

8.Smells

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Phenomenon to be Investigated

Smells spread through the air, however it would take some time before a human nose is able to detect the smell. Study different aspects of odor diffusion and sensation of odor by humans.

Theoretical Introduction

Definition of smell:

Smell is the procedure in which somebody perceives the odor or scent through stimuli affecting the olfactory nerves and system.

- Humans have the ability to distinguish over 10,000 different smells and odors
- Heated food is easier to smell by a distance than cold food
- Solid objects are highly unlikely to have a smell or odor

Odor

Odor definition:

Odor is a “quality” of a liquid or gas ,that stimulates the olfactory organ and receptors in the nasal cavity.

The odor of something consists of:

- Volatile molecules
- Easy to evaporate chemicals
- Esters, when referring to the smell of a flower or fruit

Odor

Orthonasal Olfaction (The process of smelling through the nose)

- Molecules, which are easy to evaporate, travel through the air molecules and reach one's nose
- The molecules pass up the nose and reach the olfactory epithelium
- There they reach mucus and cilia
- The molecules meet the odour receptors

Odor

- The molecules bind with the receptor cells to create a “signal”
- These signals are passed along nerve- fibers
- They converge on a structure on the frontal lobe
- Finally the signals are processed and we are enabled to “smell” and distinguish odors



Odor diffusion

“Diffusion is the movement of molecules from a region of high concentration to one of low concentration”.

- e.g. : If you have ever opened a bottle of cologne or , you have witnessed diffusion. Molecules of the scent escape from the container, where they are present in very high concentration. They spread outward in every direction to regions where they are in low concentration. Your nose is able to detect the smell of the cologne or perfume even if you are quite a distance from the bottle that has been opened.

Odor diffusion

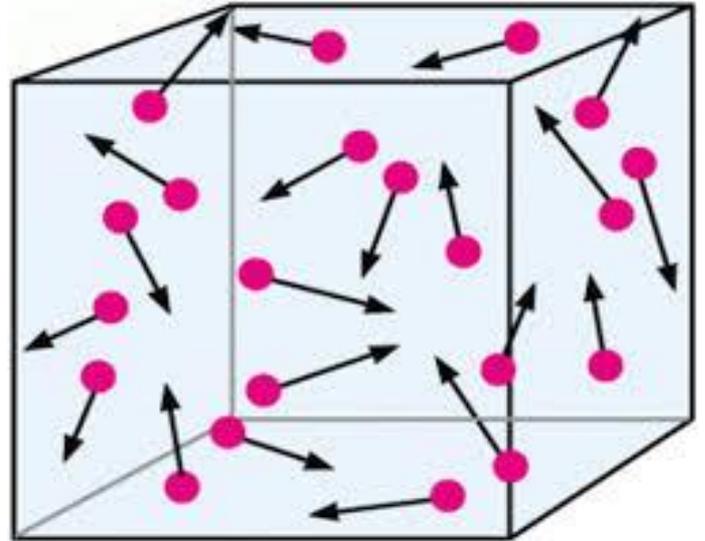
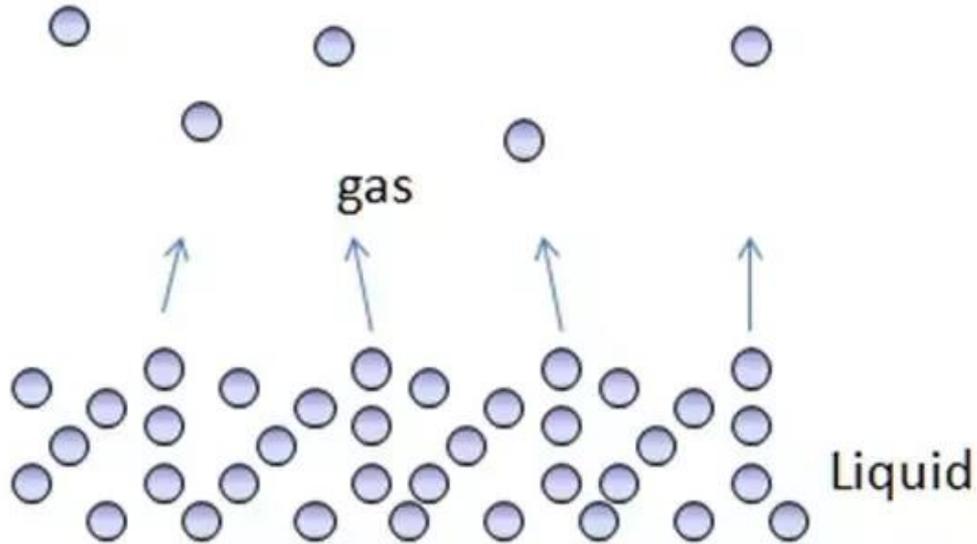
Brownian motion or movement:

Physical phenomena, in which some quantity is constantly and continuously undergoing some kind of random but small changes and fluctuations.

According to the Brownian movement:

If a number of particles, which are subjected to Brownian motion, exist in a given medium and there is no direction for the random oscillations, then the particles tend to be spread out evenly throughout the medium

Brownian motion



Odor diffusion

➤ Characteristics of diffusion:

- The particles of odors, when diffused, are mixed with the particles of air
- The particles of the odor move in an un-orderly manner until they are completely spread across a space
- The particles still move even when the smell is evenly spread



➤ Odor diffusion is a microscopic manifestation of the Brownian motion

The speed of smell

- The fundamental determinant of its speed is its tendency to spread out across a medium.
 - Other factors which can affect the speed of smell are :
 - Temperature
 - Air pressure
 - External movement (eg. wind)
- ↓
- The speed of each smell depends on many factors and therefore is not easy to be specified and determined on a general level

The speed of smell

Graham's Law of Effusion:

- The rate of effusion of a gaseous substance is inversely proportional to the square root of its molar mass.
- [Effusion, is the escape of gaseous molecules through a small (usually microscopic) hole, such as a hole in a balloon, into an evacuated space.]
- The rate and speed of the diffusion of gas molecules at higher temperatures are greater , since the molecules have greater kinetic energy

Graham's Law of Effusion

Graham's Law of Diffusion

$$\frac{v_1}{v_2} = \sqrt{\frac{m_2}{m_1}}$$

Where v is velocity of molecules and m is molecular mass of the molecules.

Primary Odors' Classification

1. Spicy
2. Flowery
3. Burned
4. Fruity
5. Putrid
6. resinous

Analytic experiment

We made 3 experiments using the following materials:

Spicy: cinamon

Burned: burned paper

Fruity:lemon

Patrid : rotten egg

Flowery: rose

Resinous: pine

1st experiment

Aim: in what distance do we start to smell the odor?

Conditions:

- Room with closed doors and windows
- Stable temperature 25°C
- No external factors (air pressure modification, wind, other odors)

1st experiment - procedure

1. Person A:

- a. opens plastic bowl with **4 grams of cinnamon** grains at **2** meters away from **Person B**
- b. starts walking towards from Person B, with stable slow speed.
- c. stops walking when Person B smells the cinnamon,
- d. measures the distance AB: **0,85 meters**

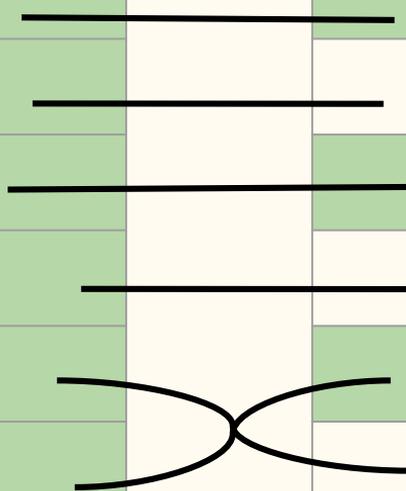
2. Leave windows open and set air condition in 25 celsius

1st experiment - Results

Sample	Smelling Distance
Rotten egg	1,42 meters
Cinnamon	0,83 meters
Pine branch	0,78 meters
rose	0,61 meters
Orange	0,56 meters
Burnt paper	0,50 meters

Comparing the results of the experiment with the theory

Ranking (experiment)	Sample	Ranking (theory)	Sample
1.	Rotten egg	1.	Rotten egg
2.	Cinnamon	2.	Cinnamon
3.	Pine branch	3.	Pine branch
4.	rose	4.	rose
5.	lemon	5.	Burnt paper
6.	Burnt paper	6.	lemon



Sources

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**THANK YOU FOR
YOUR TIME!**