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 troubleshooting	**15 – 20%**
Panel/Experiment Design	Sample source, sample integrity, sample preparation and staining, cell enrichment, and assay development (including target, sample state for functional studies, probe types, fluorochrome selection, spectral overlap and compensation, assay controls, and assay optimization)	**25 – 30%**
Applications	Immunophenotyping, functional assays, multiplex bead assays, solid organ transplant, stem cell analysis, cell cycle / DNA ploidy, rare event analysis, small particle analysis, fetal hemoglobin assay, cell sorting, imaging cytometry, and mass cytometry	**25 – 30%**
Data	Data standards, signal processing, data display, gating, statistical methods, common data modeling techniques, quantitative cytometry, and troubleshooting	**15 – 20%**
Laboratory Operations	Quality control, assay validation, safety, and 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., long pass, band pass, short pass, dichroics, neutral density, polarizing)
2. Light source (e.g., laser type, laser line, arc lamp, led)
3. Lenses (e.g., beam shape, collecting, focusing, objective)
4. Optical pathway (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. Digital vs. analog systems
4. Noise
5. Pulse measurement (e.g., time delay, window extension, area, width, Coulter impedance)
6. Threshold/discriminator

D. Troubleshooting

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, plants, whole organisms)
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 coexpression, 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)

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.** Solid Organ Transplant (e.g., HLA crossmatch)
- **E.** Stem Cell Analysis (e.g., CD34 absolute counts)
- **F.** Cell Cycle / DNA Ploidy
- **G.** Rare Event Analysis (e.g., circulating tumor cells, measurable [minimal] residual disease [MRD], circulating endothelial cells)
- **H.** Small Particle Analysis
- **I.** Fetal Hemoglobin Assay
- **J.** Cell Sorting
- **K.** Imaging Cytometry
- **L.** Mass Cytometry

IV. Data

15 – 20% of total examination

- **A.** Data Standards (e.g., image file format, FCS format, listmode, MIFlowCyt checklist, storage requirements)
- **B.** Signal Processing (e.g., binning, compensation, pulse processing, baseline restoration, background correction)
- **C.** Data Display (e.g., types of displays, transformations)
- **D.** Gating (e.g., hierarchical vs. Boolean gating, gates, regions)
- **E.** Statistical Methods (e.g., central tendency, standard deviation, CV, KS statistics, cluster analysis, principal component analysis, discriminant analysis)
- **F.** Common Data Modeling Techniques (e.g., cell cycle analysis, proliferation, phenotyping, ratiometric, high dimensional)
- **G.** Quantitative Cytometry (e.g., molecules of equivalent soluble fluorochrome [MESF], absolute counts)
- **H.** Troubleshooting (data quality assessment)

V. Laboratory Operations

10 – 15% of total examination

A. Quality Control

1. Instrument quality control (e.g., optical alignment, detector calibration)
2. Instrument optimization
3. Reagent quality control (e.g., panel verification, titration, lot to lot variation, storage, handling)
4. Sample integrity
5. Appropriate sample quality controls selection (internal, external)
6. Trend analysis and interpretation

B. Assay Validation

1. Method validation (e.g., accuracy, reproducibility/precision, sensitivity, specificity, linearity, reference range, robustness)
2. Method calibration (e.g., standards, controls)

C. Safety

1. Biosafety procedures (e.g., biosafety categories, personal protective equipment [PPE], specimen transport and preparation precautions, aerosols, decontamination)
2. Instrument safety (e.g., lasers, electronics)
3. Chemical safety (e.g., mutagenic agents, cytotoxic agents)
4. Environmental safety (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 evaluation)
4. Quality management (e.g., continuous quality improvement, risk management/medical-legal issues)

END OF CONTENT GUIDELINE