(a) OUTPUT DEVICES

Def: These are devices that display or output work which is processed or stored in the computer to the users.

Examples

- Monitors
- Printers
- Plotters
- Speakers
- projectors
- Actuators
- Facsimile machine
- Multifunction machine

FORMS OF COMPUTER OUTPUT

A computer outputs information in one or more of the following forms: -

- Graphics and images
- Sound
- Characters (text, numbers and symbols)

The computer output devices are of two major types

(i) Hardcopy output devices e.g. printers, Plotters, Facsmille machine

- **Hardcopy** is the tangible output produced on print media like paper (it is in relatively permanent form)

(ii) Softcopy output devices e.g. projectors, speakers

Softcopy is the intangible output displayed on the screen (it is temporarily) e.g. temporary characters, images displayed on a monitor, sound produced by speakers etc

COMPUTER OUTPUT DEVICES

1. MONITORS

These are sometimes called the screen or the VDU; Def: These are the devices used in getting the processed data out of the computer to be displayed to the users.

Their display adapters can be a monochrome display adapter (MDA) Or Colour graphics adapter (CGA)

a) Mono-chrome adapter. This type is capable of displaying only one colour using the white in the back ground

b) standard colour adapter which display several colours.

- ✓ Color graphics adapter (CGA)
- ✓ Enhanced graphics adapter (EGA)
- ✓ VGA (Video Graphics Array) = 640 x 480 pixels
- ✓ SVGA (Super Video Graphics Array) = 800 x 600 pixels
- ✓ XGA (Extended Graphics Array) = 1024 x 768 pixels

Functions of the monitor

* It displays the progress or output of the user's commands and this helps to decide on the next step.
* It makes a computer productive, interactive tool due to its instant visual feedback.
* It makes computing to be a continuous process due to its ability to provide constant visual feedback.

Types of monitors

a) Cathode ray tube monitors (CRT)
b) Liquid Crystal Display (LCD)
c) Plasma screen
d) Touch screen
e) Organic Light Emitting Display (OLED)

a. **CATHODE RAY TUBE MONITORS (CRT)**

This uses a cathode ray tube (CRT) to fire electrons at a coating of very tiny phosphor dots on the inside of the screen which causes the dots to glow.

Advantages

- Can produce fast and rich colour output
- Images can be viewed from a wide angle
- It is cheaper than LCD monitor

Disadvantages

- It emits higher electromagnetic radiations(heat) that cause eye defects
- It consume a lot of power than the LCD

b. LIQUID CRYSTAL DISPLAY (LCD) **Monitor -**

This screen polarizes light by an electromagnetic field applied to a crystal which produces a liquid crystal display

Advantages

- ✓ It consumes less power compared to CRT
- ✓ It emits less radiation

Disadvantages

- ✓ It is more expensive than the CRT
- ✓ Images are viewed from a narrow angel

Screen size
The screen size is measured in diagonal distance left to bottom right or top right to bottom left. The most common size is the 14-**inch** monitor (others include 17, 21, and 28)

Antiglares
These are rectangular glasses which reduce on the intensity of light and the flickering effect of the monitor screens.

Terms

Resolution
It refers to the sharpness and clearness of an image. The higher the resolution, the better the image. Often expressed in dots per inch (dpi)

Dot pitch
Refers to the vertical distance between each pixel on a monitor

Pixel
It is a single point in an electronic image

Refresh rate
This is the speed that the monitor redraws images on the screen, it is measured in hertz

2. PRINTERS

A printer is an output device that prints characters, symbols, and perhaps graphics on physical media like paper, cloth, rubber, plastic etc

The two categories of printers are **Impact** and **non Impact printers**

Impact printers have contact with –print media while non impact printers do not have contact with print media.

(a) Impact printers

Impact printers form characters or images by a print head making direct contact with the print media. They use a **striking mechanism** such as a print **hammer or wheel** against an **inked ribbon**, leaving an image on paper.

An impact printer has mechanisms resembling those of a **typewriter.**

Examples of impact printer s include Dot-matrix printers, Daisy wheel printers, drum printers, chain printers, line printers, Braille printers etc

(i) Dot-Matrix Printers

Is a set of steel pins that strike an inked ribbon onto paper producing a sequence of dots.

Dot-matrix printers print about **40-300 characters per second (cps)** and can print some graphics, although the reproduction **quality is poor**.

(ii) Daisy-Wheel Printer

Like a typewriter but with the preformed letters on the ends of spokes to form a wheel. The letters strike an inked ribbon onto paper.

Advantages of impact printers

I. **They are not very expensive**

II. **They can withstand dusty environments, vibrations and extreme temperatures**

III. They can print through multipart forms, creating several copies of a page at the same time.

IV. Print though several pages e.g. original, duplicate, triplicate

Disadvantages of impact printers

I. **They are slow when printing**

II. **Cannot print graphics**

III. The **print quality is low**

IV. They are **very noisy** because of the striking mechanism

(b) Non impact Printers

Non impact printers form characters and images without direct physical contact between the printing mechanism and the paper.

Examples of non impact printers include laser-Jet printers, ink-jet printers and thermal printers.

(i) Laser-Jet Printer:

A laser printer creates **images with dots**. However, as in a photocopying machine, these **images are created on a drum**, treated with a **magnetically charged ink like toner** (powder), and then transferred from drum to paper.

(ii) **Ink-jet printer:**

Ink-jet printers also form **images with little dots**. **Ink-jet printers spray small, electrically charged droplets of ink** from nozzles through holes in a matrix at high speed onto paper.

Ink-jet printers can **print in colour** and are quieter and much less expensive than a colour laser printer. However, they are slower and print in a somewhat lower **resolution (300-720 dpi)** than laser printers. Some new, expensive ink-jet printers print up **1200 or 1400 dpi**

(iii) PLOTTERS

Plotters are used in the scientific and engineering sectors for drawing building plans, machines and machine parts. Plotters can take A3 and A2 paper and come in different sizes and types. Some of them are as big as a small classroom.

Advantages of non impact printers

I. They are quite while printing
II. They are fast
III. They produce high quality output

Disadvantages of non impact printers

I. They are very expensive
II. They are delicate as they may not withstand dusty environments, extreme temperatures and vibrations
III. They can not print through multipart forms

Common factors to consider while buying a printer

I. Price of cartridge (toner)
II. The cost of the printer
III. Printing speed of the printer
IV. The purpose for which the printer is to be used e.g. printing on multipart forms like result slips
V. Availability of printer drivers
VI. The technical knowledge of the users

(d) ACTUATORS

These are devices that can generate physical movements from signals sent by computers. These signals can be sent through wireless (remote) transmission or through cables.

(f) SYSTEM SPEAKERS

Computers with sound cards are able to translate digital sound into audio signals via speakers.

(g) PROJECTORS

These are display devices that take characters from the computer screen and project them on a larger screen so that the large audience can see them clearly.

The three types of projectors are: -

- Overhead projectors

These use a projection panel to display data. The data to be displayed is printed on transparences (transparent paper) and then placed on the projectors glass

- LCD (Liquid Crystal Display) projectors

These use crystal display technology and they directly attach to the computer. The projectors use their own source of light to display data on the screen

- DLP (Digital Light Processing) projectors

These use tiny mirrors to reflect light. They produce bright colourful images that remain that remain in focus and they can be clearly seen in a well lit room

Advantages of display devices

- Very fast in outputting data
- Out puts data silently
- Needs no extra costs of printing and print media

(C) COMPUTER STORAGE

Computer Storage is the ability of a computer to keep data or information.
The computer stores data in two ways:

- Temporary storage
- permanent storage

Temporary storage

This is the ability of a computer to store data or information for a short time as long as the computer is still on

Permanent storage/ secondary/ backing/ auxilliary

This is the ability of a computer to store data or information on a permanent computer storage medium. This Storage is also known as **backing storage** or **secondary storage**.

Memory

A MEMORY is an inner storage space area in the computer,

1. Primary memory (temporary memory)
2. Secondary memory (Permanent)

(a) PRIMARY MEMORY

Primary storage (also called **main storage, main memory**, or **internal storage**) holds all instructions and data needed for processing temporarily

It consists of:-

- RAM: Random Access Memory
- ROM: Read Only Memory

RANDOM ACCESS MEMORY

Def: This is the memory which holds the software and other input data while the computer is working.

The contents of RAM can be altered, deleted, copied and read.
It is the main working memory of the computer i.e. the higher the RAM the better the personal computer.

CHARACTERISTICS OF RAM

1. It is volatile and therefore loses its contents when the computer is switched off.
2. It is read, copied, wrote, altered and deleted
3. The amount of data it can hold at a given time is highly limited
4. It is expensive compared to ROM.

Physically it is a chip with storage capacities in MBs. E.g. 64, 118, 128, 256, etc

Types of RAM include;

- DRAM Dynamic Random Access Memory
- SRAM Static RAM. It's faster, expensive and offers more space.

Spooling: This involves transferring data from one storage media to another. Without spooling data from input devices would be stored in the primary memory making it overloaded.

READ ONLY MEMORY (ROM)

A computer has a built up set of instructions (non volatile) it has to know what to do when switched on and those instructions are residents on ROM

The instructions in ROM are stored permanently; the computer can read or follow instructions in Rom but cannot change them.

Cannot write and thus called read only. A good example of ROM is POST (Power On Self Test), which initializes the computer when power is turned on.

CHARACTERISTICS OF ROM

1. It is non-volatile, meaning it does not lose contents when power is switched off.
2. The computer cannot write to it therefore programs or contents cannot be changed.
3. It cheaper compared to random access memory.

There are several subsets of ROM, which are:

- ***PROM (for Programmable Read Only Memory).*** This type of memory can be programmed by the user and the programmed data is held permanently once programmed.
- ***EPROM (for Erasable Programmable Read Only Memory).*** Just the same as the PROM but this has an advantage in that it can be erased and reprogrammed and for one to erase it the EPROM must be removed from the computer.
- ***EEPROM (for Electrically Erasable Programmable Read Only Memory).***

The information and be saved and removed as many times as the user wishes

Other Memory Options: -

(1) Virtual Memory:

Storage space in the Hard disk used to expand/supplement RAM. It enables the computer user ran more programs than available RAM can handle.

(2) Cache Memory:

This is a special high speed memory area that the CPU can access quickly. It can be location in the CPU or on the system board/planner. To store frequently used programs

(3) Video Memory (VRAM)

Used to storage display images for the monitor

Its size depends on:-

- How fast images appear
- No of colour available

(4) FLASH MEMORY:

This is a special non–volatile RAM chip inserted into USB port to simulate and supplement the hand-disk.

Memory size

When data are entered into a computer through a device such as a keyboard, they are not in a form that the computer can interpret; computers cannot understand the complex symbols that humans use. Computers recognize only a code composed of 0s and 1s, known as machine language. Machine language suits the computer because electronic components and storage media represent two states: on/off, conducting/ non-conducting, or present/absent.

EXPRESSION OF COMPUTER CAPACITY/DATA CONVERSION/CODING SYSTEM

In a digital computer all characters are represented by either a byte or bytes depending on the coding system used. Bytes are derived from bits (0s and ls) which are combined to represent letters, numbers, or special characters.

Hence computer capacity can be expressed as:

A bit = A single 0 or l = the smallest unit of measurement.
Byte = A group of 8 bits forming characters.
Kilobytes (KB) = 1000 byte = 8000 bits.
Megabytes (MB) = l, 048, 576bytes lm byte
Gigabyte (GB) = l, 073, 74, 824 bytes lb byte
Terabyte (TB) = l, 009, 5ll, 776 byte trillion bytes

Binary coding schemes/ standards:-

- **EBCDIC: Extended Binary Coded Decimal Interchange**.

Code used in mainframe computers.

- **ASCII: America Standard Code for Information Interchange**.

Used in microcomputers

Unicode: A super set of ASII using it byte (l6bits) for each character

CODES FOR LETTERS OF THE ALPHABET

bytes	EBCDIC	ASC11
A 1	ll00 000l	0100 0001
B 2	1100 00l0	0100 0010
C 3	1100 0011	0100 0011
D 4	1100 0100	0100 0100
E 5	1100 0101	0100 0101

CODES FOR NUMERIC FIGURES

CHARACTER	EBCDIC	ASCII
0	1111 0000	0011 0000
1	1111 0001	0011 0001
2	1111 0010	0011 0010
3	1111 0011	0011 0011
4	1111 0100	0011 0100

CONVERSION/CODING/BINARY SYSTEM

Note: A computer has got its own language or codes by which it understands instructions
Two digits of 0s and ls are combined in codes of 8 digits to represent a character i.e. letters, numbers or special drawing like lines, triangles, circles, curves, etc
Hence

One digit (0 or 1) = a bit
8 bits = l byte (B).
2^{10} bits = l024 bits = l Kilo byte (kb)
2^{10} KB = 1024 KBs = l Megabyte (Mb)
2^{10} MB = l020 MB = 1 Gigabyte (GB)
2l0 GB = l024 GB = l Terabyte (TB)

(b) SECONDARY STORAGE DEVICES / MEMORY)

Examples of devices that store information permanently and they are part of secondary memory include:

a) Hard Disks
b) Floppy Disks
c) Magnetic tapes
d) Zip Disk
e) Data Cartridges
f) Compact discs
g) Digital Versatile Discs

Storage media *refers to the electronic equipment that is used to store the data e.g hard disk whereas*

A **storage device** records and retrieves items to and from a storage medium e.g hard disk drive

Secondary storage media are of three types

1. Magnetic (HD,FD,ZD, MT)
2. Solid state (Flash D, MC,CC, SC)
3. Optical devices (DVD,CD, Blu ray discs)

1. Magnetic **Storage**

(A) HARD DISK / HARD DISK DRIVE

It is a magnetic storage device that stores Data and information magnetically on the surface of a flat circular plate that rotates at a very high speed.
The hard disk is the most common form of secondary storage found in the System Unit.
It is usually designated as Drive C and D.
Hard disks differ in size from 20GB, 80GB etc
The hard disk holds the operating system, and other application programs
The hard disk also contains the disk heads which read and write information onto a disk.
They are a type of direct access storage device since each sector containing data can be addressed directly and, because of this, access is extremely fast.

Advantages

- It has more data storage space.
- It offers faster data access

- *Seek time*: Refers to the time it takes the read/write head to locate the correct track.
- *Latency:* Refers to the time it takes the read/write head to locate the correct sector.
- *Access time:* is the summation of seek time and latency.

- Supplements RAM. Facilitate backup.
- Stores data permanently.
- Have a long life span

Disadvantages
- Relatively expensive.
- Relatively heavy.
- Virus prone.
- Can clash leading to information loss.

(B) FLOPPY DISKS (FDD)
It is a magnetic storage device that stores Data and information magnetically on a magnet ribbon
These are the removable part of secondary storage.
They are used with floppy drives and there are two types of floppy disks, the 3.5-inch (holds 1.44MB of data) and the 5.25-inch.
The 3.5-inch is used with drive A and the 5.25-inch is used with Drive B.
A drive is the unit into which the disk is inserted.

Advantages of Floppy Diskettes

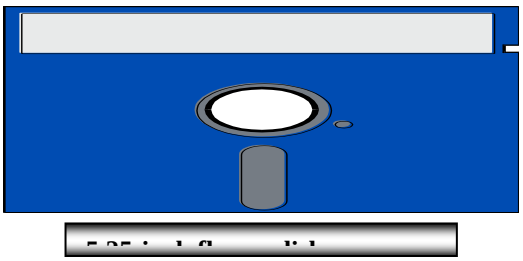
- They are cheaper than Hard disks and CD-ROMs.
- They are portable hence used to transfer data or information from one computer to another.
- They offer direct access and they are faster than magnetic tapes.
- Facilitate data transfer.
- Easily edited and formatted.

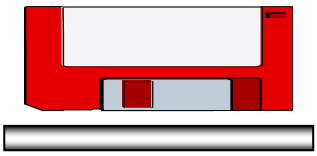
Disadvantages of Floppy Diskettes
- They are difficult and delicate to handle
- They can easily be corrupted
- They have a relatively short life span
- They hold relatively small amounts of data

Care and handling of a floppy diskette
- Don’t put the diskette near any magnetic fields.
- Don’t expose the diskette to direct sunshine or heat.

- Store the diskette in a cool dry dust-free environment.
- Don't spill liquid onto the diskette.
- Don't bend or fold a diskette.
- Don't touch the magnetic surface

Graphical examples of Floppy Diskettes





2. Optical Storage media

An optical storage device is an electro-mechanical unit that can save and retrieve (write and read) information on a special disc medium using a laser light.

Storage	Size	Use
CD	650 Mb -700Mb	Storing general software applications. Copying fairly large files to transfer from home to school.
DVD	4.7 Gb (single) 9.7 Gb (double)	Storing a large computer game or a movie

- **COMPACT disks e.g CD- ROM, CD-R, CD-RW**

These are the common means of distributing software to computers. They look exactly like the musical CD's that are played on your radio. They store large amounts of information up to 650MB in the form of text, sound, still pictures, animation and video clips. A laser beam reads the information. CDs can be found in four different forms, that is the CD-ROMs, CD-Rs, CD-RWs and finally the DVDs

(i) **CD-ROMS**

These letters stand for **C**ompact **D**isc **R**ead **O**nly **M**emory, which means you can only read but can not change anything either by deleting or adding new information. Although it's a storage device it can not be considered to be a backing store since the user can not write onto it. They are used to distribute programs, such as encyclopedias, dictionaries, bibles, multimedia programs, educational programs and games.

Advantages of using a CD – Rom:

I. Much faster to access than a floppy disk

II. Can hold a lot of data.
III. Data not changed
IV. Light and portable

(ii) CD-RRecordable

These are blank CDs that the user can write on, once only, using a CD writer which can be either external or internal.

(iii) CD-RWs

These are re-writable CDs which means the user can read and write many times as if using a hard disk.

DVDs e.g DVD-ROM, DVD+RW, DVD-R, DVD-RAM

Digital Versatile Discs use the same principle as CD-ROMs but store more information. They store information on both sides and they can take up to 17 Gigabytes. DVDS are becoming widely used for distribution of films and video material.

DVD-ROM

A **DVD-ROM (Digital Video Disc-ROM)** is an extremely high capacity compact disc capable of storing from 4.7 GB to 17 GB.

A **DVD-ROM drive** or **DVD player** is required to read a DVD-ROM.

Although the size and shape of a DVD-ROM and a CD-ROM are similar, a DVD-ROM uses one of the following three storage techniques to increase its storage capacity:

I. The first technique involves making the disc denser by packing the pits closer together.
II. A second technique involves using two layers of pits, which doubles the capacity of the disc.
III. Finally, some DVD-ROMs are double-sided, which means that they can be removed and turned over to read the other side.

(i) DVD-RAM

DVD-RAM is the recordable and rewritable versions of DVD-ROM, which allows items to be erased and recorded on it multiple times.

(ii) DVD-R

DVD-R is the recordable versions of DVD-ROM, which can be written once and read (play) for many times.

(iii) DVD+RW

DVD+RW is the recordable and rewritable versions of DVD-ROM, which can be written and read (play) for many times. A **DVD+RW** is similar to a CD-RW, except it has storage capacities up to 4.7 GB.

Advantages of compact disc over hard disk include

A compact disc is more portable than a hard disk.

Advantages of compact disc over floppy disk include

- The storage capacity of a compact disc is very much larger than that of a floppy disk.
- The average access time of a compact disc is faster than that of a floppy disk.

Disadvantages of compact disc include

Some kinds of compact discs are read only (CD-ROM and DVD-ROM).
The average access time of a compact disc is slower than that of a hard disk.

3. Solid state e.g flash disks, memory cards, smart card, credit card etc

Solid state storage (SSS)/ flash memory: is a type of computer storage media that is made from silicon microchips and stores data electronically using electrons that shuttle through the device's circuit

The devices have no moving mechanical parts. This allows the drives to consume less power than traditional magnetic drives and to retrieve data faster.

Memory Stick: The ultimate (and latest) replacement for the floppy disk. High memory capacity on microchip therefore no moving parts and instant access, it plugs directly into the USB port on any computer

Smart Card

Contains a processing microchip to provide it with intelligence as well as memory it is really a tiny computer, e.g. The SIM card used in a mobile phone identifies you through a PIN number, identifies and connects to your service provider and provides a menu of options, as well as storing phone numbers and phone settings.

A smart card, which is similar in size to a credit card or ATM card, stores data on a thin microprocessor embedded in the card.

When the smart card is inserted into a specialized card reader, the information on the smart card is read and, if necessary, updated.

An **intelligent smart card** contains a CPU and has input, process, output and storage capabilities.

Applications of smart cards include

* Storing a prepaid dollar amount (e.g., a prepaid telephone calling card).
* Storing patient records and other health-care information.
* Tracking information of customers and employees.

Data Logger

A remote input/output device, which stores data received from sensors that can then be input into a computer at another time or place. It can be left alone to collect data over a long period of

time and in hostile places, such as on a satellite, at the bottom of the ocean or at the South Pole.

Microchip

There are many chips inside a computer, some perform all the processing tasks (e.g. the Intel Pentium CPU), and some are used for the storage of data as internal memory. They have the fastest access of all storage media. Because of this, all files read from the hard disk into memory are also copied into a separate memory "**cache**" and the next time you attempt to load them from the hard disk, the computer will look in the cache first. There are two types of internal memory:

Major difference between primary and secondary memory

PRIMARY	**SECONDARY**
Data can be processed directly from storage Located on the mother board	Data cannot be processed directly but must be moved into main memory Located outside the mother board
More expensive	Less expensive
Lower storage capacity Faster access time Volatile	Higher storage capacity Slow access time Non volatile

PROCESSING DEVICES

THE SYSTEM UNIT

This is a metallic / plastic casing housing the electronic components of the computer. It contains the following components.

(i) Power supply unit: Picks Ac power from the mains converts it to DC power to run the computer.

(ii) Floppy disk drive
(iii) CD – ROM drives.
(iv) Hard/ local disk.
(v) System Power Switch.
(vi) Central Processing Unit The CPU is the brain of the computer
(vii) System Speakers.
(viii) System Board/mother board/or main system board. It is the main circuit board which houses the CPU, primary memory and expansion slots. The System Board determines the computer system

System Board in Details

- CPU Socket.
- RAM Memory sockets
- ROM Bios containing POST program, Bootstrap Loader, System board drivers, system setup program called CMOS setup. This can also determine and control how first operations can take place in the Pc.
- Integrated Disk Electronic (IDE) Connectors
- USB Ports/PCI Slots
- Jumpers
- **N**etwork Adopter Card and NIC slots
- Video Adaptor Cards/VGA Cards
- Sound cards
- media/modulation cards

- Buses: These are electrical channels that allow the various devices inside and attached to the system unit to communicate. Buses transfer data between the different components in the computer system. Data is transported and processed in series of electronic bits.

There are two types of buses I.e. **Expansion** buses which allows the CPU to communicate with the Peripheral devices, and the **System buses** that connects the CPU to Memory

The two parts of buses are **Data buses** which transfer the actual data, and the **Address buses** that transfer the information about where the data should go in memory

- Expansion slots: These are sockets on the mother board into which expansion cards are plugged. The card that is plugged into the expansion slot to add capability to the computer are referred to as adapter cars or interface cards. Examples include Video cards, network interface cards (NIC), sound cards,
- Ports. These are sockets outside the system unit that connect to the expansion board on the inside of the system unit. They are also the interface or point of attachment to the system unit. The connectors are usually used to connect external devices to the system unit via ports. The different types of ports include serial port, parallel port, USB (universal Serial Bus) port,

SCSI (Small Computer System Interface) port, MIDI (musical Instrument Digital Interface) port, IrDA (Infrared Data Association)port, 1394 port, Games port

- Serial port: Transmits only one bit of data at a time. They are usually used to connect devices tat do not require fast data transmission. E.g. key boards' mouse or modem Serial ports conform to either RS-232 or RS-422 standard which specifies the number of pins used on the port connector. Connectors used are male 25 pin connector or male 9 pin connector
- Parallel port: Capable of transmitting more than one bit of data at a time. Many printers connect to the system u nit using parallel ports that can transmit 8 bits of data simultaneously through 8 separate line4s in a single cable with a 25 pin female connector.
- USB (universal Serial Bus) port: The port can connect 127 different peripheral devices chained to one general purpose port USB port supports ***hot plugging*** (ability to add and remove devices while the computer is running), and ***plug and play*** (computers capability of recognizing any new device and assisting in its installation by loading the necessary drivers automatically and checking for conflicts with other devices). Examples of devices that can connect using USB port include mouse, keyboard, printer, projector, modem, digital camera, scanner etc
- SCSI (Small Computer System Interface) port: This is a special high speed parallel port that can transmit up to 32 bits of data at a time and they are used to connect devices like printers and dick drives.
- MIDI (musical Instrument Digital Interface) port: It is designed to connect the system unit to the musical instrument like the electronic keyboard, guitar etc. A system unit with a MIDI port has the capability of recording sounds that have been created by the synthesizer and processing the sounds to create new sounds.
- IrDA (Infrared Data Association) port: Allows wireless devices to transmit data via Infrared light waves. Examples include mouse, keyboard
- 1394 port, Games port: connects multiple types of devices that require faster data transmission

(d)PROCESSING HARDWARE

This is composed of the **Central Processing Unit** (CPU).
This is the area which is responsible for the control and execution of all the computer operations. For instance, it accesses data from memory, carries out intended operations and stores the result into memory again.
The CPU is the brain of the computer.
Physically the CPU is identified as a micro processor **chip** or multi processor **chip.** It is made up of a numbered of circuits and buses and compacted as a chip.

The CPU is composed of three main parts i.e.

1. **Arithmetic Logic Unit (ALU)**
2. **The control unit (CU)**
3. **Registers/Accumulators**

4. System clock
buses

1. Arithmetic Logic Unit (ALU) i.e. works on data to be subjected to mathematical operations/calculations and logic.

-Arithmetic operations involves fundamental math operations of -, +,*, /, etc.
-Logical Operations involve comparison of phenomena e.g. passed/failed, yes or no, present or absent,
-comparison operations involves =, >,>=, <=, < > , etc.

2. Control Unit (CU)

The CU performs the following functions;

- Fetches and sends commands to system devices and Peripherals
- Interprets commands i.e. it's is the intermediary between the user and the computer
- Controls and times all tasks by the CPU (typical of Multi-tasking where processor time is shared amongst competing tasks)
- Directs the movements of electronics signals between the CPU, input, memory and output devises. Hence the CPU acting as a data traffic warden

3. Registers: Are additional high speed storage locations in the CPU which hold data and instructions temporarily during processing. Examples of register include the

- program counter
- instruction register
- status register

4. The system clock: It controls how fast the operations in the computer take place. It is measured in Megahertz

Examples of processor on the market include;

- Intel 8085, 8085
- Intel Pentium I, II, III, and IV
- Intel Celeron – Single layer, Heats up very fast, and they are cheaper if compared to double layer processor chips.
- Pentium Dual-Core
- Cyrix
- Motorola 68040, 68030
- Motorola G3 and G4. They are relatively expensive and can work for months and months without heating up. They are usually used in servers systems

COMPUTER HARDWARE PROBLEMS

1) Excessively low/high temperature causing: - Circuit/bus cracks, Connection breaks, and Chip crapes small movement\dislocation.

2) Effects of dust:-Dust builds thick coatings in slots, ports, internal chips, etc. Dust coating can cause unnecessary heat, data and electric insulation.
3) Effects of corrosion: Hardware comes into contact with atmospheric chemicals, food, human body, water etc causing rust.
4) Magnetic Field: - They cause magnetic inductions, which disturb computer data movements and processing.
5) Electrical Noise. This can be in form of; Electronic static discharge causing short circuits, Electromagnetic interference, or Electro magnetic redactions traveling in space
6) Electrical power Variations .This causes the following, Blackouts, Power transit i.e. excessive low voltage, Blown out. Lowered power from the mains