



Gurukul Technicals Institute

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FREE EBOOK

HARDWARE, NETWORKING AND REPAIR

Laptop Care and Basic Repairs

Keep a laptop healthy and fix common problems safely

INSIDE THIS BOOK

- Getting to know your laptop
- Tools and ESD safety
- Battery care and charging
- Chargers, cables and ports
- Heat, vents and cleaning
- ...and 6 more chapters, practice questions and a glossary

Beginner

Students, technicians and laptop owners

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Laptop Care and Basic Repairs

Learn how to look after a laptop's battery, charger, keyboard, screen and cooling, and how to fix common problems such as heat, slow speed and Wi-Fi trouble. You will also learn to upgrade RAM and storage safely, clone a drive, act fast after a spill, and know when a repair belongs at an authorised service centre.

WHO IT IS FOR	Students, technicians and laptop owners
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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Getting to know your laptop

A laptop is a complete computer folded into a thin case. It has the same parts as a desktop computer, but they are packed very tightly, and many of them are soldered (fixed with melted metal) onto one board. That is why a laptop needs gentle handling and careful repairs.

The main parts

Part	What it does	Can a beginner replace it?
Processor (CPU)	The "brain" that does all the calculations	No. It is usually soldered to the board
RAM (memory)	Holds the work you are doing right now	Sometimes, if it sits in a slot
Storage (SSD or hard disk)	Keeps Windows and your files, even when the laptop is off	Often yes
Battery	Stores energy so the laptop runs without a charger	Leave internal batteries to a service centre
Motherboard	The main circuit board that joins every part	No
Fan and heatsink	Carry heat away from the processor	Cleaning yes; replacing needs training
Display	The screen	No, needs a service centre
Keyboard and touchpad	Let you type and point	Usually a service centre job

Find your model number

Every repair starts with the exact model number. Two laptops with the same name can have different RAM, different batteries and different screws. You will find the model number:

- on a label under the laptop, or inside the battery bay on older models;
- on the box and the bill;
- in Windows: press the Windows key and R together, type `msinfo32` and press Enter. The System Information window shows the "System Model".

The serial number is also on the label. The maker's support website uses it to show your exact parts, drivers (small programs that let Windows talk to the hardware) and warranty status.

EXAMPLE

Rohan in Kanpur wanted more memory for his laptop. A friend with a laptop of the same name told him to buy a DDR4 stick. Rohan checked his model number first and found that his version used DDR5. The model number saved him from buying the wrong part.

Warranty comes first

A warranty is the maker's promise to repair faults free for a set time. Before you open anything, check if the laptop is still under warranty. With some brands, opening the case yourself can affect the warranty, so read the terms first.

REMEMBER

Write the model number, serial number and date of purchase in a notebook, and keep the bill safe. You will need all three for drivers, parts and warranty claims.

CHAPTER 2

Tools and ESD safety

Laptop parts are small and delicate. Good tools and good habits protect both the laptop and you.

What ESD is

Have you ever touched a door handle after walking on a carpet and felt a small spark? That spark is **static electricity**: an electric charge that builds up on your body and jumps to a metal object. The jump is called an **electrostatic discharge**, or **ESD**.

A spark you can feel is thousands of volts. Computer chips can be damaged by a discharge far too small to feel. Worse, the damage may not show at once. A RAM stick can work today and fail a few weeks later because of one careless touch.

How to prevent ESD

1. Work on a hard wooden or laminated table, never on a bed or carpet.
2. Wear an **anti-static wrist strap**: a band that touches your skin, joined by a wire to a grounded anti-static mat or a ground point your teacher has set up. It drains charge slowly and safely.
3. If you have no strap, touch a bare, unpainted metal surface before you touch any part, and touch it again every few minutes.
4. Avoid woollen and synthetic clothes. Static is worst in dry winter air, such as a Delhi December.
5. Hold RAM and boards by their edges. Never touch the gold contacts or the chips.
6. Keep new parts in their silver anti-static bags until the moment you fit them.

Power off completely

Never work inside a laptop that has power in it.

1. Shut down fully. Sleep is not enough.
2. Unplug the charger, pen drives and every other cable.
3. After you remove the bottom cover, unplug the battery cable from the board first. Pull the connector straight out by its sides or its plastic tab, never by the wires.
4. With the battery unplugged, press and hold the power button for a few seconds to drain any charge left in the circuits.

SAFETY

Never open a laptop while the charger is plugged in. Never push a metal tool near the battery. If the battery looks puffed up, stop at once and read the battery chapter before you go any further.

A basic tools list

Tool	What it is for
Precision screwdriver set (small Phillips and Torx bits)	Removing bottom-cover and internal screws
Plastic opening tools and a spudger	Releasing plastic clips without scratching. A spudger is a flat plastic or nylon stick
Tweezers	Holding small screws and thin cables
Screw tray or magnetic mat	Keeping screws in order
Anti-static wrist strap and mat	ESD protection
Soft brush and air blower or compressed air	Removing dust
Microfiber cloth	Cleaning screens and cases
Isopropyl alcohol (IPA, 99%) and cotton buds	Cleaning contacts. It catches fire easily, so younger students use it only with an adult
Small torch	Looking into ports and vents
USB keyboard and mouse	Testing, and working while the built-in ones are faulty
USB pen drive and an external drive	Backups and rescue tools
USB-to-SSD adapter or enclosure	Cloning and backing up drives

TIP

Screws in a laptop are often different lengths. Draw the bottom cover on a sheet of paper and stick each screw on the drawing with tape, in the hole it came from. A long screw in a short hole can pierce the board underneath.

CHAPTER 3

Battery care and charging

The battery is the part that wears out fastest. Good habits can keep it useful for years.

How a laptop battery ages

Laptops use **lithium-ion** (Li-ion) or lithium-polymer cells, which store energy as a chemical change. The size of a battery is shown in watt-hours (Wh) or milliamp-hours (mAh).

A battery's life is counted in **charge cycles**. One cycle means using a total of 100% of its capacity. That can happen in one go, or in two days of 50% each. After hundreds of cycles, the battery holds less than it did when new. Heat makes it age faster, and so does sitting at 100% charge for long periods.

DID YOU KNOW

Old advice says you should drain a battery to zero before charging it. That came from older nickel-cadmium batteries, which had a "memory effect". Lithium-ion batteries have no memory effect, so small top-ups are perfectly fine.

Good battery habits

- Keep the laptop away from heat. Do not leave it in a parked car or charge it under a pillow.
- Do not let it sit at 0% for long. Charge it soon after it runs low.
- If the laptop stays plugged in most of the day, use the battery-care or charge-limit setting that many makers provide. It usually stops charging at around 80%. The name and place of this setting differ by brand, so look in the maker's own app.
- To store a laptop for some weeks, leave the battery about half charged, keep it in a cool, dry place, and check it every month or so.
- Use the correct charger, as the next chapter explains.

Check the battery's health

Windows can make a battery report. Open Command Prompt, type this command and press Enter:

```
powercfg /batteryreport
```

Windows saves a file called `battery-report.html` and shows you where it is. Open it in a web browser. Look for two numbers: **Design capacity** (what the battery held when new) and **Full charge capacity** (what it holds now). On a Mac, the battery section of System Settings shows the battery's condition.

EXAMPLE

Sana's report shows a design capacity of 45,000 mWh and a full charge capacity of 31,500 mWh. $31,500 \div 45,000 \times 100 = 70\%$. Her battery now holds 70% of its first capacity. If it once lasted 5 hours, it will now last about $5 \times 0.7 = 3.5$ hours with the same use.

Warning signs

What you notice	What it may mean	What to do
Laptop shuts down suddenly at 20 to 30%	Worn-out battery	Check the report; plan a replacement
"Plugged in, not charging"	Charge limit is on, worn battery, or charger fault	Check the setting; try a known-good charger
Base bulging, touchpad pushed up, lid will not close flat	Swollen battery	Stop using it; take it to a service centre
Very hot while doing nothing	Battery or charging fault	Unplug it and get it checked

SAFETY

A swollen battery can catch fire. Never press it, pierce it or try to flatten it. Shut the laptop down, unplug it, keep it away from anything that burns, and take it to an authorised service centre. Old batteries go to an e-waste collection point, never into the dustbin.

CHAPTER 4

Chargers, cables and ports

Many "dead laptop" complaints turn out to be a faulty charger or cable. Learn to check them safely.

Read the label

Every adapter has a label with two important lines:

- **Input**, for example "100-240V ~ 50-60Hz". This means it works on the mains supply in India (about 230 V) and in most other countries.

- **Output**, for example "19.5V $\equiv$ 3.33A". The symbol $\equiv$ means direct current (DC).

Power in watts = volts $\times$ amps. For this adapter, $19.5 \times 3.33 \approx 65$ W.

A replacement charger must have the same output voltage, the same plug size and the same polarity (which side is positive), and at least the same number of watts. A weaker charger may charge very slowly, fail to charge while you work, or overheat.

USB-C charging

Many newer laptops charge through a **USB-C** port using **USB Power Delivery (PD)**. The charger and the laptop "talk" and agree on a voltage, such as 5, 9, 15 or 20 V. The cable matters too. Ordinary USB-C cables are made for up to 60 W; a laptop that needs more needs a cable marked for a higher power.

EXAMPLE

Arjun's laptop needs 65 W. In his hostel in Pune he plugs in his 25 W phone charger. When the laptop is switched off, it charges slowly. When he works on it, the battery still goes down, because 25 W is less than the laptop uses.

Checking a charger safely

A laptop adapter plugs into the mains, so students only look and swap. Never open an adapter. Parts inside can hold a dangerous charge even after it is unplugged.

1. Unplug it. Check both cables for cuts, kinks near the ends, melted spots, burn marks and a loose plug. Sniff for a burnt smell.
2. Plug it in again. Check the charging light on the laptop or the adapter.
3. Try a different wall socket, and check that the spike guard (surge protector) is switched on.
4. Try a known-good charger of the correct rating, such as one from a friend with the same model. If the laptop charges with it, the first charger is faulty.
5. For USB-C, a small **USB-C power meter** placed between charger and laptop shows the voltage and current that actually flow.

Measuring a barrel adapter's output with a multimeter is a job your teacher can demonstrate. The adapter is plugged into the mains, and its output (often about 19 to 20 V) is above the 12 V limit for student projects.

SAFETY

If a cable is cut or burnt, stop using it. Do not wrap tape over it and carry on. Replace it with a genuine charger of the correct rating; cheap copies may skip the protection circuits that stop overheating.

Ports

- **Loose charging jack:** if the laptop charges only when the plug is held at an angle, the socket inside is worn or broken. Using it like this can cause heat and sparks, so take it for repair.
- **Dusty USB ports:** shine a torch inside, then blow the dust out with a blower. Never poke a port with a pin or a paper clip.
- **A port that does not work:** try a different device in it, and the same device in another port. This tells you whether the port or the device is at fault.

TIP

Pull the plug, not the wire. Do not let the cable bend sharply where it enters the laptop, and coil it in loose loops instead of wrapping it tightly round the adapter.

CHAPTER 5

Heat, vents and cleaning

Heat is a laptop's biggest enemy. It slows the laptop down and shortens the life of its battery and other parts.

How a laptop cools itself

The processor makes heat as it works. A small **fan** pulls cool air in through the **vents** (slots in the case) and pushes it through a **heatsink**: a block of thin metal plates called fins that soaks up heat from the processor. The warm air then leaves through another vent.

Over months, dust collects on the fins and blocks the air. The laptop gets hotter, the fan runs fast and loud, and the processor slows itself down to protect itself. This slowing down is called **thermal throttling**.

Signs of a heat problem:

- the fan is loud even when you are only browsing;
- the base becomes too hot to rest on your legs;
- the laptop slows down a few minutes into a video call or a game;
- it shuts down suddenly during heavy work.

Habits that keep it cool

- Use the laptop on a hard, flat surface. A bed, pillow or quilt blocks the vents.
- Keep the vents on the bottom, sides and back clear.
- A laptop stand or cooling pad lifts the base and lets air in.
- Keep it out of direct sunlight. On a hot afternoon, a room fan helps.
- Close heavy programs that you are not using.

Cleaning the vents from outside

1. Shut down and unplug the laptop.
2. Find the vents. Air usually goes in underneath and comes out at the side or back, where you feel warm air while it runs.
3. Blow short bursts of air into the vents from a slight angle. If grey dust flies out, the cleaning was needed.
4. Brush the grilles with a soft, dry brush.

SAFETY

Hold a compressed-air can upright. Tipped over, it can spray a freezing liquid. Keep it away from faces, and younger students should use it only with an adult. Never use a vacuum cleaner nozzle on the parts inside, because it can build up static.

Deeper cleaning with the cover off

Do this only if the laptop is out of warranty (or the warranty allows it), you have the model's service guide, and a teacher or adult is with you.

1. Follow the ESD steps, remove the bottom cover and unplug the battery.
2. Hold the fan blades still with a plastic tool. Air blown at a free fan spins it too fast and can damage it.
3. Brush the fan blades gently, then blow short bursts through the fins.
4. Use tweezers to lift out any mat of dust at the entrance to the fins.

5. Reconnect the battery, close the cover and test.

DID YOU KNOW

Between the processor and the heatsink is a thin layer of grey **thermal paste**. It fills tiny gaps so heat can flow across. Over years it can dry out. Replacing it means removing the heatsink, so leave it to a trained technician.

CHAPTER 6

Keyboard, touchpad and screen

These are the parts you touch all day, so they get dirty and take the most knocks.

Keyboard problems

Problem	Likely cause	Try this
One key sticks or does not press	Crumbs or dust under the key	Hold the laptop upside down at an angle and tap the base gently; blow short bursts of air under the key
Letters type as numbers	Num Lock is on, on a small laptop whose letter keys double as a number pad	Press Num Lock (on some laptops together with Fn)
F1 to F12 change volume or brightness instead	The Fn lock setting	Look for an Fn lock key in your manual, or hold Fn with the F key
@ and " are swapped	Wrong keyboard layout chosen	Check the language and keyboard settings in Windows
Whole keyboard dead	Software, a driver, or a loose cable	Restart; see if the keys work on the startup setup screen; use a USB keyboard meanwhile

If the keys work on the setup screen that appears before Windows starts, the hardware is fine and the problem is in Windows. Until it is fixed, you can open the on-screen keyboard by pressing the **Windows key + Ctrl + O**.

To clean the keyboard, shut down first. Brush between the keys and wipe the keytops with a cloth that is only slightly damp. Do not pull keycaps off unless you know how your model's clips work, because they break easily.

Touchpad problems

- **Not responding at all:** many laptops have a key that turns the touchpad off, marked with a touchpad picture. The touchpad page in Windows settings can also switch it off. Check both.
- **Cursor jumping:** sweaty, wet or oily fingers confuse the touchpad. Clean the pad and dry your hands. Some laptops also behave oddly while charging from a poor-quality charger.
- **Clicks stopped working:** update the touchpad driver through Windows Update or the maker's support page.

SAFETY

If the touchpad is pushed up or will not click, the battery under it may be swelling. Stop using the laptop and take it to a service centre.

Screen care

- Never close the lid with a pen, earphones or a coin on the keyboard. The screen presses on it and cracks.
- Open the lid from the middle of the top edge, not from one corner.
- To clean, switch off and wipe with a dry microfiber cloth. For stubborn marks, use the cloth just slightly damp with water. Never spray liquid on the screen, and avoid glass cleaners, tissue paper and newspaper.
- Do not press or poke the screen with your fingers.

When the display fails

1. **Black screen, but lights and fan are on:** connect an external monitor or TV with an HDMI cable and press **Windows key + P** to choose a display. If the picture appears there, the laptop works and the fault is in its own screen or screen cable.
2. **A faint picture when you shine a torch on the screen:** on many LCD screens this means the backlight has failed, not the whole panel.
3. **Flickering only at some lid angles:** the screen cable is wearing out at the hinge.
4. **Lines or coloured patches after a fall:** the panel is damaged and needs replacing.

Spills, drops and hinges

Accidents happen to everyone. What you do in the first minute decides how much they cost.

Spills: first aid in the first minute

1. **Switch off at once.** Press and hold the power button until the laptop turns off. Do not wait to save your work.
2. Unplug the charger and every other cable.
3. If the battery comes out from outside, take it out.
4. Turn the laptop upside down and stand it open like a tent (an upside-down V) on a towel, so liquid drains out of the keyboard.
5. Wipe the outside with a dry cloth. Do not shake it hard.
6. **Do not switch it on to check it.** Do not charge it.
7. Do not use a hair dryer, because the heat can damage parts and push liquid deeper. Do not bury it in rice, which does not draw liquid out of the board and leaves dust behind.
8. Take it to an authorised service centre or a trained technician as soon as you can.

DID YOU KNOW

Once the power is off, the liquid itself is not the biggest danger. Sugar from tea or a cold drink, and minerals from tap water, stay behind when it dries. They can carry current where it should not flow, and they slowly eat away metal. This damage grows over days, even when the laptop seems fine.

EXAMPLE

Imran in Lucknow knocked his chai onto the keyboard. He switched off within ten seconds, made a tent and took the laptop to a service centre the next morning. The board was cleaned and only the keyboard was replaced.

Drops and bumps

After a drop, shut down and check for cracks, rattling sounds, a bulging base or a burning smell. Back up your data soon. A hard disk has spinning parts and can be damaged by a drop while running; an SSD has no moving parts and copes with knocks much better.

To avoid drops, carry the laptop in a padded sleeve or bag, never lift it by one corner of the open screen, put it to sleep before you walk around with it, and do not pack heavy books on top of it.

Hinge problems

The hinges are metal, but they are screwed into mounts inside the case, which are often plastic with small threaded metal inserts. Opening the lid from one corner twists the hinge and strains these mounts.

Signs of trouble:

- the lid is stiff or creaks;
- a gap opens in the base near a hinge;
- the plastic frame around the screen lifts;
- the screen wobbles or falls back on its own.

What to do:

- Always open and close the lid with both hands, from the middle.
- If a crack appears near a hinge, stop using the laptop. Each opening makes the crack bigger.
- On some models the hinge screws can be reached from underneath. Tighten them gently if you are sure which ones they are. Do not over-tighten.
- Broken mounts need new case parts, so take the laptop for repair. Do not use superglue, which can run into the hinge or onto the screen cable.
- Do not oil a hinge. It works by friction, so oil makes the lid flop.

CHAPTER 8

Wi-Fi and Bluetooth problems

Wireless problems are common, and most of them are fixed without opening anything.

First checks

1. Make sure **airplane mode** is off. It switches off every radio in the laptop.
2. Make sure Wi-Fi is switched on in the quick settings. Some laptops also have a key with a wireless symbol.
3. Restart the laptop. Restart the router too: unplug it, wait about 30 seconds and plug it back in.
4. Check other devices. If no device can connect, the problem is the router or the internet connection. If only the laptop fails, the problem is the laptop.
5. Move closer to the router. Walls, floors and steel almirahs weaken the signal.

2.4 GHz and 5 GHz

Most routers send Wi-Fi on two bands, and often show two names, such as "Sharma_Home" and "Sharma_Home_5G".

Band	Range	Speed	Good to know
2.4 GHz	Longer; passes through walls better	Slower	Crowded by neighbours' Wi-Fi, microwave ovens and Bluetooth
5 GHz	Shorter	Faster	Best in the same room as the router

Fixes on the laptop

- **Forget and reconnect:** remove the saved network and join again with the correct password. Passwords are case-sensitive, so capital and small letters must match.
- **Troubleshooter:** Windows has built-in network troubleshooters in its settings.
- **Driver:** right-click the Start button, open Device Manager, expand "Network adapters" and update the Wi-Fi adapter's driver.
- **Network reset:** Windows has a network reset option that removes and reinstalls the network adapters. You will need to enter your Wi-Fi passwords again afterwards.

You can also check the connection with Command Prompt. Type `ipconfig` and look at the IPv4 address. An address starting with `169.254` means the laptop did not get an address from the router. Then type `ping 8.8.8.8`. Replies mean the internet is reachable. If that works but `ping google.com` fails, the problem is with name lookup (DNS), not the connection itself.

Bluetooth

1. Check that Bluetooth is on and the device is charged. A wireless mouse with a weak AA cell drops out often.
2. Put the device in **pairing mode** (ready to connect). How you do this depends on the device; its manual explains it.
3. If it paired before but now fails, remove it from the Bluetooth list and pair it again.
4. Earbuds still connected to your phone may refuse the laptop. Disconnect them from the phone first.
5. Stay within a few metres of the laptop, and update the Bluetooth driver if problems continue.

REMEMBER

If the Wi-Fi adapter disappears completely from Device Manager after a fall, a spill or a repair, the fault is likely to be in the hardware. A technician should check the Wi-Fi card and its two thin antenna wires.

CHAPTER 9

Fixing a slow laptop

A slow laptop is the most common complaint of all. Find the cause before you try a fix.

Find what is slowing it down

Press **Ctrl + Shift + Esc** to open Task Manager. On the Processes page, click a column heading such as CPU, Memory or Disk to sort by it.

What you see	What it means	Fix
CPU near 100% because of one program	That program is heavy or stuck	Close it, or select it and choose End task (but not Windows' own processes)
Memory near 100%	Not enough RAM for everything that is open	Close tabs and programs; think about a RAM upgrade
Disk at 100% for a long time on a hard disk	The hard disk is too slow	An SSD upgrade helps most

What you see	What it means	Fix
Everything low but still slow	Heat, malware or a power setting	Clean the vents, run a scan, check the power mode

Fixes that cost nothing

1. **Restart** the laptop instead of only closing the lid. It clears memory and finishes updates.
2. **Turn off startup apps** you do not need, in Task Manager's Startup apps page (called "Startup" in older versions).
3. **Free up storage.** A nearly full drive slows Windows down and makes updates fail. Empty the Recycle Bin, clear the Downloads folder, and use Storage Sense in settings.
4. **Uninstall** programs you never use.
5. **Use fewer browser tabs and extensions.** Each tab uses memory.
6. **Scan for malware** with Windows Security, Windows' own antivirus. Do not install two antivirus programs together; they clash.
7. **Update** Windows and the drivers.
8. **Check the power mode.** Battery saver slows the laptop on purpose. Plug in and choose a balanced or higher-performance mode.
9. **Avoid "speed booster" apps** from unknown websites. Many of them only show adverts or worse.

EXAMPLE

Deepak in Patna had a laptop with 4 GB of RAM, a hard disk and twelve programs starting with Windows. He turned off eight he did not need, and the laptop became ready to use in about half the time. Later he added an SSD, and it felt like a new machine.

When nothing else works

Windows has a "Reset this PC" option in its recovery settings. You can choose to keep your files or remove everything. Back up your files first anyway, because a reset is a big change and mistakes happen.

Upgrades: RAM, SSD and cloning a drive

Adding RAM or an SSD is often the cheapest way to make an older laptop useful again. But it only works if your model supports the part you buy.

Check what your model supports

Before you spend any money:

- Read the model's manual or specification page on the maker's support site. Look for the RAM type, the maximum RAM, the number of RAM slots, whether any RAM is soldered, and which storage slots it has.
- In Task Manager, open the Performance page and click Memory. It shows the speed, the slots used (for example "1 of 2") and the form factor.
- If you are allowed to open the laptop, look inside.

REMEMBER

Many thin laptops have their RAM soldered to the board, and it cannot be upgraded at all. Check model support first, every time.

Upgrading RAM

Laptop RAM comes on a short stick called a **SO-DIMM**. **DDR4** and **DDR5** sticks have their notch in different places, so one will not fit the other's slot. Never force a stick in. Buy the type and speed your manual lists, and stay within the maximum. Two matching sticks can work in **dual-channel** mode, which is a little faster than one.

1. Back up your files. Shut down, unplug and put on your wrist strap.
2. Remove the bottom cover and unplug the battery.
3. To remove an old stick, push the two side clips gently outwards. The stick pops up at an angle; pull it out.
4. Hold the new stick by its edges. Line up the notch, slide it into the slot at the same angle, then press it down until the clips click.
5. Reconnect the battery, close the cover and switch on. The first start may take a little longer than usual.
6. Check in Task Manager that the new total appears.

EXAMPLE

Harpreet's laptop has one 8 GB DDR4 stick in one of two slots, and her manual says the maximum is 32 GB. She adds a matching 8 GB DDR4 stick and now has 16 GB in dual channel. A DDR5 stick would not even have fitted.

Choosing an SSD

Type	What it looks like	Notes
2.5-inch SATA	A thin box about the size of a playing card	Fits the bay where an old hard disk sits
M.2 SATA	A small stick	Fits M.2 slots that support SATA
M.2 NVMe	A small stick	Much faster; needs a slot that supports NVMe

M.2 sticks come in lengths. "2280" means 22 mm wide and 80 mm long; 2242 and 2230 are shorter. The stick must match the length your slot is made for. The slot decides, not the stick: an M.2 SATA stick will not work in a slot that supports only NVMe.

Cloning a drive

Cloning copies everything on the old drive to the new one: Windows, programs, files and the hidden startup sections. The laptop then starts from the new drive exactly as before.

You need:

- a new SSD at least as large as the space used on the old drive (larger is better);
- a USB adapter or enclosure to connect the new SSD to the laptop;
- cloning software from a trusted source. Many SSD makers offer a free tool for their own drives.

Steps:

1. **Back up important files separately.** Cloning wipes the destination drive, and picking the wrong drive wipes your data.
2. If the drive is encrypted with BitLocker or device encryption, make sure you have the recovery key saved (it is often stored in the owner's Microsoft account).
3. Connect the new SSD through the USB adapter and plug in the charger.

4. In the cloning software, choose the old drive as the **source** and the new one as the **destination**. Check twice, using the size and name of each drive.
5. Let it finish. Do not let the laptop sleep.
6. Shut down, swap the drives using the ESD steps, and switch on.
7. Check that your files and programs are there. Keep the old drive untouched for a week as a spare backup.

TIP

With the charger plugged in and the battery connected, the laptop keeps running through a short power cut. If the clone does stop, just start again: cloning only reads the old drive, so it is still safe.

CHAPTER 11

When to go to an authorised service centre

An **authorised service centre** is approved by the laptop's maker. It uses genuine parts, has the model's service manuals, and keeps your warranty valid. A good technician knows which jobs to send there.

Go straight to the service centre when

- the laptop is under warranty and has any internal fault;
- the battery is swollen, leaking or very hot, or you smell burning;
- liquid has been spilled on it (after the first aid steps);
- there is no power at all, even with a known-good charger;
- the screen is broken, a hinge mount is cracked, or the body is split;
- the charging socket is loose or sparks;
- the laptop beeps or flashes lights in a pattern at startup and will not start;
- a repair needs soldering on the motherboard.

Before you go

1. Back up your data, if the laptop still starts. Technicians may need to reset or replace the storage.

2. Carry the bill, the warranty card and the charger. They often test with your own charger.
3. Write down the problem: when it happens, how often, and any error messages. A photo or short video of the fault helps a lot.
4. Remove pen drives, memory cards and discs.
5. Do not hand over passwords unless they are needed. Ask the staff whether they need to log in.

At the counter

- Ask for a **job sheet**: a written record of your laptop, the accessories you handed over, its condition (scratches and dents) and the complaint.
- Ask for an **estimate** (expected cost) before any paid work starts, and give your approval in writing.
- Ask whether the repair is covered by warranty, and whether the new part has its own warranty.

EXAMPLE

Rohan's laptop is out of warranty with a cracked hinge mount. The job sheet lists "laptop and charger, scratch on lid, left hinge loose". The service centre's estimate says ! 2,800 for parts and ! 500 for labour, a total of ! 3,300. (These are made-up figures for practice.) Rohan agrees in writing, and keeps his copy safe until he collects the laptop.

Who does what

Job	A careful student can do it	Needs a service centre or trained technician
Cleaning vents from outside	Yes	
Battery habits and health report	Yes	
Charger checks by looking and swapping	Yes	
Wi-Fi, Bluetooth and speed fixes in Windows	Yes	
RAM or SSD upgrade on a supported model	Yes, with a teacher	

Job	A careful student can do it	Needs a service centre or trained technician
Cloning a drive	Yes, after a backup	
Swollen battery, spills, no power		Yes
Screen, hinge mount, charging socket		Yes
Thermal paste, board soldering		Yes

CHECK YOURSELF

Practice questions

1. Why should you find a laptop's exact model number before buying a part?
2. What does ESD stand for, and why is it dangerous for computer parts?
3. Give three ways to prevent ESD damage while working on a laptop.
4. What is the first thing you unplug after removing a laptop's bottom cover?
5. What is a charge cycle?
6. A battery report shows a design capacity of 50,000 mWh and a full charge capacity of 40,000 mWh. What percentage of its first capacity does the battery hold now?
7. List three signs of a swollen battery.
8. An adapter label says "Output 20V --- 3.25A". What is its power in watts?
9. Why might a 25 W phone charger fail to keep a 65 W laptop charged while it is in use?
10. Why should students not open a laptop adapter?
11. What is thermal throttling, and what usually causes it in a laptop?
12. Why should you hold the fan still while blowing air through the heatsink?
13. A laptop types numbers when you press some letter keys. What is the likely cause?
14. The laptop's screen is black but its fan and lights are on. What simple test tells you whether the screen itself is at fault?
15. List the first four steps after spilling tea on a laptop.

16. Why is rice not a good way to dry a laptop after a spill?
17. Why should you not oil a stiff laptop hinge?
18. `ipconfig` shows an IPv4 address that starts with 169.254. What does this mean?
19. In Task Manager, the Disk column stays at 100% on a laptop with a hard disk. What upgrade would help most?
20. Name two things you must check before buying RAM for a laptop.
21. What does "2280" mean on an M.2 SSD?
22. Why must you back up your files before cloning a drive?
23. Give three situations when a laptop should go straight to an authorised service centre.

ANSWER KEY

Answers

1. Laptops with the same name can use different parts, such as DDR4 or DDR5 RAM, so only the exact model number tells you the right part.
2. Electrostatic discharge. A spark too small to feel can damage chips, and the damage may only show weeks later.
3. Any three: work on a hard table, wear an anti-static wrist strap, touch bare metal often, hold parts by their edges, keep parts in anti-static bags, avoid woollen or synthetic clothes.
4. The battery cable, because it is the part still holding power.
5. Using a total of 100% of the battery's capacity, either in one go or spread over several partial uses.
6. $40,000 \div 50,000 \times 100 = 80\%$.
7. Any three: a bulging base, a touchpad pushed up or hard to click, a lid that will not close flat, gaps opening in the case.
8. $20 \times 3.25 = 65 \text{ W}$.
9. The laptop uses more power than 25 W while working, so the battery drains even though it is plugged in.
10. It runs on mains power, and parts inside can hold a dangerous charge even after it is unplugged.
11. The processor slows itself down to protect itself from heat. It is usually caused by dust blocking the heatsink fins or by blocked vents.
12. Air can spin a free fan too fast and damage it.

13. Num Lock is on, on a small laptop whose letter keys double as a number pad.
14. Connect an external monitor or TV and press Windows key + P. If the picture appears there, the laptop's own screen or screen cable is at fault.
15. Hold the power button to switch off at once, unplug the charger and all cables, remove the battery if it comes out from outside, and stand the laptop upside down like a tent on a towel.
16. Rice does not draw liquid out of the board, and it can leave dust and starch inside. The sugar and minerals left by the liquid need professional cleaning.
17. Laptop hinges work by friction, so oil makes the lid flop and can creep onto nearby parts.
18. The laptop did not get an address from the router, so it cannot use the network. Restarting the router is a good first step.
19. Replacing the hard disk with an SSD.
20. Any two: the RAM type (DDR4 or DDR5), the maximum RAM, the number of free slots, and whether the RAM is soldered.
21. The stick is 22 mm wide and 80 mm long.
22. Cloning wipes the destination drive, and choosing the wrong drive by mistake would erase your data.
23. Any three: under warranty with an internal fault, a swollen or very hot battery, a liquid spill, no power with a known-good charger, a broken screen or hinge mount, a loose or sparking charging socket, or any job needing board soldering.

WORD LIST

Glossary

Airplane mode

A setting that switches off all of a laptop's radios, including Wi-Fi and Bluetooth.

Authorised service centre

A repair centre approved by the laptop's maker, which uses genuine parts and honours the warranty.

Charge cycle

Using a total of 100% of a battery's capacity, in one go or in parts.

Cloning

Copying everything on one drive, including Windows and hidden startup sections, onto another drive.

DDR4 and DDR5

Two generations of RAM that are not interchangeable; their sticks have notches in different places.

Driver

A small program that lets Windows talk to a piece of hardware.

ESD (electrostatic discharge)

A sudden jump of static electricity that can damage electronic parts.

Heatsink

A block of thin metal fins that soaks up heat from the processor so the fan can blow it away.

Job sheet

A written record of a device handed in for repair, its accessories, its condition and the complaint.

Lithium-ion (Li-ion)

The type of rechargeable battery used in laptops and phones.

M.2

A small slot and stick shape used for SSDs in modern laptops.

NVMe

A fast way for an M.2 SSD to connect, much quicker than SATA.

RAM

Memory that holds the programs and files you are using right now; it empties when the laptop is switched off.

SATA

An older, slower connection used by hard disks, 2.5-inch SSDs and some M.2 SSDs.

SO-DIMM

The short RAM stick used in laptops.

SSD (solid-state drive)

Storage with no moving parts, much faster than a hard disk.

Thermal paste

A paste between the processor and heatsink that helps heat flow across.

Thermal throttling

A processor slowing itself down because it is too hot.

USB Power Delivery (PD)

A way of charging over USB-C in which the charger and device agree on a voltage.

Wrist strap

A band worn on the wrist and connected to ground to drain static from your body safely.



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