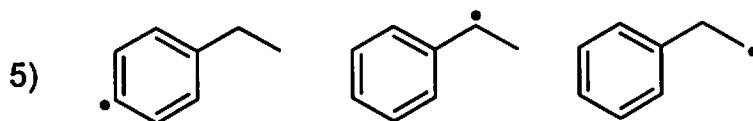
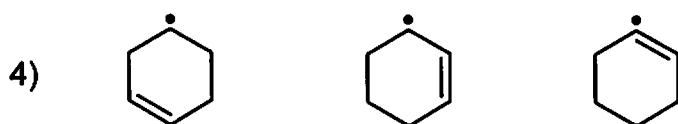
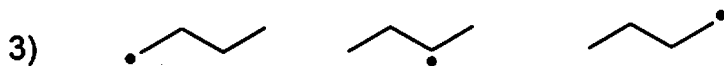


1) The word "RADICAL" comes from the Latin word for "root". In the olden days "RADICAL" referred to a fragment of a molecule that remained unchanged throughout a series of reactions (e.g. the use of R-OH to represent a variety of alcohols). The term "FREE RADICAL" then was later introduced to refer to a molecular fragment that was NOT bonded to anything else. Today, the terms *radical* and *free radical* are used interchangeably.

What is our modern scientific definition of a (free) radical species?

2-5) Circle the *most stable* species in each threesome.

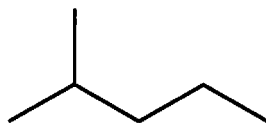


6-7) Bond Dissociation Energy (BDE) is the energy required to break a covalent bond homolytically.

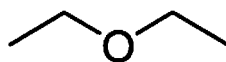
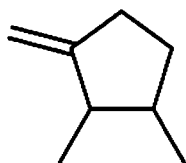
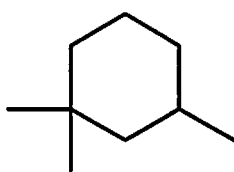
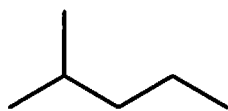
- What is a *covalent bond*?

- What does *homolytically* mean?

8) Draw in all 14 Hydrogen atoms on this line angle diagram.

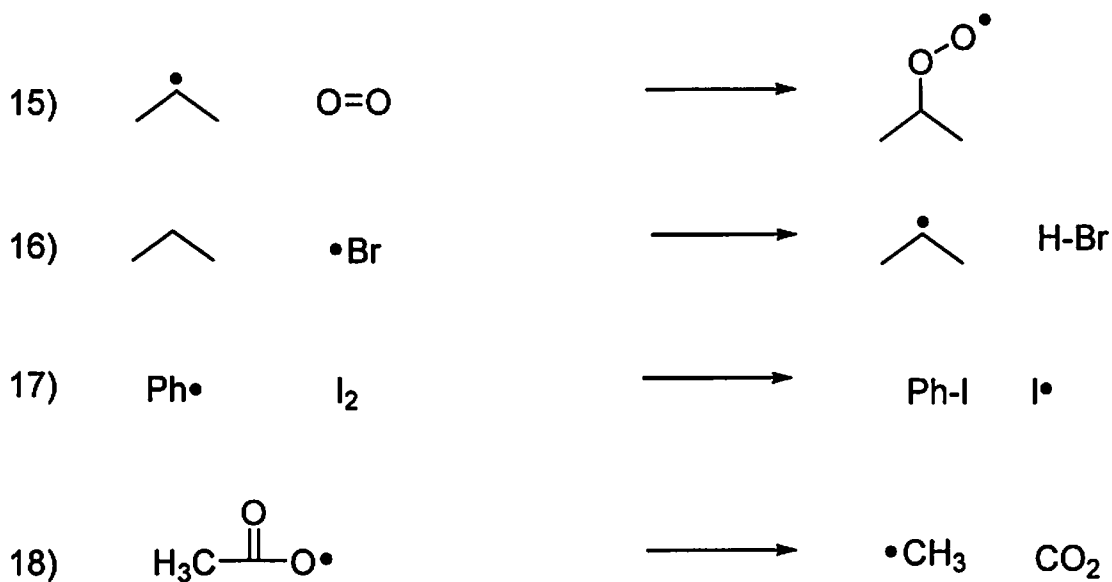


9-13) For each molecule below, indicate which C-H bond is the *weakest* (meaning *lowest* Bond Dissociation Energy).



14) Briefly explain the following (correct) observation – “steric hindrance can be used to produce especially stable (relatively long lived or persistent) radical species.

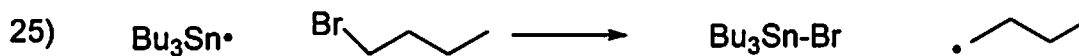
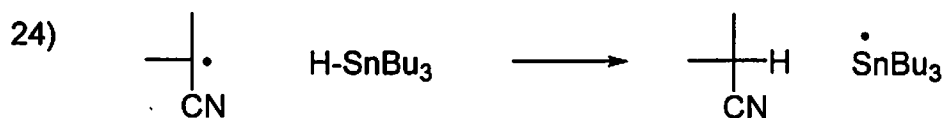
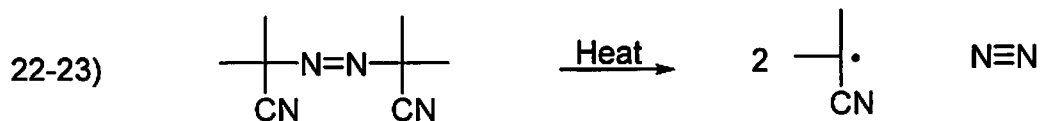
15-18) Label each reaction below as an *Addition*; *Abstraction*; *Dimerization*; *Disproportionation* or *Fragmentation*.



19) What must occur in the *initiation* step of a free radical reaction?

20) What is meant by the term “*free radical inhibitor*”?

21-25) Use appropriate curly (FISH HOOK) arrows to describe the electron movement for the following processes.



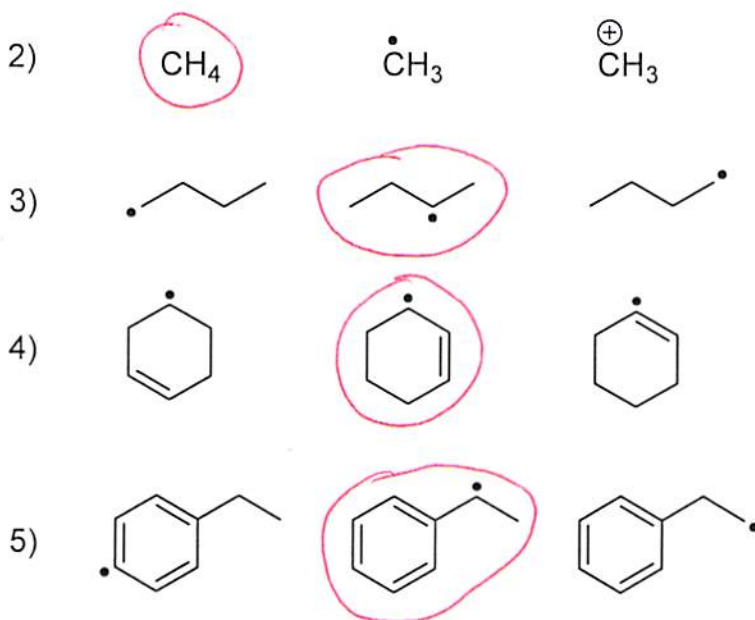
BONUS POINT: As stated in Q1, the term "RADICAL" comes from the Latin word for "root". What edible root vegetable gets its name from this word? (Hint: it is typically a crunchy salad vegetable).

1) The word "RADICAL" comes from the Latin word for "root". In the olden days "RADICAL" referred to a fragment of a molecule that remained unchanged throughout a series of reactions (e.g. the use of R-OH to represent a variety of alcohols). The term "FREE RADICAL" then was later introduced to refer to a molecular fragment that was NOT bonded to anything else. Today, the terms *radical* and *free radical* are used interchangeably.

What is our modern scientific definition of a (free) radical species?

A species with one unpaired valence electron.

2-5) Circle the *most stable* species in each threesome.



6-7) Bond Dissociation Energy (BDE) is the energy required to break a covalent bond homolytically.

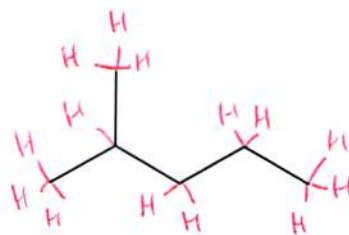
- What is a *covalent bond*?

The sharing of two electrons between two atoms.

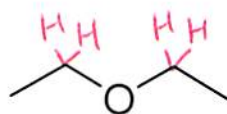
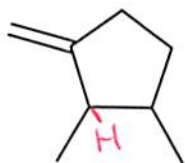
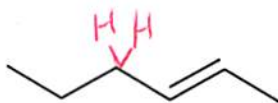
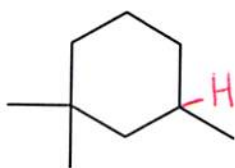
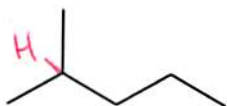
- What does *homolytically* mean?

Breaking the bond so each atom receives 1 electron.

8) Draw in all 14 Hydrogen atoms on this line angle diagram.



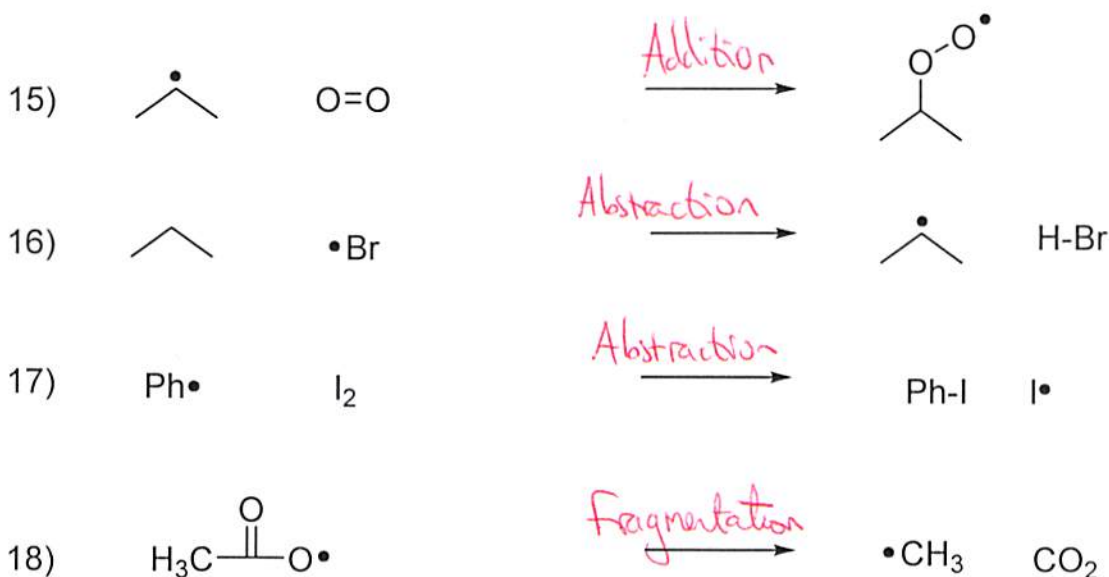
9-13) For each molecule below, indicate which C-H bond is the *weakest* (meaning *lowest* Bond Dissociation Energy).



14) Briefly explain the following (correct) observation – “steric hindrance can be used to produce especially stable (relatively long lived or persistent) radical species.

Steric hindrance will slow down (or stop) the reactions of a free radical with other species through electron pair-electron pair repulsion.

15-18) Label each reaction below as an *Addition*; *Abstraction*; *Dimerization*; *Disproportionation* or *Fragmentation*.



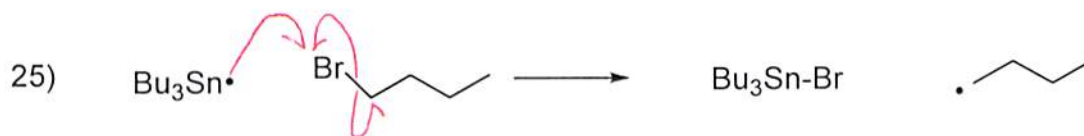
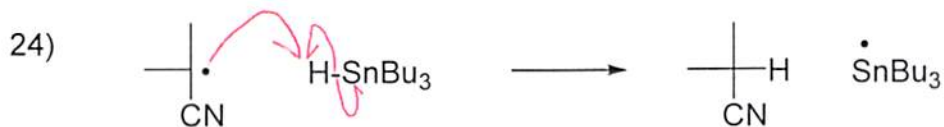
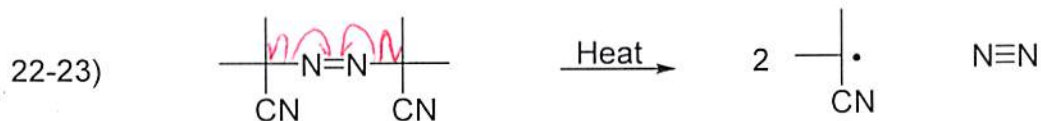
19) What must occur in the *initiation* step of a free radical reaction?

The generation of radicals.

20) What is meant by the term “free radical inhibitor”?

Something that will react with reactive radicals to produce a much more stable (or unreactive) species.

21-25) Use appropriate curly (FISH HOOK) arrows to describe the electron movement for the following processes.



BONUS POINT: As stated in Q1, the term "RADICAL" comes from the Latin word for "root". What edible root vegetable gets its name from this word? (Hint: it is typically a crunchy salad vegetable).

RADISH