MEDLAB BASICS · STUDY SHEET

Reference Ranges the Exam Uses

The ASCP BOC composite reference ranges for chemistry, blood gases, hematology, CSF, semen and urine in conventional and SI units, and the calculations the MLS and MLT exams expect

18 sources + more detail
medlabbasics.com/sheets/lab-reference-intervals.html
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1 What these ranges are

The ASCP Board of Certification publishes one set of composite reference ranges with the MLS and MLT content guidelines (revised June 9, 2026). They cover all genders and ethnic groups and come from published sources such as textbooks; the Hematology and Chemistry Examination Committees review them every year. Any laboratory value on the exam can be judged against them. The exam does not show them, so learn them; when a question needs any other range, the question gives it. Results on the exam appear in both conventional and SI units.

SAFETY ASCP states that these ranges are for examination purposes only and should not be used for clinical decisions. At the bench, use the reference intervals your own laboratory has established or verified.

EXAM TIP Because the ranges combine men and women, some are wide: hemoglobin 12.0-18.0 g/dL, hematocrit 35-50%, MCV 76-100 fL. Judge a value as high or low only when it falls outside these limits.

2 Chemistry

ASCP BOC composite ranges, MLS and MLT content guidelines, June 9, 2026. No other chemistry analyte has a published exam range; a question that needs one will state it.

ANALYTE	CONVENTIONAL	SI
Sodium	136-145 mmol/L	136-145 mmol/L
Potassium	3.5-5.1 mmol/L	3.5-5.1 mmol/L
Chloride	98-107 mmol/L	98-107 mmol/L
Total CO2	22-33 mmol/L	22-33 mmol/L
Creatinine	0.8-1.2 mg/dL	71-106 µmol/L
Blood urea nitrogen (BUN)	6-20 mg/dL	2.1-7.1 mmol/L
Glucose, fasting	74-100 mg/dL	4.1-5.6 mmol/L
Hemoglobin A1c	< 5.7%	< 39 mmol/mol
Haptoglobin	30-200 mg/dL	0.3-2.0 g/L

3 Arterial blood gases

ASCP BOC composite ranges, June 9, 2026. Note the two carbon dioxide values: total CO2 (chemistry, 22-33) and calculated bicarbonate (blood gas, 23-29).

MEASURE	CONVENTIONAL	SI
pH	7.35-7.45	7.35-7.45
pCO2	35-44 mm Hg	4.7-5.9 kPa
pO2	> 80 mm Hg	> 10.6 kPa
O2 saturation	> 95%	> 95%
Bicarbonate (HCO3-)	23-29 mmol/L	23-29 mmol/L

4 Hematology

ASCP BOC composite ranges, June 9, 2026.

MEASURE	CONVENTIONAL	SI
RBC	4.00-6.00 × 10^6/µL	4.00-6.00 × 10^{12}/L
Hemoglobin	12.0-18.0 g/dL	120-180 g/L
Hematocrit	35-50%	0.35-0.50 L/L
MCV	76-100 fL	76-100 fL
MCH	26-34 pg	26-34 pg
MCHC	32-36 g/dL	320-360 g/L
RDW	11.5-14.5%	0.115-0.145
Reticulocytes, absolute	20-115 × 10^3/µL	20-115 × 10^9/L
Reticulocytes, relative	0.5-2.5%	0.005-0.025
nRBCs	0 per 100 WBCs	0 per 100 WBCs
Platelets	150-450 × 10^3/µL	150-450 × 10^9/L
WBC, total	3.6-10.6 × 10^3/µL	3.6-10.6 × 10^9/L

Relative values in SI are fractions of 1. Absolute values are numerically the same in both systems.

WBC DIFFERENTIAL	RELATIVE	ABSOLUTE (× 10^3/ML = × 10^9/L)
Neutrophils	50-70% (0.50-0.70)	1.7-7.5
Lymphocytes	18-42% (0.18-0.42)	1.0-3.2
Monocytes	2-11% (0.02-0.11)	0.1-1.3
Eosinophils	1-3% (0.01-0.03)	0-0.3
Basophils	0-2% (0.00-0.02)	0-0.2

EXAM TIP Judge the differential by absolute counts. A lymphocyte share of 60% in a WBC of 3.6 × 10^3/µL is 2.2 × 10^3/µL, inside 1.0-3.2: relative lymphocytosis only. The ANC calculator does this step.

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5 Body fluids

CEREBROSPINAL FLUID	CONVENTIONAL	SI
WBC and RBC	0-5/µL	0-5 × 10^6/L
Glucose	50-80 mg/dL	2.8-4.4 mmol/L
Protein	15-45 mg/dL	150-450 mg/L

The MLT guideline lists only volume and sperm concentration; the MLS guideline lists all seven.

SEMINAL FLUID	CONVENTIONAL	SI
Volume	2-5 mL	2-5 mL
Sperm concentration	> 20 × 10^6/mL	> 20 × 10^9/L
Liquefaction (MLS list)	30-60 minutes	30-60 minutes
pH (MLS list)	7.2-8.0	7.2-8.0
Motility (MLS list)	> 50% within 1 hour	> 50% within 1 hour
Morphology (MLS list)	> 30% normal forms	> 30% normal forms
WBC (MLS list)	< 1 × 10^6/mL	< 1 × 10^9/L

ASCP BOC composite ranges, June 9, 2026. Any cast other than a few hyaline casts is outside the range.

URINE	CONVENTIONAL	SI
Specific gravity	1.003-1.035	1.003-1.035
pH	4.5-8.0	4.5-8.0
Protein	< 10 mg/dL, trace or negative	< 0.1 g/L, trace or negative
Glucose	≤ 15 mg/dL or negative	≤ 0.8 mmol/L or negative
Ketones	< 5 mg/dL or negative	< 0.5 mmol/L or negative
Urobilinogen	< 1.0 EU	< 17.0 µmol/L
Bilirubin, blood, nitrite, leukocyte esterase	Negative	Negative
RBC (microscopic)	0-3/HPF	0-3/HPF
WBC (microscopic)	0-8/HPF	0-8/HPF
Casts (microscopic)	0-2 hyaline/LPF	0-2 hyaline/LPF
Epithelial cells (microscopic)	0-5/HPF	0-5/HPF

6 Calculations the exam expects

The list is the guideline's; the formulas are the standard forms, worked through step by step on the Laboratory Math page.

CALCULATION	FORMULA	IN THE APP
Transferrin saturation, UIBC, TIBC	TIBC = serum iron + UIBC. Saturation (%) = serum iron ÷ TIBC × 100	By hand
Unconjugated (indirect) bilirubin	Indirect = total bilirubin − direct bilirubin	By hand
LDL (Friedewald) and non-HDL	LDL = TC − HDL − TG ÷ 5 (mg/dL; TG ÷ 2.2 in mmol/L). Not valid with TG above 400 mg/dL. Non-HDL = TC − HDL	LDL Friedewald calculator
A/G ratio	Globulin = total protein − albumin. A/G = albumin ÷ globulin	By hand
Timed urine	Amount per collection = concentration × total volume (match units: mg/dL × dL, or mg/L × L)	By hand
Creatinine clearance	CrCl (mL/min) = U × V ÷ P; V in mL/min (24 h = 1,440 min). Normalized = CrCl × 1.73 ÷ BSA (m^2)	Measured Creatinine Clearance calculator
Beer's law	A = a × b × c, so concentration is proportional to absorbance. C unknown = (A unknown ÷ A standard) × C standard. A = 2 − log %T	Beer's Law calculator
WBC corrected for nRBCs (exam: more than 10 per 100 WBCs)	Corrected WBC = uncorrected WBC × 100 ÷ (100 + nRBCs per 100 WBCs)	WBC Corrected for nRBCs calculator
Manual hemocytometer count	Cells/µL = cells counted × dilution factor ÷ (area counted in mm^2 × 0.1 mm depth)	Manual Cell Count calculator
Red cell indices	MCV (fL) = Hct (%) × 10 ÷ RBC (10^6/µL). MCH (pg) = Hgb (g/dL) × 10 ÷ RBC. MCHC (g/dL) = Hgb × 100 ÷ Hct (%)	Red Cell Indices calculator
Absolute counts from relative values	Absolute = relative (as a fraction) × total count. Example: retic 1.5% × RBC 4.50 × 10^6/µL = 67.5 × 10^3/µL	ANC and Reticulocyte Count calculators

EXAM TIP Check red cell results with the rule of three before you calculate: Hgb ≈ RBC × 3 (± 0.3) and Hct ≈ Hgb × 3 (± 3) when cells are normocytic and normochromic. A large miss points to a spurious result (see the CBC, Analyzers and Spurious Results page).

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