Liquids and Solids

Lets start by looking at water

$H_2O(s) \rightarrow H_2O(l)$ $\Delta H^\circ_{fusion} = 6.02$ kJ/mole
$H_2O(l) \rightarrow H_2O(g)$ $\Delta H^\circ_{vaporization} = 40.7$ kJ/mole

What are the difference between liquids and solids?

What are the differences between intermolecular and intramolecular forces?

Intermolecular Forces

1.

2.

3.

What do we mean by the term Van der Waals Forces?

Dipole-Dipole

Hydrogen Bonding

The Boling Points Graph

London Forces

The Halogen Family

Liquids

Surface Tension

Capillary Action

Viscosity

Types of Solids

Crystalline Amorphous

How do we determine the structure of a solid?

A father and son share a Nobel Prize.

Types of Crystalline Solids

Ionic

Molecular

Atomic

Bonding in Metals

Electron Sea Model

Alloys

Substitutional "Brass"

Interstitial "Steel"

Network Atomic Solids

Allotrope

Graphite Diamond

Molecular Solids

Ionic Solids

Network Atomic Solids

The Liquid State
Vapor Pressure

Two factors affect Vapor Pressure: Molecular Weight and Intermolecular Forces

Change in State

1)

2)

3)

4)

5)

6)

Heating Curves

Normal Boiling Point

Normal Melting Point

Super Cooling and Super Heating

Phase Diagrams

For Water!

For Carbon Dioxide and everything else.

Critical Temperature

Critical Pressure

Critical Point

Triple Point

Location	Altitude (feet)	Atmospheric Pressure (torr)	Boiling Point of Water

Putting it all together

From the 1992 Exam

Explain each of the following in terms of atomic and molecular structures and/or intermolecular forces.

(a) Solid K conducts an electric current, whereas solid KNO_3 does not.

(b) $SbCl_3$ has measurable dipole moment, whereas $SbCl_5$ does not.

(c) The normal boiling point of CCl_4 is 77°C, whereas that of CBr_4 is 190°C.

(d) $NaI_{(s)}$ is very soluble in water, whereas $I_{2(s)}$ has a solubility of only 0.03 gram per 100 grams of water.

From the 1988 Exam
Using principles of chemical bonding and/or intermolecular forces, explain each of the following.

(a) Xenon has a higher boiling point than neon has.

(b) Solid copper is an excellent conductor of electricity, but solid copper chloride is not.

(c) SiO_2 melts at a very high temperature, while CO_2 is a gas at room temperature, even though Si and C are in the same chemical family.

(d) Molecules of NF_3 are polar, but those of BF_3 are not.