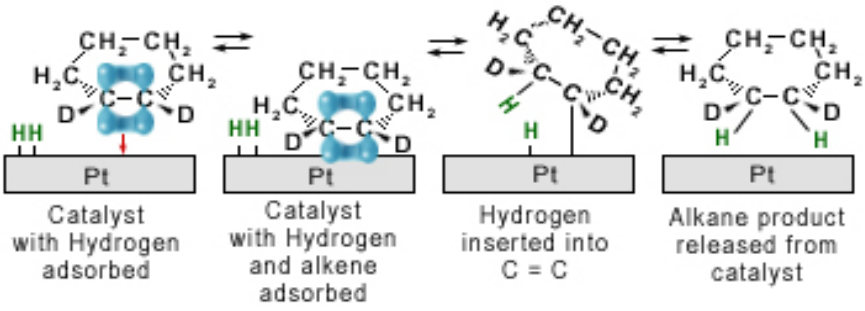
Catalytic Hydrogenation of Alkenes

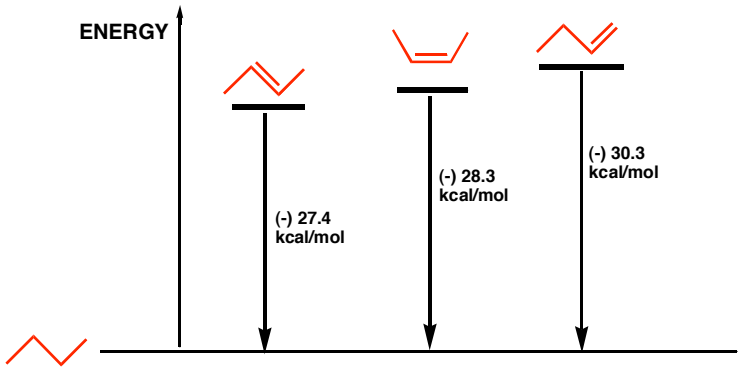


- Alkene + H2 → Alkane

Heterogeneous catalyst Pt, Pd, Ni - finely divided metal
SYN addition of hydrogen

Heat evolved upon catalytic hydrogenation (ΔH^o)
A MEASURE OF ALKENE STABILITY

ALKENE C_4H_8 —H_2/Pd-C→ ALKANE C_4H_{10} ***EXOTHERMIC***

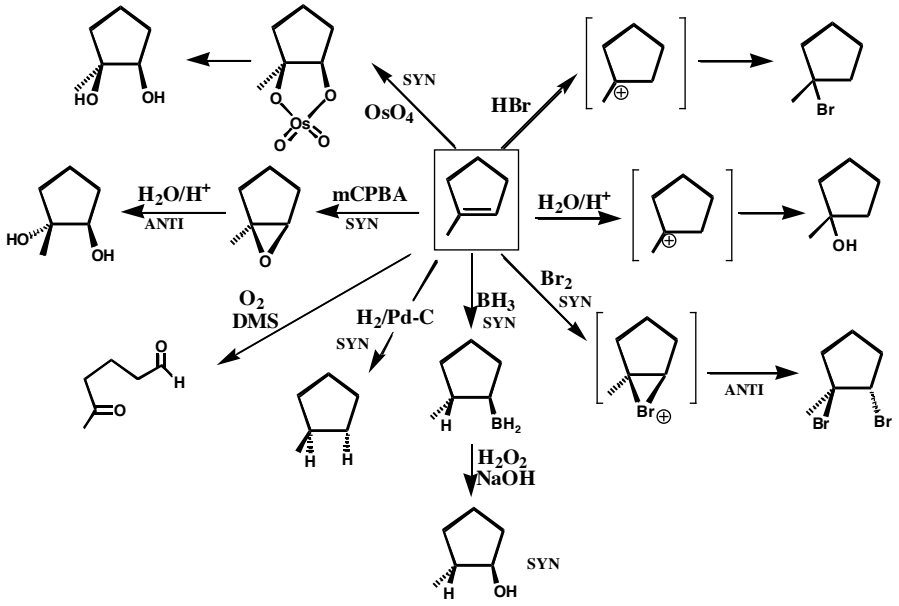


Trans > Cis > Geminal

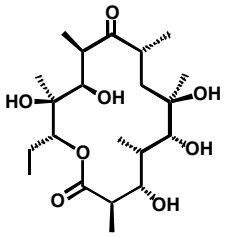
Best to compare compounds that react to form same alkane

SUMMARY OF ALKENE CHEMISTRY

(illustrated with 1-methyl cyclopent-1-ene to emphasize transformation stereochemistry)

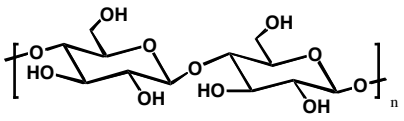


POLYOL NATURAL PRODUCTS

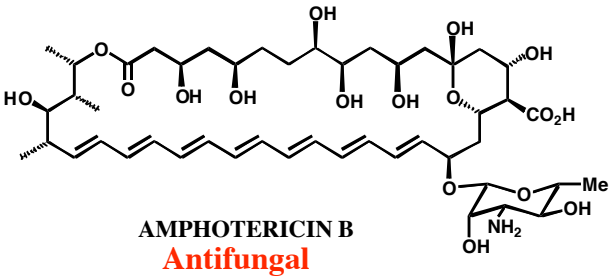


ERYTHRONOLIDE A
(ERYTHROMYCIN A)

Antibiotic



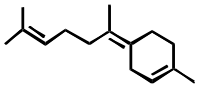
CELLULOSE



AMPHOTERICIN B

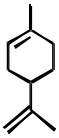
Antifungal

NATURAL PRODUCTS WITH ALKENE FUNCTIONALITY

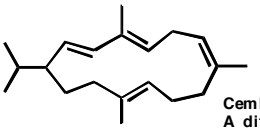


-Bisabolene
A sesquiterpene found in the essential oils of a number of plants

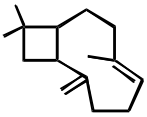
-Pinene



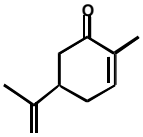
Limonene
A monoterpene common in citrus fruits



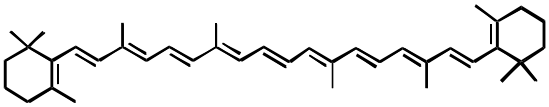
Cembrene
A diterpene from pine needles



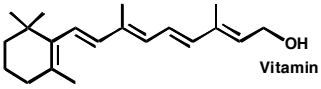
Caryophyllene
A constituent of clove oil



Carvone
Spearmint oil

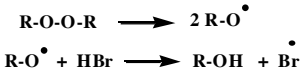


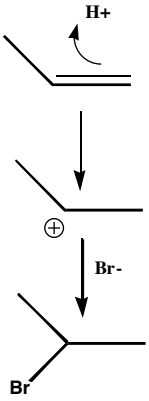
-Carotene (A vitamin)
A tetraterpene bright orange in color and the precursor to the visual pigment retinal



Vitamin A (vision)

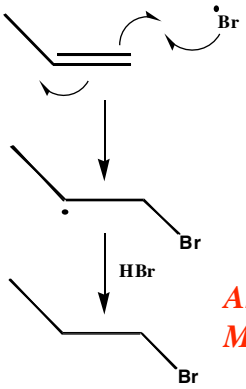
MARKOVNIKOV and ANTI-MARKOVNIKOV ADDITION TO ALKENES





Markovnikov

In the dark, in the absence of peroxides polar solvents to promote formation of polar intermediate.
Most substituted carbonium ion intermediate gives most substituted bromide product



Anti-Markovnikov

In the presence of peroxides and heat or light to promote homolytic cleavage of O-O bond.
Most substituted radical intermediate gives least substituted bromide product

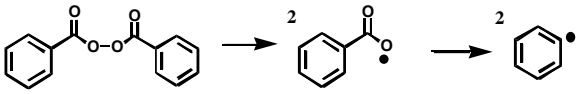
ALKENE POLYMERIZATION - SPECIAL TOPIC

MONOMER	STRUCTURE	POLYMER (trade name)
ethene	$H_2C{=}CH_2$	polyethylene (polythene)
propene	$H_2C{=}CH(CH_3)$	polypropylene
chloroethene (vinyl chloride)	$H_2C{=}CH(Cl)$	PVC (polyvinyl chloride)
acrylonitrile	$H_2C{=}C(H)C{\equiv}N$	Orlon (acrilan)
tetrafluoroethene	$F_2C{=}CF_2$	TEFLON
phenylethene (styrene)	$H_2C{=}C(H)$–Ph	POLYSTYRENE
methylmethacrylate	$CH_2{=}C(Me)C(=O)OMe$	LUCITE (Plexiglass)
1,1-dichloroethene and 1-chloroethene	$H_2C{=}CCl_2$ + $H_2C{=}CHCl$	Random co-polymer SARAN WRAP

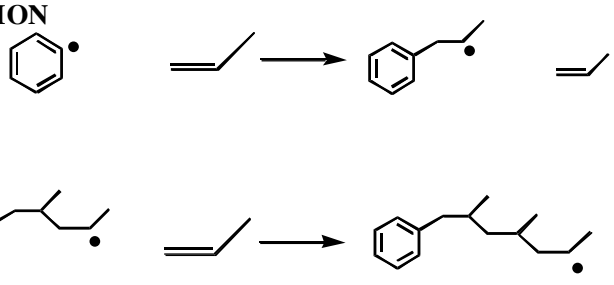
FREE RADICAL POLYMERIZATION

INITIATION, PROPAGATION (POLYMERIZATION) and TERMINATION STEPS

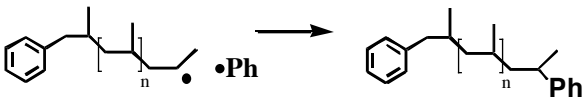
INITIATION



POLYMERIZATION



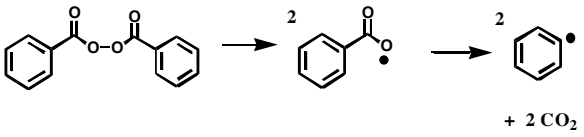
TERMINATION



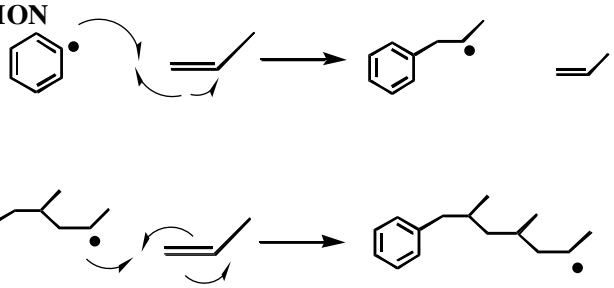
FREE RADICAL POLYMERIZATION

INITIATION, PROPAGATION (POLYMERIZATION) and TERMINATION STEPS

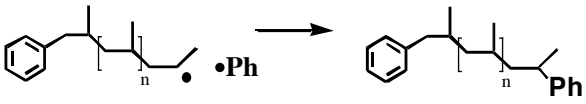
INITIATION



POLYMERIZATION



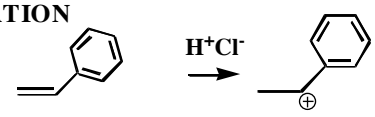
TERMINATION



CATIONIC POLYMERIZATION

INITIATION, PROPAGATION (POLYMERIZATION) and TERMINATION STEPS

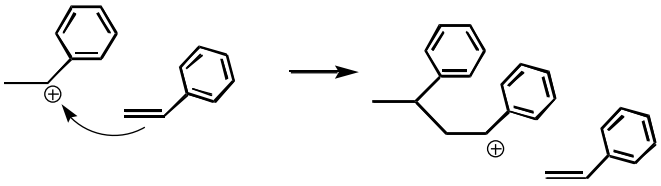
INITIATION



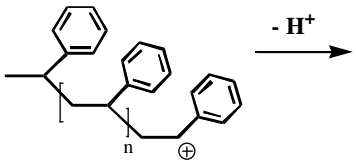
Good monomer for cationic polymerization..Why?

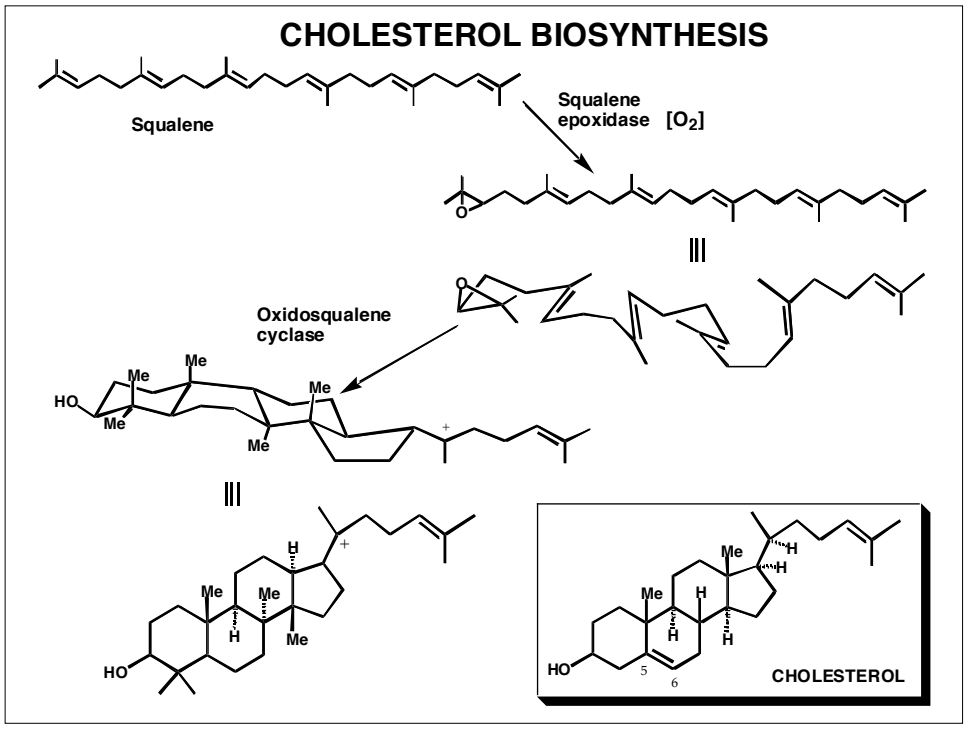
What about tetrafluoroethene?

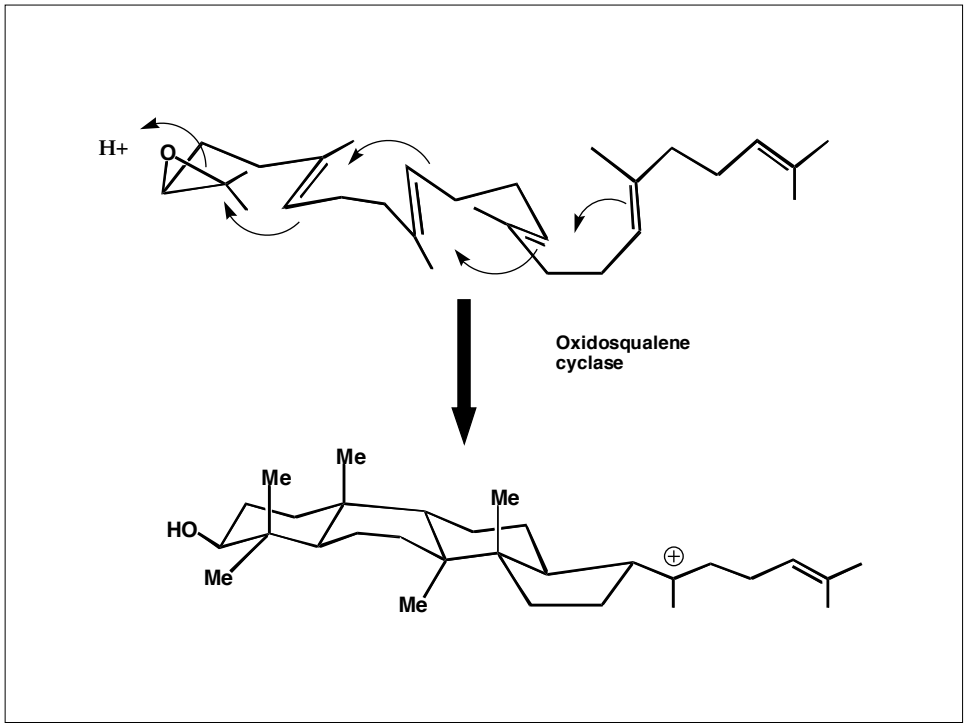
POLYMERIZATION



TERMINATION




CHOLESTEROL BIOSYNTHESIS
Squalene
Squalene epoxidase [O2]
Oxidosqualene cyclase
HO
Me
H
CHOLESTEROL


H+
O
Oxidosqualene cyclase
HO
Me