2024

Ethiopian Health Professionals Licensing Examination(EHPLE)

INFORMATION BOOKLET

MEDICAL LABORATORY SCIENCE

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MINISTRY OF HEALTH-ETHIOPIA
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Institute of
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Message From the State Minister, Ministry of Health -Ethiopia

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Improving healthcare quality is a global priority for sustainable development, with high quality healthcare being a key component of universal health coverage. One strategy to maintain health care standards is through provision of health professional competency assessment. Consequently, in 2019, the Ministry of Health Ethiopia, initiated the Ethiopian Health Professionals Licensing Examination (EHPLE) for undergraduates in seven health disciplines, which has since expanded to include 13 health disciplines.

The main goal of this competency assessment is to identify health professionals with minimal competencies necessary to perform their duties safely and competently, thus enhancing the quality of health care services. This initiative is overseen by a dedicated Health and Health Related Institutions and Professionals' Regulatory Lead Executive Office (LEO), comprising four desks, which plays a pivotal role in strengthening the system and enabling the LEO to conduct the competency exam more extensively and with improved organization and quality.

It is important to note that this competency assessment differs significantly from traditional academic or employment examinations. Hence, this information booklet has been created to address the informational needs of both examinees and teaching faculty regarding the Ethiopian Health Professionals' Licensure Examination. Additionally, it aims to facilitate the assessment process, while promoting transparency and ensuring the sustainability of the program.

The preparation of this guideline involved the collaboration of esteemed experts from various higher education institutions, the Ministry of Health, JHPIEGO-Ethiopia, Amref/HWIP, Health Professionals' Associations, and the Ministry of Education. Their invaluable contributions are acknowledged with sincere gratitude, alongside appreciation for the Ministry of Health staff for their unwavering commitment and hard work throughout the project.

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This Information Booklet for Ethiopian Health Professional's Licensure Examinations is a contribution from several educators, researchers, students and concerned individuals with a genuine interest to propel Ethiopia's medical and health sciences education forward.

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Acronyms and Abbreviations

EHPLE	Ethiopian Health Professionals Licensing Examination
ETA	Educational and Training Authority
HEIs	Higher Education Institutions
HHrIPR-LEO	Health and Health-related Institutions and Professionals Regulatory Lead Executive Office
HSTP-II	Health Sector Transformational Plan-II
MCQ	Multiple Choice Question
MoH	Ministry of Health
WHO	World Health Organization

Purpose of the Information Booklet

The Ethiopian Health Professionals' Licensure Examination (EHPLE) Information Booklet serves as a comprehensive guide for those individuals seeking information about the exam. It typically outlines basic information for candidate registration, exam development and administration processes and procedures, result notification, and the licensing process. It also includes information on the exam framework, i.e., the exam domain, sub-domain, content, process, and task, with sample exam items specific to each profession.

The publication of this Booklet is crucial for the following reasons:

- Clarity and guidance: It provides clear information about the exam by ensuring candidates understand the necessary information to prepare them.
- Accessibility: It serves as a readily accessible resource for individuals pursuing to take the exam, consolidating essential information in one document and facilitating easy access to necessary details. It also helps other stakeholders who might be interested in such resources.
- Transparency: It promotes transparency in the examination process and fosters trust among stakeholders about the exam.

In summary, the publication of this Booklet is essential for creating a transparent, standardized, and accessible framework that guides candidates through the EHPLE process.

Contents

Definition of terms

- **Domain:** a broad category or area of knowledge or skills of a profession
- **Sub-domain:** a subset of a broader domain that focuses on knowledge or skills related to the overarching domain
- **Content:** a more specific subcategory, which is a breakdown of the sub-domain
- **Task:** the responsibility, knowledge, skill, and attitude of a junior undergraduate professional in an actual work environment
- **Process:** a systematic sequence of steps or actions designed to achieve a specific outcome
- **Learning outcome**: a clear and measurable statement that describes what the examinee is expected to know or be able to do
- **Relative emphasis:** the proportional importance or weight assigned to different content areas or categories within the assessment
- **Item:** a particular multiple-choice question
- **Item developer:** a subject matter expert responsible for writing test items or questions that make up the examination
- **Item reviewer:** a subject matter expert responsible for reviewing and refining the test items or questions that make up the examination
- **Standard setting:** a process of determining a cut-off point or passing score for an exam
- **Item difficulty index:** a statistical measure that indicates the proportion of examinees who answered a particular test item correctly
- **Discrimination index:** a statistical measure that evaluates how well a particular test item differentiates between high-performing and low-performing examinees
- **Admission paper:** a printout paper generated by the system after completing registration that contains the examinee's photo, QR code, and necessary information

1. Introduction

1.1. Background

Competency assessment is one of the strategies for controlling the standard of healthcare services provided in healthcare facilities. The World Health Organization (WHO) recommends all healthcare professionals to have necessary competencies. In Ethiopia, the Health Sector Transformational Plan-II (HSTP-II) states competency assessment of all graduates before joining the health workforce as one of the strategic initiatives.

The Ministry of Health (MoH) launched the Ethiopian Health Professionals Licensing Examination (EHPLE) for undergraduates in 2019. The Health and Health-related Institutions and Professionals Regulatory Lead Executive Office (HHrIPR-LEO) of the Ministry of Health was given a mission to implement the ministry's objective to achieve competency-related goals. It has the responsibility to ensure that the EHPLE meets technical, professional, and legal standards, and to protect the health, safety, and welfare of the public by assessing candidates' abilities to practice competently.

Currently, the exam is given for 13 health professions (Medicine, Nursing, Public Health, Pharmacy, Medical Laboratory Science, Anesthesia, Midwifery, Dental Medicine, Medical Radiology Technology, Environmental Health, Psychiatric Nursing, Pediatric and Child Health Nursing, and Emergency and Critical Care Nursing). Since its introduction until February 2024, a total of 166293 examinees took the exam in 14 rounds.

1.2. The Rationale of EHPLE

One of the critical functions of the MoH is to guarantee the efficiency, quality, and equity of healthcare delivery and to protect the public from any undesirable consequences in healthcare delivery practices. As professionals' competence is a significant determinant of the quality of health, evaluation of health professionals' competence has now been given due attention. The licensing examination for health professionals serves as a crucial step to ensure that individuals entering the field meet specific competency standards. The sole aim of the competency assessment is to safeguard public health by verifying that health professionals have the minimal basic knowledge, attitude, and skill required to provide safe and effective care.

Licensing exams act as a preventive measure, ensuring that only competent professionals join the health workforce, which, in turn, contributes to reducing the occurrence of medical errors and enhancing overall patient safety. By setting standards through examinations, regulatory bodies strive to minimize the risk of medical errors caused by incompetence.

2. Key processes of EHPLE

EHPLE involves several key processes to ensure the quality and reliability of the examination.

2.1. Registration of candidates

EHPLE has a mandatory online registration system for both new and repeat candidates, which can be found at www.hple.moh.gov.et

Please note these important notes during registration.

New Test Takers:

- The list of eligible candidates from governmental and private Higher Education Institutions (HEIs) will be sent from Ministry of Education (MoE) to MoH and uploaded to the online registration system by MoH.
- Once the name of the candidate is uploaded to the system and registration has opened for the current exam round, the candidate must register at **www.hple.moh.gov.et** by uploading the necessary documents listed below.
  - ✓ a scanned original or temporary degree
  - ✓ a scanned government-issued ID, passport, driving license, or any other legal ID
  - ✓ a passport-size photo of the candidate
  - ✓ For international candidates:
    - Equivalence document from ETA
    - Completing an externship attachment according to assignment by the regulatory body
    - Externship attachment completion letter

Repeat Test Takers:

- Since the information about re-exam candidates already exists in the system, the candidate should register by directly going to **www.hple.moh.gov.et**. There is no need for re-exam candidates to upload their documents.

Both new and repeat candidates:

- After completing the registration, the candidate must download and print the admission paper by logging into his/her account using his/her email address and password
- The candidate can change the exam center by logging into his/her account only during the registration period
- Once an examinee has selected his/her exam center during the registration period, an application for center change will not be allowed

2.2. Task Analysis

The first step of exam development involves conducting a comprehensive task analysis study, which identifies the tasks, knowledge, skills, and abilities required from a junior undergraduate professional in the specific profession. The analysis is typically done through surveys, interviews, or observations of practitioners in the actual work environment, as well as through the Delphi method with subject matter experts.

2.3. Exam Blueprint

Based on the task analysis findings, a test blueprint is created that outlines the content areas to be covered in the examination and the weight or emphasis given to each area. This ensures that the exam reflects the key competencies and knowledge needed for competent practice in that specific profession. Blueprint or test specification is the matrix or chart that shows the number and type of test questions represented across the topics in the content area, consistent with the learning outcome and relative weight of the test given to each content area. The blueprint also identifies the percentage weighting of cognitive dimensions as the level of competence tested in each knowledge domain.

Key components of a blueprint are:

- Domain
- Sub-domain
- Content
- Task
- Process
- Learning outcome
- Assessment methods
- Assessment tools/instrument (test format)
- Relative emphasis (in percentage)

2.4. Item Development

The items are developed following specific guidelines to ensure clarity, relevance, and fairness. Subject matter experts with experience in the field are selected from HEIs to develop test questions (items) that align with the test blueprint. The exam questions will focus mainly on “knows how” according to the competency level of the Miller's pyramid. The items are produced in a secure location on designated computers that are free from internet connectivity. The items are scenario-based and constructed with stem, lead-in, and four options/alternatives. All items will have a single-best-answer type of Multiple Choice Question (MCQ) that addresses the learning outcome defined in each content area. Standard text books, updated guidelines, and standards are used as reference materials.

2.5. Item Review

Once developed, the items undergo a rigorous review process by item reviewers. The main purpose of the exam review process is to evaluate content relevance, technical accuracy, clarity, and sensitivity related to culture and religion. More experienced subject matter experts as well as psychometric experts will do the review to ensure the items meet psychometric standards. Subject matter experts shall review the items to confirm that they are accurate, clearly stated, and correctly keyed using the checklist. Psychometric experts shall reviews the items to ensure that

they are not technically flawed. They also work on editorial review to check grammar, punctuation, and spelling errors. This helps ensure the reliability and validity of the items.

2.6. Standard setting method

The standard setting or cut-off point of the EHPLE is determined using the Modified-Angoff method, which is one of the most widely used and legally defensible standard setting approaches to set a cut-off point for high-stake competency examinations.

The method involves a panel of subject matter experts who evaluate each test question and then estimate the probability that a minimally competent examinee would answer each test item correctly. The average of the experts' predictions for a test question becomes its predicted difficulty. The average of the predicted difficulty values across all items on a test is the recommended cut-off point. This point indicates the minimum level of knowledge and skill required to pass.

2.7. Exam Administration

The EHPLE is administered following established protocols and guidelines. Proper test administration procedures, appropriate security measures, and appropriate consideration for test-takers who need special support will be applied during exam administration at exam centers. The exam is administered in selected HEIs nationally, where candidates can choose based on their convenience at the time of registration. The exam schedule will be posted ahead of time on the MOH website and official Facebook page. Examinees who have a valid admission paper are eligible to sit for the exam. The mode of exam administration is computer-based testing.

CAUTIONS

- Candidates are allowed

- Attend the orientation session in order to sit for the exam
- Arrive at the exam center on time
- Bring a legal ID and admission paper
- Complete the exam within the allotted time frame

- Candidates are **NOT** allowed

- To bring reference materials, blank paper, or notes into the exam center
- To smoke, eat, or drink in the exam room
- To bring mobile phones, tablets, smart watches, camera devices, eyeglasses, calculators or any type of electronic device into the exam center
- To bring their personal belongings to the exam center
- To bring weapons and sharp materials into the exam center
- To give or receive assistance to or from other candidates during the examination

2.8. Scoring and post exam analysis

Once the exam is completed, the scoring process begins. The exam scoring process involves computerized scoring using software.

Post-exam analysis is the process of analyzing examinees' responses to individual test items in order to assess the quality of the items and the exam as a whole. This phase helps to identify any poorly performing items that may need revision or removal from the exam. The item difficulty index, discrimination index, and reliability coefficient are elements of exam analysis.

2.9. Result notification and appeal management

After scoring and analysis, individual score reports are generated and provided to examinees through the website *www.hple.moh.gov.et*. After result notification, examinees can submit their appeal through phone or email within 10 working days after result notification.

2.10. Licensing

The list of examinees who passed the exam will be sent to regional and city administration regulatory bodies. A license is obtained from the regional/zonal health bodies where he/she permanently lives.

Requirements for professional licensing are:

- Passing the EHPLE
- Original or temporary degree
- Educational documents (10th and 12th certificates)
- Medical certificate
- Government issued ID
- Additional prerequisites based on the requirements of regional regulatory bodies

3. Exam framework

The key broader professional roles, also known as domains or main knowledge areas serve as a building framework for the licensing examination content for medical laboratory science professionals. The domains are further divided into discrete professional attributes that constitute sub-units (also referred to as sub-domains) defining the professional identity of medical laboratory science professionals. Tasks specifying the performance level of each sub-domain serve as the final characteristic of the professional duties on which the licensing exam focuses.

The contents of the licensing examination are presented below, structured into key roles (domains), sub-units (sub-domains), and tasks. The examination emphasis for each domain and sub-domain, out of the total 100% questions, is indicated in brackets.

Key professional roles/ domains

- ❑ Patient Care (75.5%)
- ❑ Laboratory Quality Assurance and Safety care (5.3%)
- ❑ Scholar (5.0%)
- ❑ Professionalism (3.7%)
- ❑ Leadership and management (5.0%)
- ❑ Health promotion and disease prevention (5.5%)

Key role/ domain 1: Patient care (75.5%)

Description: This domain encompasses the professional roles of laboratory technologists in the provision of high-quality, safe, and patient-centered laboratory service within their scope of practice. The provision of up-to-date, ethical, and resource-efficient laboratory service requires the application of integrated knowledge of biomedical, clinical, behavioral, and social sciences. This is conducted in collaboration with patients and their families, other healthcare professionals, and the community. As patient care providers, laboratory technologists shall implement the pre-, analytic, and post-analytic phases of laboratory services. These phases include receiving test requests, identifying patients and specimens, collecting, transporting, accessioning, processing, testing, reporting test results, interpreting, following up, storing, and retesting as necessary. To demonstrate competence in this domain candidates shall apply such integrated knowledge in the following sub-areas:

- ❑ Clinical Chemistry (10.0%)
- ❑ Medical virology (3.0%)
- ❑ Mycology (2.7%)
- ❑ Bacteriology (11.0%)
- ❑ Molecular Biology (3.0%)
- ❑ Urine and Body Fluids Analysis (10.0%)
- ❑ Hematology (11.0%)
- ❑ Immunohematology (4.0%)

- Serology (5.0%)
- Medical Parasitology (10.0%)
- Instrumentation (2.0%)
- Introduction to Medical Laboratory Sciences (2.8%)
- Histopathology (1.0%)

Key role/ domain 2: Laboratory Quality Assurance and Safety care (5.3%)

Description: This domain encompasses the professional roles of laboratory technologists in quality assurance and clinical safety activities to promote public health and to ensure that clinical laboratory practice is safe, effective, good quality, and as per good practices. Implementing an up-to-date, ethical, and resource-efficient quality assurance system requires the application of integrated knowledge of GMP, biomedical, clinical, behavioral, and social sciences. As quality assurance focal persons, laboratory technologists shall perform routine quality control inspections, troubleshoot technical issues, comply with quality management system guidelines, and actively engage in quality improvement initiatives. Laboratory technologists shall also possess essential clinical safety applicable knowledge including adherence to safety protocols, implementation of equipment safety measures, ensuring emergency preparedness, and implementing environmental safety measures. To demonstrate competence in this domain candidates shall apply such integrated knowledge in the following sub-areas:

- Quality assurance (4%)
- Safety in clinical laboratory (1.3%)

Key role/ domain 3: Scholar (5.0%)

Description: This domain encompasses the professional roles of medical laboratory science professionals in generating and utilizing scientific data to improve the health and well-being of Ethiopians and broaden their scientific knowledge within the healthcare system and community setting. Providing this service requires the application of integrated knowledge in research methods, measurements of health and disease, biostatistics, epidemiology, clinical audit, evidence-based practice, and research ethics. To demonstrate competence in this domain, candidates must possess applied knowledge in planning, problem identification, data collection, analysis, interpretation, report writeup, and dissemination of research outputs. To demonstrate competence in this domain candidates shall apply such integrated knowledge in the following sub-areas:

- Research (3.0%)
- Evidence based practice (2.0%)

Key role/ domain 4: Professionalism (3.7%)

Description: This domain encompasses the professional commitment of medical laboratory science professionals to promoting the health and well-being of individuals and society through

adhering to ethical standards, maintaining personal integrity, and upholding high standards of competence in all areas of practice. To exhibit competence in this domain, candidates must possess applied knowledge of ethical principles, medico-legal practices, effective communication, accountability to the profession and society, maintenance of professional excellence and personal health, and professional values such as compassion, respect, integrity, honesty, altruism, and humility.

Key role/ domain 5: Leadership and management (5.0%)

Description: This domain encompasses the professional roles of medical laboratory science professionals in envisioning a high-quality healthcare system through self-awareness, active participation in healthcare teams, leading teams, and managing health systems. Providing this service requires the application of integrated knowledge in continuous quality improvement, effective health system leadership, management, and healthcare ethics. To demonstrate competence in this domain candidate shall possess applied knowledge to plan, organize, staff, lead, execute, monitor, and control healthcare resources and activities.

- ❑ Leadership and health system Management (2.5%)
- ❑ Health laboratory management (2.5%)

Key role/ domain 6: Health promotion and disease prevention (5.5%)

Description: This domain encompasses the professional roles of medical laboratory science professionals in enhancing the health and well-being of patients, communities, and the larger populations they serve through health advocacy, disease prevention, health promotion, health protection, and the promotion of health equity. Providing this service takes an integrated understanding of determinants of health, health informatics, epidemiology, communicable disease control, and health education. To demonstrate competence in this domain candidate shall possess essential applied knowledge of the following sub-areas.

- ❑ Community health Assessment and Intervention (2.5%)
- ❑ Public health microbiology (2.0%)
- ❑ Vector Biology (1.0%)

Table 1 Exam Content for Medical Laboratory Science Profession

Domain 1: Patient care	
Sub-domain: Clinical Chemistry	
Content	**Sub content**
Collection, handling, and processing of blood sample	Anticoagulants, Preservatives , Blood sample collection, Blood processing , Type of specimen, Factors affecting chemistry tests
Solution	Blank solution, Standard solution, Dilution, Working solution preparation
Concentration measurement	Interaction of radiant energy with matter, Fundamental laws of absorption
Assay techniques in clinical chemistry	End point assay, KINETIC assays, Differential assay
Glucose determination Glucose Oxidase Hexokinase Glucose dehydrogenase Tolerance test	
Lipid profile determination	Total cholesterol, Triglycerides , HDL-C, LDL-C
Renal function tests	Creatinine, Urea/BUN, Uric acid
Liver function tests	Total protein, Albumin, ALP, GOT/AST, GPT/ALT, GGT, Bilirubin
Cardiac function tests	Creatinine kinase, Troponin, Lactate dehydrogenase, AST
Electrolyte	Na+, K+, Cl-, Ca++
Diagnostic enzymology	Factors affecting enzyme activity
Hormone analysis	Principles of hormone analysis , Thyroid function tests (T3, T4 & TSH), Sterility tests (FSH & LH Estrogen, progestron,Testestron)
Tumor marker analysis	Principles of tumor marker analysis, PSA, ACP, AFP, CA-125, CA-19-9
Quality Assurance in Clinical Chemistry	
Sub-domain: Medical Virology	
Content	**Sub content**
Diagnostic methods in Virology	Collection, transportation and preservation of specimens for viral diagnosis, cytology, detection of viral genome and serology
Medically important DNA Viruses	Adenoviruses, Human Herpesviruses, Papilomaviruses , Hepdanaviridae (HBV)
ds RNA	Rota virus
Positive sense ss RNA	HAV, HEV, Polio virus, Rhino virus, HCV, HGV, Dengu fever, Yellow fever, Rubella virus, Chikungunya
Negative sense ss RNA	Influenza, Measles, Mumps, RSV, Rabies
RNA-RT (Retrovirus)	HIV
Emerging and re-emerging viral diseases	SARS-CoV-2, Ebola
Quality assurance in Medical Virology	
Sub-domain: Mycology	
Content	**Sub content**
Fungal Diagnosis: Collection, transportation and processing	Mycological specimen Examination methods: Microscopic, Culture
Superficial mycosis	Tinea versicolor, Tinea nigra palmaris, Tinea piedra
Cutaneous mycoses	Tinea capitis, Tinea favosa, Tinea corporis, Tinea cruris, Tinea unguium, Tinea barbae, Tinea manuum, Tinea pedis
Subcutaneous mycosis	Maduramycosis , Sporotrichosis, Chromoblastomycosis, Rhinosporidiosis

Systemic mycosis	Maduramycosis , Sporotrichosis, Chromoblastomycosis, Rhinosporidiosis
Opportunistic	Candidasis, Cryptococosis, Aspergilosis, Pneumocystis carnii
Mycotoxins and Mycotoxicoses	Aflatoxin, Ocratoxin
Sub-domain: Bacteriology	
Content	**Sub content**
Bacteriological reagent preparation	AFS/FM reagent, Gram stain reagent, 0.5% McFarland turbidity standard
Bacteriological staining	Gram stain, AFS/ZN/FM stain
Bacteriological specimens	Steriale specimen, None-Steriale specimen
Culture media preparation	Solid media, Semi solid, liquid Media
Biochemical Test	
Antimicrobial susceptibility test	
Pathogenic Gram positive cocci	Staphylococci Spp, Staphylococcus aureus, Staphylococcus saprophatics, Staphylococcus epidermides, Streptococci Spp, Streptococci pyogenes, Streptococci agalacteae , Streptococci pneumoniae, Streptococcus mutanis, Entrococcus spp
Gram-positive rods	Bacillus spp, Bacillusanthercis, Bacillus cereus, Clostridium Spp, Clostridium tetani, Clostridium perfringes, Clostridium boutilinium , Clostridium difficile , Corynebacterium Spp, Corynebacteriumdiptheriae
Gram negative cocci	*Neisseria Spp (Neisseria gonorrhoea & Neisseria meningitides)*
Gram negative coccobacilli	Haemophilus spp. (H. Influenzae, H. ducrii, & H. aegyptius), Bordetella spp. (B. pertusis & B. parapertusis), Brucella spp. (B. abortus, B. melitenis, and B. suis)
Gram negative rods	Salmonella Spp. (S. Typhi, S. Paratyphi, S. Typhimurim and S. Enteritidis), Escherichia coli, Shigella spp. (S. dysentriae, S. Sonni, S. boydii, S. flexneri), Klebsiella Spp (K. pneumonia), Proteus spp. (P. mirablis and P. vulgaris), Pseudomonas Spp (P. aeroginosa), Vibrio Spp cholera (V. cholera), Helicobacter pylori
Acid fast bacilli	Mycobacterium spp. (M. tuberculosis, M. leprae, M. bovis)
Obligate intracellular bacteria	Rickettsia spp. (R. typhi and R. prowazeki), Chlamydia spp. (C. trachomatics)
Spirochete	Borella species (B. recurrentis and B burgdorferi), Treponema Spp (T. pallidum subsppalladium, T. pallidum subsp pertenu, T. pallidum subsp endemicum and T caraetum)
Quality assurance in Bacteriology	
Sub-domain: Molecular Biology	
Content	**Sub content**
General Extraction	DNA, RNA
General Purification	DNA, RNA
General Amplification	PCR, RTPCR
Blotting techniques	
Gel electrophoresis	
Quality Assurance in Molecular Biology	
Sub-domain: Urine and Body Fluids Analysis	
Content	**Sub content**
Sample collection, preservation and processing	Urine, CSF, Semen, pleural fluid, Ascetic/peritoneal fluid,

	Synovial fluid
Physical examination	Urine, CSF, Semen, pleural fluid, Ascetic/peritoneal fluid, Synovial fluid
Chemical examination	Urine, CSF, Semen, pleural fluid, Ascetic/peritoneal fluid, Synovial fluid
Microscopic examination	Urine, CSF, Semen, pleural fluid, Ascetic/peritoneal fluid, Synovial fluid, Amniotic fluid
Sub-domain: Hematology	
Content	**Sub content**
Blood collection	Capillary blood collection, Venous blood collection, Anticoagulants and additives
Smear Preparation	Thin smear preparation, Thick smear preparation
Hematological Staining	Wright stain, Giemsa stain
Hemocytometery and differential cell counting from blood and body fluids	RBC count, WBC count, Platelet count, Differential Count
	Hemoglobin determination , Hematocrit measurement, Red cell indices, ESR Determination, Reticulocyte count, Osmotic Fragility tests
Red cell morphology	Variation in Red cell size, Variation in Red cell color, Variation in Red cell shape, Red cell inclusions, Variation in Red cell distribution
Anemia	
Leukocyte disorders	Nonmalignant, Malignant
Hemostasis Profiles (PT, APTT, INR)	
Preparation, staining and examination of BM smears. LE cell preparation and examination	
Automation	
Quality Assurance in Hematology	Internal quality control, External quality control, Source of errors in Hematology, SOPs in Hematology, Reference ranges
Sub-domain: Immunohematology	
Content	**Sub content**
Blood collection Blood Grouping Antigloblin testing (direct and indirect Coomb's test) Cross matching Donation of blood(Donor selection) Preparation, storage and clinical indication of blood and blood products Hemolytic diseases of the fetus and newborns (HDFN) Transfusion Reaction Screen donor blood	
Sub-domain: Serology	
Content	**Sub content**
Agglutination tests	Widal, CRP, Weil-Felix, Rheumatoid factor, RPR, ANA, ASO
Immunochromatographc tests	HBV, HCG, HCV, HIV, H. pylori Toxoplama IgG and IgM Malaria RDT
Enzymeimmuno assay(ELISA)	
Fluorescent antibody tests (FAT)	
Flowcytometry	Cell markers
Quality in serology	
Sub-domain: Medical Parasitology	

Content	Sub content
Intestinal Nematodes	Ascaris lumbricoides, Hook worm, Enterobius vermicularis,Trichuris trichiura, Strongyloides stercolaris
Blood and tissue nematodes	Wuchereria bancrofti, Onchocerca volvulus, Trichinella spiralis Dracunculus medinensis Loa Loa, B.Malayi, B.Timori
Cestode	Taenia species, Hymenolepis species
Trematode	Schistosoma species, Fashiola species
Sarcodina	Parasitic Amoebae , Free living amoebae
Luminal (Urogenital and Intestinal) flagellate	Trichomonas species, Giardia lamblia
Tissue and blood flagellate	Leishmania species, Trypanosoma species
Apicomplexa /intestinal coccidian	Cryptosporidium species, Cyclospora cayetanensis, Isospora belli
Apicomplexa (Blood and tissue coccidians)	Plasmodium species, Toxoplasma gondii, Babesia species
Balantidium coli	
Quality assurance in Medical Parasitology	
Sub-domain: Instrumentation	
Content	**Sub content**
Water purification and sterilization instrumentation	Types of water and their use, Distiller, Filter, Ion exchanger , Autoclave, Incubators and ovens , Biological safety cabinet
Automated micropipettes	Operating procedure, Pipetting techniques, Pipette troubleshooting , Calibration
Spectroscopic techniques	Principles of measurement, Essential components of UV-visible spectrophotometer, Manual vs automated , spectrophotometers, Factors affecting spectroscopic measurement, Principle and instrumentation of atomic spectroscopy, fluorometer, turbidimeter and nephelometer
Electrochemical techniques	pH meter: principle and instrumentation, Ion-selective electrode: Measurement principle, instrumentation and application Biosensors: Biochemical principle and application
Electrophoresis	Principle and instrumentation, Detection and quantitation, Type and application
Chromatography	Principle and type, Instrumentation, Application
Hematology analyzers	Advantage , Methods (Impedance and flow cytometers), Interpretations, Sources of errors
Sub-domain: Introduction to Medical Laboratory Sciences	
Content	**Sub content**
Laboratory glasswares and plasticwares	
Laboratory equipment	
Laboratory reagent and solution	
Clinical specimen collection, handling and transportation	
Sterilization and disinfection	
Laboratory safety	
Sub-domain: Histopathology	
Content	**Sub content**
Histopathology specimen collection and handling. Fixation and fixatives	Purpose of fixation, classification of fixatives, Factors affecting fixation
Tissue processing	Dehydration, Clearing, impregnation and embedding, factors influencing the rate of tissue processing
Tissue Sectioning	Microtomy, Type of microtome knife, Frozen section

Staining	Factors determining sensitivity of stains, Hematoxyline staining, Eosin staining, Quick hematoloxyline and eosin stain for urgent biopsies, Mounting
Special staining methods	Connective tissue staining, Protein, nucleic acid and amyloid, Carbohydrates and lipids
Domain 2: Laboratory Quality Assurance and Safety Care	
Sub-domain: Quality Assurance	
Content	**Sub content**
Errors in clinical laboratories	Sampling errors, Method Selection, Analytical errors, Method evaluation
Indicators of values of diagnostic test	
Quality control material (internal and external controls)	
Specimen Management and Standard Operating procedures	
Practical evaluation and interpretation of quality control Result	Qualitative tests, Quantitative tests systems, Levey Jennings control charts, Basic quality control rules
Approaches used to interpret patient samples in quality control	Absurd value check, Duplicate analysis ,Delta check
Post Analytical Quality Assurance	
Documentation of tests results	
Determination of Reference Interval	
External Quality Assessment	
Laboratory accreditation	
Sub-domain: Safety in Clinical Laboratory	
Content	**Sub content**
Safety in Clinical Laboratory	
Domain 3: Scholar	
Sub-domain	
Content	
Proposal writing , Problem identification, Objective setting, Study design, Sampling technique, Sample size determination, Data collection tool, Ethical consideration	
Method of data collection , Data management ,Data quality control	
Data presentation and summarization, Estimation, Hypothesis Testing, Measure of association	
Domain 4: Leadership and management	
Sub-domain	
Content	
Management functions (planning, organizing, Directing, controlling), Skills of management, Prioritize health problems	
Organizing , Staffing /human resource management Leading &directing , Decision making and problem solving, laboratory information system , PHC and Ethiopian health policy Team work, Logistic management, product selection, procurement, forecasting & inventory quantification)	
Monitoring & Evaluation	
Domain 5: Health promotion and disease prevention	
Sub-domain: Community health Assessment and Community health Intervention	
Content	
Human Behavioral model Environmental health assessment Institutional health	
Screening , Outbreak investigation & management, Surveillance	
Action plan, Level of Diseases prevention	
Result based action on prioritized problems	

Sub-domain: Public Health Microbiology
Content
Microbial analysis of Food, Meat and meat products, Poultry, Sea foods, Vegetables, Dairy products, Others
Microbial analysis of Water and Beverage, Microbiological analysis of Water , Microbiological analysis of Beverage
Food preservation and storage, Physical methods, Chemical methods, Emerging methods, Fermented food & products of fermentation
Food born disease, Bacteria, Fungi, Virus
Microbial indicators of food safety & quality
Bioterrorism
Sub-domain: Vector Biology
Content
Mosquitoes, Black flies (Simulium), Phlebotomus, Glossina (Tse tse fly), House flies
Flea, Lice, Sarcoptes scabies , Snails, Bugs, Cockroachs, Cyclops(copepod), Ticks
Domain 6: Professionalism
Sub-domain: Professional Ethics And Medico-Legal Practice
Essential content
Ethical principles, Ethical dilemmas, Factors that influence patient decision making, Professional advocacy, Standards of practice, relevant legal frameworks in governing professional practice, Health professionals liabilities
Sub-domain: Principles of professionalism
Essential content
Humanism (compassion, empathy, sympathy, respect, dignity)
Sub-domain: Communication and Collaboration
Essential content
Verbal and non-verbal communication, Inter- professional communication, Effective communication with client's/ client's family /therapeutic communication, Building trust with client

Sample questions

1. Blood sample was collected from a 32-year-old female patient for renal function tests measurement. A laboratory technologist processed and analyzed the sample using spectrophotometric method. The results showed high blood urea concentration with normal creatinine and uric acid concentrations.

   What is the most likely cause of the elevated urea concentration?
   (A) High intake of dietary lipids
   (B) High intake of purine rich diet
   (C) High intake of protein rich diet
   (D) High intake of carbohydrate rich diet

   Answer key: The answer is **C**
   Explanation: Urea is the major nitrogen-containing metabolic product of protein catabolism in humans accounting for more than 75% of the non-protein nitrogen eventually excreted. Taking diets rich in protein causes elevation of blood urea concentration. Therefore, the best answer is option C.

2. A laboratory technologist working in a Clinical Chemistry Laboratory wants to measure the glucose level of a 77-year-old female patient and received her blood specimen. The sample was processed and analyzed using spectrophotometric method. The reaction was linear and 80 mg/dl glucose standard solution was used. The absorbance of the standard was 0.2 and the absorbance of the patient sample was 0.4.

   What is the most likely concentration of glucose in the patient's blood sample?
   (A) 40 mg/dl
   (B) 80 mg/dl
   (C) 100 mg/dl
   (D) 160 mg/dl

   Answer key: The answer is **D**
   Explanation: For calculating glucose concentration in patient sample, we use beer's law using the formula; $c_u = \frac{A_u}{A_c} \times c_c$ where Cu is concentration of substance in the patient sample which is unknown, Au is absorbance of unknown, Cc IS concentration of standard and Ac is absorbance of standard. Thus, Cu=0.4/0.2*80mg/dl= 160mg/dl. Therefore, the best answer is option D.

3. A laboratory technologist who is working in a urinalysis laboratory received urine specimen of a 45-year-old female patient. When the technologist examined the specimen, it has fruity odor.

   What is the most appropriate test that the technologist should perform next?
   (A) Nitrate (B) Protein (C) Creatinine (D) Ketone bodies

Answer key: The answer is **D**
Explanation: The main purpose of physical examination of urine is to give hints for Medical Laboratory professionals for subsequent examination. The results of the physical portion of the urinalysis can also be used to confirm or to explain findings in the chemical and microscopic areas of urinalysis. One of the physical examination of urine is odor. One of the causes of unusual odor is ketone bodies which produce a sweet or fruity odor. Therefore, option D is the answer for this question.

4. A Medical Laboratory Scientist wants to prepare quality control materials for ensuring validity of glucose measurement. He used leftover serum specimen from the patients visiting Laboratory units and prepared quality control material from serum with the concentration near the level of end of detection.

   What is the most likely quality control material prepared by the Scientist?
   (A) Critically high
   (B) Abnormally low
   (C) Normal range
   (D) Critically Low

Answer key: The answer is **D**
Explanation: There are different levels of quality control materials in clinical chemistry Laboratory. These include Normal, abnormally high and abnormally low, and critically high and critically low. The Critical low quality control material is a type of quality control used for checking low concentration of substance near the low end of detection. Therefore, the answer is option D.

5. A physician requested the preparation of coagulation profile for a patient with bleeding disorder. The nurse collected the blood sample using EDTA vacutainer tube and sent it to a laboratory for coagulation analysis. However, the laboratory technologist reported that the collected blood is not appropriate for coagulation analysis.

   What is the most likely cause for rejecting the sample?
   (A) Specimen was collected at the wrong time
   (B) Specimen was contaminated with intravenous fluid
   (C) Specimen was collected in the wrong anticoagulant
   (D) Test order requisition and the tube identification do not match

Answer key: The answer is **C**
Explanation: Blood sample collected by EDTA vacutainer tube is not suitable for coagulation tests. It is because, calcium which is one of the important component in the blood clotting system, will be removed from the whole blood during anti-clotting reactions by EDTA. Thus, blood collected by EDTA will give false results in the coagulation profile tests.

6. A physician working in a hospital requested a red cell indices values for an anaemic male patient with haemoglobin value of 12.5g/dl. A laboratory technologist reported the red cell indices values as follows: *MCV: 80fl(85fl); MCH, 30pg and MCHC 34g/dl.*

   What is the most likely type of anemia in this patient?

   (A) Microcytic hypochromic anemia
   (B) Normocytic normochromic anemia
   (C) Macrocytic normochromic anemia
   (D) Macrocytic hyperchromic anemia

Answer key: The answer is **B**

Explanation: The normal concentration of hemoglobin for a male adult is 13.0-18.0 g/l, and for adult women is 12.0-15.0 g/l. The patent's hemoglobin value of 12.5 indicates slightly anemic condition. In the red cell indices measurement, the MCV, MCH, MCHC values are used for the assessment of red blood cells average volume, weight, and hemoglobin concentration with reference range of 92 +/-9 fl, 29.5 +/-2.5 pg, and 30 +/-15g/l respectively. Accordingly, the patent's RBC indices; MCV: 85 fl; MCH: 30pg, and MCHC: 34g/dl all are in normal ranges, and indicate the normocytic normochromic anemia state.

7. A physician sent a request of Rh-typing for pregnant woman prior to her CS surgery. A laboratory technologist took a blood sample from the woman and made the entire required reagents ready for cell typing.

   What is the most appropriate type of anti-serum to be used in this case?

   (A) Anti-A (B) Anti-B (C) Anti-D (D) Anti-AB

Answer key: The answer is **C**

Explanation: In the standardized ABO –Rh blood grouping, anti-human globulin, Anti-A, Anti-B, and Anti-D are used for individual's blood typing by conducting agglutination reactions. Anti-A reacts with blood group A, anti B reacts with blood group B, and individuals with blood type AB react with both anti-human globulins A and B. If anti A, and B antihuman globulins make no reaction with individual blood, it is interpreted as "O" blood type. Individual's blood cells that react with anti D and agglutinates are interpreted as Rh positive blood type.

8. In a hospital surgical department, a nurse brings a laboratory request paper for blood cross match to a blood bank laboratory, for a patient who is scheduled for major surgery in the next day. Accordingly, a laboratory technologist going to the ward collected blood sample from the patient who has surgery procedure by following SOP. Then the technologist brings the sample into laboratory doing ABO blood grouping and identifies patient blood type. Then the technologist brings appropriate donors blood bag from the fridge, to do major cross match by doing an agglutination reactions.

   What is the most appropriate method to perform the stated major cross-match in this case?
   (A) Mix the patient's serum with the donors blood cells at room temperature
   (B) Mix the patient's red blood cells, with the donor serum at room temperature
   (C) Mix the patient's serum, with the donors blood cells at 37^0C temperature
   (D) Mix the patient's red blood cells, with the donor serum at 37^0C temperature

   Answer key: The answer is **A**
   Explanation: In the transfusion medicine, the two major transfusion reactions are: major incompatibility reactions, and minor incompatibility reactions. During the major incompatibility reactions, antibodies from the recipients will kill donor's red cells; so the technologist tests it by interacting the recipient's serum with the donor's red cells agglutination reactions at room temperature. On the other hand, in the minor incompatibility reactions, the donor's antibodies destroy the recipient's red blood cells. And to diagnose it, the laboratory technologist tests it by interacting the recipient's red cells with the donor's serum agglutination reactions at room temperature.

9. A patient in gastroenterology center was allowed to ingest ^{14}C radio-labeled urea. The carbon dioxide released by urease enzyme of the suspected pathogenic bacteria was detected in the patient's breath using a mass spectrometer.

   What is the most likely bacterium diagnosed by the test method?
   (A) Campylobacters jejuni
   (B) Klebsiellae pneumonia
   (C) Helicobacter pylori
   (D) Pseudomonas aeruginosa

Answer key: The answer is **C**
Explanation: In this scenario, urease breath test used as the screening tests for *H. pylori.* This bacterium is known for causing inflammation, gastritis, peptic ulcers, and gastric cancer. The organism produces urease enzyme that is used as one of the diagnostic biochemical test. This enzyme breaks urea into carbon dioxide and ammonia. The produced carbon dioxide can be detected and used as diagnostic if the urea is radio-labeled. The ^{14}C radio-labeled urea is specifically used to differentiate microbial urease enzyme from carbon dioxide produced during respiration.

10. A mother brought an eight-month-old infant to a pediatric OPD with symptoms of teeth and bone malformation, and widespread desquamating maculopapular rash. The physician suspected syphilis and requested for serological test. The result showed positive for *Treponema pallidum*.

    What is the most likely mode of transmission for the pathogen?

    (A) Congenital
    (B) Mosquito bites
    (C) Aerosol inhalation
    (D) Fecal-oral route

Answer key: The answer is **A**

Explanation: In this scenario, *Treponema pallidum* is a well known etiological agent for congenital syphilis. The pathogen can be transmitted by sexual contact or congenitally. The probability of getting congenital infection is high if the mother of the infant has history of syphilis case. *Treponema pallidum* has the ability to cross placenta and infect the fetus. After the birth of the infant, the bacteria caused teeth and bone malformation. Whereas, the other modes of transmission listed in the options are not known means for *T. pallidum* transmission.

11. A 26-year-old male patient came to a health center with complaints of high grade fever, arthralgia, shivering and headache. A laboratory technologist processed and examined the blood film using an oil immersion objective and found small rings and some double chromatin dots on the rings. The technologist also observed accole forms of rings lying on the red blood cell membranes.

    What is the most likely plasmodium species seen under the microscope?

    (A) *Plasmodium vivax*
    (B) *Plasmodium ovale*
    (C) *Plasmodium malariae*
    (D) *Plasmodium falciparum*

Answer key: The answer is **D**

Explanation: Among different species of plasmodium, *P. falciparum* is the most frequently reported malaria case. This parasite can be diagnosed using Romanowsky stained blood film. In the stained blood film: trophozoites, schizonts, and gametocytes stage of the parasite can be observed. Typical differentiating features of the *P. falciparum* trophozoites stage from other malaria species are having small rings, double chromatin dots on the rings, having accole forms, and double infection of a single red blood cell (See the picture below).

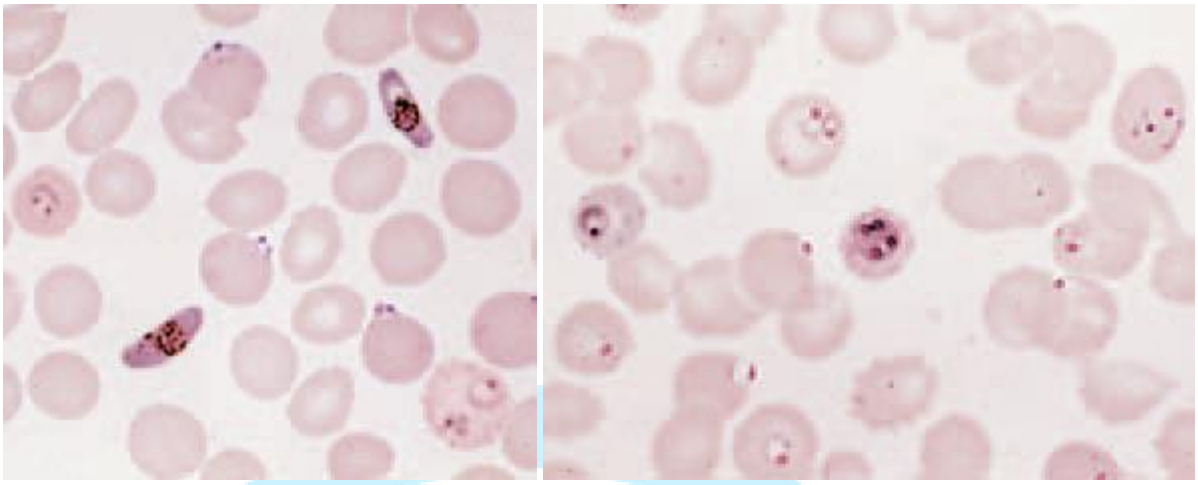

Figure1. *Plasmodium falciparum* trophozoites stage having small rings with double chromatin dots on the rings and accole forms (Source: Cheesbrough, 2009).

12. Smoking cessation programs, focused on individuals, provide an excellent example of a high-risk strategy and are appropriate since most smokers wish to abandon the habit. Thus, individual smokers and the concerned physicians are usually motivated. Such programs are more likely to be effective when complemented by population approaches to tobacco control.

    What is the most likely level of disease prevention to be considered in this intervention?

    (A) Primordial prevention
    (B) Primary prevention
    (C) Secondary prevention
    (D) Tertiary prevention

Answer key: The answer is **B**

Explanation: This question asks about level of preventions corresponding to different phases of disease development. Among the existing level of prevention, primordial and primary prevention mostly contribute to the health and well-being of the whole population. The question specifically asks about prevention of smoking which is a known risk of diseases. The purpose of primary prevention is to limit the incidence of a disease by controlling causes and risk of factors. Therefore, primary prevention is used for such specific risk factors.

13. A senior laboratory microbiologist, who has been serving in a microbiology laboratory for the last six years, carries out his duty according to professional standards and requirements. In addition, the microbiologist strives to strengthen the professional association and tries to promote the advancement of laboratory tests especially in the area of microbiology.

    What is the most appropriate type of responsibility that concerns this microbiologist?

    (A) Duty to self
    (B) Duty to the patient
    (C) Duty to the profession
    (D) Duty to the environment

Answer key: The answer is **C**

Explanation: Medical laboratory professionals have various duties and obligation mentioned in Ethiopian Medical Laboratory Association (EMLA) code of ethics booklet. The duty to the profession (option C) can be expressed through: promoting the image and status of the profession by maintaining high standards in the professional practice; using standard of Operating procedure (SOP) for routine activity; and actively participating in professional matters through membership of EMLA. On the other hand, duty to self (option A) is professional commitment to self growth, and engagement of Continuous professional development. In the same manner, duty to patient (option B) explains about duty to ensure the best interests or well-being of patients as a primary professional duty. Duty to environment (option D) explains about the duty to protect environment through proper waste management.

14. A laboratory planned to compare the efficacy of drug 'A' with the efficacy of drug 'B' on randomly selected 100 study subjects. Then, the technologist assigned the study subjects in to two independent groups randomly and treated them with either of the two drugs and followed their progress over certain period of time to see the outcome.

    What is the most likely study design used to identify the efficacious drug in this case?
    (A) Cohort study design
    (B) Case control study design
    (C) Experimental study design
    (D) Cross-sectional study design

Answer key: The answer is **C**
Explanation: In the experimental study design, the researcher is able to manipulate the exposure status to the study participants. In the scenario, the laboratory technologist wants to know the efficacy of drug 'A' and 'B'. So the technologist assigned the participants in to two groups and provided the drug for the two groups which shows the manipulation of the researcher on the exposure status of the participants. The other options are completely observational type that means the researcher simply observes the participants without any manipulation on the exposure assignment.

15. A male laboratory technologist working in a health center wanted to have a discussion with the director about the benefit he should get for his extra working hours including getting incentives and promotion. However, the technologist couldn't get the expected incentives and promotion due to the unwillingness of the director for discussion. This situation created a conflict between them and affected the performance of the health centre.

    What is the most likely conflict management strategy exercised in this case?
    (A) Lose-lose
    (B) Lose-win
    (C) Win-win
    (D) No-win no-loss

Answer key: The answer is **A**

Explanation: In conflict situations, individuals can either suppress conflict or engage in activity, which will lead to its resolution. Behaviors directed toward the resolution of conflict can be characterized by three different conflict resolution strategies, i.e. win- lose, lose- lose, and win - win. Basically, Lose –Lose conflict resolution strategy is an undesirable exercise as most people do not intentionally want to forfeit their interests. However, it becomes an option when other strategies do not work well or when conflicts are not managed on time. In this scenario, the director was not willing for discussion, and the technologist could not get incentives and promotion. So, it was a failure for the director as the performance of the health centre.

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