For determining the radioactive count rates, the following counters can also be used along with the Geiger-Müller-counter tube Type B (Order-No.09005.00) apart from the Geiger-Müller-counter (Order-No. 13606.99) used in the experiments described here:

— Digital counter, 4-Decades Order-No. 13600.93
— Digital counter, 6-Decades Order-No. 13603.93

For a demonstrative assembly of the Geiger-Müller-counter (Order-No. 13606.99) on the header of the demo board physics with stand (Order-no. 02150.00) the following components (mentioned in the material lists of the experiments) are required:

— Support clamp for small case Order-No. 02043.10
— Clamp on holder for Demo-board Order-No. 02164.00
— Support rod, st. steel, *l* = 10 cm Order-No. 02030.00

Fig.1 shows the assembly of the Geiger-Müller-counter with the help of these components.
Fig. 2: Rear view of the Geiger-Müller-counter mounted on the header of the demo-board.

Fig. 1: Front view

Fig. 2: Rear view

Room for notes

In a Geiger-Müller-counter the filled gas is ionized by the penetrating radiation particles; the impulses thus arising out of this are converted to voltage impulses, which generate irregular knocking sounds in a loudspeaker and which can be registered by an electronic counting device. The acoustic presence makes it already clear, that the radiation is emitted irregularly.

The number of impulses rises with the measurement time. In order to compare the radiation intensities of different radioactive substances it is necessary to refer the number of impulses N to the same amount of time t. The relationship of the number of impulses with time is called the impulse or the counting rate Z. Its determination is an important and a very frequently done task when studying nuclear radiation.

Equipment

Support clamp for small case	02043.10	1
Clamp on holder	02164.00	1
Support rod stainless steel	02030.00	1
Counter tube holder on fix. magnet	09201.00	1
Plateholder on fix. magnet	09203.00	1
Counter tube Type B	09005.00	1
Geiger-Müller-Counter	13606.99	1
Demo-board for Physics with stand	02150.00	1
Incandescent mantle, 4 pieces	08360.00	1

Set-up and procedure

— The experiment is set up as per Fig.1.
— The incandescent mantles are fixed at the plate holder with the help of clamps.
— The counter tube without the protective cap is placed in the counter tube holder at a distance of about 1 cm from the mantles on the board.
— Start the counter at first without any fixed measurement time (switch to the position ∞) and observe the counter display.
— Remove the radiation source and observe the counter display.
— Now place the radiation source again in front of the counter tube; Select a measurement time of 10 s and measure the registered number of impulses at least 5 times and enter the values in Table 1.
— Increase the measurement time to 60 s and then to 100 s and take at least three reading for each time and enter the number of impulses registered in Table 2.

Fig.1: Experimental setup

Determination of the counting rates with the Geiger-Müller-Counter

Observations and results

Irregular knocking sounds can be heard after switching on the counter. When the radiation source is taken away from the counter tube, the frequency of the knocking sounds reduces.

The number of the impulses registered by the counter always increases with the measurement time.

Table 1

Running no.	$\frac{Z}{\text{Imp/10 s}}$
1	94
2	89
3	98
4	93
5	91

The number of impulses registered during the same time 10s vary around a mean value. This value is N = 93 Imp./10 s

Table 2

Running no.	Imp/60 s	Imp/100s
1	569	972
2	577	919
3	578	994
Mean value	575 Imp/60 s	962 Imp/100 s

Evaluation

When the measurement time is increased from 10 s to 60 s and then to 100 s, although a higher number of impulses are registered, when one refers the number of impulses to the same duration of time, one gets approximately the same value. The quotient of the registered number of impulses and the measurement time is called the impulse or the counting rate. The mean values of the number of impulses measured during different measurement times give the following impulse rates:

Measurement time $\frac{t}{\text{s}}$	Impulse rate $\frac{Z}{\text{Imp/s}}$
10	9.3
60	9.6
100	9.6

The intensity of the radiation of a radioactive source is characterized by the counting rate $Z = N/t$.