

# LECTURE EXPERIMENT ON THE DETERMINATION OF THE SPECIFIC HEAT OF A GAS AT CONSTANT PRESSURE

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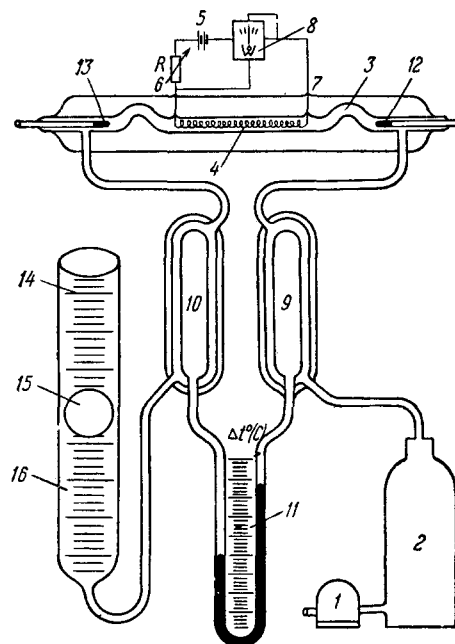
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The device is shown on the figure. The gas whose specific heat is to be measured is forced with the aid of a blower 1 into the cylindrical container 2, which smooths out the small pressure pulsations due to the action of the blower. The gas flows from the container into the calorimeter tube 3, where it is heated by the electrical heater 4. The electric energy is supplied to the heater from source 5 through leads 6 and 7 embedded in the glass. The electric power received by the heater of the calorimeter is measured by wattmeter 8 and consequently the quantity of heat  $Q$  received by the gas is determined. To measure the temperature difference of the heated gas, two differentially-connected gas thermometers 9 and 10 are placed at the entrance and exit of the calorimetric tube. The temperature difference  $\Delta t$  of the thermometers can be ascertained with sufficient precision by the difference in the level of liquid in manometer 11, which is previously calibrated with the aid of two thermocouples 12 and 13 placed at the entrance and exit of the calorimeter and connected with each other differentially. The quantity of gas  $G$  which passes through the calorimeter is determined by a special flow meter. The flow meter is calibrated against a gas meter. The principle upon which this flow meter operates is based on the dynamic action of a gas jet which lifts a light hollow glass sphere 15 in a glass tube 16. Naturally, the more gas passes through the calorimeter the higher is the sphere lifted in the tube of the meter. Behind this tube is placed a scale graduated to read the gas flowing per unit time. To decrease heat losses in the calorimetric tube and in the bulbs of the gas thermometers, they are surrounded by silver-coated vacuum Dewar jackets.

Thus, all quantities necessary for the calculation of the specific heat of the gas are easily displayed in a large auditorium. The calculation of the specific heat by the formula  $C_p = Q / (G \Delta t)$  and the whole experiment last about 7 to 10 minutes.

The lecture demonstration described was set up by the authors in the Moscow Aviation Institute. An ordinary vacuum cleaner was used as a blower. The heater in the calorimetric tube was made of constantan wire of 0.3 mm diameter and had a resistance of about 20 ohm. A storage battery served as the source of electric

energy. The power was measured with an ordinary demonstration wattmeter. The specific heats determined differed by insignificant amounts from their tabulated values.



1 -- blower; 2 -- container for smoothing out pressure pulsations; 3 -- calorimetric tube; 4 -- electric heater; 5 -- electric-energy source; 6 and 7 -- leads through the glass; 8 -- wattmeter; 9 and 10 -- gas thermometers; 11 -- manometer; 12 and 13 -- thermocouples; 14 -- flow meter; 15 -- ball of the flow meter; 16 -- flow-meter tube with scale.

We suppose that the described experiment of determining the specific heat of gases can be useful during a general physics lecture on this topic.

In view of the fact that the device is essentially made of glass, its construction is simple and possible in any institution of higher learning.

Translated by Z. Barnea