

Entropy Conduction in Metals

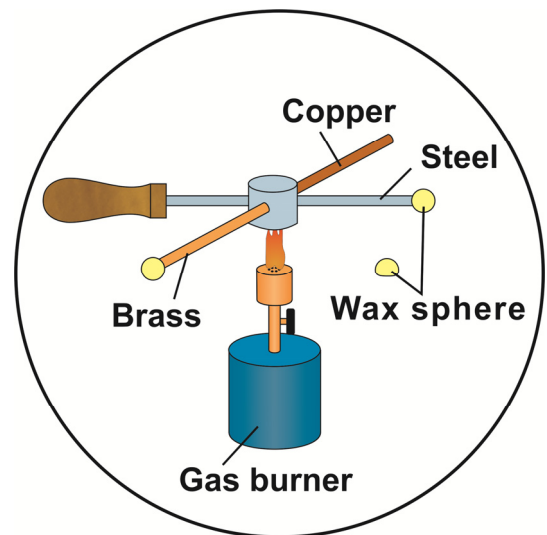
Equipment:

cross or star made of rods with equal length and diameter of different metals (e.g. copper, brass, steel) connected with an additional rod, which is used for fixation

Bunsen burner

ring stand and clamp

(optional: small steel balls)



Chemicals:

wax

Procedure:

The cross (or star) is attached in such a way to the ring stand that the hub is above the burner. Wax spheres are stuck to the ends of the rods (or small steel balls by means of wax). Subsequently, the burner is lighted.

Observation:

The wax spheres (or steel balls) fall off one after another: first the one connected with copper rod, then the one connected with the brass rod and finally the one connected with the steel rod.

Explanation:

The sequence of the falling spheres reflects the different entropy conductivity σ_S of the metals.

Because the spheres fall down when the melting temperature of wax is reached the experiment rather show the temperature conductivity (thermal diffusivity) $a = \sigma_S / (\rho \times c)$. The product of the density ρ and the specific entropy capacity c is, however, very similar for the different metals, which is why the result essentially only depend from the entropy conductivity.

Supplement:

In a simplified version of the experiment each of three pieces of chocolate is skewered with one of the thin rods (e.g. about 135 mm long, about 2 mm \varnothing) made of copper, brass and steel. The rods are then taped to the inside edge of a cup (the use of a well-adhering fabric tape is recommended). Subsequently, the cup is filled with hot water so that the rods at least are half covered. After a short while (less than 30 s), the piece of chocolate in contact with the copper rod slides down in the direction of the water. Subsequently (after about 90 s), the one in contact with the brass rod follows. The piece in contact with the steel rod,



however, does not slide down. For the experiment, milk chocolate should be used because of its lower melting point (compared to dark chocolate).

Disposal:

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