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CH 02

Beckmann & Pinacol Rearrangement

02

Step-by-step mechanism, carbocation stability, migratory aptitude and MCQ patterns for both rearrangements.

WHAT YOU WILL BE ABLE TO DO

- Draw both mechanisms with correct curved arrows, step by step
- Predict the Beckmann amide from oxime geometry — anti group to nitrogen
- Solve any pinacol question with a two-decision method: cation first, migration second
- Rank carbocations and migrating groups, and see the whole family of 1,2-shifts at once

INSIDE

A One idea behind both reactions

B Beckmann: mechanism

C Beckmann: the anti rule

D Pinacol: mechanism

E Pinacol: the two decisions

F Migratory aptitude

G The 1,2-shift family

H Traps · MCQs · revision

USEFUL FOR JEE ADVANCED MHT CET TGT / PGT B.SC.

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HOW TO USE THESE NOTES

IN ONE LINE The core idea of a section	**KEY IDEA** The concept to remember	**EXAM TRAP** Where marks are usually lost
SOLVED EXAMPLE Worked step by step	**CHECK YOURSELF** Quick self-test	**MEMORY HOOK** A line that sticks

SECTION A

One idea behind both reactions

A

Beckmann and pinacol look unrelated — one starts from an oxime, the other from a diol. Underneath, both do the same move: a group slides, with its bonding pair of electrons, onto a neighbouring atom that has just become electron-poor.

IN ONE LINE Create an electron-poor atom ⟶ the neighbouring group shifts onto it (a 1,2-shift).

	Beckmann	Pinacol
Starting material	Ketoxime, $R_2C{=}N{-}OH$	1,2-Diol (vicinal glycol)
Electron-poor atom	Nitrogen (as water leaves)	Carbon (a carbocation)
Group moves	From C to N	From C to C^+
Who moves is decided by	Geometry — the group **anti** to –OH	Cation stability, then migratory aptitude
Product	N-substituted amide	Ketone (or aldehyde)

THINK OF IT LIKE THIS

Think of a relay: one runner (the leaving group) drops out, and the runner standing right next to that spot steps in. The new runner keeps their own shape — the migrating group **retains its configuration**.

SECTION B

Beckmann rearrangement: the mechanism

B

A ketoxime treated with acid (or a reagent that turns –OH into a good leaving group) becomes an N-substituted amide. The group anti to –OH ends up on nitrogen.

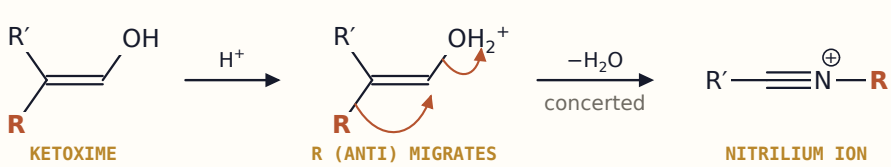
IN ONE LINE Make OH leave ⟶ the anti group jumps from C to N ⟶ water adds ⟶ amide.

R′-C(=N-OH)-R ⟶ R′-CO-NH-R (R is anti to OH)

Reagents: conc. H_2SO_4, PCl_5, $SOCl_2$, P_2O_5, polyphosphoric acid (PPA), TsCl / pyridine.

Stage 1 · Activation and migration

BECKMANN — STAGE 1



As water leaves N, the anti group R moves from C to N in the same step. Result: a nitrilium ion.

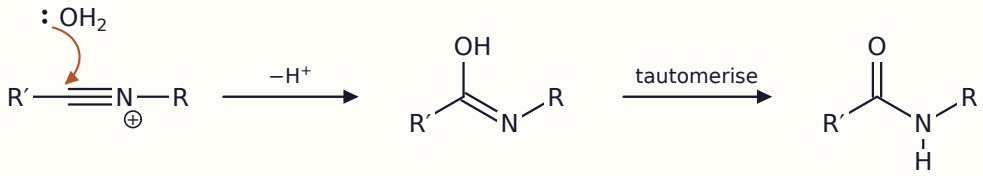
01 **Activate the –OH.** Acid protonates it to $-OH_2^+$, a good leaving group. (PCl_5 or TsCl convert it to $-OPCl_4$ or –OTs instead.)

02 **Migrate and leave together.** The C–R bond anti to the leaving group swings over to N while water departs. There is no free nitrogen cation — it is one concerted step.

03 **Nitrilium ion forms:** R′–C≡N$^+$–R. Linear and strongly electrophilic at carbon.

Stage 2 · Water adds, then tautomerism

BECKMANN — STAGE 2



Water attacks the nitrilium carbon; the imidic acid (iminol) tautomerises to the stable amide.

01 **Water attacks** the electrophilic nitrilium carbon, then loses H^+.

02 **Imidic acid forms:** R′–C(OH)=N–R — the ‘enol’ form of an amide.

03 **Tautomerisation** moves the H from O to N, giving the amide R′–CO–NH–R (C=O is far more stable than C=N).

WHY IT HAPPENS

The migration is concerted because a nitrogen with only six electrons is too unstable to exist on its own. The anti group is the only one lined up behind the N–O bond, so only it can push in as the leaving group pulls out. Geometry, not group size, decides.

SOLVED EXAMPLE 01 RING EXPANSION

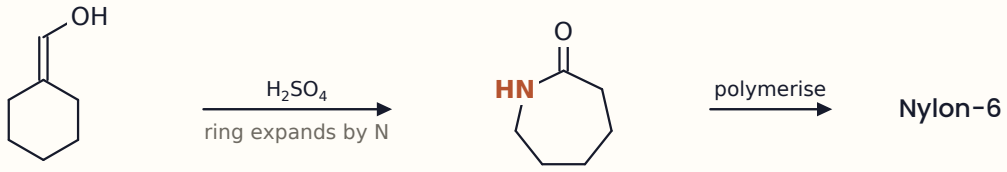
Write the Beckmann product of cyclohexanone oxime with conc. H_2SO_4, and state its use.

SOLUTION

1. The ring carbon anti to –OH migrates to N.
2. N is inserted into the ring: a 6-membered ring becomes a 7-membered ring containing N–H and C=O.
3. This cyclic amide is ε-caprolactam.

ANSWER ε-Caprolactam — the monomer of Nylon-6.

INDUSTRIAL BECKMANN



CYCLOHEXANONE OXIME ε-CAPROLACTAM

Cyclohexanone oxime ⟶ ε-caprolactam ⟶ Nylon-6. The new N–H sits next to C=O.

NOTE

Aldoximes (RCH=N–OH) usually lose water to give **nitriles** (R–C≡N) under these conditions, not amides.

If the anti group can leave as a very stable carbocation (e.g. tertiary), **Beckmann fragmentation** (nitrile + carbocation) competes.

CHECK YOURSELF

C1 What is the key cationic intermediate of the Beckmann rearrangement?

C2 Why does the iminol convert to the amide?

Answers at the end of the chapter.

SECTION C

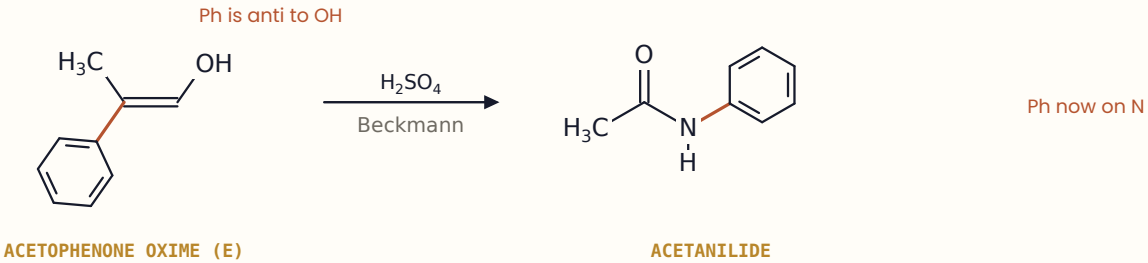
The anti rule: where Beckmann marks are won

C

The two oxime isomers of an unsymmetrical ketone give two different amides. You must read the geometry.

IN ONE LINE Whatever sits opposite (anti) to –OH across C=N is what ends up on nitrogen.

READING THE GEOMETRY



ACETOPHENONE OXIME (E) ACETANILIDE

In the usual (E) oxime of acetophenone the phenyl is anti to OH, so phenyl moves to N.

FOUR-STEP METHOD

1. Draw the oxime; find the –OH on nitrogen.
2. Look across the C=N bond: the group on the **opposite** side is anti.
3. That group goes to N. The other group stays on the carbonyl carbon.
4. Write: (group that stayed)–CO–NH–(group that moved).

Oxime	Group anti to OH	Product
Acetophenone oxime (E, usual)	Phenyl	Acetanilide, $CH_3CO–NH–C_6H_5$
Acetophenone oxime (Z)	Methyl	N-Methylbenzamide, $C_6H_5CO–NH–CH_3$
Benzophenone oxime	Phenyl (either)	Benzanilide, $C_6H_5CO–NH–C_6H_5$
Acetone oxime	Methyl (either)	N-Methylacetamide, $CH_3CO–NH–CH_3$
Cyclohexanone oxime	Ring carbon	ε-Caprolactam

SOLVED EXAMPLE 02 GEOMETRY DECIDES

Butan-2-one forms two oximes. In oxime X the ethyl group is anti to –OH. What does X give on Beckmann rearrangement?

SOLUTION

1. Butan-2-one = $CH_3–CO–C_2H_5$. Its oxime has CH_3 and C_2H_5 on carbon.
2. In X, ethyl is anti ⟶ ethyl migrates to N.
3. Methyl stays on the carbonyl carbon: $CH_3–CO–NH–C_2H_5$.

ANSWER **N-Ethylacetamide. (The other oxime would give N-methylpropanamide.)**

EXAM TRAP

Migratory aptitude does **not** decide Beckmann. If a question shows the E/Z structure, follow the geometry even if the 'better' migrator is syn.

Under harsh acid, oximes can isomerise — but MCQs assume the drawn geometry is kept.

SECTION D

Pinacol rearrangement: the mechanism

D

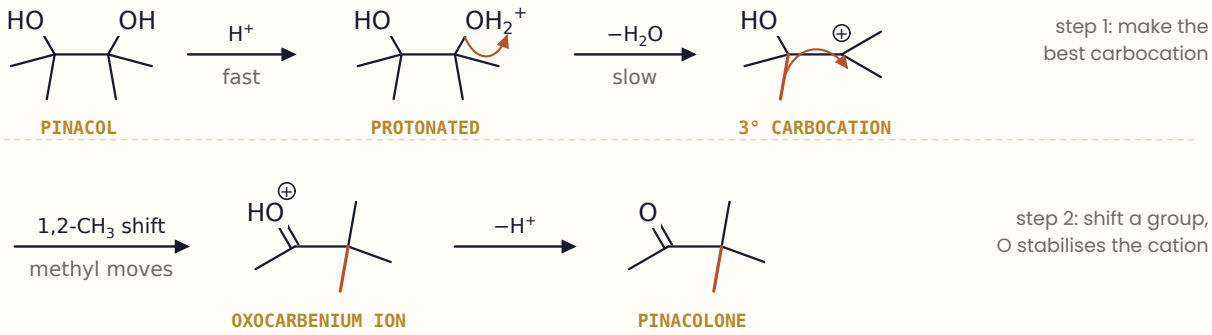
A 1,2-diol in acid loses water and rearranges into a ketone. The named example turns pinacol into pinacolone.

IN ONE LINE Lose OH as water ⟶ carbocation ⟶ a neighbour group shifts ⟶ oxygen stabilises ⟶ ketone.

$$(CH_3)_2C(OH)\text{-}C(OH)(CH_3)_2 \longrightarrow (CH_3)_3C\text{-}CO\text{-}CH_3 + H_2O$$

Pinacol (2,3-dimethylbutane-2,3-diol) ⟶ pinacolone (3,3-dimethylbutan-2-one). Acid: dil. or conc. H_2SO_4.

PINACOL — FULL MECHANISM



Red bond = the methyl that migrates. It moves to the cation; the C–OH carbon becomes C=O.

01 **Protonate one –OH** — the one whose loss gives the more stable carbocation (here both are equal).

02 **Lose water** ⟶ a tertiary carbocation. This is the slow step.

03 **1,2-Shift.** A methyl from the neighbouring carbon moves, with its electron pair, onto C^+.

04 **Oxygen takes the charge.** The new cation is next to O, which shares a lone pair: $C{=}O^+{-}H$ (oxocarbenium). Every atom now has an octet.

05 **Lose H^+** ⟶ pinacolone.

WHY IT HAPPENS

Why shift at all, if the first cation is already 3°? Because the cation formed after the shift is stabilised by oxygen's lone pair — a full octet everywhere. That is far more stable than any alkyl carbocation, and it is the driving force.

SECTION E

Pinacol: the two decisions

E

With an unsymmetrical diol you face two choices. Make them in the right order and the product follows automatically.

IN ONE LINE	Decision 1: which OH leaves (best carbocation). Decision 2: which group moves (best migrator on the OTHER carbon).

Decision 1 · Which –OH leaves? → the more stable carbocation

$$Ph_3C^+ > Ph_2C^+R > PhC^+R_2 \approx 3^\circ \text{ alkyl} > 2^\circ > 1^\circ$$

Benzylic cations are stabilised by resonance; more aryl groups = more stable. Alkyl groups help by hyperconjugation.

- **Resonance beats hyperconjugation:** a cation next to a benzene ring rivals or beats a 3° alkyl cation.
- **Donor groups on the ring** ($-OCH_3$, $-CH_3$) make a benzylic cation even more stable; $-NO_2$ makes it less stable.

Decision 2 · Which group moves? → highest migratory aptitude on the other carbon

Only groups on the carbon that **still carries its** –OH can migrate. That carbon becomes the C=O.

SOLVED EXAMPLE 03 — TWO DECISIONS IN ORDER

Predict the product of $Ph_2C(OH)–C(OH)(CH_3)_2$ with acid.

SOLUTION

1. Decision 1: compare Ph_2C^+ (two phenyls, resonance) and $(CH_3)_2C^+$ (two methyls). Ph_2C^+ wins, so the –OH on the diphenyl carbon leaves.
2. Decision 2: the other carbon carries only CH_3 groups, so a methyl migrates.
3. That carbon keeps its O and becomes C=O: $Ph_2C(CH_3)–CO–CH_3$.

ANSWER 3,3-Diphenylbutan-2-one.

SOLVED EXAMPLE 04 ARYL MIGRATION

Benzopinacol, $Ph_2C(OH)–C(OH)Ph_2$, is warmed with acid. Product?

SOLUTION

1. Both carbons are identical, so either –OH can leave; Ph_2C^+ forms.
2. The other carbon carries only phenyls, so phenyl migrates.
3. $Ph_3C–CO–Ph$.

ANSWER **Benzopinacolone, $Ph_3C–CO–Ph$ (1,2,2,2-tetraphenylethan-1-one).**

SOLVED EXAMPLE 05 RING EXPANSION

1,1′-Bi(cyclopentyl)-1,1′-diol (two cyclopentane rings joined at C–C, each carbon bearing OH) is treated with acid. What type of product forms?

SOLUTION

1. One –OH leaves; a 3° cation forms on one ring carbon.
2. The groups available on the other carbon are its **ring bonds**. A ring bond migrates.
3. The ring that migrated grows from 5 to 6 atoms, with C=O at the junction.

ANSWER **Spiro[4.5]decan-6-one — ring expansion (5 ⟶ 6).**

CHECK YOURSELF

C3 In a pinacol rearrangement, which carbon becomes the carbonyl carbon?

C4 Why can't phenyl migrate in $Ph_2C(OH)–C(OH)Me_2$?

Answers at the end of the chapter.

SECTION F

Migratory aptitude

F

When a choice exists, the group better at carrying positive charge in the transition state moves first.

IN ONE LINE **Electron-rich, charge-stabilising groups migrate best.**

$$H > \text{aryl} > 3^\circ\ \text{alkyl} > 2^\circ\ \text{alkyl} > 1^\circ\ \text{alkyl} > CH_3$$

$$p\text{-}CH_3O\text{-}C_6H_4 > p\text{-}CH_3\text{-}C_6H_4 > C_6H_5 > p\text{-}Cl\text{-}C_6H_4 > p\text{-}NO_2\text{-}C_6H_4$$

Order commonly used in Indian exams. Real aptitudes vary with substrate; the hydride position is the least reliable.

Factor	Effect on migration	Example
Electron donation	Faster	p-Anisyl > phenyl
Electron withdrawal	Slower	p-Nitrophenyl is the slowest aryl
Ortho substituent	Slower (steric)	o-Tolyl < p-tolyl
Which reaction	Pinacol, Baeyer–Villiger: aptitude decides	Beckmann: geometry decides instead

MEMORY HOOK

"Hydrogen Always Takes The Prime Seat, Methyl Last." H > Aryl > 3° > 2° > 1° > Methyl.

SECTION G

The 1,2-shift family

G

Group these reactions by the atom that receives the moving group. One idea, many named reactions.

IN ONE LINE Group moves to C^+, to N, or to O — every case keeps the migrating group's configuration.

Group moves to…	Reaction	Substrate ⟶ product
Carbon (C^+)	Pinacol	1,2-Diol ⟶ ketone
Carbon (C^+)	Wagner–Meerwein	Carbocation ⟶ more stable carbocation
Nitrogen	Beckmann	Ketoxime ⟶ amide
Nitrogen	Hofmann	Amide + Br_2/NaOH ⟶ amine (one carbon fewer)
Nitrogen	Curtius / Lossen / Schmidt	Acyl azide / hydroxamic acid / HN_3 ⟶ isocyanate ⟶ amine
Oxygen	Baeyer–Villiger	Ketone + peracid ⟶ ester (Chapter 03)
Oxygen	Cumene hydroperoxide	Phenyl moves to O ⟶ phenol + acetone

SECTION H

Exam trap gallery

H

Cover the right column and test yourself before reading it.

✗ TRAP 01 · WHAT STUDENTS WRITE	✓ WHAT IS ACTUALLY CORRECT
Beckmann: the group with higher migratory aptitude moves.	The group **anti** to –OH moves, whatever its aptitude.

WHY Migration is concerted with loss of water; only the anti group is aligned with the N–O bond.

✗ TRAP 02 · WHAT STUDENTS WRITE	✓ WHAT IS ACTUALLY CORRECT
Beckmann gives an amine (or a ketone).	Beckmann gives an **amide**; a cyclic oxime gives a **lactam**.

WHY Water adds to the nitrilium ion, then tautomerism gives C=O next to N–H.

✗ TRAP 03 · WHAT STUDENTS WRITE	✓ WHAT IS ACTUALLY CORRECT
Both acetophenone oximes give acetanilide.	(E) gives acetanilide; (Z) gives **N-methylbenzamide**.

WHY Different anti groups ⟶ different amides.

✗ TRAP 04 · WHAT STUDENTS WRITE	✓ WHAT IS ACTUALLY CORRECT
Pinacol: phenyl migrates because it has high aptitude.	First choose the cation. Groups on the cation carbon **cannot** migrate.

WHY Decision 1 (best C^+) always comes before Decision 2 (best migrator).

✗ TRAP 05 · WHAT STUDENTS WRITE	✓ WHAT IS ACTUALLY CORRECT
Pinacol: C=O forms on the carbon that lost –OH.	C=O forms on the carbon that **kept** its –OH.

WHY That oxygen stabilises the new cation and becomes the carbonyl.

✗ TRAP 06 · WHAT STUDENTS WRITE	✓ WHAT IS ACTUALLY CORRECT
Pinacol of a ring diol gives the same ring size.	A ring bond can migrate ⟶ **ring expansion**.

WHY Look for ring bonds on the carbon that keeps –OH.

MEMORY HOOK

Beckmann — "Anti goes to N."

Pinacol — "Cation first, migrate second, carbonyl where the OH stayed."

SECTION I

Practice MCQs

I

Easy = recall · Moderate = one reasoning step · Tough = two ideas combined.

Q01 Cyclohexanone oxime with conc. H_2SO_4 gives: [EASY]

(a) Cyclohexanone
(b) ε-Caprolactam
(c) Cyclohexylamine
(d) Adipic acid

Q02 In the Beckmann rearrangement, the migrating group is: [EASY]

(a) The one with higher migratory aptitude
(b) The group syn to –OH
(c) The group anti to –OH
(d) Always the larger group

Q03 Pinacol with dil. H_2SO_4 gives: [EASY]

(a) 3,3-Dimethylbutan-2-one
(b) 2,3-Dimethylbut-2-ene
(c) Acetone
(d) 2,2-Dimethylbutanal

Q04 Beckmann rearrangement is used industrially to make the monomer of: [EASY]

(a) Nylon-6,6
(b) Nylon-6
(c) Terylene
(d) Bakelite

Q05 The (E) oxime of acetophenone (phenyl anti to OH) gives: [MODERATE]

(a) Acetanilide
(b) N-Methylbenzamide
(c) Benzamide
(d) Acetophenone

Q06 N-Methylbenzamide forms from acetophenone oxime when the group anti to –OH is: [MODERATE]

(a) Phenyl
(b) Methyl
(c) Hydrogen
(d) Either; both give it

Q07 The key intermediate in the Beckmann rearrangement is: [MODERATE]

(a) Nitrene
(b) Nitrilium ion
(c) Carbanion
(d) Free radical

Q08 The driving force for the migration step in pinacol rearrangement is formation of: [MODERATE]

(a) A primary carbocation
(b) An oxygen-stabilised (oxocarbenium) cation
(c) A carbanion
(d) A free radical

Q09 Highest migratory aptitude among these aryl groups: [MODERATE]

(a) p-Nitrophenyl
(b) Phenyl
(c) p-Chlorophenyl
(d) p-Methoxyphenyl

Q10 $Ph_2C(OH)–C(OH)(CH_3)_2$ in acid gives mainly: [TOUGH]

(a) 3,3-Diphenylbutan-2-one
(b) 1,2-Diphenyl-2-methylpropan-1-one
(c) Benzophenone + acetone
(d) 2,2-Diphenylpropanal

Q11 The oxime of butan-2-one with ethyl anti to –OH gives on Beckmann rearrangement: [TOUGH]

(a) N-Methylpropanamide
(b) N-Ethylacetamide
(c) Butanamide
(d) Propanenitrile

Q12 Benzopinacol rearranges in acid to: [TOUGH]

(a) Benzophenone
(b) $Ph_3C–CO–Ph$
(c) $Ph_2CH–CO–Ph$
(d) Triphenylmethanol

Answer key with explanations

Q01 (b) **ε-Caprolactam** — N inserts into the ring; 6 ⟶ 7 members.

Q02 (c) **Anti to –OH** — concerted migration as water leaves.

Q03 (a) **Pinacolone** — 3,3-dimethylbutan-2-one, by a methyl shift.

Q04 (b) **Nylon-6** — ε-caprolactam polymerises to Nylon-6.

Q05 (a) **Acetanilide** — phenyl goes to N; $CH_3–CO–NH–Ph$.

Q06 (b) **Methyl** — methyl goes to N; $Ph–CO–NH–CH_3$.

Q07 (b) **Nitrilium ion** — $R'–C{\equiv}N^+–R$, attacked by water.

Q08 (b) **Oxocarbenium ion** — oxygen's lone pair gives every atom an octet.

Q09 (d) **p-Methoxyphenyl** — +M donor stabilises the migrating transition state.

Q10 (a) — Ph_2C^+ forms; a methyl shifts from the other carbon. Option (b) is the wrong-path product (phenyl shift).

Q11 (b) **N-Ethylacetamide** — ethyl goes to N, methyl stays on C=O.

Q12 (b) **$Ph_3C–CO–Ph$** — phenyl migration gives benzopinacolone.

SECTION J

Previous-year questions

J

HONEST NOTE

Beckmann and pinacol rearrangements are not in the NCERT syllabus, so JEE Main and NEET rarely ask them directly. They do appear in JEE Advanced, MHT CET named-reaction questions, B.Sc. papers and TGT/PGT recruitment exams.

I searched published question banks for questions with a confirmed exam and year. The ones I found either had no year attached or depended on structure images I could not reproduce faithfully, so I have not included them rather than attach a year I cannot verify. The MCQs in Section I follow the same patterns these exams use.

If you have past papers from the exams your students sit (for example UP TGT/PGT or Bihar TRE), send them and I will add the matching questions with their years.

SECTION K

Advanced problems

K

Problems at JEE Advanced / PGT level. Each one tests whether you apply the rules in the right order.

IN ONE LINE Each problem combines two ideas from this chapter. Try it before reading the solution.

SOLVED EXAMPLE 06 RING + GEOMETRY

The oxime of 2-methylcyclohexanone in which the $CH(CH_3)$ ring carbon is anti to –OH is treated with conc. H_2SO_4. Give the product.

SOLUTION

1. The anti ring carbon — the one bearing CH_3 — migrates to N.
2. N is inserted between C=O and the $CH(CH_3)$ carbon: a 7-membered lactam.
3. So N–H sits next to the carbon carrying the methyl group.

ANSWER 7-Methylazepan-2-one (a methyl-substituted caprolactam, CH_3 on the carbon next to N).

SOLVED EXAMPLE 07 APTITUDE TRAP

In an oxime of 4-methoxybenzophenone, the phenyl group is anti to –OH and the 4-methoxyphenyl group is syn. Predict the Beckmann product.

SOLUTION

1. 4-Methoxyphenyl has the higher migratory aptitude — but Beckmann ignores aptitude.
2. Phenyl is anti, so phenyl migrates to N.
3. 4-Methoxyphenyl stays on C=O: $4\text{-}CH_3O\text{–}C_6H_4\text{–}CO\text{–}NH\text{–}C_6H_5$.

ANSWER 4-Methoxy-N-phenylbenzamide — geometry beats aptitude.

SOLVED EXAMPLE 08 APTITUDE DECIDES

$PhC(CH_3)(OH)\text{–}C(CH_3)(OH)Ph$ (a symmetrical diol) is warmed with acid. Predict the product.

SOLUTION

1. Both carbons are the same, so either –OH leaves to give a benzylic 3° cation, $PhC^+(CH_3)$.
2. The other carbon carries Ph and CH_3. Phenyl has the higher migratory aptitude, so phenyl moves.
3. That carbon becomes C=O, keeping its CH_3: $Ph_2C(CH_3)\text{–}CO\text{–}CH_3$.

ANSWER 3,3-Diphenylbutan-2-one.

SOLVED EXAMPLE 09 RING EXPANSION

1-(Hydroxydiphenylmethyl)cyclohexan-1-ol, $Ph_2C(OH)–C_{ring}(OH)$, is treated with acid. What happens to the ring?

SOLUTION

1. Decision 1: Ph_2C^+ (diaryl, benzylic) is far more stable than the ring 3° cation, so the –OH on the diphenyl carbon leaves.
2. Decision 2: the ring carbon still has its –OH; the groups it can donate are two ring C–C bonds.
3. A ring bond migrates to Ph_2C^+, pulling that carbon into the ring: 6 ⟶ 7 members, with C=O on the old ring carbon next to CPh_2.

ANSWER 2,2-Diphenylcycloheptan-1-one — ring expansion.

Check-yourself answers

C1 The nitrilium ion, $R'–C\equiv N^+–R$.

C2 C=O (amide) is more stable than C=N with O–H (iminol); it is a keto–enol-type tautomerism.

C3 The carbon that keeps its –OH (the one next to the carbocation).

C4 The phenyls are on the cation carbon itself; only groups on the neighbouring carbon can shift.

QUICK REVISION

One-page revision

Read this page the night before the exam. Every line points back to a section in these notes.

Common idea

- Electron-poor atom forms ⟶ neighbour group shifts (1,2-shift)
- Migrating group keeps its configuration
- Beckmann: to N · Pinacol: to C^+

Beckmann mechanism

- Protonate OH ⟶ anti group moves to N as H_2O leaves (concerted)
- Nitrilium ion ⟶ water adds ⟶ iminol ⟶ amide
- Aldoximes ⟶ nitriles

Beckmann rules

- Anti group goes to N (geometry, not aptitude)
- (E)-acetophenone oxime ⟶ acetanilide
- Cyclohexanone oxime ⟶ ε-caprolactam ⟶ Nylon-6

Pinacol mechanism

- Protonate ⟶ lose H_2O ⟶ C^+ ⟶ 1,2-shift ⟶ $C{=}O^+H$ ⟶ ketone
- Driving force: oxocarbenium (all octets)
- Pinacol ⟶ pinacolone (3,3-dimethylbutan-2-one)

Pinacol decisions

- 1: OH that gives the best C^+ leaves
- 2: best migrator on the OTHER carbon moves
- C=O on the carbon that kept OH
- Ring diols ⟶ ring expansion

Aptitude & hooks

- H > aryl > 3° > 2° > 1° > CH_3
- p-OMe-aryl > p-Me > Ph > p-Cl > p-NO_2
- "Anti goes to N"
- "Cation first, migrate second"