Measurement's uncertainty
Types of measurement's uncertainties
Accuracy and precision

Dr. Miklós BERTA
Department of Physics and Chemistry
Széchenyi István University

SZÉCHENYI ISTVÁN EGYETEM
SZE - GYŐR

Fizika és Kémia Tanszék

Measurement's uncertainty

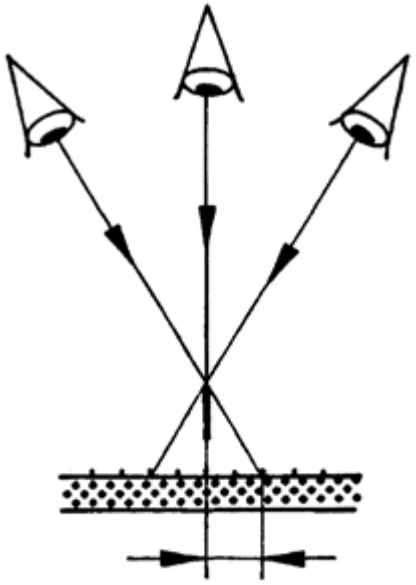
- By repeating a measurement several times, we do not always get the same result!

- *So the final result of every measurement is loaded with measurement's uncertainty ("error")! Always, without exception!*

- *The "true value" of the measured quantity can never be known with absolute certainty!!*

Types of measurement's uncertainties

- *Gross measurement error* - mistake, use of an inaccurate (faulty) instrument, ignoring the constant, large-scale influence of environmental factors, etc. - they are revealed during the evaluation of the measurement results, so they should be ignored during the final evaluation!!



Parallax error

- one common personal error results from incorrect reading of the measured value (e.g. parallax error on scale instruments)

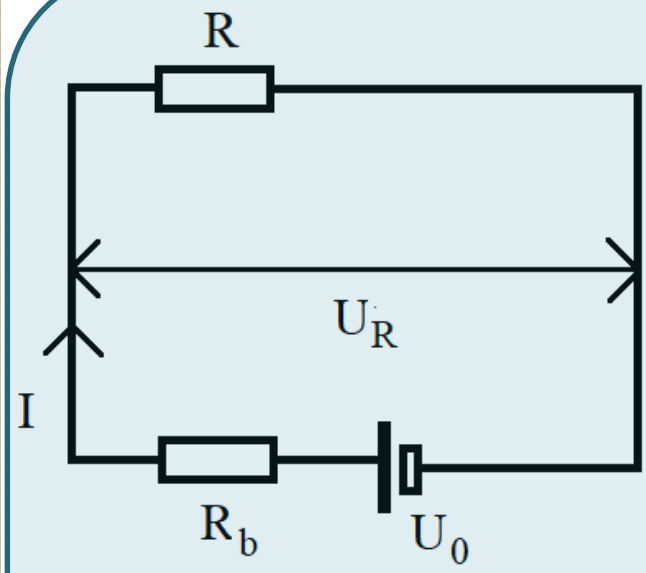
- incorrect identification of the measurement limit of the instrument

- using a Voltmeter or Ammeter with a discharged battery, using a faulty instrument

Types of measurement's uncertainties

- *Systematic measurement error* - the "inherent" error of the chosen measurement method - always causes a deviation from the "true" value in the same direction.

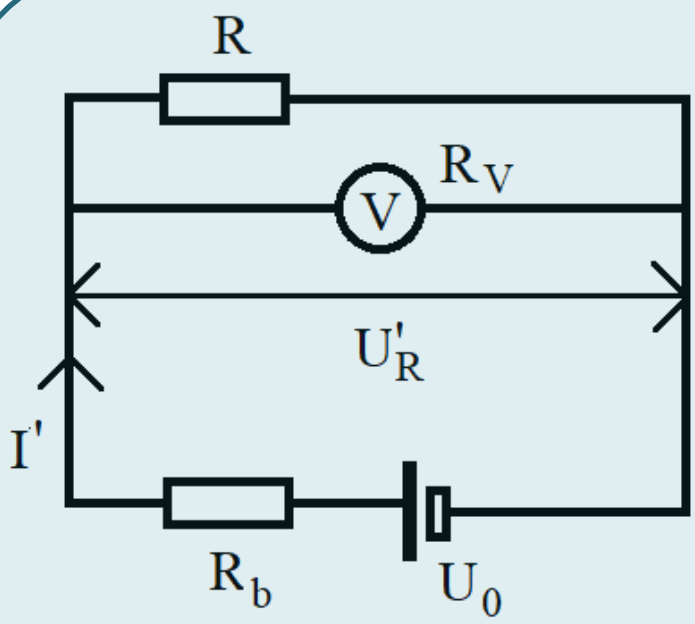
- Most of the time, their size and direction are known in advance, so they can be corrected during the evaluation of the measurement!



$$I = \frac{U_0}{R + R_b}$$

$$U_R = I.R$$

$$U_R = \frac{U_0}{1 + \frac{R_b}{R}}$$



$$I' = \frac{U_0}{\frac{R_V.R}{R_V + R} + R_b}$$

$$U'_R = I' \frac{R_V.R}{R_V + R}$$

$$U'_R = \frac{U_0}{1 + \left[1 + \frac{R}{R_V}\right] \frac{R_b}{R}}$$

Types of measurement's uncertainties

- *Statistical measurement error* - during the measurement, accidental (unforeseen) changes in the measurement conditions occur, which can cause a deviation from the "real" value of the measurement in both directions!
- The essence of statistical errors is that they are unpredictable, so they can't be elimina-ted!
- The methods of mathematical statistics are used to estimate their size!

Accuracy and precision

	Accurate	Inaccurate Systematic error
Precise		
Unreliabla