ASCP BOARD OF CERTIFICATION

TECHNOLOGIST AND INTERNATIONAL TECHNOLOGIST IN HEMATOLOGY, H(ASCP) AND H(ASCP^{i})
SPECIALIST AND INTERNATIONAL SPECIALIST IN HEMATOLOGY, SH(ASCP) AND SH(ASCP^{i})

EXAMINATION CONTENT GUIDELINE

EXAMINATION MODEL

The H(ASCP), H(ASCP^{i}), SH(ASCP), and SH(ASCP^{i}) certification examinations are composed of 100 questions given in a 2 hour 30 minute time frame. All exam questions are multiple-choice with one best answer. The certification exams are 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 classified by content area. The content area aligns with the examination specific content outline. The examinee must answer enough questions correctly to achieve a measure above the pass point in order to successfully pass the certification examination. There is no set number of questions one must answer to pass, nor is there a set percentage one must achieve to pass. If at the end of the exam the examinee's score is above the pass point, then he or she passes the exam.

EXAMINATION CONTENT AREAS

The H and SH exam questions encompass the following content areas within Hematology: Hematology Physiology, Hematology Disease States, Hematology Laboratory Testing, Hemostasis, and Laboratory Operations. Each of these content areas comprise a specific percentage of the overall 100-question exam. The content areas and percentages are described below:

CONTENT AREA	DESCRIPTION	EXAM PERCENTAGE
HEMATOLOGY PHYSIOLOGY	Physiology (production, destruction, and function) of blood, body fluids, and bone marrow	**10 – 15%**
HEMATOLOGY DISEASE STATES	Disease states associated with qualitative/quantitative abnormalities of erythrocytes, leukocytes, and platelets	**20 – 25%**
HEMATOLOGY LABORATORY TESTING	Cell counts, differentials/morphology evaluation, hemoglobin/hematocrit, indices, hemolytic indicators, special stains, flow cytometry, molecular/cytogenetic testing, and other studies	**20 – 25%**
HEMOSTASIS	Physiology (pathways and vascular system), hemostasis-related disease states, and hemostasis lab determinations	**20 – 25%**
LABORATORY OPERATIONS	Quality assessment/troubleshooting, compliance, regulations, safety, laboratory mathematics, instrumentation, and laboratory administration **(SH ONLY)**	**15 – 20%**

For a more specific overview of the H and SH exams, please refer to the **CONTENT OUTLINE** starting on page 2.

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EXAMINATION CONTENT OUTLINE

Examination questions, which are related to the subtest areas outlined below, 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. Additionally, regulatory questions are based on U.S. sources (e.g., AABB, FDA, CLIA, etc.).

I. HEMATOLOGY PHYSIOLOGY (to include blood, body fluids, and bone marrow) (10 – 15% of total exam)

- **A. Production**
- **B. Destruction**
- **C. Function**

II. HEMATOLOGY DISEASE STATES (20 – 25% of total exam)

- **A. Erythrocytes**
  1. Anemia
     - a. Microcytic
       1) Iron deficiency
       2) Thalassemia
       3) Sideroblastic
       4) Chronic inflammation
     - b. Normocytic
       1) Hereditary hemolytic
       2) Acquired hemolytic
       3) Hypoproliferative
       4) Acute hemorrhage
     - c. Macrocytic
       1) Megaloblastic
       2) Non-megaloblastic
     - d. Hemoglobinopathies
  2. Erythrocytosis
     - a. Relative
     - b. Absolute
- **B. Leukocytes (WHO classification)**
  1. Benign leukocyte disorders
     - a. Myeloid
     - b. Lymphoid
  2. Myeloid neoplasia
     - a. Acute leukemia
     - b. Myelodysplastic syndromes
     - c. Myeloproliferative neoplasms
  3. Lymphoid neoplasia
     - a. Acute leukemia
     - b. Chronic leukemia/lymphoma
     - c. Plasma cell dyscrasias
  4. Hereditary anomalies
- **C. Platelets**
  1. Quantitative abnormalities
     - a. Thrombocytopenia
       1) Increased destruction (e.g., ITP, TTP, HIT)
       2) Decreased production
       3) Pseudothrombocytopenia
     - b. Thrombocytosis
  2. Qualitative defects
     - a. von Willebrand disease
     - b. Bernard-Soulier syndrome
     - c. Glanzmann thrombasthenia

III. HEMATOLOGY LABORATORY TESTING (20 – 25% of total exam)

- **A. Cell Counts (to include Blood and Body Fluids)**
  1. Manual
  2. Automated
  3. Reticulocyte
- **B. Differentials and Morphological Evaluation (to include Blood and Body Fluids)**
- **C. Hemoglobin**
  1. Quantitative
  2. Qualitative
     - a. Electrophoresis
     - b. HPLC
     - c. Sickle solubility

- **D. Hematocrit**
- **E. Indices**
- **F. Hemolytic Indicators (e.g., haptoglobin, LD)**
- **G. Special Stains**
  1. Esterase
  2. Myeloperoxidase
  3. Prussian blue
  4. Kleihauer Betke
- **H. Other Studies**
  1. ESR
  2. G-6-PD
  3. Heinz body
- **I. Flow Cytometry Immunophenotyping**
  1. Leukemia
  2. Lymphoma
  3. Lymphocyte subsets
  4. PNH
- **J. Molecular and Cytogenetic Testing**
  1. Recurring cytogenetic abnormalities (WHO classification)
  2. *BCR/ABL*
  3. *JAK2*

IV. HEMOSTASIS (20 – 25% of total exam)

- **A. Physiology**
  1. Coagulation pathways
  2. Fibrinolytic pathway
  3. Vascular system
- **B. Disease States**
  1. Coagulation factor deficiencies
     a. Acquired
     b. Hereditary
  2. Inhibitors
  3. Fibrinolytic system
  4. Hypercoagulable states
  5. DIC
- **C. Laboratory Determinations**
  1. PT/INR
  2. APTT
  3. Fibrinogen
  4. D-dimer
  5. Thrombin time
  6. Mixing studies
  7. Platelet function (e.g., PFA)
  8. Inhibitor assays
  9. Factor assays
  10. von Willebrand assays
  11. Platelet aggregation
  12. Thromboelastography
  13. Hypercoagulability assessment
      a. Assays (e.g., lupus anticoagulant, Protein S, Protein C)
      b. Molecular (e.g., Factor V Leiden, prothrombin 20210)
  14. Anti-Xa
  15. Direct thrombin inhibitors
  16. Heparin neutralization

V. LABORATORY OPERATIONS (15 – 20% of total exam)

- **A. Quality Assessment/Troubleshooting**
  1. Pre-analytical, analytical, post-analytical
  2. Quality control
  3. Point-of-care testing (POCT)
  4. Compliance
  5. Regulation
- **B. Safety**
  1. Safety programs and practices
     a. Prevention of infection with bloodborne pathogens
     b. Use of personal protective equipment (PPE)
     c. Safe work practices
     d. Safety data sheets (SDS) for chemicals and reagents
  2. Emergency procedures (e.g., needlesticks, splashes to mucous membranes, fire)
  3. Packaging and transportation of specimens
- **C. Laboratory Mathematics**
  1. Concentration, volume, and dilutions
  2. Molarity, normality
  3. Standard curves
  4. Mean, median, mode, and confidence intervals
  5. Sensitivity, specificity, and predictive value
- **D. Instrumentation**
  1. Microscopes
  2. Cell counters
  3. Differential analyzers
     a. Histograms
     b. Digital imaging
     c. Scatter plots
  4. Coagulation analyzers
  5. Point-of-care analyzers
  6. Centrifuges

E. Laboratory Administration (SH EXAM ONLY)

1. Financial
   a. Budgets
   b. Capital equipment acquisition
   c. Cost analysis and reimbursement
   d. Purchasing and inventory
2. Operations
   a. Customer service
   b. Facility management (e.g., laboratory design, utilities)
   c. Information technology
   d. Data management (e.g., research, outcomes)
   e. Test verification/validation
3. Personnel
   a. Staffing and productivity
   b. Performance standards (e.g., training, competency assessment)
   c. Counseling, disciplinary action, and conflict resolution
4. Quality management
   a. Continuous quality improvement
   b. Individualized Quality Control Plan (IQCP)
   c. Risk management/medical-legal issues

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.

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THE EXAMINEE IS EXPECTED TO KNOW THESE ADDITIONAL CALCULATIONS AND REFERENCE RANGES:

CALCULATIONS

- Corrected WBC counts when > 10 nRBCs present
- Manual hemocytometer counts
- Red blood cell indices (e.g., MCV, MCH, MCHC)
- Absolute cell counts given the relative values (e.g., WBCs, reticulocytes)

REFERENCE RANGES (COMBINED MALE AND FEMALE)

FOR BOTH H AND SH EXAMS

Analyte	Conventional Units	SI Units
RBC	4.0 – 6.0 x 10^6/µL	4.0 – 6.0 x 10^{12}/L
HGB	12.0 – 18.0 g/dL	120 – 180 g/L
HCT	35% – 50%	0.35 – 0.50 L/L
MCV	76 – 100 fL	76 – 100 fL
MCH	26 – 34 pg	26 – 34 pg
MCHC	32 – 36 g/dL	320 – 360 g/L
Reticulocytes (absolute)	20 – 115 x 10^3/µL	20 – 115 x 10^9/L
Reticulocytes (relative)	0.5 – 2.5%	0.05 – 0.025
nRBCs	0 nRBC/100 WBC	0 nRBC/100 WBC
Platelets	150 – 450 x 10^3/µL	150 – 450 x 10^9/L
WBC (total):	3.6 – 10.6 x 10^3/µL	3.6 – 10.6 x 10^9/L
Neutrophils (absolute)	1.7 – 7.5 x 10^3/µL	1.7 – 7.5 x 10^9/L
Neutrophils (relative)	50 – 70%	0.50 – 0.70
Lymphocytes (absolute)	1.0 – 3.2 x 10^3/µL	1.0 – 3.2 x 10^9/L
Lymphocytes (relative)	18 – 42%	0.18 – 0.42
Monocytes (absolute)	0.1 – 1.3 x 10^3/µL	0.1 – 1.3 x 10^9/L
Monocytes (relative)	2 – 11%	0.02 – 0.11
Eosinophils (absolute)	0 – 0.3 x 10^3/µL	0 – 0.3 x 10^9/L
Eosinophils (relative)	1 – 3%	0.01 – 0.03
Basophils (absolute)	0 – 0.2 X 10^3/µL	0 – 0.2 x 10^9/L
Basophils (relative)	0 – 2%	0.00 – 0.02
Hgb electrophoresis		
Hgb A	> 95%	> 0.95
Hgb F	0 – 2.0%	0.00 – 0.02
Hgb A_2	0 – 3.5%	0 – 0.035
Fluid counts		
CSF: WBCs and RBCs	0 – 5/µL	0 – 5 x 10^6/L
Synovial fluid: WBCs	0 – 200/µL less than 25% PMN's	0 – 200 x 10^6/L less than 25% PMN's

FOR SH EXAM ONLY

Analyte	Conventional Units	SI Units
PT	11 – 14 seconds	11 – 14 seconds
APTT	25 – 35 seconds	25 – 35 seconds
Fibrinogen	160 – 415 mg/dL	1.60 – 4.15 g/L
Thrombin time	≤ 21 seconds	≤ 21 seconds
Coagulation factor activity	50 – 150%	50 – 150%

All values on the H and SH exams can be interpreted using the reference ranges above. These reference ranges will not be given on the exam. Other reference ranges will be provided as needed on the exam.

END OF CONTENT GUIDELINE