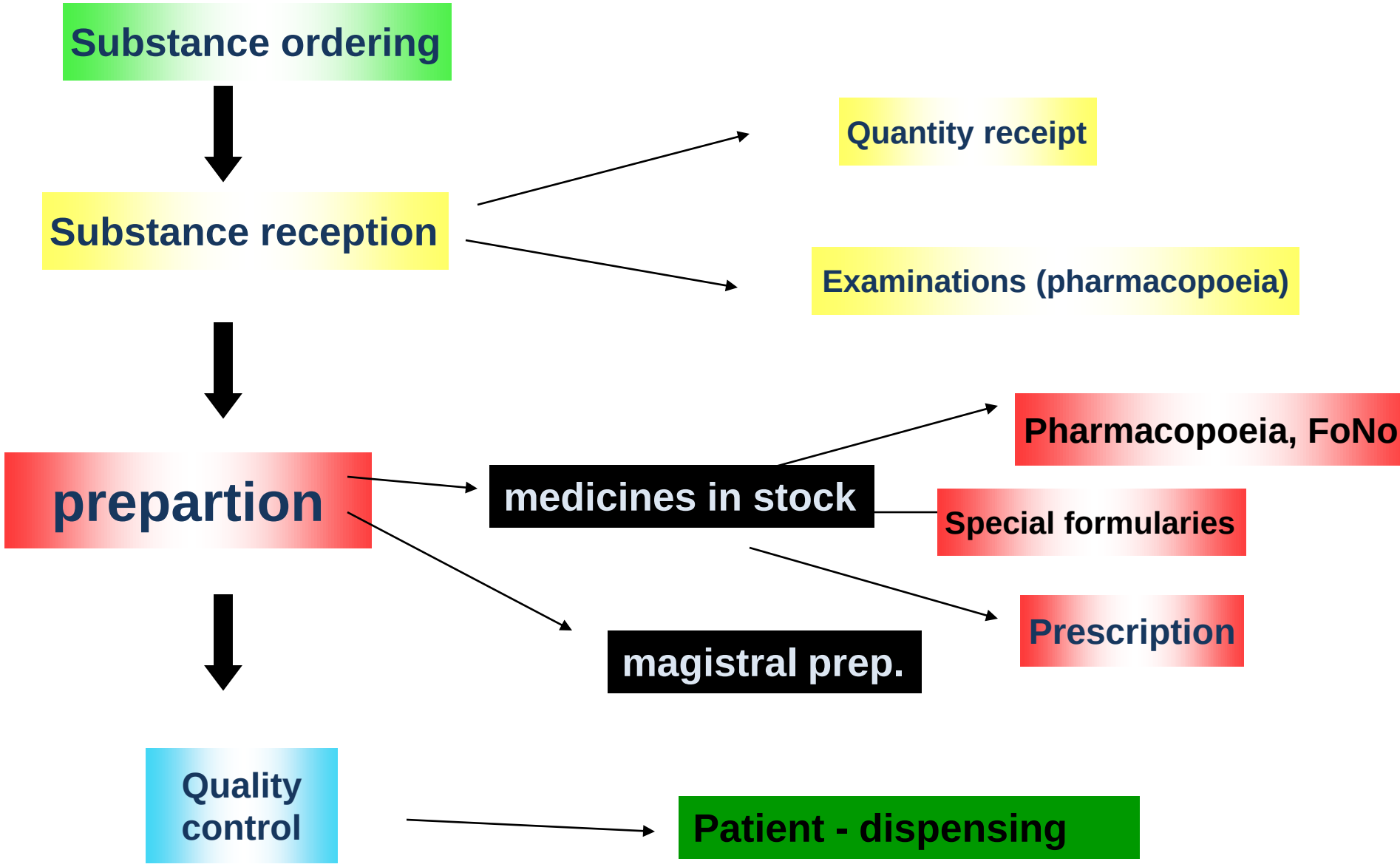
Measurement

University of Pécs

Institute of Pharmaceutical Technology and Biopharmacy

Preparation of medicines in a pharmacy



Pharmaceutical tehcnology in a pharmacy and industry

- Measurement of substances
  - Industrial scale
  - Contemporaneous preparation and dispensing

Measurement- metrology

- **Measurement:**
- is an action or sequence of actions in order to measure substances.
- in measuring mass we compare with the help of a balance the mass of the material to be measured with the known mass of measuring bodies which are members of a set of weights.

Quantity is described by an appropriate value.:

Type of measurement

Physical	weight, volume, density, colour
Chemical	pH, degree of polymerisation
Physico-chemical	solubility, HLB value
Biological	pharmacokinetics, biopharmaceutical...

SI units

- The base units of The International System of Units (SI):
- 1) *meter (m)* is the unit of *length (l)*
- 2) *kilogram* (*kg*) is the unit of *mass (m)*
- 3) *second (s)* is the unit of *time (t)*
- 4) *ampere (A)* is the unit of *electric current (I)*
- 5) *kelvin (K)* is unit of *thermodynamic temperature (T)*
- 6) *mole (mole)* is the unit of *amount* of *substance (n)*
- 7) *candela (cd)* is the unit of *luminous intensity (Iv)*

SI prefixes

some examples...

prefix	sign	value
kilo	k	10^{3}
centi	c	10^{-2}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}

Measuring the weight:

kilogramm (kg)
gramm (g),
centigramm (cg)
milligramm (mg),
microgramm (µg)

Measuring the volume:

liter (l) (1 l= 0,001 m^3)
cubic centimeter (cm^3),
milliliter (ml)

Concentration in the practice

-generally: mass percent (%m/m)

-alcohols: volume percent (%v/v)

-injections, infusions – (%m/v)

Measurement

- *Measurement error* is the difference between the measured and the true value. The bigger the measurement error is, the smaller is the accuracy. Result of the measurement can only be given in view of the measurement data and the extent of the measurement error.

Measurement errors

- Main types of the measurement error:
  - 1) absolute
  - 2) relative
  - 4) accidental
  - 5) crude

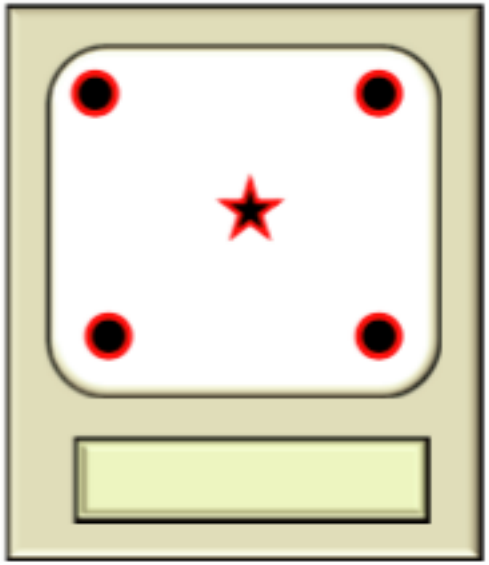
Validation

The measured result is generally only valid and acceptable, if is created by measurement performed by a valid device with proofed conformance. That device can be regarded to be valid, which is validated by metrological authorities. Measuring device with expired validation is forbidden to use!

The validation processes have to be repeated, if:

- the validity period is expired,
- repair has been done in the device,
- the measurement technique properties of the device has been changed,
- the result done with controlling standard is not appropriate.

Validation



In every 2 years by agency (certification)
In every day before labour (self-cheking)

Important parametres of scales

1. Load capacity
2. Accuracy
3. Sensitivity

Capacity

- The measuring range represents the minimum and maximum weight, including containers and tares, that can be placed on a balance plan.
- - The scale can display the weight from 0.01g to 200.0g

Sensitivity

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Sensitivity

Measuring range	Sensitivity
0-15kg	10g
0-2000g	0.1g
0-200g	0.01g

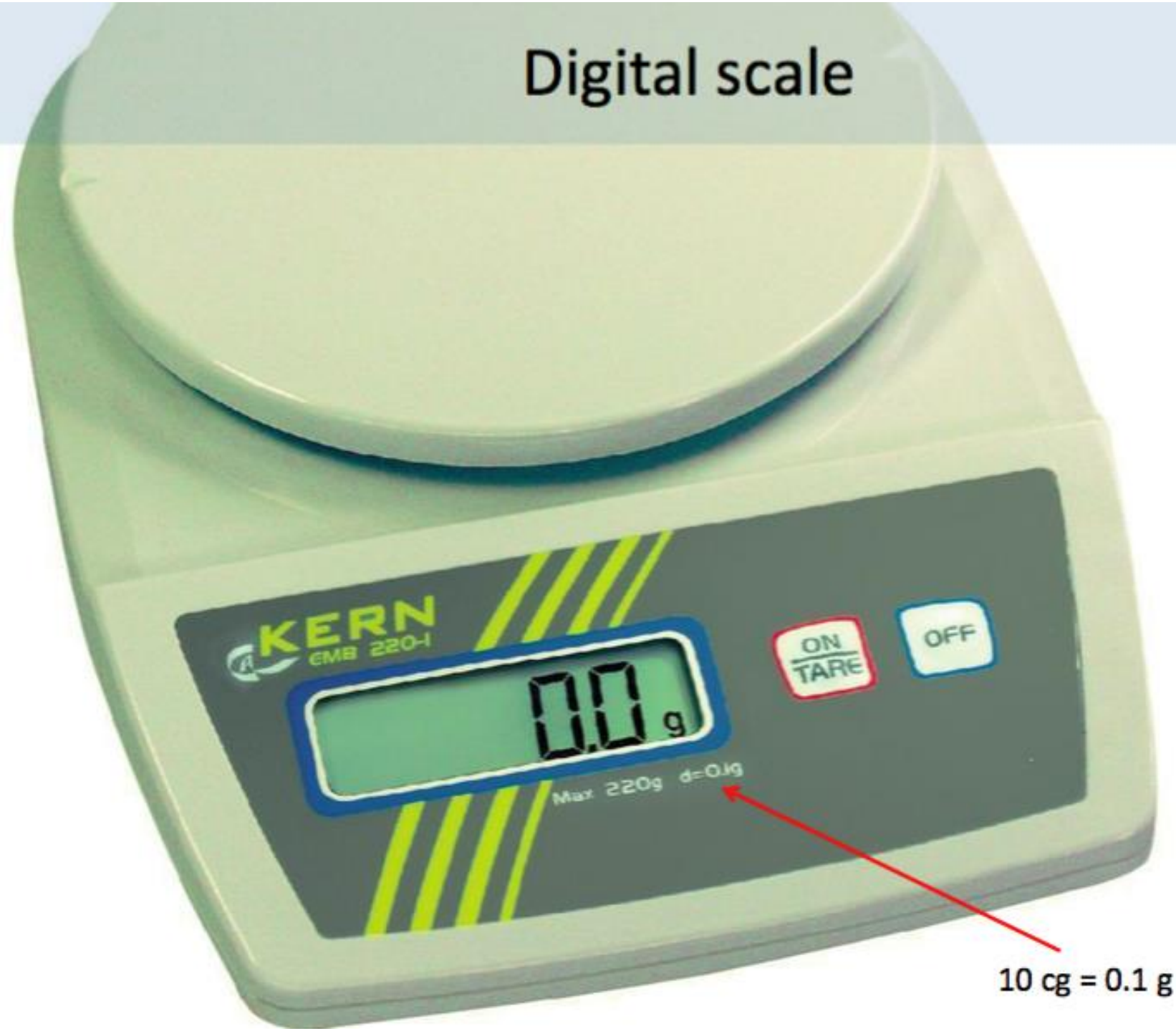
Accuracy

- The closeness of the displayed weight, as measured by the balance, to the true weight
- Determining the accuracy of a measurement usually
  requires calibration of the analytical method with a known standard.

Accuracy

Labeled value	Real meaning
10g	5-14g
0.1g	0.05-0.14g
0.01g	0.005-0.014g

Digital scale



1 kg =

100 dkg

1000 g

1 g =

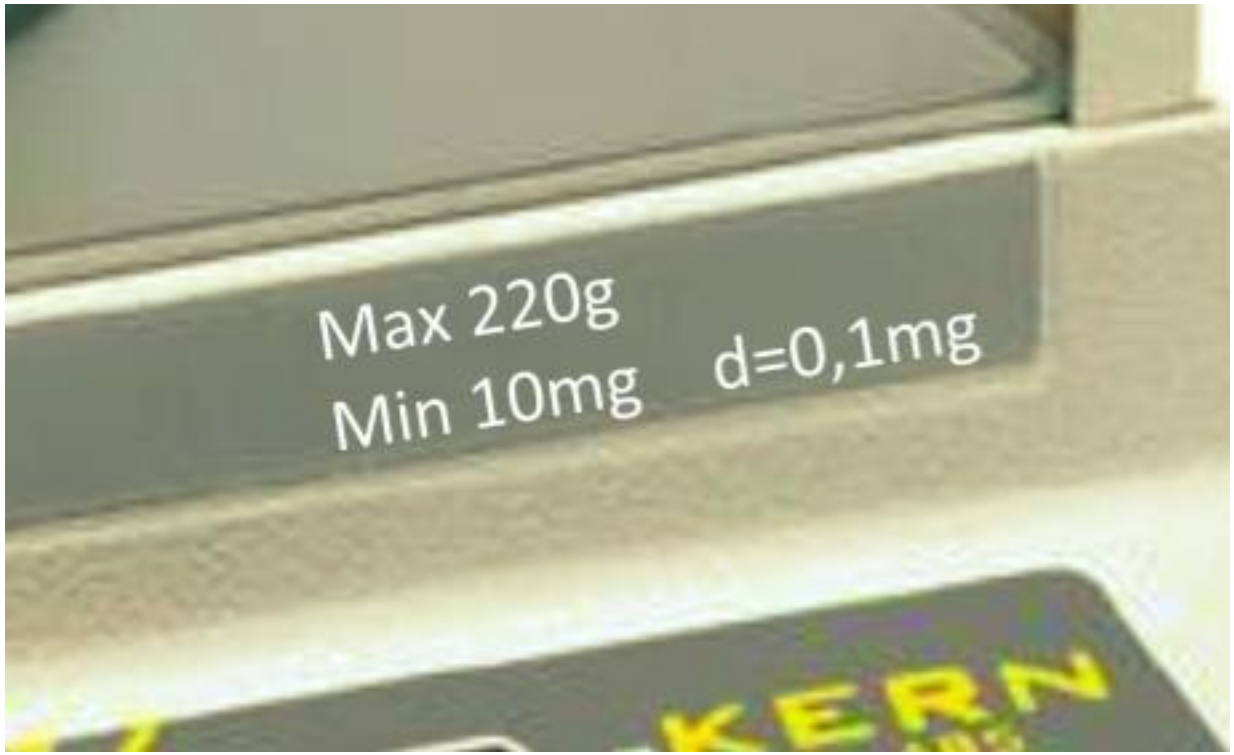
100 cg

1000mg

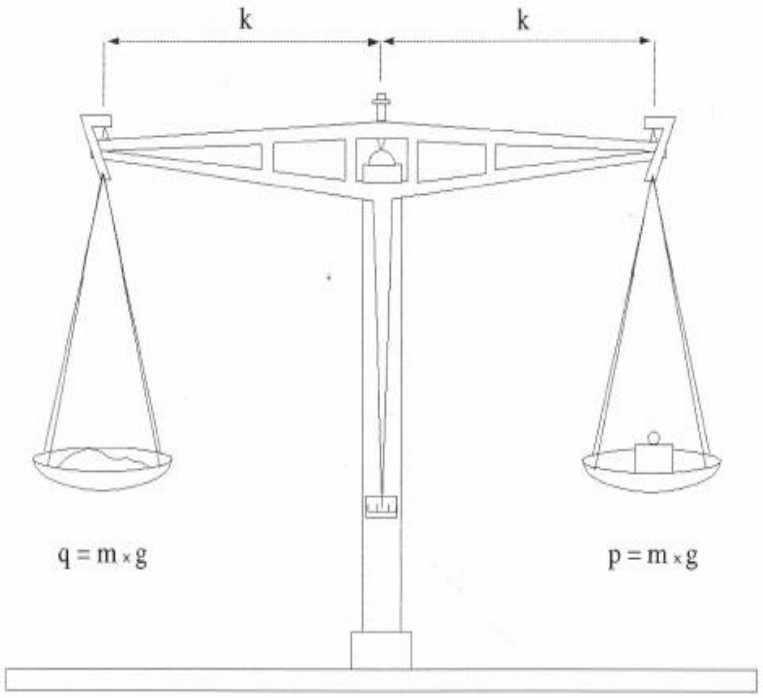
10 cg = 0.1 g

Analytical scale

Analytical scale



Equal-arm balance



Equal-arm balance **is the used most known, conventional, equal arm type weighting device, which can measure maximum 1000,0 g of materials, although its accuracy is 0,1g. Quantities less than 1,0g are not measured with this type of balance. In these cases latter mentioned scales can be used due to their accuracy.**


ÉRLEGGYÁR

Special scales

- Digital dosing spoon is capable to weight accurately powders, crystals, and granules digitally.

Digital industrial scales

How to measure weight?

- Check the setup of the balance (**location**, **level**, **stability, zero point**)
- Check that the pan is clean
- Put a beaker or plastic pan/card on the balance
- Measure the substance.
- Always leave the balance and the desk clean and dry!

Volume measurement

- Volume is the unit expressing the extent of subject, and describes the space which is occupied by the subject.
- At compounding, at the most of the cases weight measuring is preferred rather than volume measuring.

tools	volume
1 coffe spoon	5 ml
1 dessert spoon	10 ml
1 tablespoon	15 ml

Problem with volume measurement

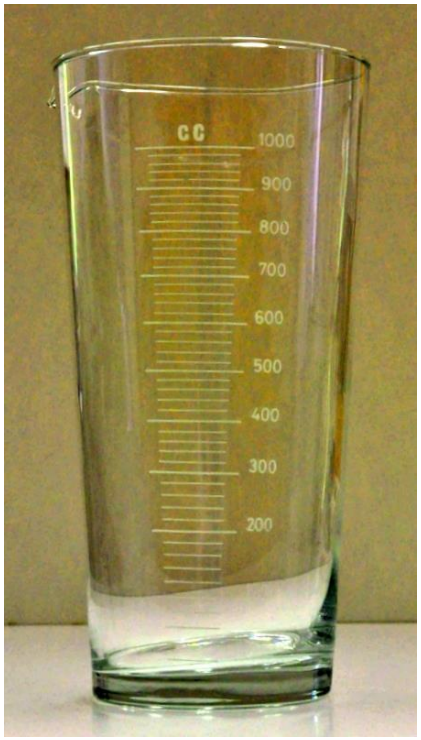
Temperature dependence of density of ethanol

temprerature *(°C)*	**density** *(g/cm^3)*
5	0,80207
10	0,79788
15	0,79381
20	0,78945
25	0,78522
30	0,78097
35	0,77671
40	0,77244

Volume measuring devices

At volume measurement, bulb pipette, flask or burettes should to be used because of their accuracy if both the digit and the end of the digit number is zero after the decimal point (e.g. 10.0 or 0.50 ml). In other cases measuring cylinder or measuring pipette are sufficient as well.

Volume measuring tools



Thank you for your attention!