KNQF LEVEL 4 · CYCLE 3 · ISCED 061 2354A

ICT Operator Level 4

Competency-Based Learner and Trainer Companion Guide
Computer Essentials · Computer Operations · Network Setup · Repair and Maintenance

1 Computer Essentials

2 Computer Operations

3 Network Setup

4 Repair & Maintenance



Alphonce Kirui
alphoncekirui.com

Aligned to the TVET CDACC
Curriculum and Occupational Standards

ICT Operator Level 4

Competency-Based Learner and Trainer Companion Guide

KNQF Level 4 · Cycle 3 · Programme ISCED code 061 2354A

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About the source documents

This book is an independent study companion. It is aligned to, and organised around, the *Competency-Based Modular Curriculum for Information and Communication Technology (KNQF Level 4, Cycle 3)* and the *National Occupational Standards for Information and Communication Technology Operator (KNQF Level 4, Cycle 3)*, both issued by the TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), Nairobi. The explanations, examples, diagrams, activities, questions and checklists in this book are the author's own work. It is **not** an official publication of TVET CDACC and has not been endorsed by it. Where any detail of assessment or certification matters to you, always confirm against the current official documents from TVET CDACC (info@tvetcdacc.go.ke).

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Safety notice

Repairing and assembling computers and working with cables and electrical equipment carry real risks. Follow your institution's laboratory rules, wear the protective equipment described in this book and work under the supervision of a qualified trainer. The author and publisher accept no liability for injury or damage that results from the use of the information in this book.

Feedback

Found an error, or have a suggestion for the next edition? Please tell us through the contact page at alphoncekirui.com.

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GETTING STARTED

Welcome: How to Use This Book

For learners, trainers and self-study readers

What you will learn

- Understand who this book is written for and how it follows the national ICT Operator Level 4 curriculum.
- Recognise the learning features that appear in every chapter (outcomes, key terms, activities, questions and checklists).
- Plan your study time so that most of it is spent practising, as the curriculum requires.

Most Vocational Training Centres (VTCs) and TVET institutions in Kenya teach the ICT Operator Level 4 programme with very few textbooks. Trainers often prepare notes from the official curriculum alone, and trainees copy those notes down. The curriculum is an excellent *map* of what must be taught, but it is deliberately short: it lists topics such as “Cable termination” or “Mail merge” without explaining what they are, how to do them, or how to check that you have done them properly.

This book fills that gap. It takes every topic in the TVET CDACC curriculum and the national occupational standard and turns it into readable explanation, worked examples, clear diagrams, step-by-step practical activities, review questions with answers, and checklists that mirror the way you will be assessed.

Who this book is for

Trainees will find plain-language explanations that assume no previous knowledge beyond basic reading and numeracy, which matches the entry requirement of KCSE mean grade E or an equivalent qualification. **Trainers and instructors** can use the chapters as ready-made lesson material, the activities as practical sessions, and the checklists as observation tools. **VTC managers and county education officers** can use the crosswalk at the back of the book to confirm that every performance criterion in the standard is covered. **Self-learners** who are preparing for online work or for an entry-level ICT job can work through the book at their own pace.

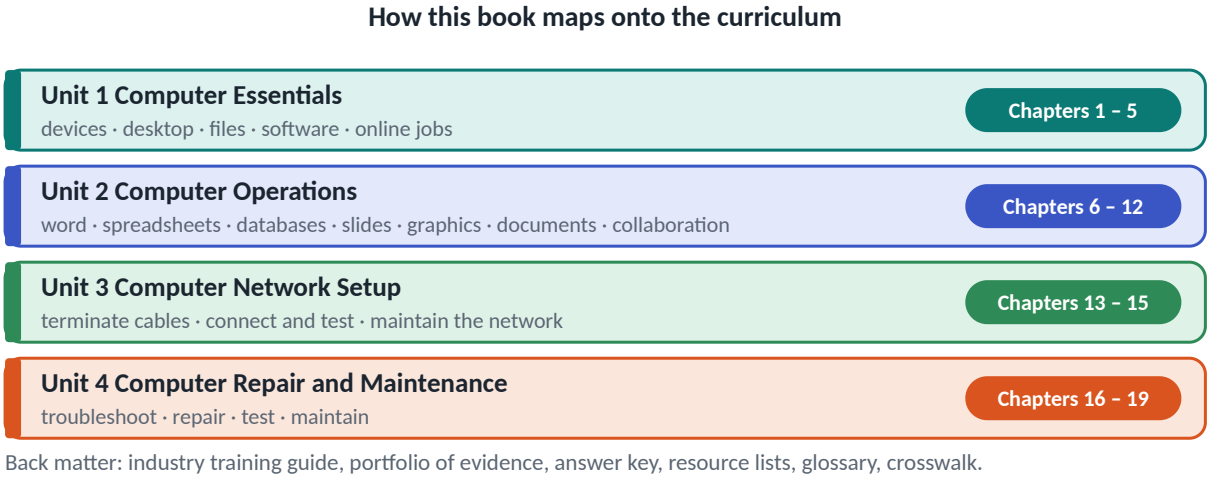


Figure 1 — The four units of the curriculum and the chapters that cover them.

Why the curriculum is competency-based

Kenya's TVET reforms, set out in the TVET Act No. 29 of 2013 and Sessional Paper No. 1 of 2019, moved training away from "learn facts and sit an exam" towards **competency-based education and training (CBET)**. In a competency-based programme:

- the content is defined together with industry, so that you learn what employers actually need;
- you are certified because you have *demonstrated* that you can perform a task to a required standard, not merely because you sat in class for a set time;
- the programme is divided into **units of learning** that can be certified separately, so you can enter and exit at different points and build up a qualification step by step.

Because of this, roughly nine-tenths of your assessment marks in every unit are for practical work. The most valuable way to use this book is therefore with a computer beside you.

> **COMPETENCE**
>
> The ability to perform a work activity to the standard expected in employment, using the required knowledge, skills and attitudes, and to keep performing it in different situations.

How every chapter is organised

Each of the 19 chapters follows the same pattern, so you always know where to look.

Feature	What it gives you
What you will learn	The learning outcomes and performance criteria the chapter covers, written in the words of the occupational standard.
Explanations and figures	The theory you need, with diagrams and illustrations that show how things look and work.
Key terms	A short glossary box for the new vocabulary in the chapter.

Feature	What it gives you
Tip, Note, Watch out, Safety first, In Kenya	Coloured boxes with shortcuts, warnings, safety rules and local context.
Practical activity	Numbered, hands-on steps to complete at a computer or workbench. Do these!
Review questions	Questions for self-testing. Answers are in the answer key at the back of the book.
Assessment checklist	A checklist in the style of an observation tool. Ask your trainer or a classmate to tick it as you perform the task.

Planning your study time

The curriculum sets aside **990 hours**: 670 hours of learning across the four units plus at least 320 hours of industry training. If your institution runs about 25 hours of training a week, that is roughly 27 weeks of learning and 13 weeks of attachment. Use the table below to plan.

Table 1 — Suggested time budget for each unit of learning.

Unit	Hours	Roughly how many weeks at 25 hours a week
Unit 1: Computer Essentials	120	5
Unit 2: Computer Operations	150	6
Unit 3: Computer Network Setup	200	8
Unit 4: Computer Repair and Maintenance	200	8
Industry training	320	13

STUDY LIKE A PRACTITIONER

Read a section, then *immediately* do the matching activity on a computer. Skills fade fast if they are only read. Keep a notebook or a folder of screenshots as you go: these become the seeds of your **portfolio of evidence**, which is one of the assessment methods used in every unit.

Conventions used in this book

- Menu paths are written with arrows, for example **Settings → Personalization → Themes**.
- Keyboard keys are shown like this: `Ctrl` + `C`.
- Things you type, file names and commands are shown in `code style`.
- Screens are described for a current Windows computer and Microsoft Office because those are the most common in Kenyan training institutions. Free alternatives such as LibreOffice and Google Docs are named wherever they help. Menu names differ slightly between versions, so use the search box in the software if a command is not where this book says.

CURRICULUM NOTE ON HOURS

In the curriculum's hour breakdown for Unit 2, six learning outcomes add up to 150 hours, while the content table also lists document production (printing, scanning and duplication) as a seventh outcome, which the occupational standard treats as a full element. This book teaches all seven. Ask your institution how it allocates document production time within the 150 hours.

For trainers: suggested delivery methods

The curriculum recommends a mix of *demonstration by the trainer*, *practical work by the trainee*, *viewing related videos*, *group discussions* and *direct instruction*, with *simulation* in the network unit and *active learning strategies* in Units 2 and 4. A workable pattern for a three-hour session is shown below.

Time	Activity	Where in the book
20 minutes	Recap and short oral questions	Review questions from the last session
25 minutes	Trainer demonstration on the projector	The explanation and figures
90 minutes	Trainees practise in pairs, trainer circulates	The practical activity
25 minutes	Group discussion, error clinic, peer checking	The checklist
20 minutes	Exit questions and portfolio update	Review questions, portfolio folder

RECOMMENDED RESOURCES

Each unit in the curriculum lists the resources needed for a class of 25 trainees, for example one computer per trainee, a projector, printers, flash drives and, for Unit 3, cable testers and crimping tools. The back matter of this book collects these lists in one place for planning and procurement.

GETTING STARTED

The ICT Operator Level 4 Qualification at a Glance

Course overview, assessment and certification

What you will learn

- Describe the structure, duration and credit value of the qualification.
- State the entry requirements, trainer qualifications and industry-training requirement.
- Explain how competence is assessed, how marks are weighted and how the results are rated.
- Read a unit code and explain what certificates can be awarded.

2.1 What the qualification is about

The **ICT Operator Level 4** curriculum is made up of the competencies that a person needs in order to *support or enable the use of ICT equipment and applications*. In practice this means an ICT Operator can set up and look after a computer, use the common office applications well, connect a small network, and find and fix ordinary faults. The occupational standard names four core units of competency, and the curriculum turns each into a unit of learning.

The qualification sits at **KNQF Level 4** on the Kenya National Qualifications Framework, is coded under the international ISCED classification as programme **061 2354A**, and is issued by TVET CDACC as the *Kenya National TVET Certificate in ICT Operator Level 4*.

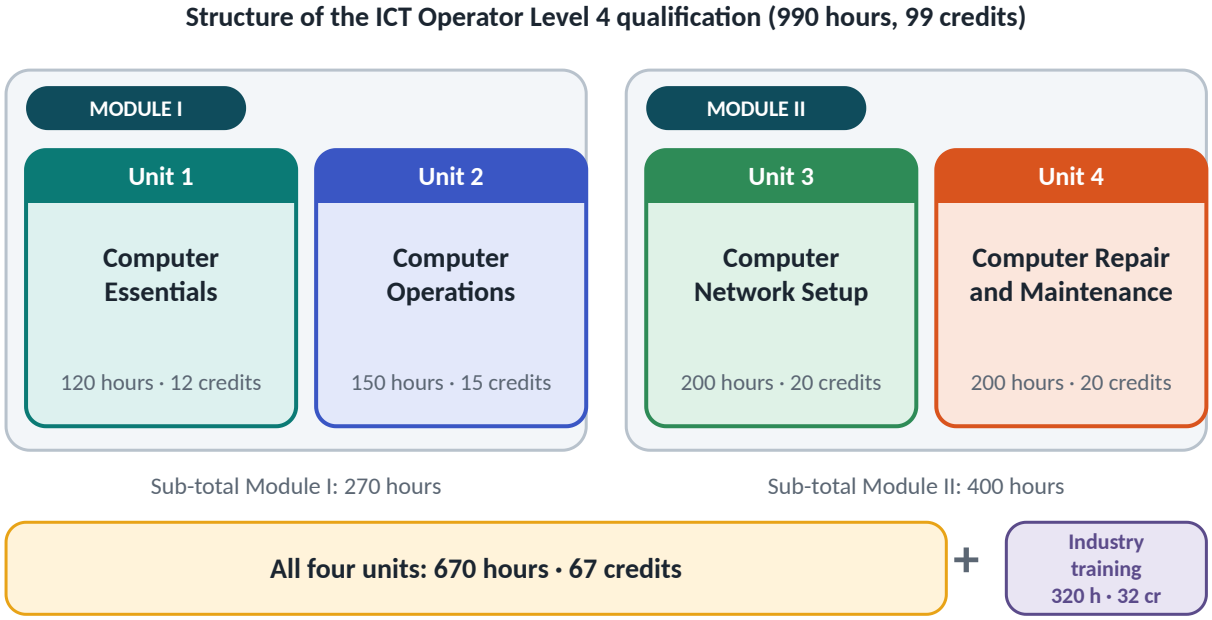


Figure 1 — The two modules, four units and industry training that make up the 990-hour programme.

Table 1 — Summary of units of learning (from the curriculum).

ISCED unit code	TVET CDACC unit code	Unit title	Hours	Credits
0611 351 01A	IT/CU/ICTA/CR/01/4/MA	Computer Essentials	120	12
0611 351 02A	IT/CU/ICTA/CR/02/4/MA	Computer Operations	150	15
0612 351 03A	IT/CU/ICTA/CR/03/4/MA	Computer Network Setup	200	20
0714 351 04A	IT/CU/ICTA/CR/04/4/MA	Computer Repair and Maintenance	200	20
		Sub-total	**670**	**67**
		Industry training	320	32
		Grand total	**990**	**99**

Notice that one credit corresponds to ten hours of learning. Units are grouped into **modules** so that a trainee who completes Module I can already be employable in a basic ICT support role while continuing to Module II. This is what the curriculum means by “part qualifications” and “multiple entry and exit”.

2.2 Who can join, and who can teach

Entry requirements. A trainee joining the course should have either the Kenya Certificate of Secondary Education (KCSE) with a mean grade of E, or an equivalent qualification as determined by the Technical and Vocational Education and Training Authority (TVETA).

Trainer qualifications. A trainer of any unit in this course must hold at least a KNQF Level 5 ICT qualification (or an equivalent in a related trade area) and must be registered by TVETA.

2.3 Industry training

Every trainee is required to complete industry training of at least **320 hours** in the ICT sector. For a full-qualification trainee it may be taken after all units are complete. For a trainee pursuing a part qualification it can be spread equally across the units. Where an institution runs the *dual training* model, industry training follows the dual training policy. The back matter of this book includes a logbook format to record your attachment activities.

2.4 How you are assessed

The course is assessed **formatively** (during learning) and **summatively** (at the end of each unit). The rules in the curriculum are:

1. During formative assessment, *all performance criteria* are assessed, according to their weighting.
2. Summative assessment concentrates on the *critical aspects of the unit of competency*.
3. The theory and practical weighting is **10:90** in each unit of learning.
4. Formative and summative assessments make up **60%** and **40%** of the overall score.
5. To be declared competent in a unit you must score at least **40% in theory**, at least **50% in practical** (where it applies), and at least **50% in the weighted total** of formative and summative results.

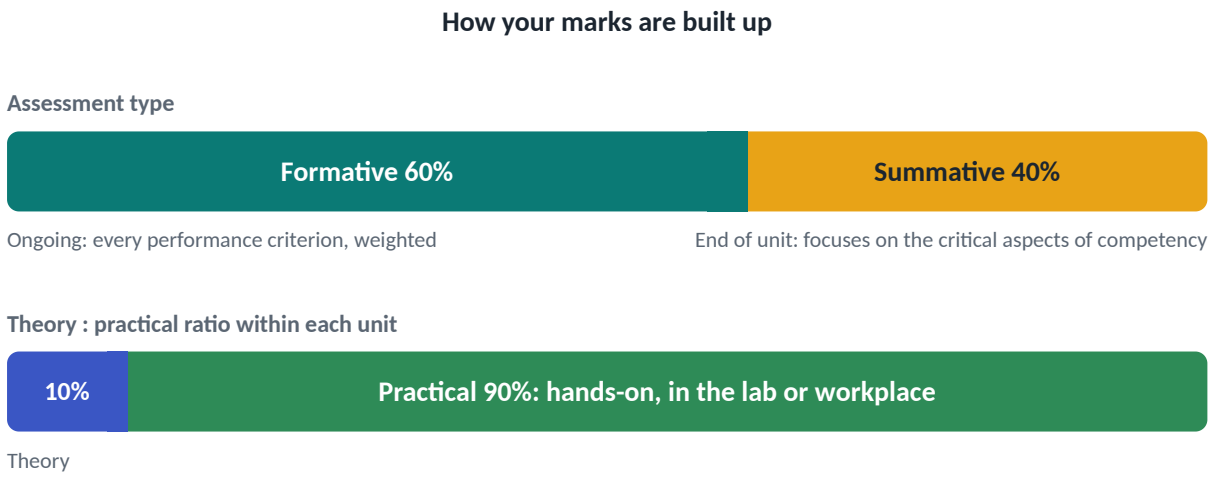


Figure 2 — Assessment weightings: type of assessment (top) and theory-to-practical ratio (bottom).

🔧 WORK OUT YOUR OWN RESULT

A trainee scores as follows in Unit 1: formative theory 45%, formative practical 75%, summative theory 55%, summative practical 60%. Practise the rules above.

1. Check the theory condition: both theory scores are at least 40%, so it is met.
2. Check the practical condition: both practical scores are at least 50%, so it is met.
3. Work out the formative mark using the 10:90 split: (45 × 0.10) + (75 × 0.90) = 4.5 + 67.5 = 72%.
4. Work out the summative mark in the same way: (55 × 0.10) + (60 × 0.90) = 5.5 + 54 = 59.5%.
5. Combine them with the 60:40 weighting: (72 × 0.60) + (59.5 × 0.40) = 43.2 + 23.8 = 67%.
6. Look up 67% on the rating scale below: it falls in the 65 – 79 band, so the trainee is rated **Proficient**.

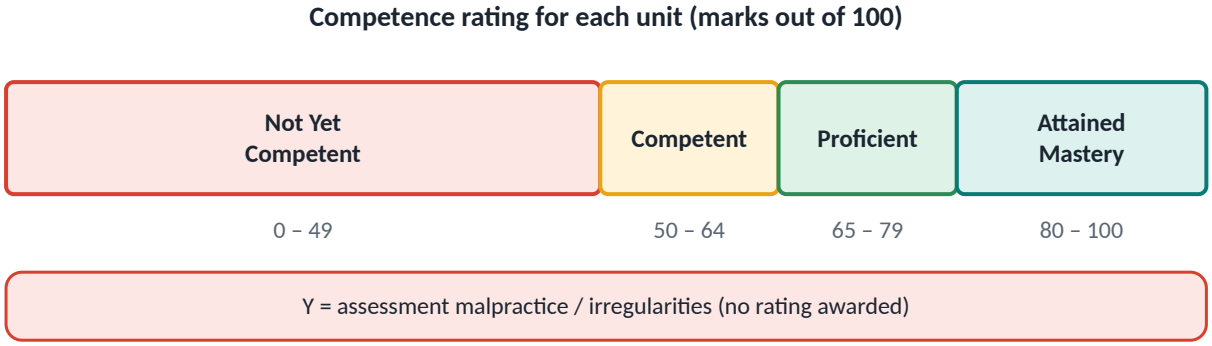


Figure 3 — Competence rating scale used for each unit of competency.

If a candidate is caught cheating or breaking the assessment rules, the rating is **Y** (assessment malpractice or irregularities) rather than a mark. The curriculum also allows **Recognition of Prior Learning (RPL)**, which means a person who already has the skills, for example from years of informal work, may be assessed and awarded a part or full qualification without repeating the training.

ASSESSMENT METHODS YOU WILL MEET

Across the four units the suggested methods include practical assessment, oral questions, written tests, observation, reports, projects, simulations, observation and product checklists, third-party reports and a **portfolio of evidence**. Each chapter's checklist and the back matter's portfolio guide help you prepare for these.

2.5 Certification

- A **Certificate of Competency** is issued when a candidate demonstrates competence in a *core unit of competency*.
- The **Kenya National TVET Certificate in ICT Operator Level 4** is issued when the candidate demonstrates competence in *all* the units in the qualification pack.
- A **Statement of Attainment** may be awarded for a certifiable element within a unit.

All these certificates are issued by TVET CDACC.

2.6 Reading the unit codes

Every unit has two codes. The **ISCED unit code** (for example 0611 351 01A) follows the international education classification: it carries the sector, sub-sector and occupational area, then the level, orientation and completion, the unit number and a version letter. The **TVET CDACC unit code** is easier to read, and it is the one used on assessment documents.

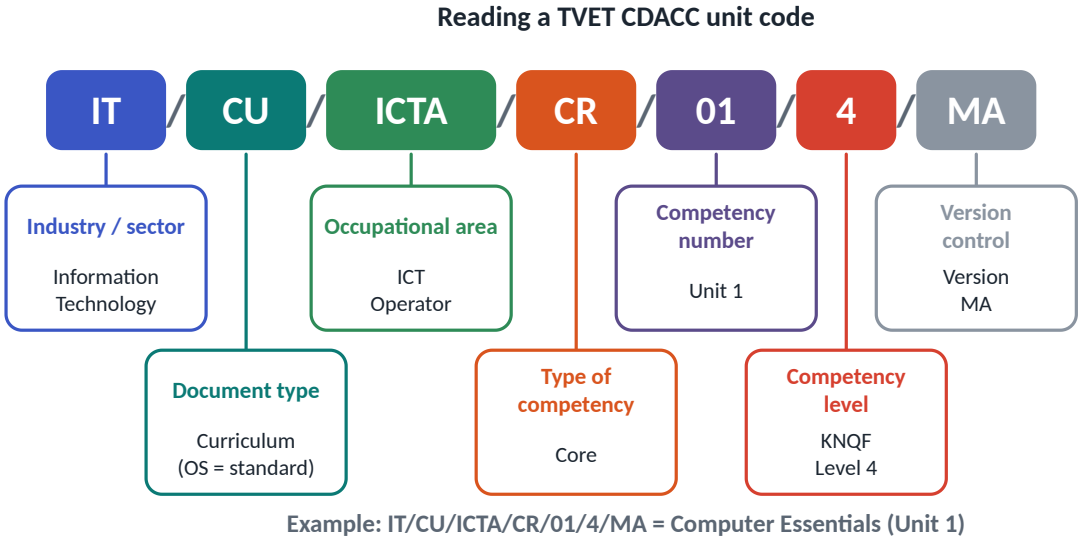


Figure 4 — Decoding IT/CU/ICTA/CR/01/4/MA. In the occupational standard the second block reads OS (occupational standard) instead of CU (curriculum).

2.7 Your journey through the programme



Repeat the cycle for every unit. Competence is proven by doing, not by memorising.

Figure 5 — Every unit follows the same cycle: learn, practise, check, assess and certify.

KEY TERMS

CBET — competency-based education and training.

KNQF — Kenya National Qualifications Framework.

TVET CDACC — TVET Curriculum Development, Assessment and Certification Council.

TVETA — TVET Authority, which registers trainers and institutions.

Formative assessment — assessment carried out during learning.

Summative assessment — assessment at the end of a unit.

Portfolio of evidence — an organised collection of work that proves your competence.

RPL — recognition of prior learning.

REVIEW QUESTIONS

1. State the total number of hours and credits for the ICT Operator Level 4 qualification, and name the four units.
2. What is the minimum industry-training requirement?
3. Give the conditions that must all be met for a candidate to be declared competent in a unit.
4. A candidate scores 78% overall in a unit. What is the competence rating?
5. Explain the difference between a Certificate of Competency and a Statement of Attainment.
6. Decode the unit code IT/CU/ICTA/CR/03/4/MA.

UNIT OF LEARNING

1

Computer Essentials

This unit covers the competencies required to perform computer essentials: managing computer devices, managing desktop settings, performing file management, managing computer software and performing online jobs.



LEARNING OUTCOMES AND HOURS

1. Manage computer devices	**20 hours**
2. Manage desktop settings	**30 hours**
3. Perform file management	**20 hours**
4. Manage computer software	**20 hours**
5. Perform online jobs	**30 hours**

Unit duration: 120 hours · Credit factor: 12 · TVET CDACC unit code: IT/CU/ICTA/CR/01/4/MA

CHAPTER 1

Manage Computer Devices

20 hours | Unit 1 · Learning outcome 1

What you will learn

- Select computer hardware devices to match a user's requirements (performance criterion 1.1).
- Disassemble computer hardware devices safely and clean them (1.2).
- Assemble computer hardware devices and connect the monitor and system unit (1.3).
- Explain and perform the computer booting process according to Unified Extensible Firmware Interface (UEFI) standards (1.4).
- Connect and configure peripheral devices such as printers, speakers, mice, keyboards and projectors following the user manual (1.5).

1.1 Selecting computer hardware devices

1.1.1 What is computer hardware?

A computer is an electronic machine that accepts **input**, **processes** it according to instructions, **stores** the results and produces **output**. Everything you can touch on a computer is **hardware**; the programs that tell the hardware what to do are **software**. An ICT Operator must know the hardware well, because choosing, connecting and looking after it is the foundation of every other task in this book.

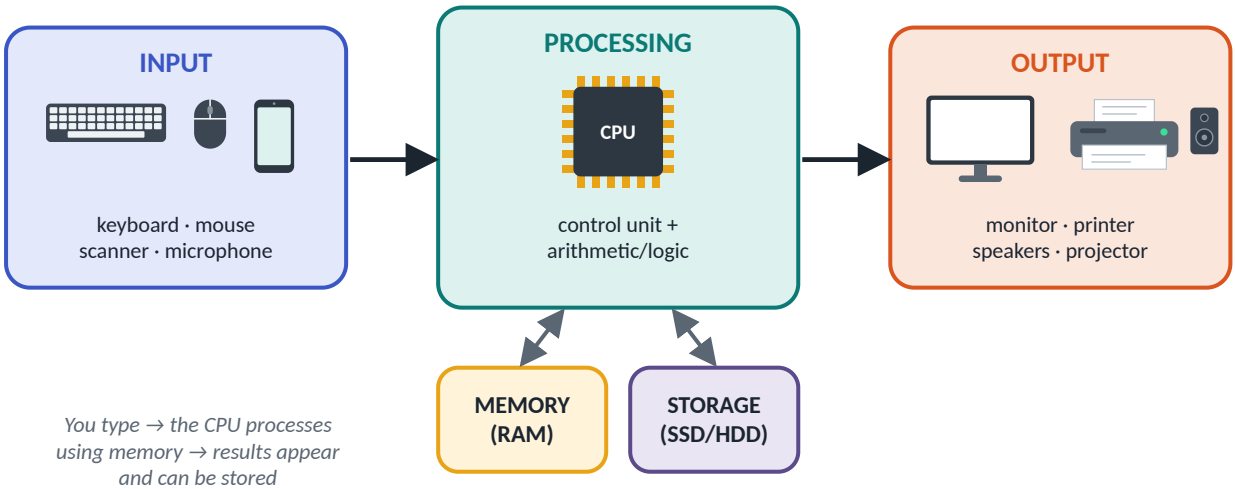


Figure 1.1 — The information-processing cycle: input devices feed the processor, which uses memory and storage, and sends results to output devices.

KEY TERMS

Hardware — the physical parts of a computer system.

Software — programs and data that instruct the hardware.

System unit — the case and the components inside it (motherboard, processor, memory, storage, power supply).

Peripheral — a device connected to the system unit, such as a printer or mouse.

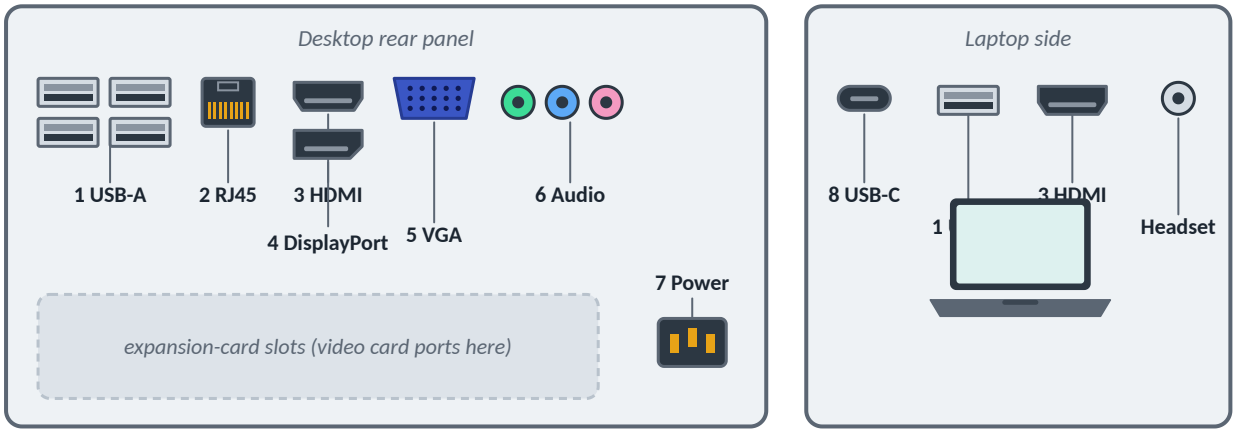
Port — a socket on the computer where a cable or device is plugged in.

Component — one part of the computer system, such as a hard disk drive or video card.

Identifying computer components and ports

Before you can select or connect anything you must recognise it. The back and sides of a computer carry **ports**. Each port has a shape that lets only the correct plug fit, and most have a small symbol beside them.

Ports on a desktop (rear) and a laptop (side)



Rule of thumb: match the plug to the socket by shape. Never force a connector.

VGA carries picture only; HDMI carries picture and sound; USB-C can carry data, video and charging power.

Figure 1.2 — Common ports on the back of a desktop computer and the side of a laptop.

Table 1.1 — The ports you will meet most often.

Port	Typical use	Tip for recognising it
USB-A	Keyboards, mice, flash drives, printers	Flat rectangle; only fits one way up
USB-C	Phones, newer laptops, docks, fast drives	Small oval, reversible
HDMI	Monitor, TV or projector (picture and sound)	Flat, one angled-cut side
DisplayPort	Monitors, especially high resolution	Similar to HDMI with one corner cut off
VGA	Older monitors and projectors (picture only)	Blue, 15 pins in three rows, two screws
RJ45 (Ethernet)	Wired network cable	Looks like a fat telephone socket
Audio jacks	Speakers (green), microphone (pink), line-in (blue)	Round 3.5 mm sockets, colour coded
Power socket	Mains power to the power supply	Three-pin socket at the back

1.1.2 The computer case, monitor, keyboard and mouse

The **computer case** protects the components, carries the power switch and front ports, and directs cooling air. Common shapes are the *tower* (mini, mid and full), the *small-form-factor* desktop, the *all-in-one* (the computer is built into the monitor) and the *laptop*, which combines the case, screen, keyboard and pointing device in one folding unit.

The **monitor** displays the output. Modern monitors use LCD panels lit by LEDs; sizes are measured diagonally in inches, and sharpness is described by the **resolution**, for example 1920 × 1080 pixels ("Full HD"). The **keyboard** is the main text input device; the standard letter layout is called **QWERTY** after the first six letters on the top row. The **mouse** moves a pointer on screen; optical mice track movement with a small light sensor, and laptops replace it with a touchpad.

1.1.3 The parts inside the computer case

Open a desktop case and you will see the following components. Learn to recognise each one by shape and position.

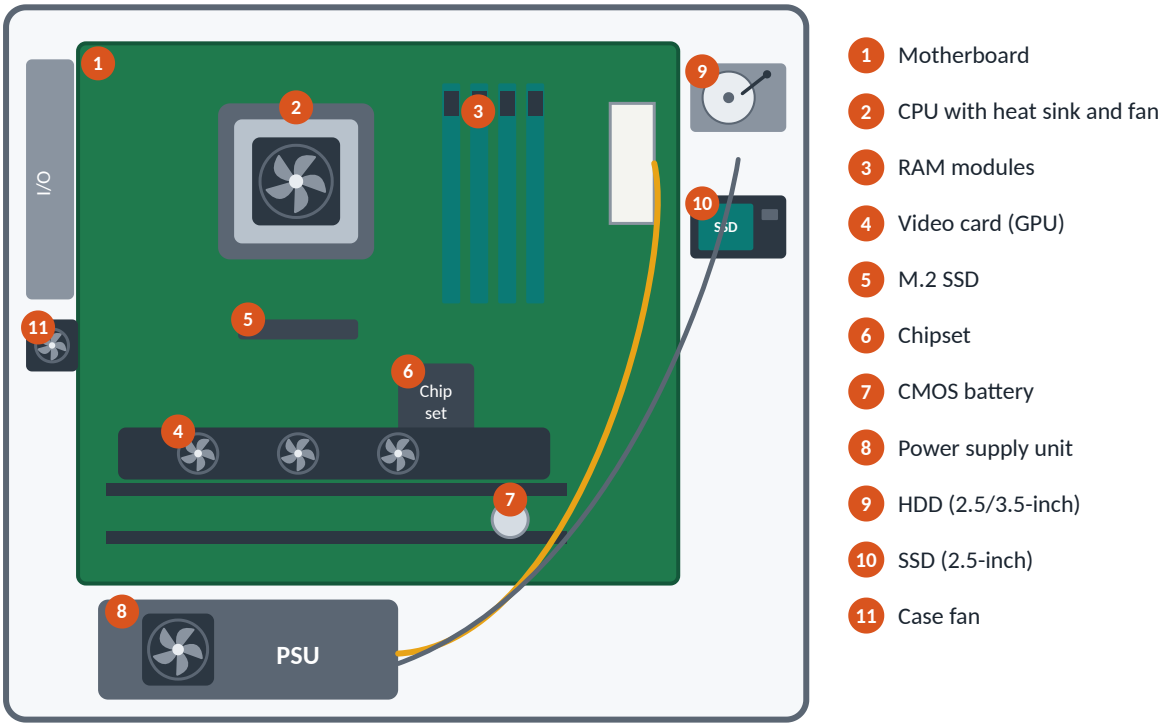


Figure 1.3 — A labelled view inside a typical desktop system unit.

- The **motherboard** is the main circuit board. Every other component plugs into it or connects to it, and it carries the chipset, the memory slots, expansion slots, storage connectors and the firmware (UEFI) chip.
- The **central processing unit (CPU)** is the "brain" that executes instructions. Its speed is quoted in gigahertz (GHz) and its power in the number of *cores*. It sits in a socket on the motherboard under a heat sink and fan.
- **Random access memory (RAM)** is the fast, temporary working memory. Anything not saved is lost when power is off. Typical office computers today have 8 GB or 16 GB.
- **Storage** keeps programs and files permanently. A **hard disk drive (HDD)** stores data on spinning magnetic platters; a **solid-state drive (SSD)** uses flash memory, has no moving parts and is much faster. SSDs come as 2.5-inch drives (SATA) or small M.2 sticks.

- The **power supply unit (PSU)** converts mains AC electricity into the low-voltage DC power the components need.
- The **video card** (graphics card or GPU) produces the picture. Many processors have graphics built in, so a separate card is only needed for demanding graphics work.
- **Cooling** is provided by heat sinks and fans; overheating shortens the life of every component.
- The **CMOS battery** is a small coin cell that keeps the clock and firmware settings when the computer is unplugged.

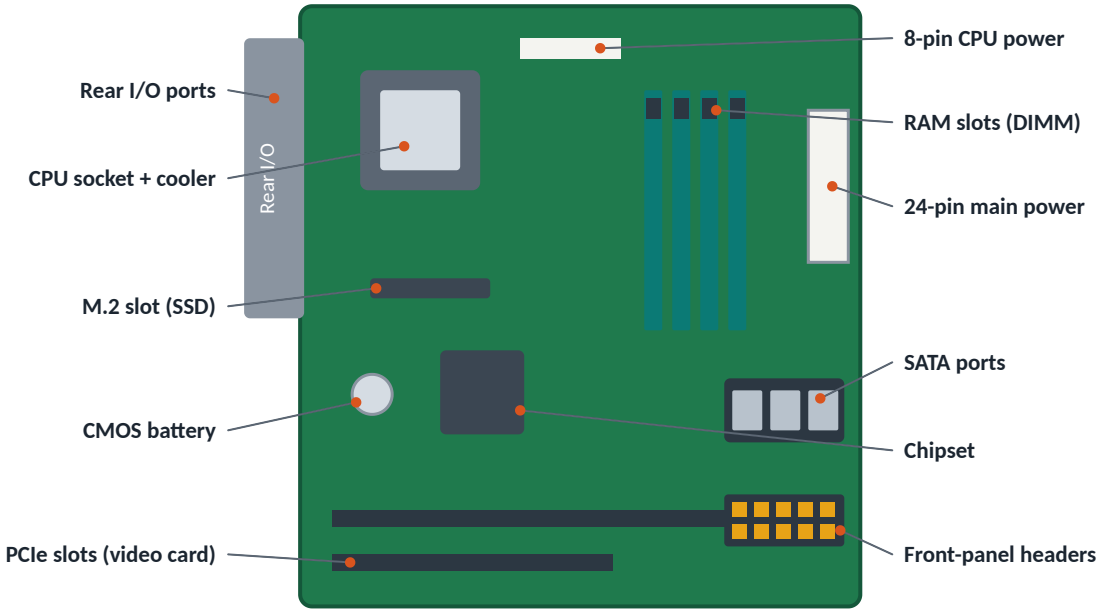


Figure 1.4 — Main areas of a motherboard.

Classification of computer hardware devices

Hardware is grouped by what it does in the information-processing cycle. This classification is used in the occupational standard, so learn it well.

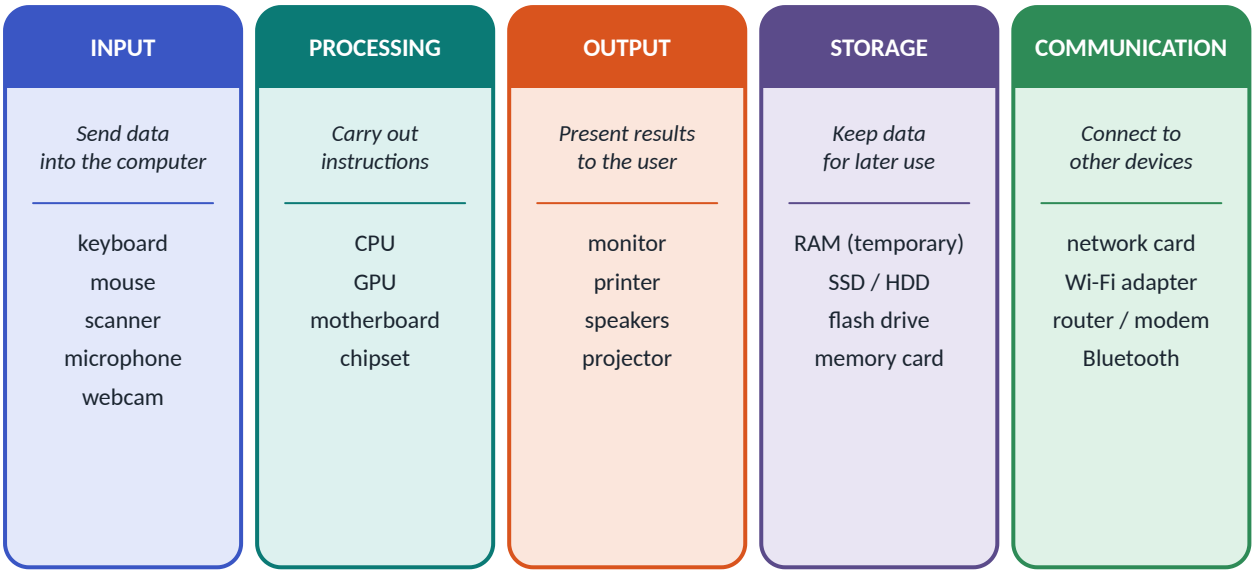


Figure 1.5 — Hardware classified by function: input, output, processing, storage and communication.

Selecting hardware to match a user's requirement

The performance criterion says hardware must be selected "as per user requirement". This means you begin with the user's *work*, not the price tag or brand. Ask what programs they will run, how many files they handle, whether they move around, and what budget and power supply they have.

Table 1.2 — Matching a user profile to typical hardware. Figures are typical starting points, not fixed rules.

User profile	Processor	RAM	Storage	Other notes
Office and clerical work (documents, spreadsheets, email)	Entry to mid-range dual/quad-core	8 GB	256 GB SSD	22-inch Full HD monitor; a printer on the network
Student in a VTC computer lab	Mid-range quad-core	8 GB	256 GB SSD	Durable keyboard and mouse; headphones for tutorials
Graphic design and video editing	Mid to high-range multi-core	16 to 32 GB	512 GB SSD plus large data drive	Dedicated video card; colour-accurate monitor
Mobile staff who travel to sub-counties	Efficient laptop processor	8 to 16 GB	256 to 512 GB SSD	Long battery life, lightweight, carry case
Shared server or file store	Multi-core server-class	16 GB or more	Mirrored drives (RAID)	Uninterruptible power supply (UPS)

BUYING HARDWARE IN KENYA

Check that the power supply matches the local mains (230 V, 50 Hz), that the keyboard layout is the one your users type on, and that the seller gives a warranty and a spare-parts contact. Frequent voltage fluctuations make a surge protector or UPS a sensible addition to any office or lab purchase. Refurbished computers can be good value if you test them properly using the methods in Unit 4.

🔧 **WRITE A HARDWARE SPECIFICATION**

1. Choose a user from the table above, for example a clerk in a sub-county education office.
2. List the tasks that person performs every day.
3. Write down the minimum processor, RAM and storage that would run those tasks comfortably.
4. List the peripherals they need (printer, scanner, speakers, and so on).
5. Compare two real product specifications from a shop or website, and record which one meets the requirement better and why.
6. Present your recommendation in one paragraph to the class.

1.2 Disassembling and cleaning computer hardware

Disassembly means taking a computer apart in a careful, reversible order. You disassemble to clean, upgrade, repair, or reuse parts. Because parts are delicate and expensive, the aim is that every screw and cable goes back exactly where it came from.

BEFORE YOU OPEN ANY COMPUTER

- Shut down, then disconnect the **power cable** and any battery. Press the power button once to drain remaining charge.
- Protect components from **electrostatic discharge (ESD)**: wear an antistatic wrist strap clipped to bare metal on the case, or touch the metal frame often, and work on an antistatic mat if you have one.
- Work on a clean, well-lit, uncluttered table. Never wear rings, loose bracelets or dangling jewellery.
- Never open a power supply unit. It can hold a dangerous charge even when unplugged.

Tools and preparation

You need a set of screwdrivers (Phillips and flat), a small container or magnetic tray for screws, zip ties, a soft brush, a torch, and a phone to photograph each stage. Label cables and take a photograph before you unplug anything.

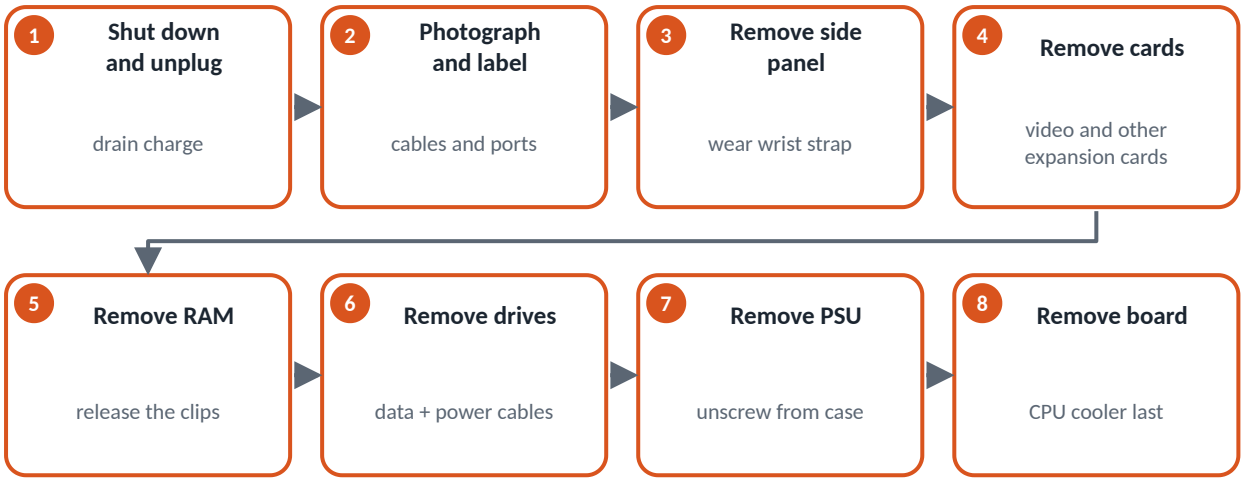


Figure 1.6 — A safe order for taking a desktop computer apart. Assembly is the same steps in reverse.

1.2.1 Cleaning computer devices

Dust is the enemy of every computer: it blocks air flow, traps heat and can short circuits when damp. Clean components while the computer is apart.

- Blow dust off heat sinks, fans and slots with **compressed air** or a small blower. Hold fans still so they do not over-spin.
- Use a soft, dry brush for stubborn dust on the motherboard.
- Clean contacts (RAM and card edges) gently with a lint-free cloth; use **isopropyl alcohol** only if truly necessary and let it dry fully.
- Clean the screen with a slightly damp microfibre cloth. Never spray liquid directly on the screen.
- Wipe the case and keyboard with a cloth lightly moistened with mild cleaner.

DO NOT DO THIS

Do not use a household vacuum cleaner inside the case (it can create static). Do not use water, thinners or petrol. Do not touch the gold contacts of memory modules or processors with your fingers.

🔧 DISASSEMBLE AND LABEL A DESKTOP SYSTEM UNIT

1. Work in pairs, wearing an antistatic wrist strap. Shut down and unplug the computer.
2. Photograph the back panel, then remove and label each cable.
3. Remove the side panel and photograph the inside.
4. Remove the expansion cards and the memory modules, and place each on an antistatic mat.
5. Disconnect the drive cables and remove the drives, then remove the power supply's motherboard connectors.
6. Remove the CPU cooler carefully, noting which way the fan cable points.
7. Place all screws in a labelled container. Draw a quick sketch showing where each part came from.
8. Clean the parts using the methods above.

9 Have your partner check your sketch and photographs, then keep them in your portfolio.

1.3 Assembling computer hardware

1.3.1 Types of computer hardware devices and their functions

By now you can name the devices; the table below summarises their functions so that you can decide the order and manner of connection when assembling.

Table 1.3 — Functions of the main hardware devices.

Device	Function
Motherboard	Connects and lets all components communicate
CPU	Executes program instructions
RAM	Holds programs and data currently in use
SSD/HDD	Permanent storage of the operating system and files
Power supply unit	Supplies regulated DC power to all parts
Video card	Generates the display output
Monitor	Displays text, images and video
Keyboard, mouse	Enter text and control the pointer
Network card	Connects the computer to a network

1.3.2 Assembly procedure

The order matters. In general, work outward from the motherboard to the case and then to the peripherals.

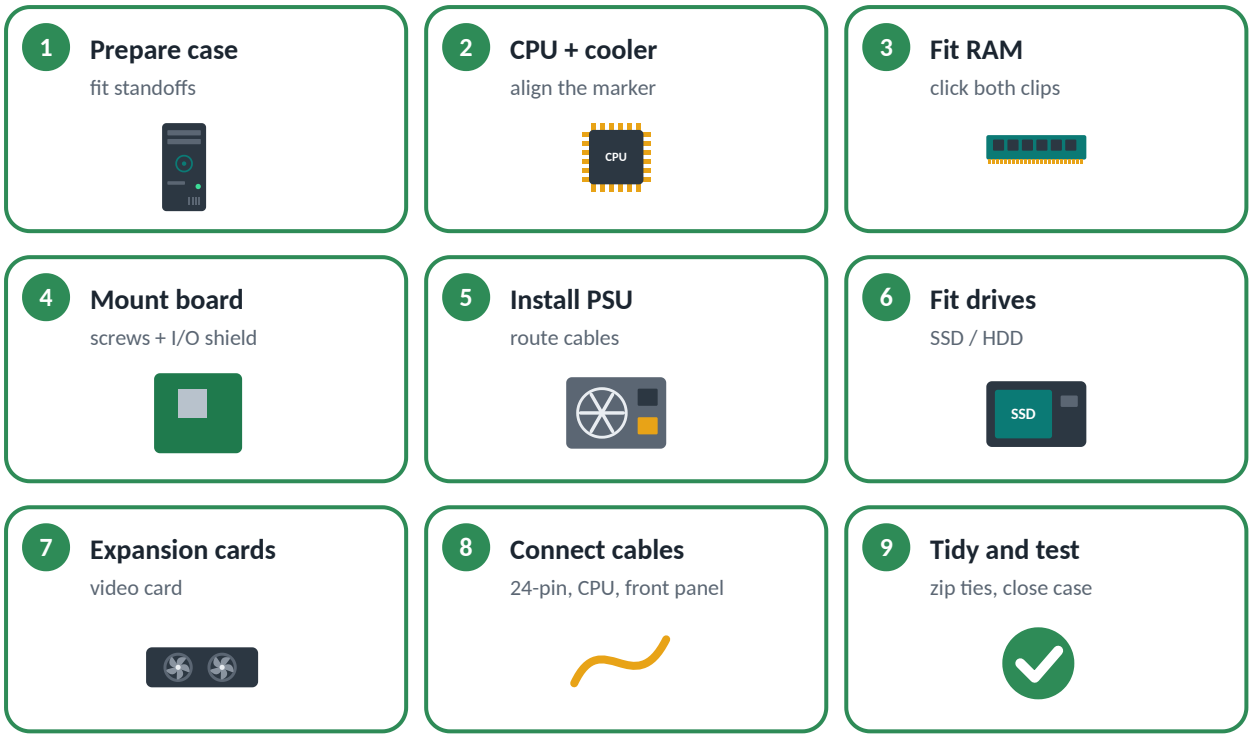
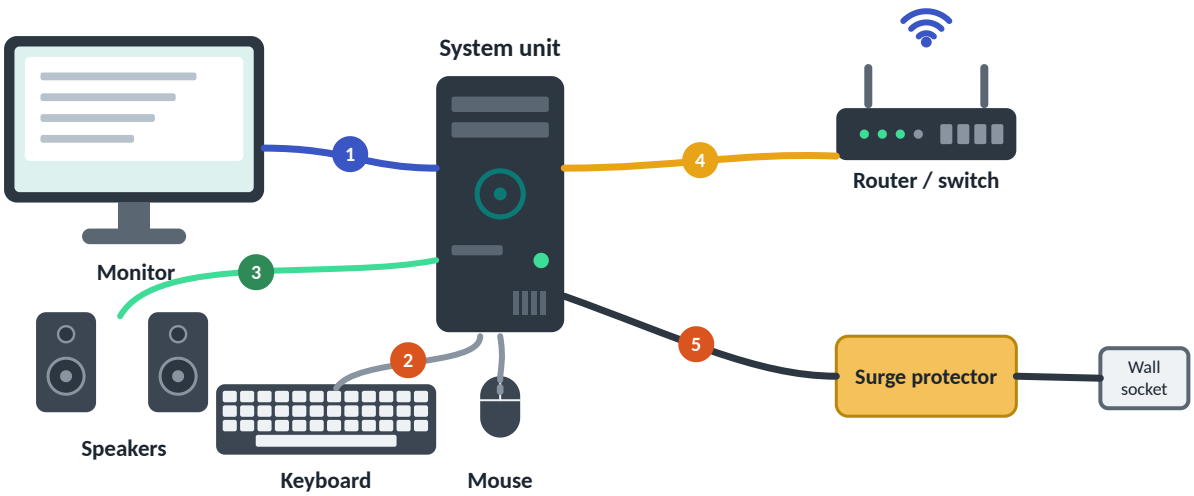


Figure 1.7 — Building a desktop computer, step by step.

1. **Prepare the case.** Remove the side panels and check that the motherboard standoffs are in the right positions.
2. **Install the CPU and cooler** on the motherboard while it is on its box or an antistatic mat: align the notches or triangle marker, lower the CPU in, secure the socket lever, apply thermal paste if the cooler does not have it pre-applied, then fit the cooler and connect its fan to the CPU-fan header.
3. **Install the RAM** in the correct slots (see the motherboard manual), pushing evenly until the clips click.
4. **Mount the motherboard** in the case and screw it in, then fit the I/O shield if needed.
5. **Install the power supply** and route the main cables.
6. **Install storage drives** in bays or on the M.2 slot, and connect data and power cables.
7. **Fit any expansion cards** such as a video card.
8. **Connect the power cables** (24-pin main, 4/8-pin CPU, drive and card power) and the **front-panel cables** (power switch, reset, LEDs, USB, audio).
9. **Tidy the cables** with zip ties so that air can flow, then close the case.

1.3.3 Connecting the monitor and system unit

With the system unit assembled you connect the outside world. Plug the monitor's video cable into the correct video output (the video card's port if one is fitted, otherwise the motherboard's), then the keyboard and mouse into USB ports, speakers into the green audio jack, network cable into the RJ45 port, and lastly the power cables to a surge-protected outlet.



1 Video cable (HDMI, VGA or DisplayPort) to the monitor
2 USB cables from the keyboard and mouse
3 Audio cable to the green jack for the speakers
4 Network cable (RJ45) to the router or switch
5 Power cable through a surge protector to the wall (the monitor also has its own power cable)

Figure 1.8 — Connecting the monitor, keyboard, mouse and power to the system unit.

VIDEO PORT TRAP

If your computer has a separate video card, plug the monitor into the *card's* ports, not the motherboard's. If you plug into the motherboard, the screen may stay blank because the built-in video is disabled.

🔧 **REASSEMBLE AND TEST**

1. Using your sketch and photos, reassemble the computer you took apart in Section 1.2.
2. Check that every cable is connected and every screw is used.
3. Connect the monitor, keyboard, mouse and power.
4. Switch on and confirm the computer starts (see the booting section below).
5. If it does not start, retrace your steps against the photographs. Note the fault and what fixed it.

1.4 Booting a computer

1.4.1 What is booting?

Booting is the sequence of events from pressing the power button until the operating system is running and ready for use. The word comes from "bootstrapping" (lifting yourself by your own bootstraps), because the computer must start itself from almost nothing.

The occupational standard requires booting to follow the **Unified Extensible Firmware Interface (UEFI)** standard. UEFI is the modern replacement for the older BIOS. It is firmware stored on a chip on the motherboard that initialises the hardware, runs checks, and hands control to the operating system.

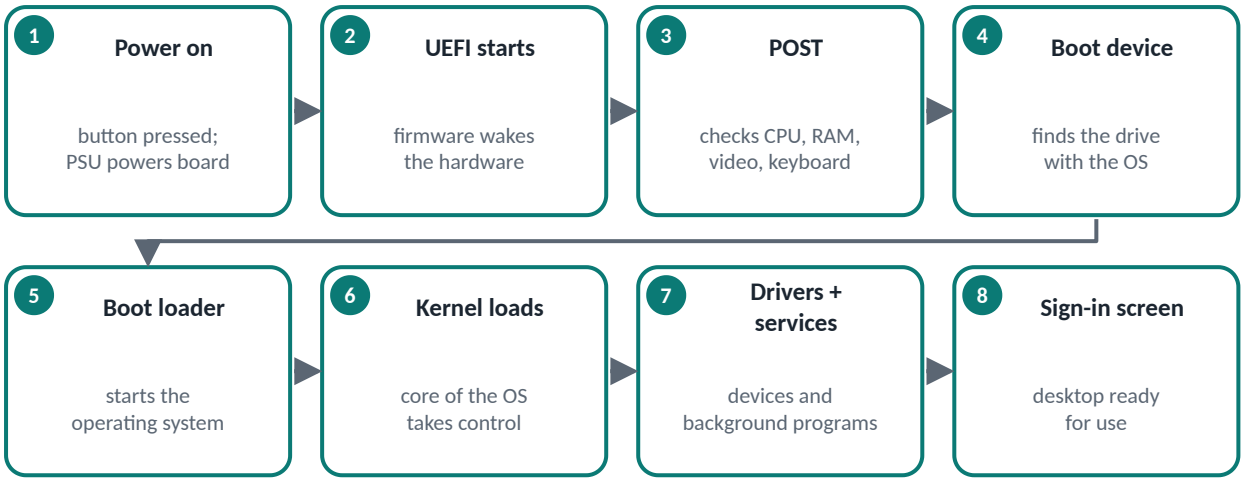


Figure 1.9 — What happens between pressing the power button and seeing the login screen.

Table 1.4 — UEFI compared with the older BIOS.

Feature	BIOS (older)	UEFI (current)
Interface	Text screens, keyboard only	Graphical, mouse support
Boot drive size	Limited to about 2 TB (MBR)	Very large drives (GPT)
Start-up speed	Slower	Faster
Security	Little	Secure Boot verifies the operating system
Extras	Few	Network tools and diagnostics

POST

Power-On Self-Test. A quick check of the processor, memory, video and keyboard that the firmware performs before it loads the operating system. If POST fails you may hear beeps or see an error message. Unit 4 explains how to read them.

1.4.2 Types of booting

Table 1.5 — Cold booting compared with warm booting.

	Cold boot (hard boot)	Warm boot (soft boot)
Starting condition	Computer is completely off	Computer is already on
How you do it	Press the power button	Choose **Restart** from the Start menu, or press the reset button
What happens	Power is applied and POST runs in full	The operating system restarts, often skipping some hardware checks
When to use it	Start of day; after shutting down for hardware changes	After installing software or updates; to clear a minor fault

FAST STARTUP

Modern Windows has “Fast startup”, which makes **Shut down** save part of the system to disk so the next start is quicker. If a problem persists after shutting down and starting again, choose **Restart** instead, which always performs a full clean restart.

🔧 OBSERVE THE BOOT PROCESS AND OPEN UEFI SETUP

1. Restart a lab computer and watch the screen. Note the manufacturer logo and the key prompt (usually `F2`, `Del` or `F10`).
2. Restart again and press that key repeatedly to enter UEFI setup. Do **not** change any setting.
3. Find the information page and record the firmware version, processor, memory size and boot order.
4. Exit **without saving** and let the computer start normally.
5. Time how long a cold boot takes, then a warm boot, and write down the difference.

1.5 Connecting computer peripheral devices

A **peripheral** is any device connected to the system unit that adds to its abilities. The occupational standard lists printers, speakers, mice, keyboards and projectors.

1.5.1 Types of peripheral devices

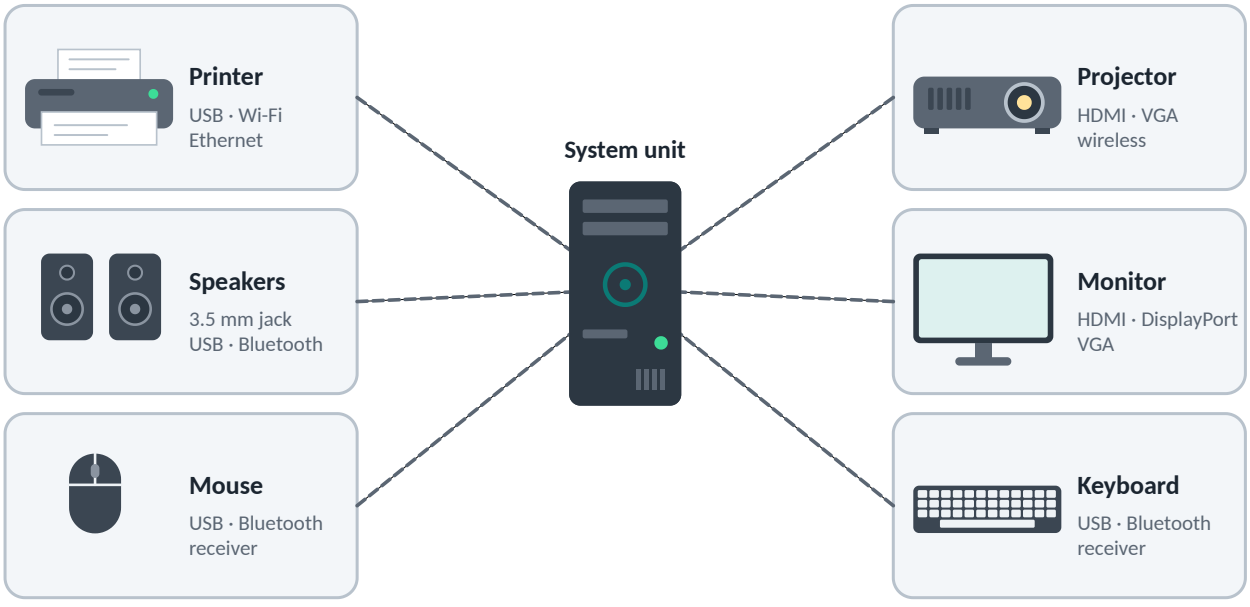


Figure 1.10 — Common peripherals and how each connects to a computer.

- **Printer:** produces paper output. Inkjet printers spray liquid ink; laser printers use toner powder fused by heat; multifunction printers also scan and copy.
- **Speakers:** give sound output through the audio jack, USB, HDMI or Bluetooth.
- **Mouse and keyboard:** input devices, wired (USB) or wireless (a small USB receiver or Bluetooth).

- **Projector:** displays the screen on a wall or screen for a class or meeting; connects by HDMI or VGA.

1.5.2 Configuration of peripheral devices

Most peripherals work as soon as they are plugged in because the operating system carries a built-in **driver**, the small program that lets the operating system talk to a device. Some, especially printers, need the manufacturer's driver.

Installing a printer (Windows).

1. Connect the printer's power and USB or network cable and switch it on.
2. Open **Settings → Bluetooth & devices → Printers & scanners**.
3. Choose **Add device** and select your printer. If it is not listed, choose *Add manually* or install the driver from the manufacturer's website or disc.
4. Once installed, click the printer and choose **Print test page** to confirm it works.
5. Set it as the **default printer** if it will be used most often.

Pairing a Bluetooth device. Turn the device on and switch it to pairing mode, then open **Settings → Bluetooth & devices → Add device → Bluetooth** and select it.

Setting up a projector. Connect the video cable, switch on the projector, and press `Win` + `P` to choose a display mode.

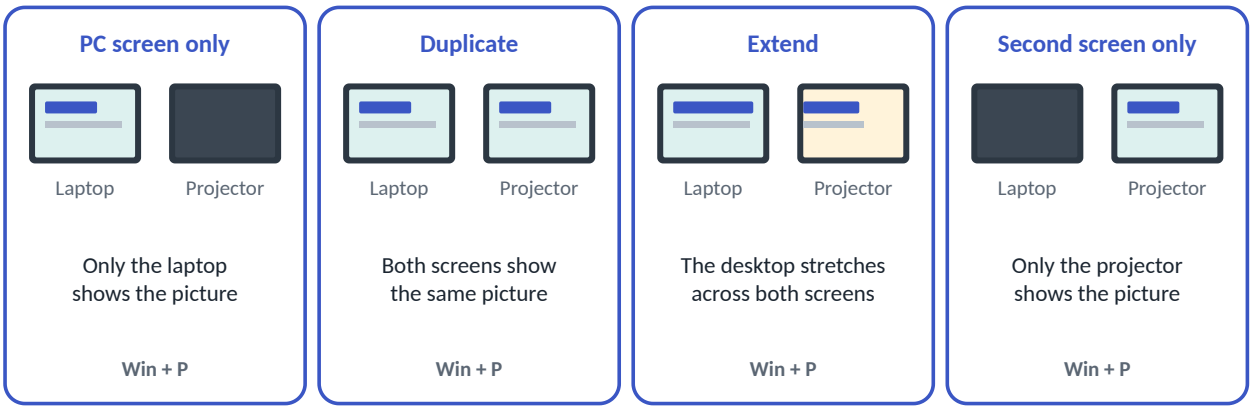


Figure 1.11 — The four display modes in Windows for projectors and second screens.

IF THE PROJECTOR SHOWS "NO SIGNAL"

Check that the correct input (HDMI or VGA) is selected on the projector, that the cable is firmly seated at both ends, and that the display mode on the computer is not set to *PC screen only*. If the image is blurry, set the computer's resolution to the projector's native resolution.

🔧 **CONNECT AND CONFIGURE PERIPHERALS**

1. Connect a printer to a computer and install its driver if Windows does not do it automatically.
2. Print a test page and set the printer as default.
3. Connect a wireless mouse and pair a Bluetooth speaker.

4. Connect a projector, project the desktop in *Duplicate* mode, then in *Extend* mode, and drag a window between the two screens.
5. Record the model numbers of each device and the driver version used in your portfolio of evidence.

REVIEW QUESTIONS

1. Define *hardware*, *software* and *peripheral*.
2. Name the five functional groups into which computer hardware is classified and give one example of each.
3. State the function of the motherboard, RAM, and power supply unit.
4. Give two differences between an HDD and an SSD.
5. List four safety precautions to observe before opening a computer case.
6. Why is dust harmful to a computer, and how would you remove it safely?
7. Explain the difference between a cold boot and a warm boot.
8. What is POST, and when does it happen?
9. State two advantages of UEFI over BIOS.
10. A projector shows “No signal”. Describe the steps you would follow to fix it.

ASSESSMENT CHECKLIST: MANAGE COMPUTER DEVICES

Performance criterion / evidence	Yes	Not yet	Trainer comments
1.1 Selected hardware that matches the stated user requirement and justified the choice.			
1.2 Followed safety rules (power off, ESD protection) before disassembly.			
1.2 Disassembled the system unit in the correct order without damaging any part.			
1.2 Cleaned components using appropriate methods and materials.			
1.3 Assembled the computer following the correct order and used every screw and cable correctly.			
1.3 Connected the monitor, keyboard, mouse and power to the system unit correctly.			
1.4 Booted the computer, identified the UEFI setup key and explained cold and warm boot.			
1.5 Connected and configured a printer, a mouse, speakers and a projector as per the user manual.			
Evidence Portfolio contains photographs, sketches and a specification sheet.			

END OF FREE SAMPLE

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