* The differences between RAM and ROM :-

RAM	ROM
• Stand for Random-Access Memory	• Stand for Read Only Memory
• Read / Write Memory	• Read Only Memory
• Sending data (writing) to RAM memory address is called destructive write because the new data erases whatever was there before.	• Sending data to ROM memory address is in effective because the contents of ROM cannot changed (write not allowed) because this memory for read only.
• Form of primary storage for holding temporary data and instruction	• Form of primary storage for holding permanent data and instruction
• Volatile :program and data are erased when the power is off	• Permanent :program and data are intact even power is off

• Type of RAM is
  ➢ Static RAM
  ➢ Dynamic RAM
	• Type of ROM is
	  ➢ PROM
	  ➢ EPROM
	  ➢ EAPROM

3-Cache Memory: many modern computer applications (Microsoft office 98, for example) are very complex and have huge numbers of instructions it takes considerable RAM capacity (usually a minimum 16MB) to store the entire instruction set. Or you may be using an application that exceeds your RAM. In that case, your computer has to go into secondary storage to retrieve the instruction. To alleviate this problem, software is often written in smaller blocks of instruction. As need, these blocks can be brought from secondary storage into RAM; this is still slow however, cache memory is the place closer to the CPU where the computer can temporarily store those blocks used most often. Those used less often remain in RAM until they are transferred to cache; those used infrequently stay stored in secondary storage. Cache memory is faster than RAM. Because, the instructions travel a shorter distance to the CPU.

4- **Flash memory:** is one such device. This memory can be accessed like RAM (read and written), but is non-volatile i.e. it is a form of permanent storage. At the time of writing flash memory is available in the 512Mb to 1GB range. One disadvantage of current NVRAMs is that they cannot be written

to, as quickly as ordinary RAM. However, they are much faster to access than disk storage systems and they consume less power, so that in small portable computer

systems they offer an alternative low-powered option to disk storage. However, NVRAMs are more expensive than disk storage devices.

5- Virtual Memory: If your computer lacks the random access memory (RAM) needed to run a program or operation, Windows uses virtual memory to compensate. Virtual memory combines your computer's RAM with temporary space on your hard disk. When RAM runs low, virtual memory moves data from RAM to a space called a *paging file*. Moving data to and from the paging file frees up RAM to complete its work. The more RAM your computer has, the faster your programs will generally run. If a lack of RAM is slowing your computer, you might be tempted to increase virtual memory to compensate. However, your computer can read data from RAM much more quickly than from a hard disk, so adding RAM is a better solution.

في حالة افتقار الحاسبة إلى ذاكرة وصول عشوائي(RAM)كافية لتشغيل برنامج أو عملية، يستخدم نظام التشغيل Windowsذاكرة افتراضية للتعويض. لمعرفة حجم الذاكرة الافتراضية تقوم الذاكرة الافتراضية بجمع ذاكرة الوصول العشوائي (RAM)الخاصة بالحاسبةمع مساحة مؤقتة على القرص الثابت. عند انخفاض اداءذاكرة الوصول العشوائي (RAM)تنقل الذاكرة الظاهرية البيانات من ذاكرة الوصول العشوائيإلى مساحة تُعرف باسم ملف ترحيل الصفحات*paging file*. نقل البيانات من ملف ترحيل الصفحات*paging file* وإليه يحرر مساحة على ذاكرة الوصول العشوائي حتى تتمكن من إكمال عملها. كلما كان عدد ال RAM(حجم ال RAM)على الحاسبة كبيركلما سيكون تشغيل البرامج بشكل عام اسرع. وعكس هذه الحالة (اي عدد (حجم)ال RAM صغير)يتسبب في بطىءالحاسبة ،في هذه الجالة تبدا في زيادة الذاكرة الافتراضية للتعويض .الا ان الحاسبة تتمكن من قراءة البيانات من ذاكرة الوصول العشوائي بسرعة اكبر من قراءتها من القرص الثابت ، لذلك ان اضافة RAM الى الحاسبة يعتبر افضل حل .

-Bios: Short for (**B**asic **I**nput / **O**utput **S**ystem), Bios is a chip located on all computer motherboard that contains instructions and setup for how your system should boot and how it operates. To the right is a picture of what a **BIOS** chip may look like in your computer. The BIOS includes instructions on how load basic computer hardware and includes a test referred to as a **POST** (**P**ower **O**n **S**elf **T**est) that helps verify the computer meets requirements to boot up properly, if the computer does not pass the **POST**,

you will receive a combination of beeps indicating what is malfunctioning within the computer.

 In most PCs, the **BIOS** have four main functions:-

1-POST: - Test computer hardware, ensuring hardware is properly functioning before starting process of loading operation system. Additional information on the POST can be found on our POST/Beep Code Page.

2- Bootstrap Loader:- Process of location the operating system. If capable operation system located, BIOS will pass the control to it.

3-BIOS:-Software/Drives that interface between the operating system and your hardware. When running DOS or Windows you are using complete BIOS support.

4-BIOS/CMOS Setup:- Configuration program that allows you to configure hardware setting including system setting such as computer password, time, and data.

*Secondary Storage (Backing Storage)
Secondary storage is designed to store very large amounts of data for extended periods of time .secondary storage can have memory capacity of gigabyte or more; only small portions of the data are placed in primary storage at any one time. Secondary storage **has the following Characteristics:**
1-it is non-volatile
2-it takes much more time to retrieve data from secondary storage than it does from RAM
3-it much more cost-effective than primary storage
4-it can take place on a variety of media each with its own technology, as is cussed below:
a) Magnetic tape
b) Magnetic disc
c) Magnetic diskette (floppy disc)
d) Optical discs

A- Features of the Magnetic tapes
   1- It is1/4 inch wide and 300, 1200, 2400, or 3600 feet long.

   2- It has a plastic base, coated with magnetic able material on one side.

3- Data is stored in tracks; there are 7 or 9 tracks (depending on the tape unit) which run the length of the tape. The data is recorded so that one character is recorded across the 7 or 9 tracks.
4- The density of recording can vary between 2
5- It is serial access device.

6- The tape is reusable i.e. it can be overwritten
7- The same tape can be used for input and output. The tape can be writing protected.

B-Features of magnetic disks (hard disks)
1. Disks are randomly accessed.

2. Disks are of size and shape similar to a long-playing record

3. The surfaces of each disk are of magnetic able material.

4. Each disk surface is divided into a number of concentric tracks (typically 200).

5. Disks are placed on pack and each pack may have 6 or 11 disks and is used as a single unit.

6. The latest models of disk packs can store many hundreds of megabytes of data (i.e. hundreds of millions of characters).

C-Features of floppy disks
1- A pliable disk permanently sealed with a rigid, protective plastic envelope

2- They have random access facility.

3- Data are stored in concentric tracks

4- The floppy disks sizes are 8, 5 1/4, 3 1/2 inch.

5- Storing capacity of 3 1/2 inch disks is 1.44 megabytes i.e. one million four hundred thousand characters.

Floppy Disk (1.44MB)

D-Features of optical disks
1- This is a random access device.

2- Data is written into the disk by burning a permanent pattern into the surface of the disk by means of high precision laser beam.

3- Data is read by using the laser at lower intensity and detecting the pattern reflected from its beam by the surface of the disk there are many types of optical disks:
a- Compact disk read-only memory (CD-ROM) storing devices feature high capacity, low cost. It has become popular for recorded music as well as information (such as books) a variant is the digital video disk (DVD), used for movies.
b- Write once, read many (WORM) disk can be written.
c- Rewritable CD is a less common technology that allows the disk to be written upon and written up to 1.000 times.

Hard Disk Performance: Several basic parameters determine the performance of a given hard disk drive. A seek operation is the movement of the read/write head to the desired track.

1- Seek Time: A seeks time is the movement of the read\write head to the desired track. The seek time is the average time for this operation to be performed. Typically, hard disk drives have an average seek time of several milliseconds, depending on the particular drive.

2- Latency Time: The latency period is the time takes for the desired sector to spin under the head once the head is positioned over the desired track. Latency time depend on the constant rotational speed of the disk.

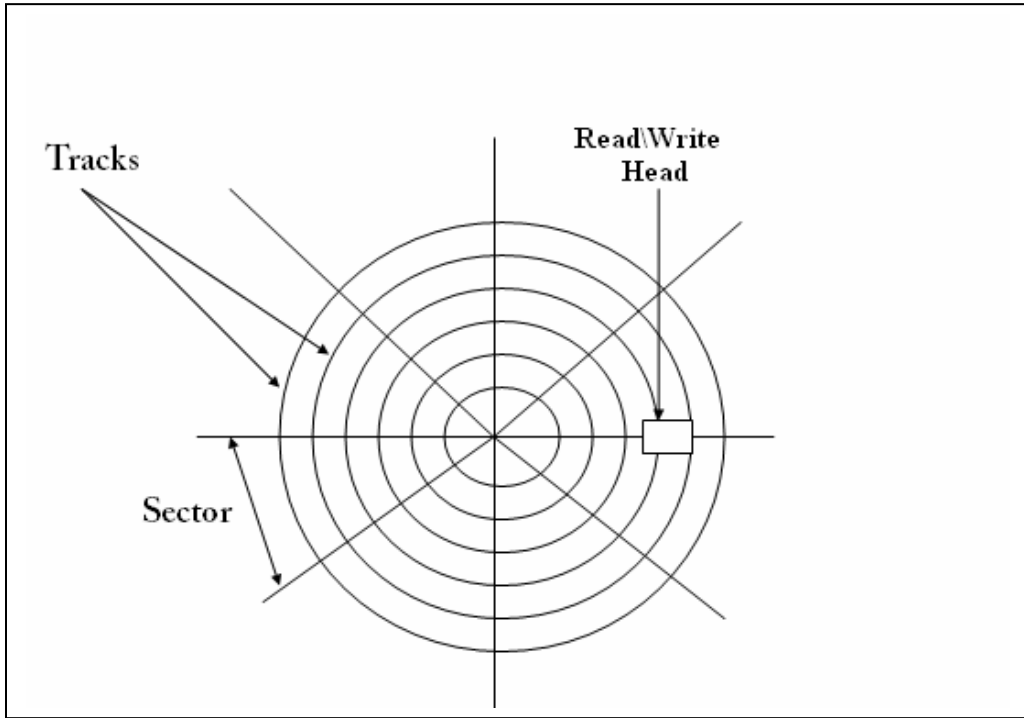• The sums of average seek time and the average latency time is the access time for the disk drive.

Figure (5): Hard Disk