



Medical Laboratory

NTQF Level III

Learning guide #12

Unit of Competence:- Applying Infection Prevention Techniques and Workplace

Module Title: Applying Infection Prevention Techniques and Workplace

LG Code:- HLT MLT3 M02 LO5-LG12

TTLM Code:- HLT MLT3 TTLM 0919 v1

LO 7: Clean environmental surfaces



This learning guide is developed to provide you the necessary information regarding the following **content coverage and topics** –

Clean environmental surfaces

- wearing PPE during cleaning procedures
- removal of dust, dirt and physical debris from work surfaces
- cleaning work surfaces before and after any activity
- decontamination of equipments
- drying work surfaces before and after use
- replacing surface covers
- maintaining and storing Cleaning equipments

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you **will be able to** –

- worn personal protective clothing and equipment during cleaning procedures
- remove all dust, dirt and physical debris from work surfaces
- clean all work surfaces with a neutral detergent and warm water solution before and after each session or when visibly soiled
- decontaminate equipment requiring special processing in accordance with quality management systems to ensure full compliance with cleaning, disinfection and sterilization protocols
- all work surfaces are dried before and after use
- replace surface cover where applicable
- maintain and store cleaning equipment

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number **3 to 16**.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1” **in page 8**.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).



6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your trainer for further instructions or go back to Information sheet 1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Read the information written in the “Information Sheet 2”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
9. Accomplish the “Self-check 2” in page 16.
10. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-check 2).
11. Read the information written in the “Information Sheets 7”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
12. Accomplish the “Self-check 3” in page 19.
13. Ask your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-check 3).
14. If you earned a satisfactory evaluation proceed to “Operation Sheet 1” in page 21; However, if your rating is unsatisfactory, see your trainer for further instructions or go back to Information sheet 3.
15. Read the “Operation Sheet 1 and try to understand the procedures discussed.
16. Do the “LAP test” in page 22 (if you are ready). Request your trainer to evaluate your performance and outputs. Your trainer will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your trainer shall advice you on additional work. But if satisfactory you can proceed to Learning Guide #2.

Information Sheet-1	wearing PPE during cleaning procedures
----------------------------	--

- wearing PPE during cleaning procedures



7.1 Personal protective clothing and equipment during *cleaning procedures*

Wear **gloves** while cleaning instruments and equipment. (Thick household or utility gloves work well.) If torn or damaged, they should be discarded; otherwise they should be cleaned and left to dry at the end of the day for use the following day.

- Even when wearing heavy-duty utility gloves, care should be taken to prevent needle sticks or cuts when washing sharps.

Wear protective eyewear (**plastic visors, face shields, goggles or glasses**) and a plastic apron, if available, while cleaning instruments and equipment to minimize the risk of splashing contaminated fluids into the eyes and onto the body.

- In most cleaning situations, gloves and aprons are sufficient.
- If there is risk of splashing waste into the face or eyes, face shields should also be used.
- PPE can only work if it is intact and undamaged, is fit for the purpose and is worn correctly
- Make sure the PPE fits you securely.
- If you notice any damaged PPE, notify your supervisor immediately
- Be familiar with the type of clothing you are required to wear for the purpose; for example, should the apron be waterproof

Self-Check 1	Written Test
---------------------	---------------------

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. In most cleaning situations, gloves and aprons are sufficient. **True** | False



2. If there is risk of splashing waste into the face or eyes, face shields should also be used. **True** | False
3. PPE can only work if it is intact and undamaged, is fit for the purpose and is worn correctly **True** | False
4. In most cleaning situations make sure the PPE fits you securely. **True** | False
5. Be familiar with the type of clothing you are required to wear for the purpose; for example, should the apron be waterproof. **True** | False

Note: Satisfactory rating - 16 points Unsatisfactory - below 16 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____



2.

3.

4.

5.

6.



7. _____

Information Sheet 2

Removal of dust, dirt and physical debris

7.2 Removing dust, dirt and physical debris

Dust, soil and microbes on surfaces can all transmit infection. Cleaning removes foreign material and reduces the numbers of infectious agents and thus makes transmission of infectious organisms less likely

Floors

- Vacuum carpets and clean hard floors daily. Sweeping with an ordinary broom releases dust and bacteria into the air and so is not suitable.
- Wash buckets and mops after use with detergent and water and store them dry

Walls and fittings



- Generally, walls, blinds and curtains need less attention than floors unless they are in areas where soiling often happens (particularly if soiling is with blood or other body fluids). They should all be cleaned regularly and when visibly soiled. Curtains need changing regularly.

Self-Check 2	Written Test
---------------------	---------------------

Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page.

1. _____ is the removes foreign material and reduces the numbers of infectious agents and thus makes transmission of infectious organisms less likely
 - A. Disposing
 - B. Disinfecting
 - C. Sterilization
 - D. Cleaning**



Note: Satisfactory rating - 12 points Unsatisfactory – below 12 points

You can ask your trainer for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____

2. _____



3. _____

4. _____

5. _____

7.3 Cleaning

Cleaning is the process that physically removes soiling, including large numbers of microorganisms and the organic material on which they grow. This is usually carried out using neutral detergent and warm water. Or

Cleaning is the removal of visible soil, organic, and inorganic contamination from a device or surface, using either the physical action of scrubbing with a surfactant or detergent and water or an energy based process with appropriate chemical agents.

Routine environmental cleaning is required to minimize the number of microorganisms in the environment. A risk assessment must be undertaken to determine the method of decontamination required. Items not in close contact with patients or their immediate surroundings, e.g., floors, walls, ceiling, sinks and drains, present a minimal risk to patients and do not usually require disinfection. In most cases cleaning with a neutral detergent and warm water will be sufficient.

Disinfection: describes a process that eliminates **many** or all pathogenic microorganisms, except **bacterial** spores, on inanimate objects

Sterilization is a process that destroys or eliminates all forms of microbial life, including bacterial spores



Routine cleaning is the standard, everyday procedure for cleaning of clinical areas, including mopping of floors, damp dusting of surfaces with detergent, etc.

Terminal cleaning is performed when a patient with a transmissible illness is discharged (usually for isolation rooms), e.g. MRSA and other drug-resistant bacteria, tuberculosis, *Clostridium difficile*. The terminal cleaning process requires:

- Removal and discarding of all unused consumables and personal protective equipment (PPE) from the room
- Removal and laundering of all linen
- Removal and safe disposal of all waste
- Washing of all surfaces with detergent (including walls to a height of 2 metres)
- Wiping of all surfaces with an appropriate disinfectant (including bed frame, mattress and pillows). The IPC practitioner should be asked to advise on an appropriate disinfectant (usually alcohol-based or chlorine-based disinfectants at an appropriate strength or dilution). Remember that chlorine can be corrosive (causing damage to metal surfaces).
- Allowing all surfaces to dry before admission of a new patient.

Cleaning Methods

Dry Methods

- Dust attractant mop
- Dry dusting is not recommended as it may disperse dust and micro-organisms
- Sweeping brushes must not be used in clinical areas as they disperse dust and micro-organisms

Wet Methods

- Scrubbing
- Mopping
- Damp dusting

Once an item is washed it also needs to be rinsed and usually dried. Thorough rinsing with **clean** water removes any soap residue that can interfere with sterilization or HLD.3 After rinsing, items should be dried, especially if they will be sterilized or high-level disinfected using chemical disinfectants. Water remaining on the items (e.g., surgical instruments) dilutes the solution and may cause the process to fail

7.3.1 Purposes of cleaning

Cleaning in healthcare serves the dual functions of providing surface cleanliness and infection prevention and control

Cleaning holds special importance for hospitals and other healthcare facilities. The healthcare industry represents a significant population for health studies on cleaners because of the intensive and frequent cleaning with a wide range of cleaning and disinfecting products.

While the aesthetic benefits of cleaning are necessary for attracting and retaining patients, cleaning and disinfection play an essential role in healthcare settings by preventing healthcare-associated infections (HAIs)

Cleaning is important because:

- It is an effective way to reduce the number of microorganisms, especially endospores that cause tetanus, on soiled instruments and equipment.
- Neither sterilization nor high-level disinfection is effective without prior



A thorough washing with soap and clean water also physically removes organic material such as blood and body fluids.² This is important because dried organic material can entrap microorganisms, including endospores, in a residue that protects them against sterilization or disinfection. Organic matter also can partially inactivate some high-level disinfectants, rendering them less effective (AORN 1992; Rutala et al 1998).

Use of soap is important for effective cleaning because water alone will not remove protein, oils and grease (Nyström 1981). The use of hand (bar) or powdered soap is discouraged because the fatty acids in bar soap react with the minerals in hard water leaving a residue or scum (insoluble calcium salt), which is difficult to remove. Using liquid soap, if available, is preferable because it mixes more easily with water than bar or powdered soaps. In addition, liquid soap breaks up and dissolves or suspends grease, oil and other foreign matter in solution so that they can be removed more easily by the cleaning process.

7.3.2 Maintaining a clean work place

The importance of a clean workplace

The workplace environment influences employees' productivity, performance and well-being. No matter the industry, maintaining a clean workplace may help keep staff members safe, healthy and efficient. However, busy production schedules and increasing workloads may cause standards to dip.

Essential to safety

- When employees work in a messy environment, they may not notice all hazards, which increases the risk of an accident. According to the Occupational Safety and Health Administration (OSHA), an occupational hazard is anything in the workplace that may cause harm.

An occupational hazard is commonly caused by neglect on the part of the employer or a lack of awareness by workers. When the office or worksite isn't clean, it may increase the chance that a hazard will go unnoticed by a supervisor and staff members.

Employers may want to remember to keep the workplace free of debris and remind workers to put all equipment, such as personal protective equipment (PPE), in designated places to prevent an accident.

Crucial to health

- Flu season is rapidly approaching and workplaces may see an increase in the number of employees using sick days if they become ill. According to Kimberly-Clark Professional, germs can spread quickly through the workplace if supervisors and employees don't adequately sanitize their hands and their workspaces. Commonly used spaces, such as break rooms, can be hot spots for germs to accumulate.

Cleanliness is crucial in healthcare settings

- Controlling the spread of infections or viruses is vitally important in many different locations and settings – such as schools, leisure centres and the workplace – but it is even more crucial for healthcare providers. People visiting or receiving treatment in these environments are already vulnerable to the spread of infection, so making sure that effective cleaning regimes are in place for waiting rooms, corridors, reception areas and wards is key. A clean and welcoming environment is also important from an aesthetic point of view, engendering feelings of well-being and trust in people who may be anxious or unwell.



The steps for cleaning are:

- Wear gloves while cleaning instruments and equipment. (Thick household or utility gloves work well.)
- Wear protective eyewear (plastic visors, face shields, goggles, or glasses), protective shoes, and a plastic apron, if available, while cleaning instruments and equipment to minimize the risk of splashing contaminated fluids into the eyes and onto the body.
- Using a soft brush or old toothbrush, detergent, and water, scrub instruments and other items vigorously to completely remove all blood, other bodily fluids, tissue, and other foreign matter. Hold items under the surface of the water while scrubbing and cleaning to avoid splashing. Disassemble instruments and other items with multiple parts, and be sure to brush in the grooves, teeth, and joints of items where organic materials can collect and stick.
- Rinse items thoroughly with clean water to remove all detergent. Any detergent left on the items can reduce the effectiveness of further chemical processing.
- Allow items to air dry (or dry them with a clean towel).

The guidance goes on to say that the arrangements for cleaning should include:

- Clear definition of specific roles and responsibilities for cleaning
- Clear, agreed and available cleaning routines
- Sufficient resources dedicated to keeping the environment clean and fit for purpose
- Consultation with Infection Control Teams (ICTs) or equivalent local expertise on cleaning protocols when internal or external contracts are being prepared
- Details of how staff can request additional cleaning, both urgently and routinely

6 Reasons Why a Clean Workplace Means a Safe Workplace

A clean workplace means more than just having a sparkling, fresh building. A clean workplace also ensures the safety and health of employees and visitors. In 2012 alone, nearly 3 million nonfatal workplace injuries and illnesses were reported by private industry employers. Workplace injuries can be prevented by taking action to ensure a clean, safe work environment.

Here are six reasons why a clean workplace also means a safe workplace:

- 1. Clean, dry floors to prevent slips and falls.**
 - Maintaining clean, dry floors is essential for the prevention of slips and falls in the workplace.
- 2. Disinfectants prevent the spread of germs and illness, including the flu.**
 - Germs can easily spread throughout a workplace, particularly during flu season—but disinfecting surfaces and objects stop germs in their tracks.
- 3. Proper air filtration lowers employee exposure to hazardous substances.**
 - Dusts and vapors are hazardous substances that can create an unsafe environment for employees. Building ventilation is one important factor in reducing airborne transmission of respiratory infections and maintaining the health and productivity of workers. Regularly cleaning prevents them from becoming saturated, which could lead to potential microbial growth and odor concerns..
- 4. Clean light fixtures improve lighting efficiency.**



- Dirty light fixtures can reduce essential light levels, making it difficult and unsafe for employees to complete their daily tasks. Clean light fixtures significantly improve lighting efficiency in the workplace.
5. **Green cleaning products are safer for both your employees and the environment.**
 - Not all cleaning products are the same, and some are held to a higher standard than others. Products with third-party certifications, such as Green Seal or GREENGUARD, must meet specific standards and guidelines, which ensures they're safer for both people and the environment.
 6. **Proper disposal of waste and recyclable materials keeps work areas clutter-free.**
 - Allowing trash to pile up not only produces clutter, but it also presents a breeding ground for pests that pose a threat to your work environment. Placing “no-touch” wastebaskets in key locations throughout your facility ensures materials are disposed of and reduces the spread of germs. Recycling materials using clearly labeled waste receptacles also makes for a more sustainable environment.

7.3.3 General Principles of Cleaning

1. Ensure any electrical equipment to be cleaned is unplugged before commencing the decontamination cleaning. (Ensure cold chain for vaccine storage is maintained if fridge is unplugged).
2. Refer to the health and safety data sheets before using any product.
3. Display warning signs in the area, ensuring all signs are visible.
4. Wear suitable personal protective equipment. For most tasks gloves and aprons are sufficient. If there is the potential of a splash/irritation to the conjunctiva or mucous membranes face protection such as a mask and visor or goggles must be worn.
5. Prepare a fresh solution of cleaning agent or disinfectant as required.
6. Do not over-wet the floor.
7. Clean using lightly moistened clean disposable cloths (color coded as per National Hospital Office, below).The number of cloths required for cleaning per room depends on the level of activity being carried out e.g one for patient examination area, one for desk area, one for washbasin to prevent transfer of microorganism from one area to another.
8. Particular attention should be given to frequently touched surfaces and those most likely to be contaminated with blood or body fluids e.g., toilet seats/flush handles, sinks/taps and doorknobs.
9. Sodium hypochlorite may damage metal surfaces. Remove disinfectant solution with clean water and dry with a disposable paper towel.
10. Dry equipment with paper towel.
11. Change gloves and perform hand hygiene between different tasks.
12. Dispose of solution in the toilet or designated household sink. Do not discard into wash hand basins
13. Dispose of cleaning cloth.
14. All chemicals must be used in accordance with manufacturer's instructions to ensure correct dilution and usage. These should be stored in a locked cupboard/room safely away from public access.
15. All equipment should be left clean, dry and tidy in storage area after use.



16. Do not use abrasive cleaners (e.g., Vim® or Comet®) or steel wool because these products can scratch or pit metal or stainless steel. These scratches then become a nesting place for microorganisms, making cleaning more difficult, as well as increasing the chance of corrosion (rusting).

7.4 Cleaning agents

All work surfaces must be cleaned correctly both before and after each session and when visibly soiled. There are different procedures depending on the level of risk; that is, the probability and the consequences of contamination. The following outlines some of the cleaning products that are commonly used in cleaning different surfaces in different areas.

Detergents

- When dealing with non-critical areas, detergent and warm water is all that is needed to clean the work area.
- Typically, detergents with a neutral pH are used. This means that they are neither alkaline nor acidic. Both alkaline and acidic substances can damage the skin and eyes and will also reduce the life of equipment and furnishings.
- Detergents with a neutral pH are far gentler and they clean most work areas effectively.
- Always complete any documentation necessary to indicate that cleaning has been carried out

Sanitisers and disinfectants

- Stronger cleaning products can be used when appropriate. These vary in strength:
 - **Low-level** disinfectants are effective in killing some bacteria and viruses; these can be used in most domestic settings.
 - **Medium-level** disinfectants are effective at killing a range of bacteria and viruses; these should be used if clients have tuberculosis or where there is a high likelihood that tuberculoid-causing pathogens are present.

High-level disinfectants are effective in killing all pathogens except for bacterial spores; these disinfectants should be used when cleaning medical equipment



Self-Check 3	Written Test
---------------------	---------------------

Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page.

1. _____ is the removal of visible soil, organic, and inorganic contamination from a device or surface.
 - A. Disposing
 - B. Disinfecting
 - C. Sterilization
 - D. Cleaning**

2. **An occupational hazard** is commonly caused by
 - A. neglect on the part of the employer
 - B. lack of awareness by workers
 - C. When the office or worksite isn't clean
 - D. ALL**
 - E.



Note: Satisfactory rating - 09 points Unsatisfactory - below 09 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____



7.4. Instruments processing

One area of infection prevention and control (IPC) in health facilities is the proper processing of instruments and other items that have come in contact with patients' bodily fluids. It is critical in reducing the transmission of infections during clinical procedures and patient care.

Every item, whether it is soiled metal instruments or a pair of surgical gloves, requires special handling and processing in order to minimize the risk of accidental injury or blood or body fluid exposure to cleaning and housekeeping staff; provide a high-quality end product (i.e., sterile or high-level disinfected instruments and other items).

The basic IPC practices recommended to reduce disease transmission from soiled instruments and other reusable items are decontamination, cleaning, and either sterilization or HLD.

After completing an operation or invasive medical procedure, and while still wearing gloves, the health worker should

- Dispose of contaminated objects (gauze or cotton and other waste items) in a plastic bag or leak-proof, covered container.
- Next, disposable sharps (e.g., scalpel blades and suture needles) should be placed in a sharps container.
- Finally, all instruments and reusable items such as surgical gloves and suction cannulas, whether or not they were used in the operation, should be decontaminated by soaking for 10 minutes in a disinfectant (e.g., 0.5 percent chlorine solution).

Following decontamination

- The instruments and reusable items should be thoroughly cleaned with soap and water, completely rinsed, and dried.
- The surgical instruments and those items that come in contact with the bloodstream or that normally touch sterile tissue beneath the skin (critical items) should be sterilized to destroy all microorganisms including bacterial endospores.
 - When sterilization is not feasible or equipment is not available, however, HLD by boiling, steaming, or soaking in a chemical disinfectant is the only acceptable alternative.
- Instruments and other items that touch only mucous membranes or broken skin (semi-critical items), however, only need to be high-level disinfected

Important Definitions



Decontamination: This is a process that makes inanimate objects safer to be handled by staff before cleaning (i.e., inactivates HBV, HCV, and HIV, and reduces the number of other microorganisms but does not eliminate them).

Cleaning: A process that physically removes all visible dust, soil, blood, or other body fluids from inanimate objects as well as removing sufficient numbers of microorganisms to reduce risks for those who touch the skin or handle the object. It consists of thoroughly washing with soap or detergent and water, rinsing with clean water, and drying.

HLD: A process that eliminates all microorganisms except some bacterial endospores from inanimate objects by boiling, steaming, or using chemical disinfectants.

Sterilization: A process that eliminates all microorganisms (bacteria, viruses, fungi, and parasites) including bacterial endospores from inanimate objects by high-pressure steam (autoclave), dry heat (oven), chemical sterilants, or radiation

Chemical Disinfectants

Disinfectants are chemicals that destroy or inactivate microorganisms on inanimate objects, such as instruments and surfaces. Disinfectants are not meant to be used on the skin or mucous membranes. Many disinfectants are used alone or in combination (e.g., hydrogen peroxide and peracetic acid) in the health care setting. In most instances, a given product is designed for a specific purpose and is to be used in a certain manner. Therefore, users should read labels carefully to ensure the correct product is selected for the intended use and applied efficiently.

Decontamination

In instrument processing, decontamination is the first step in handling used instruments and gloves. Decontamination inactivates HBV, HCV, and HIV and reduces the number of microorganisms. It is one of the most highly effective IP measures that can minimize the risk of transmission of these viruses to health care workers, especially cleaning and housekeeping staff, when they handle soiled medical instruments, surgical gloves, or other items. The objective of decontamination is to protect individuals who handle surgical instruments and other items that have been in contact with blood or bodily fluids from serious diseases.

Before cleaning, all soiled surgical instruments, surgical gloves, and other items should be first decontaminated by placing them in a 0.5 percent chlorine solution for 10 minutes. Because of the potentially high load of microorganisms and/or other organic material (blood or other bodily fluids) on soiled items, using a 0.5 percent solution for decontamination

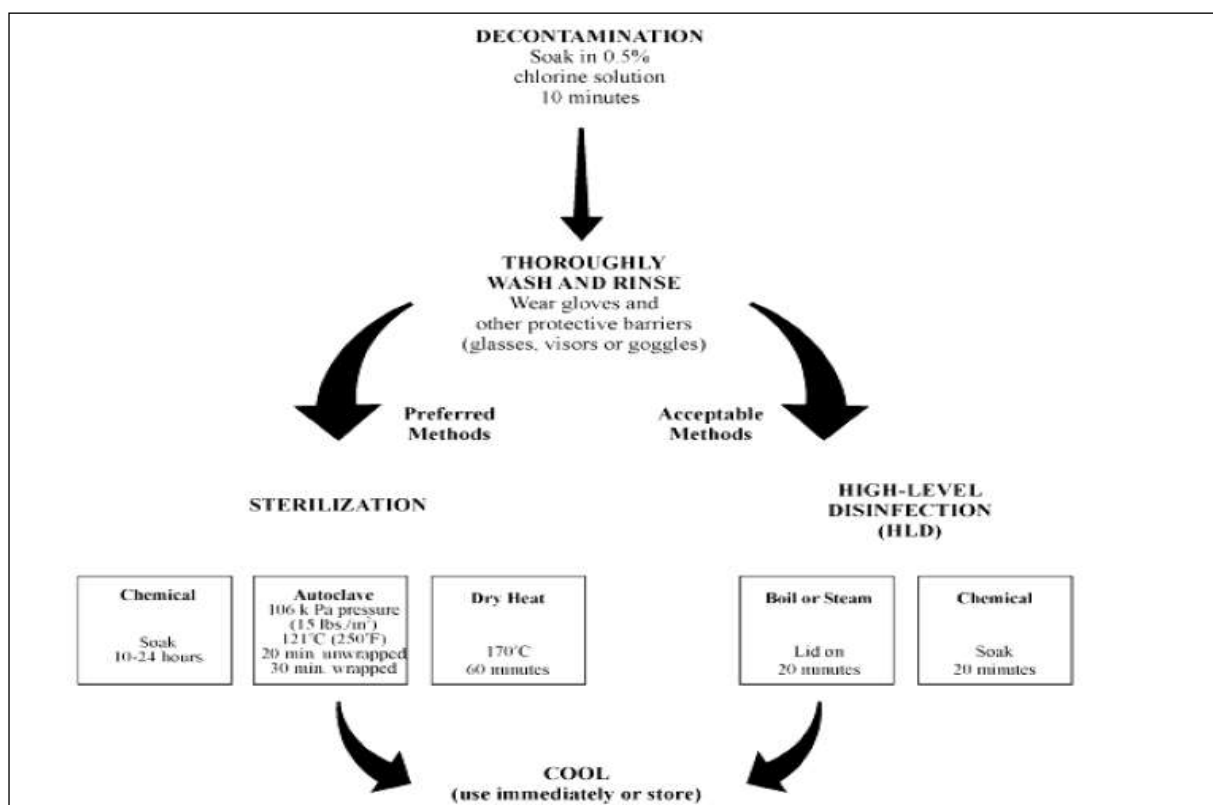
Decontaminating Used Instruments and Other Items

1. Place all instruments in a 0.5 percent chlorine solution for 10 minutes immediately after completing the procedure
2. Decontaminate any surfaces contaminated during the procedure by wiping them with a cloth soaked in a 0.5 percent chlorine solution.
3. Immerse gloved hands in a 0.5 percent chlorine solution.
4. Remove gloves by turning inside out. If disposing of gloves, place them in a leak-proof container or heavy-duty plastic container.
5. If reusing gloves, soak in a 0.5 percent chlorine solution for 10 minutes for decontamination.
6. Remove instruments from the 0.5 percent chlorine solution after 10 minutes and immediately rinse them with cool water to remove residual chlorine before being thoroughly cleaned.



7. Two buckets can be used in the procedure areas or operating rooms, one filled with 0.5 percent chlorine solution and one with water, so instruments can be placed in the water after 10 minutes to help prevent corrosion.
 - a. Use a plastic container for decontamination to help prevent:
 - i. Dulling of sharps (e.g., scissors) due to contact with metal containers
 - ii. Rusting of instruments

Key steps in processing instruments and other items



Cleaning

After decontamination, cleaning is the next step in instrument processing. Cleaning is a process of physically removing infectious agents and other organic matter on which they live and thrive. This process does not necessarily destroy infectious agents. This is important because dried organic material can entrap microorganisms, including endospores, in a residue that protects them against sterilization or disinfection. Cleaning is an essential prerequisite to ensure effective disinfection or sterilization. Neither sterilization nor HLD could be effective without prior cleaning

Recall the steps of cleaning from chapter six

Sterilization and Storage



Sterilization is the destruction of all microorganisms, including bacterial endospores. Sterilization in health facilities can be achieved by high-pressure steam (autoclaves), dry heat (oven), chemical sterilants (glutaraldehyde or formaldehyde solutions), or physical agents (radiation).

To be effective, sterilization requires time, contact, temperature, and, with steam sterilization, high pressure. Because sterilization is a process, not a single event, all components must be carried out correctly for sterilization to occur. The effectiveness of any method of sterilization is also dependent on the following four factors:

1. The type of microorganism present.
2. The number of microorganisms present.
3. The amount and type of organic material that protects the microorganisms. Blood or tissue remaining on poorly cleaned instruments acts as a shield to microorganisms during the sterilization process.
4. The number of cracks and crevices on an instrument that might harbor microorganisms.

Methods of Heat Sterilization

The most common and readily available sterilization methods are:

1. High-pressure steam sterilization (autoclaves)
2. Dry heat sterilization (oven)
3. Chemical sterilization

High-Pressure Steam Sterilization (Autoclaves)

High-pressure steam sterilization (autoclave) is an effective method of sterilization but is the most difficult to do correctly.

The temperature, pressure, and time combinations for steam sterilization are as follows:

- At a temperature of 121°C (250°F), pressure of 106 kPa (15 lb/in²) for 20 minutes for unwrapped items and 30 minutes for wrapped items.
- At a higher temperature of 132°C (270°F), pressure of 30 lb/in² for 15 minutes for wrapped items

Note: Pressure settings (kPa or lb/in²) may vary slightly depending on the sterilizer used. When possible, follow the manufacturer's recommendations.

The two reasons why steam sterilization is an effective sterilization are as follows:

- Saturated steam is an extremely effective carrier of thermal energy that makes it many times more effective in conveying the necessary energy to the items to be sterilized than dry air.
- Steam is an effective sterilant because any resistant, protective outer layer of the microorganisms can be softened by steam, allowing coagulation of the inner sensitive portion of the microorganisms.

Advantages:

- Most commonly used effective method of sterilization.
- Sterilization cycle time is shorter than with dry heat or chemical sterilants.

Limitations:

- Requires a continuous source of heat (wood fuel, kerosene, or electricity).



- Requires equipment (steam sterilizer) that must be expertly maintained to keep it in working condition.
- Requires strict adherence to time, temperature, and pressure settings.
- Difficult to produce dry packs because breaks in procedure are common (e.g., not allowing items to dry before removing, especially in hot, humid climates).
- Repeated sterilization cycles can cause pitting and dulling of cutting edges of instruments (i.e., scissors).
- Plastic items cannot withstand high temperatures.

Preparing Items for Steam Sterilization

All instruments and other items should be decontaminated and thoroughly cleaned and dried before being sterilized. All jointed instruments should be open (or in the unlocked position) and disassembled. Reusable cloth items should be laundered and dried prior to sterilization.

Packing and Wrapping

Wrapping items to be sterilized permits sterile items to be handled and stored without being contaminated. Materials used for wrappers should:

- Allow air removal and steam penetration
- Act as a barrier to microorganisms and fluids
- Resist tears and punctures and be free of holes
- Be inexpensive

Dry Heat Sterilization (Oven)

Dry heat sterilization is caused by hot air that destroys microorganisms through oxidation that causes slow destruction of the microorganisms' protein. Initially heat is absorbed by the exterior surface of an item and then passed to the next layer. Eventually, the entire object reaches the temperature needed for sterilization. Dry heat sterilization can be achieved with a simple oven as long as a thermometer is used to verify the temperature inside the oven.

Advantages:

- Effective method, as dry heat by conduction reaches all surfaces of instruments, even of instruments that cannot be disassembled
- Protective of sharps or instruments with a cutting edge (fewer problems with dulling of cutting edges)
- Leaves no chemical residue
- Eliminates “wet pack” problems in humid climates

Limitations:

Plastic and rubber items cannot be dry heat sterilized because temperatures used (160–170°C) are too high for these materials.

- Dry heat penetrates materials slowly and unevenly.
- It requires oven and continuous source of electricity.

Instructions for Dry Heat Oven

To ensure correct operation, consult specific operating instructions supplied by the oven's manufacturer.

- **Step 1:** Decontaminate, clean, and dry all instruments and other items to be sterilized.
- **Step 2:** If desired, wrap instruments in aluminum foil or place in a metal container with a tight-fitting, closed lid. Wrapping helps prevent recontamination prior to use. Hypodermic or suture needles should be placed in glass tubes with cotton stoppers.



- **Note:** When using dry heat to sterilize instruments wrapped in cloth, be sure that the temperature does not exceed 170°C/340°F.
- **Step 3:** Place loose (unwrapped) instruments in metal containers or on trays in the oven and heat to desired temperature.
- **Step 4:** After the desired temperature is reached, begin timing
 - **Note:** Use dry heat only for items that can withstand a temperature of 170°C (340°F). Needles and other instruments with cutting edges should be sterilized at lower temperatures (160°C [320°F]), because higher temperatures can destroy the sharpness of cutting edges.
 - Depending on the temperature selected, the total cycle time (preheating, sterilization time, and cool down) will range from about 2.5 hours at 170°C to more than 8 hours at 121°C.
- **Step 5:** After cooling, remove packs and/or metal containers and store. Loose items should be removed with sterile forceps/pickups and used immediately or placed in a sterile container with a tight-fitting lid.

Chemical Sterilization

Some high-level disinfectants will kill endospores after prolonged (10- to 24-hour) exposure. If objects need to be sterilized, but using high-pressure steam or dry heat sterilization would damage them or equipment is not available (or operational), they can be chemically sterilized. Common disinfectants that can be used for chemical sterilization include glutaraldehydes and formaldehyde. Sterilization takes place by soaking for at least 10 hours in 2 to 4 percent glutaraldehyde solution or at least 24 hours in 8 percent formaldehyde. Glutaraldehydes, such as Cidex, are often in short supply and very expensive, but they are the only practical sterilants for some instruments, such as laparoscopes, that cannot be heated. Both glutaraldehydes and formaldehyde require special handling and leave a residue on treated instruments; therefore, rinsing with sterile water is essential if the item must be kept sterile.

Advantages:

- Glutaraldehydes and formaldehyde solutions are not readily inactivated by organic materials.
- Both can be used for items that will not tolerate heat sterilization such as laparoscopes.
- Formaldehyde solutions can be used for up to 14 days (replace sooner if cloudy); some glutaraldehydes can be used for up to 28 days.

Limitations:

- Glutaraldehydes and formaldehyde are chemicals that cause skin irritation; therefore, all equipment soaked in either solution must be thoroughly rinsed with sterile water after soaking.

Storage of Sterile Instruments and Items

All sterile items should be stored appropriately to protect them from dust, dirt, moisture, animals, and insects. The storage area should be located next to or connected to where sterilization occurs and in a separate enclosed area with limited access that is used only to store sterile and clean patient care supplies.



Instructions for Storing Sterile Items

1. Keep the storage area clean, dry, dust-free, and lint-free.
2. Control temperature and humidity (approximate temperature 24°C and relative humidity less than 70 percent) when possible.
3. Packs and containers with sterile (or high-level disinfected) items should be stored 20 to 25 cm off the floor, 45 to 50 cm from the ceiling, and 15 to 20 cm from an outside wall.
4. Do not use cardboard boxes for storage. Cardboard boxes shed dust and debris and may harbor insects.
5. Date and rotate the supplies (first in/first out). This process serves as a reminder, but does not guarantee sterility of the packs.
6. Distribute sterile and high-level disinfected items from this area.

High-Level Disinfection and Storage

When sterilization equipment is either not available or not suitable, HLD is the only acceptable alternative method for the final processing of instruments. The HLD process destroys all microorganisms (including vegetative bacteria, tuberculosis, yeasts, and viruses) except some bacterial endospores.

HLD can be achieved by:

- Boiling in water
- Steaming (moist heat)
- Soaking instruments in chemical disinfectants (chemical disinfection)

Boiling

Boiling in water is an effective, practical way to high-level disinfect instruments and other items. Although boiling instruments in water for 20 minutes will kill all vegetative forms of bacteria, viruses (including HBV, HCV, and HIV), yeasts, and fungi, boiling will not reliably kill all endospores.

Steps for High-Level Disinfection by Boiling

- **Step 1:** Decontaminate and clean all instruments and other items to be high-level disinfected
- **Step 2:** If possible, completely immerse items in water. Adjust the water level so that there is at least 2.5 cm (1 inch) of water above the instruments. In addition, make sure all bowls and containers to be boiled are full of water. For example, empty bowls that turn bottom side up and float to the surface contain air pockets.
- **Step 3:** Close lid over pan and bring water to a gentle, rolling boil. (Boiling too vigorously wastes fuel, rapidly evaporates the water, and may damage delicate [or sharp] instruments or other items.) Hence, a gentle rolling boil is sufficient and will prevent instruments or other items from being bounced around and possibly damaged by striking other instruments or the side walls of the boiling pot.
- **Step 4:** Boil all items for 20 minutes. Start timing when the water begins to boil.



- **Step 5:** After boiling for 20 minutes, remove objects with previously high-level disinfected forceps. Never leave boiled instruments in water that has stopped boiling. As the water cools and steam condenses, air and dust particles are drawn down into the container and may contaminate those instruments.
- **Step 6:** Use instruments and other items immediately, or with high-level disinfected forceps or gloves, place objects in a high-level disinfected container with a tight-fitting cover. Once the instruments are dry, if any pooled water remains in the bottom of the container, remove the dry items and place them in another high-level disinfected container that is dry and can be tightly covered

Steaming

The best method for HLD of gloves and a useful method of HLD of cannulas used during MVA is to steam them in a steamer containing one to three tiers of gloves or cannulas.

Steps for High-Level Disinfection by Steaming

After instruments and other items have been decontaminated and thoroughly cleaned, they are ready for HLD by steaming.

- **Step 1:** Place instruments, plastic MVA cannulas, and other items in one of the steamer pans with holes in its bottom. To make removal from the pan easier, do not overfill the pan.
- **Step 2:** Repeat this process until up to three steamer pans have been filled. Stack the filled steamer pans on top of a bottom pan containing water for boiling. A second empty pan without holes should be placed on the counter next to the heat source.
 - **Remember:** Be sure there is sufficient water in the bottom pan for the entire 20 minutes of steaming.
- **Step 3:** Place a lid on the top pan and bring the water to a full rolling boil. (When water only simmers, very little steam is formed and the temperature may not get high enough to kill microorganisms.)
- **Step 4:** When steam begins to come out between the pans and the lid, start the timer or note the time on a clock and record the time in the HLD log.
- **Step 5:** Steam items for 20 minutes.
- **Step 6:** Remove the top steamer pan and put the lid on the pan that was below it (the pan now on top). Gently shake excess water from the pan just removed.
- **Step 7:** Put the pan that was just removed onto the empty pan (see Step 3). Repeat until all pans are restacked on this empty pan and the top pan is covered with the lid. (This step allows the items to cool and dry without becoming contaminated.)
- **Step 8:** Allow items to air dry in the steamer pans (one to two hours) before using.
- **Step 9:** Using a high-level disinfected forceps, transfer the dry items to a dry, high-level disinfected container with a tight-fitting cover. Instruments and other items can also be stored in the stacked and covered steamer pans as long as a bottom pan (no holes) is used.

Soaking Instruments in Chemical Disinfectants

Although a number of disinfectants are commercially available in most countries, four disinfectants—chlorine, glutaraldehydes, formaldehyde, and peroxide—are routinely used as high-level disinfectants. A high-level disinfectant should be selected for use based on the characteristics of the items to be disinfected, the physical area (i.e., is it well ventilated?), and the skills of personnel available to do the procedure.



HLD by chlorine solutions

- Prepare 0.1 percent chlorine solution using boiled water that has been filtered if the tap water is cloudy.
- Soak for 20 minutes.

Formaldehyde

- Use 8 percent formaldehyde, which is inexpensive and readily available.
- Soak for 20 minutes.

Hydrogen peroxide

- Use a 6 percent solution. The 3 percent hydrogen peroxide solutions used as antiseptics should not be used as a disinfectant.
- Soak for 20 minutes.

Glutaraldehydes

- Use a 2 to 4 percent solution.
- Soak for 20 minutes at 25°C.

Key Steps in Chemical High-Level Disinfection

- Decontaminate instruments and other items that may have been contaminated with blood and bodily fluids, and thoroughly clean and dry them before placing them in the disinfectant solution.
- Completely immerse all items in the high-level disinfectant.
- Soak for 20 minutes.
- Remove items using high-level disinfected or sterile forceps or gloves.
- Rinse well with boiled and filtered (if necessary) water three times and air dry
- Use promptly or store in a dry, high-level disinfected, covered container.

Self-Check 4	Written Test
---------------------	---------------------

Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page.

3. A process that makes inanimate objects safer to be handled is

Medical Laboratory Level III	Vision :01 Sep. 2019: Copyright Info/Author: Federal TVET Agency	Page 26 of 46
------------------------------	---	---------------



- A. Decontamination
B. Chlorination
C. Boiling
D. Incineration
4. Which of the following method of instrumental processing is used to eliminates all microorganisms including bacterial endospores from inanimate objects
A. HLD
B. Sterilization
C. Contamination
D. Decontamination
5. The effectiveness of any method of sterilization is also dependent on the following four factors:
A. The type of microorganism present.
B. The number of microorganisms present.
C. The amount and type of organic material that protects the microorganisms.
D. The number of cracks and crevices on an instrument
E. ALL
6. _____ is an effective method of sterilization but is the most difficult to do correctly
A. High-pressure steam sterilization
B. Dry Heat Sterilization
C. Chemical sterilization
D. Incineration
7. The first step in processing of instrument is
A. HLD
B. Sterilization
C. Contamination
D. Decontamination

Note: Satisfactory rating - 09 points Unsatisfactory - below 09 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions



Information Sheet 5	drying work surfaces
----------------------------	----------------------

2. _____

Self-Check 5	Written Test
---------------------	---------------------



Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page

Note: Satisfactory rating - 09 points Unsatisfactory - below 09 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions

3. _____



Information Sheet 6	replacing surface covers
----------------------------	---------------------------------

Self-Check 6	Written Test
---------------------	---------------------

Information Sheet 7	replacing surface covers



Self-Check 6	Written Test
---------------------	---------------------

Storage of Sterile Instruments and Items

All sterile items should be stored appropriately to protect them from dust, dirt, moisture, animals, and insects. The storage area should be located next to or connected to where sterilization occurs and in a separate enclosed area with limited access that is used only to store sterile and clean patient care supplies.

Instructions for Storing Sterile Items

1. Keep the storage area clean, dry, dust-free, and lint-free.
2. Control temperature and humidity (approximate temperature 24°C and relative humidity less than 70 percent) when possible.
3. Packs and containers with sterile (or high-level disinfected) items should be stored 20 to 25 cm off the floor, 45 to 50 cm from the ceiling, and 15 to 20 cm from an outside wall.
4. Do not use cardboard boxes for storage. Cardboard boxes shed dust and debris and may harbor insects.
5. Date and rotate the supplies (first in/first out). This process serves as a reminder, but does not guarantee sterility of the packs.
6. Distribute sterile and high-level disinfected items from this area.



SHELF LIFE

- The shelf life of an item (how long items can be considered sterile) after sterilization is event-related. An item remains sterile until something causes the package or container to become contaminate—time elapsed since sterilization is not the determining factor.
- To make sure items remain sterile until you need them, prevent events that can contaminate sterile packs, & protect them by placing them in plastic covers (thick polyethylene bags). An event can be a tear or worn area in the wrapping, the package becoming wet or anything else that will enable microorganism to enter the package or container.
- Before using any sterile item, look at the package to make sure the wrapper is intact and the seal unbroken and is clean and dry (as well as having not water stains).
- If the quality of wrapping cloth is poor and plastic bags are not available, limiting the shelf life is a reasonable option to ensure the sterility of the instruments

Self-Check 7	Written Test
---------------------	---------------------

Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page

1. Keep the storage area clean, dry, dust-free, and lint-free.
2. Control temperature and humidity (approximate temperature 24°C and relative humidity less than 70 percent) when possible.
3. Do not use cardboard boxes for storage.



Operation Sheet 1	Decontaminating Used Instruments and Other Items
--------------------------	---

1. Place all instruments in a 0.5 percent chlorine solution for 10 minutes immediately after completing the procedure
2. Decontaminate any surfaces contaminated during the procedure by wiping them with a cloth soaked in a 0.5 percent chlorine solution.



3. Immerse gloved hands in a 0.5 percent chlorine solution.
4. Remove gloves by turning inside out. If disposing of gloves, place them in a leak-proof container or heavy-duty plastic container.
5. If reusing gloves, soak in a 0.5 percent chlorine solution for 10 minutes for decontamination.
6. Remove instruments from the 0.5 percent chlorine solution after 10 minutes and immediately rinse them with cool water to remove residual chlorine before being thoroughly cleaned.
7. Two buckets can be used in the procedure areas or operating rooms, one filled with 0.5 percent chlorine solution and one with water, so instruments can be placed in the water after 10 minutes to help prevent corrosion.
8. Use a plastic container for decontamination to help prevent:
 - i. Dulling of sharps (e.g., scissors) due to contact with metal containers
 - ii. Rusting of instruments

LAP Test	Practical Demonstration
-----------------	--------------------------------

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 5min.

Task 1: Perform Decontamination



Operation Sheet 2	Instructions for Dry Heat Oven
--------------------------	---------------------------------------

Step 1: Decontaminate, clean, and dry all instruments and other items to be sterilized.

Step 2: If desired, wrap instruments in aluminum foil or place in a metal container with a tight-fitting, closed lid. Wrapping helps prevent recontamination prior to use. Hypodermic or suture needles should be placed in glass tubes with cotton stoppers.

- **Note:** When using dry heat to sterilize instruments wrapped in cloth, be sure that the temperature does not exceed 170°C/340°F.

Step 3: Place loose (unwrapped) instruments in metal containers or on trays in the oven and heat to desired temperature.

Step 4: After the desired temperature is reached, begin timing



- **Note:** Use dry heat only for items that can withstand a temperature of 170°C (340°F). Needles and other instruments with cutting edges should be sterilized at lower temperatures (160°C [320°F]), because higher temperatures can destroy the sharpness of cutting edges.
- Depending on the temperature selected, the total cycle time (preheating, sterilization time, and cool down) will range from about 2.5 hours at 170°C to more than 8 hours at 121°C.

Step 5: After cooling, remove packs and/or metal containers and store. Loose items should be removed with sterile forceps/pickups and used immediately or placed in a sterile container with a tight-fitting lid

LAP Test	Practical Demonstration
-----------------	--------------------------------

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 5min.

Task 1: Perform dry heat sterilization



Operation Sheet 3	Instructions for Storing Sterile Items
--------------------------	---

Steps for Storing Sterile Items

1. Keep the storage area clean, dry, dust-free, and lint-free.
2. Control temperature and humidity (approximate temperature 24°C and relative humidity less than 70 percent) when possible.
3. Packs and containers with sterile (or high-level disinfected) items should be stored 20 to 25 cm off the floor, 45 to 50 cm from the ceiling, and 15 to 20 cm from an outside wall.
4. Do not use cardboard boxes for storage. Cardboard boxes shed dust and debris and may harbor insects.
5. Date and rotate the supplies (first in/first out). This process serves as a reminder, but does not guarantee sterility of the packs.
6. Distribute sterile and high-level disinfected items from this area.



LAP Test	Practical Demonstration
-----------------	--------------------------------

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 5min.

Task 1: Perform storing of sterile items



Operation Sheet 4

High-Level Disinfection by Boiling

❖ Steps for High-Level Disinfection by Boiling

1. Decontaminate and clean all instruments and other items to be high-level disinfected
2. If possible, completely immerse items in water.
 - ✓ Adjust the water level so that there is at least 2.5 cm (1 inch) of water above the instruments. In addition, make sure all bowls and containers to be boiled are full of water. For example, empty bowls that turn bottom side up and float to the surface contain air pockets.
3. Close lid over pan and bring water to a gentle, rolling boil. (Boiling too vigorously wastes fuel, rapidly evaporates the water, and may damage delicate [or sharp] instruments or other items.) Hence, a gentle rolling boil is sufficient and will prevent instruments or other items from being bounced around and possibly damaged by striking other instruments or the side walls of the boiling pot.
4. Boil all items for 20 minutes. Start timing when the water begins to boil.
5. After boiling for 20 minutes, remove objects with previously high-level disinfected forceps. Never leave boiled instruments in water that has stopped boiling.
 - ✓ As the water cools and steam condenses, air and dust particles are drawn down into the container and may contaminate those instruments.
 - ✓ Use instruments and other items immediately, or with high-level disinfected forceps or gloves, place objects in a high-level disinfected container with a tight-fitting cover.
 - ✓ Once the instruments are dry, if any pooled water remains in the bottom of the container, remove the dry items and place them in another high-level disinfected container that is dry and can be tightly covered



LAP Test	Practical Demonstration
-----------------	--------------------------------

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 5min.

Task 1: Perform **High-Level Disinfection by Boiling**



Operation Sheet 5

High-Level Disinfection by Steaming

Steps for High-Level Disinfection by Steaming.

1. Place instruments, plastic MVA cannulas, and other items in one of the steamer pans with holes in its bottom. To make removal from the pan easier, do not overfill the pan.
2. Repeat this process until up to three steamer pans have been filled. Stack the filled steamer pans on top of a bottom pan containing water for boiling. A second empty pan without holes should be placed on the counter next to the heat source.
 - ✓ **Remember:** Be sure there is sufficient water in the bottom pan for the entire 20 minutes of steaming.
3. Place a lid on the top pan and bring the water to a full rolling boil. (When water only simmers, very little steam is formed and the temperature may not get high enough to kill microorganisms.)
4. When steam begins to come out between the pans and the lid, start the timer or note the time on a clock and record the time in the HLD log.
5. Steam items for 20 minutes.
6. Remove the top steamer pan and put the lid on the pan that was below it (the pan now on top). Gently shake excess water from the pan just removed.
7. Put the pan that was just removed onto the empty pan (see Step 3). Repeat until all pans are restacked on this empty pan and the top pan is covered with the lid. (This step allows the items to cool and dry without becoming contaminated.)
8. Allow items to air dry in the steamer pans (one to two hours) before using.
9. Using a high-level disinfected forceps, transfer the dry items to a dry, high-level disinfected container with a tight-fitting cover. Instruments and other items can also be stored in the stacked and covered steamer pans as long as a bottom pan (no holes) is used.



LAP Test	Practical Demonstration
-----------------	--------------------------------

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 5min.

Task 1: Perform **High-Level Disinfection by Steaming**

**Operation Sheet 6****Disinfecting by high level chemical****Steps in Disinfection High-Level Chemical**

1. Decontaminate instruments and other items that may have been contaminated with blood and bodily fluids, and thoroughly clean and dry them before placing them in the disinfectant solution.
2. Completely immerse all items in the high-level disinfectant.
3. Soak for 20 minutes.
4. Remove items using high-level disinfected or sterile forceps or gloves.
5. Rinse well with boiled and filtered (if necessary) water three times and air dry
6. Use promptly or store in a dry, high-level disinfected, covered container



LAP Test	Practical Demonstration
-----------------	--------------------------------

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 5min.

Task 1: Perform **Disinfecting high-level chemical**



List of Reference Materials

1. Federal Ministry of Health Ethiopia, April 2012, Infection Prevention and Patient Safety, Addis Ababa, Ethiopia: Federal Ministry of Health
2. Federal Ministry of Health, Ethiopia. 2004. *Infection Prevention Guidelines for Health Care Facilities in Ethiopia*. Addis Ababa, Ethiopia: Federal Ministry of Health.
3. Linda, Tietjen, Débora, Bossemeyer Noel McIntosh JHPIEGO, USIAD 2003 Guidelines for Healthcare Facilities with Limited Resources, , Johns Hopkins University,
4. WHO, , 2004, Practical Guidelines for Infection Control in Health Care Facilities World Health Organization Regional Office for Western Pacific, Manila Regional Office for South-East Asia, New Delhi
5. Helen Lemass , Niamh McDonnell , Dr. Nuala O'Connor , Dr. Sheila Rochford HCAI/AMR 2013, "INFECTION PREVENTION AND CONTROL FOR PRIMARY CARE IN IRELAND" ,
6. AG, Australian Guidelines for the Prevention and Control of Infection in Healthcare (2010)

Prepared By							
No	Name	Educational Back grund	LEVEL	Region	College	Email	Phaone Number
1	Kalicha Boru	Laboratory	B	oromia	Nagelle HSC	boru9683@gmail.com	0912493885
2	Furo Beshir	Laboratory	A	Harari	Harar HSC	nebi.furo@gmail.com	0911739970
3	Motuma Chali	Laboratory	B	oromia	Nekemte HSC	lammiifcaalii@gmail.com	0938456753
4	Abdirahman Mahad	Laboratory	A	Somali	Jigjiga HSC	abdirahman7584@gmail.com	0911044715
5	Adisu Tesfaye	Laboratory	B	Somali	Jigjiga HSC	adistesfaye21@gmail.com	0931747320
6	Kebebe Tadesse	Laboratory	B	BGRS	Pawi HSC	kebebetadesse@gmail.com	0926841290
7	Tagel Getachew	Laboratory	A	Harari	Harar HSC	tagegetachew@gmail.com	0915746748

