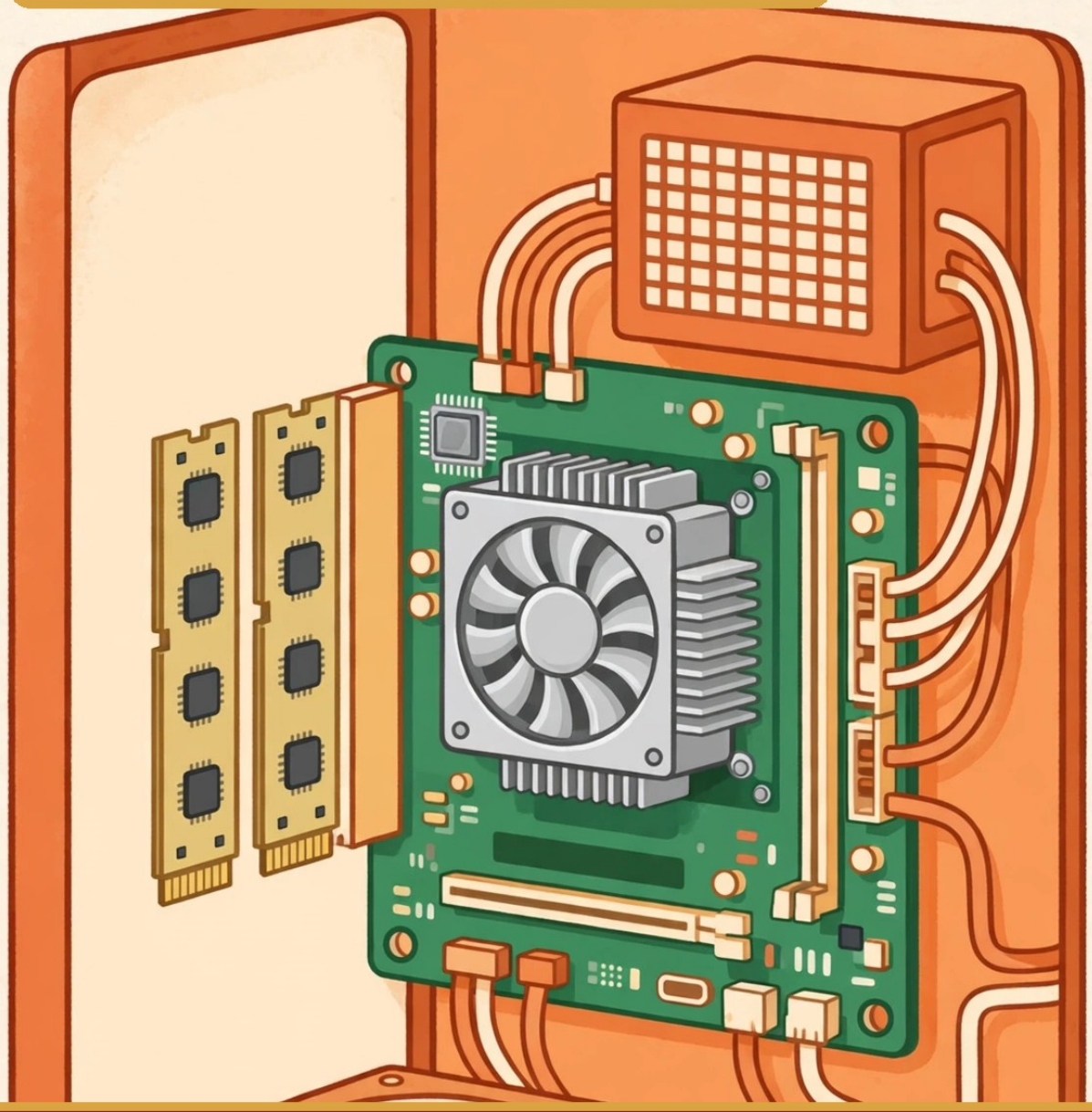
BRIAN COMPUTER INSTITUTE · BOOK SERIES

FREE INTRODUCTORY WORKBOOK



How Computers Are Made

Workbook One: Inside the Computer

Imprint

How Computers Are Made — Workbook One: Inside the Computer

A workbook of the Brian Computer Institute Book Series

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The illustrations in this book are original artwork created for the institute. They are illustrations, not photographs of real machines, real people, or real factories. The diagrams are teaching diagrams: they show the true arrangement of the parts in a simplified way.

About the institute. Brian Computer Online Institute (BRICOI) is an online institute for computing studies based in Yaoundé, Cameroon. Its classes, books, and learning materials are published at bricoi.48hourrfprescue.com.

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How to Use This Workbook

This is a **workbook**: a book you work in, not just a book you read.

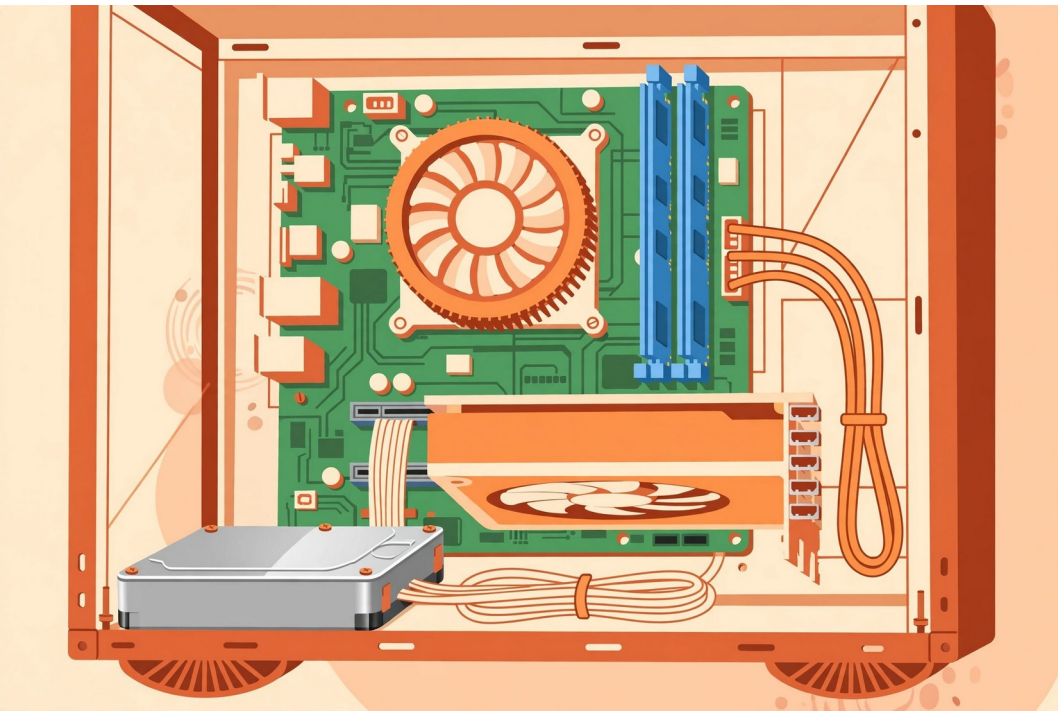
Each part teaches a little, then asks you to do something — label a diagram, match words to jobs, judge statements true or false, and put steps in order. You will need a pencil. Write your answers in the spaces, or in your exercise book if you are keeping this workbook clean.

Work in order. Part 1 introduces every component inside a computer — what it is, what it does, and how it is made. Part 2 shows how the parts are arranged and joined. Part 3 is the workshop: the big activities. The **Answer Key** at the back lets you check yourself — but promise yourself this: try first, check after.

Words in **bold** are the important computing words. The companion course book, *Computing Foundations*, explains the same machine from the user's side; this workbook goes inside it.

Part 1 — Meet the Components

A desktop computer is not one thing. It is a team of parts, each made in its own way, each with its own job, all joined inside one case. Meet the team.



Inside a real desktop computer: every part of the team, in its place. Illustration.

1. The Motherboard — the board that joins everything

The **motherboard** is the large, flat main board. Every other part plugs into it or connects to it by cable, and all data in the machine travels along its paths.

How it is made. A motherboard begins as sheets of **fiberglass** pressed together in layers. Between the layers, and on both faces, run thousands of hair-thin **copper tracks** — the board's roads — printed and etched by machines with great precision. Holes are drilled by computer-controlled drills and lasers. Then machines place hundreds of small components on the board and solder them in place (Workbook Two follows this journey in full). Sockets and slots are fitted so that the big parts — processor, memory, cards — can click in and, if needed, be replaced.

Its job. To hold the team and carry every message between its members.

2. The Processor (CPU) — the brain

The **processor**, or **CPU** (Central Processing Unit), is a square chip, usually hidden under a metal heat sink and a fan. It follows instructions and does all the calculating — billions of small steps every second.

How it is made. The processor is born from **silicon**, the element in sand, purified until it is more perfect than almost anything else humans make. A single crystal of silicon is sliced into thin round **wafers**; on each wafer, factories print hundreds of processors at once, layer by layer, using light — a process called **lithography**. Inside one modern processor there are **billions of transistors**, switches so small that thousands of them would fit across a human hair. Workbook Two tells this story step by step.

Its job. To process: fetch instructions, decode them, and execute them — the heartbeat of the machine.

3. Memory (RAM) — the worktable

RAM (Random Access Memory) comes as long, thin sticks that click into slots on the motherboard. It is the computer's short-term memory: the desk where open programs and documents lie while the processor works on them.

How it is made. A RAM stick is a small board carrying rows of memory chips — silicon chips like the processor's cousins, made on wafers the same way — soldered in a neat line, with a gold-edged connector along one side. The notches in the connector are cut so the stick fits only the right kind of slot, and only the right way round.

Its job. To hold what the computer is working on *now*, within the processor's quick reach — and to forget it all when the power goes off, which is why we save our work to storage.

4. Storage — the memory that keeps

Storage keeps the operating system, the programs, and your files permanently.

The hard disk drive (HDD) holds one or more round metal **platters** coated with a magnetic layer. The platters spin thousands of times per minute while a tiny arm floats just above them, writing and reading data as patterns of magnetism. It is a marvel of precision: the arm flies above the surface on a cushion of air thinner than a fingerprint is thick.

The solid state drive (SSD) has no moving parts at all. It stores data in **flash memory** chips — silicon again — as patterns of electric charge that stay put without power. Because nothing spins and nothing seeks, an SSD is much faster and survives knocks that would kill a hard disk.

Its job. To remember everything, power or no power.

5. The Graphics Card — the picture maker

The **graphics card** is a board of its own, with its own processor (the **GPU**, Graphics Processing Unit), its own memory, and often its own fans. It prepares every picture the screen will show — and for games, video editing, and drawing work, it does far more calculating than the main processor.

How it is made. Like the motherboard, it begins as a layered board with copper tracks; its GPU and memory chips are placed and soldered by machines, and a heat sink with fans is fitted over the GPU, because picture-making is hot work.

Its job. To turn data into the pictures on your screen, smoothly and fast.

6. The Power Supply — the feeder

The **power supply unit (PSU)** is a metal box, usually at the top or bottom corner of the case. It takes the strong electricity of the wall socket and converts it into the gentle, steady voltages — mainly 12, 5, and 3.3 volts — that the delicate parts inside can safely drink.

How it is made. Inside its box is another circuit board carrying transformers, capacitors, and control chips, with a fan to cool it and a bundle of cables ending in shaped connectors — each shaped so it fits only its proper socket.

Its job. To feed every part the right electricity, steadily and safely. No power supply, no computer.

7. Cooling — heat sinks and fans

Every working part makes heat, and heat is the enemy: a hot processor slows itself down to survive, and a very hot one can be damaged. So computers carry **cooling**: **heat sinks** — blocks of metal fins that soak heat from a chip and spread it into the air — and **fans** that push the warm air away and pull cool air in. Between the processor and its heat sink, builders spread a paste called **thermal paste** so the two metals touch perfectly with no air gaps.

Its job. To carry heat out of the machine before the heat harms it.

8. The Case — the house

The **case** is the metal or plastic house of the computer. It holds every part in its proper place, protects them from knocks and dust, gives the fans a planned road for the air (in at the front, out at the back), and carries the outside buttons and ports — power button, USB ports, audio sockets — on its front and back faces.

How it is made. Steel or aluminum sheets are cut, folded, and pressed into shape by machines; plastic fronts are molded; holes and vents are punched exactly where the standard parts will sit. Cases and motherboards follow shared size standards, so parts from different makers fit together — one of the quiet agreements that makes the whole computer industry possible.

Its job. To house, protect, and organize the team.

9. The Screen — the window

The **screen** (monitor, or display) is where the computer shows its work. Most screens today are **LCD** panels lit by **LED** lights: a sandwich of layers — a backlight, liquid crystals that twist to block or pass the light, and color filters — divided into millions of tiny **pixels**, each pixel made of red, green, and blue sub-pixels whose mixture makes every color you see.

How it is made. Display panels are made in extremely clean factories, on great sheets of glass that are later cut into individual screens, then framed, given control electronics, and tested pixel by pixel.

Its job. To show the computer's output as light your eyes can read.

10. Ports and Connectors — the doors

Ports are the doors of the computer: USB ports for flash drives, mice, and printers; HDMI ports carrying picture and sound to screens; Ethernet ports for network cables; audio jacks for headsets. Each port's shape matches its plug, and inside, each connector's pins carry power and data on their own paths.

Its job. To join the computer to the outside world — safely, and only the right way round.

> **Part 1 in one breath.** Motherboard joins; processor thinks; RAM holds the work of the moment; storage remembers; graphics card paints; power supply feeds; cooling protects; case houses; screen shows; ports connect.

Part 2 — How the Parts Are Arranged

The plan of the house

Open a desktop case and the arrangement is no accident. The **motherboard** lies flat against one side of the case, screwed to raised mounts so its back touches nothing. Everything else takes its place by relation to the board:

- The **processor** sits in its socket on the motherboard, near the top, with its heat sink and fan above it — close to the case's rear fan, so its heat leaves quickly.
- The **RAM sticks** stand in their slots beside the processor, upright like books on a shelf.
- The **graphics card** lies in its long slot across the motherboard, its ports reaching through the back of the case so a screen can plug in from outside.
- The **storage drives** rest in bays at the front of the case, joined to the motherboard by data cables and to the power supply by power cables.
- The **power supply** sits in its own corner — top-back or bottom-back — where its fan can blow its heat straight out.
- **Cables** are routed along the edges, out of the air's road: cool air enters at the front, flows over the parts, and leaves warm at the back.

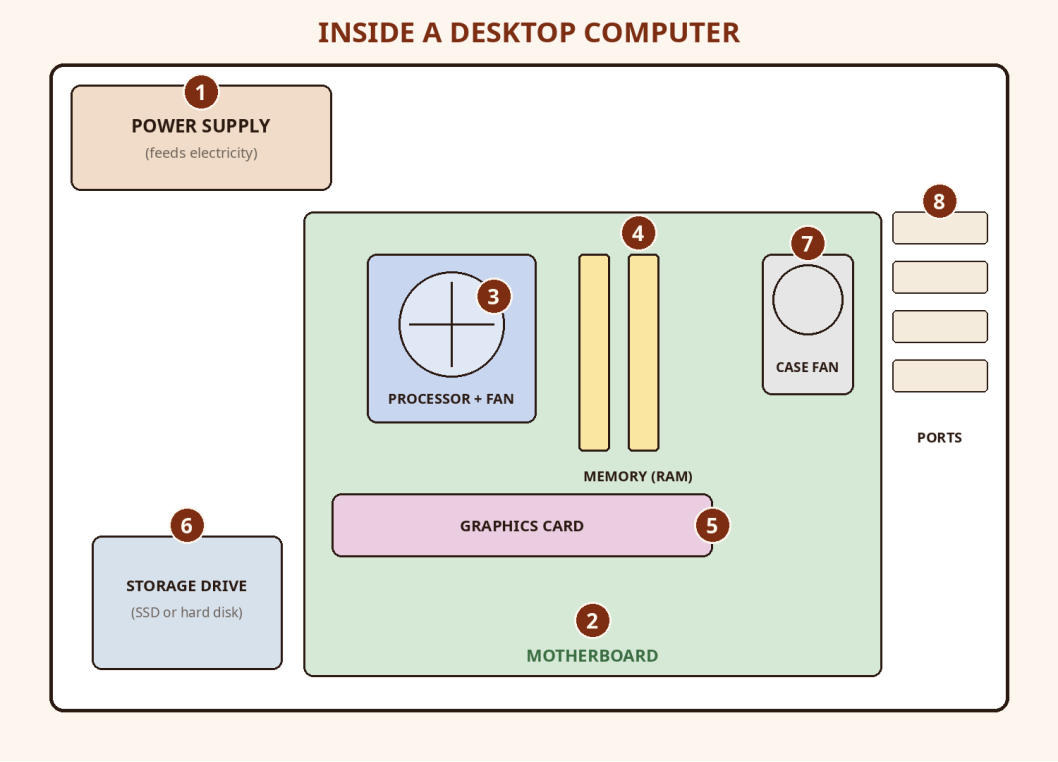


Diagram 1 — Inside a desktop computer. The numbers are your labelling exercise in Part 3. Teaching diagram.

The motherboard is a map

Look closer at the board itself. Its sockets and slots each have exactly one tenant:

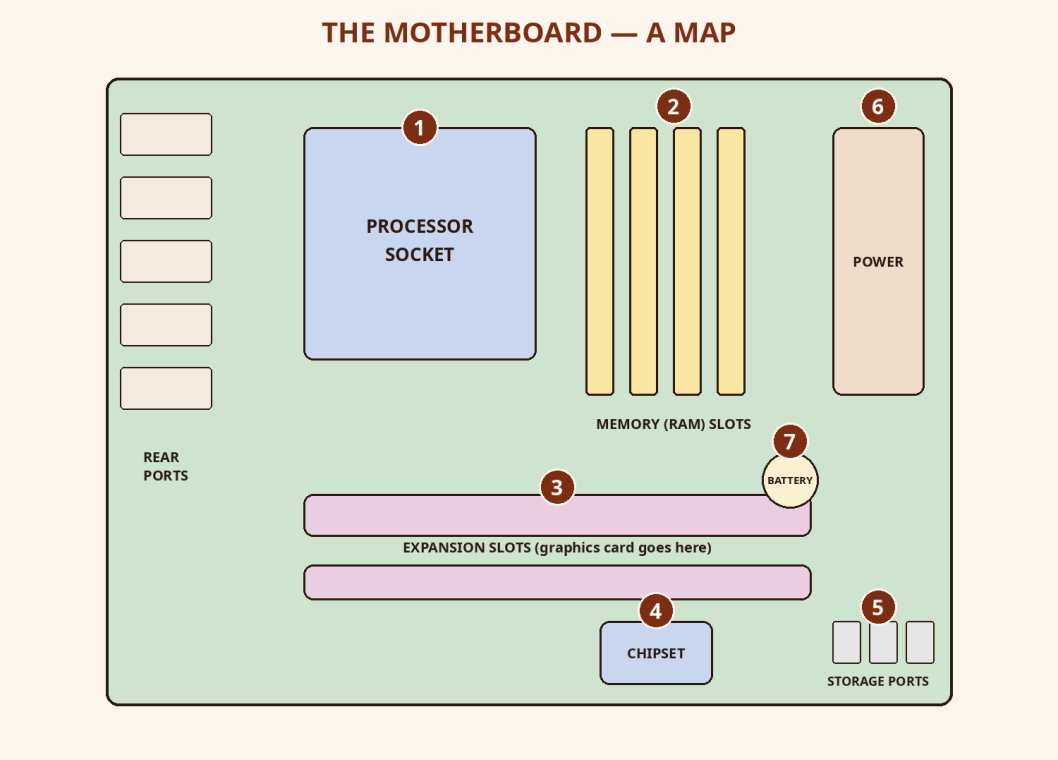


Diagram 2 — The motherboard, mapped. The numbers are your second labelling exercise in Part 3. Teaching diagram.

How the parts are joined

Parts are joined in four ways, and a builder must know all four:

1. **Slots and sockets** — the processor, RAM, and cards press into their places and are held by clips or a locking lever. No tools, but a firm, straight push — and only ever the right part in the right slot, the right way round.
2. **Cables** — power cables from the PSU to the motherboard and drives; data cables (today usually thin **SATA** cables) between the motherboard and storage. Each connector is shaped to fit one way only.
3. **Screws and mounts** — the motherboard, drives, power supply, and case panels are screwed down. Snug, never forced: overtightened screws crack boards.
4. **Solder** — the hundreds of small components that never move were melted into place at the factory on molten solder (Workbook Two shows how). Solder joints are permanent; the big parts' slots exist precisely so that *they* do not need solder and can be replaced.

> **The golden rule of arrangement.** Every part has exactly one proper place, one proper direction, and one proper partner. If something needs force, stop —

> force is the machine telling you that you have the wrong place, the wrong direction, or the wrong part.

Part 3 — The Workshop: Activities

Activity A — Label the case (Diagram 1)

Write the name of each numbered part in Diagram 1.

1. _____ 2. _____ 3. _____ 4. _____

2. _____ 6. _____ 7. _____ 8. _____

Activity B — Label the motherboard (Diagram 2)

Write the name of each numbered place in Diagram 2.

1. _____ 2. _____ 3. _____ 4. _____

2. _____ 6. _____ 7. _____

Activity C — Match the part to its job

Draw a line, or write the letter beside the number.

Part	Job
1. Processor (CPU)	a. Feeds gentle electricity to every part
2. RAM	b. Shows the computer's output as light
3. Storage drive	c. Follows instructions and calculates
4. Power supply	d. Holds the work of the moment, forgets at power-off
5. Graphics card	e. Remembers files permanently
6. Screen	f. Prepares the pictures for the screen
7. Motherboard	g. Carries heat away from hot parts
8. Heat sink and fan	h. Joins every part and carries their messages

Activity D — True or false?

Write **True** or **False** beside each statement.

1. RAM remembers your files even after the computer is switched off. _____
2. An SSD has no moving parts. _____
3. The motherboard's tracks are made of copper. _____

4. Thermal paste helps heat pass from the processor to its heat sink. _____
5. A graphics card has its own processor, called the GPU. _____
6. If a part needs a lot of force to fit, you should push harder. _____
7. The power supply converts wall electricity into gentler voltages. _____
8. A screen's picture is made of pixels, each with red, green, and blue parts. _____

Activity E — Fill in the blanks

Choose from: *silicon, lithography, platters, fiberglass, pixels, SATA, thermal paste* — one word in the list is **not** needed. Which one?

1. Motherboards are built on sheets of _____ with copper tracks.
2. Processors are printed on silicon wafers by a process called _____.
3. Inside a hard disk drive, data lives on spinning _____.
4. A thin data cable that joins a storage drive to the motherboard is a _____ cable.
5. The tiny dots that make a screen's picture are called _____.
6. The element purified from sand to make chips is _____.

Activity F — The journey of a letter

You press the letter **B** on the keyboard of a desktop computer, and **B** appears on the screen. Put these events in order (write 1–5):

_____ The graphics card paints the letter B on the screen.

_____ The keyboard sends the signal for B through its cable and port.

_____ The processor, following the program's instructions, works out what to do with B.

_____ The letter is held in RAM while you continue typing your document.

_____ The motherboard carries the signal from the port to the processor.

Activity G — Draw it yourself

In your exercise book, draw the inside of a desktop computer from memory: the case, the motherboard, and at least six parts in their proper places. Label every part. Then compare your drawing with Diagram 1 and correct it in a different color — the corrections are where the learning is.

Answer Key

Activity A. 1 Power supply. 2 Motherboard. 3 Processor and its fan. 4 Memory (RAM). 5 Graphics card. 6 Storage drive. 7 Case fan. 8 Ports.

Activity B. 1 Processor socket. 2 Memory (RAM) slots. 3 Expansion slots. 4 Chipset (the board's traffic manager — it appears in Diagram 2; Part 1 of Workbook Two gives it its story). 5 Storage ports. 6 Power connector. 7 Battery (it keeps the computer's clock and settings alive while the machine is off).

Activity C. 1–c. 2–d. 3–e. 4–a. 5–f. 6–b. 7–h. 8–g.

Activity D. 1 False — RAM forgets at power-off; storage remembers. 2 True. 3 True. 4 True. 5 True. 6 False — never force a part; stop and check place, direction, and part. 7 True. 8 True.

Activity E. 1 fiberglass. 2 lithography. 3 platters. 4 SATA. 5 pixels. 6 silicon. The unused word is *thermal paste* — it belongs to the cooling story, not to these sentences.

Activity F. The keyboard sends the signal (1). The motherboard carries it to the processor (2). The processor works out what to do (3). The letter is held in RAM (4). The graphics card paints it (5).

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