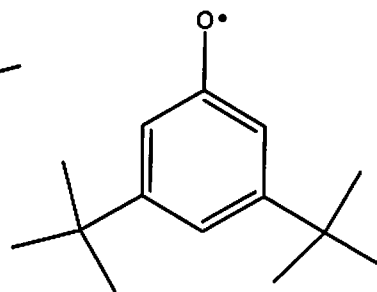
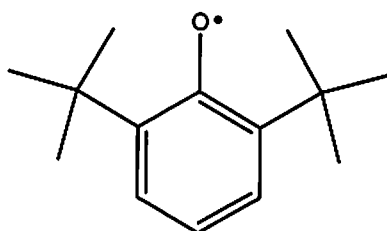
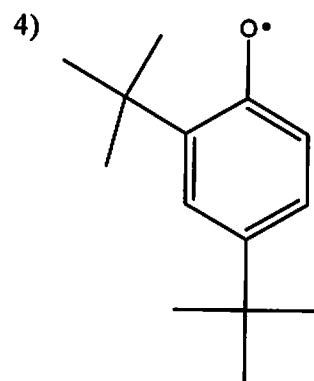
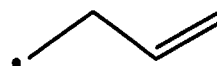
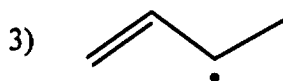
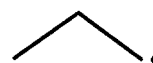
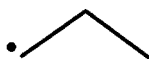
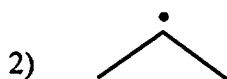


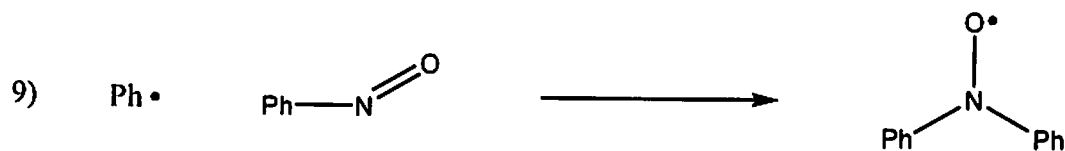
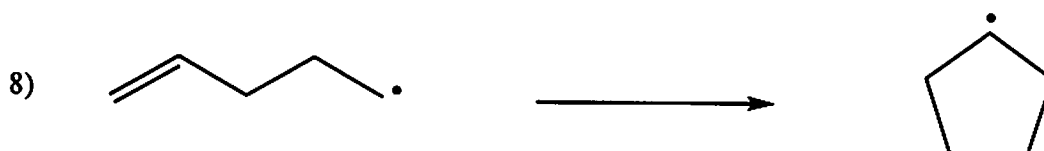
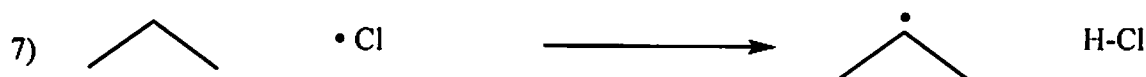
1) What is a free radical species?

2-4) Circle the most stable radical in each threesome.



5) What is the one specific thing that must occur in an initiation step for a free radical process?

6-9) Label each of these processes as either *Addition*; *Abstraction*; *Dimerization*; *Disproportionation* or *Fragmentation*.

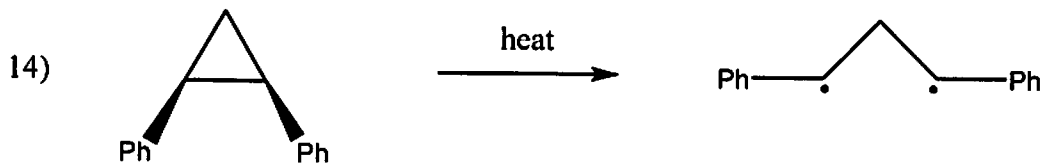
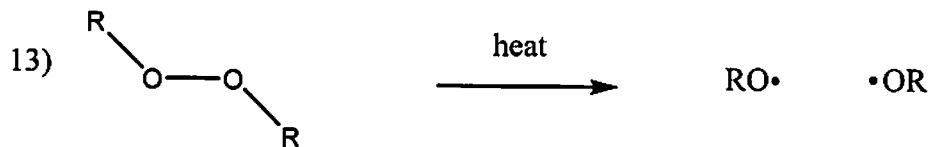


10) How are the rates of radical reactions impacted by increasing the polarity of the reaction solvent?

11) How are the rates of radical reactions impacted by the introduction of free radical inhibitors?

12) Some covalent bonds are relatively weak, and upon gentle heating they will break to generate radicals. This type of bond breaking process has a specific name that distinguishes it from an alternative process that produces ions. What is the name of this radical forming process?

13-14) Draw arrows (fish hook, single barb arrows meaning movement of 1 electron) to show how the following two compounds break their weakest covalent bonds.



15) Provide one reason why the carbon-carbon bond in Q14 is so easily broken.

16) Draw the product(s) if an ethyl radical undergoes disproportionation.

17-25) In the reaction below, A is converted into B.

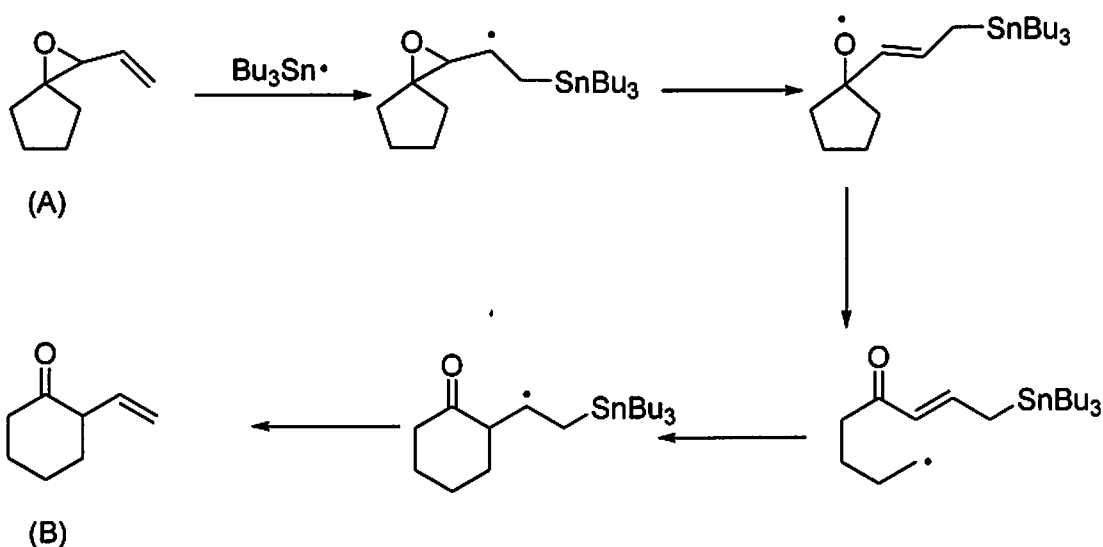
17) What is the oxygen containing functional group in A?

18) What is the oxygen containing functional group in B?

19) Is this overall transformation correctly called an isomerization?

20) Is this process likely to be a chain process?

21-25) Draw curly arrows (fish hook, single barb arrows meaning movement of 1 electron) for each of the five steps of this reaction.



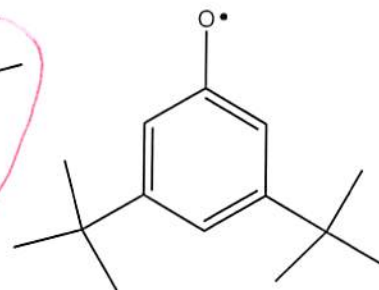
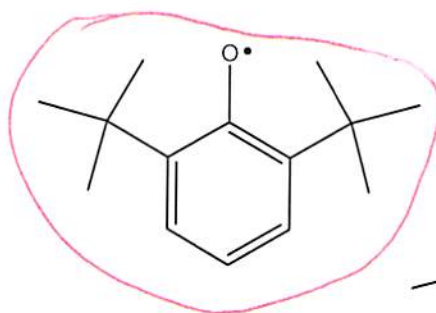
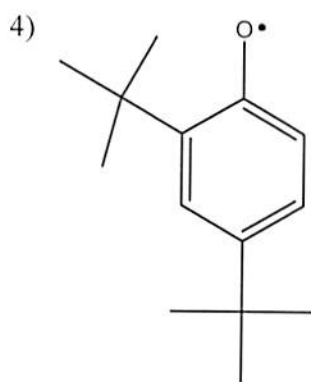
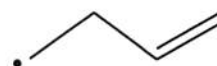
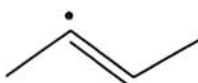
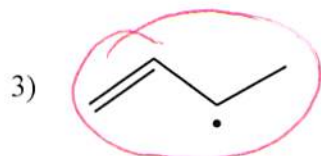
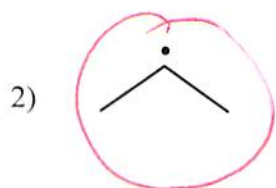
****Up to 2 bonus points****

In addition to your answer in question 15, provide up to two other additional reasons why that C-C is so easily cleaved.

1) What is a free radical species?

A species with one (or more) unpaired electron.

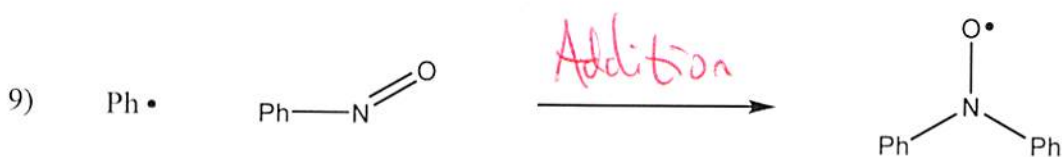
2-4) Circle the most stable radical in each threesome.



5) What is the one specific thing that must occur in an initiation step for a free radical process?

The creation of free radicals.

6-9) Label each of these processes as either *Addition*; *Abstraction*; *Dimerization*; *Disproportionation* or *Fragmentation*.



10) How are the rates of radical reactions impacted by increasing the polarity of the reaction solvent?

Very little or no change.

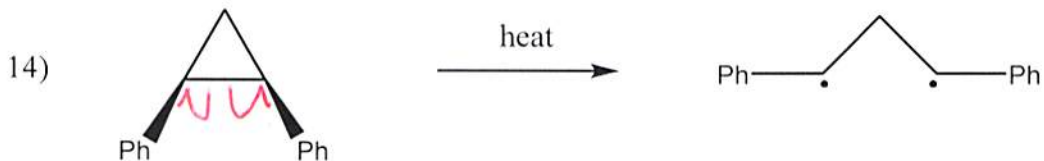
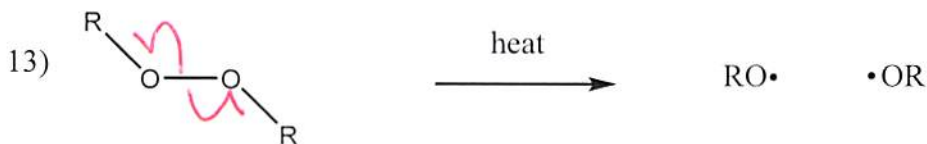
11) How are the rates of radical reactions impacted by the introduction of free radical inhibitors?

Rates slow down or even stop completely.

12) Some covalent bonds are relatively weak, and upon gentle heating they will break to generate radicals. This type of bond breaking process has a specific name that distinguishes it from an alternative process that produces ions. What is the name of this radical forming process?

Homolytic cleavage

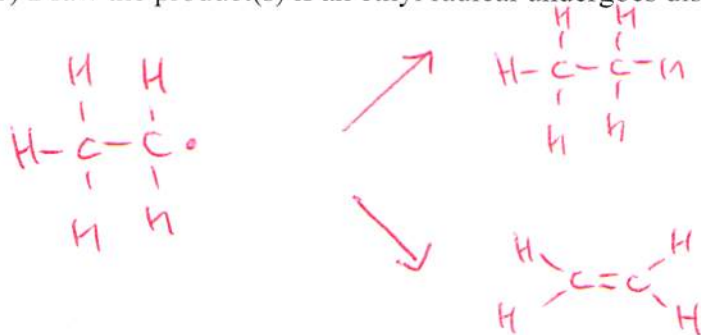
13-14) Draw arrows (fish hook, single barb arrows meaning movement of 1 electron) to show how the following two compounds break their weakest covalent bonds.



15) Provide one reason why the carbon-carbon bond in Q14 is so easily broken.

- ① Release of large ring strain
- ② Release of steric hindrance due to proximate phenyl groups
- ③ Generates resonance stabilized radicals

16) Draw the product(s) if an ethyl radical undergoes disproportionation.



17-25) In the reaction below, A is converted into B.

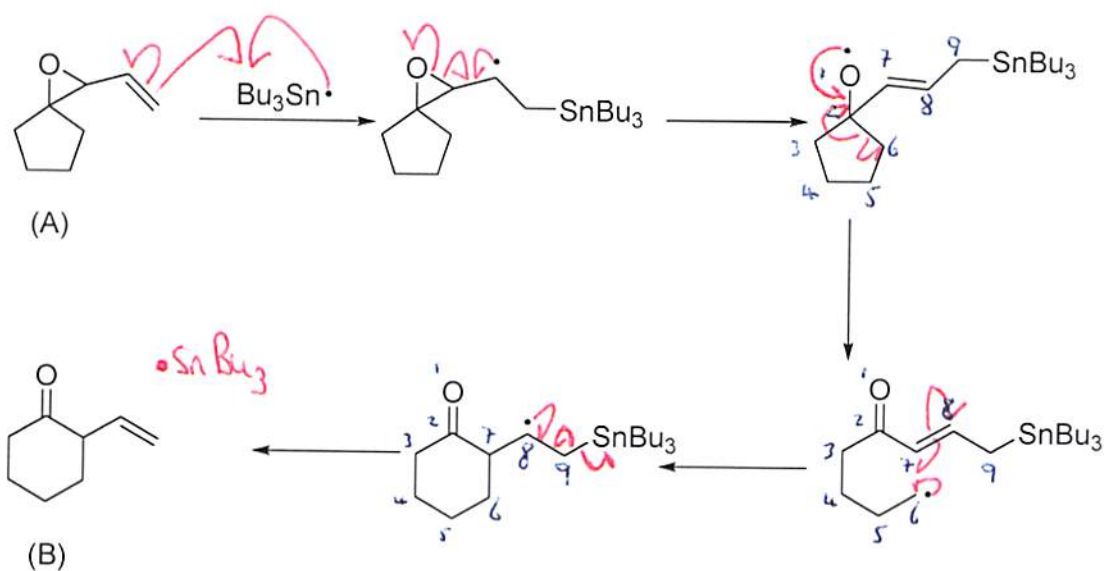
17) What is the oxygen containing functional group in A? *EPOXIDE*

18) What is the oxygen containing functional group in B? *ketone*

19) Is this overall transformation correctly called an isomerization? *Yes (Both C₈H₁₂O)*

20) Is this process likely to be a chain process? *Yes (last step regenerates Bu₃Sn•)*

21-25) Draw curly arrows (fish hook, single barb arrows meaning movement of 1 electron) for each of the five steps of this reaction.



****Up to 2 bonus points****

In addition to your answer in question 15, provide up to two other additional reasons why that C-C is so easily cleaved.

See Q15