MAYO CLINIC LABORATORIES

Test Definition: CMAMA

Comprehensive Metabolic Panel, Serum

Overview

Useful For

Routine health monitoring

Patient monitoring while hospitalized for information regarding metabolism, including the current kidney status, electrolyte and acid/base balance, and blood glucose

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
KS	Potassium, S	Yes	Yes
NAS	Sodium, S	Yes	Yes
CL	Chloride, S	Yes	Yes
HCO3	Bicarbonate, S	Yes	Yes
AGAP	Anion Gap	No	Yes
BUN	Bld Urea Nitrog(BUN), S	Yes	Yes
CRTS1	Creatinine with eGFR, S	Yes	Yes
CA	Calcium, Total, S	Yes	Yes
GLURA	Glucose, Random, S	Yes	Yes
TP	Protein, Total, S	Yes	Yes
ALB	Albumin, S	Yes	Yes
AST	Aspartate Aminotransferase (AST), S	Yes	Yes
ALP	Alkaline Phosphatase, S	Yes	Yes
ALT	Alanine Aminotransferase (ALT), S	Yes	Yes
BILIT	Bilirubin Total, S	Yes	Yes

Method Name

KS, NAS, CL: Indirect Potentiometry
ALT, AST, BUN, CA, GLURA, HCO3: Photometric
AGAP: Calculation
ALB, ALP, BILIT, CRTS1, TP: Colorimetric

NY State Available

Yes

Specimen

Specimen Type
Serum

Shipping Instructions
Ship specimen protected from light.

Necessary Information
Patient's age and sex are required.

Specimen Required
Supplies: Amber Frosted Tube, 5 mL (T915)
Collection Container/Tube:
Preferred: Serum gel
Acceptable: Red top
Submission Container/Tube: Amber vial
Specimen Volume: 0.6 mL
Collection Instructions:
1. Serum gel tubes should be centrifuged and protected from light within 2 hours of collection.
2. Red-top tubes should be centrifuged, and the serum aliquoted into an amber vial within 2 hours of collection.

Forms
If not ordering electronically, complete, print, and send a Renal Diagnostics Test Request (T830) with the specimen.

Specimen Minimum Volume
0.5 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated	24 hours	

Clinical & Interpretive

Clinical Information
The comprehensive metabolic panel measures 14 analytes and calculates an anion gap. It is used to assess kidney or liver status, electrolyte and acid/base balance, and blood glucose This comprehensive metabolic panel can also provide information about a patient's response to medications that would impact kidney or liver function.

Reference Values

SODIUM
<1 year: Not established
> or =1 year: 135-145 mmol/L

POTASSIUM
<1 year: Not established
> or =1 year: 3.6-5.2 mmol/L

CHLORIDE
1-17 years: 102-112 mmol/L
> or =18 years: 98-107 mmol/L
Reference values have not been established for patients who are younger than 12 months of age.

BICARBONATE
Males
12-24 months: 17-25 mmol/L
3 years: 18-26 mmol/L
4-5 years: 19-27 mmol/L
6-7 years: 20-28 mmol/L
8-17 years: 21-29 mmol/L
> or =18 years: 22-29 mmol/L

Females
1-3 years: 18-25 mmol/L
4-5 years: 19-26 mmol/L
6-7 years: 20-27 mmol/L
8-9 years: 21-28 mmol/L
> or =10 years: 22-29 mmol/L
Reference values have not been established for patients that are younger than 12 months of age.

ANION GAP
> or =7 years: 7-15
Reference values have not been established for patients who are younger than 7 years of age.

BLOOD UREA NITROGEN (BUN)
Males
1-17 years: 7-20 mg/dL
> or =18 years: 8-24 mg/dL
Reference values have not been established for patients who are younger than 12 months of age.

Females
1-17 years: 7-20 mg/dL
> or =18 years: 6-21 mg/dL
Reference values have not been established for patients who are younger than 12 months of age

CREATININE
Males:
0-11 months: 0.17-0.42 mg/dL
1-5 years: 0.19-0.49 mg/dL
6-10 years: 0.26-0.61 mg/dL
11-14 years: 0.35-0.86 mg/dL
> or =15 years: 0.74-1.35 mg/dL

Females:
0-11 months: 0.17-0.42 mg/dL
1-5 years: 0.19-0.49 mg/dL
6-10 years: 0.26-0.61 mg/dL
11-15 years: 0.35-0.86 mg/dL
> or =16 years: 0.59-1.04 mg/dL

ESTIMATED GLOMERULAR FILTRATION RATE (eGFR)
>= 18 years old: > or =60 mL/min/BSA
Estimated GFR calculated using the 2021 CKD_EPI creatinine equation.

Note: eGFR results will not be calculated for patients younger than 18 years old.

CALCIUM
<1 year: 8.7-11.0 mg/dL
1-17 years: 9.3-10.6 mg/dL
18-59 years: 8.6-10.0 mg/dL
60-90 years: 8.8-10.2 mg/dL
>90 years: 8.2-9.6 mg/dL

GLUCOSE
0-11 months: Not established
> or =1 year: 70-140 mg/dL

TOTAL PROTEIN
> or =1 year: 6.3-7.9 g/dL
Reference values have not been established for patients who are younger than 12 months of age.

ALBUMIN
> or =12 months: 3.5-5.0 g/dL
Reference values have not been established for patients who are younger than 12 months of age.

ASPARTATE AMINOTRANSFERASE (AST)
Males:
0-11 months: Not established
1-13 years: 8-60 U/L
> or =14 years: 8-48 U/L

Females:
0-11 months: Not established
1-13 years: 8-50 U/L
> or =14 years: 8-43 U/L

ALKALINE PHOSPHATASE (ALP)
Males
0-14 days: 83-248 U/L
15 days-<1 year: 122-469 U/L
1-<10 years: 142-335 U/L
10-<13 years: 129-417 U/L
13-<15 years: 116-468 U/L
15-<17 years: 82-331 U/L
17-<19 years: 55-149 U/L
> or =19 years: 40-129 U/L

Females
0-14 days: 83-248 U/L
15 days-<1 year: 122-469 U/L
1-<10 years: 142-335 U/L
10-<13 years: 129-417 U/L
13-<15 years: 57-254 U/L
15-<17 years: 50-117 U/L
> or =17 years: 35-104 U/L

ALANINE AMINOTRANSFERASE (ALT)
Males:
> or =1 year: 7-55 U/L
Reference values have not been established for patients who are younger than 12 months of age.

Females:
> or =1 year: 7-45 U/L
Reference values have not been established for patients who are younger than 12 months of age.

TOTAL BILIRUBIN
0-6 days: Refer to www.bilitool.org for information on age-specific (postnatal hour of life) serum bilirubin values.
7-14 days: 0.0-14.9 mg/dL
15 days to 17 years: 0.0-1.0 mg/dL
>18 years 0.0-1.2 mg/dL

Interpretation

Comprehensive metabolic panel results are usually evaluated in conjunction with each other for patterns of results. The pattern of abnormal results can help identify the possible conditions or diseases present. Many conditions will cause abnormal results including kidney failure, breathing problems, and diabetes-related complications.

Cautions

No significant cautionary statements

Clinical Reference

Comprehensive Metabolic Panel (CMP). Testing.com; Updated July 29, 2022. Accessed September 19, 2023. Available at www.testing.com/tests/comprehensive-metabolic-panel-cmp/

Performance

Method Description

Sodium, Potassium, Chloride:
An ion-selective electrode (ISE) makes use of the unique properties of ion-selective membrane to develop an electrical potential (electromotive force, EMF) for the measurements of ions in solution. Selective membrane is in contact with both the test solution and an internal filling solution. Due to the selectivity of the membrane, only the ions to be measured contribute to the EMF. The membrane EMF is determined by the difference in concentration of the test ion in the test solution and the internal filling solution. The EMF develops according to Nernst equation of a specific ion in solution.(Package insert: ISE indirect Na-K-Cl for Gen 2. Roche Diagnostics; 05/2024)

Bicarbonate:
Bicarbonate reacts with phosphoenolpyruvate (PEP) in the presence of PEPC to produce oxaloacetate and phosphate. That reaction is coupled with one involving the transfer of a hydrogen ion from reduced nicotinamide adenine dinucleotide (NADH) analog to oxaloacetate using malate dehydrogenase (MDH). The resultant consumption of NADH analog causes a decrease in absorbance, which is proportional to the concentration of bicarbonate in the sample being analyzed.(Package insert: Bicarbonate reagent. Roche Diagnostics; 02/2023)

Anion Gap:
This is a calculated result. The following equation is used to calculate the anion gap (A gap):
A gap =Na - (Cl + HCO3-)

Blood Urea Nitrogen:
Kinetic test with urease and glutamate dehydrogenase. 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 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 NADH concentrations is directly proportional to the urea concentration in the specimen and is measured photometrically.(Package insert: Urea/BUN reagent. Roche Diagnostics; 07/2024)

Creatinine:
This enzymatic method is based on the conversion of creatinine with the aid of creatininase, creatinase, and sarcosine oxidase to form glycine, formaldehyde, and hydrogen peroxide. Catalyzed by peroxidase the liberated hydrogen peroxide reacts with 4-aminophenazone and HTIB (2,4,6-triiodo03-hydroxybenzoic acid) to form a quinone imine chromogen. The color intensity of the quinone imine chromogen formed is directly proportional to the creatinine concentration in the reaction mixture.(Package insert: Creatinine plus ver.2. Roche Diagnostics; 07/2024)

Calcium:
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.(Package insert: CA2 reagent. Roche Diagnostics; 08/2023)

Glucose:
Hexokinase catalyzes the phosphorylation of glucose to glucose-6-phosphate by ATP. Glucose-6-phosphate dehydrogenase oxidizes glucose-6-phosphate in the presence of nicotinamide adenine dinucleotide phosphate (NADP) to gluconate-6-phosphate. No other carbohydrate is oxidized. The rate of NADPH formation during the reaction is directly proportional to the glucose concentration and is measured photometrically.(Package insert: Glucose HK Gen.3. Roche Diagnostics; 07/2024)

Total Protein:
Divalent copper reacts in alkaline solution with protein peptide bonds to form the characteristic purple-colored biuret complex. Sodium potassium tartrate prevents the precipitation of copper hydroxide and potassium iodide prevents autoreduction of copper. The color intensity is directly proportional to the protein concentration, which can be determined photometrically.(Package insert: Total Protein Gen.2 reagent. Roche Diagnostics; 09/2023)

Albumin:
At a pH value of 4.1, albumin displays a sufficiently cationic character to be able to bind with bromcresol green (BCG), an anionic dye, to form a blue-green complex. The color intensity of the blue-green color is directly proportional to the albumin concentration in the sample and is measured photometrically.(Package insert: Albumin reagent. Roche Diagnostics; 06/2024)

Aspartate Aminotransferase:
Aspartate aminotransferase (AST) catalyzes the transfer of an amino group between L-aspartate and 2-oxoglutarate to form oxaloacetate and L-glutamate. The oxaloacetate then reacts with NADH, in the presence of MDH to form L-malate and NAD[+]. Pyridoxal phosphate serves as a coenzyme in the amino transfer reaction. It ensures full enzyme activation. The rate of NADH oxidation is directly proportional to the catalytic AST activity. It is determined by measuring the decrease in absorbance.(Package insert: Aspartate Aminotransferase reagent. Roche Diagnostics; 01/2024)

Alkaline Phosphatase:
In the presence of magnesium and zinc ions, p-nitrophenyl phosphate is cleaved by phosphatases into phosphate and p-nitrophenol. The p-nitrophenol released is directly proportional to the catalytic alkaline phosphatase activity. It is determined by measuring the increase in absorbance.(Package insert: Alkaline Phosphatase reagent. Roche Diagnostics; 09/2022)

Alanine Aminotransferase:
Alanine aminotransferase (ALT) catalyzes the transfer of an amino group between L-alanine and 2-oxoglutarate to form pyruvate and L-glutamate. The pyruvate then reacts with NADH in the presence of lactate dehydrogenase to form L-lactate and NAD[+]. Pyridoxal phosphate serves as a coenzyme in the amino transfer reaction. It ensures full enzyme activation. The rate of NADH oxidation is directly proportional to the catalytic ALT activity. It is determined by measuring the decrease in absorbance.(Package insert: ALT reagent. Roche Diagnostics; 04/2024)

Total Bilirubin:

Total bilirubin, in the presence of a suitable solubilizing agent, is coupled with 3,5-dichlorophenyl diazonium in a strongly acidic medium. The color intensity of the red azo dye formed is directly proportional to the total bilirubin and can be determined photometrically.(Package insert: Bilirubin Total Gen. 3. Roche Diagnostics; 01/2024)

PDF Report
No

Day(s) Performed
Monday through Sunday

Report Available
Same day/1 to 2 days

Specimen Retention Time
1 week

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Main Campus

Fees & Codes

Fees
- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification
This test has been cleared, approved, or is exempt by the US Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information
KS-84132
NAS-84295
CL-82435
HCO3-82374
BUN-84520
CRTS1-82565
CA-82310
GLURA-82947
TP-84155
ALB-82040
AST-84450
ALP-84075

ALT-84460
BILIT-82247

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
CMAMA	Comprehensive Metabolic Panel, S	24323-8

Result ID	Test Result Name	Result LOINC® Value
AGAP	Anion Gap	33037-3
ALB	Albumin, S	1751-7
ALP	Alkaline Phosphatase, S	6768-6
ALT	Alanine Aminotransferase (ALT), S	1743-4
AST	Aspartate Aminotransferase (AST), S	30239-8
BILIT	Bilirubin Total, S	1975-2
BUN	Bld Urea Nitrog(BUN), S	3094-0
CL	Chloride, S	2075-0
GLURA	Glucose, Random, S	2345-7
HCO3	Bicarbonate, S	1963-8
TP	Protein, Total, S	2885-2
CA	Calcium, Total, S	17861-6
NAS	Sodium, S	2951-2
KS	Potassium, S	2823-3
CRTSA	Creatinine, S	2160-0
EGFR1	Estimated GFR (eGFR)	98979-8