Component I: **CORE**

Module 8: **Specimen Handling**

Purpose: **To prepare the phlebotomy learner with information that will expand their skills within the clinical laboratory.**

Suggested Time Frame: **3 hours**

Objectives: **Upon completion of this module, the learner will be able to:**

1. Explain the basic knowledge and skills necessary to handle specimens.
2. Discuss knowledge about central specimen processing.
3. Describe how to appropriately centrifuge and aliquot blood specimens.
4. Explain how to process and transport blood specimens for testing at reference laboratories.

Resources:

References:

Davis, Bonnie K. (2002). Phlebotomy: A Customer Service Approach. Albany, NY: Delmar, a division of Thompson Learning, Inc.

Garza, Diana & Becan-McBride, Kathleen (2002). Phlebotomy Handbook: Blood Collection Essentials. Upper Saddle, New Jersey: Prentice Hall.

Hoeltke, Lynn (2000). The Complete Textbook of Phlebotomy, 2nd edition. Albany, NY: Delmar, a division of Thompson Learning, Inc.

McCall, Ruth E. & Tankersley, Cathee M. (1998). Phlebotomy Essentials. Philadelphia, Pennsylvania: Lippincott, Williams, & Wilkins.

Component I: **CORE**

Module 8: **Specimen Handling**

Topic 1: **Handling of Specimens**

Purpose: **To provide the phlebotomy learner with the basic knowledge and skills to handle specimens**

Suggested Time Frame: **1 hour**

Objectives: **Upon completion of this topic, the learner will be able to:**

1. Define the key terms.
2. Describe the importance of proper specimen handling
3. List factors that affect specimen quality.
4. Identify factors that affect personnel safety.

Vocabulary:

Glycolic Action	Axilla	
Renin	NAACLS	Pneumatic tube
Catecholamine	Agglutinins	Cryoglobulin
Cryofibrinogen	Bilirubin	Carotene
Red cell folate	Urine porphyrins	

References:

Davis, Bonnie K. (2002). Phlebotomy: A Customer Service Approach. Albany, NY: Delmar, a division of Thompson Learning, Inc.

Garza, Diana & Becan-McBride, Kathleen (2002). Phlebotomy Handbook: Blood Collection Essentials. Upper Saddle, New Jersey: Prentice Hall.

McCall, Ruth E. & Tankersley, Cathee M. (1998). Phlebotomy Essentials. Philadelphia, Pennsylvania: Lippincott, Williams, & Wilkins.

Objectives and Content	Recommended Teaching Strategies/Evaluation
1. Define the key terms. A. Review the terms listed in the vocabulary section B. Spell the listed terms accurately C. Pronounce the terms correctly D. Use the terms in their proper context	Lecture
2. Describe the importance of proper specimen handling. A. Proper handling of specimens throughout the collection process, including transportation and processing is important for maintaining specimen integrity. B. Proper handling protects the phlebotomist and others from accidental exposure to potentially infectious substances. C. Transportation or shipping of "Infectious Substances" 1. Infectious substances are defined as "substances known to contain, or reasonably expected to contain, pathogens" a. Examples: bacteria, viruses, rickettsia, parasites, and fungi or recombinant microorganisms b. Diagnostic specimens (any human or animal material such as excretions, secretions, blood, blood components, tissue, and tissue fluids.) 2. Require specific labeling and handling. 3. Packing must include a watertight primary receptacle (specimen containers) and a watertight outer package and an absorbent material between primary and secondary containers. All outer packages must be marked with "infectious substance" labels.	Lecture
3. List the factors that affect the specimen quality. A. Excessive agitation 1. Can cause hemolysis. 2. Care should be taken to reduce agitation during transport. B. Proper temperature control 1. Preserves the quality and integrity of the specimens during transport. 2. Chilling and refrigeration a. Can stop the metabolic process or slow the process and preserve the analytes after the specimen is drawn. b. Methods i. **DO**: Completely immerse specimen in a slurry of crushed ice and water.	Lecture

Objectives and Content	Recommended Teaching Strategies/Evaluation
ii. **DO NOT**: Use large cubes of ice without water as it prevents adequate cooling of the entire specimen. Placing it in contact with a solid piece of ice can cause parts of the specimen to freeze, resulting in hemolysis and possible breakdown of analytes. • Blood gases • Ammonia • Lactic Acid • Renin • Catecholamine • Parathyroid hormone 3. At or near body temperature (37° C) a. Some analytes will be preserved if some specimen is transported at or near body temperature. b. Methods: i. Heated sand ii. Heel warmers iii. Axilla C. Light sensitivity 1. Test components are broken down in the presence of light, causing false values for erroneous results. 2. Specimens can be easily protected from light by: a. Wrapping them in aluminum foil b. Using light-inhibiting amber-colored containers for the collection and/or transport. 3. Examples: a. Infant bilirubin b. Vitamin B12 c. Carotene d. Red cell folate e. Urine porphyrins D. Delays in the preanalytic process 1. Transportation to lab within 45 minutes 2. Centrifugation within 1 hour of collection 3. Consequences a. Delay during specimen transport can cause erroneous test results due to the breaking down of test components. b. Glycolytic action from the blood cells interferes in the analysis of various chemicals, such as glucose, calcitonin,	

Objectives and Content	Recommended Teaching Strategies/Evaluation
aldosterone, phosphorus, and enzymes. c. Blood needs to be transferred to culture media to optimize the recovery rate. d. Urine specimens and body fluids need to be processed as soon as possible to minimize the contamination rate and reflect the true infection status. e. Tissue samples: maintain specimen integrity by following the processing procedure.	
4. Factors that affect the personnel safety. A. Transporting specimens in an upright fashion to: 1. Avoid breakage 2. Aid in clot formation 3. Keep blood off the stopper, which could lead to aerosols when open. B. Avoid a leaky specimen 1. Examine specimen to determine proper closure. 2. Ensure specimens for proper transport. 3. For pneumatic tube systems, specimens should be protected from shock and sealed in zipper-type bags to contain spills.	Lecture

Component I: **CORE**

Module 8: **Specimen Handling**

Topic 2: **Central Processing**

Purpose: **To provide the phlebotomy learner with background knowledge about specimen processing.**

Suggested time frame: **1 hour**

Objectives: **Upon completion of this topic, the learner will be able to:**

1. Define key terms
2. Describe the OSHA recommended protective equipment for handling specimens.
3. Describe the function of specimen processing.
4. Explain the different requirements for processing plasma specimens and serum specimens.
5. List the special precautions for processing specimens.

Vocabulary:

Aliquot tube

References:

Garza, Diana & Becan-McBride, Kathleen (2002). Phlebotomy Handbook: Blood Collection Essentials. Upper Saddle, New Jersey: Prentice Hall.

Hoeltke, Lynn (2000). The Complete Textbook of Phlebotomy, 2nd edition. Albany, NY: Delmar, a division of Thompson Learning, Inc.

McCall, Ruth E. & Tankersley, Cathee M. (1998). Phlebotomy Essentials. Philadelphia, Pennsylvania: Lippincott, Williams, & Wilkins.

Objectives and Content	Recommended Teaching Strategies/Evaluation
1. Define the key terms. A. Review the terms listed in the vocabulary section B. Spell the listed terms accurately C. Pronounce the terms correctly D. Use the terms in their proper context	Lecture
2. Describe the OSHA recommended protective equipment for handling specimens. A. Wear protective equipment when processing specimens. 1. Gloves 2. Fully buttoned lab coats or aprons 3. Protective face gear a. Mask b. Goggles with side shields c. Chin length face shields d. Desk-top shields B. Use proper techniques to avoid creating aerosol & splashing.	Lecture Demonstration of proper techniques (gauze, shield, hood)
3. Describe the function of specimen processing. A. Definition: a specific area where all specimens are received, triage (prioritized) and prepared for testing. B. Function 1. Specimens are identified, logged (accessioned), and sorted by department and type of processing required. 2. Specimens not requiring centrifugation, such as urine and hematology specimens, are distributed to the proper department for testing. 3. Specimens for tests requiring serum or plasma are centrifuged. a. Placed in aliquot tubes, if necessary b. Left in original serum/plasma separated tubes for direct tube sampling whenever possible. c. They are then distributed to the proper department for testing.	Lecture
4. Explain the different requirements for processing plasma specimens and serum specimens. A. Plasma specimens 1. Are collected in tubes containing anticoagulants 2. May be centrifuged immediately. B. Serum specimens 1. Must be completely clotted prior to centrifugation. Clotting normally takes 30 to 45	Lecture

Objectives and Content	Recommended Teaching Strategies/Evaluation
minutes at room temperature. a. Serum from incompletely clotted blood may clot during testing and interfere with test performance. b. Do not centrifuge specimens that are partially clotted. 2. Specimens from patients on anticoagulant medication may take longer to, or may never, clot. 3. Specimens from patients with high white blood counts may take longer to clot. 4. Chilled specimens will take longer to clot. 5. Serum separator tubes and other tubes containing clot-activating glass particles usually clot within 15 minutes.	
5. List the special precautions for processing specimens. A. The maximum time limit for separating serum and plasma from cells is 1 hour from the time of collection. Less time is recommended for certain specimens such as potassium and cortisol. B. Specimens that are drawn in separator tubes. 1. Blood in serum separator must be allowed to clot before centrifugation. 2. After centrifugation, the separator gel will prevent glycolysis. C. Based on facility protocol, specimens that are drawn off-site and cannot reach their destination within the allotted time period, 1. Should be allowed to clot. 2. After clotting, the specimens should be centrifuged and separated. 3. The serum/plasma is transferred to a suitable container for transport. D. Some anticoagulants and tube preservatives can preserve the specimens for a longer period than the above guidelines. For example: specimens for glucose determination drawn in sodium fluoride tubes are stable for 24 hours at room temperature and up to 48 hours when refrigerated at 2° to 8° C. E. Hematology tests drawn in lavender (EDTA) stopper tubes are performed on whole blood and should never be centrifuged. 1. EDTA specimens are stable for 24 hours. 2. Blood smears from EDTA specimen must be made within 1 hour of collection to preserve the integrity of the blood cells and prevent artifact formation due to prolonged contact with anticoagulant.	Lecture

Objectives and Content	Recommended Teaching Strategies/Evaluation
F. Specimens should be stored covered and refrigerated to avoid evaporation.	

Component I: **CORE**

Module 8: **Specimen Handling**

Topic 3: **Centrifugation & Aliquoting Blood Specimens**

Purpose: **To provide the phlebotomy learner with information necessary to appropriately centrifuge and aliquot blood specimens.**

Suggested time frame: **1 hour**

Objectives: **Upon completion of this topic, the learner will be able to:**

1. Define key terms.
2. Describe the process of centrifugation.
3. Explain the proper procedure for specimen tube stopper removal following centrifugation.
4. Describe aliquoting of blood specimens.
5. List the criteria for quality specimens.
6. List the criteria for specimen rejection.

Vocabulary:

References:

Fremgen, Bonnie & Blume, Wendy (2001). Phlebotomy Basics with other Laboratory Techniques. Upper Saddle, New Jersey: Prentice Hall.

Garza, Diana & Becan-McBride, Kathleen (2002). Phlebotomy Handbook: Blood Collection Essentials. Upper Saddle, New Jersey: Prentice Hall.

Hoeltke, Lynn (2000). The Complete Textbook of Phlebotomy, 2nd edition. Albany, NY: Delmar, a division of Thompson Learning, Inc.

McCall, Ruth E. & Tankersley, Cathee M. (1998). Phlebotomy Essentials. Philadelphia, Pennsylvania: Lippincott, Williams, & Wilkins.

Objectives and Content	Recommended Teaching Strategies/Evaluation
1. Define the key terms. A. Review the terms listed in the vocabulary section B. Spell the listed terms accurately C. Pronounce the terms correctly D. Use the terms in their proper context	Lecture
2. Describe the process of centrifugation. A. A machine called "centrifuge" spins the blood at high revolutions per minute (rpm). 1. The centrifugal force that is created causes the cells and plasma/serum to separate. 2. Centrifuge lid closed during operation 3. The lid should not be opened until the machine has stopped without using the brake. B. Tubes awaiting centrifuging must have the stopper intact; removal can result in: 1. Inaccurate results in tests such as: a. Changes in pH (increase) b. Loss of CO_2 c. Changes in acid phosphatase level 2. Evaporation leads to inaccurate results due to concentration of analytes. 3. Contamination from outside the tube a. Sweat interferes with electrolyte results. b. Powder from gloves may interfere with calcium determinations (some powders contain calcium). C. Balance blood specimen properly in the centrifuge prior to centrifugation. 1. Equal-sized tubes with equal volumes 2. Unbalanced centrifuge may break tubes D. Ideally, centrifuge each specimen only once. 1. Repeated centrifugation may cause hemolysis and analyte deterioration. 2. The volume ratio of serum or plasma to cells will change after the liquid has been removed.	Lecture Demonstration with equipment Centrifuge Balancing - Appendix 8.1 Separator Gel Tubes - Centrifugation Process - Appendix 8.2
3. Explain the proper procedure for specimen tube stopper removal following centrifugation. A. Stoppers can be removed using commercially available stopper removal devices B. Stopper can be removed manually by covering the stopper with gauze or tissue paper large enough to catch any aerosol that may be released. C. The stopper should be pulled straight up and off. Never "pop" the stoppers off. D. Evacuated tubes called "Hemogard"(Becton, Dickinson,	Lecture Demonstration

Objectives and Content	Recommended Teaching Strategies/Evaluation
Franklin Lakes, NJ) are specially designed with color-coded, hard plastic covers around the stopper to protect from splatters and aerosols	
4. Describe aliquoting of blood specimens. A. Definition of aliquoting: when one specimen is divided up into several smaller portions (aliquots) for simultaneous testing in different laboratory areas. B. Great care must be taken to match each specimen to the corresponding pre-labeled aliquot tube. C. Special care should be taken to minimize splashing, spraying, splattering and generating droplets from potentially infectious materials. D. Transfer of plasma and serum 1. Pouring specimen into aliquot tubes is not recommended. 2. Use disposable plastic pipets. Then dispose of the pipets into a biohazardous waste container. E. Cover or cap the tubes after the samples are transferred into the aliquot tubes.	Lecture Demonstration Return demonstration: stopper removal
5. List the criteria for quality specimens. A. Specimens submitted to the laboratory for testing must meet the minimum sample requirement or minimum volume. B. The degree of hemolysis should be considered depending on the test for which it is intended. C. Fasting vs. non-fasting samples are crucial for tests such as lipid profile and glucose level. D. Lipemic specimens can effect laboratory testing (refer to your institution laboratory guidelines.) E. Blood specimens should be fully clotted before they are centrifuged. F. Specimens requiring chilling should be centrifuged in a temperature controlled centrifuge, as the centrifuge will generate heat during operation.	Lecture
6. List the criteria for specimen rejection. A. Inadequate, inaccurate or missing specimen identification. B. Additive tubes containing an inadequate volume of blood. For example: partially filled coagulation tube C. Hemolyzed specimens may be rejected depending on the degree of hemolysis and analyte being tested. D. Wrong tube type example: a CBC collected in a red-top tube. E. Outdated or expired tube F. Improper mixing 1. A lavender-top drawn for a CBC that has clots	Lecture

Objectives and Content	Recommended Teaching Strategies/Evaluation
2. Hemolysis from shaking of tube instead of gentle inversion G. Contaminated specimen example: urine for bacterial culture and sensitivity collected in an unsterile container. H. Insufficient specimen, referred to as "quantity not sufficient (QNS), for the test ordered. I. Timed specimens collected at the wrong time 1. Hormone levels 2. Peak and trough drug levels 3. Glucose testing J. Failure to fast prior to blood collection Example: lipemic fasting glucose specimen.	

Component I: **CORE**

Module 8: **Specimen Handling**

Topic 4: **Reference Laboratories**

Purpose: **To provide the phlebotomy learner with the basic knowledge about processing and transporting blood specimens for testing at reference laboratories.**

Suggested time frame:

Objectives: **Upon completion of this topic, the learner will be able to:**

1. Define key terms.
2. Describe the importance of proper collection and handling of reference laboratory samples.
3. Describe the guidelines for proper collection and handling of reference laboratory samples.

Vocabulary:

References:

Fremgen, Bonnie & Blume, Wendy (2001). Phlebotomy Basics with other Laboratory Techniques. Upper Saddle, New Jersey: Prentice Hall.

Garza, Diana & Becan-McBride, Kathleen (2002). Phlebotomy Handbook: Blood Collection Essentials. Upper Saddle, New Jersey: Prentice Hall.

Hoeltke, Lynn (2000). The Complete Textbook of Phlebotomy, 2nd edition. Albany, NY: Delmar, a division of Thompson Learning, Inc.

McCall, Ruth E. & Tankersley, Cathee M. (1998). Phlebotomy Essentials. Philadelphia, Pennsylvania: Lippincott, Williams, & Wilkins.

Objectives and Content	Recommended Teaching Strategies/Evaluation
1. Define the key terms. A. Review the terms listed in the vocabulary section B. Spell the listed terms accurately C. Pronounce the terms correctly D. Use the terms in their proper context	Lecture
2. Describe the importance of proper collection and handling of reference laboratory samples. A. The quality of laboratory results depends on the proper collection and handling of the specimens. B. Proper identification of patient specimens is essential for good patient care, for both quality and safety reasons. All labels and request slips must include: 1. The name of the patient 2. Collections date 3. The origin (source) of the specimen C. In general, specimens should be refrigerated until placed in the courier box for transport to the reference laboratory. D. Specimens that are frozen must remain frozen until testing	Lecture
3. Describe the guidelines for proper collection and handling for reference laboratory samples. A. Guidelines for blood collection and separation. 1. Plasma samples: a. Draw sufficient amount of blood with the indicated anticoagulant to yield the necessary blood volume. b. Separate plasma as soon as possible by centrifugation. c. Transfer the plasma into plastic vials for transport. 2. Serum samples: a. Draw sufficient amount of blood to yield the necessary serum volume. b. Allow the blood to clot; time for clot formation may vary. i. Generally, complete clotting normally takes 30-45 minutes at room temperature. ii. Chilled specimens may take longer. iii. Clot activator tubes will take less time. c. Separate serum from clot by centrifugation.	Lecture

Objectives and Content	Recommended Teaching Strategies/Evaluation
d. Transfer serum into plastic vials for transport. e. Other types of serum samples i. Acute serum samples - collect specimens no more than 5-7 days after the onset of the illness. ii. Convalescent serum samples - collect specimens 14-21 days later in the same manner as the acute serum. 3. Whole blood samples a. Draw blood in color-coded tube containing the preservative or anticoagulant specified in the specimen requirements. b. Fill the tube to the required volume c. Invert the tube at least 5-6 times to facilitate mixing. d. Transfer the well-mixed whole blood into plastic vials for transport. e. Clearly identify the specimen and the anticoagulant on the vials. 4. Fasting samples - an overnight (12 hour) fast is required for most fasting specimens. B. Guidelines for non-blood specimen collection and handling. 1. CSF samples a. Samples should be transferred to leak-proof plastic vial for transport. b. Conventional CSF screw cap tubes generally leak and are not recommended. 2. Tissue samples a. Snap freeze a representative tissue fragment i. in liquid nitrogen (if available) ii. in a freezer (-20 degrees or colder) b. Place sample in a plastic container and pack on 5 lbs of dry ice (minimum). c. Ship specimen by overnight courier for delivery within 24 hours of the collection. 3. Urine samples a. Random urine i. Samples are collected by one of the following methods: • Clean void • Catheter • Ileal conduit	

Objectives and Content	Recommended Teaching Strategies/Evaluation
• Supra pubic needle aspirate from the bladder. ii. Transport samples immediately after collection. iii. Keep samples refrigerated if immediate transportation is not available. b. 24-hour urine samples i. Use the appropriate preservative (if needed) at the start of the collection. ii. Common types of preservatives: • 50% acetic acid • 6N hydrochloric acid (HCL) • Na_2CO_3 • Boric acid • Tolune • HNO_3 • Thymol iii. On the day of collection: • Discard the first morning urine void. • Begin the collection after the urine void. • Collect all urine for the next 24 hours so that the morning urine void on the second day is the final collection. iv. After collection: • Measure the total 24 hour urine volume. • Record the total volume of urine on the test requisition form. • Transfer the requested volume to leak-proof plastic tube for transport. • Store sample in refrigerator until transport is available. 4. Microbiology samples a. General guidelines for collection and transportation. i. Use sterile techniques to collect specimens.	

Objectives and Content	Recommended Teaching Strategies/Evaluation
ii. Samples should be kept in sterile leak-proof containers. iii. Samples should be stored at optimal temperature and transport media, if applicable, after collection. iv. Transport samples to the reference laboratory as soon as possible. v. Label samples with the name of the patient, collection date, and the source of the specimen. b. General guidelines for aerobic bacterial culture and smear. i. Acceptable specimens: • Respiratory: sputum, bronchial washing, tracheal aspirates, bronchial alveolar lavage, bronchial brushings, etc. • Urine • CSF and other body fluids • Tissue biopsies • Genital specimens • Stool • Wounds and drainage from various anatomic sites. ii. Samples should be transported with cold pack and within 24 hours of collection. iii. Blood culture • Use sterile technique to collect cultures. • Phlebotomy site must be properly cleansed prior to venipuncture. • A set of blood cultures consists of an aerobic bottle and an anaerobic bottle. • Inoculate the specified amount of blood into the bottles, swirl bottles gently to mix contents in bottles. • Keep bottles at 37 º C in	

Objectives and Content	Recommended Teaching Strategies/Evaluation
incubator until it is time to transport to laboratory. • Transport specimens at room temperature. (15 to 30 º C) c. General guidelines for bacterial susceptibility testing: i. Susceptibilities are done on organisms isolated from culture. ii. Isolates could be transported on agar plates or slants and parafilm wrapped around the paltes or tubes. iii. Specimens can be transported at ambient or refrigerated temperature, according to specimen requirements. d. General guidelines for anaerobic culture: i. Appropriate specimen sources are: • Deep wounds • Sterile fluids • Abscess material • Trans-tracheal aspirates • Tissue ii. Collect culture in an anaerobic culturette or anaerobic tube with an indicator. iii. Transport properly collected specimen at ambient temperature within 24 hours of collection. e. Fungal culture, identification and susceptibilities: i. Acceptable specimens • Respiratory tract samples (sputum, bronchial washing, trans-tracheal aspirate, bronchial alveolar lavage, brochial brushings) • Urine • CSF • Exudates • Abscess contents • Secretions • Vaginal material • Skin • Nails	

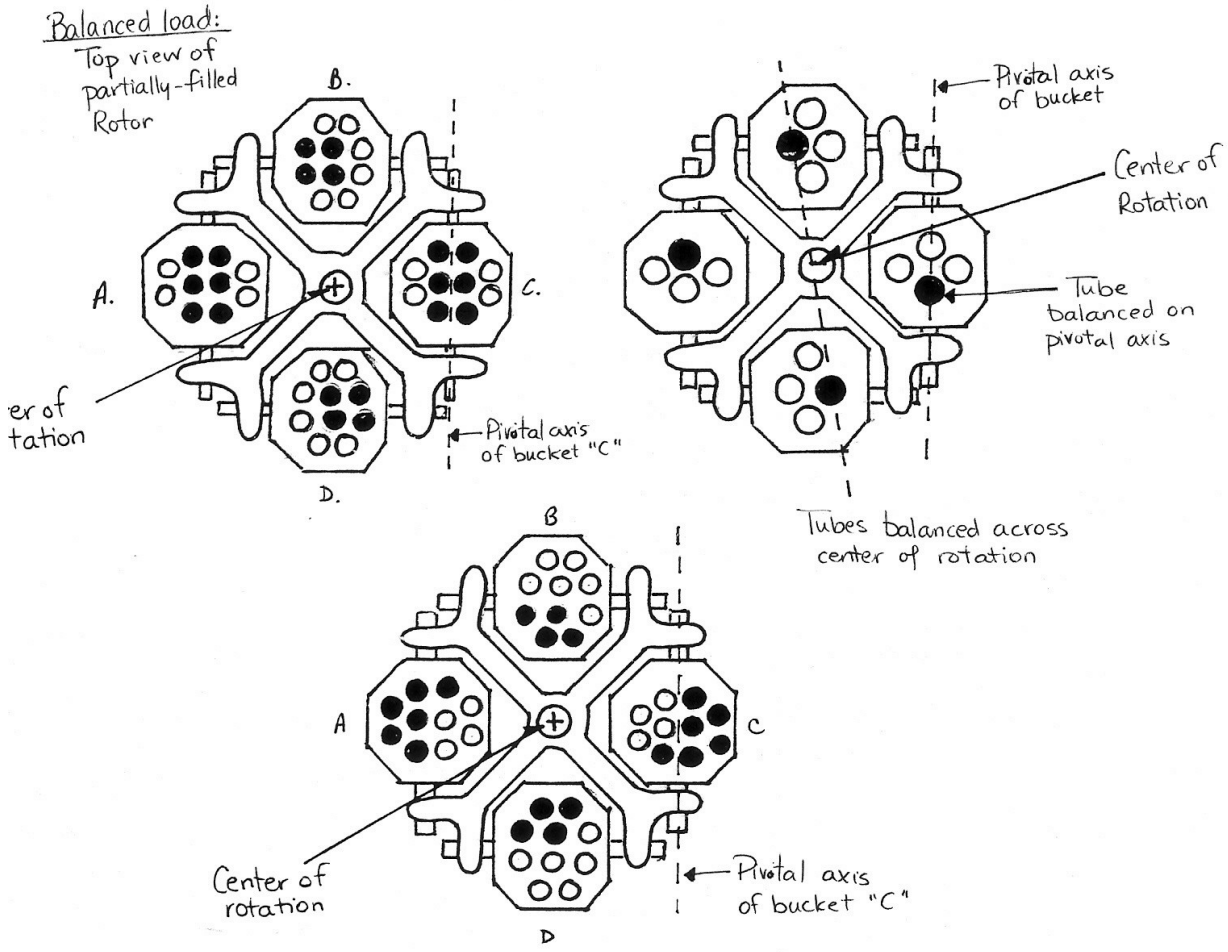
Objectives and Content	Recommended Teaching Strategies/Evaluation
• Hair • Tissue • Whole blood ii. Collect specimens in a sterile, leak-proof container. iii. Tissue specimens should be placed in a small amount of sterile saline to prevent dehydration. iv. Hold specimens at 4 º C and transport with cold pack. f. Mycobacteria culture, identification and susceptibilities. i. Acceptable specimens: • Bronchial washing • CSF • Gastric aspirate • Sputum • Urine • Bone marrow • Body fluids • Tissue biopsy • Lymph node • Skin lesion material ii. Use special precaution and handling during collection and transportation to prevent aerosol contamination. iii. Samples should be transported with cold pack within 24 hours after collection. g. Ova and parasite studies: i. A series of three specimens within a 10-day period is usually recommended. ii. Samples should be placed in modified PVA and 10% formalin preservatives immediately, within one hour maximum. iii. Commercially transport sets with preservatives are available. iv. Store and transport samples at room temperature. h. Virology: i. General guidelines for specimen collection: ii. Proper collection and	

Objectives and Content	Recommended Teaching Strategies/Evaluation
transportation of specimens is critically important to the success of any subsequent examination. • Use the correct specimen collection kit for the test methodology requested. • Avoid use of wooden swabs, which may inhibit chlamydia. • Avoid use of calcium alginate swab, which may inhibit herpes and chlamydia. • Collect specimens aseptically. • Collect the specimens from the appropriate site within several days of onset of clinical symptoms. • Preserve samples in proper transport after collection. • Transport samples according to specimen requirements and instructions. i. All microbiology samples should be packaged and transported as "Etiologic Agents". i. Infectious diagnostic specimens, those known or reasonably expected to contain infectious substances, are considered potentially more dangerous than routine diagnostic specimens. ii. All infectious diagnostic specimens must be packaged and sent in United Nations (UN) Certified packages, complying with IATA Packing Instruction 602 5. Cytology samples: General guidelines for specimen collection, preservation and fixation a. All endoscopic brushings are fixed immediately by immersion into 95 % isopropyl alcohol i. Bronchial ii. Esophageal	

Objectives and Content	Recommended Teaching Strategies/Evaluation
iii. Gastroc iv. Colon b. All gynecological pap smears are fixed immediately, before the slightest trace of drying occurs. i. By spray fixation ii. By immersion into 95% isopropyl alcohol c. All body fluids, urine, washings are submitted fresh without preservatives or fixative added. d. Fresh specimens must be refrigerated overnight if immediate delivery to the reference laboratory is not possible. e. Sputum should be submitted in 50% or 70% isopropyl alcohol. f. Samples must be properly labeled with patient identification, specimen type, collection date, and submitting physician name. g. Electronic or written orders must be submitted with the samples. h. Transport samples according to test requirements and instructions. 6. The range of temperature for storing and transporting specimens. a. Frozen (dry ice): -20 ºC or colder b. Cold pack (refrigerated: +2 to 8ºC c. Ambient: +18 to 26 ºC	

Centrifuge Balancing

2002 Phlebotomy Model Curriculum - Appendix 8.1



Separator Gel Tube: Centrifugation Process

2002 Phlebotomy Model Curriculum - Appendix 8.2