Department of Education
Region X - Northern Mindanao
DIVISION OF CAGAYAN DE ORO
Fr. William F. Masterson, SJ Avenue, Upper Balulang, Cagayan de Oro City

Learning Activity Sheets in Electronic Products Assembly and Servicing

SHARED OPTIONS

Senior High Alternative Responsive Education Delivery

Competence.Dedication.Optimism

Preface

It has been elaborated in research and literature that the highest performing education systems are those that combine quality with equity. Quality education in the Department of Education (DepEd) is ensured by the learning standards in content and performance laid in the curriculum guide. Equity in education means that personal or social circumstances such as gender, ethnic origin or family background, are not obstacles to achieving educational potential and that inclusively, all individuals reach at least a basic minimum level of skills.

In these education systems, the vast majority of learners have the opportunity to attain high-level skills, regardless of their own personal and socio-economic circumstances. This corresponds to the aim of DepEd Cagayan de Oro City that no learner is left in the progression of learning. Through DepEd's flexible learning options (FLO), learners who have sought to continue their learning can still pursue in the Open High School Program (OHSP) or in the Alternative Learning System (ALS).

One of the most efficient educational strategies carried out by DepEd Cagayan de Oro City at the present is the investment in FLO all the way up to senior high school. Hence, Senior High School Alternative Responsive Education Delivery (SHARED) Options is

operationalized as a brainchild of the Schools Division Superintendent, Jonathan S. Dela Peña, PhD.

Two secondary schools, Bulua National High School and Lapasan National High School, and two government facilities, Bureau of Jail Management and Penology-Cagayan de Oro City Jail and Department of Health-Treatment and Rehabilitation Center-Cagayan de Oro City, are implementing the SHARED Options.

To keep up with the student-centeredness of the K to 12 Basic Education Curriculum, SHARED Options facilitators are adopting the tenets of Dynamic Learning Program (DLP) that encourages responsible and accountable learning.

This compilation of DLP learning activity sheets is an instrument to achieve quality and equity in educating our learners in the second wind. This is a green light for SHARED Options and the DLP learning activity sheets will continually improve over the years.

Ray Butch D. Mahinay, PhD
Jean S. Macasero, PhD

Acknowledgment

The operation of the Senior High School Alternative Responsive Education Delivery (SHARED) Options took off with confidence that learners with limited opportunities to senior high school education can still pursue and complete it. With a pool of competent, dedicated, and optimistic Dynamic Learning Program (DLP) writers, validators, and consultants, the SHARED Options is in full swing. Gratitude is due to the following:

- Schools Division Superintendent, Jonathan S. Dela Peña, PhD, Assistant Schools Division Superintendent Alicia E. Anghay, PhD, for authoring and buoying up this initiative to the fullest;
- CID Chief Lorebina C. Carrasco, and SGOD Chief Rosalio R. Vitorillo, for the consistent support to all activities in the SHARED Options;
- School principals and senior high school teachers from Bulua NHS, Lapasan NHS, Puerto NHS and Lumbia NHS, for the legwork that SHARED Options is always in vigor;
- Stakeholders who partnered in the launching and operation of SHARED Options, specifically to the Bureau of Jail Management and Penology-Cagayan de Oro City Jail and the Department of Health-Treatment and Rehabilitation Center-Cagayan de Oro City;

- Writers and validators of the DLP learning activity sheets, to which this compilation is heavily attributable to, for their expertise and time spent in the workshops;
- Alternative Learning System implementers, for the technical assistance given to the sessions; and
- To all who in one way or another have contributed to the undertakings of SHARED Options.

Mabuhay ang mga mag-aaral! Ito ay para sa kanila, para sa bayan!

Ray Butch D. Mahinay, PhD
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MONITORING OF ACCOMPLISHED LEARNING ACTIVITY SHEETS

ELECTRONIC PRODUCTS ASSEMBLY AND SERVICING NC-II

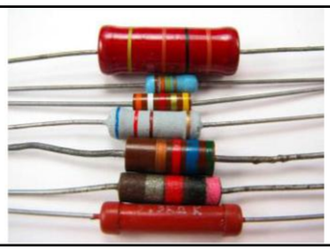
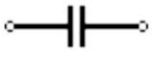
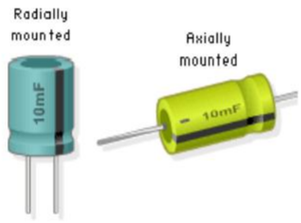
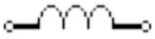
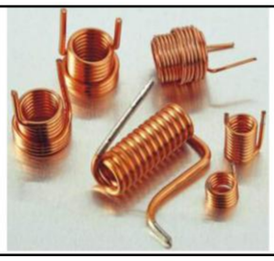
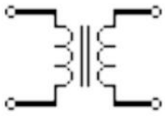
ACTIVITY NUMBER	LEARNING ACTIVITY TITLE	DATE	SCORE	ITEM
1	Electronics Circuits and Symbols (Passive Components)			4
2	Electronics Circuits and Symbols (Active Components)			4
3	Interpret Technical Drawing (Block Diagram)			5
4	Interpret Technical Drawing (Schematic Diagram)			10
5	Using Hand Tools			5
6	Using Multimeter			6
7	Electronic Test Equipment			5
8	Resistor Color Code Interpretation			3
9	Electronics Components (Passive)			5
10	Electronics Components (Active)			7
11	Microprocessor			8
12	Control Boards, Modules, Motor Controllers and Drives			10
13	Sensors, Input Devices, Actuators, Output Devices, Opto-Electronics Equipment and Devices			5
14	Testing Electronic Components (Passive)			10
15	Testing Electronic Components (Semiconductor)			10
16	PCB Designing			10
17	PCB Etching			100%
18	The Power Supply			5
19	Types of Power Supply (Analog)			3
20	Switch Mode Power Supply			3
21	Solder and Soldering Tools			3
22	Solder Electronic Components			9
23	De-solder Electronic Components			6
24	Assembling Electronic Products (Power Supply)			100%
25	CCTV Installation			100%
26	Servicing Consumer Electronic Products and Systems – Domestic Electronic Appliances with Electric Motor			100%
27	Servicing Consumer Electronic Products and Systems – Domestic Electronic Appliances with Heating Component			100%
28	Servicing Consumer Electronic Products and Systems – Domestic Electronic Appliances - Rechargeable and Electronic-Controlled Lighting Units			100%
29	Servicing Consumer Electronic Products and Systems – Domestic Electronic Appliances – Security and Solar Power Management System			100%
30	Servicing Consumer Electronic Products and Systems – Audio Products and Systems			100%

31	Servicing Consumer Electronic Products and Systems – Audio-Video Products and Systems			100%
32	Servicing Industrial Electronic Modules, Products and Systems – Control Boards, Modules, Motor Controllers and Drives			100%
33	Servicing Industrial Electronic Modules, Products and Systems – Sensors, Input Devices, Actuators, Output Devices, Opto-Electronics Equipment and Devices			5

Name:	Date:	Score:
Subject: Electronics Circuits and Symbols		
Lesson Title: Discrete Passive Components		
Lesson Competency: Preparing and Interpreting Technical Drawings		
References: https://electronicsclub.info/components.htm		LAS No.: 01

CONCEPT NOTES:

Passive Components are electronic components that do not require a Source of Energy to perform their intended functions. Resistors, capacitors, inductors, and transformers are all considered passive components.

Component	Symbol	Picture	Function
Resistor			Restrict or limit the flow of current in a circuit.
Capacitor			A discrete component that can store an electrical charge. The larger the capacitance the more charge it can store.
Inductor			An inductor, also called a coil or reactor, it resists changes in electric current passing through it.
Transformer			Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC (Alternating current).

EXERCISES: True or False

_____1. Transformers converts AC to DC.
_____2. A resistor is also called a coil or a reactor.
_____3. A capacitor can store electrical energy
_____4. Passive Components require a source of energy to perform their intended functions.

DepED DEPARTMENT OF EDUCATION K TO 12 PROGRAM

SHARED OPTIONS

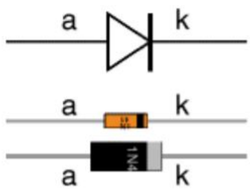
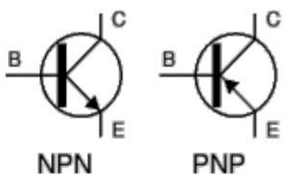
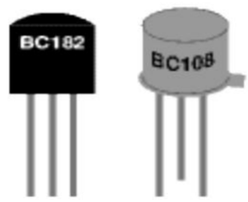
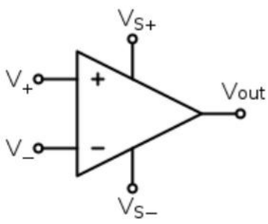
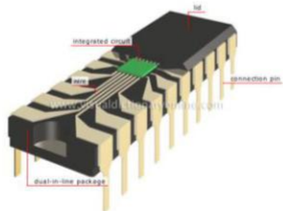
SENIOR HIGH ALTERNATIVE RESPONSIVE EDUCATION DELIVERY

GRADE 11 DLP LEARNING ACTIVITY SHEET

Name:	Date:	Score:
Subject: Electronics Circuits and Symbols		
Lesson Title: Discrete Active Components		
Lesson Competency: Preparing and Interpreting Technical Drawings		
References: https://electronicsclub.info/components.htm		LAS No.: 02

CONCEPT NOTES:

Active Components are electronic components that require a Source of Energy to perform their intended functions. Diodes, transistors and IC's (Integrated Circuit) are the examples of Active Components:

Component	Symbol	Picture	Function
Diode			A component that allows current to flow in one direction only. It is a polarized component with two leads, called the cathode and the anode.
LED (Light Emitting Diode)			(LED) is a special kind of diode that glows when electricity passes through it.
BJT (Bipolar Junction Transistors)			A transistor is a semiconductor device used to amplify and switch electronic signals and electrical power.
IC's (Integrated Circuits)			An integrated circuit (also referred to as an IC, a chip, or a microchip) is a set of electronic circuits on one small plate ("chip") of semiconductor material, normally silicon.

EXERCISES: Identification

_____1. A component that amplifies electronic signals.

_____2. A component that allows current to flow in one direction only.

_____3. It is also referred to as a microchip.

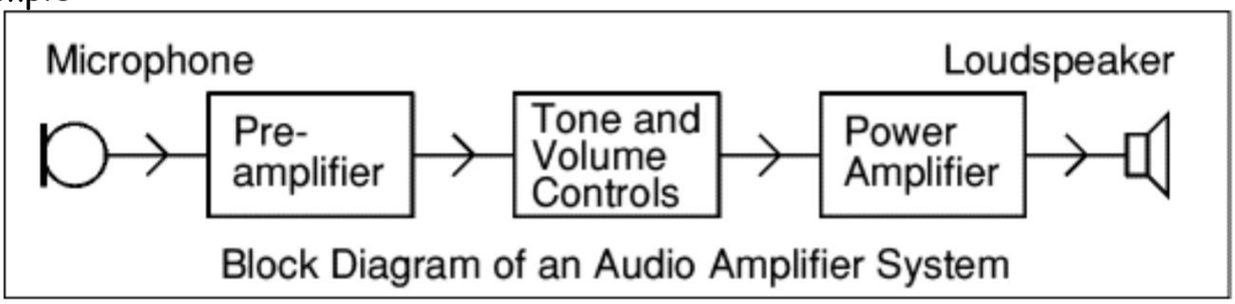
_____4. A component that glows when electricity passes through it.

Name:	Date:	Score:
Subject: Electronics Circuits and Symbols		
Lesson Title: Block Diagram Interpretation		
Lesson Competency: Preparing and Interpreting Technical Drawings		
References: https://electronicsclub.info/components.htm		LAS No.: 03

CONCEPT NOTES:

Block diagrams are used to understand (and design) complete circuits by breaking them down into smaller sections or blocks. Each block performs a particular function and the block diagram shows how they are connected together. No attempt is made to show the components used within a block, only the inputs and outputs are shown. This way of looking at circuits is called the systems approach. *Power supply (or battery) connections are usually not shown on block diagrams.*

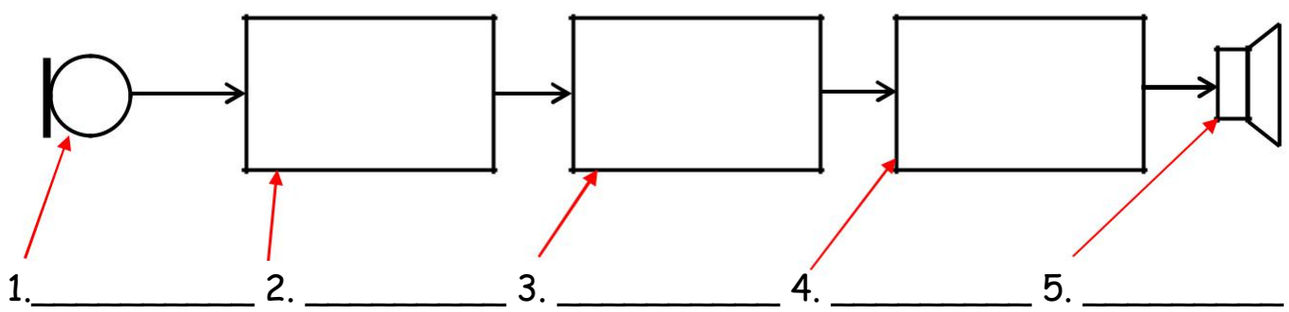
Example:



Block Diagram of an Audio Amplifier System

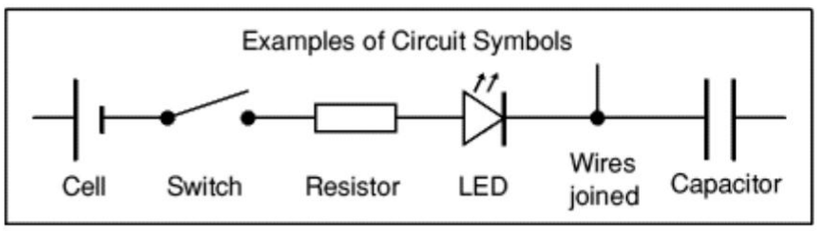
Microphone - a transducer which converts sound to voltage.
Pre-Amplifier - amplifies the small audio signal (voltage) from the microphone.
Tone and Volume Controls - adjust the nature of the audio signal.
The tone control adjusts the balance of high and low frequencies.
The volume control adjusts the strength of the signal.
Power Amplifier - increases the strength (power) of the audio signal.
Loudspeaker - a transducer which converts the audio signal to sound.

EXERCISE: Diagramming: Label each block



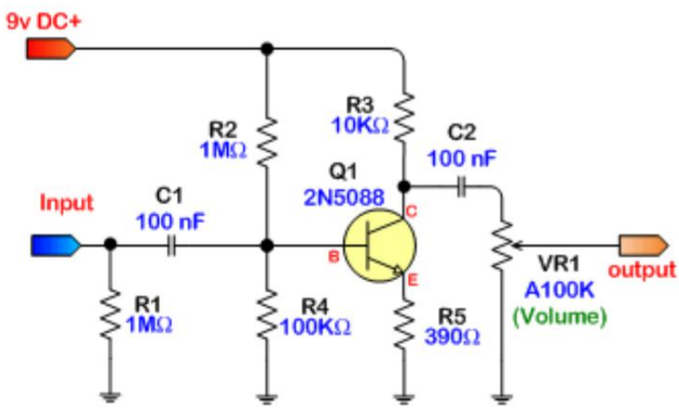
Name:	Date:	Score:
Subject: Electronics Circuits and Symbols		
Lesson Title: Schematic Diagram Interpretation		
Lesson Competency: Preparing and Interpreting Technical Drawings		
References: https://electronicsclub.info/circuitdiagrams.htm		LAS No.: 04

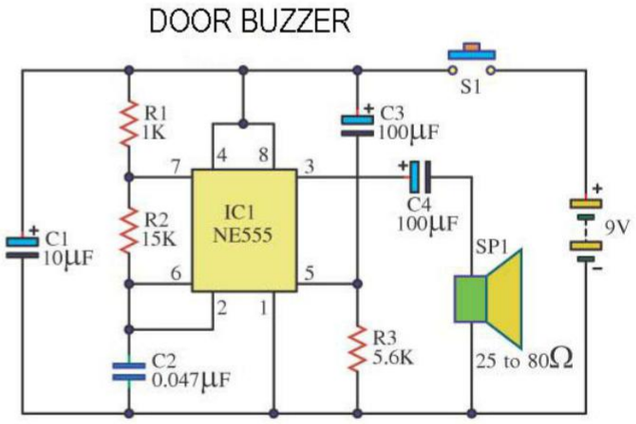
CONCEPT NOTES: Circuit diagrams show how electronic components are connected together. Each component is represented by a symbol and a few are shown on the right.



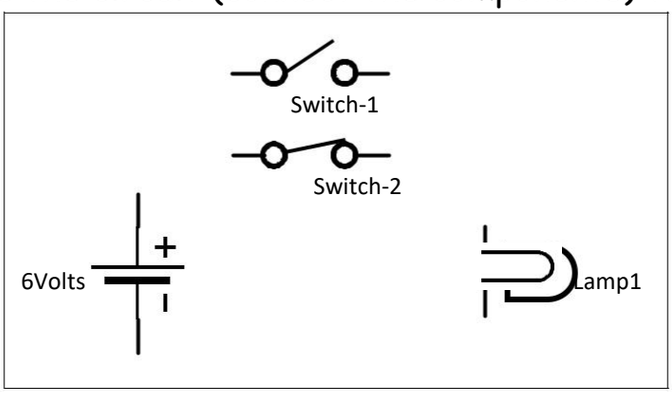
A schematic is really a map showing the path the current takes through the various components. Each component is represented by a symbol, usually with either a label or a value (or both). The arrangement of the components on paper is chosen to make the function of the circuit clear, and usually only vaguely resembles the actual construction of the device. The current path is shown with lines, again drawn for maximum clarity, with little concern for the length or position of the real wires.

Examples of Schematic Diagrams.





EXERCISE: Complete the circuit (connect the components) to make the bulb lit.



Name:	Date:	Score:
Subject: Tools Used for Electronics		
Lesson Title: Basic Hand Tools for Electronics		
Lesson Competency: Using and Maintaining Hand Tools		
References: https://electronicsclub.info/tools.htm		LAS No.: 05

CONCEPT NOTES:

Tool Image	Description	Notes
	Flat-blade screwdriver	For scraping away excess flux and dirt between tracks, as well as driving screws.
	Philips Screw drivers	Driving/removing Philips or star screws.
	ESD-safe tweezers	Holding components in surface mount soldering.
	Needle nose pliers	Useful for basic assembly of all kinds.
	Side cutter pliers	For trimming component leads close to the circuit board.
	High quality precision screwdriver set	For disassembling & reassembling electronics.
	High quality torx screwdriver set	For driving torx screws.

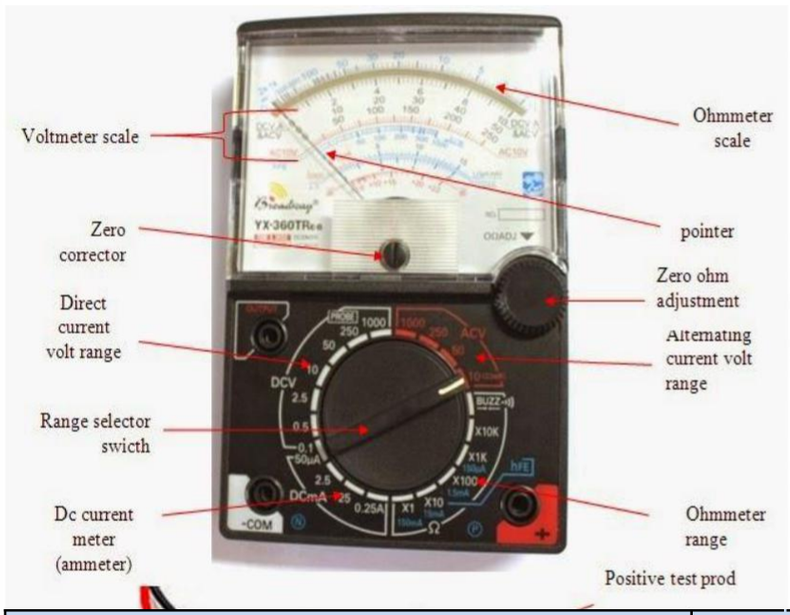
EXERCISE: Match column A with column B. Write letters only

Answer	No.	Column A		Column B
	1.	Side cutter pliers	A.	Holding components
	2.	Torx screwdriver	B.	For scraping away excess flux
	3.	Tweezers	C.	Driving/removing Star screws.
	4.	Needle nose pliers	D.	For trimming component leads
	5.	Philips Screw drivers	E.	Useful for basic assembly
			F.	For driving torx screws

Name:	Date:	Score:
Subject: Test Instruments for Electronics		
Lesson Title: Using Multimeter/Multitester		
Lesson Competency: Using and Maintaining Hand Tools		
References: https://electronicsclub.info/tools.htm		LAS No.: 06

CONCEPT NOTES:

Multimeters are very useful test instruments. By operating a multi-position switch on the meter, they can be quickly and easily set to be a voltmeter, an ammeter or an ohmmeter. They have several settings (called 'ranges') for each type of meter and the choice of AC or DC. Some multimeters have additional features such as transistor testing and ranges for measuring capacitance and frequency.



ANALOG MULTIMETER	DIGITAL MULTIMETER
It uses a meter display with markings for various ranges as per R (Ohm), V Voltage and I (current) measurements.	It uses LCD display. Direct digital display readout.
Accuracy of measurement is lower.	Accuracy of measurement is higher.
Low input resistance and vary as per range to be measured. Will cause circuit loading.	High input resistance and constant for all ranges.

EXERCISE: Compare the multimeters per usage. Write your answers below.

Aspect:	Analog	Digital
Display		
Accuracy		
Sensitivity		

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GRADE 11 DLP LEARNING ACTIVITY SHEET

Name:	Date:	Score:
Subject: Test Instruments for Electronics		
Lesson Title: Electronic Test Equipment		
Lesson Competency: Using and Maintaining Hand Tools		
References: https://www.radio-electronics.com/info/t_and_m/		LAS No.: 07

CONCEPT NOTES: Electronic test equipment are used to create signals and capture responses from electronic devices under test **(DUTs).**

Instrument Image	Description	Notes
	Dual Trace Oscilloscope	A test equipment that allows signal voltages to be displayed on a screen in a two-dimensional format. We can see waveforms on the screen and understand how a circuit is performing.
	Digital Frequency Counter	Used for radio frequency (RF) measurements, to test or measure the precise frequency of a particular signal.
	PAL-NTSC Color Pattern Generator	Use for correct color adjustments and correct alignment of the timing circuits of a television set.
	Function Generator	Generate a variety of simple repetitive waveforms, including sawtooth, triangular waveforms, square waves, and pulses.
	0-30V, 5A, DC Regulated Power Supply	An essential requirement for any electronics laboratory. It is used to power circuits or boards that do not have their own power supplies. It is possible to run up, test and develop a variety of circuits under the required conditions.

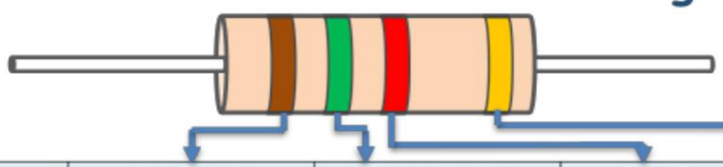
EXERCISE: Compare the instruments per usage. Write your answers below.

Answer	No.	Column A		Column B
	1.	Power Supply	A.	Generate simple repetitive waveforms
	2.	Oscilloscope	B.	Use for correct color adjustments
	3.	Function Generator	C.	Measure the frequency of a signal
	4.	Frequency Counter	D.	Used to power circuits or boards
	5.	Pattern Generator	E.	Display signal voltages on a screen

Name:	Date:	Score:
Subject: Electronics Circuits and Symbols		
Lesson Title: Resistor Color Code Interpretation		
Lesson Competency: Preparing and Interpreting Technical Drawings		
References: https://electronicsclub.info/resistors.htm		LAS No.: 08

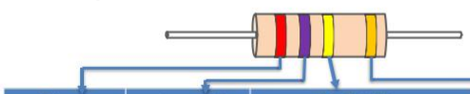
CONCEPT NOTES:

Resistor Color Code Reading



No.	Color	1st Band: 1st significant figure	2nd Band: 2nd significant figure	3rd Band: Multiplier	4th Band: Tolerance
0	Black	0	0	X1	
1	Brown	1	1	X10	
2	Red	2	2	X100	
3	Orange	3	3	X1000	
4	Yellow	4	4	X10,000	
5	Green	5	5	X100,000	
6	Blue	6	6	X1,000,000	
7	Violet	7	7	X10,000,000	
8	Grey	8	8	X100,000,000	
9	White	9	9	X1,000,000,000	
	Gold			X0.1	5%
	Silver			X0.01	10%
	Brown				1%
	Red				2%
	No Color				20%

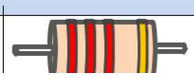
Examples:



First	Second	Multiplier	Tolerance
Red	Violet	Yellow	Gold
2	7	X10,000 or add 4 zeros	+/- 5%
27 X 10,000 = 270,000			
1,000 = 1K			
RESISTOR IS 270,000Ω OR 270KΩ			

First	Second	Multiplier	Tolerance
Brown	Black	Red	Silver
1	0	X100 or add 2 zeros	+/- 10%
10 X 100 = 1,000			
1,000 = 1K			
RESISTOR IS 1,000Ω OR 1KΩ			

EXERCISE: Calculate the numeric value of the resistor, Refer to examples above:

No.	Resistor	Color	Numeric Value
1.		RED-RED-RED	
2.		BROWN-GREEN-ORANGE	
3.		YELLOW-VIOLET-SILVER	

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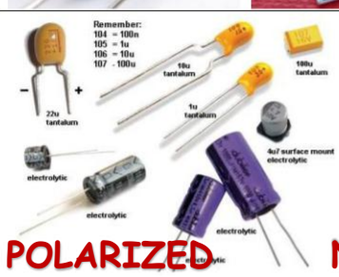
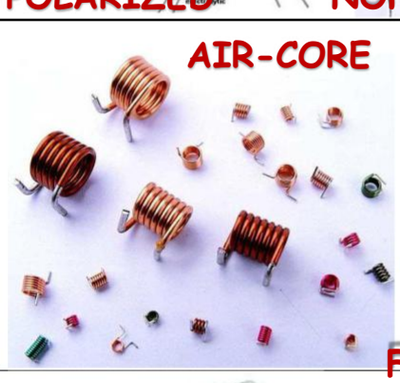
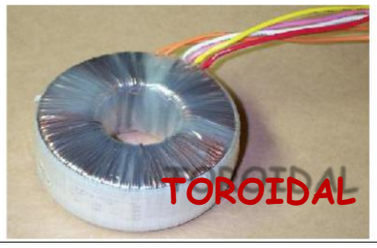
GRADE 11 DLP LEARNING ACTIVITY SHEET

Name:	Date:	Score:
Subject: Electronics Components		
Lesson Title: Passive Electronic Components		
Lesson Competency: Preparing and Interpreting Technical Drawings		
References: https://electronicsclub.info/components.htm		LAS No.: 09

CONCEPT NOTES: Common Passive Electronic Components

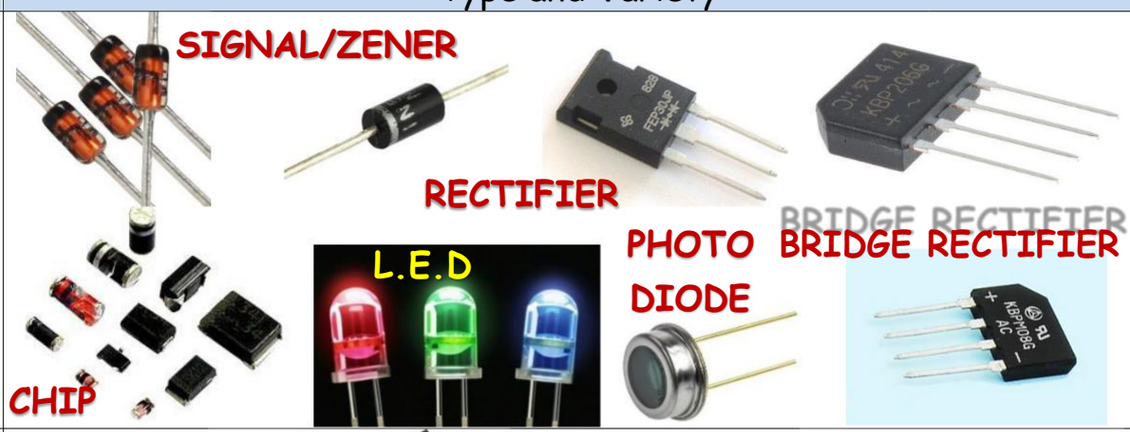
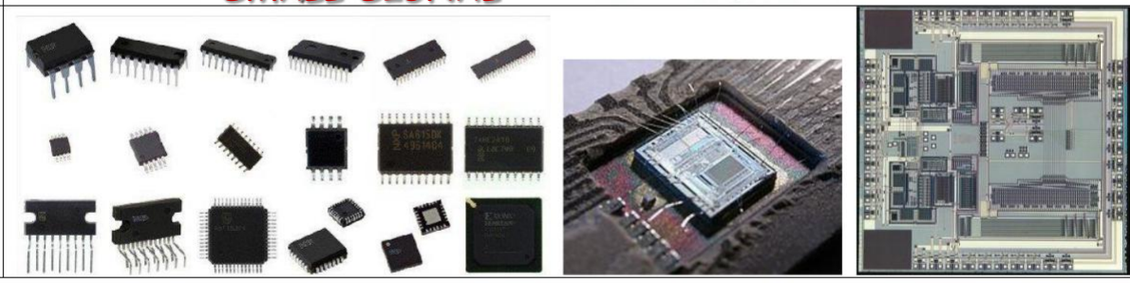
Component	Type and Variety
Resistor	 FIXED   VARIABLE  HIGH-POWER
Capacitor	 POLARIZED  NON-POLAR  VARIABLE
Inductor	 AIR-CORE  FERRITE-CORE  VARIABLE
Transformer	 E-1  TOROIDAL

EXERCISE: Identification:

1. What components that have variable types? _____,_____,_____
2. What type of resistor that are used in a miniature electronic product like a cellphone? _____.
3. It is a component commonly found in a power supply circuit? _____.

Name:	Date:	Score:
Subject: Electronics Components		
Lesson Title: Active Electronic Components		
Lesson Competency: Preparing and Interpreting Technical Drawings		
References: https://electronicsclub.info/components.htm		LAS No.: 10

CONCEPT NOTES: Active Electronic Components

Component	Type and Variety
Diode	
Transistor	
IC Integrated Circuit	

EXERCISE: Identification:

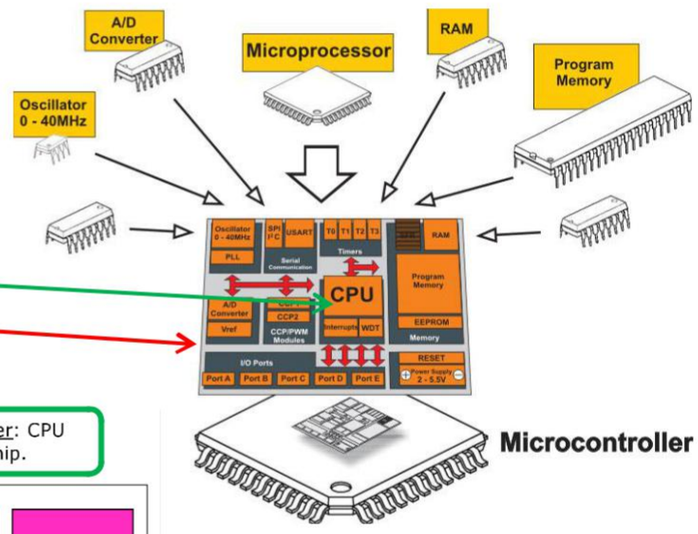
1. Enumerate the different types of diodes?
2. What component type are commonly used in a miniature electronic product like a cellphone? _____.
3. Is it possible to combine 2 or more components in an Integrated Circuit? _____.

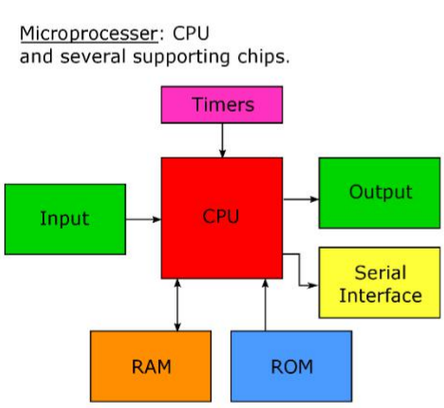
Name:	Date:	Score:
Subject: Electronics Components		
Lesson Title: Microprocessors/Microcontrollers		
Lesson Competency: Preparing and Interpreting Technical Drawings		
References: https://en.wikipedia.org/wiki/Very-large-scale_integration		LAS No.: 11

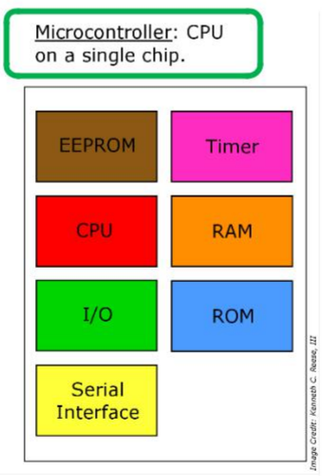
CONCEPT NOTES:

Very-large-scale integration (VLSI) is the process of creating an integrated circuit (IC) by combining hundreds of thousands of transistors or devices into a single chip. VLSI began in the 1970s when complex semiconductor and communication technologies were being developed. The microprocessor is a VLSI device. Before the introduction of VLSI technology most ICs had a limited set of functions they could perform. An electronic circuit might consist of a CPU, ROM, RAM and other glue logic. VLSI lets IC designers add all of these into one chip.

1. **Microprocessor** is a central processing unit.
2. A **microcontroller** is a computer on a chip.
3. Microprocessor is a **part** of a Microcontroller







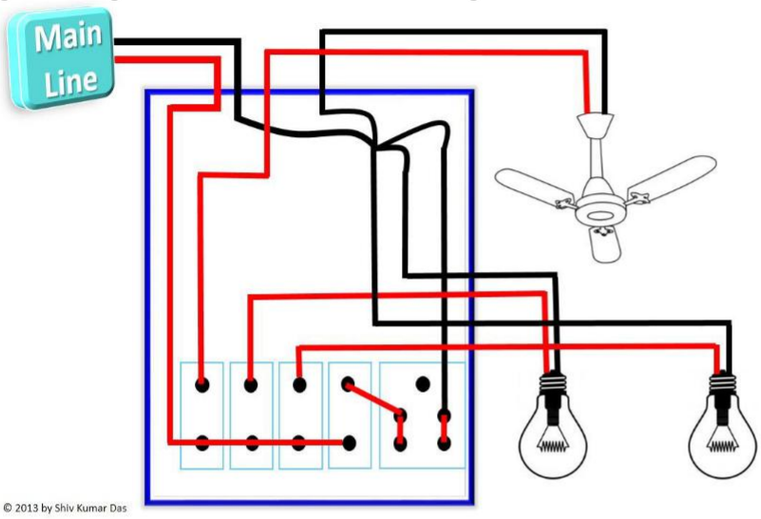
EXERCISE: Identification:

1. What is the main difference between a microprocessor and a microcontroller?
2. Enumerate the supporting chips that comprises the microcontroller.
3. Which chip has a denser integration?

Name:	Date:	Score:
Subject: Electronic Components		
Lesson Title: Control Boards, Modules, Motor Controllers and Drives		
Lesson Competency: Preparing and Interpreting Technical Drawings		
References: https://en.wikipedia.org/wiki		LAS No.: 12

CONCEPT NOTES:

Control Board is a panel containing switches, dials, and other equipment for regulating electrical devices, lights, and others.



A motor controller is a device or group of devices that serves to govern in some predetermined manner the performance of an electric motor. A motor controller might include a manual or automatic means for starting and stopping the motor, selecting forward or reverse rotation, selecting and regulating the speed, regulating or limiting the torque, and protecting against overloads and faults.

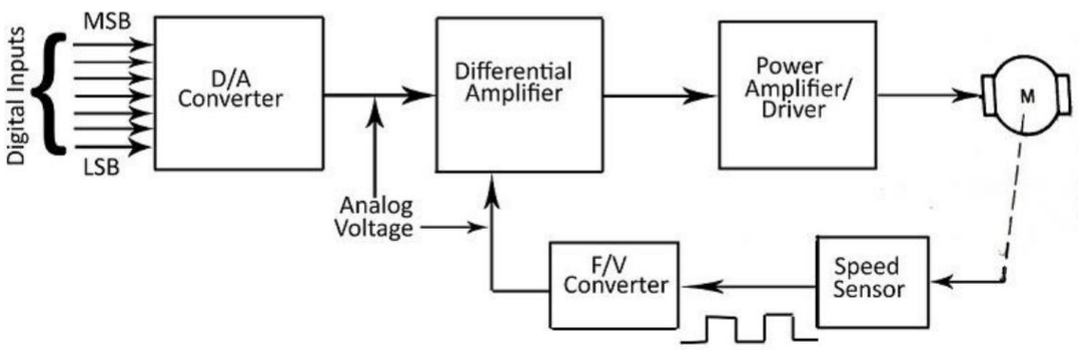
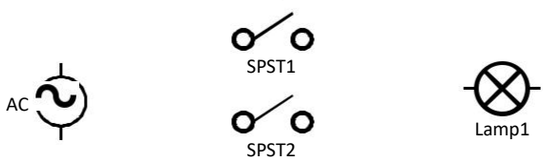


Figure 1-1 Block diagram of a digitally controlled dc motor

EXERCISE: Diagramming:

1. Design a circuit that composes 2 switches and 1 bulb. The bulb can be controlled by both switches which can be placed a distance from each other.



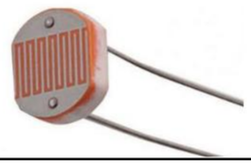
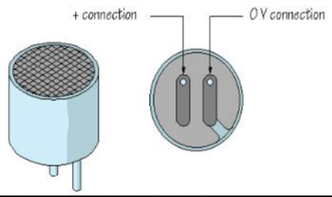
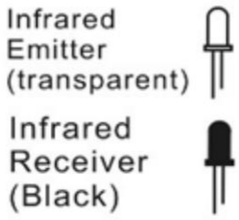
Name:	Date:	Score:
Subject: Electronic Components		
Lesson Title: Sensors, Input Devices, Actuators, Output Devices, Opto-Electronics		
Lesson Competency: Preparing and Interpreting Technical Drawings		
References: https://en.wikipedia.org/wiki		LAS No.: 13

CONCEPT NOTES:

A sensor is a device used to measure a property, such as pressure, position, temperature, or acceleration, and respond with feedback.

An actuator is a component of a machine that is responsible for moving and controlling a mechanism or system.

Optoelectronics is the study and application of electronic devices and systems that source, detect and control light.

Component	Type	Picture	Function
Light Sensor	Input Device		A light sensor is an electronic device used to detect light.
Microphone	Input Device		An instrument capable of transforming sound waves into changes in electric currents or voltage.
Actuator	Output Device		An actuator is a type of motor that is responsible for moving or controlling a mechanism or system
Infrared Emitter and Detector	Opto-Electronics		Functions as a switch with no mechanical contact.

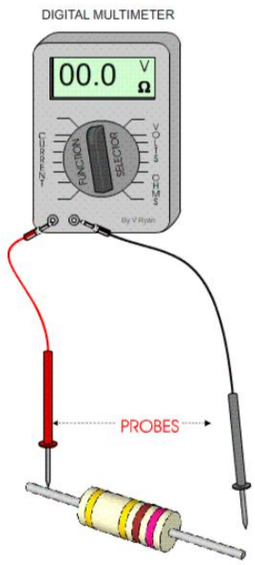
EXERCISE: Identification: Check the box of your chosen answer.

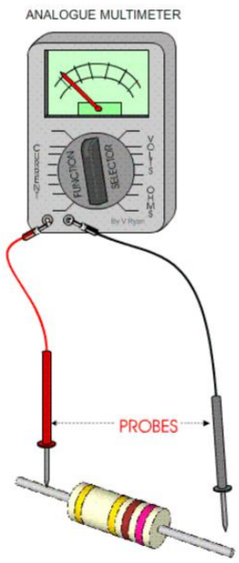
No.	Device	Input	Output	Optoelectronics
1.	Light Sensor			
2.	Motor			
3.	Actuator			
4.	Microphone			
5.	Infrared emitter/detector			

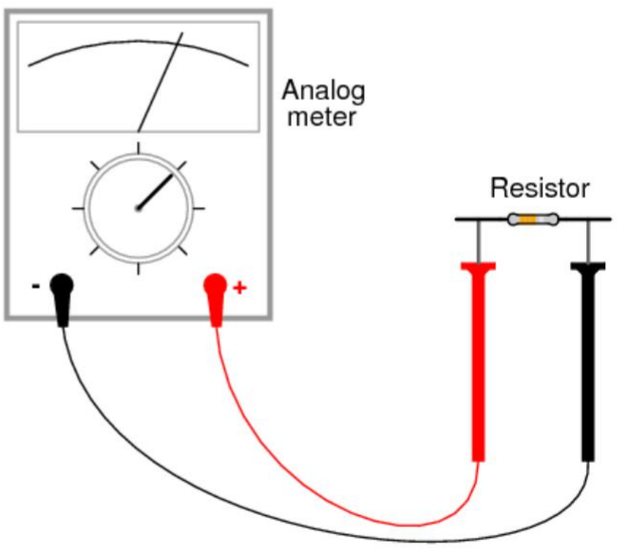
Name:	Date:	Score:
Subject: Electronic Components		
Lesson Title: Testing Passive Electronic Components		
Lesson Competency: Testing Electronic Components		
References: https://www.wikihow.com/Test-Resistors		LAS No.: 14

CONCEPT NOTES: Testing a Resistor Using Multimeter

1. Inspect the resistor. If the resistor shows signs of blackening or charring, it may be damaged by excess current flow. A resistor showing blackening or charring should be replaced and discarded.
2. Read the resistor value visually. The resistor value will be printed on the resistor. Smaller resistors may have their value indicated by color coded bands.
3. Measure the resistance. Connect the 2 leads of the DMM to the 2 legs of the resistor. Resistors have no polarity, so it does not matter which DMM lead is connected to which resistor leg.
4. Determine the actual resistance of the resistor. Read the result shown on the multimeter. In determining whether or not the resistor is within the allowable range for that resistor, do not forget to take the resistor tolerance into account.







EXERCISE: Performance Task:

1. Ask for a multimeter and assorted resistor from your trainer.
2. Read and interpret the resistor color code value.
3. Perform the steps following the procedures above.
4. List down the color code value and the multimeter readout value.
5. Submit the results to your trainer.

Name:	Date:	Score:
Subject: Electronic Components		
Lesson Title: Testing Active Electronic Components		
Lesson Competency: Testing Electronic Components		
References: https://www.wikihow.com/Test-a-Transistor		LAS No.: 15

CONCEPT NOTES: Testing a Transistor Using Multimeter

A transistor is a semiconductor that allows current to flow through it under certain conditions, and cuts current off when other conditions are present. Transistors are commonly used as either a switch or a current amplifier. You can test a transistor with a multimeter that has a diode test function.

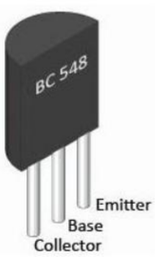
A transistor is basically 2 diodes that share one end. The shared end is called the base and the other 2 ends are called the emitter and collector.

- The collector accepts an input current from the circuit, but it can't send the current through the transistor until allowed to by the base.
- The emitter sends a current out into the circuit, but only if the base allows the collector to pass the current through the transistor to the emitter.
- The base acts like a gate. When a small current is applied to the base, the gate opens and a large current can flow from the collector to the emitter.

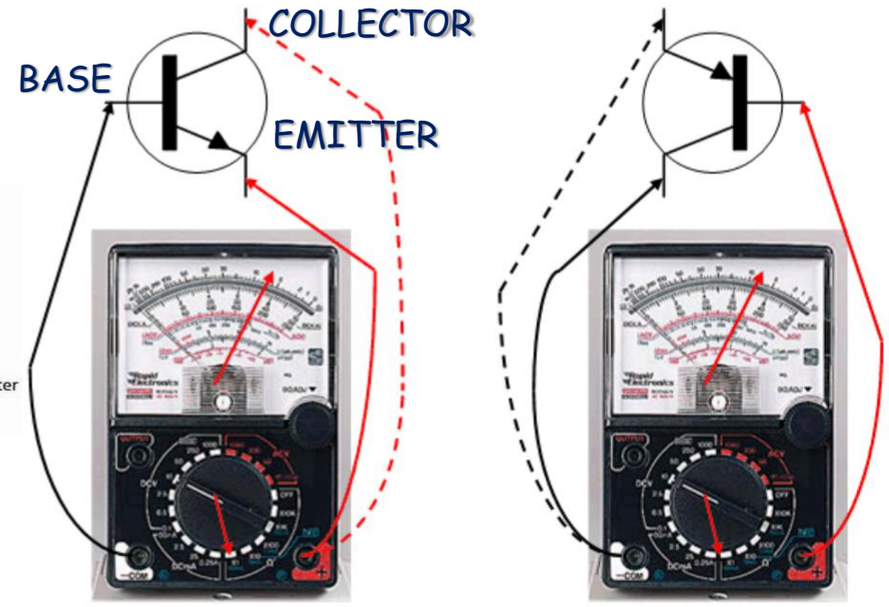
Indication of a Good NPN Transistor:

- Forward bias = low resistance
- Base-Emitter
- Base-Collector

(Base is the common pin)



- Reverse bias = infinity *(test leads are reversed)*
- Range: Ohmmeter X1



*For PNP transistor: Reverse the leads

EXERCISE: Performance Task:

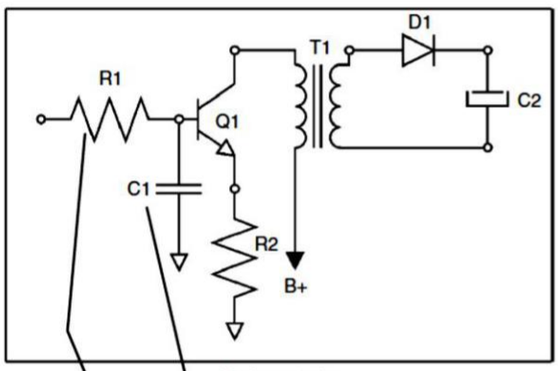
1. Ask for a multimeter and an NPN and PNP transistors from your trainer.
2. Perform the steps following the illustration above.
3. List down the multimeter readout value. (base-emitter; base-collector, both forward and reverse configurations)
4. Submit the results to your trainer.

Name:	Date:	Score:
Subject: Electronic Components		
Lesson Title: PCB Designing		
Lesson Competency: Assembling Electronic Products		
References: https://maker.pro/pcb/tutorial/		LAS No.: 16

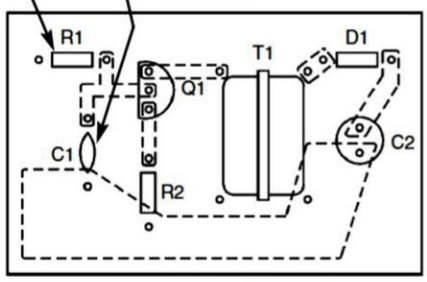
CONCEPT NOTES:

The component side of a printed circuit board should always have a drawing showing the placement of the parts and their schematic marking (R1, R2, etc.). This drawing is called the Top Legend. When a board needs to be repaired, the schematic becomes the "road map" and the top legend becomes the "address" on the part. Figure below shows the correlation between the Schematic and the Top Legend.

SAMPLE PCB DESIGN

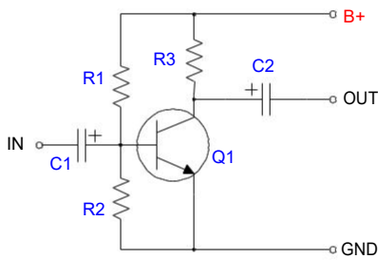


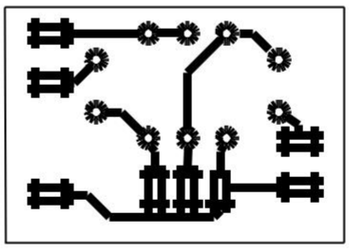
Schematic

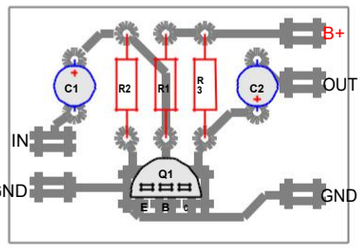


Printed Circuit Board

TRANSISTOR CIRCUIT

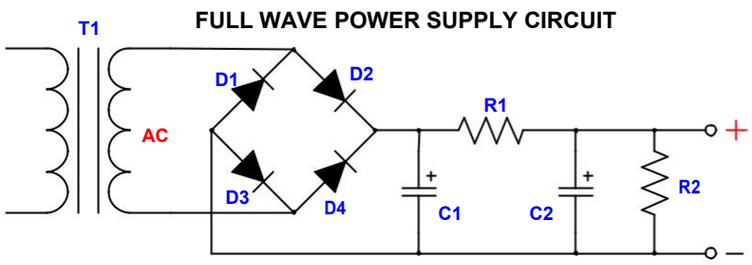



PCB COPPER SIDE



PCB COMPONENT SIDE

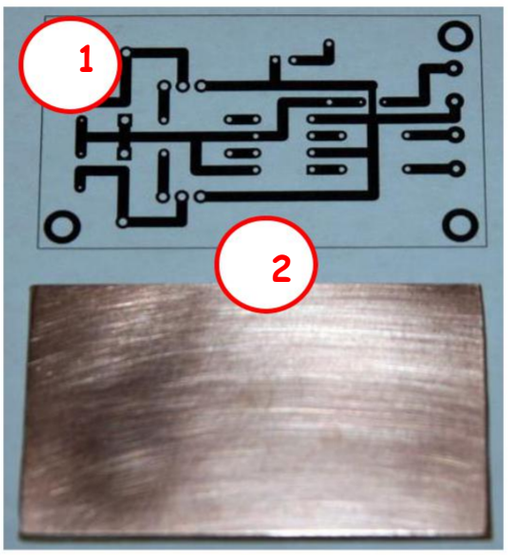
EXERCISE: Performance Task: Design a PCB of the circuit below, exclude the transformer T1, only the 4 diodes, 2 resistors and 2 capacitors.

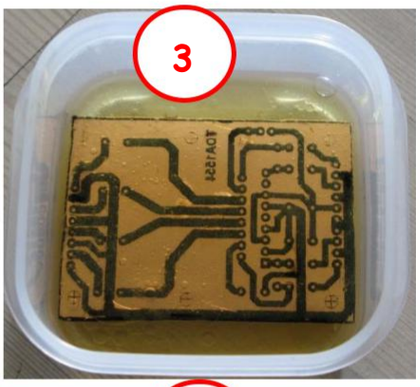


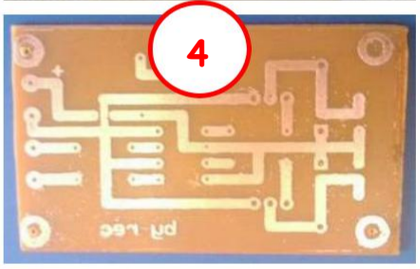
Name:	Date:	Score:
Subject: Electronic Components		
Lesson Title: PCB Etching		
Lesson Competency: Assembling Electronic Products		
References: https://maker.pro/pcb/tutorial/		LAS No.: 17

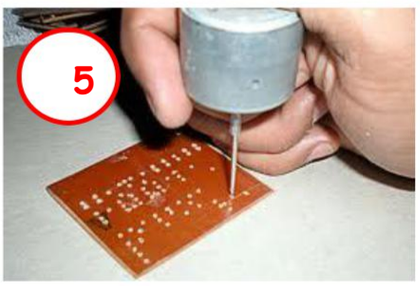
CONCEPT NOTES:

Etching a printed circuit board is simply placing the blank board with its resist image in a solution capable of dissolving copper, and wait until it dissolves all of the copper that isn't protected by the resist. Then washing the board thoroughly for drilling and use.



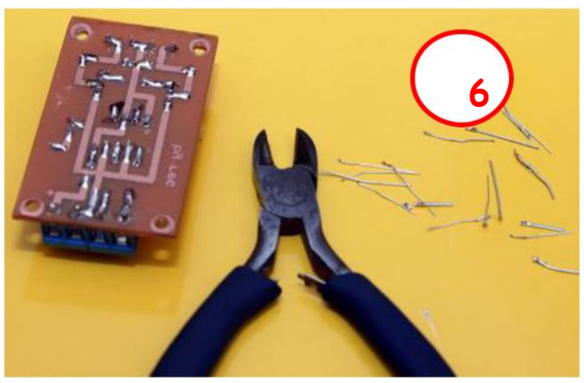




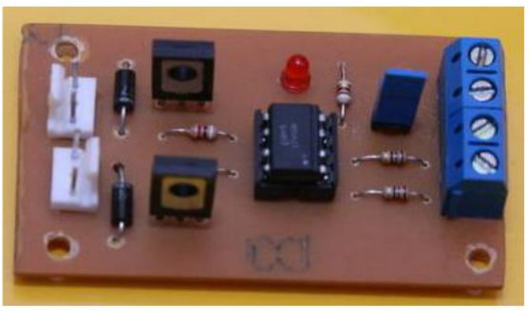


STEPS:

1. Design
2. Transfer design to PCB using permanent ink marker
3. Etch (ferric chloride solution)
4. Clean with soap and water
5. Drill holes
6. Mount and solder components



EXERCISE: Performance Task: Etch a PCB following the procedures stated. Ask from your trainer materials needed. Rubrics:



Design	40%
Cleanliness	20%
Etched copper (over/under etched)	40%
Total	100%

Name:	Date:	Score:
Subject: Power Supply		
Lesson Title: DC Low Voltage Power Supply		
Lesson Competency: Assembling Electronic Products		
References: https://electronicsclub.info/powersupplies.htm		LAS No.: 18

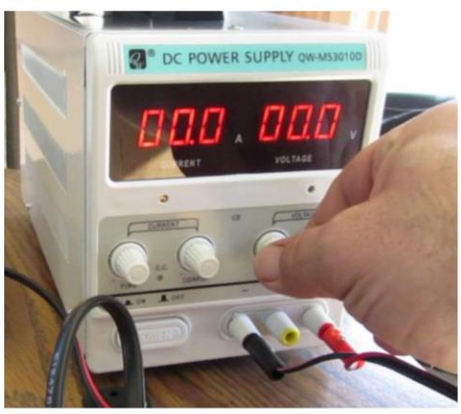
CONCEPT NOTES:

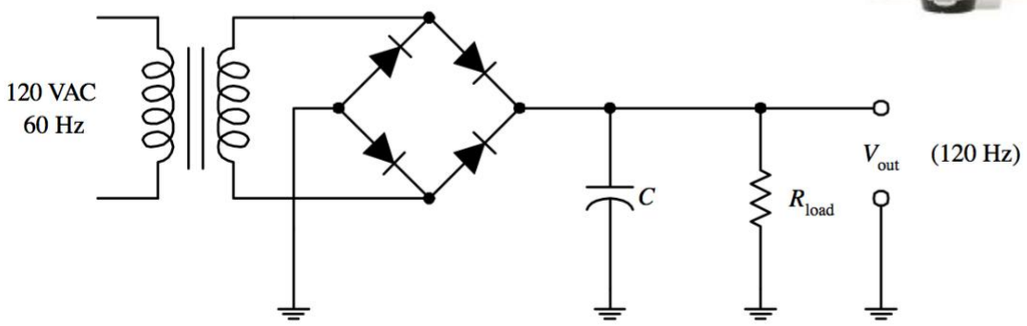
A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load.

Applications

D.C. variable bench supply is capable of supplying a variety of output voltages useful for BE (bench testing) electronic circuits, possibly with continuous variation of the output voltage, or just some preset voltages;

- Mobile Phone power adaptors
- Regulated power supplies in appliances
- Various amplifiers and oscillators





EXERCISE:

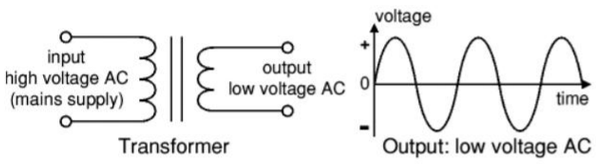
1. Enumerate the electronic components that are in a power supply circuit.
2. Aside from cellphones, what are other electronic devices that the power supply can be used?

Name:	Date:	Score:
Subject: Power Supply		
Lesson Title: Types of Power Supply		
Lesson Competency: Assembling Electronic Products		
References: https://electronicsclub.info/powersupplies.htm		LAS No.: 19

CONCEPT NOTES:

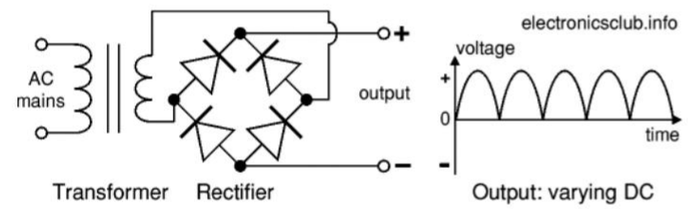
There are many types of power supply. Most are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function.

1. Transformer only



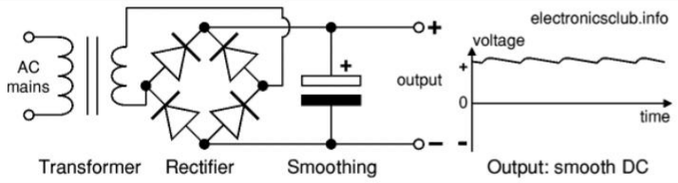
The low voltage AC output is suitable for lamps, heaters and special AC motors. It is not suitable for electronic circuits unless they include a rectifier and a smoothing capacitor.

2. Transformer + Rectifier



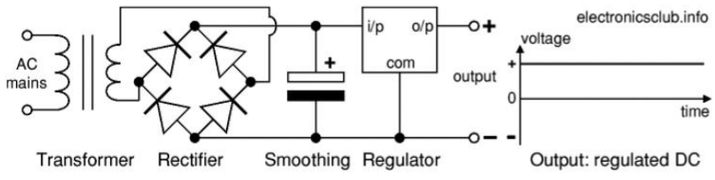
The varying DC output is suitable for lamps, heaters and standard motors. It is not suitable for electronic circuits unless they include a smoothing capacitor.

3. Transformer + Rectifier + Smoothing



The smooth DC output has a small ripple. It is suitable for most electronic circuits.

4. Transformer + Rectifier + Smoothing + Regulator



The regulated DC output is very smooth with no ripple. It is suitable for all electronic circuits.

EXERCISE: Identification

What is the main function of a power supply?

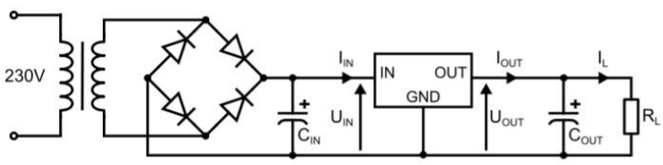
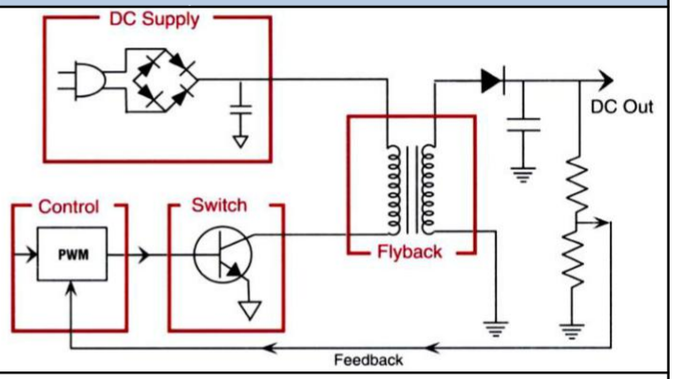
What component that is present in all power supply types?

What is the most suitable type of power supply for all electronic circuits?

Name:	Date:	Score:
Subject: Power Supply		
Lesson Title: Switch Mode Power Supply		
Learning Competency: Assembling Electronic Products		
References: https://electronicsclub.info/powersupplies.htm		LAS No.: 20

CONCEPT NOTES:

A switched-mode power supply (SMPS) is an electronic circuit that converts power using switching devices that are turned on and off at high frequencies.
Switching power supplies have high efficiency and are widely used in a variety of electronic equipment, including computers and other sensitive equipment requiring stable and efficient power supply.

Linear	SMPS
	

Size	
	
Large and Heavy	Small and Light

Efficiency	30-40%	70-95%
Complexity	Simple	Complex
EMI (Electromagnetic Interference)	Low Noise	Filtering Required
Cost	High (Due to Material)	Low

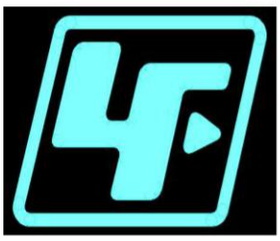
EXERCISE:

1. In which type of device SMPS Power supply suit best?
2. Is a cellphone charger an SMPS type?
3. Is application usage and important consideration in choosing a power supply type? Elaborate.

Name:	Date:	Score:
Subject: Using and Maintaining Hand Tools		
Lesson Title: Solder and Soldering Tools		
Learning Competency: Assembling Electronic Products		
References: https://electronicsclub.info/soldering.htm		LAS No.: 21

CONCEPT NOTES:

- Solder = Alloy; commonly of Tin (Sn) and Plumbum (Pb)
- Cheapest in market Sn:Pb = 60:40
- Solder melting temperature ~ 180°C to 190°C



Why Lead-Free Solder? LEAD IS DANGEROUS TO THE ENVIRONMENT

- Current disposal methods of electronic equipment result in ground water being contaminated with lead from solder.
- It has been proved that high intake of lead causes serious illnesses in humans.

Why was Lead used?

- It was cheap and easy to process
- No research was done on the dangers of using Lead
- No thought was given to the possible volume of usage of Leaded Solder
- No thought was given to the disposal methods

Soldering Iron	
	It must be 220V, have a heatproof cable for safety, power rating should be 15 to 40W and fitted with a small bit of 2 to 3mm diameter.
Soldering iron stand with damped sponge	
	A safe place to put the iron when not in use. The stand should include a sponge which can be dampened for cleaning the tip of the iron.
Desoldering pump	
	A tool for removing solder when desoldering a joint to correct a mistake or replace a component.
Solder Wire	
	Must be Lead-Free for general purpose thru-hole, wiring, repair, large surface mount.

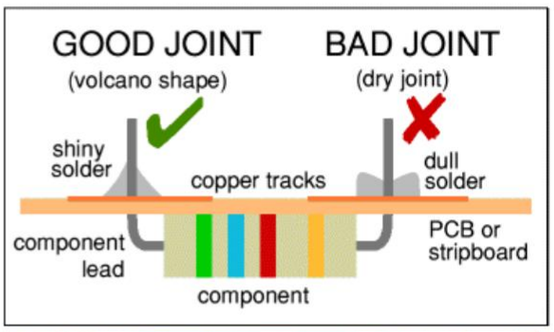
EXERCISE:

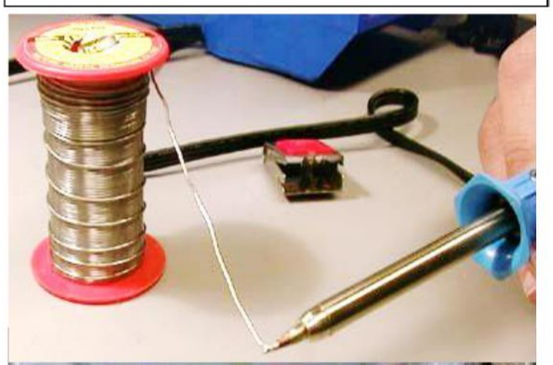
1. Why was Soldering Lead replaced by a Lead-Free Solder?

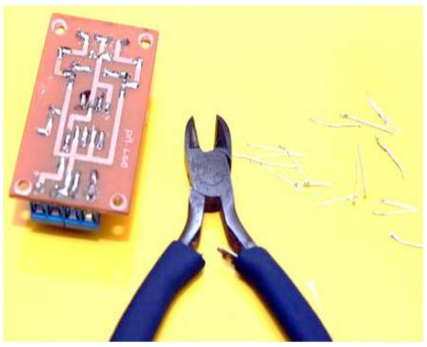
Name:	Date:	Score:
Subject: Using and Maintaining Hand Tools		
Lesson Title: Solder Electronic Components		
Learning Competency: Assembling Electronic Products		
References: https://electronicsclub.info/soldering.htm		LAS No.: 22

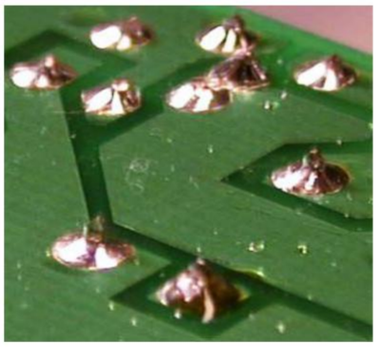
CONCEPT NOTES: Soldering a Component Procedure

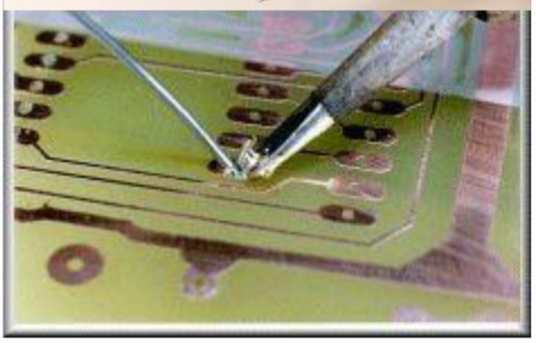
1. Prepare the component for solder.
2. Insert the component to its place in the board. See figure below.
3. Prepare soldering iron for soldering work.
4. Hold the soldering iron like a pen, near the base of the handle.
5. Touch the soldering iron onto the joint to be made.
6. Feed a little solder onto the joint.
7. Remove the solder, then the iron, while keeping the joint still.
8. Inspect the joint closely.
9. Cut off excess wires/component leads.









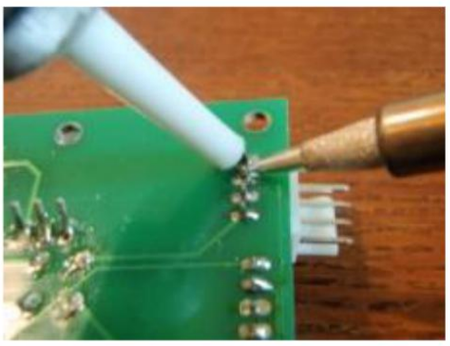


EXERCISE: Assessment

Criteria	YES	NO
Prepared the component for solder		
Inserted the component to its place in the board		
Prepared soldering iron for soldering work		
Held the soldering iron like a pen, near the base of the handle		
Touched the soldering iron onto the joint to be made		
Fed a little solder onto the joint		
Removed the solder, then the iron, while keeping the joint still		
Inspected the joint closely		
Cut off excess wire		

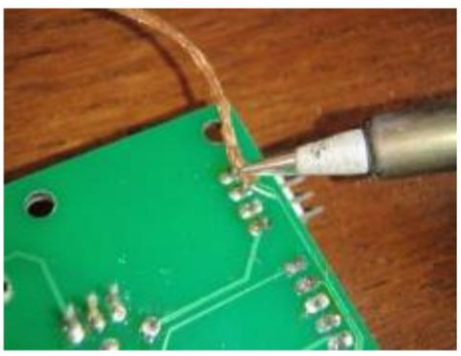
Name:	Date:	Score:
Subject: Using and Maintaining Hand Tools		
Lesson Title: De-solder Electronic Components		
Learning Competency: Assembling Electronic Products		
References: https://electronicsclub.info/soldering.htm		LAS No.: 23

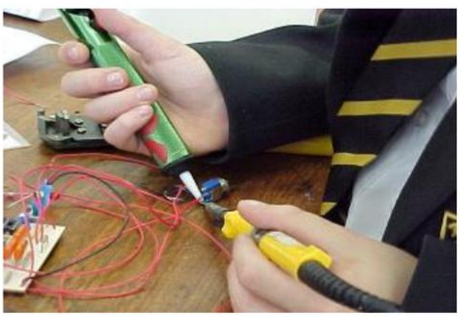
CONCEPT NOTES: Unmount or desolder a joint



Two ways to remove the solder:

1. **With a desoldering pump (solder sucker)**
   - 1.1 Set the pump by pushing the spring-loaded plunger down until it locks.
   - 1.2 Apply both the pump nozzle and the tip of your soldering iron to the joint.
   - 1.3 Wait a second or two for the solder to melt.
   - 1.4 Then press the button on the pump to release the plunger and suck the molten solder into the tool.
   - 1.5 Repeat if necessary to remove as much solder as possible.
   - 1.6 The pump will need emptying occasionally by unscrewing the nozzle.
2. **With solder remover wick (copper braid)**
   - 2.1 Apply both the end of the wick and the tip of your soldering iron to the joint.
   - 2.2 As the solder melts most of it will flow onto the wick, away from the joint.
   - 2.3 Remove the wick first, then the soldering iron.
   - 2.4 Cut off and discard the end of the wick coated with solder.





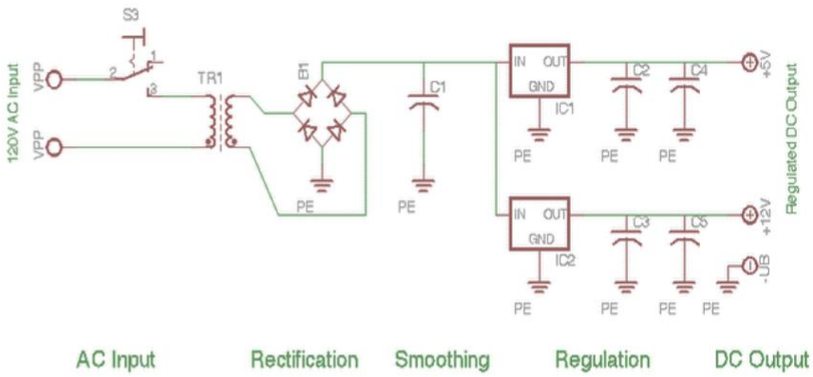
EXERCISE: Assessment

Criteria	YES	NO
Removed component using desoldering tool (solder sucker)		
Removed component using solder wick (copper braid)		
Followed all safety precautions in preparing and handling the		
Took great care of avoiding touching the mains flex with the tip of		
Returned the soldering iron to its stand when not in use		
Washed hands after using solder		

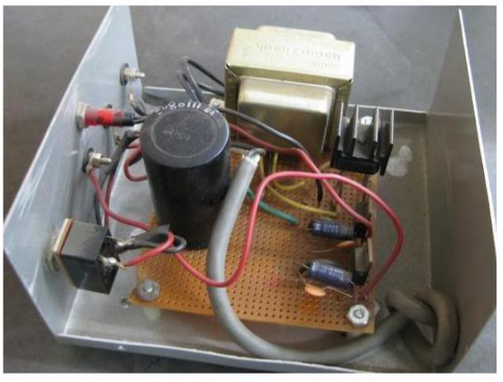
Name:	Date:	Score:
Subject: Assembling Electronic Products		
Lesson Title: Assemble a Power Supply		
Learning Competency: Assembling Electronic Products		
References: https://www.popsci.com/diy/article/2009-12/build-simple-ps		LAS No.: 24

CONCEPT NOTES:

PARTS LIST



- Power cord
- Male Plug
- Appropriate Chassis
- SPST 220V toggle switch
- Panel mount 220V neon lamp
- 3x Binding Posts
- Transformer 220V input, output voltage 24V to keep the V-in for the 7812 regulator above the minimum.
- Full-wave bridge rectifier
- 1x 6,800 F/50V Capacitor
- 2x 100F /50V capacitors
- 2x 1 F/50V capacitors
- 7805 5V Voltage Regulator
- 7812 12V Voltage Regulator



PROCEDURE:

1. Procure Materials
2. Design and Build the P.C.B.
3. Mount and Solder components to P.C.B.
4. Mount the Transformer, Switch, Panel Lamp and Binding Posts to chassis.
5. Connect the necessary wirings.
6. Re-check assembled device for mistakes.
7. Test the assembled device.

EXERCISE: Assessment

Rubric/Criteria	%	
PCB Design	20%	
Proper Soldering	20%	
Neatness of Wiring	20%	
Proper use of tools and equipment	15%	
Adherence to OHS in the assembly process	15%	
Overall Device functionality	10%	

Name:	Date:	Score:
Subject: Security and Solar Power Management System		
Lesson Title: CCTV Installation		
Learning Competency: Servicing Consumer Electronic Products and Systems		
References: http://satsecure.uk/blog/392-basic-cctv-installation-guide/		LAS No.: 25

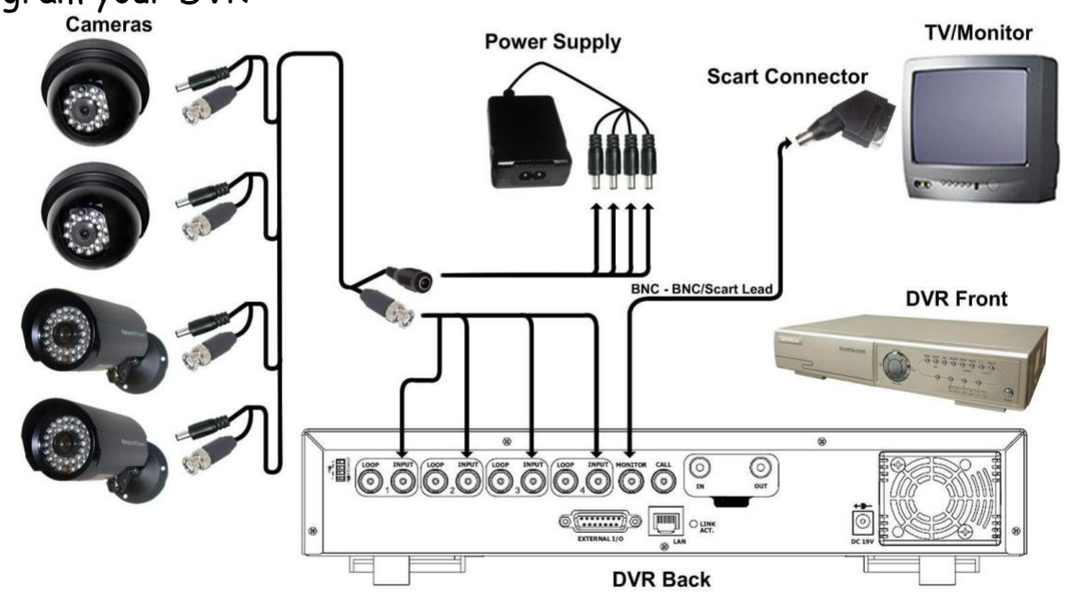
CONCEPT NOTES:

System Planning:

1. How can I estimate how many cameras I will need?
2. Where will I store the DVR and power supplies for the cameras?
3. How far will the cameras be located from the DVR and power supply?
4. Do you want to access your cameras remotely?

Installation Procedure: (Refer to Manufacturer's Installation Manual)

1. Choose Camera Locations
2. Run Your Cables
3. Power your Cameras
4. Power your DVR
5. Connect the Monitor to the DVR
6. Program your DVR



EXERCISE: Assessment

Rubric/Criteria	%	
Physical Camera and DVR Installation	20%	
Neatness of Wiring/Harness	20%	
Proper use of tools and equipment	20%	
Adherence to OHS in the Installation process	15%	
Serviceability	15%	
Overall Device functionality	10%	

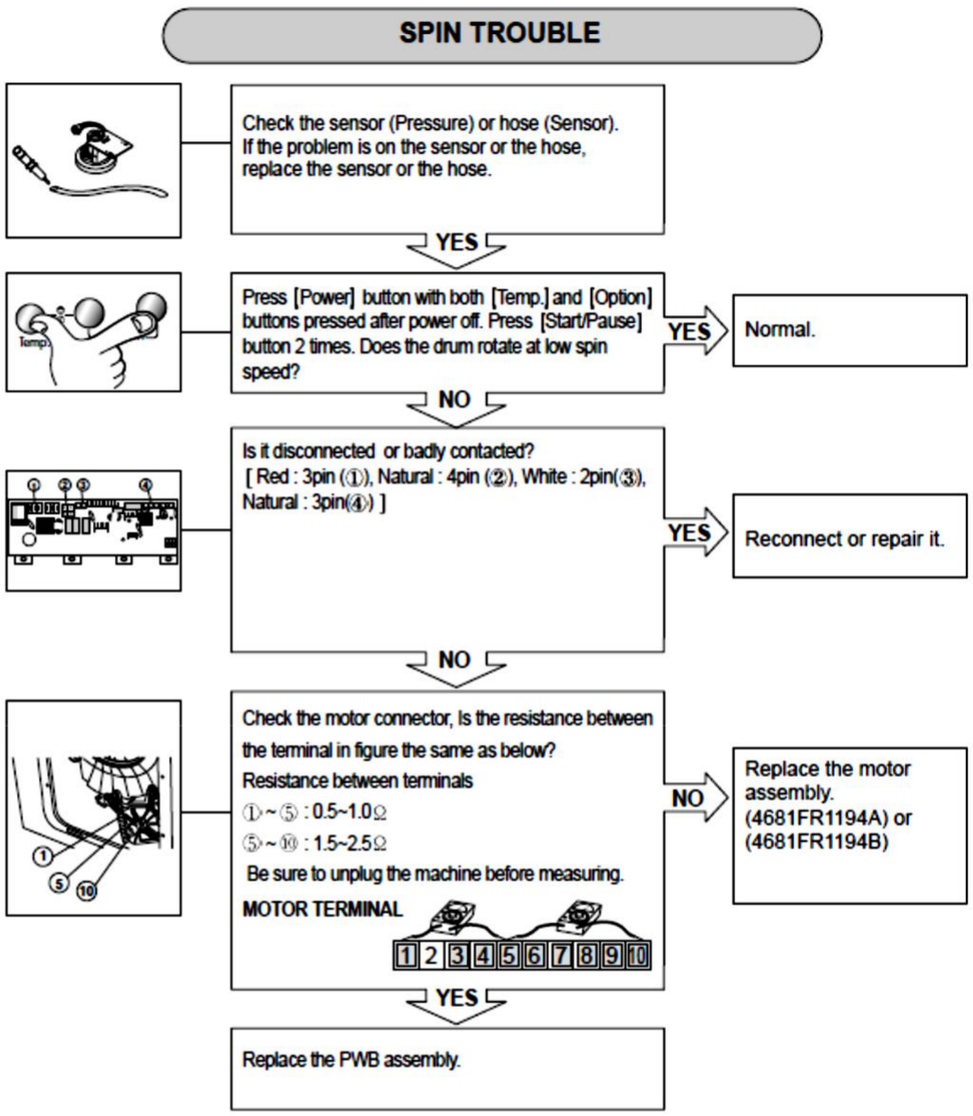
Name:	Date:	Score:
Subject: Servicing Consumer Electronic Products and Systems		
Lesson Title: Servicing Domestic Electronic Appliances with Electric Motor		
Learning Competency: Servicing Consumer Electronic Products and Systems		
References: https://www.thespruce.com/diy-washer-repairs-prevent-service	LAS No.: 26	

CONCEPT NOTES:

If motor of the appliance in not working, most probably the motor is defective. But we need to confirm it by checking its connections.

- Check AC Power
- Check drive belt
- Check switches and/or logic board.
- Physically rotate motor if not stocked.

If all pre-checks were done and confirmed working then most probably motor is defective.



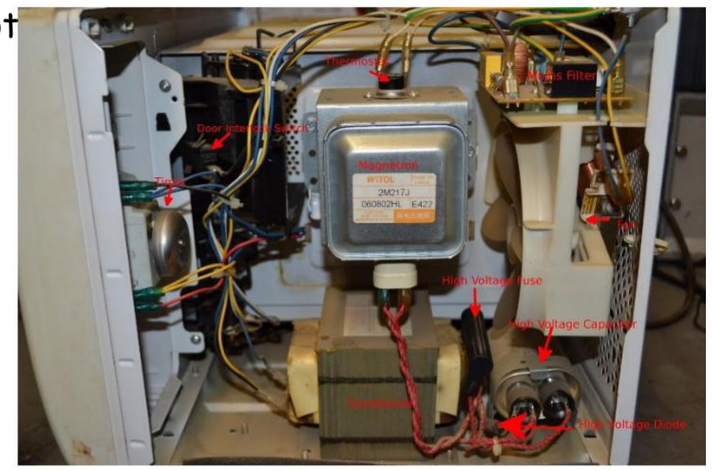
EXERCISE: Assessment

Rubric/Criteria	%	
Appliance pre-inspection and defect confirmation	10%	
Disassembly of the product	20%	
Accuracy of the diagnosed fault (defective part)	30%	
Reassembly and Testing	20%	
Proper use of tools and equipment	10%	
Adherence to OHS in the servicing process	10%	

Name:	Date:	Score:
Subject: Servicing Consumer Electronic Products and Systems		
Lesson Title: Servicing Domestic Electronic Appliances with Heating Element		
Learning Competency: Servicing Consumer Electronic Products and Systems		
References: https://www.repairclinic.com/RepairHelp/How-To-Fix-A-Microwa		LAS No.: 27

CONCEPT NOTES: Servicing Microwave Oven

Most Frequent Causes for Microwave not heating



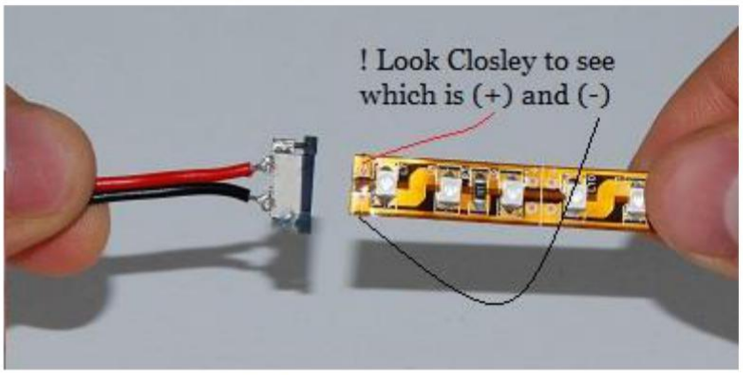
1. **Diode-** The diode converts the A/C power output of the transformer to D/C, doubling the voltage to nearly 5,000 volts. This high voltage powers the magnetron to heat the food.
2. **Door Switch-** Most microwaves have three or four door switches. When the microwave door closes, the door switches actuate in sequence to ensure that the door is closed properly.
3. **Magnetron-** The magnetron uses high voltage, high current DC power to generate the microwave frequency that cooks the food.
4. **High Voltage Capacitor-** The high voltage capacitor works with the high voltage diode to convert the output of the transformer to DC voltage and to double the output voltage
5. **High Voltage Transformer-** Microwave ovens produce a very high voltage in order to power the magnetron antenna, which emits the energy that cooks the food. When a high voltage transformer fails, it will usually arc and have a burning smell.
6. **Thermal Fuse-** The thermal fuse cuts off power to the microwave if the microwave overheats.

EXERCISE: Assessment

Rubric/Criteria	%	
Appliance pre-inspection and defect confirmation	10%	
Disassembly of the product	20%	
Accuracy of the diagnosed fault (defective part)	30%	
Reassembly and Testing	20%	
Proper use of tools and equipment	10%	
Adherence to OHS in the servicing process	10%	

Name:	Date:	Score:
Subject: Servicing Consumer Electronic Products and Systems		
Lesson Title: Servicing Domestic Electronic Appliances with Electronic Controlled Lighting		
Learning Competency: Servicing Consumer Electronic Products and Systems		
References:https://www.ecolocityled.com/category/led_troubleshoot_ecoligh	LAS No.: 28	

CONCEPT NOTES: Servicing Electronic Controlled Lighting System



1. **Power Supply Issues-** Whether you want to call them LED Power Supplies, LED Drivers, or LED Transformers, they are the driving factor behind the power of your LED Lights. There are many different types of LED Power Supplies and it is important to know what type you are using.

2. **LED Wiring Issue-** Wiring is one of the most important parts of any LED installation. A majority of LED issues that we experience come from incorrect or careless wiring. Even if you are an experienced electrician go through this guide to see the most common wiring mistakes.
3. **LED Soldering Issue-** Soldering your LED Strip Lights or LED Connection wires is one of the best long-term solution for any LED installation but if done incorrectly the results can be irreversible. Read through this troubleshooting guide to see soldering techniques to avoid.

EXERCISE: Assessment

Rubric/Criteria	%	
Appliance pre-inspection and defect confirmation	10%	
Disassembly of the product	20%	
Accuracy of the diagnosed fault (defective part)	30%	
Reassembly and Testing	20%	
Proper use of tools and equipment	10%	
Adherence to OHS in the servicing process	10%	

Name:	Date:	Score:
Subject: Servicing Consumer Electronic Products and Systems		
Lesson Title: Servicing Domestic Electronic Appliances with Solar Power Management System		
Learning Competency: Servicing Consumer Electronic Products and Systems		
References: https://www.solarquotes.com.au/blog/solar-panel-maintenance		LAS No.: 29

CONCEPT NOTES: Solar Panel Maintenance

Safety Issues to Consider:

Unfortunately, rooftop solar is not perfectly safe. Anything with live current running through it can be dangerous if damaged or defective and solar systems are no exception. Fires have resulted from faults and, while most have been small, some have resulted in whole buildings being burned to bits.

While solar systems have no moving parts to wear out, problems that can potentially occur include:

- Deterioration of cable insulation over time.
- Failure of defective components.
- Components filling with water.
- Corrosion.
- Animals chewing on cables.
- Damage from natural disasters such as earthquakes, bush fires, and storms.
- Damage from home renovations.
- Incompetent installation.
- DC isolator fires.

Having a professional inspect a system can result in problems being identified and rectified before they become a danger.

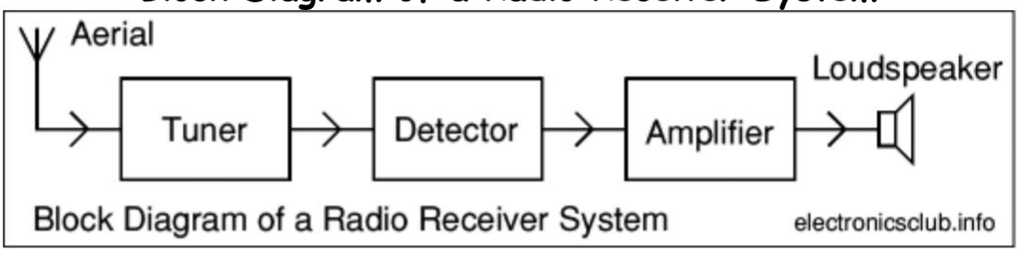
EXERCISE: Assessment

Rubric/Criteria	%	
Solar Cell inspection for preventive maintenance	20%	
Accuracy of the diagnosed fault (defective part if any)	20%	
Proper use of tools and equipment	20%	
Proper Use of Personal Protective Equipment	20%	
Adherence to OHS in the Inspection Process	20%	

Name:	Date:	Score:
Subject: Servicing Consumer Electronic Products and Systems		
Lesson Title: Servicing Domestic Electronic Appliances, Audio Products and Systems		
Learning Competency: Servicing Consumer Electronic Products and Systems		
References: https://electronicsclub.info/blockdiagrams.htm		LAS No.: 30

CONCEPT NOTES: Radio Receiver System

Block Diagram of a Radio Receiver System



The power supply (not shown) is connected to the audio amplifier block.
Aerial - picks up radio signals from many stations.
Tuner - selects the signal from just one radio station.
Detector - extracts the audio signal carried by the radio signal.
Audio Amplifier - increases the strength (power) of the audio signal.
Loudspeaker - a transducer which converts the audio signal to sound.

In actual troubleshooting, it's important to know the functions of each block. In this way, you can easily pinpoint to which block you will focus. Of course, the power supply is the one that should be checked first. For new technicians, a schematic diagram is very important as it will guide you navigating the circuit.
Common defects:

- No power – Blown fuse, shorted rectifier diode
- Motorboating sound – Leaky filter capacitor
- Can't pick-up a station – defective tuner

Ask for a defective set from your trainer and perform the troubleshooting job.

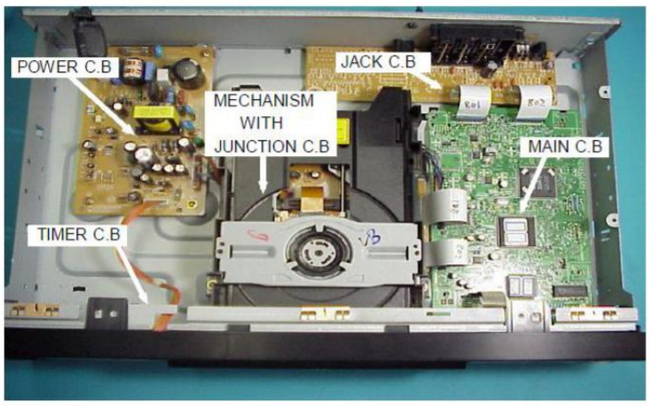
EXERCISE: Assessment

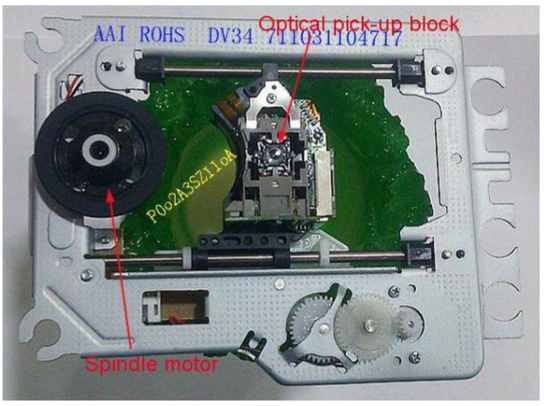
Rubric/Criteria	%	
Set pre-inspection and defect confirmation	10%	
Disassembly of the product	20%	
Accuracy of the diagnosed fault (defective part)	30%	
Reassembly and Testing	20%	
Proper use of tools and equipment	10%	
Adherence to OHS in the servicing process	10%	

Name:	Date:	Score:
Subject: Servicing Consumer Electronic Products and Systems		
Lesson Title: Servicing Domestic Electronic Appliances, Audio – Video Products and Systems		
Learning Competency: Servicing Consumer Electronic Products and Systems		
References: https://electronicsclub.info/blockdiagrams.htm		LAS No.: 31

CONCEPT NOTES: Repairing DVD System

Problem:	Won't play and displays "no disc"





Solution:

1. Remove top cover.
2. Clean the optical block lens with dry cotton swab. See picture above right.
3. Test unit: if OK, then problem is only dirt in the pick-up block
4. If still no play, check spindle motor.
5. Unsolder 2 wires (red and black).
6. Test motor using analog tester, Ohmmeter Range X1.
7. Normal reading is about 1Kohm while the motor is running very smoothly.
8. If reading is below 20ohms, replace the motor.

Ask for a defective set from your trainer and perform the troubleshooting job.

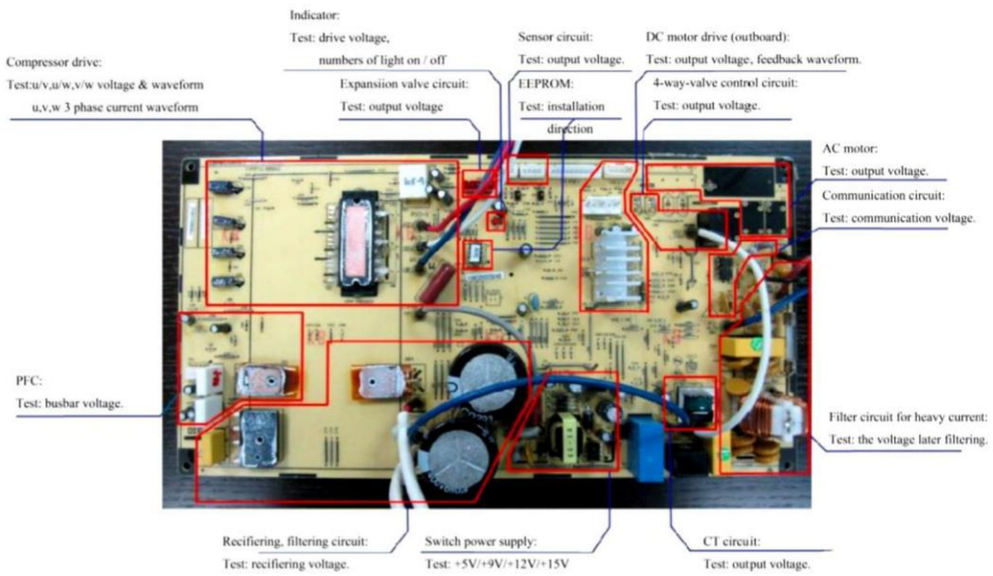
EXERCISE: Assessment

Rubric/Criteria	%	
Set pre-inspection and defect confirmation	10%	
Disassembly of the product	20%	
Accuracy of the diagnosed fault (defective part)	30%	
Reassembly and Testing	20%	
Proper use of tools and equipment	10%	
Adherence to OHS in the servicing process	10%	

Name:	Date:	Score:
Subject: Control Boards, Modules, Motor Controllers and Drives		
Lesson Title: Servicing Industrial Electronic Modules		
Learning Competency: Servicing Industrial Electronic Modules, Products and Systems		
References: Repair Guideline for TCL DC Inverter Air Conditioner Version 3		LAS No.: 32

CONCEPT NOTES: Troubleshooting PC Board of a Split Type Air conditioner.

Voltage test and inspection. We need to test the key point voltage on the PCB.



1. Switch on the air conditioner normally.
2. Use a digital multimeter to measure the AC power supply.
3. Measure the busbar voltage, normally it should be DC 310V.
4. Test voltage +5V, +9V, +12V and +15V.

Analysis:

1. If AC power input normal but without DC output 310V, please check FUSE1 and/or rectifier DB101.
2. If DC 310V ok, but without +15V/+12V/+9V/+5V, inspect IC5 and/or transformer T1.
3. If +15V/+12V/+9V normal but without +5V, check IC6 (7805) broken or not.
4. If the air conditioner still can't work after inspection, replace the PCB.

* *Refer troubleshooting procedure as per manufacturer's repair manual.

Ask for a defective unit for repair from your trainer.

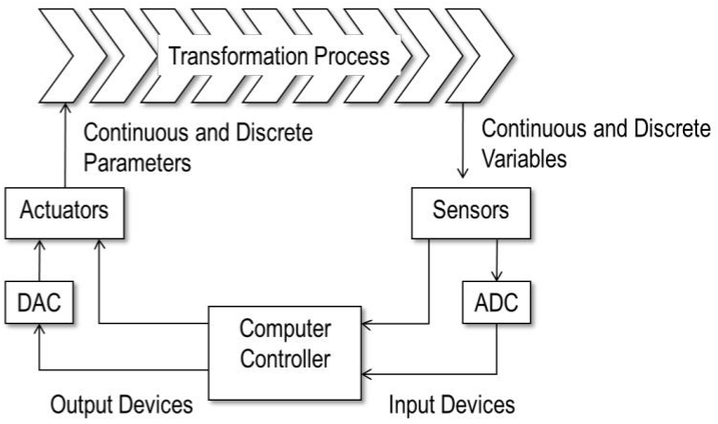
EXERCISE: Assessment

Rubric/Criteria	%	
Set pre-inspection and defect confirmation	10%	
Disassembly of the product	20%	
Accuracy of the diagnosed fault (defective part)	30%	
Reassembly and Testing	20%	
Proper use of tools and equipment	10%	
Adherence to OHS in the servicing process	10%	

Name:	Date:	Score:
Subject: Sensors, Actuators, IO Devices, Opto-Electronics Equipment and Devices		
Lesson Title: Servicing Industrial Electronic Modules		
Learning Competency: Servicing Industrial Electronic Modules, Sensor, Actuators, IO Devices		
References: Sensors and Actuators Handout		LAS No.: 33

CONCEPT NOTES: In servicing Modules with Sensors, Actuators and IO Devices it's important to have a background on how this electronic device works.

A **sensor** is a transducer that converts a physical stimulus from one form into a more useful form to measure the stimulus.



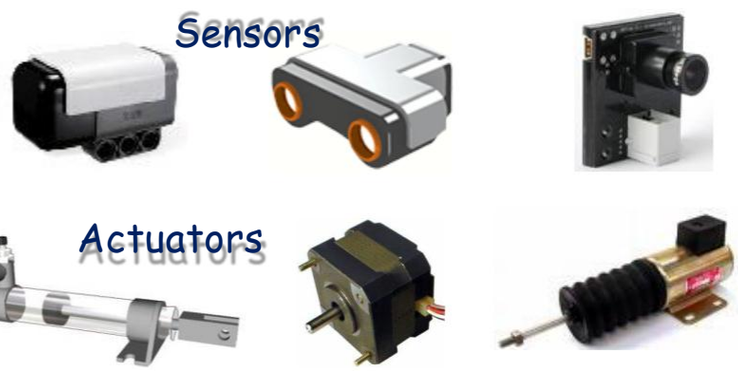
Types of Sensors:

- Sound (decibel pressure)
- Ultrasonic (distance)
- Light (intensity)
- Touch, barcode, RFID, etc.

Actuators are hardware devices that convert a controller command signal into a change in a physical parameter. The change is usually mechanical (e.g., position or velocity). An actuator is also a transducer because it changes one type of physical quantity into some alternative form.

Types of Actuators

1. Electrical actuators
   - Electric motors
   - DC servomotors
   - AC motors
   - Stepper motors
   - Solenoids



2. Hydraulic actuators
   - Use hydraulic fluid to amplify the controller command signal
3. Pneumatic actuators
   - Use compressed air as the driving force

EXERCISE: Check on the appropriate box.

No.	Device	Sensor (Input)	Actuator (Output)
1.	Microphone		
2.	Speaker		
3.	Motor		
4.	Touch Activated Switch		
5.	Solenoid		