Welcome to IIT Bombay and CH 105

CH 105 – Organic Chemistry

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Acknowledgements

Prof. R. B. Sunoj,
Prof. Pradeepkumar P. I.
Prof. S. J. Gharpure
and…several current and past colleagues at IIT B

Syllabus

- **Chemistry in 3D:** Visualization of tetrahedral carbon, representation of molecules using projection formulae and their interconversion. Factors affecting rotational barrier, stability and reactivity of alkanes, cyclohexane and decalin systems.

- **MO and photochemistry:** Importance of molecular orbitals in understanding pericyclic and organic photochemical reactions involving alkenes and polyenes.

Course Resources

Course Website: moodle.iitb.ac.in

Notes, questions, slides, available here, forum for doubts etc.

Books

- P. Volhardt and N. Schore, Organic Chemistry: Structure and Function, 8th Edition, W. H Freeman & Co, 2018.
- P. Y. Bruice, Organic Chemistry, 8th Edition, Pearson, 2017
- W. H. Brown, C. S. Foote, B. L. Iverson, E. V. Anslyn, Organic Chemistry, 6th Edition, Brooks/Cole Cengage Learning, 2012
- L. G. Wade Jr. “Organic Chemistry”, 8th Edition, Pearson, 2016

Advanced Reading:

- Organic Chemistry, Clayden, Green, Warren and Wothers, Oxford University Press

Animations:

- http://www.chemtube3d.com/

Class Info

- **Organic Chemistry until November 21**

  Classes in Slot 2

  Mon (9:30 am) , Tues (10:30 am), Thurs (11:30 am)
- **Tutorials: On Wednesdays**

  Tutorials are useful for Self Evaluation, Clarification of Concepts, Practice and…….. **quizzes** ☺

Feel Free to Raise Hand for Asking Questions

" No question is a silly question"

Also Your Tut TA will have a whatsapp group for your Tut batch

Evaluation

Evaluation: Organic + Inorganic (one grade, equal weightage)

For Organic:

- **One final exam - 80% weightage**
- **Tutorial quizzes - 20% weightage**

Mark your calendars for Final Organic Exam

November 26, 2022

9:30 – 11:30 am (tentative)

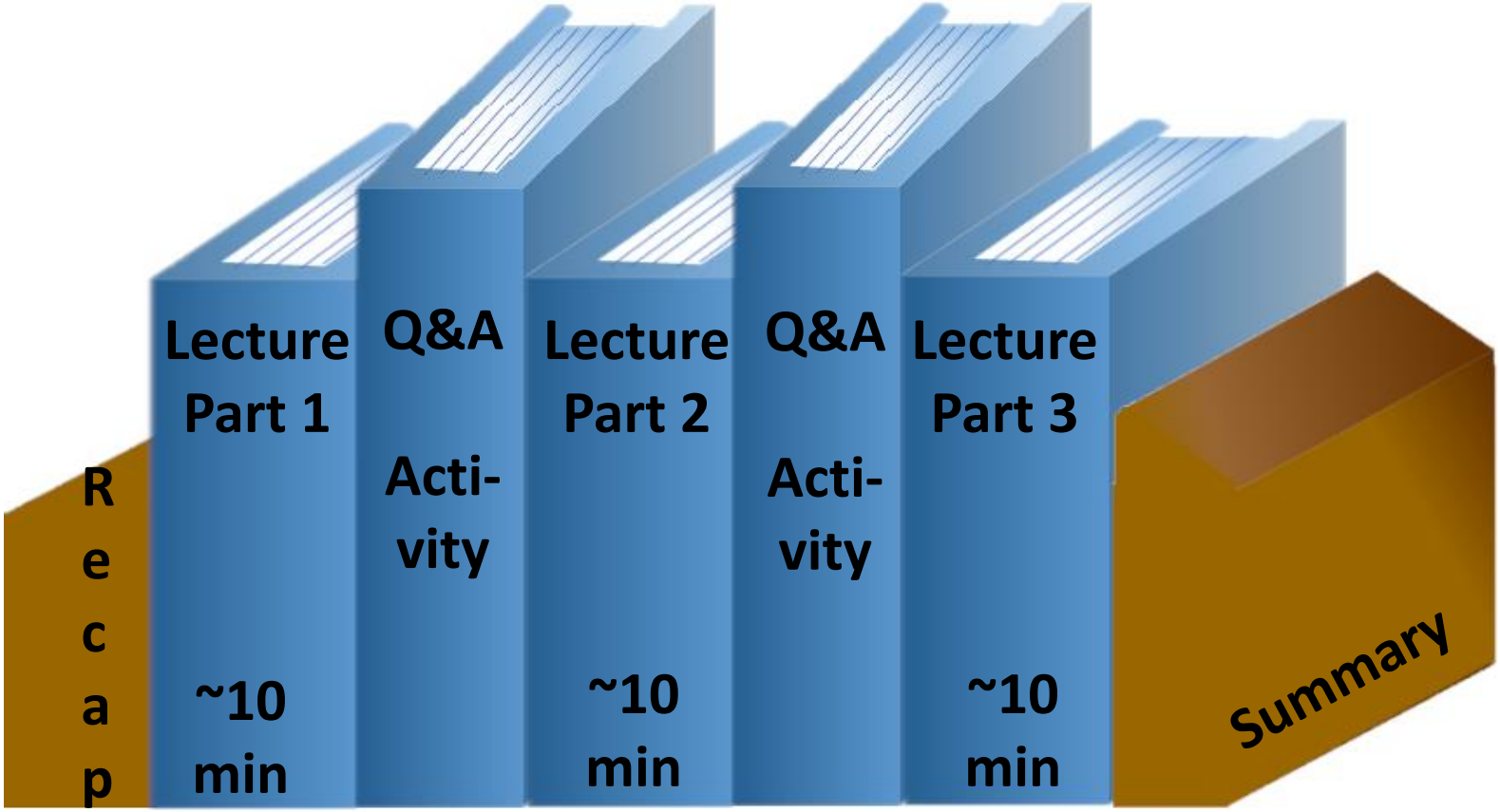
SAFE App For Tutorial Quiz

We will be using SAFE app for conducting the quiz during tutorial hour.

Step 1. Download SAFE app developed by CSE IITB on your **mobile phone** (http://safe.cse.iitb.ac.in);

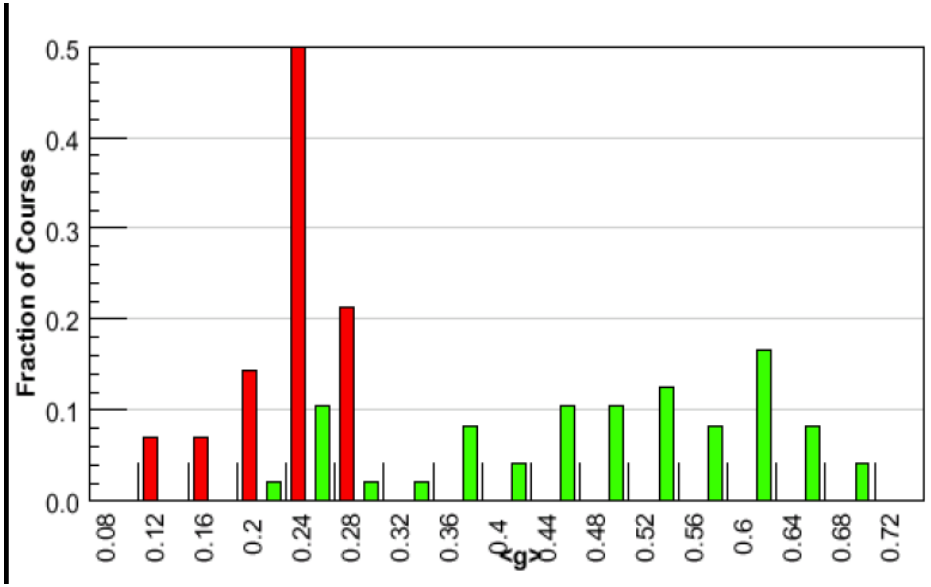
Step 2. Use the registration code 4F07RMKI to register for CH105.

What to expect in class



Why Breaks and Activities?

What does research say?



Learning gain

In Red – Lecture mode
In Green – Activity based approaches

You might feel uncomfortable asking doubts or not getting the answer right!

"what if I get this wrong ?"
"I am not able to solve this – panic mode!!",
"I am not able to sleep in class"
"why am I made to do stuff in class"

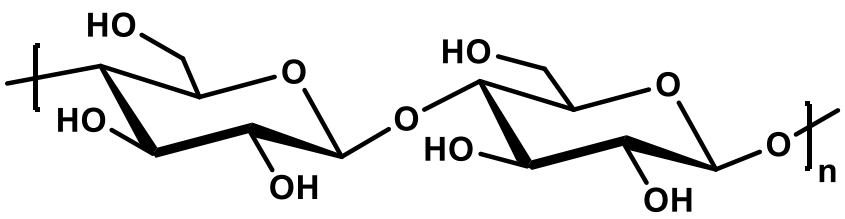
Remember -

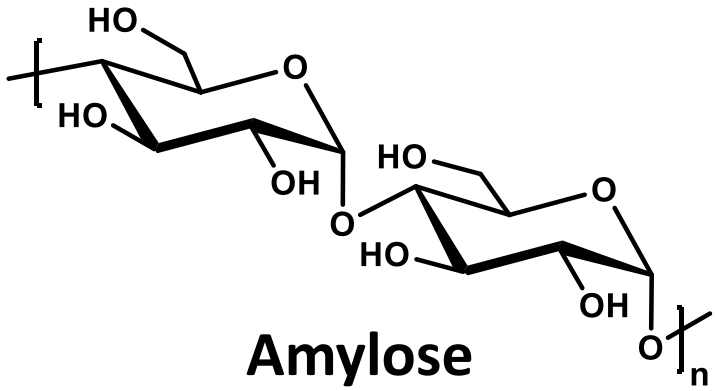
Its ok to feel uncomfortable and to be wrong!

Better to help each other in class than one day before exam!

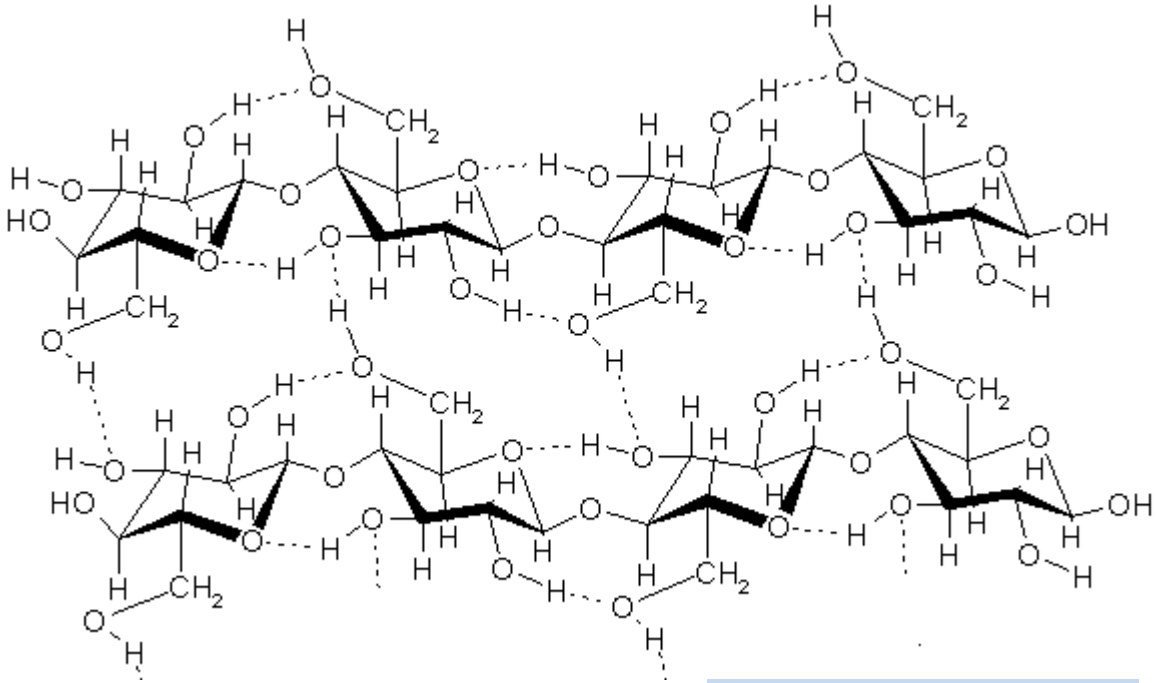
You will discover that you are not alone ☺

Spot the Differences?

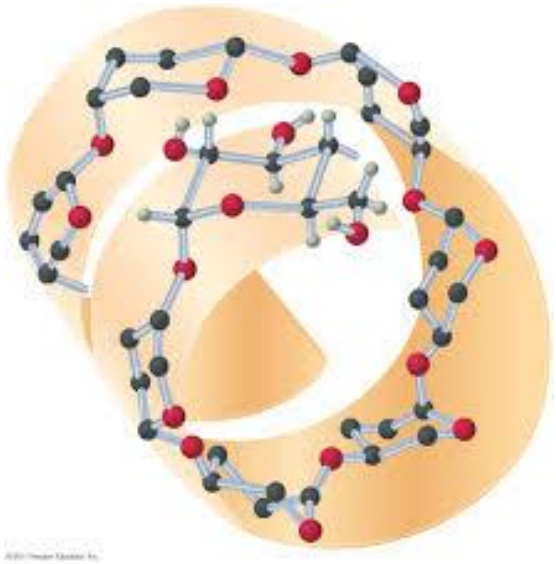




Cellulose



Amylose



Rod like structure

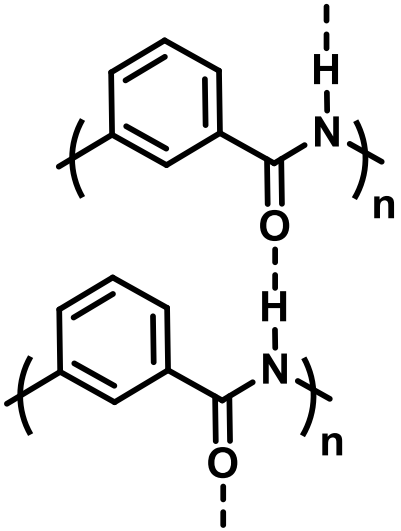
Rigid & strong

3D structure important!

Coiled structure

Soft

Inspired Man-Made Material



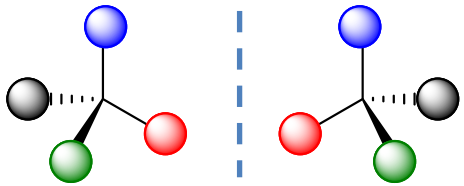
Kevlar

Non-covalent interactions in Bullet-Proof Vests!!

Organic Chemistry is Molecular Engineering

Image source: Google Images

Part 1
Chemistry in 3D



Learning Outcomes

At the end of this module you should be able to….

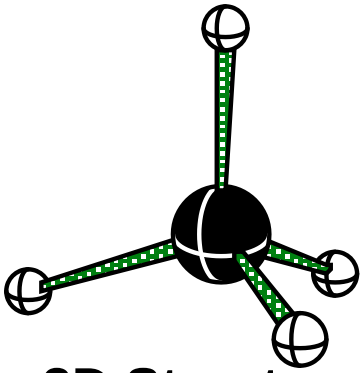
- **Represent** 3D molecules using appropriate 2D representations

- **Determine** the energetically favourable conformation of butanes, cyclohexane derivatives, decalins.

- **Explain** the effect of conformational equilibrium on reactivity.

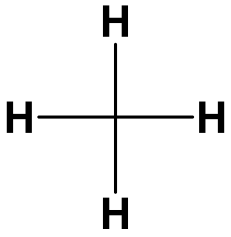
Reading assignment: Revision of CIP rules, R/S and E/Z descriptors.

Fischer Representation

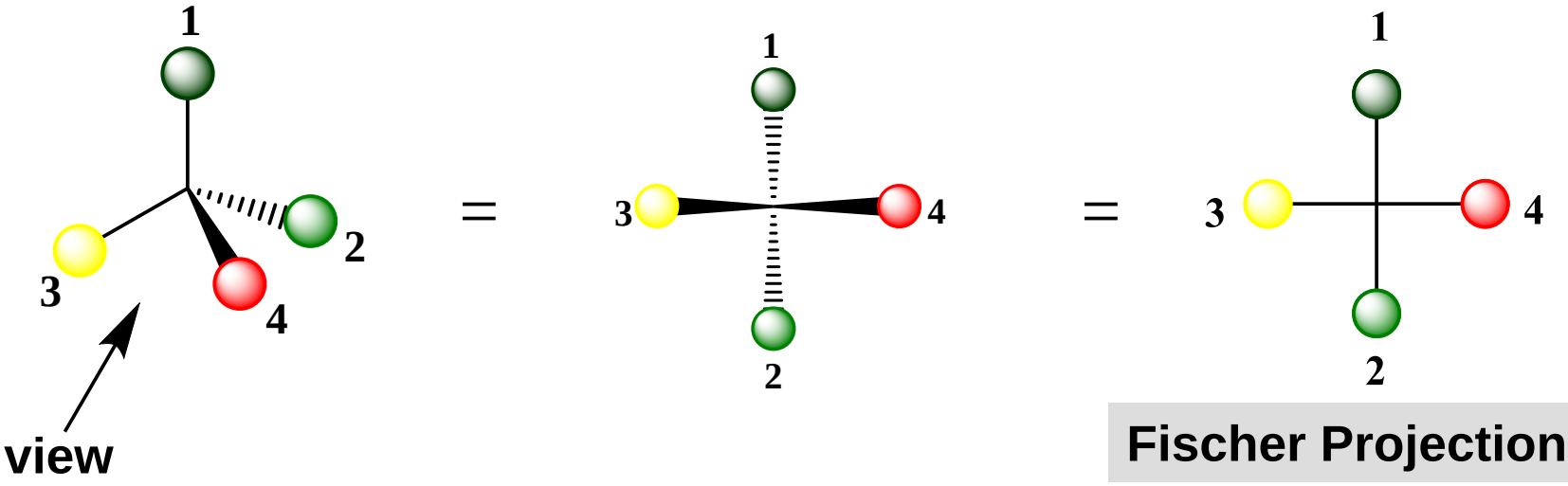


3D Structure

Methane



Fisher projection – 2D

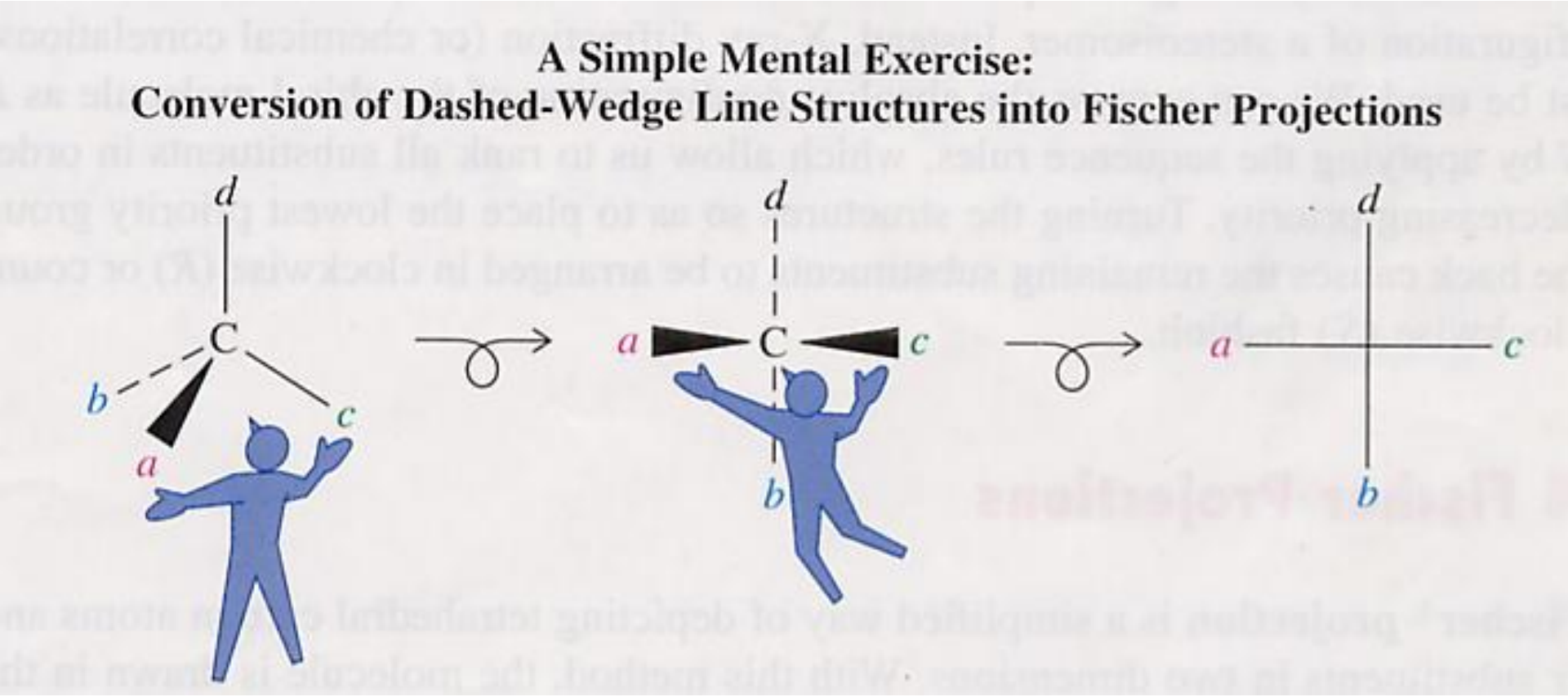


Fischer Projection

Perspective drawing

Or Flying-wedge formula

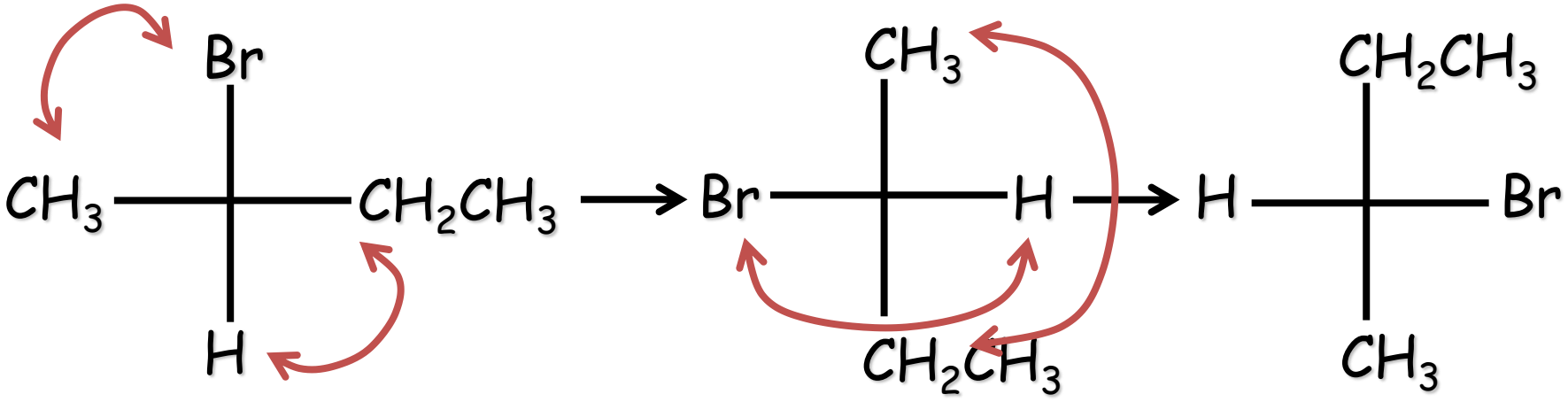
Fischer Representation



Rules for Fischer Projection

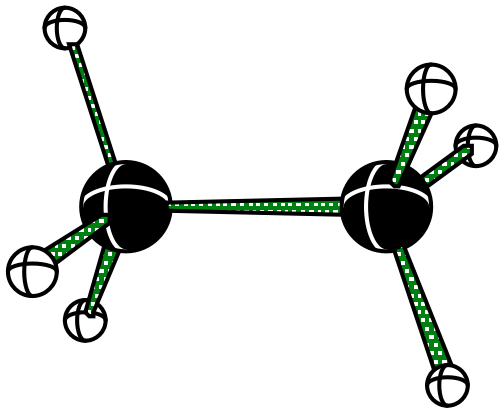
1. Cannot lift projection out of plane of paper.
2. Can be rotated in plane of paper only by 180°
3. **2 pairs** of substituents can be exchanged.

Remember - Exchange of only 1 pair gives enantiomer!



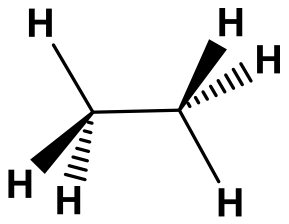
4. One atom can be fixed and the other 3 can be rotated (**DO NOT** change the sequence of 3 you are rotating)

Various Representations of Molecules

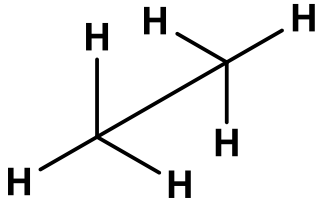


3D Image

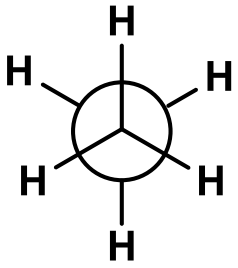
Ethane



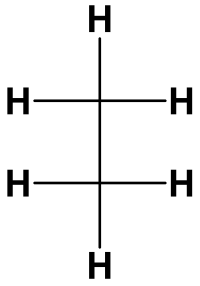
Flying-wedge formula



Sawhorse formula

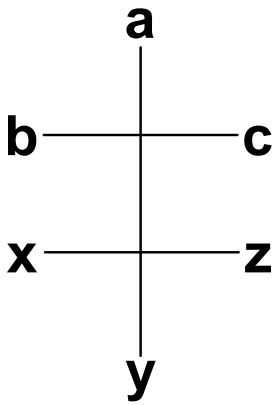


Newman Projection

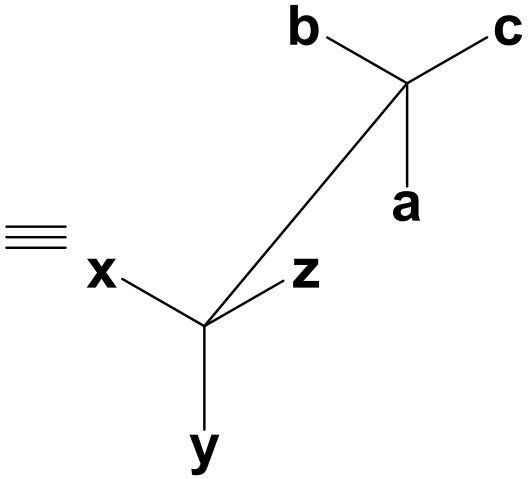


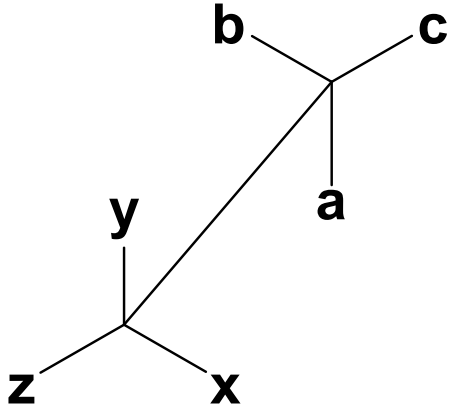
Fischer Projection

Interconverting Representations

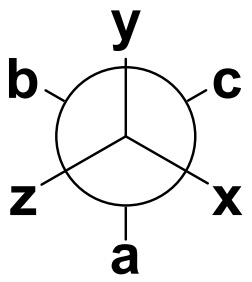


Fischer projection

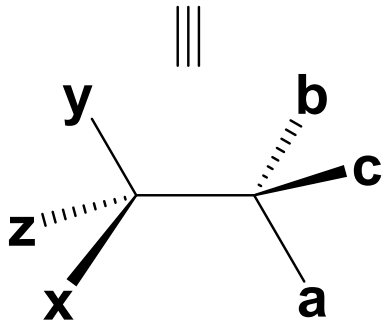




sawhorse

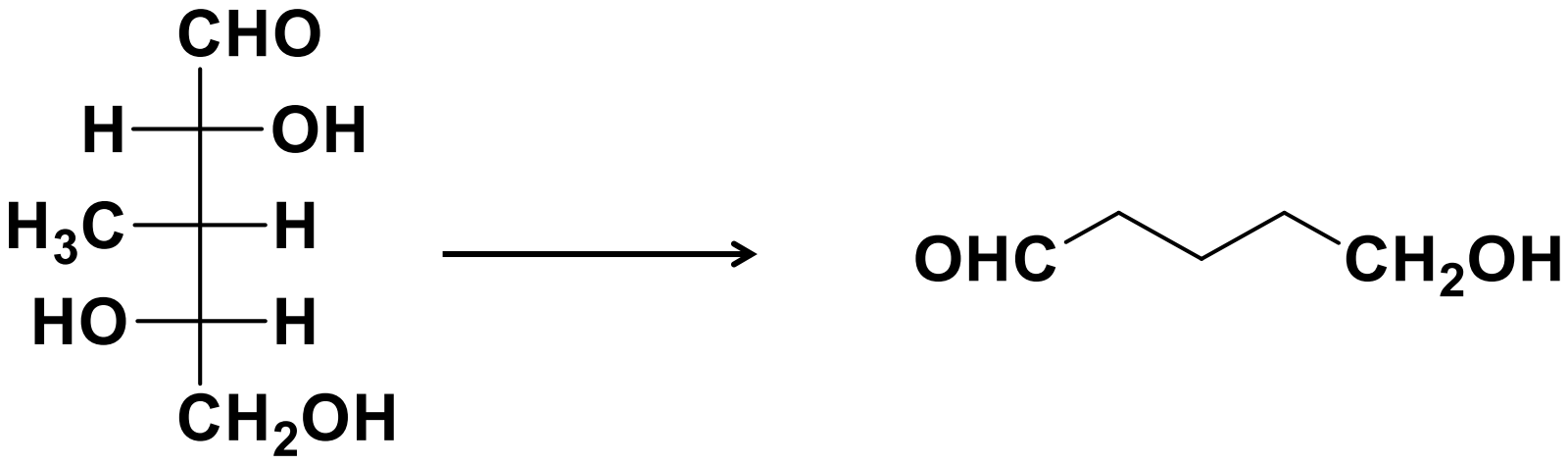


Newmann



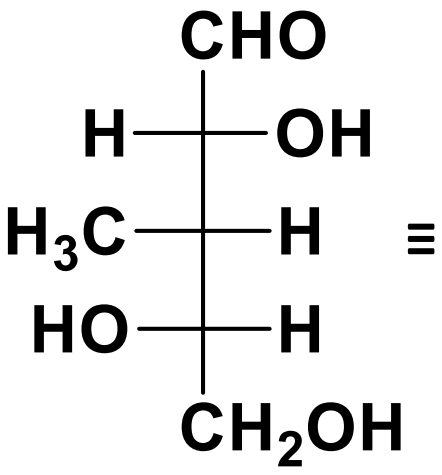
wedges

Small Activity



Convert the above structure to flying wedge

Small Activity



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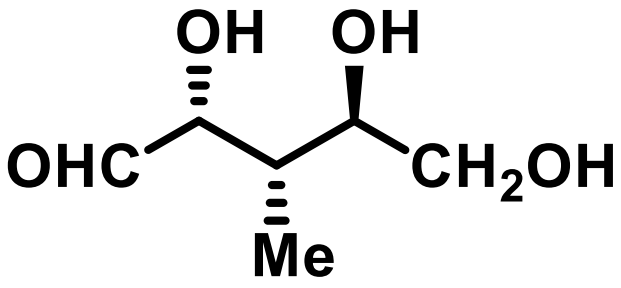
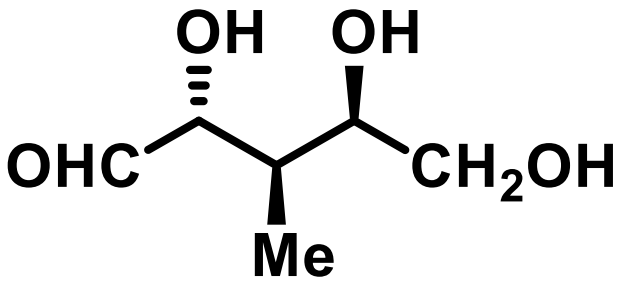
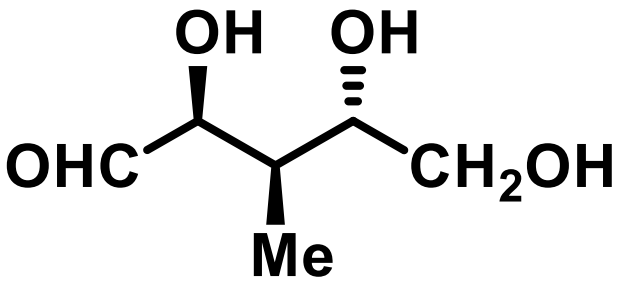


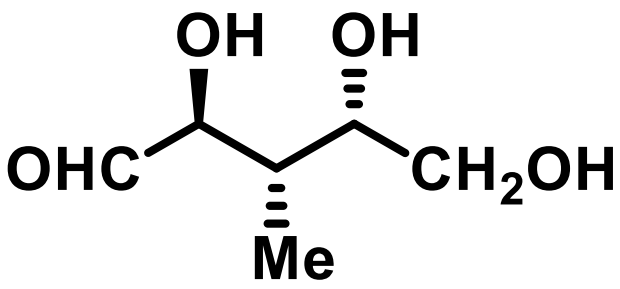
A



B



C



D

Go to www.menti.com and use the code **7908 7454**

Isomers

Isomers – Different molecules with the same molecular formula

Bonding connectivity

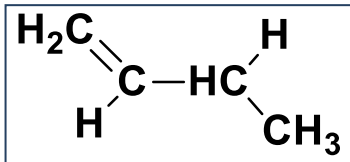
Different

Same

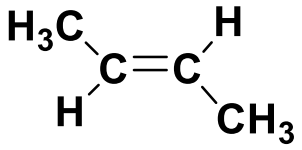
Constitutional Isomers

Stereoisomers

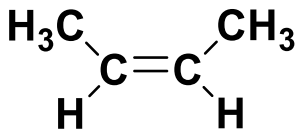
E.g. C_4H_8



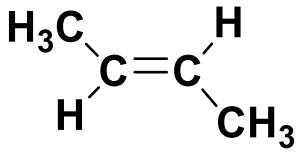
1-butene



trans-2-butene



cis-2-butene



trans-2-butene

Stereoisomers

- Configurational stereoisomers differ from one another in configuration at one or more atoms.

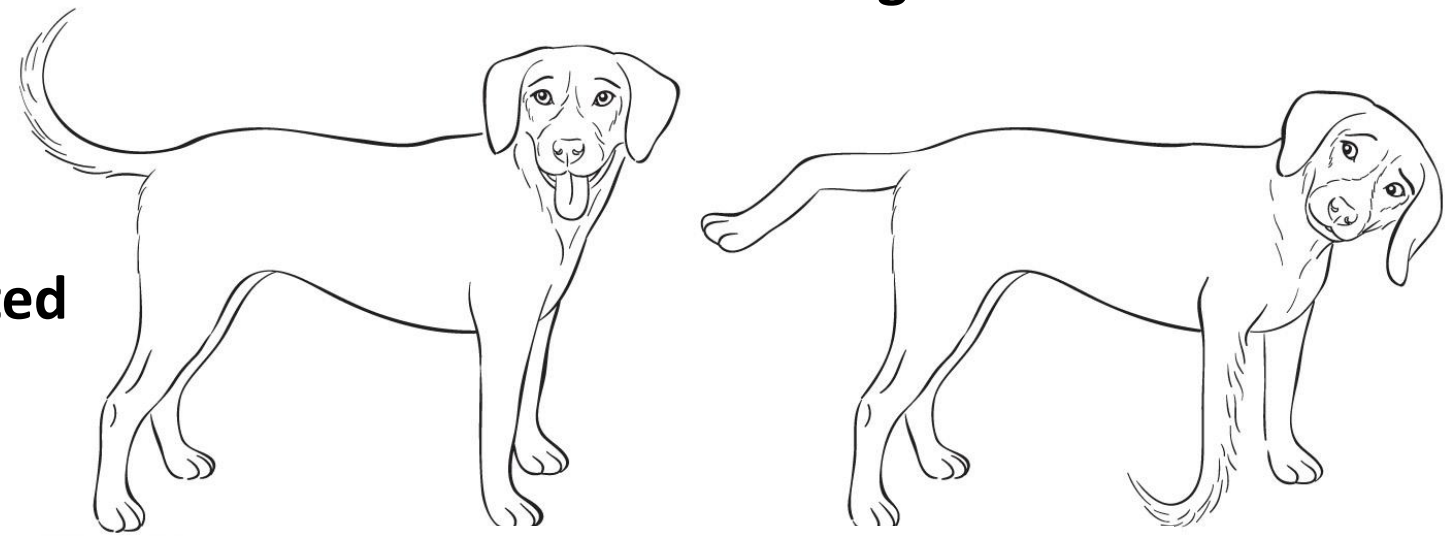
- Conformations are the various shapes that are available to molecules by single-bond rotations and other changes that do not involve bond breaking.

Conformational Isomers

Configurations & Conformations

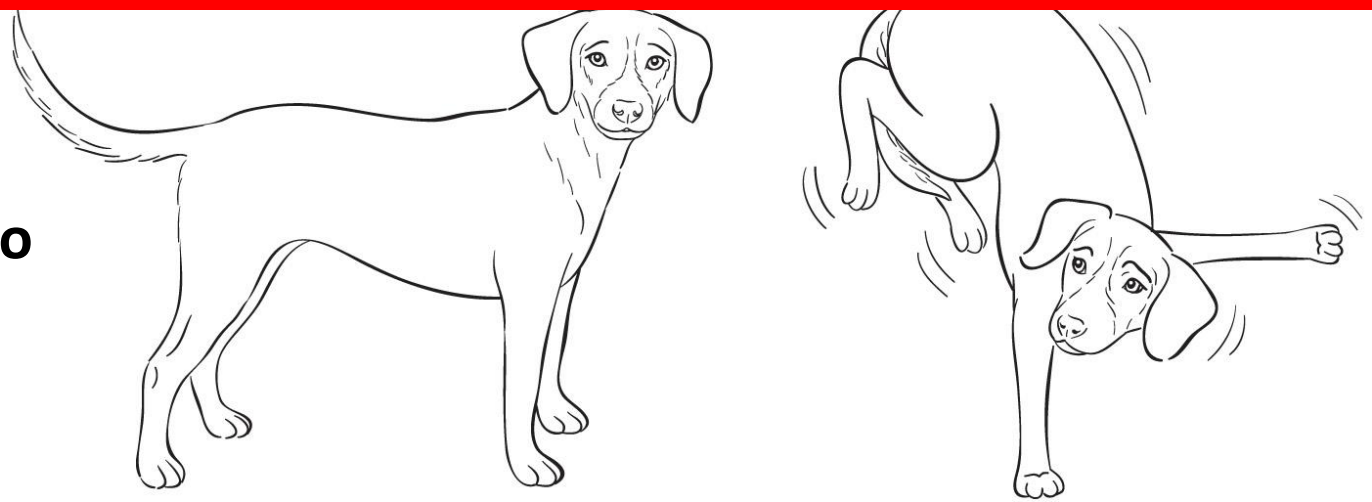
Different configurations

Can be separated



No animals were harmed in the making of this slide

Difficult to separate



Stable

Unstable