Fall 19: Organic 1 Exam 1 Ch 1-4 50 points

Name _____

If you do NOT want your graded exam placed in the box outside my office, then please check here____

1-10 Are True/False (10pts)

1) The Periodic Table has the elements listed in alphabetical order.

2) A σ covalent bond places electron density along the internuclear axis.

3) Lithium (Li) has a larger atomic radius than Beryllium (Be).

4) Nitrogen is more electronegative than Carbon.

5) All single covalent bonds are σ bonds.

6) The electron configuration of Lithium is $1s^2\ 2s^1$.

7) Carbon has 6 total electrons but only 4 valence electrons.

8) Cyclopentane has more ring strain than cyclopropane.

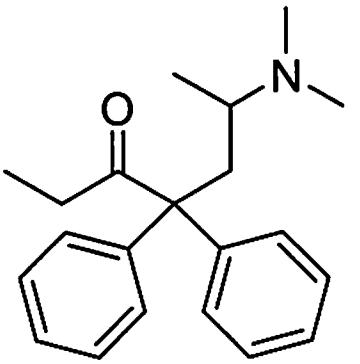
9) An sp^2 hybridized atom has one unhybridized p orbital.

10) Selenium (Se) is one of the noble gases.

11) How many lone pairs are on each of these chemical species? (2pts)

(a) N_2 (b) $BF_4^{\ominus}$

12) The molecule below is *Methadone*. It is used as a pain reliever, and as part of drug addiction detoxification and maintenance programs. Methadone can reduce withdrawal symptoms in people addicted to heroin or other narcotic drugs without causing the "high" associated with the drug addiction. For this molecule, drawn in line angle (stick figure) representation, calculate: (7pts)



The number of Carbon atoms.

The number of Hydrogen atoms.

The number of π covalent bonds.

The number of sp^2 hybridized Carbons.

The number of Halogens.

The hybridization of the Nitrogen.

The C-N-C bond angle.

13) What two factors contribute to the *ring strain* of a cycloalkane? (2pts)

14) (1+1+3=5pts) In a *free radical chain mechanism* process, there are three distinct steps that are called Initiation, Propagation and Termination steps.
a) What is required to occur in an *Initiation* step?

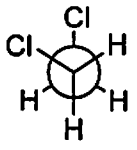
b) What must (or *must not*) happen in a *Termination* step?

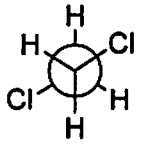
c) Using "fish hook" (single barb) arrows (which indicate the movement of ONE electron), draw the mechanism for this Propagation step.

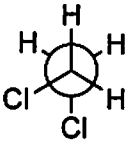
$Br\bullet \quad H{-}CH_2CH_3 \quad \rightarrow \quad Br{-}H \quad \bullet CH_2CH_3$

15) Circle the *most stable* member of each threesome. (4pts)

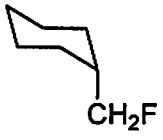
(a)

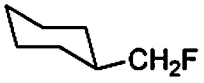


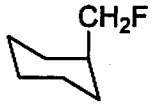




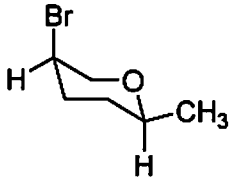
(b)

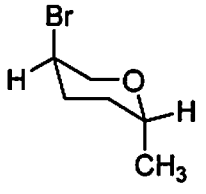


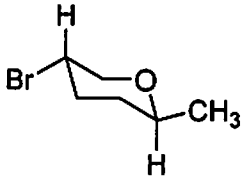




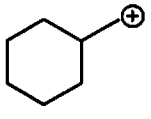
(c)

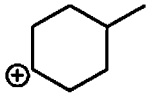


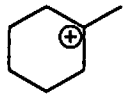




(d)

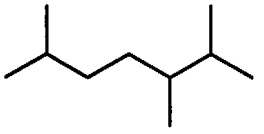




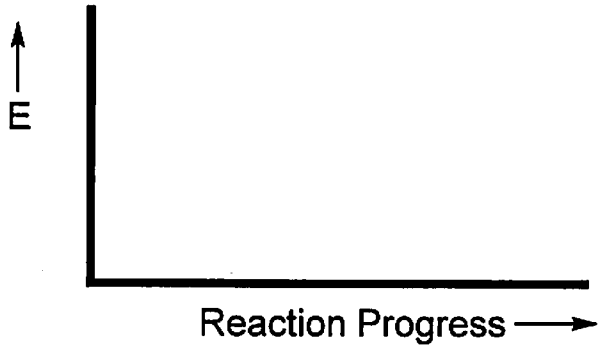


16) Using line angle formula (stick figure) representation, draw *1,1-diethylcyclopentane*. (3pts)

17) Name the following molecule in IUPAC form. (4pts)

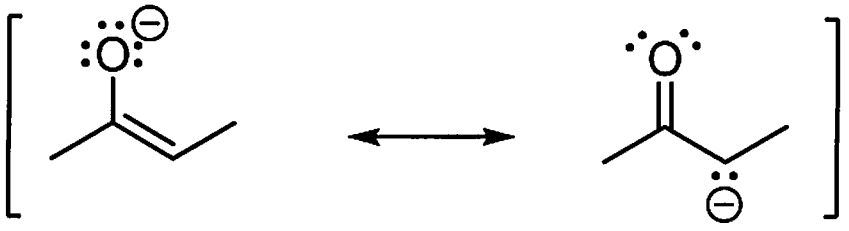


18) On the below energy level diagram (reaction profile) draw in a reaction pathway for a one step exothermic reaction. (2pts)

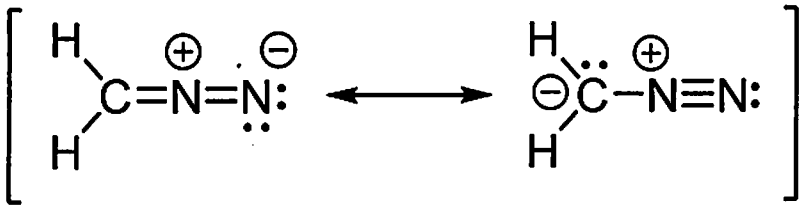


19) Use curly arrows to show how the left hand side resonance structure converts into the right hand structure. (4pts)

(a)



(b)



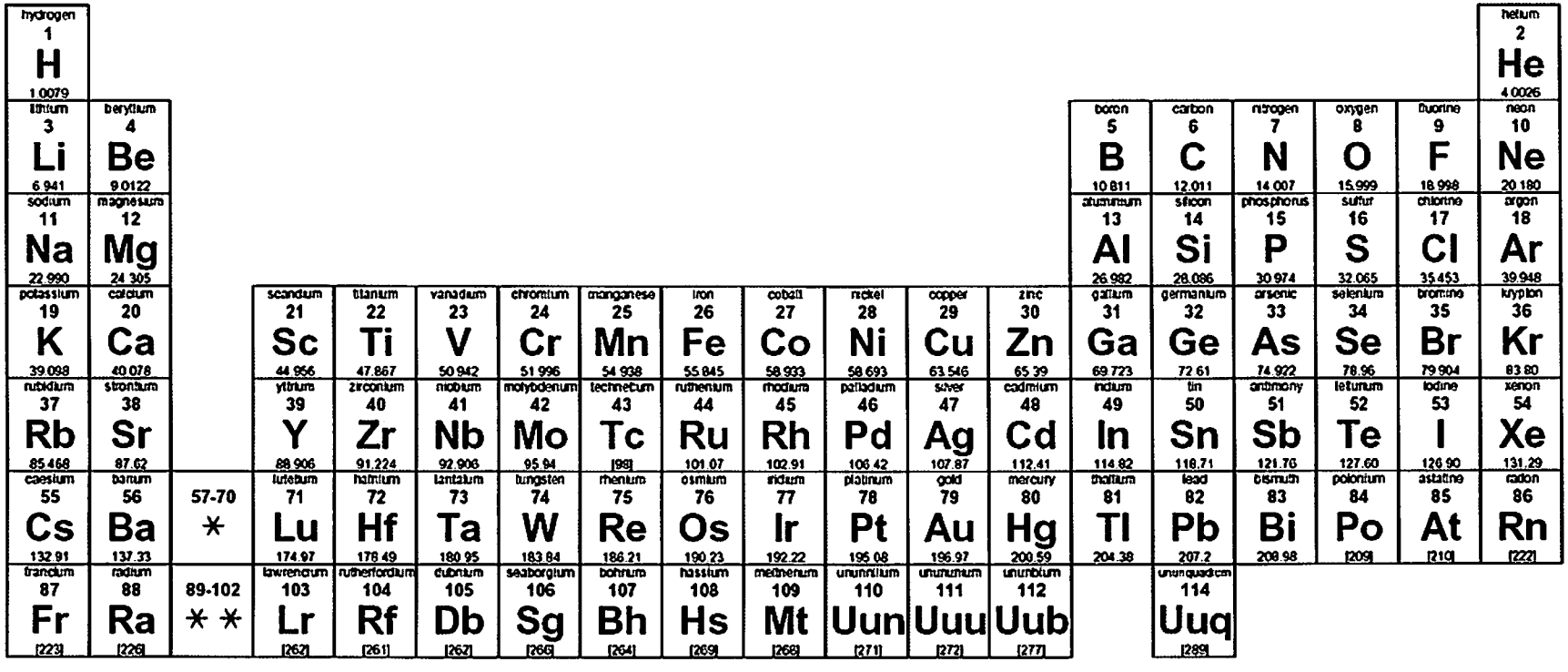
20) Using sticks and wedges or Newman or Sawhorse projection, draw *ethane* in its *LOWEST ENERGY (*most stable) conformation. (3pts)

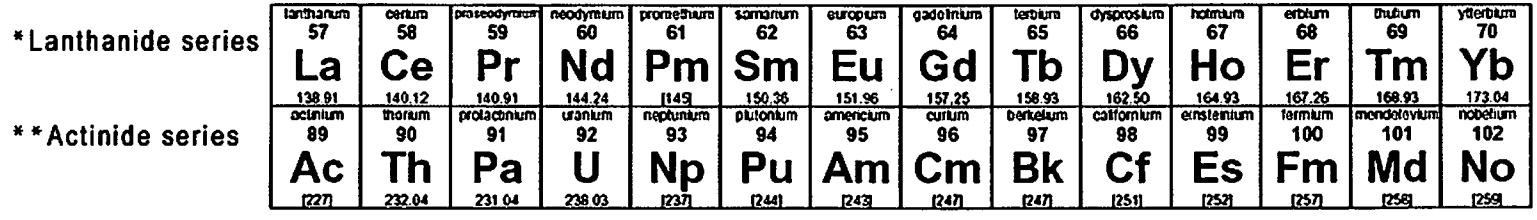
21) (2+2=4pts) (a) What is the definition of an *isomer*?

(b) There are **two** occasions where full, free rotation about covalent bonds is not permitted (leading to the existence of either *conformers* or *stereoisomers*). State the two structural features that cause this lack of full, free rotation.

****Up to TWO bonus points****

On a website (that obviously does not have the "Roche guarantee") there was a molecule with the IUPAC name of *2,3-diethylpentane.*
Based on the structure that is implied by this (incorrect) IUPAC name, what should the correct IUPAC name for that molecule be?


hydrogen 1 H 1.0079
helium 2 He 4.0026
lithium 3 Li 6.941
beryllium 4 Be 9.0122
boron 5 B 10.811
carbon 6 C 12.011
nitrogen 7 N 14.007
oxygen 8 O 15.999
fluorine 9 F 18.998
neon 10 Ne 20.180
sodium 11 Na 22.990
magnesium 12 Mg 24.305
aluminum 13 Al 26.982
silicon 14 Si 28.086
phosphorus 15 P 30.974
sulfur 16 S 32.065
chlorine 17 Cl 35.453
argon 18 Ar 39.948
potassium 19 K 39.098
calcium 20 Ca 40.078
scandium 21 Sc 44.956
titanium 22 Ti 47.867
vanadium 23 V 50.942
chromium 24 Cr 51.996
manganese 25 Mn 54.938
iron 26 Fe 55.845
cobalt 27 Co 58.933
nickel 28 Ni 58.693
copper 29 Cu 63.546
zinc 30 Zn 65.39
gallium 31 Ga 69.723
germanium 32 Ge 72.61
arsenic 33 As 74.922
selenium 34 Se 78.96
bromine 35 Br 79.904
krypton 36 Kr 83.80
rubidium 37 Rb 85.468
strontium 38 Sr 87.62
yttrium 39 Y 88.906
zirconium 40 Zr 91.224
niobium 41 Nb 92.906
molybdenum 42 Mo 95.94
technetium 43 Tc [98]
ruthenium 44 Ru 101.07
rhodium 45 Rh 102.91
palladium 46 Pd 106.42
silver 47 Ag 107.87
cadmium 48 Cd 112.41
indium 49 In 114.82
tin 50 Sn 118.71
antimony 51 Sb 121.76
tellurium 52 Te 127.60
iodine 53 I 126.90
xenon 54 Xe 131.29
caesium 55 Cs 132.91
barium 56 Ba 137.33
57-70 *
lutetium 71 Lu 174.97
hafnium 72 Hf 178.49
tantalum 73 Ta 180.95
tungsten 74 W 183.84
rhenium 75 Re 186.21
osmium 76 Os 190.23
iridium 77 Ir 192.22
platinum 78 Pt 195.08
gold 79 Au 196.97
mercury 80 Hg 200.59
thallium 81 Tl 204.38
lead 82 Pb 207.2
bismuth 83 Bi 208.98
polonium 84 Po [209]
astatine 85 At [210]
radon 86 Rn [222]
francium 87 Fr [223]
radium 88 Ra [226]
89-102 * *
lawrencium 103 Lr [262]
rutherfordium 104 Rf [261]
dubnium 105 Db [262]
seaborgium 106 Sg [266]
bohrium 107 Bh [264]
hassium 108 Hs [269]
meitnerium 109 Mt [268]
ununnilium 110 Uun [271]
unununium 111 Uuu [272]
ununbium 112 Uub [277]
ununquadium 114 Uuq [289]


*Lanthanide series
* *Actinide series
lanthanum 57 La 138.91
cerium 58 Ce 140.12
praseodymium 59 Pr 140.91
neodymium 60 Nd 144.24
promethium 61 Pm [145]
samarium 62 Sm 150.36
europium 63 Eu 151.96
gadolinium 64 Gd 157.25
terbium 65 Tb 158.93
dysprosium 66 Dy 162.50
holmium 67 Ho 164.93
erbium 68 Er 167.26
thulium 69 Tm 168.93
ytterbium 70 Yb 173.04
actinium 89 Ac [227]
thorium 90 Th 232.04
protactinium 91 Pa 231.04
uranium 92 U 238.03
neptunium 93 Np [237]
plutonium 94 Pu [244]
americium 95 Am [243]
curium 96 Cm [247]
berkelium 97 Bk [247]
californium 98 Cf [251]
einsteinium 99 Es [252]
fermium 100 Fm [257]
mendelevium 101 Md [258]
nobelium 102 No [259]

Fall 19: Organic 1 Exam 1 **Ch 1-4** **50 points**

Name GOTMA ION YU

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1-10 Are True/False (10pts)

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3) Lithium (Li) has a larger atomic radius than Beryllium (Be). T

4) Nitrogen is more electronegative than Carbon. T

5) All single covalent bonds are σ bonds. T

6) The electron configuration of Lithium is $1s^2\ 2s^1$. T

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8) Cyclopentane has more ring strain than cyclopropane. false

9) An sp^2 hybridized atom has one unhybridized p orbital. T

10) Selenium (Se) is one of the noble gases. false

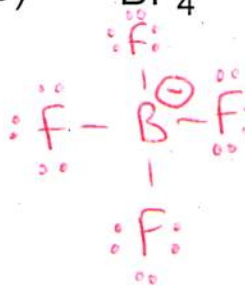
11) How many lone pairs are on each of these chemical species? (2pts)

(a) N_2

:N≡N:

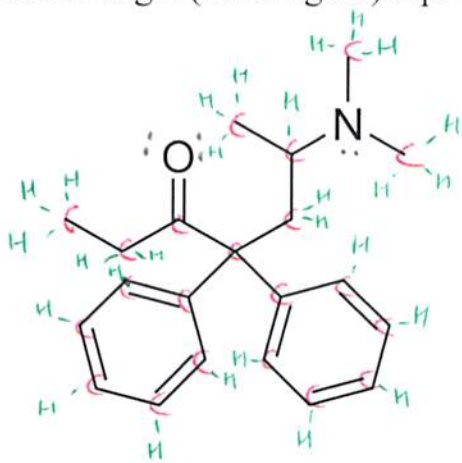
TWO

(b) $BF_4^{\ominus}$



TWELVE

12) The molecule below is *Methadone*. It is used as a pain reliever, and as part of drug addiction detoxification and maintenance programs. Methadone can reduce withdrawal symptoms in people addicted to heroin or other narcotic drugs without causing the "high" associated with the drug addiction. For this molecule, drawn in line angle (stick figure) representation, calculate: (7pts)



The number of Carbon atoms. 21

The number of Hydrogen atoms. 27

The number of π covalent bonds. 7

The number of sp^2 hybridized Carbons. 13

The number of Halogens. 0

The hybridization of the Nitrogen. sp^3

The C-N-C bond angle. $109\frac{1}{2}^\circ$

13) What two factors contribute to the *ring strain* of a cycloalkane? (2pts)

Angle strain (non ideal bond angles).

Torsional Strain (eclipsing / electron pair repulsions)

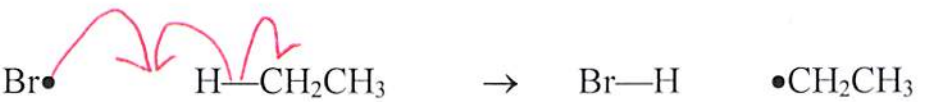
14) (1+1+3=5pts) In a *free radical chain mechanism* process, there are three distinct steps that are called Initiation, Propagation and Termination steps.
a) What is required to occur in an *Initiation* step?

The generation of a "reactive intermediate" (such as a radical)

b) What must (or *must not*) happen in a *Termination* step?

This is a step that does NOT produce a reactive intermediate.

c) Using "fish hook" (single barb) arrows (which indicate the movement of ONE electron), draw the mechanism for this Propagation step.



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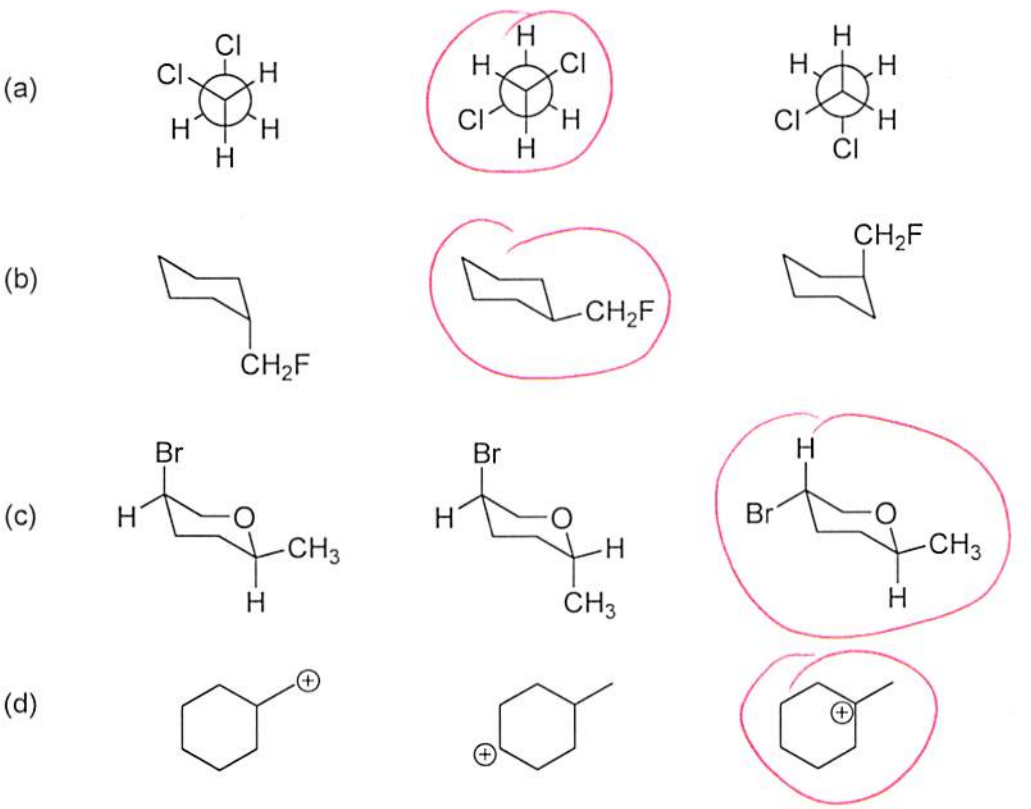

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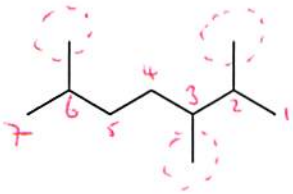
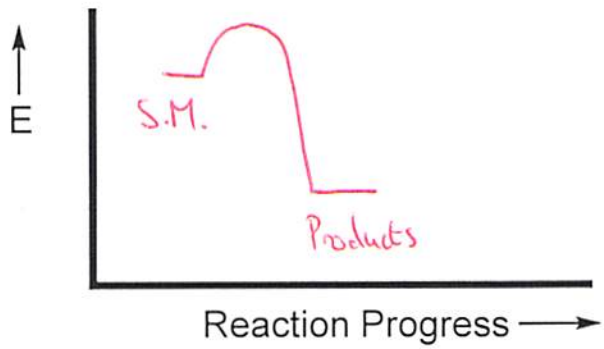
17) Name the following molecule in IUPAC form. (4pts)



2,3,6-trimethylheptane

18) On the below energy level diagram (reaction profile) draw in a reaction pathway for a one step exothermic reaction. (2pts)



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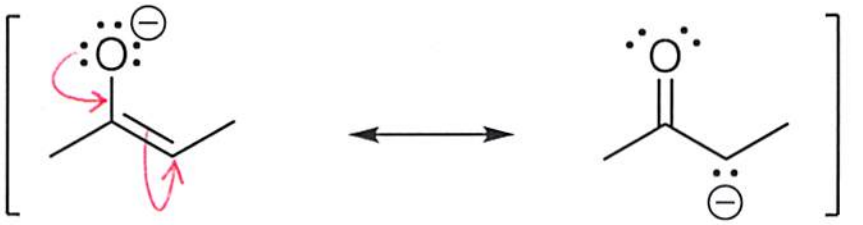
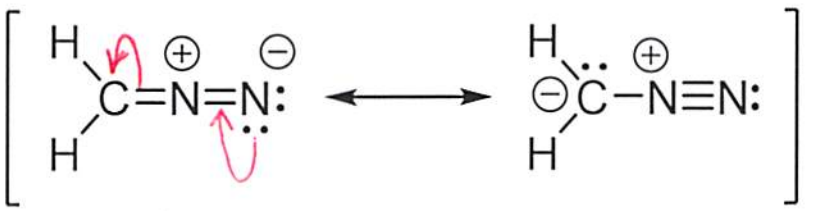


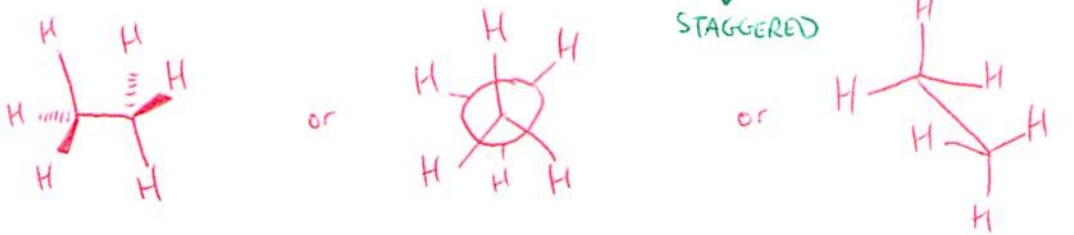
(b)



CH_3-CH_3

20) Using sticks and wedges or Newman or Sawhorse projection, draw *ethane* in its *LOWEST ENERGY (*most stable) conformation. (3pts)

STAGGERED



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Same molecular formula, but different.

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π bonds

Ring

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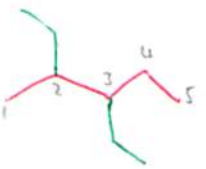
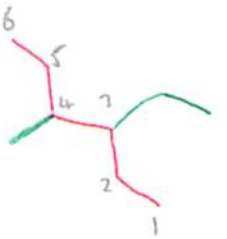


should be



3-ethyl-4-Methyl hexane