FRIDAY, 2018-07-06

UBC CHEMISTRY P1, P2, P3

STATES OF MATTER

MATTER IS GRANULAR — IT'S MADE OF ATOMS.
ATOMS ARE EXTREMELY TINY. LET'S TAKE WATER (H_2O)

H: O H_2O:

O:

WATER MOLECULES ARE SO SMALL THAT A TABLESPOON (15mL) IS APPROX 10^{23} WATER MOLECULES.

10^{23} 10^{21} 10^{18} 10^{15} 10^{12} 10^{9} 10^{6} 10^{5} 10^{2} 10^{1} 10^{0}

100,000 | 000,000 | 000,000 | 000,000 | 000,000 | 000,000 | 000 | 000 | 000

100,000 MILLION MILLION MILLIONS | HUNDREDS | TENS | ONES

SOLIDS HAVE PARTICLES WHICH ARE ALL AS CLOSE TOGETHER AS POSSIBLE. THERE ARE SPACES BETWEEN THE PARTICLES. IN A TYPICAL SOLID ABOUT 76% OF THE VOLUME IS MADE OF ATOMS AND 24% IS PURELY EMPTY SPACE. THE PARTICLES ARE IN CONSTANT MOTION BUT JUST VIBRATE IN PLACE.

LIQUIDS ALSO HAVE PARTICLES IN CONTACT. THEY ARE FREE TO MOVE FROM PLACE TO PLACE, UNLIKE PARTICLES IN A SOLID. LIKE PARTICLES IN A SOLID THEY ARE STUCK TO ONE ANOTHER BUT MORE WEAKLY AND FLEXIBLY.

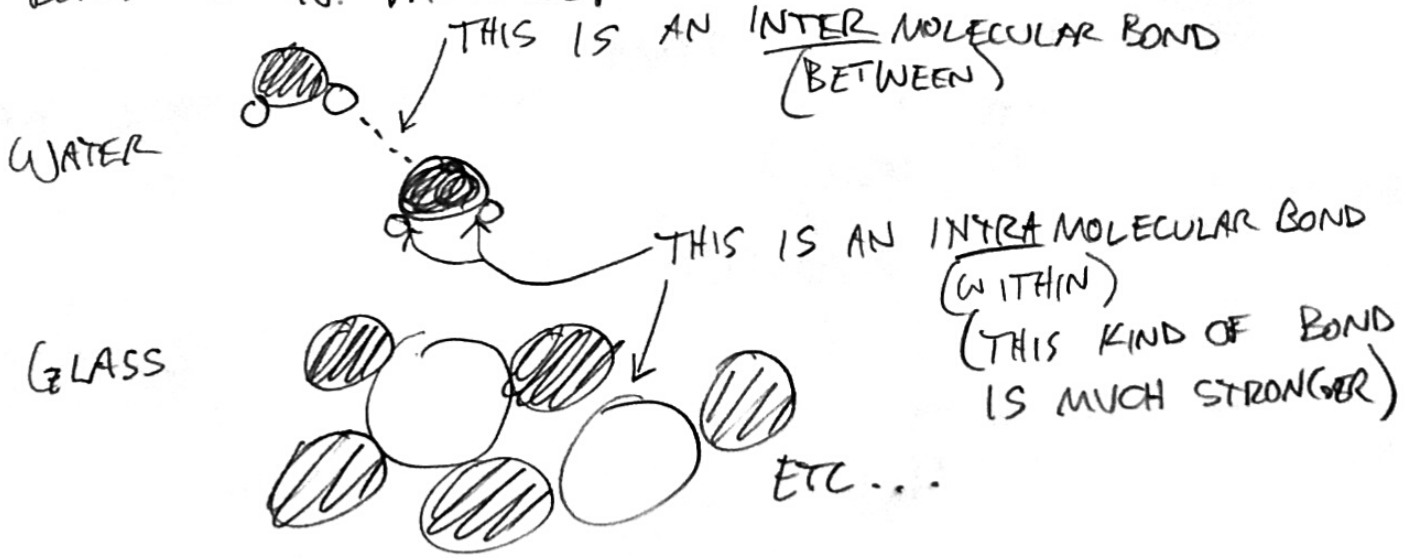
GASES HAVE PARTICLES WHICH ARE NOT IN CONTACT WITH ONE ANOTHER AT ALL. PARTICLE VOLUMES MAKE UP 1% OR LESS OF THE TOTAL VOLUME — THE REST IS EMPTY.

TEMPERATURE IS A MEASURE OF THE AVERAGE SPEED OF MOLECULES. AT HIGH TEMP. PARTICLES ARE MOVING VERY FAST, AT LOW TEMP. PARTICLES ARE MOVING MORE SLOWLY.

THE MOST COMMON SPEED OF AN AIR MOLECULE AT ROOM TEMP. IS ABOUT 1000 mi/hr.

SO WHY ARE DIFFERENT SUBSTANCES, AT THE SAME TEMP., FOUND TO BE IN DIFF. STATES OF MATTER?

THE DIFFERENCE IS BECAUSE OF THE STRENGTH OF BONDS BTWN. PARTICLES.



AT LOW TEMP., EVEN WEAK BONDS ALLOW LIQUIDS AND SOLIDS TO FORM.

AT HIGH ENOUGH TEMP., EVEN STRONG BONDS MAY BREAK ALLOWING A GAS TO FORM.

Avogadro's Law

The amount of volume taken up by a gas depends on how many particles of gas there are. At the same temp. and pressure, a larger number of particles takes up a larger volume.

At 0°C and 1 atmosphere of pressure
A certain number of particles occupies 22L.

Also at 0°C and 1 atm.
Half that number of particles occupies 11L.

Gas Pressure

At the level of particles, gas particles are constantly hitting and bouncing off of surfaces at high speeds. This is the cause of pressure.

If you reduce the number of particles, but keep the pressure the same the volume must decrease. The pressure is a force which compresses the volume.