

Heat

Kinetic theory of gases
Brownian motion of molecules

Brownian movement of smoke particles

Object of the experiment

- Observing the Brownian movement of smoke particles in an illuminated chamber under a microscope.

Principles

A particle that is floating in a gas performs a movement with permanently changing velocity and direction. *J. Perrin* explained this motion of molecules, which had been discovered by *R. Brown*. It is caused by collisions of the particles with the gas molecules. The smaller the particle, the more lively its motion, which is composed of a translational movement and a rotational motion, which changes as well.

In this experiment, the movement of smoke particles in air is observed under a microscope.

Apparatus

1 smoke chamber	372 51
1 monocular student's microscope MIC 805	662 078
1 transformer, 6 V AC, 12 V AC/ 30 VA	521 210
1 lamp housing	450 60
1 lamp, 6 V/30 W	450 51
1 aspherical condenser	460 20

Setup

The experimental setup is illustrated in Fig. 1.

- Set the magnification to 100 by turning the objective 10x into the optical train of the microscope.
- Set the coarse adjustment of the microscope so that the centre of the smoke chamber is focussed sharply.
- Equip the lamp with the aspherical condenser, and connect it to the 6 V output of the transformer.
- Arrange the illumination so that its focus is located in the centre of the smoke chamber (check by holding a sheet of paper at the position of the smoke chamber).

Carrying out the experiment

- Light an incense cone or a cigarette, and put a funnel over it for a short time.
- Using a syringe, suck smoke from the opening of the funnel, and inject it into the smoke chamber.
- If necessary, slightly rotate the smoke chamber to reduce the brightness in the smoke chamber.
- Adjust the focus of the microscope, and observe the movements of the particles.

Remark: the movement of the smoke particles can be observed over a longer period if the tubings are shortened significantly and if their ends are closed with caps (309 00 143).

Measuring example

The illuminated smoke particles are seen as small white spots that perform irregular swinging and zigzagging movements. White spots disappear from the plane on which the microscope is focussed or enter it.

Evaluation and results

The movements of the smoke particles result from their collisions with the air molecules, which in their turn are in thermal motion.

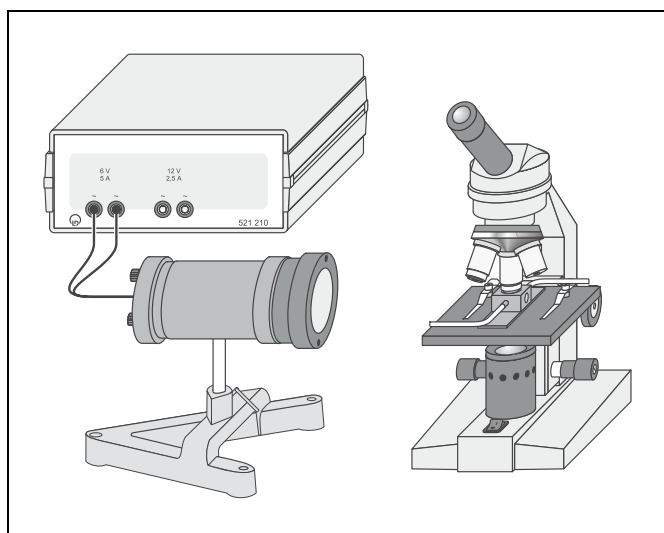


Fig. 1 Setup for observing the Brownian movement of smoke particles in air

