AS ACADEMIC STUDIO

FREE STUDY GUIDE

Organic Chemistry 2

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

Topic checklist

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

- [ ] IR spectroscopy
- [ ] ^{1}H and ^{13}C NMR
- [ ] Mass spectrometry
- [ ] Conjugated dienes: 1,2 vs 1,4 addition; Diels–Alder
- [ ] Aromaticity
- [ ] Electrophilic aromatic substitution and directing groups
- [ ] Alcohols: oxidation and reactions
- [ ] Ethers and epoxides
- [ ] Aldehydes and ketones: Grignard, hydride, acetals, imines, Wittig
- [ ] Carboxylic acids and their derivatives
- [ ] Enolates: aldol, Claisen, alkylation, acetoacetic and malonic ester synthesis
- [ ] Amines

IR peaks worth memorizing

Bond	Where (cm^{-1})	Looks like
O–H, alcohol	3200–3550	broad
O–H, carboxylic acid	2500–3300	very broad
N–H	3300–3500	medium; 2 peaks for NH_2
C≡N	~2250	sharp
Aldehyde C–H	~2720 and ~2820	two weak peaks
C=O	1650–1750	strong (ketone ~1715, aldehyde ~1730, ester ~1740, amide ~1650–1690)

C=C	1620–1680	medium

^{1}H NMR shifts worth memorizing

Hydrogen type	δ (ppm)
Alkyl C–H	0.9–1.7
Next to C=O	2.0–2.5
Next to O or a halogen	3.3–4.5
Alkene	4.5–6.5
Aromatic	6.5–8
Aldehyde	9–10
Carboxylic acid	10–12

Directing groups for aromatic substitution

Group	Effect	Directs to
–NH_2, –OH, –OR	strong activator	ortho/para
–alkyl	weak activator	ortho/para
–F, –Cl, –Br, –I	weak deactivator	ortho/para
–NO_2, –CN, –SO_3H, –CHO, –COR, –COOH, –COOR, –CF_3	deactivator	meta

The 5 most common mistakes

- **Adding a Grignard to something with an O–H or N–H.** The Grignard just gets protonated.
- **Opening epoxides at the wrong carbon.** Base attacks the less hindered side; acid attacks the more substituted side.
- **Putting groups on a benzene ring in the wrong order.** The group already on the ring decides where the next one goes.
- **Going uphill with acid derivatives.** Acid chloride → anhydride → ester → amide only runs downhill.
- **Misnumbering aldol products.** The new C–C bond joins an α-carbon to a carbonyl carbon.

How to practice

Work through the free **Organic Chemistry 2 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.