

Urea/BUN**Order information**

REF	CONTENT	Analyzer(s) on which cobas c pack(s) can be used
04460715 190	Urea/BUN 500 tests	System-ID 07 6303 9 cobas c 311, cobas c 501/502
10759350 190	Calibrator f.a.s. (12 x 3 mL)	Code 401
12149435 122	Precinorm U plus (10 x 3 mL)	Code 300
12149443 122	Precipath U plus (10 x 3 mL)	Code 301
05117003 190	PreciControl ClinChem Multi 1 (20 x 5 mL)	Code 391
05947626 190	PreciControl ClinChem Multi 1 (4 x 5 mL)	Code 391
05117216 190	PreciControl ClinChem Multi 2 (20 x 5 mL)	Code 392
05947774 190	PreciControl ClinChem Multi 2 (4 x 5 mL)	Code 392
04489357 190	Diluent NaCl 9 % (50 mL)	System-ID 07 6869 3

English**System information**

For **cobas c 311** analyzer:

UREAL: ACN 418 (serum/plasma)

U-BUN: ACN 421 (serum/plasma)

URELU: ACN 417 (urine)

UBUNU: ACN 428 (urine)

SUREA: ACN 419 (STAT, reaction time: 4, serum/plasma)

SUBUN: ACN 427 (STAT, reaction time: 4, serum/plasma)

SUREU: ACN 420 (STAT, reaction time: 4, urine)

SBUNU: ACN 429 (STAT, reaction time: 4, urine)

For **cobas c 501** analyzer:

UREAL: ACN 418 (serum/plasma/urine)

U-BUN: ACN 421 (serum/plasma/urine)

SUREA: ACN 419 (STAT, reaction time: 4, serum/plasma/urine)

SUBUN: ACN 427 (STAT, reaction time: 4, serum/plasma/urine)

For **cobas c 502** analyzer:

UREAL: ACN 8418 (serum/plasma)

U-BUN: ACN 8421 (serum/plasma)

URELU: ACN 8417 (urine)

UBUNU: ACN 8428 (urine)

SUREA: ACN 8419 (STAT, reaction time: 4, serum/plasma)

SUBUN: ACN 8427 (STAT, reaction time: 4, serum/plasma)

SUREU: ACN 8420 (STAT, reaction time: 4, urine)

SBUNU: ACN 8429 (STAT, reaction time: 4, urine)

Intended use

In vitro test for the quantitative determination of urea/urea nitrogen in human serum, plasma and urine on Roche/Hitachi **cobas c** systems.

Summary¹

Urea is the major end product of protein nitrogen metabolism. It is synthesized by the urea cycle in the liver from ammonia which is produced by amino acid deamination. Urea is excreted mostly by the kidneys but minimal amounts are also excreted in sweat and degraded in the intestines by bacterial action.

Determination of blood urea nitrogen is the most widely used screening test for renal function. When used in conjunction with serum creatinine determinations it can aid in the differential diagnosis of the three types of azotemia: prerenal, renal and postrenal.

Elevations in blood urea nitrogen concentration are seen in inadequate renal perfusion, shock, diminished blood volume (prerenal causes), chronic nephritis, nephrosclerosis, tubular necrosis, glomerular nephritis (renal causes) and urinary tract obstruction (postrenal causes). Transient elevations may also be seen during periods of high protein intake. Unpredictable levels occur with liver diseases.

Test principle

Kinetic test with urease and glutamate dehydrogenase.^{2,3,4,5}

Urea is hydrolyzed by urease to form ammonium and carbonate.



In the second reaction 2-oxoglutarate reacts with ammonium in the presence of glutamate dehydrogenase (GLDH) and the coenzyme NADH to produce L-glutamate. In this reaction two moles of NADH are oxidized to NAD⁺ for each mole of urea hydrolyzed.



The rate of decrease in the NADH concentration is directly proportional to the urea concentration in the specimen and is measured photometrically.

Reagents - working solutions

R1 NaCl 9 %

R2 TRIS buffer: 220 mmol/L, pH 8.6; 2-oxoglutarate: 73 mmol/L; NADH: 2.5 mmol/L; ADP: 6.5 mmol/L; urease (jack bean): ≥ 300 μkat/L; GLDH (bovine liver): ≥ 80 μkat/L; preservative; nonreactive stabilizers

R1 is in position C and R2 is in position B.

Precautions and warnings

For in vitro diagnostic use.

Exercise the normal precautions required for handling all laboratory reagents.

Disposal of all waste material should be in accordance with local guidelines. Safety data sheet available for professional user on request.

Reagent handling

Ready for use

Storage and stability**UREAL**

Shelf life at 2-8 °C:

See expiration date on **cobas c** pack label.

On-board in use and refrigerated on the analyzer:

8 weeks

Diluent NaCl 9 %

Shelf life at 2-8 °C:

See expiration date on **cobas c** pack label.

On-board in use and refrigerated on the analyzer:

12 weeks

Specimen collection and preparation

For specimen collection and preparation only use suitable tubes or collection containers.

Only the specimens listed below were tested and found acceptable.

Serum

Plasma: Li-heparin and K₂-EDTA plasma. Do not use ammonium heparin.

The sample types listed were tested with a selection of sample collection tubes that were commercially available at the time of testing, i.e. not all available tubes of all manufacturers were tested. Sample collection systems

Urea/BUN

from various manufacturers may contain differing materials which could affect the test results in some cases. When processing samples in primary tubes (sample collection systems), follow the instructions of the tube manufacturer.

Urine

Bacterial growth in the specimen and high atmospheric ammonia concentrations as well as contamination by ammonium ions may cause erroneously elevated results.

Stability in <i>serum/plasma</i> . ⁶	7 days at 15-25 °C
	7 days at 2-8 °C
	1 year at (-15)-(-25) °C

Stability in <i>urine</i> . ⁶	2 days at 15-25 °C
	7 days at 2-8 °C
	1 month at (-15)-(-25) °C

Centrifuge samples containing precipitates before performing the assay.

See the limitations and interferences section for details about possible sample interferences.

Materials provided

See "Reagents – working solutions" section for reagents.

Materials required (but not provided)

- See "Order information" section
- General laboratory equipment

Assay

For optimum performance of the assay follow the directions given in this document for the analyzer concerned. Refer to the appropriate operator's manual for analyzer-specific assay instructions.

The performance of applications not validated by Roche is not warranted and must be defined by the user.

Application for serum and plasma**cobas c 311 test definition**

Assay type	Rate A		
Reaction time / Assay points	10 / 10-19 (STAT 4 / 10-19)		
Wavelength (sub/main)	700/340 nm		
Reaction direction	Decrease		
Units	mmol/L (mg/dL, g/L)		
Reagent pipetting	Diluent (H ₂ O)		
R1	10 µL	90 µL	
R2	38 µL	110 µL	
<i>Sample volumes</i>	<i>Sample</i>	<i>Sample dilution</i>	
		<i>Sample</i>	<i>Diluent (NaCl)</i>
Normal	2 µL	–	–
Decreased	6 µL	15 µL	120 µL
Increased	2 µL	–	–

cobas c 501 test definition

Assay type	Rate A		
Reaction time / Assay points	10 / 16-28 (STAT 4 / 16-28)		
Wavelength (sub/main)	700/340 nm		
Reaction direction	Decrease		
Units	mmol/L (mg/dL, g/L)		
Reagent pipetting	Diluent (H ₂ O)		
R1	10 µL	90 µL	
R2	38 µL	110 µL	

<i>Sample volumes</i>	<i>Sample</i>	<i>Sample dilution</i>	
		<i>Sample</i>	<i>Diluent (NaCl)</i>
Normal	2 µL	–	–
Decreased	6 µL	15 µL	120 µL
Increased	2 µL	–	–

cobas c 502 test definition

Assay type	Rate A		
Reaction time / Assay points	10 / 16-28 (STAT 4 / 16-28)		
Wavelength (sub/main)	700/340 nm		
Reaction direction	Decrease		
Units	mmol/L (mg/dL, g/L)		
Reagent pipetting	Diluent (H ₂ O)		
R1	10 µL	90 µL	
R2	38 µL	110 µL	

<i>Sample volumes</i>	<i>Sample</i>	<i>Sample dilution</i>	
		<i>Sample</i>	<i>Diluent (NaCl)</i>
Normal	2 µL	–	–
Decreased	6 µL	15 µL	120 µL
Increased	4 µL	–	–

Application for urine**cobas c 311 test definition**

Assay type	Rate A		
Reaction time / Assay points	10 / 10-19 (STAT 4 / 10-19)		
Wavelength (sub/main)	700/340 nm		
Reaction direction	Decrease		
Units	mmol/L (mg/dL, g/L)		
Reagent pipetting	Diluent (H ₂ O)		
R1	10 µL	90 µL	
R2	38 µL	110 µL	
<i>Sample volumes</i>	<i>Sample</i>	<i>Sample dilution</i>	
		<i>Sample</i>	<i>Diluent (NaCl)</i>
Normal	2 µL	3 µL	147 µL
Decreased	2 µL	2 µL	178 µL
Increased	2 µL	–	–

cobas c 501/502 test definition

Assay type	Rate A		
Reaction time / Assay points	10 / 16-28 (STAT 4 / 16-28)		
Wavelength (sub/main)	700/340 nm		
Reaction direction	Decrease		
Units	mmol/L (mg/dL, g/L)		
Reagent pipetting	Diluent (H ₂ O)		
R1	10 µL	90 µL	
R2	38 µL	110 µL	
<i>Sample volumes</i>	<i>Sample</i>	<i>Sample dilution</i>	
		<i>Sample</i>	<i>Diluent (NaCl)</i>
Normal	2 µL	3 µL	147 µL
Decreased	2 µL	2 µL	178 µL
Increased	2 µL	–	–

Calibration

Calibrators	S1: H ₂ O S2: C.f.a.s.
Calibration mode	Linear
Calibration frequency	2-point calibration <ul style="list-style-type: none"> • after 4 weeks on board • after reagent lot change • as required following quality control procedures

Calibration interval may be extended based on acceptable verification of calibration by the laboratory.

Traceability: This method has been standardized against ID/MS.

Quality control*Serum/plasma*

For quality control, use control materials as listed in the "Order information" section.

In addition, other suitable control material can be used.

Urine

Quantitative urine controls are recommended for routine quality control.

The control intervals and limits should be adapted to each laboratory's individual requirements. Values obtained should fall within the defined limits. Each laboratory should establish corrective measures to be taken if values fall outside the defined limits.

Follow the applicable government regulations and local guidelines for quality control.

Calculation

cobas c systems automatically calculate the analyte concentration of each sample.

Conversion factors:	mmol/L urea x 6.006 = mg/dL urea
	mmol/L urea x 0.06006 = g/L urea
	mmol/L urea nitrogen x 2.801 = mg/dL urea nitrogen
	mmol/L urea nitrogen x 0.02801 = g/L urea nitrogen
	mg/dL urea x 0.467 = mg/dL urea nitrogen

When 24-hour urine is used as the specimen, multiply the result by the 24-hour volume to obtain values in g or mmol/24 hours.

Limitations - interference

Criterion: Recovery within $\pm 10\%$ of initial value at a urea concentration of 8.3 mmol/L (49.8 mg/dL urea, 23.2 mg/dL urea nitrogen) in serum/plasma and at a urea concentration of 150 mmol/L (901 mg/dL urea, 421 mg/dL urea nitrogen) in urine. Recovery within $\pm 10\%$ for drug interference.

Serum/plasma

Icterus:⁷ No significant interference up to an I index of 60 for conjugated and unconjugated bilirubin (approximate conjugated and unconjugated bilirubin concentration: 1026 μ mol/L (60 mg/dL)).

Hemolysis:⁷ No significant interference up to an H index of 1000 (approximate hemoglobin concentration: 621 μ mol/L (1000 mg/dL)).

Lipemia (Intralipid):⁷ No significant interference up to an L index of 1000. There is poor correlation between the L index (corresponds to turbidity) and triglycerides concentration.

Ammonium ions may cause erroneously elevated results.

Drugs: No interference was found at therapeutic concentrations using common drug panels.^{8,9}

In very rare cases, gammopathy, in particular type IgM (Waldenström's macroglobulinemia), may cause unreliable results.¹⁰

Urine

Drugs: No interference was found at therapeutic concentrations using common drug panels.⁹

For diagnostic purposes, the results should always be assessed in conjunction with the patient's medical history, clinical examination and other findings.

ACTION REQUIRED

Special Wash Programming: The use of special wash steps is mandatory when certain test combinations are run together on **cobas c** systems. The latest version of the carry-over evasion list can be found with the NaOHD-SMS-SmpCln1+2-SCCS Method Sheets. For further instructions refer to the operator's manual. **cobas c** 502 analyzer: All special wash programming necessary for avoiding carry-over is available via the **cobas** link, manual input is required in certain cases.

Where required, special wash/carry-over evasion programming must be implemented prior to reporting results with this test.

Limits and ranges**Measuring range***Serum/plasma*

0.5-40 mmol/L (3.0-240 mg/dL urea, 1.4-112 mg/dL urea nitrogen)

Determine samples having higher concentrations via the rerun function. Dilution of samples via the rerun function is a 1:3 dilution. Results from samples diluted using the rerun function are automatically multiplied by a factor of 3.

Urine

1-2000 mmol/L (6-12000 mg/dL urea, 2.8-5600 mg/dL urea nitrogen)

Determine samples having higher concentrations via the rerun function. Dilution of samples via the rerun function is a 1:1.8 dilution. Results from samples diluted using the rerun function are automatically multiplied by a factor of 1.8.

Determine samples having concentrations lower than the technical limit of 40 mmol/L (240 mg/dL urea and 112 mg/dL urea nitrogen) via the rerun function. Samples are measured undiluted.

Lower limits of measurement*Lower detection limit of the test**Serum/plasma*

0.5 mmol/L (3.0 mg/dL urea, 1.4 mg/dL urea nitrogen)

The lower detection limit represents the lowest measurable analyte level that can be distinguished from zero. It is calculated as the value lying 3 standard deviations above that of the lowest standard (standard 1 + 3 SD, repeatability, n = 21).

Urine

1 mmol/L (6 mg/dL urea, 2.8 mg/dL urea nitrogen)

The lower detection limit represents the lowest measurable analyte level that can be distinguished from zero. It is calculated as the value lying 3 standard deviations above that of the lowest standard (standard 1 + 3 SD, repeatability, n = 21).

Expected values

Urea:

*Serum/plasma*¹¹

Adults	2.76-8.07 mmol/L	(16.6-48.5 mg/dL)
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Urine

24-hour urine ¹²	428-714 mmol/24 h (25.7-42.9 g/24 h), corresponding to 286-595 mmol/L (1.71-3.57 g/dL) ^a
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^a Based on average urine output of 1.2-1.5 L/24 h

Urea nitrogen (BUN):

*Serum/plasma*¹²

Adults (18-60 years)	2.14-7.14 mmol/L	6-20 mg/dL
Adults (60-90 years)	2.86-8.21 mmol/L	8-23 mg/dL
Infants (< 1 year)	1.43-6.78 mmol/L	4-19 mg/dL
Infants/children	1.79-6.43 mmol/L	5-18 mg/dL

Urine

Urea/BUN

24-hour urine¹² 428-714 mmol/24 h (12-20 g/24 h),
corresponding to
286-595 mmol/L (801-1666 mg/dL)^b

b) Based on average urine output of 1.2-1.5 L/24 h

Each laboratory should investigate the transferability of the expected values to its own patient population and if necessary determine its own reference ranges.

Specific performance data

Representative performance data on the analyzers are given below. Results obtained in individual laboratories may differ.

Precision

Precision was determined using human samples and controls in an internal protocol with repeatability (n = 21) and intermediate precision (serum/plasma: 3 aliquots per run, 1 run per day, 21 days; urine: 3 aliquots per run, 1 run per day, 10 days). The following results were obtained:

Serum/plasma

Repeatability	Mean	SD	CV
	mmol/L (mg/dL urea)	mmol/L (mg/dL urea)	%
Precinorm U	6.74 (40.5)	0.07 (0.4)	1.0
Precipath U	23.4 (141)	0.2 (1)	0.9
Human serum 1	9.18 (55.1)	0.09 (0.5)	1.0
Human serum 2	15.1 (90.7)	0.1 (0.6)	0.9
Intermediate precision	Mean	SD	CV
	mmol/L (mg/dL urea)	mmol/L (mg/dL urea)	%
Precinorm U	6.66 (40.0)	0.08 (0.5)	1.2
Precipath U	23.2 (139)	0.3 (2)	1.1
Human serum 3	9.13 (54.8)	0.10 (0.6)	1.1
Human serum 4	14.9 (89.5)	0.2 (1.2)	1.3

Urine

Repeatability	Mean	SD	CV
	mmol/L (mg/dL urea)	mmol/L (mg/dL urea)	%
Control level 1	161 (967)	4 (24)	2.2
Control level 2	288 (1730)	3 (18)	1.2
Human urine 1	324 (1946)	4 (24)	1.3
Human urine 2	137 (823)	3 (18)	1.9
Intermediate precision	Mean	SD	CV
	mmol/L (mg/dL urea)	mmol/L (mg/dL urea)	%
Control level 1	154 (925)	4 (24)	2.7
Control level 2	280 (1682)	6 (36)	2.3
Human urine 3	316 (1898)	6 (36)	2.0
Human urine 4	133 (799)	3 (18)	2.4

Method comparison

Urea values for human serum, plasma and urine samples obtained on a cobas c 501 analyzer (y) were compared with those determined on Roche/Hitachi 917/MODULAR P analyzers (x), using the corresponding Roche/Hitachi reagent.

Serum/plasma

Sample size (n) = 175

Passing/Bablok¹³

$$y = 0.990x + 0.138 \text{ mmol/L}$$

$$\tau = 0.959$$

Linear regression

$$y = 0.976x + 0.303 \text{ mmol/L}$$

$$r = 0.998$$

The sample concentrations were between 2.27 and 39.4 mmol/L (13.6 and 237 mg/dL urea).

Urine

Sample size (n) = 267

Passing/Bablok¹³

$$y = 1.006x - 6.50 \text{ mmol/L}$$

$$\tau = 0.949$$

Linear regression

$$y = 1.035x - 14.1 \text{ mmol/L}$$

$$r = 0.998$$

The sample concentrations were between 39.0 and 1314 mmol/L (234 and 7892 mg/dL urea).

References

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- Bablok W, Passing H, Bender R, et al. A general regression procedure for method transformation. Application of linear regression procedures for method comparison studies in clinical chemistry, Part III. J Clin Chem Clin Biochem 1988 Nov;26(11):783-790.

A point (period/stop) is always used in this Method Sheet as the decimal separator to mark the border between the integral and the fractional parts of a decimal numeral. Separators for thousands are not used.

Symbols

Roche Diagnostics uses the following symbols and signs in addition to those listed in the ISO 15223-1 standard (for USA: see dialog.roche.com for definition of symbols used):

CONTENT

Contents of kit



Volume after reconstitution or mixing

GTIN

Global Trade Item Number

0104460715190c501V13.0

UREAL

Urea/BUN

cobas®

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