

JCTLM C17RMP3

Calculation of the measurement uncertainty for total protein with GUM Workbench

Equation model:

$c_{Sample} = MW \cdot u_{VRP} \cdot u_{VP} \cdot u_{VStd} \cdot u_{VRStd} \cdot u_{Std} \cdot u_{Cuvette}$ (Calculation is based on the least squares method)

List of quantities:

Quantity	Unit	Definition
MW	g/l	Measured quantity values
cSample	g/l	Result
uVRP		Measurement uncertainty of the reagent volume for the sample
uVP		Measurement uncertainty of the sample volume
uVStd		Measurement uncertainty of the standard volume
uVRStd		Measurement uncertainty of the reagent volume for the standard
uStd		Measurement uncertainty of the standard SRM Nist 927e
uCuvette		Measurement uncertainty of the cuvette

MW:

Type A

Method of observation: Direkt

Number of observations: 12

No.	Observation
1	47.4
2	47.8
3	47.8
4	47.5
5	47.7
6	47.8
7	47.2
8	48.3
9	48.5
10	47.8
11	48.0
12	48.3

Arithmetic Mean: 47.842 g/l

Standard deviation: 0.38 g/l

Standard uncertainty: 0.111 g/l

Degrees of freedom: 11

uVRP(Measurement uncertainty of the reagent volume for the sample):

Type B normal distribution

Value: 1

Expanded uncertainty: 0.5 %

Coverage factor: 2

Random measurement error of the Eppendorf Multipette with 25mL Combitip, pipetting volume 5mL

uVP(Measurement uncertainty of the sample volume)::

Type B normal distribution

Value: 1

Expanded uncertainty: 0.4 %

Coverage factor: 2

uVStd(Measurement uncertainty of the standard volume):

Type B normal distribution

Value: 1

Expanded uncertainty: 0.4 %

Coverage factor: 2

Random measurement error of the Eppendorf Reference,
fixed volume 100µL

Random measurement error of the Eppendorf Reference,
fixed volume 100µL

uVRStd(Measurement uncertainty of the reagent volume for the standard):

Type B normal distribution

Value: 1

Expanded uncertainty: 0.5 %

Coverage factor: 2

Random measurement error of the Eppendorf Multipette
with 25mL Combitip, pipetting volume 5mL

uStd:

Type B normal distribution

Value: 1

Expanded measurement uncertainty: 1.87 %

Coverage factor: 2

Measurement uncertainty of the standard SRM Nist 927e
69,58 g/L +/- 1,30 g/L (= 1,87%)

uCuvette:

Type B rectangular distribution

Value: 1

Halfwidths of limits: 1 %

Measurement uncertainty of the cuvette

Uncertainty Budget:

cSample: Result

Quantity	Value	Standard uncertainty	Distribution	Sensitivity coefficient	Uncertainty contribution	Index
MW	47.842 g/l	0.111 g/l	Normal	1.0	0.11 g/l	3.7 %
uVRP	1.00000	0.00250	Normal	48	0.12 g/l	4.3 %
uVP	1.00000	0.00200	Normal	48	0.096 g/l	2.7 %
uVStd	1.00000	0.00200	Normal	48	0.096 g/l	2.7 %
uVRStd	1.00000	0.00250	Normal	48	0.12 g/l	4.3 %
uStd	1.00000	0.00935	Normal	48	0.45 g/l	59.6 %
uCuvette	1.00000	0.00577	Rectangular	48	0.28 g/l	22.7 %
cSample	47.842 g/l	0.579 g/l				

Results:

Quantity	Value	Expanded uncertainty	Coverage factor	Coverage
cSample	47.8 g/l	2.4 % (relativ)	2.00	95% (normal distribution)