The kinetic theory of matter

According to the kinetic theory we have three essentials:

- all matter is made up of tiny particles – molecules
- these molecules are constantly in motion (chaotic motion – thermal motion)
- the molecules attract each other strongly when they are close to one another

Molecules have kinetic energy (because of their motion).

Molecules have potential energy (their motion keeps them separated despite the attractions which are trying to pull them together).

In a solid:

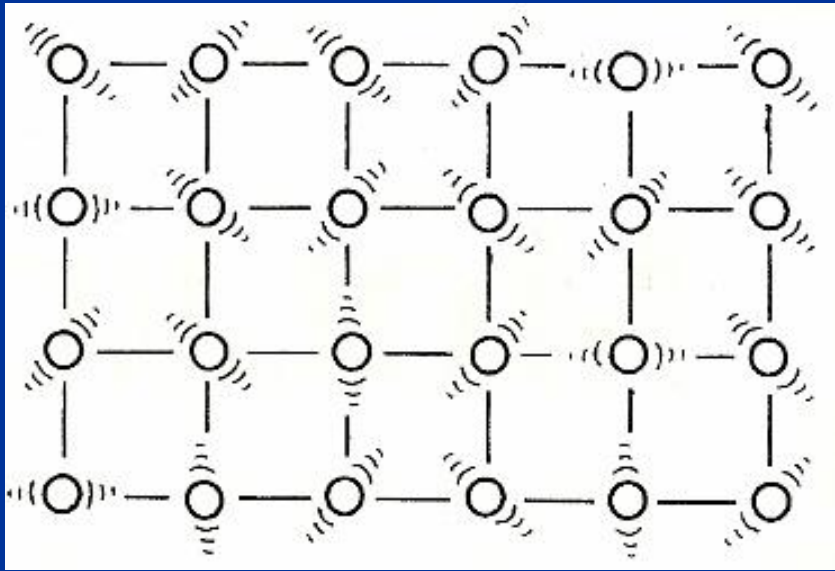
•strong forces of attraction hold the molecules close together in a regular structure

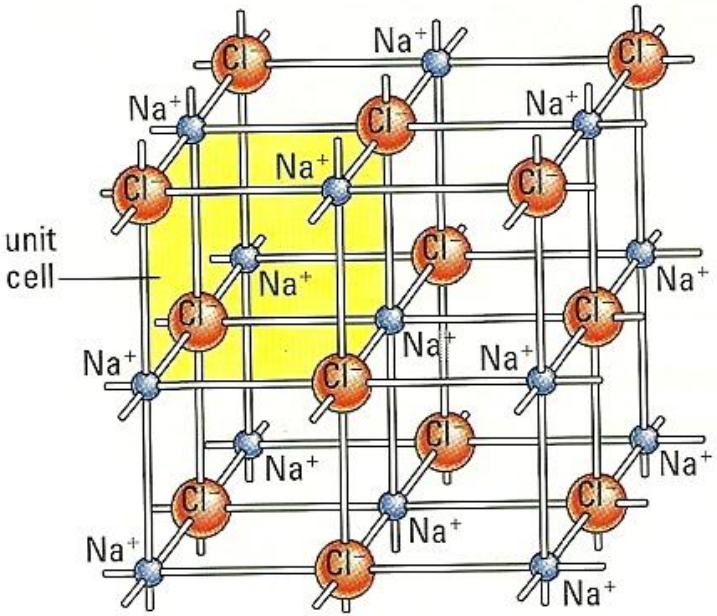
•the molecules vibrate to and fro, but they are not free to change positions

•a solid has a definite shape and volume

•crystalline substance (salt, sugar)

•amorphous substances (glass, wax)





The cubic ionic lattice of sodium chloride (NaCl), showing the unit cell. Each atom is shared by 8 unit cells which meet at these points, so really there is 1/8 atom at each of the 8 corners of the unit cell and therefore 1 atom per unit cell.

In a liquid:

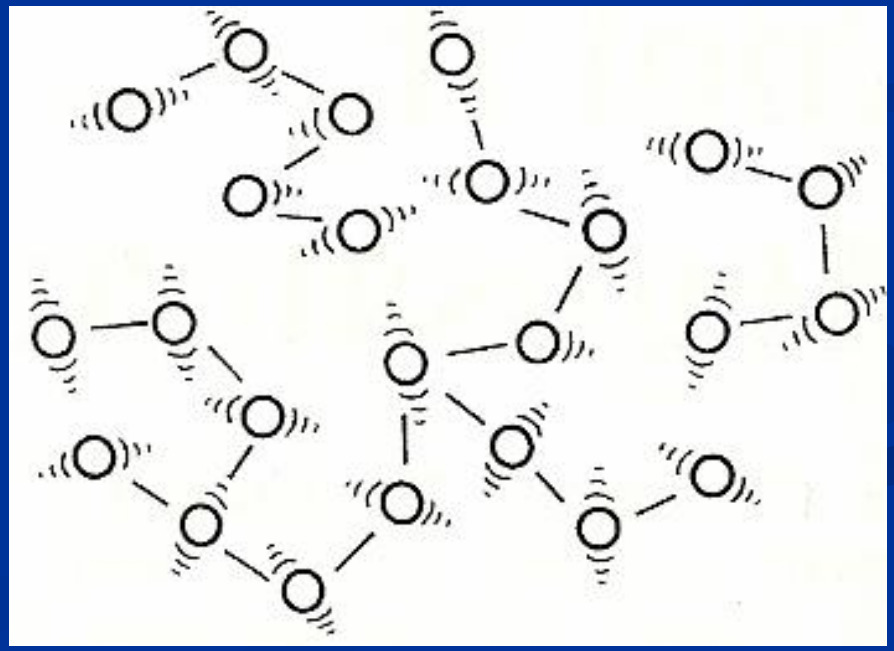
•the molecules are close together

•the molecules vibrate to and fro

•the molecules have enough energy to prevent the attractions from holding them in fixed positions

•a liquid has a definite volume but no fixed shape

•a liquid can flow



In a gas:

•the molecules are well spaced out

•the molecules have enough energy to be virtually free of any attraction between one another

•the molecules travel at high speed and may also spin

•moving about at random, the molecules collide with each other and the walls of any container they happen to be in

•unlike the molecules of a solid or liquid, they do not occupy a fixed volume

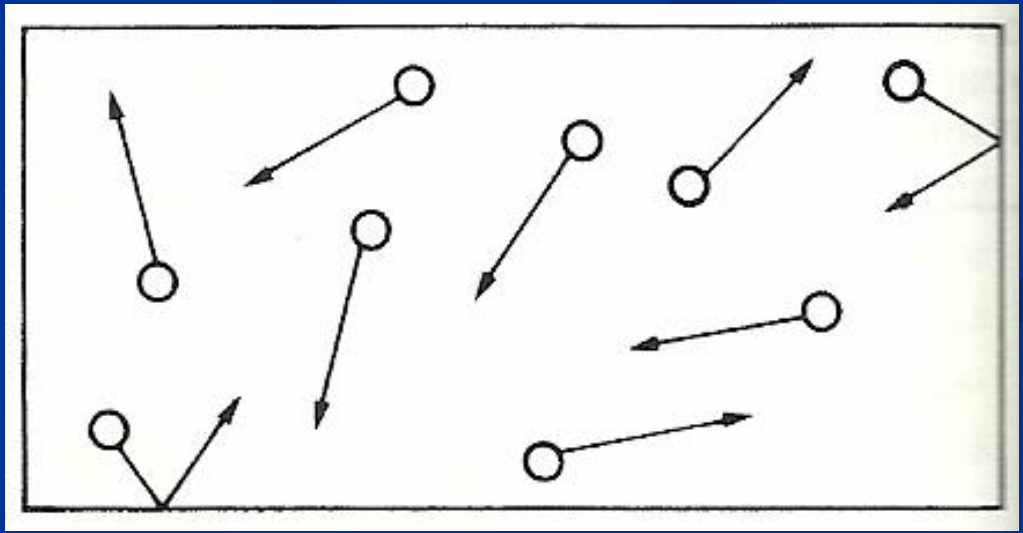
•the molecules quickly fill any space available

Plazma:

•electric charged particles (electrons

and ions) and neutral particles

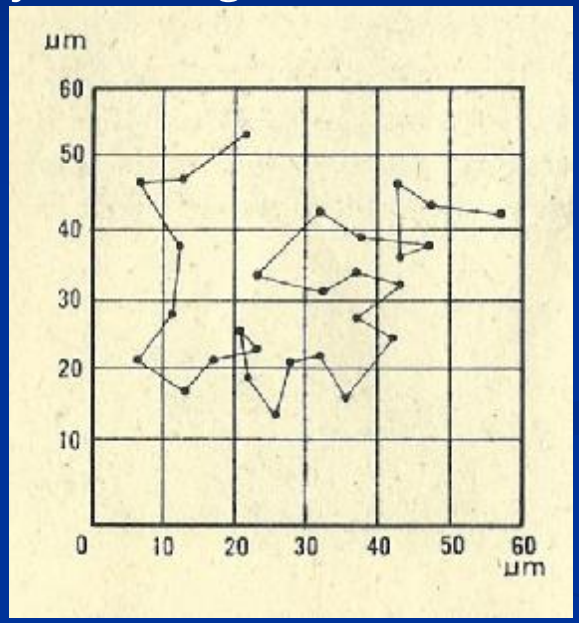
(flash, aurora).



The Brownian motion

•In 1827 – Robert Brown (tiny grains of pollen suspended in water were constantly wobbing and wandering about)

•Brownian motion – caused by vibrating molecules bumping into the pollen grains

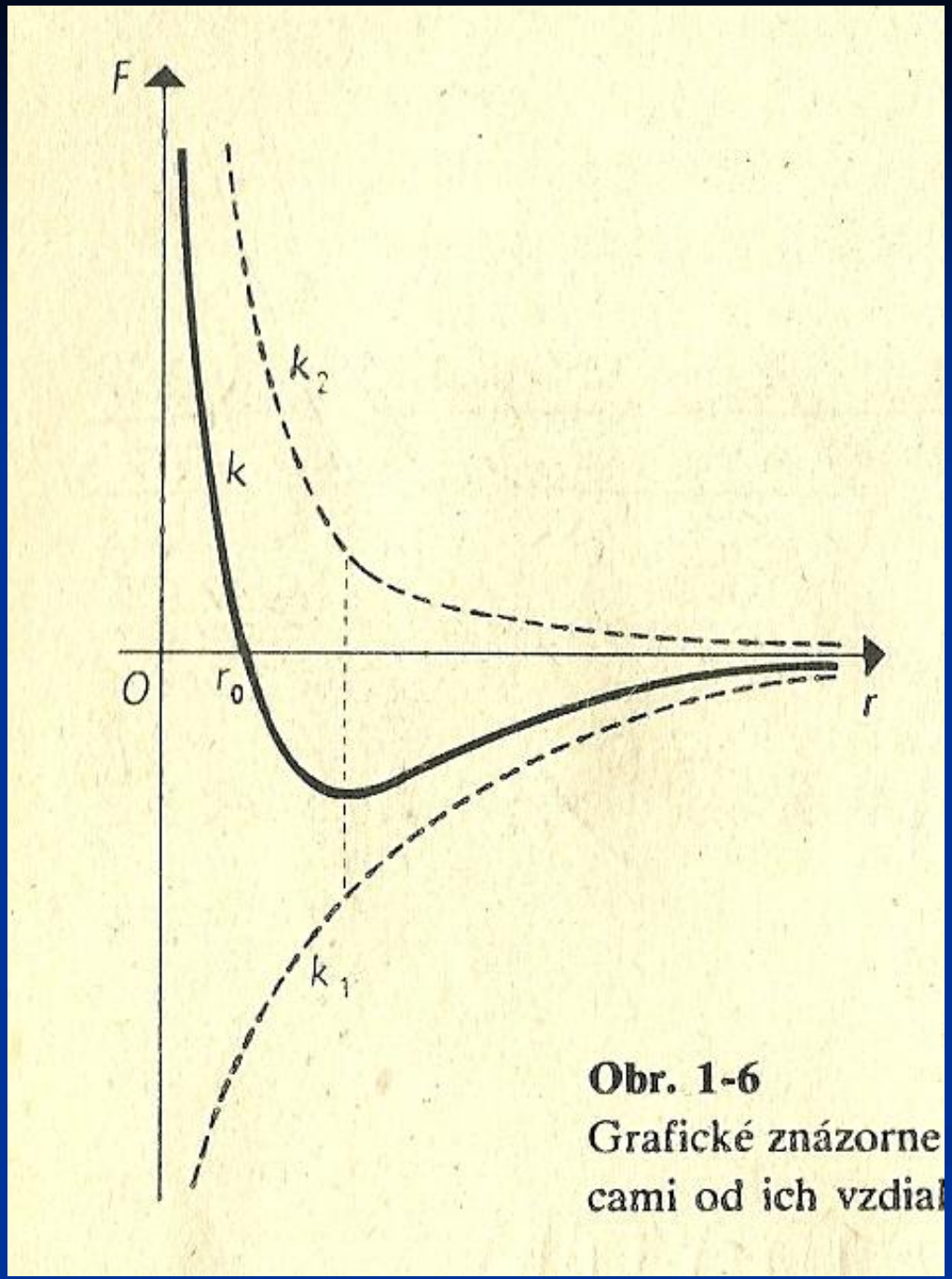


Diffusion:

•ink is dropped into a dish of water – the colour spreads soon through the water – the process is called diffusion

•the ink molecules wander at random through the water as they are bumped and jostled by the water molecules around them

The higher temperature of matter, the higher speed the molecules are moving at.



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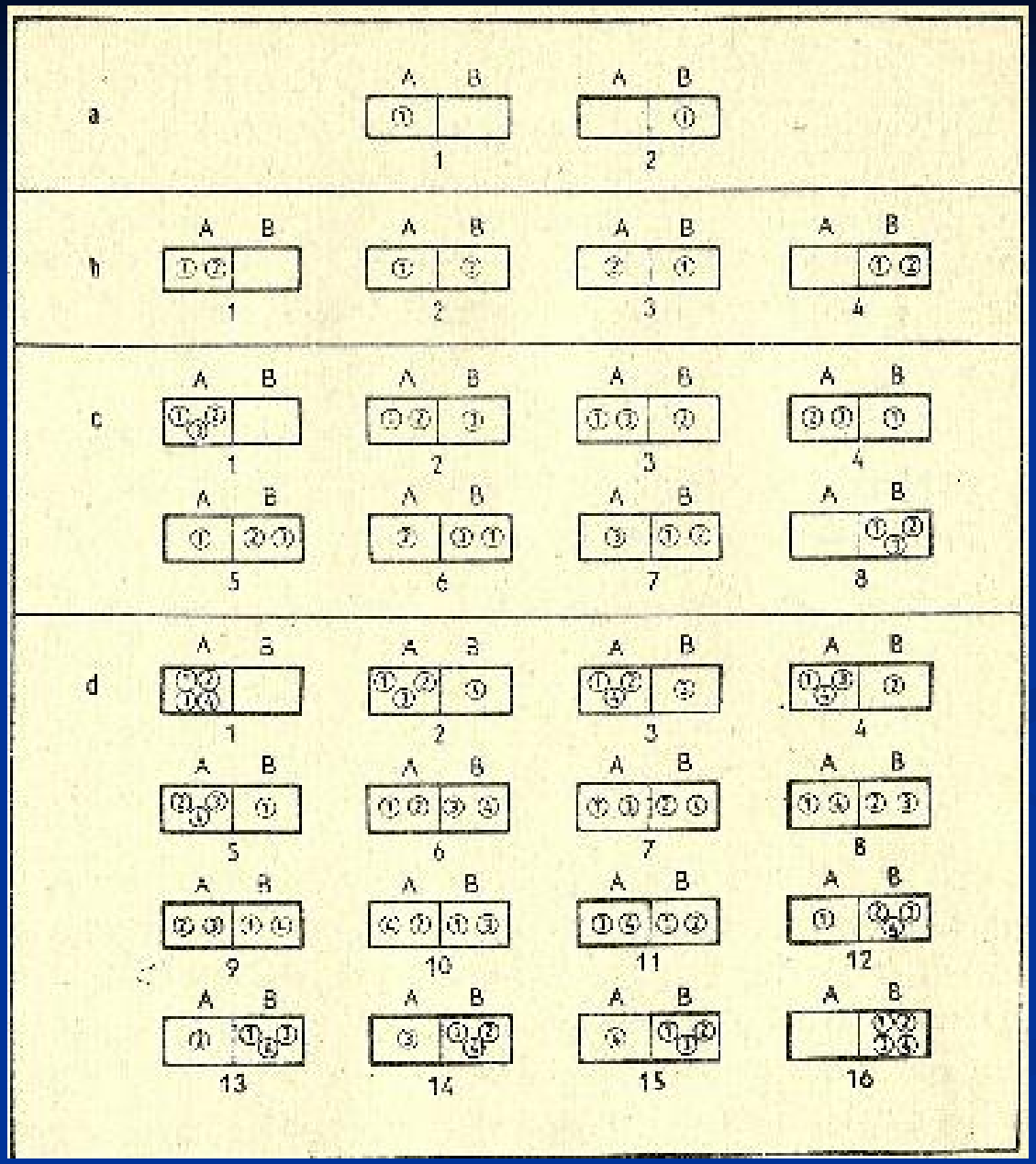
k1 - attractive force

k_2 – repulsion (repulsive forces

k – net force

When there is a distance between the two molecules equal to r_0 the molecules are in equilibrium.



p – probability

$p = 1 / 2^N$

where N is number of molecules

steady-state system :

a) N = 1

$p = 1 / 2^1 = 0.5$

b) N = 2

$p = 1 / 2^2 = 0.25$

c) N = 3

$p = 1 / 2^3 = 0.125$

d) N = 4

$p = 1 / 2^4 = 0.06$

$N = 100\ p = 0.8 \times 10^{-30}$