What is a computer?

A computer is an electronic machine which can accept data in a certain form, process the data, and give the results of the processing in a specified format as information.

First, data is fed into the computer's memory. Then, when the program is run, the computer performs a set of instructions and processes the data. Finally, we can see the results (the output) on the screen or in printed form (see Fig. 1 below).

A computer system consists of two parts: hardware and software. **Hardware** is any electronic or mechanical part you can see or touch. **Software** is a set of instructions, called a program, which tells the computer what to do. There are three basic hardware sections: the **central processing unit** (**CPU**), **main memory** and **peripherals**.

Perhaps the most influential component is the central processing unit. Its function is to execute program instructions and coordinate the activities of all the other units. In a way, it is the 'brain' of the computer. The main memory (a collection of RAM chips) holds the

Storage devices (hard drives, DVD drives or flash drives) provide a permanent storage of both data and programs. **Disk drives** are used to read and write data on disks. **Input devices** enable data to go into the computer's memory. The most common input devices are the **mouse** and the **keyboard**. **Output devices** enable us to extract the finished product from the system. For example, the computer shows the output on the **monitor** or prints the results onto paper by means of a **printer**.

On the rear panel of the computer there are several **ports** into which we can plug a wide range of peripherals – a modem, a digital camera, a scanner, etc. They allow communication between the computer and the devices. Modern desktop PCs have USB ports and memory card readers on the front panel.

B Match these words from the text (1–9) with the correct meanings (a–i).

C ← 1 software
f ← 2 peripherals
g ← 3 main memory
h ← 4 hard drive (also known as hard disk)
b ← 5 hardware
d ← 6 input
i ← 7 ports
e ← 8 output
a ← 9 central processing unit (CPU)

a the brain of the computer
b physical parts that make up a computer system
c programs which can be used on a particular computer system
d the information which is presented to the computer
e results produced by a computer
f input devices attached to the CPU
g section that holds programs and data while they are executed or processed
h magnetic device used to store information
i sockets into which an external device may be connected

3 Different types of computer

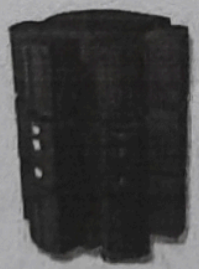
A Listen to an extract from an ICT class. As you listen, label the pictures (a–e) with words from the box.

laptop	desktop PC	PDA	mainframe	tablet PC

a _____

b _____

c _____



d _____

e _____

B Listen again and decide whether these sentences are true or false. Correct the false ones.

F ← 1 A mainframe computer is less (more) powerful than a PC.
T ← 2 A mainframe is used by large organizations that need to process enormous amounts of data.
T ← 3 The most suitable computers for home use are desktop PCs.
F ← 4 A laptop is not (✗) portable.
F ← 5 Laptops are not as powerful as desktop PCs.
T ← 6 Using a stylus, you can write directly onto the screen of a tablet PC. (can be)
T ← 7 A Personal Digital Assistant is small enough to fit into the palm of your hand.
F ← 8 A PDA does not (✗) allow you to surf the Web.

What is inside a PC system?

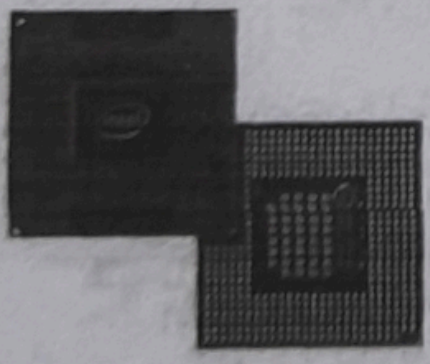
Processing

The nerve centre of a PC is the **processor**, also called the **CPU**, or **central processing unit**. This is built into a single **chip** which executes program instructions and coordinates the activities that take place within the computer system. The chip itself is a small piece of silicon with a complex electrical circuit called an **integrated circuit**.

The processor consists of three main parts:

- The **control unit** examines the instructions in the user's program, interprets each instruction and causes the circuits and the rest of the components – monitor, disk drives, etc. – to execute the functions specified.
- The **arithmetic logic unit** (**ALU**) performs mathematical calculations (+, -, etc.) and logical operations (AND, OR, NOT).
- The **registers** are high-speed units of memory used to store and control data. One of the registers (the program counter, or PC) keeps track of the next instruction to be performed in the main memory. The other (the instruction register, or IR) holds the instruction that is being executed (see Fig. 1 on page 13).

The power and performance of a computer is partly determined by the speed of its processor. A **system clock** sends out signals at fixed intervals to measure and synchronize the flow of data. **Clock speed** is measured in **gigahertz** (**GHz**). For example, a CPU running at 4GHz (four thousand million hertz, or cycles, per second) will enable your PC to handle the most demanding applications.

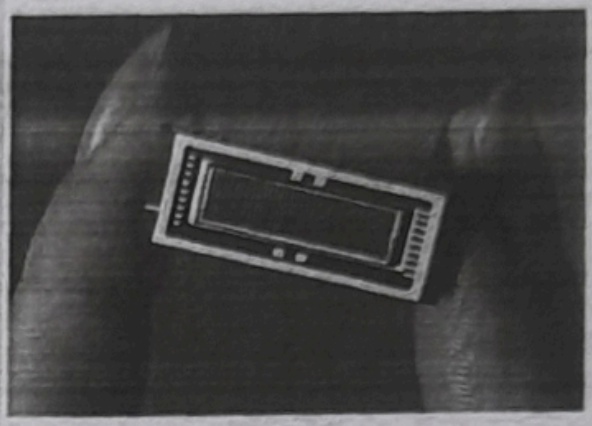


The Intel Core 2 Duo processor; other chip manufacturers are AMD and Motorola

RAM and ROM

The programs and data which pass through the processor must be loaded into the main memory in order to be processed. Therefore, when the user runs a program, the CPU looks for it on the hard disk and transfers a copy into the **RAM** chips. RAM (**random access memory**) is volatile – that is, its information is lost when the computer is turned off. However, **ROM** (**read only memory**) is non-volatile, containing instructions and routines for the basic operations of the CPU. The **BIOS** (**basic input/output system**) uses ROM to control communication with peripherals.

RAM capacity can be expanded by adding extra chips, usually contained in small circuit boards called dual in-line memory modules (**DIMMs**).



A RAM chip

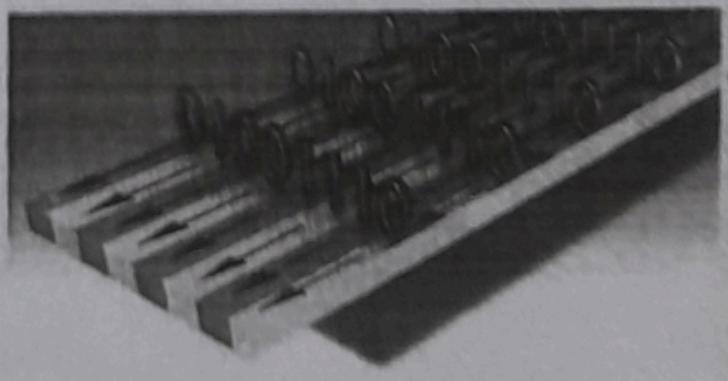
Buses and cards

The main circuit board inside your system is called the **motherboard** and contains the processor, the memory chips, expansions slots, and controllers for peripherals, connected by **buses** – electrical channels which allow devices inside the computer to communicate with each other. For example, the front side bus carries all data that passes from the CPU to other devices.

The size of a bus, called **bus width**, determines how much data can be transmitted. It can be compared to the number of lanes on a motorway – the larger the width, the more data can travel along the bus. For example, a 64-bit bus can transmit 64 bits of data.

Expansion slots allow users to install **expansion cards**, adding features like sound, memory and network capabilities.

A data bus



Bits and bytes

Computers do all calculations using a code made of just two numbers – 0 and 1. This system is called **binary code**. The electronic circuits in a digital computer detect the difference between two states: ON (the current passes through) or OFF (the current doesn't pass through) and represent these states as 1 or 0. Each 1 or 0 is called a **binary digit**, or **bit**.

Bits are grouped into eight-digit codes that typically represent characters (letters, numbers and symbols). Eight bits together are called a **byte**. Thus, each character on a keyboard has its own arrangement of eight bits. For example, 01000001 for the letter A, 01000010 for B, and 01000011 for C.

One bit

A PC-compatible keyboard

B Match the descriptions (1–8) with the names of the keys (a–h). Then find them on the keyboard.

f ← 1 A long key at the bottom of the keyboard. Each time it is pressed, it produces a blank space.

b ← 2 It moves the cursor to the beginning of a new line. It is also used to confirm commands.

h ← 3 It works in combination with other keys. For example, you press this key and *C* to copy the selected text.

g ← 4 It removes the character to the left of the cursor or any selected text.

d ← 5 It produces UPPER CASE characters.

c ← 6 It produces UPPER CASE letters, but it does not affect numbers and symbols.

e ← 7 It moves the cursor horizontally to the right for a fixed number of spaces (in tabulations and data fields).

a ← 8 They are used to move the cursor, as an alternative to the mouse.

a arrrow keys
b return/enter
c Caps Lock
d shift
e tab
f space bar
g backspace
h Ctrl

Complete this text about the mouse with verbs from the box.

click	double-click	drag	grab	select	move	control
3	7	5	6	4	2	1

Mouse actions

A mouse allows you to (1) _____ the cursor and move around the screen very quickly. Making the same movements with the arrow keys on the keyboard would take much longer. As you (2) _____ the mouse on your desk, the pointer on the screen moves in the same direction. The pointer usually looks like an I-bar, an arrow, or a pointing hand, depending on what you are doing.

A mouse has one or more buttons to communicate with the computer. For example, if you want to place the insertion point or choose a menu option, you just (3) _____ (press and release) on the mouse button, and the option is chosen.

The mouse is also used to (4) _____ text and items on the screen. You can highlight text to be deleted, copied or edited in some way.

The mouse is widely used in graphics and design. When you want to move an image, you position the pointer on the object you want to move, press the mouse button, and (5) _____ the image to a new location on the screen. Similarly, the mouse is used to change the shape of a graphic object. For example, if you want to convert a square into a rectangle, you (6) _____ one corner of the square and stretch it into a rectangle.

The mouse is also used to start a program or open a document: you put the pointer on the file name and (7) _____ on the name – that is, you rapidly press and release the mouse button twice.

2 How screen displays work

A Complete these definitions with words from the box. Then read the text on page 33 and check your answers.

resolution	pixel	aspect ratio	colour depth	video adapter	plasma screen
5	1	3	6	2	4

1 _____ – the smallest unit on a display screen or bitmapped image (usually a coloured dot)

2 _____ – an expansion card that generates the video signal sent to a computer display

3 _____ – the width of the screen in proportion to its height

4 _____ – also called *gas discharge display*

5 _____ – the number of pixels contained in a display, horizontally and vertically

6 _____ – the number of bits used to hold a colour pixel; this determines the maximum number of colours that can be displayed

B Read the text again and answer these questions.

1 What do CRT and LCD stand for?

2 How is the screen size measured?

3 What technology is used by active-matrix LCDs?

4 Which unit of frequency is used to measure the brightness of a display?

5 What substance produces light and colour when hit by electrons in a CRT monitor?

6 What are the three advantages of OLED displays?

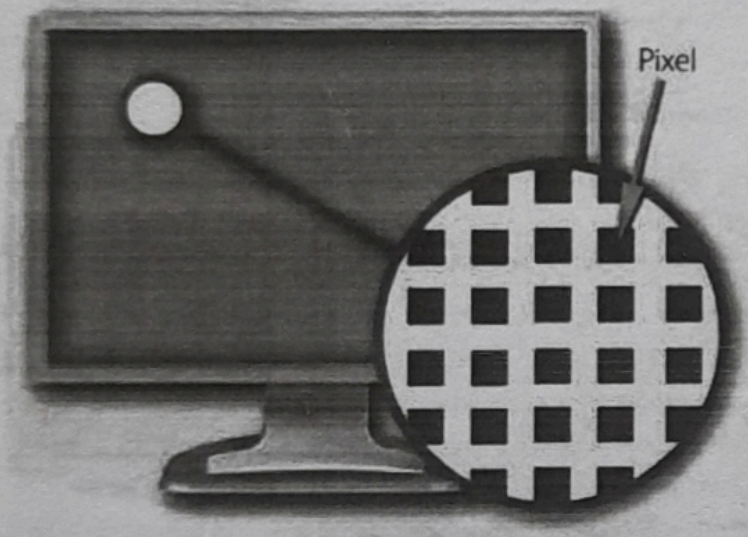
How screen displays work

Displays, often called **monitors** or **screens**, are the most-used output device on a computer. They provide instant feedback by showing you text and graphic images as you work or play.

Most desktop displays use **Liquid Crystal Display (LCD)** or **Cathode Ray Tube (CRT)** technology, while nearly all portable computing devices, such as laptops, incorporate LCDs. Because of their slimmer design and lower energy consumption, LCD monitors (also called **flat panel** or **flat screen** displays) are replacing CRTs.

Basic features

Resolution refers to the number of dots of colour, known as **pixels** (picture elements), contained in a display. It is expressed by identifying the number of pixels on the horizontal and vertical axes. A typical resolution is 1024x768.



A pixel is a combination of red, green and blue subpixels

Two measurements describe the size of your display: the **aspect ratio** and the **screen size**. Historically, computer displays, like most televisions, have had an aspect ratio of 4:3 – the width of the screen to the height is four to three. For widescreen LCD displays, the aspect ratio is 16:9, very useful for viewing DVD movies, playing games and displaying multiple windows side by side. High-definition TV also uses this format. The viewable screen size is measured diagonally, so a 19" screen measures 19" from the top left to the bottom right.

Inside the computer there is a **video adapter**, or graphics card, which processes images and sends signals to the monitor. CRT monitors use a **VGA (video graphics adapter)** cable, which converts digital signals into analogue signals. LCD monitors use a **DVI (digital video interface)** connection.

Colour depth refers to the number of colours a monitor can display. This depends on the number of bits used to describe the colour of a single pixel. For example, an old VGA monitor with an 8-bit depth can generate 256 colours and a SuperVGA with a 24-bit depth can generate 16.7 million colours. Monitors with a 32-bit depth are used in digital video, animation and video games to get certain effects.

Display technologies

An **LCD** is made of two glass plates with a liquid crystal material between them. The crystals block the light in different quantities to create the image. **Active-matrix LCDs** use **TFT (thin film transistor)** technology, in which each pixel has its own switch. The amount of light the LCD monitor produces is called brightness or luminance, measured in cd/m² (candela per square metre).

A **CRT** monitor is similar to a traditional TV set. It contains millions of tiny red, green and blue phosphor dots that glow when struck by an electron beam that travels across the screen and create a visible image.

PCs can be connected to **video projectors**, which project the image onto a large screen. They are used for presentations and home theatre applications.

In a **plasma screen**, images are created by a plasma discharge which contains noble (non-harmful) gases. Plasma TVs allow for larger screens and wide viewing angles, making them ideal for movies.

Organic Light-Emitting Diodes (OLEDs) are thin-film LED displays that don't require a backlight to function. The material emits light when stimulated by an electrical current, which is known as electroluminescence. They consume less energy, produce brighter colours and are flexible – i.e. they can be bent and rolled up when they're not being used.

WHICH TYPE OF PRINTER SHOULD I BUY?

Printing is the final stage in creating a document. *Since* the results you can obtain with different types of printer will vary substantially, here is a guide to help you decide which one is most suitable for your needs.

To begin with, you should take into account that printers vary in cost, speed, print quality, and other factors *such as* noise or printing method. Technology is evolving so quickly that there is always a printer for every application or need.

Dot-matrix printers use pins to print the dots required to shape a character. They can print text and graphics; however, they produce relatively low resolution output – 72 to 180 dots per inch (dpi). They are used to print multi-part forms, self-copying paper and continuous-form labels. They are slower than laser printers (see below) but much cheaper.

Inkjet printers operate by projecting small ink droplets onto paper to form the required image. Colour and hues are created by the precise mixing of cyan, magenta, yellow and black inks. Inkjets are fairly fast, quiet, and not as expensive as laser printers. Nevertheless, you can still expect high quality results *because* there are some inkjet printers on the market with a resolution of 2,400 dpi.

Laser printers produce output at great speed and with a very high resolution of 1,200–2,400 dpi. They scan the image with a laser beam and transfer it to paper with a special ink powder called toner. They are constantly being improved. In terms of speed and image quality, laser printers are preferred by experts for various reasons; *for instance*, they have a wider range of scalable fonts than inkjets, can emulate different language systems, and can produce high-quality graphics; however, they are still expensive for home users.

Thermal transfer printers are used to produce colour images by transferring a wax-based ink onto the paper. They are popular for printing bar codes, labels and medium-resolution graphics.

Imagesetters produce very high-resolution output (up to 3,540 dpi) on paper or on the actual film for making the printing plates. In addition, they are extremely fast. Imagesetters are most often used in desktop publishing (DTP). Although they produce the highest quality output, they have one important disadvantage: they are too expensive for homes or small offices.

In modern lithographic printing, images are created on a DTP computer and *then* output directly to the printing plates, without requiring film as an intermediate step. This technology is called **computer to plate**, or **CTP**, and the machine used is called a **platesetter**.

Finally, we have **plotters**. Plotters use ink and fine pens held in a carriage to draw very detailed designs on paper. They are used for construction plans, engineering drawings and other technical illustrations. Nowadays, traditional plotters are being replaced with wide-format inkjets.

C Find words in the article with the following meanings.

1 designs and images used in magazines, books, etc. (lines 10–15) graphics
2 output quality, measured in dots per inch (lines 10–15) resolution
3 a particular colour within the colour spectrum (lines 15–20) hue
4 an ink powder used in laser printers and copiers (lines 25–30) toner
5 set of characters that can be resized (enlarged or reduced) without introducing distortion (lines 30–35) scalable fonts
6 a rectangular pattern of black lines of magnetic ink printed on an object so that its details can be read by a computer system (lines 35–40) bar code
7 surface that carries a reproduction of the image, from which the pages are printed (lines 45–50) printing plates
8 in-between; middle (lines 50–55) intermediate

one partition and your data files on another; this allows you to reinstall the OS when a problem occurs, without affecting the data partition.

Toshiba's 1.8" hard drive; mini hard drives are used in small gadgets, such as PDAs and wristwatches

The average time required for the read/write heads to move and find data is called **seek time** (or **access time**) and it is measured in milliseconds (ms); most hard drives have a seek time of 7 to 14 ms. Don't confuse this with **transfer rate** – the average speed required to transmit data from the disk to the CPU, measured in megabytes per second.

How to protect your hard drive

- Don't hit or move the computer while the hard drive is spinning. Hard drives are very sensitive to vibration

C Match these words (1–5) with the definitions (a–e).

d	1 formatted	a	a file system that defines the structure for keeping track of the files
a	2 directory	b	the part of a drive that reads and records data on a disk
b	3 read/write head	c	to make a copy of data or software in case the original disk is damage
e	4 head crash	d	initialized; when the tracks and sectors on magnetic disks are set
c	5 back up	e	a serious disk malfunction; when the read/write head touches the rotating disk

4 Language work: precautions

A Look at the HELP box and then match the instructions (1–6) with the pictures (a–f).

b 1 Do not expose discs to heat or direct sunlight.

d 2 Check for viruses before opening files you receive from the Web or via email.

e 3 Make backup copies of your files.

a 4 Don't shake or move the computer violently while the hard drive is spinning.

f 5 Keep your discs away from water and humidity.

c 6 Hold discs by the edges, or by one edge and the centre hole.

HELP box

Precautions

- We use the imperative to give precautions and warnings.

  Check *your hard drive regularly for logical and physical errors.*

  ... formatting erases any existing files on a disk, so ***do not format*** *disks on which data that you don't want to lose is stored.*

- We use **should** + infinitive without *to* to give advice or to talk about what we think is right.

  ... you ***should*** *install an up-to-date virus scanner.*

- We use **shouldn't** + infinitive without *to* to give advice or to talk about what we think is