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Chapter 10 Radical Reactions – Practice Problems

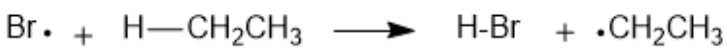
Many of these problems are from the Ch. 10 skeleton notes (page).

Predict the major product for each of the following reactions (assume monohalogenation p.10-3

1 *Group work: provide a mechanism for the monobromination of ethane.*
Begin with an initiation step, and then use propagation steps until the product is formed.

Consider: why does the chlorine radical abstract a H atom not a C group?
Estimate ΔH for competing propagation steps...

bond broken bond formed



BDE (kcal/mol)	C-H 98	H-Br 88	C-C 90	C-Br 68

Thermodynamic considerations (strengths of bonds formed and bonds broken) also explain why reaction with F_2 and I_2 are not useful. Fluorination releases too much energy (explosive) and iodination forms very weak bonds so it is endothermic and unfavorable.

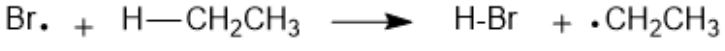
******Therefore, free-radical halogenation always replaces a H atom with a Cl or Br atom******

** **Bromination occurs at most substituted carbon, chlorination forms all possible products****

p.10-4

Consider: why is bromination more selective than chlorination?
See ΔH for the H atom abstraction step for both...

bond broken bond formed

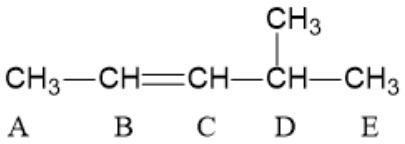


BDE (kcal/mol)	C-H 98	H-Br 88	H-Cl 103

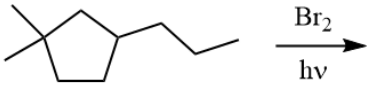
**The first propagation step for bromination is *endothermic* so it is slow and the transition states leading to the different intermediates (1°/2°/3°) are significantly different (primary is over 1600 times slower than tertiary).

**For chlorination, this step is *exothermic* so it is fast and does not discriminate about which hydrogen is abstracted. The transition states for chlorination at 1°/2°/3° sites are not significantly different, so the reaction rates are similar (primary is one-fourth the rate of teriary).

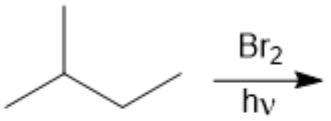
In the compound shown below, which hydrogen is most easily abstracted in a free radical bromination reaction?



Predict the major product of the following reaction. **2**



Predict the major product(s) for each reaction. Consider both regiochemistry and stereochemistry. p.10-4



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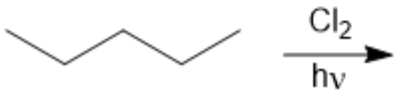
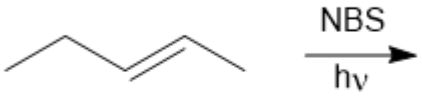


predict the major product(s) p.10-5



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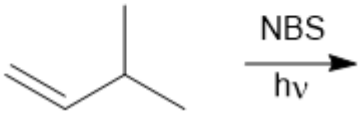
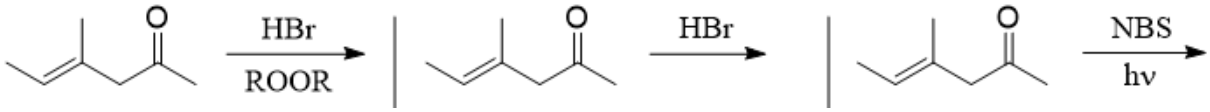


Predict the major products for the following reactions.

5



6 Predict the major product and briefly explain.