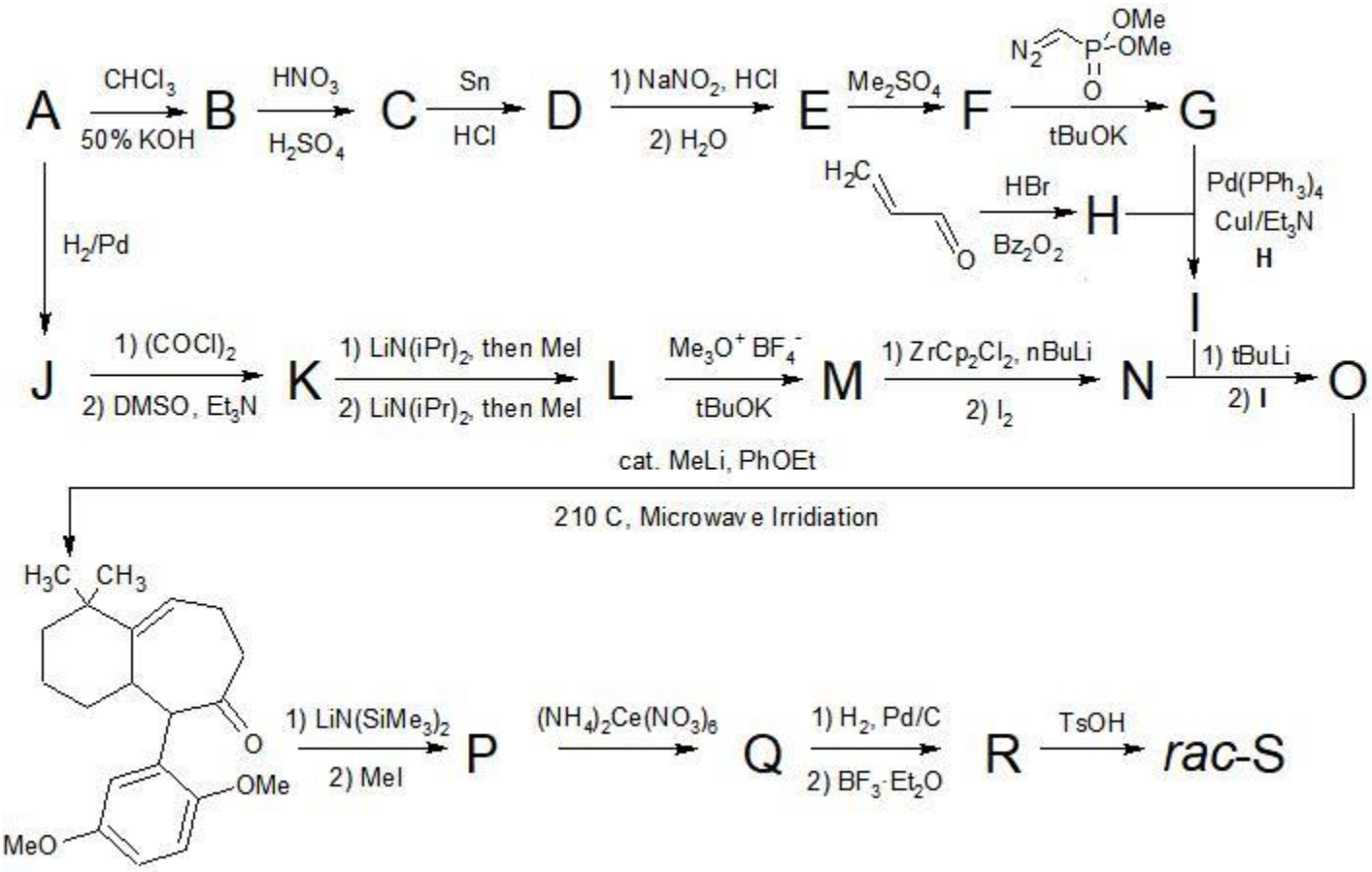
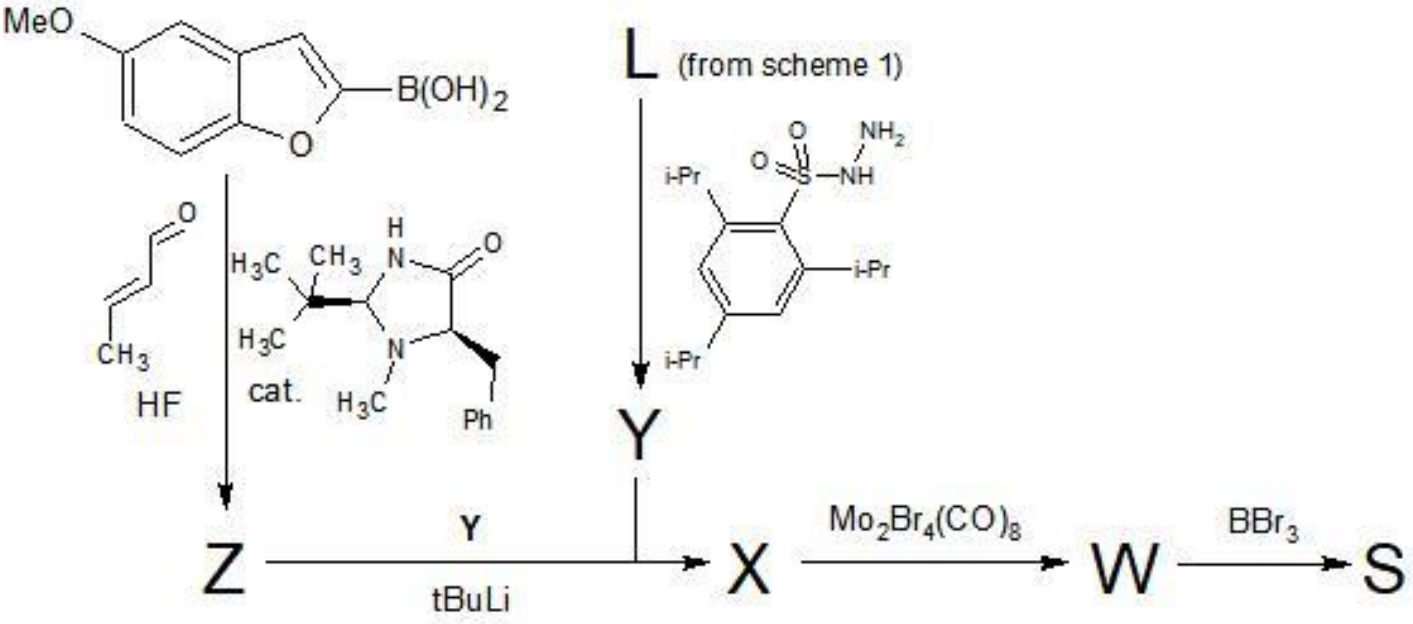
A certain natural product (represented as **S** in the schemes below) can be synthesized racemically as follows:



Cp = -C5H5, Bz = -COPh,

Alternatively, the natural product can be enantioselectively synthesized as follows:



1. Draw the structures of intermediates **A-R** (no stereochemistry required).

Hints:
The formula of **B** is $C_7H_6O_2$.
The formula of **I** is $C_{13}H_{14}O_3$.
The NMR spectrum of **A** is as follows:
13C NMR: 155.02, 129.79, 121.09, 115.48
1H NMR: 7.240 (1H), 6.931 (2H), 6.838 (2H), 5.35 (1H, exchanges with D_2O)

Compound **R** contains 2 aromatic cycles.
rac-**S** is a more stable isomer of Compound **R**.

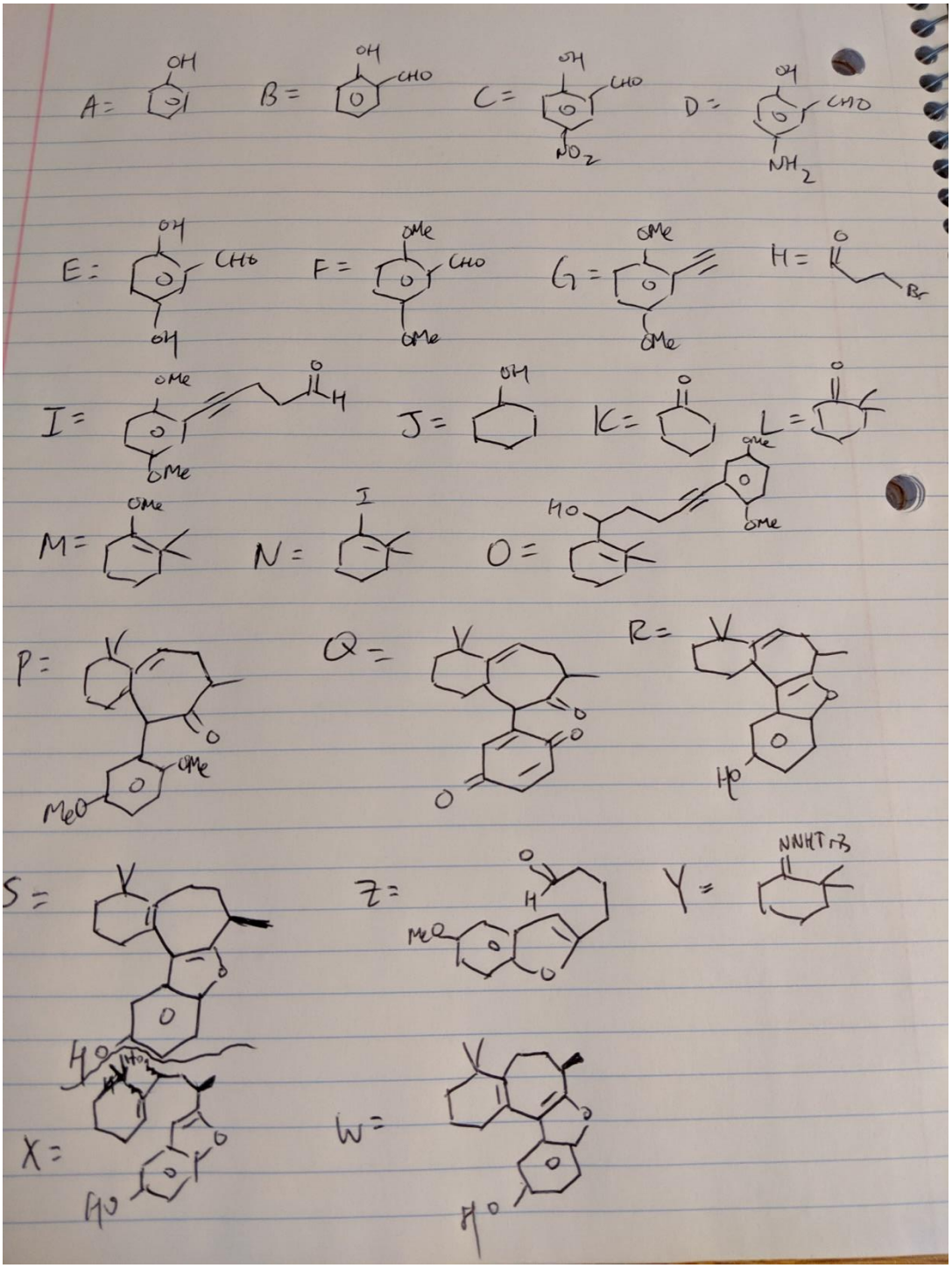
A	**B**	**C**	**D**
E	**F**	**G**	**H**
I	**J**	**K**	**L**
M	**N**	**O**	**P**
Q	**R**	Scratch Work. Nothing written here will be graded.	

2. Draw the structures of **Z**-**W** (with stereochemistry) and **S** (you may draw *rac*-**S** without penalty).

Hints:
Compound **Z** has R configuration.
Compound **W** is tetracyclic and contains two oxygen atoms.

Z	**Y**	**X**
W	**S**	Scratch Work. Nothing written here will be graded.

3. Draw the mechanism of the reaction between **Y** and **Z** that produces **X**. What is this reaction known as?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