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 and SH certification examinations are composed of 100 questions given in a 2-hour 30-minute time frame. All examination questions are multiple-choice with one best answer. The certification examinations are administered using the format of computer adaptive testing (CAT).

With CAT, when a person answers a question correctly, the next examination 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 examination 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 examination the examinee's score is above the pass point, then he or she passes the examination.

EXAMINATION CONTENT AREAS

The H and SH examination 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 examination. The content areas and percentages are described below:

CONTENT AREA	DESCRIPTION	EXAMINATION 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 immunophenotyping, molecular/cytogenetic testing	**20 – 25%**
HEMOSTASIS	Physiology (pathways and vascular system), hemostasis-related disease states, hemostasis laboratory determinations	**20 – 25%**
LABORATORY OPERATIONS	Quality assessment/troubleshooting, point-of-care testing (POCT), regulations, safety, laboratory mathematics, instrumentation, and laboratory administration **(SH ONLY)**	**15 – 20%**

For a more specific overview of the H and SH examinations, 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).

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

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

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

- **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) Nonmegaloblastic
     - 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 examination)

- **A. Cell Counts (to include blood and body fluids)**
  1. Manual
  2. Automated
  3. Reticulocyte
- **B. Differentials and Morphology 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/ABL1*
  3. *JAK2*

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

- **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 examination)

- **A. Quality Assessment/Troubleshooting**
  1. Preanalytical, analytical, postanalytical
  2. Quality control
  3. Point-of-care testing (POCT)
  4. Regulation (e.g., proficiency testing, competency assessment, accreditation standards)
- **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 EXAMINATION 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

In support of effective examination preparation, the ASCP BOC provides the following composite reference ranges, inclusive of all genders and ethnic populations, as derived from published sources such as textbooks. These reference ranges are reviewed annually by the Hematology Examination Committees. All corresponding laboratory values on the H and SH examinations can be interpreted using these reference ranges. These reference ranges are for examination purposes only and will not be provided during the H and SH examination. Other reference ranges will be provided as needed during the H and SH examinations. These reference ranges should not be considered for clinical applications.

FOR BOTH H AND SH EXAMINATIONS

	Conventional Units	SI Units
RBC	4.00 – 6.00 x 10^6/µL	4.00 – 6.00 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
RDW	11.5 – 14.5%	0.115 – 0.145
Reticulocytes (absolute)	20 – 115 x 10^3/µL	20 – 115 x 10^9/L
Reticulocytes (relative)	0.5 – 2.5%	0.005 – 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 – 0.02
Hgb electrophoresis		
Hgb A	> 95.0%	> 0.95
Hgb F	0 – 2.0%	0 – 0.02
Hgb A_2	0 – 3.5%	0 – 0.035

Fluid counts		
CSF: WBC and RBC	0 – 5/µL	0 – 5 x 10^6/L
Synovial fluid: WBC	0 – 200/µL less than 25% PMNs	0 – 200 x 10^6/L less than 25% PMNs

FOR SH EXAMINATION ONLY

	Conventional Units	SI Units
PT	11.0 – 14.0 seconds	11.0 – 14.0 seconds
APTT	25.0 – 35.0 seconds	25.0 – 35.0 seconds
Fibrinogen	160 – 415 mg/dL	1.60 – 4.15 g/L
Thrombin time	≤ 21.0 seconds	≤ 21.0 seconds
Coagulation factor activity	50 – 150%	0.50 – 1.50

END OF CONTENT GUIDELINE