

TECHNOLOGIST IN MOLECULAR BIOLOGY, MB(ASCP) INTERNATIONAL TECHNOLOGIST IN MOLECULAR BIOLOGY, MB(ASCPⁱ) EXAMINATION CONTENT GUIDELINE & OUTLINE

EXAMINATION CONTENT GUIDELINE

EXAMINATION MODEL

The MB(ASCP) and MB(ASCPⁱ) certification examination is composed of 100 examination questions given in a 2 hour 30 minute time frame. All examination questions are multiple-choice with one best answer. The certification 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 certification examination.

EXAMINATION SUBTESTS

The MB(ASCP) and MB(ASCPⁱ) certification examination questions encompass four different subtests within the area of Molecular Biology: Molecular Science, Molecular Techniques, Laboratory Operations, and Applications of Molecular Testing. Each of these subtests comprises a specific percentage of the overall 100-question certification examination. The subtests for the examination are described in the following table:

SUBTESTS	DESCRIPTION	EXAM PERCENTAGES
Molecular Science (MS)	Basic structure and function as related to principles and theory of Molecular Biology	25-30%
Molecular Techniques (MT)	Basic principles and select, prepare, perform, optimize, troubleshoot, and evaluate results of Molecular Techniques	20-30%
Laboratory Operations (LO)	Contamination, Quality Assurance, Guidelines/Regulations, Personnel, Safety	15-25%
Applications of Molecular Testing (AMT)	Disease-specific applications of Molecular Techniques	25-30%

For a more specific overview of the four subtest areas on the MB(ASCP) and MB(ASCPⁱ) certification examination, please refer to the **CONTENT OUTLINE** on pages 2 – 3.

EXAMINATION CONTENT OUTLINE

TECHNOLOGIST IN MOLECULAR BIOLOGY

INTERNATIONAL TECHNOLOGIST IN MOLECULAR BIOLOGY

Examination questions, which are related to the subtest areas outlined below, will 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. MOLECULAR SCIENCE (25-30%)

A. Nucleic Acid Chemistry

1. Sugars
2. Bases
3. Chemical structure
4. Associated proteins
5. Mutations

B. Basic Molecular Theory

1. Replication
2. Transcription
3. Exons, introns, and splicing
4. Translation
5. Chromosome structure
6. Extrachromosomal structure (e.g., phage, plasmid, mitochondrial)
7. Protein structure

C. Biochemical Reagents

1. Polymerase enzymes
 - a. DNA
 - b. RNA
2. Endo and exonuclease enzymes
3. Reverse transcriptase
4. DNA ligase
5. Assay development and design

D. Genetics

1. Human
2. Microbial

II. MOLECULAR TECHNIQUES (20-30%)

A. Separation and Detection

1. Electrophoresis
 - a. Gel (including agarose acrylamide and pulsed field)
 - b. Capillary
2. Blotting and probing procedures (including washing and stringency)
3. Probe hybridization
4. Nucleic acid purification
5. Probe structure (e.g., TaqMan, FRET, simple, beacon, scorpion)

B. Nucleic Acid Amplification

1. Polymerase chain reaction (PCR)
2. PCR variations (e.g., real-time, nested, multiplex, arrays, reverse transcriptase)
3. Branched DNA (bDNA) technology
4. Sequence based (NASBA)
5. Transcription-mediated technology (TMA)
6. Strand displacement amplification (SDA)
7. Loop-mediated isothermal amplification (LAMP)
8. Other (e.g., hybrid capture, ligase chain reaction, cleavase)

C. DNA Sequence Analysis

1. Sanger Sequencing (e.g., chain terminators)
2. Next generation sequencing
3. Automated sequence analyzer
4. Other (e.g., pyrosequencing)

D. Other Techniques

1. Denaturing HPLC
2. Melt curves analysis
3. Nucleic acid labeling
4. *in-situ* hybridization (ISH)
5. Restriction fragment length polymorphism (RFLP)
6. Epigenetic modification
7. Array technology (e.g., bead, microarray)
8. Multiplex ligation-dependent probe amplification (MLPA)
9. Mass spectrophotometry
10. Multi-locus sequence typing (MLST)

III. LABORATORY OPERATIONS (15-25%)

A. Contamination (e.g., biological, amplified and non-amplified nucleic acid)

1. Prevention
2. Monitoring and detection
3. Elimination

B. Quality Assurance

1. Specimen collection, preparation, transport and storage
 - a. Evaluate quality and quantity of specimen
 - b. Evaluate quality and quantity of nucleic acid
2. Reagent selection, preparation (including calculations), storage, and disposal
3. Assay selection and validation
4. Result calculation, interpretation and reporting
5. Quality control and proficiency testing
 - a. Assay controls
 - b. Proficiency testing
6. Equipment and Instrumentation – principles, calibration, maintenance, troubleshooting and validation

C. Guidelines and Regulations

1. Test System Categories: Analyte specific reagent (ASR), research use only (RUO), *in-vitro* diagnostics (IVD) and lab developed tests (LDT)
2. Regulations and Standards: CLIA, The Joint Commission, CAP, CMS, CLSI, FDA

D. Personnel

1. Continuing education
2. Competency

E. Safety

IV. APPLICATIONS OF MOLECULAR TESTING (25-30%)

A. Infectious Disease

1. Qualitative Analysis (e.g., MRSA, *C. difficile*, respiratory pathogens, STD)
2. Quantitative Analysis (e.g., viral load)
3. Genotypic Characterization (e.g., molecular epidemiology, viral typing, resistance testing)

B. Oncology

1. Leukemias/Lymphomas (e.g., CML, ALL, translocations, clonal rearrangements)
2. Solid Tumors
3. Hereditary cancer syndromes (e.g., breast, colon, ovarian)

C. Genetics

1. Hemoglobinopathies (e.g., thalassemias, sickle cell anemias)
2. Coagulopathies (e.g., Factor V Leiden, prothrombin, MTHFR)
3. Trinucleotide repeat disorders (e.g., Fragile X, Huntington, muscular dystrophy)
4. Single gene disorders (e.g., cystic fibrosis, Gaucher, hereditary hemochromatosis)
5. Epigenetic disorders (e.g., Prader-Willi, Angelman)

D. Other

1. Histocompatibility
2. Genetic identity (e.g., parentage, specimen identification, forensic)
3. Engraftment
4. Pharmacogenomics (e.g. Herceptin[®], warfarin, Plavix[®], carbamazepine)

Examples provided (as indicated by e.g.) are not limited to those listed.

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

END OF CONTENT GUIDELINE