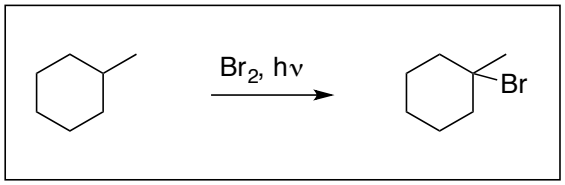
Radical Halogenation

1. A. For each step in the mechanism, add curly arrows to show the movement of electrons.
B. Classify each step as either homolytic cleavage, hydrogen abstraction, halogen abstraction, addition, or coupling

Overall Reaction:



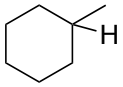
Initiation:

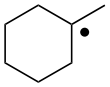
Br—Br ⟶ Br• + •Br

full octet → radical + radical

Classification

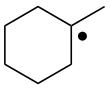
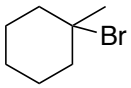
Propagation:



+ •Br ⟶  + HBr

full octet + radical → radical + full octet

Classification

 + Br—Br ⟶ 

+ •Br

radical + full octet → full octet + radical

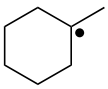
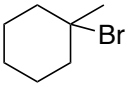
Classification

Termination:

Br• + •Br ⟶ Br—Br

radical + radical → full octet

Classification

 + •Br ⟶ 

radical + radical → full octet

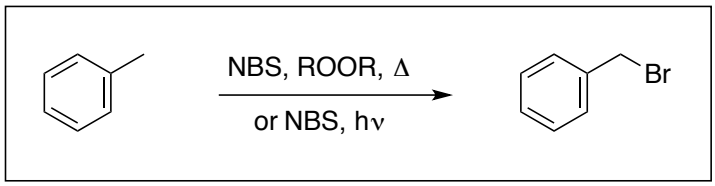
Classification

2. In the first propagation step, why was hydrogen abstracted from the tertiary carbon?

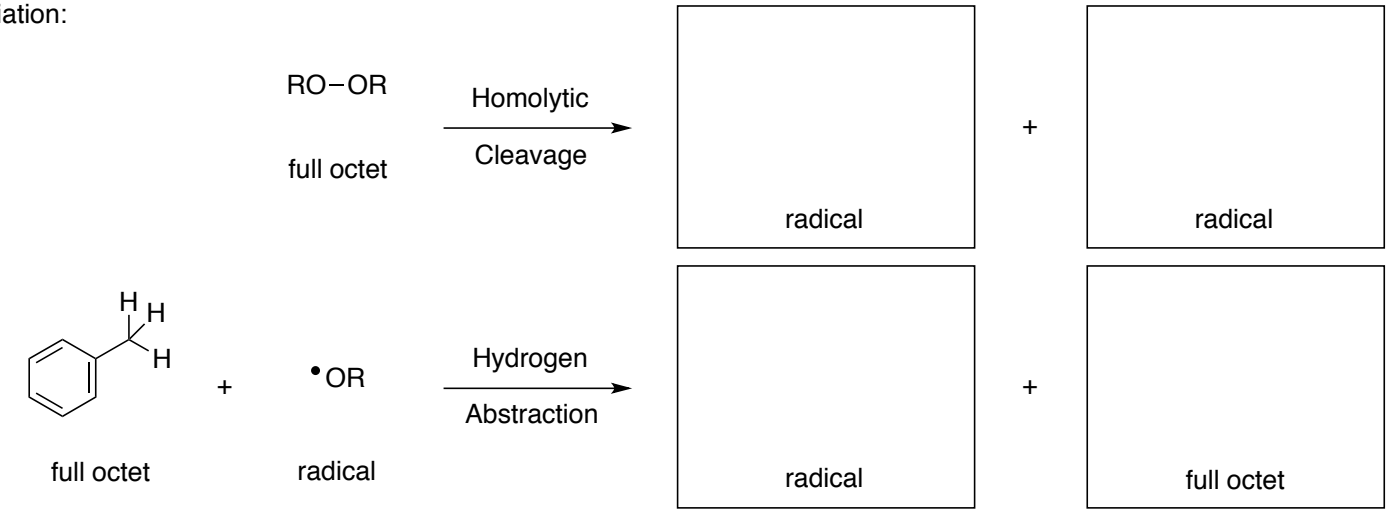
Allylic and Benzylic Bromination

3. A. For each step in the mechanism, add curly arrows to show the movement of electrons and draw the products.

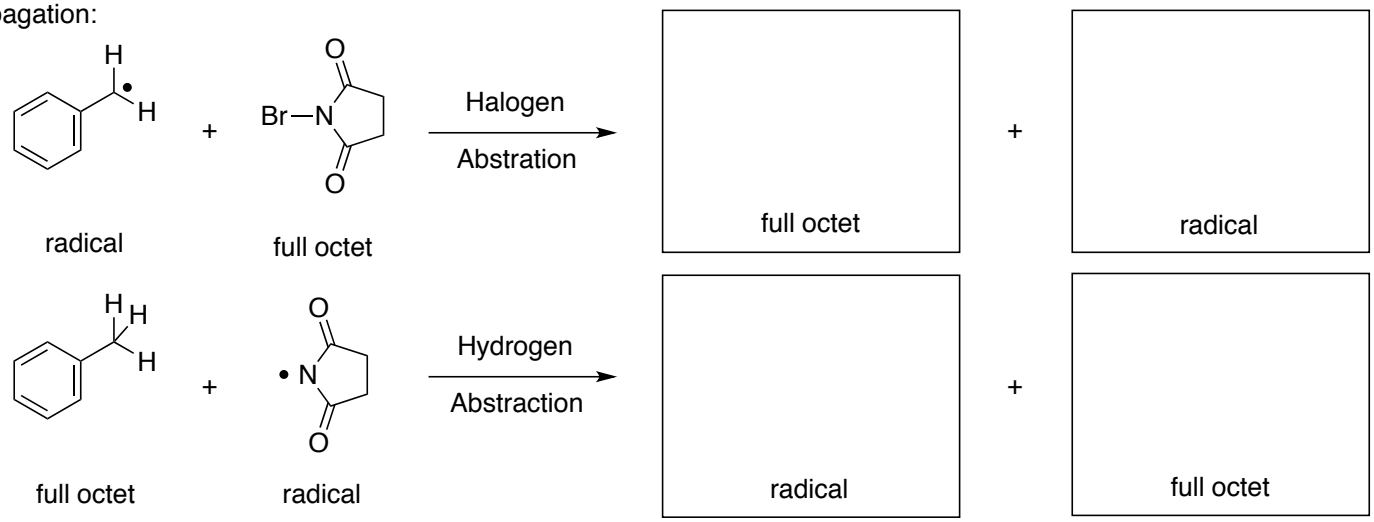
Overall Reaction:



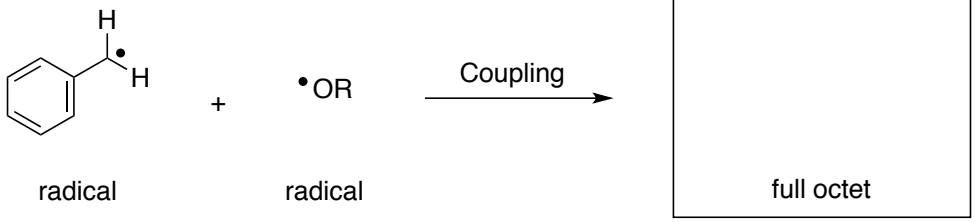
Initiation:



Propagation:



Termination:



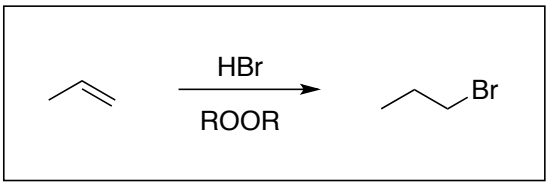
4. Why did we abstract hydrogen from the benzylic position?

5. Why are there two initiation steps in this reaction?

Radical Addition of HBr to Alkenes

6. For each step in the mechanism, add curly arrows to show the movement of electrons, draw the products and starting structures for each step.

Overall Reaction:



Initiation:

RO−OR

full octet

Homolytic Cleavage

radical + radical

Br−H + radical → Hydrogen Abstraction → radical + full octet

Propagation:

full octet + radical → Addition → radical

Br−H + radical → Hydrogen Abstraction → radical + full octet

Termination: Provide an example of a termination reaction

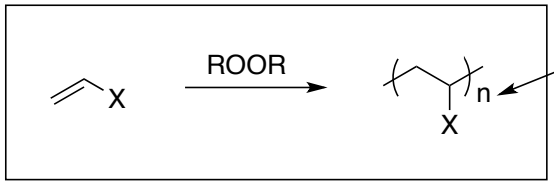
7. Why did we end up with bromine on the terminal carbon (the anti-Markovnikov product)? Hint: look at the first propagation step.

8. Why are there two initiation steps in this reaction?

Radical Polymerization of Alkenes

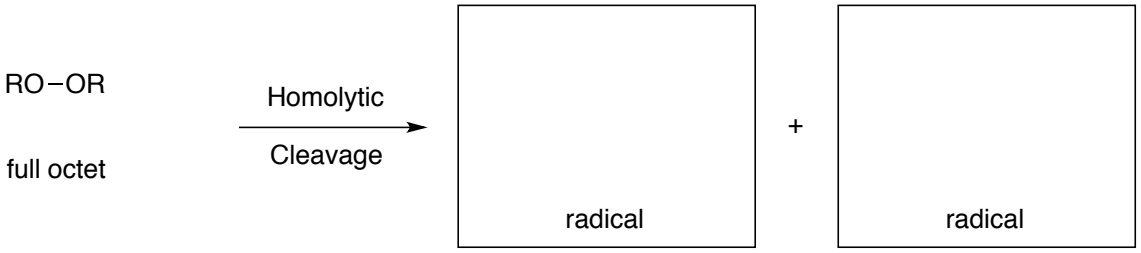
9. For each step in the mechanism, add curly arrows to show the movement of electrons, draw the products and starting structures for each step.

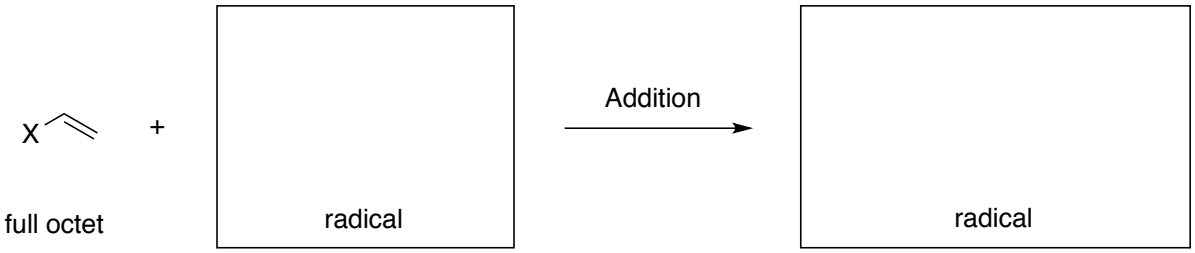
Overall Reaction:



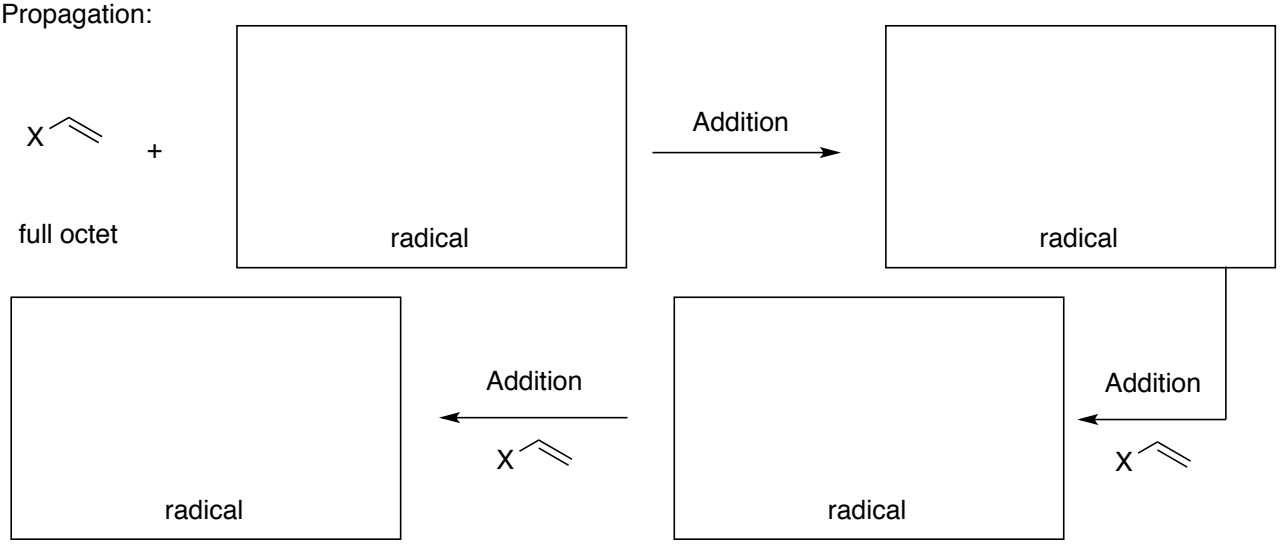
The letter n indicates that the structure inside the brackets repeats itself. Typically, n can be anywhere from 1,000 to 100,000!

Initiation:





Propagation:



Termination: Provide two examples of termination reactions

10. Compare the propagation steps for polymerization and radical addition of HBr to alkenes. Explain why polymerization repeats the addition step over and over?