5. Hard / Floppy / CD/DVD drives

These drives are placed inside the system unit on a mounting bracket.

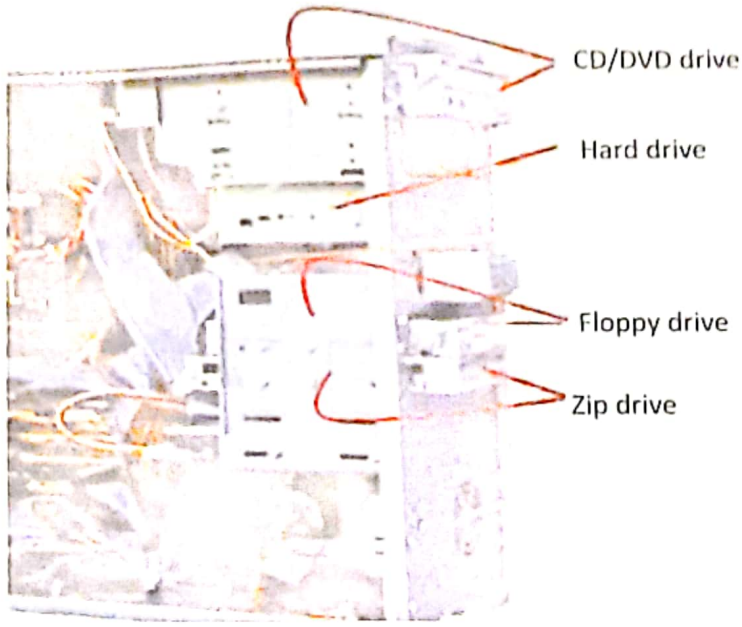

Figure 1.9

6. Central processing unit (CPU)

This is also called the processor. It manages most of the computer's operations. The CPU is considered the **brain of the computer.**

The CPU is directly mounted on the motherboard and covered by a heatsink. You have to remove the heatsink in order to see the CPU.

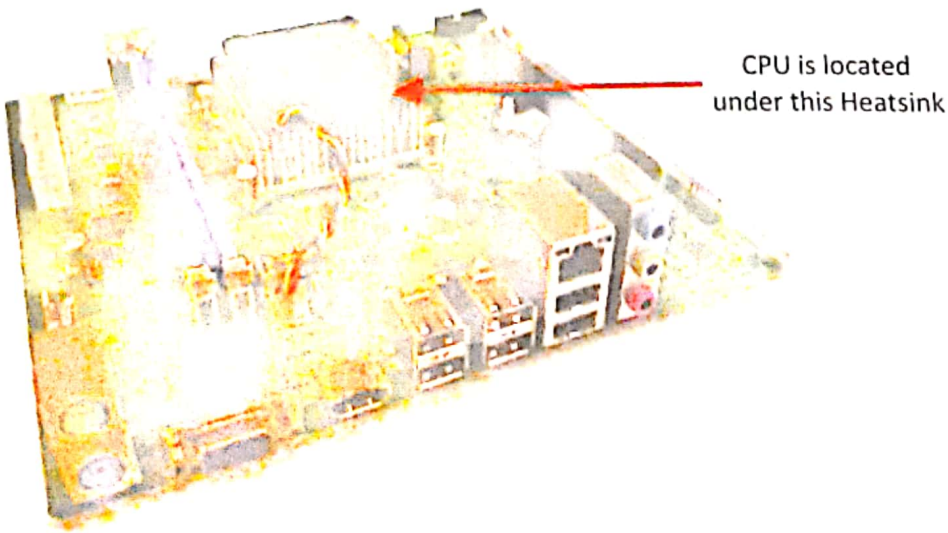

Figure 1.10

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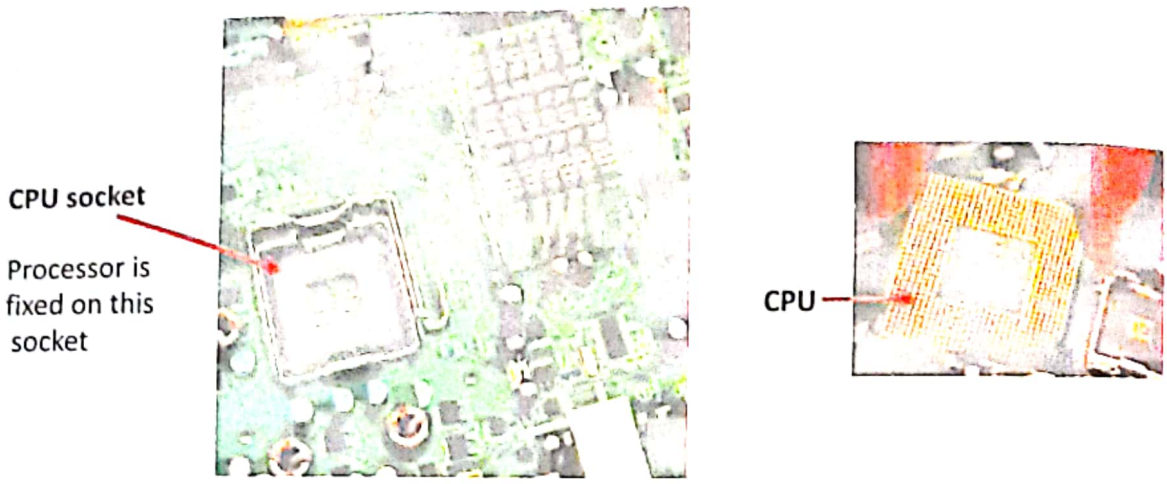

Figure 1.11

CPU consists of two parts,

1. Control Unit
2. Arithmetic and Logic Unit

Control Unit

The Control unit controls the operations of all parts of the computer but does not process data.

- Controls the transfer of data and instructions among other devices of the computer.
- Coordinates all the parts of the computer.
- Fetches instructions from the memory, interprets them.
- Controls Input/output devices in order to transfer data and results.

Arithmetic & Logic Unit (ALU)

Actual processing is done by the ALU.

- Performs arithmetic operations like addition, subtraction, multiplication, division and all complex mathematical operations.
- Performs logical operations such as comparing, selecting and matching data.

7. Heat sink

Figure 1.12

The CPU generates lot of heat. Therefore, it needs to be cooled constantly. A cooling device called the **"Heat sink"** is used for this task. It protects the CPU from over-heating.

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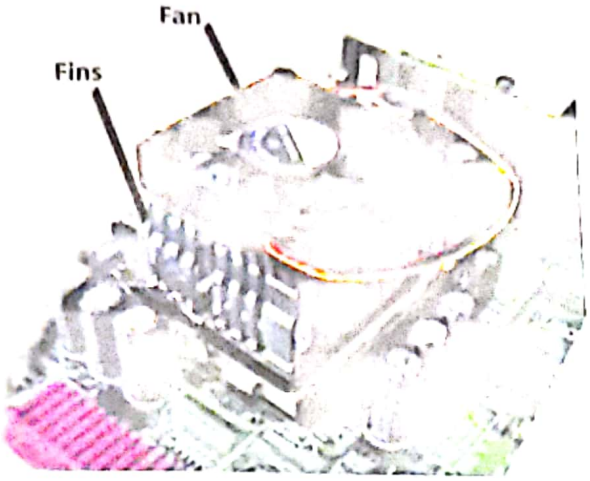

Figure 1.13

The Heat sink is made out of materials which are good thermal conductors. Heat is absorbed from and carried away from the processor into **'fins'.** Fins increase the surface area for the heat to scatter and when air flow through fins, they get cooled thus cooling the processor. The fan circulates cool air through fins speeding up the cooling process.

8. Memory

Memory is a storage place for data, instructions and information. There are two types of memory.

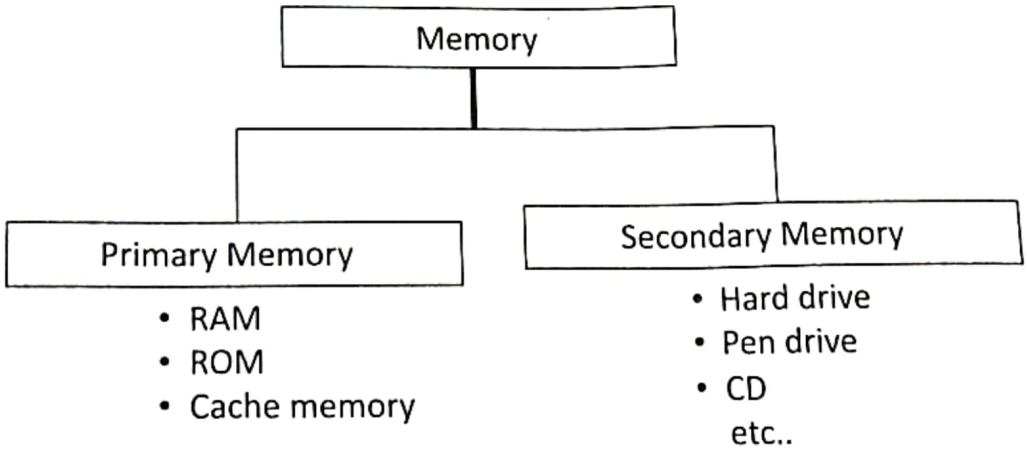

Figure 1.14

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Primary Memory

1. RAM (Random Access Memory)

Figure 1.15

The RAM is the only storage unit which can be easily accessed by the CPU. Therefore, data, informatio and application programs need to be loaded on to RAM to be accessed by the processor.

The RAM is volatile, which means it is a temporary memory that loses its content when not powerec Therefore, data (instructions, results generated by processing, programs or applications, etc...) cannc be permanently stored in the RAM.

2. Cache Memory

Cache memory is a type of RAM that acts as a buffer between RAM and the CPU. It holds frequently requested data and instructions so that they are immediately available to the CPU when needed. This reduces the time taken to access data from the memory thus improving the processing time. Cache memory is located very close to or embedded in the CPU.

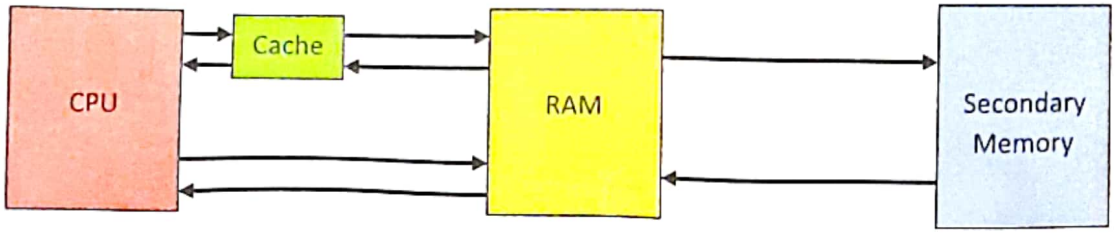

Figure 1.16

3. ROM (Read-Only Memory)

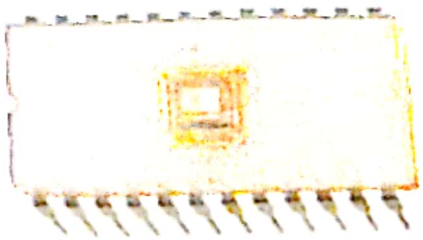

Figure 1.17

This is a non-volatile memory, which means it is a permanent memory. Information is storec permanently in ROM during the manufacture.

ROM stores instructions that are required to start a computer (boot firmware). On a PC, the boo firmware is called the **BIOS** (Basic Input Output System). BIOS tells the computer what to do when it start up, e.g., running hardware diagnostics and loading the operating system.

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Secondary Memory

Storage devices such as the hard drive are considered the secondary memory of a computer. These devices can store data permanently and have high capacities. Processor cannot directly access data from these devices. Secondary memory is mainly utilised to keep data stored for later use.

Exercise U1.1

1. Write down three components of the system unit that were new to you until today.
2. Write two facts that you have learned in this lesson.
3. Write one question that you think you need to ask your teacher or discuss in the class (it should be relevant to this lesson).

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Measuring Data

Data too need to be measured using a standard measuring unit just like we measure length with centimeters and meters or weight with grams and kilograms.

'**Bit**' is the smallest measuring unit of data. One bit can contain one binary digit; either 1 or 0. A collection of 8 bits is called a '**Byte**'. Byte is considered the standard basic unit of measuring data.

The following table shows the list of standard units used in measuring data.

Table 2.1

Value	Unit
One binary digit	Bit (b)
8b	1 Byte (B)
1024B	1 Kilobyte (KB)
1024KB	1 Megabyte (MB)
1024MB	1 Gigabyte (GB)
1024GB	1 Terabyte (TB)

Secondary Storage

We have discussed in the previous lesson that RAM is a temporary memory and therefore it cannot keep data stored permanently.

However there are other devices such as the hard drive, CD, DVD, pen drive which are capable of permanent storage. They are called 'secondary storage devices'.

Secondary storage devices can be grouped into 3 main categories.

1. Magnetic storage
2. Optical storage
3. Solid state storage

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Magnetic Storage

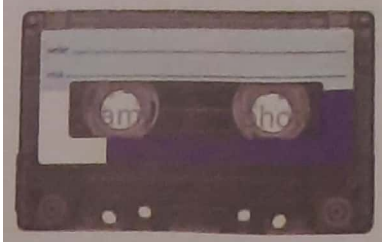
Magnetic storage devices use magnetism to store and retrieve data. Surfaces of these devices are coated with a ferromagnetic substance which contains millions of tiny iron particles. These Iron particles can be magnetised using an electromagnet. The electro magnet which is used for this purpose is called the '**Read / write head**'.

There are two types of magnetic storage devices.

1. Magnetic tape
2. Magnetic disk

1. Magnetic Tape

Have you seen audio and video cassettes used to record music or movies few decades ago? They are magnetic tapes.



An Audio cassette

Figure 2.1

A video cassette

Figure 2.2

The Tape

Figure 2.3

Figure 2.4

Michael Jackson released his 7th studio album BAD in 1987 in the form of audio and video cassettes.

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A special machine called the 'cassette recorder' is needed to play or record into audio and video tapes.

Computers also use magnetic tapes to store data. The magnetic tape where data is stored uses a somewhat similar technology as audio/video tape.

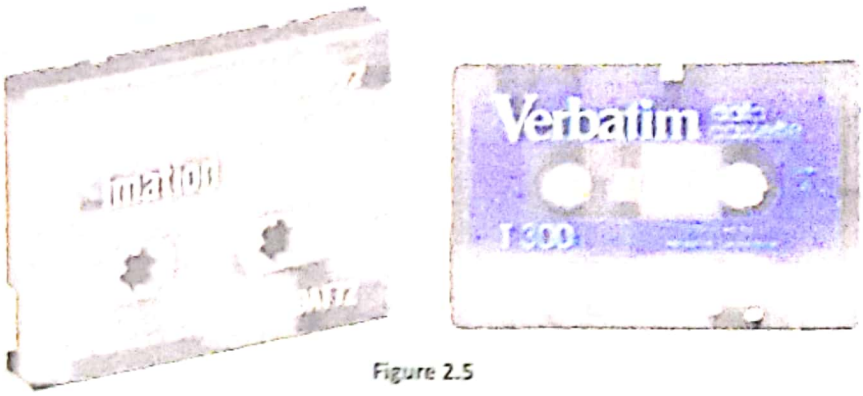

Figure 2.5

Magnetic tape is a long, thin, plastic film where both sides are coated with a ferromagnetic substance. A special machine called the '**magnetic tape drive**' is needed to save data into or retrieve data from the tape.

When storing data on the tape, the 'read/write head' creates a series of magnetic polarities on the tape which represent data. When reading data from the tape, the read/write head senses those magnetic polarities and converts them back to data.

Magnetic tape is a '**Sequential Access**' device. Which means the tape needs to be played back or forth until the desired data is found.

e.g: To find '**Data 4**', the tape needs to be played forward or rewound.

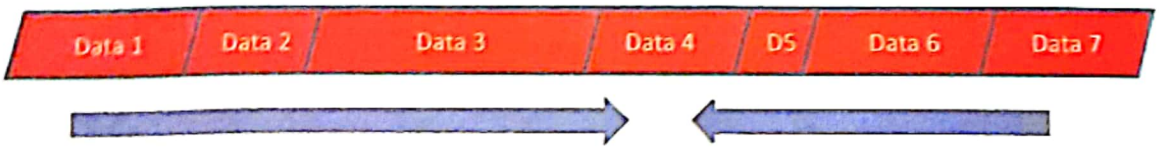

Figure 2.6

This method of 'sequential access' makes the magnetic tape rather slow. Therefore, magnetic tapes are too slow for day-to-day use of modern PCs which contain high speed processors. However, magnetic tape has a large storage capacity thus are still in use for data backup and archival purposes.

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2. Magnetic Disks

A magnetic disk is a circular-shape plate made out of metal or plastic. Both top and bottom surfaces of the disk are coated with a ferromagnetic substance. Disks too use magnetism to store data.

A magnetic disk needs a machine to make it work. This machine is called the '**drive**'. The drive contains read/write heads and other necessary equipments. Inside the drive, the disk is spun at a very high speed while the read/write head reads from or writes to the disk. Data stored on disks are arranged along a series of circular tracks.

Magnetic disks don't need to be played in a sequence to find data. Instead, they can access data directly from the location it is stored. This is called '**Random access / Direct access**' method. Random access makes these devices very fast.

There are several types of magnetic disks.

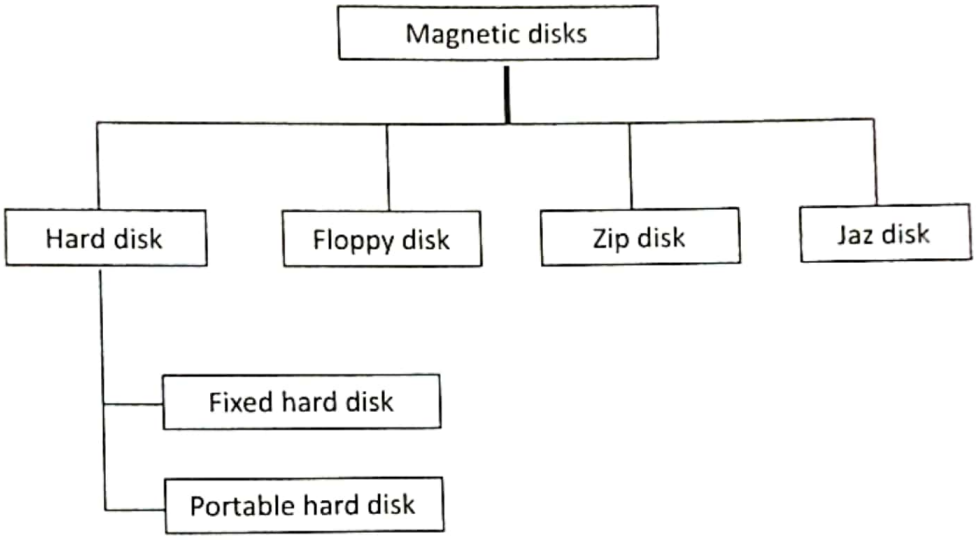

Figure 2.7

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Hard Disk / Hard Drive

The hard disk, which is widely called the hard drive, is made out of one or more disks (platters) which are stacked together and surrounded by the drive.

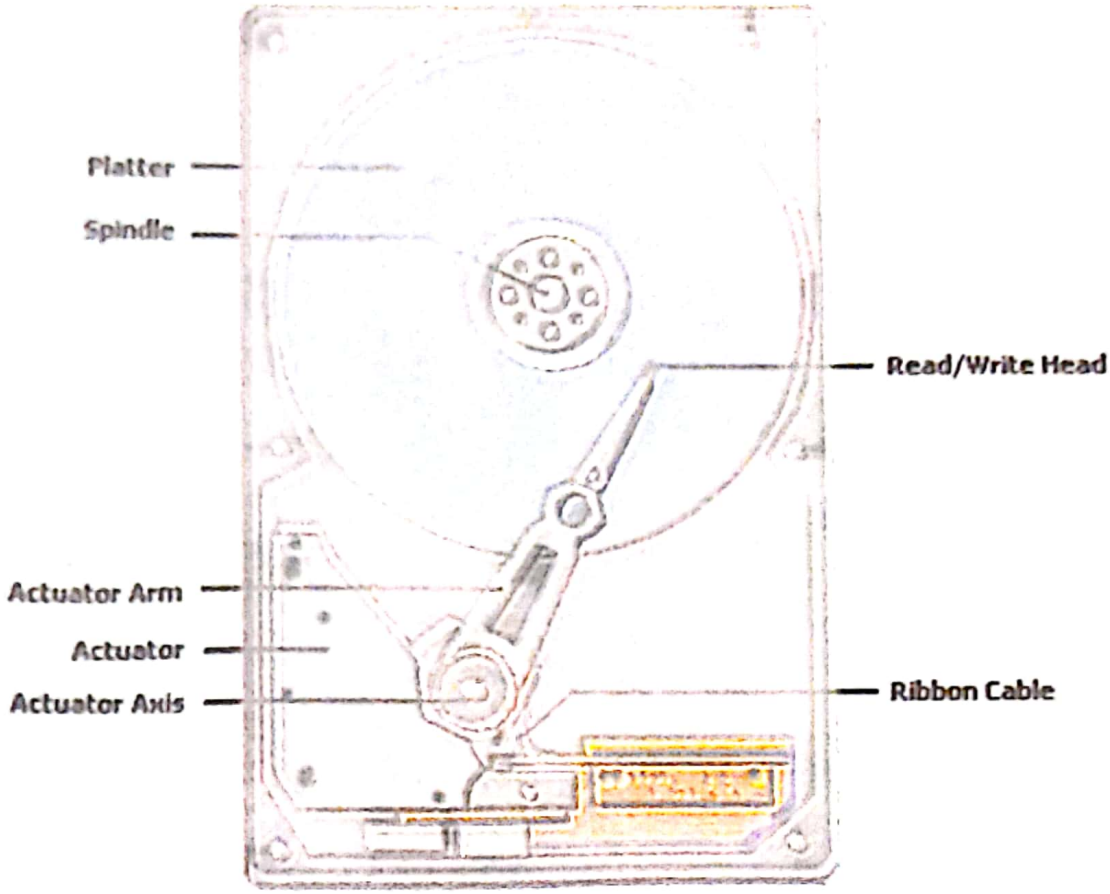

Figure 2.8

Platter	–	This is the magnetic disk where data are stored. Both top and bottom surfaces are used for storing data.
Spindle	–	Keeps the platters stacked and spins them at a high speed.
Actuator	–	Moves the actuator arm at a high speed moving the read/write head back and forth.
Read/write head	–	This is the electromagnet which reads data from and writes to the disk.
Circuit board	–	Passes electric signals for the hard drive to function properly.

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There are two types of hard drives.

1. **Fixed hard drive**
   This is permanently located inside the system unit and is the main internal secondary storage device of a computer. Almost all programs, applications, data and information needed by a PC are stored in the fixed hard drive.

Figure 2.9

2. **Portable hard drive**
   The external hard drive, also known as the portable hard drive, is yet another hard drive that is designed as a plug and play device. It gets connected to the computer externally through a USB connection. Large amounts of data can be carried and stored in external hard drives.

Figure 2.10

Floppy Disk

Floppy disk is a small plastic disk encased in a plastic cover. This was once the most popular portable storage device. It remained popular for nearly 40 years (early 1970s to 2000s).

Floppy is a disk a of 3 ½ inch in diameter and 1.44 MB in capacity. It was very economical in price. Since the capacity of one floppy disk was limited to 1.44MB, many floppies were needed to carry larger files. For example, Windows 95 came in 21 floppies.

Figure 2.11

How many floppy disks do you think would it take to install Windows 10 (if it was available on floppy)?

A **Floppy drive** is needed to read the disk or write to the disk. The floppy can be inserted to the drive and remove from it very easily.

In mid 2000s, floppy disk started being replaced by devices such as DVDs and pen drives which had higher capacity and reliability.

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