

## Order information

REF	CONTENT	Analyzer(s) on which <b>cobas c</b> pack(s) can be used
05168449 190*	Calcium Gen.2 (2250 tests)	System-ID 05 7476 6 Roche/Hitachi <b>cobas c</b> 701/702
05168449 214*	Calcium Gen.2 (2250 tests)	System-ID 05 7476 6 Roche/Hitachi <b>cobas c</b> 701/702

Materials required (but not provided):

10759350 190	Calibrator f.a.s. (12 × 3 mL)	Code 401
10759350 360	Calibrator f.a.s. (12 × 3 mL, for USA)	Code 401
12149435 122	Precinorm U plus (10 × 3 mL)	Code 300
12149435 160	Precinorm U plus (10 × 3 mL, for USA)	Code 300
12149443 122	Precipath U plus (10 × 3 mL)	Code 301
12149443 160	Precipath U plus (10 × 3 mL, for USA)	Code 301
05117003 190	PreciControl ClinChem Multi 1 (20 × 5 mL)	Code 391
05947626 190	PreciControl ClinChem Multi 1 (4 × 5 mL)	Code 391
05947626 160	PreciControl ClinChem Multi 1 (4 × 5 mL, for USA)	Code 391
05117216 190	PreciControl ClinChem Multi 2 (20 × 5 mL)	Code 392
05947774 190	PreciControl ClinChem Multi 2 (4 × 5 mL)	Code 392
05947774 160	PreciControl ClinChem Multi 2 (4 × 5 mL, for USA)	Code 392
05172152 190	Diluent NaCl 9 % (119 mL)	System-ID 08 6869 3

\* Some kits shown may not be available in all countries.

## English

## System information

**CA2:** ACN 8698

**S-CA2:** ACN 8699 (STAT, reaction time: 3)

## Intended use

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

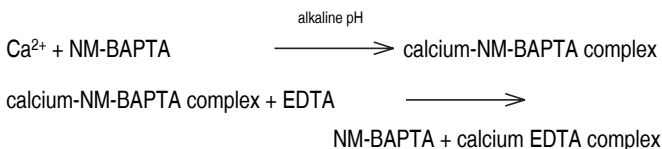
Summary<sup>1</sup>

Calcium is the most abundant mineral element in the body with about 99 % in the bones primarily as hydroxyapatite. The remaining calcium is distributed between the various tissues and the extracellular fluids where it performs a vital role for many life sustaining processes. Among the extra skeletal functions of calcium are involvement in blood coagulation, neuromuscular conduction, excitability of skeletal and cardiac muscle, enzyme activation, and the preservation of cell membrane integrity and permeability.

Serum calcium levels and hence the body content are controlled by parathyroid hormone (PTH), calcitonin, and vitamin D. An imbalance in any of these modulators leads to alterations of the body and serum calcium levels. Increases in serum PTH or vitamin D are usually associated with hypercalcemia. Increased serum calcium levels may also be observed in multiple myeloma and other neoplastic diseases. Hypocalcemia may be observed e.g. in hypoparathyroidism, nephrosis, and pancreatitis.

## Test principle

Calcium ions react with 5-nitro-5'-methyl-BAPTA (NM-BAPTA) under alkaline conditions to form a complex. This complex reacts in the second step with EDTA.



The change in absorbance is directly proportional to the calcium concentration and is measured photometrically.

## Reagents - working solutions

**R1** CAPSO:<sup>a)</sup> 557 mmol/L; NM-BAPTA: 2 mmol/L; pH 10.0; non-reactive surfactant; preservative

**R3** EDTA: 7.5 mmol/L; pH 7.3; non-reactive surfactant; preservative  
**(STAT R2)**

a) 3-[cyclohexylamino]-2-hydroxy-1-propanesulfonic acid

R1 is in position B and R3 (STAT R2) is in position C.

## Precautions and warnings

For in vitro diagnostic use for health care professionals. Exercise the normal precautions required for handling all laboratory reagents.

Infectious or microbial waste:

Warning: handle waste as potentially biohazardous material. Dispose of waste according to accepted laboratory instructions and procedures.

Environmental hazards:

Apply all relevant local disposal regulations to determine the safe disposal.

Safety data sheet available for professional user on request.

For USA: Caution: Federal law restricts this device to sale by or on the order of a physician.

## Reagent handling

Ready for use

## Storage and stability

**CA2**

Shelf life at 2-8 °C:

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

On-board in use and refrigerated on the analyzer: 6 weeks

On-board on the Reagent Manager: 24 hours

*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: 4 weeks

On-board on the Reagent Manager: 24 hours

## 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: Fresh serum collected in the fasting state is the preferred specimen. Plasma: Li-heparin plasma.

Serum or plasma should be separated from blood cells as soon as possible, because prolonged contact with the clot may cause lower calcium values.<sup>2</sup>

Sera from patients receiving EDTA (treatment of hypercalcemia) are unsuitable for analysis, since EDTA will chelate the calcium and render it unavailable for reaction with NM-BAPTA. Co-precipitation of calcium with fibrin (i.e. heparin plasma), lipids, or denatured protein has been reported with storage or freezing.<sup>1,3</sup>

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 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: Urine specimens should be collected in acid-washed bottles. 24-hour specimens should be collected in containers containing 20-30 mL of 6 mol/L HCl to prevent calcium salt precipitation. Precipitated calcium salts may not be completely dissolved by the addition of HCl following urine collection.<sup>4</sup>

Stability in *serum/plasma*.<sup>5</sup>

7 days at 15-25 °C
3 weeks at 2-8 °C
8 months at (-15)-(-25) °C

Stability in *urine*.<sup>5</sup>

2 days at 15-25 °C
4 days at 2-8 °C
3 weeks at (-15)-(-25) °C

Stored serum or urine specimens must be mixed well prior to analysis. Centrifuge samples containing precipitates before performing the assay. See the limitations and interferences section for details about possible sample interferences.

Sample stability claims were established by experimental data by the manufacturer or based on reference literature and only for the temperatures/time frames as stated in the method sheet. It is the responsibility of the individual laboratory to use all available references and/or its own studies to determine specific stability criteria for its laboratory.

#### 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 701/702 test definition

Assay type	2-Point End	
Reaction time / Assay points	10 / 18-22 (STAT 3 / 6-10)	
Wavelength (sub/main)	376/340 nm	
Reaction direction	Decrease	
Units	mmol/L (mg/dL)	
Reagent pipetting	Diluent (H <sub>2</sub> O)	
R1	20 µL	160 µL
R3 (STAT R2)	20 µL	–

Sample volumes	Sample	Sample dilution	
		Sample	Diluent (NaCl)
Normal	3 µL	–	–
Decreased	3 µL	–	–
Increased	3 µL	–	–

#### Application for urine

##### cobas c 701/702 test definition

Assay type	2-Point End	
Reaction time / Assay points	10 / 18-22 (STAT 3 / 6-10)	
Wavelength (sub/main)	376/340 nm	
Reaction direction	Decrease	
Units	mmol/L (mg/dL)	
Reagent pipetting	Diluent (H <sub>2</sub> O)	
R1	20 µL	160 µL
R3 (STAT R2)	20 µL	–

Sample volumes	Sample	Sample dilution	
		Sample	Diluent (NaCl)
Normal	2 µL	–	–
Decreased	4 µL	15 µL	135 µL
Increased	2 µL	–	–

#### Calibration

Calibrators	S1: H <sub>2</sub> O S2: C.f.a.s.
Calibration mode	Linear
Calibration frequency	2-point calibration - 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 the SRM 956 c level 2 reference material.

#### 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

Roche/Hitachi **cobas c** systems automatically calculate the analyte concentration of each sample.

Conversion factors: mmol/L × 4.01 = mg/dL

In studies with 24-hour urine, multiply the value obtained by the 24-hour volume in order to obtain a measurement in mg/24 h or mmol/24 h.

#### Limitations - interference

Criterion: Recovery within ± 0.22 mmol/L (0.9 mg/dL) of initial value of samples ≤ 2.2 mmol/L (8.8 mg/dL) and within ± 10 % for samples > 2.2 mmol/L.

##### *Serum/plasma*

Icterus:<sup>6</sup> No significant interference up to an I index of 60 for conjugated and unconjugated bilirubin (approximate conjugated and unconjugated bilirubin concentration: 1026 µmol/L or 60 mg/dL).

Hemolysis:<sup>6</sup> No significant interference up to an H index of 1000 (approximate hemoglobin concentration: 621 µmol/L or 1000 mg/dL).

Lipemia (Intralipid):<sup>6</sup> No significant interference up to an L index of 1000. There is a poor correlation between the L index (corresponds to turbidity) and triglycerides concentration.

Magnesium: No significant interference from magnesium up to a concentration of 15 mmol/L (36.5 mg/dL).

Drugs: No interference was found at therapeutic concentrations using common drug panels.<sup>7,8</sup>

The interference of intravenously administered gadolinium containing MRI (magnetic resonance imaging) contrast media was tested (Omniscan®, Optimark®) but no interference was found at the therapeutic concentration. Interferences at higher concentrations were observed.

In very rare cases, gammopathy, in particular type IgM (Waldenström's macroglobulinemia), may cause unreliable results.<sup>9</sup>

#### Urine

Icterus: No significant interference up to a conjugated bilirubin concentration of 1026 µmol/L or 60 mg/dL.

Hemolysis: No significant interference up to a hemoglobin concentration of 621 µmol/L or 1000 mg/dL.

Magnesium: No significant interference from magnesium up to a concentration of 60 mmol/L (145.8 mg/dL).

Urea: No significant interference from urea up to a concentration of 1600 mmol/L (9610 mg/dL).

Drugs: No interference was found at therapeutic concentrations using common drug panels.<sup>8</sup>

The interference of intravenously administered gadolinium containing MRI (magnetic resonance imaging) contrast media was tested (Omniscan®, Optimark®). For Optimark® no interference was observed at the therapeutic concentration, but there was interference at higher concentrations. For Optimark® interference was observed at therapeutic and higher concentrations.

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 Roche/Hitachi cobas c systems. All special wash programming necessary for avoiding carry-over is available via the cobas link, manual input is required in certain cases. The latest version of the carry-over evasion list can be found with the NaOHD/SMS/SmpCln1+2/SCCS Method Sheet and for further instructions refer to the operator's manual.

**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

0.20-5.0 mmol/L (0.8-20.1 mg/dL)

###### Urine

0.20-7.5 mmol/L (0.8-30.1 mg/dL)

Determine urine samples having higher concentrations via the rerun function. Dilution of samples via the rerun function is a 1:5 dilution. Results from samples diluted using the rerun function are automatically multiplied by a factor of 5.

#### Lower limits of measurement

##### Limit of Blank, Limit of Detection and Limit of Quantitation

###### Serum/plasma and urine

Limit of Blank = 0.10 mmol/L (0.4 mg/dL)

Limit of Detection = 0.20 mmol/L (0.8 mg/dL)

Limit of Quantitation = 0.20 mmol/L (0.8 mg/dL)

The Limit of Blank, Limit of Detection and Limit of Quantitation were determined in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP17-A2 requirements.

The Limit of Blank is the 95<sup>th</sup> percentile value from n ≥ 60 measurements of analyte-free samples over several independent series. The Limit of Blank corresponds to the concentration below which analyte-free samples are found with a probability of 95 %.

The Limit of Detection is determined based on the Limit of Blank and the standard deviation of low concentration samples.

The Limit of Detection corresponds to the lowest analyte concentration which can be detected (value above the Limit of Blank with a probability of 95 %).

The Limit of Quantitation is the lowest analyte concentration that can be reproducibly measured with a total error of 30 %. It has been determined using low concentration calcium samples.

#### Expected values<sup>10</sup>

##### Serum/plasma

Children (0-10 days): 1.90-2.60 mmol/L (7.6-10.4 mg/dL)

Children (10 days-2 years): 2.25-2.75 mmol/L (9.0-11.0 mg/dL)

Children (2-12 years): 2.20-2.70 mmol/L (8.8-10.8 mg/dL)

Children (12-18 years): 2.10-2.55 mmol/L (8.4-10.2 mg/dL)

Adults (18-60 years): 2.15-2.50 mmol/L (8.6-10.0 mg/dL)

Adults (60-90 years): 2.20-2.55 mmol/L (8.8-10.2 mg/dL)

Adults (> 90 years): 2.05-2.40 mmol/L (8.2-9.6 mg/dL)

##### Urine

2.5-7.5 mmol/24 h (100-300 mg/24 h) with normal food intake.

Roche has not evaluated reference ranges in a pediatric population.

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

Repeatability was determined using human samples and controls in an internal protocol (n = 21, 1 run). Intermediate precision was determined using human samples and controls in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP5 requirements (2 aliquots per run, 2 runs per day, 21 days). The following results were obtained:

##### Serum/plasma

Repeatability	Mean	SD	CV
	mmol/L (mg/dL)	mmol/L (mg/dL)	%
Human serum 1	0.59 (2.4)	0.01 (0.0)	2.0
Human serum 2	2.57 (10.3)	0.02 (0.1)	0.7
Human serum 3	4.54 (18.2)	0.02 (0.1)	0.4
Precinorm U	2.31 (9.3)	0.02 (0.1)	0.7
Precipath U	3.63 (14.6)	0.02 (0.1)	0.5

##### Intermediate precision

	Mean	SD	CV
	mmol/L (mg/dL)	mmol/L (mg/dL)	%
Human serum 1	0.60 (2.4)	0.02 (0.1)	2.5
Human serum 2	2.55 (10.2)	0.02 (0.1)	0.9
Human serum 3	4.46 (17.9)	0.04 (0.2)	0.9
Precinorm U	2.25 (9.0)	0.02 (0.1)	0.8
Precipath U	3.51 (14.1)	0.03 (0.1)	0.9

##### Urine

Repeatability	Mean	SD	CV
	mmol/L (mg/dL)	mmol/L (mg/dL)	%
Human urine 1	0.56 (2.2)	0.03 (0.1)	5.9
Human urine 2	3.96 (15.9)	0.03 (0.1)	0.7

Human urine 3	5.29 (21.2)	0.04 (0.2)	0.8
Human urine 4	6.21 (24.9)	0.04 (0.2)	0.6
Control Level 1	1.91 (7.7)	0.02 (0.1)	1.2
Control Level 2	2.77 (11.1)	0.03 (0.1)	0.9

<i>Intermediate precision</i>	<i>Mean</i>	<i>SD</i>	<i>CV</i>
	<i>mmol/L (mg/dL)</i>	<i>mmol/L (mg/dL)</i>	<i>%</i>
Human urine 1	0.58 (2.3)	0.02 (0.1)	3.1
Human urine 2	3.92 (15.7)	0.05 (0.2)	1.2
Human urine 3	5.18 (20.8)	0.06 (0.2)	1.1
Human urine 4	6.09 (24.4)	0.08 (0.3)	1.3
Control Level 1	1.85 (7.4)	0.03 (0.1)	1.5
Control Level 2	2.72 (10.9)	0.04 (0.2)	1.3

Results for intermediate precision were obtained on the master system **cobas c 501** analyzer.

#### Method comparison

Calcium values for human serum, plasma and urine samples obtained on a Roche/Hitachi **cobas c 701** analyzer (y) using the Roche Calcium Gen.2 reagent were compared with those determined using the corresponding reagent on a Roche/Hitachi **cobas c 501** analyzer (x).

#### Serum/plasma

Sample size (n) = 69

Passing/Bablok <sup>11</sup>	Linear regression
$y = 0.995x + 0.023$ mmol/L	$y = 0.991x + 0.031$ mmol/L
$\tau = 0.978$	$r = 1.00$

The sample concentrations were between 0.27 and 4.72 mmol/L (1.1 and 18.9 mg/dL).

#### Urine

Sample size (n) = 61

Passing/Bablok <sup>11</sup>	Linear regression
$y = 1.028x + 0.003$ mmol/L	$y = 1.027x + 0.012$ mmol/L
$\tau = 0.990$	$r = 1.00$

The sample concentrations were between 0.29 and 7.32 mmol/L (1.2 and 29.4 mg/dL).

#### References

- Endres DB, Rude RK. Mineral and Bone Metabolism. In: Burtis CA, Ashwood ER, Bruns ED, eds. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, 4th ed. St. Louis (MO): Saunders Elsevier 2006:1891-1965.
- Heins M, Heil W, Withold W. Storage of Serum or Whole Blood Samples? Effect of Time and Temperature on 22 Serum Analytes. Eur J Clin Chem Clin Biochem 1995;33:231-238.
- Wilding P, Zilva JF, Wilde CE. Transport of specimens for clinical chemistry analysis. Ann Clin Biochem 1977;14:301-306.
- Burtis CA, Ashwood ER, Bruns DE, eds. Tietz Fundamentals of Clinical Chemistry, 6th ed. St. Louis (MO): Saunders Elsevier 2008:715.
- WHO Publication: Use of anticoagulants in diagnostic laboratory investigations, WHO/DIL/LAB/99.1 Rev.2:Jan 2002.
- Glick MR, Ryder KW, Jackson SA. Graphical Comparisons of Interferences in Clinical Chemistry Instrumentation. Clin Chem 1986;32:470-475.
- Breuer J. Report on the Symposium "Drug effects in Clinical Chemistry Methods". Eur J Clin Chem Clin Biochem 1996;34:385-386.
- Sonntag O, Scholer A. Drug interference in clinical chemistry: recommendation of drugs and their concentrations to be used in drug interference studies. Ann Clin Biochem 2001;38:376-385.




- Bakker AJ, Mücke M. Gammopathy interference in clinical chemistry assays: mechanisms, detection and prevention. Clin Chem Lab Med 2007;45(9):1240-1243.
- Wu AHB, ed. Tietz Clinical Guide to Laboratory Tests, 4th ed. St. Louis (MO): Saunders Elsevier 2006:202-207.
- 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.

Any serious incident that has occurred in relation to the device shall be reported to the manufacturer and the competent authority of the Member State in which the user and/or the patient is established.

#### 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):

	Contents of kit
	Volume after reconstitution or mixing
	Global Trade Item Number

#### FOR US CUSTOMERS ONLY: LIMITED WARRANTY

Roche Diagnostics warrants that this product will meet the specifications stated in the labeling when used in accordance with such labeling and will be free from defects in material and workmanship until the expiration date printed on the label. THIS LIMITED WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. IN NO EVENT SHALL ROCHE DIAGNOSTICS BE LIABLE FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES.

COBAS, COBAS C, PRECICONTROL, PRECINORM and PRECIPATH are trademarks of Roche.

All other product names and trademarks are the property of their respective owners.

Additions, deletions or changes are indicated by a change bar in the margin.

© 2020, Roche Diagnostics



Roche Diagnostics GmbH, Sandhofer Strasse 116, D-68305 Mannheim  
www.roche.com  
+800 5505 6606



Distribution in USA by:  
Roche Diagnostics, Indianapolis, IN  
US Customer Technical Support 1-800-428-2336