



AMT
American Medical Technologists
Certifying Excellence in Allied Health

American Medical Technologists Medical Laboratory Scientist (MLS) Certification Competencies and Examination Specifications

Summary Table

	Work Area	Number of Questions	Percentage of Exam
I.	General Laboratory	44	21.0%
II.	Chemistry	38	18.1%
III.	Hematology	32	15.2%
IV.	Coagulation and Hemostasis	10	4.7%
V.	Immunology and Serology	7	3.3%
VI.	Immunohematology	22	10.5%
VII.	Blood Banking and Transfusion Services	16	7.6%
VIII.	Microbiology	26	12.4%
IX.	Urinalysis and Body Fluids	15	7.1%
Total		210	100%

Question Weightings, Work Areas, Task Areas, and Competencies

Number of items

[44] I. General Laboratory (21.0% of exam)

Laboratory quality

- Perform testing to maintain the quality of laboratory results

Laboratory laws and regulations

- Know laws and regulations governing the laboratory (OSHA, CLIA, HIPAA)

Laboratory safety

- Employ laboratory safety
- Employ chemical hazard safety and Safety Data Sheets (SDS)
- Employ proper infection control
- Follow accredited standards

Laboratory instrumentation, maintenance, and principles of operation

- Employ manual laboratory instrumentation
- Employ automated laboratory instrumentation

Laboratory mathematics

- Apply laboratory mathematics; understand and calculate essential indices such as mean, standard deviation, and coefficient of variation

General microscopy

- Perform microscopy, including types of microscopes and parts of binocular microscope

Biological specimen collection and processing

- Evaluate and problem solve collection and processing of biological specimens, including consideration of physiological processes and requirements

Phlebotomy and specimen collection, handling, and integrity

- Evaluate the suitability of specimens for testing
- Accept specimens for testing
- Appropriately maintain the integrity of samples
- Collect, handle, and process all specimens for analysis (including infant collection)
- Understand the differences between serum, plasma, and whole blood
- Employ safety precautions when collecting blood samples
- Employ procedures to prevent hemolysis
- Collect blood in collecting tubes for analysis (clotted blood and anticoagulated blood)
- Employ proper order of draw when collecting blood in multiple types of vacuum tubes
- Employ proper anticoagulants for each analysis and know effects of improper anticoagulant use
- Know procedure for blood culture collection
- Know the proper labeling of blood tubes including sentinel event with bloodbank armbands
- Perform glucose tolerance test
- Know length of time in which samples clot
- Handle and preserve body fluids for chemical analysis
- Preserve urine specimens
- Process irretrievable specimens (CSF, tissue, etc.)
- Determine the suitability of specimens for analysis
- Determine preanalytical, analytical, and/or postanalytical causes of erroneous results

Patient identification

- Assure continual accuracy of patient identification (including STAT, call reports for inpatient and outpatient, etc.)

Waived testing

- Perform waived testing in the clinical laboratory

[38] II. Chemistry (18.1% of exam)

Instrumentation

- Demonstrate knowledge of the components of a spectrophotometer
- Demonstrate the ability to operate and describe the principles of operation of osmometer, nephelometer, random access analyzers, blood gas analyzers, discrete analysis
- Demonstrate the ability to perform and describe the principles of immunoassay
- Describe the principles of electrophoresis
- Describe the importance of preventative maintenance; chemistry analyzer maintenance

Renal function tests

- Describe knowledge of the anatomy and physiology of the kidneys
- Understand kidney function tests, reference limits, and correlate results to pathological conditions

Hepatic function tests

- Describe knowledge of the anatomy and physiology of the liver
- Understand liver function tests, reference limits, and correlate results to pathological conditions

Carbohydrate metabolism

- Define terminology related to carbohydrates and describe carbohydrate metabolism
- carbohydrate ketones lipogenesis
monosaccharide insulin renal
threshold disaccharide glycolysis diabetes
mellitus polysaccharide glycogenesis A₁C
hemoglobin glycogen glycogenolysis
- Define, perform, and interpret carbohydrate metabolism tests and understand different types of diabetes

Protein analysis

- Describe the proteins of the body, their structure and function; synthesis, distribution, catabolism, and excretion of proteins; protein classification
- Describe the methodology for measuring plasma proteins, perform protein analyses, and correlate results with disease states

Enzymology

- Demonstrate understanding of enzymology concepts:
 - Clinically-significant enzymes (CP, ALT, GGT, ALP, AST, CK, LD, amylase, lipase)
 - Isoenzymes (CK, ALP, LD)
 - Cardiac enzymes and related cardiac markers (troponin and myoglobin)
 - Pancreatic enzymes
 - Enzymes associated with the liver

- Understand methodology for measuring enzyme activity, perform analyses, and correlate results with disease states
- Demonstrate knowledge of, and perform tests to assess cardiopulmonary function (troponin, T and I, myoglobin, natriuretic peptide (BNP), and ultra-sensitive C-reactive protein (CRP))

Endocrinology

- Understand the anatomy and physiology of the endocrine system
- Understand methodology for measuring endocrine activity, perform analyses, and correlate test levels with disease states

Lipids

- Demonstrate knowledge of lipids and lipid metabolism
- Describe the desirable levels of lipids, and correlate hyperlipidemia to the risk factor assessment with coronary artery disease
- Perform lipid analyses

Water and electrolytes

- Demonstrate knowledge of electrolytes in body fluids (characteristics, fluid compartments and movements, electrolyte balance, reference limits for electrolyte profiles, expression of concentration of electrolytes)
- Understand common causes of electrolyte imbalances and the correlations to disease states
- Describe methods used in electrolyte measurements, including expression concentrations

Acid-base balance

- Demonstrate knowledge of acid-base regulatory and compensatory mechanisms of the body and causes of acid/base imbalances
- Describe and perform analyses for evaluating acid-base levels

Cerebrospinal fluid (CSF)

- Describe the formation, function, and physical characteristics of spinal fluid, the proper handling and laboratory tests of CSF
- Recognize the appearance of abnormal spinal fluid and abnormal chemistry analyses in disease states

Other chemistry procedures

- Demonstrate understanding of tumor markers: B-HCG, CA 27-29, PSA, CEA, CA 125, CA 19, HER2
- Perform therapeutic drug monitoring and drugs of abuse testing; understand peak and trough, screening and confirmatory, methodologies used
- Understand the principles of fetal wellness tests (fibronectin, AFP, L/L ratio, $\Delta 450$)

[32] III. Hematology (15.2% of exam)

General knowledge

- Demonstrate an understanding of hematologic physiology
- Evaluate basic hematologic testing and correlate with normal and abnormal physiology

Erythrocyte procedures

- Perform automated and manual methods/calculations for RBC, WBC, and platelet counts

Cytogenic and molecular assays

- Perform blood and bone marrow examinations for cytogenic and molecular assays
- Perform body fluid analyses (synovial fluids, cerebrospinal fluid, seminal fluid)
- Perform testing to evaluate hemoglobinopathy

Automated instrumentation

- Operate automated instrumentation (calibration, validation, QC, maintenance, troubleshooting) and evaluate results

[10] IV. Coagulation and Hemostasis (4.7% of exam)

- Understand the physiologic principles of hemostatic testing
- Perform coagulation testing and correlate hemostatic with normal and abnormal hemostatic physiology
- Perform prothrombin time, partial thromboplastin time (PTT or APTT), fibrinogen, and D-dimer tests
- Perform fibrin degradation and fibrin split product tests (FDP or FSP)
- Perform heparin assay
- Perform mixing studies; factor testing
- Perform platelet function testing

[7] V. Immunology and Serology (3.3% of exam)

General knowledge

- Know principles of immunologic examination (antibody production, antigen-antibody reaction)

Serological tests

- Perform qualitative and quantitative tests for immunologic antigen-antibody reaction and antibody production

Analytic procedures

- Perform heterophile agglutination (mono) tests, rheumatoid arthritis tests, and pregnancy tests

Special procedures

- Perform cytomegalovirus, retrovirus, Epstein-Barr, Rubella, and anti-human immunodeficiency virus (HIV) tests

[22] VI. Immunohematology (10.5% of exam)

Blood typing

- Demonstrate knowledge of the principles of antigen-antibody reactions, histories of the ABO and Rh systems, chemical structures of the H, A, and B antigens, antigens and antibodies of the ABO system, and frequencies of antigen phenotypes (screening for antigens)
- Perform ABO forward typing and reverse typing
- Perform Rh_o(D) typing and Du (weak D) testing
- Perform genotyping (ABO and Rh systems, genetics of blood group antigen)

Immune response

- Perform antibody identification tests; know soluble components of immune response (immunoglobulins, complement, and cytokines)
- Demonstrate knowledge of the following related to antibodies: five major classes of immunoglobulins, ABO antibodies, Rh antibodies, antibodies to other common blood group systems (MNS, Duffy, Kidd, Lewis, HLA), cold-reacting antibodies, warm-reacting antibodies, naturally-occurring antibodies
- Perform direct antiglobulin tests
- Perform indirect antiglobulin tests
- Demonstrate knowledge of tests for IgG and IgM immunoglobulins

Compatibility testing principles and procedures

- Perform compatibility tests (crossmatch); know crossmatch principles and procedures (saline tube, Gel, enzyme, pre-warmed)
- Interpret compatibility testing (crossmatch) results: use of auto control, grading of reactions, interferences (cold agglutinins, Rouleaux)

Rh immune globulin

- Perform Rh immune globulin evaluation; know principles of Rh immune globulin (indications, patient criteria, dosage)
- Perform qualitative fetal screen and fetal stain (Kleihauer-Betke)

Special tests

- Address cold agglutinins and ABO discrepancies
- Perform tests to elute antibodies from red blood cells

[16] VII. Blood Banking-Transfusion Services (7.6%)

- Know blood and blood storage requirements

- Know all other requirements and procedures for bloodbank operations
- Conduct transfusion reaction investigation
- Understand therapeutic phlebotomy and performance
- Know and understand special requirements of blood products (e.g., cmv-negative, baby units)
- Know and evaluate blood donor collection requirements and deferrals

[26] VIII. Microbiology (12.4%)

Bacteriology

General knowledge

- Understand bacterial cell morphology and metabolism, including staining procedures (Gram stain)
- Understand the principles behind different culture media and their functions related to identifying bacterial biochemical reactions and aerobic/anaerobic characteristics

Media quality control, techniques, and cultures

- Perform quality control on media based on standards of the Clinical and Laboratory Standards Institute (CLSI)

Bacterial identification

- Evaluate the acceptability of specimens by knowing the criteria outlining collection, transport, processing, and storage
- Understand and identify mechanisms in anti-microbial resistance and sensitivity and perform culture and sensitivity testing methods
- Know and perform quality control and maintenance of equipment and instrumentation for microbiologic diagnostic procedures
- Demonstrate knowledge of commonly-used immunology-based testing
- Understand commonly-used molecular assays, such as PCR (be familiar with the basic principle of PCR)

Virology

- Understand testing methods commonly used for viral identification (for example; PCR, film array, latex agglutination, ELISA, NAAT)

Parasitology

- Prepare clinical specimens for parasitology studies

Mycology

- Prepare clinical specimens for mycological studies, such as KOH prep and basic fungal stains

[15] IX. Urinalysis and Body Fluids (7.1%)

Renal function

- Understand renal function; formation of urine, renal anatomy, and normal and abnormal physiology of the urinary system
- Describe physical and chemical properties of urine

- Identify microscopic structures formed in urine

Urinalysis procedures

- Perform physical examination of urine (color, clarity, specific gravity)
- Perform chemical examination of urine:
 - Chemical tests (pH, glucose, nitrate, urobilinogen, specific gravity, protein, ketones, bilirubin, blood, leukocyte esterase)
 - Confirmatory tests (Ictotest[®], sulfosalicylic acid (SSA) test, Acetest[®], Clinitest[®])
- Perform microscopic examination of urine (cells, casts, crystals, artifacts/contaminants, microorganisms)
- Correlate complete urinalysis results to normal and disease states

Special tests

- Perform diagnostic testing on urine, feces, and gastric contents (Bence Jones protein, Watson-Schwartz differentiation test, Hoesch screening test, osmolality, myoglobin, urine pregnancy test (HCT), stool and gastric occult blood tests)

Task inventory note: The entries constituting this inventory are considered to be representative of the laboratory practitioner's role. This document should be considered dynamic, to reflect the practitioner's current role with respect to contemporary health care. Therefore, entries may be added, removed, or modified on an ongoing basis, without notice.