

Exercise: Determining the accuracy and precision of automatic pipette measurement

Checking the accuracy and precision for measuring the volume using automatic pipettes is based on pipetting a specific volume of demineralized water and measuring the mass of the sample. The aim of the exercise is to determine the error associated with the operations of taking up different volumes of liquid. Verification should be carried out using 2÷4 pipettes with differing usage ranges.

The correction of accuracy of the used automatic pipettes should be carried out by slowly and fluently measuring a specific volume of demineralized water, then slowly and fluently introducing the water volume to a flask located at an analytical balance, which allows to determine the mass of the sample.

Assuming that the density of demineralized water at 20°C is equal to **0.998 g/cm³**, 1 ml of demineralized water measured with an accurate automatic pipette should be equivalent to a mass of 0.998 g determined using the electronic analytical balance.

Results regarding the verification of automatic pipettes should be listed in Table 1 and the standard deviation (**SD**), relative standard deviation (**RSD**) as well as the measurement error should be calculated.



$$\text{Measurement error} = \frac{m_{\text{avg}}[\text{g}] - 0,998 \frac{\text{g}}{\text{cm}^3} \cdot V[\text{cm}^3]}{0,998 \frac{\text{g}}{\text{cm}^3} \cdot V[\text{cm}^3]} \cdot 100\%$$

V – assumed volume of the liquid [cm³]

M_{avg} – average mass of the weighted samples [g]



Attention

The exercise may be expanded to include traditional glass pipettes.

Table 1. Precision and accuracy of the verified automatic pipettes.

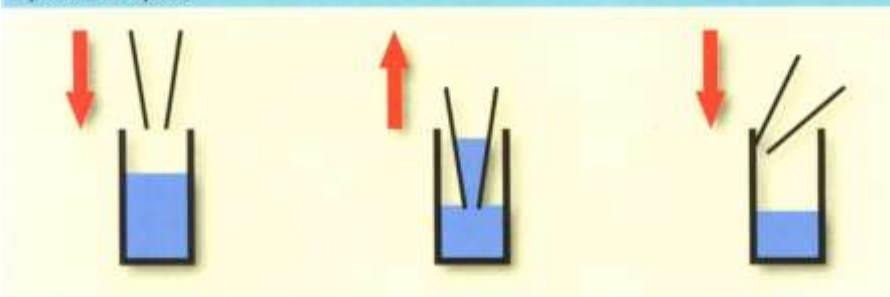
L.p.	Pipette type					
	Pipette name 1 range		Pipette name 2 range		Pipette name 3 range	
	Pipette name 4 range		Determined mass [g]			
	for.... μl	for μl	for μl	for μl	for μl	for μl
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
Average						
SD						
RSD [%]						
Measurement error [%]						

SD – standard deviation

RSD – relative standard deviation

Direct pipetting

Pipetowanie wprost



1: Push the button to reach the first stop, the tip should be dipped into the liquid for a couple of millimetres

2: Slowly release the button, the tip is filled

3: Deposit the liquid by pushing the button to the first stop, then blow out the remaining liquid by further pushing the button to the second stop

In case of volumes $> 10 \mu\text{l}$ the tip should be moistened beforehand.

This type of pipetting is recommended for: standard solvents such as water, buffers, diluted salts, diluted acids and bases.

