

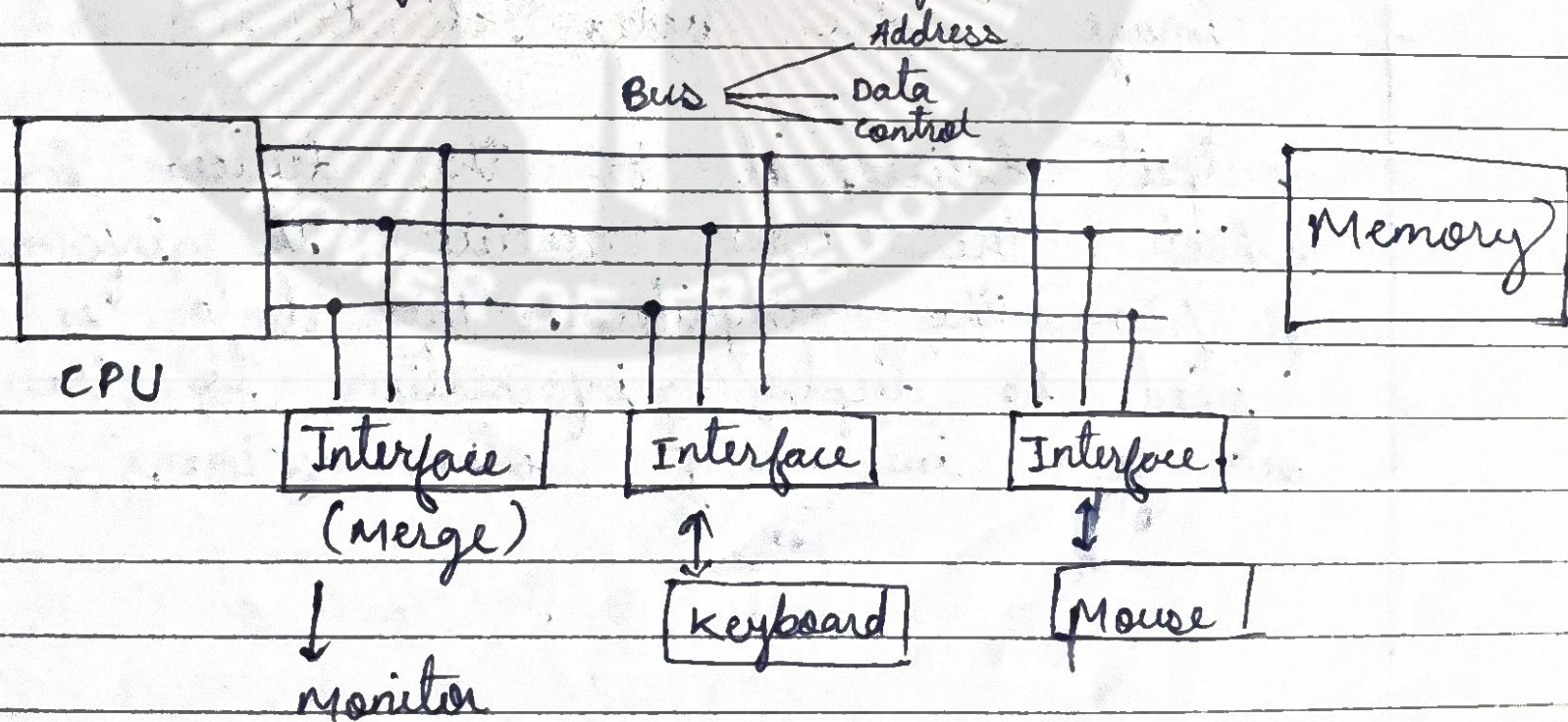


input output interface ^(connection)

Input output interface, it is used as a method which helps in transferring the of information between the ~~inter~~ internal storage device that is memory and external peripheral devices.

The peripheral devices is the device which provide input and output for the computer.

~~for~~ For example A keyboard and A mouse provide input to the computer (input devices), A monitor and A printer gives the output (output devices). Some other peripheral devices like external hard drive which provide both input and output.





Functions of input output interface

1. It is capable of providing signals like control signal, store signal.
2. It also contain error detection.
3. It also convert digital data into analog data and vice versa.

Input devices and output devices

Input devices creates an interface between the user and the computer.

It transform the information in the acceptable form to the computer. It is any piece of peripheral devices, send data to the computer (in the form of text, command, image, audio, video, etc.)

output devices, it is the devices in which the user receive the information from the computer. This data is used to display information to the user in any other form.



Types of computer ports

ports are a connector between the external and internal input output devices using cables. It allows to communicate between the external devices with the laptop or computer.

There are two types of computer ports.

1. Internal ports : It is used to connected internal devices like CD drive, Disk drive, other internal devices to the motherboard.
2. External ports : It is used to connect modem, printer, mouse, flash drive with the motherboard.

A few important ports :-

1. Serial port : It is also a communication ports. They are also used for the connection of external devices like mouse, keyboard. Serial cables are cheaper as compared to parallel cables.

There are two version of serial ports.

1. 9-pin serial port
2. 25-pin serial port



2. parallel port : It is used to connect the scanners and printers.

It sends the several bits at the same time.

The transfer of data or speed is higher.

USB

3. USB :

It is used to connect all kind of external devices like keyboard, mouse, printer, scanner.

Serial connection

4. PS/2 port

It is used to connect old computer keyboard and mouse.

In previous computers, the mouse connector ^{was} like this PS/2

5. VGA port

It is video Graphic Array connector.

It is used to connect the monitor to the computer video card.

Serial connector



6. Fire wire port

- ⊙ used to transfer large amount of data at a very high speed.
- ⊙ It is used in the video or camera process.

7. Infrared port

- ⊙ It is a wireless communication interface that is used to send and receive infrared signal to the other devices.

8. Modem port

- ⊙ It is used to connect computer modem to the telephone network.

9. Digital video Interface (DVI) port

- ⊙ It is used to connect LCD monitor to the computer video graphics card.

10. Ethernet port

- ⊙ It is used to connect users with LAN (Local Area Network) and provide high-speed internet.
- ⊙ connects by using a network cable to a computer.



Electrical cable

The cable that is used for the ^{transmission} transformation and distribution of electrical power is known as the electrical power cable. It is used for the transmission of high voltages in places where overhead lines are impractical to use.

The power cable is made of three main components, namely, conductor, dielectric and sheath. The conducting path for the current in the cable is provided by the conductor. The insulation of dielectric withstands the service voltage and isolates the live conductor with other objects. The sheath does not allow the moisture to enter and protects the cables from all external influences like chemical or electrochemical attacks and fire.

Cables are classified into 5 types depending upon their purpose as follows:

- Ribbon electric cables

It consists of multiple insulated wires running parallel with one another and is used for transmission of multiple data simultaneously.



For example, this is used to connect the CPU with the motherboard and is generally used for the interconnection of networking devices.

Ribbon Cable

- Ribbon cables, essential in many electronics, offer efficient and reliable connections between components.
- They have a flat design, originating from the 1950s, ideal for compact spaces and reducing signal interference.
- used widely in computers, telecoms, automotive and medical devices, selecting the right ribbon cable requires considering conductor number, wire gauge, insulation type, and connector compatibility.
- proper handling and maintenance ensure their longevity and optimal performance.

Shielded cables

It consists of 1 or 2 insulated wires which are covered by a woven braided shield or aluminium Mylar foil for better signal transmission and removing irregularities in the frequency of power and external interference in radio. These cables transmit high voltage electric current and are protected by a shield.



- Twisted pair cables

It has two or more insulated copper wires which are twisted with each other and are colour-coded. These types of wires are usually used in telephone cables and the resistance to external interference can be measured by the number of wires.

- coaxial cables

This consists of solid copper or steel conductor plated with copper which is enclosed in the metallic braid and metallic tape. This is entirely covered with an insulated protective outer jacket. These types of cables are used for ~~temp~~ computer networking and audio-video networking.

- Fibre optics cable

There are these types of cables which transport optical data signals from an attached light source to the receiving device. we are pretty much aware of what is optical fibre and its uses in a wide variety of applications.



HDMI and USB

HDMI and USB are two popular interfaces used for connecting devices and peripherals with computers and other electronic devices.

The fundamental difference between HDMI and USB is that USB (Universal Serial BUS) is an interface designed for data transfer, while HDMI (High-Definition Multimedia Interface) is designed for transferring high-quality audio and video signals.

Parameter	HDMI	USB
Full form	HDMI is an acronym for High-Definition Multimedia Interface.	USB is an acronym for Universal Serial Bus.
Main objective	HDMI is mainly designed for transferring high-quality audio and video signals.	USB is mainly designed to transfer data between a computer and peripheral devices.
Speed	HDMI transfers signals at a <u>faster speed</u> than USB.	USB transfers data at a <u>slower speed</u> .
Resolution	HDMI supports <u>higher resolutions</u> .	USB supports <u>lower audio and video resolutions</u> than HDMI.



Parameter	HDMI	USB
compatibility	HDMI is primarily compatible with display devices like <u>TVs, monitors</u>	USB is compatible with a wide range of devices
Maximum data transfer speed	HDMI 2.1 provides a maximum data transfer speed of 48 GB/s.	USB 3.2 Gen 2x2 provides a maximum data transfer speed of 20 GB/s
cost	HDMI is more more costly than USB	USB is relatively less expensive
connector	HDMI connector has a large rectangular shape and specialized design	USB connector smaller size and less specialized design
power	HDMI can provide power to connected devices	USB can provide power to connected devices
Bandwidth	HDMI support wider bandwidth	USB supports lower bandwidth than HDMI
Types	HDMI is of several types like standard HDMI, mini HDMI and micro HDMI	USB also has several types such as Type-A, Type-B, Type-C USB

Parameter	HDMI	USB
Data encryption	HDMI supports HDCP (High-Bandwidth Digital Content Protection) protocol for data encryption.	USB does not support any encryption protocol.

~~Ques~~

what do you mean by motherboard

Motherboard is a device or a circuit board inside general purpose computing system, including personal computer, smart television, monitors which support the communication between different electrical components. Such as CPU, Memory.

It is made up of fiber glass or copper. It distribute the electricity and communicate ~~It~~ between the CPU and RAM and other computer components.

They are characterized using a form factor ATX (Advance Technology Extended) being the most common among all industry.

The types of mother board:

1. ATX

It is a motherboard created by Intel company in 1990. It is more compact and enabled the associated components to be interchanged together. It uses advanced technology.

2. Extended ATX (EATX)

This form of the motherboard, consist of $344 \times 330 \text{ mm}$. It is used in web station and station. Multiple PC or computer joined together.

★ It is used in AI technology, server management, 3D models

3. Micro ATX

General purpose computing.

very few joined together (1 or 2)

They are used in home or office computers.

4. Mini ATX

They are more compact, reduce the power consumption and quicker cooling capabilities.

low level of fan noise.

★ It is used in home theatre, because it is all rounder and enhance the overall performance of the system.

5. Mini ITS (Information Technology) extended)

It is developed in 2000.

It reduces the power consumption and basically used in computer with

It can also be a all rounder, more costly, enhances the computer system.

eg. used in movie theatre, 3D modeling, IOT, etc.

SMPS

It is a switch mode power supply. Sometimes referred as Switcher, Switched power supply. This power supply converts the electrical power while transferring the power from AC to DC.

SMPS is a electronic device that converts the electrical power into DC output. They are used in many applications.

(1) computers

SMPS are used in computers to provide a stable and consistence voltage for the safe and efficient operation of the devices connected.

(2) Industrial appieation

They are used in security systems, machine tools, digital devices, aviation and marine and process and control automation systems.

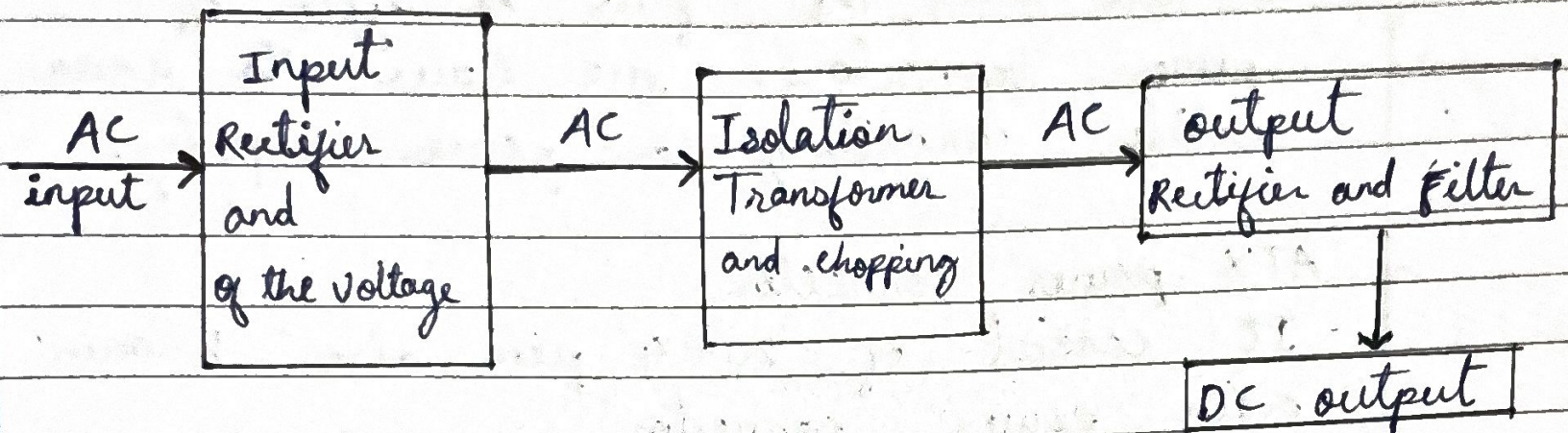
(3) pocket calculator

The design SMPS are used for the pocket calculators.

* There are various advantages of using SMPS as they are at a high frequency, which reduces energy lose and heat generation

* SMPS are small and lighter.

The working principle of SMPS



How the SMPS work on a computer device?

First of all, SMPS converts the AC voltage into the DC voltage using a rectifier and a filter. After that, the alternation current breaks ~~into~~ down into the DC voltage to create a series of high frequency ~~put~~ square-wave pulses (using chopper). The SMPS increase or ~~decr~~ decrease the voltage to maintain the constant output even if the load ~~chap~~ changes after that based upon the connected devices it gives the DC output.

#NOTE

The rectifier convert AC to DC having very few steps, while SMPS also convert AC to DC or vice versa have more complicated steps as compared to rectifier to produce high frequency DC voltage.

Connectors

power supply connectors :-

~~The~~ There are the five types of power connectors. we have to know while connecting a power supply.

ATX power connector

It consist of 20+4 pin, also known main power connector

ATX 12 Volt power connector

It is a 4+4 pin, also known as CPU power connector, P4 power connector.

It connects to the motherboard.

For most of the computer we need to connect single 4 pin connector

SATA power connector

It called as serial ATA power connector cable they are connect to the hard drives or SATA optical drives

Molex

It is a 4 pin connector connector, also called as device connector. It is used to connect to the computer fans; sometimes hard drive.

PCI

It is a 6 Pin also called as PCIe / PCIE connector. It is used to the graphics card. Graphics card require power supply, power consumption so this connector will help us.

color coding

It is also called as color systems, consistently associate the colors with the particular levels of Hazards

For e.g., The red signs symbolize the highest level of danger, orange symbolize ~~the~~ warning, yellow symbolize caution, Green symbolize safety or first-aid, Blue symbolize the safety information provided to the user.

The color coding basically means to identify which system are danger or not.

* The Red color are the identification of

1. Fire protection equipment & apparatus
2. Fire extinguishers
3. Fire pumps
4. Emergency Buttons and exit
5. other containers which contain concentrated liquids or flammable liquids

* The orange color are the identification of the dangerous parts of the machine of energized equipment.

* yellow are use for marking physical hazards such as

- such as falling from the cliff
- striking against any wild animals.

* Green or white used for the first aid equipment

* Blue are used for the movement of devices under repair.

* Blue are used for the

* Black or yellow

They are used for the radiation, X-Ray, Gamma Ray,
Beta-Ray

Standard output voltage of a computer power supply

There are several output voltages for specific purposes within the system

Standard voltage

3.3 Volts: They are used for the digital circuits like memory and internal components

5.5 Volts

This voltage are used for the older CPU and now they are used for the motherboard, USB ports and other devices connected.

12 Volts

They are given for the processor, graphics card, hard drive and a fan

Additional voltage supply

5 volt additional

They are given for the ~~lower~~ low power as a additional to the computer LAN system even if the computer is OFF.

Mainly the output voltage are the conversion of AC to DC (~~105V~~ to 230 V) based upon your region using a SMPS.

The DC voltage is regulated to the different levels of each output using transformer and voltage regulators. This ensures stable and consistent power supply to each component. After that each output the voltage distribution starts based upon the requirement.

Computer

Q. which device supply power to the various system components of the computer?

→ It consist of two answers:

1. SMPS

→ It's main work is to provide the DC voltage to all the power supply system component, fan

2. The PSU

→ The PSU (power supply unit), it is the component that provides the power to the internal components such as register including the motherboard.

The motherboard signal the PSU to turn ON and OFF when the devices needs connection (all the hard drives and additional devices).

Computer Supported measurement technique.

The computer are mainly used to communicate with the other user as well as the internal communication. There are many ways to implement ~~this~~ ~~com~~ the communication, it can be done with the serial ports or a USB ports using low level programming language whereas for the user like us we generally use high level language to communicate with the devices.

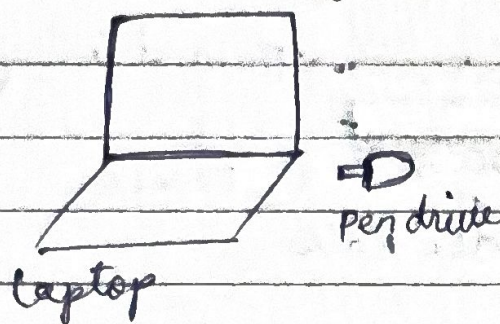
These languages can also used to manipulate the data and display it. Some of the measurements with which the computer uses is VISA (Virtual instrument software architecture - they are mainly used to recognize the which devices are connected to the computer and communicate with them). programs which understand the VISA are connected to the computer and also communicate by sending the text strings to the devices. There is also one common format which is ~~SCPI~~ SCPI.

(Standard commands for programmable instruments)
→ It defines as syntax to control the devices.

~~SCPI~~
→ It defines as syntax to control the devices.

Nowadays microprocessor are often used for to upload the program into the computer system.

SCPI $\rightarrow$ It is also API which either in high/low level language to control the devices connected.



VISA $\rightarrow$ It's a API (application programming interface) which help us to recognise which device (pen drive) get connected.

Microprocessor (inside the CPU)



low level language

load a

load b

add a, b

store c

exit

High level language

$a + b = c$

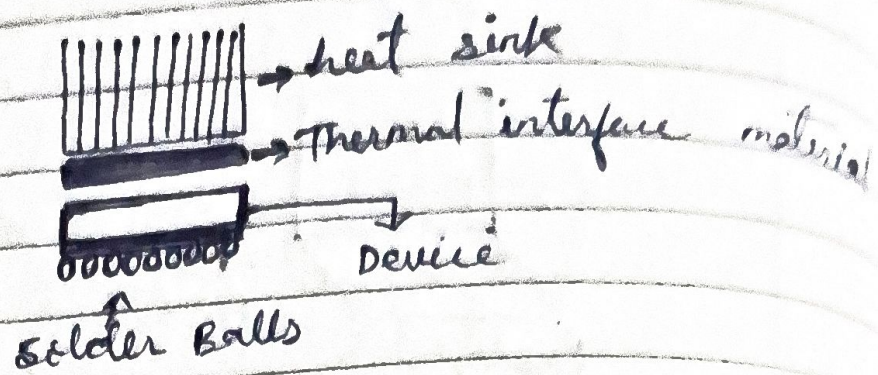
$a = 2$

$b = 3$

$c = 5$

Heat sink

It looks like this



A heat sink is used in electronic devices, to dissipate the heat and prevent overheating. It is made up of a metal such as aluminium or copper. It absorbs and transfer the heat from the CPU or other heat generating components. Basically by increasing the surface area available for the heat transfer to ~~en~~ increase the flow of air and cool down the surface.

The device transfer the heat to the heat sink by conduction. The heat transfer from the heat sink is done by the process convection or sometime radiation

(i) Natural convection through heat sink

↳ when the heat is upto the level so that the device/CPU can take it, so → no worries

(ii) Forced convection through heat sink → when the movement of the heat is done by either fan or blower.

electric components $\xrightarrow{\text{generate}}$ heat due to the flow of electricity $\xrightarrow{\text{overheating occurs}}$

Thus the heat sink works by absorbing the heat &

Surface area of heat sink $\uparrow$

heat passes quickly $\uparrow$

Time & efficiency $\uparrow$

*

Wattage Rating

The rating which is given to the device which specify the maximum power which the device can safely handle.

what should you look for ~~the~~ when choosing a power supply (PSU)?

1. The first thing which we notice is voltage, identify the voltage requirement your PSU will need to connect with the components. Find and input and output voltage depending upon the computer.

It must be a specified range upto 230 Volt.

2. Wattage: The wattage the simply means how much ~~the~~ a power supply a computer can handle with the heat generation and overheating and sometimes shutdown.

3. Location and Space :-

(i) The computer system need ~~on~~ the protection from the dust, moisture, extreme temperature, harmful radiation.

(ii) Ventilation & cooling

(iii) power standard

80+ rating system

80+ has to be around since 2004. It is a voluntary certification program so that the industry design more power efficient PSU. A power supply takes the AC voltage convert into the DC voltage in which your PC components use to operate, all the PSU can't convert all the energy or power into the DC voltage, some power can be lost as a heat.

There are 5 tier of power supply rating.

80+ silver

80+ gold

80+ Bronze

80+ platinum

80+ titanium

Benefits of 80+ rating power supply :-

→ Energy saving or electricity

→ less noise, less heat loss

→ Environment friendly

→ you can also upgrade your system if you want

NOTE : PSU must have 80% efficiency in all the components, with the 20%, 50%, as a heat loss or may be the load (that's why it has given 80+)

It is a certification of a PSU having 80% of power to the 20% of heat ratio.

Modular power supply :-

Basically modular power supply is used to provide the or improve the air flow and cooling inside the CPU, cables. It can also be used to make your CPU look neat and clean while accessing the wire.

more flexibility and customization option by letting you choose the type of cable you want.

you can also troubleshoot and maintain the CPU by allowing you to isolate and replace the faulty cables.

Drawbacks :-

- It is more expensive than non-modulator
- Failure may occur.
- potential risk of loose or damage pins.

SMPS failure or common problems from faulty SMPS

→ power is not reaching the computer system some time because of the SMPS failure, or the power supply connection is not connected properly to the motherboard, due to ~~some~~ such reasons SMPS fails.

→ Displays comes to the monitor and then blackout, it can also happen 2-3 times.

It's solution is replace the SMPS, also the motherboard.

→ The PC power ON but the computer monitor isn't working & sometimes it happens, check the VGA cable and the monitor connection. Also check the SMPS connection (voltage fluctuation).

→ The PC freeze or in a hangmode or reboot suddenly

(i) it can happen because of overheating of SMPS

→ There is a whistling / squealing / motor like noise from the SMPS when the PC starts.

(i) Either the SMPS fan has a fault or the full SMPS is at fault.

* Trouble shooting power supply

There are some things you can check when troubleshooting a power supply.

(i) power input :- you have to look into whether the correct power supply is being received by the PC or not.

(ii) power buttons :- check whether any physical damage or any issue related to the powersupply or power button.

(iii) over heating :- A warm power powersupply is normal sometimes, too much heat indicate a problem.

(iv) visual inspection : look for the sign of damage in the CPU or any cable connected to it.

(v) Software trouble : Sometimes not a hardware is at fault, the software is the main problem (operating system is not working properly).

chapter - 03

Electrical quantities

what is the comparison between the voltage and a current?

1. voltage is the difference in electrical potential between the two points (electromotive force)

2. The SI unit is Volt

3. voltage is the cause of the current.

4. $V = \frac{\text{work done}}{\text{charge}}$

5. In a series connection voltage changes that is it get distributed over all the components.

6. In a parallel connection the voltage remain same across all the components.

1. It is the rate of flow of electric charge or we can say the amount of charge flow in a circuit at a particular point.

2. The SI unit is

3. current is the effect of the voltage that is current cannot flow without voltage.

4. $I = \frac{\text{charge}}{\text{Time}}$

5. In a series connection the current remain the same throughout all the components.

6. In a parallel connection current changes that is it get distributed over all the components.

what is resistance?

According to the ohm's law, there is a relation between the current flowing through a conductor and the potential difference across it. It can also be called, to oppose the flow of current, is called as resistance.

$$V = IR,$$

V = potential difference

I = current

R = Resistance

The factor affecting the resistance

$$R = \frac{\rho l}{A},$$

l = length

ρ = Resistivity

A = Area of the cross-sectional Area.

what are active components?

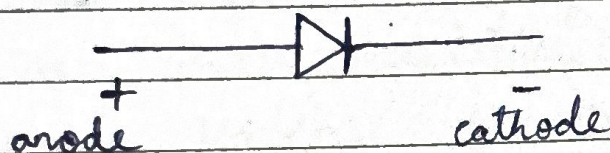
The active components are the semi conductor devices consisting of semi conductor materials. Typical electronic devices such are diodes and transistors. for performing the active operations such as, rectifying, amplifying, and converting supplied current

The active components supply electric power to the circuit or power gain in the circuit.

(Semi conductor) are the substance which have both the properties of conductor & as well as insulators. eg. Silicon, germanium

DIODE

Diode are used to protect the circuit by limiting the voltage and also transform AC to DC. Semiconductors such as germanium and silicon are used to make most of the diode. Even though they transmit the current into single direction, the way with which they transmit differs.



~~cat~~ what is P-N Junction?

A P-N Junction is an interface or a boundary between two semiconductor material types, namely the P-type and the n-type inside a semiconductor.

In a semiconductor, the P-N junction is created by the method of doping. The P-side or the positive side of the semiconductor has an excess of holes, and the n-side or the negative side has an excess of electrons. The process of doping is explained in

There are three biasing conditions for the P-N junction diode, and this is based on the voltage applied?

Zero bias : — No external voltage is applied to the PN junction diode.

Forward bias : The positive terminal of the voltage potential is connected to the P-type while the negative terminal is connected to the n-type.

Reverse bias : The negative terminal of the voltage potential is connected to the P-type and the positive is connected to the n-type.

Forward Bias in P-N junction
When the P-type is connected to the battery's positive terminal and the n-type to the negative terminal, then the P-N junction is said to be forward-biased. When the P-N junction is forward biased, the built-in electric field at the P-N junction and the applied electric field are in positive directions. When both the electric fields add up, the resultant electric field has a magnitude lesser than the built-in electric field. This results in a less resistive and thinner depletion region. The depletion region's resistance becomes negligible when the applied voltage is large. In silicon, at the voltage of 0.6V, the resistance of the depletion region becomes completely negligible, and the current flows across it unimpeded.

Reverse Bias in Pn junction

when the p-type is connected to the battery's negative terminal and the n-type is connected to the positive side, the P-N junction is reversed biased. In this case, the built-in electric field and the applied electric field are in the same direction. when the two fields are added, the resultant electric field is in the same direction as the built-in electric field, creating a more resistive, thicker depletion region. The depletion region becomes more resistive and thicker if the applied voltage becomes larger.

P-N Junction formula

The formula used in the P-N junction depends upon the built-in potential difference created by the electric field is given as

$$E_0 = VT \ln \frac{N_D \cdot N_A}{(n_i)^2}$$

E_0 is the zero bias junction voltage.

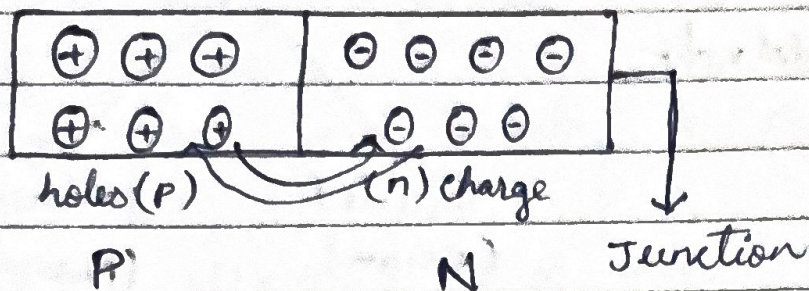
VT is the thermal voltage of 26 mV at room temperature.

N_D and N_A are the impurity concentrations
 n_i is the intrinsic concentration.

How does current flow in the PN junction diode?

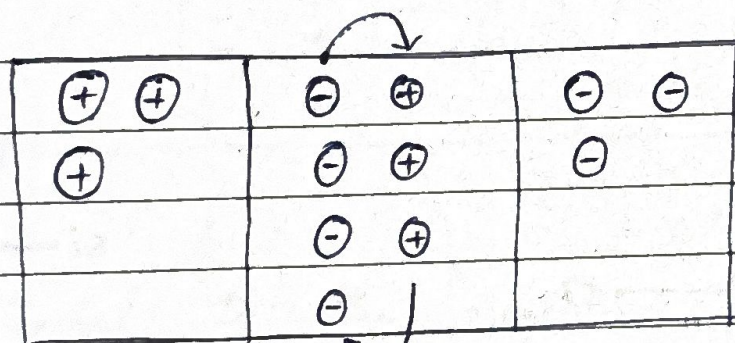
The flow of electrons from the n-side towards the p-side of the junction takes place where there is an increase in the voltage. Similarly, the flow of holes from the p-side towards the n-side of the junction takes place along with the ~~voltage~~ increase in the voltage. This results in the concentration gradient between both sides of the terminals due to the concentration gradient formation, charge carriers will flow from higher - concentration regions to lower - concentration regions. ~~to~~ The movement of charge carriers inside the P-N junction is the reason behind the current flow in the circuit.

P-N Junction diodes

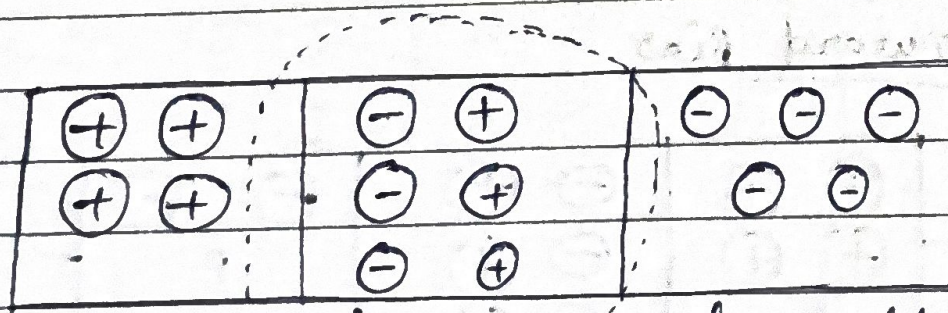


e^- near the junction jump from N. to P Semiconductors and vice versa

Due to e^- movement a space charge Region get created between them.



Space charge
Region



Electric field created due to the movement of the e^- s.

pure semiconductor

impurity added.

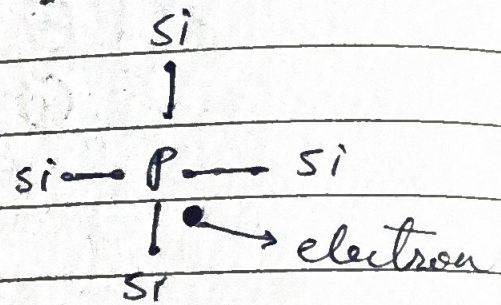
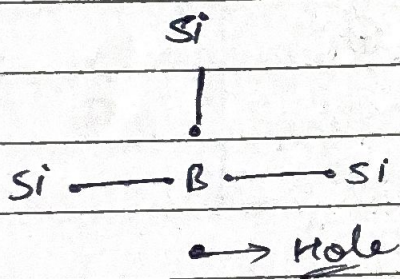
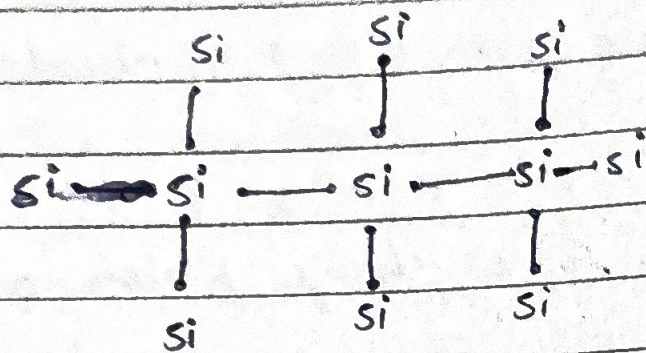
semiconductor used

Trivalent
(Boron)

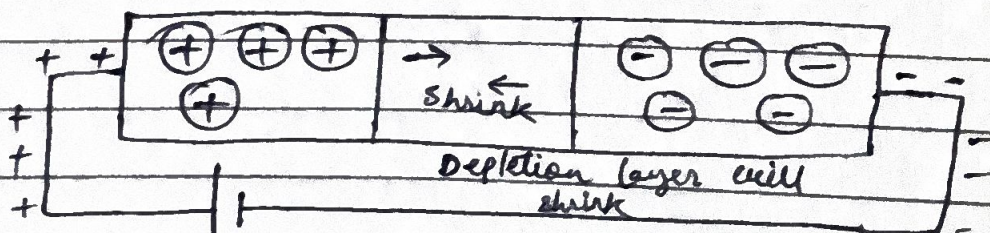
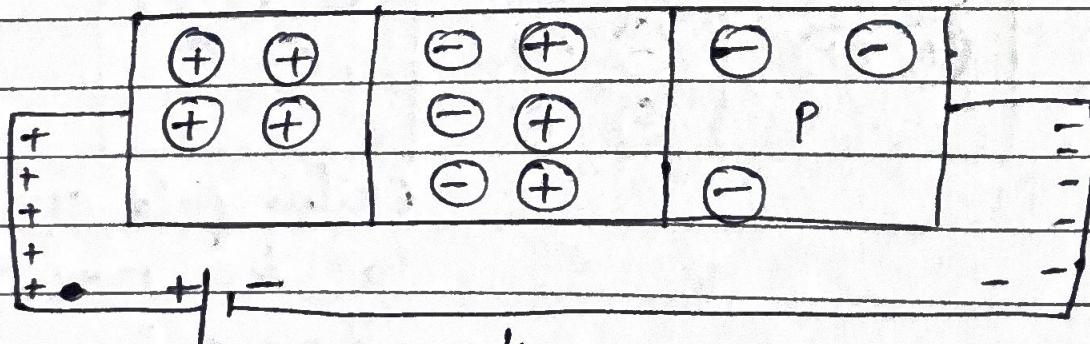
B^{3+}

Pentavalent
(Phosphorus)

P^{5+}



Forward Bias

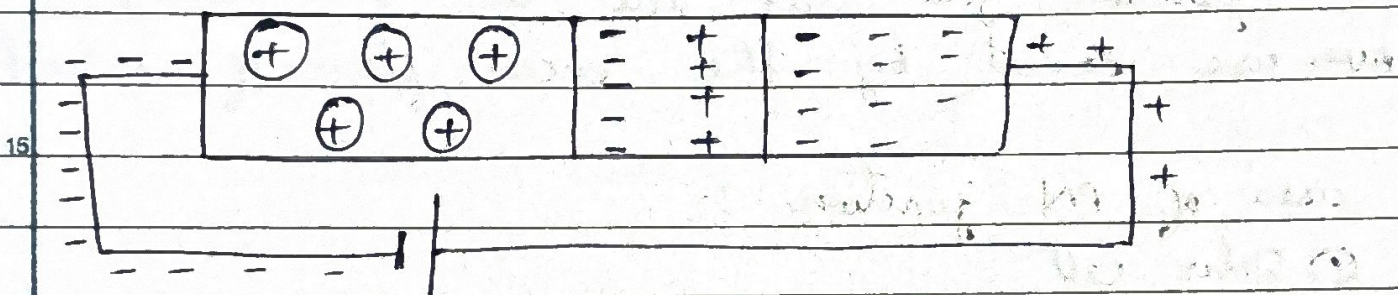


due to repulsion the depletion region will narrow down.

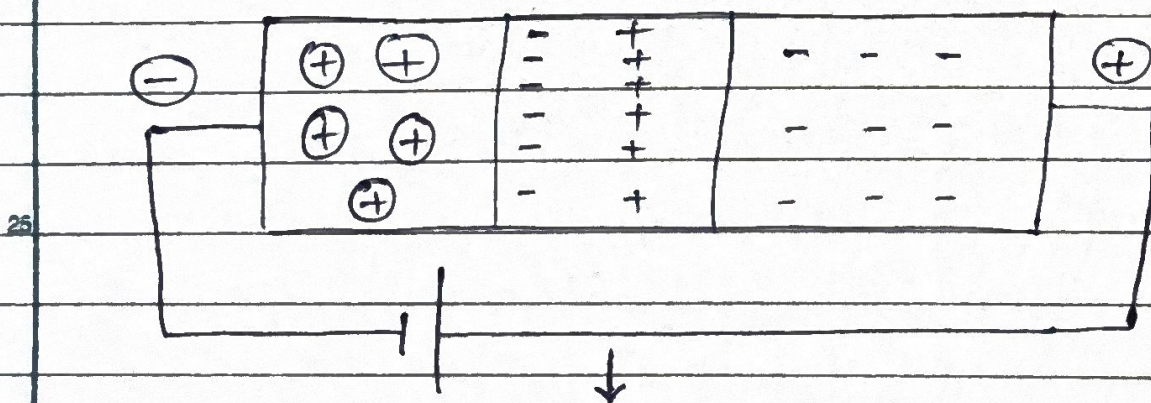
But if the voltage in the forward bias is above the specified range the e^- s in the N region drifts through the junction and migrates to the P region and vice versa.

Now the current flows across the circuit ~~etc~~ called as drift current.

Reverse Bias

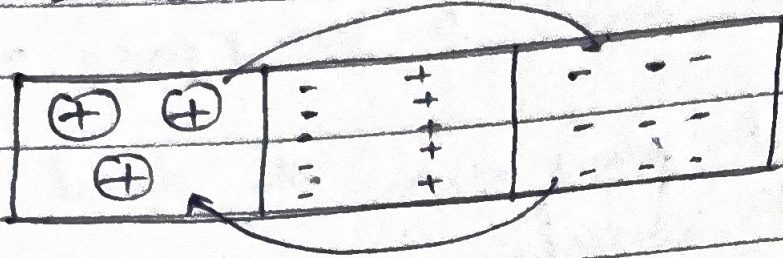


holes get attracted to the negative terminal of the battery and vice versa. This results in increase of the depletion layer.



Now the PN junction acts as an insulator will not allow any current to flow in the circuit, if the battery voltage is above a particular limit (Reverse Bias Breakdown voltage) thus,

~~the~~ e^- s and the holes breakdown through the PN junction and cross resulting in the current to flow through the circuit.
This Breakdown called as Avalanche breakdown



In this process the current flowing through the PN junction is very high and ultimately the PN junction gets died due to overheating and over use caused by the excess flow of current.

uses of PN junction :-

- ① Solar cell
- ② LED (light emitting diode) forward bias