

Reactions that Distinguish Alkenes from Alkanes

In this overhead projector demonstration, 1-octene and octane are added to separate solutions of 1% Br₂ in dioxane and 0.01 M KMnO₄ to show that alkenes react with these reagents but alkanes do not.

Chemicals and Equipment Needed

- Dropper bottle of octane – **R4**
- Dropper bottle of 1-octene – **R4**
- 1% Br₂ in dioxane – **R2**
 - Must be made fresh
- 0.01 M KMnO₄ – **H1**
- 4-50 mL beakers – **Q3**
- 2 Plastic petri dishes or watchglasses – **P3**
- 4 glass stirring rods – **U1**
- Plexiglass square – **J2**
- Transparency – **this packet**

Chemicals and Equipment for Bromine solution

- 1% Br₂ in dioxane – **R2**
- Bromine – **R1**
- 1,4-dioxane – **R2**
- 10 mL graduated cylinder – **Q3**
- Pasteur pipet
- Gloves – **U2**

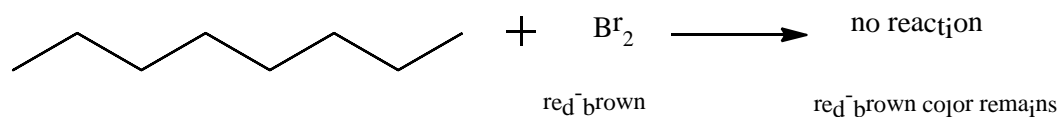
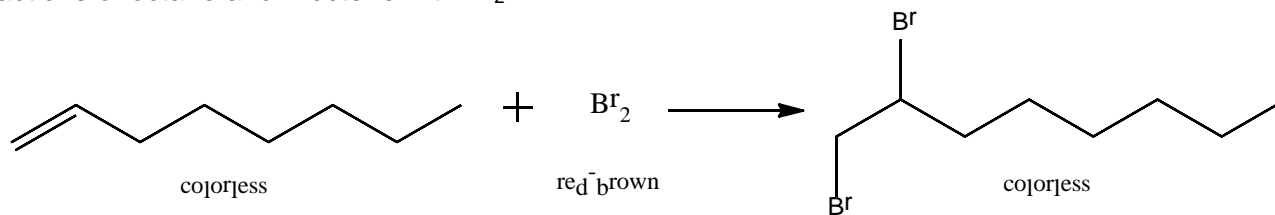
Preparation

- The day of the demo, prepare the 1% Br₂ in dioxane solution:
 - The labeled bottle in R1 is 500 mL. Estimate the remaining dioxane (or add more from bottles of 1,4-dioxane in R1), and divide by 100 to get the amount of bromine needed for a 1% solution. (for 500 mL solution, you would need 5 mL bromine, for 250 mL solution, 2.5 mL bromine)
 - In the hood, while wearing gloves, measure out the appropriate amount of bromine and add it to the “1% Br₂ in dioxane” bottle. Shake gently to combine.
- On delivery, place the plexiglass square and transparency on the overhead projector. Put the 50 mL beakers on top, and add just enough Br₂ in dioxane and 0.01 M KMnO₄ to the appropriate beakers to cover the bottom. Place petri dishes or small watchglasses on the Br₂ beakers. Set the stirring rods and dropper bottles of octane and 1-octene next to the projector.

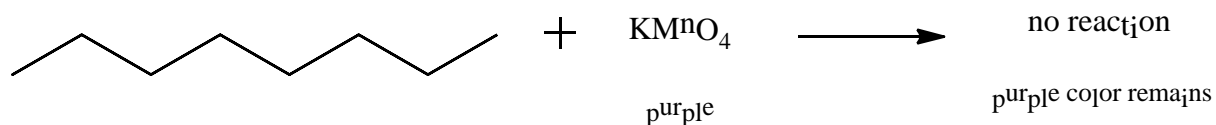
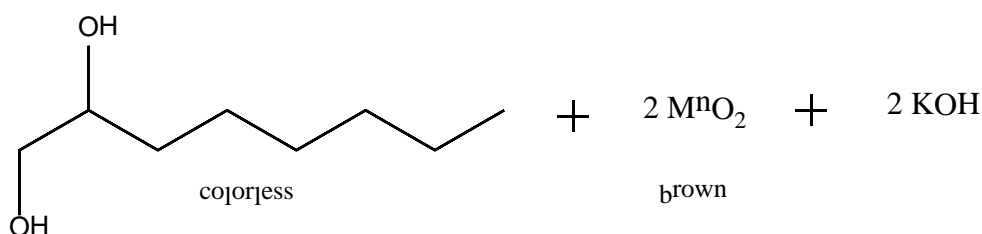
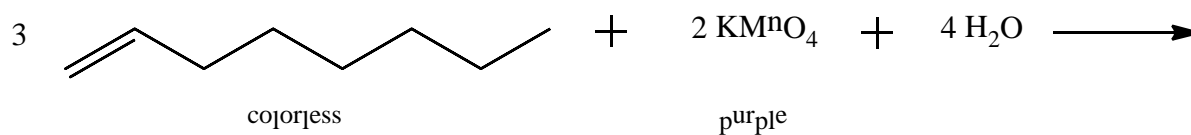
Presentation

- Let the students know that Br₂ and KMnO₄ are responsible for the orange and purple colors of the solutions, respectively.
- Add 5 drops of octane to one Br₂ beaker, and 5 drops of 1-octene to the other, and stir or swirl the solutions. There is no visible change in the octane+Br₂ beaker, but the 1-octene+Br₂ beaker quickly decolorizes due to addition of bromine to 1-octene
- Cover the beakers to minimize the release and smell of bromine
- Add 5 drops of octane to one KMnO₄ beaker, and 5 drops of 1-octene to the other, and stir or swirl the solutions. There is no visible change in the octane+ KMnO₄ beaker, but the 1-octene+ KMnO₄ beaker decolorizes and a precipitate forms. The double bond in 1-octene is oxidized by KMnO₄ to produce a diol and a brown precipitate, MnO₂. The purple color of the solution fades as is consumed in the redox reaction.

Reactions of octane and 1-octene with Br₂:



Reactions of octane and 1-octene with KMnO₄:



Clean-Up

- Dispose of the octane/octene/Br₂ solutions in the organic waste container, along with an acetone rinse. The octane/octene/KMnO₄ solutions can go in the white waste container, along with an acetone rinse.

NOTES: The KMnO₄ solution needs to be retested. It didn't result in as much precipitate as expected.