

From Iverson C, Christiansen S, Flanagan A, et al. *AMA Manual of Style: A Guide for Authors and Editors*. 10th ed. New York, NY: Oxford University Press; 2007. © American Medical Association.

Table 2. Selected Laboratory Tests, With Reference Ranges and Conversion Factors^a

Analyte	Specimen	Reference Range, Conventional Unit	Conventional Unit	Conversion Factor (Multiply by)	Reference Range, SI Unit	SI Unit
Acetaminophen	Serum, plasma	10-30	μg/mL	6.614	66-200	μmol/L
Acetoacetate	Serum, plasma	< 1	mg/dL	97.95	< 100	μmol/L
Acetone	Serum, plasma	< 1.0	mg/dL	0.172	< 0.17	mmol/L
Acid phosphatase	Serum	< 5.5	U/L	16.667	< 90	ncat/L
Activated partial thromboplastin time (APTT)	Whole blood	25-40	s	1.0	25-40	s
Adenosine deaminase	Serum	11.5-25.0	U/L	16.667	190-420	ncat/L
Adrenocorticotrophic hormone (ACTH)	Plasma	< 120	pg/mL	0.22	< 26	pmol/L
Alanine	Plasma	1.87-5.89	mg/dL	112.2	210-661	μmol/L
Alanine aminotransferase (ALT)	Serum	10-40	U/L	0.0167	0.17-0.68	μkat/L
Albumin	Serum	3.5-5.0	g/dL	10	35-50	g/L
Alcohol dehydrogenase	Serum	< 2.8	U/L	16.667	< 47	ncat/L
Aldolase	Serum	1.0-7.5	U/L	0.0167	0.02-0.13	μkat/L
Aldosterone	Serum, plasma	2-9	ng/dL	27.74	55-250	pmol/L
Alkaline phosphatase	Serum	30-120	U/L	0.0167	0.5-2.0	μkat/L
Alprazolam	Serum, plasma	10-50	ng/mL	3.24	32-162	nmol/L
Amikacin	Serum, plasma	20-30	μg/mL	1.708	34-52	μmol/L
α-Aminobutyric acid	Plasma	0.08-0.36	mg/dL	96.97	8-35	μmol/L
δ-Aminolevulinic acid	Serum	15-23	μg/dL	0.0763	1.1-8.0	μmol/L
Amiodarone	Serum, plasma	0.5-2.5	μg/mL	1.55	0.8-3.9	μmol/L
Amitriptyline	Plasma	120-250	ng/mL	3.605	433-903	nmol/L
Ammonia (as nitrogen)	Serum, plasma	15-45	μg/dL	0.714	11-32	μmol/L
Amobarbital	Serum	1-5	μg/mL	4.42	4-22	μmol/L

Amphetamine	Serum, plasma	20-30	ng/mL	7.4	148-222	nmol/L
Amylase	Serum	27-131	U/L	0.01667	0.46-2.23	μkat/L
Androstenedione	Serum	75-205	ng/dL	0.0349	2.6-7.2	nmol/L
Angiotensin I	Plasma	< 25	pg/mL	0.772	< 15	pmol/L
Angiotensin II	Plasma	10-60	pg/mL	0.957	0.96-58	pmol/L
Angiotensin-converting enzyme	Serum	< 40	U/L	16.667	< 670	nkat/L
Anion gap Na ⁺ - (Cl ⁻ + HCO ₃ ⁻)	Serum, plasma	8-16	mEq/L	1.0	8-16	mmol/L
Antidiuretic hormone (ADH)	Plasma	1-5	pg/mL	0.923	0.9-4.6	pmol/L
Antithrombin III	Plasma	21-30	mg/dL	10	210-300	mg/L
α ₁ -Antitrypsin	Serum	78-200	mg/dL	0.184	14.5-36.5	μmol/L
Apolipoprotein A-I	Serum	80-151	mg/dL	0.01	0.8-1.5	g/L
Apolipoprotein B	Serum, plasma	50-123	mg/dL	0.01	0.5-1.2	g/L
Arginine	Serum	0.37-2.40	mg/dL	57.05	21-138	μmol/L
Arsenic	Whole blood	< 2-23	μg/L	0.0133	0.03-0.31	μmol/L
Ascorbic acid (see Vitamin C)						
Asparagine	Plasma	0.40-0.91	mg/dL	75.689	30-69	μmol/L
Aspartate aminotransferase (AST)	Serum	10-30	U/L	0.01667	0.17-0.51	μkat/L
Aspartic acid	Plasma	< 0.3	mg/dL	75.13	< 25	μmol/L
Atrial natriuretic hormone	Plasma	20-77	pg/mL	0.325	6.5-2.5	pmol/L
Bands (see White blood cell count)						
Basophils (see White blood cell count)						
Base excess	Whole blood	-2 to 3	mEq/L	1.0	-2 to 3	mmol/L
Bicarbonate	Serum	21-28	mEq/L	1.0	21-28	mmol/L
Bile acids (total)	Serum	0.3-2.3	μg/mL	2.448	0.73-5.63	μmol/L
Bilirubin, total	Serum	0.3-1.2	mg/dL	17.104	5.0-21.0	μmol/L
Bilirubin, direct (conjugated)	Serum	0.1-0.3	mg/dL	17.104	1.7-5.1	μmol/L

Table 2. Selected Laboratory Tests, With Reference Ranges and Conversion Factors^a (cont)

Analyte	Specimen	Reference Range, Conventional Unit	Conventional Unit	Conversion Factor (Multiply by)	Reference Range, SI Unit	SI Unit
Biotin	Serum	200-500	pg/mL	0.00409	0.82-2.05	nmol/L
Bismuth	Whole blood	1-12	µg/L	4.785	4.8-57.4	nmol/L
Blood gases						
Carbon dioxide, P _{CO₂}	Arterial blood	35-45	mm Hg	0.133	4.7-5.9	kPa
pH	Arterial blood	7.35-7.45		1.0	7.35-7.45	
Oxygen, P _{O₂}	Arterial blood	80-100	mm Hg	0.133	11-13	kPa
Brain-type natriuretic peptide (BNP)	Plasma	< 167	pg/mL	1.0	< 167	ng/L
Bromide (toxic)	Serum	> 1250	µg/mL	0.0125	> 15.6	mmol/L
C1 esterase inhibitor	Serum	12-30	mg/dL	10	120-300	mg/L
C3 complement	Serum	1200-1500	µg/mL	0.001	1.2-1.5	g/L
C4 complement	Serum	350-600	µg/mL	0.001	0.35-0.60	g/L
Cadmium	Whole blood	0.3-1.2	µg/L	8.896	2.7-10.7	nmol/L
Caffeine	Serum, plasma	3-15	µg/L	0.515	2.5-7.5	µmol/L
Calcitonin	Plasma	3-26	pg/mL	0.292	0.8-7.6	pmol/L
Calcium, ionized	Serum	4.60-5.08	mg/dL	0.25	1.15-1.27	mmol/L
Calcium, total	Serum	8.2-10.2	mg/dL	0.25	2.05-2.55	mmol/L
Cancer antigen (CA) 125	Serum	< 35	U/mL	1.0	< 35	kU/L
Carbamazepine	Serum, plasma	8-12	µg/mL	4.233	34-51	µmol/L
Carbon dioxide (total)	Serum, plasma	22-28	mEq/L	1.0	22-28	mmol/L
Carboxyhemoglobin, toxic	Whole blood	> 20	%	0.01	> 0.2	Proportion of 1.0
Carcinoembryonic antigen (CEA)	Serum	< 3.0	ng/mL	1.0	< 3.0	µg/L
β-Carotene	Serum	10-85	µg/dL	0.01863	0.2-1.6	µmol/L
Carotenoids	Serum	50-300	µg/dL	0.01863	0.9-5.6	µmol/L

Ceruloplasmin	Serum	20-40	mg/dL	10	200-400	mg/L
Chloramphenicol	Serum	10-25	µg/mL	3.095	31-77	µmol/L
Chlordiazepoxide	Serum, plasma	0.4-3.0	µg/mL	3.336	1.3-10.0	µmol/L
Chloride	Serum, plasma	96-106	mEq/L	1.0	96-106	mmol/L
Chlorpromazine	Plasma	50-300	ng/mL	3.126	157-942	nmol/L
Chlorpropamide	Plasma	75-250	mg/L	3.61	270-900	µmol/L
Cholecalciferol (see Vitamin D)						
Cholesterol (total)						
Desirable	Serum, plasma	< 200	mg/dL	0.0259	< 5.18	mmol/L
Borderline high	Serum, plasma	200-239	mg/dL	0.0259	5.18-6.18	mmol/L
High	Serum, plasma	≥240	mg/dL	0.0259	≥ 6.21	mmol/L
Cholesterol, high-density (HDL) (low level)						
	Serum, plasma	< 40	mg/dL	0.0259	< 1.03	mmol/L
Cholesterol, low-density (LDL) (high level)						
	Serum, plasma	> 160	mg/dL	0.0259	4.144	mmol/L
Cholinesterase	Serum	5-12	mg/L	2.793	14-39	nmol/L
Chorionic gonadotropin (β-hCG) (nonpregnant)						
	Serum	5.0	mIU/mL	1.0	5.0	IU/L
Chromium	Whole blood	0.7-28.0	µg/L	19.232	13.4-538.6	nmol/L
Citrate	Serum	1.2-3.0	mg/dL	52.05	60-160	µmol/L
Citrulline	Plasma	0.2-1.0	mg/dL	57.081	12-55	µmol/L
Clonazepam	Serum	10-50	ng/mL	0.317	0.4-15.8	nmol/L
Clonidine	Serum, plasma	1.0-2.0	ng/mL	4.35	4.4-8.7	nmol/L
Clozapine	Serum	200-350	ng/mL	0.003	0.6-1.0	µmol/L
Coagulation factor I						
(Fibrinogen)	Plasma	150-350	mg/dL	0.01	1.5-3.5	g/L
Coagulation factor II (prothrombin)						
	Plasma	70-130	%	0.01	0.70-1.30	Proportion of 1.0

Table 2. Selected Laboratory Tests, With Reference Ranges and Conversion Factors^a (cont)

Analyte	Specimen	Reference Range, Conventional Unit	Conventional Unit	Conversion Factor (Multiply by)	Reference Range, SI Unit	SI Unit
Coagulation factor V	Plasma	70-130	%	0.01	0.70-1.30	Proportion of 1.0
Coagulation factor VII	Plasma	60-140	%	0.01	0.60-1.40	Proportion of 1.0
Coagulation factor VIII	Plasma	50-200	%	0.01	0.50-2.00	Proportion of 1.0
Coagulation factor IX	Plasma	70-130	%	0.01	0.70-1.30	Proportion of 1.0
Coagulation factor X	Plasma	70-130	%	0.01	0.70-1.30	Proportion of 1.0
Coagulation factor XI	Plasma	70-130	%	0.01	0.70-1.30	Proportion of 1.0
Coagulation factor XII	Plasma	70-130	%	0.01	0.70-1.30	Proportion of 1.0
Cobalt	Serum	4.0-10.0	µg/L	16.968	67.9-169.7	nmol/L
Cocaine (toxic)	Serum	> 1000	ng/mL	3.297	> 3300	nmol/L
Codeine	Serum	10-100	ng/mL	3.34	33-334	nmol/L
Coenzyme Q10 (ubiquinone)	Plasma	0.5-1.5	µg/mL	1.0	0.5-1.5	mg/L
Copper	Serum	70-140	µg/dL	0.157	11-22	µmol/L
Coproporphyrin	Urine	< 200	µg/24 h	1.527	< 300	µmol/d
Corticotropin	Plasma	< 120	pg/mL	0.22	< 26	pmol/L
Cortisol	Serum, plasma	5-25	µg/dL	27.588	140-690	nmol/L
Cotinine	Plasma	0-8	µg/L	5.675	0-45	nmol/L
C-peptide	Serum	0.5-2.5	ng/mL	0.331	0.17-0.83	nmol/L
C-reactive protein	Serum	0.08-3.1	mg/L	9.524	0.76-28.5	nmol/L
Creatine	Serum	0.1-0.4	mg/dL	76.25	8-31	µmol/L
Creatine kinase (CK)	Serum	40-150	U/L	0.0167	0.67-2.5	µkat/L
Creatine kinase-MB fraction	Serum	0-7	ng/mL	1.0	0-7	µg/L
Creatinine	Serum, plasma	0.6-1.2	mg/dL	88.4	53-106	µmol/L

Creatinine clearance	Serum, plasma	75-125	mL/min/1.73 m ²	0.0167	1.24-2.08	mL/s/m ²
Cyanide (toxic)	Whole blood	> 1.0	µg/mL	23.24	> 23	µmol/L
Cyclic adenosine monophosphate (cAMP)	Plasma	4.6-8.6	ng/mL	3.04	14-26	nmol/L
Cyclosporine	Serum	100-400	ng/mL	0.832	83-333	nmol/L
Cystine	Plasma	0.40-1.40	mg/dL	41.615	16-60	µmol/L
D-dimer	Plasma	< 0.5	µg/mL	5.476	< 3.0	nmol/L
Dehydroepiandrosterone (DHEA)	Serum	1.8-12.5	ng/mL	3.47	6.2-43.3	nmol/L
Dehydroepiandrosterone sulfate (DHEA-S)	Serum	50-450	µg/dL	0.027	1.6-12.2	µmol/L
Deoxycorticosterone	Serum	2-19	ng/dL	30.5	61-576	nmol/L
Desipramine	Serum, plasma	50-200	ng/mL	3.754	170-700	nmol/L
Diazepam	Serum, plasma	100-1000	ng/mL	0.0035	0.35-3.51	µmol/L
Digoxin	Plasma	0.5-2.0	ng/mL	1.281	0.6-2.6	nmol/L
Diltiazem	Serum	< 200	mg/L	2.412	< 480	µmol/L
Disopyramide	Serum, plasma	2.8-7.0	µg/mL	2.946	8.3-22.0	µmol/L
Dopamine	Plasma	< 87	pg/mL	6.528	< 475	pmol/L
Doxepin	Serum, plasma	30-150	ng/mL	3.579	108-538	nmol/L
Electrophoresis (protein)						
Proportion of total protein						
Albumin	Serum	52-65	%	0.01	0.52-0.65	Proportion of 1.0
α ₁ -Globulin	Serum	2.5-5.0	%	0.01	0.025-0.05	Proportion of 1.0
α ₂ -Globulin	Serum	7.0-13.0	%	0.01	0.07-0.13	Proportion of 1.0
β-Globulin	Serum	8.0-14.0	%	0.01	0.08-0.14	Proportion of 1.0
γ-Globulin	Serum	12.0-22.0	%	0.01	0.12-0.22	Proportion of 1.0

Table 2. Selected Laboratory Tests, With Reference Ranges and Conversion Factors^a (cont)

Analyte	Specimen	Reference Range, Conventional Unit	Conventional Unit	Conversion Factor (Multiply by)	Reference Range, SI Unit	SI Unit
Concentration						
Albumin	Serum	3.2-5.6	g/dL	10.0	32-56	g/L
α_1 -Globulin	Serum	0.1-0.4	g/dL	10.0	1-10	g/L
α_2 -Globulin	Serum	0.4-1.2	g/dL	10.0	4-12	g/L
β -Globulin	Serum	0.5-1.1	g/dL	10.0	5-11	g/L
γ -Globulin	Serum	0.5-1.6	g/dL	10.0	5-16	g/L
Eosinophils (see White blood cell count)						
Ephedrine (toxic)	Serum	> 2	$\mu\text{g/mL}$	6.052	> 12.1	$\mu\text{mol/L}$
Epinephrine	Plasma	< 60	pg/mL	5.459	< 330	pmol/L
Erythrocyte count (see Red blood cell count)						
Erythrocyte sedimentation rate	Whole blood	0-20	mm/h	1.0	0-20	mm/h
Erythropoietin	Serum	5-36	IU/L	1.0	5-36	IU/L
Estradiol (E ₂)	Serum	30-400	pg/mL	3.671	110-1470	pmol/L
Estriol (E ₃)	Serum	5-40	ng/mL	3.467	17.4-138.8	nmol/L
Estrogens (total)	Serum	60-400	pg/mL	1.0	60-400	ng/L
Estrone (E ₁)	Serum, plasma	1.5-25.0	pg/mL	3.698	5.5-92.5	pmol/L
Ethanol (ethyl alcohol)	Serum, whole blood	< 20	mg/dL	0.2171	< 4.3	mmol/L
Ethchlorvynol (toxic)	Serum, plasma	> 20	$\mu\text{g/mL}$	6.915	> 138	$\mu\text{mol/L}$
Ethosuximide	Serum	40-100	mg/L	7.084	280-700	$\mu\text{mol/L}$
Ethylene glycol (toxic)	Serum, plasma	> 30	mg/dL	0.1611	> 5	mmol/L
Fatty acids (nonesterified)	Serum, plasma	8-25	mg/dL	0.0355	0.28-0.89	mmol/L
Fecal fat (as stearic acid)	Stool	2.0-6.0	g/d	1.0	2-6	g/24 h

Fenfluramine	Serum	0.04-0.30	µg/mL	4.324	0.18-1.30	µmol/L
Fentanyl	Serum	0.01-0.10	µg/mL	2.972	0.02-0.30	µmol/L
Ferritin	Serum	15-200	ng/mL	2.247	33-450	pmol/L
α ₁ -Fetoprotein	Serum	< 10	ng/mL	1.0	< 10	µg/L
Fibrin degradation products	Plasma	< 10	µg/mL	1.0	< 10	mg/L
Fibrinogen	Plasma	200-400	mg/dL	0.0294	5.8-11.8	µmol/L
Flecainide	Serum, plasma	0.2-1.0	µg/mL	2.413	0.5-2.4	µmol/L
Fluoride	Whole blood	< 0.05	mg/dL	0.5263	< 0.027	mmol/L
Fluoxetine	Serum	200-1100	ng/mL	0.00323	0.65-3.56	µmol/L
Flurazepam (toxic)	Serum, plasma	> 0.2	µg/mL	2.5	> 0.5	µmol/L
Folate (folic acid)	Serum	3-16	ng/mL	2.266	7-36	nmol/L
Follicle-stimulating hormone (FSH)	Serum, plasma	1-100	mIU/mL	1.0	1-100	IU/L
Fructosamine	Serum	36-50	mg/L	5.581	200-280	mmol/L
Fructose	Serum	1-6	mg/dL	55.506	55-335	µmol/L
Galactose	Serum, plasma	< 20	mg/dL	0.0555	< 1.10	mmol/L
Gastrin	Serum	25-90	pg/mL	0.481	12-45	pmol/L
Gentamicin	Serum	6-10	µg/mL	2.090	12-21	µmol/L
Glucagon	Plasma	20-100	pg/mL	1.0	20-100	ng/L
Glucose	Serum	70-110	mg/dL	0.0555	3.9-6.1	mmol/L
Glucose-6-phosphate dehydrogenase	Whole blood	10-14	U/g hemoglobin	0.0167	0.17-0.24	nkat/g hemoglobin
Glutamic acid	Plasma	0.2-2.8	mg/dL	67.967	15-190	µmol/L
Glutamine	Plasma	6.1-10.2	mg/dL	68.423	420-700	µmol/L
γ-Glutamyltransferase (GGT)	Serum	2-30	U/L	0.01667	0.03-0.51	µkat/L
Glutethimide	Serum	2-6	µg/mL	4.603	9-28	µmol/L
Glycerol (free)	Serum	0.3-1.72	mg/dL	0.1086	0.32-0.187	mmol/L

Table 2. Selected Laboratory Tests, With Reference Ranges and Conversion Factors^a (cont)

Analyte	Specimen	Reference Range, Conventional Unit	Conventional Unit	Conversion Factor (Multiply by)	Reference Range, SI Unit	SI Unit
Glycine	Plasma	0.9-4.2	mg/dL	133.2	120-560	μmol/L
Gold	Serum	< 10	μg/dL	50.770	< 500	nmol/L
Growth hormone (GH)	Serum	0-18	ng/mL	1.0	0-18	μg/L
Haloperidol	Serum, plasma	6-24	ng/mL	2.66	16-65	nmol/L
Haptoglobin	Serum	26-185	mg/dL	10	260-1850	mg/L
Hematocrit	Whole blood	41-50	%	0.01	0.41-0.50	Proportion of 1.0
Hemoglobin	Whole blood	14.0-17.5	g/dL	10.0	140-175	g/L
Mean corpuscular hemoglobin (MCH)	Whole blood	26-34	pg/cell	1.0	26-34	pg/cell
Mean corpuscular hemoglobin concentration (MCHC)	Whole blood	33-37	g/dL	10	330-370	g/L
Mean corpuscular volume (MCV)	Whole blood	80-100	μm ³	1.0	80-100	fL
Hemoglobin A _{1c} (glycated hemoglobin)	Whole blood	4-7	% of total hemoglobin	0.01	0.04-0.07	Proportion of total hemoglobin
Hemoglobin A ₂	Whole blood	2.0-3.0	%	0.01	0.02-0.03	Proportion of 1.0
Histamine	Plasma	0.5-1.0	μg/L	8.997	4.5-9.0	nmol/L
Histidine	Plasma	0.5-1.7	mg/dL	64.45	32-110	μmol/L
Homocysteine	Plasma	0.68-2.02	mg/L	7.397	5-15	μmol/L
Homovanillic acid	Urine	1.4-8.8	mg/24 h	5.489	8-48	μmol/d
Hydrocodone	Serum	< 0.02	μg/mL	3.34	< 0.06	μmol/L
Hydromorphone	Serum	0.008-0.032	μg/mL	3504	28-112	nmol/L
β-Hydroxybutyric acid	Plasma	< 3.0	mg/dL	96.06	< 300	μmol/L
5-Hydroxyindoleacetic acid (5-HIAA)	Urine	2-6	mg/24 h	5.23	10.4-31.2	μmol/d
Hydroxyproline	Plasma	< 0.55	mg/dL	76.266	< 42	μmol/L

Ibuprofen	Serum	10-50	µg/mL	4.848	50-243	µmol/L
Imipramine	Plasma	150-250	ng/mL	3.566	536-893	nmol/L
Immunoglobulin A (IgA)	Serum	40-350	mg/dL	10	400-3500	mg/L
Immunoglobulin D (IgD)	Serum	0-8	mg/dL	10	0-80	mg/L
Immunoglobulin E (IgE)	Serum	0-1500	µg/L	0.001	0-1.5	mg/L
Immunoglobulin G (IgG)	Serum	650-1600	mg/dL	0.01	6.5-16.0	g/L
Immunoglobulin M (IgM)	Serum	54-300	mg/dL	10	550-3000	mg/L
Insulin	Serum	2.0-20	µIU/mL	6.945	14-140	pmol/L
Insulinlike growth factor	Serum	130-450	ng/mL	0.131	18-60	nmol/L
Iodine	Serum	58-77	µg/L	7.880	450-580	nmol/L
Iron	Serum	60-150	µg/dL	0.179	10.7-26.9	µmol/L
Iron-binding capacity	Serum	250-450	µg/dL	0.179	44.8-80.6	µmol/L
Isoleucine	Plasma	0.5-1.3	mg/dL	76.236	40-100	µmol/L
Isoniazid	Plasma	1-7	µg/mL	7.291	7-51	µmol/L
Isopropanol (toxic)	Serum, plasma	> 400	mg/L	0.0166	> 6.64	mmol/L
Kanamycin	Serum, plasma	25-35	µg/mL	2.08	52-72	µmol/L
Ketamine	Serum	0.2-6.3	µg/mL	4.206	0.8-26	µmol/L
17-Ketosteroids	Urine	3-12	mg/24 h	3.33	10-42	µmol/d
Lactate	Plasma	5.0-15	mg/dL	0.111	0.6-1.7	mmol/L
Lactate dehydrogenase (LDH)	Serum	100-200	U/L	0.0167	1.7-3.4	µkat/L
LDH isoenzymes						
LD ₁	Serum	17-27	%	0.01	0.17-0.27	Proportion of 1.0
LD ₂	Serum	27-37	%	0.01	0.27-0.37	Proportion of 1.0
LD ₃	Serum	18-25	%	0.01	0.18-0.25	Proportion of 1.0
LD ₄	Serum	3-8	%	0.01	0.03-0.08	Proportion of 1.0

Table 2. Selected Laboratory Tests, With Reference Ranges and Conversion Factors^a (cont)

Analyte	Specimen	Reference Range, Conventional Unit	Conventional Unit	Conversion Factor (Multiply by)	Reference Range, SI Unit	SI Unit
LD ₅	Serum	0-5	%	0.01	0-0.05	Proportion of 1.0
Lead	Serum	< 10-20	µg/dL	0.0483	< 0.5-1.0	µmol/L
Leucine	Plasma	1.0-2.3	mg/dL	76.237	75-175	µmol/L
Leukocytes (see White blood cell count)						
Lidocaine	Serum, plasma	1.5-6.0	µg/mL	4.267	6.4-25.6	µmol/L
Lipase	Serum	31-186	U/L	0.01667	0.5-3.2	µkat/L
Lipoprotein(a) [Lp(a)]	Serum	10-30	mg/dL	0.0357	0.35-1.0	µmol/L
Lithium	Serum	0.6-1.2	mEq/L	1.0	0.6-1.2	mmol/L
Lorazepam	Serum	50-240	ng/mL	3.114	156-746	nmol/L
Luteinizing hormone (LH)	Serum, plasma	1-104	mIU/mL	1.0	1-104	IU/L
Lycopene	Serum	0.15-0.25	mg/L	1.863	0.28-0.46	µmol/L
Lymphocytes (see White blood cell count)						
Lysergic acid diethylamide	Serum	< 0.004	µg/mL	3726	< 15	nmol/L
Lysine	Plasma	1.2-3.5	mg/dL	68.404	80-240	µmol/L
Lysozyme	Serum, plasma	0.4-1.3	mg/dL	10	4-13	mg/L
Magnesium	Serum	1.3-2.1	mEq/L	0.50	0.65-1.05	mmol/L
Manganese	Whole blood	10-12	µg/L	18.202	182-218	nmol/L
Maprotiline	Plasma	200-600	ng/mL	1.0	200-600	µg/L
Melatonin	Serum	10-15	ng/L	4.305	45-66	pmol/L
Meperidine	Serum, plasma	400-700	ng/mL	4.043	1620-2830	nmol/L
Mercury	Serum	< 5	µg/L	4.985	< 25	nmol/L
Metanephrine (total)	Urine	< 1.0	mg/24 h	5.07	< 5	µmol/d
Metformin	Serum	1-4	µg/mL	7.742	8-30	µmol/L

Methadone	Serum, plasma	100-400	ng/mL	0.00323	0.32-1.29	μmol/L
Methamphetamine	Serum	0.01-0.05	μg/mL	6.7	0.07-0.34	μmol/L
Methanol	Plasma	< 200	μg/mL	0.0312	< 6.2	mmol/L
Methaqualone	Serum, plasma	2-3	μg/mL	4.0	8-12	μmol/L
Methemoglobin	Whole blood	< 0.24	g/dL	155	< 37.2	μmol/L
Methemoglobin	Whole blood	< 1.0	% of total hemoglobin	0.01	< 0.01	Proportion of total hemoglobin
Methicillin	Serum	8-25	mg/L	2.636	22-66	μmol/L
Methionine	Plasma	0.1-0.6	mg/dL	67.02	6-40	μmol/L
Methotrexate	Serum, plasma	0.04-0.36	mg/L	2200	90-790	nmol/L
Methylidopa	Plasma	1-5	μg/mL	4.735	5.0-25	μmol/L
Metoprolol	Serum, plasma	75-200	ng/mL	3.74	281-748	nmol/L
β ₂ -Microglobulin	Serum	1.2-2.8	mg/L	1.0	1.2-2.8	mg/L
Morphine	Serum, plasma	10-80	ng/mL	3.504	35-280	nmol/L
Myoglobin	Serum	19-92	μg/L	0.0571	1.0-5.3	nmol/L
Naproxen	Serum	26-70	μg/mL	4.343	115-300	μmol/L
Niacin (nicotinic acid)	Urine	2.4-6.4	mg/24 h	7.30	17.5-46.7	μmol/d
Nickel	Whole blood	1.0-28.0	μg/L	17.033	17-476	nmol/L
Nicotine	Plasma	0.01-0.05	mg/L	6.164	0.062-0.308	μmol/L
Nitrogen (nonprotein)	Serum	20-35	mg/dL	0.714	14.3-25.0	mmol/L
Nitroprusside (as thiocyanate)		6-29	μg/mL	17.2	103-500	μmol/L
Norepinephrine	Plasma	110-410	pg/mL	5.911	650-2423	pmol/L
Nortriptyline	Serum, plasma	50-150	ng/mL	3.797	190-570	nmol/L
Ornithine	Plasma	0.4-1.4	mg/dL	75.666	30-106	μmol/L
Osmolality	Serum	275-295	mOsm/kg	1.0	275-295	mmol/kg
Osteocalcin	Serum	3.0-13.0	ng/mL	1.0	3.0-13.0	μg/L

Table 2. Selected Laboratory Tests, With Reference Ranges and Conversion Factors^a (cont)

Analyte	Specimen	Reference Range, Conventional Unit	Conventional Unit	Conversion Factor (Multiply by)	Reference Range, SI Unit	SI Unit
Oxalate	Serum	1.0-2.4	mg/mL	11.107	11-27	μmol/L
Oxazepam	Serum, plasma	0.2-1.4	μg/mL	3.487	0.7-4.9	μmol/L
Oxycodone	Serum	10-100	ng/mL	3.171	32-317	nmol/L
Oxygen, partial pressure (Po ₂)	Arterial blood	80-100	mm Hg	0.133	11-13	kPa
Paraquat	Whole blood	0.1-1.6	μg/mL	5.369	0.5-8.5	μmol/L
Parathyroid hormone	Serum	10-65	pg/mL	0.1053	10-65	ng/L
Pentobarbital	Serum, plasma	1-5	μg/mL	4.439	4.0-22	μmol/L
Pepsinogen	Serum	28-100	ng/mL	1.0	28-100	μg/L
pH (see Blood gases)						
Phencyclidine (toxic)	Serum, plasma	90-800	ng/mL	4.109	370-3288	nmol/L
Phenobarbital	Serum, plasma	15-40	μg/mL	4.31	65-172	μmol/L
Phenylalanine	Plasma	0.6-1.5	mg/dL	60.544	35-90	μmol/L
Phenylpropanolamine	Serum	0.05-0.10	μg/mL	6613	330-660	nmol/L
Phenytoin	Serum, plasma	10-20	mg/L	3.968	40-79	μmol/L
Phosphorus (inorganic)	Serum	2.3-4.7	mg/dL	0.323	0.74-1.52	mmol/L
Placental lactogen	Serum	0.5-1.1	μg/mL	46.296	23-509	nmol/L
Plasminogen (antigenic)	Plasma	10-20	mg/dL	0.113	1.1-2.2	μmol/L
Plasminogen activator inhibitor	Plasma	4-40	ng/mL	19.231	75-750	pmol/L
Platelet count (thrombocytes)	Whole blood	150-350	×10 ³ /μL	1.0	150-350	×10 ⁹ /L
Porphyrins (total)	Urine	20-120	μg/L	1.203	25-144	nmol/L
Potassium	Serum	3.5-5.0	mEq/L	1.0	3.5-5.0	mmol/L
Prealbumin	Serum	19.5-35.8	mg/dL	10	195-358	mg/L
Pregnanediol	Urine	< 2.6	mg/24 h	3.12	< 8	μmol/d

Pregnanetriol	Urine	< 2.5	mg/24 h	2.972	< 7.5	μmol/d
Primidone	Serum, plasma	5-12	μg/mL	4.582	23-55	μmol/L
Procainamide	Serum, plasma	4-10	μg/mL	4.25	17-42	μmol/L
Progesterone	Serum	0.15-25	ng/mL	3.18	0.5-79.5	nmol/L
Prolactin	Serum	3.8-23.2	μg/L	43.478	90-140	pmol/L
Proline	Plasma	1.2-3.9	mg/dL	86.858	104-340	μmol/L
Propoxyphene	Plasma	0.1-0.4	μg/mL	2.946	0.3-1.2	μmol/L
Propranolol	Serum	50-100	ng/mL	3.856	193-386	nmol/L
Prostate-specific antigen	Serum	< 4.0	ng/mL	1.0	< 4.0	μg/L
Protein (total)	Serum	6.0-8.0	g/dL	10.0	60-80	g/L
Prothrombin time (PT)	Plasma	10-13	s	1.0	10-13	s
Protoporphyrin	Red blood cells	15-50	μg/dL	0.0178	0.27-0.89	μmol/L
Protriptyline	Serum, plasma	70-250	μg/dL	3.787	266-950	nmol/L
Pyridoxine (see Vitamin B ₆)						
Pyruvate	Plasma	0.5-1.5	mg/dL	113.56	60-170	μmol/L
Quinidine	Serum	2.0-5.0	μg/mL	3.082	6.2-15.4	μmol/L
Red blood cell count	Whole blood	3.9-5.5	×10 ⁶ /μL	1.0	3.9-5.5	×10 ¹² /L
Renin	Plasma	30-40	pg/mL	0.0237	0.7-1.0	pmol/L
Reticulocyte count	Whole blood	25-75	×10 ³ /μL	1.0	25-75	×10 ⁹ /L
Reticulocyte count	Whole blood	0.5-1.5	% of red blood cells	0.01	0.005-0.015	Proportion of red blood cells
Retinol (see Vitamin A)						
Riboflavin (see Vitamin B ₂)						
Rifampin	Serum	4-40	mg/L	1.215	5-49	μmol/L
Salicylates	Serum, plasma	150-300	μg/mL	0.0724	1086-2172	μmol/L
Selenium	Serum, plasma	58-234	μg/L	0.0127	0.74-2.97	μmol/L

Table 2. Selected Laboratory Tests, With Reference Ranges and Conversion Factors^a (cont)

Analyte	Specimen	Reference Range, Conventional Unit	Conventional Unit	Conversion Factor (Multiply by)	Reference Range, SI Unit	SI Unit
Serine	Plasma	0.7-2.0	mg/dL	95.156	65-193	μmol/L
Serotonin (5-hydroxytryptamine)	Whole blood	50-200	ng/mL	0.00568	0.28-1.14	μmol/L
Sex hormone-binding globulin	Serum	1.5-2.0	μg/mL	8.896	13-17	nmol/L
Sodium	Serum	136-142	mEq/L	1.0	136-142	mmol/L
Somatomedin C (Insulinlike growth factor)	Serum	130-450	ng/mL	0.131	18-60	nmol/L
Somatostatin	Plasma	< 25	pg/mL	0.6110	< 15	pmol/L
Streptomycin	Serum	7-50	mg/L	1.719	12-86	μmol/L
Strychnine	Whole blood	< 0.5	mg/L	2.99	< 1.5	μmol/L
Substance P	Plasma	< 240	pg/mL	0.742	< 180	pmol/L
Sulfate	Serum	10-32	mg/L	31.188	310-990	μmol/L
Sulfmethemoglobin	Whole blood	< 1.0	% of total hemoglobin	0.01	< 0.010	Proportion of total hemoglobin
Taurine	Plasma	0.3-2.1	mg/dL	79.91	24-168	μmol/L
Testosterone	Serum	300-1200	ng/dL	0.0347	10.4-41.6	nmol/L
Tetrahydrocannabinol	Serum	< 0.20	μg/mL	3.180	< 0.60	μmol/L
Theophylline	Serum, plasma	10-20	μg/mL	5.55	56-111	μmol/L
Thiamine (see Vitamin B ₁)						
Thiopental	Serum, plasma	1-5	μg/mL	4.144	4.1-20.7	μmol/L
Thioridazine	Serum, plasma	1.0-1.5	μg/mL	2.699	2.7-4.1	μmol/L
Threonine	Plasma	0.9-2.5	mg/dL	84	75-210	μmol/L
Thrombin time	Plasma	16-24	s	1.0	16.24	s
Thrombocytes (see Platelet count)						

Thyroglobulin	Serum	3-42	ng/mL	1.0	3-42	µg/L
Thyroid-stimulating hormone (TSH)	Serum	0.4-4.2	mIU/L	1.0	0.4-4.2	mIU/L
Thyroxine, free (FT ₄)	Serum	0.9-2.3	ng/dL	12.871	12-30	pmol/L
Thyroxine, total (T ₄)	Serum	5.5-12.5	µg/dL	12.871	71-160	nmol/L
Thyroxine-binding globulin	Serum	16.0-24.0	µg/mL	17.094	206-309	nmol/L
Tissue plasminogen activator	Plasma	< 0.04	IU/mL	1000	< 40	IU/L
Tobramycin	Serum, plasma	5-10	µg/mL	2.139	10-21	µmol/L
Tocainide	Serum	4-10	µg/mL	5.201	21-52	µmol/L
α-Tocopherol (see Vitamin E)						
Tolbutamide	Serum	80-240	µg/mL	3.70	296-888	µmol/L
Transferrin	Serum	200-400	mg/dL	0.0123	2.5-5.0	µmol/L
Triglycerides	Serum	< 160	mg/dL	0.0113	1.8	mmol/L
Triiodothyronine, free (FT ₃)	Serum	1.4-4.4	pg/mL	0.0154	0.22-6.78	pmol/L
Triiodothyronine, total (T ₃)	Serum	60-180	ng/dL	0.0154	0.92-2.76	nmol/L
Troponin I	Serum	0-0.4	ng/mL	1.0	0-0.4	µg/L
Troponin T	Serum	0-0.1	ng/mL	1.0	0-0.1	µg/L
Tryptophan	Plasma	0.5-1.5	mg/dL	48.967	25-73	µmol/L
Tyrosine	Plasma	0.4-1.6	mg/dL	55.19	20-90	µmol/L
Urea nitrogen	Serum	8-23	mg/dL	0.357	2.9-8.2	mmol/L
Uric acid	Serum	4.0-8.0	mg/dL	59.485	240-480	µmol/L
Urobilinogen	Urine	1-3.5	mg/24 h	1.7	1.7-5.9	µmol/d
Valine	Plasma	1.7-3.7	mg/dL	85.361	145-315	µmol/L
Valproic acid	Serum, plasma	50-100	µg/mL	6.934	346-693	µmol/L
Vancomycin	Serum, plasma	20-40	µg/mL	0.690	14-28	µmol/L
Vanillylmandelic acid (VMA)	Urine	2.1-7.6	mg/24 h	5.046	11-38	µmol/d
Vasoactive intestinal polypeptide	Plasma	< 50	pg/mL	0.2960	< 15	pmol/L

Table 2. Selected Laboratory Tests, With Reference Ranges and Conversion Factors^a (cont)

Analyte	Specimen	Reference Range, Conventional Unit	Conventional Unit	Conversion Factor (Multiply by)	Reference Range, SI Unit	SI Unit
Vasopressin	Plasma	1.5-2.0	pg/mL	0.923	1.0-2.0	pmol/L
Verapamil	Serum, plasma	100-500	ng/mL	2.20	220-1100	nmol/L
Vitamin A (retinol)	Serum	30-80	μg/dL	0.0349	1.05-2.80	μmol/L
Vitamin B ₁ (thiamine)	Serum	0-2	μg/dL	29.6	0-75	nmol/L
Vitamin B ₂ (riboflavin)	Serum	4-24	μg/dL	26.6	106-638	nmol/L
Vitamin B ₃	Whole blood	0.2-1.8	μg/mL	4.56	0.9-8.2	μmol/L
Vitamin B ₆ (pyridoxine)	Plasma	5-30	ng/mL	4.046	20-121	nmol/L
Vitamin B ₁₂	Serum	160-950	pg/mL	0.7378	118-701	pmol/L
Vitamin C (ascorbic acid)	Serum	0.4-1.5	mg/dL	56.78	23-85	μmol/L
Vitamin D (1,25 dihydroxyvitamin D)	Serum	25-45	pg/mL	2.6	60-108	pmol/L
Vitamin D (25-hydroxyvitamin D)	Plasma	14-60	ng/mL	2.496	35-150	nmol/L
Vitamin E (α-tocopherol)	Serum	5-18	μg/mL	23.22	12-42	μmol/L
Vitamin K	Serum	0.13-1.19	ng/mL	2.22	0.29-2.64	nmol/L
Warfarin	Serum, plasma	1.0-10	μg/mL	3.247	3.2-32.4	μmol/L
White blood cell count	Whole blood	4500-11 000	/μL	0.001	4.5-11.0	×10 ⁹ /L
Differential count						
Neutrophils-segmented	Whole blood	1800-7800	/μL	0.001	1.8-7.8	×10 ⁹ /L
Neutrophils-bands	Whole blood	0-700	/μL	0.001	0-0.70	×10 ⁹ /L

Lymphocytes	Whole blood	1000-4800	/ μ L	0.001	1.0-4.8	$\times 10^9$ /L
Monocytes	Whole blood	0-800	/ μ L	0.001	0-0.80	$\times 10^9$ /L
Eosinophils	Whole blood	0-450	/ μ L	0.001	0-0.45	$\times 10^9$ /L
Basophils	Whole blood	0-200	/ μ L	0.001	0-0.20	$\times 10^9$ /L
Differential count (number fraction)						
Neutrophils-segmented	Whole blood	56	%	0.01	0.56	Proportion of 1.0
Neutrophils-bands	Whole blood	3	%	0.01	0.03	Proportion of 1.0
Lymphocytes	Whole blood	34	%	0.01	0.34	Proportion of 1.0
Monocytes	Whole blood	4	%	0.01	0.04	Proportion of 1.0
Eosinophils	Whole blood	2.7	%	0.01	0.027	Proportion of 1.0
Basophils	Whole blood	0.3	%	0.01	0.003	Proportion of 1.0
Zidovudine	Serum, plasma	0.15-0.27	μ g/mL	3.7	0.56-1.01	μ mol/L
Zinc	Serum	75-120	μ g/dL	0.153	11.5-18.5	μ mol/L

^aThe laboratory values and reference ranges are provided for illustration only and are not intended to be comprehensive or definitive. Each laboratory determines its own values, and reference ranges are highly method dependent. Reference values given are for adults. For some entries for which specific molecular masses are not known (eg, proteins), reference values in SI are given as mass amounts per liter.

The information in this table is adapted from and based on the following sources: (1) Kratz A, Ferraro M, Sluss PM, Lewandrowski KB. Laboratory reference values. *N Engl J Med*. 2004;351(15):1548-1563; (2) Young DS, Huth EJ. *SI Units for Clinical Measurement*. Philadelphia, PA: American College of Physicians; 1998; (3) Henry JB, ed. *Clinical Diagnosis and Management by Laboratory Methods*. 20th ed. Philadelphia, PA: WB Saunders; 2001; (4) Kasper DL, Braunwald E, Fauci AS, et al, eds. *Harrison's Principles of Internal Medicine*, 16th ed. New York, NY: McGraw Hill; 2004; and (5) Goldman L, Ausiello D. *Cecil Textbook of Medicine*. 22nd ed. Philadelphia, PA: WB Saunders; 2004.