

# Grade 10

GOP – Textbook Funds

# Consumer Electronics Servicing NC II

## Learner's Material

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## Personal Entrepreneurial Competencies (PECs)

Content Standards	Performance Standards
The learner demonstrates understanding of one’s PECs in <b><u>CONSUMER ELECTRONICS SERVICING NC II.</u></b>	The learner independently creates a plan of action that strengthens/ further develops his/her PECs in <b><u>CONSUMER ELECTRONICS SERVICING NC II.</u></b>

**Quarter I**

**Time Allotment: 4 hours**

### Module 1

### Personal Entrepreneurial Competencies

#### Introduction

In this module you will learn more about entrepreneurship and the entrepreneurial competencies related to **CONSUMER ELECTRONICS SERVICING NC II.** You will have a first-hand experience in educational activities leading to personal assessment of your entrepreneurial competencies and to become a successful CONSUMER ELECTRONICS TECHNICIAN within your area. You will also have some activities to align your competencies with the competencies of successful practitioners. Moreover, this module is designed to stimulate your mind to think about entrepreneurship, its role in the business community in particular and to the economic and social development in general.

Now, to start with this module, let us first understand the meaning of entrepreneurs and entrepreneurship.

Entrepreneurs are people with skills and capabilities to see and evaluate business opportunities. They are individuals that can strategically identify products or services needed in the community and they deliver these at the right time and the right place.

Entrepreneurs are agent of economic change; they organize, manage, and assume risks of a business. Some of the good qualities of an entrepreneur are opportunity seeker, risk taker, goal setter, excellent planner, a confident problem solver, hardworking, persistent, and a committed worker.

Entrepreneurship, on the other hand, is not just a simple business activity. It is a strategic process of innovation and new venture creation.

Basically, entrepreneurship is both an art and science of converting business ideas into marketable products or services to improve the quality of living.

Now that you have a little background knowledge about entrepreneur and entrepreneurship, can you now walk through in assessing your Personal Entrepreneurial Competencies (PECs)? Always remember that “**Successful entrepreneurs continuously develop and improve their PECs.**”

To begin with, let us first try to find out the competencies you will master after finishing this module.

## OBJECTIVES

At the end of this module, you are expected to:

- identify areas for improvement, development and growth;
- align your PECs according to your business/career choice;
- create a plan of action that ensures success in your business/career choice

Now that you have an idea about the enabling knowledge and skill that you will develop/achieve and master, try to take the first challenge in this module -- the pre assessment.

## PRE ASSESSMENT

As part of your initial activity, you will be challenged to deepen your knowledge and previous experiences on the topic. Try to diagnose/assess what you already know about personal entrepreneurial competencies by answering Task 1.

### Task 1: Matching Type

**Directions: Match the *entrepreneurial competencies* in column A with their *meaning* in column B. Write the letter of the correct answer on a separate sheet of paper.**

<b>A</b>	<b>B</b>
___ 1. Creative	a. make a wise decision towards the set objectives
___ 2. Profit-Oriented	b. strategic thinking and setting of goals
___ 3. Discipline	c. trust in one's ability
___ 4. Decision Making	d. adoptable to change
___ 5. People Skill	e. innovative to have edge over other competitors
___ 6. Planner	f. solid dedication



- |                                 |  |
|---------------------------------|--|
| ___ 7. Self-confidence          | g. skillful in record keeping                                      |
| ___ 8. Hardworking              | h. always stick to the plan  |
| ___ 9. Ability to accept change | i. working diligently  |
| ___ 10. Committed               | j. effective and efficient communication<br>and relation to people |
|                                 | k. always looking for income                                       |

## Task 2: Guide Questions

**Directions:** The following are guide questions which encapsulate the entire module. Write your answers on your assignment notebook, then share these to the class.

- A. Explain why entrepreneurial competencies are important to social development and progress of the economy.
- B. What entrepreneurial activities do you know and capable of doing which are related to **CONSUMER ELECTRONICS SERVICING NC II?**
- C. Given the opportunity to own a business that relates with **CONSUMER ELECTRONICS SERVICING NC II**, are you confident to manage it? Explain your answer.
- D. What do you think are the most important competencies you must possess in order to become successful in running your chosen business?
- E. Name successful entrepreneurs from your province whose business is related to **CONSUMER ELECTRONICS SERVICING NC II**. Be able to share to the class their PECs that made them successful.

After all the guide questions have been answered to the best of your knowledge and skills, share these with your classmates. You too, may compare your insights, personal knowledge of, and relevant experiences on the topic to make it more exciting and engaging.

## LEARNING GOALS AND TARGET

After reading and understanding the objectives of this module and having gone through pre-assessment and answering the guide questions, you will be asked to set your own personal goals. These goals will trigger you to further achieve the ultimate objective of this module. In the end, these goals would motivate you to learn more about PECs.



Figure 1: Strategic process to achieve the objectives of this module

## READING RESOURCES AND INSTRUCTIONAL ACTIVITIES

After setting your own personal goals and targets to achieve the objectives of this module, check first your inherent knowledge of PECs. Try to answer the following guide questions with the help of your classmates.

### Task 3: Group Activity

**Directions:** Answer the following guide questions on a separate sheet of paper. Share your answer to the class.

1. Explain the importance of assessing one's PECs before engaging in a particular entrepreneurial activity.

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2. Are there other strategies or approaches where you can assess your PECs? Explain how these would become more useful in selecting a viable business venture.

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3. What are the desirable personal characteristics, attributes, lifestyles, skills and traits of a prospective entrepreneur? Why do you think these are important?

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4. Why is there a need to assess one's PECs in terms of characteristics, attributes, lifestyles, skills, and traits before starting a particular business?

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5. What is the significance of evaluating PECs of a successful entrepreneur? What helpful insights can you draw from this activity?

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How was your experience in answering the guide questions with your classmates? Were you able to benefit from them? What were the insights you have realized?

Now, this time you're going to study the different topics that will enrich your knowledge of PECs. Read carefully all the important details about the succeeding topic.



**Assessment of Personal Entrepreneurial Competencies (PECs) and skills vis-à-vis a practicing entrepreneur/employee in a province.**

The **entrepreneurial competencies** refer to the important characteristics that should be possessed by an individual in order to perform entrepreneurial functions effectively. In this module, you will learn some of the most important characteristics, attributes, lifestyle, skills and traits of a successful entrepreneur in order to be successful in a chosen career.

**Below are few important characteristics/traits/attributes of a good entrepreneur:**

- **Hardworking:** One of the important characteristics of a good entrepreneur is hardworking. This means habitually working diligently for a long period of hours. Hardworking people keep on improving their performance to produce good products and provide good services.
- **Self-confident:** Entrepreneurs have confidence in one's ability and own judgment. They exhibit self-confidence in order to cope with all the risks of operating their own business.
- **Discipline:** Successful entrepreneurs always stick on the plan and fight the temptation to do what is unimportant.
- **Committed:** A good entrepreneur accepts full responsibility of everything in his/her business. He/she gives full commitment and solid dedication to make the business successful.
- **Ability to accept change:** Nothing is permanent but change. Change occurs frequently. When you own a business, you should cope with and thrive on changes. Capitalize on positive changes to make your business grow.
- **Creative:** An entrepreneur should be creative and innovative to stay in the business and in order to have an edge over the other competitors.
- **Has the Initiative:** An entrepreneur takes the initiative. You must put yourself in a position where you personally are responsible for the failure or success of your business.
- **Profit-Oriented:** You enter into the world of business to generate profit or additional income. This shall become your bread and butter and for your family as well. Therefore, you must see to it that the business can generate income.

**Listed below are the important skills of a successful entrepreneur:**

- **Planner:** Planning is a strategic thinking and setting of goals to achieve objectives by carefully maximizing on all the available resources. A good entrepreneur develops and applies step-by-step plans to realize goals. A good entrepreneur knows that planning is an effective skill only when combined with action.

- **People Skills:** Is a skill which is very important in order to be successful in any kind of business. People skills refer to an effective and efficient communication and relation to people working in and out of your business. In day-to-day business transactions, you need to deal with people. A well- developed people skills can spell out the difference between success and failure of the business.
- **Decision Making:** Successful entrepreneurs have the ability to think quickly and make a wise decision towards the pre-determined set objectives. No one can deny that the ability to make decision is an important skill that an entrepreneur should possess. Sound decision should spring out from given facts/information and should be towards the pre-determined objectives.



In order to firm up what you have learned and to have a better appreciation of the different entrepreneurial competencies, try to read the PECs checklist presented below, then answer the same.

#### **Task 4: PECs Checklist**

**Directions:** Using the PECs Checklist, assess yourself by indicating a check (/) mark in either strengths and/or development areas column. Interpret the results by counting the total number of check marks in each of the columns. After accomplishing the checklist, form a group and share your insights and experiences why you come up with that personal assessment.

**Table 1: PECs Checklist**

Personal Entrepreneurial Competencies of an Entrepreneur	Personal Assessment in terms of:	
	Strength	Development Areas
<b>Hardworking</b> - <i>Working diligently</i>		
<b>Self-confident</b> - Confidence in one's ability		
<b>Discipline</b> - Always stick to the plan		
<b>Committed</b> - Solid dedication		
<b>Ability to accept change</b> - Adoptable to change		
<b>Creative</b> - Innovative to have edge over other competitors		
<b>Profit-oriented</b> - Always looking for income		
<b>Planner</b> - Strategic thinking and setting of goals		
<b>People Skill</b> - effective and efficient communication and relation to people		
<b>Decision Making</b> - make a wise decision towards the set objectives		
<b>TOTAL</b>		

**Interpretation/Insights:**

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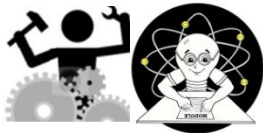
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How was your experience in discovering your strengths and the areas to be developed? Did you gain valuable experience in exchanging insights with your classmates? To learn more and deepen your understanding of PECs, do the Task 5 below.

### Task 5: Interview

Interview a successful entrepreneur in your province whose type of business is related with **CONSUMER ELECTRONICS SERVICING NC II**. Focus your interview on PECs and other business-related attributes that help them become successful. Analyze the result of the interview and reflect on the similarities and/or differences. Write your answer on a separate sheet of paper.

Sample Interview Guide

Name of Proprietor/Practitioner:

\_\_\_\_\_

Age: \_\_\_\_\_ Number of Years in Business: \_\_\_\_\_

Business Name: \_\_\_\_\_

Business Address: \_\_\_\_\_

1. What are your preparations before you engaged in this type business/job?
2. What are your special skills/characteristics that are related with your business/job?
3. How did you solve business-related problems during the early years of your business operation?
4. Did you follow the tips from a successful businessman/practitioner before you engaged in your business?
5. What are your best business practices that you can share with aspiring students?
6. What are the salient characteristics, attributes, lifestyle, skills and traits that made you successful in your business/job?

Note: Cull the needed information from the interview to supply answer/s to Row 1 in the table below. Meanwhile, fill out the second row with your PECs.

<b>Personal Entrepreneurial Competencies</b>	<b>Characteristics</b>	<b>Attributes</b>	<b>Lifestyles</b>	<b>Skills</b>	<b>Traits</b>
Successful Entrepreneur in the province					
My PECs					

Using the information on the table above, analyze, and reflect on the similarities and differences in your answers. Put your reflection on the table below. Write your conclusion on the space provided below.

<b>Personal Entrepreneurial Competencies</b>	<b>Similarities</b>	<b>Differences</b>
Characteristics Attributes Lifestyles Skills Traits		

**Conclusion:**

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After performing the activities on the importance of PECs, let's determine how much you have learned. Perform the Task 6 to determine how well you have understood the lesson.

**Task 6: Preparation of a Plan of Action**

**Directions:** Using the table below and the information generated from Task 5 (Interview), prepare an action plan that indicates how you would align your PECs to the PECs of the successful entrepreneur *CONSUMER ELECTRONICS SERVICING NC II* in your area.

Objective	Area	Activities	Strategies	Time Frame	Expected Outcome
To align my PECs with the PECs of a successful entrepreneur in <u>CONSUMER ELECTRONICS SERVICING NC II.</u>	Characteristics				
	Skills				
	Attribute				
	Traits				

**Task 7: Essential Questions**

**Directions:** Read and study the following questions below. You may use a separate sheet of paper or your notebook to write your answers.

1. Why is there a need to compare and align your PECs with the PECs of a successful entrepreneur?

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2. How does your action plan help sustain your strong PECs and/or address your development areas?

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3. What plan of action would you do to address your development areas?

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## **FEEDBACK**

### ***Pre/Post Assessment***

1. **E**
2. **K**
3. **H**
4. **A**
5. **J**
6. **B**
7. **C**
8. **I**
9. **D**
10. **F**

## ENVIRONMENT AND MARKET (EM)

Content Standards	Performance Standards
The learner demonstrates understanding of environment and market in <b><u>CONSUMER ELECTRONICS SERVICING NC II</u></b> in one's municipality.	The learner independently creates a business vicinity map reflective of potential market in <b><u>CONSUMER ELECTRONICS SERVICING NC II</u></b> in a municipality.

**Quarter I**

**Time Allotment:** 4 hours

### **Module 2 Environment and Market Introduction**

People who aspire to start a business need to explore the economic, cultural and social conditions prevailing in the area. Needs and wants of the people in a certain area that are not met may be considered as business opportunities. Identifying the needs of the community, its resources, available raw materials, skills, and appropriate technology can help a new entrepreneur in seizing a business opportunity.

To be successful in any kind of business venture, potential entrepreneurs should always look closely at the environment and market. They should always be watchful on the existing opportunities and constraints. The opportunities in the business environment are those factors that provide possibilities for a business to expand and make more profits. Constraints, on the other hand, are those factors that limit the ability to grow, hence reduce the chance of generating profit. One of the best ways to evaluate the opportunities and constraints is to conduct SWOT analysis (Strengths, Weaknesses, Opportunities and Threats).

SWOT analysis is a managerial tool to assess the environment. This gathers important information, which in turn is used in strategic planning. Strengths and Weaknesses are internal in an organization. Basically they relate to resources owned by organization, things that you have control over, and as well as the extent of its marketing.

Opportunities and Threats exist in the external environment. Opportunities relate to the market, to the development of new technologies, and external factors such as government policies, climate, and trends. Threats relate to what the competition is doing as well as legal and other constraints.

Now that you have read some of the important considerations to look into to be successful in any business, you are now ready to explore more about the environment and market.

To begin with, let's first try to find out the competencies that you will master after finishing this module.

## **OBJECTIVES**

At the end of this module, you are expected to:

- identify what is of "Value" to the customer;
- identify the customer to sell to;
- explain what makes a product unique and competitive;
- apply creativity and innovative techniques to develop marketable product; and
- employ a Unique Selling Proposition (USP) to the product/service.

Now that you have an idea about the things you will learn, try to take the first challenge in this module-- the pre assessment.

## **PRE ASSESSMENT**

### **Task I: Multiple Choice**

**Directions:** Choose the letter of the best answer. Write your answer on a separate sheet of paper.

1. This is generated by examining what goods and services are sold outside by the community.  
A. Business Creation  
B. Business Pricing  
C. Business Concept  
D. Business Idea
2. A process of making a new product to be sold to the customers.  
A. Product Analysis  
B. Product Conceptualization  
C. Product Development  
D. Product Implementation
3. These are luxuries, advantages, and desires that every individual considers beyond necessary.  
A. Wants  
B. Desires  
C. Requirements  
D. Needs
4. This is the factor or consideration presented by a seller as the reason that one product or service is different from and better than that of the competition.  
A. Unique Selling Plan  
B. Unique Selling Proposition  
C. Unique Pricing Policy  
D. Finding Value-Added

5. In this stage, the needs of the target market are identified, review and evaluated.
 

A. Concept Development	C. Project
Development	
B. Economic Analysis	D. Refine Specification
6. This is the introduction of new idea to make the product and services more attractive and saleable to the target customers.
 

A. New Idea	C. Product
Development	
B. Creativity	D. Innovation
7. A managerial tool used to assess the environment to gather important information used for strategic planning.
 

A. Environmental Scanning	C. WOTS Analysis
B. SWOT Analysis	D. Survey Analysis
8. A marketing practice of creating name, symbol or designs that identifies and differentiate a product from the other products.
 

A. Product Naming	C. Branding
B. Unique Selling Proposition	D. Tagline
9. This is a meaningful and unforgettable statement that captures the essence of your brand.
 

A. Product Naming	C. Branding
B. Unique Selling Proposition	D. Tagline
10. These are the things that people cannot live without.
 

A. Wants	C. Requirements
B. Desires	D. Needs

## **Task 2: Guide Questions**

**Directions:** Read and study the guide questions below. Use a separate sheet of paper to write your responses to the guide questions.

1. How does one determine the product or services to be produced and/or to be offered/ delivered to the target customers?
2. How does one select an entrepreneurial activity?
3. When can one say that a certain product has a “value”?
4. Is innovation and creativity to your product/ services important? Explain.
5. How can one effectively respond to the needs of the target customer?
6. Express from the viewpoint of business owner the importance of scanning the environment and market in generating business idea.

7. Using self-assessment, explain your level of confidence in formulating a business idea.

After all the guide questions have been answered and skills have been mastered, share those with your classmates. Discuss your insights, personal knowledge of, and relevant experiences on the topic to make it more exciting and engaging.

### **LEARNING GOALS AND TARGET**

After reading and understanding the objectives of this module and having gone through pre-assessment and answering the guide questions, you will be asked to set your own personal goals. These goals will trigger you to further achieve the ultimate objective of this module. In the end, these goals would motivate you to learn more about Environment and Market.



Figure 2: Strategic process to reach the objectives of this module

### **READING RESOURCES AND INSTRUCTIONAL ACTIVITIES**

After setting your own personal goals and targets to achieve the objectives of this module, you will have the opportunity to read and learn more about environment and market. You too, will also be given a chance to do practical exercises and activities to deepen your understanding of the topic.



## Product Development

When we talk of product development, we are referring to a process of making a new product to be sold by a business or enterprise to its customers. The product development may involve modification of an existing product or its presentation, or formulation of an entirely new product that satisfies a newly defined customer's needs and/or want and/or a market place.

The term development in this module refers collectively to the entire process of identifying a market opportunity, creating a product to appeal to the identified market, and finally, testing, modifying and refining the product until this will be ready for production. This product can be any item to be sold to the consumers.

There are basic, yet vital questions that you can ask yourself about. When you find acceptable answers to these, you may now say that you are ready to develop a product and/or render service.

1. For whom are the products/ services aimed at?
2. What benefit will the customers expect from your product/ service?
3. How will the product differ from the existing brand? Or from their competitor?

Likewise, needs and wants of the people within the area should also be taken into big consideration. Everyone has his or her own needs and wants. However, people have different concepts of needs and wants. Needs in business are important things that every individual cannot do without in a society. These include:

1. Basic commodities for consumption
2. Clothing and other personal belongings
3. Shelter, sanitation, and health
4. Education

Basic needs are essential to every individual so he/she may be able to live with dignity and pride in the community of people. These needs can obviously help you generate business ideas and subsequently to product development.

Wants are desires, luxury, and extravagance that signify wealth and an expensive way of living. Wants or desires are considered above all the basic necessities of life. Some examples are the eagerness or the passion of every

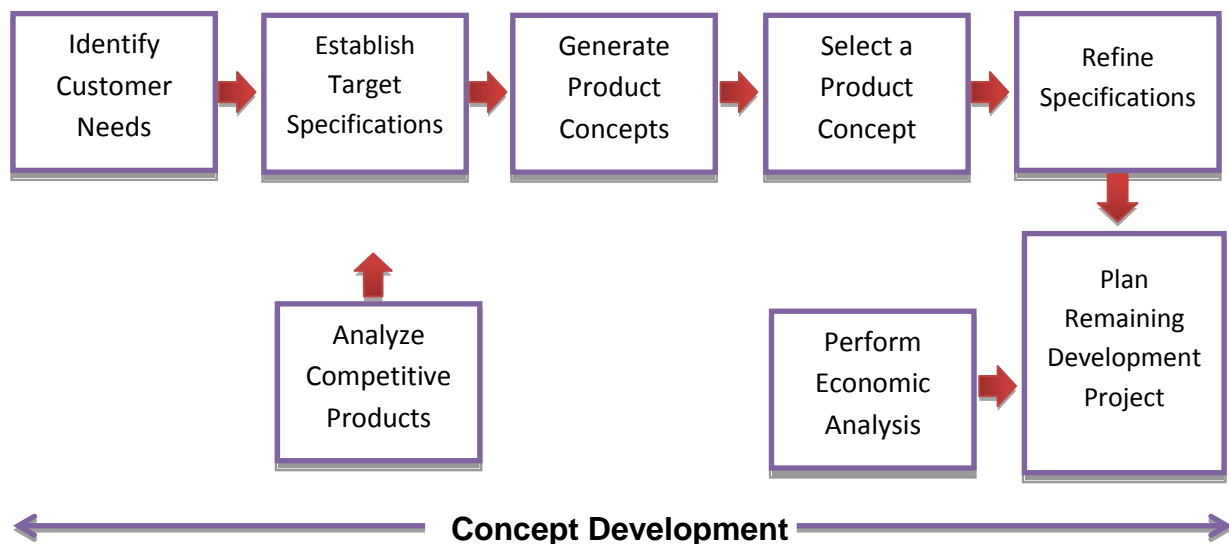
individual which are non- basic needs like; fashion accessories, shoes, clothes, travelling around the world, eating in an exclusive restaurant; watching movies, concerts, plays, having luxurious cars, wearing expensive jewelry, perfume, living in impressive homes, and others.

Needs and wants of the people are the basic indicators of the kind of business that you may engage into because they can serve as the measure of your success. Some other good points that you might consider in business undertakings are the kind of people, their needs, wants, lifestyle, culture and tradition, and social orientation that they belong.

To summarize, product development entirely depends to the needs and wants of the customers. Another important issue to deal with is the key concepts of developing a product. The succeeding topic shall enlighten you about the procedure in coming up with a product.

### Concepts of Developing a Product

Concept development is very critical phase in the development of a product. From this stage, the needs of the target market are identified and competitive products are reviewed before the product specifications are defined. The product concept is selected along with an economic analysis to come up with an outline of how a product is being developed. Below is a figure that shows the stages of concept development of a product.



**Figure 3: Concept Development**



**The process of product development follows the following steps:**

- A. Identify Customer Needs** - Using a survey form, interviews, researches, focus group discussions, and observations an entrepreneur can easily identify customers' needs and wants. In this stage, the information that can be possibly gathered here are product specifications (performance, taste, size, color, shape, life span of the product, etc.). This stage is very important because this would determine the product to be produced or provided.
- B. Establish Target Specifications** - Based on customers' needs and reviews of competitive products, you may now establish target specifications of the prospective new product and/or services. Target specifications are essentially a wish-list.
- C. Analyze Competitive Products** - It is imperative to analyze existing competitive products to provide important information in establishing **products/ services** specifications. Other products may exhibit successful design attributes that should be emulated or improved upon in the new product/service.
- D. Generate Product Concepts** - After having gone through with the previous processes, you may now develop a number of product concepts to illustrate what types of product/service are both technically feasible and would best meets the requirements of the target specifications.
- E. Select a Product Concept** - Through the process of evaluation between attributes, a final concept is selected. After the final selection, additional market research can be applied to obtain feedback from certain key customers.
- F. Refine Product Specifications** - In this stage, product/service specifications are refined on the basis of input from the foregoing activities. Final specifications are the result of extensive study, expected service life, projected selling price and among others are being considered in this stage.
- G. Perform Economic Analysis** - Throughout the process of product development, it is very important to always review and estimate the economic implications regarding development expenses, manufacturing costs, and selling price of the **products/ services** to be offered/provided.
- H. Plan the Remaining Development Project** - In this final stage of concept development, you may prepare a detailed development plan which includes a list of activities, the necessary resources and expenses, and a development schedule with milestones for tracking progress.

## Finding Value

People buy for a reason, there should be something in your **products/ services** that would give consumers a good reason to go back and buy for more. There must be something that has to make you the best option for your target customers; otherwise they have no reason to buy what you're selling. This implies further, that you offer something to your customers that they will make them value or treasure your **products/ services**.

The value that you incorporate to your product is called value proposition. Value proposition is "a believable collection of the most persuasive reasons people should notice you and take the action you're asking for." Value is created by fulfilling deep desires and solving deep problems. This is what gets the people moving, what gets spending for your product/service.

## Innovation

Innovation is the introduction of something new in your **products/ services**. This may be a new idea, a new method or a device. If you want to increase your sales and profit you must innovate. Some of the possible innovations in your products are change of packaging, improve taste, color, size, shape and perhaps price. Some of the possible innovations in providing services are application of new improved methods, additional featured services, and possibly freebies.

## Unique Selling Proposition (USP)

Unique Selling Proposition is the factor or consideration presented by a seller as the reason that one product or service is different from and better than that of the competition. Before you can begin to sell your product or service to your target customers, you have to sell yourself on it. This is especially important when your product or service is similar to those around you.

USP would require careful analysis of other businesses' ads and marketing messages. If you analyze what they say or what they sell, not just their product or service characteristics, you can learn a great deal about how companies distinguish themselves from competitors.

## Here's how to discover your USP and use it to increase your sales and profit:

- ***Use empathy: Put yourself in the shoes of your customers.*** Always focus on the needs of the target customers and forget falling in love

with your own product or services. Always remember, you are making this product or providing for the target customers to eventually increase sales, earn profit and not making this product or services for yourself. Essential question such as what could make them come back again and again and ignore competition? Most possible answers will be focused on the quality, availability, convenience, cleanliness, reliability, and friendliness.

- **Identify what motivates your customers.** It is very important for you to understand and find out what drives and motivates your customers to buy your product/service. Make some efforts to find out, analyze, and utilize the information what motivates the customers in their decisions to purchase the **products/ services**.
- **Discover the actual and genuine reasons why customers buy your product instead of a competitor's.** Information is very important in decision making. A competitive entrepreneur always improve their products/services to provide satisfaction and of course retention of customers. As your business grows, you should always consider the process of asking your customers important information and question that you can use to improve your **products/ services**.



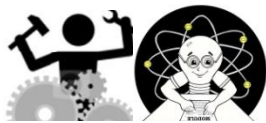
In order to firm up your understanding of the topic previously presented, you will be tasked to form a group and conduct an interview with a successful entrepreneur/practitioner. You have to document this interview and present this to the whole class for reflection and appreciation.

### **Task 3: Interview**

**Directions:** Select a successful entrepreneur/practitioner. Conduct an interview by utilizing the sets of questions below. Document the interview and present this to the class.

1. How did you identify your customers?
2. What were your considerations in selecting your customers?
3. Explain how your products/ services become unique to other product/s.

4. Did you consult somebody before you engage in this business? Cite sample insights that you gained from the consultation.
5. What were your preparations before you started the actual business?
6. What creative and innovative techniques did you adopt to your **products/ services**? What was the effect of the innovative techniques to the sales and profits of your business?
7. What strategy did you consider to have a unique selling proposition to your product/service?



#### **Task 4: Video Viewing**

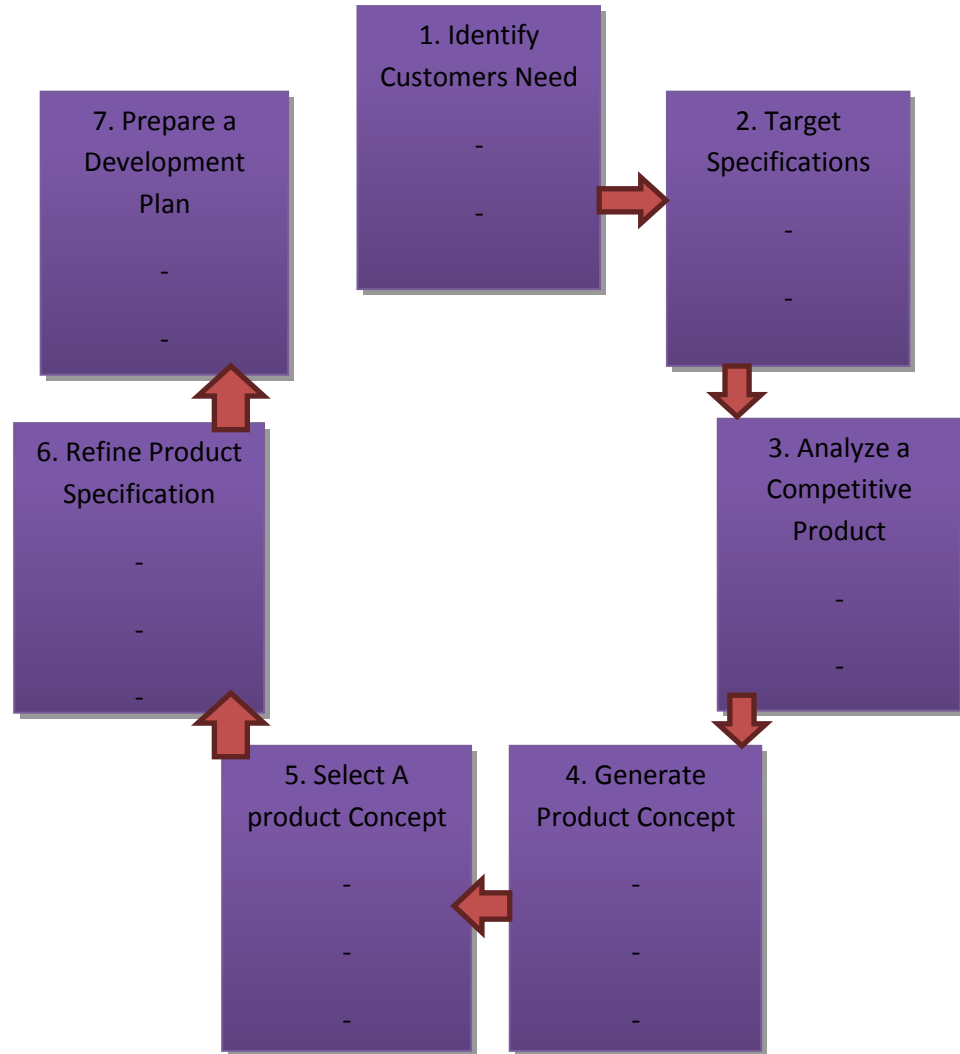
In order to deepen your understanding of the lesson, perform the following tasks:

1. Browse the internet on topics related to:
  - a. Customers' needs and wants;
  - b. Techniques in identifying customers' needs and wants;
  - c. Creativity/innovations in products and services;
  - d. Unique selling proposition; and
  - e. Product development.
2. Prepare a short narrative report about the aforementioned topics. You may highlight the "aspect" that intensifies your knowledge of product development.



#### **Task 5: Product Conceptualization**

**Directions:** Using the figures below develop your own concept for your products/ services.




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## Generating Ideas for Business

The process of developing/generating business idea is not a simple process. Some people just come to a bunch of business ideas, but some really are without ideas. There are two problems that might arise: **first** is the excessive generation of ideas and that can make forever to remain dreaming

stage, and **second** is when they don't have ideas and want to become entrepreneurs.

The most optimal way is to have a systematic approach in generating and selecting business idea that will be transferred in real business. Here are some basic yet very important considerations you may use to generate possible ideas for business:

1. **Examine the existing goods and services.** Are you satisfied with the product? What do other people who use the product say about it? How can it be improved? There are many ways of improving a product from the way it is made to the way it is packed and sold? You can also improve the materials used in crafting the product. In addition, you introduce new ways of using the product, making it more useful and adaptable to the customers' need. When you are improving the product or enhancing it, you are doing an *innovation*. You can also do an *invention* by introducing an entirely new product to replace the old one.

Business ideas may also be generated by examining what goods and services are sold outside by the community. Very often, these products are sold in a form that can still be enhanced or improved.

2. **Examine the present and future needs.** Look and listen to what the customers, institution, and communities are missing in terms of goods and services. Sometimes, these needs are already obvious and felt at the moment. Other needs are not that obvious because they can only be felt in the future, in the event of certain developments in the community. For example, a province will have its electrification facility in the next six months. Only by that time will the entrepreneur could think of electrically-powered or generated business such as photo copier, computer service, digital printing, etc.
3. **Examine how the needs are being satisfied.** Needs for the products and services are referred to as market demand. To satisfy these needs is to supply the products and services that meet the demands of the market. The term market refers to whoever will use or buy the products or service, and these may be people or institutions such as other businesses, establishments, organizations, or government agencies.

There is a very good business opportunity when there is absolutely no supply to a pressing market demand.

Businesses or industries in the locality also have needs for goods and services. Their needs for raw materials, maintenance, and other services such as selling and distribution are good sources of ideas for business.

4. **Examine the available resources around you.** Observe what materials or skills are available in abundance in your area. A business can be started out of available raw materials by selling them in raw form and by processing and manufacturing them into finished products. For example, in a copra-producing town, there will be many coconut husks and shells available as “waste” products. These can be collected and made into coco rags/doormat and charcoal bricks and sold profitably outside the community.

A group of people in your neighborhood may have some special skills that can be harnessed for business. For example, women in the Mountain Province possess loom weaving skills that have been passed on from one generation to the next generation. Some communities there set up weaving businesses to produce blankets, as well as decorative items and various souvenir items for sale to tourists and low land communities.

Business ideas can come from your own skills. The work and experience you may have in agricultural arts, industrial arts, home economics, and ICT classes will provide you with business opportunities to acquire the needed skills which will earn for you extra income, should you decide to engage in income-generating activities. With your skills, you may also tinker around with various things in your spare time. Many products were invented this way.

5. **Read magazines, news articles, and other publications on new products and techniques or advances in technology.** You can pick up new business ideas from Newsweek, Reader’s Digest, Business Magazines, “Go Negosyo”, KAB materials, Small-Industry Journal. The Internet serves as a library where you may browse and surf on possible businesses. It will also guide you on how to put the right product in the right place, at the right price, and at the right time.

Listing of possible businesses to set up in an area may also be available from banks or local non-government organizations.

## Key concepts of selecting a Business Idea

Once you have embarked on identifying the business opportunities, you will eventually see that there are many possibilities that are available for you. It is very unlikely that you will have enough resources to pursue all of them at once. Which one will you choose?

You have to select the most promising one from among hundreds and one ideas. It will be good to do this in stages. In the first stage, you screen your ideas to narrow them down to about five choices. In the next stage, trim down the five choices to two options. In the final stage, choose between the two and decide which business idea worth pursuing.

In screening your ideas, examine each one in terms of the following factors:

1. How much capital is needed to put up the business?
2. How big is the demand for the product? Do many people need this product and will continue to need it for a long time?
3. How is the demand met? Who are processing the products to meet the need (competition or demand)? How much of the need is now being met (supply)?
4. Do you have the background and experience needed to run this particular business?
5. Will the business be legal, not going against any existing or foreseeable government regulation?
6. Is the business in line with your interest and expertise?

Your answers to these questions will be helpful in screening which ones from among your many ideas are worth examining further and worth pursuing.

## Branding

Branding is a marketing practice of creating name, symbol or designs that identifies and differentiates **products/ services** from other products/services. It is also a promise to your customers. It tells them what they can expect from your product/ services and it differentiate your offerings from other competitors. Your brand is derived from who you are, who you want to be, and how people perceive you to be.

Branding is one of the most important aspects of any business. An effective brand strategy gives you a major edge in increasingly competitive markets.



The features of a good product brand are as follows:

- Delivers the message clearly
- Confirms your credibility
- Connects your target prospects emotionally
- Motivates the buyer
- Concretizes user loyalty

Here are some simple tips to publicize your brand.

- **Develop a tagline.** Write a meaningful unforgettable, and easy to remember statement that captures the essence of your brand.
- **Get a great logo.** Create a logo suitable to your business and consistent with your tagline and place it everywhere.
- **Write down your brand messaging.** Select key messages you want to communicate about your brand.
- **Be true to your brand.** Deliver your brand promise.
- **Be consistent.** Be reliable and consistent every time.



In generating business idea, you should first identify what type of business is suited to your business idea. You should analyze and scan the potential environment, study the marketing practices and strategies of your competitors, analyze the **Strengths, Weaknesses, Opportunities**, and the **Threats** in your environment to ensure that the products/goods and services you are planning to offer will be patronized within the easy reach by your target markets/consumers.

**Bear in mind these simple rules for successful SWOT analysis.**

- Be realistic about the strengths and weaknesses of your business when conducting **SWOT** analysis.
- SWOT analysis should distinguish between where your business is today, and where it could be in the future.

- SWOT should always be specific. Avoid any grey areas.
- Always apply SWOT in relation to your competition i.e. better than or worse than your competition.
- Keep your SWOT short and simple. Avoid complexity and over analysis
- SWOT is subjective.

**Task 6: SWOT Analysis**

**Directions:** In generating a business idea, environmental scanning is very important. Utilize the SWOT analysis table below to list up all your observations. Consider the strategies below to select the best business idea.

Strength (S)	Weaknesses (W)
<ul style="list-style-type: none"> <li>-</li> <li>-</li> <li>-</li> <li>-</li> <li>-</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>-</li> <li>-</li> <li>-</li> <li>-</li> <li>-</li> <li>-</li> </ul>
Opportunities (O)	Threats (T)
<ul style="list-style-type: none"> <li>-</li> <li>-</li> <li>-</li> <li>-</li> <li>-</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>-</li> <li>-</li> <li>-</li> <li>-</li> <li>-</li> <li>-</li> </ul>

**Strategize:**

- **SW** – Utilize the strengths to overcome the weakness
- **OS** - Capitalize on the opportunities to eliminate the weakness
- **ST** – Maximize on your strengths to eliminate the external threats
- **OT** – Take advantage of the available opportunities to eliminate the external threats.

**Strategies/Activities:**

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**Analysis:**

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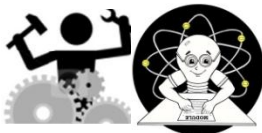
**My Best Business Idea:**

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In order to deepen your understanding of the topics previously discussed, you will be asked to perform the following activities:

**Task 7: Extra Readings and Video Viewing**

Reading books and watching videos have been considered as one of the most effective educational activities that help learners deepen their understanding of certain topic. In this particular circumstance, you will be asked to conduct an extra readings and video viewings on the following topics:

- A. Steps in selecting business idea
- B. Criteria of a viable business idea
- C. Benefits of a good brand
- D. Ways on developing a brand

After successfully performing the assigned task, make a narrative report about this and share it to the class.



## Task 9: Making my own Logo

**Directions:** Generate a clear appealing product brand with logo and tagline.

Logo

Logo

Tagline

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## Feedback

1. D
2. C
3. A
4. B
5. A
6. D
7. B
8. C
9. D
10. D

## PROCESS AND DELIVERY

CONTENT STANDARD	PERFORMANCE STANDARD
The learner demonstrates an understanding of the concepts in maintaining and repairing appliances with motor and with a heating element:  1. washing machine 2. flat iron 3. toaster oven 4. rice cooker	The learner independently maintains and repairs appliances with motor and with a heating element:  1. washing machine 2. flat iron 3. toaster oven 4. rice cooker

### QUARTER I

**TIME ALLOTMENT: 40 HOURS**

### **UNIT OF COMPETENCY: MAINTAIN AND REPAIR ELECTRONICALLY-CONTROLLED DOMESTIC APPLIANCE**

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#### **I. INTRODUCTION:**

This lesson contains information and suggested learning activities in Maintaining and Repairing a **Washing Machine**. Additionally, pre-testing and disassembling-assembling procedure of a washing machine are included to comply with the standard operating procedure. There are forms to accomplish for proper documentation.

#### **II. PRE/DIAGNOSTIC ASSESSMENT**

**Directions:** Read each statement carefully and write the letter and word/s of your answer on a separate sheet.

1. It refers to a domestic appliance that washes clothes and linens.  
A. Blender  
B. Microwave Oven  
C. Vacuum Cleaner  
D. Washing Machine
2. It is a device that is responsible in the conversion of electrical energy into mechanical energy to facilitate an act of washing.  
A. AC cord  
B. AC motor  
C. Spin timer  
D. Wash timer
3. In a washing machine, it serves as a washing tub.  
A. Drain Hose  
B. Drum  
C. Pulsator  
D. Top Cover

4. In a washing machine, it serves as a passage way out of water.
  - A. Drain Hose
  - B. Drum
  - C. Pulsator
  - D. Top Cover
5. It is a rotating part inside the tub of a washing machine and responsible in making the water to spin.
  - A. Drain Hose
  - B. Drum
  - C. Pulsator
  - D. Top Cover
6. It is a processing circuit that accepts the input signal coming from sensor, program selection control and it provides the triggering voltage to the power controller.
  - A. Comparator
  - B. Drain Hose
  - C. Input command
  - D. Pulsator
7. It is used to cover the tub.
  - A. Drain Hose
  - B. Drum
  - C. Pulsator
  - D. Top Cover
8. It is responsible in transmitting mechanical energy from the AC motor to the pulley of gear assembly.
  - A. AC motor
  - B. Drive belt
  - C. Drive control
  - D. Pulley
9. It is a handtool used in holding, gripping and cutting of wires.
  - A. Blade cutter
  - B. Pliers
  - C. Screwdriver
  - D. Soldering iron
10. It is a measuring instrument used to check continuity and resistance of a circuit.
  - A. Ammeter
  - B. Ohmmeter
  - C. Voltmeter
  - D. Wattmeter

### **III. LEARNING COMPETENCIES**





#### **LO 1: PREPARE UNIT, TOOLS, EQUIPMENT AND WORKPLACE FOR MAINTENANCE/REPAIR**

- Prepare necessary tools, test instruments and personal protective equipment in line with job requirements
- Acquire service manuals and service information required for repair/maintenance as manufacturer's specifications
- Conduct complete check-up of electronically-controlled domestic appliances
- Document the identified defects based on check-up conducted

**INFORMATION SHEET 1.1**  
**TOOLS AND MATERIALS IN MAINTAINING ELECTRONICALLY-CONTROLLED WASHING MACHINE**



In every electronic work, it is a must to prepare first the necessary tools, materials, and equipment needed as well as the information. The following list of tools, materials, and equipment are needed in maintaining and repairing a washing machine:

		
Soldering Iron with stand	Soldering Lead	Desoldering Tool
		
Diagonal Cutting Pliers	Long Nose Pliers	Wire Stripper
		
Adjustable Plier	Philip Screwdriver	Flathead Screwdriver
		
Multitester/ Volt-Ohm-Milliammeter (VOM)	Combination Wrench	Utility Knife

		
ESD Wrist Strap	Mask	Non-Static Brush
		
Apron	Cable Tie	Electrical Tape
		
Eye Protector/ Goggles	Gloves	Soldering Paste

**SELF-CHECK 1.1**  
**TOOLS AND MATERIALS IN MAINTAINING ELECTRONICALLY-CONTROLLED DOMESTIC APPLIANCE (WASHING MACHINE)**

Familiarization: Identify the tools, equipment and materials in maintaining and repairing a washing machine as numbered. Write your answers on a separate sheet.

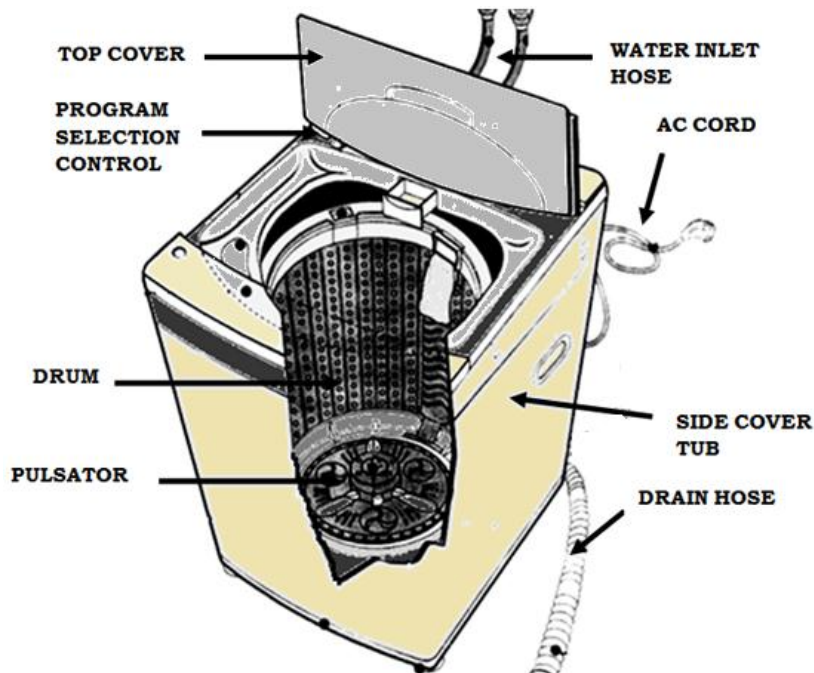
1	2	3	4	5
				
6	7	8	9	10
				



## INFORMATION SHEET 1.2 OPERATION OF A WASHING MACHINE

Washing Machine is a domestic appliance that washes clothes with the aid of water and detergent. It is also called laundry machine, clothes washer, or washer that includes immersing dipping, rubbing, or scrubbing of clothes in water. This machine is power driven with an AC motor connected to the power source (220v/60 Hz) so that the electrical energy can be converted into mechanical energy in order to facilitate an act of washing rinsing and spinning. The simplest washing machine just agitates clothes in water with detergent, wherein some includes wash and spin timers for automatic operations. Automatic machines or those electronically controlled may fill, empty, wash, spin and heat in a cycle. The usual domestic washing machine can be considered automatic because of the mechanical timer used. Electronically-controlled are those machines that utilize electronic circuit for switching and program of the operation depending on the features.

### Parts of Washing Machine and their Functions



Source: Service Manual- Automatic Washing Machine DWF-270G

Internal Parts	External Parts
Drum	Program Selection Control
Pulsator	AC Cord
	Water Inlet
	Side Cover Tub
	Drain Hose
	Top Cover

### Functions of each part

**Top Cover** is used to cover the tub.

**Pulsator** is a rotating part inside the tub and responsible in making the water spin.

**Drain Hose** is an outlet serves as a passage way out for water after spinning has been done.

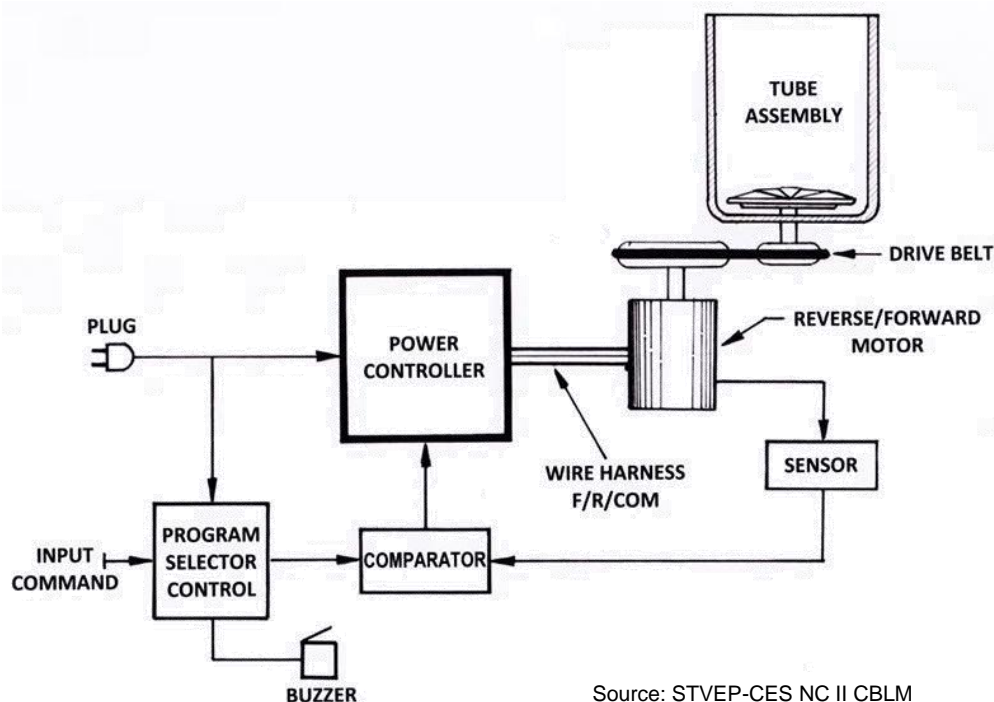
**Side Cover Tub** is the main casing/housing for the parts of the unit.

**Drum** serves as a washing tub.

**Water Supply Hose** is an inlet of water.

**Tub** is a drum-like component in which water, clothes and soap are put together prior to washing/spinning.

### Block Diagram of Electronically-Controlled Washing Machine



**Power Controller**- is a circuit that controls the amount of power supplied to the motor.

**Sensor**- is an input receiver that detects input signal coming from forward and reverse motor. It detects any abnormality of the operation for automatic shut off.

**Program Selection Control**- is a set of push button switch that set the operation required of the washing machine. This circuit has a timing sequence to be selected as low, medium, or high depending on how long and type of fabric to be washed.

**Comparator**- is a processing circuit that accepts the input signal coming from sensor and program selection control. This enables/disables a sequence of command for the power controller.

**Forward/Reverse Motor-** is an electric machine which changes applied electrical energy or power into mechanical output energy or power.

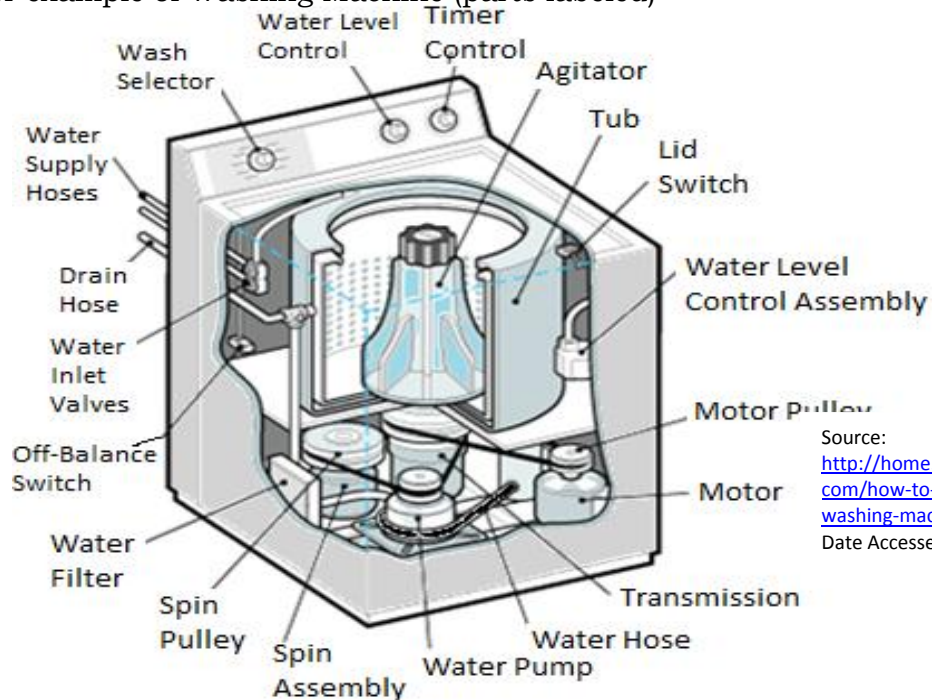
**Input Command** - is a setting period of the user.

**AC Plug-** is a connector intended for connecting the unit to the main power source of 220V.

**Drive Belt** - is used to transmit mechanical energy from a driving pulley to a drive pulley.

**Buzzer-** is an audio/ sound signal device to confirm or indicate that task programmed or set is done or a problem occurred. This may be mechanical, electromechanical, or piezoelectric.

Another example of Washing Machine (parts labeled)



Source:  
<http://home.howstuffworks.com/how-to-repair-a-washing-machine.htm>  
Date Accessed: May 2014

### Functions of each part

**Timer Control-**is a special clock mechanism or motor operated device used to perform switching operations at predetermined time intervals.

**Water Level Control-** is a dial used to manage the quantity of water needed.

**Wash Selector-** is used to choose the task to be done

**Water Supply Hoses-** is an access for water supply

**Drain Hose-** is an outlet for the water to be dispense

**Water Inlet Valve-** is used to allow or stop water to flow

**Off-Balance Switch-** is used to shut the washer off to protect the washer if load is unbalance

**Water Filter-** is used to take out dirt from water by means of a fine physical barrier

**Spin Pulley-** is used to transmit power from the electric motor to spin assembly

**Spin Assembly-** is used to control the power at the transmission

**Water Pump**- is used to push the water out of the unit.

**Water Hose**- is a passage way out of the water.

**Transmission**- is also known as gear box assembly; transmit and boost mechanical power from the motor to the agitator.

**Motor**- is an electromechanical device that converts electrical energy into mechanical energy or motion.

**Motor Pulley**- is used to transmit power from the electric motor to the transmission through drive belt.

**Water Level Control Assembly**- it contains valve that is used to control the quantity of water needed.

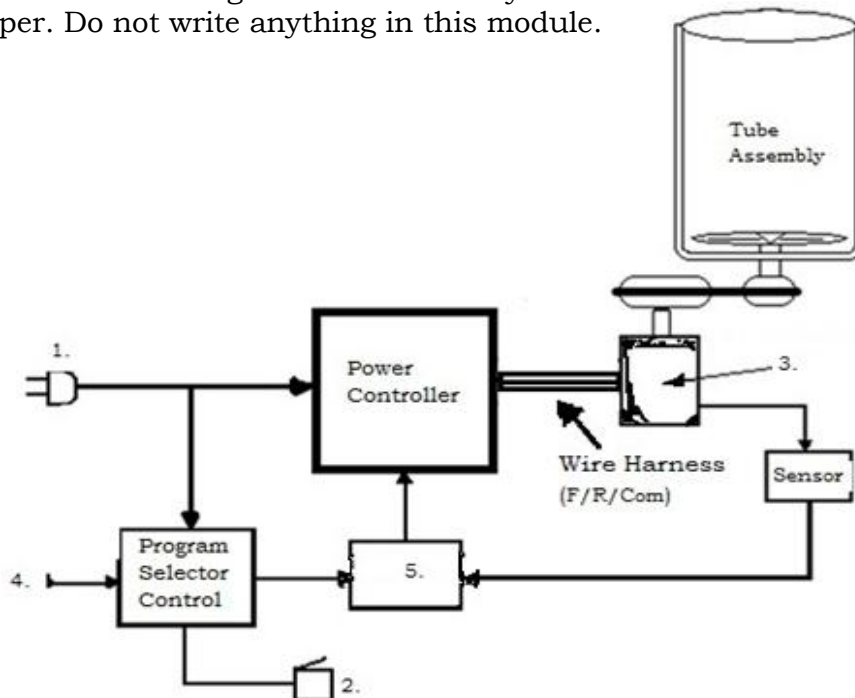
**Lid Switch**- is the safety feature of the unit that operates with the lid.

**Tub**- is a large round container where act of washing happen.

**Agitator**- is a mechanism inside the tub that makes the water and clothes to spin.

### SELF-CHECK 1.2 OPERATION OF A WASHING MACHINE

- A. Directions:** Label the different blocks that resemble an electronically-controlled washing machine. Write your answer in another sheet of paper. Do not write anything in this module.



- B. Direction:** State the function of each part of the washing machine listed below.

6. Pulsator
7. Drain Hose
8. Buzzer
9. Program Selection Control
10. Power Control

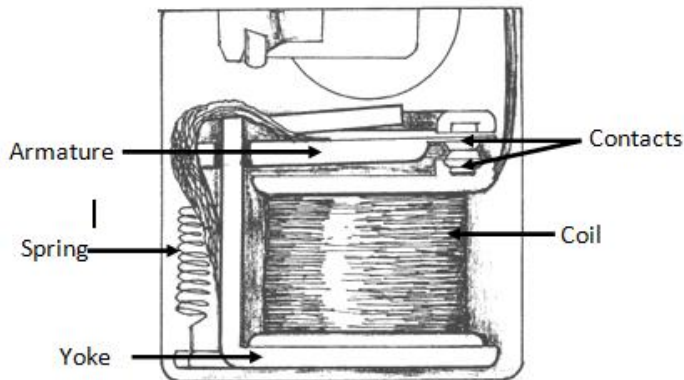
## INFORMATION SHEET 1.3 BASIC CONCEPT OF ELECTRONIC CONTROL

Electronic control is also referred as electronic regulation that is done to an appliance, situation or load by electronic devices. Domestic appliances are commonly controlled directly or manually using electrical switches and timers. In electronic devices, transformer is commonly used not just to reduce the supply voltage (220VAC) but also to isolate the load from the power source. To apply this safety feature to domestic appliance, a device (electrically or electronically operated) is needed. Relay and triac is just an example of devices that can be used.

### Relay

A relay is an electrically operated switch. Various relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal or where several circuits must be controlled by one signal.

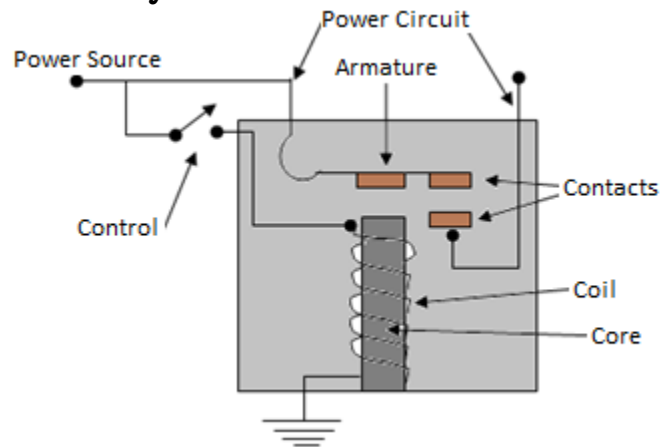
### Electromagnet Type



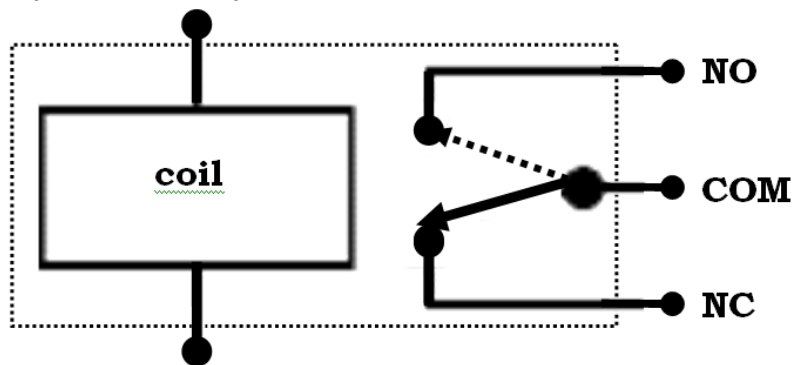
### Parts of Electromagnet Type Relay

1. **Yoke:** Heavy-duty frame that enclose and supports the parts of the relay.
2. **Coil:** Magnetic wire that is wound around a metal core. Creates an electromagnetic field when energize.
3. **Armature:** A relays moving part. The armature opens and closes the contacts. An attached spring returns the armature to its original position.
4. **Contacts:** The conducting part of the switch that closes or opens a circuit.

### Illustration of a Relay



### Schematic symbol of relay



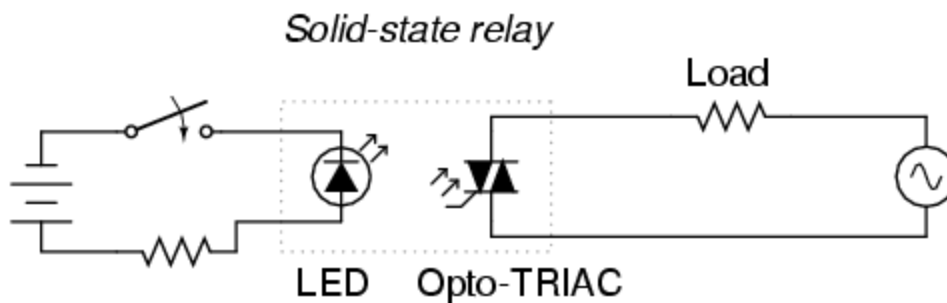
Coil is a wire wound around a metal core. If this coil of wire is energized, electromagnetic field is produced causing the COM terminal to connect with NO terminal. If coil is not energized, COM is at NC terminal (COM-common/ NO- normally open/ NC- normally-closed).

Relays involve two circuits: the energizing circuit and the contact circuit. The coil is on the energizing side; and the relays contacts are on the contact side. When a relays coil is energized, current flow through the coil creates a magnetic field. Whether in a DC unit where the polarity is fixed, or in an AC unit where the polarity changes, the basic function remains the same: the magnetic coil attracts a ferrous plate, which is part of the armature. One end of the armature is attached to the metal frame, which is formed so that the armature can pivot, while the other end opens and closes the contacts. Contacts come in a number of different configurations, depending on the number of Breaks, poles and Throws that make up the relay. For instance, relays might be described as Single-Pole, Single-Throw

(SPST), or Double-Pole, Single-Throw (DPST). These terms will give an instant indication of the design and function of different types of relays.

### **Solid-State Type**

Semiconductors such as Silicon-Controlled Rectifier (SCR), TRIAC, or transistor output are used instead of mechanical contacts to switch the controlled power. The output device (SCR, TRIAC, or transistor) is optically-coupled to an LED light source inside the relay. The relay is turned on by energizing this LED, usually with low-voltage DC power. This optical isolation between inputs to output rivals the best that electromechanical relays can offer.



Being solid-state devices, there are no moving parts to wear out, and they are able to switch on and off much faster than any mechanical relay armature can move. There is no sparking between contacts and no problems with contact corrosion.

Triac is one type of thyristor that functions as an electrically controlled switch for AC loads. This device can switch the current in either direction by applying a small current of either polarity between the gate and one of the two main terminals. It is used in AC applications such as light dimming, motor-speed control, and in micro-controller power control.

### **Self-Check 1.3**

#### **Basic Concept of Electronic Control**

**Directions:** Give the function of the following:

1. Frame
2. Coil
3. Armature
4. Contacts
5. SCR, TRIAC or Transistor

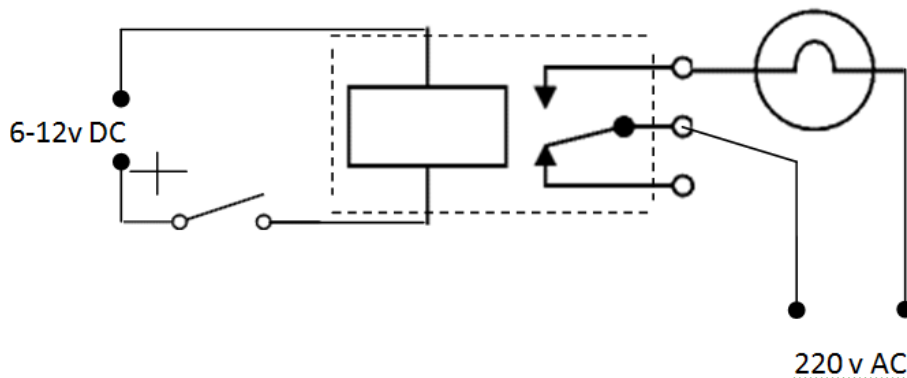
## ACTIVITY SHEET 1.1

### Relay Circuit

**Directions:** Construct a simple controlled circuit using a relay with a breadboard. Prepare the resources needed together with the hand tools and workplace. Follow the procedures accordingly.

**Resources:**

Qty/Unit	Description	Qty/Unit	Description
1	Breadboard	1	DC Power Supply (6-12V)
1	Diagram of circuit with relay	1	220vAC outlet
1 pc.	Relay: 6-12v/ 220vAC (NC/NO)	1.5ft.	Solid wire #22
1 pc.	Bulb 220vAC with socket	1	AC Plug



Schematic Diagram of Simple Controlled Circuit using Relay

**Procedure:**

1. Insert the components (relay, SPST switch and bulb) to the breadboard, it is necessary to be careful in making connection for the AC part of the circuit.
2. Connect the power supply (DC source and AC source). When the circuit is energized, switch ON the SPST switch. The bulb should light ON. Then, switch OFF the SPST switch to turn the light OFF.
3. If the circuit fails, unplug the AC source and refer to the schematic diagram for possible corrections.
4. After the activity, fill-up Performance Check 1.1 and submit your work to your teacher for assessment.



### Performance Check 1.1

**Directions:** Read each item and check the appropriate box.

Tasks	YES	NO
1. Prepared the resources needed.		
2. Inserted the components on the breadboard properly.		
3. Connected the each component accordingly.		
• Relay		
• SPST switch		
• Bulb		
• Power supply		
4. Energized the circuit (it should be functional).		
6. Observed proper use of tools.		
7. Performed housekeeping.		
8. Finished the activity within the timeframe.		

### Performance Assessment for the Activity

**Directions:** Assess student's performance in constructing a circuit using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by multiplying the point/s to corresponding percentage, then add the products and divide by 5, multiply by 100.

Criteria	%	Rating
Prepared the resources needed		
Inserted the components on the breadboard properly		
Connected the each component accordingly		
Energized the circuit for its functionality		
Observed proper use of tools		
Performed housekeeping		
Finished the activity within the timeframe		
TOTAL		

Student's Signature \_\_\_\_\_ Date prepared: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date checked: \_\_\_\_\_

## Rubrics in Assessing Performance:

Prepared the resources needed: 10%				
POINTS				
5	4	3	2	1
Resources, hand tools and workplace are prepared	Resources & hand tools are prepared; workplace is not.	Resources are prepared; hand tools and workplace is not	Incomplete resources and hand tools but workplace is prepared	Resources, hand tools and workplace were incomplete and not prepared

Inserted the components on the breadboard properly: 10%				
POINTS				
5	4	3	2	1
All components were inserted properly	One to two components were not inserted properly	Three to four components were not inserted properly	Most of the components were not inserted properly	All of the components were not inserted properly

Connected each component accordingly. 30%				
POINTS				
5	4	3	2	1
All components were connected properly.	Components were connected properly except transistor	Two to three components were not properly connected	Most of the components were not connected properly	All components were not connected properly

Energized the circuit for its functionality: 30%				
POINTS				
5	4	3	2	1
The circuit was energized and functions as it is.	The circuit was energized but not functions accordingly.	The circuit was not energized.	Incomplete materials.	No materials.

Observed proper use of tools: 10%				
POINTS				
5	4	3	2	1
Tools were used properly	One tool was not used properly	Two tools were not properly used.	Tools were not used properly.	No tools were used.

Performed housekeeping: 5%				
POINTS				
5	4	3	2	1
Performed housekeeping before & after the activity.	Performed housekeeping one time only.	Housekeeping was not performed accordingly.	Housekeeping was not observed	The work area was not cleaned.

Finished the activity within the timeframe: 5%				
POINTS				
5	4	3	2	1
Finished the activity within the timeframe.	Five minutes beyond the timeframe.	Ten minutes beyond the timeframe.	Thirty minutes beyond the timeframe.	The activity was not finished.

**ACTIVITY SHEET 1.2**  
**RECEIVING A WASHING MACHINE (ELECTRONICALLY-CONTROLLED) FOR MAINTAIN/ REPAIR**

**Directions:** Provided with a defective Washing Machine, use maintain and repair form to gather and document the information about the appliance at hand. Follow the procedures below:

**Resources:**

Domestic appliance: Washing Machine  
 (preferably electronically-controlled)  
 Maintain and repair form

**Procedure:**

1. Conduct an initial interview to the owner of the appliance.
  - \* Ask what the problem is.
  - \* Request for the details of the problem (how does it happen/ since when/ nature of the problem)
2. As a serviceman, you must recognize the problem/ complain.
3. Make an initial inspection of the appliance.
  - \*Physical appearance
  - \*Operating controls and other parts
  - \*Power cord
4. Take note of the information gathered and observed.
5. Accomplish Receiving and Repair form.

**Receiving and Repair Form**

Customer's name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Product/ Brand name: \_\_\_\_\_  
 Serial no: \_\_\_\_\_  
 Complain: \_\_\_\_\_  
 \_\_\_\_\_

Washing Machine Checklist

PARTS		
	GOOD	DEFECTIVE
Top Cover		
Pulsator		
Drain Hose		
Side Cover Tub		
Drum		
Water Supply Hose		
Tub		
AC cord		

Student's Signature \_\_\_\_\_ Date prepared: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date checked: \_\_\_\_\_

**PERFORMANCE CHECK 1.2  
RECEIVING ELECTRONICALLY-CONTROLLED WASHING  
MACHINE FOR MAINTAIN/ REPAIR**

**Directions:** Read the questions/ item and check the appropriate box.

Tasks:	YES	NO
1. Recorded the name and address of the owner of the appliance?		
2. Copied product/ brand/ name and serial number of the appliance?		
3. Asked for complain and the remarks/ condition of the appliance?		
4. Verified complain on the condition of the appliance?		
5. Accomplished checklist of appliance parts condition.		
• Top Cover		
• Pulsator		
• Drain Hose		
• Side Cover Tub		
• Drum		
• Water Supply Hose		
• Tub		
• AC cord		
<b>TOTAL</b>		

Note: You should check at least nine YES for you to proceed to the next lesson. If not, you will repeat the activity.

Student's Signature \_\_\_\_\_ Date prepared: \_\_\_\_\_  
Teacher's Signature \_\_\_\_\_ Date checked: \_\_\_\_\_

## **LO2: DIAGNOSE FAULTS OF ELECTRONICALLY-CONTROLLED DOMESTIC APPLIANCES**

- Observe systematic pre-testing procedure in accordance with manufacturer's instructions
- Check and isolate circuits using specified testing procedure
- Document results of diagnosis and testing accurately and completely within the specified timeframe
- Explain identified defects and faults based on the result of diagnosis and testing
- Provide data/information regarding the status and service ability of the unit as per procedure

### **INFORMATION SHEET 2.1**

#### **PRE-TESTING and TROUBLESHOOTING a WASHING MACHINE (ELECTRONICALLY-CONTROLLED)**

##### **Procedure and Techniques in Pre-Testing an Electronically-Controlled Washing Machine**

1. Be sure you understand how the washing machine operates. If possible, read the operation's manual first for its function and additional features.
2. Determine what the problem really is.
3. Perform preliminary inspection to locate where the problem has originated.
4. Perform closer inspection into the suspected parts or components.
5. Use appropriate instrument in initial testing of the appliance. (With the aid of ohmmeter, connect the test prods to the AC plug, turn on the timer switch and observe the pointer of the ohmmeter. If resistance is observed, the power line as well as the motor is in good condition. If the pointer did not move it means an open circuit.)
6. Plan your approach to repair the problem.

##### **Diagnosing and Troubleshooting Procedure/ Guide:**

<b>SYMPTOM: Washer is not energized.</b>		
<b>POSSIBLE DEFECT</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Power cord	Check the continuity of the power cord using ohmmeter.	Replace power cord if necessary
Fuse	Check the continuity of the fuse using ohmmeter.	Replace fuse if necessary
Timer	Check for the continuity of the timer using ohmmeter.	Replace timer if necessary

<b>SYMPTOM: Washer is energized but not spinning.</b>		
<b>POSSIBLE DEFECT</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Starting capacitor	Check the condition of the capacitor using ohmmeter.	Replace starting capacitor if necessary
Disconnected capacitor	Check the continuity of the capacitor wiring using ohmmeter.	Replace/reconnect capacitor wiring if necessary
Broken belt	Check the size/ specification of the belt for replacement.	Replace belt

<b>SYMPTOM: Pulsator doesn't rotate normally.</b>		
<b>POSSIBLE DEFECT</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Loose belt	Check the fitness of the belt from the motor to the pulley.  Check the motor fixing screw/nut.	Adjust the motor alignment to tighten the belt, if necessary replace belt. Adjust the motor accordingly with the belt.
Gear box assembly	Unplug the unit from the power source. Turn the pulsator clockwise (cw) and counter-clockwise (ccw) and see if the pulley responds accordingly. If not, the assembly is defective.	Replace the gearbox.
Timer	Turn on the washing machine and observe the interval of motor rotation(cw/ccw).If the interval is not normal, timer is defective.	Replace the timer.

<b>SYMPTOM: Abnormal Noise and Vibration</b>		
<b>POSSIBLE DEFECT</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Friction between pulsator and wash tub	Unplug the unit from the power source. Turn the pulsator clockwise (cw) and counter-clockwise (ccw) and check the tightness of the screw. Check the pulsator for misalignment or deformed spline.	Tighten screw.  Replace pulsator
Presence of foreign matter	Check for unnecessary materials in between pulsator and wash tub.	Remove foreign material/s with care.
Over tightened belt	Check the belt for its tightness. If too tight, loosen the two nut of the wash motor prior to adjustment.	Adjust the wash motor accordingly.

**ACTIVITY SHEET 2.1**  
**Pre-Testing and Diagnosing/ Troubleshooting an Electronically-  
Controlled Washing Machine (ECWM)**

**Directions:** Provided with the resources, perform the procedure and techniques in pre-testing and troubleshooting a washing machine.

**Resources:**

Service manual of ECWM  
Washing Machine (functional and defective)  
Activity sheet/ Forms  
Tools and Equipment Needed  
Pliers  
Screwdrivers  
Volt-Ohm Milliammeter  
Cleaning materials  
Personal Protective Equipment (PPE)

**Procedure:**

1. Let one of your classmates acts as the owner of the washing machine subject for maintenance or repair.
2. Perform the procedures in accepting and pre-testing an appliance.
3. Accomplish receiving and repair form and copy the form for diagnosis/ troubleshooting in a separate sheet to be filled-up with necessary information as you perform the activity.
4. Provide information regarding the status and serviceability of the appliance.
5. Thirty minutes will be allotted for this activity.

### Receiving and Repair Form

Customer's name: \_\_\_\_\_

Address: \_\_\_\_\_

Product/ Brand name: \_\_\_\_\_

Serial no: \_\_\_\_\_

Complain: \_\_\_\_\_

#### Washing Machine Checklist

PARTS	CONDITION	
	GOOD	DEFECTIVE
Top Cover		
Pulsator		
Drain Hose		
Side Cover Tub		
Drum		
Water Supply Hose		
Tub		
AC cord		

#### SYMPTOM:

POSSIBLE DEFECTIVE PART	PROCEDURE	CORRECTIVE MEASURE

Remarks: \_\_\_\_\_

Student's Signature \_\_\_\_\_ Date prepared: \_\_\_\_\_

Teacher's Signature \_\_\_\_\_ Date checked: \_\_\_\_\_



**PERFORMANCE CHECK 2.1**  
**PRE-TESTING AND DIAGNOSING/ TROUBLESHOOTING AN**  
**ELECTRONICALLY-CONTROLLED WASHING MACHINE (ECWM)**

**Directions:** Assess the students on how competent they have applied the skill in pre-testing and diagnosing washing machine using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by multiplying the points earned by the corresponding percentage, then divide each item by 5, multiply by 100. Add the products to get the rating.

Criteria	%	Points					Rating
		5	4	3	2	1	
Workmanship	50						
Use of Tools	30						
Use of Personal Protective Equipment	10						
SPEED	5						
House Keeping	5						
<b>Total</b>							

**RUBRICS**

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
SPEED	Finished within the time/ Less 1 point for every five minutes delay
House Keeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date prepared: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date checked: \_\_\_\_\_

### **LO3: MAINTAIN/REPAIR WASHING MACHINE**

- Use Personal Protective Equipment (PPE) in accordance with Occupational Health and Safety Practices (OHSP)
- Perform repair activity within the required timeframe
- Observe safety precautions in handling the unit/product as per standard operating procedure
- Replace defective parts/ components with identical parts or recommended parts with equivalent ratings
- Solder/mount repaired or replaced parts/components in accordance with industry standards
- Clean unit in accordance with standard operating procedure

### **INFORMATION SHEET 3.1 PERSONAL PROTECTIVE EQUIPMENT**

It is the employer's responsibility to provide personnel protective clothing and equipment. It includes work clothes and specially designed protective clothing intended for your protection. Wear the correct clothing and equipment to protect you from possible serious injury. Do not interfere with or misuse any item provided for health and safety.

Personal Protective Equipment (PPE) is defined in the Occupational Safety and Health Administration (OSHA) as a tool used to protect workers from injury or illness caused by having contact with the dangers (hazards) in the workplace, whether they are chemical, biological, radiation, physical, electrical, mechanical and other. Exposures to hazards are reduced using PPE.

The types of Personal Protective Equipment

Personal Protective Equipment can be classified according to target organs potentially affected of the risk of danger. Identification of hazard and risk assessment of a job, process and activity must be done first before deciding which type of PPE to be used.

<b>Organ</b>	<b>Source of danger</b>	<b>PPE</b>
1 Eye	splashes of liquid chemicals or metals, dust, catalyst powder, projectiles, gas, steam and radiation.	safety spectacles, goggles, face shield, welding shield
2 Ear	the sound with the noise level more than 85 dB.	ear plug, ear muff, canal caps.
3 Head	crushed by falling objects, hit by hard objects, rotating objects entangled hair	helmets, bump caps.
4 Respiratory	dust, steam, gas, lack of oxygen (oxygen deficiency).	respirators, breathing apparatus

5	Body	extreme temperatures, bad weather, splashes of liquid chemicals or metals, a blast from a leaking pressure, penetration of sharp objects, dust contaminated	boiler suits, chemical suit, vest, apron, full body suits, jackets.
6	Hand and Arm	extreme temperatures, sharp objects, crushed by heavy objects, electric shock, chemicals, skin infections.	gloves, armlets, mitts.
7	Foot	slippery floors, wet floors, sharp objects, falling objects, chemical splashes and liquid metals aberration.	safety shoes, safety boot leggings.



Examples of Personal Protective Equipment

- Wear clothes that are tight, plain, and well-built and keep them buttoned up.
  - Loose sleeves, unbuttoned or torn shirts or sweaters, ties or loose belts can easily be caught in revolving machinery.
- Wear cuffless trouser.
  - Trousers cuffs may cause you to trip or they may catch sparks or harmful substances.
- Wear suitable footwear and keep it in good repair.
- Wear safety shoes or boots with insulated sole for electrical work.
  - Safety shoes and boots will reinforce toe caps to protect against heavy falling objects.
- Keep long hair under a tight fitting cap or net. If your hair is long, it can be easily caught by the machine.
- Do not wear accessories such as rings or wrist watches, earrings, neck chains, pendants and bracelets while on the job.

- Such items can be caught by moving machinery. It is extremely dangerous to wear them in certain types of work. You may lose your fingers.
- Wear personal protective equipment suitable to the kind of work to be done.
  - Learn the purpose of each item from the wide range of protective devices available.

### **How is Electrostatic Discharge (ESD) Generated?**

Static charge is a form of electricity at rest. It can be generated by simple friction that is, rubbing two objects together. A simple method of generating a static charge is to rub a plastic ball pen case on a nylon cloth. Once generated, the static electricity will remain on the ball pen for as long as it is not placed on any other charged materials. If ever the ball pen comes in contact with another object, the static electricity can move to or from the ball pen to equalize the charge between the two objects. The transfer of static electricity from any of the two objects is called electro-static discharge.

One inexhaustible source of electrons that can supply or can accept them without any effect is the earth. Whatever charged object brought into it is immediately discharged.

### **ESD wrist straps**

ESD wrist straps are also called conductive wrist straps or bands. They are usually made of elastic cloth but contain conductive strands that touch your skin and discharge any static electricity on your body. Some straps are made of conductive rubber. The wire attached to the strap containing a large value resistor usually one mega ohm (1,000,000 ohms). It allows any charge on your body to be slowly transferred to a washing machine ground point.

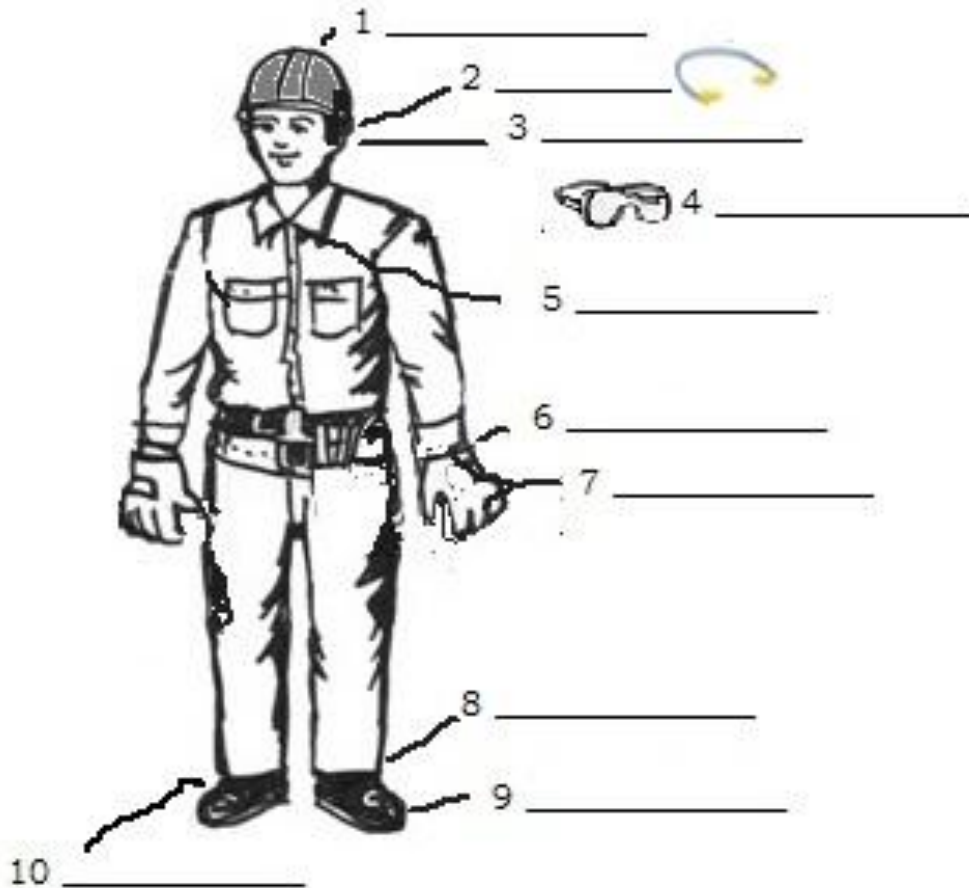
### **ESD Protection Procedure**

1. Anti-static kit can be purchased from a computer or electronics store. The main component is an ESD wrist strap with a wire several feet long having an alligator clip at the other end.
2. Before troubleshooting any domestic appliance, wear an ESD wrist strap and wear it as you go under the covers, handle ICs, and circuit boards.
3. Put the adjustable strap around your wrist. If you are wearing an ESD wrist strap connected to frame or ground, it drains static charges of your body, thus, it prevents damaging ESD sensitive devices.
4. Attach the clip at the end of the wire to an electrical ground connection or metal framework of the washing machine.
5. If you work on a washing machine without a conductive wrist strap, touch an electrical appliance such as a lamp or the screw in a wall outlet cover plate before touching the PCB. An electrostatic discharge of just a few hundred volts is too small to feel in most cases but can be usually deadly to ESD sensitive devices.

Also avoid wearing clothes that easily produce a static charge, such as knits and wools and limit your movements as much as possible, especially on carpets while working on electronic circuits of a washing machine.

### SELF - CHECK 3.1 PPE

I. **Directions:** Identify the different personal protective equipment in the drawing as numbered. Write your answer in a separate sheet of paper.



## **INFORMATION SHEET 3.2 OCCUPATIONAL HEALTH AND SAFETY POLICIES and PROCEDURE**

**Occupational Health and Safety (OHS)** is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work. The goal is to promote a safe work environment. It may also protect co-workers, family members, employers, customers, suppliers, nearby communities, and other members of the public who are impacted by the workplace environment.

As Consumer Electronic Servicing National Certificate Level II (CES NC II) student, you should know how to conduct yourself when working in the classroom/ laboratory room, as well as implement a safe way of accomplishing every task. Safety practices should be learned early and always adhered to when working with any electrical and electronic device. This is for your protection as well as of the people working with you, and also for the devices that you are using. The basis for this process begins with Occupational Health and Safety Policies.

### **Personal Safety While Working Along Electronic Circuits**

Electronics equipment can be dangerous, and you or others can be injured or even killed if you don't follow proper safety guidelines when working or servicing these circuits. The following are some precautionary measures to take before working with any electrical/ electronic circuits:

- Wear shoes with non-conductive rubber soles to help reduce the chance of being shocked or seriously injured in an electrical accident.
- Do not work on components that are plugged into their power source.
- Do not remove expansion cards from electronic product when it is turned on.
- Remove jewelries when working inside any electronic related equipment.
- Be sure not to merge electronic components and water.

### ***Occupational Health and Safety standards***

Each student has a responsibility to their colleagues and their organization to report and act upon any potential workplace hazard. All students need to be aware of the *type of hazards* that are possible in their work environment.

#### **Procedure:**

1. Identify the hazard
2. Clear the area close to the hazard
3. Partition the hazard off or clearly identify the area to protect other people from harm
4. If the hazard is easily and safely cleared, then do so **If not...**

5. Report the hazard to the appropriate person, to obtain assistance
6. Fill out the correct documentation to assist in identifying improved practice to reduce further incidence of hazards.

All hazards must be reported and recorded. This enables us to track the kinds of hazards we have in our workplace, and take action where necessary to make it safer for all student and clients.

### **Fire exits**

All fire exits should be kept clear of any obstacles. All students have a responsibility to make sure that chairs, empty boxes or any other type of obstacle are not placed in or near fire exit doorways. All corridors also need to have equipment stored on one side only to ensure that in the event of an emergency there is a clear exit.

### **In case of fire**

- Assess the danger prior to doing anything.
- If it is safe to move assist anyone in the area of the fire away from danger.
- If it is possible close the door to the fire area.
- Call for assistance. Verbally call FIRE, FIRE, in a loud and clear voice.
- Break the glass section of the fire alert call point.
- Call to the switch; ensure you know where the fire is, any other details that may be of assistance to the fire brigade. Details could be *size of the fire, cause or type of fire, any people hurt or trapped, has anyone tried to put it out.*
- If safe to do so, attack the fire with the correct extinguisher or fire hose.

### **If the designated fire officer is not present, someone quickly needs to take responsibility and:**

1. Locate the source of the fire.
2. Locate any people.
3. Remove all people from the building.
4. Once outside do a head count.
5. Notify the authorities.

### **INFORMATION SHEET 3.3 COMPONENT REPLACEMENT**

#### **Procedure:**

1. Determine the description of the values and ratings of the individual defective parts using the manufacturer's service manual.
2. Identify the sources of the replacement components/parts.
  - Original replacement components from the original factory sources
  - Universal replacement components from independent factory sources(Note: Always consider the physical size of the replacement part).
3. Consider the following factors in selecting parts.
  - **Quality.** The ability to provide exact value or specification to replacement part
  - **Tolerance.** The ability to provide exact value or acceptable parameters to replacement parts.
  - **Availability.** The local access to parts and whether the parts are available.
  - **Price.** Refers to the affordability of the replacement parts at a reasonable price.
4. Disconnect or remove properly the electrical/mechanical parts of an electric fan.
5. Install correctly the replacement parts/components in the existing electric fan.
6. For burnt components where values are impossible to recognize, secure a schematic diagram or service manual if possible. In other case, you can look for the same brand and model as reference.
7. Double check the testing procedure in suspected defective components (on and off the circuit).
8. Check the nearby components for possible consequence of being damaged too.
9. Consider the original orientation/connection of the components in replacing defective one.
10. Observe safety at all times.



### **SELF-CHECK 3.3 COMPONENT REPLACEMENT**

**Directions:** Identify the term being described in each item. Write your answers on a separate sheet of paper.

1. It is one of the factors to consider in selecting replacement parts that refers to the capability of local market to have the supply.
2. It is one of the factors to consider in selecting replacement parts that refers to the conformity of the available parts as per acceptable specification.
3. It is one of the factors to consider in selecting replacement parts that refers to the ability to provide exact value/ specification.
4. It is one of the factors to consider in selecting replacement parts that refers to the affordability of the replacement parts.
5. It contains the necessary data of a particular domestic appliance including the schematic diagram.

### **INFORMATION SHEET 3.4 TROUBLESHOOTING TIPS**

#### **Steps in Troubleshooting:**

1. Conduct a *quick* diagnosis of the trouble symptom and repair the defective set in the *shortest possible time*. Do not troubleshoot an washing machine unless you have determined the fault. Trace the fault from the mechanical section or electrical circuit section.
2. When troubleshooting integrated circuits (ICs) in the electrical/electronic circuit section, do not remove the IC from the PCB. Secure a circuit diagram from the manufacturer to help you identify the function of the IC. Consider the pin out of the IC.
3. When troubleshooting in the electrical/ electronic circuit section, prior to pre-testing, consider voltage measurement on components first before removing it for testing. If the measured voltage is normal, the component might be the cause of the problem. Either way, if the measured voltage is not normal (increased or decreased) the preceding circuit/ components might be the cause.
4. If the trouble symptom is caused by aging components, the defective component is usually one of them. However, in high-power-handling circuits, a defective component may cause other components to malfunction.
5. Be familiar with the usual defects of components. (e.g. capacitors usually become leaky, shorted or open/ resistor increase their resistance when they become defective/ semi-conductors such as transistors usually become open or shorted)
6. Don't replace an opened fuse or burned resistor unless you have corrected the trouble.

7. Always suspect a faulty contact on mechanical switch circuit rather than defective electronic components.
8. When measuring resistance in the circuit, make sure that the circuit is OFF and power is not being supplied in the circuit, and that stored charges in capacitors are properly discharged. Failure to do so can damage the volt-ohm-milliammeter (VOM) and the circuit due to the low resistance of the ohmmeter.
9. While using a VOM for in-circuit resistance measurement, always exchange the setting of positive and negative probes. Take the higher meter reading with the approximate resistance.
10. Use soldering irons with the proper power rating to prevent the components and the circuit board from being overheated and damaged. Soldering iron tips should be cleaned and preferably slim.
11. Use proper tools and soldering aids when troubleshooting PCB. Ground the soldering iron to avoid damaging ICs and transistors.
12. Dry solder joints are hard to detect. However, when they are found or suspected, remove the components from the PCB; then, file or clean the leads and solder the joints back. Reheating dry joints with a new soldering lead is another remedy. When re-soldering, make sure you do not overheat the components. Overheating the PCB may cause the copper layer on it to warp and peel off.
13. USE Personal Protective Equipment.

## **Maintenance of Washing Machine**

### **Steps**

1. Turn off the washing machine and remove the cord from the source of voltage.
2. Apply lubricant to mechanical parts of the washing machine that requires lubrication through a drop of oil or grease to assure smooth operation without grinding or squeaks.
3. Replace the bushings or end bells for squeaks with the use of appropriate tools if squeaks cannot be corrected by applying lubricants.
4. Apply or spray anti-rust lubricants to all mechanical parts of the washing machine to drive out moisture, protect corrosion, loosen rusted metal parts and even frees sticky mechanism.
5. Clean and check cooling louvers for any obstructions to avoid cutting off the air flow.
6. Clean or wipe dust and foreign particles at the PC Board and metal parts of the motor.
7. Replace worn or frayed AC cord and electrical wires.

## **Cleaning Instructions**

### **Steps**

1. Use mild soap and damp cloth or rug when cleaning plastic front panel and cover. They are susceptible to immediate and long term damage from solvents.

2. Apply denatured alcohol as the safest solvent to use for plastic front panel and cover with heavy stain. It should be used only as a last resort and apply to areas with heavy stain.

### **Procedure in Repairing a Washing Machine**

1. Once the specific electrical/mechanical problem is located:
  - consider the techniques for the proper removal of the defective component or parts;
  - anticipate what to do if the replacement part does not correct the problem;
  - and check the installation of the replacement or original part for any improper mounting in the mechanical assembly or circuit board.
2. Examine carefully the mounting of the replacement of original parts of the system.
  - Check the placement of the wires or leads of the replacement component.
  - Consider significant factors used in the original installation such as insulating washer, silicon grease and locating mark for pin connections.
  - Observe proper placement of the component leads for electrical parts.
3. Perform the techniques for the proper soldering of electrical parts.
  - Be careful not to damage adjacent components.
  - Be careful not to lift the copper conductive path from circuit board base material.
  - Avoid any solder bridges between board paths.
  - Do not destroy the component being removed in case it is still functional and be careful not to damage the component being installed.
4. Verify all connections and harness.
  - Be sure that all components pre-positioned in a manner that will avoid the possibility of having adjacent components short circuited.
  - Be sure to check or inspect all insulators and barriers between sections after working on any model/brand of washing machine.
  - Check for frayed or broken insulation on all wiring including the AC line cord.
  - Be sure to replace fuses, resistors and capacitors with special designation such as flame proof to components equal to the original value for both safety and liability purposes.
5. Once the repair is completed, perform an AC leakage test on all exposed metal parts of a washing machine to eliminate the possibility of electric shock.

- Perform complete retesting of the washing machine to ensure the correctness of the actual repair.
  - Connect the washing machine into the 60Hz power to allow the time period required to let the new parts settle in and operate as they are designed to work with each other.
  - Recheck or inspect if the repair was done correctly and the unit functions properly to ensure successful completion of the repair.
6. Clean the washing machine before it would be returned to the customer.
- Be sure that the drum, pulsator, side cover tub and top cover of the washing machine are properly cleaned.
  - Be sure that proper cleaning is given to the control panel or switch box to ensure safety.

### **ACTIVITY SHEET 3.1**

#### **MAINTAIN and REPAIR a WASHING MACHINE**

**Directions:** Provided with the resources, perform the maintenance/ repair procedure in a given washing machine. Observe safety precautions at all times and consider the information given in this lesson.

**Resources:**

Service manual of ECWM  
 Washing Machine (functional and defective)  
 Activity sheet/ Forms  
 Tools and Equipment Needed  
     Pliers  
     Screwdrivers  
     Volt-Ohm Milliammeter  
 Cleaning materials  
 PPE

**Procedure:**

1. Let one of your classmates acts as the owner of the washing machine subject for maintenance or repair.
2. Perform the procedures in accepting and pre-testing an appliance.
3. Accomplish receiving and repair form and copy the form for maintenance and repair in a separate sheet to be filled-up with necessary information as you perform the activity.
3. Provide information regarding the status and serviceability of the appliance.
5. Fifty minutes will be allotted for this activity.

### Receiving and Repair Form

Customer's name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Product/ Brand name: \_\_\_\_\_  
 Serial no: \_\_\_\_\_  
 Complain: \_\_\_\_\_  
 \_\_\_\_\_

#### Washing Machine Checklist

PARTS	CONDITION	
	GOOD	DEFECTIVE
Top Cover		
Pulsator		
Drain Hose		
Side Cover Tub		
Drum		
Water Supply Hose		
Tub		
AC cord		

SYMPTOM:		
DEFECTIVE PART	PROCEDURE	CORRECTIVE MEASURE
Remarks:		

Student's Signature \_\_\_\_\_ Date prepared: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date checked: \_\_\_\_\_

### PERFORMANCE CHECK 3.1

#### MAINTAIN and REPAIR a WASHING MACHINE

**Directions:** Assess the students on how competent they have applied the skill in pre-testing and diagnosing washing machine using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by multiplying the points earned by the corresponding percentage, then divide each item by 5, multiply by 100. Add the products to get the rating.

Criteria	%	Points					Rating
		5	4	3	2	1	
Workmanship	<b>50</b>						
Use of Tools	<b>30</b>						
Use of Personal Protective Equipment	<b>10</b>						
SPEED	<b>5</b>						
House Keeping	<b>5</b>						
<b>Total</b>							

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
SPEED	Finished within the time/ Less 1 point for every five minutes delay
House Keeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date prepared: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date checked: \_\_\_\_\_

## **LO 4: REASSEMBLE AND TEST REPAIRED APPLIANCE**

- Perform the final test for reassembled units in conformity with manufacturer's specifications

### **INFORMATION SHEET 4.1 REASSEMBLING and TESTING REPAIRED WASHING MACHINE**

#### **Reassembling Procedure:**

1. After replacing the defective component of the appliance, prepare the parts for reassembling. Make sure that there are no missing parts and as well as the screw/s.
2. Fix all the disassembled parts in the housing/compartment, considering the fittings/locks.
3. Wires and loose parts should be in proper place to avoid damaged due to misaligned compartment.
4. All sides of the housing should fit accordingly. Moving parts must move as it can be moved by hand and free from obstructions.
5. Tighten screw/s accordingly.
6. Clean the unit before doing the post-testing procedure.

#### **Post-testing Procedure:**

1. Test the resistance at the AC plug to determine the continuity of the power line to the AC motor. A resistance reading must be observed as you turn the timer switch to ON position. This indicates that the circuit connection is good.
2. In the case of electronically-controlled washing machine, there is no resistance reading as you test the AC plug. The reason is that there is a low-voltage power supply circuit that controls the functions of the appliance.
3. Energize the unit to check its functionality. Plug the AC cord to the power source (the timer switch is at OFF position and power ON button for electronically-controlled must be OFF too). Turn the timer switch accordingly and observe if the unit functions as it should be. In the case of electronically-controlled, press button one at a time observing the behavior. This time, the unit should operate normally. If not, review the documentation and the problem for the second time.

#### **Testing Procedure:**

1. Test the resistance at the AC plug to determine the continuity of the power line to the AC motor. A resistance reading must be observed.
2. Energize the unit to check its functionality. Press button one at a time observing the behavior. This time, the unit should operate normally. If not, review the documentation and the problem for the second time.

**ACTIVITY 4.1**  
**REASSEMBLING AND TESTING REPAIRED APPLIANCE**

**Directions:** Provided with the resources, reassemble the repaired appliance and test its functionality.

**Resources:**

- Repaired appliance (electric fan or blender)
- Hand tools and instrument
- Maintain and Repair form

**Procedure:**

1. Refer to the documentation to check if the problem/ complain was addressed.
2. Perform the post-testing procedure. The unit/ appliance must operate in its normal operating condition.
3. Twenty minutes will be given to perform the activity.

**PERFORMANCE CHECK 4.1**  
**REASSEMBLING AND TESTING REPAIRED APPLIANCE**

**Directions:** You will be assessed using the listed criteria with ratings 1-3, 3 is the highest. Each criterion has its indicator and corresponding points for you to assess yourself. Multiply the score by the corresponding percentage and divide it by 3, then multiply by 100. Add the products to get the rating.

Criteria	%	Rating
Workmanship	50	
Accuracy	30	
SPEED	10	
House Keeping	10	
<b>Total</b>		

Student's Signature \_\_\_\_\_ Date prepared: \_\_\_\_\_  
Teacher's Signature \_\_\_\_\_ Date checked: \_\_\_\_\_



## SCORING RUBRICS

CRITERIA	SCORE
<b>Workmanship</b>	
Disassembled parts are prepared. Fittings and screws are complete and returned. The housing fits accordingly. Used the proper tools.	3
Disassembled parts are prepared. Fittings and screws are incomplete. The housing fits accordingly. Used the proper tools.	2
Disassembled parts are not prepared. Fittings and screws are incomplete. The housing fits inaccurate. Used the improper tools.	1
<b>Accuracy</b>	
All parts/components were installed/returned. Housing fits properly. The unit tested and functions accordingly.	3
Not all parts/components were installed/returned. Housing fits properly. The unit tested and functions accordingly.	2
Not all parts/components were installed/returned. Housing does not fit properly. The unit tested and uneven operation observed.	1
<b>Speed</b>	
Finished task before time frame	3
Finished task 5 minutes after the time frame	2
Finished task 10 minutes after the time frame	1
<b>Safety</b>	
The whole area was cleaned before and after the activity	3
The whole area was dirty at the start but cleaned after	2
The whole area was cleaned before the activity but dirty after	1
TOTAL	12

## V. SUMMATIVE ASSESSMENT

**I. Directions.** Write only the letter of the correct answer on your answer sheet.

1. This group of PPE protects us against slippery floors, wet floors, sharp objects, falling objects, chemical splashes and liquid metals aberration.
  - A. Boiler suits, chemical suit, vest, apron, full body suits & jackets
  - B. Gloves, armlets & mitts
  - C. Helmets, bump caps
  - D. Safety shoes, safety boots & leggings
2. This group of PPE protects us against being crushed by falling objects, hit by hard objects, rotating objects and entangled hair.
  - A. Boiler suits, chemical suit, vest, apron, full body suits & jackets
  - B. Gloves, armlets & mitts
  - C. Helmets, bump caps
  - D. Safety shoes, safety boots & leggings
3. This group of PPE protects us against extreme temperatures, bad weather, splashes of liquid chemicals or metals, a blast from a leaking pressure, penetration of sharp objects, contaminated dust.
  - A. Boiler suits, chemical suit, vest, apron, full body suits & jackets.
  - B. Gloves, armlets & mitts
  - C. Helmets, bump caps
  - D. Safety shoes, safety boots & leggings
4. The ability to provide exact value or specification is what factor in selecting replacement parts?
  - A. Availability
  - B. Price
  - C. Quality
  - D. Tolerance
5. The ability to provide exact value or acceptable parameters to replacement parts.
  - A. Availability
  - B. Price
  - C. Quality
  - D. Tolerance

**II. Directions.** Write the word or group of words which will make the statement correct and complete.

6. \_\_\_\_ charge is a form of electricity at rest.
7. \_\_\_\_ wrist straps are also called conductive wrist straps or bands.
8. When working with the electronic system control of any domestic appliance, it is a safety practice to \_\_\_\_ ground point first.
9. For unfamiliar appliance the \_\_\_\_ should be produced to understand its operation.
10. \_\_\_\_ is necessary after the repair process of an appliance in order to know if its functionality was restored.

**III. Directions.** Explain the procedure of the following: Write the answers on your answer sheet.

A. Troubleshooting Tips (5pts).

B. Repairing a Washing Machine (5pts).

**CRITERIA**

- 5 Sequence and transition of ideas were highly effective.
- 3 Some ideas and sequence may be improved to be highly effective.
- 2 Some signs of and/or abrupt change of ideas.
- 1 Very little or unclear flow of ideas.
- 0 No idea.

**IV. Directions.** Perform an actual repair of a Washing Machine

**CRITERIA**

**Workmanship**

- 4 -Workplace, materials, tools and instrument are prepared. Utilize the resources accordingly. Converse competently. Handle resources properly.
- 3 -Workplace, materials, tools and instrument are prepared. Utilize the resources accordingly. Converse competently. Handle resources improperly.
- 2 -Workplace, materials, tools and instrument are prepared. Not utilize the resources accordingly. Resources not properly handled.
- 1- Workplace is prepared but materials, tools and instrument are not. Not utilize the resources accordingly. Resources not properly handled.
- 0 -Workplace, materials, tools and instruments are not set. Utilize the resources unevenly. Resources not properly handled.

**Accuracy**

- 4 -Accomplished the documentation. Pre-testing procedure was performed. Diagnose/ troubleshoot competently. The cause of the problem was identified. The functionality of the unit was restored.
- 3 - Accomplished the documentation. Pre-testing procedure was not performed. Diagnose/ troubleshoot competently. The cause of the problem was identified. The functionality of the unit was restored.
- 2 -Accomplished the documentation. Pre-testing procedure was not performed. Diagnose/ troubleshoot competently. The cause of the problem is not identified. Not able to restore the functionality of the unit.
- 1 -Incomplete documentation. Pre-testing procedure was not performed. Diagnose/ troubleshoot competently. The cause of the problem is not identified. Not able to restore the functionality of the unit.
- 0 -Documentation is not accomplished. Pre-testing is not performed. Did not able to diagnose/troubleshoot competently. The cause of the problem is not identified. Not able to restore the functionality of the unit.

**Safety & Cleanliness**

- 2 -The whole area was cleaned before and after the activity. No accident happened.
- 0 - The whole area was dirty before and/or after the activity or an instance of accident.

<b>Content Standard</b>	<b>Performance Standard</b>
<p>The learner demonstrates an understanding of the concepts in maintaining and repairing appliances with motor and with a heating element:</p> <ul style="list-style-type: none"> <li>• Flat Iron</li> </ul>	<p>The learner independently maintains and repairs appliances with motor and with a heating element:</p> <ul style="list-style-type: none"> <li>• Flat Iron</li> </ul>

**Quarter II**

**Time Allotment: 40Hours**

**UNIT OF COMPETENCY: MAINTAIN AND REPAIR ELECTRONICALLY CONTROLLED DOMESTIC APPLIANCE**

**I. INTRODUCTION:**

This lesson contains necessary information and suggested learning activities in Maintaining and Repairing an **Electric Flat Iron**. Additionally, pre-testing and disassembling-assembling procedure of Electric Flat Iron are included to comply with the standard operating procedure. There are forms to accomplish for proper documentation.

**II. PRE/ DIAGNOSTIC ASSESSMENT**

**Directions:** Read each statement carefully and select the letter of the correct answer. Write your answer on a separate sheet of paper.

- Tool used to join two pieces of metals.
  - Diagonal Cutting Pliers
  - Long Nose Pliers
  - Soldering Iron
  - Wire Stripper
- Tool used to remove wire insulator from its conductor.
  - Soldering Iron
  - Diagonal Cutting Pliers
  - Long Nose Pliers
  - Wire Stripper
- Part of Electric Flat Iron that regulates the temperature.
  - Heating Element
  - Selector Switch
  - Thermal Fuse
  - Thermostat
- Part of Electric Flat Iron used to select the amount of heat
  - Heating Element
  - Selector Switch
  - Thermal Fuse
  - Thermostat
- Indicates that electricity is flowing along the heating element.
  - AC Cord
  - Body/Case
  - Neon/Pilot Lamp
  - Sole Plate
- A safety device used to cut-off the circuit when the temperature rises above normal.
  - Heating Element
  - Selector Switch
  - Thermal Fuse
  - Thermostat

7. The base metal part of electric flat iron that presses the fabric.
  - A. AC Cord
  - B. Body/Case
  - C. Neon/Pilot Lamp
  - D. Sole Plate
8. Connects the unit to power source.
  - A. AC Cord
  - B. Body/Case
  - C. Neon/Pilot Lamp
  - D. Sole Plate
9. Upon receiving a defective appliance, the technician should immediately \_\_\_\_\_.
  - A. disassemble the unit for troubleshooting.
  - B. explain to the client the identified defects.
  - C. make an initial inspection/testing of the appliance.
  - D. conduct an initial interview to the owner of the appliance.
10. This procedure in Pre-Testing and Troubleshooting requires simple inspection by merely looking for burned, dented or dislocated parts.
  - A. Operate the device.
  - B. Perform visual inspection of the unit.
  - C. Test the unit for continuity using VOM.
  - D. Determine the specific problem by asking the symptom.

### **III. LEARNING COMPETENCIES**

#### **LO1: PREPARE UNIT, TOOLS, EQUIPMENT AND WORKPLACE FOR MAINTENANCE/REPAIR**

- Prepare necessary tools, test instruments and personal protective equipment in line with job requirements.
- Acquire service manuals and service information required for repair/maintenance as manufacturer's specifications.
- Conduct complete check-up of electronically-controlled domestic appliances.
- Document the identified defects based on check-up conducted.

#### **INFORMATION SHEET 1.1 TOOLS AND MATERIALS IN MAINTAINING ELECTRONICALLY-CONTROLLED DOMESTIC APPLIANCE (ELECTRIC FLAT IRON)**

In every electronic work, it is a must to prepare first the necessary tools, materials, and equipment needed as well as the information. The following list of tools, materials, and equipment are needed in maintaining and repairing electronically-controlled domestic appliance:

		
Soldering Iron	Long Nose Pliers	Diagonal Cutting Pliers
		
Soldering Lead	Desoldering Tool	Wire Stripper
		
Soldering Stand	Utility knife (Blade Cutter)	Multitester/ Volt-Ohm-Milliammeter (VOM)
		
Flathead Screwdriver	Philip Screwdriver	Mask
		
Non-Static Brush	Apron	ESDWrist Strap
		
Eye Protector/ Goggles	Gloves	Electrical Tape

## **INFORMATION SHEET 1.2 OPERATION OF AN ELECTRIC FLAT IRON, PARTS AND FUNCTIONS**

The domestic Electric Flat Iron was the first of the household heating devices to receive universal recognition.

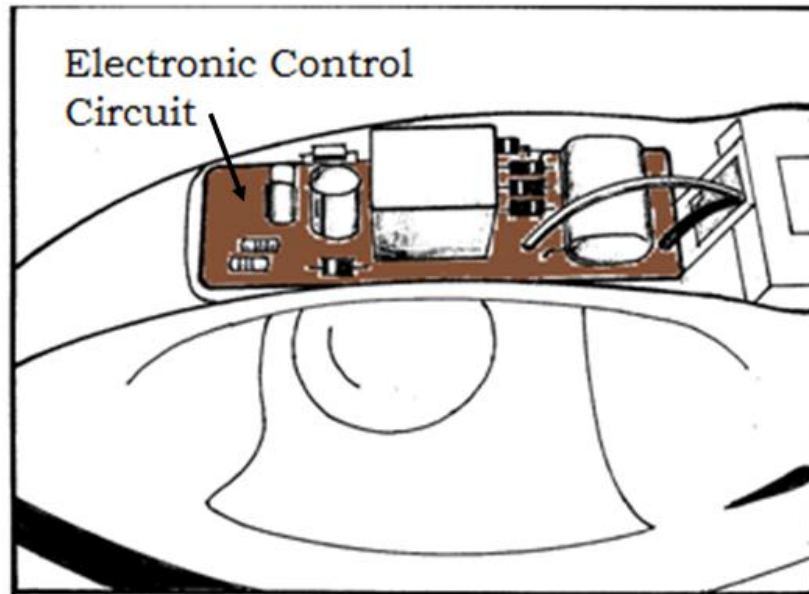
From the power source at home, electricity flows through a flat cord passes through a thermal fuse and a temperature control going to the heating element. Heating element is insulated by a mica insulator from the body and it heats up the sole plate for the purpose of removing wrinkles from fabric. With the heat and the weight of the ironing plate, the fibers are stretched and the fabric maintains its new shape when cool. Some materials such as cotton require the use of water to loosen the intermolecular bonds. Many materials developed in the twentieth century are advertised as needing little or no ironing.

Modern irons for home use can have the following feature:

- a method of setting the iron down
- a thermostat to ensure maintenance of constant temperature
- a temperature control dial (usually marked with types of cloth)
- an electrical cord with heat resistant Teflon insulation
- a steam features
- a cord control/ anti-burn control/ energy-saving control/ cordless iron



Example of Common Electric Flat Iron



Modern Flat Iron with Electronic Control

### Basic Parts of Flat Iron

1. **AC line cord** is used to connect the unit to power source.



2. **Selector Switch** is a type of switch used to select the amount of heat required in ironing different types of fabrics. It can be a rotary or slide type.





3. **Thermal Fuse** is a safety protective device used to cut-off the circuit when the temperature rises at above normal as designed for the unit. It also protects the unit from damage when overheating and short circuit occurs.



4. **Heating Element** is a form of nichrome wire that assembles properly inside the high temperature metallic tube in flat iron to provide heat.



5. **Soleplate** is a base metal that serves as fabric pressing part made of metal where the heating element is placed.



6. **Handle** is the part of a flat iron by which it is carried or controlled.



7. **Body/Case** is used to protect the internal parts of the flat iron and serve as shield for the heat and protection of the hand of the user.



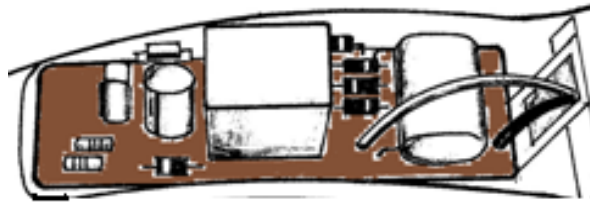
8. **Neon/Pilot Lamp** is used to indicate that electricity is flowing along the heating element.



9. **Thermostat Assembly** is used to regulate the temperature.

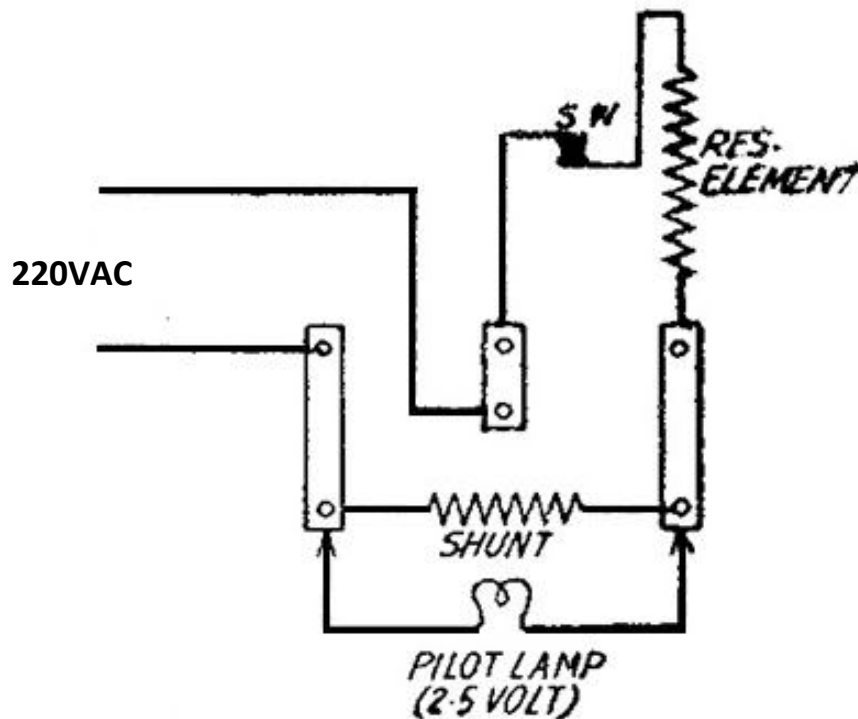


10. **Electronic Control** is the added feature of modern electric flat iron which can act as timer or automatic power cut-off switch for additional protection.

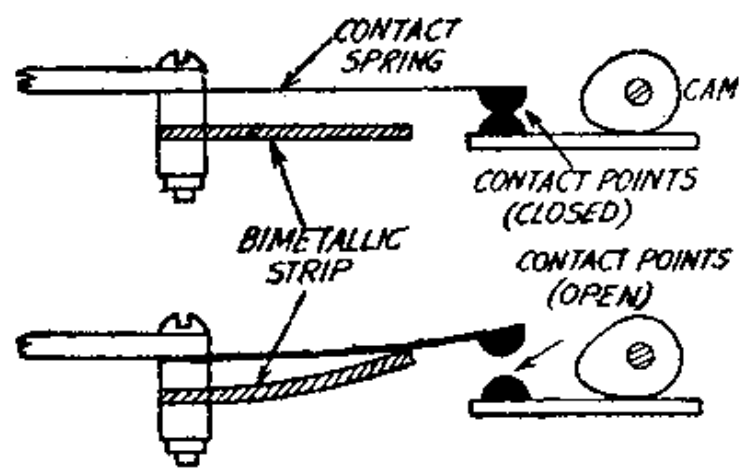
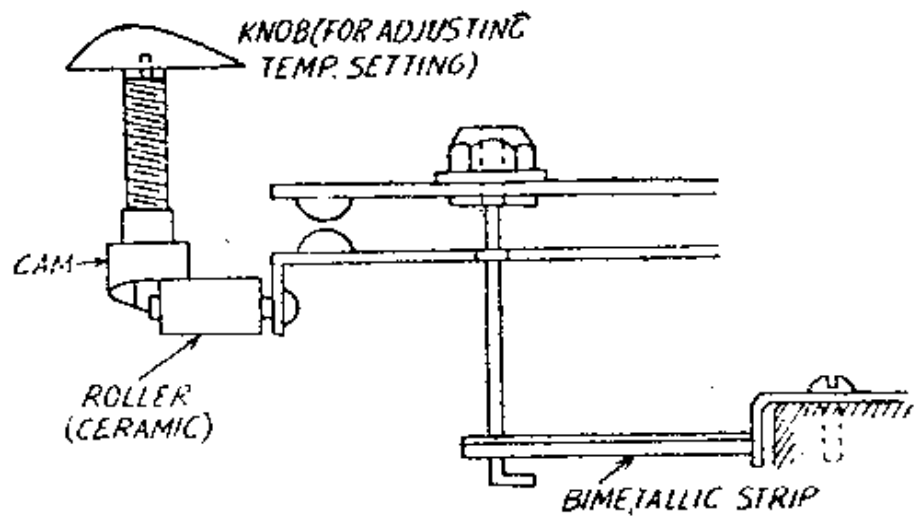


Note: To avoid a circuit from overload, do not operate another high wattage appliance on the same circuit. If an extension cord is absolutely necessary a 16A cord should be used with a 220V iron. Cords rated for less amperage may overheat. Care should be taken to arrange the cord so that it cannot be pulled or ripped over.

**Sample Schematic Diagram**









### Parts of Thermostat Assembly







## SELF CHECK 1.1

### Identify the Parts and Functions of an Electric Flat Iron

**Directions:** Name the parts of an electric flat iron and give their function.  
Write your answers on another sheet of paper.

Picture/Parts	Name/ Part	Function
1. 		
2. 		
3. 		
4. 		
5. 		
6. 		

<p>7.</p> 		
<p>8.</p> 		
<p>9.</p> 		
<p>10.</p> 		

*Note: If you got all the answers right, that is an excellent mark. If you missed one or more item/s, review the questions, go back to information sheet 1.3, and study them more closely. Before you proceed to the next lesson you must got all the answers right.*

**SELF CHECK 1.2**  
**Schematic Diagram of an Electric Flat Iron**  
**(Without the Electronic Control)**

**Directions:** Bring an Electric Flat Iron which will serve as reference in drawing the schematic diagram. Use a separate sheet of paper and pencil in performing this.

<b>Criteria</b>	<b>Points</b>
Complete diagram with labels.	10
With one missing component or label	8
With 1 missing component and label	6
With 2 missing component or label	4
With 2 missing component and label	2
With more than 3 missing components or labels	0

*Note: If the student has drawn the schematic diagram accurately, that is an excellent mark. If the diagram is erroneous, let the student review the questions, and review information sheet 1.2 Operation of an Electric Flat Iron, Parts and Functions, and study them more closely. Before you proceed to the next lesson you should have master this activity.*

## **INFORMATION SHEET 1.3**

### **HEATING AS ONE OF THE EFFECTS OF ELECTICITY**

As the famous saying goes “Energy cannot be created or destroyed, it can only be changed from one form to another” by Albert Einstein.

In line with this, electricity is also converted into another usable power like heat. When an electric current flow through a wire some loss occurs and this loss is almost inevitable, more the resistance of wire, more the loss. This loss is due to the electrical resistance of wire is mainly responsible for the heating effect of electric current.

The more electrical resistance of the wire, the more generated heat. The fixed atoms of the wire resist the flow electrons and as a result, there are collisions and as the kinetic energy converts into heat energy we see that the wire is getting hot.

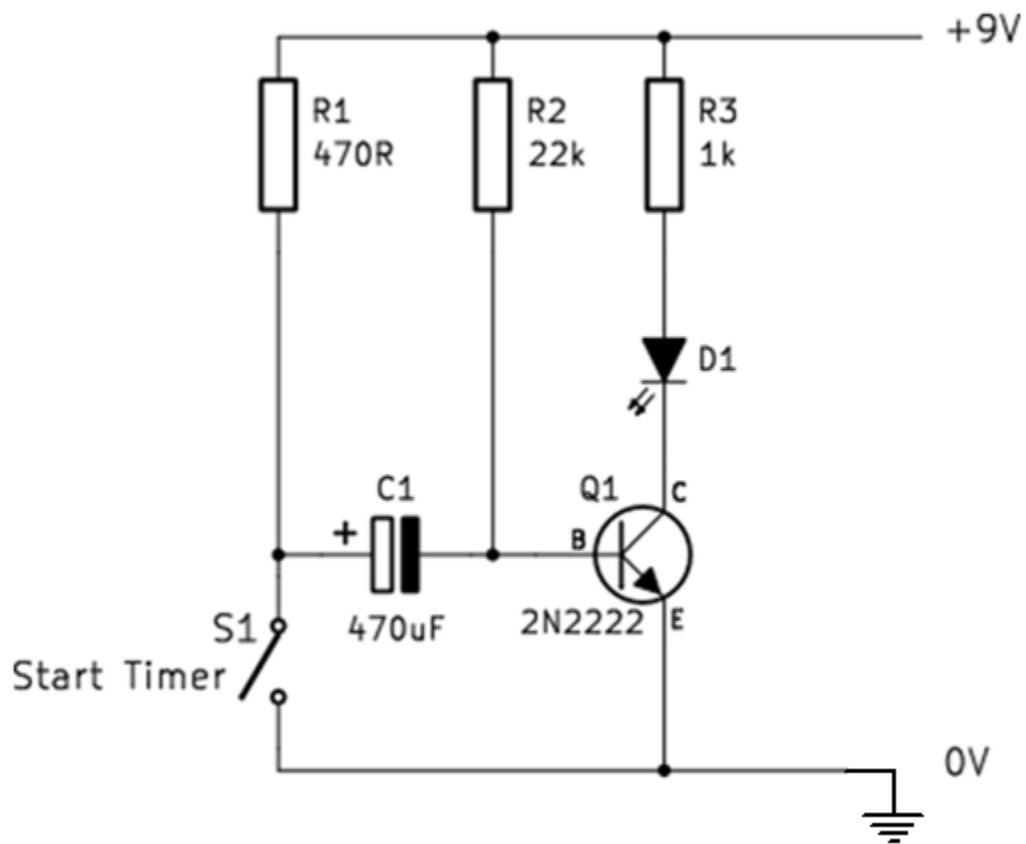
Electric heating has several advantages: it can be precisely controlled to allow a uniformity of temperature within very narrow limits; it is cleaner than other methods of heating because it does not involve any combustion; it is considered safe because it is protected from overloading by automatic breakers; it is quick to use and to adjust; and it is relatively quiet. For these reasons, electric heat is widely chosen for industrial, commercial, and residential use.

Resistance heaters produce heat by passing an electric current through a resistance: a coil, wire, or other obstacle which impedes current and causes it to give off heat. Heaters of this kind have an inherent efficiency of 100% in converting electric energy into heat. Devices such as electric ranges, ovens, hot-water heaters, sterilizers, stills, baths, furnaces, and space heaters are part of the long list of resistance heating equipment.



## INFORMATION SHEET 1.4 BASIC CONCEPT OF ELECTRONIC CONTROL (TRANSISTOR TIMER)

Timer has a wide variety of uses specially when used with relay to include auto shut-off for safety of electrical appliances. For our lesson we will be concentrating in the timer using basic components like transistor, capacitor, resistor, and LED. When the circuit is powered by a 9V battery the LED switches on. A switch is closed to start the timer causing the LED to switch off for a time period. After the time period is over, the LED will switch on again.



## ACTIVITY 1.1 Electronic Timer Control

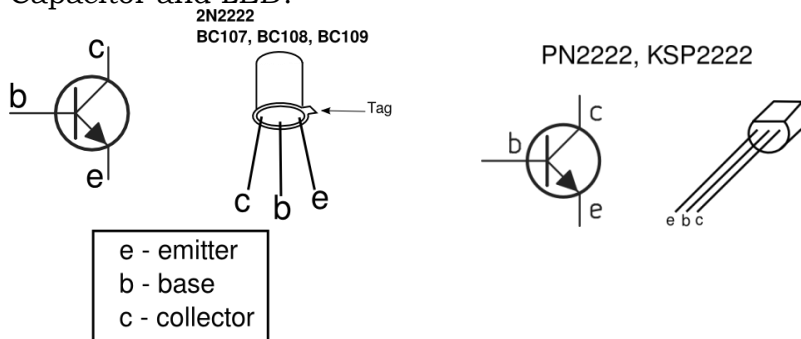
**Directions:** Construct the electronic timer control circuit using a breadboard.

**Resources:**

- |                             |                                    |
|-----------------------------|------------------------------------|
| Breadboard                  | 1pc 9 V Battery or DC Power Supply |
| Diagram of Electronic Timer | 1pc 470/16v uF Capacitor           |
| 1pc 470 ohm 1/4w Resistor   | 5 mm LED (preferably red)          |
| 1pc 1K ohm 1/4w Resistor    | 1pc 2N222 Transistor               |
| 1pc 22K ohm 1/4w Resistor   | # 22 Solid Wire (Jumper)           |

**Procedure:**

- Connect the components to the breadboard following the diagram and observing the correct pins of the Transistor, the polarity of the Capacitor and LED.



- Connect the power supply. When the battery is connected, the LED will light. Use jumper wire as switch. Close the switch to start the timer. After the timer has finished timing or "timed out", the LED will switch on again.
- Try using different capacitor value in the circuit to see the time period change. Using a 100uF capacitor will result in a very short time period. Using a 1000uF capacitor will result in a longer time period.
- If your project failed to work, review the procedures and/or check the condition of battery or power supply and other electronic components.

### Criteria for Functional Project

**Directions:** Rate yourself on how competent you have applied the skill in pre-testing and diagnosing using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by multiplying each item by its corresponding percentage, divide it by 5 then multiply by 100. Get the sum of your ratings.

CRITERIA	%	POINTS					RATING
		5	4	3	2	1	
Workmanship	50						
Use of Tools	30						
Use of PPE	10						
Speed	5						
Housekeeping	5						
<b>TOTAL</b>							

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances.
SPEED	Finished within the time/ Less 1 point for every five minutes delay.
Housekeeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed.

Student's Signature \_\_\_\_\_ Date Repaired \_\_\_\_\_  
Teacher's Signature \_\_\_\_\_ Date Checked \_\_\_\_\_

## ACTIVITY 1.2 RECEIVING ELECTRONICALLY-CONTROLLED DOMESTIC APPLIANCE FOR MAINTAIN/REPAIR

**Directions:** Provided with the defective domestic appliance use Maintain and Repair Form to gather and document the information about the appliance at hand. Follow the procedures below:

**Resources:**

Domestic appliance: Electric Flat Iron

Receiving/Check-up Form

**Procedure:**

1. Conduct an initial interview to the owner of the appliance.
  - Ask what the problem is.
  - Request for the details of the problem (how does it happen/since when/ nature of the problem)
2. As serviceman, you must confirm the problem/ complain.

3. Make an initial inspection/ testing of the appliance.
  - Physical appearance
  - Operating controls
  - Power cord . . .
4. Take note of the information gathered and observed.
5. Accomplish Receiving and Repair Form.

**Receiving and Repair Form**

Customer's name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Product/ Brand name: \_\_\_\_\_  
 Serial no: \_\_\_\_\_  
 Complain: \_\_\_\_\_  
 \_\_\_\_\_

**Electric Flat Iron Checklist**

EXTERNAL PARTS	CONDITION	
	GOOD	DEFECTIVE
AC Cord		
Selector Switch		
Soleplate		
Handle		
Body/Case		
Neon/Pilot Lamp		

Student's Signature \_\_\_\_\_ Date Repaired: \_\_\_\_\_

Teacher's Signature \_\_\_\_\_ Date Checked: \_\_\_\_\_

**PERFORMANCE CHECK 1.1  
RECEIVING ELECTRONICALLY-CONTROLLED DOMESTIC  
APPLIANCE FOR REPAIR**

**Directions:** Read the questions and answer by checking the appropriate box.

Tasks	YES	NO
1. Recorded the name and address of the owner?		
2. Copied product/brand/name and serial number of the appliance?		
3. Asked for complain and the remarks/condition of the appliance?		
4. Verified complain on the condition of the appliance?		
5. Accomplished checklist of appliance parts condition.		
• AC Cord		
• Selector Switch		
• Soleplate		
• Handle		
• Body/ Case		
• Neon/ Pilot Lamp		
TOTAL		

Student's Signature \_\_\_\_\_ Date Repaired: \_\_\_\_\_

Teacher's Signature \_\_\_\_\_ Date Checked: \_\_\_\_\_

**LO2. DIAGNOSE FAULTS OF ELECTRONICALLY-CONTROLLED DOMESTIC APPLIANCES (ELECTRIC FLAT IRON)**

- Observe systematic pre-testing procedure in accordance with manufacturer's instructions
- Check and isolate circuits using specified testing procedure
- Document results of diagnosis and testing accurately and completely within the specified timeframe
- Explain identified defects and faults based on the result of diagnosis and testing
- Provide data/information regarding the status and serviceability of the units as per procedure.

## **INFORMATION SHEET 2.1**

### **Procedure in Pre-Testing and Troubleshooting an Electric Flat Iron**

1. Determine the specific problem by asking the symptom.
  - a. Ask the owner/operator of the electric fan of what is the symptom of the unit.
  - b. Request for the details of the symptom (how does the symptom happen) and how long it has been observed).
2. Operate the device. Make sure that you know how to operate an electric flat iron. If not, review the operating manual as well as the service manual (if available) of the unit prior to its testing and operation
  - a. If you have worked on the same unit before, test out to see if it operates in the same way.
  - b. Determine the last time it has been modified/repaired.
  - c. You must recognize the symptom/ complain of the owner to the unit.
3. Perform visual inspection of the unit.
  - a. Prepare the tools needed and remove the cover ready for inspection.
  - b. Apply careful physical inspection of the parts/components. (Look for burned and broken components; Inspect for loose connections or broken wires)
4. If all looks fine, test the unit for resistance checks.
  - a. Get the multitester and set it at range Rx1. Connect the test probes to each of the plug terminals, the reading must be infinite having the temperature control at zero position.
  - b. Then, adjust slowly the temperature control, decrease in resistance should be observed. If this happen, the unit might be in good condition. For safety, place one probe across to the plug terminals and the other probe to the body. There should be very high (infinite) resistance. If there's something different, refer to troubleshooting guide on this lesson.
5. Record your findings for future reference.

### **How to use an electric flat iron**

1. Adjust the temperature selector to a minimum position before plugging cord into electrical outlet.
2. Pre-heat the unit at least 2 minutes before using.
3. To improve dry ironing results, sprinkle the garments with water evenly at least one hour before ironing.
4. Unplug iron by gripping plug and pulling it from the outlet. Never pull the cord.

**Diagnosing and Troubleshooting Procedure/ Guide:**

<b>SYMPTOM: Flat iron not energized.</b>		
<b>POSSIBLE DEFECTIVE PART</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Power Cord	Measure the continuity of the power cord using ohmmeter.	Replace power cord.
Thermal Fuse	Measure the continuity of the fuse using ohmmeter.	Replace fuse.
Selector Switch	Check for the alignment of the switch to the thermostat.	Align the selector switch.
Thermostat	Measure the continuity of the power cord using ohmmeter.	Replace thermostat.
Heating Element	Measure the continuity of the heating element.	Replace heating element.

<b>SYMPTOM: Intermittent Power or Heat</b>		
<b>POSSIBLE DEFECTIVE PART</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Thermostat	Check the contact points for accumulated carbon or dirt.	Clean the contact points with fine sand paper. Adjust the temperature knob if necessary.

**ACTIVITY 2.1  
PRE-TESTING AND TROUBLESHOOTING ELECTRIC FLAT IRON**

**Directions:** Provided with the defective domestic appliance use Maintain and Repair Form to gather and document the information about the appliance at hand. Follow the procedures below.

**Resources:**

- Domestic appliance: Electric Flat Iron
- Activity Sheet/Forms
- Tools & Equipment
  - Screwdriver
  - VOM
- Cleaning Materials
- PPE

**Procedure:**

1. Perform the procedure and technique in pre-testing and troubleshooting a flat iron.
2. Let one of your classmates act as the owner of the appliance.
3. Accomplish receiving and repair form in your notebook, record the progress of your activity.
4. Perform the procedures in accepting and repair in 30 minutes.

**Receiving and Repair Form**

Customer's name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Product/ Brand name: \_\_\_\_\_  
Serial no: \_\_\_\_\_  
Complain: \_\_\_\_\_  
\_\_\_\_\_

**Electric Flat Iron Checklist**

EXTERNAL PARTS	CONDITION	
	GOOD	DEFECTIVE
AC Cord		
Selector Switch		
Soleplate		
Handle		
Body/Case		
Neon/Pilot Lamp		

SYMPTOM: _____		
POSSIBLE DEFECTIVE PART	PROCEDURE	CORRECTIVE MEASURE
Remarks:		

Student's Signature \_\_\_\_\_ Date Repaired: \_\_\_\_\_  
Teacher's Signature \_\_\_\_\_ Date Checked: \_\_\_\_\_



**PERFORMANCE CHECK 2.1  
PRE-TESTING AND TROUBLESHOOTING ELECTRIC FLAT IRON**

**Directions:** Rate yourself on how competent you have applied the skill in pre-testing and diagnosing electric flat iron using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by multiplying each item by its corresponding percentage, divide it by 5, then multiply by 100. Get the sum of your ratings.

Criteria	%	Points					Rating
		5	4	3	2	1	
Workmanship	50						
Use of Tools	30						
Use of Personal Protective Equipment	10						
SPEED	5						
House Keeping	5						
<b>TOTAL</b>							

**Rubrics**

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
SPEED	Finished within the time/ Less 1 point for every five minutes delay
Housekeeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date Repaired: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date Checked: \_\_\_\_\_

**LO3: REPAIR AND MAINTAIN ELECTRIC FLAT IRON**

- Use PPE in accordance with OHS practices
- Perform repair activity within the required timeframe
- Observe safety precautions in handling the unit/product as per standard operating procedure
- Replace defective parts/ components with identical parts or recommended parts with equivalent ratings
- Solder/mount repaired or replaced parts/components in accordance with industry standards
- Clean unit in accordance with standard operating procedure

**SELF CHECK 3.1**  
**Personal Protective Equipment& OHS**

**Directions:** Identify sources of danger in your workplace according to target organs and give examples of PPE. In the absence of danger just indicate NONE.

	Organ	Source of Danger	PPE
1	Eye		
2	Ear		
3	Head		
4	Respiratory		
5	Body		
6	Hand and Arm		
7	Foot		

*Note: PPE and OHS were discussed on previous quarter. The student should have identified all possible sources of danger in the workplace. If one or more item/s were missed, review the questions, go back to information sheet 3.1, and study them more closely. Before you proceed to the next lesson you must get all the answers right.*

**INFORMATION SHEET 3.1**  
**COMPONENT REPLACEMENT**

1. Determine the description of the values and ratings of the individual defective parts using the manufacturer's service manual.
2. Identify the sources of the replacement components/parts.
  - Original replacement components from the original factory sources
  - Universal replacement components from independent factory sources
3. Consider the following factors in selecting parts.
  - **Quality.** The ability to provide exact value or specification to replacement part.
  - **Tolerance.** The ability to provide exact value or acceptable parameters to replacement parts.
  - **Availability.** The local access to parts and whether the parts are available .
  - **Price.** Refers to the affordability of the replacement parts at a reasonable price.

4. Disconnect or remove properly the electrical/mechanical parts of an electric flat iron.
5. Install correctly the replacement parts and other components.
6. For burnt components where values are impossible to recognize, secure a schematic diagram or service manual if possible. In other case, you can look for the same brand and model as reference.
7. Double check the testing procedure in suspected defective components.
8. Check the nearby components for possible consequence of being damaged too.
9. Consider the original orientation/connection of the components in replacing defective one.
10. Observe safety at all times.

### **INFORMATION SHEET 3.2 TROUBLESHOOTING, MAINTENANCE AND CLEANING TIPS**

#### Troubleshooting

6. Conduct a *quick* diagnosis of the trouble symptom and repair the defective set in the *shortest possible time*. Do not troubleshoot an electric flat iron unless you have determined the fault.
7. Secure a circuit diagram.
8. If the iron doesn't heat, make sure power is on to the outlet, check the electrical cord, and check the thermostat.
9. Always suspect a faulty contact on mechanical switch circuit rather than defective electronic/electrical parts.
5. If the iron produces too much or too little heat, test the electrical cord for loose wiring and connection. Also test and, if needed, adjust calibration of the thermostat.
6. Use Personal Protective Equipment.

#### Maintenance and Cleaning

1. Turn-off and unplug the electric flat iron and make sure it's cool before cleaning.
2. Check the owner's manual for your iron to learn the specified manufacturer's suggestions for cleaning.

3. You may use a sponge and commercial soleplate cleaner or baking soda and water to remove dirt buildup on the soleplate. Rinse well with water and dry. Don't submerge an electric flat iron in water or cleaning liquid. If needed, use very fine emery cloth or sand paper to remove scratches and burns on the soleplate. Don't use harsh abrasives.

### **ACTIVITY SHEET 3.1**

#### **Maintain and Repair an Electric Flat Iron**

**Resources:**

Service manual of Electric Flat Iron  
Electric Flat Iron  
Activity sheet/ Forms (Copy from module)  
Tools and Equipment Needed  
    Pliers  
    Screwdrivers  
    VOM  
Cleaning materials  
PPE

**Directions:**

1. Provided with the resources, perform the maintenance/repair procedure. Observe safety precautions at all times and consider the information given in this lesson.
2. Let one of your classmates act as the owner of the electric flat iron.
3. Perform the procedures in accepting and pre-testing an appliance.
4. Accomplish the Receiving and Repair Form and the Maintenance and Repair Form as you perform the activity.
5. Provide information regarding the status and serviceability of the appliance.
6. Fifty minutes will be allotted for this activity.

### Receiving and Repair Form

Customer's name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Product/ Brand name: \_\_\_\_\_  
 Serial no: \_\_\_\_\_  
 Complain: \_\_\_\_\_

#### Electric Flat Iron Checklist

PARTS	CONDITION	
	GOOD	DEFECTIVE
AC Cord		

SYMPTOM:		
POSSIBLE DEFECT	PROCEDURE	CORRECTIVE MEASURE

Remarks: \_\_\_\_\_

Student's Signature \_\_\_\_\_ Date Repaired: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date Checked: \_\_\_\_\_

### PERFORMANCE CHECK 3.1 PRE-TESTING AND DIAGNOSING/ TROUBLESHOOTING AN ELECTRIC FLAT IRON

**Directions:** Rate yourself on how competent you have applied the skill in pre-testing and diagnosing electric flat iron using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by multiplying each item by its corresponding percentage, divide it by 5 then multiply by 100. Get the sum of your ratings.

Criteria	%	Points					Rating
		5	4	3	2	1	
Workmanship	50						
Use of Tools	30						
Use of Personal Protective Equipment	10						
SPEED	5						
House Keeping	5						
<b>TOTAL</b>							

### RUBRICS

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
SPEED	Finished within the time/ Less 1 point for every five minutes delay
House Keeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date Repaired \_\_\_\_\_

Teacher's Signature \_\_\_\_\_ Date Checked \_\_\_\_\_

### LO4: REASSEMBLE AND TEST REPAIRED APPLIANCES

- Perform final test for reassembled units in conformity with manufacturer's specifications.

#### INFORMATION SHEET 4.1

#### REASSEMBLING AND TESTING AN ELECTRIC FLAT IRON

Reassembling Procedure:

1. After replacing the defective part of the appliance, prepare the parts for reassembling. Make sure that there are no missing parts or component and as well as the screws.
2. Review the operating and service manual if available.
3. Fix all the disassembled parts in the housing/compartment, considering the fittings, lock etc.
4. Wires should be in their proper places and loose parts should be tightened to avoid damaged due to misalignment.
5. All sides of the housing should fit. See to it that Selector Switch is moving appropriately and the rest of the movable parts.
6. Clean the unit before doing the testing procedure.

Testing Procedure:

1. Set the ohmmeter to Rx1. Test the AC plug to determine the continuity of the power line to the heating element. Reading must be around 14 ohms.

2. Energize the unit to check its functionality. Move the Selector Switch slowly. Within a minute or two, the unit should operate normally. If not, review the documentation and troubleshoot again.

**ACTIVITY 4.1**  
**REASSEMBLING AND TESTING REPAIRED ELECTRIC FLAT IRON**

**Directions:** Provided with the resources, follow the procedures in reassembling and testing repaired electric flat iron presented in Information Sheet 4.1. You will be rated using the Performance Check 4.1.

**Resources:**

- Service Manual of Electric Flat Iron
- Repaired Electric Flat Iron
- Tools and Equipment Needed
  - Pliers
  - Screwdrivers
  - VOM
- Cleaning materials
- PPE

**PERFORMANCE CHECK 4.1**  
**REASSEMBLING AND TESTING REPAIRED ELECTRIC FLAT IRON**

**Directions:** Rate yourself on how competent you have applied the skill in pre-testing and diagnosing electric flat iron using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by multiplying each item by its corresponding percentage, divide it by 5 then multiply by 100. Get the sum of your ratings.

Criteria	%	Points					Rating
		5	4	3	2	1	
Workmanship	50						
Use of Tools	30						
Use of Personal Protective Equipment	10						
SPEED	5						
House Keeping	5						
<b>TOTAL</b>							

## RUBRICS

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
SPEED	Finished within the time/ Less 1 point for every five minutes delay
House Keeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date Repaired \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date Checked \_\_\_\_\_

**IV. SUMMATIVE ASSESSMENT.** Let the students answer the test on a separate sheet of paper.

**I. Directions:** Write the letter of the correct answer.

1. A tool used to remove wire insulator from its conductor.
  - A. Diagonal Cutting Pliers
  - B. Long Nose Pliers
  - C. Soldering Iron
  - D. Wire Stripper
2. A safety device used in heating appliances to cut-off circuit when the temperature rises above normal.
  - A. Heating Element
  - B. Selector Switch
  - C. Thermal Fuse
  - D. Thermostat Assembly
4. An electrically operated switch that uses SCR, TRIAC or Transistor output to switch the power on or off.
  - A. Electromagnet Relay
  - B. Solid State Relay
  - C. Thermal Fuse
  - D. Timer
5. An electronic control used to automatically turn-on/turn-off electrical appliances at predetermined period.
  - A. Electromagnet Relay
  - B. Solid State Relay
  - C. Thermal Fuse
  - D. Timer
6. What is the first step in receiving electronically controlled domestic appliance.
  - A. Conduct interview.
  - B. Make an initial inspection.
  - C. Confirm the problem/complain.
  - D. Accomplish receiving and repair form.
7. Which organ is most likely in danger having sound with noise level more than 85 dB?
  - A. Eye
  - B. Ear
  - C. Foot
  - D. Head



8. If the flat iron has intermittent power or heat which of the following is most probably defective?
- A. Heating Element                      C. Thermal Fuse  
 B. Power Cord                              D. Thermostat
9. The value of this component has a great effect in the setting of the electronic timer control?
- A. Capacitor                                C. Transistor  
 B. Resistor                                  D. LED
10. In selecting parts, the availability to provide exact value or specification refers to\_\_\_\_\_.
- A. Availability                                C. Quality  
 B. Price                                        D. Tolerance

**II. Directions.** Draw the schematic diagram of an electric flat iron and label each component 11-20 (10pts).

<b>Criteria</b>	<b>Points</b>
Complete diagram with complete labels.	10
With one missing component or label	8
With 1 missing component and label	6
With 2 missing component or label	4
With 2 missing component and label	2
With more than 3 missing components or labels	0

**III. Directions:** Perform pre-testing and troubleshooting electric flat iron in thirty minutes. Initially, 10 points will be given if the appliance was repaired and point deduction will be applied following the criteria below:

<b>Criteria</b>	<b>Description</b>
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every wrong use.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
SPEED	Finished within the time/ Less 1 point for every five minutes delay
House Keeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt and disorder observed

Content Standard	Performance Standard
<p>The learner demonstrates an understanding of the concepts in maintaining and repairing appliances with motor and with a heating element:</p> <ul style="list-style-type: none"> <li>• toaster oven</li> </ul>	<p>The learner independently maintains and repairs appliances with motor and with a heating element:</p> <ul style="list-style-type: none"> <li>• toaster oven</li> </ul>

**Quarter III**

**Time Allotment: 40Hours**

**LESSON: MAINTAIN AND REPAIR ELECTRONICALLY-CONTROLLED DOMESTIC APPLIANCE**

---

**I. INTRODUCTION:**

This lesson contains information and suggested learning activities in Maintaining and Repairing a **Toaster Oven**. Additionally, pre-testing and disassembling-assembling procedure, as well as the parts and functions of a toaster oven are included to comply with the standard operating procedure. There are forms to accomplish for proper documentation.

**PRE/DIAGNOSTIC ASSESSMENT**

**Directions:** Read each statement carefully and write the letter and word/s of your answer on a separate sheet of paper.

1. It refers to a domestic appliance that is considered a small oven used primarily to make bread brown and crisp.
 

A. Blender	B. Microwave Oven
C. Toaster oven	D. Vacuum Cleaner
2. In servicing any domestic appliance, a serviceman must have these for the information needed regarding the standard operating procedure.
 

A. Parts list	B. Safety instructions
C. Service manual	D. Troubleshooting guide
3. In repairing any domestic appliance, this is needed in order to disassemble the unit.
 

A. Service manual	B. Set of tools
C. Troubleshooting guide	D. Volt-Ohm-Milliammeter

4. In a toaster oven, it is responsible in producing high temperature.
  - A. Door
  - B. Heating element
  - C. Housing
  - D. ON light indicator
5. It is a rotating parts of the toaster oven that is responsible in the circulation of air around the food.
  - A. Convection fan
  - B. Crumb tray
  - C. Heating element
  - D. Housing
6. It is a turning knob used to set the cooking purpose of a toaster oven.
  - A. Function control knob
  - B. Power switch
  - C. Temperature control knob
  - D. Timer knob
7. It is used for us to view the food inside the toaster oven.
  - A. Display
  - B. Function control knob
  - C. Glass door
  - D. Indicator
8. It is used to set the duration of cooking task of toaster oven.
  - A. Function control knob
  - B. Glass door
  - C. Temperature control knob
  - D. Timer knob
9. It is used to loosen and tighten screw of a toaster oven.
  - A. Blade cutter
  - B. Pliers
  - C. Screwdriver
  - D. Soldering iron
10. It is a measuring instrument used to check continuity and resistance of a circuit.
  - A. Ammeter
  - B. Ohmmeter
  - C. Voltmeter
  - D. Wattmeter

**LO1: PREPARE UNIT, TOOLS, EQUIPMENT AND WORKPLACE FOR MAINTENANCE/REPAIR**

- Prepare necessary tools, test instruments and personal protective equipment in line with job requirements
- Acquire service manuals and service information required for repair/maintenance as manufacturer's specifications
- Conduct complete check-up of electronically-controlled domestic appliances
- Document the identified defects based on check-up conducted

**INFORMATION SHEET 1.1  
TOOLS AND MATERIALS IN MAINTAINING ELECTRONICALLY-CONTROLLED TOASTER OVEN**

In every electronic work, it is a must to prepare first the necessary tools, materials, and equipment needed as well as the information. The following list of tools, materials, and equipment are needed in maintaining and repairing a toaster oven:

		
Soldering Iron with stand	Soldering Lead	Desoldering Tool
		
Diagonal Cutting Pliers	Long Nose Pliers	Wire stripper
		
Adjustable Plier	PhilipScrewdriver	Flathead Screwdriver
		
	Combination Wrench	
Multitester/ Volt-Ohm-Milliammeter (VOM)	Utility knife	Cable Tie
		
ESDWrist Strap	Mask	Non-Static Brush

**SELF-CHECK 1.1**  
**TOOLS AND MATERIALS IN MAINTAINING ELECTRONICALLY-CONTROLLED DOMESTIC APPLIANCE (TOASTER OVEN)**

**Directions:** From the jumbled letters at the table below, find ten tools and instrument used in maintaining a toaster oven. Write your answer on a separate sheet of paper.

A	S	R	T	G	R	D	K	A	Q	T	O	P	N	M	F	G	K	L	L	S	C	V	B	N	M	R	E	T	U	J	D
F	C	A	Z	X	C	V	N	M	F	H	L	E	R	H	S	A	K	L	O	S	C	F	T	D	Y	U	J	H	D	B	V
G	F	L	A	T	S	C	R	E	W	D	R	I	V	E	R	E	R	N	N	A	R	E	I	V	B	N	H	J	K	Y	
J	D	R	T	J	C	B	N	E	W	R	T	H	J	K	L	L	O	P	G	G	B	Y	Y	A	Y	U	I	O	P	D	C
A	X	F	G	H	N	J	K	M	T	Y	U	O	L	B	F	H	K	L	N	T	L	U	J	G	R	T	H	U	J	K	I
P	H	I	L	I	P	S	C	R	E	W	D	R	I	V	E	R	Y	H	O	P	E	Y	Y	O	Y	G	H	W	S	R	Y
K	W	Q	D	X	T	Y	U	R	T	H	N	M	G	F	C	V	B	E	S	R	T	Z	C	N	V	G	H	R	T	N	B
Y	C	V	N	S	O	L	D	E	R	I	N	G	I	R	O	N	M	G	E	K	I	T	B	A	V	C	D	E	E	Y	I
S	F	M	U	L	T	I	T	E	S	T	E	R	F	H	K	L	T	E	P	D	E	V	N	L	N	M	M	N	G	F	H
T	H	Q	S	V	B	N	M	F	H	J	K	V	B	N	M	J	K	F	L	T	R	X	Z	C	F	H	J	C	R	T	H
O	E	S	D	W	R	I	S	T	S	T	R	A	P	F	G	H	J	Y	I	D	G	J	H	U	N	B	M	H	C	G	J
O	P	L	R	Y	P	G	U	S	X	C	V	B	N	M	J	G	F	D	E	T	Y	U	I	T	E	D	F	H	J	K	L
A	G	H	P	H	L	S	D	D	S	F	G	H	J	K	M	N	F	F	R	E	R	T	Y	T	Y	U	I	O	P	L	D
D		U	F	G	K	G	F	G	J	U	R	E	T	H	K	L	R	A	I	O	Q	W	E	I	Y	K	L	M	M	D	S
P	O	T	H	H	L	S	T	Q	F	R	T	H	J	L	L	U	E	M	A	S	K	R	F	N	A	E	Y	I	O	Z	N
L	Y	Q	P	Y	N	G	Q	V	M	O	O	T	R	V	S	G	J	R	U	E	D	V	M	G	P	L	I	E	R	B	B

**INFORMATION SHEET 1.2**  
**OPERATION OF A TOASTER OVEN, PARTS and FUNCTIONS**

Toaster is an electrical or a typical small kitchen appliance used to toast a bread. Bread that is cut into slices and cooked at a high temperature to make it brown and crisp is referred as toast. Although, there are also toasters that are not electrically operated, instead, a fire or flame is used to toast bread products. This lesson will focus on electric toaster oven that is common nowadays in our kitchen. The toaster ovens at present are not just for toasting breads, instead the function was extended to other related tasks for particular purpose. The additional task are baking, roasting and broiling. There are lots of available toasters in the market to choose from.

The three selections among toasters are pop-up toaster, toaster oven, and conveyor toaster. Toaster oven will be the focus of this lesson.

Toaster oven is a small electric oven with front door, wire holder and a removable pan for roasting. This domestic appliance is considered as a miniature oven that allows you to bake and broil foods. Combination of heating elements is used to provide desired temperature for the purpose.

As the unit is plugged-in to the power source, set of controls are turned to the desired level allowing the current to flow throughout the circuit. The heating element is energized and therefore produces equivalent temperature suited for the purpose. Timer switch sets how long the cooking takes and turns the unit off upon cycle completes. Several functions were incorporated to toaster oven nowadays resulting to additional control.

Toaster oven may vary its capabilities and features depending on the brand, model, and application. The following procedures could be used as reference.

### **Toast function**

This is used for toasting breads and other similar foods. All heating elements are used during this function.

1. Place the oven **rack** on the middle oven rails.
2. Turn the **TEMP** control knob to **450°F**.
3. Turn the **FUNCTION** control knob to **TOAST**.
4. Place the food to be toasted on the oven rack.
5. Turn the **TIME** control knob to the required browning level. The **POWER** indicator turns on. (See owner's manual for preferred setting)
6. At the end of the toasting cycle, a bell will ring, to indicate the cycle has finished, and the appliance switches off. The **POWER** indicator turns off.

### **Bake function**

This function provides constant and even heat suitable to be used for baking (cookies, cakes, and pies), and roasting (beef, pork, chicken, or other meat). All heating elements are used during this function. The convection fan circulates the hot air around the inside of the appliance.

1. Place the **broil rack** in the appliance.
2. Turn the **TEMP** control knob to the required temperature.
3. Turn the **FUNCTION** control knob to **BAKE**.
4. Preheat the appliance, if required, by turning the **TIME** control knob to the required time. The **POWER** indicator turns on.

5. Place the baking dish with the item/s to be baked on the **broil rack**.
6. Turn the **TIME** control knob to **STAY ON** or to the required time. The **POWER** indicator turns on.
7. If a time was set, a bell will ring at the end of the cycle, to indicate the cycle has finished, and the appliance switches off (**POWER** indicator turns off).
8. If no time was set, turn the **TIME** control knob to **OFF** when baking is completed. The **POWER** indicator turns off.

### **Roast function**

The procedures given in the Bake function are the same. It is recommended to refer to the instruction manual of your appliance.

### **Rotisserie function**

Do not to use a roast larger than 5lb. on the **spit**. Only the upper heating elements are used during this function. Chicken should be bound to prevent the legs or wings from separating during roasting and to allow the **rotisserie assembly** to rotate smoothly. It is recommended to use a meat thermometer to check the roasting progress.

The procedures given in the Bake function are the same. It is recommended to refer to the instruction manual of your appliance.

### **Keep warm function**

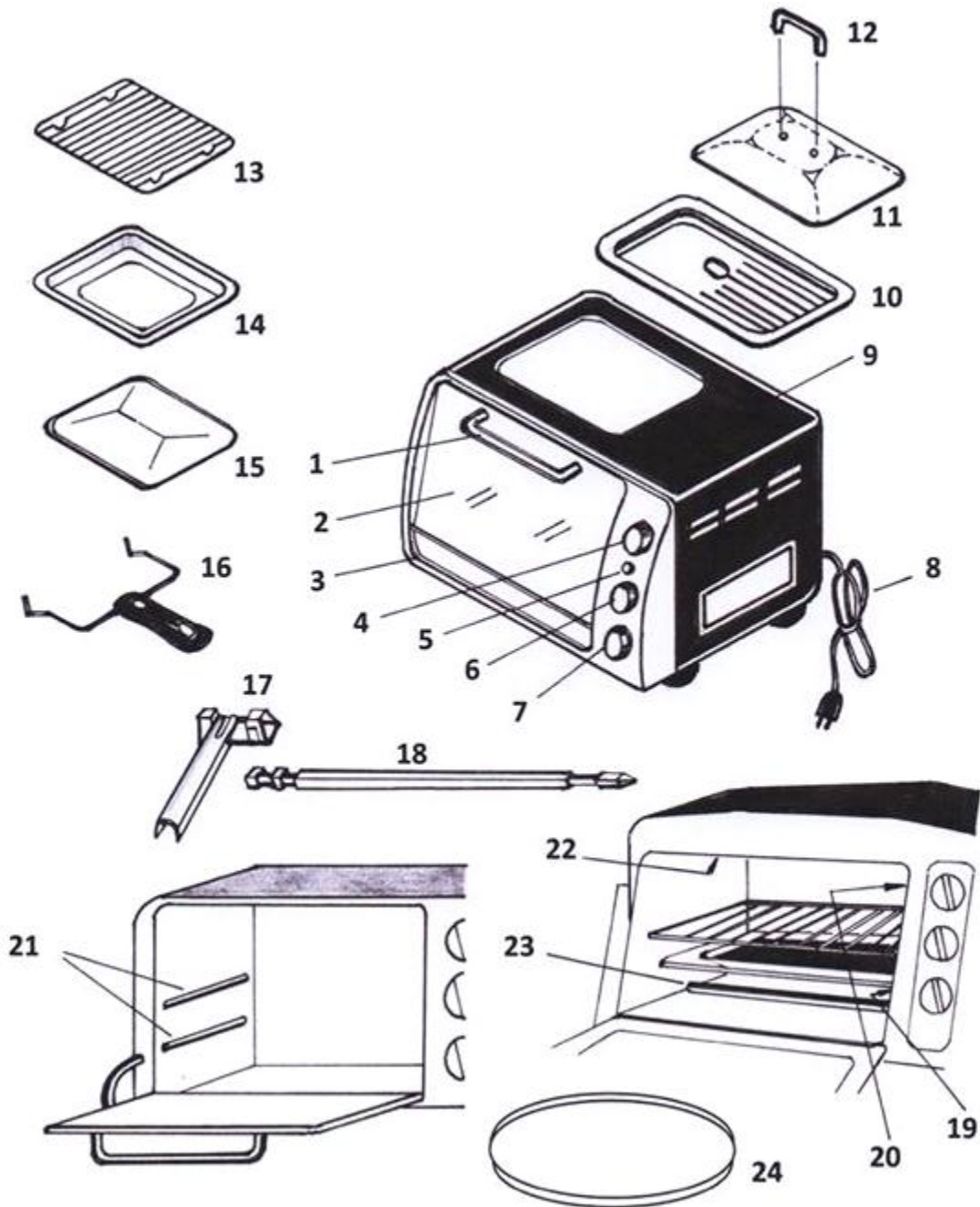
After 30 minutes, food may become dry and starts to spoil.

1. Place the **broil rack** on the **oven rails** in the middle of the appliance.
2. Turn the **TEMP** control knob to **180°F**.
3. Turn the **FUNCTION** control knob to **WARM**.
4. Place the cooked food on the broil rack.
5. Turn the **TIME** control knob to **STAY ON** or as to required time. The **POWER** indicator turns on.
6. If the time was set, a bell will ring at the end of the cycle and the **POWER** indicator turns off.
7. Remove the food from the appliance, and then switch the appliance to off position by turning the **TIME** control knob to **OFF**. The **POWER** indicator turns off.

**CAUTION:** Always wear oven mittens when placing or removing items from the appliance. Use caution when sliding the broil rack in and out of the appliance.

### A) Parts of a Toaster Oven (Manually Operated)

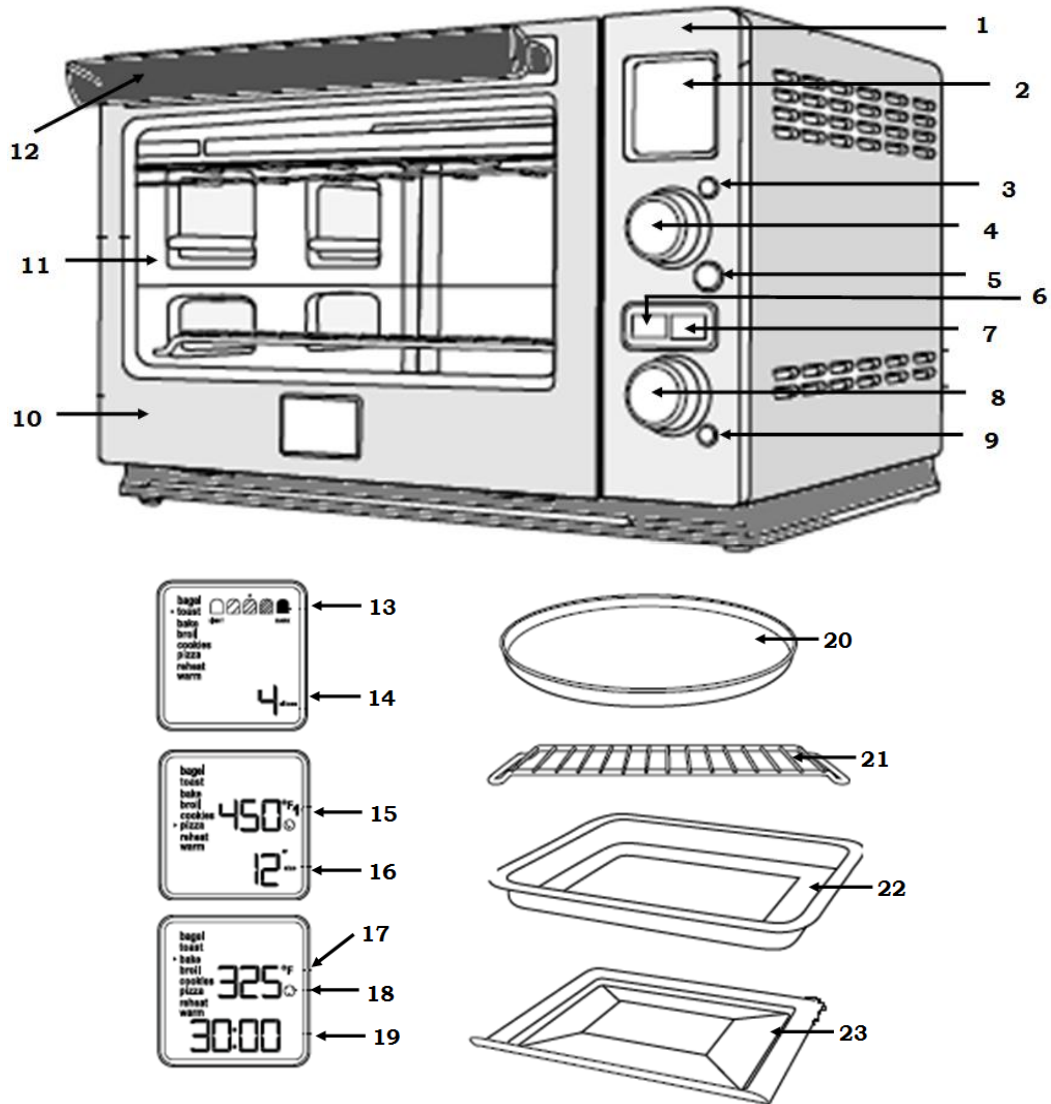
Parts and components may vary due to brand, model and feature/s of toaster oven available. The following numbered parts are identified and its function defined on the next page.





<b>PARTS</b>		<b>FUNCTIONS</b>
1	Door Handle	A small round object or lever that is attached to the glass door and used for opening and closing it
2	Glass Door	Used to secure the food and temperature inside the toaster oven. A glass is used for viewing of food.
3	Lower Door Frame	Part of the housing where the door hinges are fixed.
4	Temperature Control Knob	A turning knob used to adjust the thermostat to the desired temperature.
5	Power Indicator	To indicate that the toaster oven is ON.
6	Function Control Knob	A turning knob used to set the cooking function to a desired setting.
7	Timer Knob	A turning knob used to set the cooking time up to certain minutes and will turn the oven OFF at the end.
8	Power Cord	Used to connect the appliance to the power source.
9	Housing	A compartment where all parts of the toaster oven are in place.
10	Griddle	A piece of metal sheet or a pan placed on a cooker prior to cooking.
11	Griddle Cover	Used to cover the food.
12	Griddle Cover Handle	A small object or lever that is attached to the cover for holding purpose.
13	Wire/ Broil/ Cooking Rack	This is used for toasting, baking, and general cooking with casseroles and other cookware.
14	Bake/ Roasting Pan	Used for all your baking and roasting needs, attaches to Oven/Broil Rack.
15	Crumb Tray	A removable part inside the bottom of the oven.
16	Rotisserie Removal Handle	Used to safely remove/ replace the rotisserie.
17.	Tray Handle	Used to safely remove/ replace the tray.
18.	Rotisserie Skewer	Used in roasting purpose.
19	Drive mount	The interface for the skewer.
20	Convection fan	This is activated to provide air circulation around the food for faster and more even cooking.
21	Two Rack Levels	To accommodate a variety of foods.
22	Upper heating elements (x2)	Provide required temperature from the top.
23	Lower heating elements (x2)	Provide required temperature from the bottom.
24	Pizza pan	For broiling and baking pizza.

## ELECTRONICALLY-CONTROLLED TOASTER OVEN



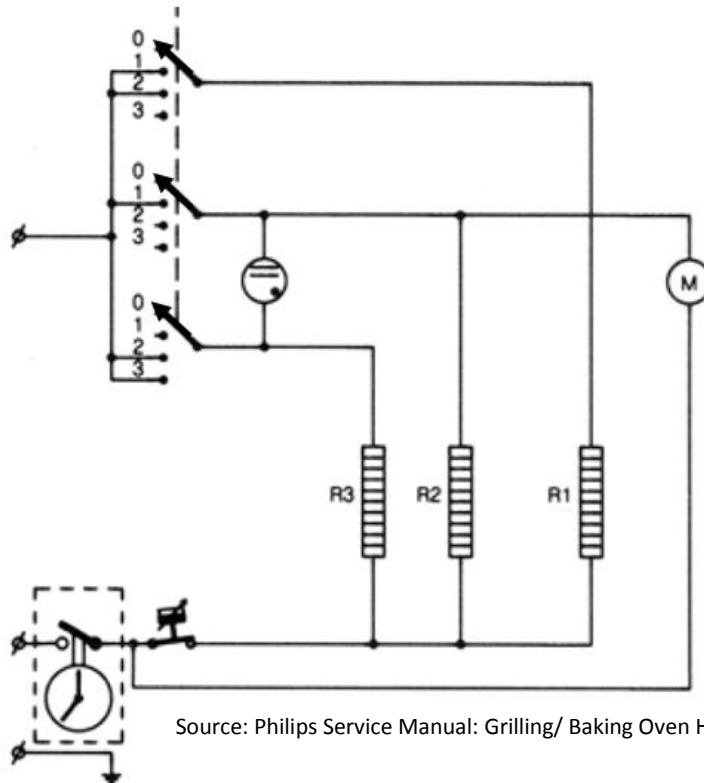
PARTS NAME					
1	Control Panel	9	Set	17	Temperature
2	LCD Screen	10	Door Frame	18	Convection
3	PowerPlus™ Convection	11	Flat Glass Door	19	Cook Time
4	Function/Mode Control	12	Door Handle	20	Pizza Pan
5	Start/Cancel	13	Toast/Bagel	21	Cooking Rack
6	Temp/Darkness	14	Number of Slices	22	Bake Pan
7	Time/Slices/Size	15	Preheat Icon	23	Crumb Tray
8	Temp/Timer	16	Pizza Size		

## **SAFETY REMINDERS IN USING A TOASTER OVEN**

1. Read carefully the instructions in the user's/ operation/ owner's manual before using a toaster oven.
2. Do not touch hot surfaces. Handles and knobs are provided for the user to easily open/close the glass door and to turn right or left the controls. Auxiliary parts are included in the package for holding purposes.
3. Keep away the cord, plugs, or appliance from the water or other liquid to avoid electric shock.
4. Unplug the toaster from outlet (power source) when not in use.
5. Do not use any appliance with a damaged cord or plug.
6. Before cleaning, unplug the cord and let the unit cool down prior to taking off parts for cleaning.
7. Place the appliance in stable position.
8. Do not use metal scouring pads in cleaning a toaster oven. This can damage the pad (buttons) and might cause electrical hazard.
9. Use only accessory that is recommended by the manufacturer to avoid injuries.
10. Keep at least four inches of space on all sides of the toaster oven to allow adequate air circulation during operation.
11. In case the plug is detachable from the unit, attach the plug to appliance first and then plug cord into the wall outlet. To unplug, turn the control to OFF first, and then remove the cord by grasping and pulling out the plug. Never pull the cord.
12. Do not use metal foil to cover Crumb Tray or any part of the toaster oven to avoid overheating.
13. When removing tray or disposing of hot grease or other hot liquids extreme caution must be observed.
14. Do not place unnecessary item on top of the oven during operation. The unit must be far from flammable materials (curtain, walls and the like).
15. Always wear protective, insulated oven mitts when putting in or removing items from the hot toaster oven.
16. Avoid scratching the glass door surface.
17. If the appliance malfunctions or has been damaged, seek technical assistance from servicemen for inspection, repair, or adjustment.

**Sample diagram of a toaster oven (w/grilling and baking function)**

**Mechanical**

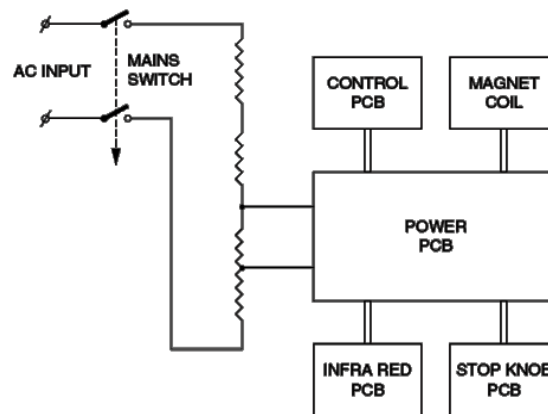


Source: Philips Service Manual: Grilling/ Baking Oven HD4465/A

Technical Specifications	
Timer	Mechanical (max. 20 min.)
Thermostat	Adjustable (30°C to 255°C)
Grill motor	2 r.p.m.
Elements top	R <sub>1</sub> = 650 W
	R <sub>2</sub> = 500 W
Elements bottom	R <sub>3</sub> = 700 W

Position	Function	Elements switched ON	Max. power consumption
1	Grilling	R <sub>1</sub> + R <sub>2</sub>	1150 W
2	Baking	R <sub>1</sub> + R <sub>3</sub>	1350 W
3	Toasting	R <sub>3</sub>	700 W

## Electronically-controlled



### SELF-CHECK1.2

#### OPERATION OF TOASTER OVEN, PARTS and FUNCTION

**A. Directions:** Read each statement below and write the letter of your answer on a separate sheet of paper.

- This is a small round object or lever that is attached to the glass door and used for opening and closing it.  
A. Door Handle  
B. Timer knob  
C. Function control knob  
D. Power switch
- This is a turning knob used to set the cooking function to a desired setting.  
A. Door Handle  
B. Timer knob  
C. Function control knob  
D. Power switch
- This is used to connect the appliance to the power source.  
A. Power cord  
B. Timer knob  
C. Function control knob  
D. Power switch
- This is turned ON to provide air circulation around the food for faster and more even cooking.  
A. Control switch  
B. Convection fan  
C. Function control knob  
D. Power switch
- This part illuminates when the timer knob of the toaster oven is turned ON.  
A. Control switch  
B. Power indicator  
C. Function control knob  
D. Power switch

**B. Essay:** Explain how the toaster oven operates (5 points).

#### CRITERIA

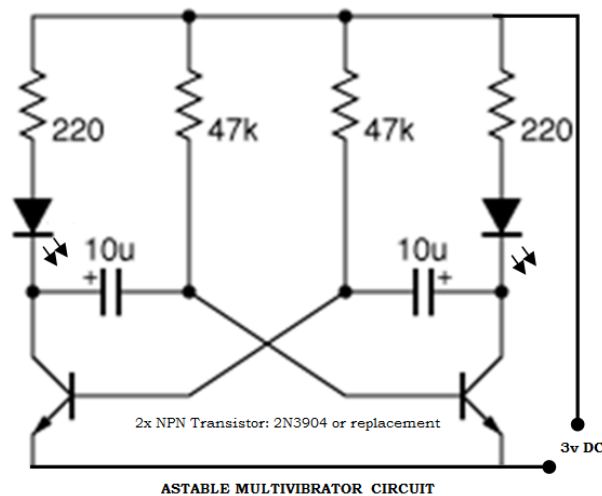
- 5 Sequence and transition of ideas were highly effective.
- 3 Some ideas and sequence may be improved to be highly effective.
- 2 Some signs of and/or abrupt change of ideas.
- 1 Very little or unclear flow of ideas.
- 0 No idea.

## INFORMATION SHEET 1.3 BASIC CONCEPT OF ELECTRONIC CONTROL (TRANSISTOR TIMER)

Timer has a wide variety of uses specially when used with relay to include auto shut-off for safety of electrical appliances. For our lesson we will be concentrating in the timer using basic components like transistor, capacitor, resistor and LED. In the given diagram (Activity 1.4), the circuit is powered by a 3V battery. A switch is closed to start the timer causing the LED to switch OFF for a time period. After the time period is over, the LED will switch ON again. We have two transistors in the circuit and the operation (switching ON and OFF of LED) will happen alternately causing an alternating light effect.

### ACTIVITY 1.3 Electronic Timer Control

**Directions:** Construct the given electronic circuit (Astable Multivibrator) using a breadboard.



Source: "Astable Multivibrator" Arrow tech IT Project.  
<http://rakeshkansara.blogspot.com/2011/04/astable-multivibrator.html>  
 (Date accessed: October 27, 2014).

**Resources:**

Qty/Unit	Description	Qty/Unit	Description
1	Breadboard	2 pcs.	Light Emitter Diode (LED)
1	Diagram of multivibrator	2 pcs.	Capacitor: 10uF/16v
2 pcs.	Resistor : 220 $\Omega$ ¼ w	2 pcs.	Transistor: 2N3904
2 pcs.	Resistor : 47K $\Omega$ ¼ w	1.5 feet	Solid Wire: #22 (for jumper)
2 pcs.	Dry cell (double A)		

**Procedure:**

1. Connect the components to the breadboard following the diagram and observing the correct pins of the Transistor, the polarity of the Capacitor and LED.
2. Connect the power supply. When the battery is connected, the two LED blink uniformly. Try using different capacitor value in the circuit (from 22k to 100k ohm should work). Value of these changes the timing of blinking (larger the value, slower the blinking).
3. If your project failed to work, review the procedures and/or check the condition of battery and other electronic components.

**Performance Assessment 1.3  
Electronic Timer Control (Transistor Timer)**

**Directions:** Assess the students on how competent they have applied the skill in constructing the astable multivibrator circuit using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by multiplying the points earned by the corresponding percentage, then divide each item by 5, multiply by 100. Add the products to get the rating.

Criteria	%	Points					Rating
		5	4	3	2	1	
Workmanship	50						
Use of Tools	30						
Use of Personal Protective Equipment	10						
Speed	5						
House Keeping	5						
<b>Total</b>							

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
SPEED	Finished within the time/ Less 1 point for every five minutes delay
Housekeeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date \_\_\_\_\_

**ACTIVITY 1.4**  
**RECEIVING A TOASTER OVEN (ELECTRONICALLY-CONTROLLED)**  
**FOR MAINTAIN/ REPAIR**

**Directions:** Provided with a defective Toaster Oven, use the Receiving and Repair Form to gather and document the information about the appliance at hand. Follow the procedures below:

**Resources:**

Domestic appliance: Toaster Oven (electronically-controlled)  
 Receiving and Repair Form

**Procedure:**

1. Conduct an initial interview to the owner of the appliance.
  - \* Ask what the problem is.
  - \* Request for the details of the problem (how does it happen/ since when/ nature of the problem)
2. As serviceman, you must recognize the problem/ complain.
3. Make an initial inspection of the appliance.
  - \*Physical appearance
  - \*Operating controls and other parts
  - \*Power cord
4. Take note of the information gathered and observed.
5. Accomplish Maintain and Repair form.

**Receiving and Repair Form**

Customer's name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Product/ Brand name: \_\_\_\_\_  
 Serial no: \_\_\_\_\_  
 Complaint: \_\_\_\_\_

**Toaster Oven Checklist**

PARTS	CONDITION	
	GOOD	DEFECTIVE
Glass door		
Knob of controls		
Indicator lamp/s		
Glass door handle		
Rack/s		
Display (if any)		
Pan/s		
AC cord		

Student's Signature \_\_\_\_\_ Date: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date: \_\_\_\_\_



**PERFORMANCE CHECK 1.4  
RECEIVING ELECTRONICALLY-CONTROLLED DOMESTIC  
APPLIANCE FOR MAINTAIN/ REPAIR**

**Directions:** Read the questions and answer by checking the appropriate box.

Tasks:	YES	NO
1. Recorded the name and address of the owner of the appliance?		
2. Copied product/ brand/ name and serial number of the appliance?		
3. Asked for complain and the remarks/ condition of the appliance?		
4. Verified complain on the condition of the appliance?		
5. Accomplished checklist of appliance parts condition.		
• Glass door		
• Knob of controls		
• Indicator lamp/s		
• Glass door handle		
• Rack/s		
• Display (if any)		
• Pan/s		
• AC cord		
TOTAL		

Student's Signature \_\_\_\_\_ Date prepared: \_\_\_\_\_  
Teacher's Signature \_\_\_\_\_ Date checked: \_\_\_\_\_

**LO2. DIAGNOSE FAULTS OF ELECTRONICALLY-CONTROLLED DOMESTIC APPLIANCES**

- Observe systematic pre-testing procedures in accordance with manufacturer's instructions
- Check and isolate circuits using specified testing procedures
- Document results of diagnosis and testing accurately and completely within the specified timeframe
- Explain identified defects and faults based on the result of diagnosis and testing
- Provide data/information regarding the status and serviceability of the unit as per procedure

**INFORMATION SHEET 2.1**  
**PRE-TESTING and TROUBLESHOOTING a TOASTER OVEN**  
**(ELECTRONICALLY-CONTROLLED)**

1. Determine the specific problem by asking the symptom.
  - c. Ask the owner/operator of the toaster oven of what is the symptom of the unit.
  - d. Request some details of the symptom (how does the symptom happen and how long it has been observed).
  
2. Operate the device if possible. Make sure that you know how to operate a toaster oven. If not, review the operating manual as well as service manual (if available) of the unit prior to its testing and operation.
  - d. If you have worked on the same unit before, check out to see if it functions in the same way.
  - e. Determine the last time it has been modified/repaired.
  - f. You must recognize the symptom/ complain of the owner to the unit.
  
3. Perform visual inspection of the unit.
  - c. Prepare the tools needed and remove the cover ready for inspection.
  - d. Apply careful physical inspection of the parts/components. (Look for burned and broken components; Inspect for loose connections or broken wires; Check for misaligned/ deformed parts)
  
4. If all looks fine, test the unit for resistance checks.
  - c. Get the multimeter and set at lower range. Connect the test probes to each of the plug terminals, the reading must be infinite having the control/s at zero position.
  - d. Then, adjust slowly the timer, temperature, and function knob, decrease in resistance should be observed upon turning the knob to the right. If this happens, the unit might be in good condition. For safety, place one probe across the plug terminals and the other probe to the body. There should be very high (infinite) resistance. If resistance is observed, do not attempt to plug the unit instead solve this first. Refer to troubleshooting guide in this lesson.
  
5. Record your findings for future reference.

### Diagnosing and Troubleshooting Procedure/ Guide:

<b>SYMPTOM: Toaster oven is not working.</b>		
<b>POSSIBLE DEFECT</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Power cord	Check the continuity of the power cord using ohmmeter.	Replace power cord if necessary.
Power source	Check the power at the outlet.	Insert the power plug into a different outlet. Reset the circuit breaker if necessary.
Fuse	Check the continuity of the fuse using ohmmeter.	Replace fuse if necessary

<b>SYMPTOM: Toaster oven is energized but not reach set temperature.</b>		
<b>POSSIBLE DEFECT</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Door not closed	Check the door.	Ensure the door is closed properly.
	Compare the thermostat setting and temperature.	Replace the thermostat if necessary.

<b>SYMPTOM: Food not fully cooked.</b>		
<b>POSSIBLE DEFECT</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Setting too low	Check the function setting as to requirements.	Set the function setting as to requirements.
	Check the temperature setting as to requirements.	Set the temperature setting as to requirements.
	Check the timer setting as to requirements.	Set the timer setting as to requirements.

<b>SYMPTOM: Food over cooked or bunt.</b>		
<b>POSSIBLE DEFECT</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Setting too high	Check the function setting as to requirements.	Set the function setting as to requirements.
	Check the temperature setting as to requirements.	Set the temperature setting as to requirements.
	Check the timer setting as to requirements.	Set the timer setting as to requirements.

<b>SYMPTOM: The skewer is not rotating.</b>		
<b>POSSIBLE DEFECT</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Oversize food	Check the food on the skew for its size and part/s touching the housing.	Switch off the appliance and remove the skew to reduce size of food. Return the skew and continue the process.

<b>SYMPTOM: The LCD display is not backlit.</b>		
<b>POSSIBLE DEFECT</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Standby mode Backlight LED	Press any button to activate the screen and backlight.	Nothing to correct.
	Check the temperature setting as to requirements.	If the screen display is ok, check the LED and replace if needed.

## **ACTIVITY SHEET 2.1**

### **PRE-TESTING AND DIAGNOSING/ TROUBLESHOOTING AN ELECTRONICALLY-CONTROLLED TOASTER OVEN**

**Resources:**

- Service manual of Toaster Oven
- Toaster oven (functional and defective)
- Activity sheet/ Forms
- Tools and Equipment Needed
  - Pliers
  - Screwdrivers
  - Volt-Ohm Milliammeter
- Cleaning materials
- PPE

**Directions:**

1. Provided with the resources, perform the procedure and techniques in pre-testing and troubleshooting a toaster oven.
2. Let one of your classmate acts as the owner of the toaster oven subject for maintenance or repair.
3. Perform the procedures in accepting and pre-testing an appliance.
4. Accomplish Receiving and Repair Form and copy the form for diagnosis/ troubleshooting in a separate sheet to be filled-up with necessary information as you perform the activity.
5. Provide information regarding the status and serviceability of the appliance.
6. Thirty minutes will be allotted for this activity.

## Receiving and Repair Form

Customer's name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Product/ Brand name: \_\_\_\_\_  
 Serial no: \_\_\_\_\_  
 Complaint: \_\_\_\_\_  
 \_\_\_\_\_

### Toaster oven Checklist

PARTS		
	GOOD	DEFECTIVE
Glass door		
Knob of controls		
Indicator lamp/s		
Glass door handle		
Rack/s		
Display (if any)		
Pan/s		
AC cord		

SYMPTOM:		
POSSIBLE DEFECT	PROCEDURE	CORRECTIVE MEASURE

Remarks: \_\_\_\_\_

Student's Signature \_\_\_\_\_ Date: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date: \_\_\_\_\_

**PERFORMANCE CHECK 2.1**  
**PRE-TESTING AND DIAGNOSING/ TROUBLESHOOTING AN**  
**ELECTRONICALLY-CONTROLLED TOASTER OVEN**

**Directions:** Rate yourself on how competent you have applied the skill in pre-testing and diagnosing toaster oven using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by dividing each item by 5, multiply by 100. Average the rating of the five criteria to get the final rating.

Criteria	%	Points					Rating
		5	4	3	2	1	
Workmanship	50						
Use of Tools	30						
Use of Personal Protective Equipment	10						
Speed	5						
House Keeping	5						
<b>Total</b>							

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
Speed	Finished within the time/ Less 1 point for every five minutes delay
House Keeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date: \_\_\_\_\_

### **LO3 MAINTAIN/REPAIR A TOASTER OVEN**

- Use PPE in accordance with OHS practices
- Perform repair activity within the required timeframe
- Observe safety precautions in handling the unit/product as per standard operating procedure
- Replace defective parts/ components with identical parts or recommended parts with equivalent ratings
- Solder/mount repaired or replaced parts/components in accordance with industry standards
- Clean unit in accordance with standard operating procedure

### **INFORMATION SHEET 3.1 PERSONAL PROTECTIVE EQUIPMENT (PPE) OCCUPATIONAL HEALTH AND SAFETY (OHS) POLICIES and PROCEDURE**

#### **Personal Protective Equipment (PPE)**

Personnel protective equipment is the employer's responsibility. It includes specially designed protective clothing intended for your protection. Wear the correct clothing and equipment to protect you from possible serious injury. Do not misuse any item provided for your health and safety.

Personal Protective Equipment (PPE) is defined in the Occupational Safety and Health Administration (OSHA) as a tool used to protect workers from injury or illness caused by having contact with the dangers (hazards) in the workplace, whether they are chemical, biological, radiation, physical, electrical, mechanical and other. Exposures to hazards are reduced using PPE.

#### **Occupational Health and Safety (OHS)**

Occupational Health and Safety (OHS) is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work. The goal is to promote a safe work environment.

As Consumer Electronic Servicing National Certificate Level II (CES NC II) student, you should know how to conduct yourself when working in the classroom/ laboratory room, as well as implement a safe way of accomplishing every task. Safety practices should be learned early and always adhered to when working with any electrical and electronic device.

Each student has a responsibility to their colleagues and their organization to report and act upon any potential workplace hazard. All students need to be aware of the *type of hazards* that are possible in their work environment.

**SELF - CHECK 3.1**  
**PPE/ OHS**

**I. Directions:** Identify the body organ that must be protected from the listed source of danger. Write your answer on a separate sheet of paper.

1. Too much sound with more than 85dB noise level.
2. Fumes, dust and others that contribute to lack of oxygen.
3. Penetration of sharp objects, extreme temperatures, splashes of liquid chemicals or metals and the like.
4. Catalyst powder, splashes of liquid chemicals or metal dust, radiation.
5. Electric shock, exposure to chemicals, skin infections and extreme temperatures.

**II. Directions:** Complete the statement below by supplying the missing word/s. Write your answer on a separate sheet of paper.

- 1-3. Occupational Health and Safety (OHS) is a cross-disciplinary area concerned with protecting the \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ of people engaged in work.
4. The goal of OHS is to promote a \_\_\_\_\_.
5. Accessories/ jewelries are \_\_\_\_\_ when working with any electronic related devices or appliances.
- 6-7. Any potential workplace hazard must be \_\_\_\_\_ and \_\_\_\_\_ upon as it is recognized.
8. All \_\_\_\_\_ should be kept clear from all obstacles at all times.
- 9-10. All hazards must be \_\_\_\_\_ and \_\_\_\_\_ in order to track the kinds of hazards in the workplace.



## **INFORMATION SHEET 3.2 COMPONENT REPLACEMENT**

1. Determine the description of the values and ratings of the individual defective parts using the manufacturer's service manual.
2. Identify the sources of the replacement components/parts.  
Original replacement components from the original factory sources  
Universal replacement components from independent factory sources  
(Note: Always consider the physical size of the replacement part).
3. Consider the following factors in selecting parts.  
**Quality:** the ability to provide exact specification of the replacement part  
**Tolerance:** the ability to provide exact value or acceptable parameters of the replacement parts.  
**Availability:** the local access to parts and availability  
**Price:** refers to the affordability of the replacement parts
4. Disconnect or remove properly the electrical/mechanical parts of a toaster oven.
5. Install correctly the replacement parts/components
6. For burnt components where values are impossible to recognize, secure a schematic diagram or service manual if possible. In other case, you can look for the same brand and model as reference.
7. Double check the testing procedure in suspected defective components (on and off the circuit).
8. Check the nearby components for possible consequence of being damaged too.
9. Consider the original orientation/connection of the components in replacing defective one.
10. Observe safety at all times.

## **SELF-CHECK 3.2 COMPONENT REPLACEMENT**

**Directions:** Identify the term being described in each item.

1. It is one of the factors to consider in selecting replacement parts that refers to the capability of local market to have the supply.
2. It is one of the factors to consider in selecting replacement parts that refers to the conformity of the available parts as per acceptable specification.
3. It is one of the factors to consider in selecting replacement parts that refers to the ability to provide exact value/ specification.
4. It is one of the factors to consider in selecting replacement parts that refers to the affordability of the replacement parts.
5. It contains the necessary data of a particular domestic appliance including the schematic diagram.

## **INFORMATION SHEET 3.3 TROUBLESHOOTING TIPS**

1. Conduct a *quick* diagnosis of the trouble symptom and repair the defective set in the *shortest possible time*. Do not troubleshoot toaster oven unless you have determined the fault. Trace the fault from the mechanical section or electrical circuit section.
2. When troubleshooting integrated circuits (ICs) in the electrical/electronic circuit section, do not remove the IC from the PCB. Secure a circuit diagram from the manufacturer to help you identify and analyze the function of the IC. Consider the pin out of the IC.
3. When troubleshooting in the electrical/ electronic circuit section, prior to pre-testing, consider voltage measurement on components first before removing it for testing. If the measured voltage is normal, the component might be the cause of the problem. Either way, if the measured voltage is not normal (increased or decreased) the preceding circuit/ components might be the cause.
4. If the trouble symptom is caused by aging components, the defective component is usually one of them. However, in high-power-handling circuits, a defective component may cause other components to malfunction.

5. Be familiar with the usual defects of components. (e.g. capacitors usually become leaky, shorted or open/ resistor increase their resistance when they become defective/ semi-conductors such as transistors usually become open or shorted)
6. Don't replace an opened fuse or burned resistor unless you have corrected the trouble.
7. Check the mechanical switch circuit for its faulty contact before assuming defective electronic components.
8. When measuring resistance in the circuit, make sure that the circuit is OFF and power is not being supplied in the circuit, and that stored charges in capacitors are properly discharged. Failure to do so can damage the volt-ohm-milliammeter (VOM) and the circuit due to the low resistance of the ohmmeter.
9. 9. While using a VOM for in-circuit resistance measurement, always exchange the setting of positive and negative probes. Take the higher meter reading with the approximate resistance.
10. Use soldering irons with the proper power rating to prevent the components and the circuit board from being overheated and damaged. Soldering iron tips should be cleaned and preferably slim.
11. Use proper tools and soldering aids when troubleshooting PCB. Ground the soldering iron to avoid damaging ICs and transistors.
12. Dry solder joints are hard to detect. However, when they are found or suspected, remove the components from the PCB; then, file or clean the leads and solder the joints back. Reheating dry joints with a new soldering lead is another remedy. When re-soldering, make sure you do not overheat the components. Overheating the PCB may cause the copper layer on it to warp and peel off.
13. Use Personal Protective Equipment.

### **Maintenance of Toaster oven**

1. Turn off the toaster oven and remove the cord from the source of voltage.
2. Apply lubricant to mechanical parts of the toaster oven that requires lubrication through a drop of oil or grease to assure smooth operation without grinding or squeaks.
3. Clean and check cooling louvers for any obstructions to avoid cutting off the air flow.
4. Clean or wipe dust and foreign particles at the PC Board and metal parts of the motor.
5. Replace worn or frayed AC cord and electrical wires.

## **Cleaning Instructions**

After every use, it is important to clean all parts of the oven. This will prolong the life of your appliance.

1. Always switch off, unplug and allow getting cool before cleaning. Never use harsh abrasives or corrosive products. These could damage the oven surface.
2. Use damp cloth to wipe the exterior of the toaster oven. Dry immediately. Do not immerse in water.
3. Wipe the interior walls with a damp cloth and a mild liquid soap solution on a sponge. Dry immediately.
4. Slide out the crumb tray and discard to remove. Wipe clean and return.

## **Procedure in Repairing a Toaster Oven**

1. Once the specific electrical/mechanical problem is located:
  - consider the techniques for the proper removal of the defective component or parts;
  - anticipate what to do if the replacement part does not correct the problem;
  - and check the installation of the replacement or original part for any improper mounting in the mechanical assembly or circuit board.
2. Examine carefully the mounting of the replacement of original parts of the system.
  - Check the placement of the wires or leads of the replacement component.
  - Consider significant factors used in the original installation such as insulating toaster oven, silicon grease and locating mark for pin connections.
  - Observe proper placement of the component leads for electrical parts.
3. Perform the techniques for the proper soldering of electrical parts.
  - Be careful not to damage adjacent components.
  - Be careful not to lift the copper conductive path from circuit board base material.
  - Avoid any solder bridges between board paths.
  - Do not destroy the component being removed in case it is still functional and be careful not to damage the component being installed.
4. Verify all connections and harness.
  - Be sure that all components pre-positioned in a manner that will avoid the possibility of having adjacent components short circuited.

- Be sure to check or inspect all insulators and barriers between sections after working on any model/brand of toaster oven.
  - Check for frayed or broken insulation on all wiring including the AC line cord.
  - Be sure to replace fuses, resistors and capacitors with special designation such as flame proof to components equal to the original value for both safety and liability purposes.
5. Once the repair is completed, perform an AC leakage test on all exposed metal parts of a toaster oven to eliminate the possibility of electric shock.
- Perform complete retesting of the toaster oven to ensure the correctness of the actual repair.
  - Connect the toaster oven into the 60Hz power to allow the time period required to let the new parts settle in and operate as they are designed to work with each other.
  - Recheck or inspect if the repair was done correctly and the unit functions properly to ensure successful completion of the repair.
6. Clean the toaster oven before it would be returned to the customer.
- Be sure that the front and rear guards of the toaster oven are properly cleaned.
- Be sure that proper cleaning is given to the control panel or switch box of the toaster oven.

## **ACTIVITY SHEET 3.1**

### **MAINTAIN AND REPAIR A TOASTER OVEN**

**Resources:**

- Service manual of Toaster Oven
- Toaster oven (functional and defective)
- Activity sheet/ Forms
- Tools and Equipment Needed
  - Pliers
  - Screwdrivers
  - Volt-Ohm Milliammeter
- Cleaning materials
- PPE

**Directions:**

1. Provided with the resources, perform the maintenance/ repair procedure in a given toaster oven. Observe safety precautions at all times and consider the information given in this lesson.
2. Let one of your classmates act as the owner of the toaster oven subject for maintenance or repair.
3. Perform the procedures in accepting and pre-testing an appliance.
4. Accomplish Receiving and Repair form and copy the form for maintenance and repair in a separate sheet to be filled-up with necessary information as you perform the activity.
5. Provide information regarding the status and serviceability of the appliance.
6. Fifty minutes will be allotted for this activity.

## Receiving and Repair Form

Customer's name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Product/ Brand name: \_\_\_\_\_  
 Serial no: \_\_\_\_\_  
 Complaint: \_\_\_\_\_  
 \_\_\_\_\_

### Toaster oven Checklist

PARTS		
	GOOD	DEFECTIVE
Glass door		
Knob of controls		
Indicator lamp/s		
Glass door handle		
Rack/s		
Display (if any)		
Pan/s		
AC cord		

SYMPTOM:		
DEFECTIVE PART	PROCEDURE	CORRECTIVE MEASURE
Remarks:		

Student's Signature \_\_\_\_\_ Date: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date: \_\_\_\_\_

**PERFORMANCE CHECK 3.1  
MAINTAINING AND REPAIRING A TOASTER OVEN**

**Directions:** Assess the students on how competent they have applied the skill in pre-testing and diagnosing toaster oven using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by multiplying the points earned by the corresponding percentage, then divide each item by 5, multiply by 100. Add the products to get the rating.

Criteria	%	Points					Rating
		5	4	3	2	1	
Workmanship	50						
Use of Tools	30						
Use of Personal Protective Equipment	10						
Speed	5						
House Keeping	5						
<b>Total</b>							

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
Speed	Finished within the time/ Less 1 point for every five minutes delay
House Keeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date: \_\_\_\_\_

Teacher's Signature \_\_\_\_\_ Date: \_\_\_\_\_



## **LO4: REASSEMBLE AND TEST REPAIRED APPLIANCE**

Perform final test for reassembled units in conformity with manufacturer's specifications

### **INFORMATION SHEET 4.1 REASSEMBLING and TESTING REPAIRED TOASTER OVEN**

Reassembling Procedure:

1. After replacing the defective component of the appliance, prepare the parts for reassembling. Make sure that there are no missing part/component and as well as the screw/s.
2. Fix all the disassembled parts in the housing/ compartment, considering the fittings/ lock/s.
3. Wires and loose parts should be in proper place to avoid damaged due to misaligned compartment.
4. All sides of the housing should fit accordingly. Moving parts must move as it can be moved by hand and free from obstructions.
5. Tighten the screw/s accordingly.
6. Clean the unit before doing the post-testing procedure.

Post-testing Procedure:

1. Test the resistance at the AC plug to determine the continuity of the power line to the heating element. A resistance reading must be observed as you turn the timer switch to ON position. This indicates that the circuit connection is good.
2. In the case of electronically-controlled toaster oven, there is no resistance reading as you test the AC plug. The reason is that there is a low-voltage power supply circuit that controls the functions of the appliance.
3. Energize the unit to check its functionality. Plug the AC cord to the power source (the timer switch is at OFF position and power ON button for electronically-controlled must be OFF too). Turn the timer switch accordingly and observe if the unit functions as it should be. In the case of electronically-controlled, press button one at a time observing the behavior. This time, the unit should operate normally. If not, review the documentation and the problem for the second time.

**ACTIVITY 4.1**  
**REASSEMBLING AND TESTING REPAIRED TOASTER OVEN**

**Resources:**

- Repaired appliance (toaster oven)
- Hand tools and instrument
- Maintain and Repair form

**Directions:**

Reassemble the repaired appliance and test its functionality. Refer to the documentation to check if the problem/ complain was addressed. Perform the post-testing procedure. The unit/ appliance must operate in its normal operating condition. Twenty minutes will be given to perform the activity.

**PERFORMANCE CHECK 4.1**  
**REASSEMBLING AND TESTING REPAIRED TOASTER OVEN**

**Directions:** You will be assessed using the listed criteria with ratings 1-5, 5 is the highest. Each criterion has its indicator and corresponding points for you to assess yourself. Multiply the score by the corresponding percentage and divide it by 5, then multiply by 100. Add the products to get the rating.

Criteria	Points					Rating
	5	4	3	2	1	
Workmanship						
Use of Tools						
Use of Personal Protective Equipment						
Speed						
House Keeping						
<b>Total</b>						

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
Speed	Finished within the time/ Less 1 point for every five minutes delay
House Keeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date: \_\_\_\_\_

Teacher's Signature \_\_\_\_\_ Date: \_\_\_\_\_

## VI. SUMMATIVE ASSESSMENT

**I. Directions.** Write only the letter of the best answer on your answer sheet.

1. It is the part of a toaster oven that provides desired temperature upon energized.  
A. Glass door    B. Heating element    C. Housing    D. Power cord
2. It is one of the controls of a toaster oven that determine the duration of the operation or cycle of the appliance.  
A. Glass door    B. Heating element    C. Timer    D. Tray
3. In electronically-controlled toaster oven, it displays the programmed function of the unit.  
A. Monitor    B. LCD screen    C. Timer    D. Relay
4. It refers to an electrically-operated switch that is common to switching circuits.  
A. Monitor    B. LCD screen    C. Timer    D. Relay
5. It refers to an electronic circuit that is useful in automatic shut-off function of electrical appliance.  
A. Monitor    B. LCD screen    C. Timer    D. Relay

**II. Directions.** Fill in the blanks with word or group of words which will make the statement correct and complete.

6. Determine the specific \_\_\_\_\_ by asking the symptom.
7. If you are not familiar on how to operate a toaster oven, read first the \_\_\_\_\_ prior to its testing.
8. Perform \_\_\_\_\_ inspection of the unit
9. Perform resistance check. Set the multimeter at lower range. Connect the test probes to each of the plug terminals, the reading must be \_\_\_\_\_ having the control/s at zero position.
10. For your future reference, \_\_\_\_\_ your findings.

**III. Directions.** Explain the following:

- A. Factors in selecting replacement parts (5pts).
- B. Troubleshooting tips of a toaster oven (5pts).

### CRITERIA

- 5 Sequence and transition of ideas were highly effective.
- 3 Some ideas and sequence may be improved to be highly effective.
- 2 Some signs of and/or abrupt change of ideas.
- 1 Very little or unclear flow of ideas.
- 0 No idea.

**IV. Directions.** Perform actual repair of Toaster Oven (Preferably Electronically-Controlled)

CRITERIA

Workmanship

- 4 -Workplace, materials, tools and instrument are prepared. Utilize the resources accordingly. Converse competently. Handle resources properly.
- 3 -Workplace, materials, tools and instrument are prepared. Utilize the resources accordingly. Converse competently. Handle resources improperly.
- 2 -Workplace, materials, tools and instrument are prepared. Not utilize the resources accordingly. Resources not properly handled.
- 1- Workplace is prepared but materials, tools and instrument are not. Not utilize the resources accordingly. Resources not properly handled.
- 0 -Workplace, materials, tools and instrument is not set. Utilize the resources unevenly. Resources not properly handled.

Accuracy

- 4 -Accomplished the documentation. Performed the pre-testing procedure. Diagnose/ troubleshoot competently. Identified the cause of the problem. Restored the functionality of the unit.
- 3 - Accomplished the documentation. Pre-testing procedure was not performed. Diagnose/ troubleshoot competently. Identified the cause of the problem. Restored the functionality of the unit.
- 2 -Accomplished the documentation. Pre-testing procedure was not performed. Diagnose/ troubleshoot competently. The cause of the problem is not identified. Not able to restore the functionality of the unit.
- 1 -Incomplete documentation. Pre-testing procedure was not performed. Diagnose/ troubleshoot competently. The cause of the problem is not identified. Not able to restore the functionality of the unit.
- 0 -Documentation is not accomplished. Did not perform pre-testing. Did not diagnose/troubleshoot competently. The cause of the problem is not identified. Not able to restore the functionality of the unit.

Safety & Cleanliness

- 2 -The whole area was cleaned before and after the activity. No accident happened.
- 0 - The whole area was dirty before and/or after the activity or an instance of accident.

<b>Content Standard</b>	<b>Performance Standard</b>
<p>The learner demonstrates an understanding of the concepts in maintaining and repairing appliances with motor and with a heating element:</p> <ul style="list-style-type: none"> <li>• Rice Cooker</li> </ul>	<p>The learner independently maintains and repairs appliances with motor and with a heating element:</p> <ul style="list-style-type: none"> <li>• Rice Cooker</li> </ul>

#### **Quarter IV**

**Time Allotment:40 Hours**

### **UNIT OF COMPETENCY: MAINTAIN AND REPAIR ELECTRONICALLY CONTROLLED DOMESTIC APPLIANCE**

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#### **IV. INTRODUCTION:**

This lesson contains necessary information and suggested learning activities in Maintaining and Repairing a Rice Cooker. Additionally, pre-testing and disassembling-assembling procedure of a rice cooker are included to comply with the standard operating procedure. There are forms to accomplish for proper documentation.

#### **V. PRE/ DIAGNOSTIC ASSESSMENT**

**I. Directions:** Write the letter of the correct answer on a separate sheet of paper.

- Open the circuit when the temperature has gone unusually high.
  - Center Thermostat
  - Thermal Fuse
  - Switch
  - Neon Lamp
- Prevents the rice cooker from being turned on without the pan.
  - Center Thermostat
  - Thermal Fuse
  - Switch
  - Neon Lamp
- Turns off the cooking cycle and starts the warming cycle.
  - Center Thermostat
  - Thermal Fuse
  - Switch
  - Neon Lamp
- A part of a control system used to monitor the output.
  - Sensor
  - Comparator
  - Controller
  - Device
- A system that compares the output with the expected result.
  - Closed Loop System
  - Open Loop System
  - Switch-On Preventive System
  - Keep Warm System

6. A test conducted to see if the rice cooker will turn-off 1 minute or after the generation comes to a stop.
- |                    |                              |
|--------------------|------------------------------|
| A. Bubbling Test   | B. Evaporation Test          |
| C. Continuity Test | D. Switch-on Preventive Test |
7. A kind of test to see if the heating element is in good condition.
- |                    |                              |
|--------------------|------------------------------|
| A. Bubbling Test   | B. Evaporation Test          |
| C. Continuity Test | D. Switch-on Preventive Test |
8. A test conducted to see the alignment and sufficiency of the heating plate on the pan.
- |                    |                              |
|--------------------|------------------------------|
| A. Bubbling Test   | B. Evaporation Test          |
| C. Continuity Test | D. Switch-on Preventive Test |
9. The metal and magnet will pop apart when this temperature is reached.
- |           |                      |
|-----------|----------------------|
| A. 65 °C  | B. 134 °C            |
| C. 100 °C | D. None of the Above |
10. The boiling point of water.
- |           |                      |
|-----------|----------------------|
| A. 65 °C  | B. 134 °C            |
| C. 100 °C | D. None of the Above |

## **VI. LEARNING COMPETENCIES**

### **LO1: PREPARE UNIT, TOOLS, EQUIPMENT AND WORKPLACE FOR MAINTENANCE/REPAIR(RICE COOKER)**

- Prepare necessary tools, test instruments and personal protective equipment in line with job requirements.
- Acquire service manuals and service information required for repair/maintenance as manufacturer's specifications.
- Conduct complete check-up of electronically-controlled domestic appliances.
- Document the identified defects based on check-up conducted.

### **INFORMATION SHEET 1.1 TOOLS AND MATERIALS IN MAINTAINING ELECTRONICALLY-CONTROLLED DOMESTIC APPLIANCE**

In every electronic work, it is a must to prepare first the necessary tools, materials, and equipment needed as well as the information. The following list of tools, materials, and equipment are needed in maintaining and repairing electronically-controlled domestic appliance:

		
Soldering Iron	Long Nose Pliers	Diagonal Cutting Pliers
		
Soldering Lead	Desoldering Tool	Wire Stripper
		
Soldering Stand	Utility knife (Blade Cutter)	Multitester/ Volt-Ohm-Milliammeter (VOM)
		
Flathead Screwdriver	Philip Screwdriver	Mask
		
Non-Static Brush	Apron	ESDWrist Strap

## INFORMATION SHEET 1.2 OPERATION OF AN ELECTRIC RICE COOKER

A rice cooker is a kitchen appliance dedicated to cooking rice. Rice is cooked by heating in boiling water and steam, or a combination (boiling until water evaporates, and then continuing in steam generated by continued heating). It absorbs a great deal of water in the process, expanding its volume and using up the cooking water.

For the modern home rice cookers, the smallest single-person model cooks 1 rice cup (180 *ml*) whereas the largest cooks 10 rice cups (1.8 *liter*). The typical lower price models use electric heaters to heat the inner cooking bowl controlled by thermostat assembly or built-in electronic control, whereas the high-end models feature various ideas of improved and better cooking methods.

Electric rice cookers automate the process by mechanically or electronically controlling heat and timing. Although the rice cooker does not necessarily speed up the cooking process, with an electric rice cooker the cook's involvement in cooking rice is reduced to simply measuring the rice, preparing the rice properly and using the correct amount of water. Once the rice cooker is set to cook, the rice will be cooked with no further attention.

### **Principle of operation (basic rice cooker models)**

The **bowl** in the rice cooker is usually removable, to which rice and water are in place. A **heater** and **thermostat** is beneath the bowl. A spring pushes the thermostat against the bottom of the bowl for good thermal contact.

During cooking, the rice/water mixture is heated at full power. The water reaches a temperature of 100 °C (212 °F); it cannot get hotter than its boiling point.



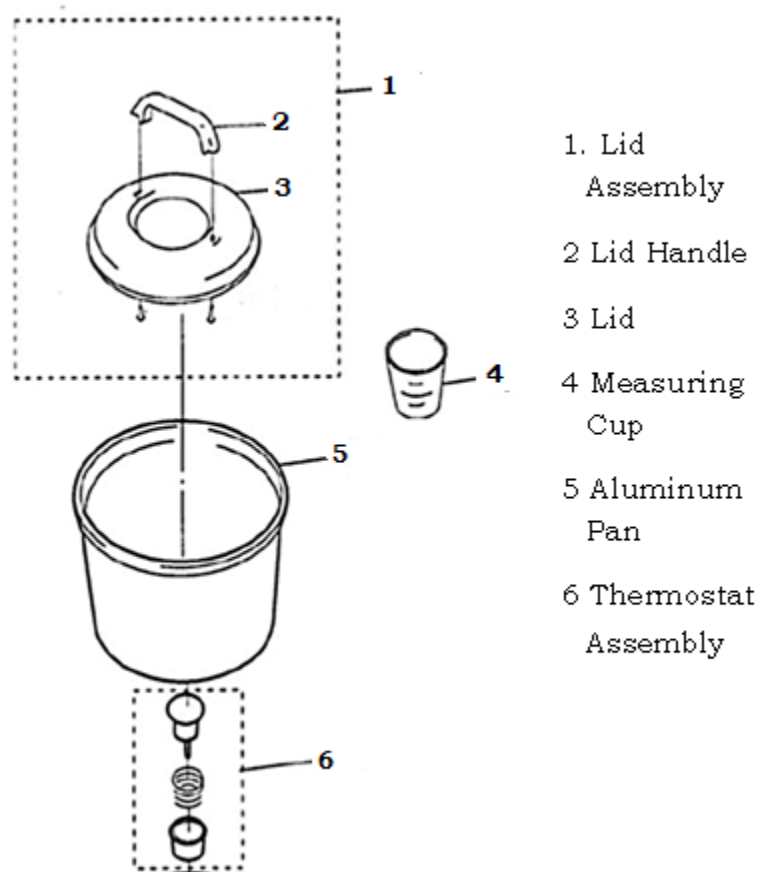


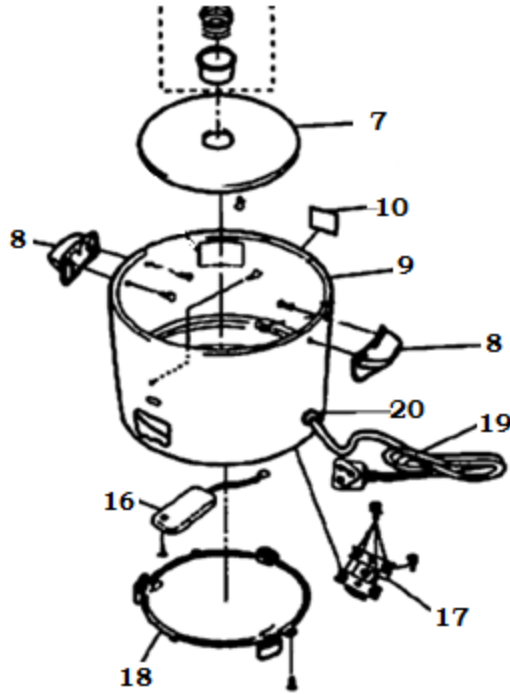
By the end of cooking there will be no free water left; most will have been absorbed by the rice, and some boiled off. As heating continues, the temperature can now rise above boiling point; this makes the thermostat trip. Some cookers switch to low-power or "warming" mode, keeping the rice at a safe temperature of approximately 65 °C (150 °F); other models simply switch off.

### Basic Parts of Electric Rice Cooker

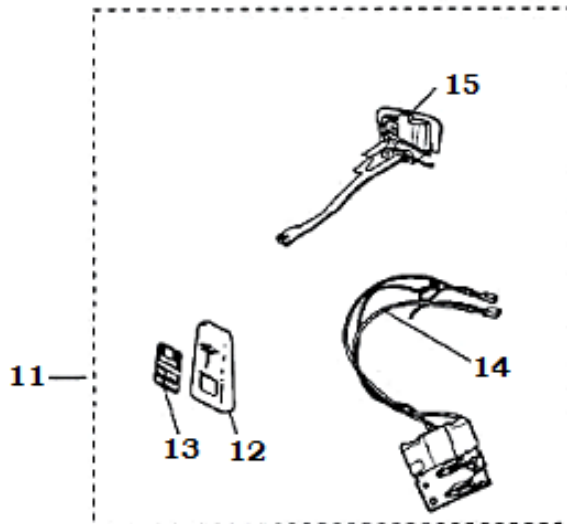
It is best to acquire Service Manual and Diagrams specific for different models, design might vary from one manufacturer and/or model to another.

### Exploded Views





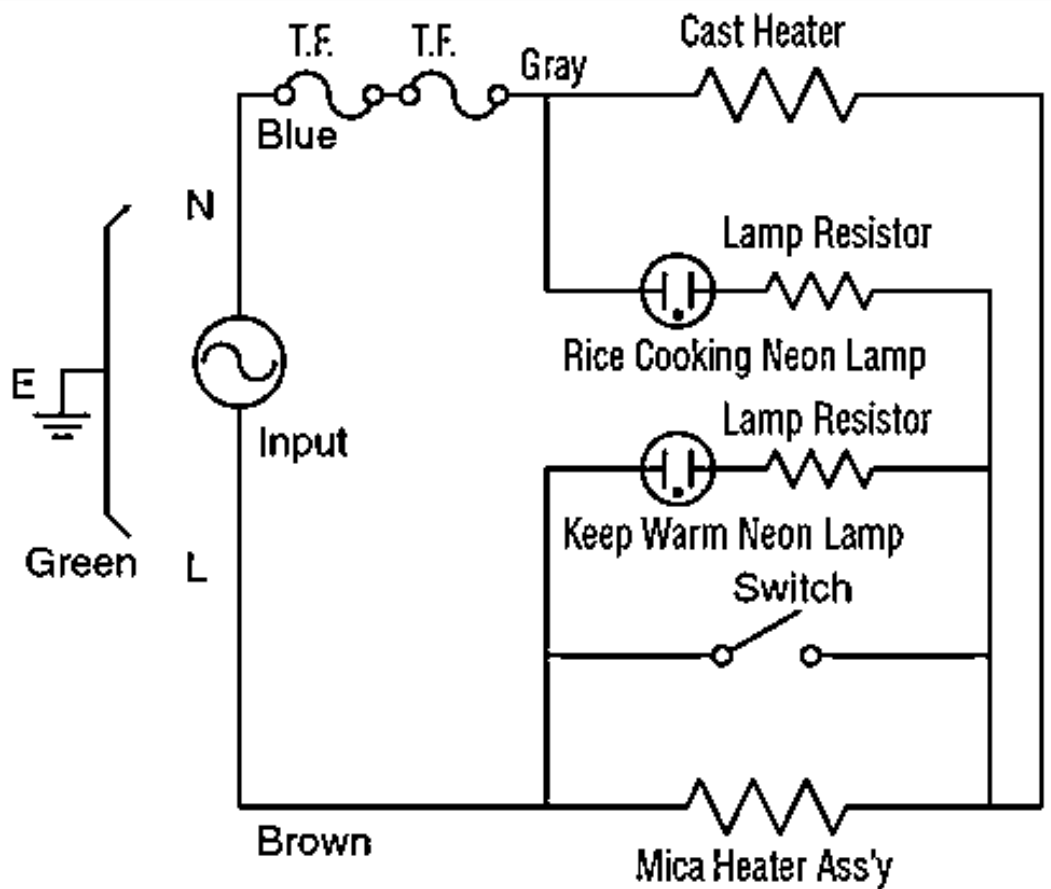
- 7 Cast Heater Assembly
- 8 Handle for the Body
- 9 Body Complete
- 10 Name Plate
- 16 Mica Heater Assembly
- 17 Wiring Terminal Assembly
- 18 Bottom Plate Assembly
- 19 Power Cord
- 20 Cord Bushing
- 21 Scoop



- 11 Switch Assembly
- 12 Switch Panel
- 13 Decorative Panel
- 14 Lamp Board Assembly
- 15 Switch Lever 1 Lid

In simple models, a mechanical thermostat is used to turn off the cooker when the rice is ready. Since 1980s, higher-end electric rice cookers have used electronic components such microprocessors to control the cooking process, often incorporating a memory and electronic timer that can be used to set the desired "ready time". Some models can be used as steamers to cook food.

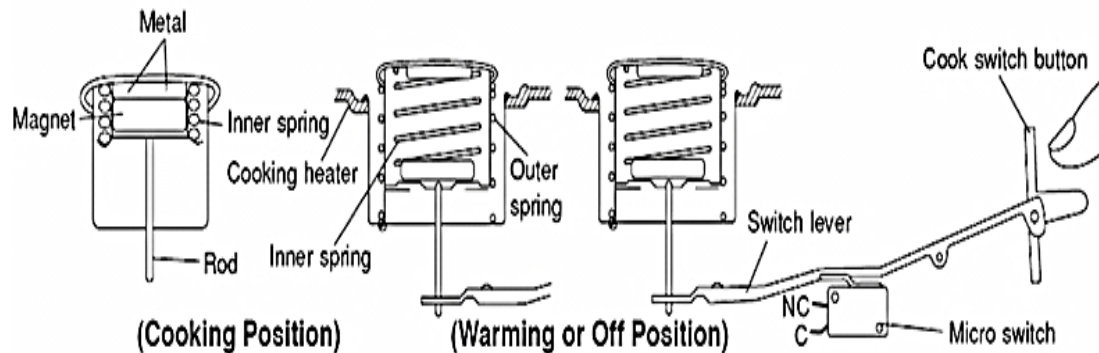
**Sample Schematic Diagram of a Rice Cooker**



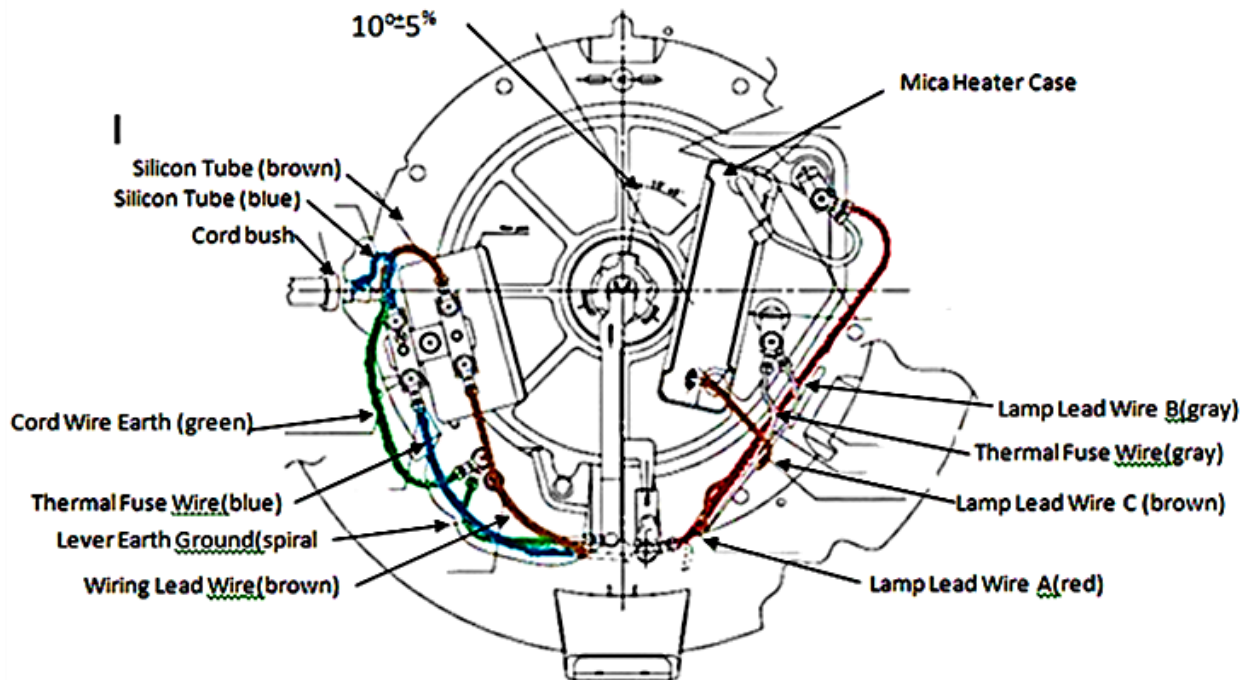
## Function of Center Thermostat and Thermal fuse

### Center Thermostat

The center thermostat turns off the cooking cycle, and starts the warming cycle when it senses that the bottom of the rice cooker pan reach  $134^{\circ}\text{C} \pm 6^{\circ}\text{C}$ . The illustration below shows the construction of center thermostat upon cooking and warming.



### Wiring Diagram of an Electric Rice Cooker



The ability of a metal to be attracted by the magnet decreases as it is heated. Finally, the inner spring pressure becomes stronger than the magnetic pull and the metal and magnet will pop apart. The rod activates the switch lever which causes the auxiliary lever to press the micro-switch button into the warming cycle.

## Switch-On Preventive System

This prevents the rice cooker from being turned on without the pan placed into position.

1. Normally when the pan is inserted properly into the rice cooker, the pan will depress the center thermostat. The center thermostat outer spring will be compressed causing the switch button to be depressed, and then the following will happen:

a. The auxiliary lever will activate the micro-switch button. This puts the micro-switch in the cook position.

b. The switch lever will push the rod which will allow the magnet to meet with the metal.

c. When the rice is cooked and the proper temperature has been reached ( $134^{\circ}\text{C} \pm 6^{\circ}\text{C}$ ), the metal and magnet will pop apart.

d. The rod will push the switch lever and cause micro-switch to turn in warming position.

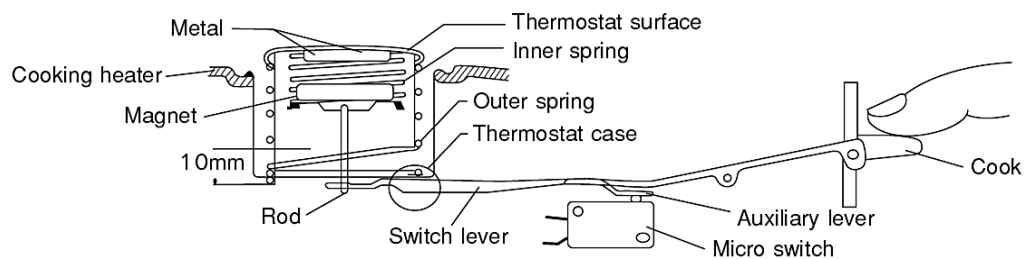
2. When the pan is not in place within the rice cooker, the center thermostat is not depressed.

a. In this condition, the outer spring is not compressed within the center thermostat preventing the metal from reaching its normal operating position.

b. When the switch button is depressed, the switch lever and auxiliary lever work as above but the magnet cannot come in contact with the metal to hold the switch lever in the cook position.

c. When the pressure is taken off the switch button, the switch lever releases immediately to the open or warm positions.

## Switch-On Preventive System



## Thermal Fuse

The thermal fuse is used to open the circuit to the cooking heater when the temperature has gone unusually high. An incomplete contact between the heater and pan or if the switch buttons is forced to stay on keeping the heater energized abnormally may cause the thermal fuse to open.

**SELF CHECK 1.2**  
**SCHEMATIC DIAGRAM OF AN ELECTRIC RICE COOKER**  
**(WITHOUT THE ELECTRONIC CONTROL)**

**Directions:** Draw the schematic diagram. Use a separate sheet of paper and pencil in performing this.

<b>Criteria</b>	<b>Points</b>
Complete diagram with labels.	10
With one missing component or label	8
With 1 missing component and label	6
With 2 missing component or label	4
With 2 missing component and label	2
With more than 3 missing components or labels	0

*Note: If you have drawn the schematic diagram accurately, that is an excellent mark. If your diagram is erroneous, review the questions, go back to information sheet 1.2, and study them more closely.*

**INFORMATION SHEET 1.3**  
**ELECTRONIC CONTROL SYSTEMS USED IN RICE COOKER**

There are two types of control system: the open loop system and the closed loop system. They can both be represented by block diagrams. A block diagram uses blocks to represent processes, while arrows are used to connect different input, process and output parts.

**Open Loop System**

In an open loop control, the controller may operate a switch to adjust the input to the process. This is often done by a timer.

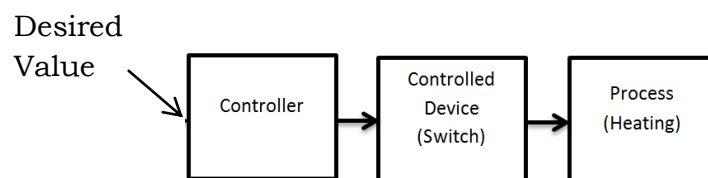
A timer is set by the operator which operates a switch on the electrical circuit to the electric heating element. Once the oven reaches the pre-set time it will open or close the switch.

Controlled Variable is what needs to be controlled such as temperature.

A controlled device is the piece of apparatus which adjusts or switches the controlled variable.

A system with no feedback i.e. there is no way to monitor the process to find out if the control system is working effectively.

This control system can also be described as simple ON/OFF control.

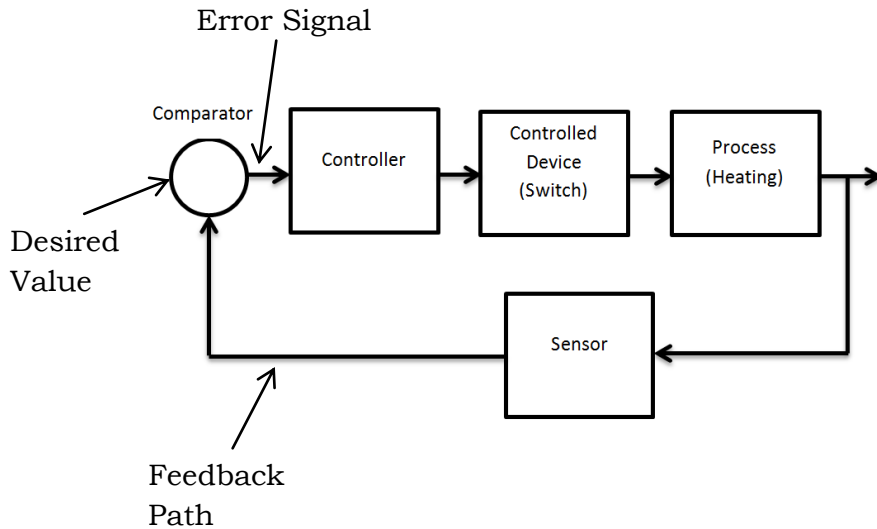


### **Open Loop System Diagram**

The drawback of an open loop control system is that it is incapable of making automatic adjustments. Even when the magnitude of the output is too big or too small, the system will not make the appropriate adjustments. For this reason, an open loop control system is not suitable for use as a complex control system. Sometimes it may even require monitoring and response from the user.

### **Closed Loop System**

Sometimes, we may use the output of the control system to adjust the input signal. This is called feedback. Feedback is a special feature of a closed loop control system. A closed loop control system compares the output with the expected result or status then it takes appropriate actions to adjust the input signal. Therefore, a closed loop system is always equipped with a sensor, which is used to monitor the output and compare it with the expected result.



**Closed Loop System Diagram**

The comparator or comparison device compares the desired value with the actual measured variable - temperature in the case of the rice cooker or oven. The difference between the desired value and the measured value is known as the error signal.

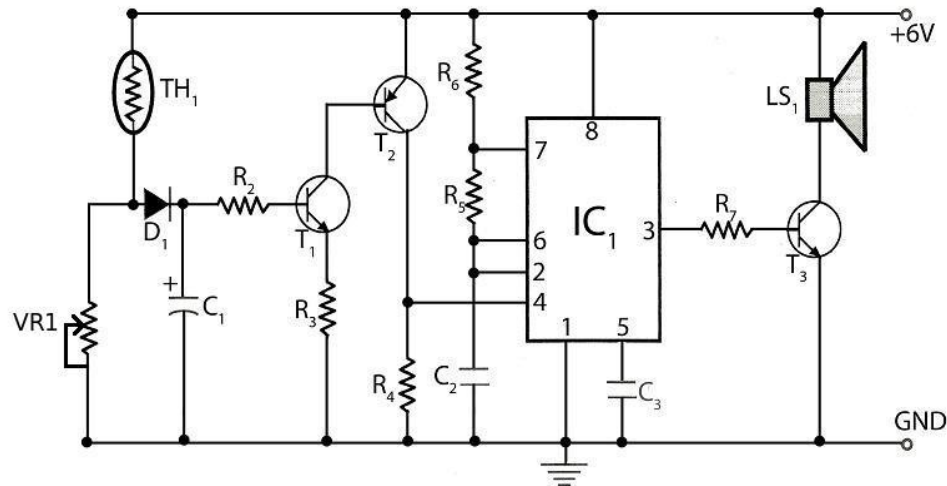
The error signal is fed into the controller which adjusts the actuator or switch depending on the size and polarity of the error.

### **ACTIVITY 1.1 HEAT SENSOR (SIMPLE FIRE ALARM)**

The whole circuit of fire alarm using thermistor is built and fabricated around thermistor (TH1) and timer IC (IC1) with its driver transistor. The timer IC (IC1) used in this circuit is as astable multivibrator oscillator used to oscillate in audio frequency band. The two transistors T1 and T2 used to drive the timer IC (IC1). The output from pin 3 of IC1 is fed to loudspeaker through transistor T3 to generate sound. The value of resistor (R5 and R6) and capacitor (C2) determines the frequency of IC2.

The low resistance path of extend positive voltage to the base of transistor is provided when the thermistor TH1 become hot. Further collector of transistor T1 is connected to base of transistor T2 provides positive voltage to reset pin 4 of IC1 for reset. Fire alarm using thermistor circuit works on wide range of input power supply voltage i.e. 6v to 12V.





**Circuit Diagram of the Fire Alarm**

**Directions:** Construct the Fire Alarm circuit using a breadboard. (You may use other similar projects considering availability of electronic parts and components.)

**Resources:**

Tools and Equipment

PPE

Circuit Diagram of the Fire Alarm

Materials:

Breadboard	Capacitors
Resistors (All ¼ w, Carbon)	C1 = 10 µF/ 16V
VR1=10 KΩ Variable	C2 = 0.04 µF
R3, R7, R8 = 470 Ω	C3 = 0.01 µF
R2 = 33 K Ω	Semiconductors
R4 = 560 Ω	IC1 = NE555 (timer IC)
R5 = 47 KΩ	T1 = BC548
R6 = 2.2 KΩ	T2 = BC558
Miscellaneous	T3 = SL100B (any medium power general purpose NPN transistor like: 2N4922 , 2N4921,2N4238, FCX1053A)
TH1 = Thermistor 10 KΩ	D1 = 1N4001
LS1 = 8 Ω, 1W speaker	
Mica Tape	

**Procedure:**

1. Connect the components to the breadboard following the diagram and observing the correct pins of the components. For breadboard care thermistor should not be placed on the breadboard.
2. Power-up and test your project by placing a lighted match or candle near the thermistor. To adjust sensor sensitivity you may want to adjust VR1.

- If your project failed to work, review the procedures and/or check the condition of battery or power supply and other electronic components.

### Criteria for Functional Project

**Directions:** Compute for the rating by multiplying each item by its corresponding percentage, divide it by 5 then multiply by 100. Get the sum of your ratings.

CRITERIA	%	POINTS					RATING
		5	4	3	2	1	
Workmanship	50						
Use of Tools	30						
Use of PPE	10						
Speed	5						
Housekeeping	5						
<b>TOTAL</b>							

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
Speed	Finished within the time/ Less 1 point for every five minutes delay
Housekeeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date \_\_\_\_\_

### ACTIVITY 1.2 RECEIVING ELECTRONICALLY-CONTROLLED DOMESTIC APPLIANCE FOR MAINTAIN/REPAIR

**Directions:** Provided with the defective domestic appliance use Maintain and Repair Form to gather and document the information about the appliance at hand. Follow the procedures below:

**Resources:**

Domestic appliance: Electric Rice Cooker

Receiving/Check-up Form

**Procedure:**

1. Conduct an initial interview to the owner of the appliance.
  - Ask what the problem is.
  - Request for the details of the problem (how does it happen/since when/ nature of the problem)
2. As serviceman, you must confirm the problem/ complain.
3. Make an initial inspection/ testing of the appliance.
  - Physical appearance
  - Operating controls
  - Power cord . . .
4. Take note of the information gathered and observed.
5. Accomplish Receiving and Repair Form.

**Receiving and Repair Form**

Customer's name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Product/ Brand name: \_\_\_\_\_  
 Serial no: \_\_\_\_\_  
 Complain: \_\_\_\_\_  
 \_\_\_\_\_

**Electric Rice cooker Checklist**

PARTS	CONDITION	
	GOOD	DEFECTIVE
Lid Assembly		
Aluminum Pan		
Handle		
Thermostat		
Body		
Power Cord		
Switch		

Student's Signature \_\_\_\_\_ Date \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date \_\_\_\_\_

**PERFORMANCE CHECK 1.1**  
**RECEIVING ELECTRONICALLY-CONTROLLED DOMESTIC**  
**APPLIANCE FOR REPAIR**

**Directions:** Read and answer the questions by checking the appropriate box.

Tasks	YES	NO
1. Recorded the name and address of the owner of the appliance?		
2. Copied product/ brand/ name and serial number of the appliance?		
3. Asked for the complaint and the remarks/ condition of the appliance?		
4. Verified complaint on the condition of the appliance?		
5. Accomplished checklist of appliance parts condition.		
• Lid Assembly		
• Aluminum Pan		
• Handle		
• Thermostat		
• Body		
• Power Cord/Switch		

Student's Signature \_\_\_\_\_ Date \_\_\_\_\_

Teacher's Signature \_\_\_\_\_ Date \_\_\_\_\_

## **LO2. DIAGNOSE FAULTS OF ELECTRONICALLY-CONTROLLED DOMESTIC APPLIANCE (RICE COOKER)**

- Observe systematic pre-testing procedure in accordance with manufacturer's instructions
- Check and isolate circuits using specified testing procedure
- Document results of diagnosis and testing accurately and completely within the specified timeframe
- Explain identified defects and faults based on the result of diagnosis and testing
- Provide data/information regarding the status and serviceability of the units as per procedure.

### **INFORMATION SHEET 2.1 PROCEDURE IN PRE-TESTING AND TROUBLESHOOTING AN ELECTRIC RICE COOKER**

1. Determine the specific problem by asking the symptom.
  - a. Ask the owner/operator of the electric rice cooker of what is the symptom of the unit.
  - b. Request for the detail of the symptom (how does the symptom happen) and how long it has been observed.
2. Operate the device. Make sure that you know how to operate an electric rice cooker. If not, review the operating manual as well as service manual (if available) of the unit prior to its testing and operation
  - a. If you have worked on the same unit before, test out to see if it operates in the same way.
  - b. Determine the last time it has been modified/repaired.
  - c. You must recognize the symptom/ complain of the owner to the unit.
3. Perform visual inspection of the unit.
  - a. Prepare the tools needed and remove the cover ready for inspection.
  - b. Apply careful physical inspection of the parts/components. (Look for burned and broken components; Inspect for loose connections or broken wires)
4. If all looks fine, test the unit for resistance checks.
  - a. Get the multimeter and set it at range Rx1 Connect the test probes to each of the plug terminal, the reading must be very high since you are measuring the resistance of the keep warm heater having the temperature control at zero position.

- b. Then, turn-on the cook switch, make sure that you have properly inserted or placed the pan into the rice cooker with enough weight to depress the center thermostat, decrease in resistance should be observed since the cook heater will be activated. If this happen, the unit might be in good condition. For safety, place one probe across to the plug terminals and the other probe to the body. There should be very high (infinite) resistance. Proceed to checking for consistency of heat. If there's something different, refer to troubleshooting guide o this lesson.

5. Record your findings for future reference.

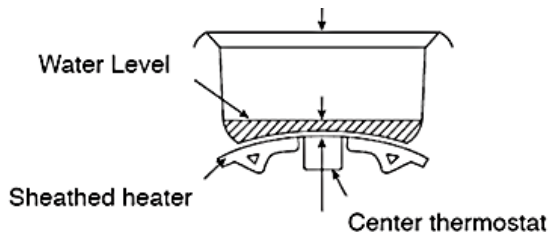
### Checking for Consistency of Heat (Rice Cooker is Energized)

While receiving the cooker to be repaired, do not focus only on the cooker body instead, consider also the pan and the lid, and ask details for the symptom of the trouble. If the rice cooker needs to be connected to power supply for checking of reliability of heat extra care should be observed and use of gloves and other related PPE is a must.

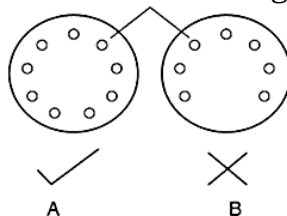
#### 1. Bubbling Test

Input the pan in the main body, and lightly rotate the pan clockwise and counter clockwise to set the pan on the heating plate properly.

- a. Fill water until the center area of the pan bottom is dipped, and close the lid. Then turn the cook switch on.



- b. When it is already producing steam, remove the lid and immediately check the bubbling condition on the pan bottom.



Bubbling Condition

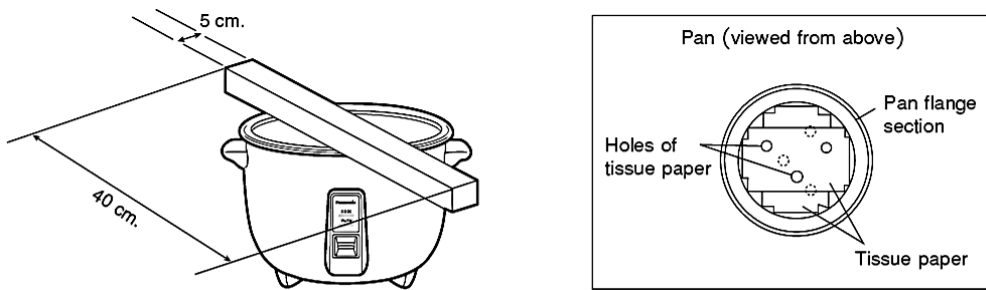
- A. Bubbles generate throughout the circumference of the pan bottom-Good
- B. Bubbles generate only on certain part of the pan bottom-Bad

This may result from insufficient or misaligned contact between the pan bottom and the sheathed heater. Check the pan bottom and the sheathed heater for foreign material remained. Clean up the foreign materials or replace the parts if necessary.

## 2. Evaporation Test

After the bubbling test, remove the lid and put a weight on the cooker.

1. Cover the entire pan bottom with 2 or 3 pieces of tissue paper (or gauze), and turn on the switch subsequently. Make sure you put enough weight on the pan so you can turn on the switch, a 5x5x40cm lumber or piece of wood will be fine.



2. The cooker is considered acceptable if it turns-off automatically 1 minute before or after the steam generation comes to a stop. If these requirements are not satisfied, check the center thermostat as well as the contacted condition between the pan bottom and the cooking heater, and then repair or replace the parts if necessary.

**Diagnosing and Troubleshooting Procedure/ Guide:**

<b>SYMPTOM: Electric rice cooker not energized.</b>		
<b>POSSIBLE DEFECTIVE PART</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Power Cord	Measure the continuity of the power cord using ohmmeter.	Replace power cord.
Thermal Fuse	Measure the continuity of the fuse using ohmmeter.	Replace fuse.
Switch	Check for the alignment of the switch to the thermostat.	Align the selector switch.
Thermostat	Measure the continuity of the power cord using ohmmeter.	Replace thermostat.
Heating Element	Measure the continuity of the heating element.	Replace heating element.

<b>SYMPTOM: Electric rice cooker energized, burns rice/overcooked.</b>		
<b>POSSIBLE DEFECTIVE PART</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Thermostat	Confirm using evaporation test.	Replace center thermostat.
Switch Lever	Check the adjustment and alignment of switch lever.	Adjust/align switch lever accordingly.
Control System	Check sensor and other components.	Replace defective components.

<b>SYMPTOM: Electric rice cooker energized, cooks improperly either too hard/half-boiled or too soft.</b>		
<b>POSSIBLE DEFECTIVE PART</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Pan and/or Sheathed Heater	Poor contact between pan and sheathed heater (check with bubbling test)	Fix/Replace pan or sheathed heater.
	Center thermostat is defective (check with evaporation test)	Fix/Replace center thermostat
	Switch lever is misaligned.	Adjust or align switch lever.
Control System	Check sensor and other components.	Replace defective components.



<b>SYMPTOM: Electric rice cooker energized, warming fails.</b>		
<b>POSSIBLE DEFECTIVE PART</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Micro switch	Check condition of micro switch.	Adjust or replace micro switch.
Mica/Warming Heater	Check continuity of Mica/Warming Heater	Fix or replace Mica/Warming Heater
Control System	Check sensor and other components.	Replace defective components.

## **ACTIVITY 2.1 PRE-TESTING AND TROUBLESHOOTING A RICE COOKER**

**Directions:** Provided with the defective domestic appliance use Maintain and Repair Form to gather and document the information about the appliance at hand. Follow the procedures below:

**Resources:**

Domestic appliance: Electric Rice Cooker  
 Activity Sheet/Forms  
 Tools & Equipment  
     Screwdriver  
     VOM  
 Cleaning Materials  
 PPE

**Directions:**

5. Let one of your classmates act as the owner of the appliance.
6. Accomplish Receiving and Repair Form in your notebook, record the progress of your activity.
7. Perform the procedures in accepting appliance
8. Repair defective rice cooker.

### **Receiving and Repair Form**

Customer's name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Product/ Brand name: \_\_\_\_\_  
 Serial no: \_\_\_\_\_  
 Complain: \_\_\_\_\_  
 \_\_\_\_\_

### Electric Rice Cooker Checklist

EXTERNAL PARTS	CONDITION	
	GOOD	DEFECTIVE
Lid Assembly		
Aluminum Pan		
Handle		
Thermostat		
Body		
Power Cord		
Switch		

<b>SYMPTOM:</b> _____		
POSSIBLE DEFECTIVE PART	PROCEDURE	CORRECTIVE MEASURE
Remarks:		

Student's Signature \_\_\_\_\_ Date: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date: \_\_\_\_\_

### PERFORMANCE CHECK 2.1 PRE-TESTING AND DIAGNOSING/ TROUBLESHOOTING AN ELECTRIC RICE COOKER

**Directions:** Rate yourself on how competent you have applied the skill in pre-testing and diagnosing electric rice cooker using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by multiplying each item by its corresponding percentage, divide it by 5 then multiply by 100. Get the sum of your ratings.

Criteria	%	Points					Rating
		5	4	3	2	1	
Workmanship	50						
Use of Tools	30						
Use of Personal Protective Equipment	10						
Speed	5						
House Keeping	5						
<b>TOTAL</b>							

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
Speed	Finished within the time/ Less 1 point for every five minutes delay
House Keeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date Prepared \_\_\_\_\_

Teacher's Signature \_\_\_\_\_ Date Checked \_\_\_\_\_

### **LO3: MAINTAIN AND REPAIR ELECTRIC RICE COOKER**

- Use PPE in accordance with OHS practices
- Perform repair activity within the required timeframe
- Observe safety precautions in handling the unit/product as per standard operating procedure
- Replace defective parts/ components with identical parts or recommended parts with equivalent ratings
- Solder/mount repaired or replaced parts/components in accordance with industry standards
- Clean unit in accordance with standard operating procedure

**SELF CHECK 3.1**  
**PERSONAL PROTECTIVE EQUIPMENT**

**Directions:** Identify sources of danger in your workplace in repairing Rice Cooker according to target organs and give examples of PPE. In the absence of danger just indicate NONE.

	<b>Organ</b>	<b>Source of Danger</b>	<b>PPE</b>
1	Eye		
2	Ear		
3	Head		
4	Respiratory		
5	Body		
6	Hand and Arm		
7	Foot		

*Note: The student should have identified all possible sources of danger in the workplace. If one or more item/s were missed, review the questions, go back to information sheet 3.1, and study them more closely. Before you proceed to the next lesson you must get all the answers right.*

**INFORMATION SHEET 3.1**  
**REMINDERS FOR COMPONENT REPLACEMENT**

1. Determine the description of the values and ratings of the individual defective parts using the manufacturer's service manual.
2. Identify the sources of the replacement components/parts.
  - Original replacement components from the original factory sources
  - Universal replacement components from independent factory sources
3. Consider the following factors in selecting parts.
  - **Quality.** The ability to provide exact value or specification to replacement part.
  - **Tolerance.** The ability to provide exact value or acceptable parameters to replacement parts.
  - **Availability.** The local access to parts and whether the parts are available .
  - **Price.** Refers to the affordability of the replacement parts at a reasonable price.
4. Disconnect or remove properly the electrical/mechanical parts of Rice Cooker

5. Install correctly the replacement parts and other components.
6. For burnt components where values are impossible to recognize, secure a schematic diagram or service manual if possible. In other case, you can look for the same brand and model as reference.
7. Double check the testing procedure in suspected defective components.
8. Check the nearby components for possible consequence of being damaged too.
9. Consider the original orientation/connection of the components in replacing defective one.
10. Observe safety at all times.

### **INFORMATION SHEET 3.2 TROUBLESHOOTING, MAINTENANCE AND CLEANING TIPS**

#### Troubleshooting

1. Conduct a *quick* diagnosis of the trouble symptom and repair the defective set in the *shortest possible time*. Do not troubleshoot Rice Cooker unless you have determined the fault.
2. Secure a circuit diagram.
3. If the Rice Cooker doesn't heat, make sure there is power on the outlet, check the electrical cord, and check the thermostat thermal fuse.
4. Always suspect a faulty contact on mechanical switch circuit rather than defective electronic/electrical parts.
5. If the Rice Cooker produces too much or too little heat, test the electrical cord for loose wiring and connection. Also test and, if needed, adjust calibration of the thermostat.
6. Use Personal Protective Equipment.

#### Maintenance and Cleaning

1. Turn-off and unplug the electric Rice Cooker and make sure it's already cool before cleaning.
2. Check the owner's manual for your Rice Cooker to learn the specified manufacturer's suggestions for cleaning.
3. You may use a sponge and commercial cleaner or baking soda and water to remove dirt buildup on the external parts. Don't submerge a Rice Cooker in water or cleaning liquid.

## ACTIVITY SHEET 3.1 MAINTAIN AND REPAIR A RICE COOKER

**Resources:**

- Service manual of Rice Cooker
- Rice Cooker
- Activity sheet/ Forms (Copy from module)
- Tools and Equipment Needed
  - Pliers
  - Screwdrivers
  - VOM
- Cleaning materials
- PPE

**Directions:**

1. Provided with the resources, perform the maintenance/repair procedure. Observe safety precautions at all times and consider the information given in this lesson.
2. Let one of your classmate acts as the owner of the Rice Cooker.
3. Perform the procedures in accepting and pre-testing an appliance.
4. Accomplish the Receiving and Repair Form and the Maintenance and Repair Form as you perform the activity.
5. Provide information regarding the status and serviceability of the appliance.
6. Forty minutes will be allotted for this activity.

### Receiving and Repair Form

Customer's name: \_\_\_\_\_

Address: \_\_\_\_\_

Product/ Brand name: \_\_\_\_\_

Serial no: \_\_\_\_\_

Complaint: \_\_\_\_\_

\_\_\_\_\_

Electric Rice Cooker Checklist

PARTS	CONDITION	
	GOOD	DEFECTIVE
AC Cord		

<b>SYMPTOM:</b>		
<b>POSSIBLE DEFECT</b>	<b>PROCEDURE</b>	<b>CORRECTIVE MEASURE</b>
Remarks:		

Student's Signature \_\_\_\_\_ Date: \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date: \_\_\_\_\_

**PERFORMANCE CHECK 3.1  
 MAINTAIN AND REPAIR A RICE COOKER**

**Directions:** Rate yourself on how competent you have applied the skill in maintaining and repairing rice cooker using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by multiplying each item by its corresponding percentage, divide it by 5 then multiply by 100. Get the sum of your ratings.

Criteria	%	Points					Rating
		5	4	3	2	1	
Workmanship	50						
Use of Tools	30						
Use of Personal Protective Equipment	10						
Speed	5						
House Keeping	5						
<b>TOTAL</b>							

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
Speed	Finished within the time/ Less 1 point for every five minutes delay
House Keeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date \_\_\_\_\_  
 Teacher's Signature \_\_\_\_\_ Date \_\_\_\_\_

## **LO4: REASSEMBLE AND TEST REPAIRED APPLIANCES**

Perform final test for reassembled units in conformity with manufacturer's specifications.

### **INFORMATION SHEET 4.1 REASSEMBLING AND TESTING AN ELECTRIC RICE COOKER**

To comply with manufacturer's specification in testing and assembly a service manual should be secured for particular rice cooker brand and model.

Reassembling Procedure:

1. After replacing the defective part of the appliance, prepare the parts for reassembling. Make sure that there are no missing part or component and as well as the screws.
2. Review the operating and service manual if available.
3. Fix all the disassembled parts in the housing/compartment, considering the fittings, lock etc.
4. Wires should be in their proper places and loose parts should be tighten to avoid damaged due to misalignment.
5. All sides of the housing should fit. See to it that all movable parts are moving appropriately.
6. Clean the unit before doing the testing procedure.

Testing Procedures:

1. Get the multimeter and set it at range Rx1. Connect the test probes to each of the plug terminals; the reading must be very high since you are measuring the resistance of the keep warm heater having the temperature control at zero position.
2. Then, turn-on the cook switch, make sure that you have properly inserted or placed the pan into the rice cooker with enough weight to depress the center thermostat, decrease in resistance should be observed since the cook heater will be activated. If this happen, the unit might be in good condition. For safety, place one probe across to the plug terminals and the other probe to the body, there should be very high (infinite) resistance. Proceed to checking for consistency of heat. If there's something different, refer to troubleshooting guide of this lesson.



**ACTIVITY 4.1**  
**REASSEMBLING AND TESTING A RICE COOKER**

**Resources:**

Service Manual of Rice Cooker  
 Repaired Rice Cooker  
 Tools and Equipment Needed  
     Pliers  
     Screwdrivers  
     VOM  
 Cleaning materials  
 PPE

**Directions:**

Provided with the resources, follow the procedure in reassembling and testing repaired electric rice cooker presented in Information Sheet 4.1. You will be rated using the Performance Check 4.1

**PERFORMANCE CHECK 4.1**  
**REASSEMBLING AND TESTING A RICE COOKER**

**Directions:** Rate yourself on how competent you have applied the skill in reassembling and testing electric rice cooker using the criteria below by checking on the appropriate box (points 1 to 5, 5 being the highest). Compute for the rating by multiplying each item by its corresponding percentage, divide it by 5 then multiply by 100. Get the sum of your ratings.

Criteria	%	Points					Rating
		5	4	3	2	1	
Workmanship	50						
Use of Tools	30						
Use of Personal Protective Equipment	10						
Speed	5						
House Keeping	5						
<b>TOTAL</b>							

Criteria	Description
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every misused.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
Speed	Finished within the time/ Less 1 point for every five minutes delay
House Keeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt observed

Student's Signature \_\_\_\_\_ Date \_\_\_\_\_

Teacher's Signature \_\_\_\_\_ Date \_\_\_\_\_

#### IV. SUMMATIVE ASSESSMENT

**I. Directions:** Write the letter of the correct answer. Let the students answer the test on a separate sheet of paper.

1. A part of the rice cooker that prevents it from being turned on without the pan.
  - A. Center Thermostat
  - B. Thermal Fuse
  - C. Switch
  - D. Neon Lamp
2. A part of the rice cooker that opens the circuit when the temperature has gone unusually high.
  - A. Center Thermostat
  - B. Thermal Fuse
  - C. Switch
  - D. Neon Lamp
3. A part of the rice cooker that turns off the cooking cycle and starts the warming cycle.
  - A. Center Thermostat
  - B. Thermal Fuse
  - C. Switch
  - D. Neon Lamp
4. A system that compares the output with the expected result.
  - A. Closed Loop System
  - B. Open Loop System
  - C. Switch-On Preventive System
  - D. Keep Warm System
5. A part of a control system used to monitor the output.
  - A. Sensor
  - B. Comparator
  - C. Controller
  - D. Device
6. A test conducted to see the alignment and sufficiency of the heating plate on the pan.
  - A. Bubbling Test
  - B. Evaporation Test
  - C. Continuity Test
  - D. Switch-on Preventive Test
7. A test conducted to see if the rice cookers will turn-off 1 minute or after the generation comes to a stop.
  - A. Bubbling Test
  - B. Evaporation Test
  - C. Continuity Test
  - D. Switch-on Preventive Test
8. A kind of test to see if the heating element is in good condition.
  - A. Bubbling Test
  - B. Evaporation Test
  - C. Continuity Test
  - D. Switch-on Preventive Test
9. A boiling point of water.
  - A. 65°C
  - B. 134 °C
  - C. 100 °C
  - D. None of the Above
10. The metal and magnet will pop apart when this temperature is reached.
  - A. 65°C
  - B. 134 °C
  - C. 100 °C
  - D. None of the Above

**II. Directions.** Draw the schematic diagram of an electric rice cooker (without electronic control) and label each component 11-20 (10pts).

<b>Criteria</b>	<b>Points</b>
Complete diagram with labels.	10
With one missing component or label	8
With 1 missing component and label	6
With 2 missing component or label	4
With 2 missing component and label	2
With more than 3 missing components or labels	0

**III. Directions:** Perform pre-testing and troubleshooting electric rice cooker in 30minutes. Initially, 10 points will be given if the appliance was repaired and point deduction will be applied following the criteria below:

<b>Criteria</b>	<b>Description</b>
Workmanship	Followed the steps accordingly/ Less 1 point for every missed procedure.
Use of Tools	Used tools/ materials in right task/ Less 1 point for every wrong use.
Use of Personal Protective Equipment	Used PPE during the whole activity/ Less 1 point for every forgotten instances
Speed	Finished within the time/ Less 1 point for every five minutes delay
House Keeping	The workplace is clean before, during and after the activity/ Less 1 point for every dirt and disorder observed

## Technical Terms

AC (Alternating Current)	a type of current which periodically reverses direction.
Breadboard	a construction base for prototyping or testing of electronic project.
Comparator	a processing circuit that accepts the input signal coming from sensor and program selection control.
DC (Direct Current)	a type of current with unidirectional flow of electric charge
Domestic Appliance	a machine which accomplishes some housekeeping task
Electric Motor	an electric machine that converts electrical energy into mechanical energy.
Electronic control	electronic regulation that is done to an appliance, situation or load by electronic devices
Electronic Control	
Flat Iron	a small appliance: a handheld piece of equipment with a flat, roughly triangular surface that, when heated, is used to press clothes to remove creases.
Heating Element	converts electricity into heat through the process of resistive or Joule heating.
LCD ( Liquid Crystal Display)	is a flat panel display, electronic visual display.
LED	a type of diode which emits light.
Maintain	refers to keeping the functionality of a circuit or device
Oven	is a thermally insulated chamber used for the heating, baking or drying of a substance,
Power Source	a device that supplies electric power.
Pre-testing	a procedure that is done to an appliance to determine its working condition
Repair	refers to restoring the functionality of a circuit or device
Replacement	refers to a spare component or part of a circuit or appliance
Rice Cooker	an electric kitchen appliance used to boil or steam rice.
Toaster Oven	an electrical or a typical small kitchen appliance used to toast bread.
Toasting	a common method of making stale bread .
Troub leshooting	a process of finding the cause of a problem or fault of a device or circuit
Washing Machine	a domestic appliance that is use to wash clothes
Washing Machine	a mechanical apparatus, usually powered by electricity, for washing clothing, linens, etc

## **Bibliography:**

CBLM STVEP CHS NC II.TECH-VOC, 2011.

Wikimedia Foundation. Wikipedia. <http://www.wikipedia.org/> (accessed July 1, 2014).

Wikimedia Foundation. "Clothes iron." Wikipedia. [http://en.wikipedia.org/wiki/Clothes\\_iron](http://en.wikipedia.org/wiki/Clothes_iron) (accessed July 4, 2014).

"HowStuffWorks "Home and Garden"."HowStuffWorks. <http://home.howstuffworks.com/> (accessed July 1, 2014).

"How to Repair an Electric Rice Cooker."DIY Home Improvement Information. <http://www.doityourself.com/stry/how-to-repair-an-electric-rice-cooker#.U7YyQ5SSxqU> (accessed July 4, 2014).

eHow Home & Garden Editor. "How to Fix a Rice Cooker." eHow. [http://www.ehow.com/how\\_2156241\\_fix-rice-cooker.html](http://www.ehow.com/how_2156241_fix-rice-cooker.html) (accessed July 4, 2014).

How a Washing Machine Works  
<https://www.youtube.com/watch?v=7HiNABH1kYE>  
150714 16:13H

How a Washing Machine Works  
<http://www.youtube.com/watch?v=7HiNABH1kYE> 16072014 23:54H

Teardown Toaster. Detailed look inside a toaster  
<https://www.youtube.com/watch?v=MZOy0cMXiSM> 150714 08:230

[http://www.youtube.com/watch?v=j8\\_TzloPCwY](http://www.youtube.com/watch?v=j8_TzloPCwY) 150714 07:45

Whirlpool Top-Load Washer Disassembly  
<http://www.youtube.com/watch?v=ozhiWgOtxho>  
Samsung Washing Machine top load demo 150714 08:11