

Ideal Gases and Kinetic Molecular Theory

Aim: What are the properties of an "ideal gas"?

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Properties of an Ideal Gas

1. Particles have zero volume b/c particles are so small compared to distance between them. (dimensionless points)

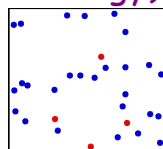
2. Particles have no attractions.

marbles bounced apart

marble in doorway

3. Particles transfer energy fully (no loss of energy) when colliding.

4. Move in constant, random straight lines.



marbles path unpredictable

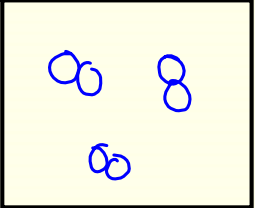
5. Equal volumes of any gas must have an equal number of particles if their pressures and temperatures are the same.

Avogadro's Gas Theory

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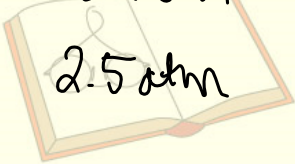
Avogadro's Theory

2L



O_2

298 K
2.5 atm



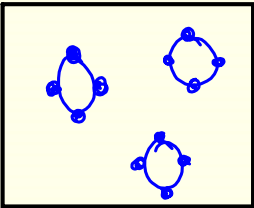
Same space occupied

must have an equal # of particles

Same amount of particle movement

Same amount of particle collisions

2L



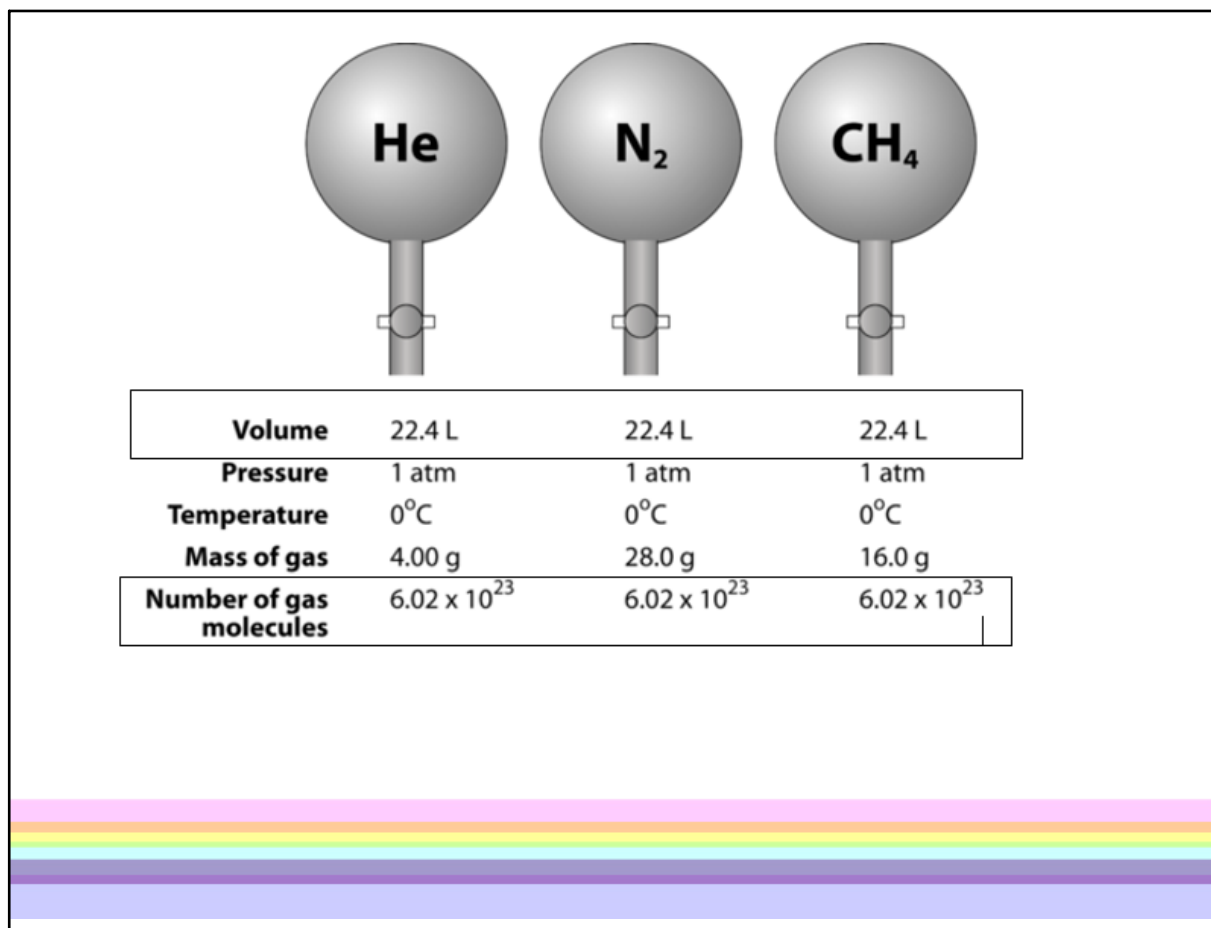
CH_4

298 K
2.5 atm

Avogadro's and Ideal Gases



- Avogadro's Theory: equal volumes of any gas with the same temperature and pressure have the **same number of particles**.
- We assume this because they behave in the exact same way at equal volumes.



Volume	22.4 L	22.4 L	22.4 L
Pressure	1 atm	1 atm	1 atm
Temperature	0°C	0°C	0°C
Mass of gas	4.00 g	28.0 g	16.0 g
Number of gas molecules	6.02×10^{23}	6.02×10^{23}	6.02×10^{23}

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Marble Activity

page 22 in packet

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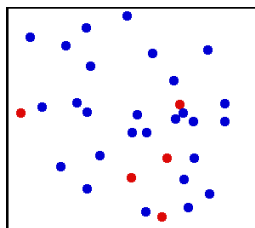
Ideal Gases Do Not Exist

Real gases DO NOT behave like an ideal gas because:

- Real gases **HAVE** intermolecular forces b/w particles.
- Real gas particles **HAVE** volume.
- Real gases **LOSE** energy upon colliding.

ONLY SIMILARITY:

both move in constant, random, straight-line motion.



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Behaving like an Ideal Gas

Real gases behave most like ideal gases when:

- the attractions between molecules are weak
- the molecules are far apart from each other.



Ideal Gas on a Beach

What type of pressures and temperatures allows molecules to be far apart and have little attractions while colliding?

Low pressures + High temperatures


molecules are far apart (LARGE VOLUME)

molecules collide with great force and deflect, little attractions.

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The most ideal gases:

- H_2 (hydrogen) & He (Helium)- the smallest gases
- The smallest gases have the weakest attractions and most space between particles.
- Behave the most ideal over other gases.



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