Experiment 3

Statistical Variation

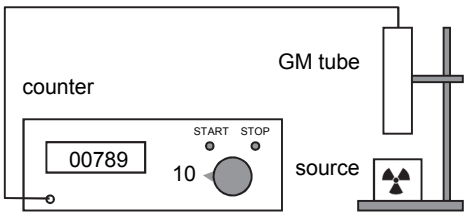
Name:
……...

Aim

- To show that the number of disintegrations of unstable nuclei as measured in pulses per second is not constant, but varies around *N*.
- To check whether this variation around the average *N* of the measured number of pulses is approximately $\sqrt{N}$.

Set-up

The set-up consists of a Geiger-Müller tube, a pulse counter and a source of radium-226 (^{226}Ra).



Read the introduction on page 5 of the booklet *ISP Experiments* about the statistical nature of radioactive decay.

Measurements

1 Position the source with the side marked red upwards underneath the GM tube.

2 Measure thirty times the number of pulses *N* in 10 seconds time. Record your measurements in the table below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

Assignments

1 From the measurements, calculate the average number of pulses *N* in a 10 second period.

N = …… pulses/10s

2 To consider the variation in the measurements, it makes sense to divide your measurements into categories. This is done as follows. Make up ten categories that are suited to your measurements, and count the number of measurements in each category. For example, you might have five measurements with a value between 311 and 320 pulses/10s (category 1), four measurements with a value between 321 and 330 pulses/10s (category 2), and so on.
Record your results in the table below.

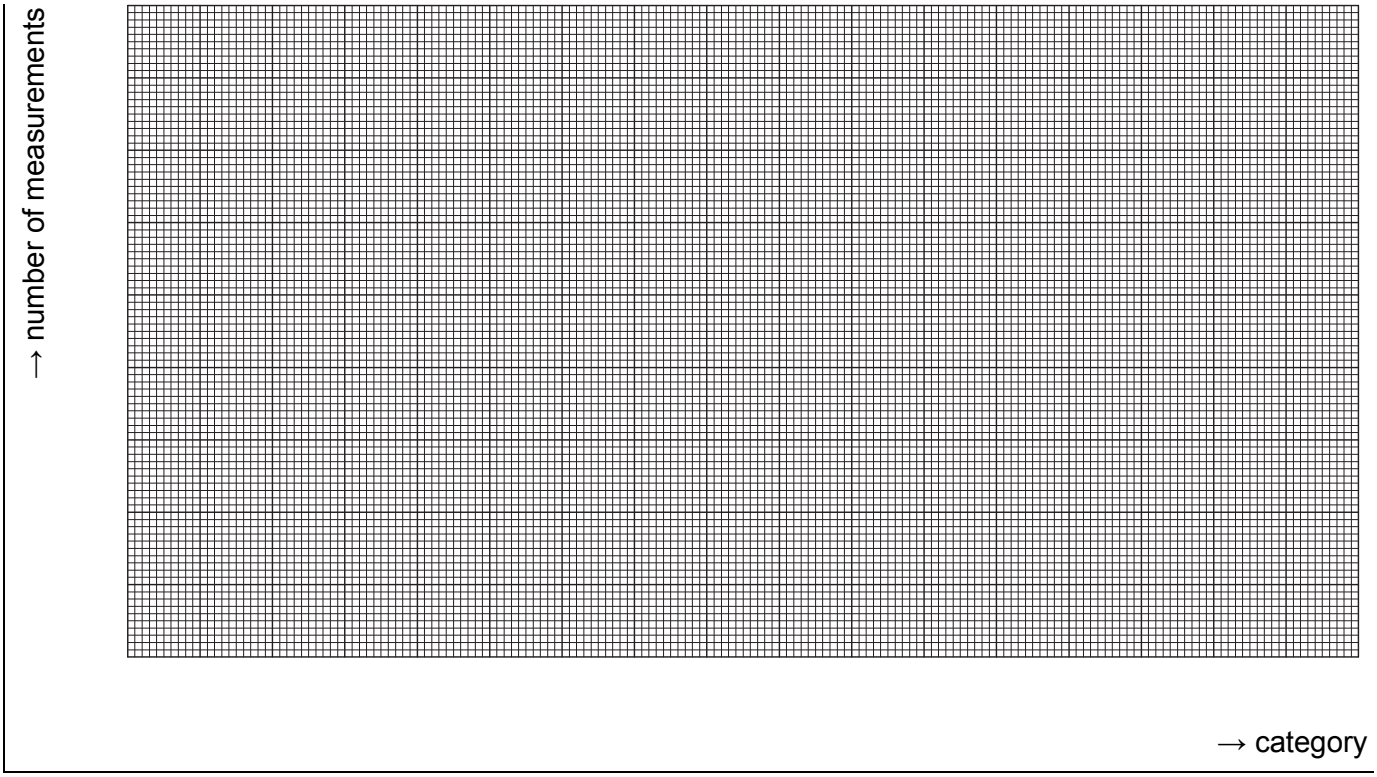
category										
number of measurements										

3 Display the data from the table in the form of a bar graph on the other side of this worksheet.

4 In the bar graph, draw a vertical line in the category that contains the average *N* (see assignment 1).

5 In the bar graph, draw two dotted vertical lines at a distance $\sqrt{N}$ to the left and to the right of the average N.
Calculate the number of measurements in between these two dotted lines as a percentage of the total number of measurements.

Percentage: …… %



6 The literature value of the calculated percentage from assignment 5, coming from statistics theory, is 68.8%. What is the difference between the calculated percentage and the literature value?

Difference: …… %

The calculated percentage of measurements between the values $N + \sqrt{N}$ en $N - \sqrt{N}$ is different from the literature value. Explain this difference. Or, in other words: what can you do to make the measurement more accurate?

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