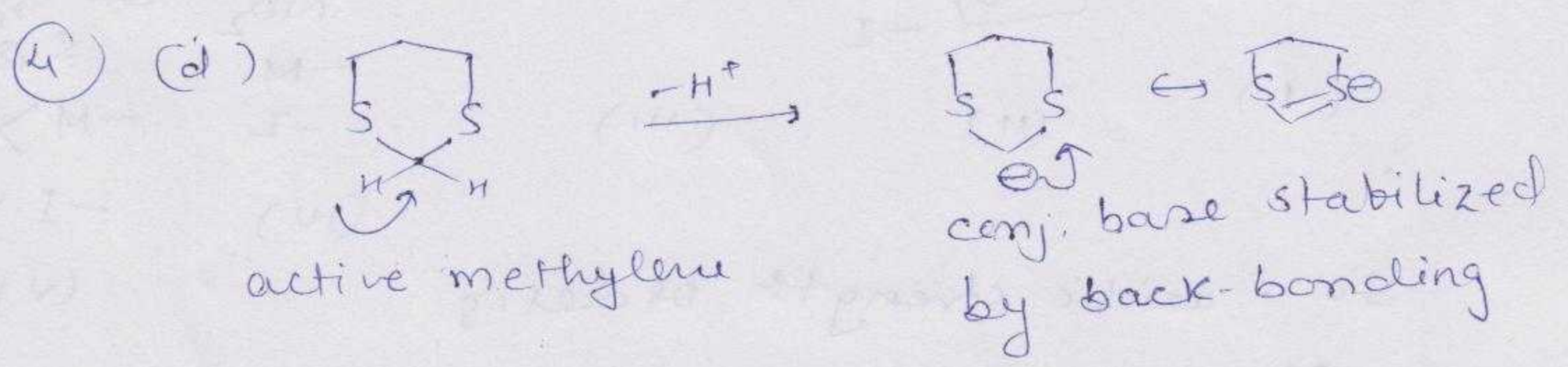
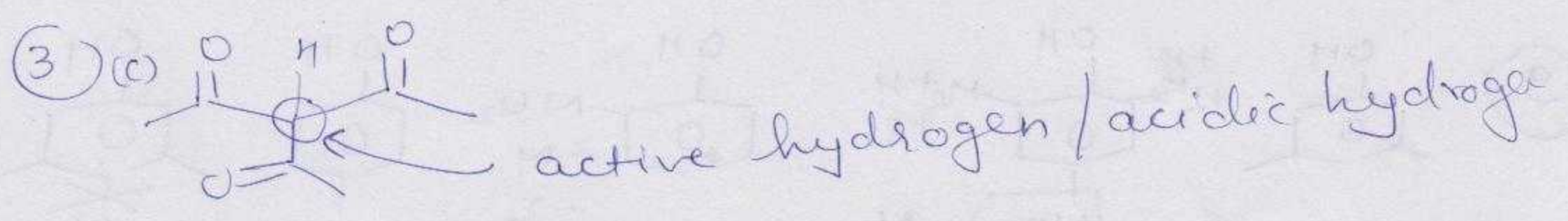
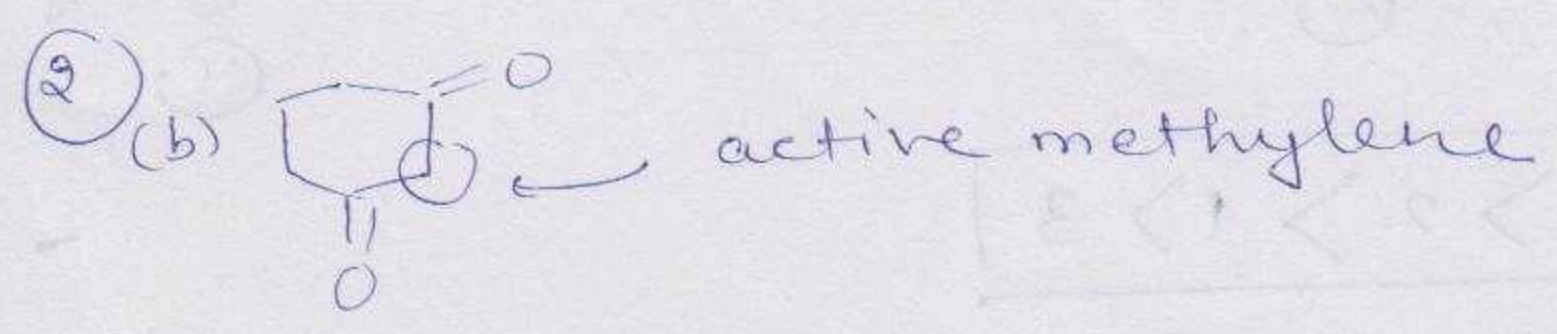
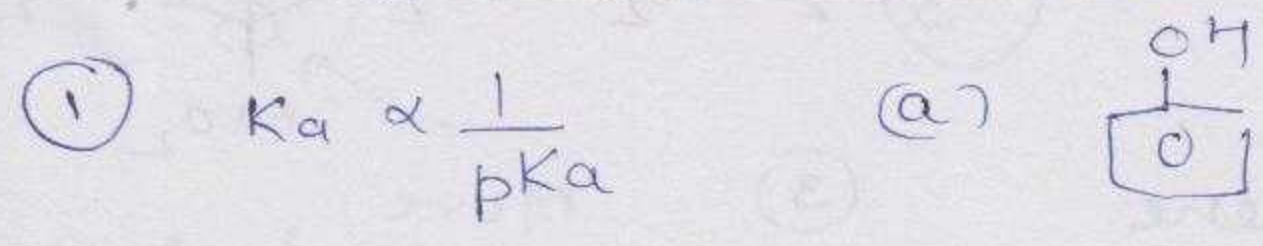
So K_a <

(12) a → IV, b → I, c → II, d → III



$K_a = 1 > 2 > 3$
 $pK_a = 1 < 2 < 3$

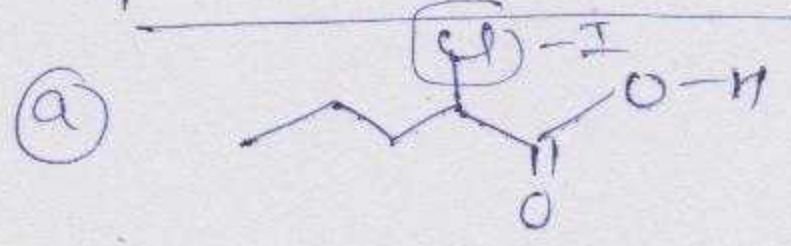
EXERCISE - V

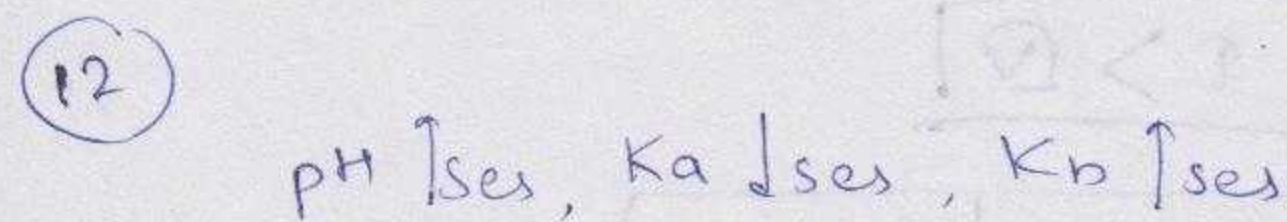
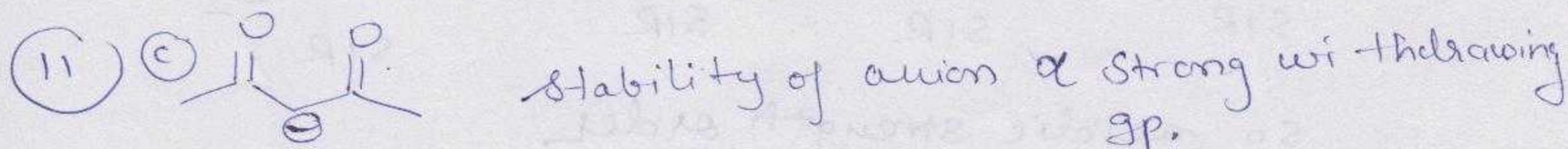
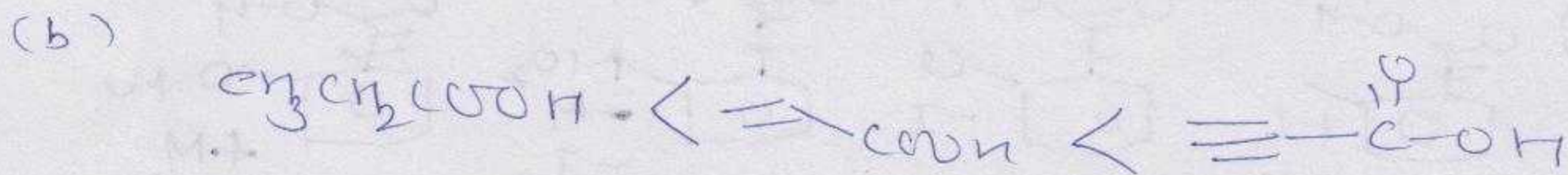
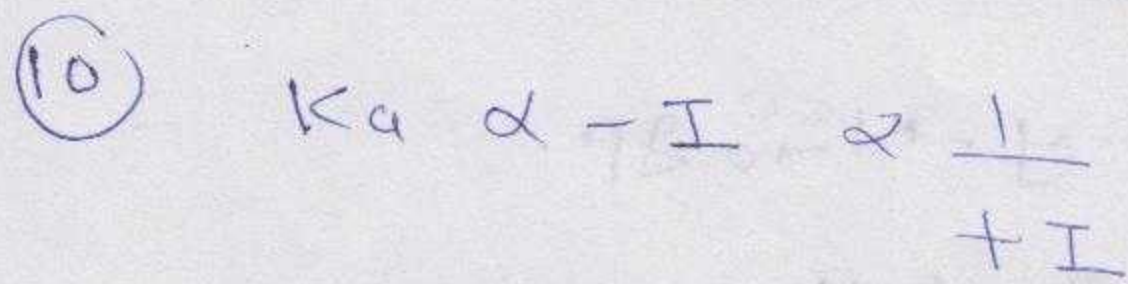
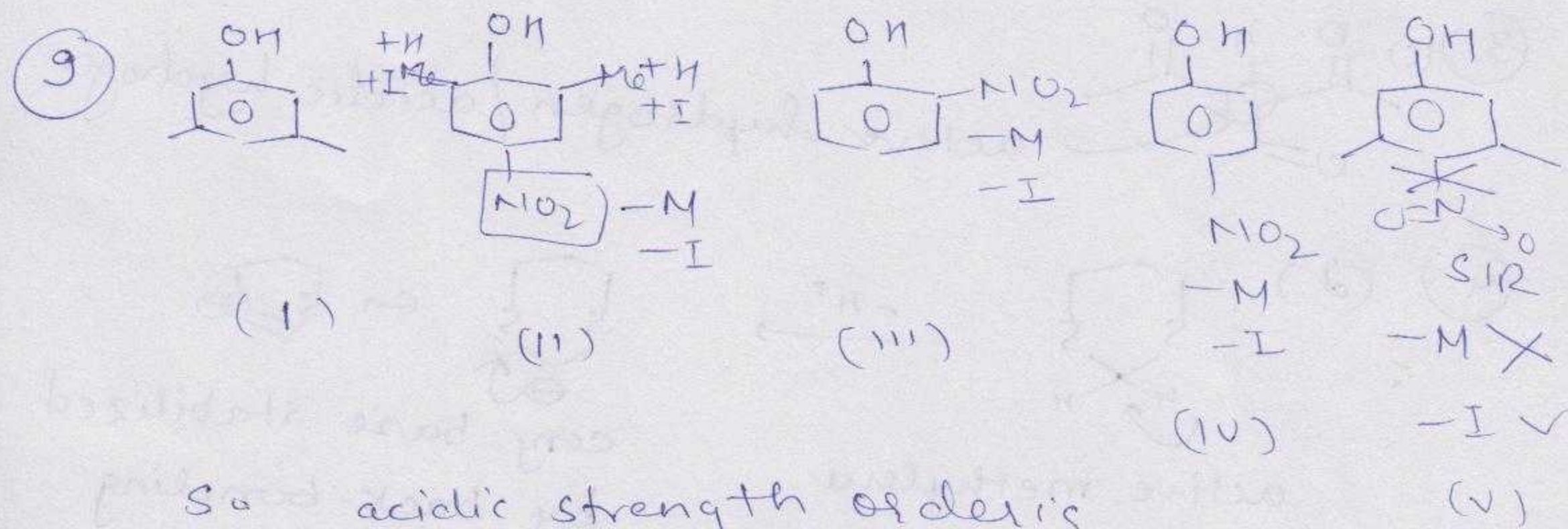
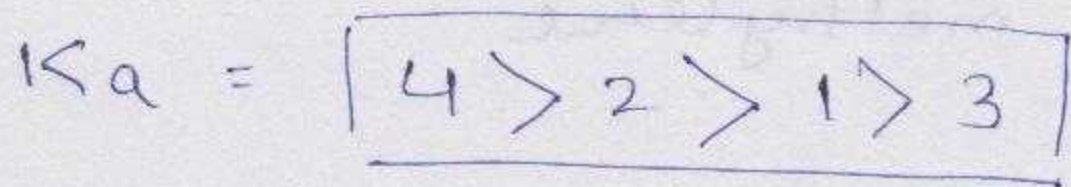
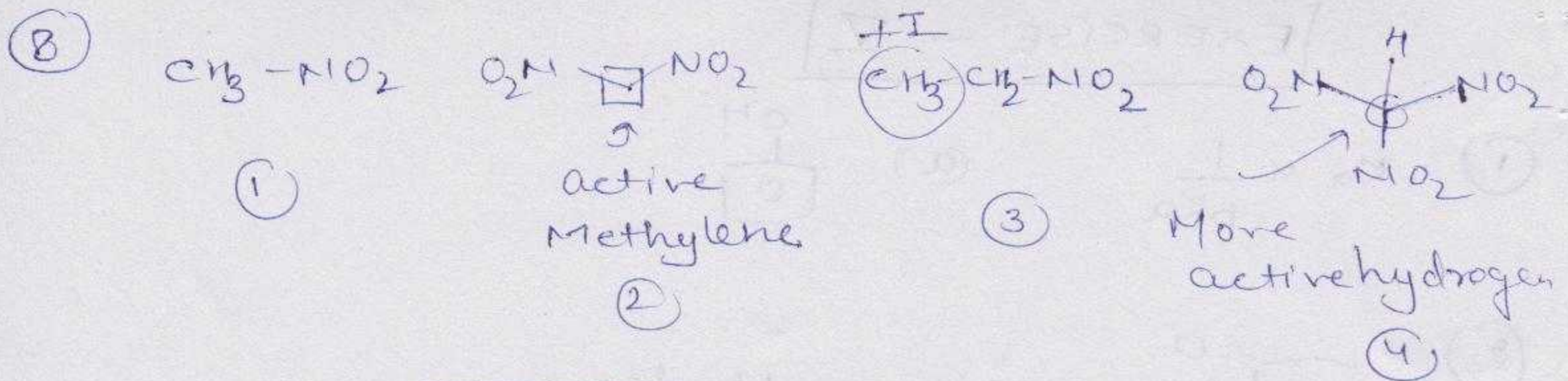


so acidic strength order

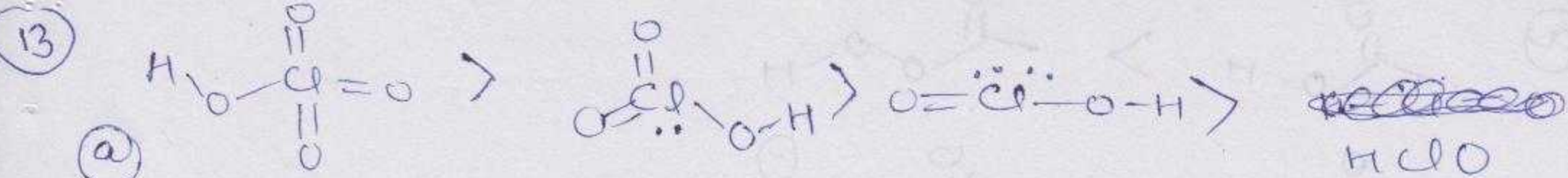
$K_a = \text{III} > \text{II} > \text{I} > \text{IV}$

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



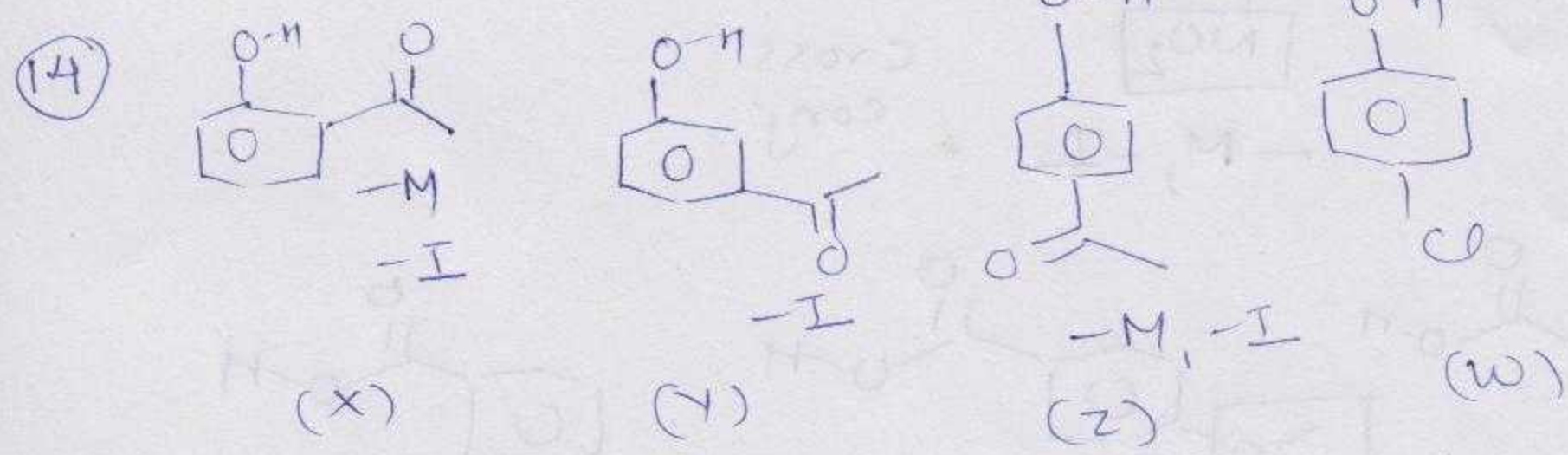


So ans is (b)



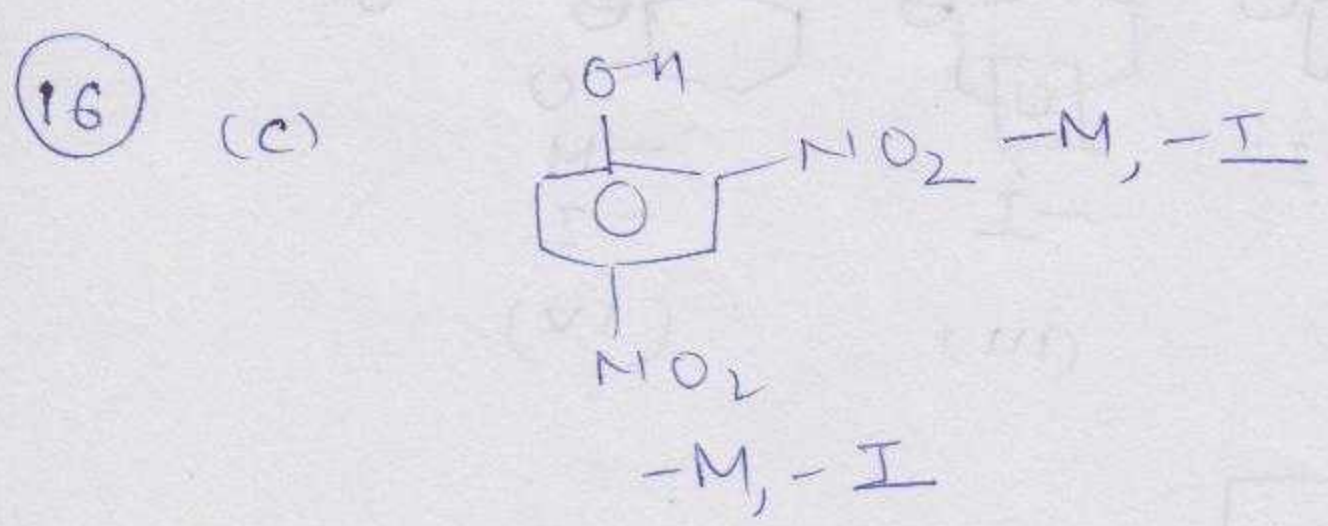
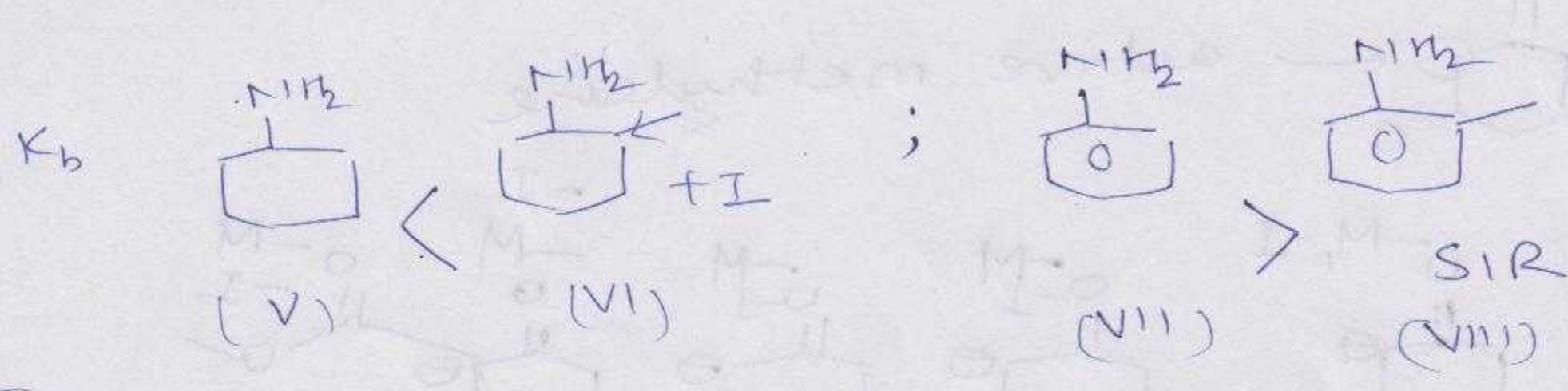
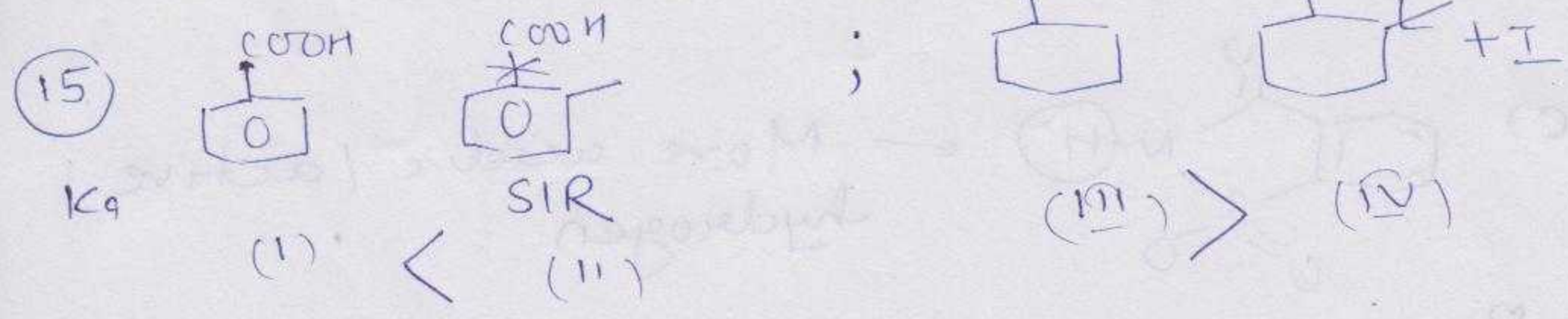
Conj base
Stabilized by
4 eq. R.S.

(c) size $Cl < Br < I$



so acidic strength order is

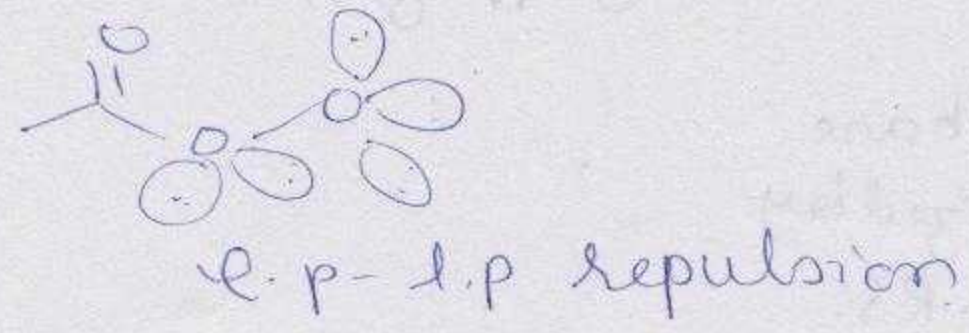
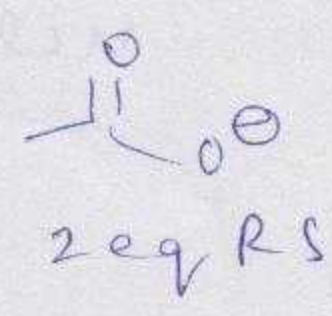
$K_a = x > z > y > w$



$K_a = VI > I > III > II$

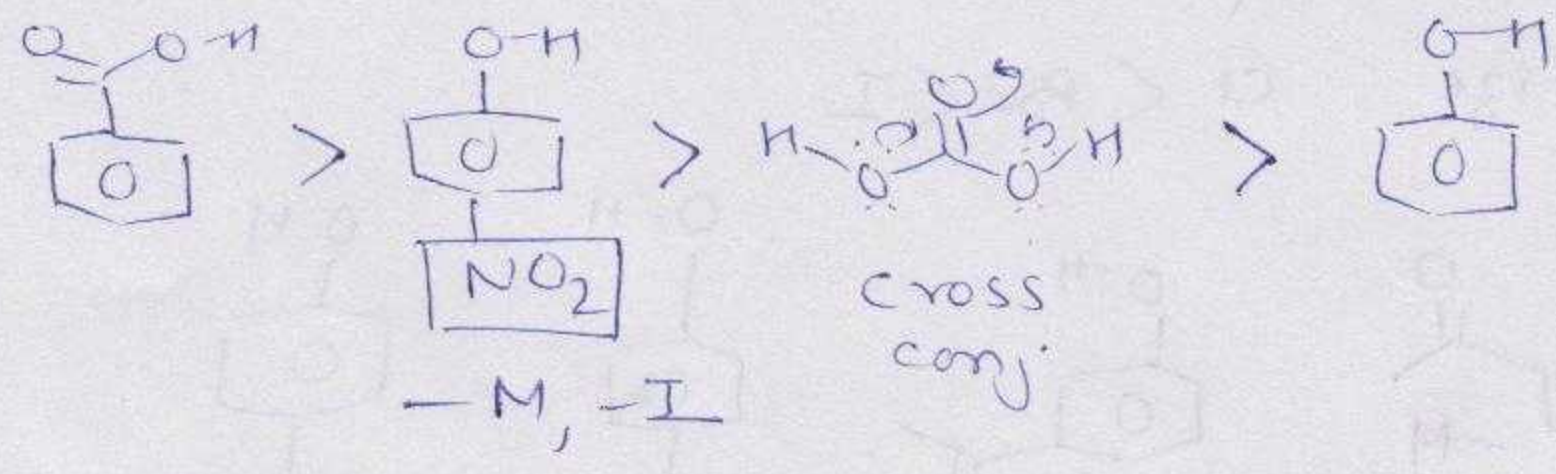
17

(a)

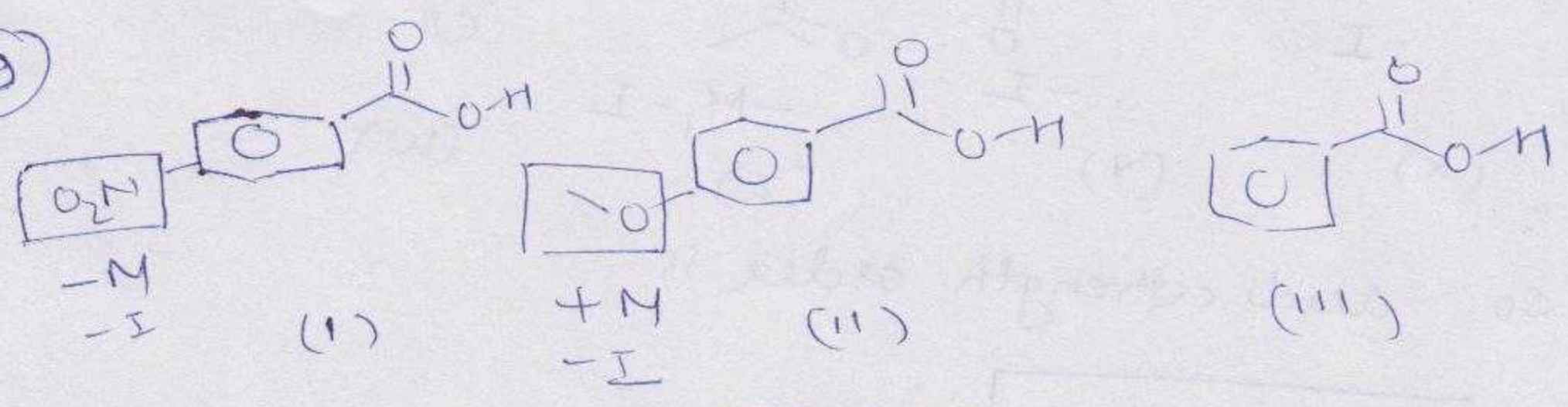


18

(a)



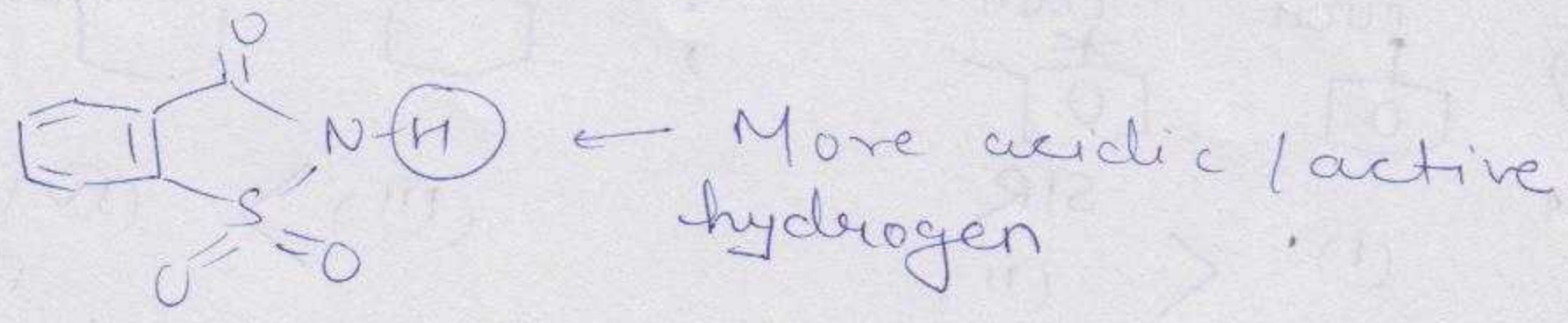
19



so Ka order I > III > II

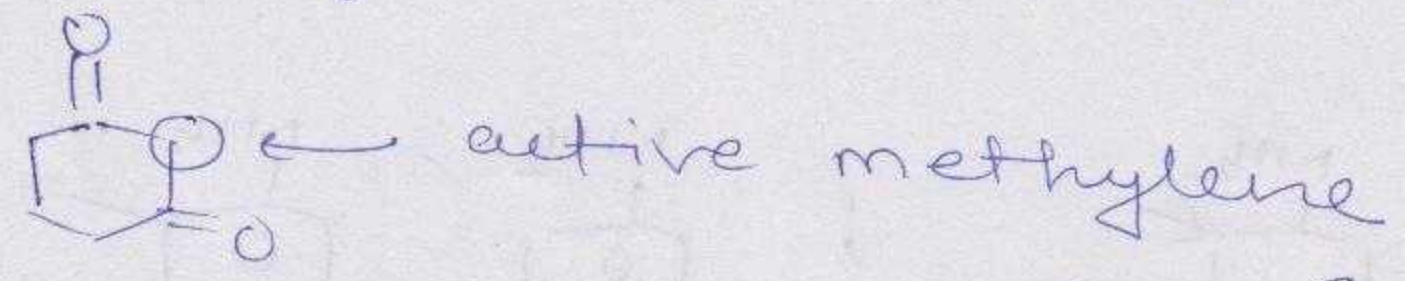
20

(c)

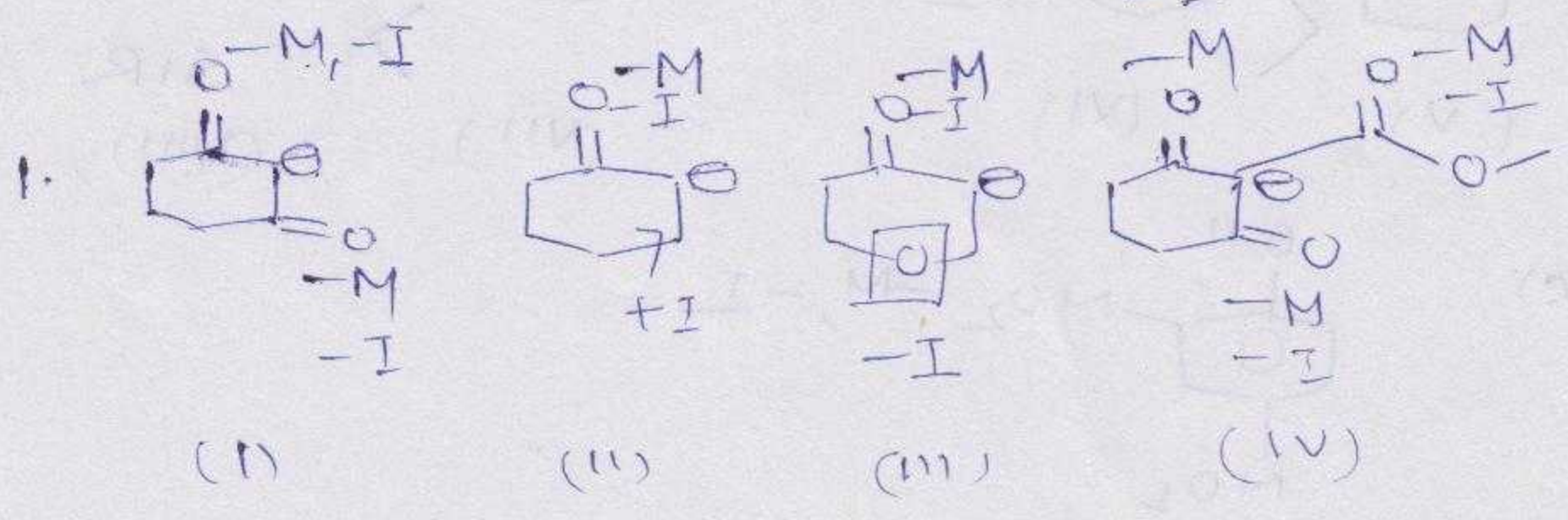


21

(c)

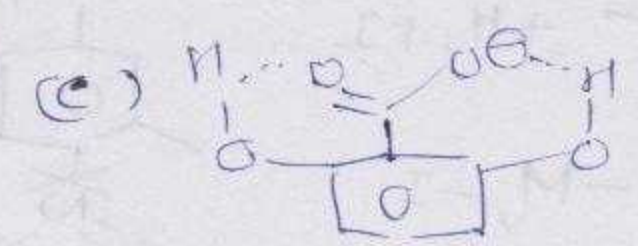


22



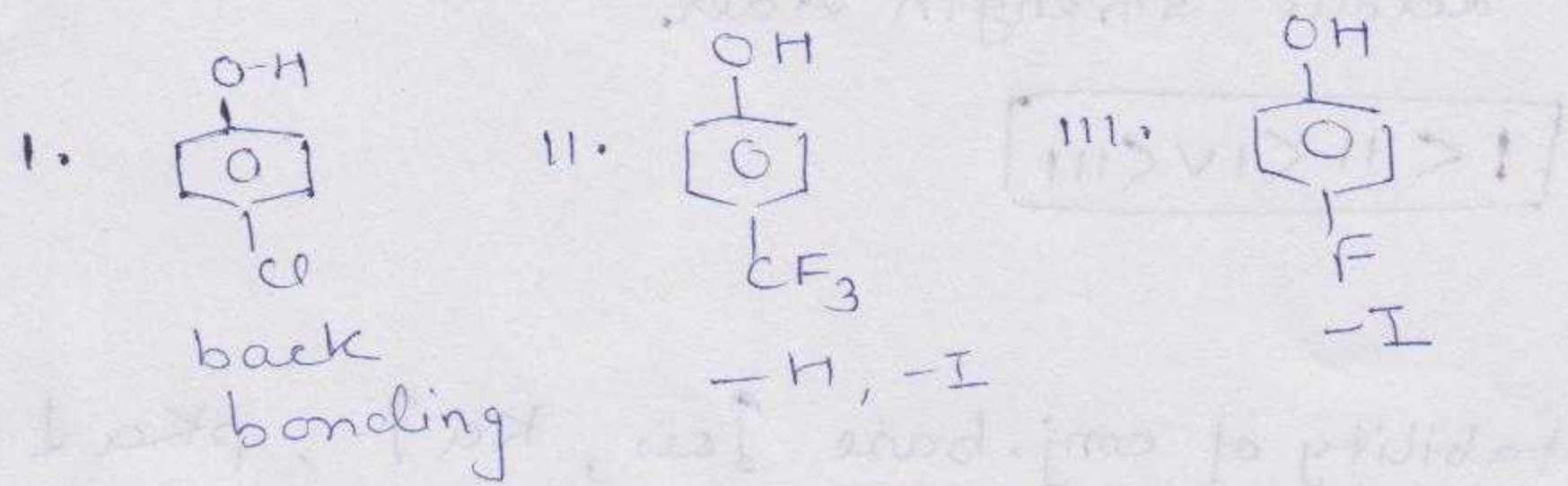
Ka = II < III < I < IV

Q3



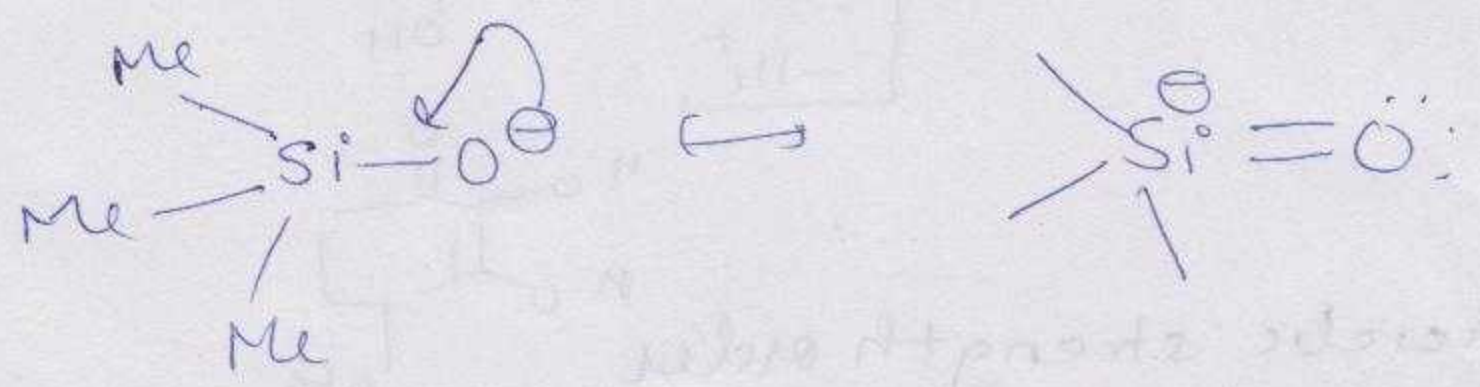
Due to intramolecular H-bonding

Q4

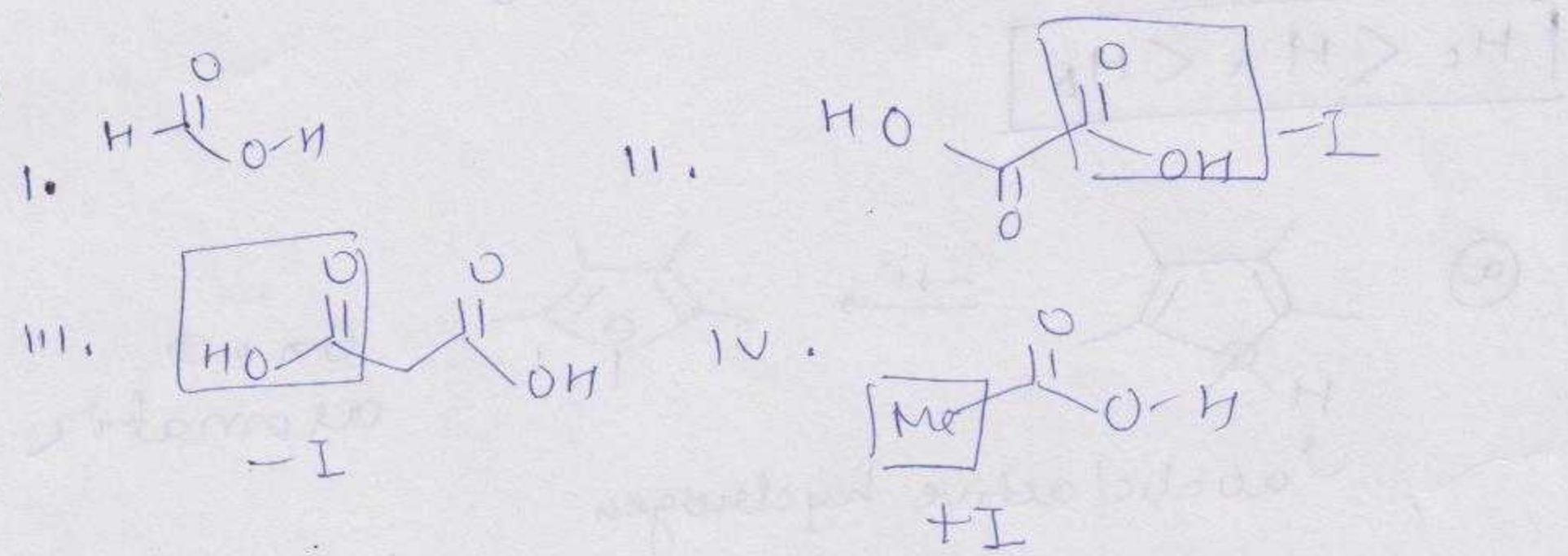


So Ka order = $\boxed{II > I > III}$

(25) (b) Stabilized due to back bonding



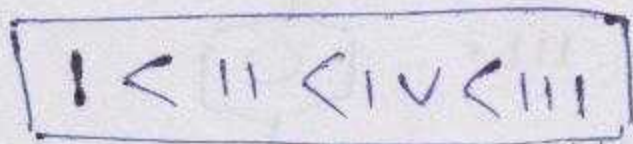
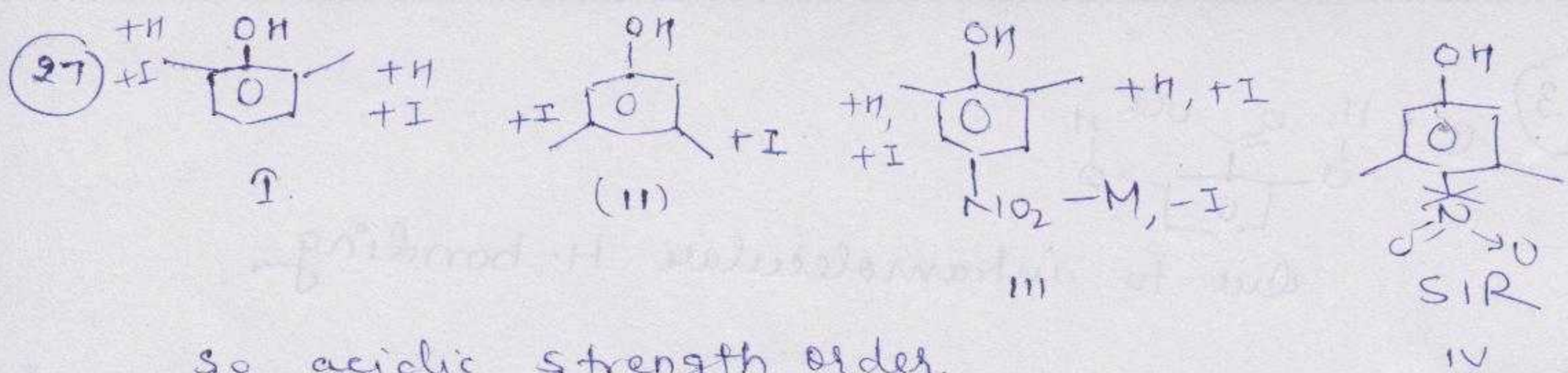
(26)



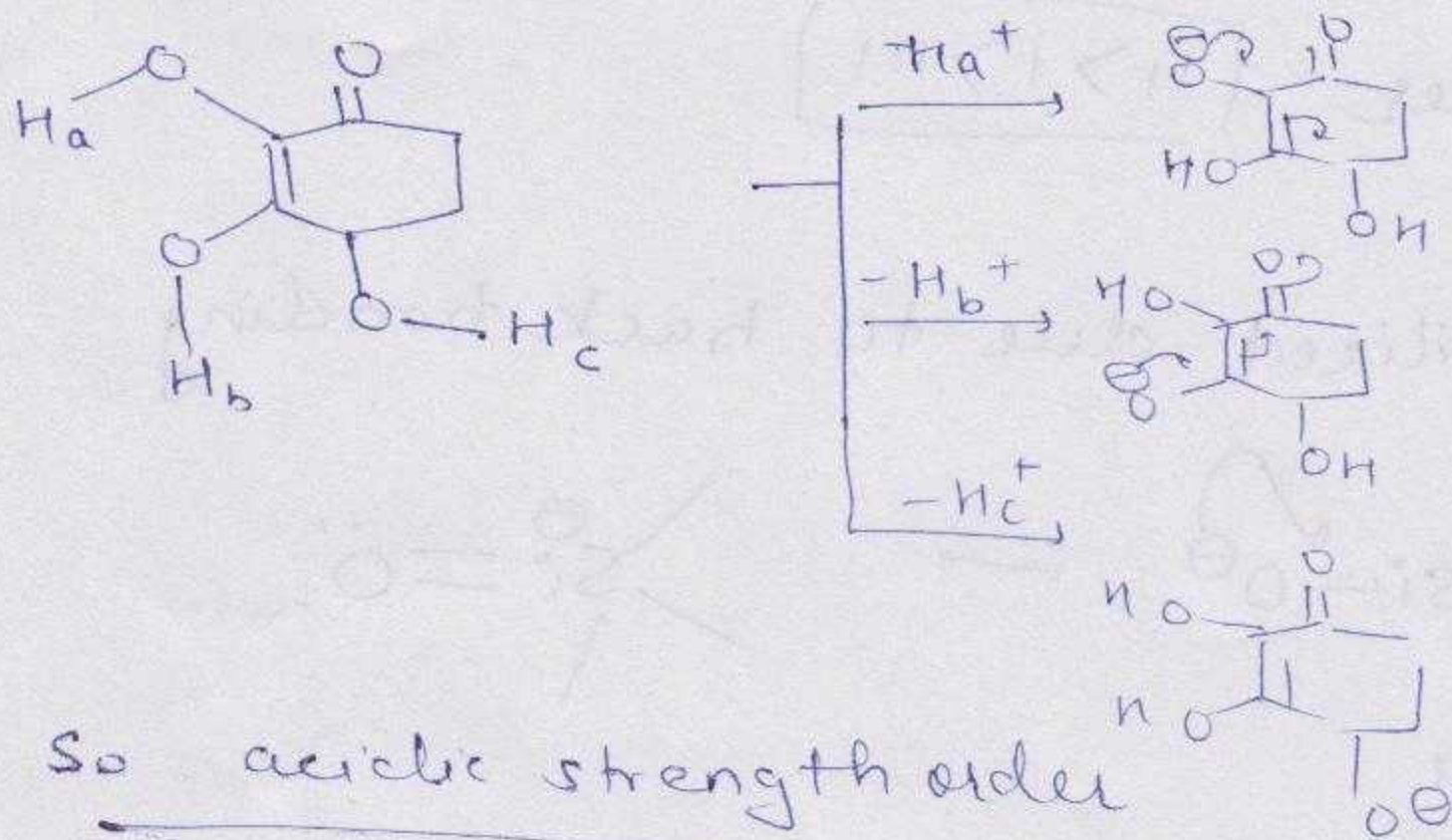
So acidic strength order

$K_a = \boxed{II > III > I > IV}$

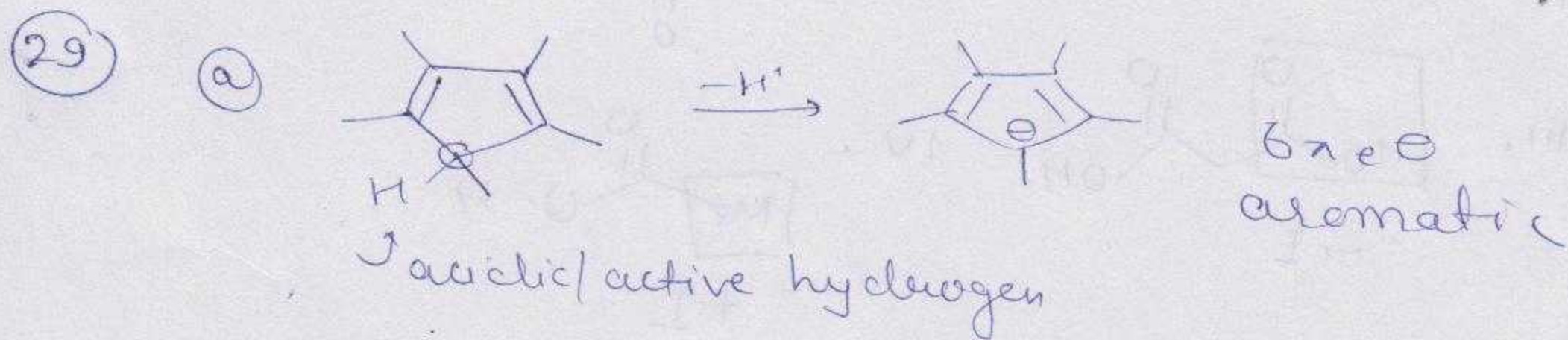
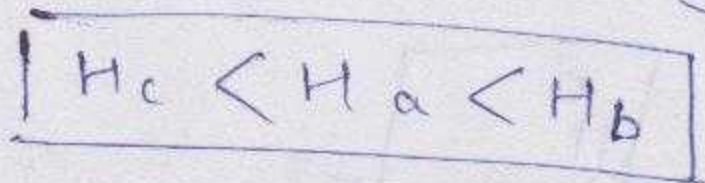
$pK_a \boxed{III < I < IV}$



28 stability of conj. base \uparrow $\text{res}, K_a \uparrow, pK_a \downarrow$



So acidic strength order

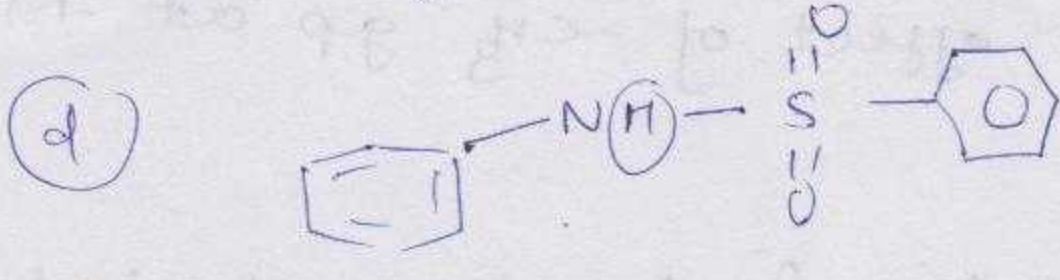
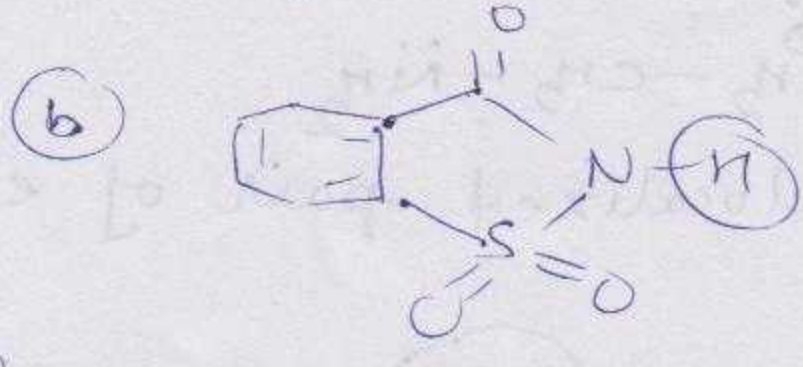
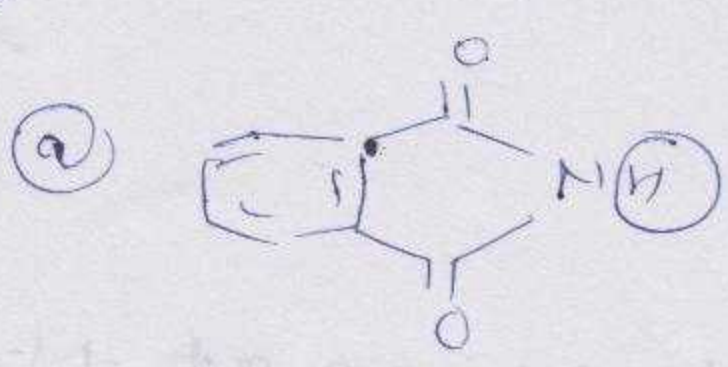


30 carboxylic acid are stronger acid than phenol

31 because during rxn. formⁿ of weak acid H_2CO_3 (carbonic acid)
so ans is (b, c)

32

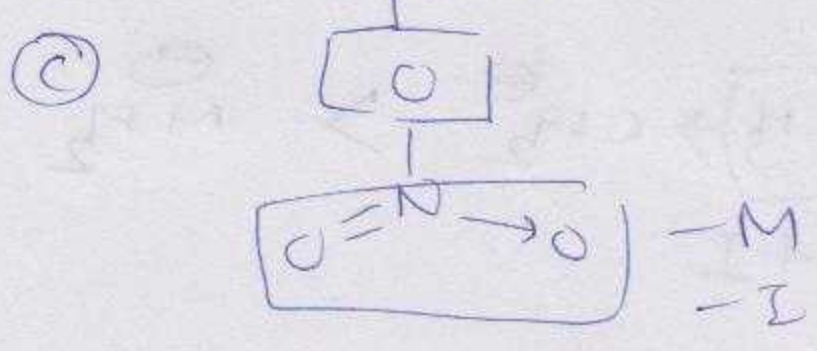
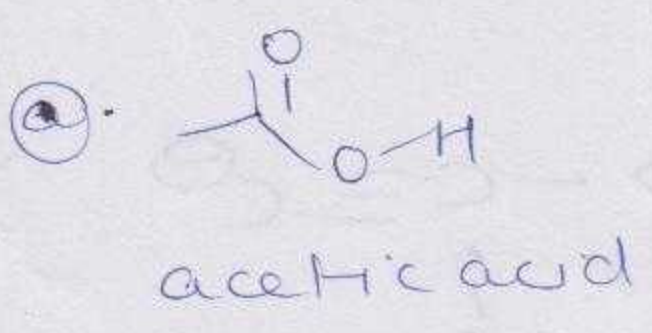
acidic / active hydrogen



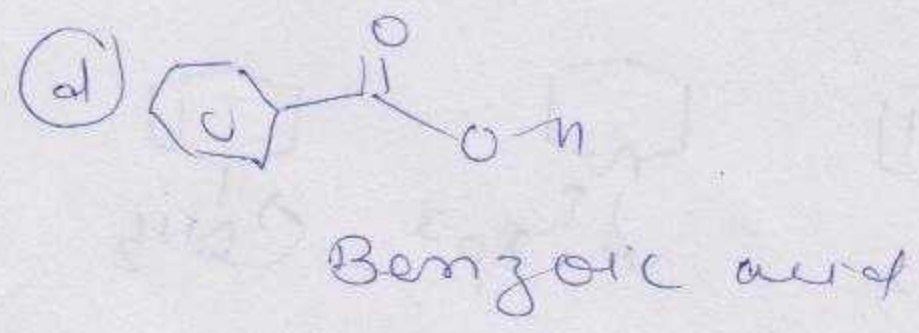
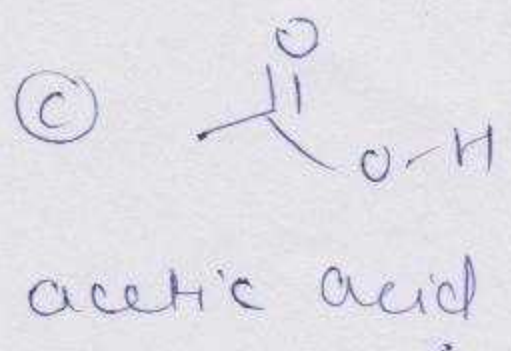
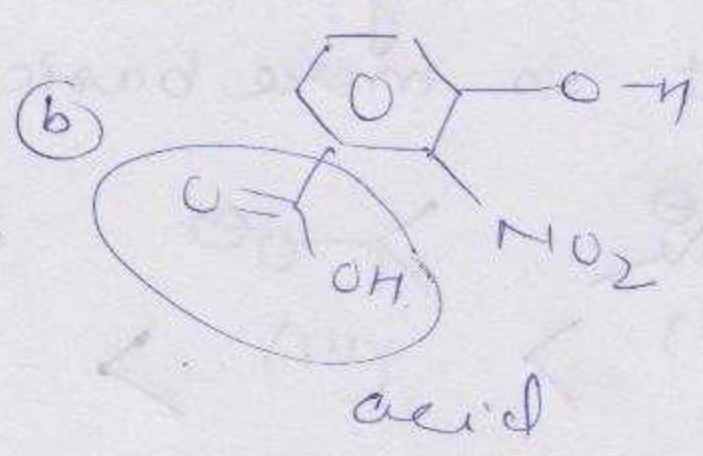
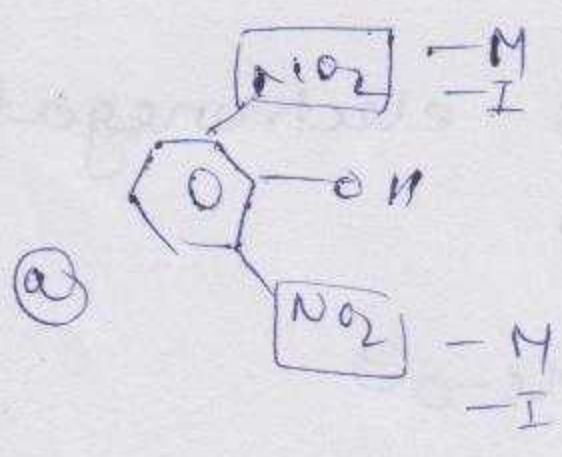
33

during ion. formⁿ of H_2CO_3 takes place which is weaker acid than carboxylic acid & squaric acid but stronger acid than phenol.

34

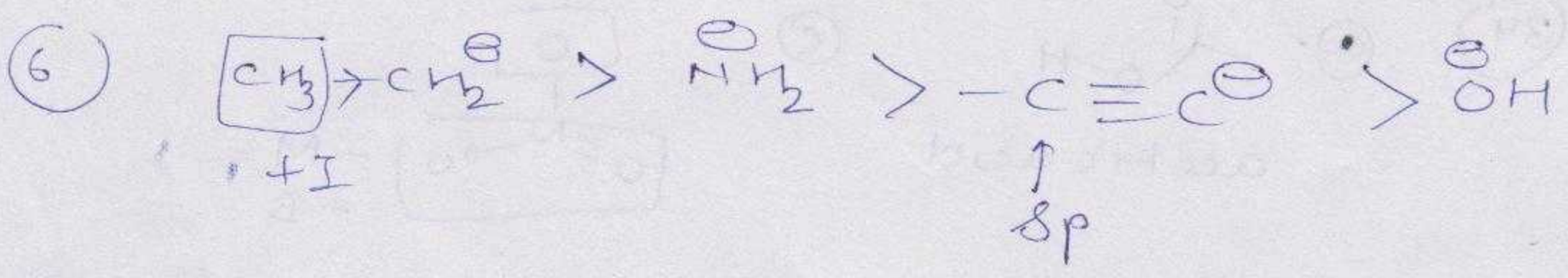
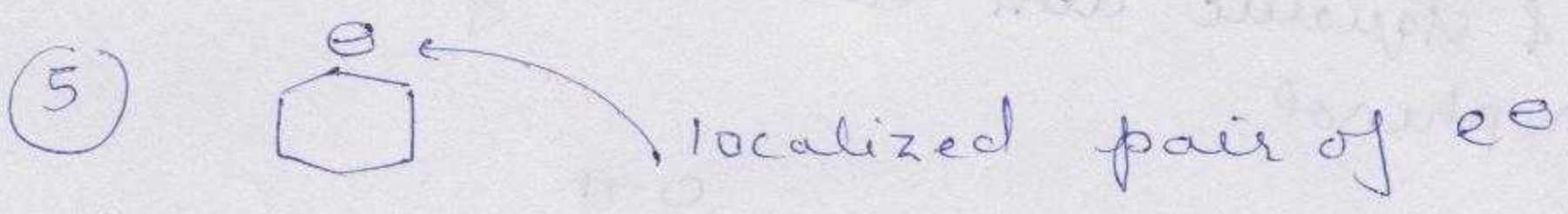
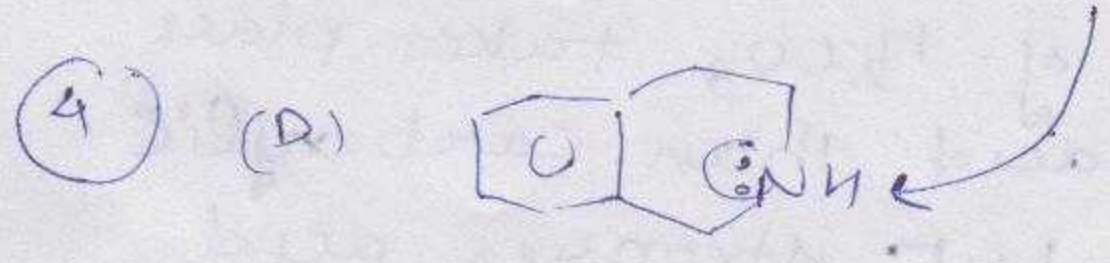
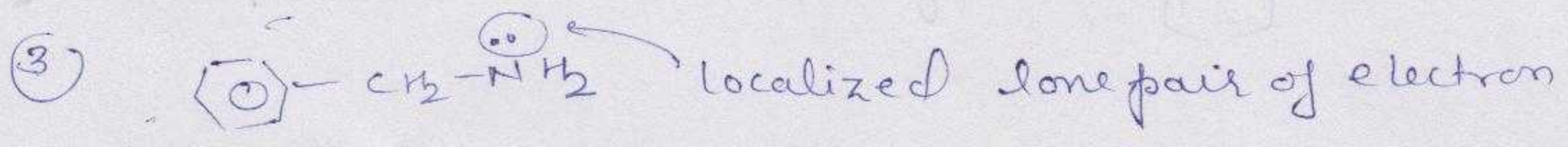
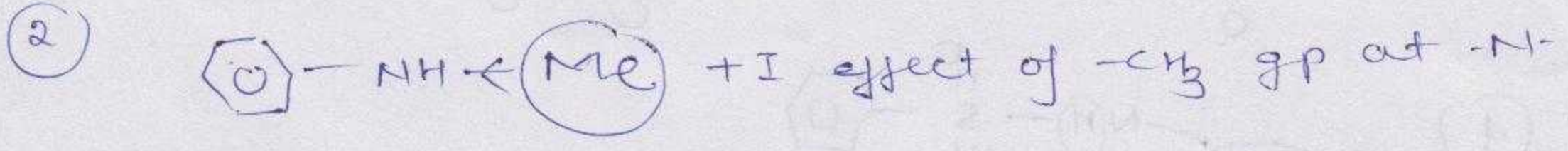
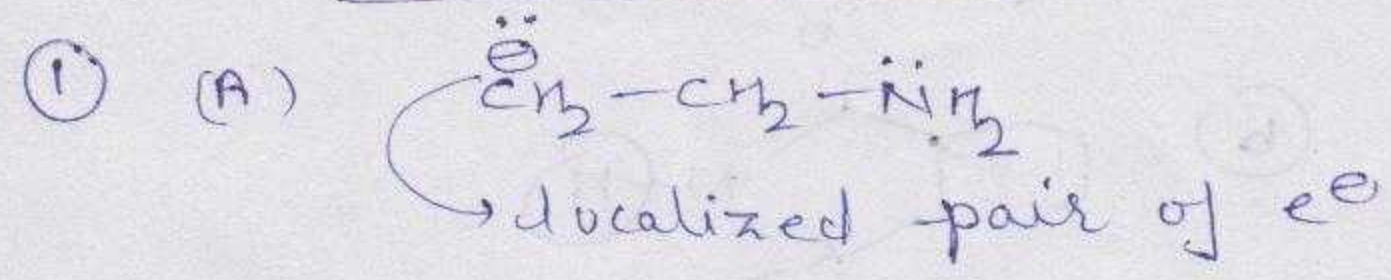


35

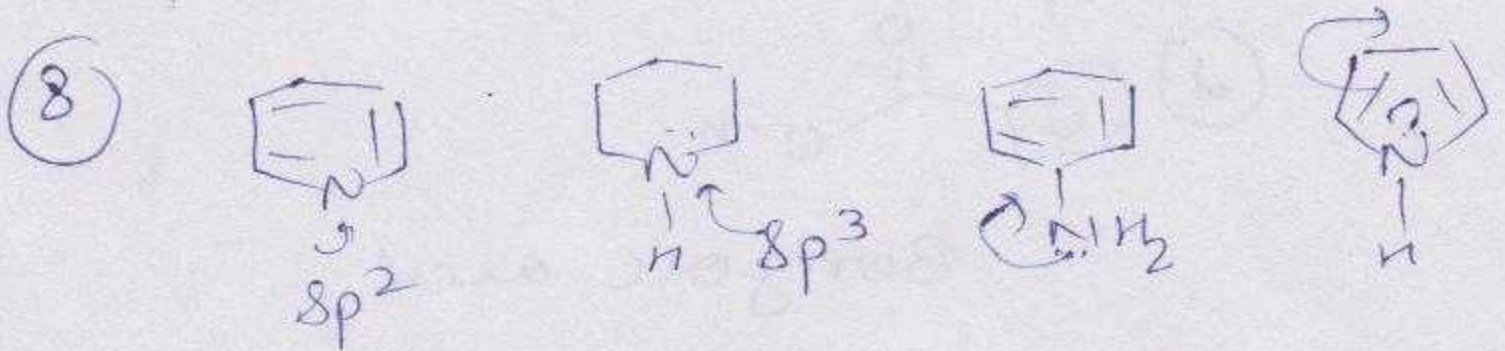
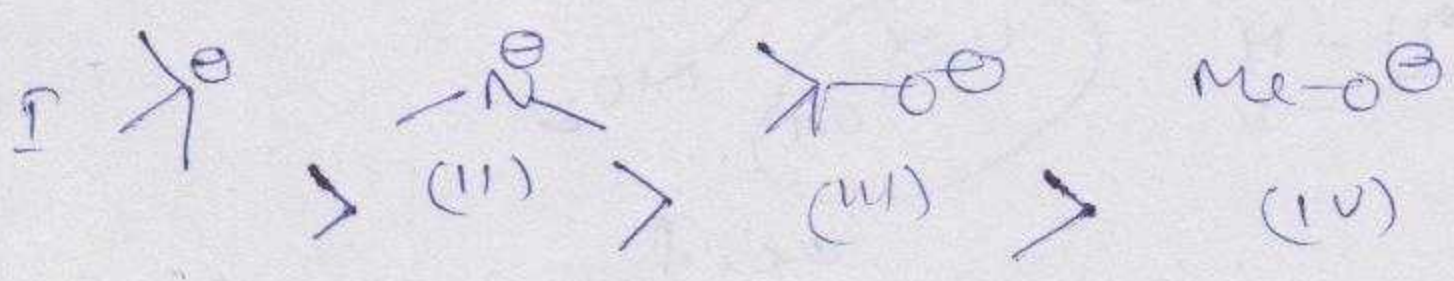


all (a, b, c, d) give effervescence with $NaHCO_3$

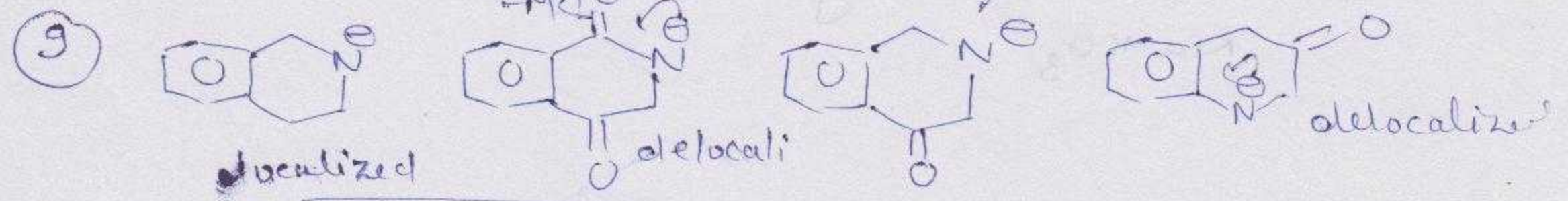
EXERCISE - 6



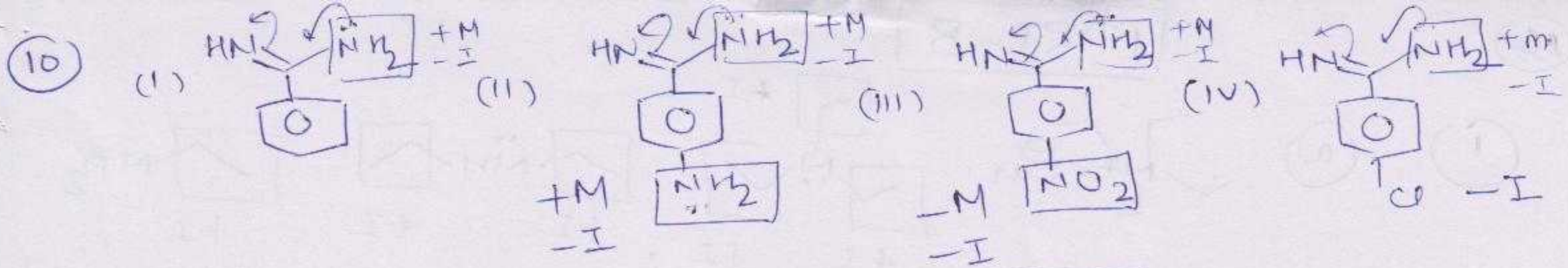
⑦ Negative charge on less electronegative element is more basic.



$K_b = \boxed{II > I > III > IV}$

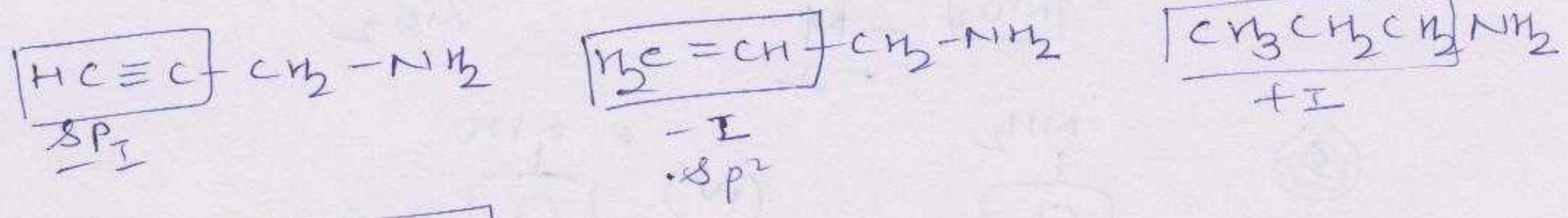


So $K_b = \boxed{I > III > IV > II}$

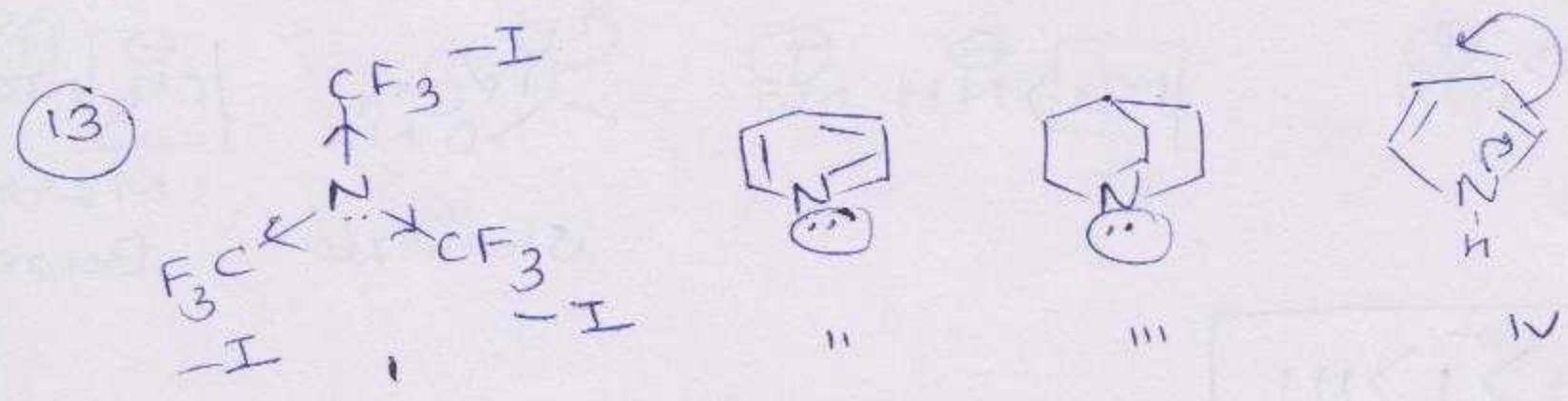


Basicity order is K_b II > I > IV > III

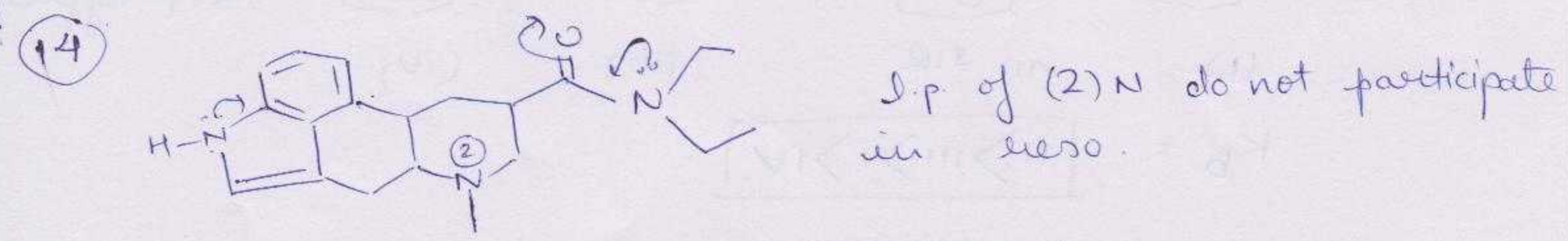
(11) $K_b \propto \frac{1}{pK_b} \propto +I \propto \frac{1}{-I}$



$K_b = \text{c} > \text{b} > \text{a}$
 $pK_b = \text{c} < \text{b} < \text{a}$

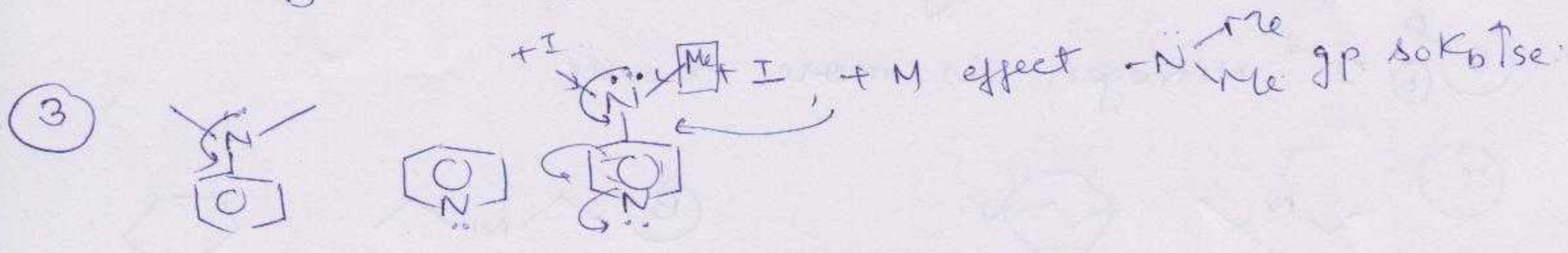
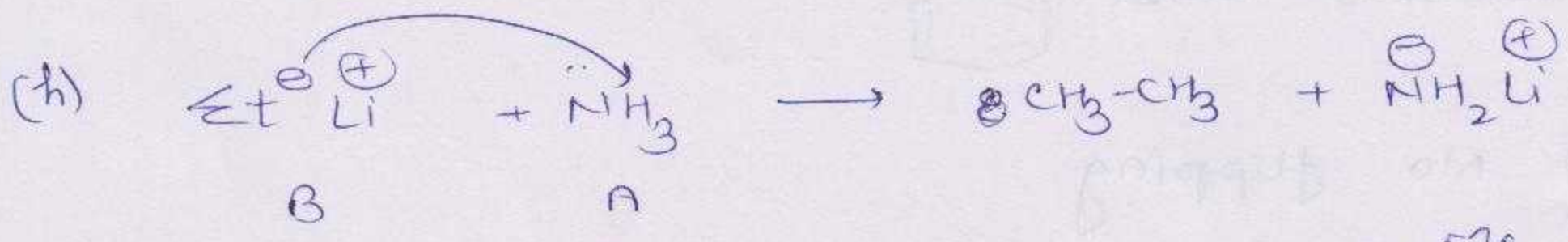
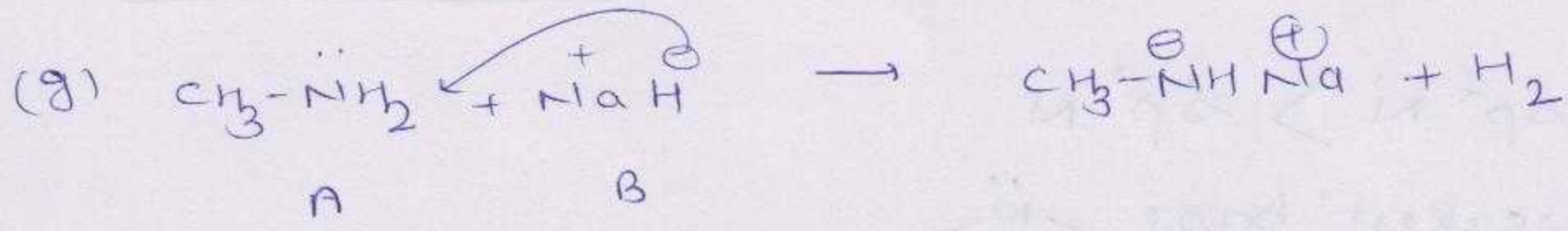
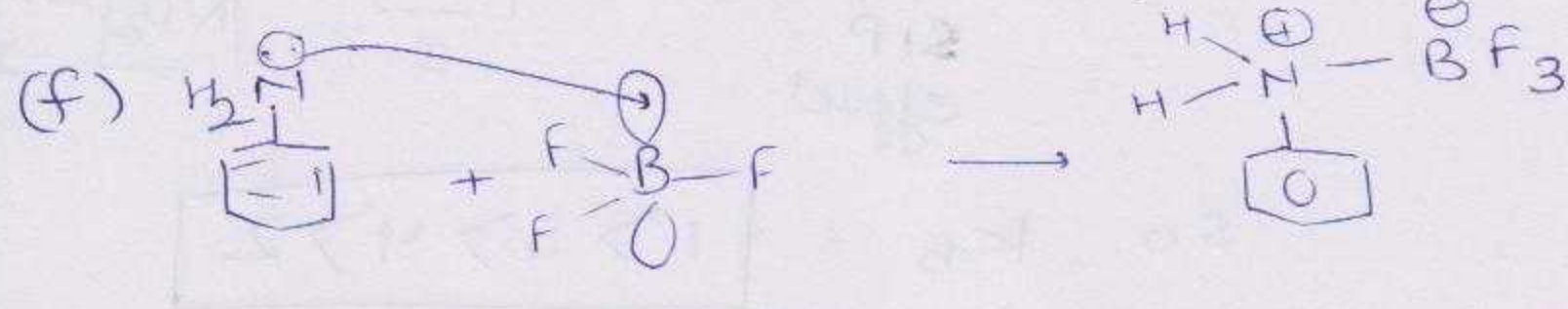
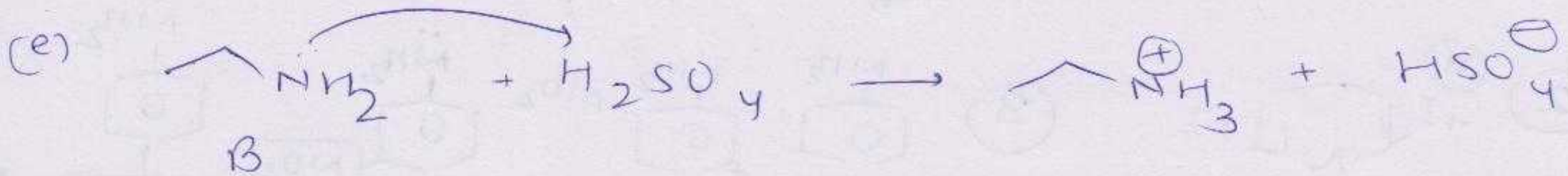
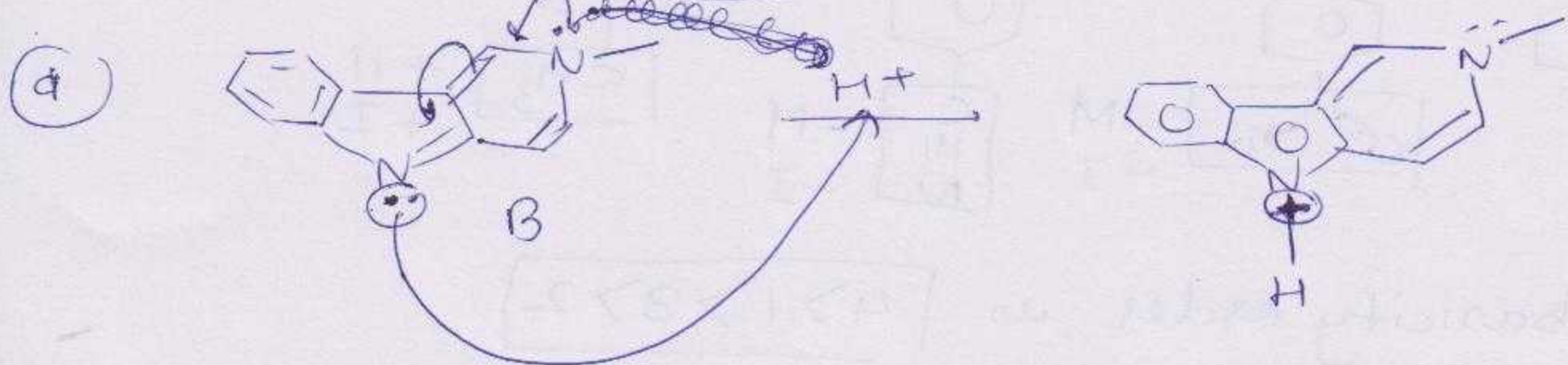


$K_b = \text{III} > \text{II} > \text{IV} > \text{I}$



so basicity order 2 > 1 > 3

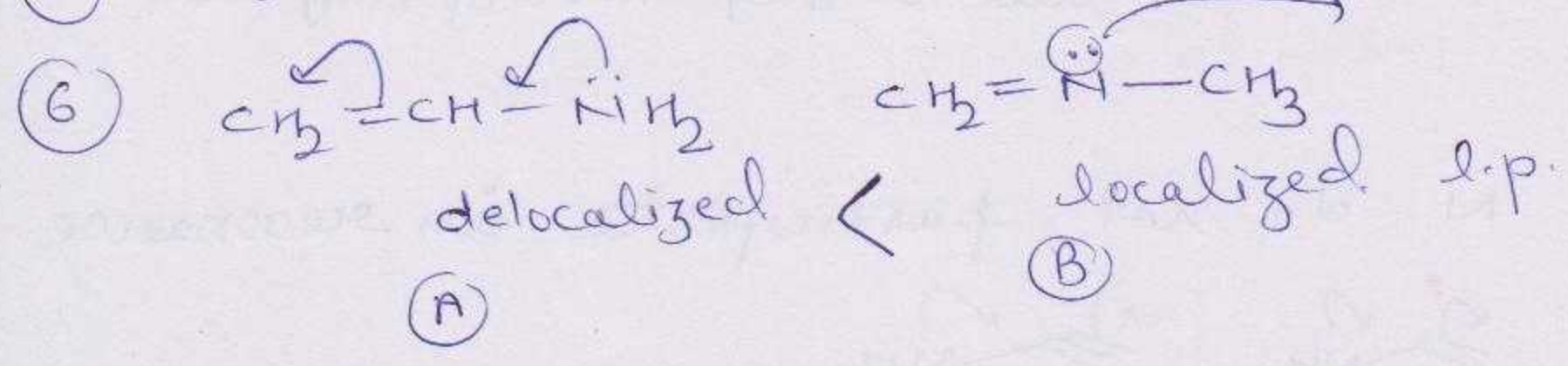
(15) basicity order is 3 > 4 > 1 > 2



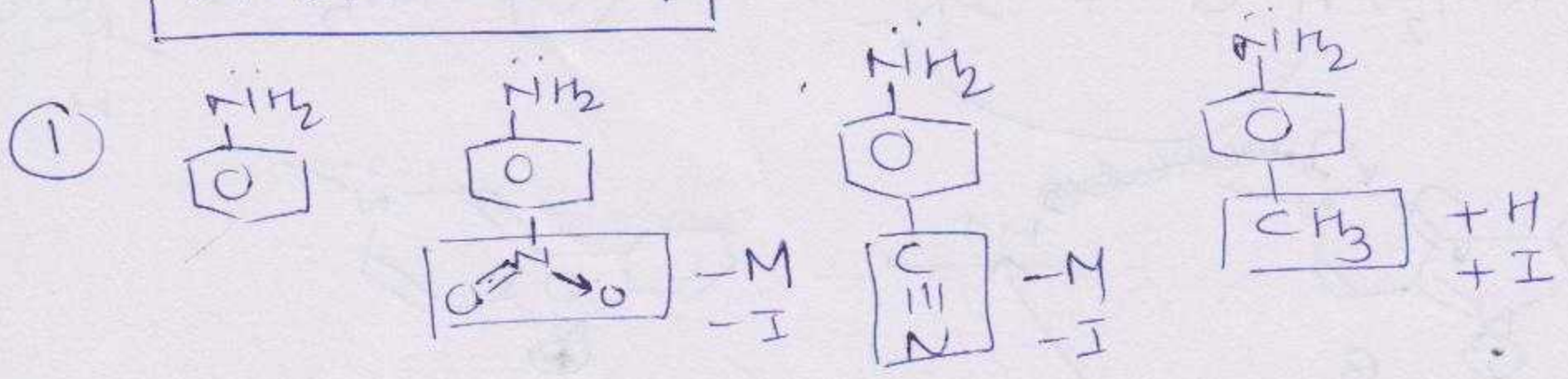
so basicity order. C > B >> A

(4) Due to -N- flipping

(5) Due to resonance



EXERCISE = 7

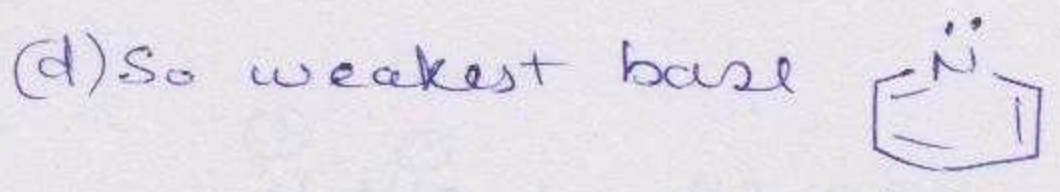


So basicity order is $4 > 1 > 3 > 2$



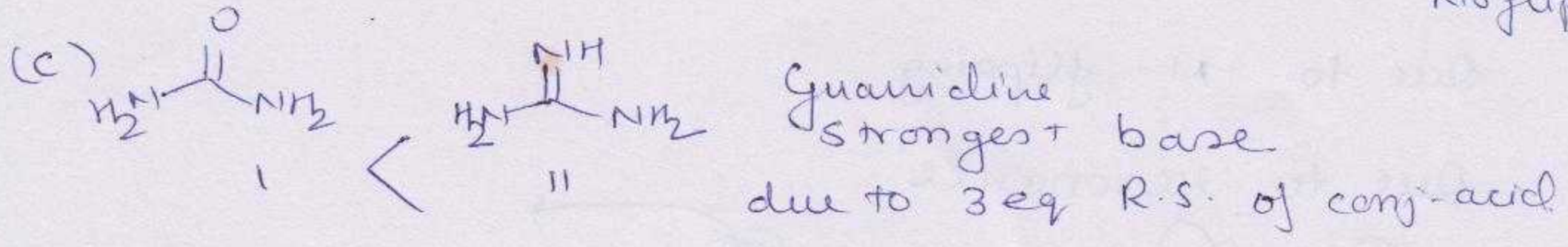
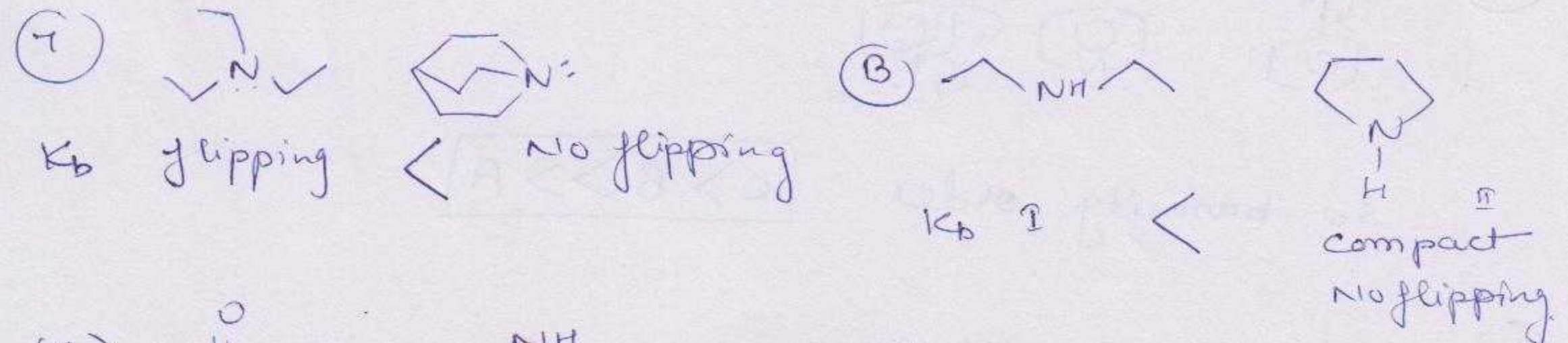
So $K_b = 1 > 3 > 4 > 2$

④ $K_b \text{ } sp^3 \text{ N} > sp^2 \text{ N}$

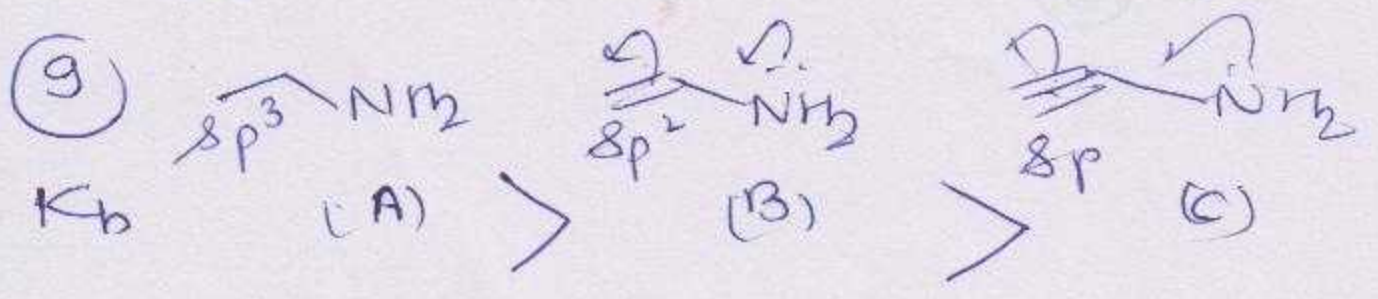


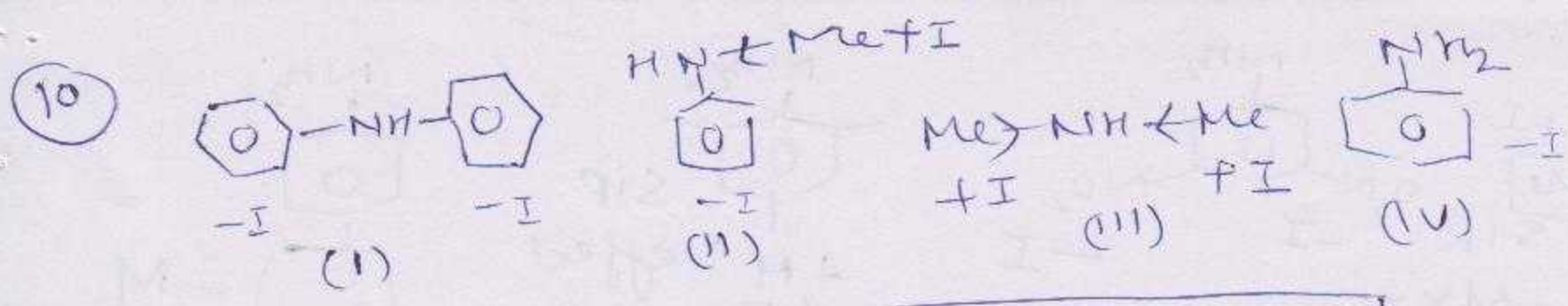
⑤ (d) No flipping

⑥ (b) 2nd Nitrogen is more basic



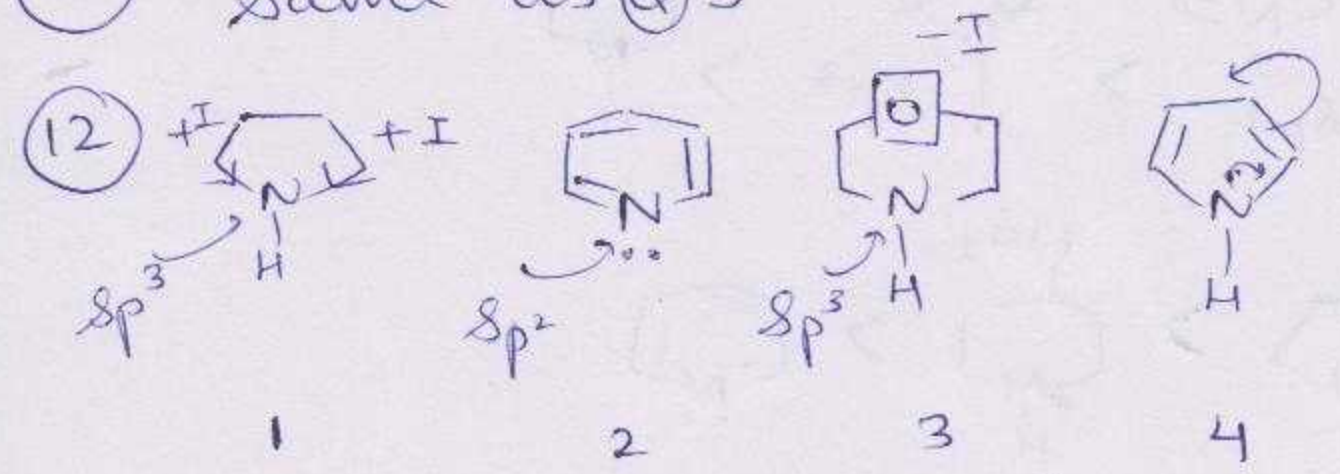
⑧ (b) lp of N do not participate in resonance





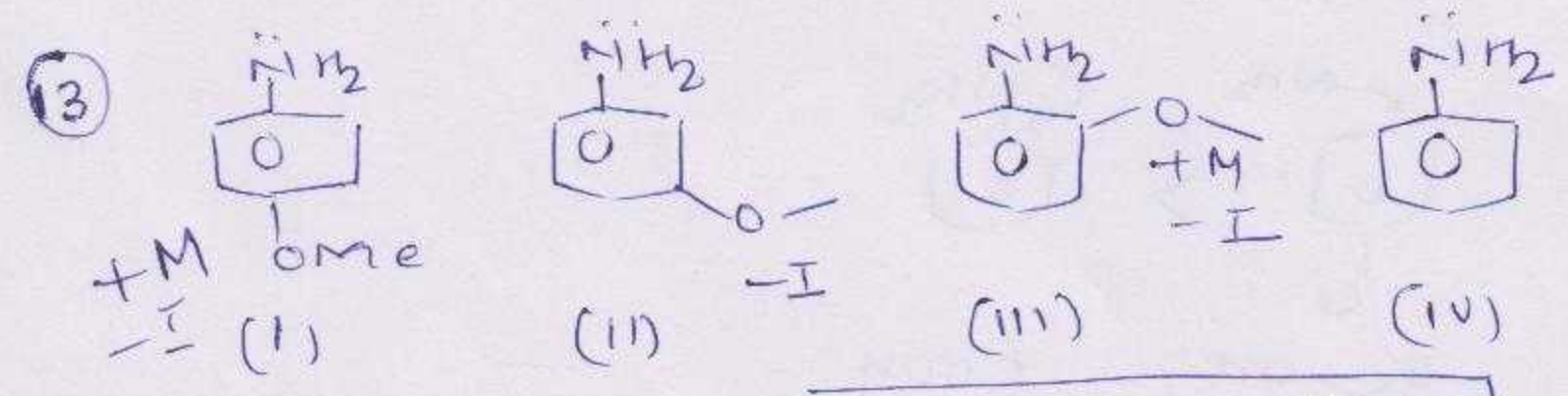
so K_b order is $I < IV < II < III$

11 same as (9)



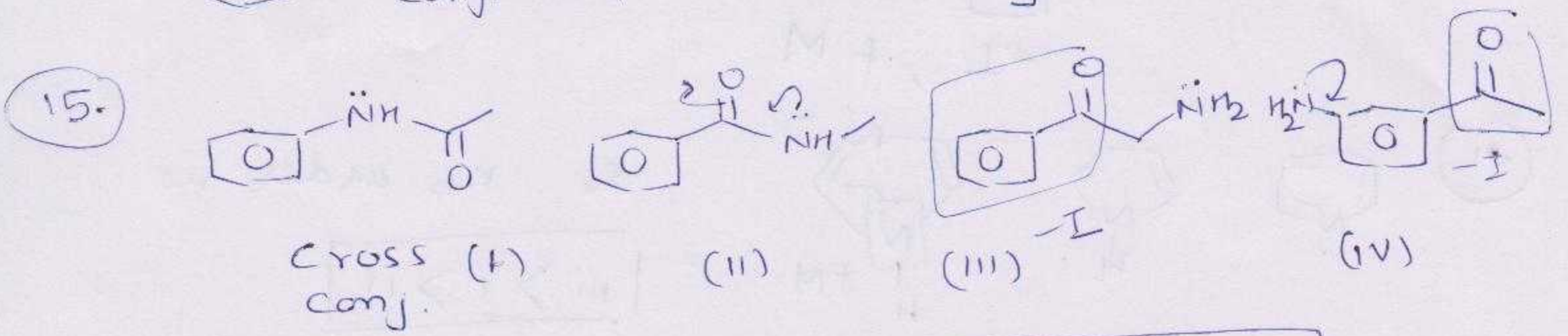
basicity order is

$I > 3 > 2 > 4$



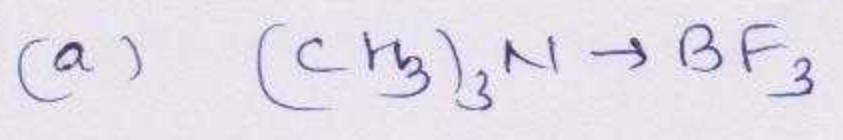
so K_b order $I > IV > III > II$

14 guanidine type
conj. acid stabilized by 3 eq. R.S.



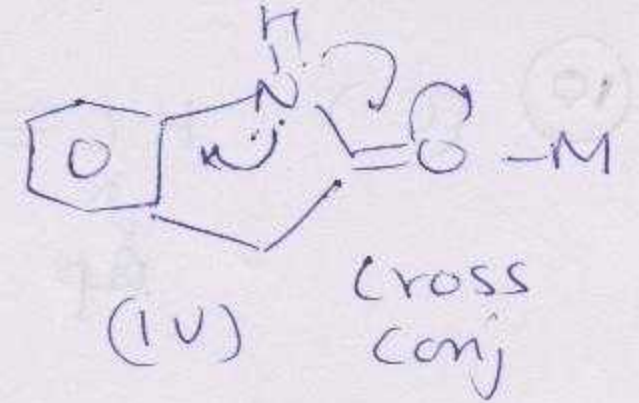
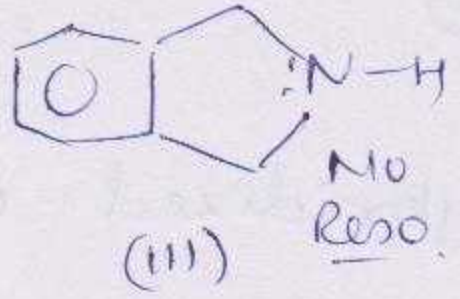
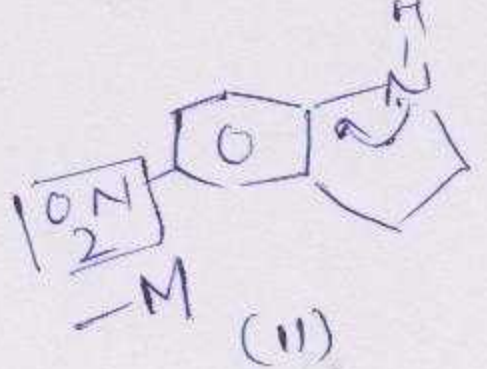
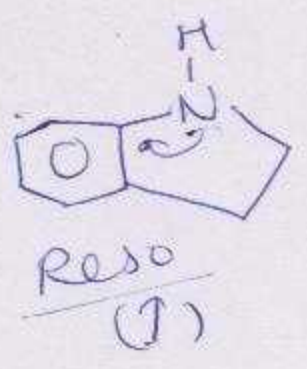
so K_b (basic strength) $III > IV > II > I$

16 Minimum heat of dissociation



so basicity order is

24

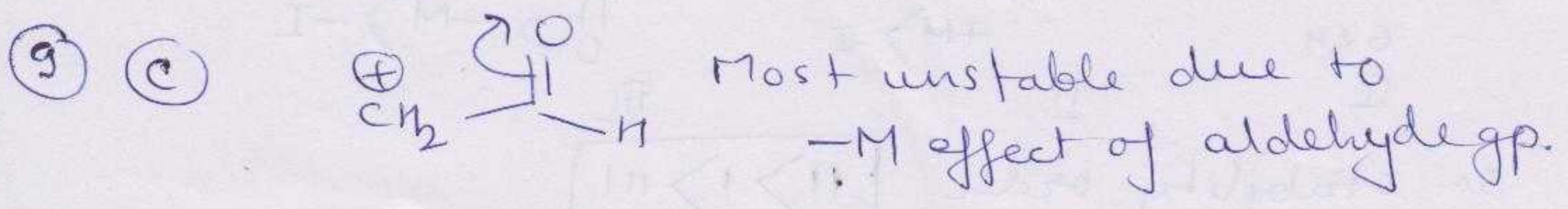
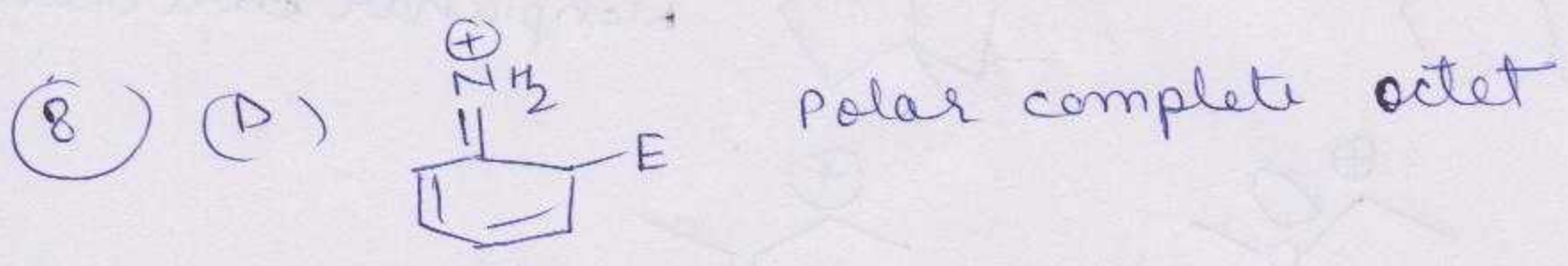
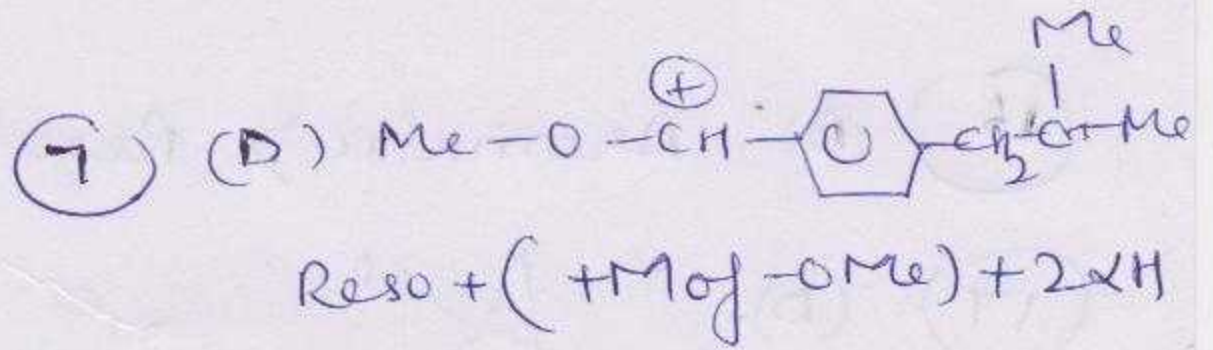
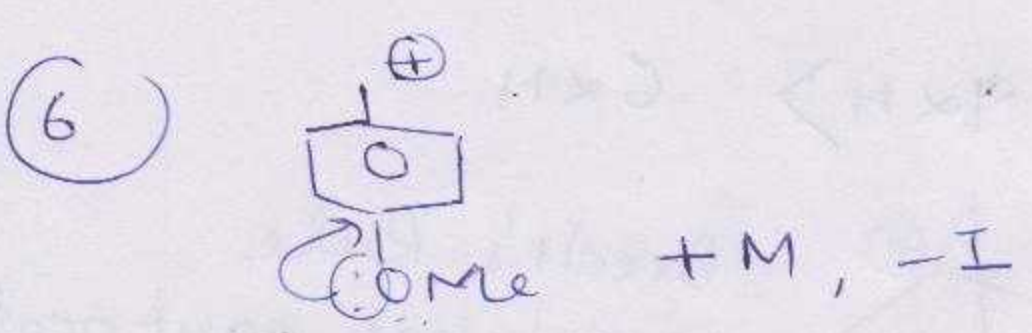
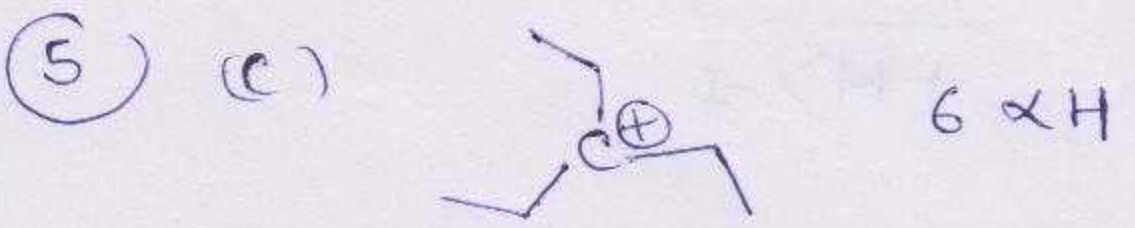
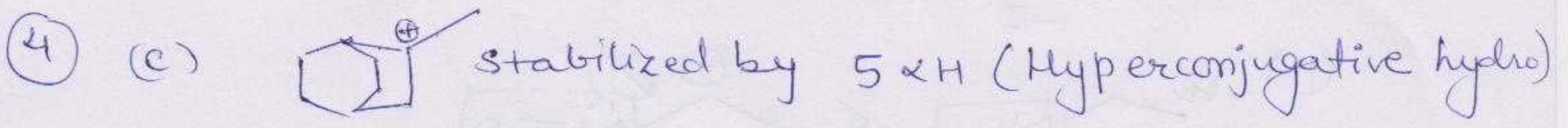
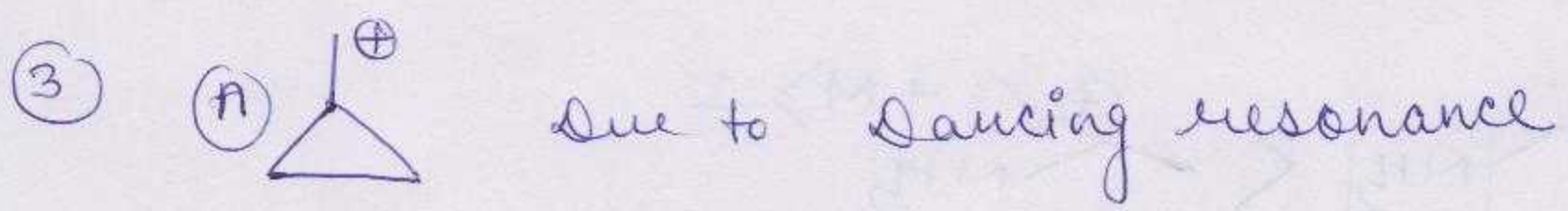
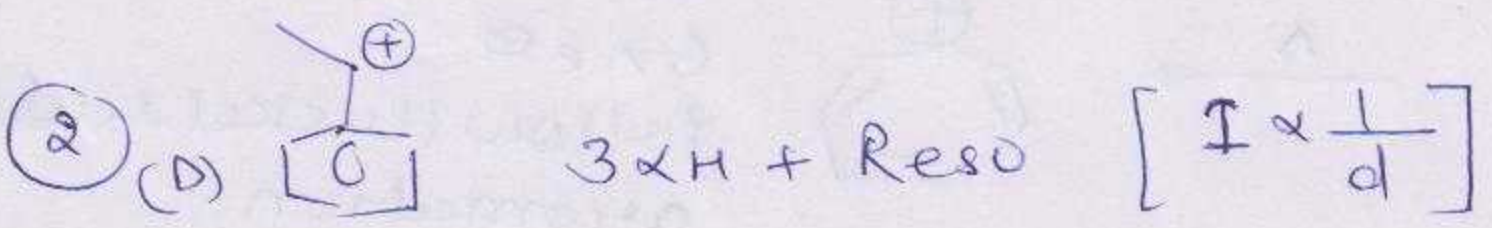
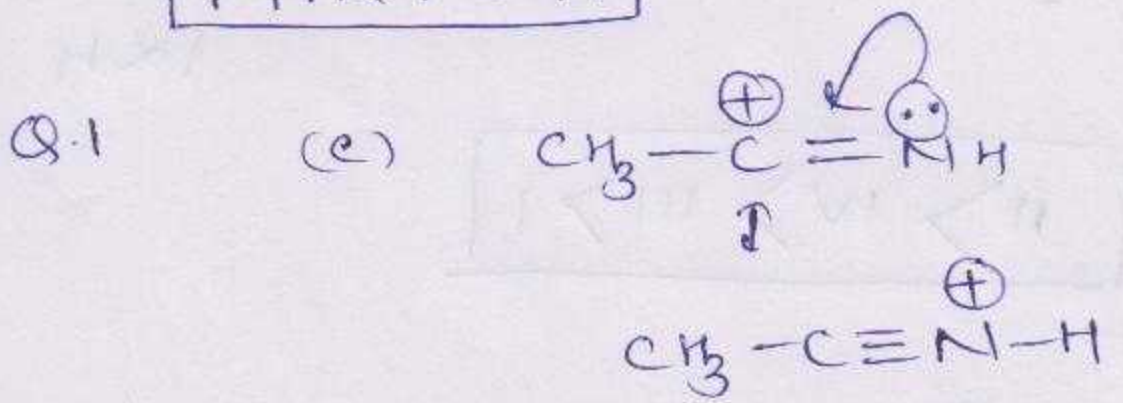


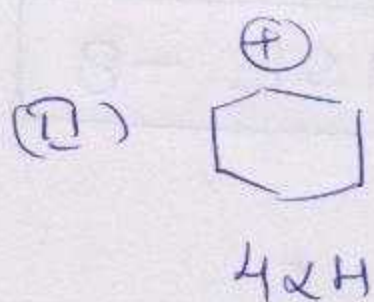
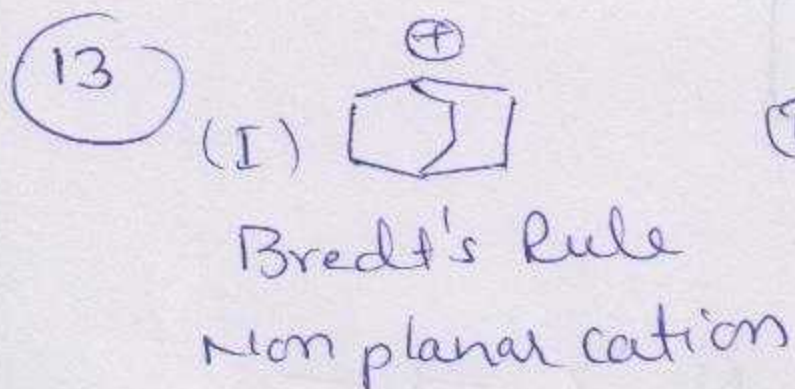
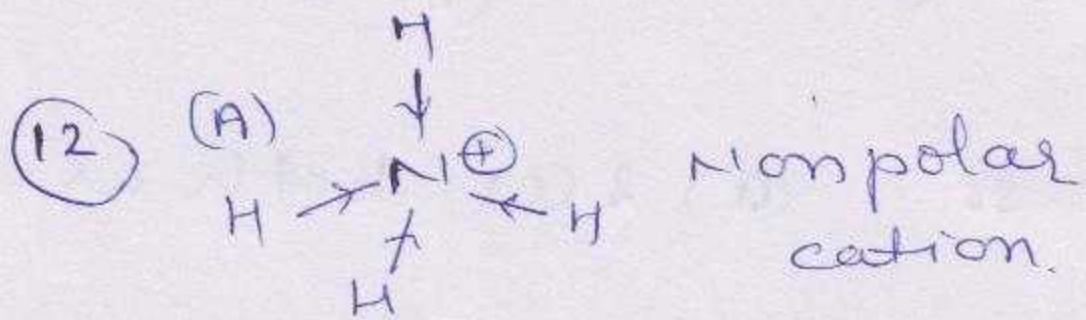
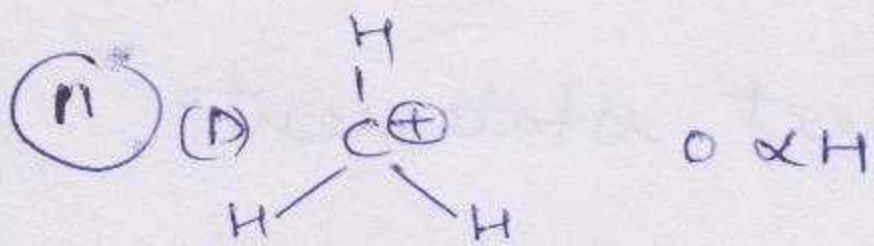
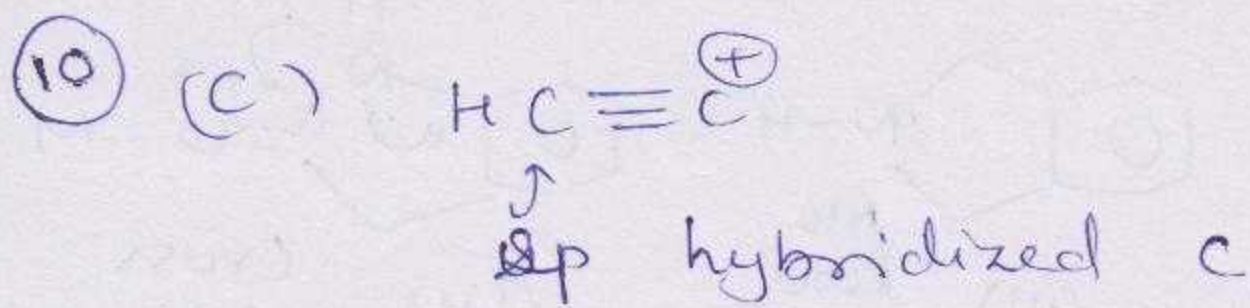
so (a) & (c) both are correct statement

25

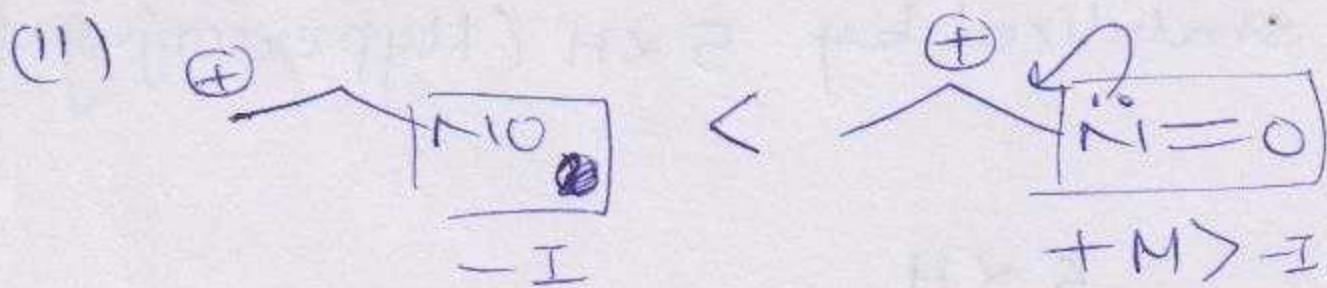
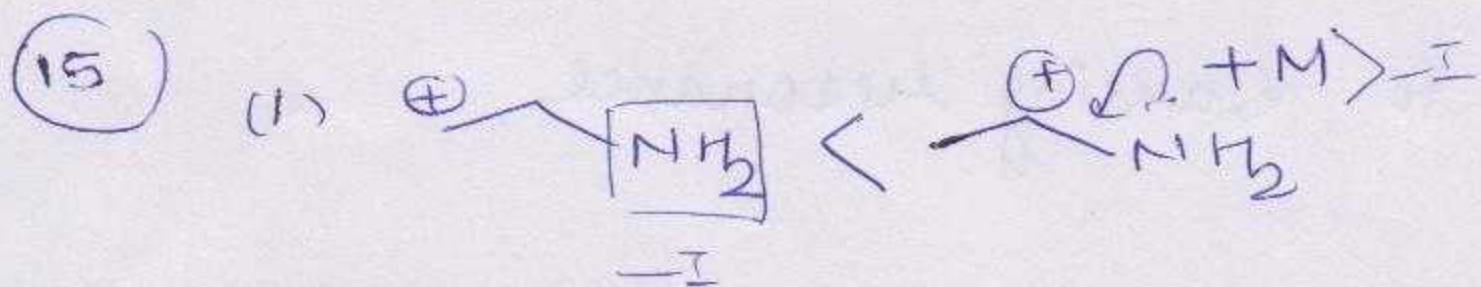
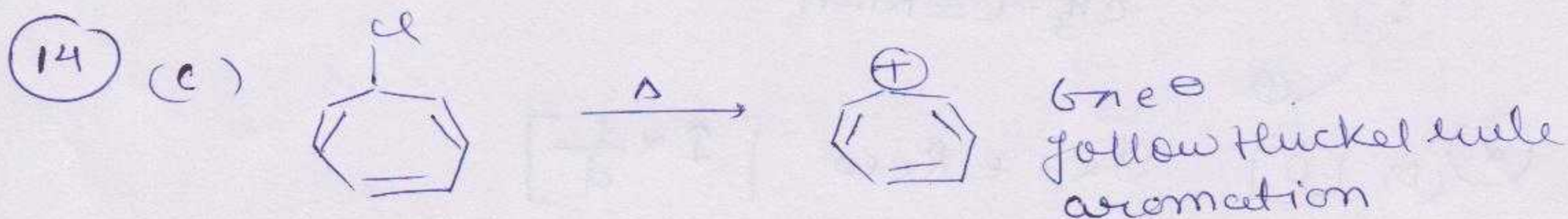
EXERCISE - 8

PART - A

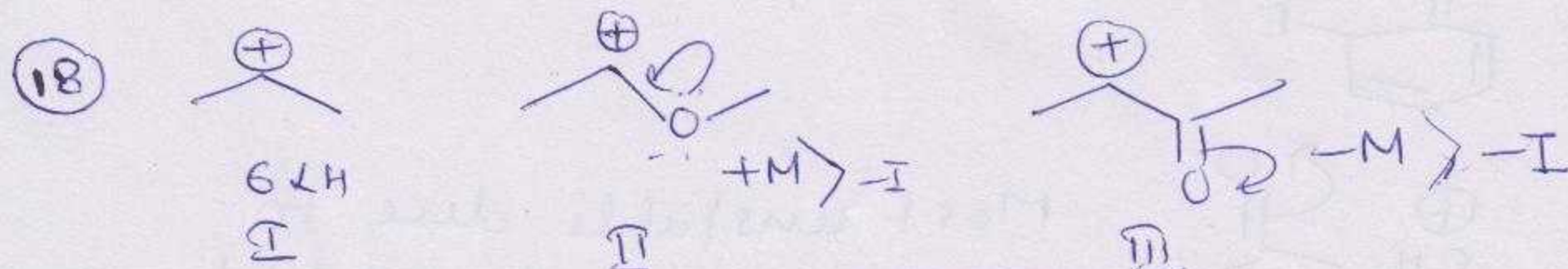
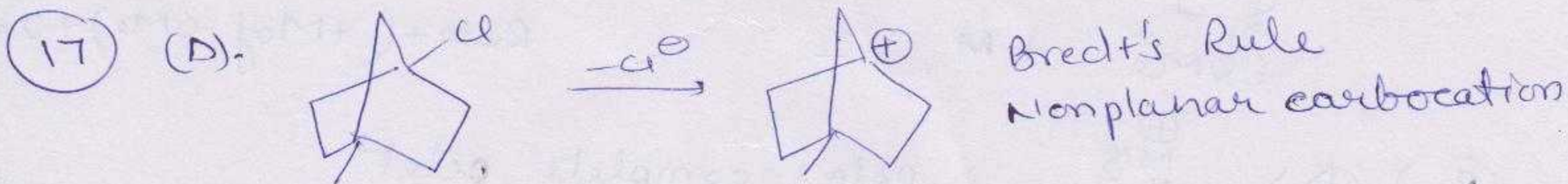




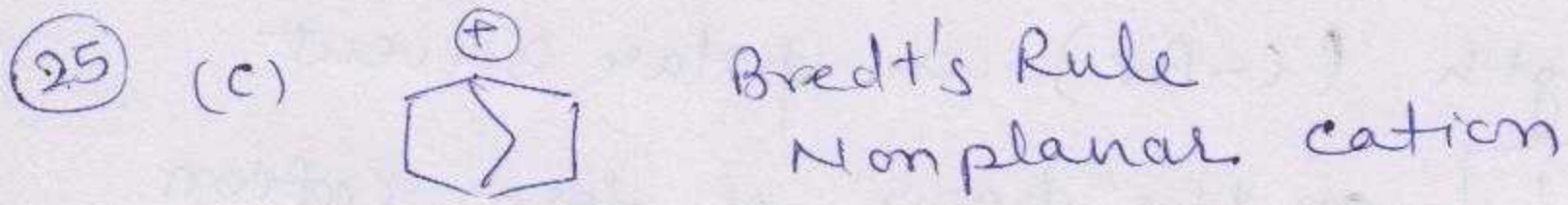
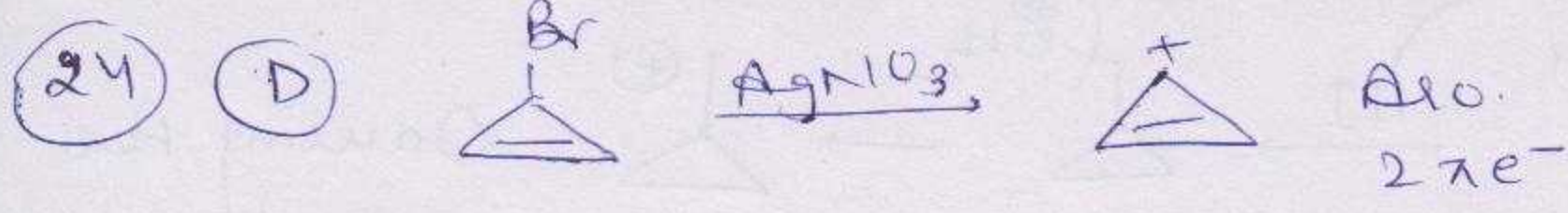
So order of stability $\boxed{\text{II} > \text{IV} > \text{III} > \text{I}}$



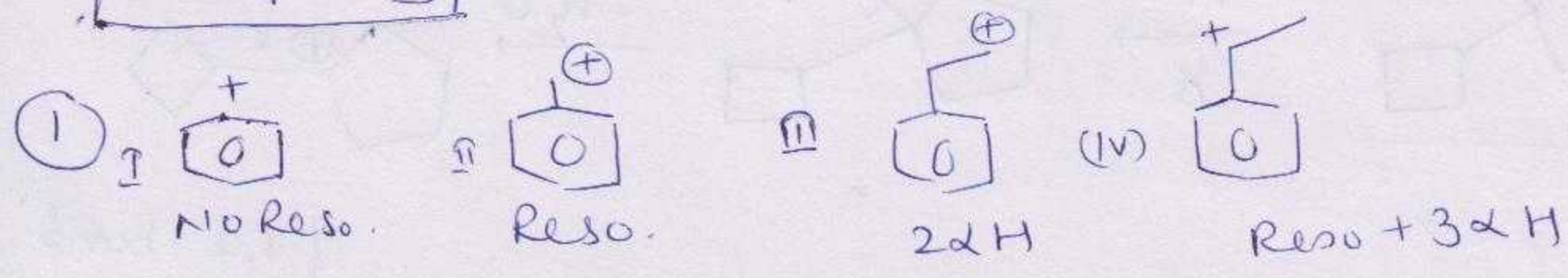
16 (B) Aromatic $>$ Reso $>$ $9 \times \text{H}$ $>$ $6 \times \text{H}$



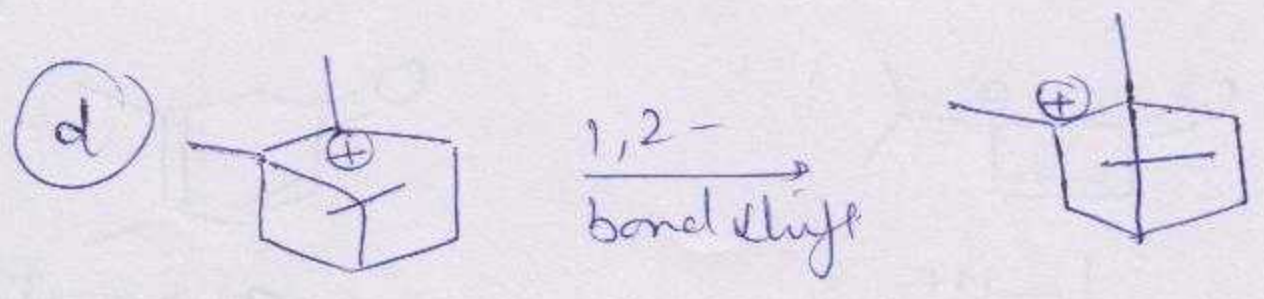
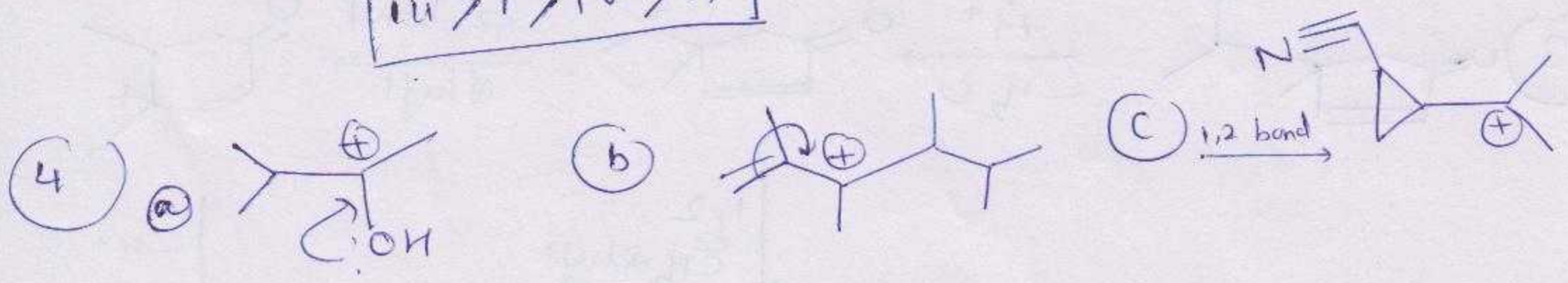
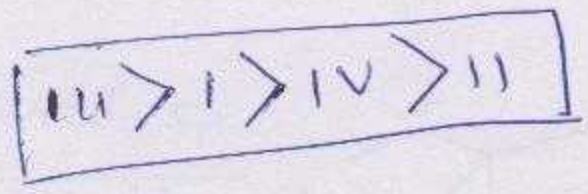
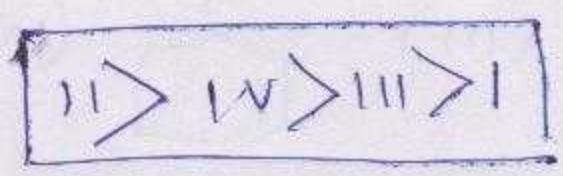
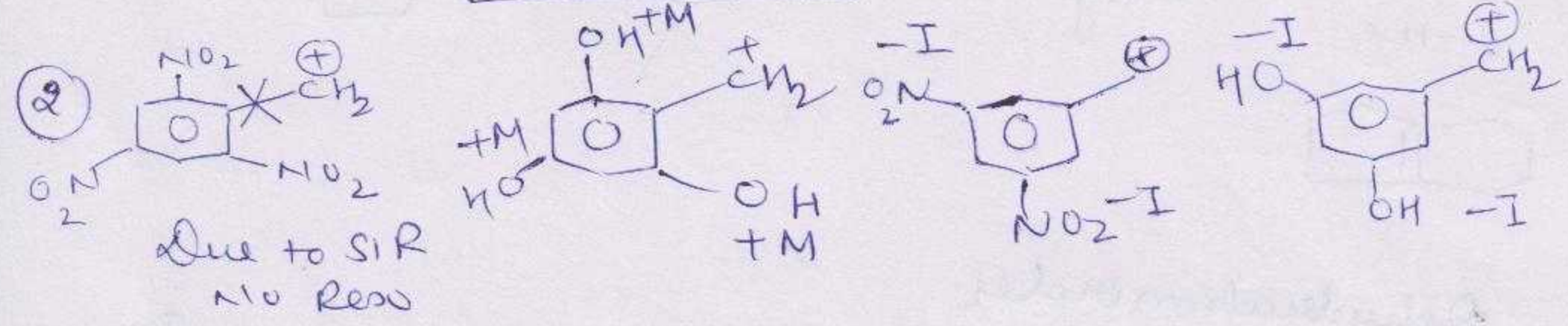
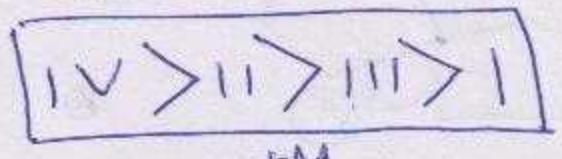
So stability order $\boxed{\text{II} > \text{I} > \text{III}}$

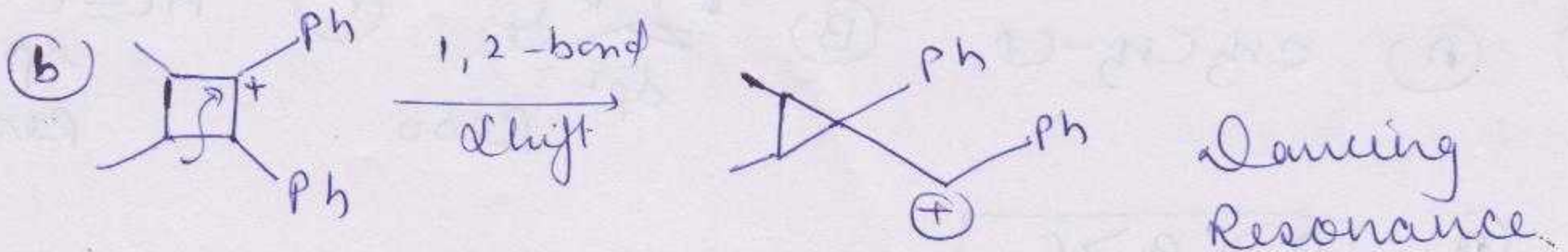
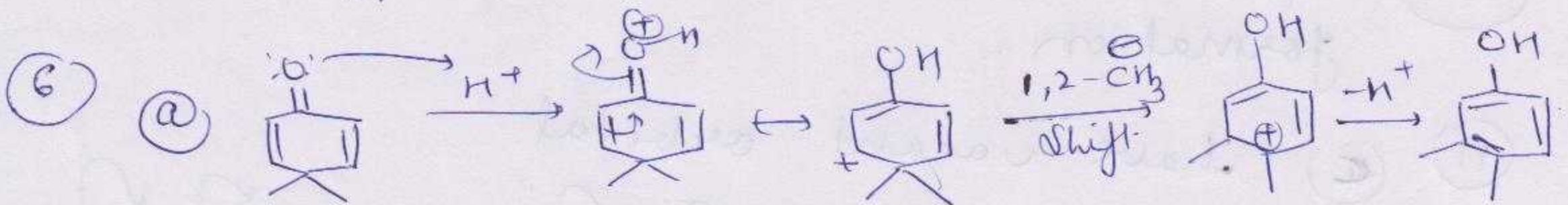
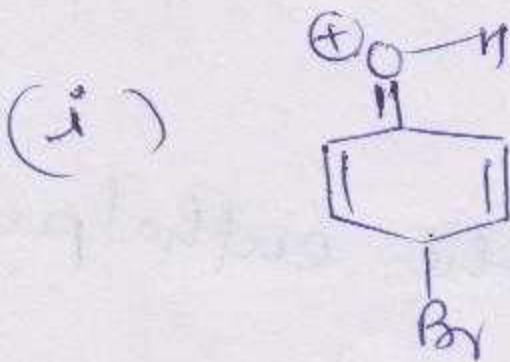
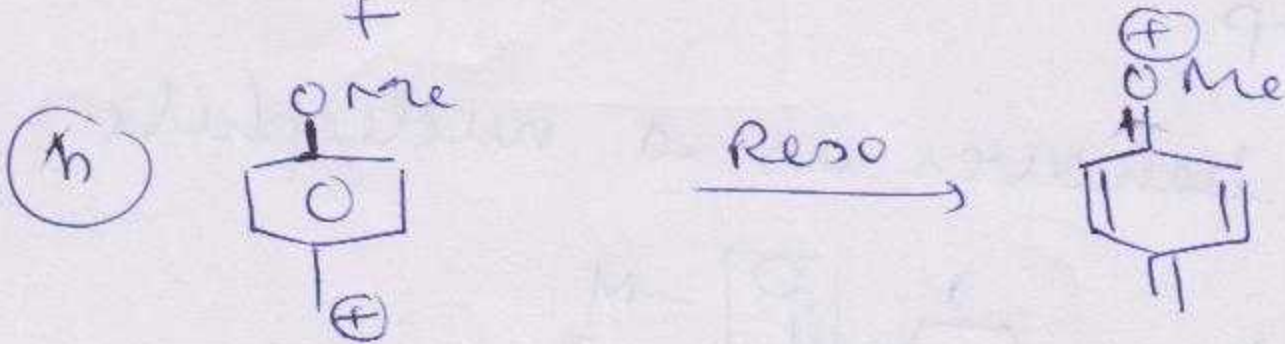
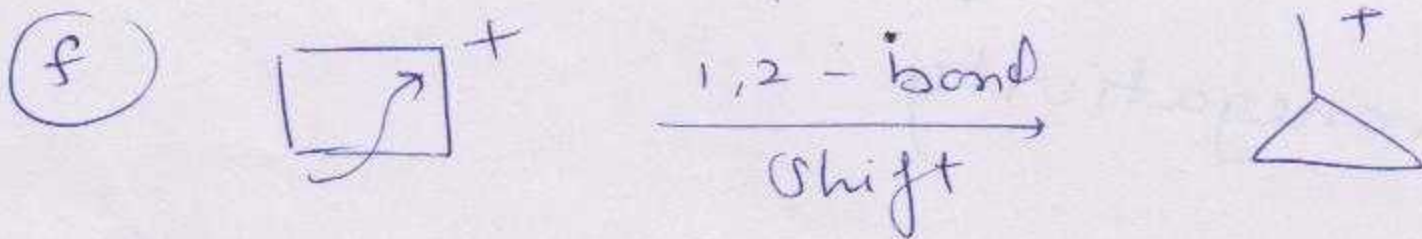
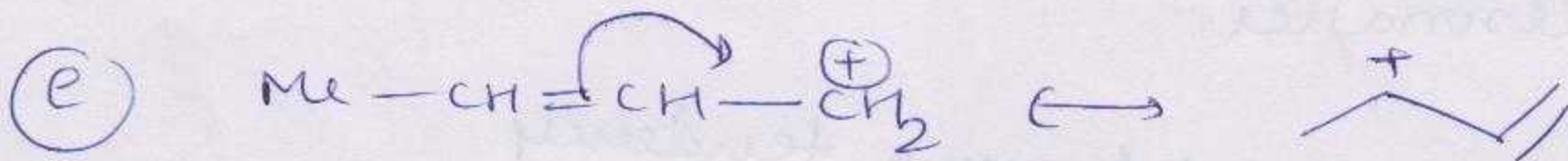
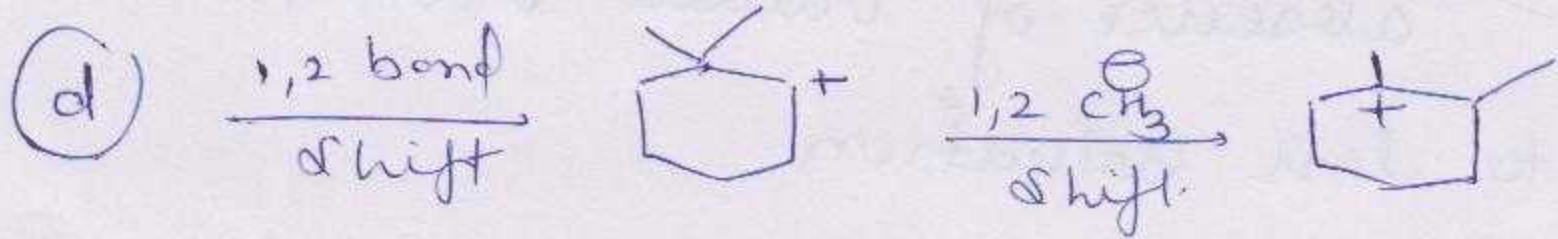
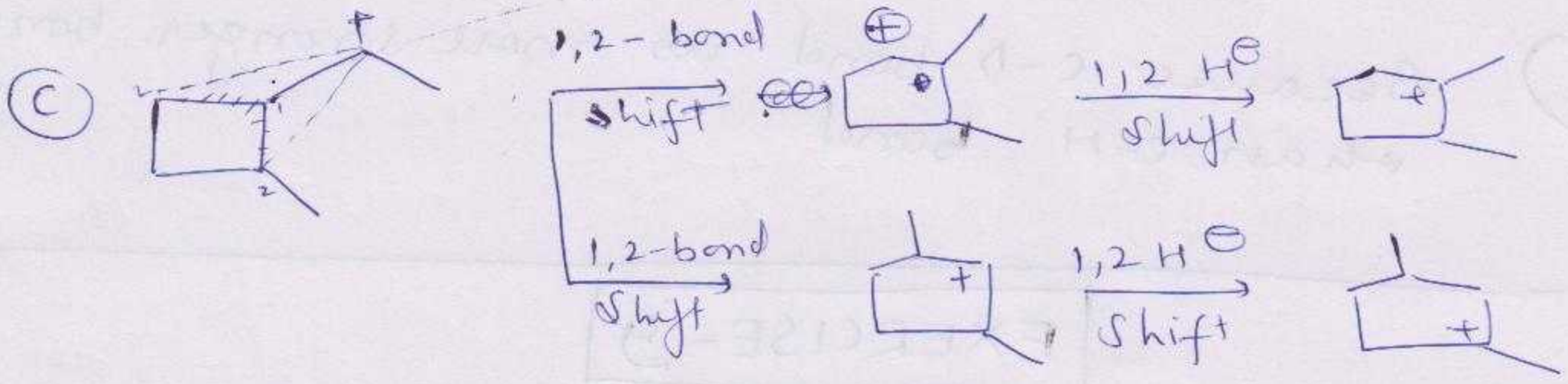
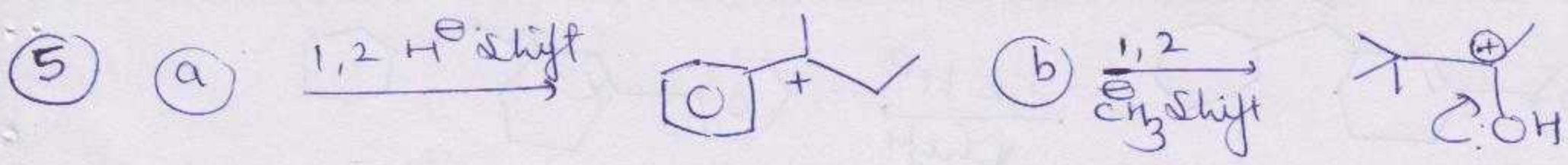


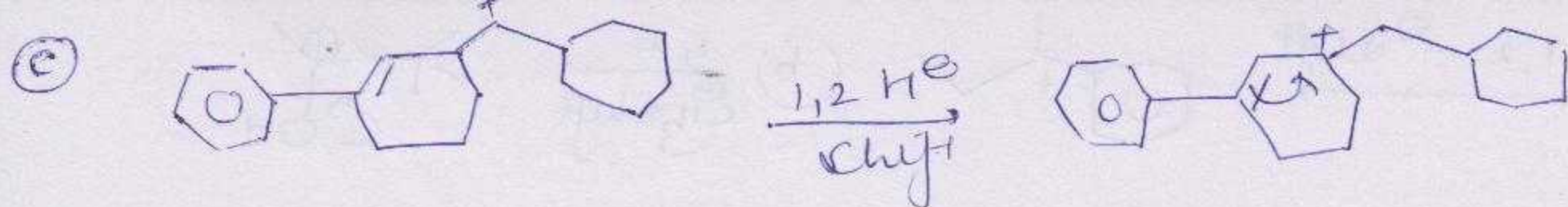
PART - B



So stability order







(7) Because C-D bond is more stronger bond than C-H bond

EXERCISE-9

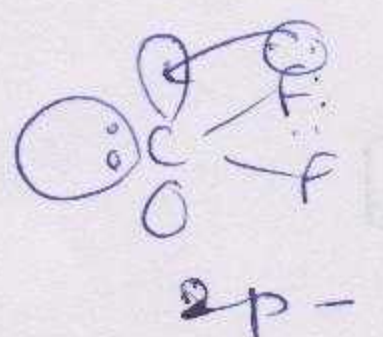
(1) (c) K^+H_4 absence of vacant orbital

(2) (a) Due to less solvation

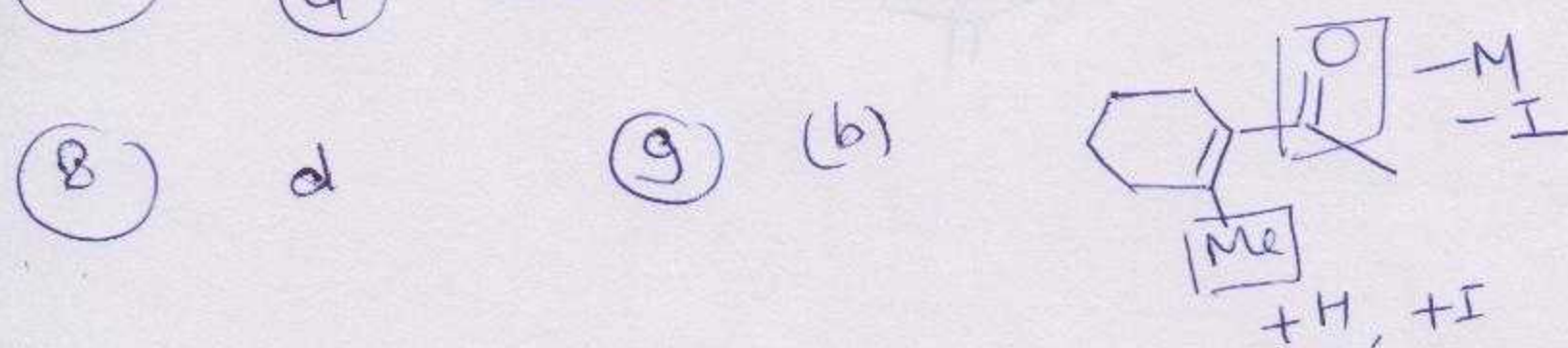
(3) (a) Resonance

(4) (d) more withdrawing tendency

(5) (a) electronegativity

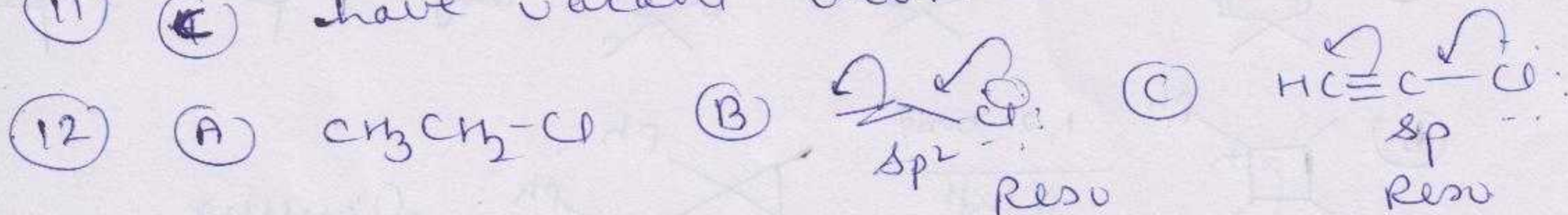
(6) (a)  effective overlapping in blue
2p-2p

(7) (d) alkene behaves as a nucleophile

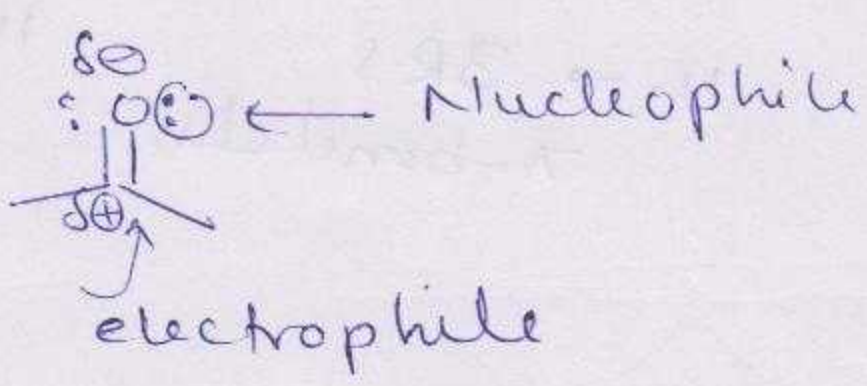


(10) (b) More stable C^+ less will be the enthalpy of formation.

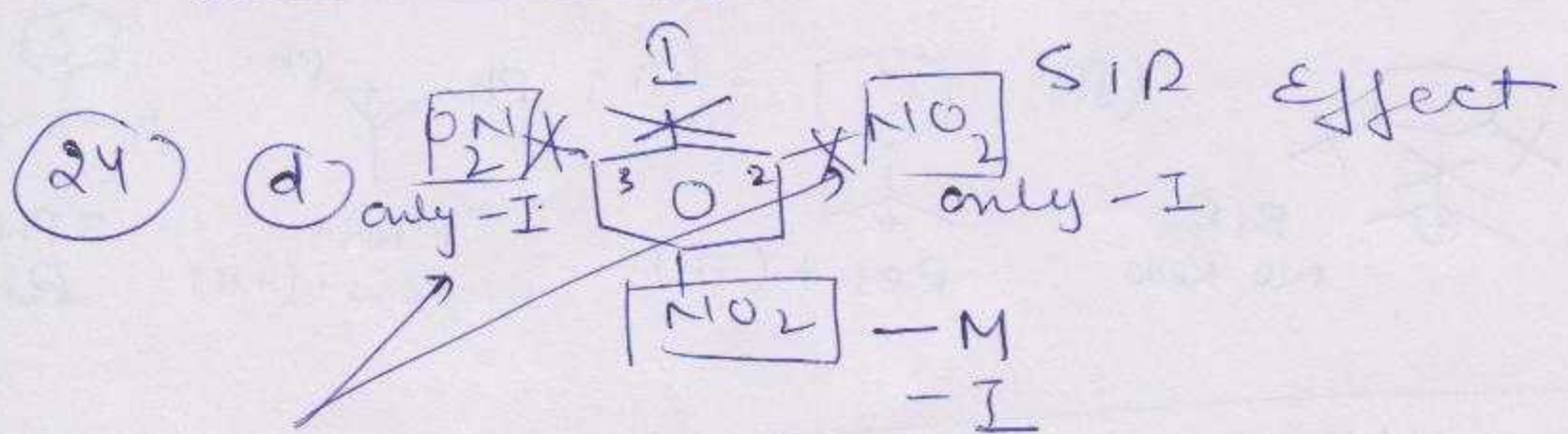
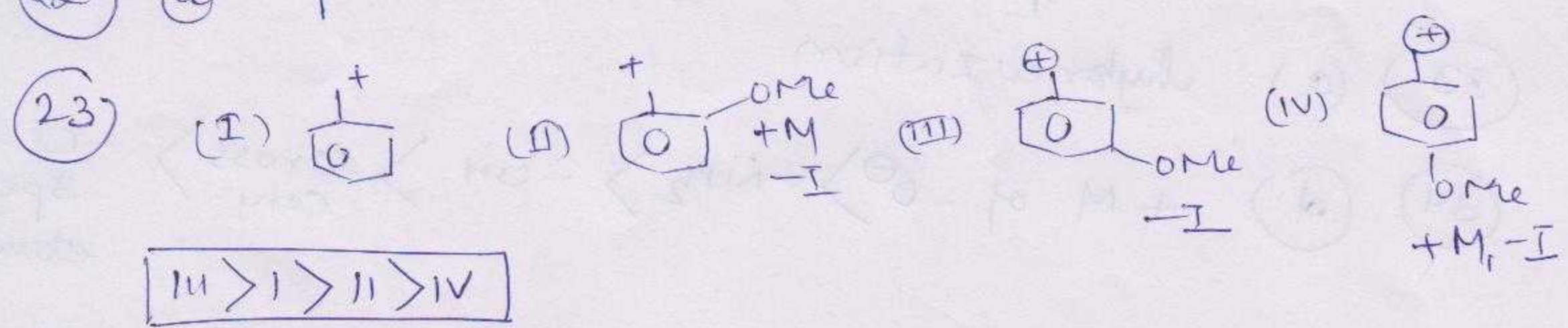
(11) (c) have vacant orbital



(a) $A > B > C$

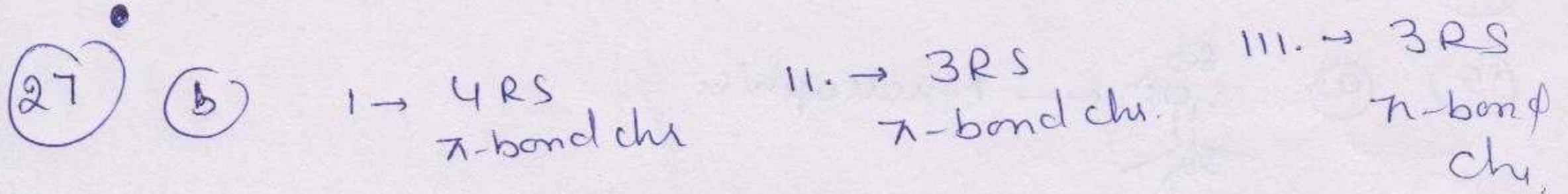
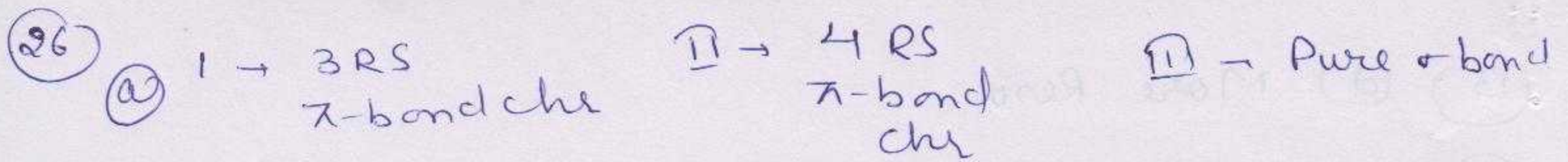
- 13 (d) More Reso.
- 14 (c) stable carbocation
- 15 (a) 

- 16 (c) (-)ve charge on less E.N. element
- 17 (a) Electronegativity diff
- 18 (d) symmetrical comp.
- 19 Intramolecular H-bonding
- 20 (d) Intramolecular H-bonding
- 21 (a) Electronegativity of halogen > d.p. donating
- 22 (a) proton donor



Both (2,3)-NO₂ gp go out of the plane w.r.t benzene ring

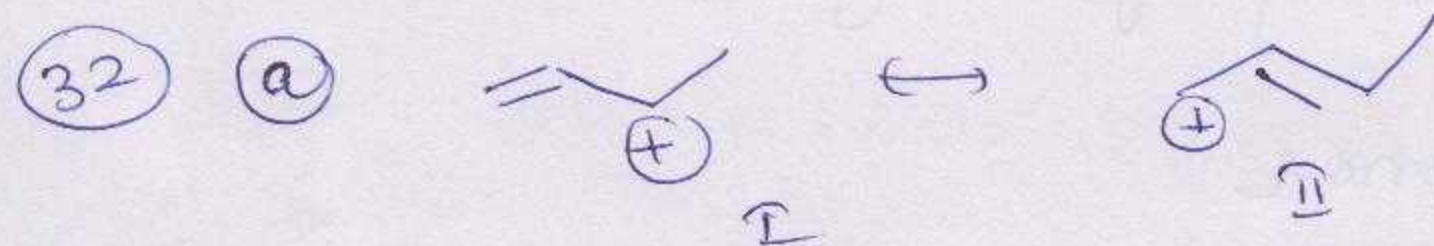
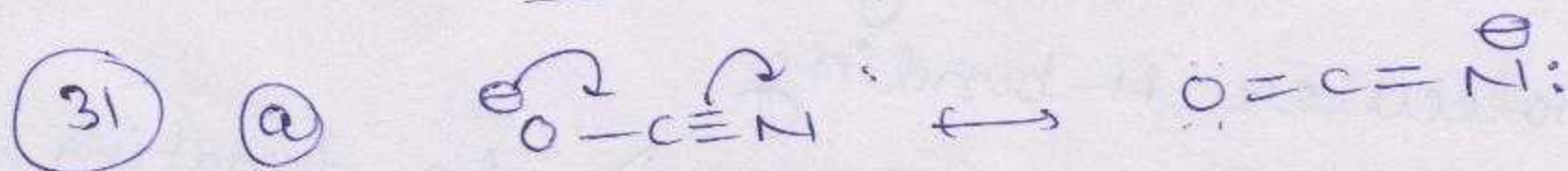
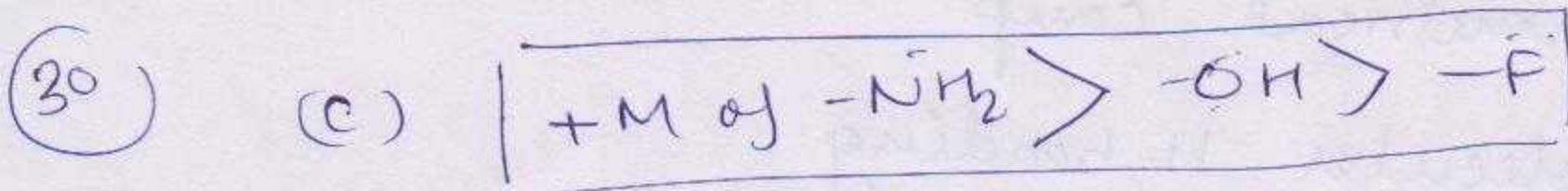
- 25 (b) Due to cross conjugation



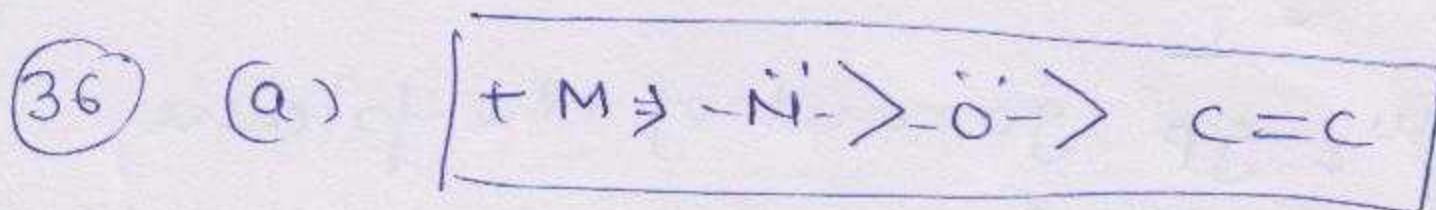
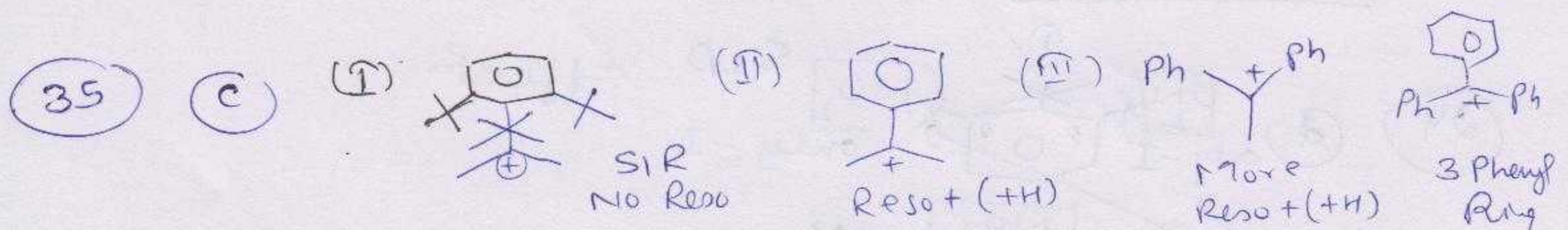
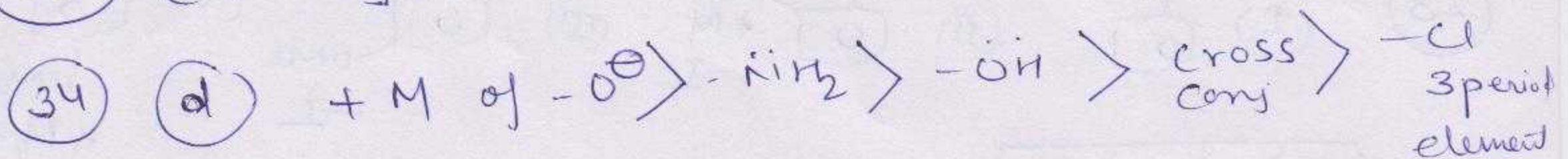
So $\boxed{\text{III} > \text{II} > \text{I}}$

28 (b) unequivalent R.S.

29 (b) unequivalent R.S.



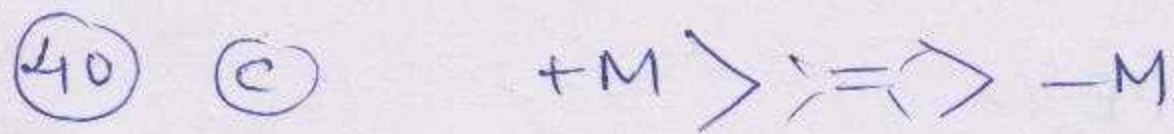
33 (a) hybridization



37 (a) More conj., More Resonance Energy



39 (a) Due to cross conj.



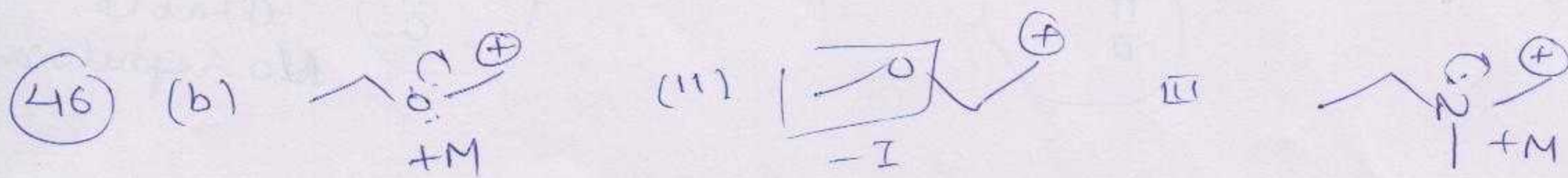
41 (b) More +M, more will be the πe^- density

42 (a) $3 \times H$

43 (d) Polar complete octet $>$ Polar incomplete octet
 $S^+ = N^+ > O^+$

44 Both are different resonating str. of diff. comp.

45 (a) Neutral $>$ Polar complete octet $>$ Polar incomplete octet $>$ Polar incomplete octet
 More EN Element carry (+)ve



48 (d) C-H bond dissociation energy (BDE) $\propto \frac{1}{\text{Stability of free radical}}$

49 (a) $BDE \propto \frac{1}{\text{St. of Radical}}$

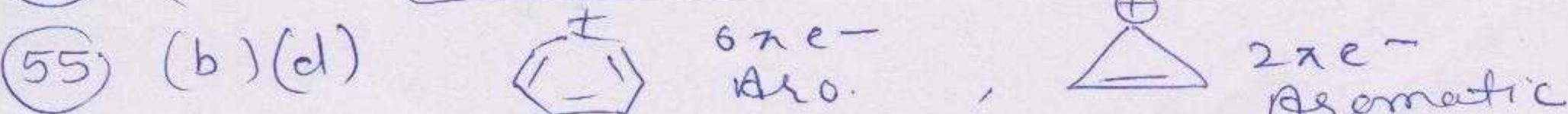
50 (b) — same —

51 (a) — " —

52 (c) Resonance

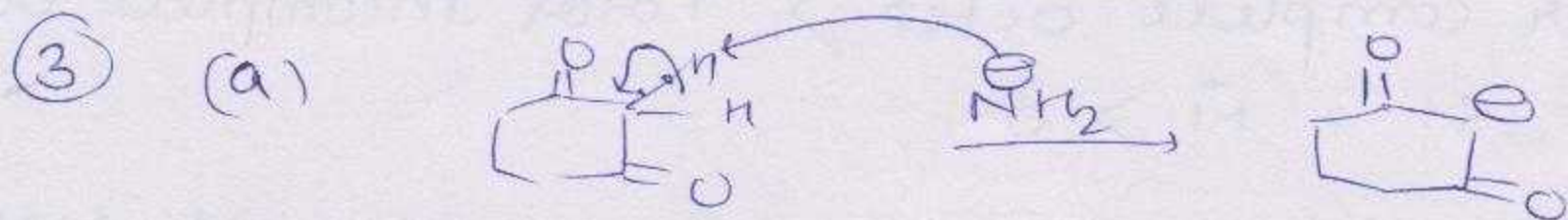
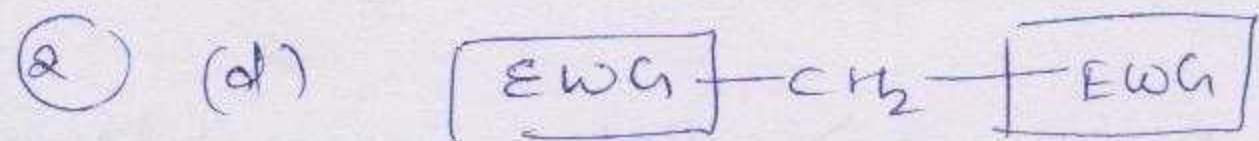
53 (d) Hyperconjugation (Hyperconjugative hydrogen)

54 (a, b) $+H > +I$



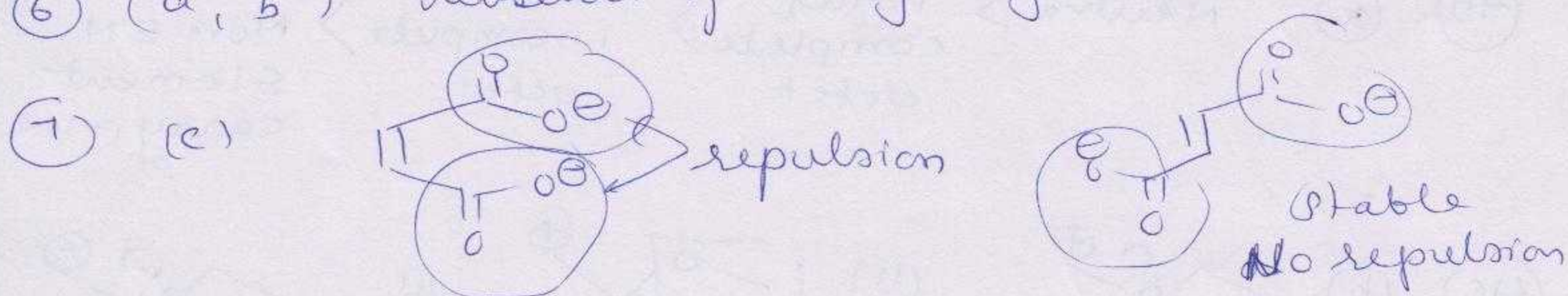
Q11 - COMPREHENSION TYPE :-

1 (d) due to cross conjugation present in conj. base.



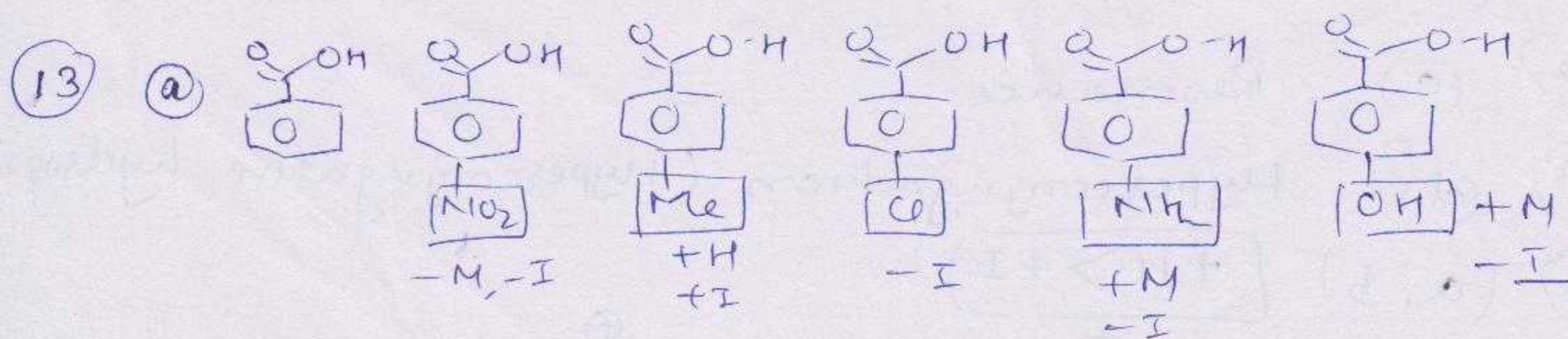
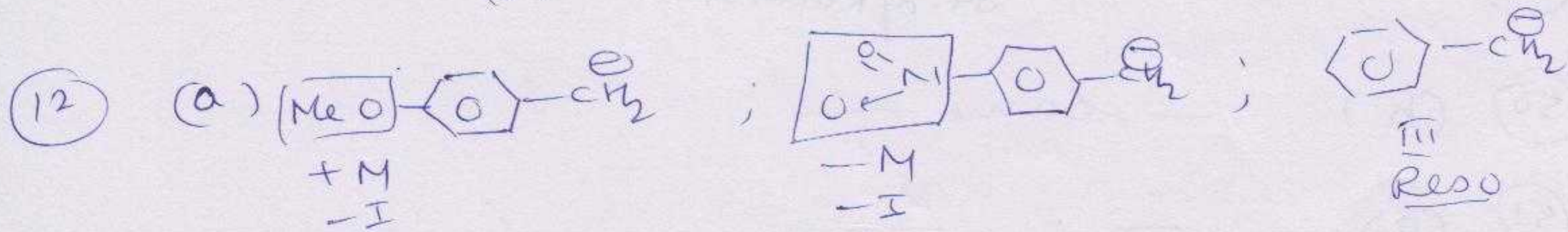
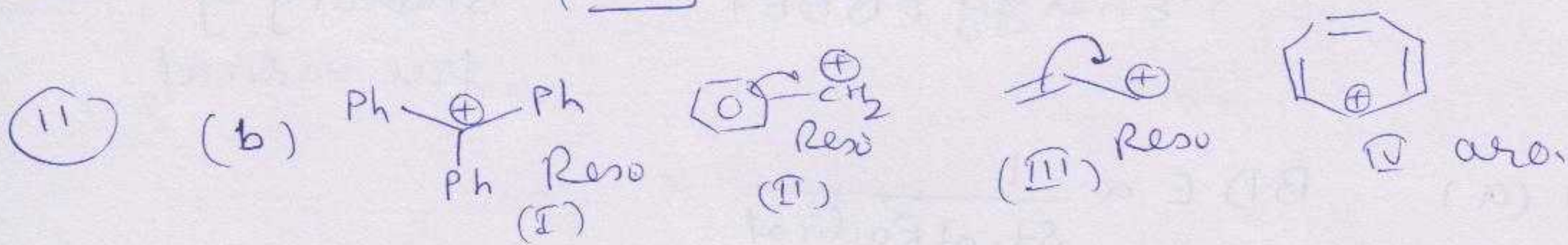
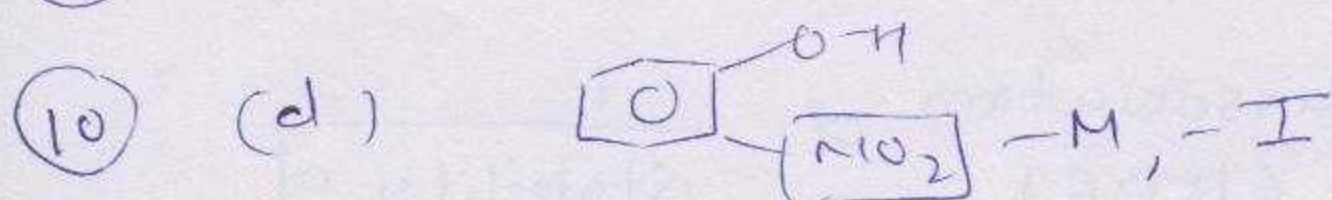
4 (c) $9 \times \text{H}$ 5 (a, b) $\rightarrow \alpha$ Hydrogen.

6 (a, b) absence of α -hydrogen

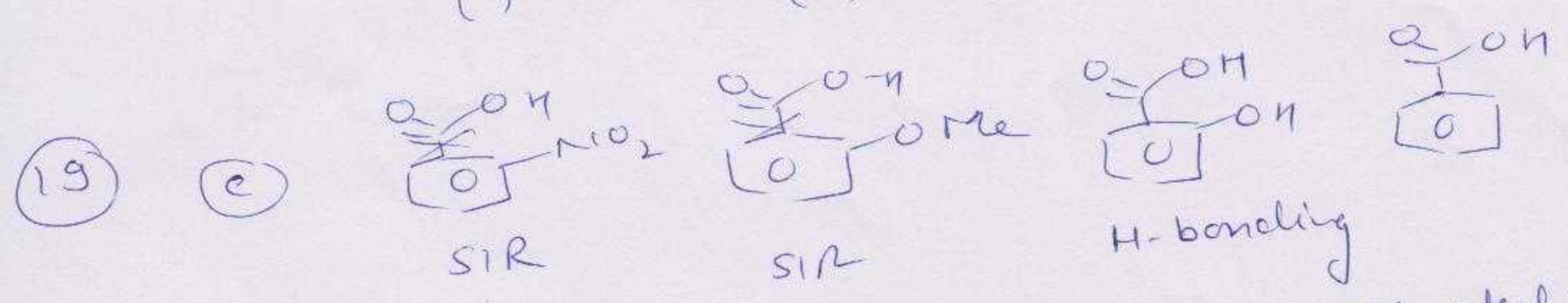
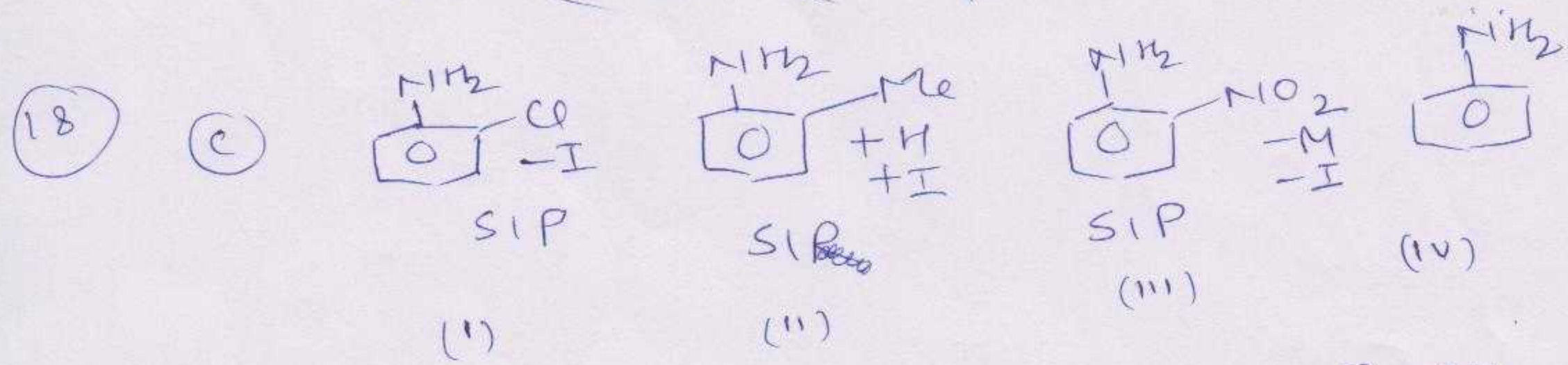
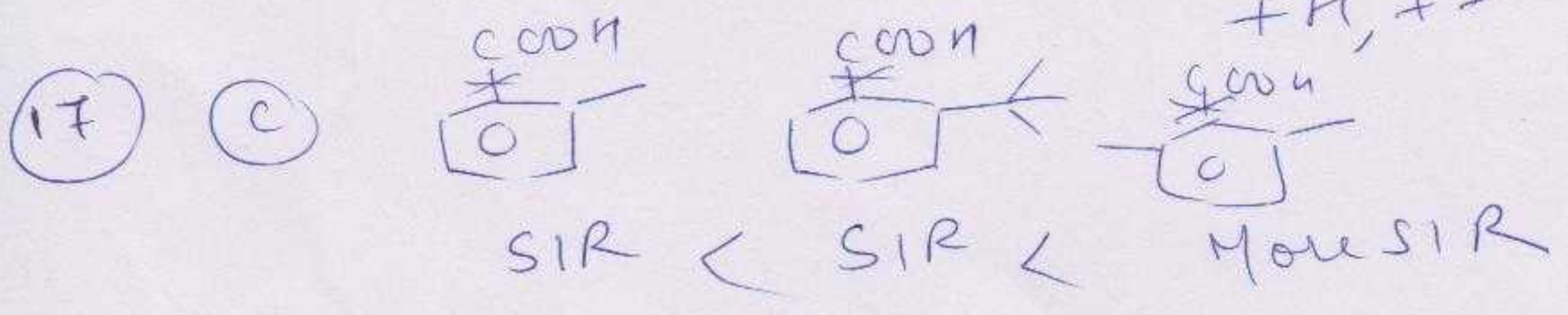
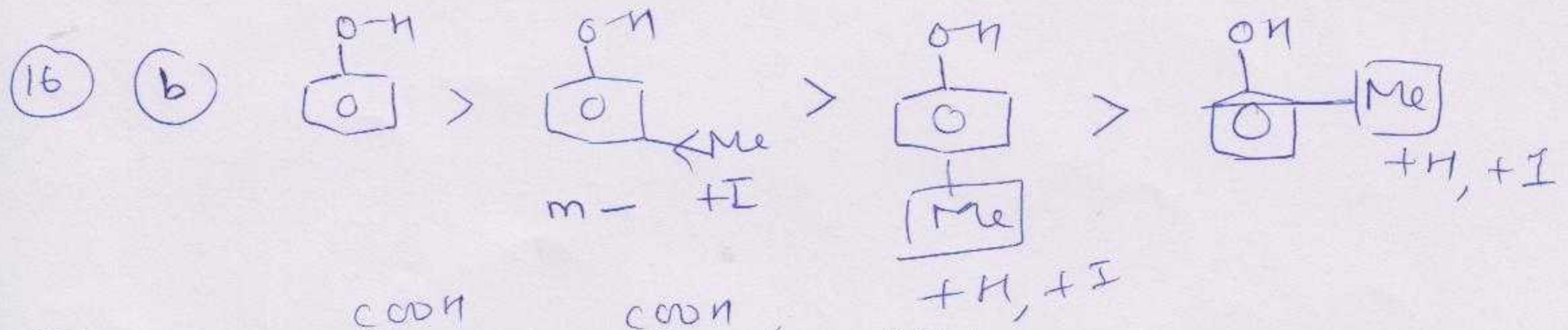
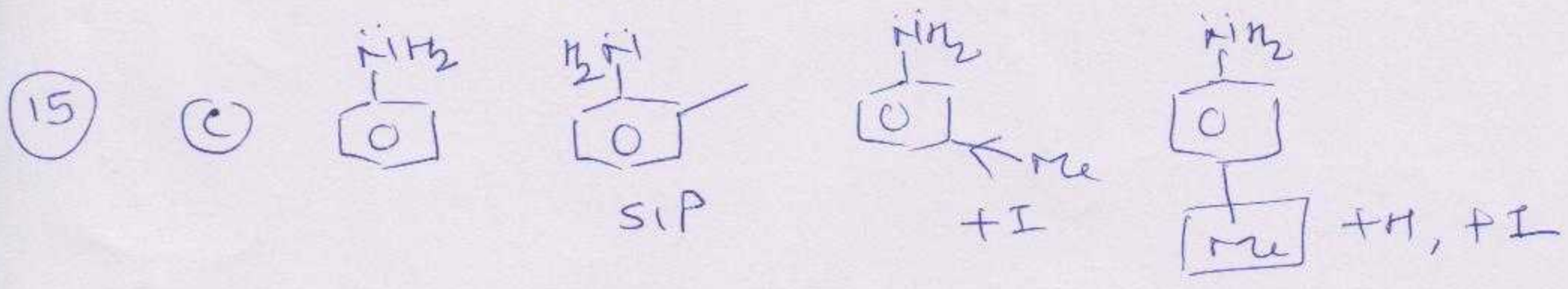


8 (a) localized lone pair

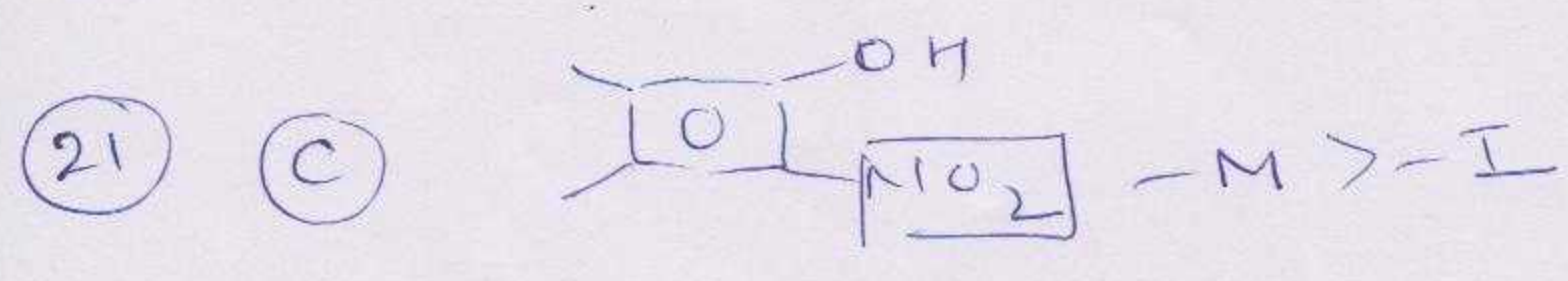
9 (c) due to +M effect of -O-Me gp. at p-position



14) (d) $K_b \propto \frac{1}{pK_b} \propto \text{Electron donating gp} \propto \frac{1}{EWG}$



20) (b) active methylene + follow Huckel Rule (6πe⁻)



22) (b) -I of -C≡C > -C=C

23) (c) Inductive effect $\propto \frac{1}{\text{distance}}$