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FREE EBOOK

HARDWARE, NETWORKING AND REPAIR

Assembling a Desktop Computer

Choose parts and build a PC step by step, safely

INSIDE THIS BOOK

- What is inside a desktop computer
- Choosing parts that work together
- Safety, static and your toolkit
- Preparing the motherboard: CPU, cooler and RAM
- Storage, the motherboard and the power supply
- ...and 6 more chapters, practice questions and a glossary

Beginner

Hardware students and anyone building their first PC

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Assembling a Desktop Computer

Learn what each part of a desktop computer does, how to pick parts that fit together, and how to assemble them safely, one step at a time. The book then takes you through the first start, the BIOS settings, tidy cables and a clear plan for fixing a computer that will not power on or show a picture.

WHO IT IS FOR	Hardware students and anyone building their first PC
LEVEL	Beginner
SUBJECT AREA	Hardware, networking and repair
WHAT IS INSIDE	11 chapters, practice questions with answers, and a glossary

HOW TO USE IT

Read one chapter at a time and try the examples as you go: on a computer, at your workbench or in your notebook. The boxes give tips, safety points and short activities. When you finish, test yourself with the practice questions and check your answers at the end. Words you may not know are explained in the glossary.



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What is inside a desktop computer

A desktop computer looks like one box, but inside it is a team of parts. Each part has one main job. Once you know the jobs, building a computer stops being scary. It becomes a large, careful puzzle.

The main parts and their jobs

Part	Its job	A simple comparison
CPU (processor)	Follows the instructions of every program	The brain
Motherboard	Connects all the parts and carries signals between them	The roads of a city
RAM (memory)	Holds the work the CPU is doing right now	A study table
Storage (SSD or HDD)	Keeps files and programs when power is off	A cupboard
PSU (power supply unit)	Turns mains power into the low voltages the parts need	The kitchen that feeds everyone
Cabinet (case)	Holds the parts and moves air through them	The house
GPU (graphics)	Makes the picture you see on the monitor	An artist
CPU cooler	Carries heat away from the CPU	A fan on a hot day

A closer look

The CPU (Central Processing Unit) is a small square chip. It does a huge number of small calculations every second and gets hot while it works, so it always needs a cooler on top. Most desktop CPUs are made by Intel or AMD.

The motherboard is the large circuit board that everything plugs into. It has a socket for the CPU, slots for RAM, storage and graphics cards, and ports at the back for USB, sound and network.

RAM (Random Access Memory) is fast, but it forgets everything when the power goes off. More RAM lets you keep more programs open without slowing down. Windows 11 needs at least 4 GB, but 8 GB is a sensible minimum and 16 GB is comfortable.

Storage keeps your files when the computer is off.

- An **HDD** (Hard Disk Drive) stores data on spinning discs. It is cheap for large sizes but slow.
- An **SSD** (Solid State Drive) stores data on memory chips with no moving parts. A computer with Windows on an SSD starts in seconds instead of minutes.

SSDs come in two common shapes. A **2.5-inch SATA SSD** is a small flat box that connects with two cables. An **M.2 SSD** looks like a stick of chewing gum and plugs straight into the motherboard.

The PSU takes 230 volt mains power from the wall and changes it into safe low voltages, mainly 12 V, 5 V and 3.3 V. A good PSU protects every other part, so it is never the place to save money.

The GPU (Graphics Processing Unit) creates the picture. Many CPUs have a small GPU built in, which is enough for office work, studies and videos. Gamers, video editors and designers add a separate **graphics card**.

TRY THIS

Look at the back of a desktop computer at home or in your lab. Find the PSU's power socket, the motherboard's USB ports and the monitor cable. Is the monitor cable in the motherboard's ports, or in a separate graphics card lower down?

Choosing parts that work together

The costliest parts do not make a good computer. The parts must **fit each other**, which is called **compatibility**. A mistake here means a part that will not go into its slot, or a computer that does not start. Check four things before you buy.

Check 1: The CPU socket

The **socket** is the place on the motherboard where the CPU sits. Each CPU family needs its own socket. An Intel CPU never fits an AMD socket, and an older CPU may not fit a newer socket from the same company.

Socket	Made for	RAM it uses
Intel LGA1700	Intel Core 12th, 13th and 14th generation	DDR4 or DDR5, depending on the board
Intel LGA1851	Intel Core Ultra 200 series desktop	DDR5
AMD AM4	AMD Ryzen 1000 to 5000 series	DDR4
AMD AM5	AMD Ryzen 7000 and 9000 series	DDR5

New sockets appear every few years, so always look at the motherboard maker's **CPU support list**, which names every processor the board accepts.

REMEMBER

On LGA sockets the pins are in the socket and the CPU has flat gold pads. On AM4 the pins are on the CPU itself. Either way, pins bend easily.

Check 2: The RAM type

RAM comes in generations: DDR3, DDR4 and DDR5. Each has its notch (a small gap) in a different place, so the wrong type will not go in, and pushing harder breaks the slot. The motherboard decides the type. Some LGA1700 boards take DDR4 and others take DDR5, never both, so read the box.

Buy RAM as a **pair** of equal sticks, such as 2 × 8 GB rather than 1 × 16 GB. Two sticks allow **dual channel**: two lanes to memory instead of one, which is noticeably faster.

Check 3: The form factor

Form factor means the size and shape of the motherboard.

Form factor	Size	Notes
ATX	305 × 244 mm	Full size, most slots
Micro-ATX	244 × 244 mm	Popular for home and office builds
Mini-ITX	170 × 170 mm	Very small, usually two RAM slots

A bigger cabinet can hold a smaller board, because the screw holes are placed to match. A small cabinet cannot hold a big board. Also check the cabinet's maximum graphics card length and cooler height.

Check 4: PSU wattage

Wattage is how much power the PSU can supply. Add up what your parts need, then add spare room, called **headroom**.

EXAMPLE

Kavya in Pune is planning a gaming PC. Her CPU is rated at 65 W and the graphics card maker says the card uses about 160 W. She allows about 50 W for the board, RAM, SSD and fans: $65 + 160 + 50 = 275$ W. Graphics cards can briefly draw more than their rating, and a PSU runs cooler well below its limit. The card's box also recommends a minimum PSU size. Kavya follows that advice and buys a good quality 550 W PSU.

Look for an **80 PLUS** label (Bronze, Gold and so on), which means less power is wasted as heat, plus a known brand and a proper warranty. Avoid unbranded PSUs that come free inside cheap cabinets.

TIP

Write your list in a notebook with four columns: part, model number, price, and "fits?". Prices change every month, so check them on the day you buy. Tick "fits?" only after checking socket, RAM type, form factor and wattage against each other.

Safety, static and your toolkit

A finished computer runs on low voltage inside, but building one still needs care: care for **you**, and care for the **parts**.

Keeping yourself safe

SAFETY

Switch off the wall socket and pull out the power cable before you put your hands inside a computer. Never open a PSU or a monitor. They contain capacitors that can hold a dangerous charge even after unplugging. A faulty PSU is replaced, never repaired by students.

- Cabinet edges can be sharp, so move your hands slowly.
- Use side cutters on cable ties only with an adult's permission, cutting away from your body.
- Keep water, tea and food away from the work table.
- If you smell burning or see smoke, switch off at the wall and tell your teacher.

Static electricity

When you walk on a carpet and touch a metal door handle, you sometimes feel a small spark. That is **static electricity**. A spark too small to feel can still damage the tiny circuits in RAM or a CPU. This is called **ESD** (electrostatic discharge). Sometimes the part dies at once; sometimes it is weakened and fails weeks later, which is even harder to diagnose.

1. Work on a wooden or plastic table, not on a carpet or bed.
2. Wear an **anti-static wrist strap** and clip it to bare, unpainted metal on the cabinet.
3. With no strap, touch bare metal on the cabinet often, especially before picking up a part.
4. Keep parts in their **anti-static bags** until needed. Do not place a part on top of its bag; the outside of some bags can carry charge.
5. Hold cards and sticks by their edges. Never touch gold contacts or chips.

DID YOU KNOW

Dry air makes static worse, so take extra care during dry winter months in north India.

The toolkit

Tool	Use
Phillips screwdriver, size 2	Almost every screw in a PC
Small Phillips screwdriver, size 1	Tiny M.2 screws
Anti-static wrist strap	Protecting parts from ESD
Torch or phone light	Seeing inside the cabinet
Small bowls or a magnetic tray	Keeping screws from rolling away
Velcro straps or cable ties	Tidying cables
Thermal paste	Only if the cooler has none
Isopropyl alcohol and lint-free cloth	Cleaning old thermal paste

REMEMBER

Keep every box and manual. The motherboard manual is your most useful tool. It shows where every header is, which RAM slots to use and what each light or beep means.

CHAPTER 4

Preparing the motherboard: CPU, cooler and RAM

Builders usually fit the CPU, cooler and RAM onto the motherboard **before** it goes into the cabinet, because there is more room on the table. Lay the board flat on its own cardboard box.

Step 1: Install the CPU

Follow your manual. The general method is:

1. Lift the metal lever beside the socket. On Intel boards this also lets you open a metal frame called the **load plate**.
2. Find the small gold triangle on one corner of the CPU and the matching mark on the socket.
3. Hold the CPU by its edges and line up the triangle and the side notches.
4. Lower it **straight down**. Do not slide or press it. It should drop in under its own weight.
5. Close the load plate if there is one, then push the lever down under its hook. This takes some force, which is normal.

On many Intel boards a black plastic cover pops off as you close the lever. Keep it; the maker may want it back for a warranty repair.

SAFETY

Never force a CPU. If it does not drop in, lift it out and check the triangle again. Bent socket pins are the most common costly mistake in PC building.

Step 2: Fit the cooler

The cooler must press closely on the CPU with **thermal paste** in between. The paste fills tiny air gaps between the two metal surfaces so heat can flow out.

1. Look under the cooler. Many come with grey paste already applied. If so, add no more.
2. If there is none, put one pea-sized dot in the centre of the CPU. The cooler's pressure spreads it.
3. Peel off any plastic film from the cooler's base. A forgotten film is a common cause of overheating.
4. Fix the cooler as its instructions say: push pins, screws or a clip on a plastic bracket.
5. Tighten screws a few turns at a time in a cross pattern, like the nuts on a car wheel, to keep pressure even.

6. Plug the cooler's fan into the header marked **CPU_FAN**. Many boards stop with a warning if nothing is there.

Step 3: Install the RAM

1. Check the manual for which slots to fill first. With two sticks on a four-slot board it is often the second and fourth slots from the CPU, but confirm.
2. Open the clips at the end of the slot.
3. Line up the stick's notch with the bump in the slot.
4. Press down firmly on both ends with your thumbs until the clips snap shut with a click.

EXAMPLE

Arjun in Indore installed 2×8 GB of RAM, but Windows showed only 8 GB. One clip was half open because the stick was not fully down. He pressed it until it clicked, and all 16 GB appeared.

DID YOU KNOW

Thermal paste is not glue. The screws or clips hold the cooler. If you ever remove a cooler, clean off the old paste with isopropyl alcohol and apply a fresh dot.

CHAPTER 5

Storage, the motherboard and the power supply

The motherboard is ready. Now fit the M.2 SSD, move the board into the cabinet and fit the PSU and other drives.

Step 4: Install an M.2 SSD

1. Find the M.2 slot. It may be under a metal cover called a **heatsink**. Unscrew the heatsink.
2. Peel the plastic film off the thermal pad under the heatsink, if there is one.
3. Insert the SSD at about 30 degrees, contacts first. It fits only one way.

4. Press the other end down gently and fix it with its tiny screw or clip.
5. Refit the heatsink.

Some M.2 slots accept only NVMe drives, some only SATA M.2 drives, and some both. On some boards, using a certain M.2 slot disables one or two SATA ports. Check the manual before you choose a slot.

Step 5: Prepare the cabinet

1. Lay the cabinet on its side, open side up.
2. Check the **standoffs**: small metal spacers that hold the motherboard above the cabinet wall. Many cabinets have them fitted already.
3. Hold the board above them. A standoff must sit under every screw hole of the board.
4. Remove any standoff with **no** matching hole. An extra one touching the back of the board can short it, and the PC may not start.
5. If the board came with a separate **I/O shield** (the metal plate around the back ports), press it into the cabinet's back opening from inside until the corners click. Many boards have it attached already.

Step 6: Put the motherboard in

1. Hold the board by the cooler and edges, and tilt it so the back ports slide into the I/O shield first.
2. Lower it onto the standoffs and check that every hole lines up.
3. Fit the screws, usually six to nine, firmly but gently. Too much force can crack the board.

TIP

Before fitting the screws, look at the I/O shield from outside. Make sure no metal tab has bent into a USB or network port. Fixing that later means taking the board out again.

Step 7: Install the PSU

1. If the cabinet has a filtered vent under the PSU, mount it fan facing down. With no vent, the fan faces up.

- 2. Fix it with four screws from the back.
- 3. If it has a 115/230 voltage switch, set 230 for India. Many modern PSUs have no switch because they adjust by themselves.
- 4. With a **modular** PSU, the cables plug into it separately. Connect only the ones you need.

SAFETY

Keep the PSU unplugged while you work. Use only the modular cables that came with that exact PSU. Cables from another PSU can look the same but be wired differently, and they can destroy drives and the motherboard.

Step 8: Other drives

A 2.5-inch SSD or 3.5-inch HDD goes in the cabinet's drive trays. Each needs a thin **SATA data cable** to a SATA port on the motherboard and a flat **SATA power cable** from the PSU. Both are L-shaped, so they fit only one way.

REMEMBER

If a part is hard to reach in your cabinet, it is fine to fit the PSU before the motherboard. The order matters less than never forcing anything.

CHAPTER 6

Connecting the cables

The inside of a cabinet can look like a bowl of noodles. Take one cable at a time. Every connector fits only one way; if it will not go in, turn it round instead of pushing harder.

Power cables from the PSU

Cable	Pins	Where it goes
ATX main power	24 (sometimes 20 + 4)	Wide socket on the right edge of the board
CPU power (EPS)	8 (often 4 + 4)	Top left corner of the board, near the CPU

Cable	Pins	Where it goes
PCIe power	6 or 8 (often 6 + 2)	The graphics card, if it needs one
16-pin graphics power	16	Some newer graphics cards instead of PCIe plugs
SATA power	Flat, L-shaped	SATA SSDs and hard disks

Push the 24-pin until its clip clicks. The 8-pin CPU cable is the most forgotten cable in a first build; without it the fans may spin but the PC will not start properly.

SAFETY

The CPU 8-pin and the graphics 8-pin look alike but are wired differently. They are usually labelled "CPU" and "PCIe". Never force one into the other's socket. Push a 16-pin graphics plug fully home until no gap shows; a half-inserted one can overheat.

Front panel connectors

The cabinet's power button, reset button and lights connect to a small group of pins, usually near the bottom right of the board and labelled **F_PANEL** or **JFP1**.

Label on the wire	What it is	Does + and – matter?
POWER SW	Power button	No
RESET SW	Reset button	No
POWER LED + and –	Power light	Yes
HDD LED + and –	Drive activity light	Yes

1. Open the manual's front panel diagram and turn it to match the board in front of you.
2. Use a torch; the pins are small and close together.
3. Fit the power switch first, since the PC cannot start without it.
4. Fit the LEDs. If one does not light later, turn its plug round. That causes no harm.

Some boards include an adapter block: plug the wires into it on the table, then push the whole block onto the pins.

Other front connectors

- **USB 3.0:** a thick cable with a 19-pin plug. It is keyed, and its pins bend easily, so press it straight in gently.
- **USB 2.0** and **HD Audio:** small 9-pin plugs, each with one blocked hole.
- **USB Type-C:** a small, flat, keyed plug, if board and cabinet both have it.
- **Case fans:** headers marked **SYS_FAN** or **CHA_FAN**.

Installing a graphics card

1. Use the top long slot, the PCIe x16 slot closest to the CPU.
2. Remove the matching metal slot covers at the back of the cabinet. Big cards need two or three.
3. Open the clip at the end of the slot, line up the card and press straight down until it clicks.
4. Screw the card's bracket to the cabinet and connect its power cable if it has a socket.

REMEMBER

With a graphics card fitted, the monitor cable goes into the card, not into the motherboard's ports. This is the most common "no display" call a technician gets.

TRY THIS

Take an old motherboard and its manual. Without connecting anything, point to the 24-pin socket, the CPU power socket, the CPU_FAN header, the front panel pins and the USB 3.0 header. Time yourself, and try again next week.

CHAPTER 7

Tidy cables and good airflow

A working computer can still be badly built. Loose cables block air, collect dust and can catch in fans. Good **cable management** takes about twenty minutes and makes the computer cooler, quieter and easier to repair.

Why airflow matters

Every part turns some electricity into heat. A simple, common plan is:

- **Front fans** pull cool air in. These are **intake** fans.
- **Rear and top fans** push warm air out. These are **exhaust** fans.

Warm air rises, so a top or rear exhaust works naturally. Most fans have small arrows on the frame: one shows the air direction and one shows the blade direction.

DID YOU KNOW

If a fan has no arrows, look for its sticker. Air usually leaves from the side with the sticker and the support frame.

Cable management step by step

1. Route each PSU cable behind the motherboard tray (the metal wall the board sits on) and bring it out through the nearest rubber-edged hole.
2. Run the thick 24-pin and 8-pin cables first.
3. Bundle cables going the same way, with a strap every 10 to 15 cm.
4. Tuck unused cables into an empty drive bay. With a modular PSU, leave them out.
5. Spin each fan with a finger to check no cable touches the blades.
6. Check that the back panel closes without pressing hard on any cable.

TIP

Use Velcro straps where you can. A cable tie must be cut off, and cutting near a cable can nick its insulation. Velcro opens again when you add a part next year.

Keeping dust out

Dust traps heat and slows fans, and it is heavy near busy roads and building work.

- Choose a cabinet with removable dust filters.
- Keep the computer off the floor, on a low stand or shelf.
- Clean the filters every month or two with a soft brush.
- Set up slightly more intake than exhaust, so air leaks out through gaps instead of pulling dust in.

EXAMPLE

Sameer runs a cyber café in Patna. His machines kept shutting down in May. The front filters were packed with dust and the coolers were clogged. After cleaning them and lifting the cabinets onto a shelf, the shutdowns stopped. He now cleans the filters on the first Sunday of every month.

CHAPTER 8

First start and the BIOS or UEFI setup

Before you press the power button, do one last check.

The pre-start check

1. Is the cooler firmly fixed, with its fan on CPU_FAN?
2. Are the 24-pin and 8-pin CPU cables fully in?
3. Is the RAM clicked in at both ends?
4. Is the monitor cable in the right place?
5. Are any loose screws lying inside? Shake the cabinet gently and listen.
6. Is the switch on the back of the PSU at I (on)? O means off.

SAFETY

Do the first start with your teacher watching. Plug into a properly earthed wall socket, preferably through a UPS, and keep your hands out of the cabinet while it is on.

What should happen

The fans spin and the computer runs a quick self-check called **POST** (Power-On Self-Test) of the CPU, RAM and graphics. If all is well, the motherboard maker's logo appears.

The first start of a new build can take longer. Computers with DDR5 memory may show a black screen for a minute or more while the board tests and tunes the RAM. This is called **memory training**. Be patient and do not switch off.

Beep codes and debug lights

If POST finds a problem, the board tells you. Older boards beep through a small speaker. On many boards one short beep means the check passed, while other patterns, such as repeated long beeps, point to a part like the RAM. The patterns differ between BIOS makers and boards, so look them up in your manual. Many cabinets have no speaker, so you may hear nothing.

Most modern boards have **debug LEDs** instead: four small lights marked CPU, DRAM, VGA and BOOT. Each lights briefly as that part is checked. If one stays lit, check that part. Some boards show a two-digit code instead, explained in the manual.

Entering the BIOS or UEFI

The **BIOS** is the program stored on the motherboard that starts the computer before Windows loads. Modern boards use a newer, mouse-friendly version called **UEFI** (Unified Extensible Firmware Interface), but people still say "the BIOS". To enter it, tap the right key repeatedly just after switching on. On most desktop boards it is **Delete**, on some **F2**. The start screen usually shows it.

Check	What you want to see
CPU name	The correct model
Memory size	The full amount, such as 16 GB
Drives	Every SSD and HDD listed
CPU temperature	Steady, not climbing fast
Date and time	Correct
Memory profile	XMP (Intel) or EXPO (AMD) turned on so RAM runs at its rated speed
TPM	Turned on (Intel PTT or AMD fTPM), which Windows 11 needs
Secure Boot	Available, which Windows 11 also needs
Boot order	The Windows USB first, while installing

Then choose "Save and Exit", often the F10 key.

REMEMBER

If the CPU temperature keeps rising quickly past about 80 °C while you are only sitting in the BIOS, switch off. The cooler is probably not pressing properly, or its film is still on.

TIP

If a setting change stops the PC starting, **clear the CMOS** to reset the BIOS. Use the CLR_CMOS jumper or button shown in the manual, or switch off, unplug the PSU and remove the round CR2032 battery for a few minutes.

CHAPTER 9

Installing the operating system and drivers

The **operating system** (OS) is the main program that runs everything else. Most home and office PCs in India use Windows 11. Free Linux systems such as Ubuntu are also popular for learning and for older machines.

An overview of installing Windows

1. On a working computer, download Microsoft's official **Media Creation Tool** from Microsoft's Windows download page.
2. Plug in a USB pen drive of at least 8 GB. Everything on it will be erased.
3. Run the tool and make installation media on the USB drive.
4. Plug the USB into the new PC, switch on and open the **boot menu** (often F8, F11 or F12; the start screen or manual shows which). Choose the USB.
5. Follow the screens: language, edition, licence terms, then the drive. On a new SSD, select the unallocated space and continue. Windows creates the partitions it needs.
6. The PC restarts a few times. Then answer the questions about region, keyboard, network and user account.

NOTE

Windows 11 needs a supported CPU, at least 4 GB of RAM, at least 64 GB of storage, TPM 2.0 and a Secure Boot capable system. Most new parts qualify, but the TPM may need switching on in the BIOS first.

Installing drivers

A **driver** is a small program that tells Windows how to talk to a piece of hardware.

1. Connect to the internet and run Windows Update until it finds nothing more.
2. On the support page for your exact motherboard model, download the **chipset**, **LAN** (network), **Wi-Fi** and **audio** drivers.
3. For a graphics card, get the driver from its chip maker: NVIDIA, AMD or Intel.
4. Open **Device Manager** (right-click the Start button). A device with a yellow warning mark still needs a driver.

SAFETY

Download drivers only from the hardware maker's website or through Windows Update. "Driver updater" programs and random download sites often carry adware or malware.

EXAMPLE

Neha built a PC for her father's shop in Kochi. The internet did not work because there was no network driver. She downloaded the board's LAN driver on her laptop, copied it to a pen drive and installed it on the new PC. Windows Update then fetched the rest.

CHAPTER 10

Fixing no power and no display

Even careful builders sometimes press the button and nothing happens. Do not pull parts out at random. Work from the simplest causes to the hardest, and change one thing at a time.

Nothing happens at all

No fans, no lights, no sound:

- 1. Is the wall socket on? Test it with a lamp or phone charger.
- 2. Is the power cable firmly in at both ends, and the PSU switch at I?
- 3. Is the 24-pin fully clicked in?
- 4. Is the power switch plug on the correct two front panel pins?
- 5. Does the board have a small LED that lights when power is connected? If it lights, power is arriving and the button connection is the likely problem.
- 6. Is an extra standoff shorting the board? Take the board out and check.
- 7. Is the PSU faulty? A technician checks with a **PSU tester** or a known good PSU.

Fans spin for a second, then stop

The PSU has sensed a problem and shut off to protect the parts. Look for a short circuit (an extra standoff or loose screw), a missing 8-pin CPU cable, or a modular cable from a different PSU.

Fans spin but there is no picture

- 1. Is the monitor on and set to the right input, HDMI or DisplayPort?
- 2. Is the cable in the graphics card rather than the motherboard?
- 3. With no graphics card, does your CPU have built-in graphics? Some do not; Intel models ending in "F" have none.
- 4. On a first start, did you wait for memory training?
- 5. Which debug LED stays lit?
- 6. Re-seat the RAM, then try a single stick in the slot the manual names.
- 7. Clear the CMOS and try again.

A quick fault table

What you see	Likely cause	First thing to try
No lights, no fans	No mains power reaching the PSU	Wall switch, cable, PSU switch

What you see	Likely cause	First thing to try
Board LED on, button does nothing	Power switch on wrong pins	Front panel diagram
Fans spin then stop	Short circuit or missing CPU power	Standoffs and the 8-pin
DRAM LED stays on	RAM not seated or wrong slot	Re-seat, try one stick
VGA LED stays on	Graphics card or its power	Re-seat card, check power
"CPU fan error"	Fan not on CPU_FAN	Move the fan cable
Shuts down after minutes	Overheating	Cooler, paste and film
Less RAM shown than fitted	Stick half-seated	Press until it clicks

REMEMBER

Change one thing, then test. If you change three things and the PC starts, you will not know which one fixed it.

EXAMPLE

Ritu in Bhopal got fans but no picture, and the DRAM light stayed on. Re-seating both sticks did not help. A single stick in the slot the manual named worked. The second stick was faulty, and the shop replaced it under warranty.

CHAPTER 11

The final checklist and handing over

A good technician makes sure a computer is safe, tidy and ready for its owner, not just working.

Stage	Check
Parts	Socket, RAM type, form factor and wattage all match
CPU and cooler	Triangles matched, lever closed, film removed, fan on CPU_FAN

Stage	Check
RAM and M.2	Correct slots, clips closed, M.2 screwed down
Board	No extra standoffs, I/O shield tabs clear
Power	24-pin, 8-pin CPU, graphics and drive power connected
Front panel	Power, reset, LEDs, USB and audio connected
Cables	Tied, clear of fans, side panels close easily
BIOS	CPU, full RAM and drives seen; XMP or EXPO on; TPM on
Software	Windows updated, no yellow marks in Device Manager
Test	An hour or more of real use without overheating or restarts

Testing before you hand it over

Let the computer do real work for a while: play a long video, open many browser tabs and copy a large folder. Watch the temperatures in the motherboard maker's monitoring app. A sudden restart, a fan that roars all the time or a temperature that keeps climbing all need checking now, not after the customer has taken the machine home.

Handing over

- Return every box, manual and spare screw.
- Give a written parts list with model numbers, and keep the bills together; warranty claims need them.
- Explain that a UPS protects the computer from sudden power cuts.
- Advise the owner to clean the dust filters regularly.

TIP

Take photos as you build: the CPU in its socket, the front panel wiring, the finished cables. They help when you explain a problem to a shop later, and they make a good record of your practical work.

Practice questions

1. Name the part that follows the instructions of every program, and say why it needs a cooler.
2. What is the difference between RAM and storage?
3. Give one advantage of an SSD over an HDD.
4. What is a CPU socket, and why must it match the CPU?
5. Which type of RAM does an AMD AM5 motherboard use?
6. Why is it better to buy RAM as two equal sticks?
7. Can a Micro-ATX motherboard fit inside an ATX cabinet? Explain.
8. A CPU is rated at 65 W, the graphics card at about 200 W and the other parts at about 50 W. Roughly what do they need in total, and why should the PSU be bigger?
9. What is ESD? Give two ways to prevent it.
10. Why must a student never open a PSU?
11. Describe how to place a CPU in its socket.
12. Why is thermal paste needed, and how much should you use?
13. A new PC overheats within minutes. Name two cooler mistakes that could cause this.
14. What are standoffs, and what can an extra one do?
15. Which two power cables must reach the motherboard?
16. For which front panel connectors does + and – matter?
17. A graphics card is fitted, but the monitor cable is in a motherboard port. What will happen?
18. What is POST?
19. What is memory training, and why should you wait during the first start?

20. What does turning on XMP or EXPO do?
21. Give two ways to clear the CMOS.
22. The fans spin for a second and stop. Give two likely causes.

ANSWER KEY

Answers

1. The CPU. It turns electricity into heat as it works, so a cooler must carry the heat away.
2. RAM holds the work being done right now and is cleared when power goes off; storage keeps files when the power is off.
3. It is much faster, so Windows and programs start quickly. It also has no moving parts.
4. The place on the motherboard where the CPU sits. Each CPU family has its own shape, so a CPU fits only its matching socket.
5. DDR5.
6. Two sticks allow dual channel, giving the CPU two lanes to memory, which is faster.
7. Yes. ATX cabinets have screw holes placed for smaller boards too.
8. About 315 W. The PSU should be bigger because graphics cards briefly draw more than their rating and a PSU runs cooler well below its limit; follow the card maker's recommended PSU size.
9. Electrostatic discharge, a static spark that can damage chips. Any two of: a wrist strap clipped to bare metal, touching bare metal often, a wooden table, anti-static bags, holding parts by the edges.
10. Its capacitors can hold a dangerous charge even after it is unplugged.
11. Lift the lever, line up the gold triangle with the socket mark, lower the CPU straight down without pressing, then close the plate and lever.
12. It fills tiny air gaps so heat flows from the CPU into the cooler. One pea-sized dot, or none if the cooler already has paste.
13. Any two of: plastic film left on the cooler, no paste, the cooler loose or uneven, the fan not connected.
14. Small spacers that hold the motherboard off the cabinet wall. An extra one can touch the back of the board and cause a short circuit.
15. The 24-pin ATX main power cable and the 8-pin CPU power cable.

16. The power LED and HDD LED. The switches work either way round.
17. Usually no picture, because the display comes from the graphics card's ports.
18. The Power-On Self-Test, a quick check of the CPU, RAM and graphics each time the computer starts.
19. The board tests and tunes the RAM on the first start, which can take a minute or more with a black screen. Switching off interrupts it.
20. It lets the RAM run at its rated speed instead of a slower default.
21. Use the CLR_CMOS jumper or button, or remove the CR2032 battery for a few minutes with the PSU unplugged.
22. Any two of: a short circuit from an extra standoff or loose screw, the 8-pin CPU cable missing, a modular cable from a different PSU.

WORD LIST

Glossary

BIOS

the program on the motherboard that starts the computer before the operating system loads.

Cable management

routing and tying cables neatly so air flows and repairs are easy.

CMOS

the small memory that stores BIOS settings, kept alive by a coin battery.

CPU

the processor, the chip that follows the instructions of every program.

Debug LED

a light on the motherboard that shows which part failed the start-up check.

Driver

a small program that tells the operating system how to use a piece of hardware.

Dual channel

using two matched RAM sticks so the CPU has two lanes to memory.

ESD

electrostatic discharge, a static spark that can damage electronic parts.

Form factor

the standard size and shape of a motherboard, such as ATX.

Headroom

spare capacity, such as PSU wattage beyond what the parts need.

Intake fan

a fan that pulls cool air into the cabinet; an exhaust fan pushes warm air out.

I/O shield

the metal plate around the motherboard's back ports.

M.2

a small slot and drive shape for SSDs that plug straight into the motherboard.

Memory training

the RAM testing and tuning a board does on its first start.

Modular PSU

a power supply whose cables plug in separately.

POST

the Power-On Self-Test that runs each time the computer starts.

PSU

the power supply unit, which turns mains power into low voltages.

RAM

fast working memory that is cleared when the power goes off.

Socket

the place on the motherboard where the CPU is fitted.

SSD

a solid state drive, fast storage with no moving parts.

Standoff

a metal spacer that holds the motherboard off the cabinet wall.

Thermal paste

a paste that fills air gaps between the CPU and its cooler.

TPM

a security chip or firmware feature that Windows 11 needs.

UEFI

the modern, graphical form of the BIOS.



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