Examination Model

The American Society for Clinical Pathology Board of Certification (ASCP BOC) SCYM certification examination is composed of 100 questions given in a 2-hour 30-minute time frame. All examination questions are multiple-choice with one best answer. More information is available on the ASCP BOC website.

The examination questions may be both theoretical and/or 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 and follow quality assurance protocols.

Examination Content Areas

The examination questions encompass the following content areas within cytometry. Each of these content areas comprises a specific percentage of the overall 100-question examination.

Content Area	Description	Examination Percentage
Instrumentation	Principles of fluidic, optical, and electronic instrumentation including maintenance and troubleshooting	**15 – 20%**
Panel/Experiment Design	Sample source, sample integrity, sample preparation and staining, cell enrichment, assay development (including target, sample state for functional studies, probe types, fluorochrome selection, spectral overlap and compensation, assay controls, assay optimization, and instrument optimization)	**25 – 30%**
Applications	Immunophenotyping, functional assays, multiplex bead assays, transplantation testing, stem cell analysis, cell cycle / DNA ploidy testing, rare event analysis, small particle analysis, fetal red blood cell detection assays, cell sorting, imaging flow cytometry, full spectrum cytometry	**25 – 30%**
Data	Data standards, data display, gating, statistical methods, data modeling techniques, high-dimensional data analysis, quantitative cytometry, data quality assessment and troubleshooting	**15 – 20%**
Laboratory Operations	Quality management, regulatory compliance, laboratory safety, laboratory administration	**10 – 15%**

For a more detailed overview of the examination, refer to the content outline starting on page 2.

Examination Content Outline

- Regulatory questions on the examination are based on U.S. sources (e.g., AABB, FDA, CLIA, etc.).
- The examples provided in this content outline (as indicated by e.g.,) are not limited to those listed.
- The laboratory results and reference ranges on the examination will be provided in both conventional and SI units.

I. Instrumentation

15 – 20% of total examination

A. Fluidics

1. Hydrodynamic focusing and properties of sheath fluids
2. Sample delivery (e.g., syringe pump, pressure based, vacuum, acoustic)

B. Optics

1. Optical filters (e.g., bandpass, long-pass, short-pass, dichroic, neutral density, polarizing)
2. Light sources (e.g., laser type, laser line, LED)
3. Lenses (e.g., beam shape, collecting, focusing, objective)
4. Optical pathways (e.g., transmission, reflection, interrogation point, collinear, spatial separation, light scatter)

C. Electronics

1. Amplifiers (e.g., linear, logarithmic)
2. Detectors (e.g., photomultiplier tube, photodiode, CCD camera, avalanche photon detector)
3. Noise reduction/correction
4. Pulse measurement (e.g., area, width, height)
5. Signal processing (e.g., compensation, time delay, window extension, binning, baseline restoration, background correction)
6. Thresholds/discriminators

D. Instrument Troubleshooting

E. Instrument Maintenance

II. Panel/Experiment Design

25 – 30% of total examination

A. Sample

1. Sample source (e.g., beads, blood, bone marrow, solid tissue, body fluids, subcellular components, cultured cells, microorganisms)
2. Sample integrity (e.g., collection, handling, storage, viability)
3. Sample preparation and staining (e.g., disaggregation, lysing agents, aggregates, filtering, fixation, permeabilization)
4. Cell enrichment (e.g., cell sorting, density gradient isolation, magnetic beads)

B. Assay Development

1. Target (e.g., cell type, subcellular location, molecule)
2. Sample state for functional studies (e.g., activated, resting, proliferating)
3. Probe types (e.g., antibodies, viability/DNA dyes, physiological, tracking dyes, fluorescent proteins)
4. Fluorochrome selection (e.g., antigen density, protein co-expression, optimal combination, photostability, F/P ratio, quenching, signal to noise)
5. Spectral overlap and compensation
6. Assay controls (e.g., fluorescence minus one [FMO], autofluorescence, biological systems control, background measurement controls)
7. Assay optimization (e.g., appropriate use of limited sample, frequency of target, cell concentration, kinetics, scalability, blocking, statistical design)
8. Instrument optimization (e.g., detector settings, filter selections)

III. Applications

25 – 30% of total examination

- **A.** Immunophenotyping (e.g., immunologic evaluations, hematologic disorders)
- **B.** Functional Assays (e.g., cytokines, chronic granulomatous disease, calcium flux, phospho flow)
- **C.** Multiplex Bead Assays (e.g., cytokines, proteins, chemokines)
- **D.** Transplantation Testing (e.g., HLA crossmatch)
- **E.** Stem Cell Analysis (e.g., CD34 absolute counts)
- **F.** Cell Cycle / DNA Ploidy Testing
- **G.** Cell Death (e.g., apoptosis, necrosis)
- **H.** Rare Event Analysis (e.g., circulating tumor cells, measurable residual disease [MRD], circulating endothelial cells)
- **I.** Small Particle Analysis (e.g., viruses, extracellular vesicles, lipid nanoparticles)
- **J.** Fetal Red Blood Cell Detection Assays
- **K.** Cell Sorting
- **L.** Imaging Flow Cytometry
- **M.** Full Spectrum Cytometry

IV. Data

15 – 20% of total examination

- **A.** Data Standards (e.g., FCS format, image file format, listmode, MIFlowCyt checklist, storage requirements)
- **B.** Data Display (e.g., types of displays, transformations)
- **C.** Gating (e.g., hierarchical vs. Boolean gating, gates, regions)
- **D.** Statistical Methods (e.g., central tendency, standard deviation, CV)
- **E.** Data Modeling Techniques (e.g., cell cycle analysis, proliferation)
- **F.** High-Dimensional Data Analytics (e.g., t-SNE, PCA, UMAP, clustering algorithms)
- **G.** Quantitative Cytometry (e.g., molecules of equivalent soluble fluorochrome [MESF], absolute counts)
- **H.** Data Quality Assessment and Troubleshooting (e.g., compensation, unmixing, acquisition stability, doublet detection)

V. Laboratory Operations

10 – 15% of total examination

A. Quality Management

1. Instrument quality assurance (e.g., optical alignment, detector calibration, filter integrity, optimization)
2. Instrument quality control (e.g., instrument performance assessment)
3. Reagent verification (e.g., antibody, panel, titer, lot-to-lot variation, storage, viability dyes)
4. Sample quality control (internal, external)
5. Trend analysis and interpretation (e.g., Levy-Jennings)

B. Regulatory Compliance

1. Validation (e.g., accuracy, precision, compensation, sensitivity, specificity, linearity, reference ranges, limit of detection [LOD])
2. Calibration (e.g., standards, controls, MESF, scatter)
3. Proficiency testing

C. Laboratory Safety

1. Biological (e.g., biosafety categories, personal protective equipment [PPE], specimen transport and preparation precautions, aerosols, decontamination)
2. Instrument (e.g., lasers, electronics)
3. Chemical (e.g., mutagenic agents, cytotoxic agents)
4. Environmental (e.g., waste disposal)

D. Laboratory Administration

1. Financial (e.g., capital equipment acquisition, cost analysis, reimbursement, purchasing, inventory)
2. Operations (e.g., customer service, facility management, information technology)

3. Personnel (e.g., staffing and productivity, performance standards, training and evaluations, competency assessments)
4. Quality management (e.g., continuous quality improvement, risk management/medical-legal issues)

END OF CONTENT GUIDELINE