

## Intermolecular Forces & Unit Cells – Solids, Liquids, Phase Changes

### IM Forces

Define-

intramolecular forces:

intermolecular forces:

phase:

phase change:

Types of phase changes –

condensation:

vaporization:

melting:

fusion:

freezing:

sublimation:

deposition:

What two enthalpy changes sum to the heat of sublimation?

The Clausius-Clapeyron equation –

What is the Clausius-Clapeyron equation used for?

Examples:

The vapor pressure of ethanol is 115 torr at 34.9°C. If  $\Delta H_{\text{vap}}$  of ethanol is 40.5 kJ/mol, calculate the temperature (in °C) when the vapor pressure is 760. torr. ( $R=8.314 \text{ J/mol K}$ )

At 34.1°C, the vapor pressure of water is 40.1 torr. What is the vapor pressure at 85.5°C. The  $\Delta H_{\text{vap}}$  of water is 40.7 kJ/mol.

Define-boiling point:

melting point:

phase diagram:

critical point:

triple point:

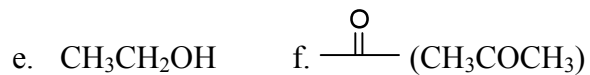
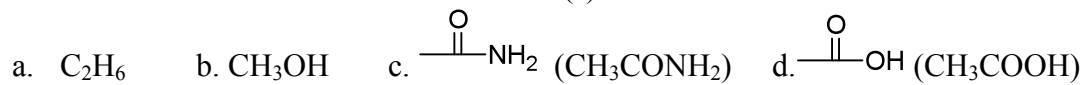
### Types of Inter and Intramolecular Forces

Force	Looks Like	Basis of Attraction	Energy (kJ/mol)	Example
Ionic				
Covalent				
Metallic				
Ion-Dipole				
H bond				
Dipole-Dipole				

Force	Looks Like	Basis of Attraction	Energy (kJ/mol)	Example
Ion-induced dipole				
Dipole-induced dipole				
Dispersion (London)				

Hydrogen bonding-

Which of the following substances exhibits H bonding? For those that do, draw two molecules of the substance with the H bond(s) between them.



Predicting the type of intermolecular forces-

For each pair of substances, identify the key intermolecular force(s) in each substance, and select the substance with the higher boiling point.

- a.  $\text{MgCl}_2$  and  $\text{PCl}_3$
  
- b.  $\text{CH}_3\text{NH}_2$  and  $\text{CH}_3\text{F}$
  
- c.  $\text{CH}_3\text{OH}$  and  $\text{CH}_3\text{CH}_2\text{OH}$
  
- d. Hexane ( $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ ) and 2,2-dimethylbutane
  
- e.  $\text{CH}_3\text{Br}$  and  $\text{CH}_3\text{F}$
  
- f.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$  and  $\text{CH}_3\text{CH}_2\text{OCH}_3$
  
- g.  $\text{C}_2\text{H}_6$  and  $\text{C}_3\text{H}_8$

### Unit Cells

Define-  
crystal lattice:

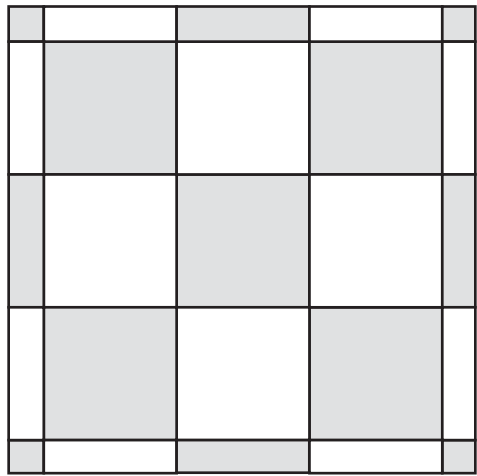
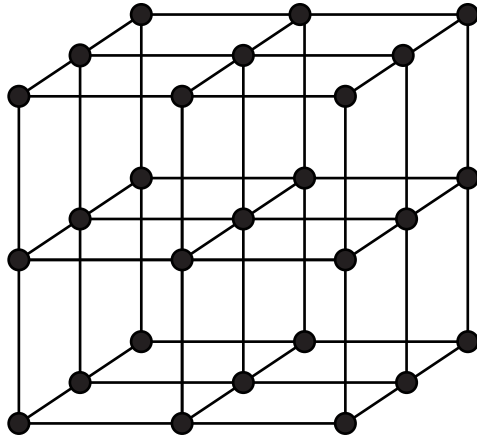
unit cell:

coordination number:

crystalline solid:

amorphous solid:

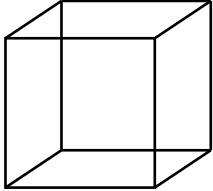
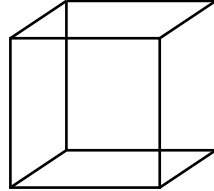
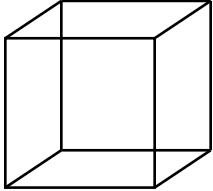
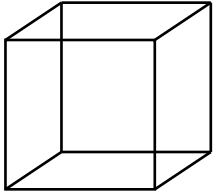
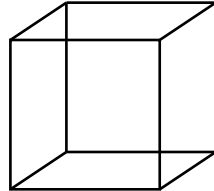
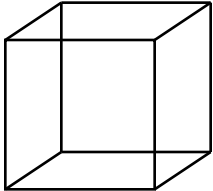
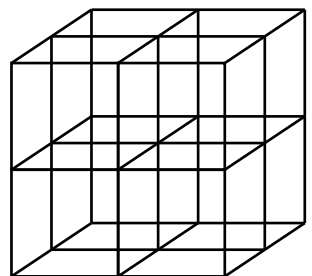
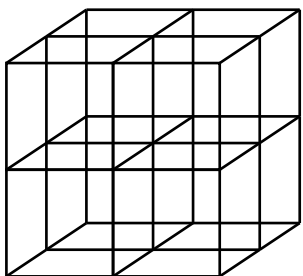
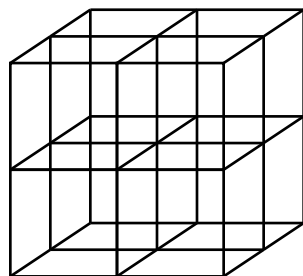
Understanding the unit cell in relation to the crystal lattice-  
On the diagrams below, identify and mark the unit cell and the lattice point.



Which item do both diagrams have in common?

If the black dots in the lattice diagram were all atoms, what kind of unit cell would result?

### Types of Unit Cells

<p><b>Basic Sketch</b></p>			
<p><b>Packing Sketch</b></p>			
<p><b>Lattice Sketch</b></p>			
<p><b>C.N.</b></p>			
<p><b>Atoms/ Unit Cell</b></p>			