Hour Exam #1 (PM)
Chemistry 343
Professor Gellman
8 October 2012

Last Name Answer

First Name key

General Instructions:

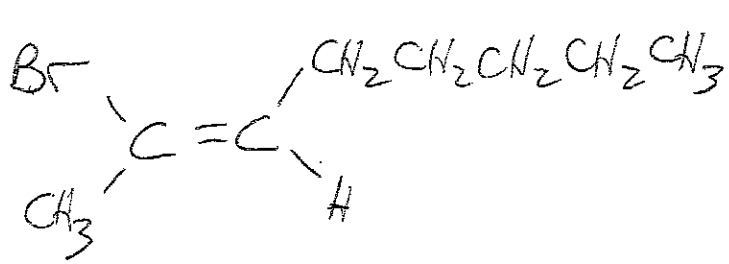
(i) Use scratch paper at back of exam to work out answers; final answers must be recorded at the proper place on the exam itself for credit. Models are allowed.

(ii) Print your name on each page.

(iii) Please keep your paper covered and your eyes on your own work. Misconduct will lead to failure in the course.

1. (10 points) Draw a structure that corresponds to each of the following names. Show all atoms in each structure, including hydrogen atoms.

(a) Z-2-bromo-2-octene

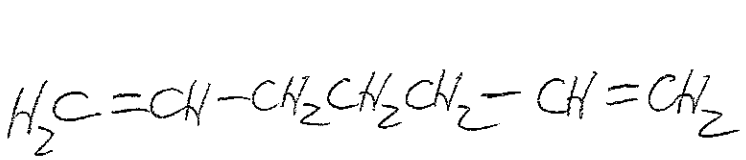


+5

if its E instead +3

if some C are not written in -1

(b) 1,6-heptadiene

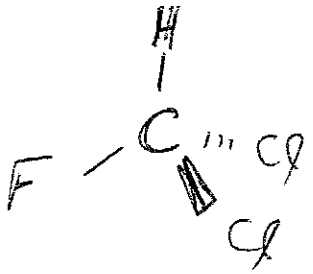


+5

Name PM

2. (16 points) $CFCl_3$ was one of the first widely-used refrigerants, but it is very harmful to Earth's ozone layer. Therefore, this compound was replaced by $CHFCl_2$, which is less destructive to the ozone layer; however, $CHFCl_2$ is now in disfavor because it has a strong greenhouse effect (causes global warming). Answer the questions below.

(a) Provide a drawing of $CHFCl_2$ that indicates the three-dimensional structure.



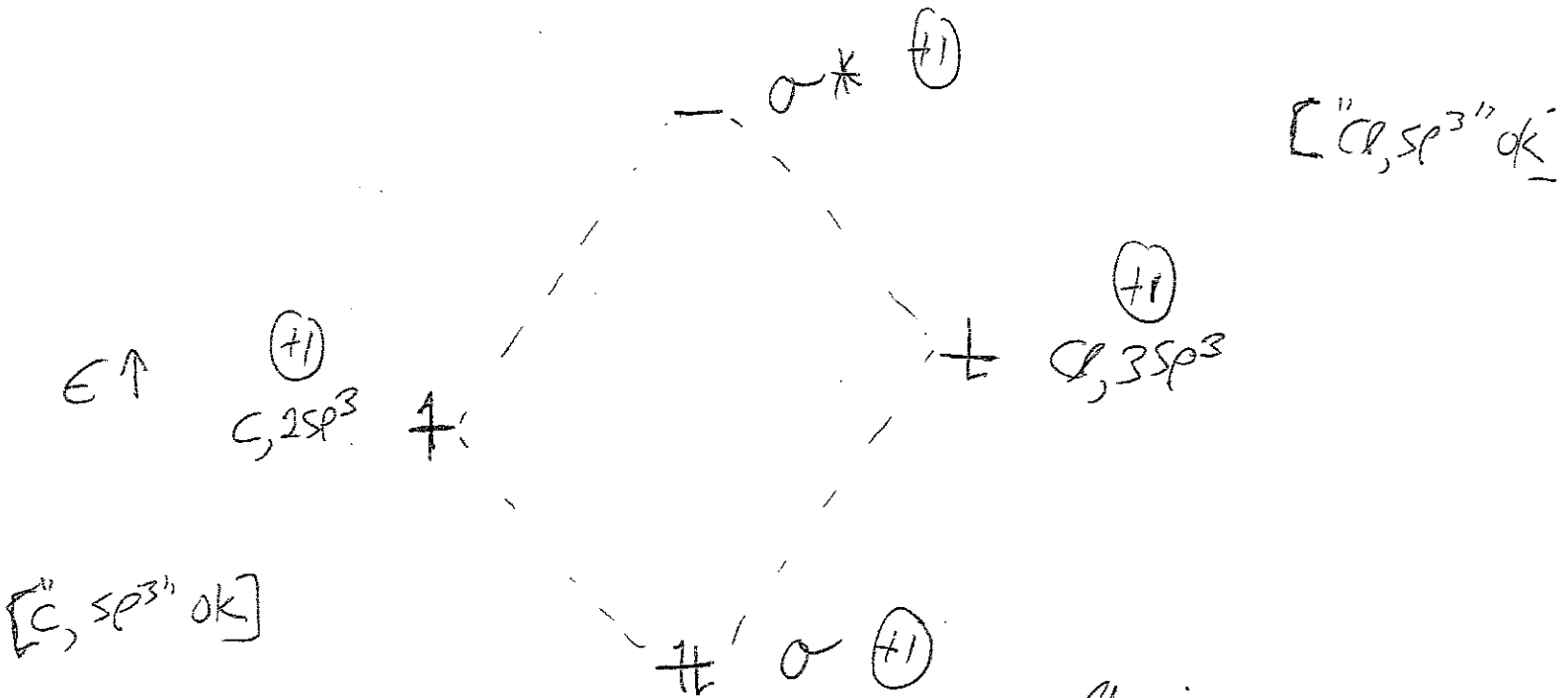
+4

(b) Indicate the F-C-Cl bond angle (approximation) in the box.

~109°

+4

(c) Provide an energy diagram that shows how the relevant atomic orbitals combine to form the molecular orbitals of one C-Cl bond, and where the bonding electrons are expected to reside. Assume that Cl is sp3 hybridized.



Atomic orbital

Molecular orbitals

Atomic orbital

Total for 2c = +8

2e⁻'s in σ = +2

σ is lowest = +2

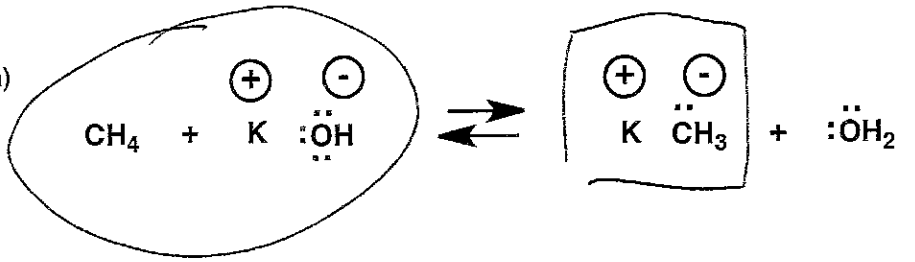
Name PM

3. (12 points) For each equilibrium shown below, do two things:

(i) Put a SQUARE around the STRONGER BASE, of the two species that are serving as bases in the equlibrium.

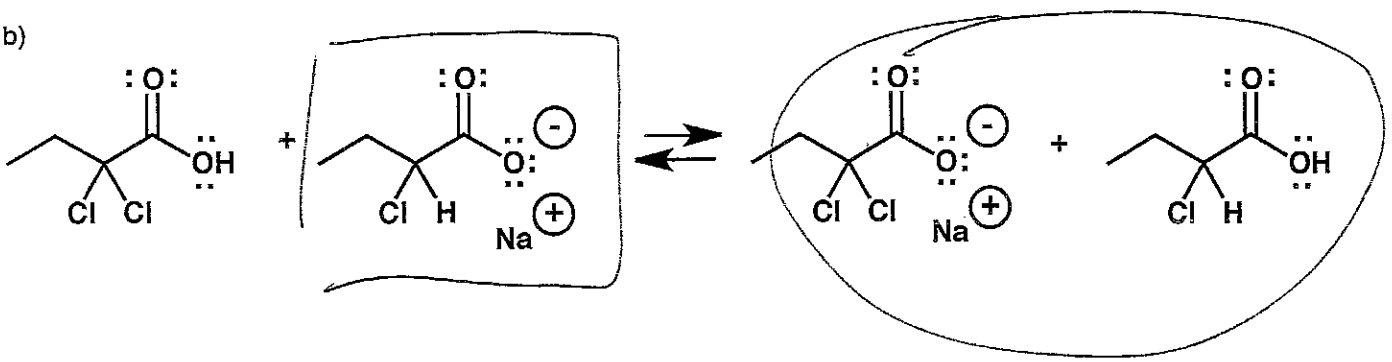
(ii) Put a CIRCLE around the SIDE of the equilibrium that you expect to be MORE FAVORED.

(a)

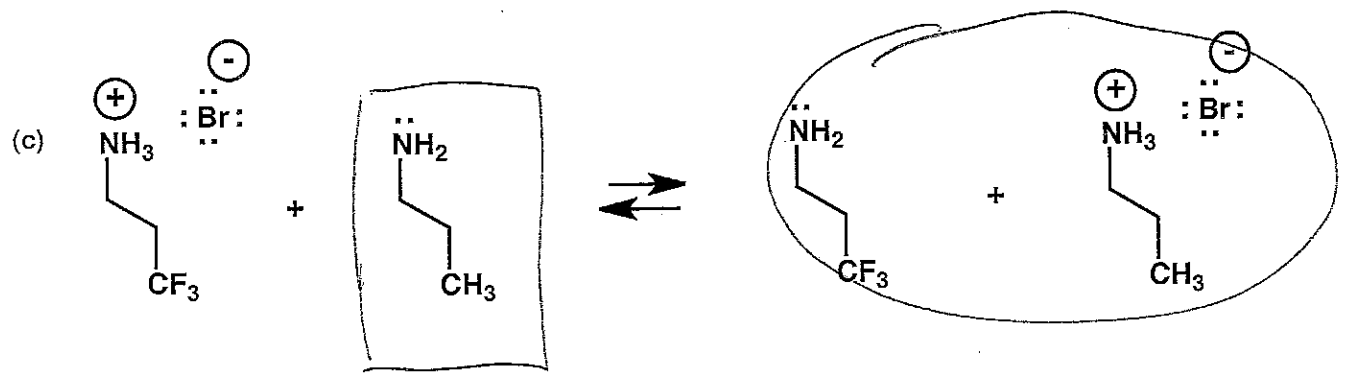


+2 for each correct circle & square

(b)



(c)



Name PM

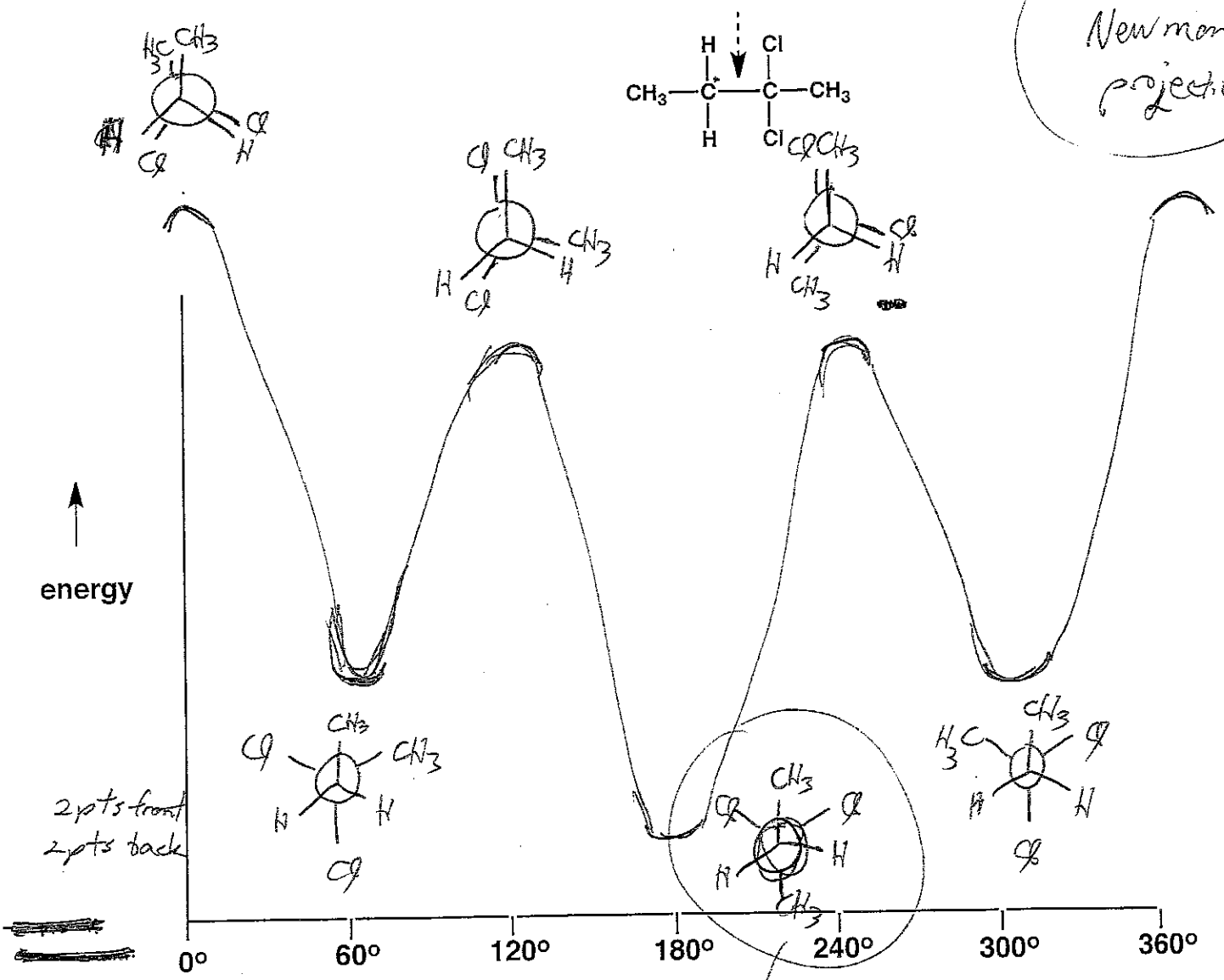
4. (25 points)

(a) Draw the energy diagram for rotation about the indicated carbon-carbon bond (dotted arrow) of the molecule shown below. Draw appropriate chemical structures for each minimum and each maximum in the energy function.

CIRCLE the most stable structure(s).

NOTE: A methyl group is larger (causes more steric repulsion) than a Cl atom.

+4 for each correct Newman projection



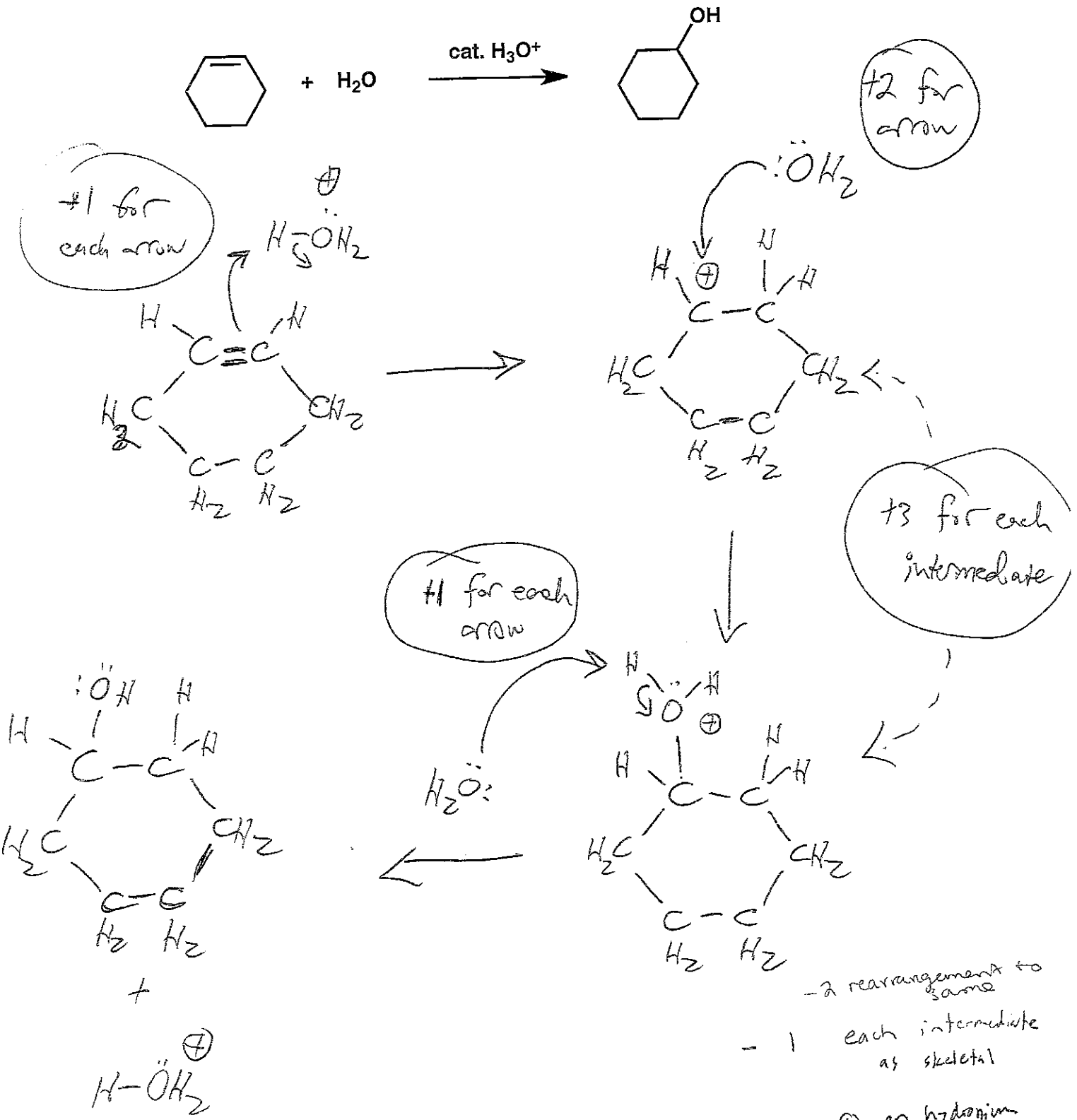
2 pts front
2 pts back

- 2 pts for incorrect en. placement (min vs max)

Most stable +1

Name PM

5. (12 points) Provide a mechanism ("curved arrows") for the reaction shown below. You do not have to account for the way that H_3O^+ is formed. Show every atom in each structure you draw.



-2 rearrangement to same

-1 each intermediate as skeletal

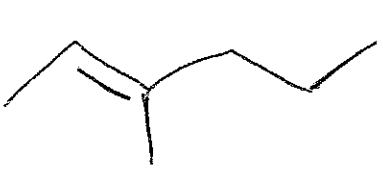
-1 no ⊕ on hydronium

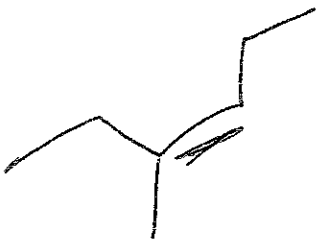
• no points awarded after $^{\ominus}OH$ attacks / formation

Name PM

6. (25 points)

Draw FIVE isomers with the formula C_7H_{14} that would ALL give the same major product upon reaction with HCl (without any rearrangement) and that would ALL generate 3-methylhexane upon reaction with H_2 and Pd/C.





+5 for each correct structure