Medical laboratory

NTQF Level -III

Learning Guide -33

Unit of Competence	**Prevent and Eliminate MUDA**
Module Title	**Preventing and Eliminate MUDA**
LG Code:	**HLT MLT3 M01 LO4-LG-33**
TTLM Code:	**HLT MLT3 TTLM 1019v1**

LO No: Prevent occurrence of wastes/MUDA

Instruction Sheet	Learning Guide 33

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

- Methods for waste prevention
- TPM concept and its pillars
- Reporting method and formats/checklists for improvement gained by waste elimination

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 –**

- Prepare and implement Plan of MUDA prevention.
- Discus and prepare Standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement.
- Prevent Occurrences of wastes/MUDA by using visual and auditory control methods.
- Create Waste-free workplace by using 5W and 1Hsheet.
- Complete the required operation in accordance with standard procedures and practices.
- Facilitate the updating of standard procedures and practices.
- Align the capability of the work team with the requirements of the procedure.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2 and Sheet 3 **in page 3, 9 and 22** respectively.
4. Accomplish the “Self-check 1and Self-check 2”**in page 8 and 19** respectively
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1”**in page 24.**
6. Do the “LAP test” **in page 25**

Information Sheet-1	Methods for waste prevention

1.1. Introduction

- We have discussed how you discover waste and what to do to remove it; but it doesn't end there. Unfortunately, problems always crop up, and we prevent them from becoming sources of waste we will be right back where we started in no time at all. That is one reason why one of the very first things mentioned about discovering waste adopting the right attitude. If everyone is paying attention to keeping waste from taking hold, then you have a good chance of sustaining production flow. There are four important methods you can use for maintaining a waste-free production environment:
  - ✓Standardization
  - ✓Visual controls
  - ✓Auditory controls
  - ✓5W and 1H Sheet

1.1.1. **Standardization**

- The primary purpose of standardization is to create and sustain a waste-free process. Standardization means establishing standard procedures for every operation so that anyone can understand and use them – and everyone does. There are many aspects to standardization. Standards must be created, documented, well-communicated, adehered to, and regularly re-assessed.
- Standards are required for:
  - ✓ Machines
  - ✓ Operations
  - ✓ Defining normal and abnormal conditions
  - ✓ Clerical procedures
  - ✓ Procurement

1.1.2. **Visual and Auditory Controls**

- One way waste enters into operations is when standards are not improved to meet changing conditions. Even standardization fails to sustain waste-free production if not systematically updated to take advantage of new materials, new technology, and worker improvement ideas. If the slightest defect occurs, the standard must be reconsidered.

- The factory is a living thing and must constantly be adjusted to stay responsive to changes in the environment. Responsiveness must be systematic so that problems are addressed without losing the solid foundation of the waste-removing methods already established. The best way to do this is through visual and auditory controls.
- ***Red-tagging –*** You probably did this at the beginning of your improvement activities when you implemented 5S. If not, do it now: put a red tag on everything in the factory that is not necessary to the current operations of the production process. After everyone has had time to notice red-tagged items and claim any that are needed in their area, remove the remaining red-tagged items from the environment.
- Management can decide what to do with them: they can be sold, thrown out, or moved to a location where they are needed. Always keep the production floor free of any thing that is not directly part of the production peocess.
- ***Signboards-*** The purpose of workstations and the names of the workers who operate
- them should be displayed at every processing point. Signboards can also identify equipment and processes so that everyone knows what things are and what they are used for. Standard quanities should be included on supply bins or carts. The products produced on each line or in each cell can be displayed, and so on.
- ***Outlining***- Boarders around tools and equipment, big and small, help people find and return things. Outlining can also create patterns of work-flow by using the floor to indicate where and where not to place things, where to walk, safety zones and danger zones. Outlining to indicate goods to be processed or parts that have been processed becomes a signal to material handlers for replenishing or for delivery to the next process.
- ***Andons***- Different colored lights can report the status and needs of a system and signal when defects or abnormal conditions occur so that problems can be solved immediately.
- ***Kanban***- These little signs accompany work-in-process. They are the flexible production instructions or work orders that trigger materials supply and production in a pull system, the hallmark of lean manufacturing.
- ***Pitch and Inspection Buzzers***- These indicate when operations get out of sync with demand or when defects are around. They keep awareness focused on solving problems and keep waste from taking root.

1.1.3. **The 5W and 1H Sheet**

The 5W and 1H (five “whys” and one “how”) is a powerfull method and one that never stops being wasteful in sustaining a waste-free production environment. The 5W and 1H sheet is a tool that will help you systematically apply this method.

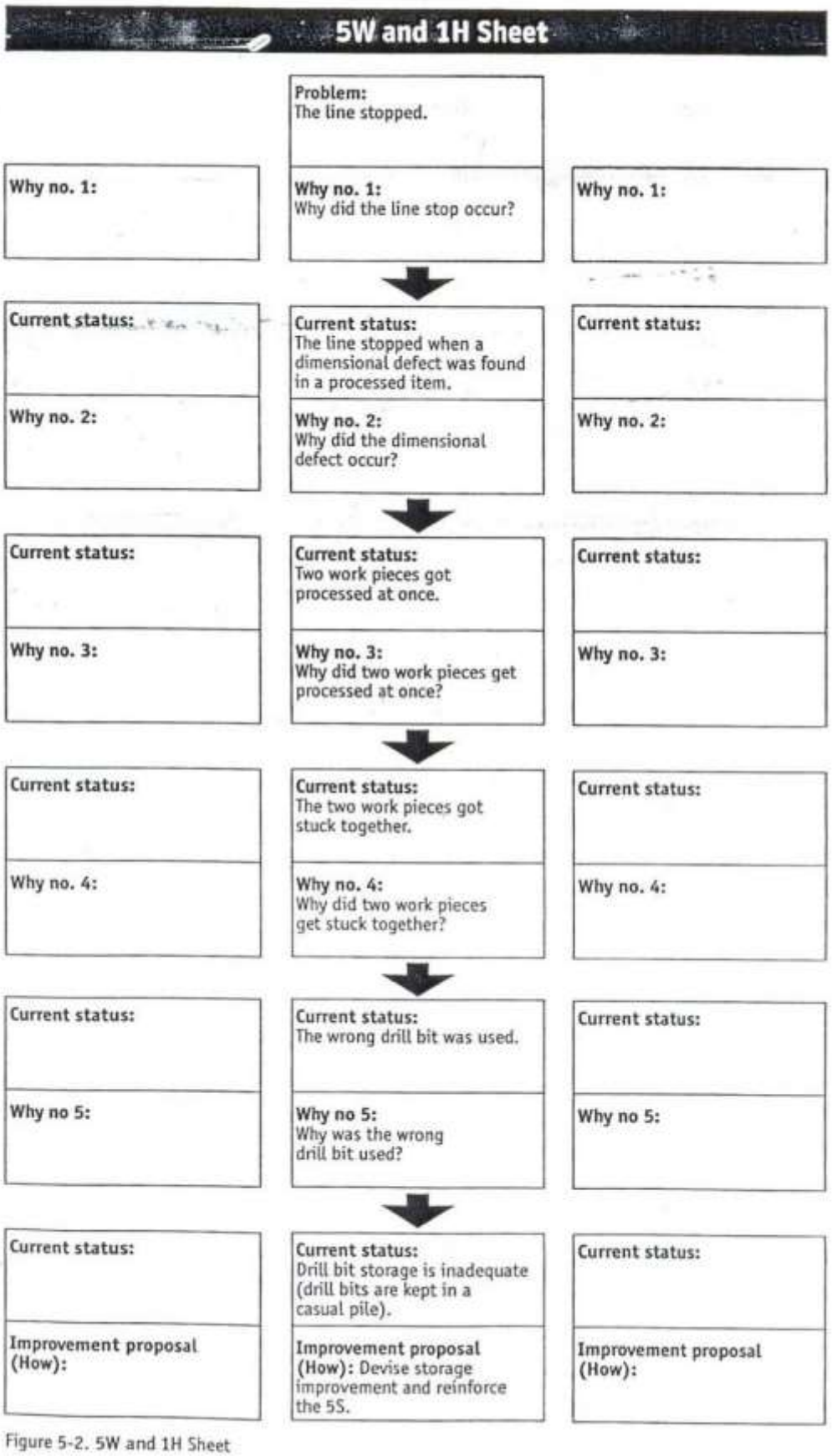


Figure 5-2. 5W and 1H Sheet

Figure 1 shows one sheet filled out.(Use the side columns when multiple questions or answers arise at any step of solving a single problem).

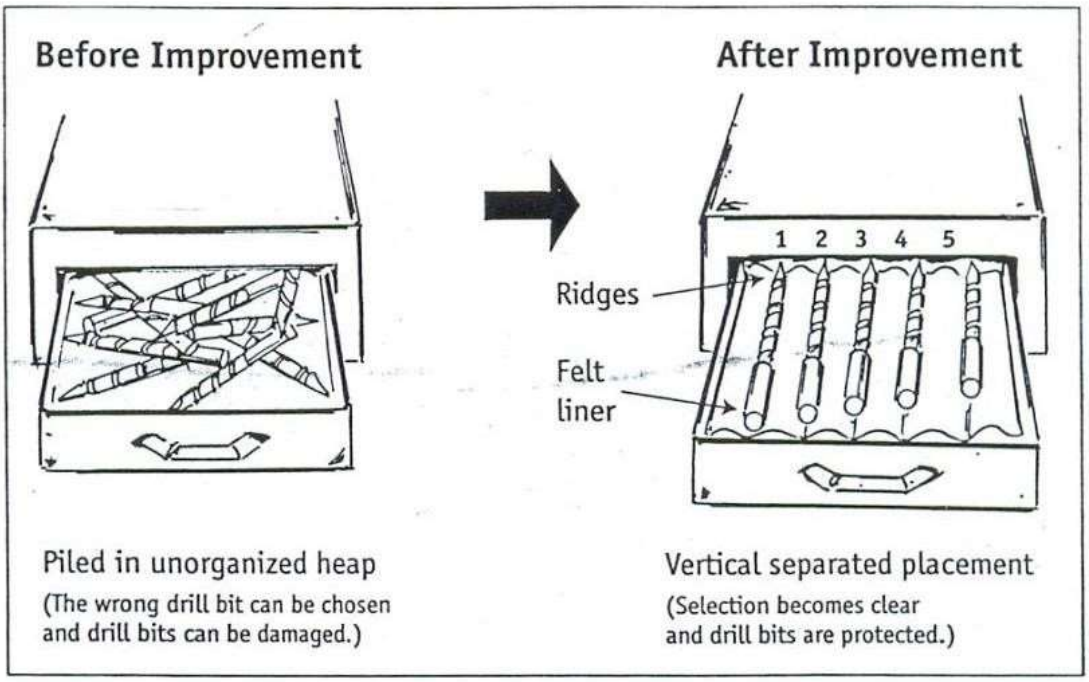


Figure 5-3. Improvement in Drill Bit Storage

Figure 2 shows an example of an improvement idea that resulted from the use of the 5W1H Sheet in figure 1.

Five Key Concepts for Asking "Why" and "How"

Following these principles suggested by Hiroyuki Hirano when you are asking the 5"whys" and 1"how":

1. **Look with the eyes of a child-** All improvement begins with the first why. Never cease looking and never cease asking that first why. As you practice this, the result will follow.
2. **Remember three essentials for fact finding-** (1) Go to where the problem occurred.(2) See the problem first-hand. (3) Confirm the facts based on your own observations.
3. **Be a walker and an observer-** Supervisors and managers must continually work through the factory to see that standards are being followed and to practice seeing waste. Operators need to continually examine their own operations to stay alert for new problems and new ideas for solving them that may come to mind as they do their jobs.
4. **Break down fixed thinking-** If you ask "why" and "how" often enough you will

eventually run out of “known” answers. At this point you may reach internal mental resistance to the discovery of what you don’t know. Get in the habit of asking why and how beyond this point of fixed thinking. That is when you will make the big discoveries about waste and how to solve it.

5. Do it now- Don’t wait. Put your ideas into practice immediately!

Self-Check -1	Written Test

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

1. What are the four methods for maintaining a waste free production environment? (4 Points)

2. How does standardization maintains a waste free environment? (4 Points)
3. How does visual and auditory controls maintains a waste free environment? (4 Points)
4. How does 5W and 1H sheet maintains a waste free environment? (3 Points)

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
2. _____
   _____
3. _____
   _____
4. _____
   _____

Information Sheet-2	TPM concept and its pillars

2.1 Introduction to Total Productive Maintenance (TPM)

- **Total** means All individuals in the organization working together. **Productive** means Production of goods that meet or exceed customer's expectations.
- **Maintenance** means Keeping equipment and plant in good condition at all times**. What is Total Productive Maintenance (TPM) ?**
- *It can be considered as the medical science of machines.* Total Productive Maintenance (TPM) is a maintenance program which involves a newly defined concept for maintaining plants and equipment. The goal of the TPM program is to markedly increase production while, at the same time, increasing employee morale and job satisfaction.
- TPM brings maintenance into focus as a necessary and vitally important part of the business. It is no longer regarded as a non-profit activity. Down time for maintenance is scheduled as a part of the manufacturing day and, in some cases, as an integral part of the manufacturing process. The goal is to hold emergency and unscheduled maintenance to a minimum.

Why TPM ?

- TPM was introduced to achieve the following objectives. The important ones are listed below.
  - ✓ Avoid wastage in a quickly changing economic environment.
  - ✓ Producing goods without reducing product quality.
  - ✓ Reduce cost.
  - ✓ Produce a low batch quantity at the earliest possible time.
  - ✓ Goods send to the customers must be non defective.

Types of maintenance

1. Breakdown maintenance

- This refers to the maintenance strategy, where repair is done after the equipment failure/stoppage or upon occurrence of severe performance decline. This concept has the disadvantage of unplanned stoppages, excessive damage, spare parts problems, high repair costs, excessive waiting and maintenance time and high trouble shooting problems.

2. Preventive maintenance

- PM comprises of maintenance activities that are undertaken after a specified period of time or amount of machine use.This type of maintenance relies on the estimated probability that the equipment will breakdown or experience deterioration in performance in the specified interval.The preventive work undertaken may include equipment lubrication, cleaning, parts replacement, tightening, and adjustment.The production equipment may also be inspected for signs of deterioration during preventive maintenance work.
- It is further divided into periodic maintenance and predictive maintenance. Just like human life is extended by preventive medicine, the equipment service life can be prolonged by doing preventive maintenance.

A. Periodic maintenance (Time based maintenance - TBM)

Time based maintenance consists of periodically inspecting, servicing and cleaning equipment and replacing parts to prevent sudden failure and process problems.

B. Predictive maintenance

This is a method in which the service life of important part is predicted based on inspection or diagnosis, in order to use the parts to the limit of their service life. Compared to periodic maintenance, predictive maintenance is condition based maintenance. It manages trend values, by measuring and analyzing data about deterioration and employs a surveillance system, designed to monitor conditions through an on-line system.

3. Corrective maintenance

- This is a system in which the concept to prevent equipment failures is further expanded to be applied to the improvement of equipment so that the equipment failure can be eliminated (improving the reliability) and the equipment can be easily maintained (improving equipment maintainability).
- The primary difference between corrective and preventive maintenance is that a problem must exist before corrective actions are taken.
- The purpose of corrective maintenance is improving equipment reliability, maintainability, and safety; design weaknesses (material, shapes); existing equipment undergoes structural reform; to reduce deterioration and failures, and to aim at maintenance-free equipment.
- Maintenance information, obtained from CM, is useful for maintenance prevention for the next equipment and improvement of existing manufacturing facilities. It is important to form setups to provide the feedback of maintenance information.

4. Maintenance prevention

- It indicates the design of a new equipment. Weakness of current machines are sufficiently studied (on site information leading to failure prevention, easier maintenance and prevents of defects, safety and ease of manufacturing) and are incorporated before commissioning a new equipment.

History of TPM

- TPM is innovative Japanese concept. The origin of TPM can be traced back to 1951 when preventive maintenance was introduced in Japan. However the concept of preventive maintenance was taken from USA. Nippondenso was the first company to introduce plant wide preventive maintenance in 1960. Preventive maintenance is the concept wherein, operators produced goods using machines and the maintenance group was dedicated with work of maintaining those machines, however with the automation of Nippondenso, maintenance became a problem as more maintenance personnel were

required. So the management decided that the routine maintenance of equipment would be carried out by the operators. (This is Autonomous maintenance, one of the features of TPM). Maintenance group took up only essential maintenance works.

- Thus Nippondenso which already followed preventive maintenance also added Autonomous maintenance done by production operators. The maintenance crew went in the equipment modification for improving reliability. The modifications were made or incorporated in new equipment. This lead to maintenance prevention. Thus *preventive maintenance* along with *Maintenance prevention* and *Maintainability Improvement* gave birth to ***Productive maintenance***. The aim of productive maintenance was to maximize plant and equipment effectiveness to achieve optimum life cycle cost of production equipment.
- By then Nippon Denso had made quality circles, involving the employees participation. Thus all employees took part in implementing Productive maintenance. Based on these developments Nippondenso was awarded the distinguished plant prize for developing and implementing TPM, by the *Japanese Institute of Plant Engineers* (JIPE). Thus Nippondenso of the Toyota group became the first company to obtain the TPM certification.

TPM Targets:

- ✓ Productivity
- ✓ Obtain Minimum 80% OPE (Overall Plant Efficiency)
- ✓ Obtain Minimum 90% OEE (Overall Equipment Effectiveness)
- ✓ Run the machines even during lunch. (Lunch is for operators and not for machines!) Quality - Operate in a manner, so that there are no customer complaints.
- ✓ Cost - Reduce the manufacturing cost by 30%.
- ✓ Delivery time - Achieve 100% success in delivering the goods as required by the customer.
- ✓ Safety - Maintain accident free environment.
- ✓ Moral - Increase the suggestions by 3 times. Develop Multi-skilled and flexible workers.

Motives of TPM	1. Adoption of life cycle approach for improving the overall performance of production equipment. 2. Improving productivity by highly motivated workers which is achieved by job enlargement. 3. The use of voluntary small group activities for identifying the cause of failure, possible plant and equipment modifications.
Uniqueness of TPM	The major difference between TPM and other concepts is that the operators are also made to involve in the maintenance process. The concept of *"I (Production operators) Operate, You (Maintenance department) fix"* is not followed.
TPM Objectives	1. Achieve Zero Defects, Zero Breakdown and Zero accidents in all functional areas of the organization. 2. Involve people in all levels of organization. 3. Form different teams to reduce defects and Self Maintenance.

Direct benefits of TPM	1. Increase productivity and OPE (Overall Plant Efficiency) by 1.5 or 2 times. 2. Rectify customer complaints. 3. Reducethe manufacturing cost by 30%. 4. Satisfy the customers needs by 100 % (Delivering the right quantity at the right time, in the required quality.) 5. Reduce accidents. 6. Follow pollution control measures.
Indirect benefits of TPM	1. Higher confidence level among the employees. 2. Keep the work place clean, neat and attractive. 3. Favorablechange in the attitude of the operators. 4. Achieve goals by working as team. 5. Horizontaldeployment of a new concept in all areas of the organization. 6. Share knowledge and experience. 7. The workers get a feeling of owning the machine.

Factors affecting equipment effectiveness

- Equipment failure (breakdown)
- Setup and adjustment downtime
- Idling and minor stoppages
- Reduced speed
- Process defects
- Reduced yield

Cycle Time and Set-Up Reduction

- The amount of time that elapses between the completion of two parts completed on the same line. Cycle time may also be defined as the amount of time it takes for a single operation to complete a single part. Both working definitions are based on shop floor observation. The general term “Cycle Time” should be specified as “Observed Cycle Time”. It is important to note that with all variations of “Cycle Time” definitions, the starting and ending point of each cycle must be exactly the same point to ensure a complete cycle.
- Shorter runs produce customer orders with less lead time.However, equipment breakdowns, idling and minor stoppages will make it very difficult to reduce cycle times. Hence, cycle time reductions result in shorter and more frequent production runs. Suddenly, set-ups and adjustments become crucial in reducing cycle times. Past OEE (Overall Equipment Efficieny) studies show that set-up and adjustments can consume up to 50% of total production time.
- The Equipment Losses (you can and must measure)

Equipment Availability	Set up and adjustments including: ✓ Changeovers ✓ Programming ✓ Test runs Equipment Failures: ✓ Sporadic breakdowns. ✓ Chronic breakdowns.
Equipment Efficiency	Idling and Minor Stoppages ✓ Jams and other short ✓ stoppages. ✓ No parts, no operator. ✓ "Blocked". Reduced Speed ✓ Equipment worn out. ✓ Lack of accuracy.
Quality	Process defects ✓ Scrap ✓ Rework
Others	Equipment warm up etc. No parts, no operator.

Availability

- ✓ Loading time = Total available time per day (or month) – Planned downtime
- ✓ Planned downtime: amount of downtime officially scheduled in the production plan.

OEE (Overall Equipment Efficiency) :

$$OEE = A \times PE \times Q$$

- Possibly there are three ways that failure may occur

1. *A - Availability of the machine*. Availability is proportion of time machine is actually available out of time it should be available. (t*he equipment can stop working completely* known as a *total failure*),

$$Availability\ (\%) = \frac{total\ time\ available - downtime}{total\ time\ available} * 100\%$$

2. *The equipment can work slower than it is capable of known as the partial failure (throughput rate/Performance), and*

$$Performance\ (\%) = \frac{number\ of\ units\ manufactured}{possible\ number\ of\ manufacturable\ units} * 100\%$$

3. *The equipment or product can lose quality known as* quality failure (Quality)

$$Quality\ (\%) = \frac{number\ of\ units\ produced - number\ of\ defects}{number\ of\ units\ produced} * 100\%$$

OEE Exercise

- Calculate Availability, Performance, Quality and OEE based on the following information.

Item	**Data**
Shift Length	8 hrs = 480 min
Short Breaks	2@15 min = 30 min
Meal Breaks	1@30min=30min
Down Time	47min
Ideal Run Time	60 pieces per min
Total Pieces	19,271 pieces
Reject Pieces	423 pieces

a. Availability = $\frac{\text{Operating time}}{\text{Planned production time}}$

= 373 minutes / 420 minutes

= **0.8881 = 88.81%**

b. Performance = $\frac{\text{(Total pieces /Operating time)}}{\text{Ideal Run Time}}$

= (19,271 pieces/373 minutes)/60 pieces per minute

= **0.8611 = 86.11%**

c. Quality = $\frac{\text{Good Pieces}}{\text{Total Pieces}}$

= 18,848 / 19,271 pieces

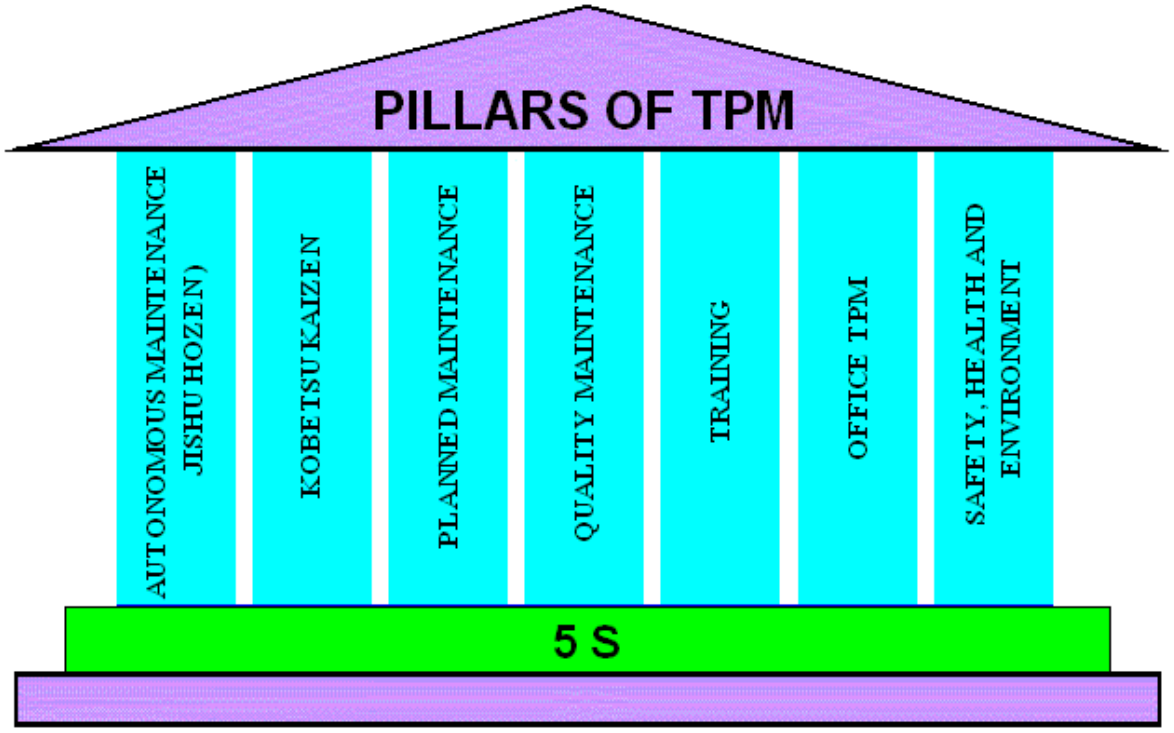
= **0.9780 = 97.80 %**

d. OEE = Availability X Performance X Quality

= 0.8881 X 0.8611 X 0.9780

= 0.7479 = 74.79%

The 8 Pillars of TPM



PILLAR 1 - 5S :

- TPM starts with 5S. Problems cannot be clearly seen when the work place is disorganized. Cleaning and organizing the workplace helps the team to uncover problems. Making problems visible is the first step of improvement.

PILLAR 2 - Autonomous maintenance (JISHU HOZEN)

- This pillar is geared towards developing operators to be able to take care of small maintenance tasks, thus freeing up the skilled maintenance people to spend time on more value added activity and technical repairs. The operators are responsible for upkeep of their equipment to prevent it from deteriorating.

PILLAR 3 - KAIZEN :

- "Kai" means change, and "Zen" means good (for the better). Basically kaizen is for small improvements, but carried out on a continual basis and involve all people in the organization. Kaizen is opposite to big spectacular innovations. Kaizen requires no or little investment. The principle behind is that "a very large number of small improvements are morTPMe effective in an organizational environment than a few improvements of large value. This pillar is aimed at reducing losses in the workplace that affect our efficiencies. By using a detailed and thorough procedure we eliminate losses in a systematic method using various Kaizen tools. These activities are not limited to production areas and can be implemented in administrative areas as well.

The Six Big Loses

Down Time

1. Breakdowns due to equipment failure.
2. Setup and adjustment (e.g. exchange of dies in injection molding machines, etc.)

Speed Losses

3. Idling and minor stoppages (abnormal operation of sensor, etc.).
4. Reduced speed (discrepancies between designed and actual speed of equipment)

Defects

5. Defects in process and rework (scrap and quality defects requiring repair)
6. Reduced yield between machine startup and stable production.

Classification of losses :

Aspect	Sporadic Loss	Chronic Loss
Causation	Causes for this failure can be easily traced. Cause-effect relationship is simple to trace.	This loss cannot be easily identified and solved. Even if various counter measures are applied
Remedy	Easy to establish a remedial measure	This type of losses are caused because of hidden defects in machine, equipment and methods.
Impact / Loss	A single loss can be costly	A single cause is rare - a combination of causes trends to be a rule
Frequency of occurrence	The frequency of occurrence is low and occasional.	The frequency of loss is more.
Corrective action	Usually the line personnel in the production can attend to this problem.	Specialists in process engineering, quality assurance and maintenance people are required.

PILLAR 4 - PLANNED MAINTENANCE :

- It is aimed to have trouble free machines and equipments producing defect free products for total customer satisfaction. This breaks maintenance down into 4 "families" or groups which was defined earlier.
    1. Preventive Maintenance
    2. Breakdown Maintenance
    3. Corrective Maintenance
    4. Maintenance Prevention
- With Planned Maintenance we evolve our efforts from a reactive to a proactive method and use trained maintenance staff to help train the operators to better maintain their equipment.

Target :

1. Zero equipment failure and break down.
2. Improve reliability and maintainability by 50 %
3. Reduce maintenance cost by 20 %
4. Ensure availability of spares all the time.

PILLAR 5 - QUALITY MAINTENANCE :

- It is aimed towards customer delight through highest quality through defect free manufacturing. Focus is on eliminating non-conformances in a systematic manner, much like Focused Improvement. We gain understanding of what parts of the equipment affect product quality and begin to eliminate current quality concerns, then move to potential quality concerns. Transition is from reactive to proactive (Quality Control to Quality Assurance).
- QM activities is to set equipment conditions that preclude quality defects, based on the basic concept of maintaining perfect equipment to maintain perfect quality of products. The condition are checked and measure in time series to very that measure values are within standard values to prevent defects. The transition of measured values is watched to predict possibilities of defects occurring and to take counter measures before hand.

Target :

1. Achieve and sustain customer complaints at zero
2. Reduce in-process defects by 50 %
3. Reduce cost of quality by 50 %.

PILLAR 6 - TRAINING :

- It is aimed to have multi-skilled revitalized employees whose morale is high and who has eager to come to work and perform all required functions effectively and independently. Education is given to operators to upgrade their skill. It is not sufficient know only "Know-How" by they should also learn "Know-why". By experience they gain, "Know-How" to overcome a problem what to be done. This they do without knowing the root cause of the problem and why they are doing so. Hence it become necessary to train them on knowing

"Know-why". The employees should be trained to achieve the four phases of skill. The goal is to create a factory full of experts. The different phase of skills are

Phase 1 : Do not know.

Phase 2 : Know the theory but cannot do.

Phase 3 : Can do but cannot teach

Phase 4 : Can do and also teach.

PILLAR 7 - OFFICE TPM :

- Office TPM should be started after activating four other pillars of TPM (JH, KK, QM, PM). Office TPM must be followed to improve productivity, efficiency in the administrative functions and identify and eliminate losses. This includes analyzing processes and procedures towards increased office automation.

Office TPM and its Benefits :

1. Involvement of all people in support functions for focusing on better plant performance
2. Better utilized work area
3. Reduce repetitive work
4. Reduced inventory levels in all parts of the supply chain
5. Reduced administrative costs
6. Reduced inventory carrying cost
7. Reduction in number of files
8. Reduction of overhead costs (to include cost of non-production/non capital equipment)
9. Productivity of people in support functions
10. Reduction in breakdown of office equipment
11. Reduction of customer complaints due to logistics
12. Reduction in expenses due to emergency dispatches/purchases
13. Reduced manpower
14. Clean and pleasant work environment.

PILLAR 8 - SAFETY, HEALTH AND ENVIRONMENT :

Target :

1. Zero accident,
2. Zero health damage
3. Zero fires.

- In this area focus is on to create a safe workplace and a surrounding area that is not damaged by our process or procedures. This pillar will play an active role in each of the other pillars on a regular basis.
- To create awareness among employees various competitions like safety slogans, Quiz, Drama, Posters, etc. related to safety can be organized at regular intervals.

Self-Check -2	Written Test

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

1. What is Total Productive Maintenance (TPM)? (3 Points)
2. What are the four types of maintenance? (4 Points)
3. Describe the four types of maintenance. (8 Points)
4. What are the disadvantages of breakdown maintenance?(write at least four)(4 Points)
5. What are the advantages of preventive maintenance over breakdown maintenance? (3 Points)
6. What are the activities carried out on the machine during preventive maintenance? (write at least four) (4 Points)
7. What is the primary difference between corrective and preventive maintenances? (2 Points)
8. What is cycle time? (2 Points)
9. What are the factors affecting Equipment Effectiveness? (At least three) (3 Points)
10. What are the eight pillars of TPM? (8 Points)
11. What are the aims of each pillars of TPM? (8 Points)

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____

_____

_____

_____

_____

Information Sheet-3	Reporting method and formats/checklists for improvement gained by waste elimination

3.1 Kaizen Effect Evaluation Sheet

Name of the process:_____

Work Place:_____

Problem Solving Title:_____

Part one –Quantitative Results

S.No	Improvement Indicators	Before Kaizen	Target	After Kaizen	Improvement	Remark
1	Muda Elimination Indicators					
	1.1 Tools& Equipment					
	1.2 Parts Saving					
	1.3 Raw Material saving					
	1.4 Transportation					
	1.5 Motion in Meter					
	1.6 Transaction Time					
	1.7 excess tock/Inventory					
	1.8 expired material/Stock)					
2	Productivity indicators					
	2.1 Lead time					
	2.2 Machine down time					
	2.3 Frequency of					
	2.4 Production volume					
	2.5 Labor saving					
	2.6 labour productivity					
	2.7 Delivery Time					
3	Quality Indicators					
	3.1 Defect rate					
	3.2 Raw Material					
	3.3 Number of					
4	Other Indicators					
	4.1 Number of New					
	4.2 Minimized Cost of					

Part Two –Qualitative Results

1. Describe the Qualitative results and change that are achieved by Muda Elimination/Reduction based on the indicators listed below

S.No	Improvement Indicators	Description of the Result
1	Muda Elimination capacity of workers	
2	New inventions and Improvements by workers	
3	Motivation of workers	
4	Awareness about Safety	
5	Corporate culture of kaizen	
6	Team work	
7	Transaction Time	

Name of Worker: _____

Signature: _____

Date _____

Name of Leader : _____

Signature : _____

Date : _____

Operation Sheet 1	Planning and procedure for Preventing Muda

1. After implementing improvement idea and confirming the result establish a new standard procedure.
2. Document the new standard procedure.
3. Train the workers the new standard procedure.
4. Prepare action plan to implement and follow up the standard procedure.

No.	What	When	Where	Who	How	Why	Counter point	Follow up
1		Always		Operator				Team Leader
2		At the time of purchasing		Leader				
3		Always		Leader				
		Once every 6 months		Leader and maintenance head				
4		Every 6 months		Leader & members				
		When necessary		Leader & trainers				
		Once a year		Leader				
5		When necessary		Operators				

Sample action plan.

5. Follow up the workers to correctly apply the standard procedure according to the action plan.
6. Improve the standard procedure when conditions change.

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 --- hour.

Task 1. After confirming the result, prepare a new standard procedure that is capable of preventing reccurance of Muda eliminated

Task 2. Prepare action plan to implement and follow up the standard procedure using the given template

List of Reference Materials

- **BOOKS**

1- Identifying Waste on the Shopfloor (1996).

2- □ Ethiopian Kaizen Manual (2011)