

## Brugsvejledning til radiometer

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Dette er et såkaldt "radiometer". Navnets sidste del er lidt misvisende, idet et "meter" normalt er noget, man forbinder med måling. Det kan man ikke med dette apparat. Ordet radio betyder stråling – i dette tilfælde varmestråling.

I radiometeret er anbragt en mølle med 4 "vinger", der kan rotere om en nålespids. Vingerne er fremstillet af glimmer, der er varmeisolerende. De er matsorte på den ene side og blanke/reflekterende på den anden side.

Hvis radiometeret anbringes i direkte sollys vil møllen rotere.

Forklaringen på dette fænomen er følgende: Når sollyset rammer de sorte flader opsuges varmen, og de sorte sider bliver varme, hvorimod de blanke sider reflekterer varmestrålingen og derfor opnår en lavere temperatur.

Lufttrykket på en overflade er bestemt af luftmolekylernes hastighed ved overfladen, som igen er bestemt af luftens temperatur. Da temperaturen ved den sorte flade er højere end temperaturen ved den blanke flade, er der på tilsvarende vis en trykforskel, som får møllen til at dreje rundt.

## Users manual for Radiometer

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This apparatus is called Crookes' Radiometer. "Radio" refers to radiation, and "meter" means measuring instrument. It consists of a partially evacuated glass bulb within which a four vaned rotor is mounted on a low friction spindle bearing. Each vane is black on one side and white or polished metal on the other. The device was invented by the British chemist Sir William Crookes. In the course of very accurate quantitative chemical work, he was weighing samples in a partially evacuated chamber to reduce the effect of air currents, and he noticed that the weighings were disturbed when sunlight shone on the balance. After further investigation he devised the device named after him, still manufactured and sold to this day for demonstration experiments.

The device is sensitive to radiation, specifically to the radiation band which is absorbed by the black surfaces of the vane and reflected by the white surfaces. The vanes are made of the highly insulating material mica. The instrument will normally be exposed to visible and near infrared from electric lamps, the sun or other common light sources.

If the radiometer is exposed to strong illumination e.g. from the sun, the vanes will rotate. This occurs due to the following processes:

- More of the incident radiation is absorbed by the black sides of the vanes than by the white sides, which reflect the incident radiation.
- The absorbed radiation heats the black sides more than the white. Because the vanes are insulated due to the mica, the black sides become warmer than the white.
- The glass bulb is not completely evacuated, only partially so in order to permit the vanes to rotate with little air resistance. Some air remains, however.
- The remaining air is heated to a greater or lesser degree due to contact with the black and white sides of the vanes. Thus the air near the black surfaces has a slightly higher temperature than the air near the white surfaces.
- Air molecules striking the black surface thus have a slightly higher kinetic energy than those striking the white surface and thus impart a greater impact on the black sides than the white.
- Thus the rotor will tend to rotate because a greater force is applied to the black sides of the vanes than the white. Observe the direction of rotation!