

CHEM 101 SECTION – B

Fundamentals of Chemistry

Solutions: Solutions and their classification, Unit expressing concentration, Colligative properties and dilute solutions, Raoult's law, Van't Hoff's law of osmotic pressure

Thermochemistry: Laws of thermochemistry, Enthalpy, Hess's law, Heat of formation, Kirchoff's equations, Heat of neutralization, Heat of reaction

Electrochemistry: Conductors and nonconductors, Difference between electrolytic and metallic conduction, Electrolytic conductance, Factors influencing the conductivity of electrolytes, Kohlrausch Law and conductometric titrations

Chemical Equilibria: Equilibrium law/constant, K_p and K_c , Homogeneous and heterogeneous equilibrium, Van't Hoff's reaction isotherm, Le Chatelier's principle

Phase Rule: Basic terms and phase rule derivation, Phase diagram of water and carbon dioxide

Chemical Kinetics: Order and rate of reaction, Pseudo and zero order reaction, Half-life, Determination and factors affecting the rate of a reaction, First order reaction, Second order reaction, Collision theory, Transition state theory

State of Matters

The five states of matter

There are four natural states of matter:

Solids, liquids, gases and plasma.

The fifth state is the man-made Bose-Einstein condensates.

Solids

- In a solid, particles are packed tightly together so they don't move much.
- The electrons of each atom are constantly in motion, so the atoms have a small vibration, but they are fixed in their position. Because of this, particles in a solid have very low kinetic energy.
- Solids have a definite shape, as well as mass and volume, and do not conform to the shape of the container in which they are placed.
- Solids also have a high density, meaning that the particles are tightly packed together.

Liquids

In a liquid, the particles are more loosely packed than in a solid and are able to flow around each other, giving the liquid an indefinite shape. Therefore, the liquid will conform to the shape of its container.

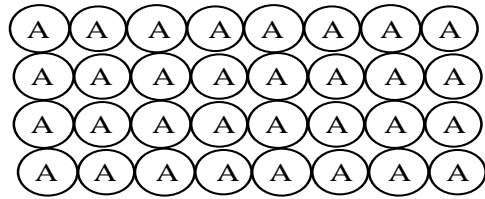
Much like solids, liquids (most of which have a lower density than solids) are incredibly difficult to compress.

Plasma

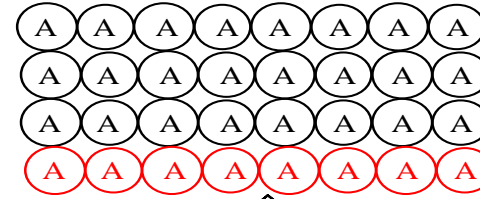
- Plasma is not a common state of matter here on earth, but it may be the most common state of matter in the universe.
- Stars are essentially superheated balls of plasma.
- Plasma consists of highly charged particles with extremely high kinetic energy.
- The noble gases (helium, neon, argon, krypton, xenon and radon) are often used to make glowing signs by using electricity to ionize them to the plasma state.

Bose-Einstein condensate

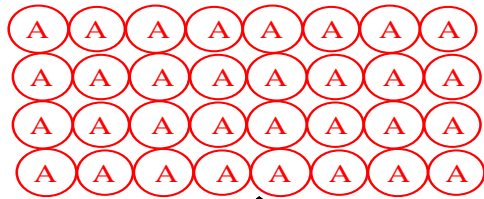
- The Bose-Einstein condensate (BEC) was created by scientists in 1995. Using a combination of lasers and magnets, Eric Cornell and Carl Weiman, scientists at the Joint Institute for Lab Astrophysics (JILA) in Boulder, Colorado, cooled a sample of rubidium to within a few degrees of absolute zero. At this extremely low temperature, molecular motion comes very close to stopping. Since there is almost no kinetic energy being transferred from one atom to another, the atoms begin to clump together. There are no longer thousands of separate atoms, just one "super atom."
- A BEC is used to study quantum mechanics on a macroscopic level. Light appears to slow down as it passes through a BEC, allowing scientists to study the particle/wave paradox. A BEC also has many of the properties of a super-fluid, or a fluid that flows without friction. BECs are also used to simulate conditions that might exist in black holes.



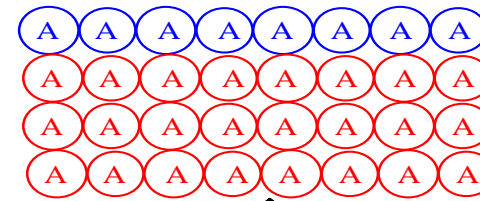
Solid body with compact structure of the molecules A



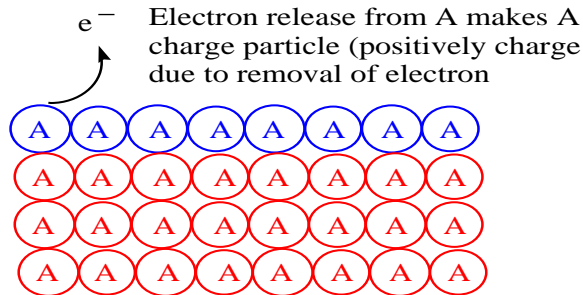
Heat Applied



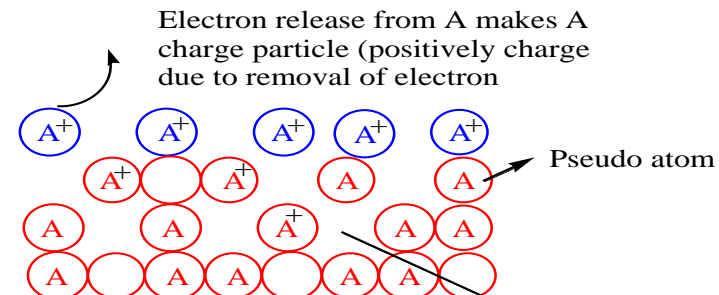
Heat transformed to the adjacent layers



Heat transformed to the electronic level



An electron will come out



Phase change to liquid

If the interatomic distance is higher enough, the phase will transformed to gas

A solution is a homogeneous mixture of two or more substances, consisting of ions or molecules.

A **colloid**, although it also appears to be homogeneous, consists of comparatively large particles of a substance dispersed throughout another substance.

A mixture is a heterogeneous part of two or more substances.

Recognition through experiment / observation

Question: Difference between solution, colloid, mixture and emulsion