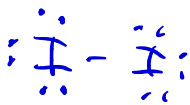
4/24/20

Temporary dipoles — Dipoles <u>not</u> caused directly by molecular structure and therefore are not permanent in nature.

Spontaneous dipoles

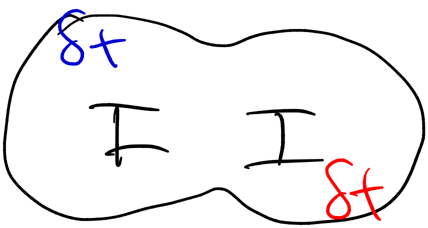
I_2 – solid at room temperature

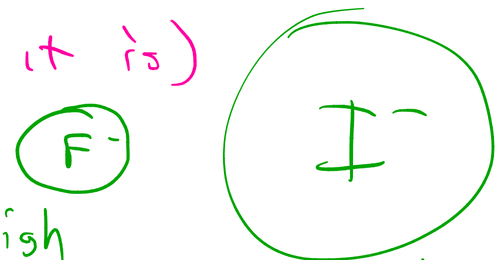


linear → non-polar

→ no permanent molecular dipole

→ shouldn't be able to be a solid at RT (but it is)





high charge density

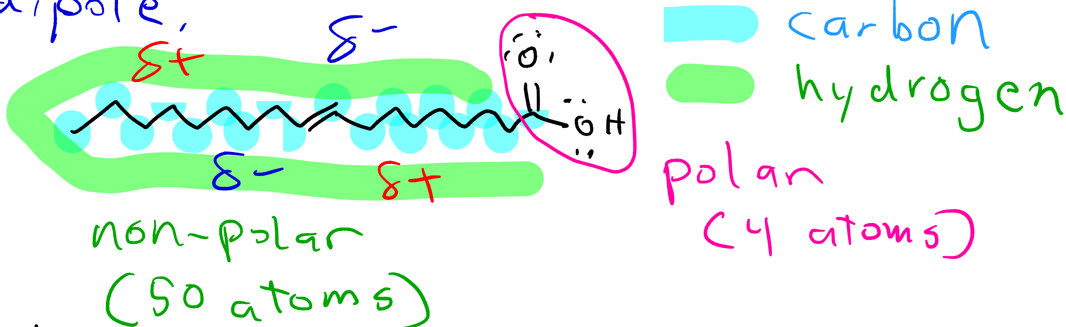
low charge density

Spontaneous polarizability – the ability of an atom or a molecule to develop temporary dipoles due to the movement of the atom/molecule and low charge density.

* compared to other diatomic molecules

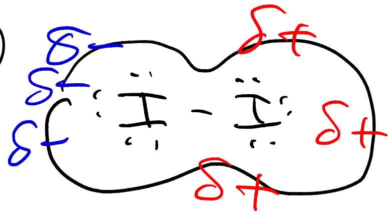
Because iodine has very low charge density and a *large size, it easily develops enough temporarily dipoles that the overall IMFs are strong enough to hold I_2 together as a solid at the standard state, despite the fact it has no permanent molecular dipole.

1 bar pressure, 25°C.



Oleic acid is non-polar, because although a small portion of the molecule is polar, the vast majority of the structure is non-polar. However, due to oleic acid's large size, and therefore large surface area, it experiences enough temporary dipoles that it has enough IMF that it turns solid slightly below RT.

Na+



Induced dipole – when a particle with a charge on a dipole passes another particle, that charge or dipole on the first molecule can cause a partial charge to develop on the second molecule. This is known as induction.

Van der Waals – Electrostatic attractions between particles

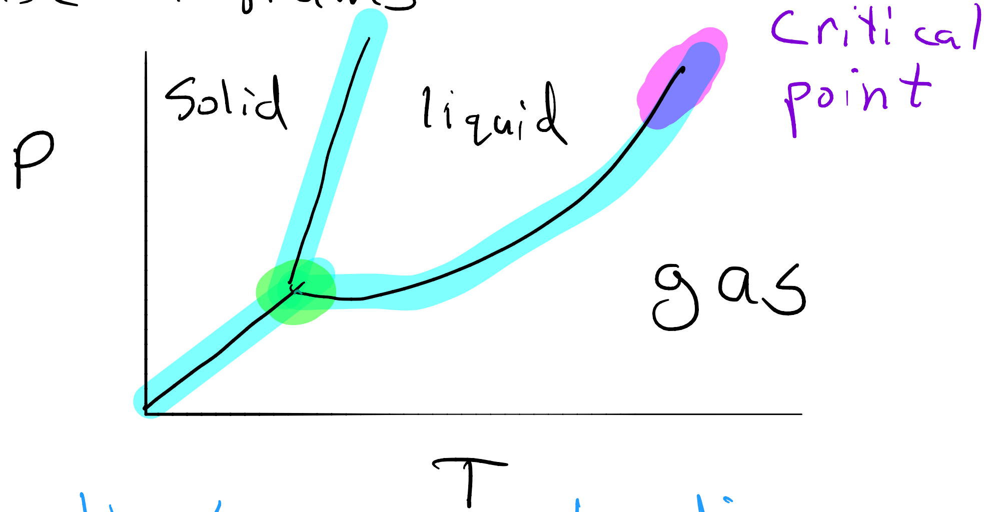
- ion-dipole (permanent)
- dipole-dipole
  - → Keesom forces

- ion-dipole (temporary)
- dipole-dipole
  - → Debye forces

instantaneous (spontaneous)
  - → London dispersion forces

All substances experience London dispersion forces.

Phase diagrams



The lines/curves on the diagram represent pressure/temperature combinations in which phases of matter are in equilibrium.

The triple point represents the temperature and pressure at which all three phases of matter are in equilibrium.

The critical point is where the distinction between a gas and liquid disappears. This fluid has the density of a liquid (high P), but the molecular mobility (high T) of a gas.