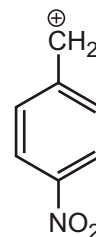
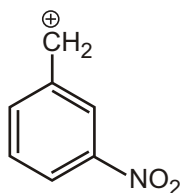
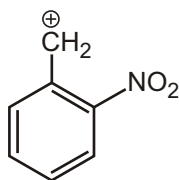
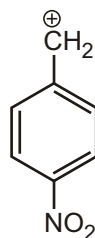
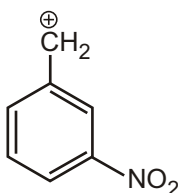
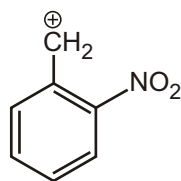


Application of Resonance, Hyperconjugation & Inductive Effect

ADDITIONAL PROBLEMS BASED ON RESONANCE, HYPERCONJUGATION AND INDUCTIVE EFFECT

Solved Example

► What is correct order of Stability of given Carbocation :



Sol.

(I)

(i) Increase in the magnitude of positive charge by – I and – R effect

(ii) – I and – R power is maximum

(II)

Increase in positive charge only by – I effect

(III)

(i) Increase in positive charge by – I – R effect

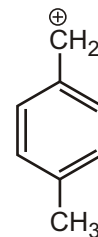
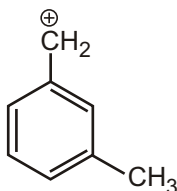
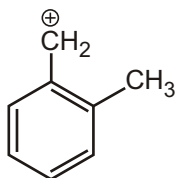
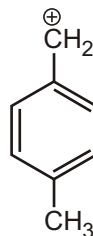
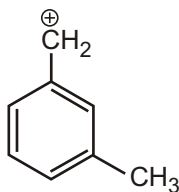
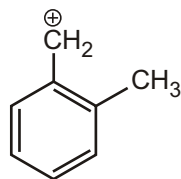
(ii) – I and – R power is minimum

Hence (II) is more stable than (III) which is more stable than (I).

Thus meta derivative is more stable than p-derivative which is more stable than o-derivative.

Solved Example

► What is correct order of Stability of given Carbocation :



Sol.

(I)

Positive charge is decreased by +I and +H group or stabilised by +I and +H group and +I and +H power is maximum

(II)

Stabilised by +I group only

(III)

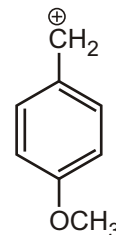
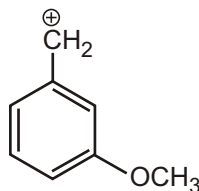
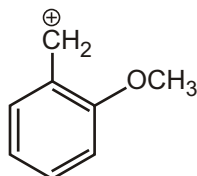
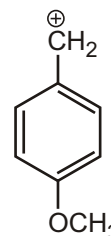
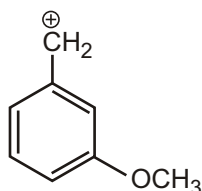
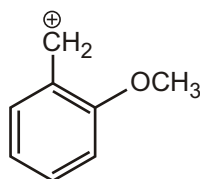
Stabilised by +I and +H effect and +I and +H power is minimum

Hence (I) is more stable than (III) which is more stable than (II).

Thus o-derivative is more stable than p-derivative which is more stable than m-derivative.

Solved Example

► What is correct order of Stability of given Carbocation :



Sol.

(I)

Stabilised by +R effect
destabilised by -I effect
-I power is maximum
(due to distance)

(II)

Destabilised by -I effect

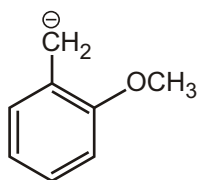
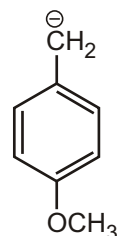
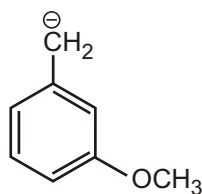
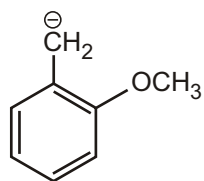
(III)

Stabilised by +R effect
destabilised by -I effect
-I power is minimum
(due to distance)

Hence III is more stable than I which is more stable than II.

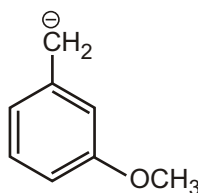
Solved Example

- What is correct order of Stability of given Carbanion :



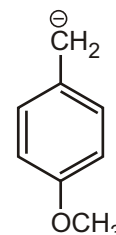
(I)

Destabilised by +R effect and
stabilised by -I effect
-I power is maximum



(II)

Stabilised by -I effect



(III)

Destabilised by +R effect
stabilised by -I effect and
-I power is minimum

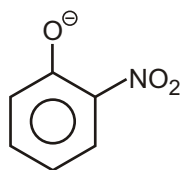
Sol.

Thus m-derivative is more stable o-derivative which is more stable than p-derivative.

Solved Example

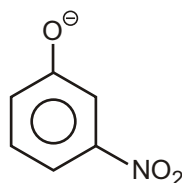
- What is the correct order of acidic strength of orthonitro phenol, metanitro phenol and paranitro phenol.

Sol. Acidity of Substituted Phenols : Acidity of substituted phenols depends on the stability of the phenoxide ion because acidity is the function of the stability of acid anion.



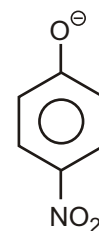
(I)

Phenoxide ion is stabilised by
-R and -I effect and
-I power is maximum
-R power is maximum



(II)

Stabilised by
-I effect only



(III)

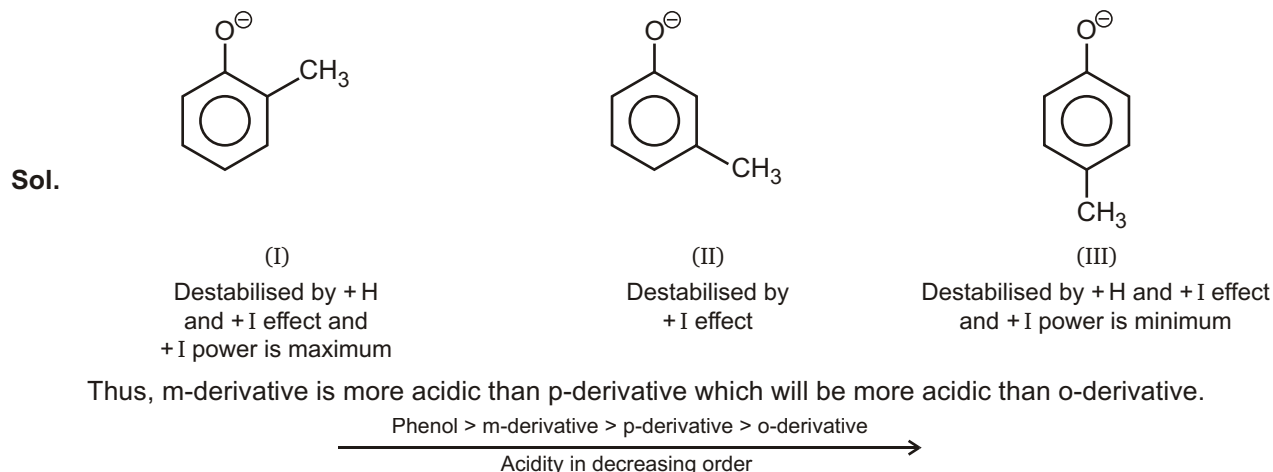
Stabilised by -R and -I effect
and -I power is minimum
-R power is minimum

Thus according to stability of anions o-derivative will be more acidic than p-derivative which will be more acidic than m-derivative. But result is as follows in case of nitrophenols p-derivative is more acidic than o-derivative which is more acidic than m-derivative. In o-derivative, there is hydrogen bonding which decreases acidity. Thus order of acidity is as follows :

paranitro phenol > orthonitro phenol > metanitro phenol > phenol

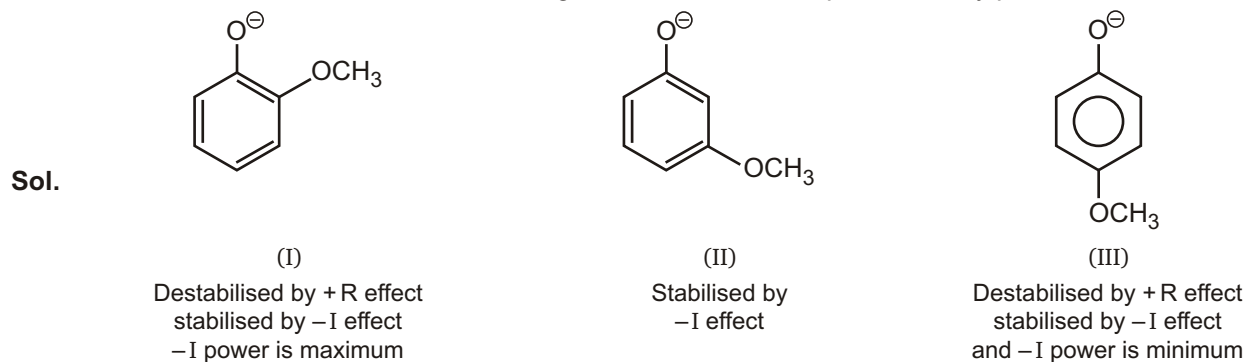
Solved Example

- What is the correct order of acidic strength of orthocresol, metacresol and paracresol.



Solved Example

- What is the correct order of acidic strength of ortho, meta and para methoxy phenol.



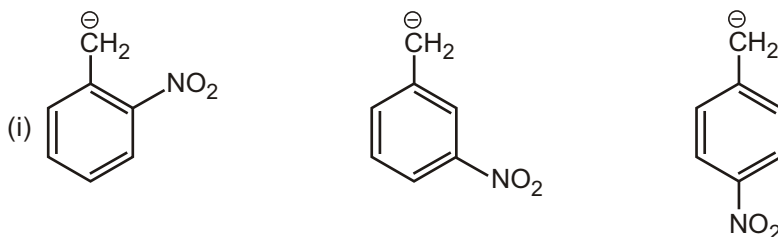
Therefore (II) is more stable than (I) which is more stable than (III).

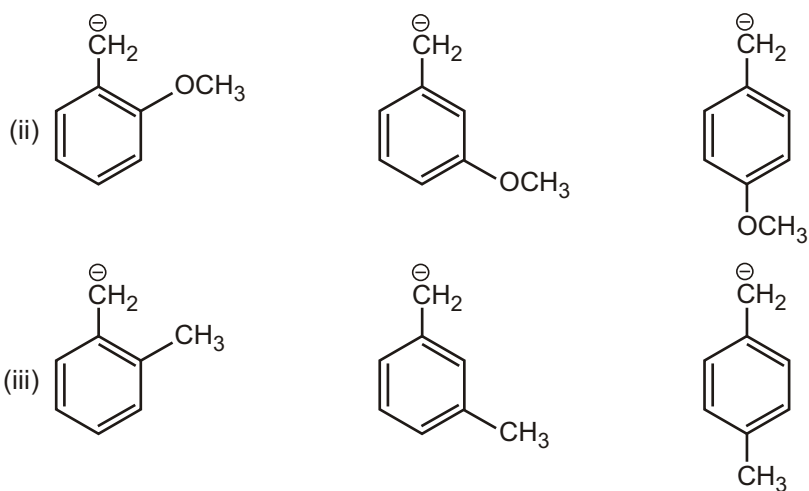
Thus, m-derivative is more acidic than o-derivative which is more acidic than p-derivative.

EXERCISE

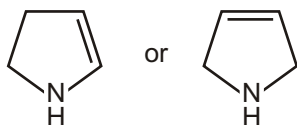
UNSOLVED EXAMPLE

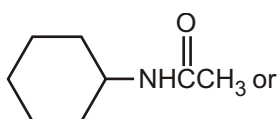
1. Correct order of Stability of given Carbanion :

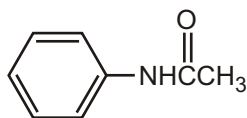




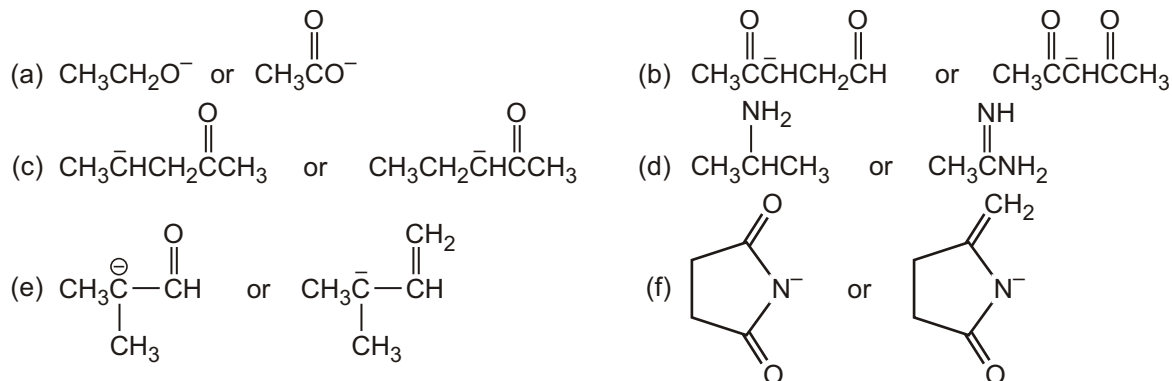
2. (a) Which oxygen atom has the greater electron density $\text{CH}_3\text{C}(=\text{O})\text{OCH}_3$
 (b) Which compound has the greater electron density on its nitrogen atom



- (c) Which compound has the greater electron density on its oxygen atom  or

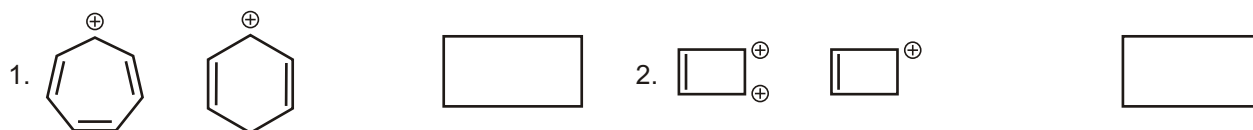


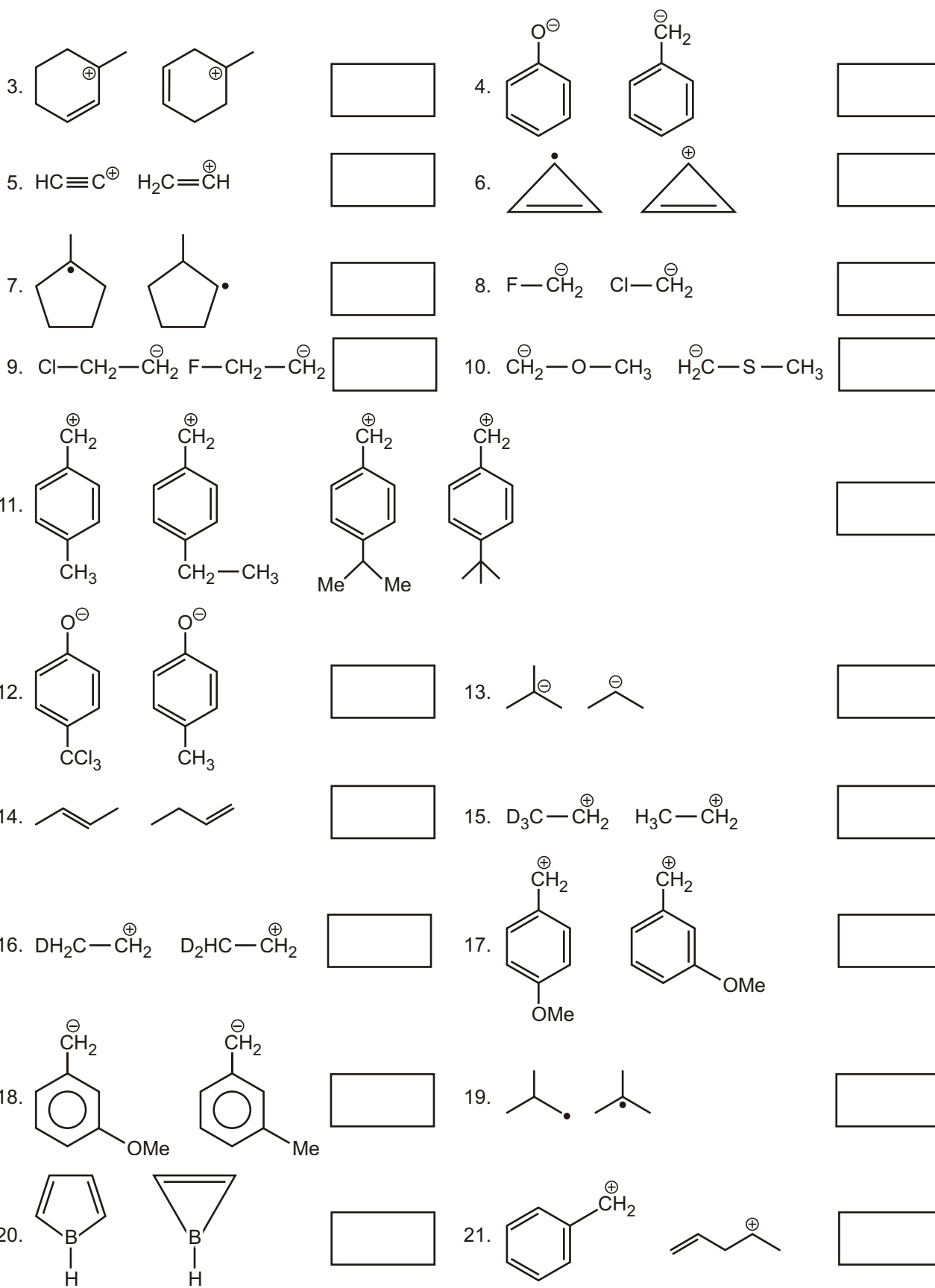
3. In each of the following pairs, which species is more stable?

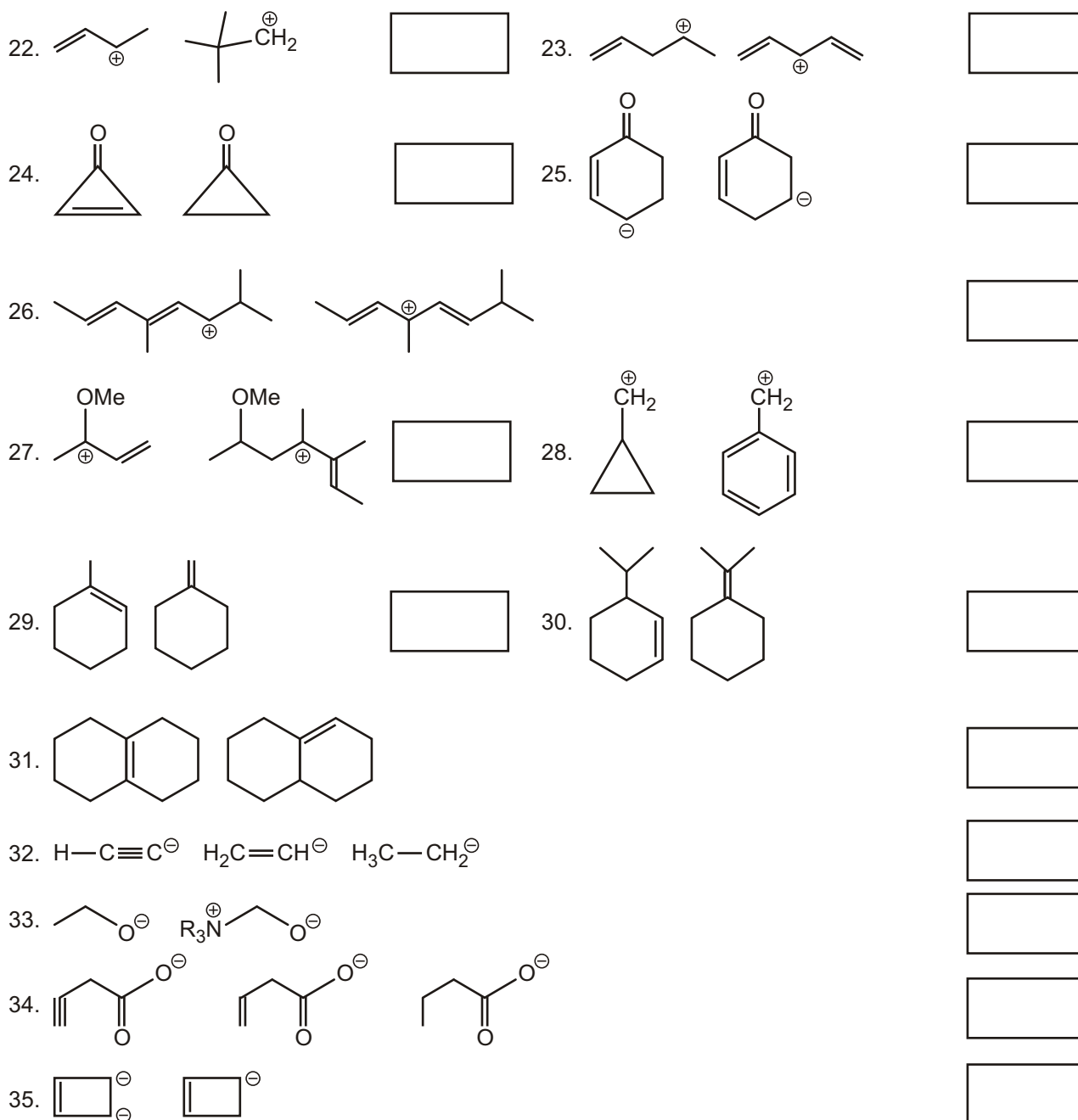


WORK SHEET - 1

1. Which of the following is more stable, Write in the box?







Answers

Unsolved Example

1. (i) **Stability order** : $a > c > b$

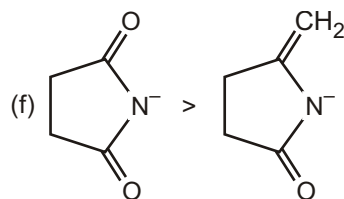
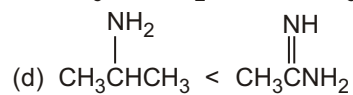
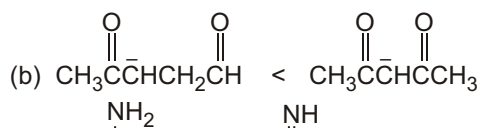
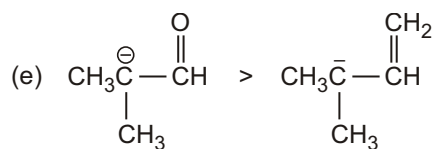
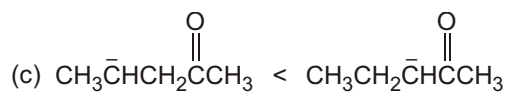
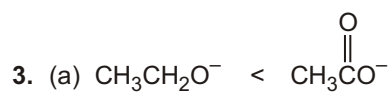
(ii) **Stability order** : $b > a > c$

(iii) **Stability order** : $b > c > a$

2. (a)

(b) $a < b$

(c) $a > b$



Work sheet - 1

- | | | | | | | | |
|-----------------|-------------|---------------------|-------------|-------------|-------------|-------------|-------------|
| 1. $a > b$ | 2. $a > b$ | 3. $a > b$ | 4. $a > b$ | 5. $a < b$ | 6. $a < b$ | 7. $a > b$ | 8. $a < b$ |
| 9. $b > a$ | 10. $a < b$ | 11. $a > b > c > d$ | 12. $a > b$ | 13. $a < b$ | 14. $a > b$ | 15. $a < b$ | 16. $a > b$ |
| 17. $a > b$ | 17. $a > b$ | 18. $a > b$ | 19. $a < b$ | 20. $a < b$ | 21. $a > b$ | 22. $a > b$ | 23. $a < b$ |
| 24. $a > b$ | 25. $a > b$ | 26. $a > b$ | 27. $a > b$ | 28. $a > b$ | 29. $a > b$ | 30. $a < b$ | 31. $a > b$ |
| 32. $a > b > c$ | 33. $a < b$ | 34. $a > b > c$ | 35. $a > b$ | | | | |