

# CALIFORNIA MEDICAL LABORATORY TECHNICIAN, CMLT EXAMINATION CONTENT GUIDELINE & OUTLINE

## EXAMINATION MODEL

The Board of Certification California Medical Laboratory Technician examination is composed of 80 examination questions given in a 2 hour time frame. All examination questions are multiple-choice with one best answer. The examination is administered using the format of computer adaptive testing (CAT).

With CAT, when a person answers a question correctly, the next test question has a slightly higher level of difficulty. The difficulty level of the questions presented to the examinee continues to increase until a question is answered incorrectly. Then a slightly easier question is presented. In this way, the test is tailored to the individual's ability level.

Each question in the test bank is calibrated for level of difficulty and is assigned a content area that matches with the subtest area of the content outline for a particular examination. The weight (value) given to each question is determined by the level of difficulty. Therefore, the examinee must answer enough difficult questions to achieve a score above the pass point in order to successfully pass the examination.

## EXAMINATION SUBTESTS

The CMLT examination questions encompass different subtests within the area of Medical Laboratory Science: Urinalysis and Other Body Fluids, Chemistry, Hematology, Immunology, Microbiology and Laboratory Operations. Each of these subtests comprises a specific percentage of the overall 80-question examination. The subtests for the examination are described in the following table:

SUBTESTS	DESCRIPTION	EXAM PERCENTAGES
<b>Urinalysis and Other Body Fluids (UA)</b>	Physical and Chemical Urinalysis and Body Fluid Analysis (CSF, Amniotic, Synovial, Serous, Semen & Feces)	<b>5%</b>
<b>Chemistry (CHEM)</b>	Carbohydrates, Acid Base, Electrolytes, Proteins & Other Nitrogen-Containing Compounds, Enzymes, Lipids & Lipoproteins, Endocrinology, Tumor Markers, TDM, Toxicology	<b>40%</b>
<b>Hematology (HEMA)</b>	Erythrocytes & Leukocytes, Reticulocyte Count, ESR, RBC/WBC Morphology & Differentials, Platelets, Hemostasis	<b>20%</b>
<b>Immunology (IMMU)</b>	Autoimmunity, Immune Responses, Physiology of the Immune System, Immunology of Viral & Microbial Infectious Diseases	<b>10%</b>
<b>Microbiology (MICR)</b>	General Microbiology, Aerobic Gram-positive Cocci, Gram-negative Bacilli, Gram-negative Cocci, Gram-positive Bacilli, Anaerobes, Fungus, Viruses, Mycobacteria, Parasites	<b>12%</b>
<b>Laboratory Operations (LO)</b>	Quality Assessment/Troubleshooting, Safety, Laboratory Mathematics, Instrumentation, Laboratory Information Systems	<b>13%</b>

For a more specific overview of the subtest areas on the CMLT examination, please refer to the **CONTENT OUTLINE** on pages 2 – 3.

# CONTENT OUTLINE

## CALIFORNIA MEDICAL LABORATORY TECHNICIAN

**IMPORTANT:** Examination questions, which are related to the subtest areas outlined below, may be both theoretical and procedural. Theoretical questions measure skills necessary to apply knowledge, calculate results, and correlate patient results to disease states. Procedural questions measure skills necessary to perform laboratory techniques, evaluate laboratory data, and follow quality assurance protocols.

### I. URINALYSIS & OTHER BODY FLUIDS (5% of total exam)

#### 1. Urinalysis

- A. Physical
  - 1) Color and clarity
  - 2) Specific gravity/osmolality
- B. Chemical
  - 1) Reagent strip
  - 2) Confirmatory tests
- C. Physiology

#### 2. Other Body Fluids

- A. CSF
- B. Amniotic, Synovial, Serous, Semen, and Feces

### II. CHEMISTRY (40% of total exam)

#### 1. Carbohydrates, Acid Base, and Electrolytes

- A. Carbohydrates
  - 1) Glucose
  - 2) Glycated hemoglobin
  - 3) Other carbohydrates (e.g. lactate)
- B. Acid Base
  - 1) pH, pCO<sub>2</sub>, pO<sub>2</sub>
  - 2) Osmolality, base excess
- C. Electrolytes
  - 1) Sodium, potassium, chloride, bicarbonate, anion gap
  - 2) Calcium, magnesium, phosphorus

#### 2. Proteins and Other Nitrogen-Containing Compounds

- A. Protein and Other Nitrogen-Containing Compounds
  - 1) Total protein, albumin
  - 2) Globulins (alpha 1, alpha 2, beta, gamma)
  - 3) Ferritin, transferrin
  - 4) Iron and TIBC
  - 5) Ammonia
  - 6) Creatinine, BUN
  - 7) Uric acid
  - 8) Troponin
  - 9) Other (e.g., BNP)
- B. Heme Derivatives
  - 1) Hemoglobin (S, fetal, A<sub>2</sub>, plasma)
  - 2) Bilirubin, urobilinogen
  - 3) Other (e.g., myoglobin)

### 3. Enzymes, Lipids and Lipoproteins

- A. Enzymes
  - 1) Amylase, lipase
  - 2) AST, ALT
  - 3) CK, LD
  - 4) ALP
  - 5) GGT
- B. Lipids and Lipoproteins
  - 1) Cholesterol (total, HDL, LDL)
  - 2) Triglycerides
  - 3) Phospholipids
  - 4) Other lipids and lipoproteins

### 4. Special Chemistry (Endocrinology, Tumor Markers, TDM, Toxicology)

- A. Endocrinology and Tumor Markers
  - 1) T<sub>3</sub>, T<sub>4</sub>, TBG, TSH
  - 2) hCG, FSH, LH, estradiol
  - 3) Other hormones (e.g., cortisol)
  - 4) Tumor markers (e.g., alpha fetoprotein, CEA, hCG, PSA)
- B. TDM and Toxicology
  - 1) Therapeutic drug monitoring
  - 2) Drugs of abuse
  - 3) Other toxicology (e.g., carbon monoxide)

### III. HEMATOLOGY (20% of total exam)

#### 1. Erythrocytes and Leukocytes

- A. Red Blood Cells and Indices
  - 1) RBC count
  - 2) Hemoglobin, hematocrit and indices
- B. White Blood Cell Count
- C. CBC

#### 2. Other Tests

- A. Reticulocyte Count
- B. ESR
- C. Tests for Hemoglobin Defects (e.g., sickle cell tests)
- D. Other (e.g. G-6PD)

#### 3. Platelets and Hemostasis

- A. Platelets
  - 1) Platelet count
  - 2) Platelet function
- B. Hemostasis
  - 1) PT, aPTT, TT
  - 2) Fibrinogen, FDP, D-dimer
  - 3) Factor assays
  - 4) Inhibitor anticoagulants
  - 5) Mixing studies
  - 6) Anticoagulant therapy

#### IV. IMMUNOLOGY (10% of total exam)

##### 1. Immunity

- A. Autoimmunity
  - 1) ANA, anti-DNA
  - 2) CRP/RF
  - 3) Thyroid antibodies
- B. Immune Responses
- C. Physiology of the Immune System

##### 2. Infectious Diseases

- A. Viral
  - 1) EBV/infectious mononucleosis
  - 2) Hepatitis
  - 3) HIV/HTLV/CMV
  - 4) Rubella/measles
  - 5) Other viruses
- B. Microbial
  - 1) Syphilis
  - 2) Other microorganisms

#### V. MICROBIOLOGY (12% of total exam)

**Includes biochemical, immunologic, serologic, and molecular methodologies required for identification and detection of microorganisms and antimicrobial susceptibility testing**

##### 1. Aerobic Gram-positive Cocci

- A. Microbiology and Antimicrobial Susceptibility Testing
- B. Aerobic Gram-positive Cocci: *Staphylococcus*, *Micrococcus*, *Streptococcus*, *Enterococcus*

##### 2. Gram-negative Bacilli

- A. Enterobacteriaceae: *Citrobacter*, *Escherichia*, *Enterobacter*, *Klebsiella*, *Morganella*, *Proteus*, *Providencia*, *Salmonella*, *Serratia*, *Shigella*, *Yersinia*
- B. Other Gram-negative Bacilli: *Acinetobacter*, *Aeromonas*, *Bordetella*, *Brucella*, *Campylobacter*, *Francisella*, *Haemophilus*, *Legionella*, *Pasteurella*, *Pseudomonas*, *Burkholderia*, *HACEK*, *Stenotrophomonas*, *Vibrio*

##### 3. Gram-negative Cocci, Gram-positive Bacilli and Anaerobes

- A. Aerobic Gram-negative Cocci (e.g., *Neisseria*, *Moraxella*)
- B. Aerobic or Facultative Gram-positive Bacilli: *Bacillus*, *Corynebacterium*, *Gardnerella*, *Lactobacillus*, *Listeria*
- C. Anaerobes
  - 1) Gram-positive: *Clostridium*, *Peptostreptococcus*, *Propionibacterium*
  - 2) Gram-negative: *Bacteroides*, *Fusobacterium*

#### 4. Fungus, Viruses, Mycobacteria and Parasites

##### A. Fungi

- 1) Yeast (e.g., *Candida*, *Cryptococcus*)
- 2) Dimorphic fungi (e.g., *Blastomyces*, *Coccidioides*, *Histoplasma*, *Sporothrix*)
- 3) Dermatophytes
- 4) Zygomycetes (e.g., *Rhizopus*)
- 5) Opportunistic molds/septate hyaline molds (e.g., *Aspergillus*, *Penicillium*)

##### B. Mycobacteria

- 1) *Mycobacterium tuberculosis* complex (e.g., *M. tuberculosis*)
- 2) Other Mycobacteria (e.g., *M. avium-intracellulare*, rapid growers)

##### C. Viruses and Other Microorganisms

- 1) Viruses (e.g., specimen collection/transport/processing, rapid antigen detection)
- 2) Other microorganisms (e.g., *Chlamydia*)

##### D. Parasites (specimen processing and handling only)

- 1) Blood and tissue protozoa (e.g., *Plasmodium*, *Trypanosoma*)
- 2) Intestinal and urogenital protozoa (e.g., *Cryptosporidium*, *Entamoeba*, *Giardia*, and *Trichomonas*)
- 3) Intestinal and tissue helminths (e.g., *Ascaris*, *Enterobius*, hookworm, *Schistosoma*, *Taenia*, *Trichinella*, *Trichuris*)

#### VI. LABORATORY OPERATIONS

##### (13% of total exam)

##### 1. Quality Assessment/Troubleshooting

- A. Pre-Analytical, Analytical, Post-Analytical
- B. Quality Control
- C. Compliance
- D. Regulation

##### 2. Safety

##### 3. Instrumentation

##### 4. Laboratory Mathematics

##### 5. Laboratory Information Systems

*All Board of Certification examinations use conventional and SI units for results and reference ranges.*

**END OF CONTENT GUIDELINE**