

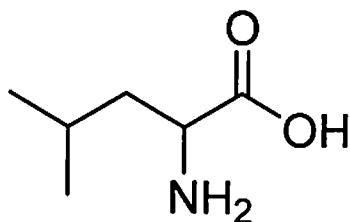
Name _____

1-10 are True / False. (10pts)

- 1) The Periodic Table has the elements listed in increasing Atomic Number
 - 2) A σ bond places electron density along the internuclear axis
 - 3) Boron has a larger atomic radius than Carbon
 - 4) Nitrogen is more electronegative than Fluorine
 - 5) All single covalent bonds are σ bonds
 - 6) The electron configuration of Beryllium is $1s^2 2s^2$
 - 7) Carbon has 6 total electrons but only 4 valence electrons
 - 8) Cyclopropane has more ring strain than cyclopentane
 - 9) An sp^2 hybridized atom still has one unhybridized p orbital
 - 10) Mercury (Hg) is one of the noble gases
- 11) How many lone pairs are on each of these chemical species? (2pts)



12) The molecule below is *Leucine*, which is an essential amino acid that is used in the biosynthesis of proteins. For this molecule, drawn in line angle (stick figure) representation, calculate: (6+1=7pts)



The number of Carbon atoms.

The number of Hydrogen atoms.

The number of sp^2 hybridized carbons.

The number of sp hybridized carbons.

The hybridization of the Nitrogen.

Either of the C-C-N bond angles.

What structural feature qualifies this molecule as a *branched chain* version of an amino acid (BCAA)?

13) Circle the **acid** on the left hand side of this equation. (1pts)

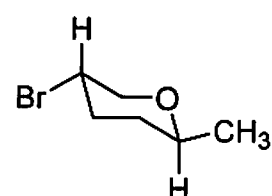
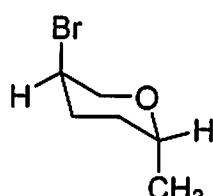
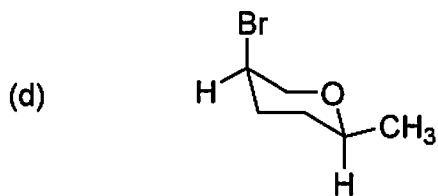
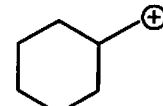
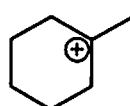
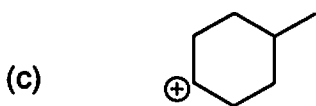
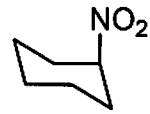
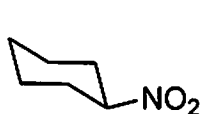
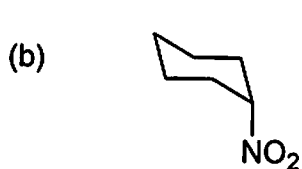
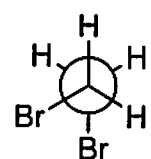
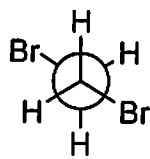
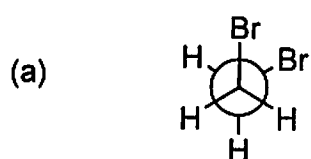


14) How are the changes in entropy, Gibbs free energy and enthalpy mathematically related? (2pts)

15) What two features contribute to *ring strain*? (2pts)

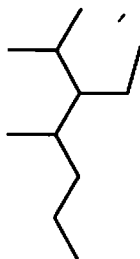
16) What is meant in chemical terms by the term *radical* (or *free radical*)? (2pts)

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

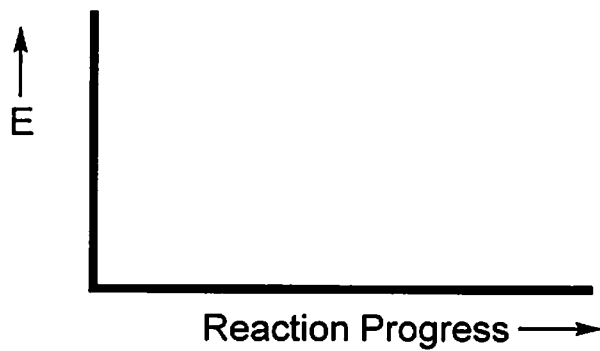


18) Using line angle formula (stick figure) representation, draw *cis-1,3-dimethylcyclobutane*. (4pts)

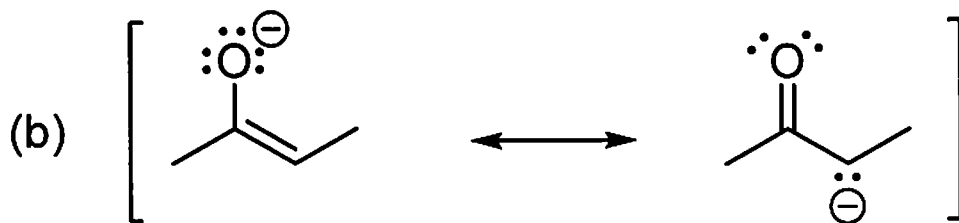
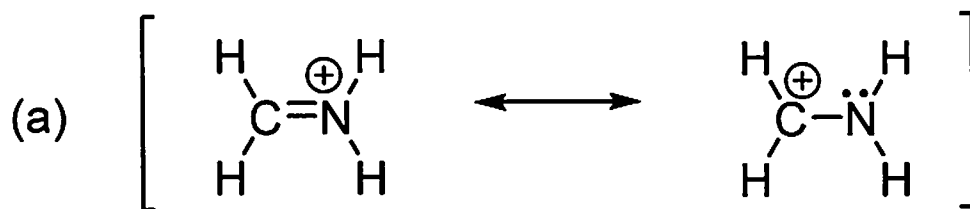
19) Name the following molecule in IUPAC form. (4pts)



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



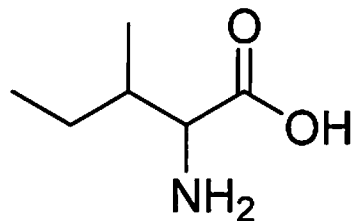
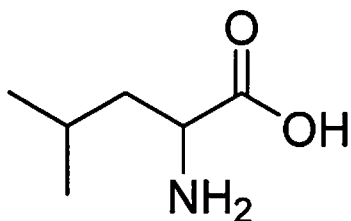
21) Use curly arrows to show how the left hand side resonance structure converts into the right hand structure. (4pts)



22) Using sticks and wedges or Newman or Sawhorse projection, draw *ethane* in its *eclipsed* conformation. (3pts)

23) (3pts) (a) What is the definition of an *isomer*?

(b) Are the following two molecules isomers?



If you think YES, state what type of isomers they are.

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

What term is given to a type of property that depends only on the *ratio of the number* of particles of solute and solvent in the solution, and not the chemical identity of the solute?

State one such property.

Name Low IS BASS

1-10 are True / False. (10pts)

- 1) The Periodic Table has the elements listed in increasing Atomic Number **T**
- 2) A σ bond places electron density along the internuclear axis **T**
- 3) Boron has a larger atomic radius than Carbon **T**
- 4) Nitrogen is more electronegative than Fluorine **false**
- 5) All single covalent bonds are σ bonds **T**
- 6) The electron configuration of Beryllium is $1s^2 2s^2$ **T**
- 7) Carbon has 6 total electrons but only 4 valence electrons **T**
- 8) Cyclopropane has more ring strain than cyclopentane **T**
- 9) An sp^2 hybridized atom still has one unhybridized p orbital **T**
- 10) Mercury (Hg) is one of the noble gases **false**

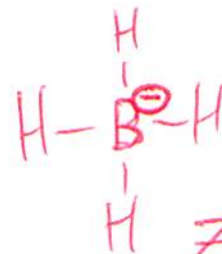
11) How many lone pairs are on each of these chemical species? (2pts)

(a) HOOH



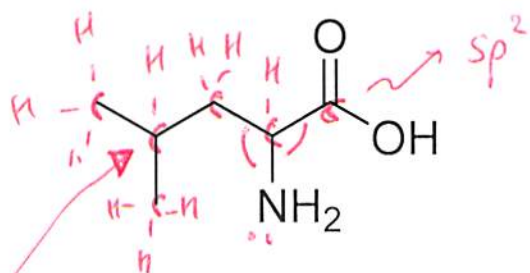
FOUR

(b) BH_4^-



ZERO

12) The molecule below is *Leucine*, which is an essential amino acid that is used in the biosynthesis of proteins. For this molecule, drawn in line angle (stick figure) representation, calculate: (6+1=7pts)



The number of Carbon atoms. 6

The number of Hydrogen atoms. 13

The number of sp^2 hybridized carbons. 1

The number of sp hybridized carbons. 0

The hybridization of the Nitrogen. sp^3

Either of the C-C-N bond angles. $109\frac{1}{2}^\circ$

What structural feature qualifies this molecule as a *branched chain* version of an amino acid (BCAA)?

The branched alkyl chain.

13) Circle the **acid** on the left hand side of this equation. (1pts)



14) How are the changes in entropy, Gibbs free energy and enthalpy mathematically related? (2pts)

$$\Delta G = \Delta H - T\Delta S$$

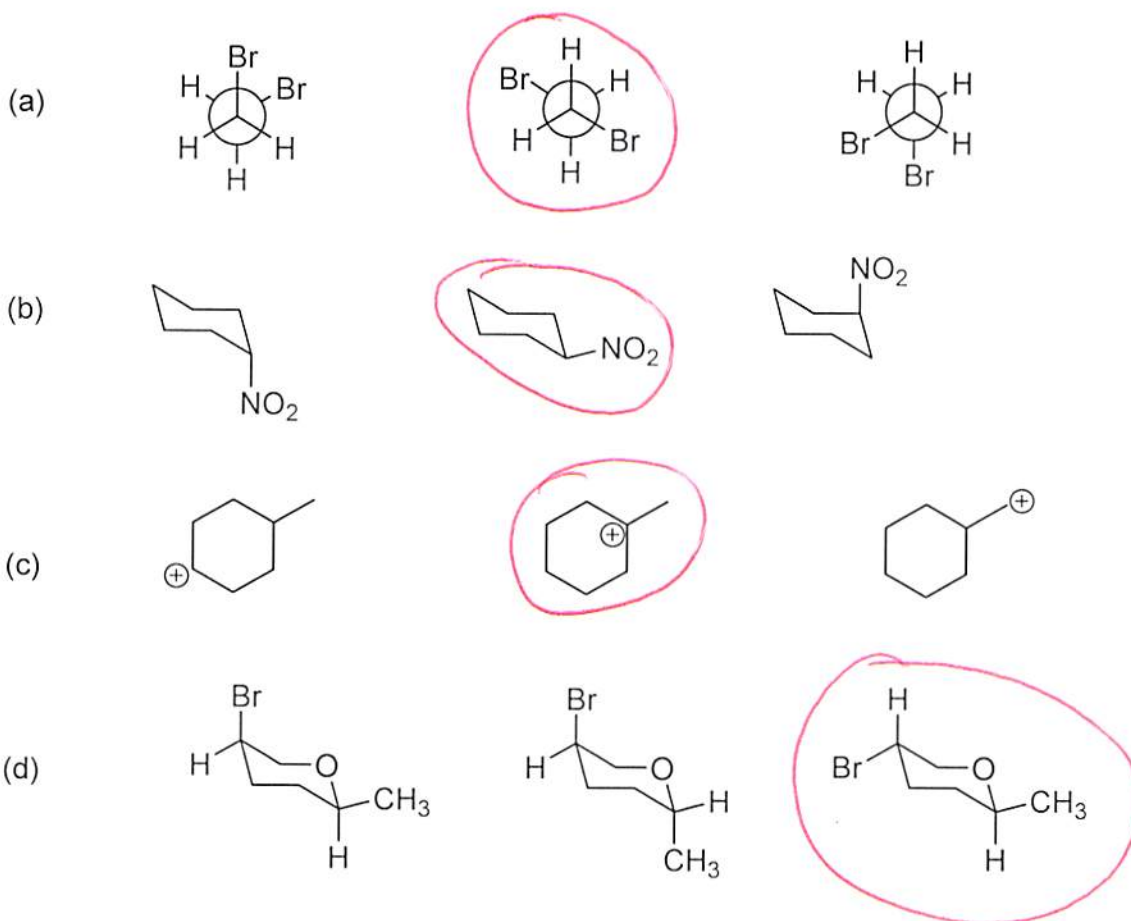
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Angle Strain & Torsional Strain

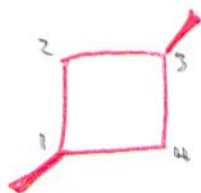
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A radical is a species with an unpaired electron.

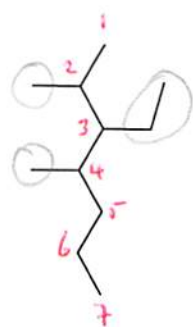
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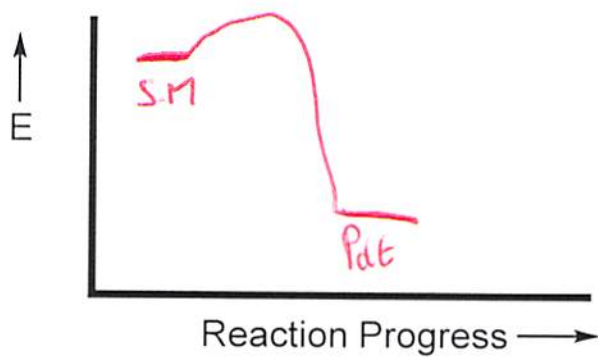


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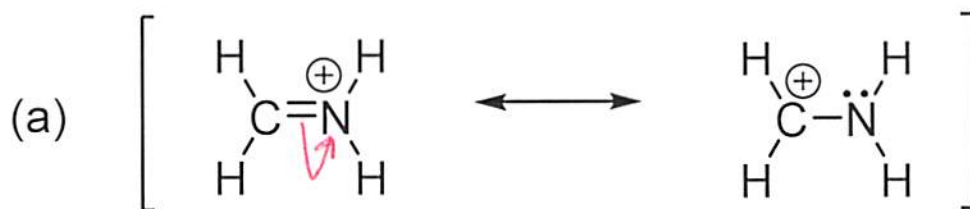


3-ETHYL-2,4-DIMETHYL HEPTANE

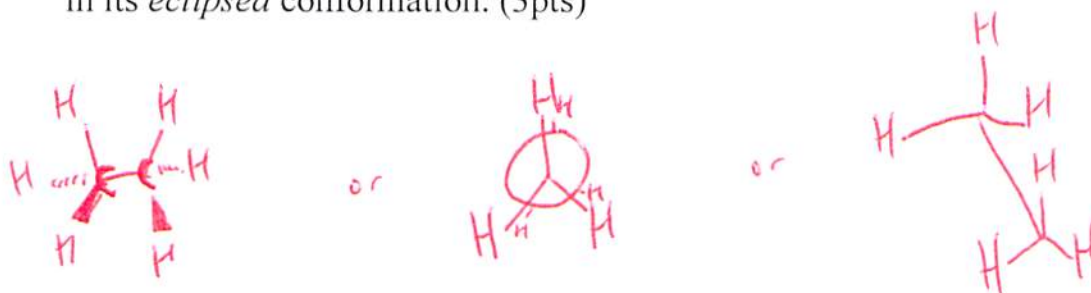
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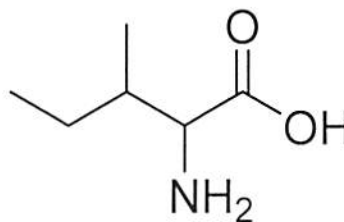
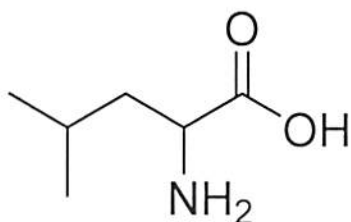
22) Using sticks and wedges or Newman or Sawhorse projection, draw *ethane* in its *eclipsed* conformation. (3pts)



23) (3pts) (a) what is the definition of an *isomer*?

Species that have the same molecular formula but are different.

(b) Are the following two molecules isomers?



Yes (both $C_6H_{13}NO_2$) (Leucine & Isoleucine)

If you think YES, state what type of isomers they are.

Structural isomers.

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

What term is given to a type of property that depends only on the *ratio of the number* of particles of solute and solvent in the solution, and not the chemical identity of the solute?

Colligative Properties

State one such property.

E.g. Lowering of vapour pressure; increase of boiling point, depression of freezing point (melting point); osmotic pressure; etc