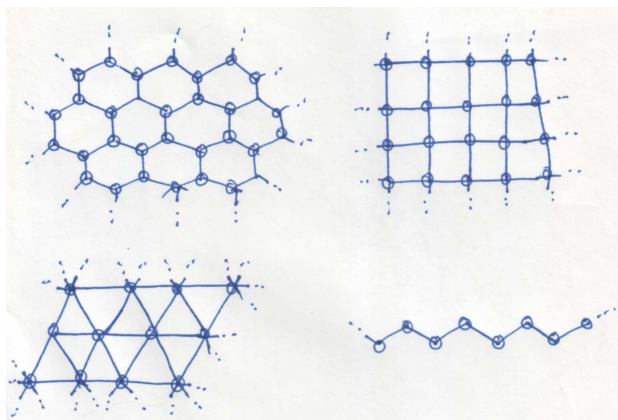


1 Cognitive reasoning in the chemical sciences 5.11

1. Pure Bi follows normal bonding rules and forms in one of the four bonding patterns structures given below (shown in diagram are just possible connectivities). Which one of the four is the correct one? Deduce the steric number of Bi and draw a possible three-dimensional Bi solid structure.



2. Please answer the following problems:

1) Please draw arrangement of the lowest energy ethyl alcohol-ethyl alcohol dimer which you can think of.

2) Please draw arrangement of the lowest energy acetaldehyde-acetaldehyde dimer which you can think of.

3) Does ethyl alcohol or acetaldehyde have a lower boiling point? Why?

ethyl alcohol is $\text{CH}_3\text{CH}_2\text{OH}$

acetaldehyde is CH_3CHO

Please draw a picture of liquid ethyl alcohol. (Draw five liquid alcohol molecules in a container.) Indicate the strongest intermolecular interactions with a dotted line.

Please draw a picture of liquid acetaldehyde. (Draw five liquid acetaldehyde molecules in a container.) Indicate the strongest intermolecular interactions with a dotted line.

Please draw a picture of gaseous ethyl alcohol. (Draw five gaseous alcohol molecules in a container.) Indicate any intermolecular interactions.

Please draw a picture of solid ethyl alcohol. (Draw five solid alcohol molecules in a container.) Indicate the strongest intermolecular interactions with a dotted line. (In solids, molecules make regular patterns)

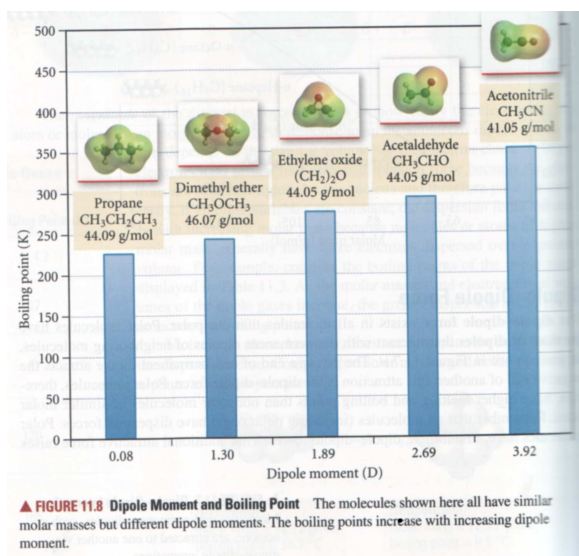
Please draw a picture of **cold** liquid ethyl alcohol. Draw five liquid alcohol molecules in a container. Indicate the strongest intermolecular interactions with a dotted line.

Please draw a picture of **hot** liquid ethyl alcohol. Draw five liquid alcohol molecules in a container. Indicate the strongest intermolecular interactions with a dotted line.

What is the main difference between cold and hot liquid ethyl alcohol?

Do you think cold or hot liquid ethyl alcohol is more dense. Why?

3. Please draw the Lewis structures for the molecules given in the chart below as well as formic acid, HCO_2H , boiling point 101°C . Please rationalize, using pictures if necessary, why the boiling points are in the observed order.



4. For the compounds below, please draw plausible shapes for all the molecules or molecular ions listed below. If you believe the compound is not a molecule, but is instead an extended solid, please draw the local bonding environment of a pair of adjacent atoms, stating clearly the number of atoms these neighboring adjacent atoms are bonded to.
- ClO_2^+ , please also state the SN.
 - OCCCO , carbon suboxide. There are no rings of bonded atoms in this compound.
 - ScF_3