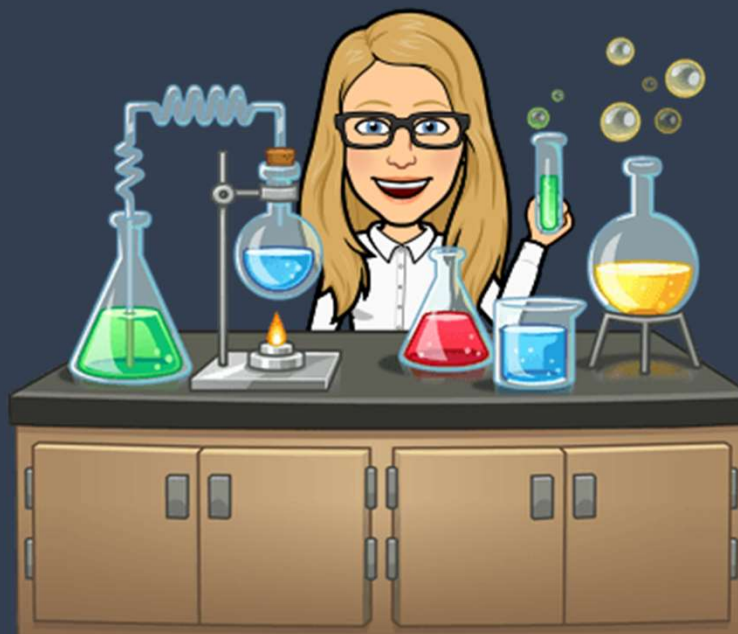


For clicker question voting, go to:
<https://pollev.com/lauriestarke263>



Dr. Laurie S. Starkey
Cal Poly Pomona

CHM 3150 Organic Chemistry II
9/11/25

Today's Topic: Ch. 13, Step 2

Reactions of Epoxides/Ethers

Daily To-Do

Flipped Lectures

Step 2

Read

- Read Klein
 - 13.10 Reactions of Epoxides
 - 13.6 Reactions of Ethers with HX
 - 13.11 Thiols and Sulfides
- Watch flipped lecture
- Work through SkillBuilders 13.4, 13.5
- Epoxide ring-opening [homework](#) (submit to [Gradescope](#))

[Ring-opening reactions of epoxides](#)
57 minutes, pages 13-4 to 13-7

Watch

Practice

Step 3

- Read Klein 13.12 Synthesis Strategies
- Watch flipped lecture
- Work through SkillBuilders 13.6, 13.7
- All Ch. 12 and 13 assignments are meant to prepare you for the exam, so they are due no later than **11 pm on the day of Exam 1**

[Ether synthesis strategies](#)
7 minutes, page 13-8

For Tuesday

Lecture: Ch. 13 Reactions of Epoxides & Ethers

Reaction of Ethers	33:35
Reaction of Ethers	33:36
Reactions of Ethers with HBr or HI	34:44
Reactions of Ethers with HBr or HI	34:45
Mechanism	35:25
Epoxide Ring-Opening Reaction	39:25
Epoxide Ring-Opening Reaction	39:26
Example: Epoxide Ring-Opening Reaction	42:42
Acid-Catalyzed Epoxide Ring Opening	44:16
Acid-Catalyzed Epoxide Ring Opening Mechanism	44:17
Acid-Catalyzed Epoxide Ring Opening	50:13
Acid-Catalyzed Epoxide Ring Opening Mechanism	50:14
Catalyst Needed for Ring Opening	53:34
Catalyst Needed for Ring Opening	53:35
Stereochemistry of Epoxide Ring Opening	55:56
Stereochemistry: SN2 Mechanism	55:57
Acid or Base Mechanism?	58:30
Example	61:03
Transformation	61:04
Regiochemistry of Epoxide Ring Openings	65:29
Regiochemistry of Epoxide Ring Openings in Base	65:30
Regiochemistry of Epoxide Ring Openings in Acid	67:34
Example	70:26
Example 1: Epoxide Ring Openings in Base	70:27
Example 2: Epoxide Ring Openings in Acid	72:50
Reactions of Epoxides with Grignard and Hydride	75:35
Reactions of Epoxides with Grignard and Hydride	75:36
Example	81:47
Example: Ethers	81:50
Example	87:01
Example: Synthesize	87:02

Reactions of Epoxides & Reaction of Ethers with HX

One Week from Today: Exam 1

CHM 3150 Organic Chemistry II, Dr. Laurie S. Starkey, Fall 2025					
<i>Tentative Schedule (Chapter and Worksheet #)</i>					
Week	Mon	Tues	Wed	Thurs	Fri
0	8/18	8/19	8/20	8/21 Review 7-11 #1	8/22
1	8/25	8/26 Review 7-11 #2	You are here	8/28 Ch. 12 #1	8/29
2	9/1 Holiday	9/2 Ch. 12 #2		9/4 Ch. 12 #3	9/5
3	9/8	9/9 Ch. 13 #1	9/10	9/11 Ch. 13 #2	9/12
4	9/15	9/16 Ch.13 #3, Review	9/17	9/18 Exam I	9/19

Exam 1
Thursday, 9/18
Chapters 11,12,13

- 60-minute written exam.
- No notes or model kits allowed, but Periodic Table is provided.

No surprises! See sample exams on Course Homepage (links at very bottom).

Sample Exams

Why are there no answer keys? What is the best way to study for an exam? [Click here to find out!](#)

[CHM 3150 Exam I](#) (Alcohol/Ether, Ch. 11/12/13)
 [Sample Transforms](#) and [answer key](#)

Study hints

Extra practice

Work on a VARIETY of Textbook Problems!

Ch. 11 Text - Synthesis Strategies TEXTBOOK PROBLEMS

Ch. 11 textbook problems = 5 points course credit

- 11.1: One-Step Syntheses
Module 11: Synthesis Module | 30 pts
- 11.2: Functional Group Transformations (SkillBuilder 11.1)
Module 11: Synthesis Module | 25 pts
- 11.3: Reactions that Change the Carbon Skeleton (SkillBuilder 11.2)
Module 11: Synthesis Module | 20 pts
- 11.4: How to Approach a Synthesis Problem (SkillBuilder 11.3)
Module 11: Synthesis Module | 20 pts
- 11.5: Multi-Step Synthesis and Retrosynthetic Analysis (SkillBuilder 11.4)
Module 11: Synthesis Module | 30 pts
- End of Chapter Problems: Chapter 11
Module 11: Synthesis Module | 87 pts

WileyPLUS 210 points possible (~60 from EOC and/or variety of SkillBuilders = full credit)

Ch. 12 Text - Synthesis Strategies TEXTBOOK PROBLEMS

Ch. 12 textbook problems = 10 points course credit

- Module 12: Alcohols and Phenols Module | 25 pts
- 12.4: Preparation of Alcohols via Reduction (SkillBuilders 12.3 & 12.4)
Module 12: Alcohols and Phenols Module | 40 pts
- 12.6: Preparation of Alcohols via Grignard Reagents (SkillBuilder 12.5)
Module 12: Alcohols and Phenols Module | 20 pts
- 12.7: Protection of Alcohols
Module 19: Aldehydes and Ketones Module | 10 pts
- 12.9: Reactions of Alcohols - Substitution and Elimination (SkillBuilders 12.8 & 12.9)
Module 12: Alcohols and Phenols Module | 30 pts
- 12.10 - 12.12: Reactions of Alcohols - Oxidation, Biological, and Other (SkillBuilders 12.10, 12.11, & 12.12)
Module 12: Alcohols and Phenols Module | 20 pts
- 12.13: Synthesis Strategies (SkillBuilders 12.8 & 12.9)
Module 12: Alcohols and Phenols Module | 45 pts
- End of Chapter Problems: Chapter 12
Module 12: Alcohols and Phenols Module | 195 pts

WileyPLUS 465 points possible (~120 from EOC and/or variety of SkillBuilders = full credit)

Chapter 12 Mechanism Questions

Module 12: Alcohols and Phenols Module | 15 pts

Ch. 13 Text - Ethers & Epoxides TEXTBOOK PROBLEMS

Ch. 13 textbook problems = 10 points course credit

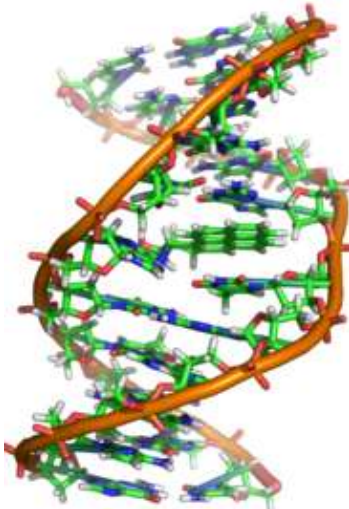
- 13.1 - 13.3: Intro to Ethers, Nomenclature of Ethers (SkillBuilder 13.1)
Module 13: Ethers and Epoxides, Thiols and Sulfides Module | 25 pts
- 13.5: Preparation of Ethers (SkillBuilder 13.2)
Module 13: Ethers and Epoxides, Thiols and Sulfides Module | 30 pts
- 13.6: Reactions of Ethers
Module 13: Ethers and Epoxides, Thiols and Sulfides Module | 20 pts
- 13.8 Preparation of Epoxides (SkillBuilder 13.3)
Module 13: Ethers and Epoxides, Thiols and Sulfides Module | 15 pts
- 13.10: Ring-Opening Reactions of Epoxides (SkillBuilders 13.4 & 13.5)
Module 13: Ethers and Epoxides, Thiols and Sulfides Module | 50 pts
- 13.11: Thiols and Sulfides
Module 13: Ethers and Epoxides, Thiols and Sulfides Module | 10 pts
- 13.12: Synthesis Strategies Involving Epoxides (SkillBuilder 13.6)
Module 13: Ethers and Epoxides, Thiols and Sulfides Module | 50 pts
- End of Chapter Problems: Chapter 13
Module 13: Ethers and Epoxides, Thiols and Sulfides Module | 175 pts
- Chapter 13 Mechanism Questions
Module 13: Ethers and Epoxides, Thiols and Sulfides Module | 20 pts

WileyPLUS 400 points possible (~100 from EOC and/or variety of SkillBuilders = full credit)

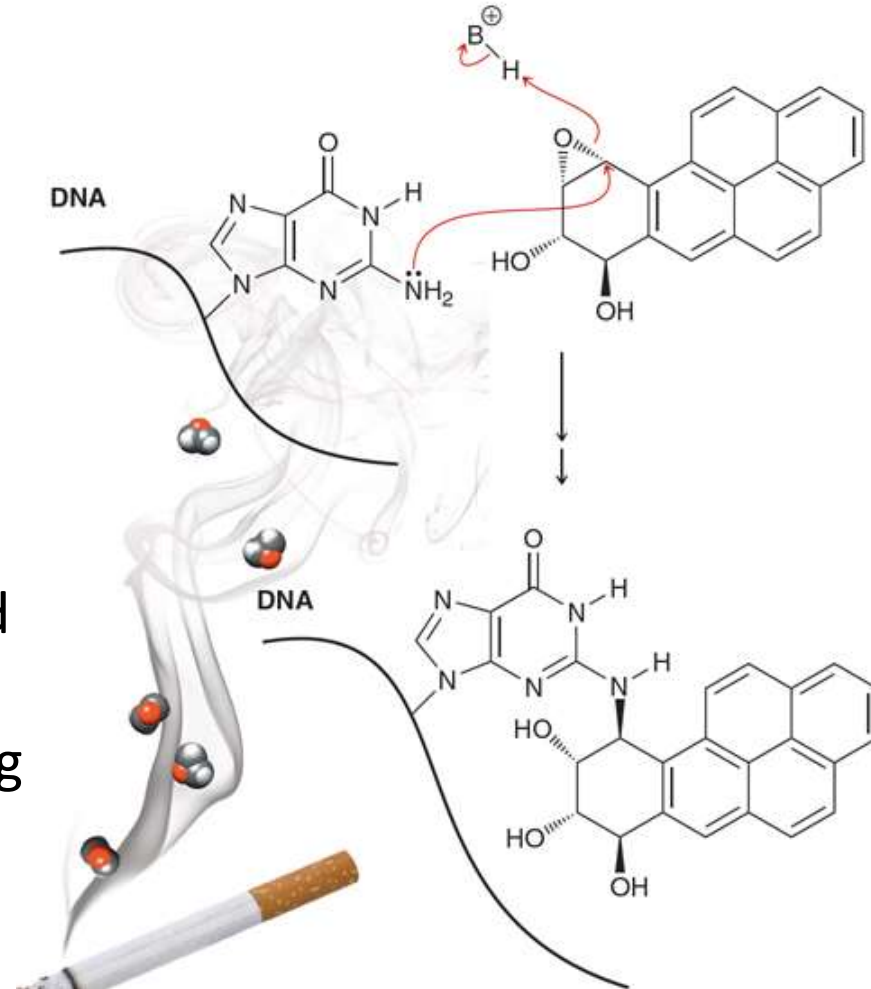
Cigarette Smoke, Charred Food Produces Epoxides that are Carcinogenic “Alkylating Agents”



Cigarette Smoke and Carcinogenic Epoxides



Copying alkylated DNA gives rise to mutations, leading to cancer.



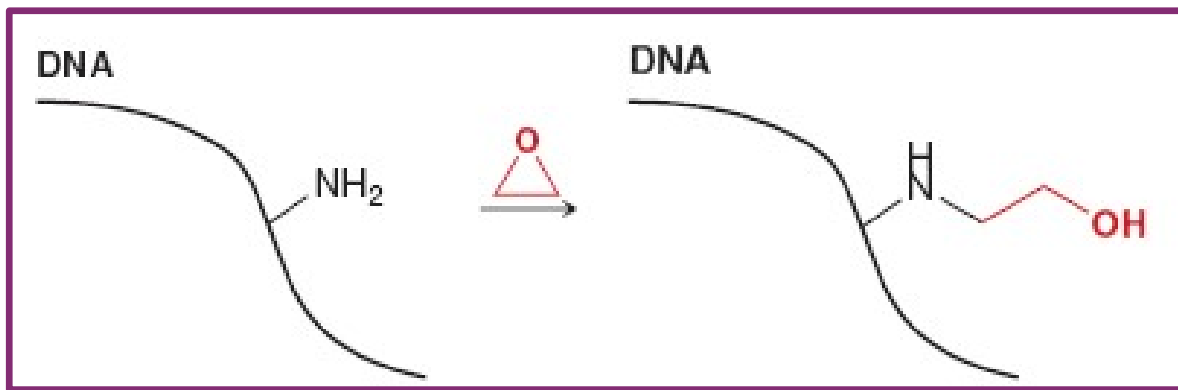
A DNA adduct (at center) of benzo[a]pyrene, the major mutagen in tobacco smoke.^[26]



WorldLinks

Ethylene Oxide for Sterilizing Medical Equipment

To prevent the spread of infections, medical equipment must be sterilized frequently. It is challenging to keep equipment germ-free if it is made of plastics that cannot withstand autoclave temperatures (120°C), but are too expensive to dispose of after each individual use (such as the duodenoscope shown below). Ethylene oxide can be used as a sterilizing agent for sensitive equipment. The gas easily diffuses through porous materials and effectively kills all forms of microorganisms, even at room temperature. The mechanism of action likely involves a nucleophilic amino group in DNA attacking the ring and causing a ring opening of the epoxide, effectively attaching a carbon chain at alkylating that site.



This alkylation process interferes with the normal function of DNA, thereby killing the microorganisms. The use of pure ethylene oxide presents a hazard, because when the flammable gas mixes with atmospheric oxygen, it becomes susceptible to explosion. This problem is circumvented by using a mixture of ethylene oxide and carbon dioxide, which is no longer explosive. Such mixtures are sold commercially for the sterilization of medical equipment and can also be used to treat agricultural grains. One such mixture, called Carboxide, is comprised of 10% ethylene oxide and 90% CO₂. Carboxide can be exposed to air without the danger of explosion.

Ethylene oxide is an effective sterilizing agent, but it is also toxic, explosive at high concentrations, and requires great care to use effectively. Other methods of sterilization are continuously being explored, but no method is foolproof. In 2015, several patients at the UCLA medical school came down with a “carbapenem resistant” enterobacteria, i.e. an intestinal bacteria resistant to virtually all antibiotics. Two patients died. It was discovered that several duodenoscopes had not been adequately sterilized between patients. In response, UCLA tightened up their nonautoclave sterilization procedure, returning to the use of ethylene oxide.

