AS ACADEMIC STUDIO

FREE STUDY GUIDE

Organic Chemistry 1

Study guide: what to know, the reactions to memorize, and the mistakes to avoid

Topic checklist

Check off each topic when you can do a problem on it without your notes.

- [ ] Bonding, hybridization and drawing skeletal structures
- [ ] Resonance and curved-arrow pushing
- [ ] Acids and bases: pKa values and ARIO
- [ ] Functional groups and IUPAC naming
- [ ] Newman projections and conformations
- [ ] Cyclohexane chairs: axial, equatorial, ring flips
- [ ] Stereochemistry: R/S, enantiomers, diastereomers, meso
- [ ] SN1, SN2, E1 and E2: choosing the mechanism
- [ ] Carbocation stability and rearrangements
- [ ] Alkene addition reactions
- [ ] Alkyne reactions
- [ ] Radical halogenation
- [ ] Planning multistep syntheses

pKa values worth memorizing

Acid	Approx. pKa
HCl	-7
H_3O^+	-1.7
Carboxylic acid (RCOOH)	4–5
Phenol	10
Water	15.7
Alcohol (ROH)	16–18
Terminal alkyne	25

NH_3	38
Alkane	~50

SN1, SN2, E1 or E2

Substrate	Strong nucleophile	Strong, bulky base	Weak nucleophile/base
Methyl or 1°	SN2	E2	Very slow
2°	SN2 (E2 with strong base, heat)	E2	SN1/E1 (slow)
3°	No SN2; E2 if it is also a strong base	E2	SN1/E1

Alkene and alkyne reagent chart

Reagents	Adds	Where / how
HX	H and X	Markovnikov; watch for rearrangements
HBr, ROOR	H and Br	Anti-Markovnikov (radical)
H_2O, H_2SO_4	H and OH	Markovnikov; rearrangements possible
$Hg(OAc)_2$, H_2O; then $NaBH_4$	H and OH	Markovnikov, no rearrangement
BH_3·THF; then H_2O_2, NaOH	H and OH	Anti-Markovnikov, syn
Br_2	Br and Br	Anti (bromonium)
Br_2, H_2O	Br and OH	Anti; OH on the more substituted carbon
H_2, Pt/Pd	H and H	Syn
OsO_4; then $NaHSO_3$	OH and OH	Syn diol
mCPBA	O	Epoxide
O_3; then $(CH_3)_2S$	—	Cuts the C=C into two C=O
Alkyne + H_2, Lindlar	H and H	cis-alkene
Alkyne + Na, NH_3(l)	H and H	trans-alkene
Alkyne + H_2O, H_2SO_4, $HgSO_4$	—	Ketone (Markovnikov)
Terminal alkyne + R_2BH; then H_2O_2, NaOH	—	Aldehyde

The 5 most common mistakes

- **Drawing arrows from atoms or H^+.** Arrows start at electrons: a lone pair or a bond.

- **Forgetting to flip R/S** when the lowest priority points toward you.
- **Skipping the carbocation shift.** Always check if a hydride or methyl shift makes it more stable.
- **Putting SN2 on a tertiary carbon.** It's too crowded; it does SN1, E1 or E2.
- **Mixing up cis/trans on chairs.** Decide up/up or up/down first, then place groups.

How to practice

Work through the free **Organic Chemistry 1 Practice Exam** one problem per day, or take it all at once under a 2-hour timer. Check every answer with the answer key and add each miss to your mistake log (see the How to Study Chemistry & Biology guide).

Want help with this? AS Academic Studio offers affordable one-on-one chemistry tutoring online, with flexible pricing for anyone who needs it. Book a free 15-minute intro call at asacademicstudio.com.