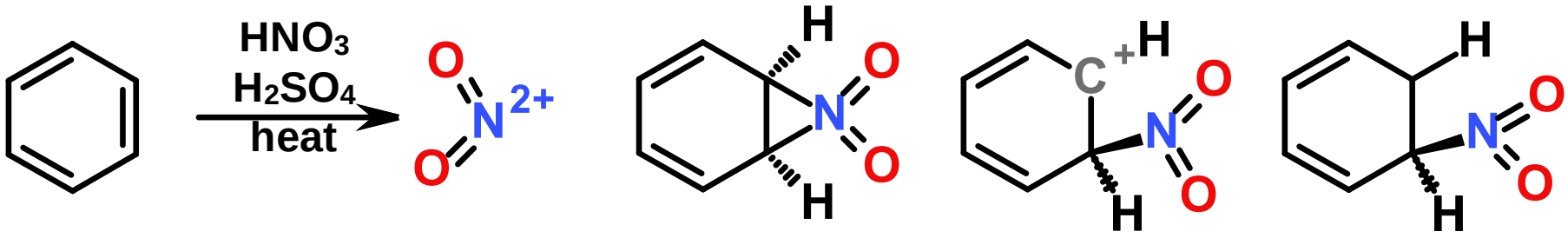
Give the final product of the following reaction. Give your answer as a text answer. If more than one species is correct, put your answers in alphabetical order.

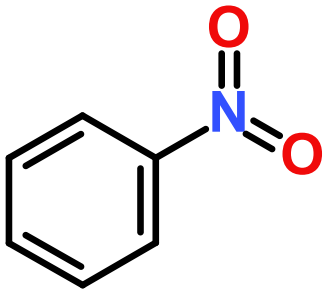


A

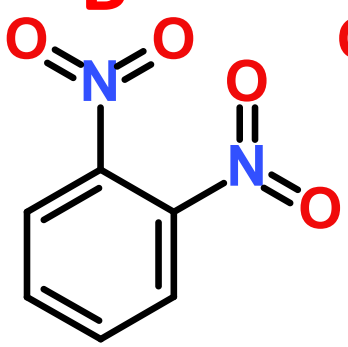
B

C

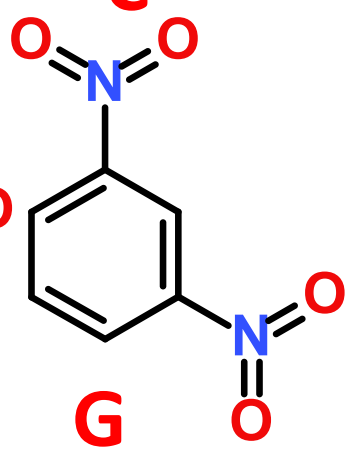
D



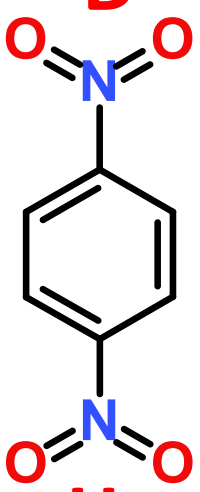
E



F



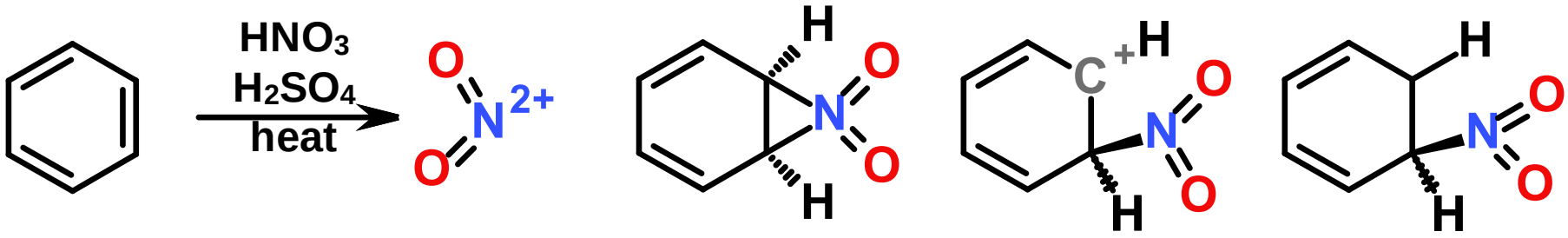
G



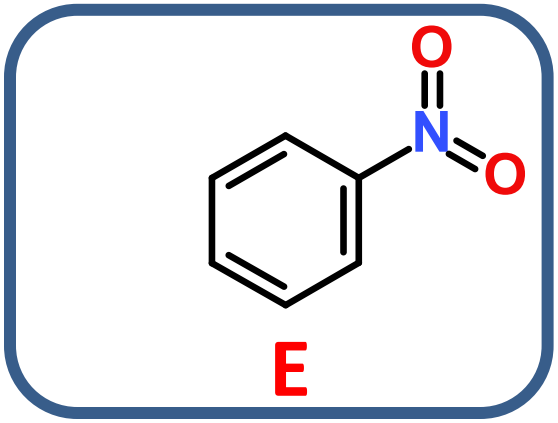
H

2016-09-09 Q1

Give the final product of the following reaction. Give your answer as a text answer. If more than one species is correct, put your answers in alphabetical order.

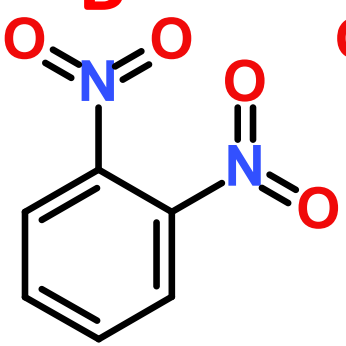


A



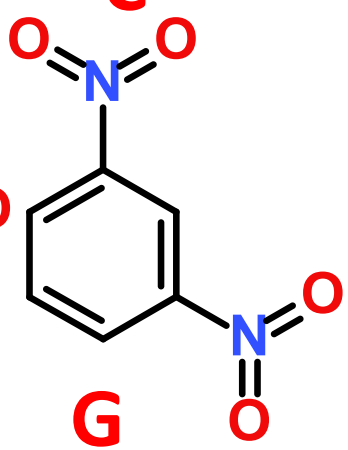
E

B



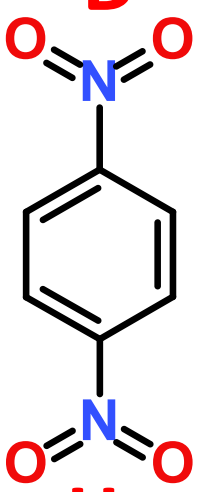
F

C



G

D



H

2016-09-09 Q1

Exam 1

- **Time:**
  - **Tuesday, September 20: 7:00 – 9:00PM OR**
  - **Wednesday, September 21: 7:00 – 9:00PM OR**
  - **Thursday, September 22: 7:00 – 10:00PM**
- **Location – Soc/Anthro Testing Center**
  - Chapters will be covered in this order: Chapter 11, 14, 15, 19, 13
- **Practice Exams are Posted**
  - B7-19-98A Practice Exam 1A
  - B7-19-98B Practice Exam 1B
- **Deadline for alternate arrangements is Monday, 9/19/2016 at 4:30 PM (i.e., close of business)**
  - **An oral make-up exam will be required for making up the exam for all students not taking the exam on the above dates or having already made prior arrangements**

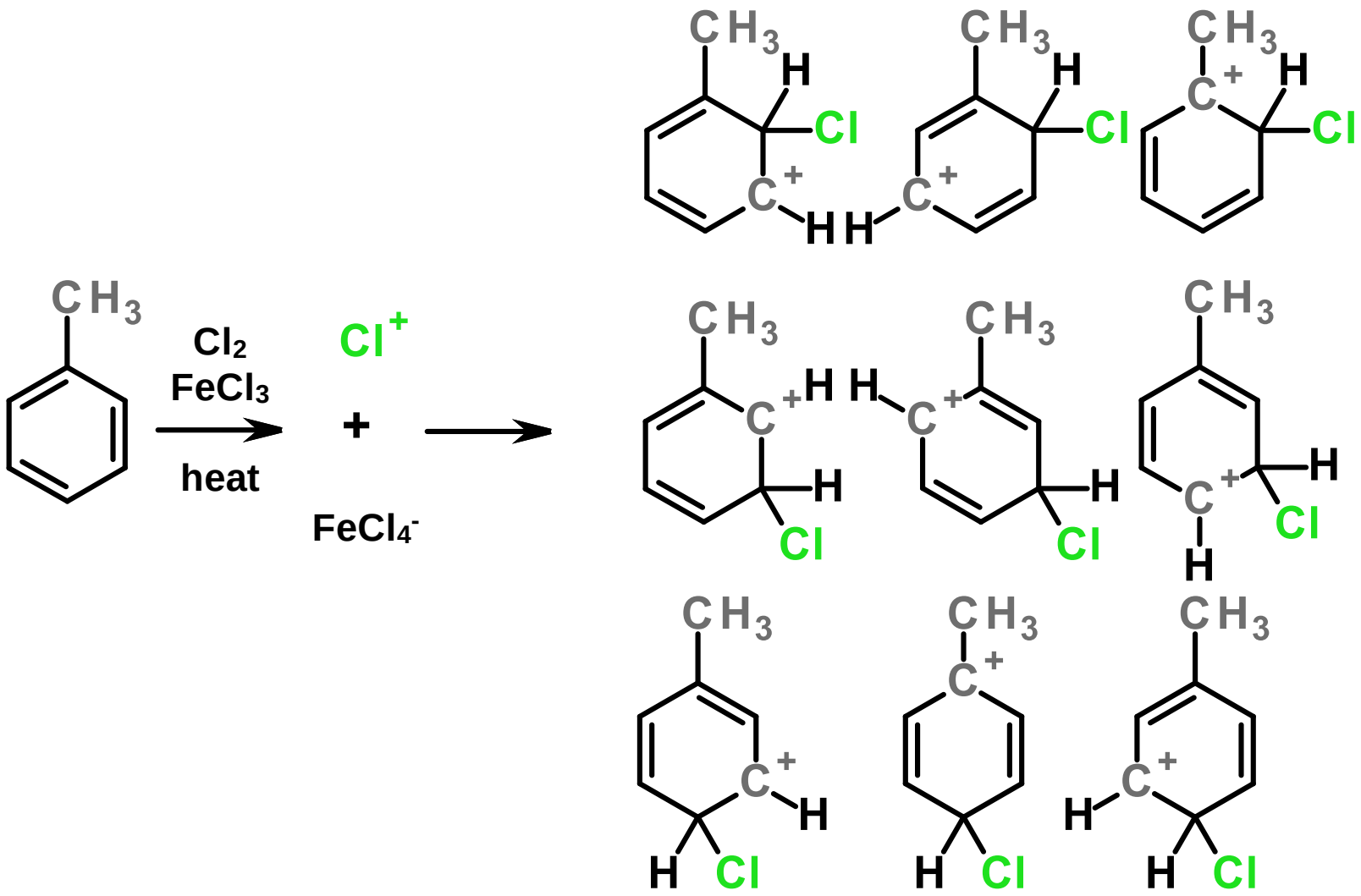
Order of Coverage (Exam 1)

	Homework Assignment	Due Date
1	B4-11-01 IR Functional Groups (wDeadline)	Tuesday, August 23
2	B7-14-02 Mass Spec - Molecular Ion (wDeadline)	Wednesday, August 24
3	B7-14-03 Mass Spec - Isotope Effects (wDeadline)	Thursday, August 25
4	B7-15-01 Number of Peaks 1H NMR Spectra (wDeadline)	Friday, August 26
5	B7-15-06 Number of Peaks 13C NMR (wDeadline)	Saturday, August 27
6	B7-15-02 Theoretical NMR Chemical Shift (wDeadline)	Sunday, August 28
7	B7-15-03 Theoretical NMR Integration (wDeadline)	Monday, August 29
8	B7-15-04 Theor. NMR Spin-Spin Splitting (wDeadline)	Tuesday, August 30
9	B7-15-05 NMR Spectroscopy Problems (wDeadline)	Wednesday, August 31
10	B7-15-07 13C NMR Structure ID (wDeadline)	Thursday, September 1
11	B7-13-01A Nomenclature Alkyl Halides (wDeadline)	Friday, September 2
12	B7-13-01B Alkyl Halide Nomenclature (wDeadline)	Saturday, September 3
13	B7-13-02A Halogenation of Alkanes (wDeadline)	Sunday, September 4
14	B7-13-02B Halogenation of Alkanes (wDeadline)	Monday, September 5

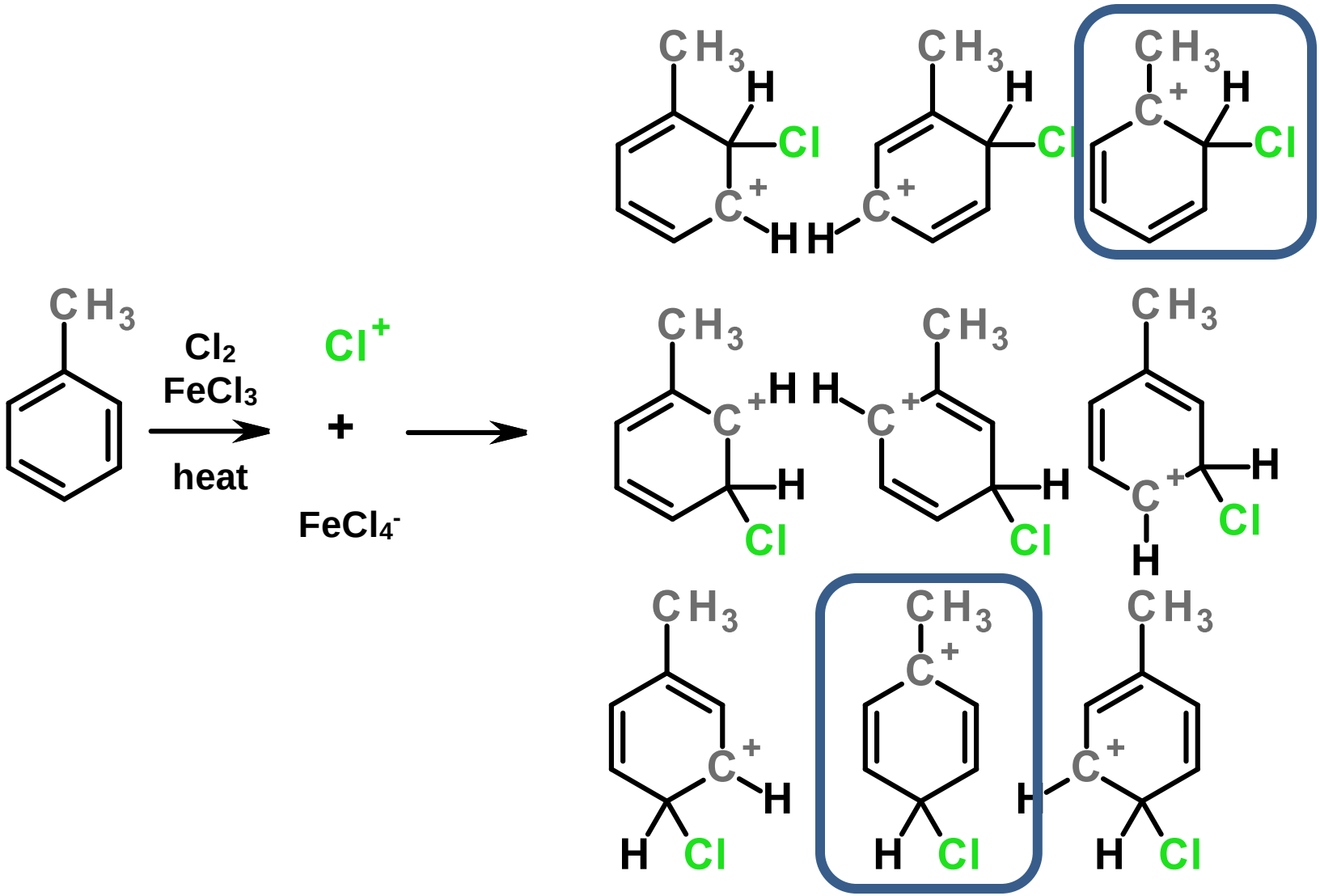
Order of Coverage (Exam 1)

	Homework Assignment	Due Date
15	B7-13-03A Oxidation and Anti-oxidants (wDeadline)	Tuesday, September 6
16	B7-19-01 Aromaticity (wDeadline)	Wednesday, September 7
17	B7-19-02B Arene Nomenclature (wDeadline)	Thursday, September 8
18	B7-19-03A Halogenation of Arenes (wDeadline)	Friday, September 9
19	B7-19-03B Halogenation of Arenes (wDeadline)	Friday, September 9
20	B7-19-04A Arene Rxns Inorganic Acids (wDeadline)	Saturday, September 10
21	B7-19-04B Arene Rxns Inorganic Acids (wDeadline)	Saturday, September 10
22	B7-19-05A Friedel-Crafts (wDeadline)	Sunday, September 11
23	B7-19-05B Friedel-Crafts (wDeadline)	Sunday, September 11
24	B7-19-06 Arene Mechanistic Issues (wDeadline)	Wednesday, September 12
25	B7-19-06B Arene Mechanisms (wDeadline)	Wednesday, September 12
26	B7-19-07A Nucleophilic Aromatic Subs (wDeadline)	Thursday, September 13
27	B7-19-07B Nucleophilic Aromatic Subs (wDeadline)	Friday, September 14
	Exam 1	**September 20, 21, 22**

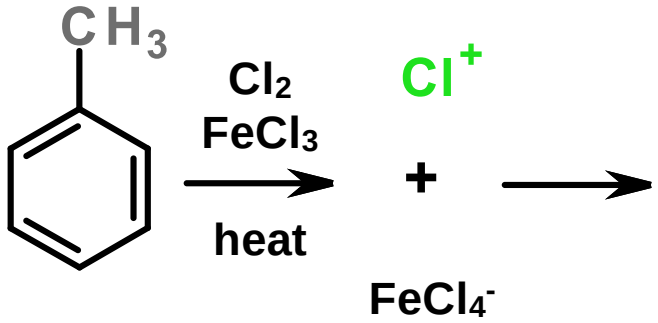
Regiochemistry of the Halogenation

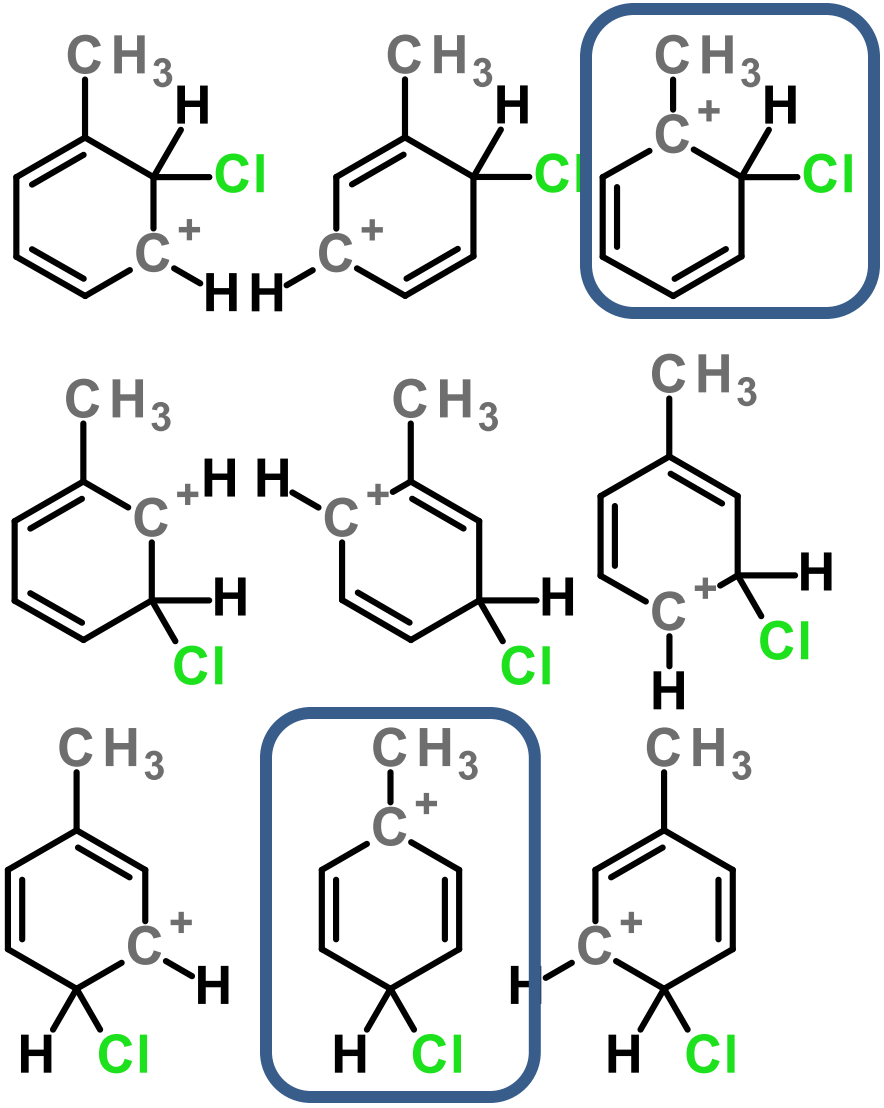


Regiochemistry of the Halogenation



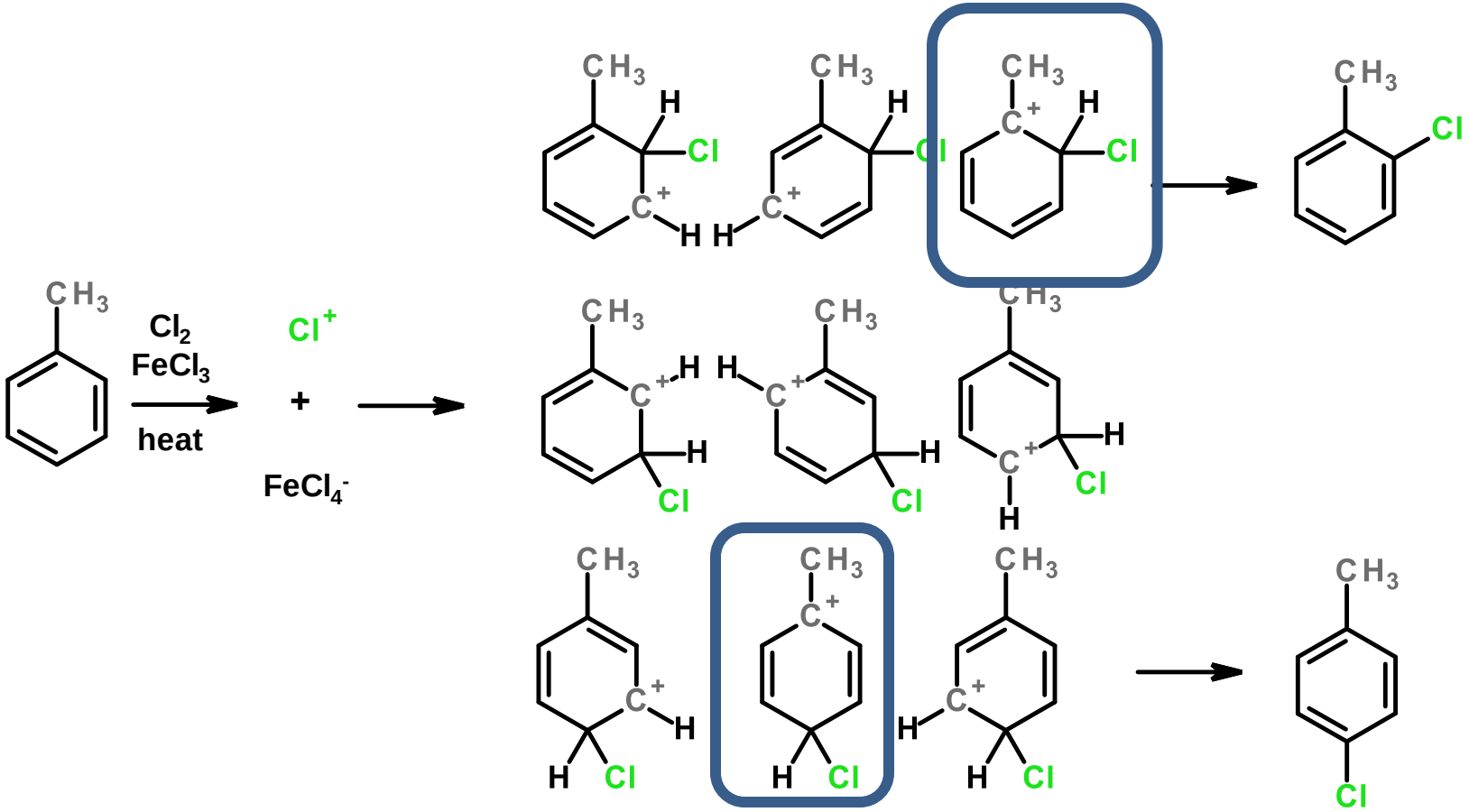
Regiochemistry of the Halogenation





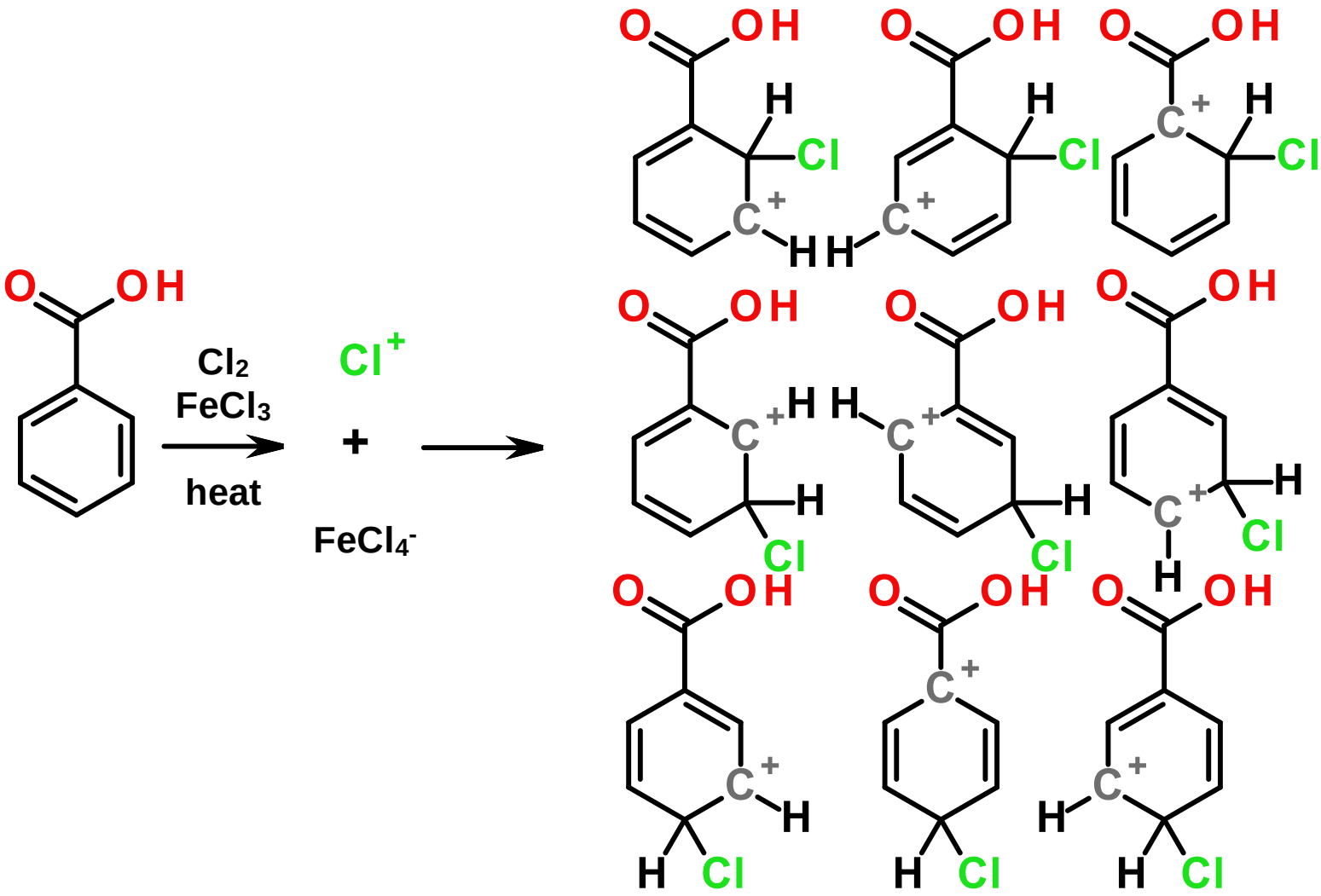
The circled groups are more stable than the other resonance structures.

Regiochemistry of the Halogenation

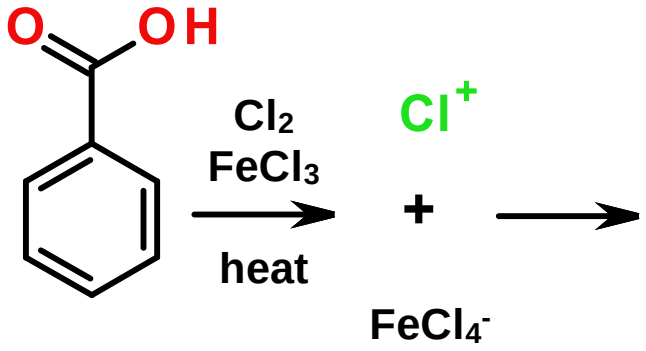


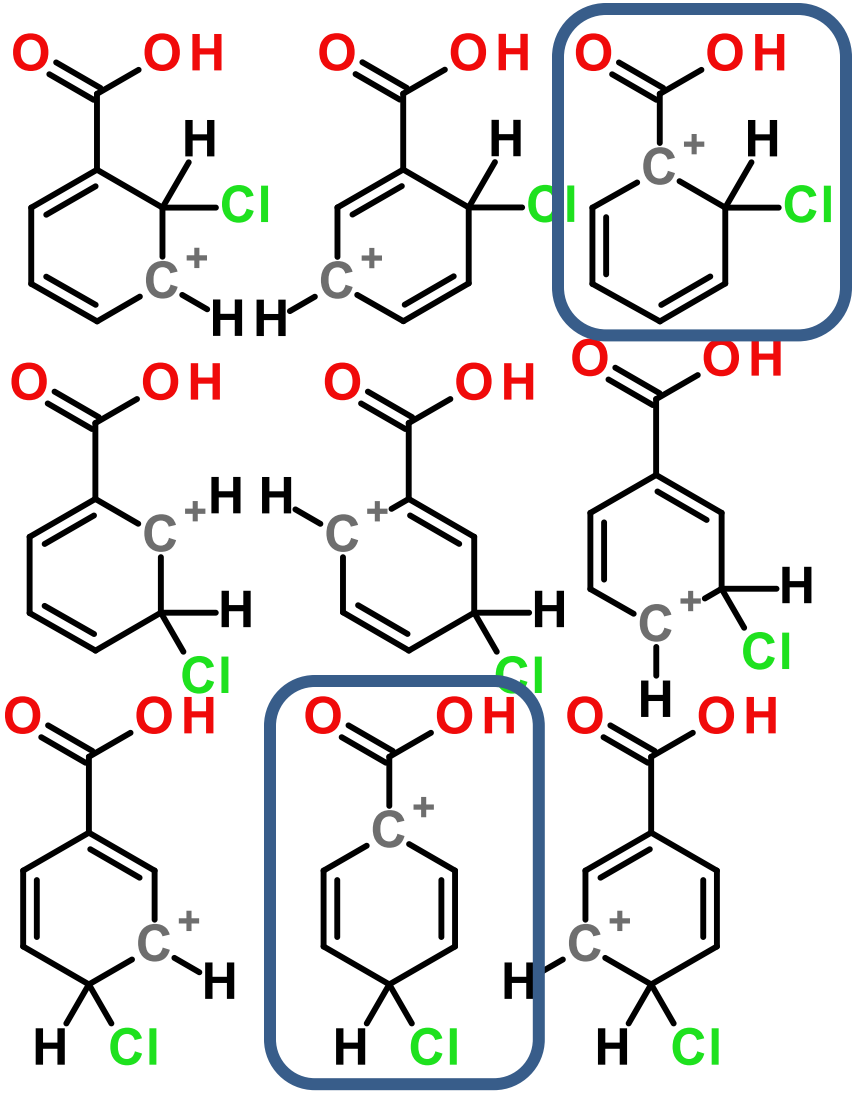
Groups that stabilize a carbocation lead to o,p-direction

Regiochemistry of the Halogenation



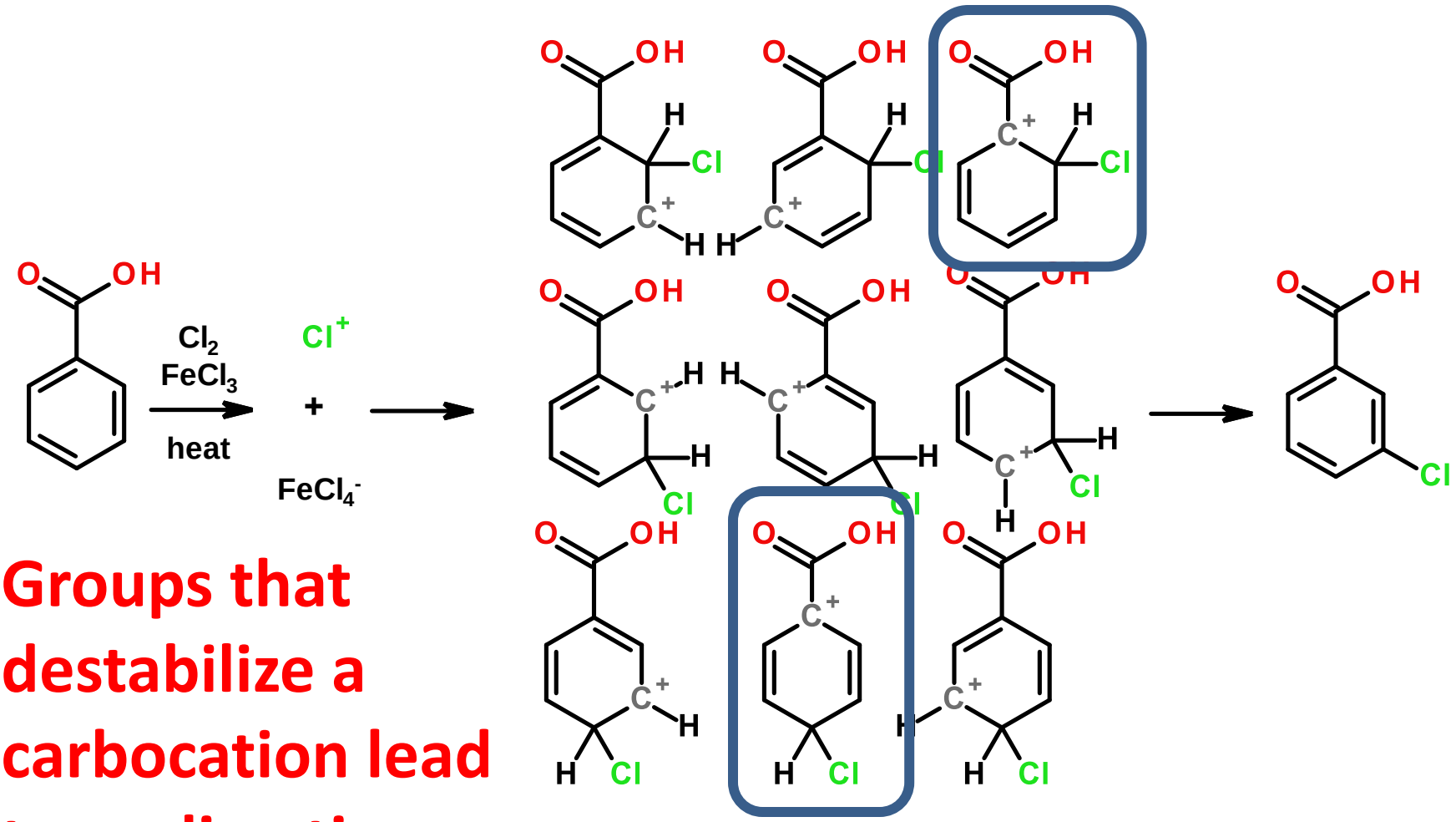
Regiochemistry of the Halogenation





The circled groups are less stable than the other resonance structures.

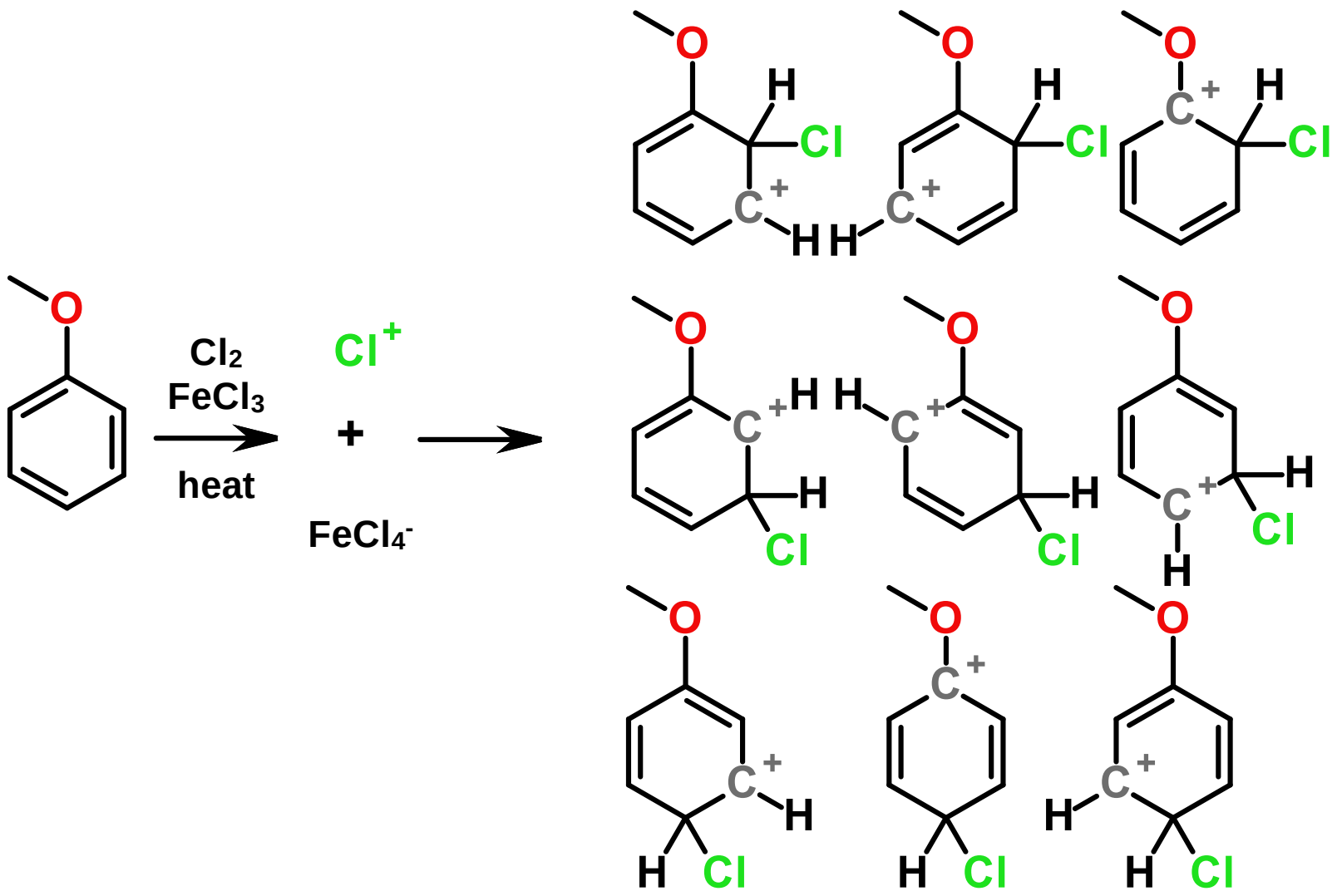
Regiochemistry of the Halogenation



Groups that destabilize a carbocation lead to m-direction

Regiochemistry

- Ortho, Para-Directors
  - Groups that stabilize a carbocation
  - Usually alkyl groups
- Meta-Directors
  - Groups that destabilize a carbocation
  - RC=O, CN


O
Cl2
FeCl3
heat
Cl+
+
FeCl4-
O
H
Cl
C+
H H
O
H
Cl
C+
O
C+
H
Cl
O
C+
H H
H
Cl
O
C+
H H
H
Cl
O
C+
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Cl
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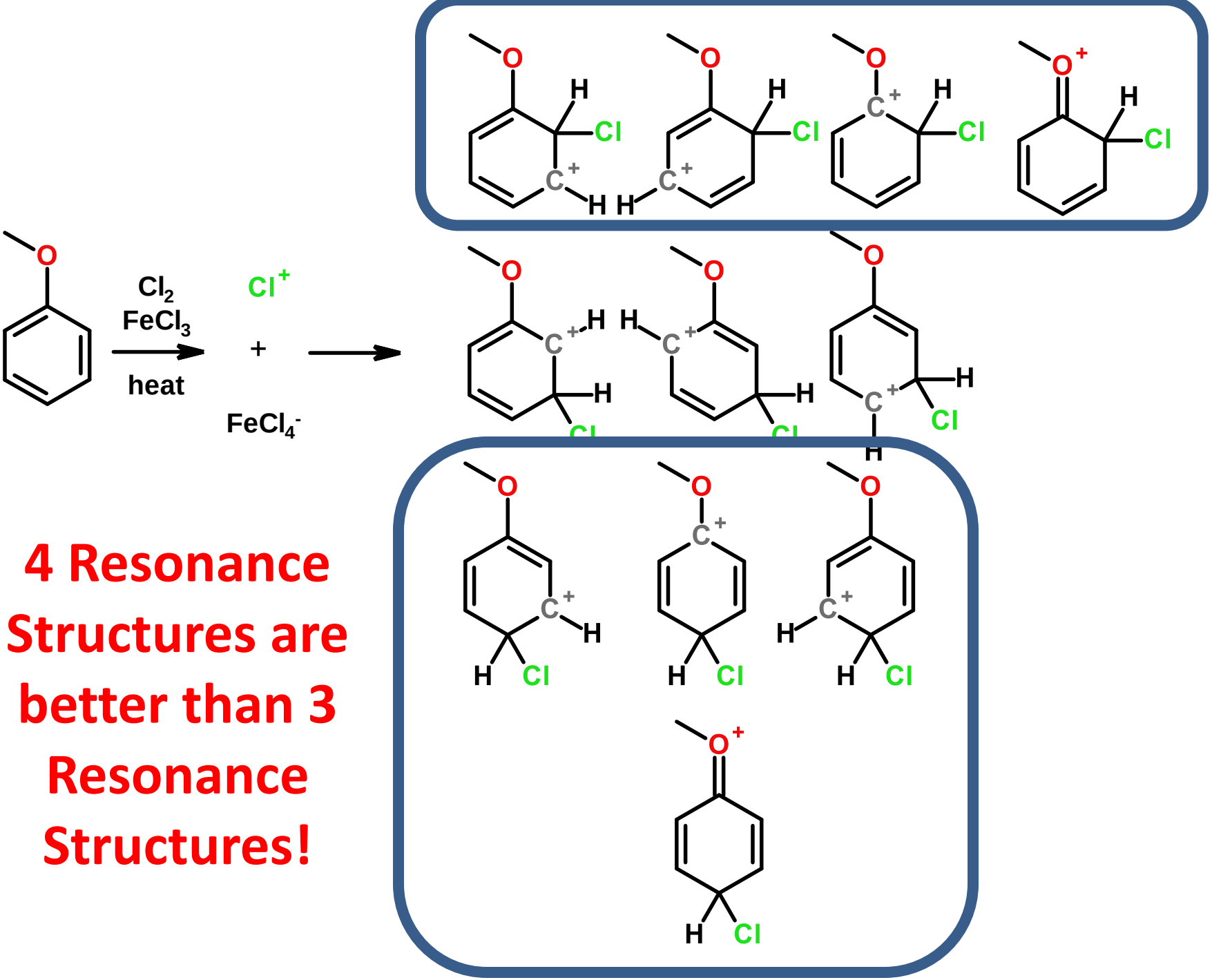
Cl
O
C+
H
H
Cl

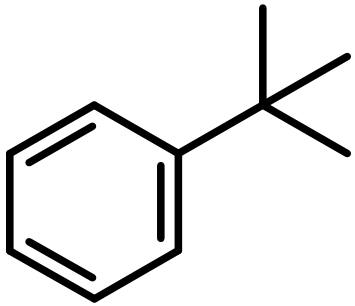


4 Resonance Structures are better than 3 Resonance Structures!

Regiochemistry

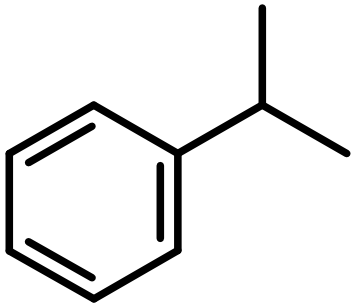
- Ortho, Para-Directors
  - Groups that stabilize a carbocation
  - Usually alkyl groups
  - **Groups with lone pair electrons**
    - **O**
    - **N**
- Meta-Directors
  - Groups that destabilize a carbocation
  - RC=O, CN

Steric Hindrance Issues



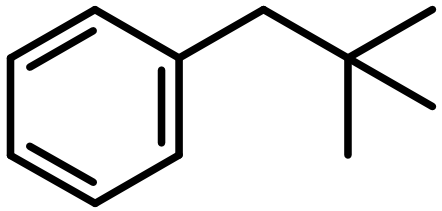
Para > Ortho

No steric hindrance to approach at *para*-position while there is steric hindrance to approach at the *ortho*-position.



Para > Ortho

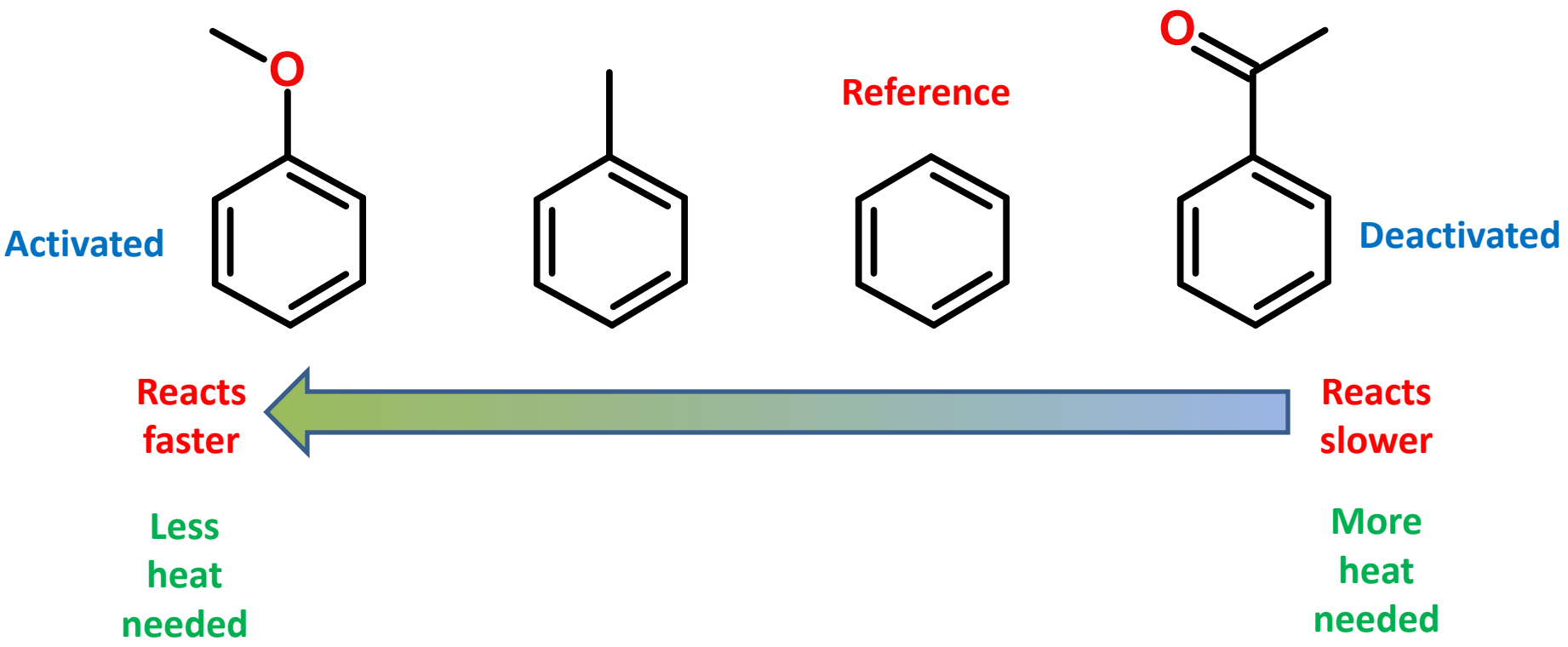
No steric hindrance to approach at *para*-position while there is steric hindrance to approach at the *ortho*-position.



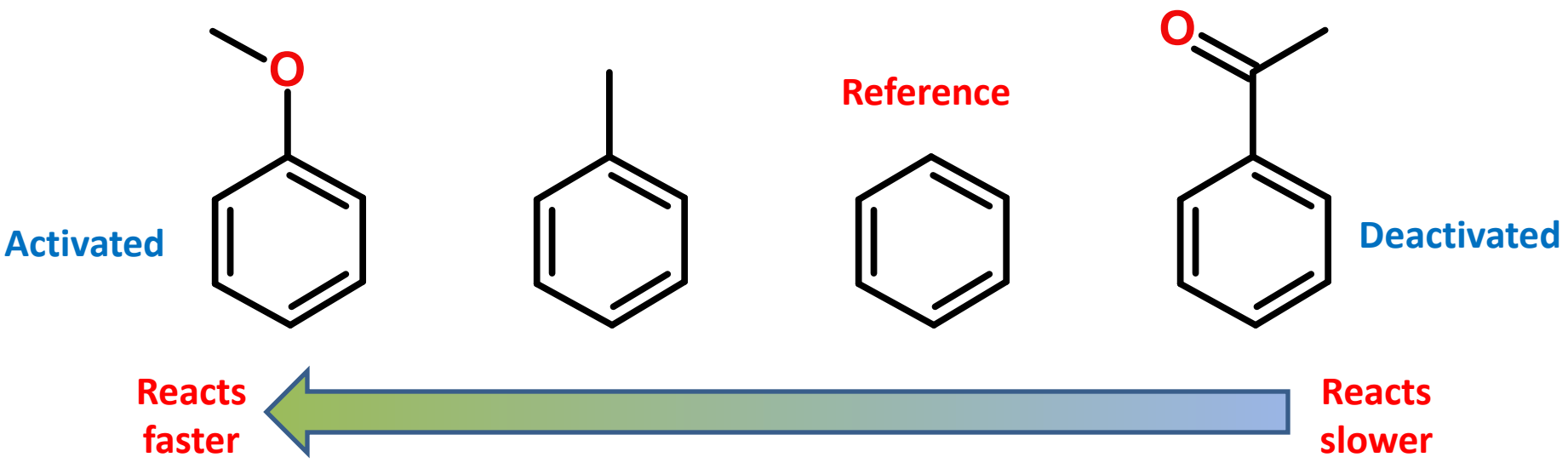
Para = Ortho

No steric hindrance to approach at *para*-position while there is only a little steric hindrance to approach at the *ortho*-position.

Activated vs Deactivated



Activated vs Deactivated

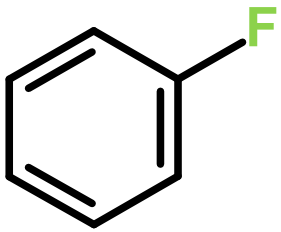


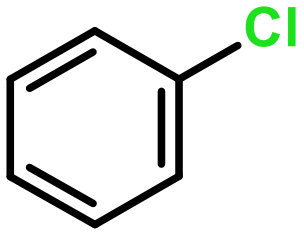
Reacts faster ← **Reacts slower**

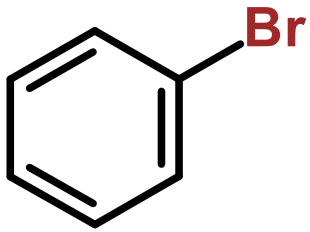
Less heat needed — Cl_2 or Br_2 — **More heat needed**

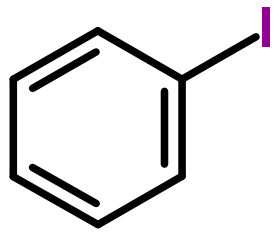
Reacts at room temperature without catalyst	Need FeX_3, heat	Need FeX_3, heat	Need FeX_3, heat

Halogens









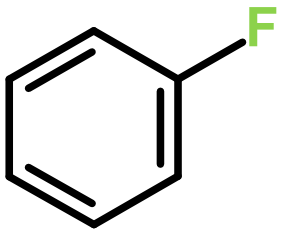
Electronegativity

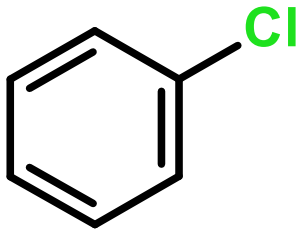
- Destabilizes carbocations

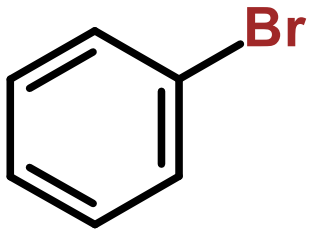
π-electron Resonance

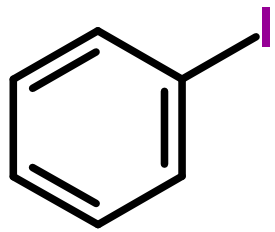
- Stabilizes carbocations

Halogens









Electronegativity

- Destabilizes carbocations

π-electron Resonance

- Stabilizes carbocations

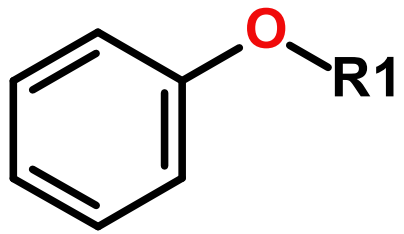
In general, resonance beats electronegativity

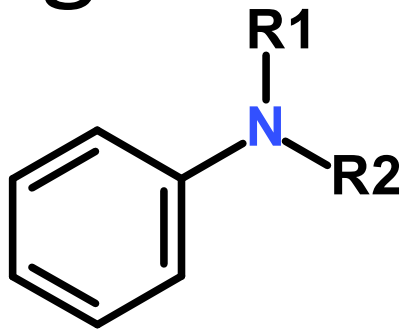
Halogens are o,p-directing, but are deactivated

Regiochemistry

- Ortho, Para-Directors
  - Groups that stabilize a carbocation
  - Usually alkyl groups
  - **Groups with lone pair electrons**
    - **O**
    - **N**
    - **Halogen**
- Meta-Directors
  - Groups that destabilize a carbocation
  - RC=O, CN

Oxygen vs Nitrogen



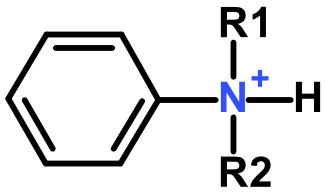


Oxygen

- Does not bond well to acids (H^+) or catalysts
- Activated and always o,p-directing

Nitrogen

- Bonds well and fast to acids (H+) or catalysts

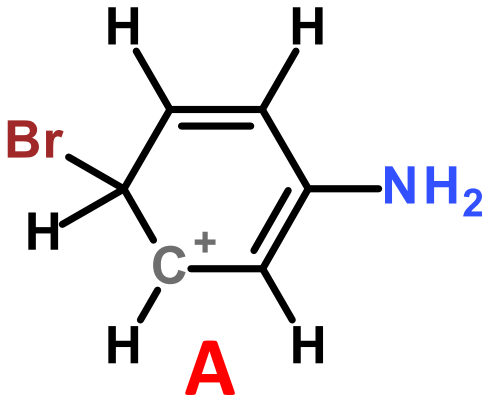


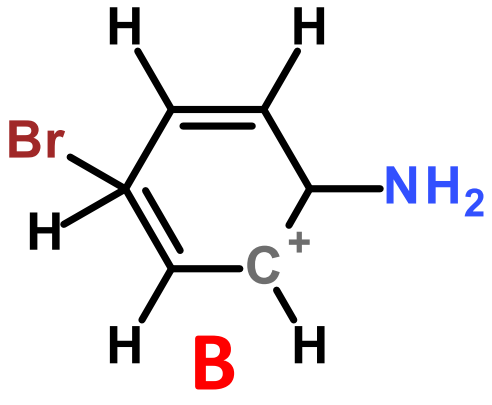
- Acids – meta-directing
- No acids – o,p-directing

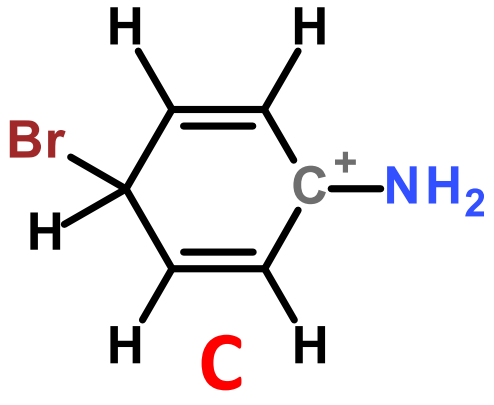
Regiochemistry

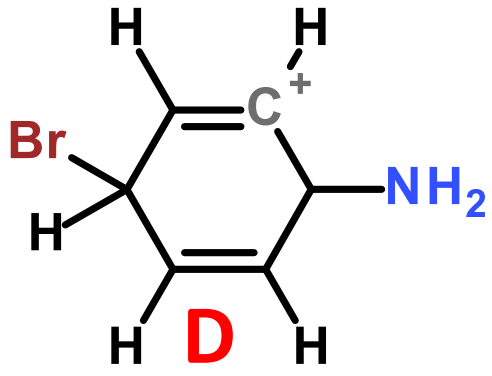
- Ortho, Para-Directors
  - Groups that stabilize a carbocation
  - Usually alkyl groups
  - **Groups with lone pair electrons**
    - **O**
    - **N (NOT in acid (H^+) or with a catalyst)**
    - **Halogen**
- Meta-Directors
  - Groups that destabilize a carbocation
  - RC=O, CN
  - N with acid (H^+) or a catalyst

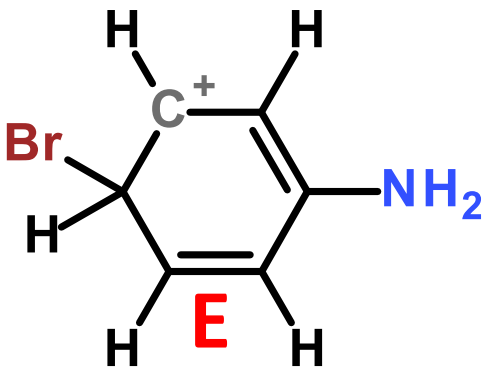
Which of the following resonance structures are correct for the p-bromination of aniline?

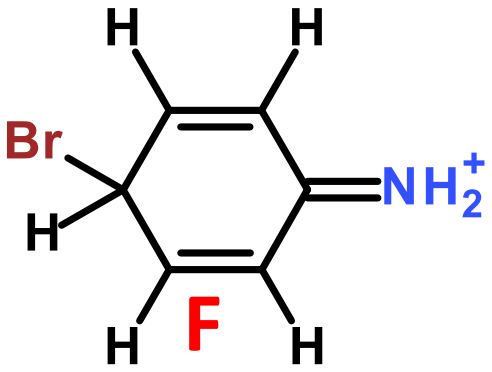






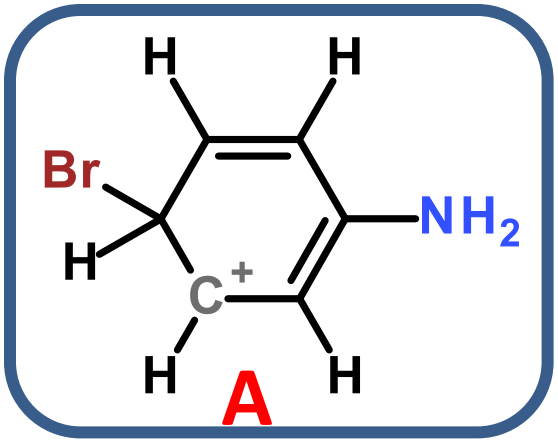


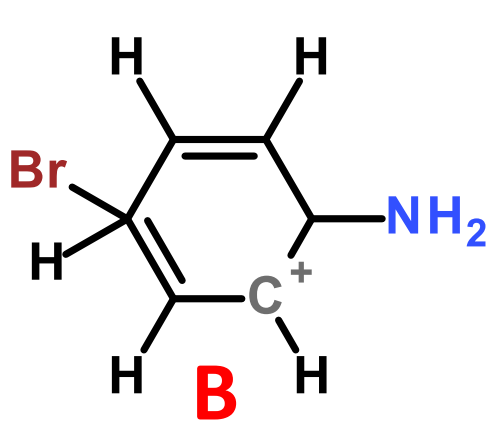


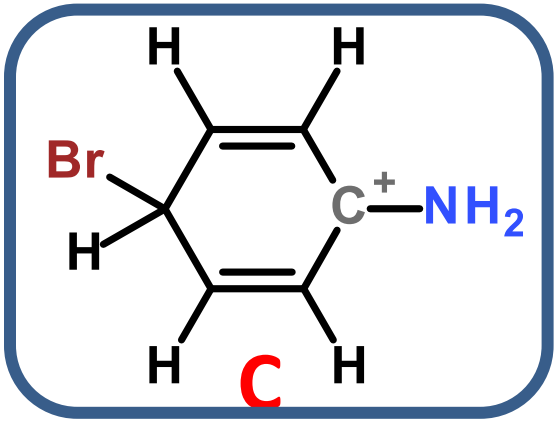


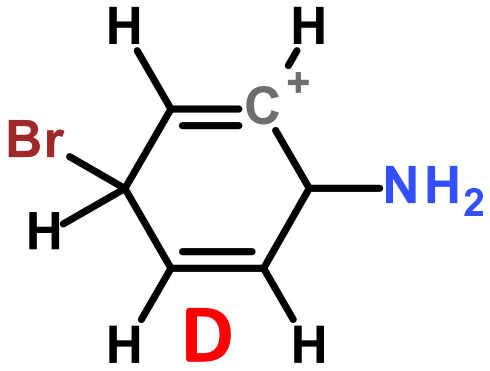
2016-09-09 Q2

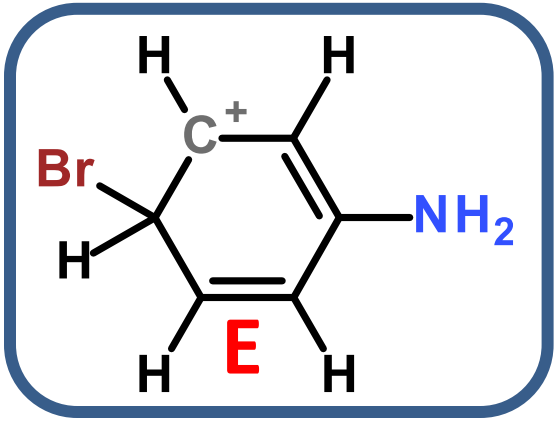
Which of the following resonance structures are correct for the p-bromination of aniline?

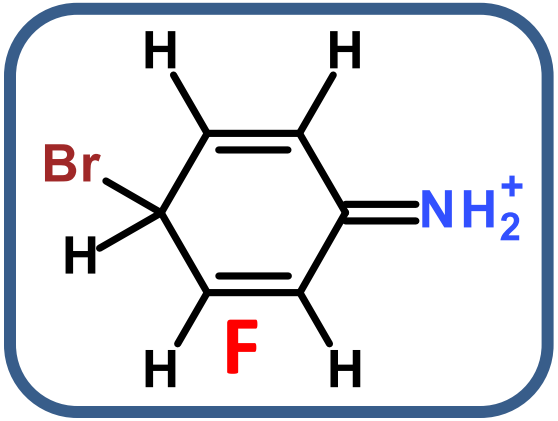






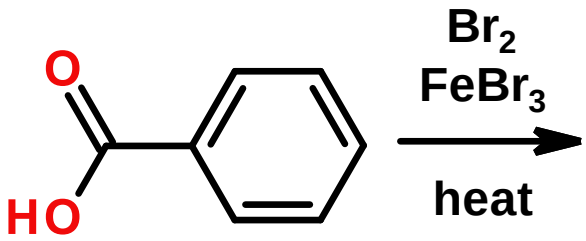




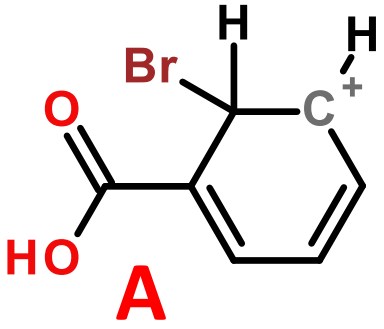


2016-09-09 Q2

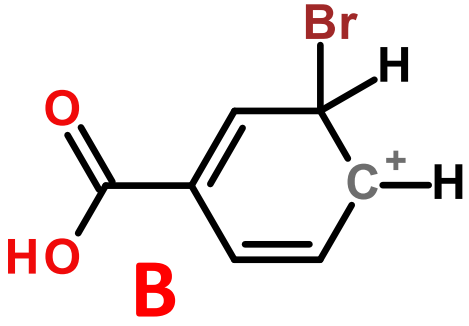
Give the next major organic intermediate(s) of the following reaction.



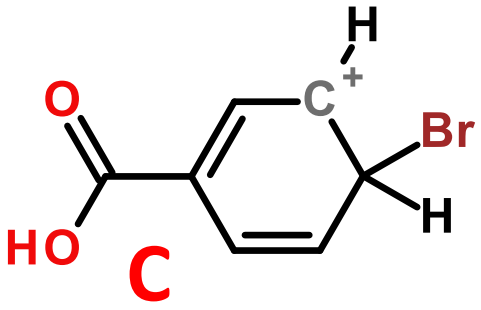
2016-09-09 Q3



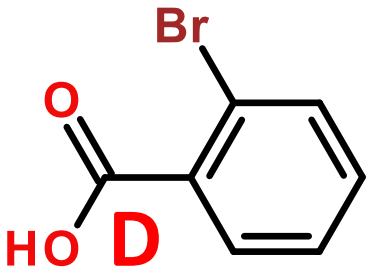
A



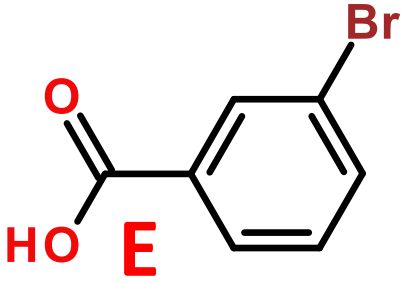
B



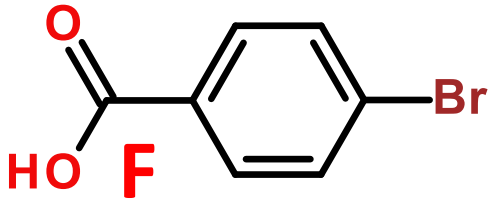
C



D

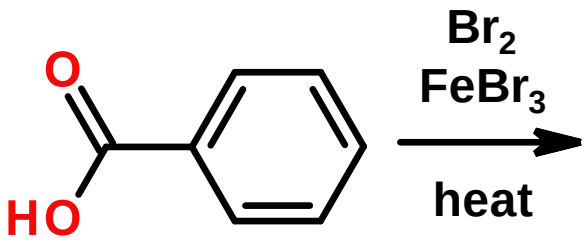


E



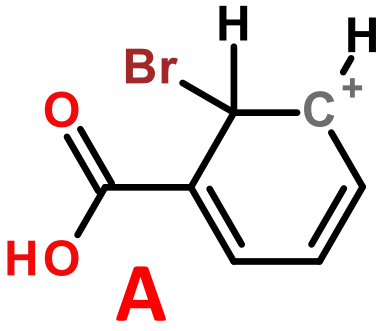
F

Give the next major organic intermediate(s) of the following reaction.

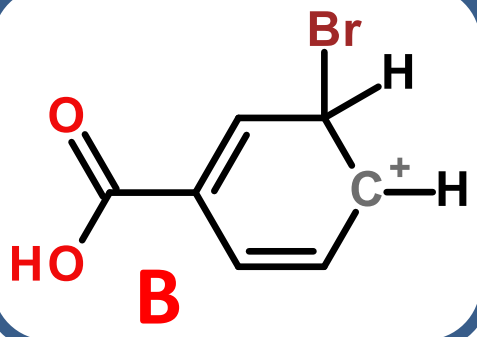


Br_2
$FeBr_3$
heat

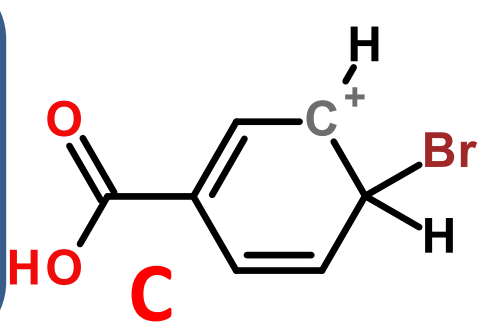
2016-09-09 Q3



A



B



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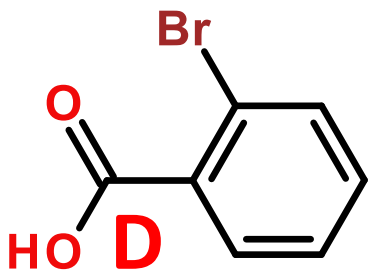
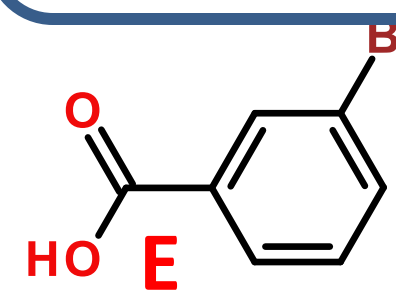
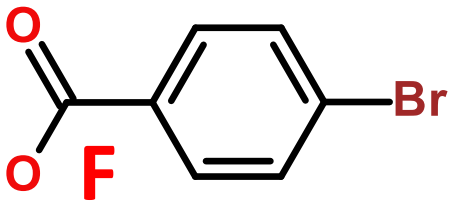


D

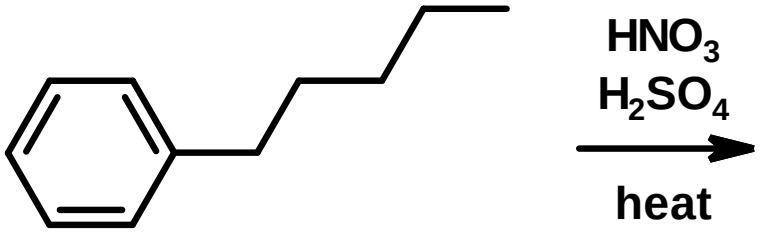


E

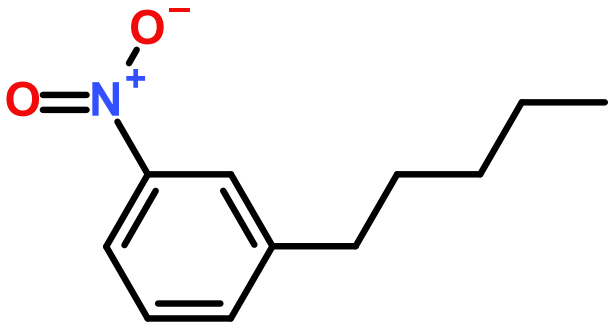


F

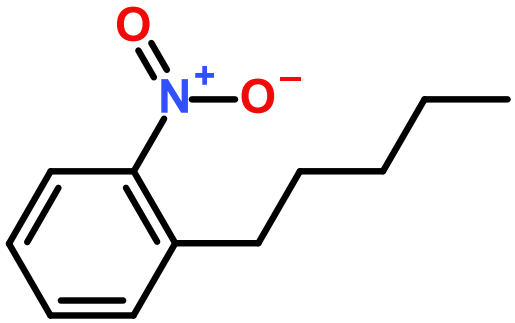
Give the major product(s) of the following reaction.



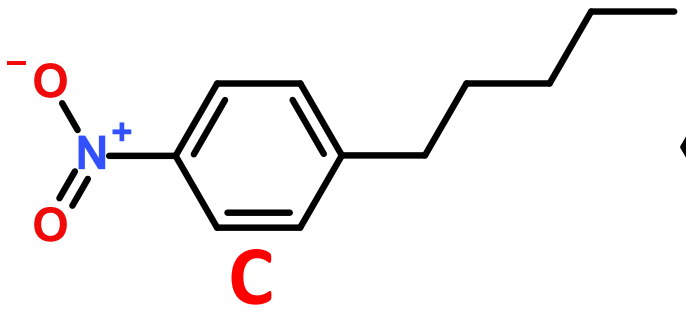
2016-09-09 Q4



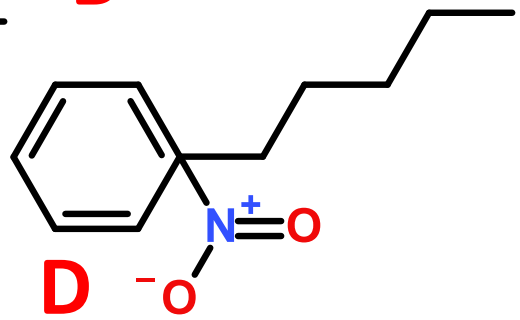
A



B



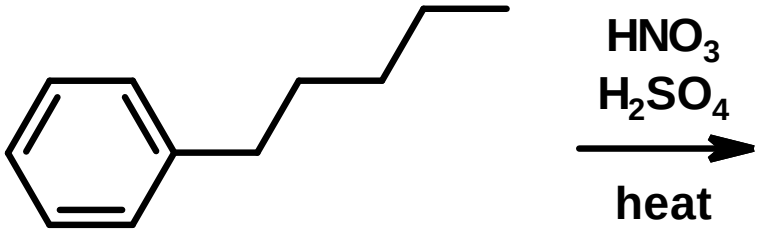
C



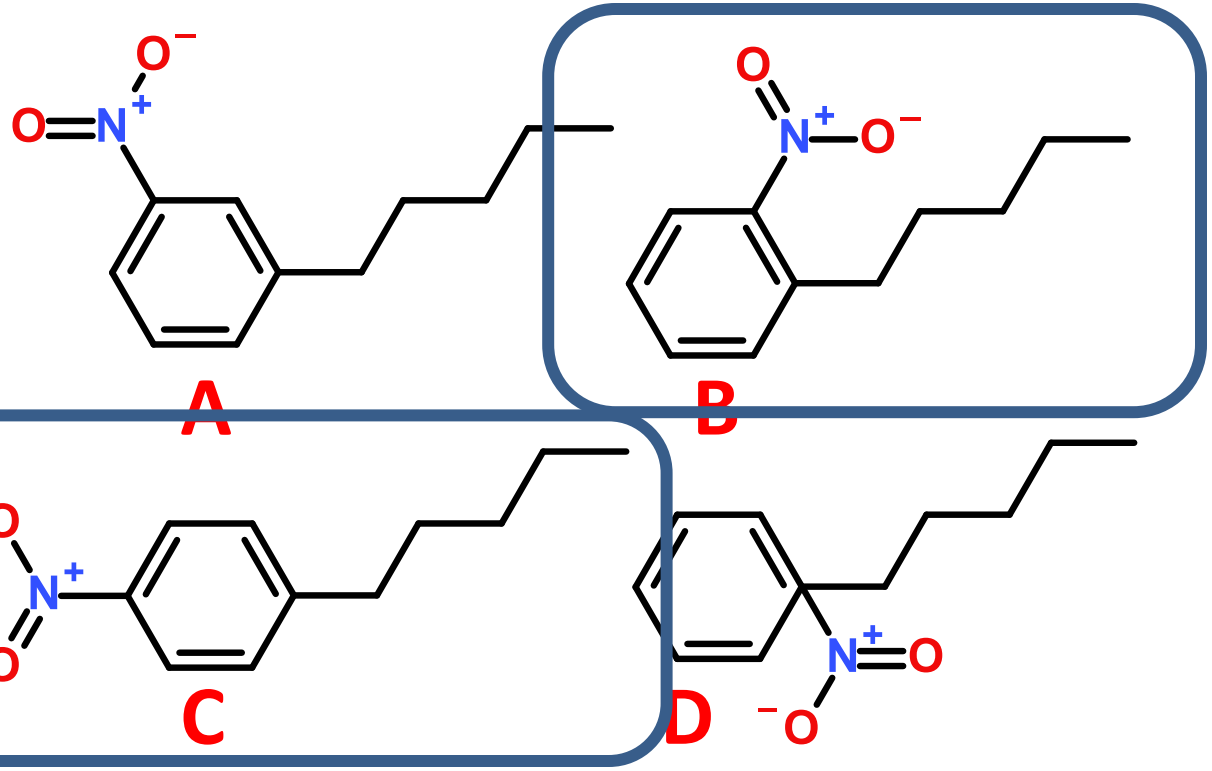
D

E. There is no reaction or the correct product is not listed here.

Give the major product(s) of the following reaction.



2016-09-09 Q4



E. There is no reaction or the correct product is not listed here.