1. Types and Components of Computers | IGCSE ICT

The syllabus says that you should be able to:

a. define **hardware**, giving examples;
b. define **software**, giving examples;
c. describe the **difference** between hardware and software;
d. identify the **main components** of a general-purpose computer:
   - central processing unit (CPU),
   - main/internal memory (including ROM and RAM),
   - input devices,
   - output devices,
   - secondary/backing storage.
e. identify **operating systems**, including:
   - graphic user interface (GUI),
   - command-line interface
f. identify different **types of computer** including:
   - personal computer (PC) or desktop
   - mainframe
   - laptop
   - palmtop
   - personal digital assistant (PDA).

Notes covering this section:

- Hardware and Software
- Main Computer Components
- What is an Operating System?
- User Interfaces
- Types of Computer

Help with this section:

Ask questions and get help on this section of the syllabus in the help forum.

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Hardware and Software | IGCSE ICT

What is Hardware?

Hardware is the **physical** parts of the computer system – the parts that you can **touch** and **see**.

A motherboard, a CPU, a keyboard and a monitor are all items of hardware.

An analogy…

Your hardware is all of the parts that make up your body: bones, muscles, skin, blood, etc.

What is Software?

Software is a **collection of instructions** that can be 'run' on a computer. These instructions tell the computer what to do.

Software is **not a physical thing** (but it can of course be stored on a physical medium such as a CD-ROM), it is just a bunch of codes.

An operating system such as Windows XP or Mac OS X, applications such as Microsoft Word, and the instructions that control a robot are all examples of software.

To continue the analogy…

Your software is all of your thoughts and mental processes: these are the instructions that tell your physical body what to do

The Difference Between Hardware and Software

Computer **hardware** is the **physical components** that make up the computer system. Hardware is useless without software to run on it.

Completing the analogy…

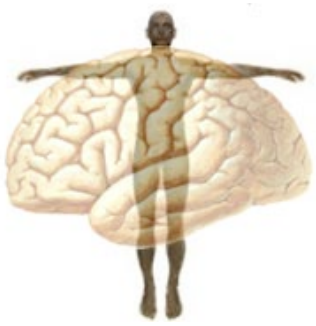
Your physical body cannot function without your thoughts.

Software is **instructions** that tell computer hardware what to do. Software is useless unless there is hardware to run it on.

And your thoughts need a physical body to exist within

For a computer system to be **useful** it has to consist of **both hardware and software**.

+



Next Up → Main Computer Components

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Main Computer Components | IGCSE ICT

Central Processing Unit (CPU)

The CPU is the '**brain**' of the computer. It is the device that carries out software instructions.

The Pentium processor made by Intel is an example of a CPU.

CPUs usually plug into a large socket on the main circuit board (the motherboard) of a computer. They get very hot when they are operating so usually have a large fan attached to their top to keep them cool.

*The speed of a CPU is measured in **Hertz** (Hz).*

The speed generally corresponds to the number of actions the CPU can perform every second.

- *1 **Megahertz** (MHz) is 1,000,000 (1 million) Hertz*
- *1 **Gigahertz** (GHz) is 1,000,000,000 (1 billion) Hertz*

A typical, modern, fast CPU runs at around 2.8GHz. That means it can perform almost 3 billion actions every second!

Main Memory

Any **data** or **instructions** that are to be **processed** by the CPU must be placed into **main memory** (sometimes known as **primary storage**).

Random Access Memory (RAM)

Random Access Memory (RAM) is the part of the computer that **temporarily stores** the **instructions** that the computer is running, and the **data** it is processing.

RAM is a **volatile** storage device. This means that if the computer's

*The storage capacity of memory is measured in **Bytes**.*

power is turned off the contents of RAM disappear and are **lost**.

RAM, like the CPU, also plugs in to sockets on the motherboard.

When a computer is in use, its RAM will contain…

1. The **operating system** software
2. The **application software** currently being used
3. Any **data** that is being processed

Usually RAM can hold millions of bytes of data, so you will see capacities measured in:

- ***Megabytes** (MB) or 1,000,000 (1 million) Bytes*
- ***Gigabytes** (GB) or 1,000,000,000 (1 billion) Bytes*

So, if a computer has 2GB of RAM, it can hold 2 billion bytes of data and instructions at any time.

Read-Only Memory (ROM)

Read-Only Memory (ROM) is used in most computers to hold a small, special piece of software: the '**boot up**' program.

This software runs when the computer is switched on or 'boots up'. The software checks the computer's hardware and then loads the operating system.

ROM is **non-volatile** storage. This means that the data it contains is **never lost**, even if the power is switched off.

*This 'boot up' software is known as the **BIOS** (Basic Input Output System)*

Peripheral Devices

Technically, a computer need only be made up of a CPU and some RAM. But a computer like this would not be much use to anybody – other devices need to be connected to allow data to be passed in and out of the computer.

The general name for these extra devices is '**peripheral devices**'. They are usually categorised into **input** devices, **output** devices and **storage** devices.

Input and **output** devices are explored more fully in **Section 2**.

Storage devices are explored more fully in **Section 3**.

'Peripheral' literally means 'around the edge'.

In other words these devices are not part of the central core of the computer.

What Are Input Devices?

Devices that pass **data into the computer** are known as input devices.

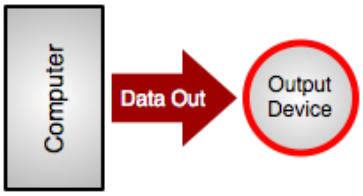
A keyboard, a mouse and a webcam are all examples of input devices.

They all take information from the outside world (key presses, hand

movements, images), convert them into data and then send this data into the computer for processing.

What Are Output Devices?

Devices that take **data from the computer** are known as output devices.



A monitor, a printer and a loudspeaker are all examples of output devices.

They all take information from the computer and convert it into real world things (images, paper hardcopy, sound).

What is Secondary / Backing Storage?

Secondary storage (sometimes called **backing storage**) is the name for all of the devices (apart from ROM and RAM) that can **store** data in a computer system.

A hard drive, a CD-ROM, a floppy disc and a USB memory stick are all examples of secondary storage devices.

Secondary storage is **non-volatile**, so data that is stored on these devices remains there safely.

When we talk about 'saving' a file, what we mean is moving data from volatile RAM to non-volatile secondary storage.

e.g. If we are typing a letter using Word, the data for the letter is in RAM (if the power goes off we lose it all).

When we save the letter, the data is copied from RAM to a storage device such as a memory stick or hard-drive for safe-keeping.

Next Up → What is an Operating System?

What is an Operating System? | IGCSE ICT

An operating system is a special piece of **software** that **manages** the general operation of a computer system:

- It provides a **user interface** so that we can interact with the computer
- It manages **applications** that are running on the computer, starting them when the user requests, and stopping them when they are no longer needed
- It manages **files**, helping us save our work, organise our files, find files that we have saved and load files
- It manages the computers **memory**, deciding what should be loaded into memory and what should be removed
- It looks after computer **security**, preventing unauthorised access to the system
- It manages the computer's **input and output** hardware such as printers, etc.

An operating system is a bit like the manager of a factory - the manager's job is to keep the factory running smoothly, to make sure all the sections of the factory work together, to check that deliveries arrive on time, etc.

But, for the factory to actually make anything, other people (the workers) are required - the manager cannot make anything him/herself.

Without an operating system, a computer is of little use.

But, just having an operating system running alone on a computer is also not very useful - we need to have **application software** (such as Word, Excel, etc.) so that we can actually do useful tasks with the computer.

Useless!

On its own, the **hardware** of a computer is a fairly useless lump of plastic and metal!

It Works!

(But it's not very useful)

Add in an **operating system** and you have a computer that actually works.

Useful!

To do any useful work you will also have to add **application software**.

Operating systems that you may have heard of:

- *Windows XP*
- *Windows Vista*
- *Mac OS X*
- *Linux*

Next Up → User Interfaces

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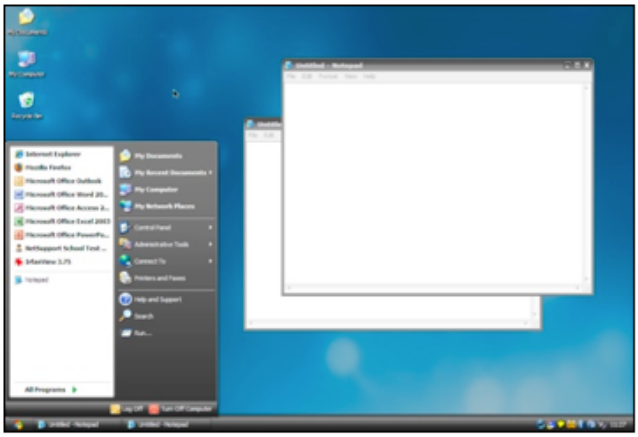
User Interfaces | IGCSE ICT

The system that **people** use to **interact** with a **computer** (to give it commands, to see the results of those commands, etc.) is known as the **user interface**.

There are two that you need to be aware of:

- Graphical User Interface (GUI)
- Command-Line Interface (CLI)

Graphical User Interface (GUI)



A GUI is an interface built around visual (graphical) things:

- **Windows** are regions of the screen used to display information
- **Icons** are small pictures that are used to represent folders, software, etc.
- **Menus** are lists of options the user can select from
- A **pointer** is an arrow that can be moved around the screen and is used to select things

Windows XP is an example of an operating system with a GUI.

GUIs are quite **easy to use** due to the visual nature of the interface – the user has lots of visual clues as to what things do.

However, to display all of the nice graphics required by a GUI takes a lot of computing power so quite a **powerful** computer is needed.

A GUI is sometimes called a WIMP interface:

***W**indows, **I**cons, **M**enus, **P**ointer*

Command Line Interface (CLI)

Many years ago when computers were **not very powerful** they could not display the colourful graphics required for a GUI. The only interface available to most computer uses was the 'command line'.

The user would see nothing but a black screen. They would have to **type a command** to make anything happen.

e.g. To copy a text file called NOTES from a floppy disc to the hard drive the user would have to type:

```
C:\>dir
 Volume in drive C is Windows
 Volume Serial Number is B4F7-C128

 Directory of C:\

01/10/2007  19:38    <DIR>          25c7843ff7527e04ca374
19/09/2007  16:56    <DIR>          97a61370812ce95093c63
19/09/2007  16:42                 0 AUTOEXEC.BAT
19/09/2007  16:36               211 boot.ini.comodofireva
19/09/2007  16:42                 0 CONFIG.SYS
19/09/2007  16:48    <DIR>          Documents and Setting
19/09/2007  16:53    <DIR>          e4a32567d68c0d02f07b4
19/09/2007  16:54    <DIR>          Intel
01/03/2008  21:48    <DIR>          Program Files
19/09/2007  16:57               516 RHDSetup.log
25/11/2007  13:03    <DIR>          UBCD4Win
13/03/2008  11:32    <DIR>          WINDOWS
               4 File(s)            727 bytes
               8 Dir(s)   1,479,077,888 bytes free

C:\>
```

```
> COPY A:\NOTES.TXT C:\
```

The user would have to learn a whole set of strange commands so that they could make use of the computer system. Plus it was not very interesting look at – no visual clues to tell you what to do next.

This meant computers used to be quite **difficult to use**, so this type of interface is only really suitable for **expert users**.

Command-line interfaces are still used today on many servers.

These computers need to use all of their computing power running networks, etc. so they do not use GUIs.

Next Up → 2. Types of Computer

Types of Computer | IGCSE ICT

Computers come in all sorts of shapes and sizes. You are all familiar desktop PCs and laptops, but did you know that computers can be as small as your mobile phone (in fact your phone *is* a computer!) and as large as a room?!

Mainframe Computer

A **mainframe** computer is a large computer, often used by large businesses, in government offices, or by universities.

Mainframe computers are typically:

- **Powerful** - they can process vast amounts of data, very quickly
- **Large** - they are often kept in special, air-conditioned rooms
- **Multi-user** - they allow several users (sometimes hundreds) to use the computer at the same time, connected via remote terminals (screens and keyboards)

From their invention back in the 1940s until the late 1960s, computers were large, very expensive machines that took up the whole of a room (sometimes several!) These were the only computers available.

*The circuit-boards of these computers were attached to large, metal racks or frames. This gave them the nickname **'mainframe'** computers.*

*Some of the most powerful mainframe computers can process so much data in such a short time, that they are referred to as **'supercomputers'***

Personal Computer (PC)

The early **1980s** saw a revolution in computing: The creation of computers that were **small** enough to fit on a desk, and **cheap** enough that everyone could have their own, personal computer, instead of having to share access to a mainframe.

These computers came to be known as **desktop** computers, or **personal computers** (PCs).

A typical PC contained the same basic components as a mainframe computer (CPU, RAM, storage, etc.) but at a fraction of the size and cost.

Early PCs were quite unlike the PCs that we all use today:

- *Displays were black and white, and only displayed text (no graphics)*
- *No hard-drives (way too expensive)*
- *Just a few 100 kB of RAM (not MB or GB!)*
- *Slow - a typical speed would be 5MHz (not GHz!)*
- *No mouse (no pointer to move!)*
- *Light brown case (for some reason every early PC was brown!)*

Because PCs were so much smaller than mainframe computers, they were called 'microcomputers' for a while

Laptop Computer

A 'laptop' computer is a **light**, **compact** and **portable** PC.

Laptops contain a **rechargeable battery** so that they can be used even when not plugged in to a mains power supply. They also have a built-in LCD **monitor**.

To make them as portable as possible, most laptops try to avoid any sort of cable or wire. Instead of a mouse, a **trackpad** is used. Instead of a wired connection to a network or printer, '**wireless**' radio connections are used.

Early portable computers were far from being 'laptops' - you would have crushed your legs if you'd tried to put these beasts on your lap!

Palmtop Computer

A **palmtop** computer is similar to a laptop computer, but smaller. It's **small** enough to fit in the **palm of your hand** (hence the name!)

Palmtops are usually not very powerful since fast CPUs require a large battery and get hot - both problems in a small device.

A typical palmtop have a very **small keyboard** - too small to type on normally. Instead the user types using both thumbs. Also there is no room for a trackpad, so a **touchscreen** or tiny **joystick** is used instead.

Palmtops are **extremely portable**, but the small keyboard and screen make the devices tiring to use for long periods.

Early palmtop computers were pretty basic by today's standards

*Palmtops are often called ultra-mobile PCs (**UMPC**)*

Personal Digital Assistant (PDA)

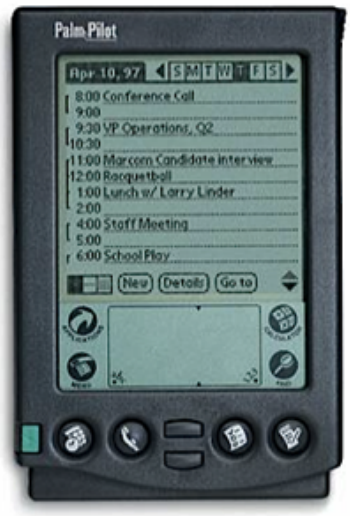
A PDA is similar to a palmtop computer, except it is even more **compact**, and typically has **no keyboard**, using a **touchscreen** for all

data input. Since the screen is so small, many PDAs have a small stylus (plastic stick) that is used to press things on the screen.

Most PDAs use some sort of **handwriting-recognition** system to allow the user to write on the screen, and have their writing converted into text.

PDAs tend to be used a 'digital diaries' allowing users to take their **e-mail**, **documents**, **appointments**, etc. with them wherever they go.

Note: You never see PDAs any more since modern 'smart' phones can do all of this, and work as a phone too!



Early PDAs, like early palmtops, were pretty basic. But they were a revolutionary way to take digital data with you on the move.

In the 1990s every business person either had, or wanted one of these!

*PDAs are often called **Pocket-PC**s (for obvious reasons!)*

Next Up → 2. Input and Output Devices

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