

Upcoming schedule...

Previously in Molecularity...

Upcoming schedule

- Today:
§11.3–11.4 Intermolecular interactions
- Monday:
§11.4, 11.8 Last bit of intermolecular whatnot
- Tuesday:
§4.11 Determining chemical formulae from experiments
- Wednesday, Recitate!
- Thursday, Exam 3.

Upcoming schedule

- Today:
§11.3–11.4 Intermolecular interactions
- Monday:
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- Tuesday:
§4.11 Determining chemical formulae from experiments
- Wednesday, Recitate! **Bonus going out.**
- Thursday, Exam 3. **Bonus due.**

Let me know if you're missing any
Dailies!!!!

(read: let me know NOW)

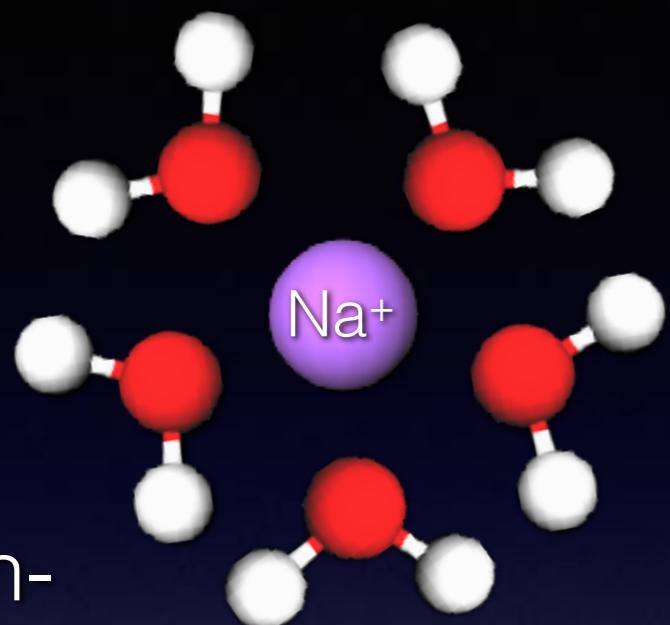
A photograph of a metal fork standing upright in a field of lavender. The fork's tines are pointing downwards, and its handle is pointing upwards. In the background, there is a paved road with a yellow dashed line, some trees, and a blue sky.

Where are we going today?

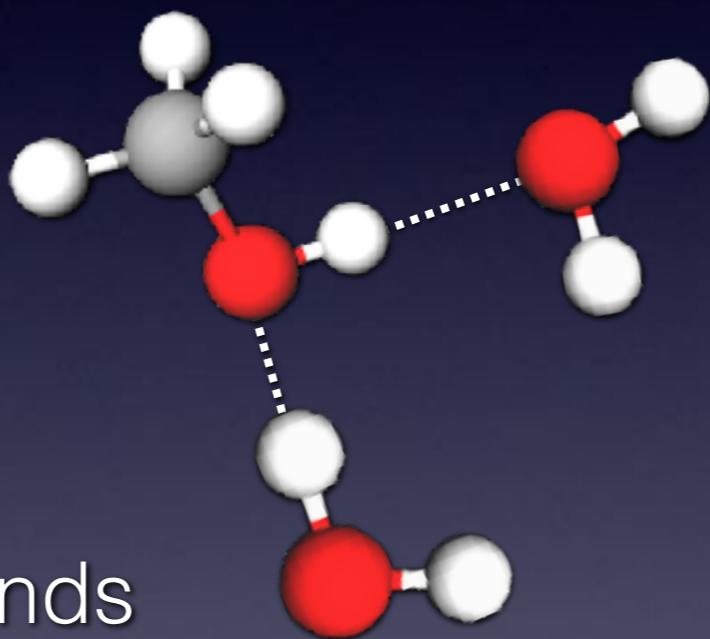
Ch1010-A17-A03 Lecture 23

- §11.3 London fog and also dispersion
- §11.3 Polar interactions

Intermolecular forces (Strong)

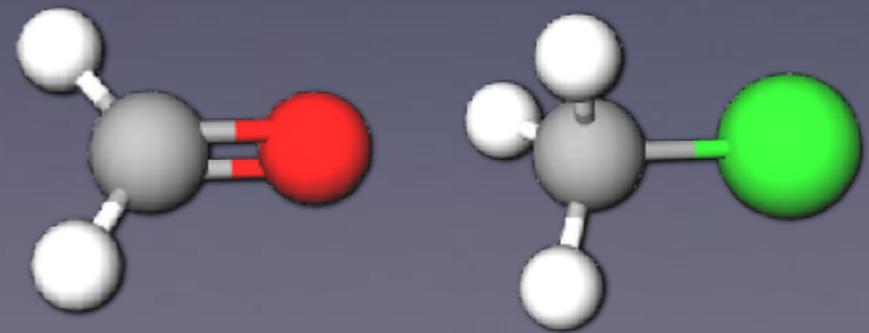


Ion-dipole



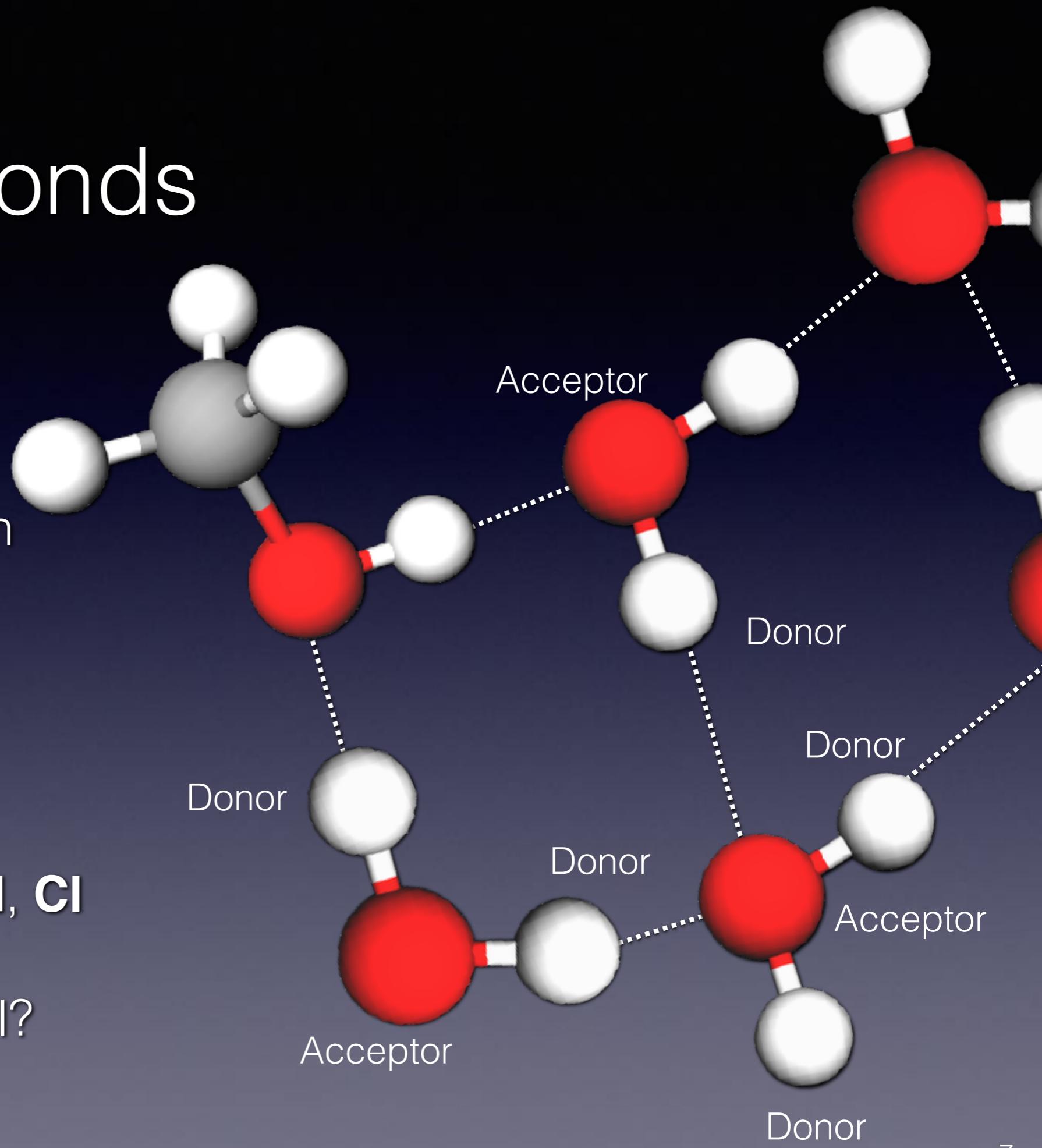
Hydrogen bonds

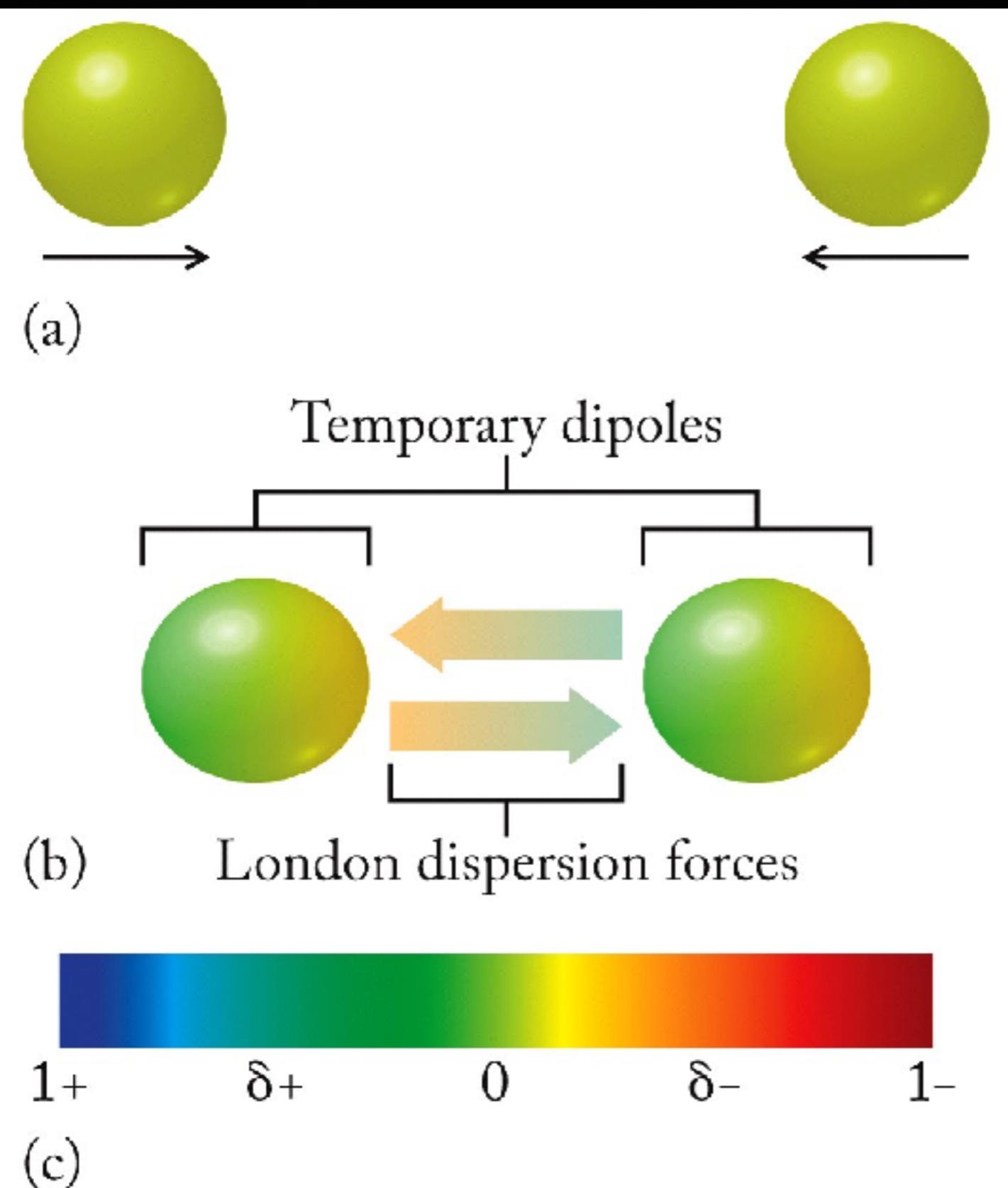
Dipole-dipole



Hydrogen bonds

- Special dipole interactions between
- Acceptors:
F, O, N, Cl
- Donors:
H bonded to **F, O, N, Cl**
- Why is water special?



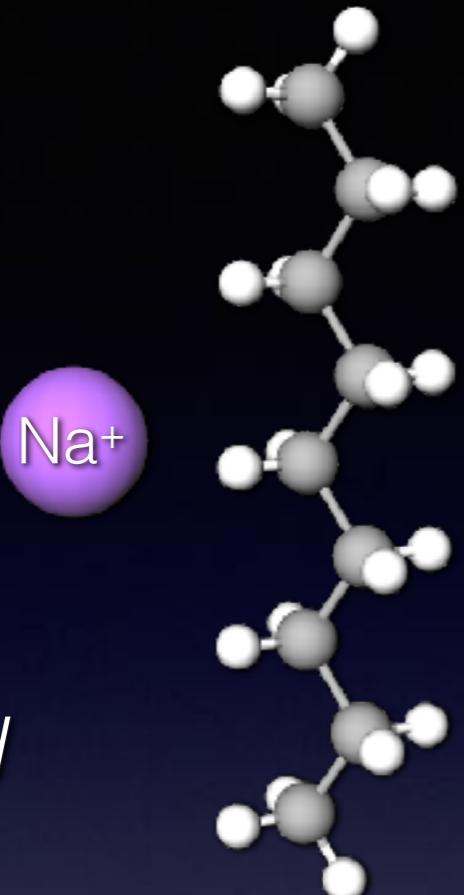


Fritz London
[www.phy.duke.edu
smlondon.jpg](http://www.phy.duke.edu/smlondon.jpg)

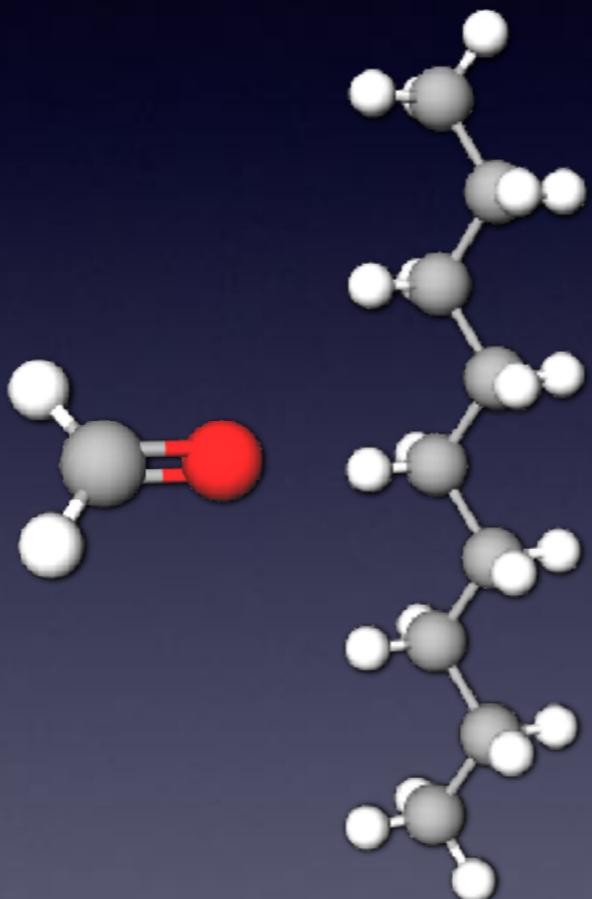
Effect scales
with the
polarizability
of a species

Intermolecular forces (Less strong)

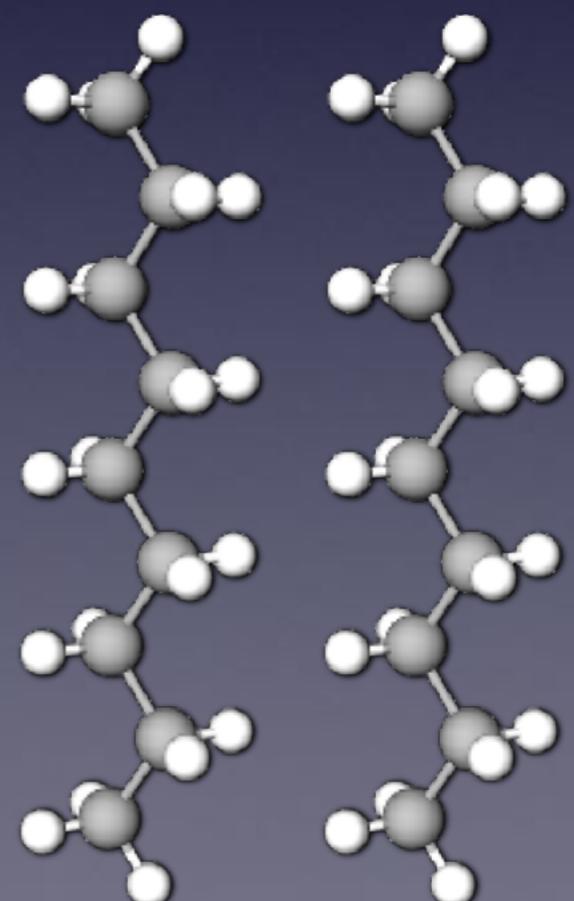
Ion-
induced
dipole



Dipole-
induced
dipole



Fluctuating dipole-
induced dipole
(aka dispersion)



How to quantify?

[aos.iacpublishinglabs.com
boiling-point-milk_9e6e0dba0627bf18.jpg](http://aos.iacpublishinglabs.com/boiling-point-milk_9e6e0dba0627bf18.jpg)



- Boiling temp relates to the energy required to break intermolecular forces
- Higher boiling point ... stronger intermolec. forces
- Lower boiling point ... weaker intermolec. forces

Periodic trends...

- What is the physical parameter effecting boiling point differences down this group?
- How might we use this to predict trends among organics of different size?

TABLE 6.1 Boiling Points of the Noble Gases

Noble Gas	Atomic View	Z	Boiling Point (K)
He		2	4
Ne		10	27
Ar		18	80
Kr		36	110
Xe		54	160
Rn		86	210
K ^u		89	220

Periodic trends...

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K^u

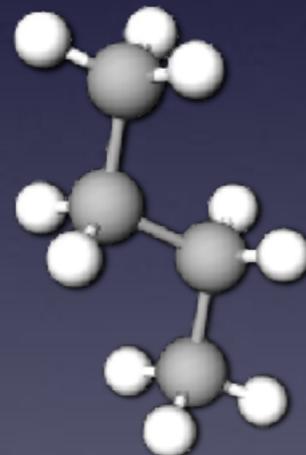


89

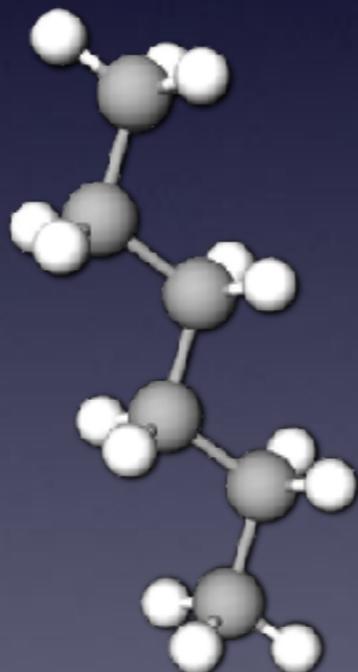
511

Predict the boiling points in...

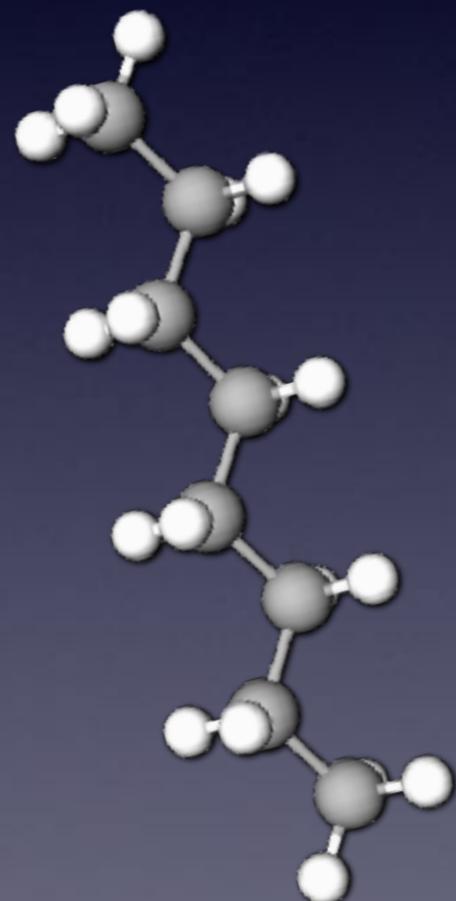
- Which one has the highest boiling point?
Lowest? Why?



Butane

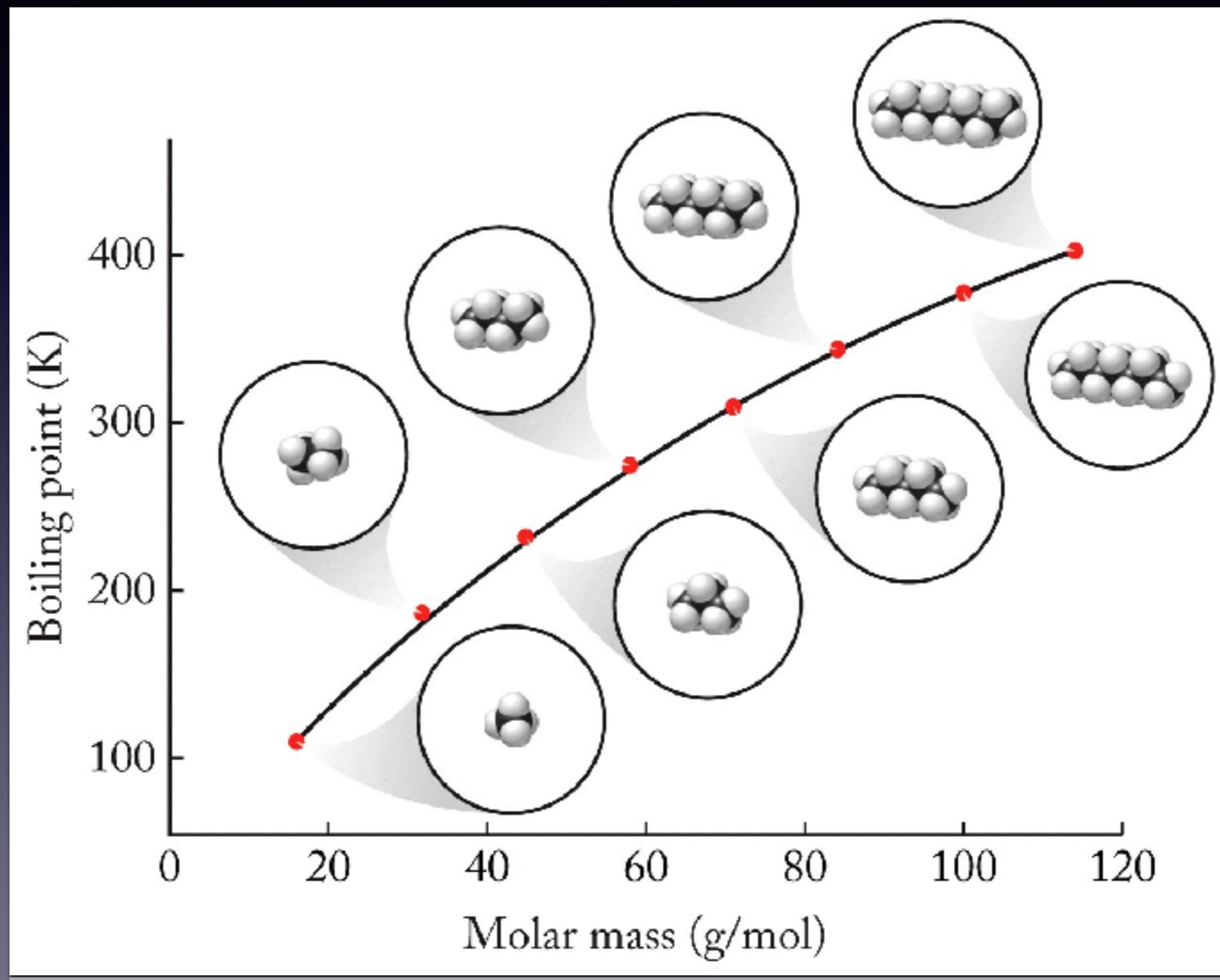


Hexane

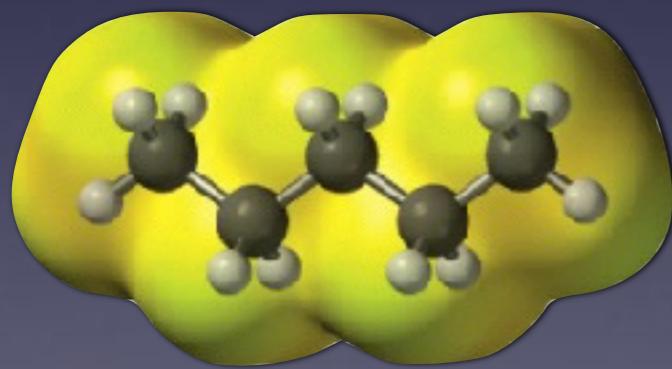
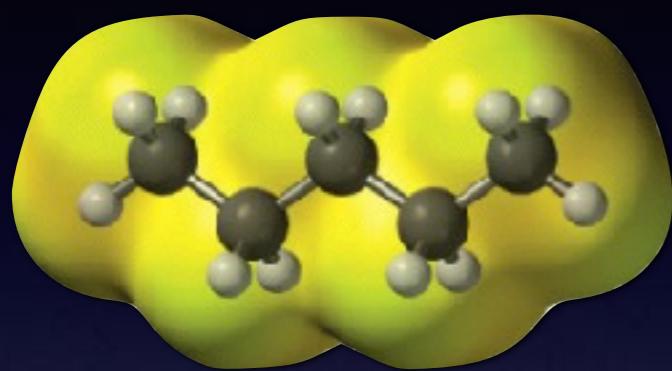


Octane

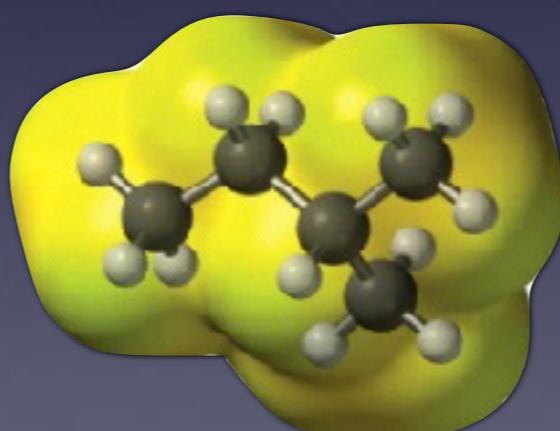
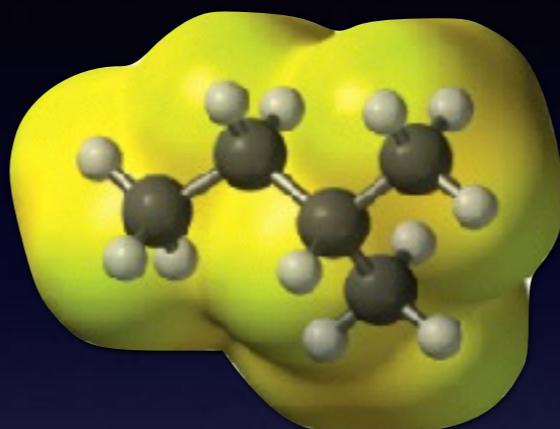
Predict the boiling points in...



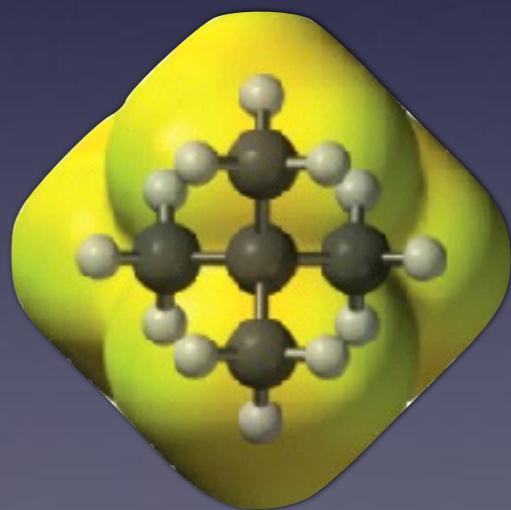
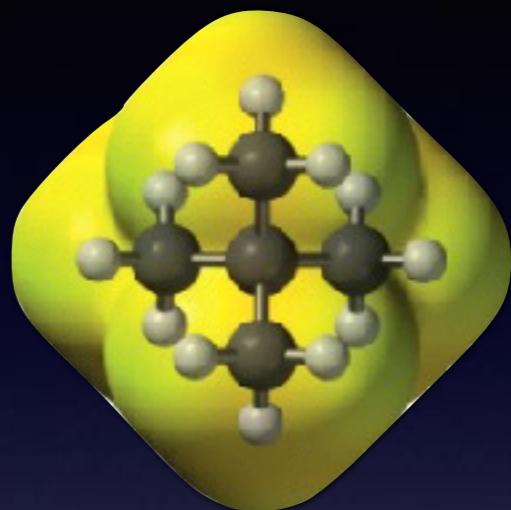
Predict the boiling points in...



Pentane



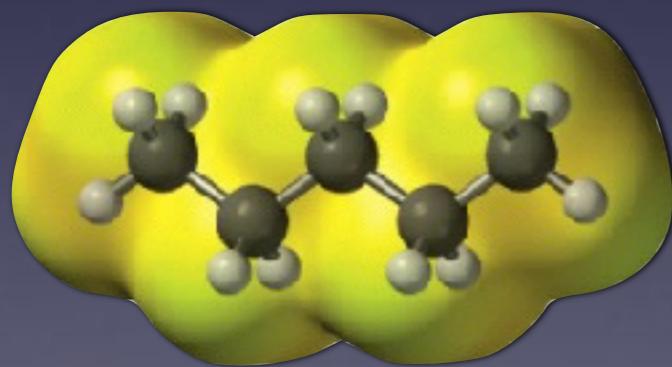
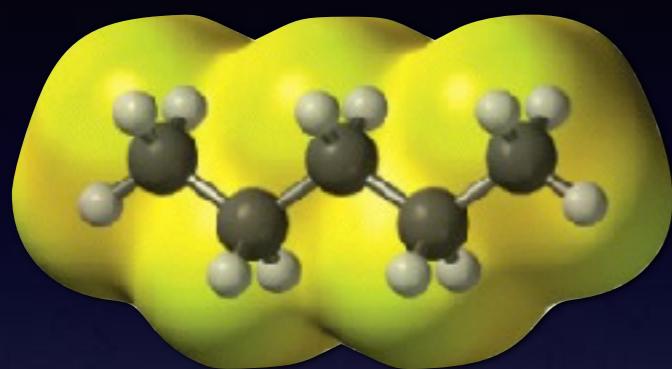
2-methyl-butane



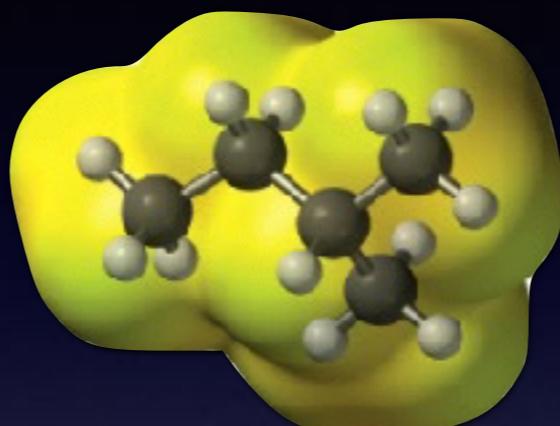
2,2-dimethyl-propane

GKF 6.2

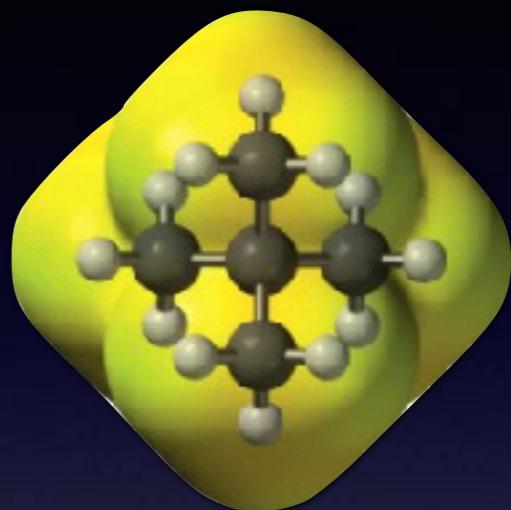
Predict the boiling points in...



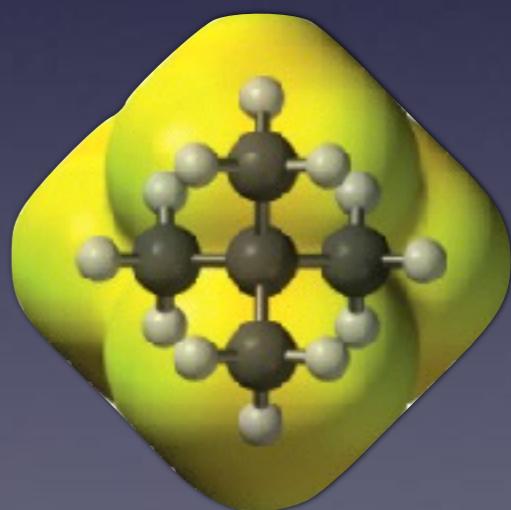
Pentane



2-methyl-butane
28 °C

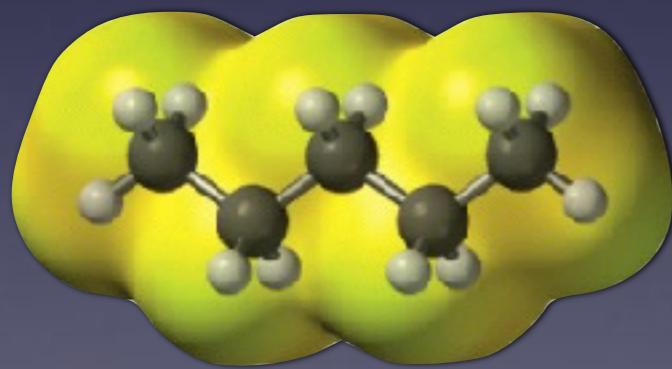
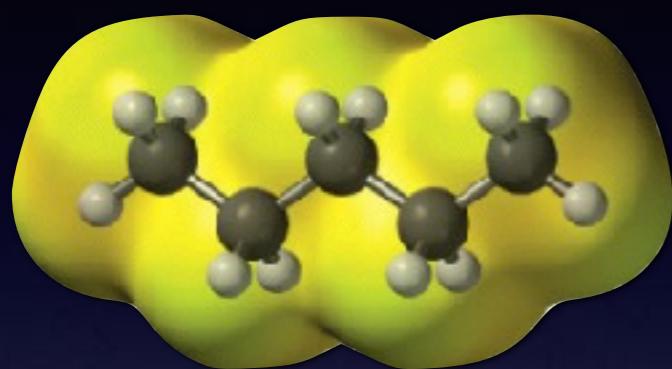


GKF 6.2



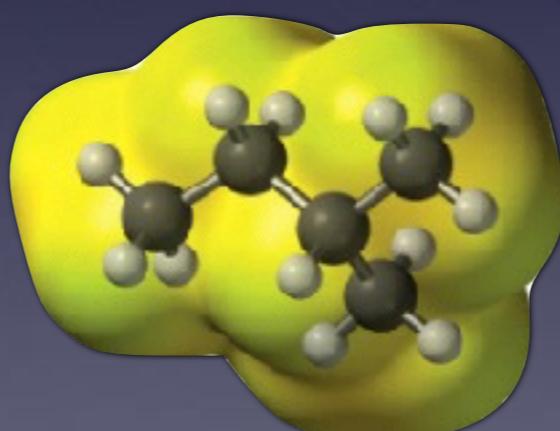
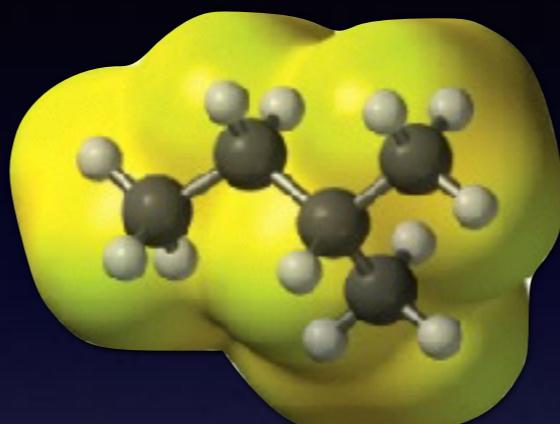
2,2-dimethyl-propane

Predict the boiling points in...



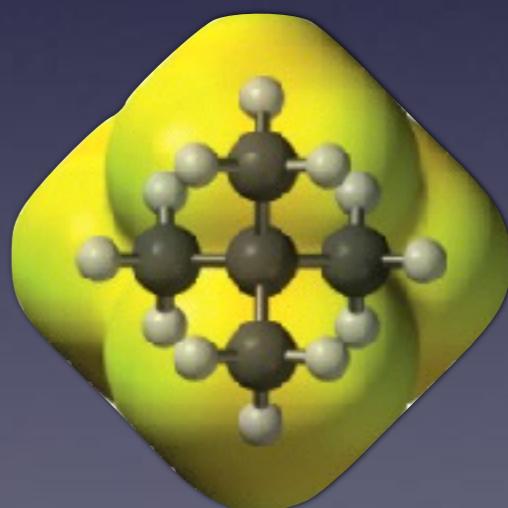
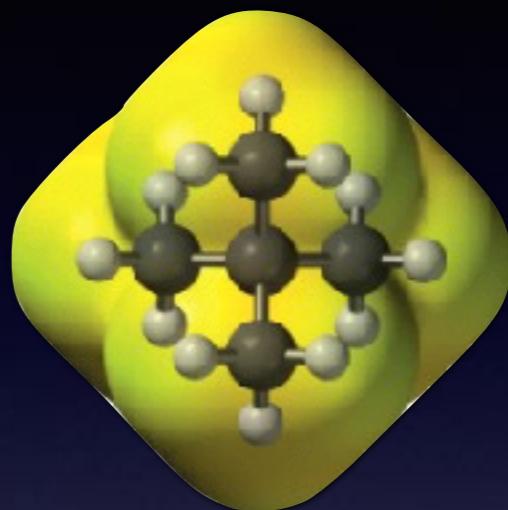
Pentane

36 °C



2-methyl-butane

28 °C

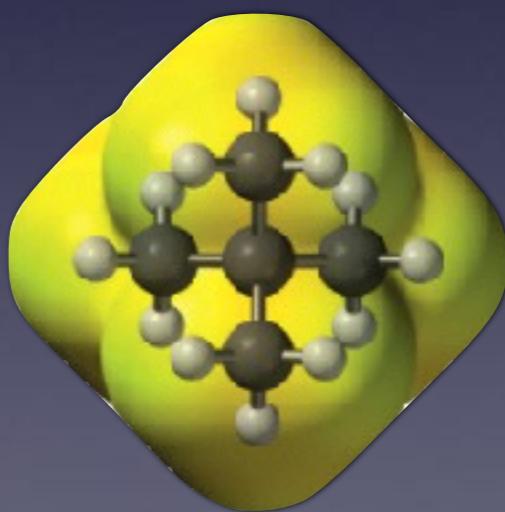
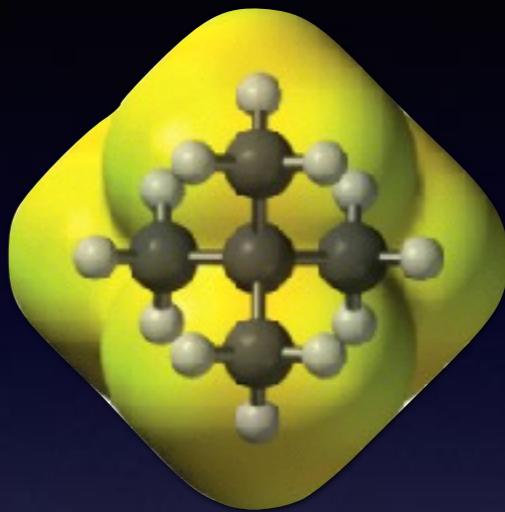
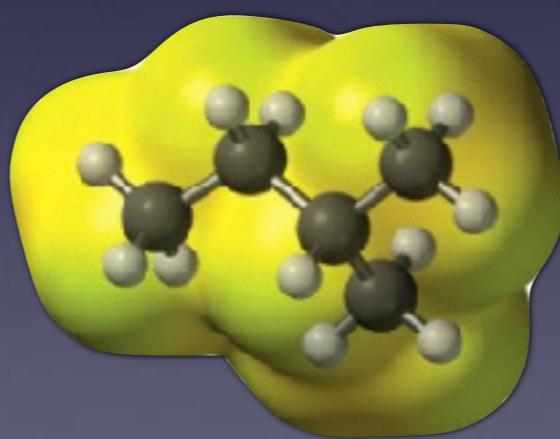
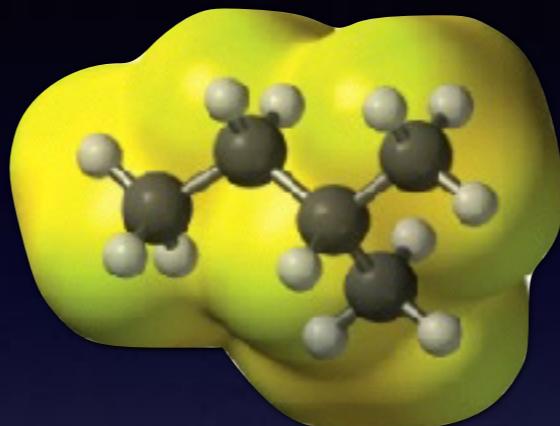
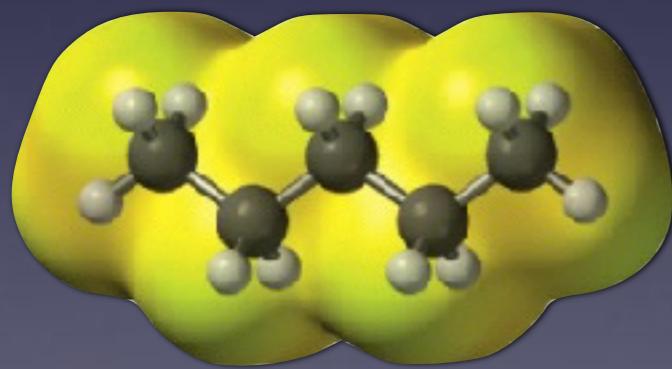
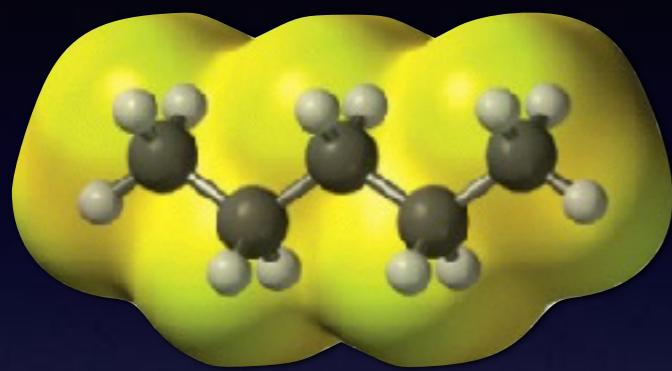


2,2-dimethyl-propane

9 °C

GKF 6.2

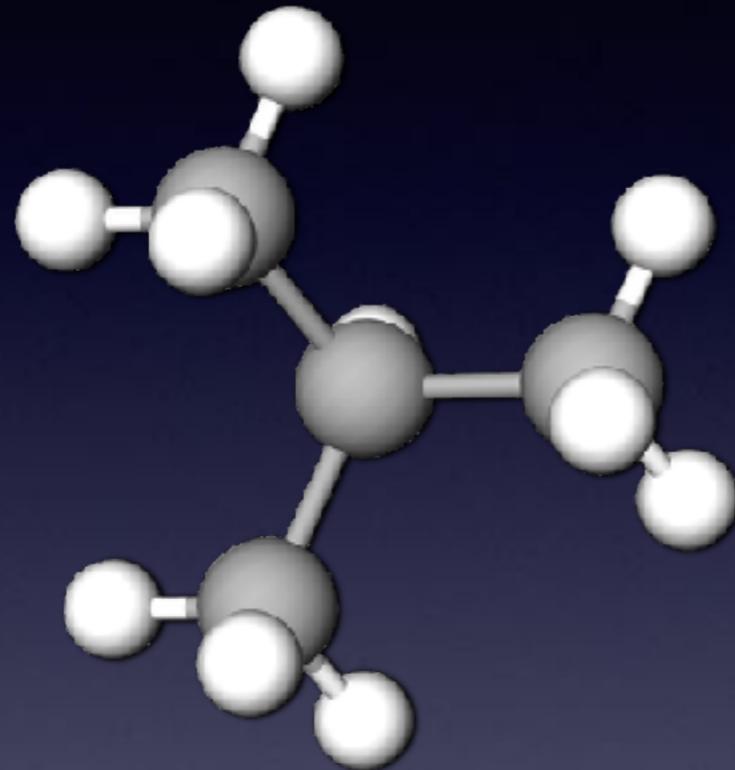
Predict the boiling points in...



GKF 6.2

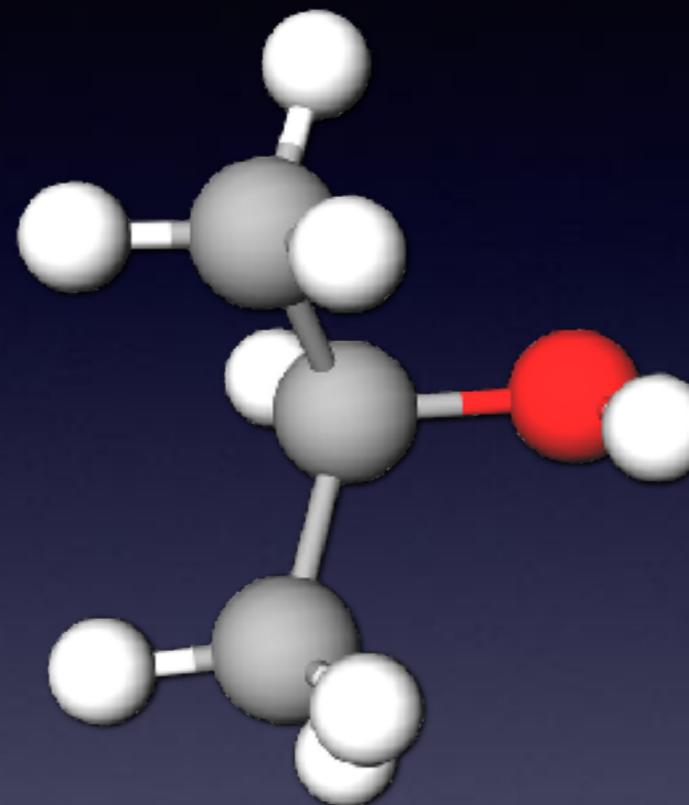
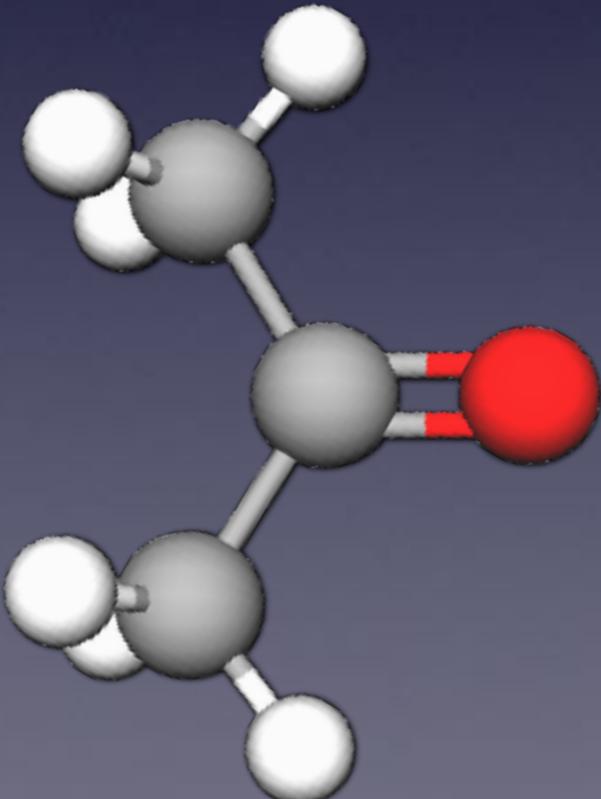
Among isomers of the same mass and formula, longer chains have higher T_{boil} than branched compounds

Predict the boiling points in...



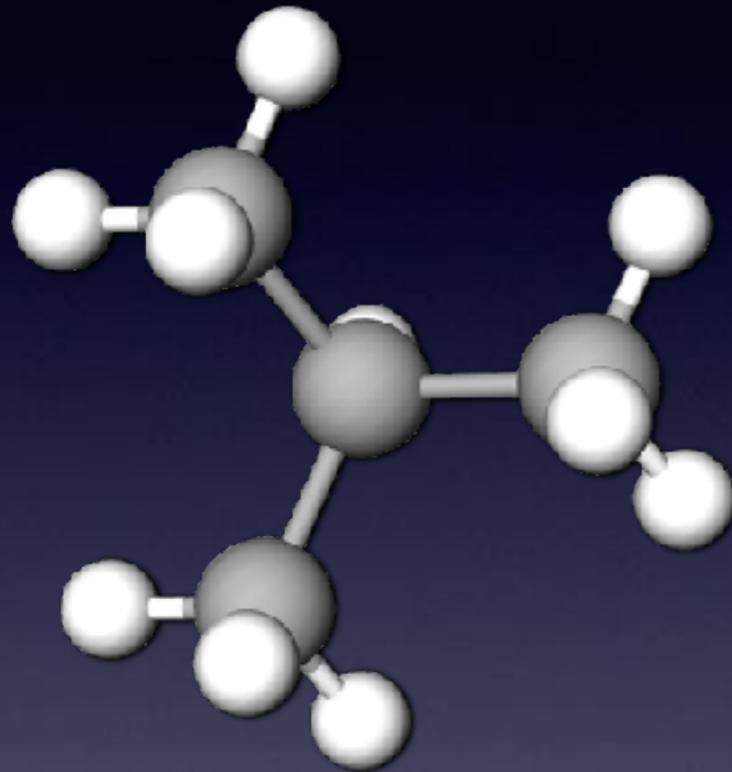
2-methyl-propane
(isobutane)

2-propanone
(acetone)



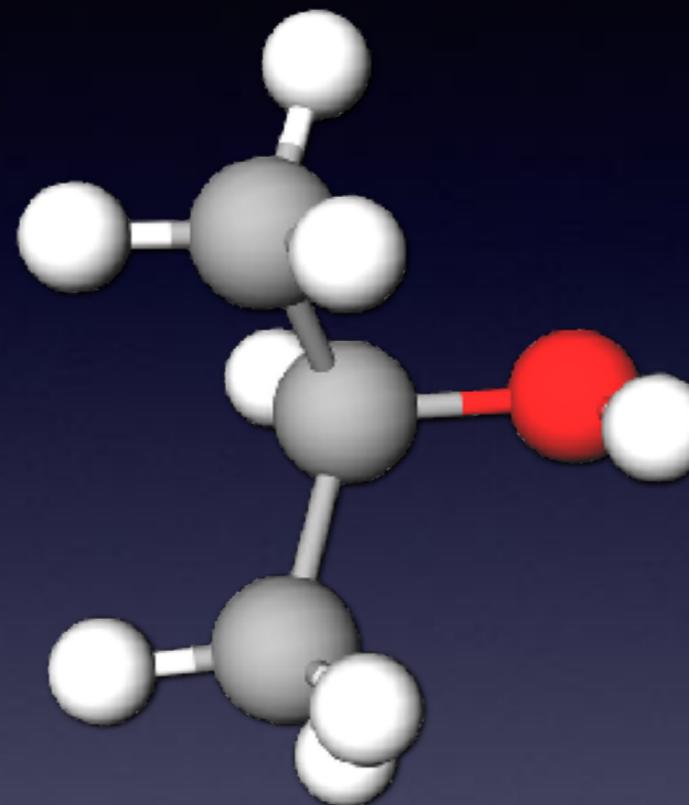
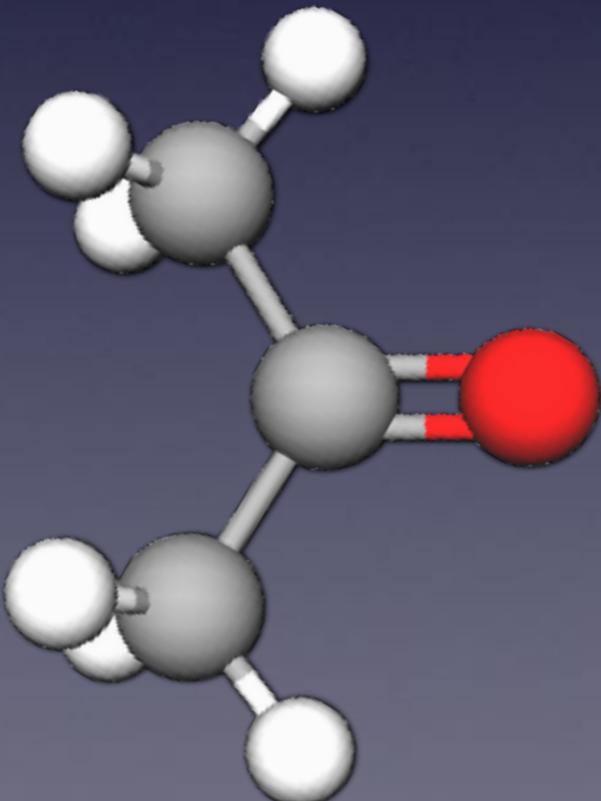
2-propanol
(isopropyl
alcohol)

Predict the boiling points in...



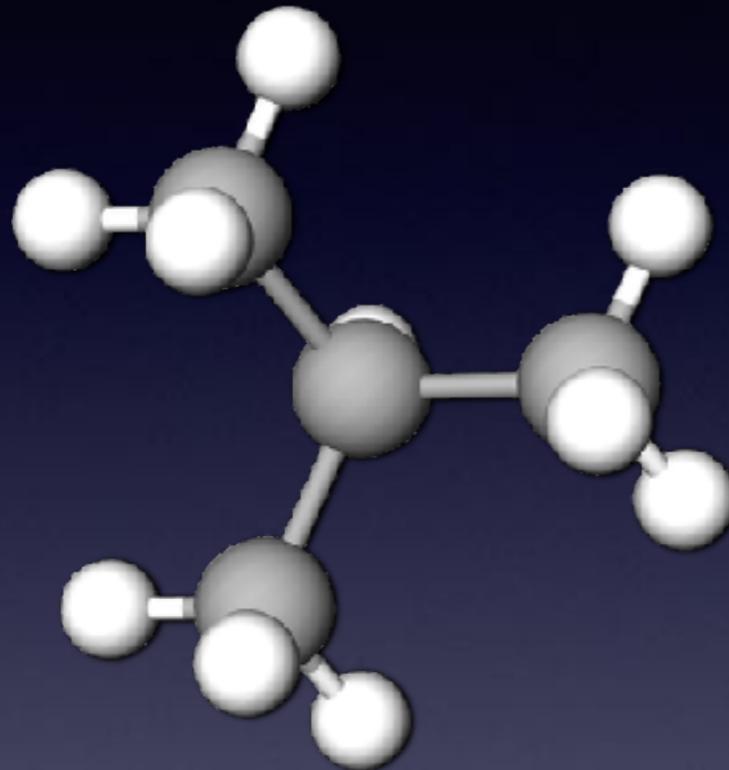
2-methyl-propane
(isobutane)

56 °C
2-propanone
(acetone)



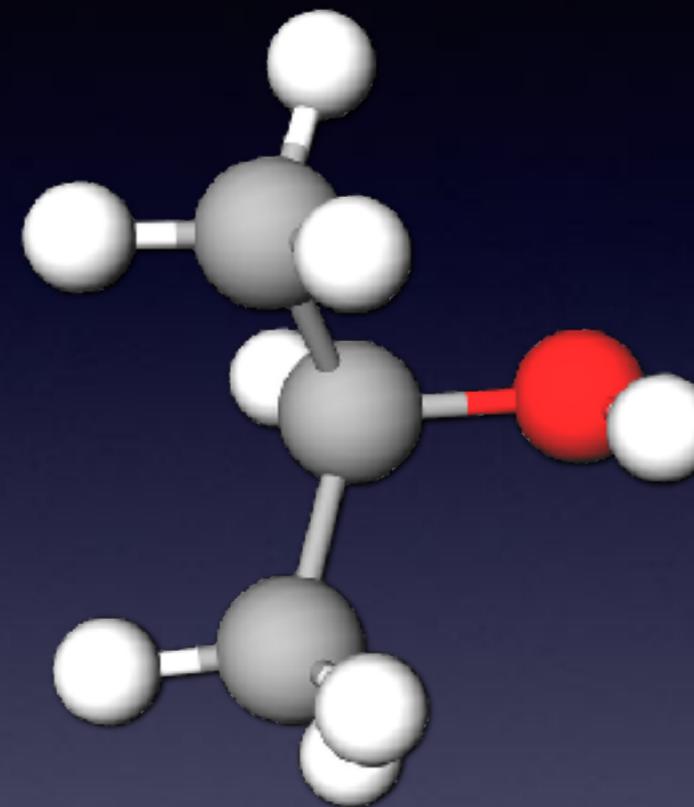
2-propanol
(isopropyl
alcohol)

Predict the boiling points in...



2-methyl-propane
(isobutane)

-12 °C



2-propanol
(isopropyl
alcohol)

86 °C



Where did we go today?

Ch1010-C17-C02 Lecture 23

- §11.3 London fog and also dispersion
- §11.3 Polar interactions

Next time...

- §11.4 and §11.8