DoctorMCAT

ORGANIC CHEMISTRY STRATEGY

The Reaction Roadmap

A 4-step shortcut for decoding any organic chemistry passage on the MCAT in under 90 seconds — so you can spend your time answering questions, not re-reading mechanisms.

4	90s	15	+2–3
STEPS	PER PASSAGE	KEY REAGENTS	MIN SAVED

1. Anchor — Start → End functional groups → **2. Scan** — Reagents = the "verb" of the reaction → **3. Check** — Conditions predict the mechanism → **4. Answer** — From your framework — don't re-read

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1 Anchor the Passage

Target: 15 seconds — identify start & end functional groups

a Find the First Molecule and the Last Molecule

Before reading a single mechanism arrow, look at **the starting material** and **the final product**. Ask: what functional group am I starting with? What did I end up with? This tells you the *category* of transformation.

START → END	CATEGORY	KEY CONCEPT
Alcohol → Aldehyde/Ketone	Oxidation	Loss of H, gain of C=O bond
Aldehyde → Carboxylic Acid	Oxidation	Terminal carbon fully oxidised
Ketone → Alcohol	Reduction	Gain of H, loss of C=O bond
RCOOH → Ester/Amide	Acyl Substitution	Leaving group replaced at carbonyl
Alkene → Alcohol/Diol	Addition	π bond opens, atoms add across
Alcohol → Alkene	Elimination	Loss of H_2O, π bond forms
R-X → R-Nu	Substitution	Leaving group swapped for nucleophile

Dr. Donnelly's Rule: If you can name the functional group transformation in 15 seconds, you've already eliminated half the answer choices. The MCAT loves to offer distractors from the *wrong reaction category*.

EXAMPLE — ANCHORING IN ACTION

$$CH_3CH_2OH \rightarrow [PCC] \rightarrow CH_3CHO$$

Start: primary alcohol → **End:** aldehyde. **Category:** Oxidation. You don't need to know PCC's mechanism — you know it's a mild oxidant that stops at the aldehyde. Any answer choice describing "reduction" or "substitution" is instantly eliminated.

2 Scan the Reagents

Target: 30 seconds — reagents are the "verb" of the reaction

a Categorise Each Reagent by Role

You don't need to memorise hundreds of reagents. For the MCAT, **~15 high-yield reagent patterns** cover 90%+ of what you'll encounter. Categorise each as: oxidant, reductant, acid/base catalyst, or nucleophile/electrophile.

b The 15 High-Yield Reagent Patterns

These reagents appear repeatedly across MCAT C/P passages. Know the *role* of each — that matters more than memorising every mechanism.

Oxidising Agents

- **PCC** — mild, stops at aldehyde
- **$KMnO_4$, CrO_3, Jones** — strong, goes to carboxylic acid
- **NAD^+ / FAD** — biological oxidants (biochem crossover)

Reducing Agents

- **$NaBH_4$** — mild, reduces C=O to alcohol
- **$LiAlH_4$** — strong, reduces esters & acids too
- **NADH / $FADH_2$** — biological reductants

Acid/Base Catalysts

- **H_3O^+ / H_2SO_4** — acid: protonation first, then nucleophilic attack
- **NaOH / KOH / LDA** — base: deprotonation first

Nucleophiles / Electrophiles

- **RMgBr (Grignard)** — strong C^- nucleophile attacks carbonyl
- **HBr / HCl** — electrophilic addition (Markovnikov)
- **Br_2 / Cl_2** — halogenation of alkenes

Novel reagent? Don't panic. The MCAT often uses unfamiliar reagent names or novel catalysts. Look for the *functional result* — if the passage says a reagent converts an alcohol to a ketone, it's an oxidant, regardless of its name. The MCAT tests *concepts*, not memorisation.

3 Check the Conditions

Target: 30 seconds — predict the mechanism from the conditions

a Use the Decision Grid to Predict the Mechanism

You've identified the transformation (Step 1) and the reagent (Step 2). Now the **reaction conditions** tell you which mechanism is operating. This is the highest-yield question type in MCAT organic chemistry.

The SN/E Decision Grid

Strong nucleophile + primary/methyl substrate	→ **SN2**	*Backside attack, inversion*
Weak nucleophile + tertiary substrate + polar protic	→ **SN1**	*Carbocation intermediate, racemisation*
Strong/bulky base + high temperature	→ **E2**	*One-step, anti-periplanar*
Weak base + tertiary substrate + heat	→ **E1**	*Carbocation, then proton loss*
Acid catalyst + carbonyl + nucleophile	→ **Nuc. Add.**	*Protonation activates C=O*
Peroxide (ROOR) or anti-Markovnikov	→ **Radical**	*Radical chain mechanism*

The 3-Second Shortcut: Look at the substrate carbon. **Primary = SN2/E2. Tertiary = SN1/E1. Secondary = read the other conditions carefully.** This single heuristic answers ~70% of mechanism questions correctly.

4 Answer the Question

Don't go back to the passage — answer from your framework

a Match Each Question to Your Framework

After Steps 1–3 (60–90 seconds total), you have a complete mental model. Go directly to the questions. Only return to the passage for specific detail lookups (yield %, temperature, step number).

"What's the intermediate?" → Your mechanism (Step 3) → **"What's the product?" → Your transformation (Step 1)** → **"Why this reagent?" → Your reagent role (Step 2)**

b Stereochemistry Quick-Fire Rules

Stereochemistry questions are the most common "twist" in OChem passages. Match the mechanism to the outcome:

MECHANISM	STEREOCHEMICAL OUTCOME	WHY
SN2	Inversion of configuration	Backside attack on the carbon
SN1	Racemisation (mix of R & S)	Planar carbocation attacked from both sides
E2	Anti-periplanar required	H and leaving group must be anti to each other
Addition to alkene	Syn or anti (depends on reagent)	H_2/Pd = syn; Br_2 = anti

! Common MCAT Traps

And how the Roadmap defeats them

The "Novel Reagent" Trap

A catalyst you've never seen. Students panic and freeze.

Roadmap fix: Step 1 already told you it's an oxidation. The novel reagent is just a fancy oxidant. Eliminate reduction/substitution answers.

The "Too Many Steps" Trap

A 6-step synthesis with 4 intermediates. Students try to follow every step.

Roadmap fix: Questions ask about 1–2 key steps. Read the question first after your 90s scan, then focus only on the relevant step.

The "Stereo Switcheroo" Trap

SN2 followed by SN1. Students apply the wrong stereochemical rule.

Roadmap fix: Step 3 identifies the mechanism for each step independently. Don't blend them.

The "Biochem Crossover" Trap

An enzymatic reaction using NAD^+. Students think it's biochem, not orgo.

Roadmap fix: NAD^+ is an oxidant. Apply Step 2 as normal. The enzyme is just a biological catalyst.

⚡ Your Reaction Roadmap Game Plan

0:00 – 0:15	**Anchor:** Starting functional group → final product. Name the transformation type.
0:15 – 0:45	**Scan:** Reagents above/below each arrow. Categorise: oxidant, reductant, nucleophile, base, acid, or "novel — read context."
0:45 – 1:30	**Check:** Conditions for the key step. Predict mechanism using the Decision Grid.
1:30 onward	**Answer:** From your framework. Only return to the passage for specific detail lookups.