

IT Support Fundamentals: The Complete A+ Companion

High School IT Fundamentals — Grades 9–12

Tech for Everyone

CHAPTER 1

Hardware: The Physical Computer

If You Can Name It, You Can Fix It

Every IT career — help desk, cybersecurity, networking, cloud — starts with the same foundation: knowing what's physically inside a computer and what each part does. This chapter covers the largest single domain on the CompTIA A+ Core 1 (220-1201) exam: **Hardware, worth 25% of your score**. It also gives you your first look at **Hardware and Network Troubleshooting**, which at **28%** is the heaviest domain on the entire exam. Together, that means more than half of Core 1 rewards exactly what you'll learn here: identifying components, choosing the right ones, and diagnosing them when they fail.

A quick orientation to the certification itself: the A+ is two exams — Core 1 (220-1201) and Core 2 (220-1202) — each with up to 90 questions in 90 minutes, scored on a 100–900 scale. Core 1 requires a 675 to pass; Core 2 requires a 700. You don't need to memorize every spec sheet ever printed. You need to understand *why* each component exists, how they differ, and what it looks like when one goes bad. That's what this chapter builds.

1.1 — System Components

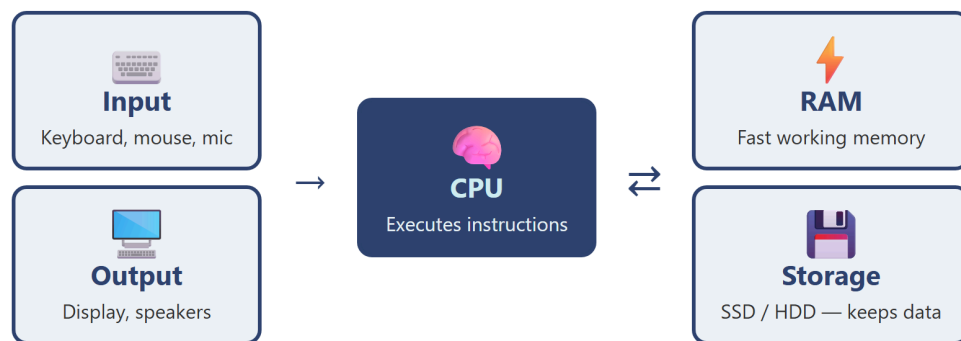
Open any desktop case and you'll find the same cast of characters. Knowing them by sight — and by spec — is the baseline skill of the trade.

The CPU (central processing unit) is the computer's engine. Three numbers describe it. **Cores** are independent processing units on one chip — a quad-core CPU can genuinely do four things at once. **Threads** are the work queues the operating system sees; many CPUs run two threads per core (Intel calls this Hyper-Threading, AMD calls it SMT), so an 8-core chip may present 16 threads. **Clock speed**, measured in gigahertz (GHz), is how many cycles each core completes per second. More cores help with multitasking and heavy workloads like video rendering; higher clock speed helps individual programs feel snappy. Neither number alone tells the whole story — a modern 6-core chip at 3.5 GHz will demolish a decade-old chip with the same specs, because architecture matters too.

RAM (random access memory) is the CPU's workspace. It's *volatile* — everything in it

vanishes when power is cut — but it's enormously faster than storage. Today's systems use **DDR4** or **DDR5** memory modules. DDR5 offers higher bandwidth and runs at lower voltage, but the two are **not interchangeable**: the modules are keyed differently and a motherboard supports one or the other, never both. When a computer "runs out" of RAM, the OS swaps data to slow storage, and everything crawls — which is why "add more RAM" is a classic, legitimate upgrade.

The Main Components of a Computer



Every computer — phone, laptop, or server — has all five.

The five essential components every computer shares, from input through CPU to memory and storage.

The **motherboard** is the circuit board that connects everything: CPU socket, RAM slots, expansion slots, storage connectors, and rear ports. Boards come in standard **form factors** — full-size **ATX**, smaller **microATX**, and compact **Mini-ITX** — which must match the case you put them in. Stored on a chip on the motherboard is the system firmware, BIOS/UEFI. **UEFI** is the modern standard (legacy BIOS is its predecessor): it tests hardware at power-on, controls boot order, and offers security features like Secure Boot. Techs enter UEFI setup with a key press at startup — often Delete or F2.

Finally, the **power supply unit (PSU)** converts wall AC power to the DC voltages components need. PSUs are rated in **watts**; a build's PSU must exceed the total draw of its parts, with headroom. A high-end graphics card alone can demand hundreds of

watts, and an undersized PSU causes crashes and random restarts — a classic troubleshooting culprit.

Key Idea

The A+ exam loves component-matching scenarios: DDR5 RAM will not fit a DDR4 board, a CPU only fits its matching socket, and a Mini-ITX board fits in an ATX case but not the reverse. When you see a "why won't this part work?" question, check compatibility first.

Try It

Read a Real Spec Sheet Like a Tech

Find any computer for sale online — a school Chromebook, a gaming desktop, anything — and pull up its full specifications. Identify five things from this chapter: the CPU's cores and clock speed, the RAM type (DDR4 or DDR5?) and amount, the storage type (HDD, SATA SSD, or NVMe?) and capacity, and at least two ports you can name precisely. Then answer the professional's question: who is this machine actually built for, and what would you upgrade first? Spec sheets stop being gibberish surprisingly fast, and reading them fluently is a skill you'll use for every purchase — yours or a client's — for the rest of your life.

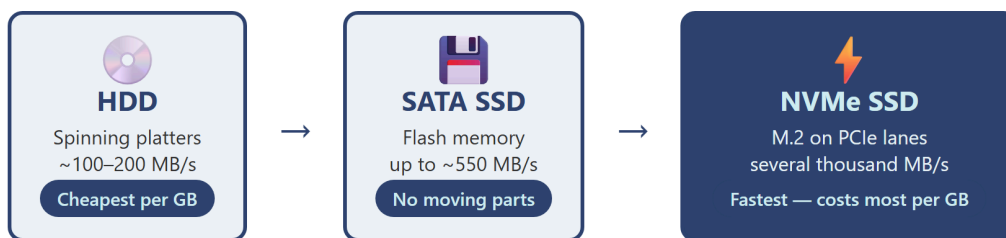
1.2 — Storage Technologies

RAM forgets; storage remembers. Every file, program, and the operating system itself lives on a storage drive, and the type of drive shapes how fast a computer feels more than almost any other component.

The **hard disk drive (HDD)** is the veteran: spinning magnetic platters (commonly 5,400 or 7,200 RPM) read by a moving arm. HDDs are cheap per gigabyte and available in huge capacities, but they're slow — physical parts have to move — and fragile if

dropped. The **solid-state drive (SSD)** replaced moving parts with flash memory chips: no noise, no moving parts, far faster. Early SSDs connected over the same **SATA** interface as hard drives, which caps them around 550 MB/s. The modern standard is NVMe (Non-Volatile Memory Express): a small **M.2** stick that talks directly to the CPU over PCIe lanes, reaching speeds of several thousand megabytes per second.

The Storage Ladder: Speed vs. Cost per Gigabyte



← Bigger & cheaper for bulk files Faster for OS & programs →

Classic build: a fast NVMe drive for the OS + a big HDD for media and backups.

Storage options trade speed against cost per gigabyte, from spinning hard drives up to NVMe.

The trade-off every tech weighs is **capacity versus speed versus cost**. NVMe is fastest but costs the most per gigabyte; HDDs are slowest but cheapest for bulk data. That's why many desktops pair a modest NVMe drive (for the OS and programs) with a large HDD (for media and backups) — the best of both.

When one drive isn't enough — or isn't safe enough — techs combine drives using **RAID** (RAID, Redundant Array of Independent Disks). The two levels to know cold:

RAID Level	How It Works	Benefit	Risk
RAID 0 (striping)	Data split across 2+ drives	Faster reads/writes; full combined capacity	No redundancy — one drive fails, <i>all</i> data is lost

RAID Level	How It Works	Benefit	Risk
RAID 1 (mirroring)	Identical copy on 2 drives	One drive can fail with zero data loss	Usable capacity is halved

Notice what RAID 1 is and isn't: it protects against *drive failure*, not against accidental deletion or ransomware — if you delete a file, the mirror deletes it too. Redundancy is not backup, and the exam (and real clients) will test whether you know the difference.

Watch Out!

RAID 0 has zero fault tolerance despite being "RAID." If a scenario mentions striping across two drives and asks what happens when one dies, the answer is total data loss. Don't let the word "redundant" in the acronym fool you.

Career Takeaway

Hardware Knowledge Is the Price of Admission

Nearly every entry-level IT job posting — help desk technician, field service tech, desktop support — lists the CompTIA A+ as required or preferred, and the hardware domain in this chapter is its single biggest slice. These roles are the proven on-ramp into the industry: help desk techs routinely move into networking, cybersecurity, or cloud roles within a few years, and hiring managers consistently say they'll take a candidate who can calmly diagnose a no-boot PC over one with better grades and no hands-on instincts. Every senior engineer you'll ever meet started by knowing, cold, what's inside the box.

1.3 — Cables, Connectors, and Peripherals

A huge share of real-world "computer problems" are actually cable problems — wrong cable, loose cable, or a cable that can't carry what the user expects. Knowing

connectors on sight is a daily-use skill.

USB is the universal workhorse, but "USB" spans wildly different speeds:

Generation	Typical Speed	Notes
USB 2.0	480 Mbps	Fine for keyboards, mice, printers
USB 3.x	5–20 Gbps	External drives, docks; often blue ports
USB4	Up to 40 Gbps	Uses the USB-C connector

The **USB-C** connector deserves special attention: it's the small, oval, *reversible* plug now standard on phones, laptops, and tablets. Crucially, USB-C describes the **connector shape, not the speed** — a USB-C port might run at USB 2.0 speeds or at 40 Gbps depending on the device. **Thunderbolt** (versions 3 and 4) also uses the USB-C shape and delivers 40 Gbps plus the ability to carry video and power over a single cable, which is what makes one-cable laptop docking stations possible.

For displays, the two connectors to know are **HDMI** — the ubiquitous standard on TVs, monitors, and projectors, carrying video *and* audio — and **DisplayPort**, common on PCs and preferred for high refresh-rate monitors and multi-monitor setups. Older connectors like VGA (analog, 15-pin, blue) still lurk on projectors in schools and conference rooms, so recognize them even if you rarely use them.

Peripherals round out the survey. **Displays** vary by panel type (IPS panels favor color accuracy and viewing angles; TN panels favor cheap speed), resolution, and refresh rate. **Printers** come in three main technologies a tech should recognize: **laser** printers (fast, cheap per page, use toner — the office standard), **inkjet** printers (great color and photo output, expensive ink), and **thermal** printers (heat-sensitive paper — every store receipt you've ever gotten). Techs don't need to repair printers at this level, but they absolutely need to match the right technology to a user's need and swap consumables

safely.

Try It

Find three cables in your home or classroom and identify each one precisely: connector name, what it carries (data, video, power — or several), and roughly how fast. Bonus points if you can find a USB-C cable and determine whether the *port* it plugs into supports more than USB 2.0 speed.

Current Events

The Right-to-Repair Movement Is Changing the Hardware You'll Fix

For years, manufacturers glued batteries in place, soldered RAM to motherboards, and restricted access to parts and manuals — making devices nearly impossible to fix. Pushback arrived: right-to-repair laws in states like New York, California, and Colorado now require manufacturers to sell parts and publish repair documentation, and companies including Apple and Samsung have launched self-repair programs. Meanwhile, companies like Framework sell laptops designed to be opened, upgraded, and repaired by their owners. For future technicians, the stakes are direct: repairability determines what your job can even attempt.

Think: Manufacturers say sealed designs make devices thinner and safer; repair advocates say they create waste and take away ownership. Who do you think is right — and who should get to decide?

1.4 — Hardware Troubleshooting

Troubleshooting is the single most valuable — and most heavily tested — skill in IT. On Core 1, Hardware and Network Troubleshooting is worth **28%**, more than any other domain, and CompTIA expects you to follow a specific, professional process rather than

guessing.

Start with what happens when you press the power button. Firmware runs the POST (Power-On Self-Test), a hardware check that runs *before* the operating system loads. If POST fails, the machine reports it however it can: **beep codes**, blinking indicator LEDs, or an on-screen error. A computer that powers on but never reaches the OS is a POST-era problem — think RAM not seated, a failed drive, or a dead component — not a Windows problem.

Common hardware symptoms and their usual suspects:

- **No power at all** — check the outlet, the power cable, the PSU switch, then the PSU itself.
- **Powers on, no display** — reseal RAM and the graphics card; check the monitor cable and input source.
- **Overheating: sudden shutdowns, roaring fans, throttled performance** — dust-clogged heatsinks, failed fans, or dried thermal paste between CPU and cooler.
- **Clicking or grinding from a hard drive** — imminent mechanical failure; back up data *immediately*.
- **Random crashes and restarts** — frequently failing RAM or an overloaded/failing PSU.

Symptoms only get you so far without a process. Memorize the six-step troubleshooting methodology — CompTIA's official sequence, tested on both exams and used verbatim in real IT departments:

1. **Identify the problem** — question the user, determine what changed, back up data before touching anything.
2. **Establish a theory of probable cause** — start with the obvious; question everything.
3. **Test the theory** — if it holds, move on; if not, form a new theory or escalate.
4. **Establish a plan of action and implement the solution.**
5. **Verify full functionality and implement preventive measures** — confirm it's truly

fixed and won't recur.

6. **Document findings, actions, and outcomes** — so the next tech (often future you) benefits.

CompTIA's Six-Step Troubleshooting Methodology

1  **Identify the problem** — question the user, note what changed, back up data first

2  **Establish a theory of probable cause** — start with the obvious, question everything

3  **Test the theory** — confirmed? move on. Not confirmed? new theory or escalate

4  **Establish a plan of action** and implement the solution

5  **Verify full functionality** and implement preventive measures

6  **Document** findings, actions, and outcomes for the next tech

The order matters — skipping step 1 fixes the wrong problem; skipping step 6 fixes it forever, alone.

CompTIA's six-step troubleshooting methodology moves from identifying the problem through documentation.

The order matters. Techs who skip step 1 fix the wrong problem; techs who skip step 6 doom their team to solving the same problem forever. Exam questions frequently describe a scenario mid-process and ask *what you should do next* — knowing the sequence cold turns those into free points.

SEL Connection

Opening a computer for the first time is intimidating — the parts look fragile, expensive, and unforgiving, and the fear of breaking something stops a lot of

people before they start. Here's what experienced techs know: careful beginners almost never destroy hardware, and every professional you'll ever meet has fried a part, bent a pin, or spent an hour on a machine that wouldn't boot because of one unseated cable. Competence isn't the absence of mistakes; it's the willingness to work slowly, ground yourself, double-check connections, and try again after an error. Treat every failed boot as information, not judgment. The methodical patience you practice on hardware — calm hands, one variable at a time — is the same skill that steadies you in any high-pressure situation.

Key Concepts Checklist

- ☐ I can explain what cores, threads, and clock speed each measure in a CPU
- ☐ I can explain why DDR4 and DDR5 RAM are not interchangeable and what RAM does
- ☐ I can describe the roles of the motherboard, BIOS/UEFI firmware, and power supply
- ☐ I can compare HDD, SATA SSD, and NVMe storage by speed, cost, and use case
- ☐ I can explain RAID 0 versus RAID 1, including which one protects data
- ☐ I can identify USB generations, USB-C, Thunderbolt, HDMI, and DisplayPort
- ☐ I can recite and apply the six-step CompTIA troubleshooting methodology in order

CHAPTER 1 · LAB

Lab: PC Build Plan

Hardware: The Physical Computer

You'll spec a complete, compatible PC build for a real budget — and defend every choice like a professional writing a purchase justification.

Part 1: Define the Requirements

Choose a client scenario: a student needing a homework-and-streaming machine (\$600 budget), a video editor (\$1,500), or an esports gamer (\$1,000). Write a short requirements statement: what will this machine do daily, what performance matters most (CPU cores? GPU? storage speed?), and what can be sacrificed?

Part 2: Spec the Build

Using a parts-listing site (such as PCPartPicker) or a provided catalog, select every component: CPU, motherboard, RAM (type and amount), storage (type and capacity), PSU (wattage), case, and — if the budget allows — a graphics card. Verify compatibility: CPU socket matches the board, RAM generation matches the board, the board's form factor fits the case, and the PSU wattage covers the total draw with headroom.

Part 3: Defend It

For each component, write one to two sentences justifying the choice *for this client*: why this part, why this capacity or speed, and what you'd upgrade first if the budget grew by \$200. Trade a build plan with a classmate and find one weakness in theirs — a compatibility risk, a bottleneck, or wasted money.

CHAPTER 1

Chapter Review

Hardware: The Physical Computer

Chapter Summary

- The **CPU** executes instructions, measured by **cores** (parallel processing units), **threads** (work queues, often two per core), and **clock speed** in GHz — and modern architecture matters as much as the raw numbers.
- **RAM** is fast, volatile working memory; **DDR4** and **DDR5** modules are keyed differently and are never interchangeable on the same motherboard.
- The **motherboard** connects every component and comes in standard form factors (**ATX**, **microATX**, **Mini-ITX**); its **BIOS/UEFI** firmware initializes hardware, controls boot order, and provides features like Secure Boot.
- The **power supply (PSU)** converts AC to DC and must be rated with wattage headroom above the build's total draw — undersized PSUs cause crashes and random restarts.
- Storage trades speed against cost: **HDDs** are cheap and slow, SATA **SSDs** are much faster, and **NVMe** drives on M.2 talk directly to PCIe for the highest speeds.
- **RAID 0** (striping) adds speed but loses *everything* if one drive fails; **RAID 1** (mirroring) survives a drive failure but halves usable capacity — and neither replaces backups.
- **USB generations** range from 480 Mbps (2.0) to 40 Gbps (USB4); **USB-C** is a connector shape, not a speed; **Thunderbolt** adds video and power for one-cable docking; **HDMI** and **DisplayPort** carry display output.
- The **POST** checks hardware before the OS loads, and the six-step **troubleshooting methodology** — identify, theorize, test, plan/implement, verify/prevent, document — is the professional standard for every repair.

Multiple Choice

1. A customer's PC has an 8-core CPU that the operating system reports as 16 logical processors. What best explains this?

- A) The motherboard has two CPU sockets
- B) The CPU runs two threads per core using simultaneous multithreading
- C) The clock speed has been doubled by overclocking
- D) Eight cores are physical and eight are stored in RAM

2. A technician tries to install DDR5 memory in a system and finds the module will not physically seat in the slot. What is the most likely cause?

- A) The module must be installed upside down
- B) The RAM needs to be formatted first
- C) The PSU wattage is too low for DDR5
- D) The motherboard supports DDR4, which uses different keying than DDR5

3. A video editor needs the fastest possible drive for active project files. Which option delivers the highest performance?

- A) An NVMe SSD in an M.2 slot using PCIe
- B) A 7,200 RPM hard disk drive
- C) A SATA solid-state drive
- D) Two HDDs in RAID 1

4. A small business configures two drives in RAID 0 to speed up its workstation. One drive fails. What is the result?

- A) The system keeps running from the surviving drive's mirror copy
- B) Only files larger than the stripe size are lost
- C) All data on the array is lost, because striping has no redundancy
- D) The array rebuilds automatically when a new drive is inserted

5. A user needs a single cable from their laptop to drive two external monitors, wired networking, and charging through a docking station. Which connection technology is designed for this?

- A) USB 2.0
- B) Thunderbolt over USB-C
- C) HDMI
- D) VGA

6. A technician confirms a reported problem, backs up the user's data, and forms a theory that the RAM is unseated. According to the CompTIA troubleshooting methodology, what should the technician do next?

- A) Document the findings and close the ticket
- B) Implement preventive measures on all other machines
- C) Establish a plan of action and order replacement RAM
- D) Test the theory by reseating the RAM to determine the cause

Short Answer

1. A friend is choosing between two laptops: one with a faster clock speed and four cores, one with a slower clock speed and eight cores. Explain what each spec means and describe one kind of user who would be better served by each machine.
2. Explain why many desktop builds pair a small NVMe drive with a large HDD. Then explain why RAID 1 mirroring still does not eliminate the need for backups.
3. A computer powers on — fans spin, lights glow — but nothing ever appears on screen and the OS never loads. Using the six-step methodology, describe how you would approach this: list the steps in order and give one specific action you would take at each of the first three steps.

Key Terms

Term	Definition
CPU	Central Processing Unit — the chip that executes instructions, measured by cores, threads, and clock speed in GHz
RAM	Random Access Memory — fast, volatile working memory for programs and data in active use
BIOS/UEFI	Motherboard firmware that initializes hardware and starts the boot process; UEFI is the modern standard with Secure Boot and large-drive support
NVMe	Non-Volatile Memory Express — a protocol connecting SSDs directly to PCIe, typically via M.2, for speeds far beyond SATA
RAID	Redundant Array of Independent Disks — combining drives for speed (RAID 0, striping) or redundancy (RAID 1, mirroring)
POST	Power-On Self-Test — the firmware's hardware check at startup, reported via beep codes, LEDs, or on-screen errors
Troubleshooting methodology	CompTIA's six steps: identify the problem; establish a theory; test the theory; plan and implement; verify and prevent; document

Answer Key

Multiple choice: 1. B • 2. D • 3. A • 4. C • 5. B • 6. D