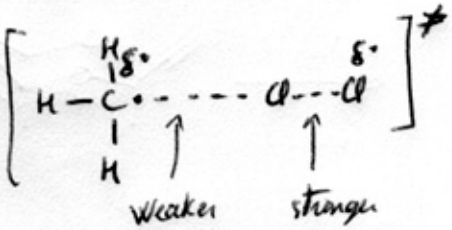
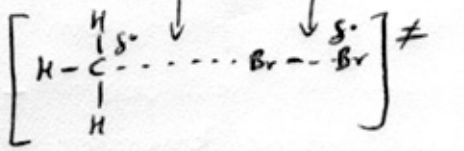
# Answer Key Homework #2:



a) 


The second step is highly exothermic. The Transition state resembles ~~the~~ reactants. The Cl-Cl bond will be slightly stretched and Cl-$CH_3$ bond will start to form.

b) 


same thing than above.

$\Delta H^\circ_{Cl} = -26$ Kcal/mole.
$\Delta H^\circ_{Br} = -24$ Kcal/mole.

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a) initiation:

$Br_2 \xrightarrow{h\nu} Br\cdot + Br\cdot$ +46 Kcal/mole

propagation:

$Br\cdot + Bu_2SnH \longrightarrow Bu_2Sn\cdot + HBr$ +74 − 88 = −14 Kcal/mole.

$Bu_2Sn\cdot + phBr \longrightarrow Bu_2SnBr + ph\cdot$ +68 −132 = −64 Kcal/mole

$ph\cdot + Bu_2SnH \longrightarrow phH + Bu_2Sn\cdot$ +74 − 95 = −21 Kcal/mole.

a) homolytic Cleavage = $Cl_2 \longrightarrow 2\,Cl\cdot$

carbocation =

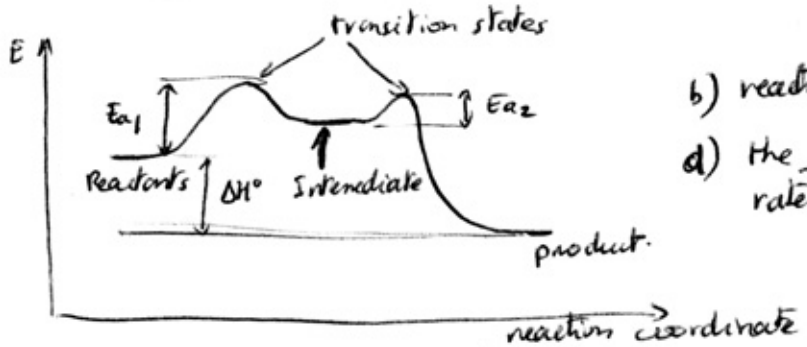
heterolytic cleavage =

free radical =

carbanion =

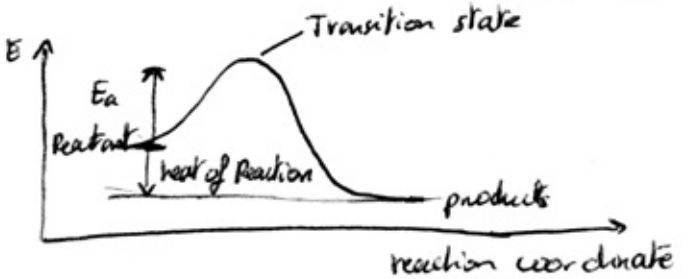
Read book.

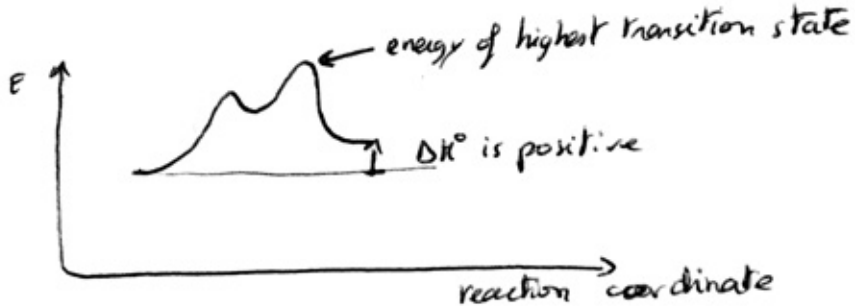
a)



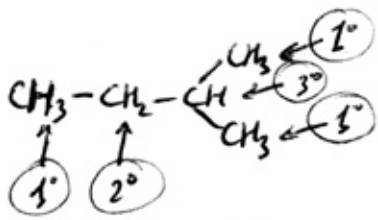

b) reaction is exothermic, $\Delta H^\circ$ is negative

d) the first transition state determine the rate since it is the highest energy point.

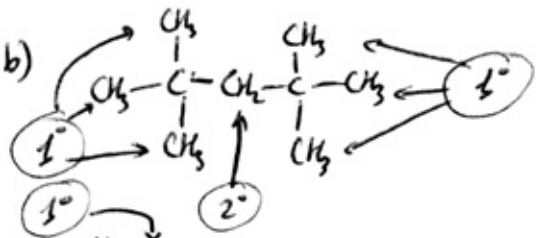


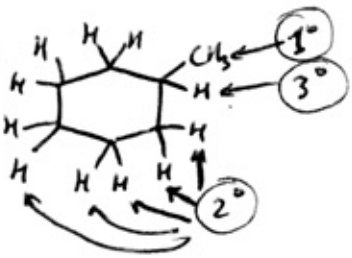

a)



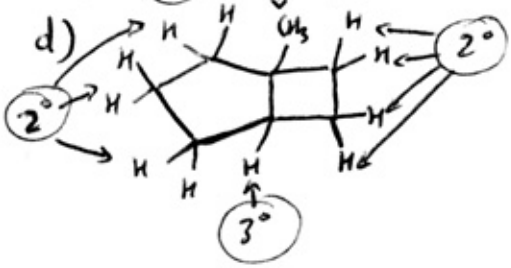

b)



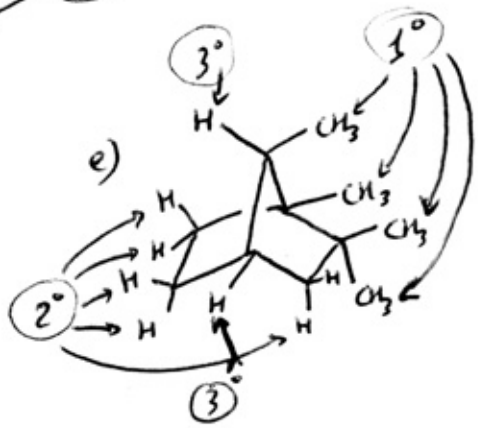

c)




d)




e)




a) break $H-CH_2CH_3$ and $I-I$, make $I-CH_2CH_3$ and $H-I$

Kcal/mole: $(\underline{+98} + \underline{+36}) + (\underline{-53} + \underline{-71}) = +10$ kcal/mole.

b) break $CH_3CH_2-Cl$ and $H-I$, make $CH_3-CH_2-I$ and $H-Cl$

Kcal/mole: $(\underline{+81} + \underline{+71}) + (\underline{-53} + \underline{-103}) = -4$ kcal/mole.

c) break $(CH_3)_3C-OH$ and $H-Cl$, make $(CH_3)_3C-Cl$ and $H-OH$

Kcal/mole: $(\underline{+91} + \underline{+103}) + (\underline{-79} + -119) = -4$ kcal/mole

d) break $CH_3CH_2-CH_3$ and $H-H$, make $CH_3CH_2-H$ and $H-CH_3$

kcal/mole : $(\underline{+85} + \underline{+104}) + (\underline{-98} + \underline{-104}) = -13$ kcal/mole

e) break $CH_3CH_2-OH$ and $H-Br$, make $CH_3-CH_2-Br$ and $H-OH$

kcal/mole : $(\underline{+91} + +88) + (\underline{-68} + \underline{-119}) = -8$ kcal/mole

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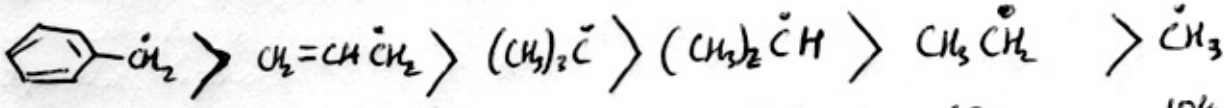
Ranking:



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Bond dissociation energies (kcal/mol) | 85 | 87 | 91 | 95 | 98 | 104 | kcal/mole |
| | 356 | 364 | 381 | 397 | 410 | 435 | kJ/mole |

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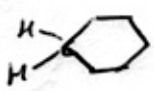
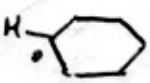
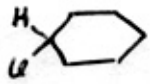
Initiation: [ (1) $Cl-Cl \xrightarrow{h\nu} 2\,Cl\cdot$

propagation [ (2) $Cl\cdot$ +  $\longrightarrow H-Cl$ + 

(3) $Cl-Cl$ +  $\longrightarrow Cl\cdot$ + 

Termination [ any two radicals combining.

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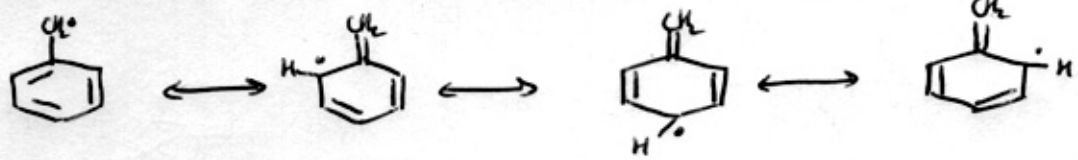
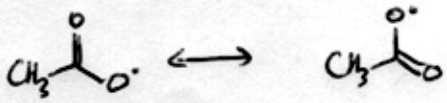
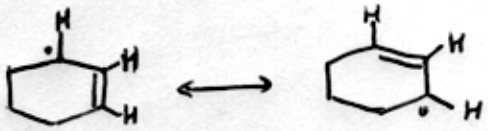
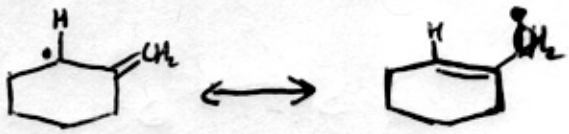
a) $CH_2=CH-\dot{C}H_2 \longleftrightarrow \dot{C}H_2-CH=CH_2$

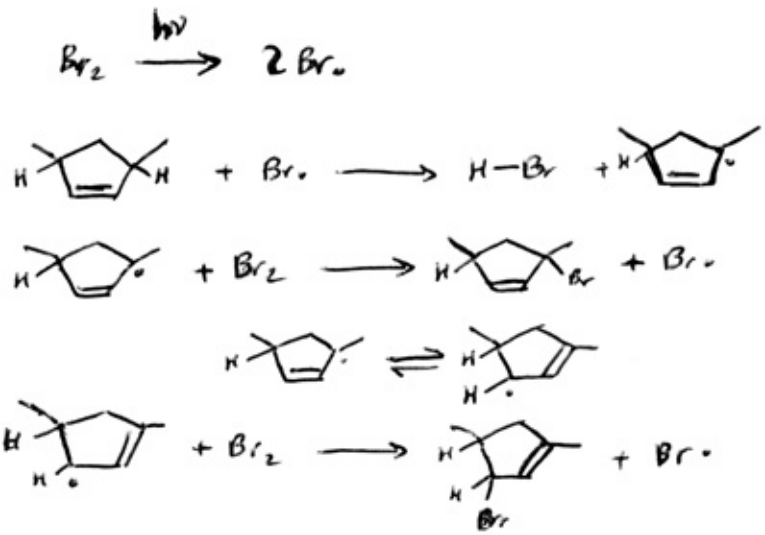
b) 

c) 

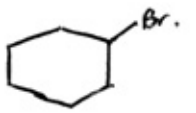
d) 

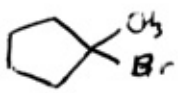
e) 

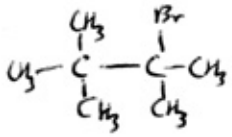
a)

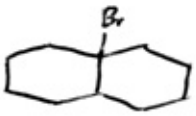


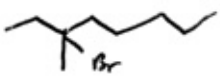
b) 3° abstract faster

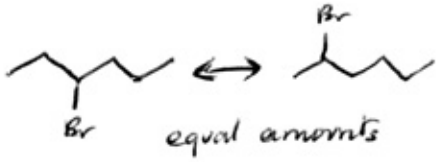
a) 

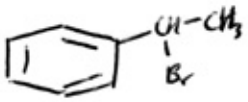
b) 

c) 

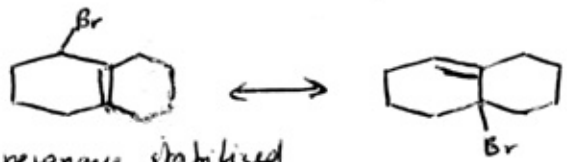
d) 

e) 

f) 

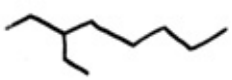

g) 

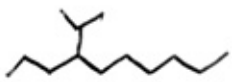
resonance stabilized radical

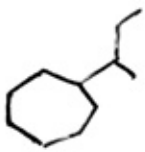
h) 

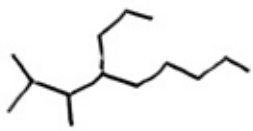
resonance stabilized radical

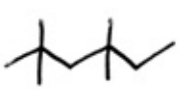
structures:

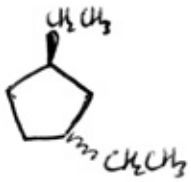
a) 

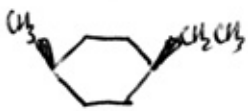
b) 

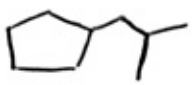
c) 

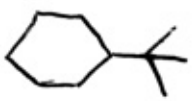
d) 

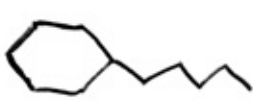
e) 

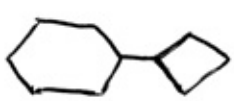
f) 

g) 

h) 

i) 

j) 

k) 

l) 

## IUPAC Names:

a) 3-ethyl-2,2,6-trimethylheptane.
b) 3-ethyl-2,6,7-trimethyloctane.
c) 3,7-diethyl-2,2,8-trimethyldecane.
d) 2-ethyl-1,1-dimethylcyclobutane.
e) bicyclo[4.1.0] heptane.
f) cis-1-ethyl-3-n-propylcyclopentane.
g) (1,1-diethylpropyl) cyclohexane.
h) cis-1-ethyl-4-isopropylcyclodecane.

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## higher boiling point:

a) n-Octane has higher boiling point. because linear molecules boil higher than branched one when same molecular weight.
b) 2-Methylnonane has higher b.p. because of higher molecular weight.
c) n-Nonane boils higher. same as in (a).

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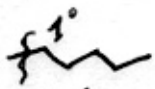
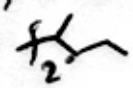
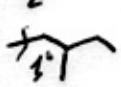
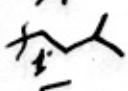
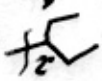
a) n-pentyl 

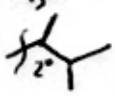
1-methylbutyl 

2-methylbutyl 

3-methylbutyl 

1-ethylpropyl 

1,1-dimethylpropyl 

1,2-dimethylpropyl 

2,2-dimethylpropyl 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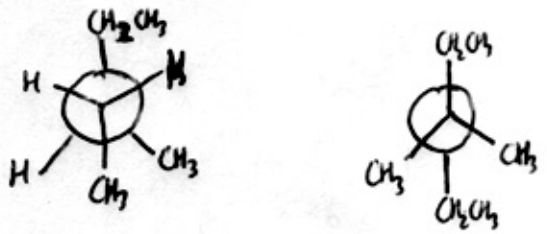
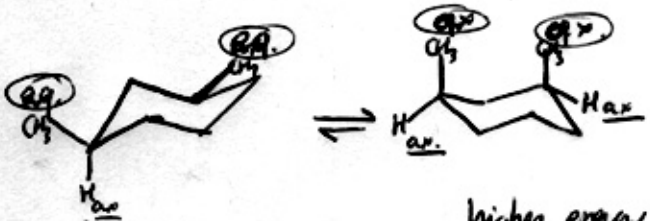
## Newman projection:

a) 

b)




lowest energy
more stable

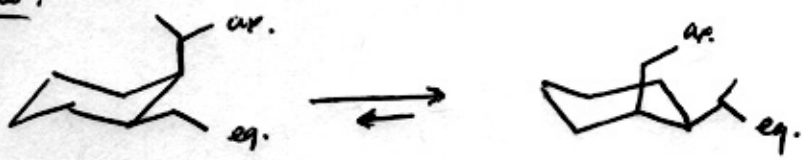
higher energy

c) each gauche interaction raises the energy by 0.9 kcal mole
each axial methyl has two gauche interactions
so energy = 2 methyls × 2 × 0.9 = 3.6 kcal/mole

d) 1,3 diaxial interaction ~~&~~ strain is the difference between the total energy and the energy due to gauche interactions : 5.4 − 3.6 = 1.8 kcal/mole

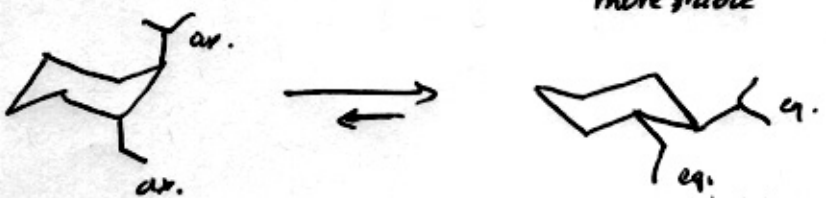
→ Draw :

a)



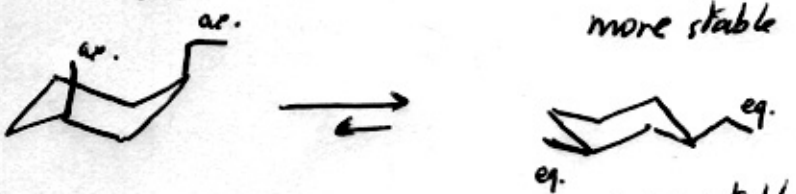

more stable

b)



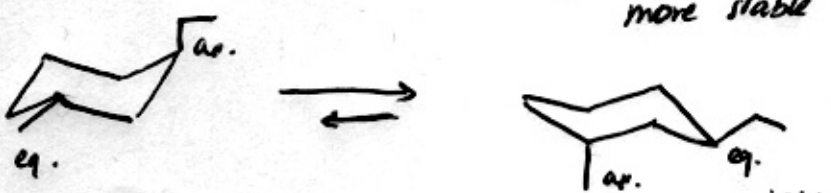

more stable

c)



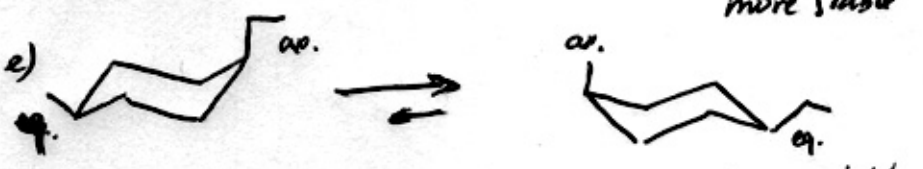

more stable

d)

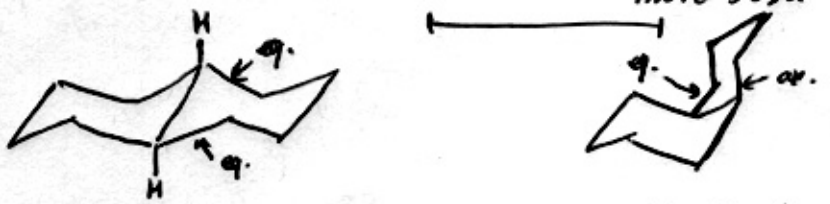



more stable

e)




more stable




trans decalin.
more stable : No axial substituents

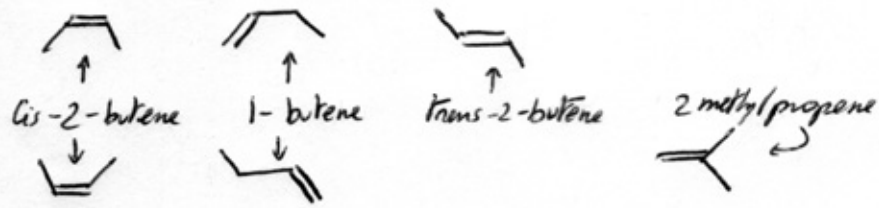
cis decalin
one axial substituent.

most stable conformer has all substituent equatorial

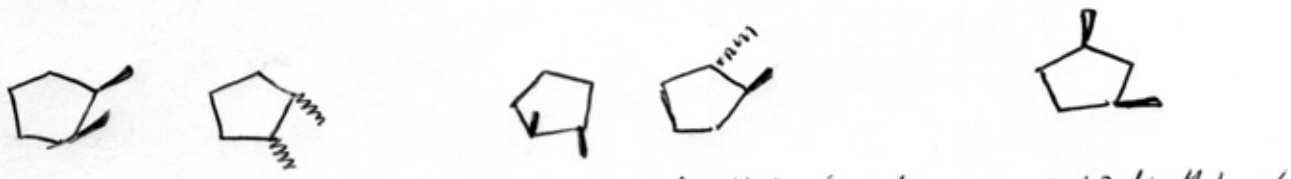

glucose

a) all are butane except the structure in the middle (third) which is 2-methyl-propane.

b)

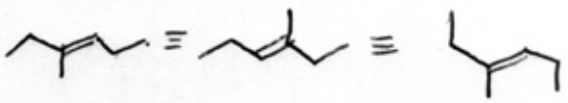



c)

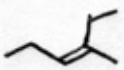


cis-1,2-dimethyl cyclopentane  trans-1,2 dimethyl cyclopentane  cis-1,3 dimethyl cyclo pentane

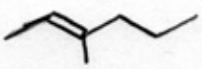
d)



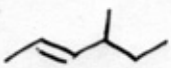
Z-3 methyl-3-hexene



E-3 methyl-3-hexene

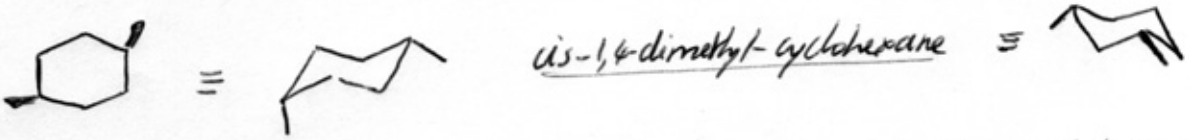


Z-3 methyl-2-hexene

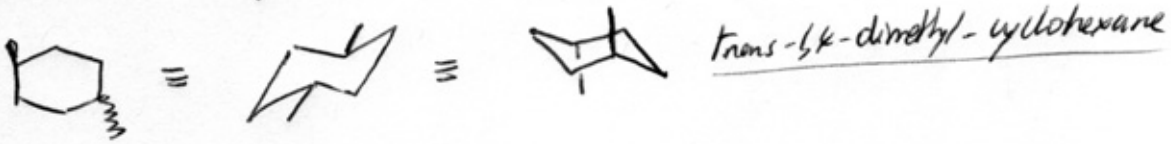


trans-4-methyl-2-hexene

e)



cis-1,4-dimethyl-cyclohexane



trans-1,4-dimethyl-cyclohexane