E/Z Assignments

1) Assign the following alkenes with *E* or *Z* alkene geometry.

E   E   Z   E
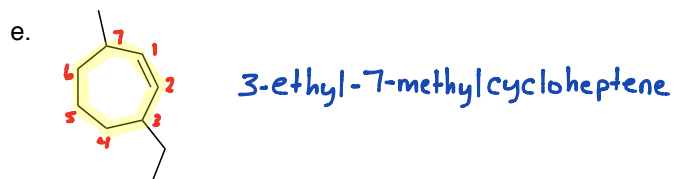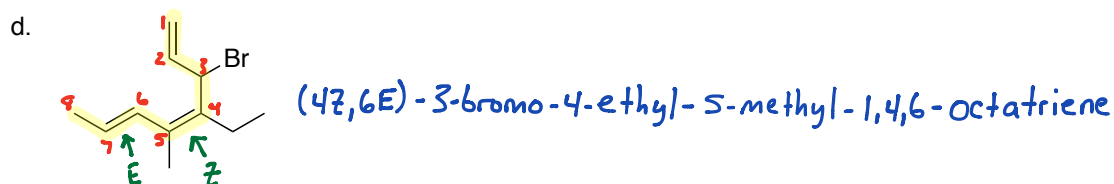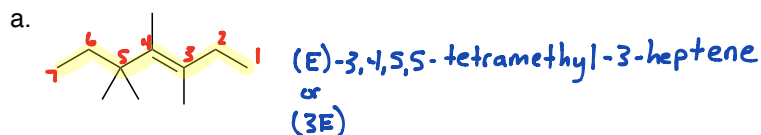
N/A   E
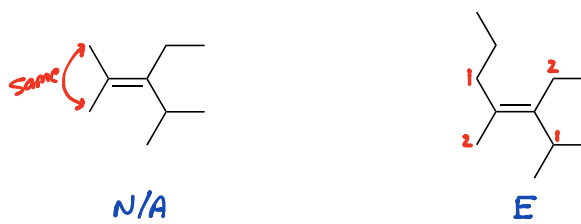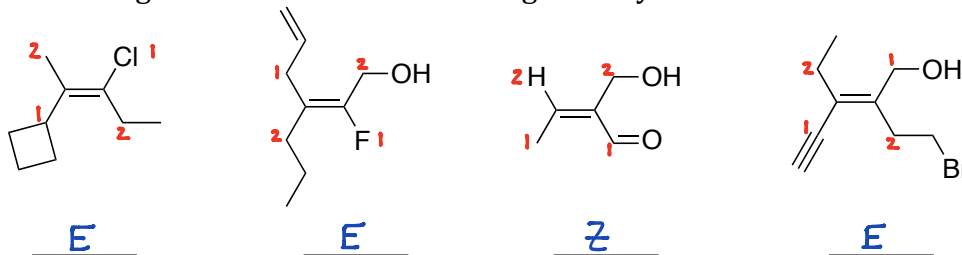
Naming Alkenes

2) Generate an IUPAC systematic name for the following compounds.

a.

(E)-3,4,5,5-tetramethyl-3-heptene
or
(3E)

b.

3-chloro-1-ethylcyclohexene

c.

3-cyclopropyl-5-propylcyclopentene

d.

(4Z,6E)-3-bromo-4-ethyl-5-methyl-1,4,6-octatriene

e.

3-ethyl-7-methylcycloheptene

Because the Chiral Centers do not have 3D shown (✏/ıııı) it is not possible to assign any R/S Configurations.

Degrees of Unsaturation

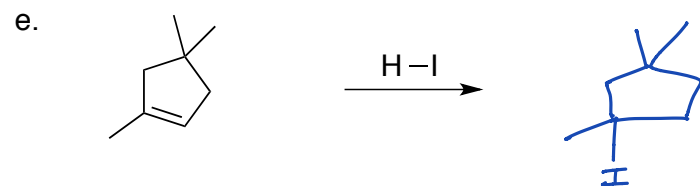3) Determine the degrees of unsaturation in the following compounds.
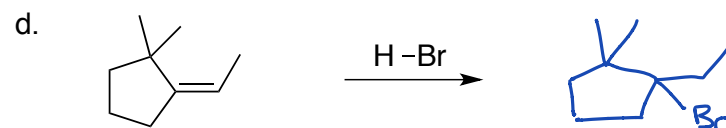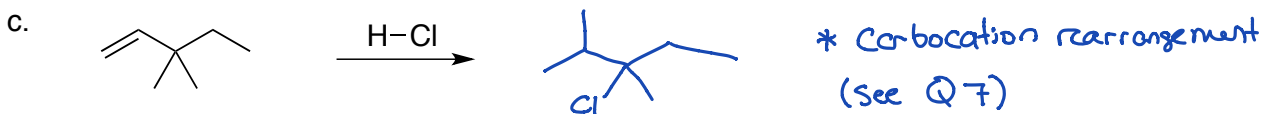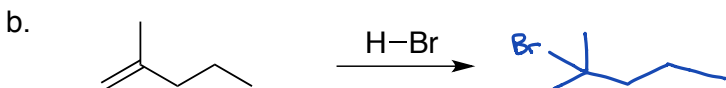

  3 ___   4 ___   3 ___   6 ___   5 ___
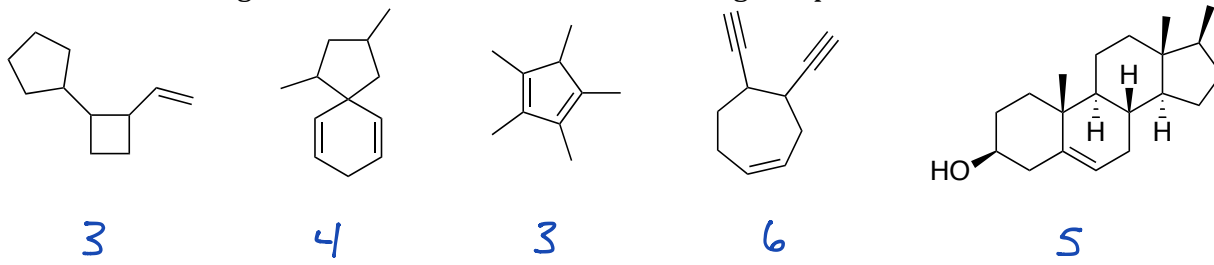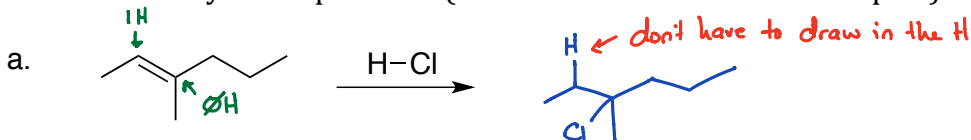
4) From the molecular formulas provided, determine the degrees of unsaturation.

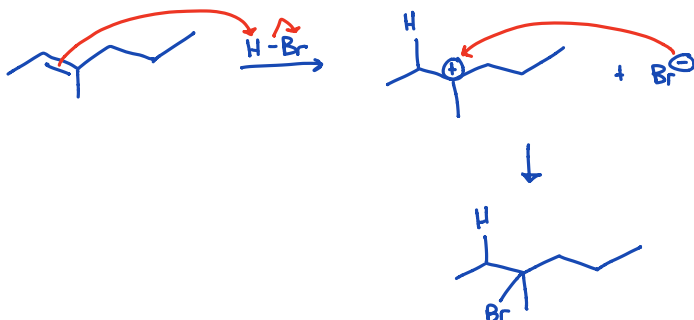| C_2H_2 $2(2)+2=6$	C_6H_6 $2(6)+2=14$	C_8H_{18} $2(8)+2=18$	$C_{40}H_{56}$ $2(40)+2=82$	C_6H_8 $2(6)+2=14$	C_3H_4 $2(3)+2=8$
$(6-2)/2 = ②$	$(14-6)/2 = ④$	$(18-18)/2 = ⓪$	$(82-56)/2 = ⑬$	$(14-8)/2 = ③$	$(8-4)/2 = ②$
$C_6H_{11}\underline{Br}$ $2(6)+2=14$	$C_4H_7\underline{NO}$ $2(4)+2=10$	$C_6\underline{Br}_3\underline{Cl}_3$ $2(6)+2=14$	$C_7H_{17}\underline{N}$ $2(7)+2=16$	$C_4H_8\underline{S}$ $2(4)+2=10$	$C_4\underline{F}_6$ $2(4)+2=10$
$(14-11-1)/2 = ①$	$(10-7+1)/2 = ②$	$(14-6)/2 = ④$	$(16-17+1)/2 = ⓪$	$(10-8)/2 = ①$	$(10-6)/2 = ②$

$$\#unsat = \frac{2(\#C)+2 - \#H - \#X + \#N}{2}$$ Ignore IIA elements such as O + S
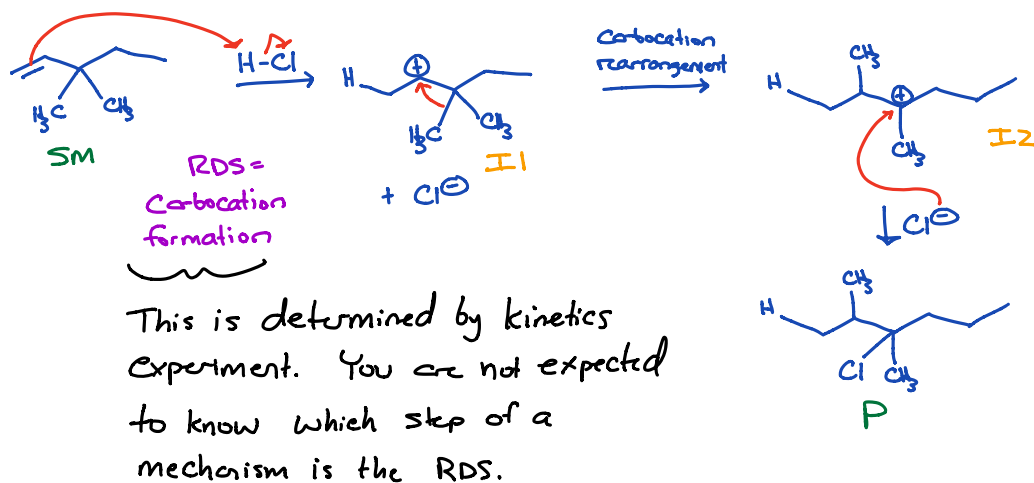
Addition of HX To Alkenes

5) Predict the products for each of the following reactions. For now, don't worry about drawing stereochemistry in the products (we will deal with that next chapter)..

a.

H–Cl
← don't have to draw in the H

b.

H–Br

c.

H–Cl
* Carbocation rearrangement (see Q7)
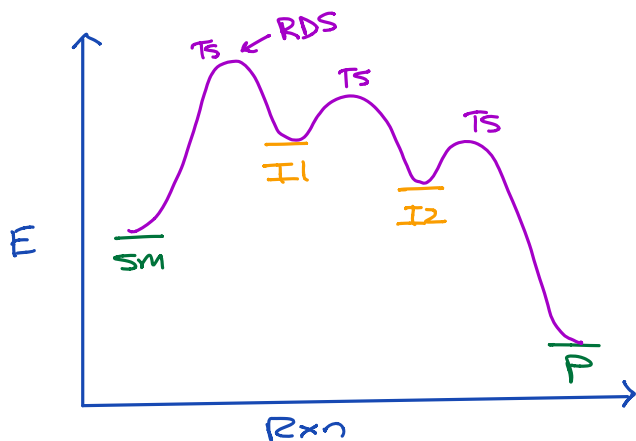
d.

H–Br

e.

H–I

6) Show the full arrow pushing mechanism for the reaction in **part a** (above).

7) Show the full arrow pushing mechanism for the reaction in **part c** (above).

This is determined by kinetics experiment. You are not expected to know which step of a mechanism is the RDS.
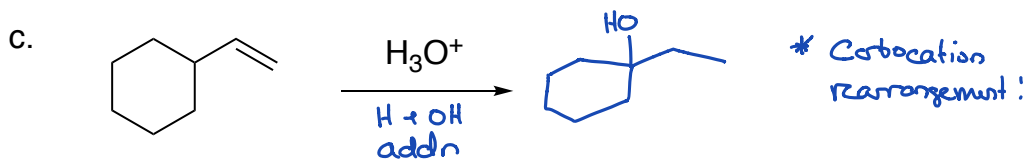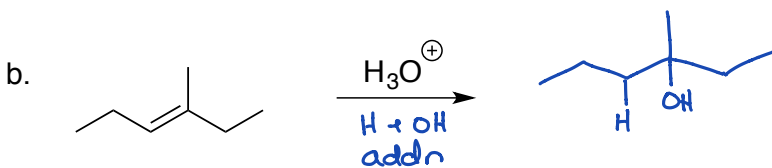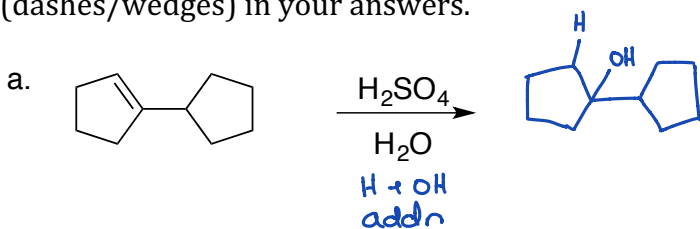
8) Draw a simple energy diagram for the reaction in **part c**. Label your starting material, product, and each intermediate.
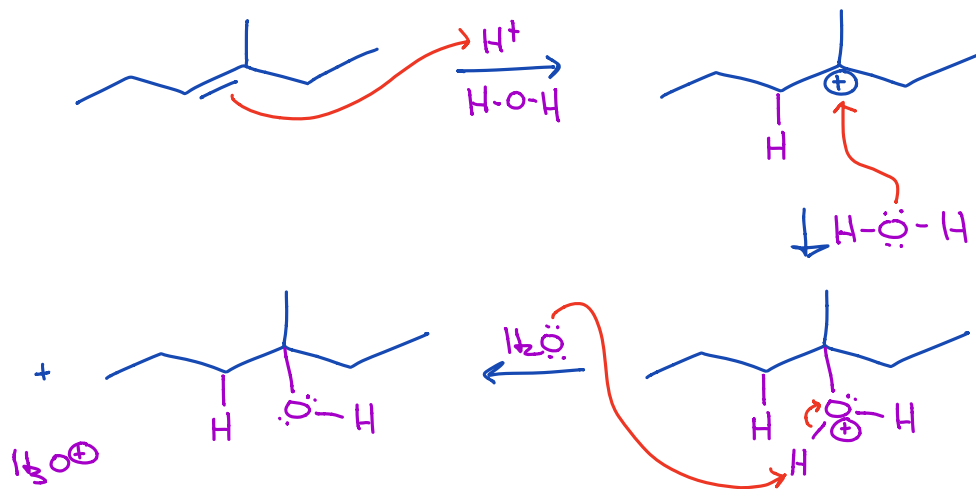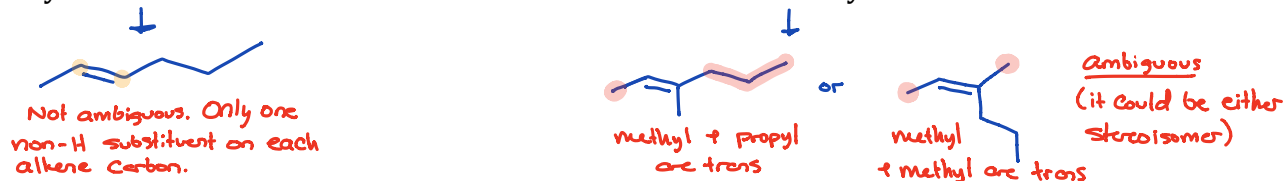
Addition of H⁺ and H₂O to Alkenes

9) Predict the products for each of the following reactions. You do not need to include 3D (dashes/wedges) in your answers.

a.
$$\frac{H_2SO_4}{H_2O}$$
H + OH
addn

b.
$$H_3O^{\oplus}$$
H + OH
addn

c.
$$H_3O^+$$
H + OH
addn

* Carbocation rearrangement!

10) Show the full arrow pushing mechanism for the reaction in part b (above).

H⁺
H-O-H

H-Ö-H

H₂Ö

H₃O⊕

11) Explain why *trans*-2-hexene is a valid IUPAC name while *trans*-3-methyl-2-hexene is not.

Not ambiguous. Only one non-H substituent on each alkene carbon.

or

methyl + propyl are trans

methyl + methyl are trans

ambiguous (it could be either stereoisomer)

12) Draw the structure of (3*E*,6*R*,7*Z*)-6-chloro-3,8-dimethyl-1,3,7-decatriene