

# COMPUTER HARDWARE AND GSM REPAIRS - SS1

## COMPLETE NOTES

**SUBJECT:** Computer Hardware and GSM Repairs

**CLASS:** Senior Secondary School 1

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## FIRST TERM

### WEEK 1: INTRODUCTION TO COMPUTER HARDWARE AND GSM REPAIRS

#### Learning Objectives

By the end of this lesson, students should be able to:

- Define computer hardware and GSM repairs
- Explain the scope of computer hardware and GSM repairs
- State the importance of computer hardware and GSM repairs in ICT development

#### TOPIC: Introduction to Computer Hardware and GSM

##### Repairs A. MEANING OF KEY TERMS

**Computer Hardware** Computer hardware refers to the physical, tangible parts of a computer system that you can see and touch. These include:

- Monitor
- Keyboard
- Mouse
- System unit (CPU)
- Printer
- Scanner

**Computer Hardware Repair** This is the process of identifying, diagnosing, and fixing problems or faults in the physical components of a computer system. It involves:

- Testing faulty components
- Replacing damaged parts
- Maintaining computer systems

**GSM (Global System for Mobile Communications)** GSM is a digital mobile network technology used worldwide for mobile communication. It allows users to make calls, send text messages, and use data services on mobile phones.

**GSM Repairs** This refers to the process of identifying and fixing hardware or software faults in mobile phones (GSM devices). It includes:

- Screen replacement
- Battery replacement
- Charging port repairs
- Software troubleshooting
- Network problems solving

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### B. SCOPE OF COMPUTER HARDWARE AND GSM REPAIRS

The field of computer hardware and GSM repairs covers the following areas:

#### 1. Computer Hardware Repairs:

- Diagnosis of computer problems
- Replacement of faulty parts (motherboard, RAM, hard drive, etc.)
- Computer system assembly and disassembly
- Preventive maintenance
- Networking and connectivity issues
- Installation of operating systems and drivers
- Laptop repairs

## **2. GSM Repairs:**

- Mobile phone hardware repairs (screen, battery, charging port)
- Software troubleshooting (flashing, unlocking, virus removal)
- Network problems (SIM issues, signal problems)
- Data recovery and backup
- Phone maintenance and care
- Accessory repairs (earphones, chargers)

### **Related Services:**

Sales of computer parts and phone accessories  
 ICT consulting services  
 Training and skill acquisition  
 Device maintenance contracts

## **C. IMPORTANCE OF COMPUTER HARDWARE AND GSM REPAIRS IN ICT DEVELOPMENT**

### **Economic Benefits**

Creates employment opportunities for technicians  
 Generates income for repair business owners  
 Saves money by extending device lifespan  
 Reduces importation costs

### **Skill Development**

Develops technical and problem-solving skills  
 Encourages entrepreneurship among youth  
 Promotes self-reliance and independence  
 Enhances ICT literacy

### **Environmental Protection**

Reduces electronic waste (e-waste)  
 Promotes recycling and reuse of components  
 Minimizes environmental pollution  
 Encourages sustainable practices

### **Technology Advancement**

Increases access to ICT facilities  
 Supports digital transformation in Nigeria  
 Enhances communication infrastructure  
 Promotes innovation and creativity

### **Educational Support**

Maintains school ICT laboratories  
 Ensures continuous learning with functional devices  
 Supports e-learning initiatives

Reduces downtime in educational institutions

### **Business Continuity**

Ensures minimal disruption to business operations

Maintains productivity in organizations

Supports critical business communications

Reduces operational costs

### **Social Benefits**

Improves communication among people

Bridges the digital divide

Supports emergency services

Enhances social connectivity

## **EVALUATION QUESTIONS**

### **Essay Questions:**

Define computer hardware and give five examples.

What is GSM technology?

Explain the meaning of computer hardware repairs.

List five areas covered in the scope of GSM repairs.

State five importance of computer hardware and GSM repairs in Nigeria.

### **Objective Questions:**

GSM stands for \_\_\_\_\_ (a) Global System for Mobile (b) General System for Machines (c) Global System for Mobile Communications (d) Great System for Mobile

**Answer: C**

The physical parts of a computer are called \_\_\_\_\_ (a) Software (b) Hardware (c) Firmware (d) Programs **Answer: B**

One of the following is NOT a computer hardware component (a) Monitor (b) Windows 10 (c) Keyboard (d) Mouse **Answer: B**

The process of fixing faulty computer parts is called \_\_\_\_\_ (a) Repair (b) Installation (c) Configuration (d) Programming **Answer: A**

Which of the following is a GSM repair service? (a) Screen replacement (b)

Typing documents (c) Browsing internet (d) Playing games **Answer: A**

## **CLASS ACTIVITIES**

### **Group Discussion:** Form groups of 5 students and discuss:

Three computer hardware problems you have witnessed

Three phone problems you or your family members have experienced

How these problems were solved?

10 computer hardware components

5 common tools used for computer repairs

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## **ASSIGNMENT**

Write a short essay (150 words) on "Why I Want to Learn Computer Hardware and GSM Repairs"

List 10 career opportunities in computer hardware and GSM repair industry

Interview a computer or phone technician in your area and write a brief report on their work

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## **WEEK 2: HISTORY OF COMPUTERS AND GSM TECHNOLOGY IN NIGERIA**

### **Learning Objectives**

By the end of this lesson, students should be able to:

- Trace the history of computers from early computing devices to modern computers
- Explain the evolution of GSM technology in Nigeria
- Identify key milestones in ICT development in Nigeria

### **TOPIC: History of Computers**

#### **A. PRE-COMPUTER ERA (Early Computing Devices)**

##### **Abacus (3000 BC)**

Still used in some Asian countries today

##### **Napier's Bones (1617)**

- Invented by John Napier (Scottish mathematician)
  - Used for multiplication and division
  - Made of rods with numbers inscribed

##### **Slide Rule (1622)**

- Invented by William Oughtred
- Used for multiplication, division, and trigonometry
- Popular until the 1970s

##### **Pascal's Calculator/Pascaline (1642)**

- Invented by Blaise Pascal (French mathematician)
- First mechanical calculator
- Used for addition and subtraction

##### **Leibniz Calculator (1673)**

- Invented by Gottfried Wilhelm Leibniz
- Improved on Pascal's calculator
- Could perform multiplication and division

##### **Jacquard's Loom (1801)**

- Invented by Joseph Marie Jacquard
- Used punched cards to control weaving patterns
- Inspired early computer programming

##### **Charles Babbage's Machines**

- Difference Engine (1822)** - mechanical calculator
- Analytical Engine (1837)** - first general-purpose computer design
- Charles Babbage is called "Father of Computers"

##### **Herman Hollerith's Tabulating Machine (1890)**

- Used punched cards for data processing
- Used in 1890 US Census
- Reduced census processing time from 8 years to 6 months

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## **B. GENERATIONS OF COMPUTERS**

### **FIRST GENERATION (1940-1956) - Vacuum Tubes**

#### **Characteristics:**

- Used vacuum tubes for circuitry
- Used magnetic drums for memory
- Very large in size (room-sized)
- Generated much heat
- Consumed lots of electricity
- Very expensive
- Unreliable and frequent failures
- Slow in operation
- Used machine language (0s and 1s)

#### **Examples:**

- ENIAC (Electronic Numerical Integrator and Computer) - 1946
- EDVAC (Electronic Discrete Variable Automatic Computer) - 1952
- UNIVAC (Universal Automatic Computer) - 1951
- IBM ( International Business Machine) 701 - 1953

### **SECOND GENERATION (1956-1963) - Transistors**

#### **Characteristics:**

- Used transistors instead of vacuum tubes
- Smaller in size than first generation
- Generated less heat
- More reliable
- Faster processing speed
- Used assembly language and high-level languages (FORTRAN, COBOL)
- Less expensive than first generation
- Still required air conditioning

#### **Examples:**

- IBM 1401
- IBM 7094
- CDC 1604
- UNIVAC 1108

### **THIRD GENERATION (1964-1971) - Integrated Circuits (ICs)**

#### **Characteristics:**

- Used Integrated Circuits (ICs)
- Much smaller in size
- More reliable and efficient
- Generated less heat
- Faster processing speed
- Used high-level languages (BASIC, Pascal)
- Keyboards and monitors introduced
- Operating systems developed
- More affordable

**Examples:**

- IBM 360 series
- IBM 370 series
- PDP-8
- PDP-11

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**FOURTH GENERATION (1971-Present) -****Microprocessors Characteristics:**

- Uses microprocessors (complete CPU on a single chip)
- Very small in size (laptops, tablets, smartphones)
- Very fast processing speed
- Highly reliable
- Generates minimal heat
- Very affordable
- Portable and user-friendly
- Uses high-level languages and GUIs
- Internet connectivity

**Examples:**

- Personal Computers (PCs)
- Tablets
- Smartphones
- IBM PC (1981)
- Apple Macintosh (1984)
- Dell, HP, Lenovo computers

**Key Invention:**

- Intel 4004 (first microprocessor) - 1971

**FIFTH GENERATION (Present and Future) - Artificial Intelligence****Characteristics:**

- Based on Artificial Intelligence (AI)
- Uses parallel processing
- Voice recognition
- Natural language understanding
- Machine learning
- Quantum computing (developing)
- Ultra-fast processing
- Advanced robotics

**Examples:**

- AI assistants (Siri, Alexa, Google Assistant)
- Self-driving cars
- Advanced robotics
- Quantum computers (in development)
- Neural networks and deep learning systems

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**C. HISTORY OF GSM TECHNOLOGY**

## **Global Development:**

### **Early Mobile Communications (1940s-1970s)**

1946: First mobile telephone service in USA

1973: First handheld mobile phone call by Martin Cooper (Motorola)

Phone weighed 2kg!

### **Birth of GSM (1980s)**

1982: GSM project started in Europe

GSM stands for "Groupe Spécial Mobile" (later "Global System for Mobile Communications")

1987: GSM standards agreed upon

1991: First GSM call made in Finland

## **Mobile Network Generations:**

### **1G (First Generation) - 1980s**

- Analog technology
- Voice calls only
- Poor quality and security
- Large mobile phones

### **2G (Second Generation) - 1991**

- Digital technology (GSM introduced)
- SMS (text messaging) introduced
- Better voice quality
- Data services (GPRS, EDGE)
- Smaller phones

### **3G (Third Generation) - 2001**

High-speed mobile data

Video calling

Mobile internet

Multimedia messaging (MMS)

Smartphones emerged

### **4G (Fourth Generation) - 2009**

Very high-speed internet

HD video streaming

Online gaming

Cloud services

IP telephony (VoIP)

### **5G (Fifth Generation) - 2019**

Ultra-fast speeds

Low latency

IoT (Internet of Things) support

Smart cities

Enhanced mobile experiences

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## **D. HISTORY OF GSM TECHNOLOGY IN NIGERIA**

### **Timeline of Mobile Telecommunications in Nigeria:**

#### **1. Pre-GSM Era (Before 2001)**

1992: NITEL (Nigerian Telecommunications Limited) introduced mobile services

Very expensive and limited coverage  
Poor service quality  
Few subscribers (mainly businesses and wealthy individuals)

### **GSM Era Begins (2001)**

**August 2001:** Nigerian Communications Commission (NCC) licensed four GSM operators:

**MTN Nigeria** (launched August 2001) - first to launch

**Econet Wireless** (now Airtel) - launched August 2001

**Globacom (Glo)** - launched August 2003

**Etisalat** (now 9mobile) - launched 2008

### **Key Milestones:**

#### **2001:**

MTN and Econet launched GSM services

- Initial subscription cost: ₦20,000 for SIM card  
Limited coverage (Lagos, Abuja, Port Harcourt)

#### **2003:**

Globacom entered the market

Per-second billing introduced (revolutionary!)

SIM card prices dropped significantly

- Competition increased

#### **2008:**

Etisalat (now 9mobile) launched

3G services introduced

Mobile internet became popular

Blackberry phones gained popularity

#### **2013-2014:**

4G LTE services launched

Smartphones became affordable

Social media usage exploded

Mobile money services introduced

#### **2019-Present:**

NCC approved 5G spectrum auction

MTN and Mafab won 5G licenses (2021)

5G services launched in Nigeria (2022)

Over 200 million mobile subscribers in Nigeria

### **Impact on Nigeria:**

**Economic:** Created millions of jobs (technicians, vendors, call centers)

**Social:** Improved communication nationwide

**Educational:** Enabled e-learning and online education

**Business:** Facilitated mobile banking, e-commerce

**Entrepreneurship:** Created repair business opportunities

### **GSM Repair Industry in Nigeria:**

Emerged shortly after GSM introduction (2001)

Initially dominated by foreign technicians

Nigerian technicians trained through apprenticeship

Growth of phone repair markets (Computer Village, Lagos; Wuse Market, Abuja)



Training centers established  
Spare parts importation business boomed

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## **E. IMPORTANCE OF STUDYING THIS**

### **HISTORY For Students:**

**Appreciation:** Understand technological progress

**Inspiration:** Learn from inventors and innovators

**Career Guidance:** See opportunities in ICT field

**Problem-Solving:** Learn how challenges were overcome

**Future Preparation:** Anticipate future trends

**Digital Economy:** Understanding foundation helps build future

**Skills Development:** Historical knowledge guides training

3. **Innovation:** Learn from past to create new solutions

**Employment:** Recognize job creation potential

**National Development:** ICT as driver of growth

## **EVALUATION QUESTIONS**

### **Essay Questions:**

List five early computing devices before modern computers.

Who is called the "Father of Computers" and why?

Explain the five generations of computers with one example each.

Describe how GSM technology started in Nigeria.

State five impacts of GSM technology on Nigerian society.

### **Objective Questions:**

The first mechanical calculator was invented by \_\_\_\_\_ (a) Charles Babbage (b) Blaise Pascal (c) John Napier (d) Herman Hollerith **Answer: B**

Which generation of computers used vacuum tubes? (a) First (b) Second (c) Third (d) Fourth **Answer: A**

GSM services started in Nigeria in \_\_\_\_\_ (a) 1999 (b) 2000 (c) 2001 (d) 2003 **Answer: C**

The first GSM operator to launch services in Nigeria was \_\_\_\_\_ (a) Glo (b) MTN Airtel (d) 9mobile **Answer: B**

5G means \_\_\_\_\_ generation mobile network (a) Third (b) Fourth (c) Fifth (d) Sixth **Answer: C**

ENIAC was a \_\_\_\_\_ generation computer (a) First (b) Second (c) Third (d) Fourth **Answer: A**

Transistors were used in \_\_\_\_\_ generation computers (a) First (b) Second (c) Third Fifth **Answer: B**

The father of computers is \_\_\_\_\_ (a) Bill Gates (b) Steve Jobs (c) Charles Babbage Blaise Pascal **Answer: C**

Which network introduced per-second billing in Nigeria? (a) MTN (b) Glo (c) Airtel (d) 9mobile **Answer: B**

AI (Artificial Intelligence) is associated with \_\_\_\_\_ generation computers (a) Third Fourth (c) Fifth (d) Second **Answer: C**

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## **CLASS ACTIVITIES**

**Group Project:** In groups of 4-5 students:

- Create a timeline poster showing the evolution of computers OR GSM in Nigeria
- Research and present on one generation of computers
- Interview 3 adults about their first mobile phone experience

**Individual Activity:**

- Draw and label an abacus
- Create a comparison table of all five generations of computers
- Write about which generation of computers you find most interesting and why

## **ASSIGNMENT**

- Research and write about Charles Babbage and his contributions to computing (200 words)
- Create a chart showing the differences between 2G, 3G, 4G, and 5G networks
- Interview a phone technician: Ask how the phone repair business has changed since 2001
- List 10 phone brands that were popular in Nigeria in 2001-2010 (ask parents/older siblings)

## **WEEK 3: CLASSIFICATION OF COMPUTERS**

### **Learning Objectives**

By the end of this lesson, students should be able to:

- Classify computers based on size, purpose, and functionality
- Explain the characteristics of each classification
- Give examples and uses of different computer types

### **TOPIC: Classification of Computers**

Computers can be classified based on several criteria:

- Size and Processing Power**
- Purpose**
- Functionality**

## **A. CLASSIFICATION BY SIZE AND PROCESSING POWER**

### **1. MICROCOMPUTERS (Personal Computers)**

**Definition:** Microcomputers are small, single-user computers designed for personal or office use. They use microprocessors as their Central Processing Unit (CPU).

#### **Characteristics:**

- Smallest in size
- Designed for single user
- Least expensive
- Moderate processing speed
- Portable or desktop
- Uses microprocessor chip
- Easy to use
- Widely available

#### **Types of Microcomputers:**

**a) Desktop Computers**

- Designed to fit on a desk
- Separate monitor, keyboard, mouse, system unit •
- Not portable
- More powerful than laptops
- Cheaper than laptops with similar specs
- Easy to upgrade components

**b) Laptop Computers (Notebooks)**

- Portable computers
- Built-in screen, keyboard, touchpad
- Battery-powered
- Can work without electricity
- More expensive than desktops
- Slightly less powerful than desktops
- Perfect for students and travelers

**c) Tablets**

- Touchscreen devices
- Very portable
- Smaller than laptops
- Runs mobile operating systems (Android, iOS)
- Good for reading, browsing, basic tasks
- Examples: iPad, Samsung Galaxy Tab

**d) Smartphones**

- Pocket-sized computers
- Combines phone with computer functions
- Touchscreen interface
- Internet connectivity
- Multiple sensors (camera, GPS, gyroscope)
- Examples: iPhone, Samsung Galaxy, Tecno

**e) Wearable Computers**

- Worn on the body
- Very small
- Examples: Smartwatches (Apple Watch), Fitness trackers

**Examples of Microcomputers:**

- Dell Inspiron
- HP Pavilion
- Apple MacBook
- Lenovo ThinkPad
- Acer Aspire

**Uses of Microcomputers:**

Home use (entertainment, personal tasks)  
Office work (word processing, spreadsheets)  
Education (e-learning, research)  
Gaming  
Web browsing and social media  
Graphic design and video editing

Programming and software development  
Small business operations

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### **MINICOMPUTERS (Midrange Computers)**

**Definition:** Minicomputers are medium-sized, multi-user computers designed for small to medium organizations. They are more powerful than microcomputers but less powerful than mainframes.

**Characteristics:**

- Medium size (size of a refrigerator)
- Supports multiple users (10-200 users simultaneously)
- More expensive than microcomputers
- Higher processing speed
- Requires controlled environment (air conditioning)
- Needs technical personnel to operate
- More reliable than microcomputers

**Examples of Minicomputers:**

- IBM AS/400
- HP 3000
- DEC PDP-11
- Sun SPARC Enterprise

**Uses of Minicomputers:**

Departmental computing in universities  
Small to medium business operations  
Bank branch operations  
Manufacturing process control  
Scientific research  
Hospital management systems  
Inventory management  
Regional office operations

### **MAINFRAME COMPUTERS**

**Definition:** Mainframe computers are large, powerful, multi-user computers designed to process huge amounts of data at very high speeds. They serve as central data repositories for large organizations.

**Characteristics:**

Very large in size (room-sized)  
Very expensive (millions of dollars)  
Supports thousands of users simultaneously  
Extremely fast processing speed  
Very high storage capacity (terabytes to petabytes)  
High reliability (99.999% uptime)  
Requires special environment (temperature controlled, raised floors)  
Needs specialized technical staff  
Can run multiple operating systems simultaneously  
Excellent security features

**Examples of Mainframe Computers:**

IBM Z Series  
IBM System z10  
Fujitsu PRIMEPOWER  
Hitachi Z800

**Banking and Finance:**

- Process millions of transactions daily
- ATM networks
- Online banking systems
- Credit card processing

**Government:**

- National census data processing
- Tax processing systems
- Social security systems
- National databases

**Airlines:**

- Flight reservation systems
- Flight scheduling
- Baggage tracking

4. **Telecommunications:**

- Call routing
- Billing systems
- Network management

**Large Corporations:**

- Enterprise Resource Planning (ERP)
- Customer databases
- Supply chain management

**Insurance Companies:**

- Policy management
- Claims processing
- Customer records

## **SUPERCOMPUTERS**

**Definition:** Supercomputers are the most powerful, fastest, and most expensive computers. They are designed to solve extremely complex problems that require massive calculations.

**Characteristics:**

- Largest and most powerful
- Extremely expensive (tens to hundreds of millions of dollars)
- Fastest processing speed (measured in petaflops or exaflops)
- Massive storage capacity
- Uses parallel processing (multiple processors working together)
- Requires huge power supply
- Needs extensive cooling systems
- Specially designed rooms with controlled environment
- Used for very specialized tasks
- Operated by highly trained specialists

## **World's Fastest Supercomputers (as of 2024):**

**Frontier** (USA) - Oak Ridge National Laboratory

**Fugaku** (Japan) - RIKEN Center

**LUMI** (Finland/Europe)

**Leonardo** (Italy)

### **Weather Forecasting:**

- Climate modeling
- Hurricane tracking
- Long-term climate predictions

### **Scientific Research:**

- Nuclear research
- Molecular modeling
- Genetic research
- Drug development

### **Space Exploration:**

- Spacecraft design
- Satellite data analysis
- Astronomical calculations
- Simulation of space missions

### **Military and Defense:**

- Weapon design and testing
- Cryptography (code breaking)
- Nuclear weapon simulations
- Flight simulations

### **Oil and Gas Industry:**

- Seismic data analysis
- Oil reservoir modeling
- Exploration planning

### **Engineering:**

- Aircraft design
- Automobile crash simulations
- Structural analysis of buildings

### **Animation and Special Effects:**

- Movie special effects rendering
- Complex 3D animations

### **Artificial Intelligence:**

- Training large AI models
- Deep learning research
- Pattern recognition

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## **CLASSIFICATION BY PURPOSE**

### **GENERAL PURPOSE COMPUTERS**

- Designed to perform variety of tasks
- Can run different types of programs
- Examples: Personal computers, laptops

Uses: Office work, entertainment, education

### **SPECIAL PURPOSE COMPUTERS (Dedicated Computers)**

Designed for specific tasks only

Cannot easily be reprogrammed for other tasks

More efficient at their specific task

Examples:

- **ATM machines** (banking transactions only)
- **Traffic light controllers**
- **Washing machine controllers**
- **Calculator** (calculations only)
- **Video game consoles** (gaming)
- **Medical diagnostic machines** (CT scan, MRI)
- **Weather monitoring stations**

## **C. CLASSIFICATION BY FUNCTIONALITY/DATA**

### **HANDLING 1. ANALOG COMPUTERS**

- Process continuous data (temperature, pressure, speed)
- Measure physical quantities
- Less accurate
- Examples: Speedometer, thermometer, voltmeter
- Uses: Scientific experiments, industrial process control

### **2. DIGITAL COMPUTERS**

- Process discrete data (0s and 1s)
- Operate on binary system
- Very accurate
- Most common type
- Examples: Calculators, PCs, smartphones
- Uses: All modern computing applications

### **3. HYBRID COMPUTERS**

- Combination of analog and digital
- Accept both continuous and discrete data
- Examples: Hospital ICU monitors, fuel pumps with digital displays
- Uses: Medical diagnostics, industrial control, aviation

## **COMPARISON TABLE: CLASSIFICATION BY SIZE**

<b>Feature</b>	<b>Micro</b>	<b>Mini</b>	<b>Mainframe</b>	<b>Super</b>
<b>Size</b>	Smallest	Medium	Large	Largest
<b>Users</b>	1	10-200	1000+	Specialists
<b>Speed</b>	Moderate	High	Very High	Fastest
<b>Cost</b>	Low	Medium	High	Highest
<b>Example</b>	Laptop	IBM AS/400	IBM Z Series	Frontier
<b>Use</b>	Personal	Department	Enterprise	Research

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## **EVALUATION QUESTIONS**

**Essay Questions:**

Define microcomputers and state five characteristics.  
Explain the difference between mainframe and supercomputers.  
List and explain three types of microcomputers.  
State five uses of supercomputers.  
Differentiate between general purpose and special purpose computers with examples.

**Objective Questions:**

Which of these is the smallest computer? (a) Mainframe (b) Minicomputer (c) Supercomputer (d) Microcomputer **Answer: D**  
Supercomputers are used for \_\_\_\_\_ (a) Playing games (b) Weather forecasting (c) Typing (d) Watching movies **Answer: B**  
A computer designed for a specific task is called \_\_\_\_\_ (a) General purpose (b) Special purpose (c) Mainframe (d) Hybrid **Answer: B**  
Which computer supports thousands of users? (a) Microcomputer (b) Minicomputer (c)

Mainframe (d) Desktop **Answer: C**

Laptops are examples of \_\_\_\_\_ (a) Mainframes (b) Supercomputers (c) Microcomputers (d) Minicomputers **Answer: C**  
ATM machines are examples of \_\_\_\_\_ computers (a) General purpose (b) Special purpose (c) Analog (d) Hybrid **Answer: B**  
Which processes continuous data? (a) Digital (b) Analog (c) General purpose (d)

The fastest computer is \_\_\_\_\_ (a) Mainframe (b) Supercomputer (c) Minicomputer Laptop **Answer: B**  
\_\_\_\_\_ computers are used in banks' head offices (a) Micro (b) Mini (c) Mainframe Desktop **Answer: C**  
A tablet is a type of \_\_\_\_\_ (a) Mainframe (b) Supercomputer (c) Minicomputer (d) Microcomputer **Answer: D**

**CLASS ACTIVITIES**

**Group Activity:**

Form 4 groups representing: Microcomputers, Minicomputers, Mainframes, and Supercomputers

Each group creates a poster showing:

Characteristics

- Examples
- Pictures/drawings
- Uses

Present to the class

**Practical Activity:**

Visit the school ICT lab and classify the computers found there

Take a school tour and identify special purpose computers (security systems, clocks, etc.)

**Discussion:**

- Which type of computer does your school use?
- Which type would you like to work with in the future and why?

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**ASSIGNMENT**





Pointing device  
Controls cursor on screen  
Types: Wired, Wireless, Optical, Trackball  
Functions: Clicking, scrolling, dragging  
Parts: Left button, right button, scroll wheel

### **Scanner**

Converts physical documents/images to digital format  
Types: Flatbed, Sheet-fed, Handheld  
Uses: Digitizing documents, photos  
Output: Digital image files (PDF, JPEG)

### **Digital Camera**

Captures photos and videos digitally  
Stores images on memory cards  
Can transfer to computer via USB/WiFi  
Uses: Photography, video recording

### **Microphone**

Converts sound to digital audio  
Used for: Voice recording, video calls, voice commands  
Types: Dynamic, Condenser, USB

## **6. Webcam**

Camera for video capture and streaming  
Used for: Video calls, live streaming, recording  
Can be built-in or external

### **Joystick**

Gaming input device  
Controls movement in games  
Used in: Gaming, flight simulators

### **Light Pen**

Pen-shaped pointing device  
Used on touchscreens  
Applications: Graphic design, signatures

### **Touch Screen**

Input through touching the screen  
Found in: Smartphones, tablets, ATMs, kiosks  
Types: Resistive, Capacitive

### **Barcode Reader**

Reads barcodes on products  
Converts barcode to digital data  
Used in: Supermarkets, libraries, warehouses

### **Biometric Devices**

Fingerprint scanner  
Face recognition camera  
Retina scanner  
Used for: Security, attendance, authentication

### **Graphics Tablet**

Drawing input device

Used by: Digital artists, graphic designers  
Comes with stylus pen  
Example: Wacom tablet

### **Trackpad (Touchpad)**

Built into laptops  
Alternative to mouse  
Touch-sensitive surface  
Supports gestures (pinch, zoom, swipe)

### **Voice Recognition Systems**

Accept voice commands  
Examples: Siri, Google Assistant, Alexa  
Uses: Voice typing, smart home control

### **Card Reader**

- Reads data from cards (credit cards, ID cards)  
Types: Magnetic stripe, Smart card, SD card readers  
Used in: Banks, security systems

## **C. PROCESSING UNIT (CPU - Central Processing Unit)**

**Definition:** The CPU is the "brain" of the computer. It processes all data and instructions, performs calculations, and controls all other components. ●

### **Components of CPU:**

#### **1. Control Unit (CU)**

Controls and coordinates all computer operations  
Directs flow of data between components  
Interprets instructions  
Manages timing of operations

#### **Arithmetic and Logic Unit (ALU)**

Performs all arithmetic operations (+, -, ×, ÷)  
Performs logical operations (AND, OR, NOT)  
Compares data  
Makes decisions

#### **Registers**

Temporary storage within CPU  
Fastest memory in computer  
Stores data being processed  
Very small capacity (bytes)  
Types: Accumulator, Program Counter, Instruction Register

### **How CPU Works:**

**FETCH:** Gets instruction from memory

**DECODE:** Interprets the instruction

**EXECUTE:** Performs the instruction

**STORE:** Saves the result

### **CPU Characteristics:**

**Clock Speed:** Measured in GHz (Gigahertz)

Example: 3.2 GHz = 3.2 billion operations per second

**Cores:** Modern CPUs have multiple cores

Dual-core (2 cores)

- Quad-core (4 cores)
- Octa-core (8 cores)

**Cache Memory:** Small, fast memory inside CPU

### **Examples of CPU Manufacturers:**

Intel (Core i3, i5, i7, i9)  
 AMD (Ryzen series)  
 Apple (M1, M2 chips)  
 Qualcomm (Snapdragon - for phones)  
 MediaTek (for phones)

## **D. OUTPUT UNIT/DEVICES**

**Definition:** Output devices are hardware components that receive processed data from the computer and convert it into human-readable form (text, images, sound, video).

### **Functions of Output Devices:**

Receive processed data from CPU  
 Convert digital signals to human-readable form  
 Present information to users  
 Provide feedback

### **Types of Output Devices:**

#### **1. Monitor (Visual Display Unit - VDU)**

Displays text, images, videos

Types:

**CRT (Cathode Ray Tube)** - old, bulky, heavy

**LCD (Liquid Crystal Display)** - thin, lightweight

- **LED (Light Emitting Diode)** - energy efficient ○

**OLED** - better colors, used in smartphones

Sizes: 14", 17", 19", 21", 24", 27", etc.

Resolution: 720p, 1080p (Full HD), 4K, 8K

### **Printer**

Produces hard copy (paper output)

Types:

#### **Impact Printers:**

##### **Dot Matrix Printer**

Uses pins to strike ribbon  
 Noisy  
 Low quality  
 Cheap  
 Can print carbon copies

#### **Non-Impact Printers:**

##### **Inkjet Printer**

Sprays ink droplets on paper  
 Good quality color printing  
 Affordable  
 Slower than laser  
 Used in: Homes, small offices

##### **Laser Printer**

Uses laser beam and toner

Very fast  
High quality  
Expensive  
Used in: Large offices

### **3D Printer**

Creates three-dimensional objects  
Uses plastic, metal, or other materials  
Used in: Manufacturing, medicine, architecture

### **Speakers**

Output sound and audio  
Types: Built-in, External, Wireless (Bluetooth)  
Used for: Music, videos, notifications, gaming

### **Headphones/Earphones**

- Personal audio output

Types: Wired, Wireless (Bluetooth), In-ear, Over-ear  
Used for: Private listening, gaming, calls

### **Projector**

Projects computer display onto large screen  
Used in: Classrooms, presentations, conferences, cinemas

- Types: LCD, DLP, LED

## **6. Plotter**

Prints large-format graphics  
Used for: Engineering drawings, architectural plans, banners  
More accurate than regular printers  
Types: Pen plotter, Inkjet plotter

### **Computer Output Microfilm (COM)**

Stores computer output on microfilm  
Saves space  
Used in: Libraries, archives

## **E. STORAGE UNIT/DEVICES**

**Definition:** Storage devices hold data and programs permanently or temporarily. They store data even when the computer is turned off.

### **Types of Storage:**

#### **PRIMARY STORAGE (Main Memory)**

##### **a) RAM (Random Access Memory)**

Temporary/volatile memory (loses data when power off)  
Stores data currently being used  
Very fast access speed  
Measured in GB (Gigabytes)  
Example: 4GB, 8GB, 16GB, 32GB RAM  
Types: DDR3, DDR4, DDR5

##### **ROM (Read-Only Memory)**

Permanent/non-volatile memory  
Contains boot-up instructions (BIOS)  
Cannot be easily changed  
Data remains when power is off

Types: PROM, EPROM, EEPROM

### **Cache Memory**

Very fast temporary memory

Located inside or near CPU

Stores frequently used data

Very small capacity (MB)

Levels: L1, L2, L3 cache

---

## **SECONDARY STORAGE (Auxiliary Storage)**

### **a) Hard Disk Drive (HDD)**

Main storage device in computers

Magnetic storage

Large capacity: 500GB - 10TB

Slower than SSD

Mechanical parts (spinning disks)

Cheaper per GB

Can fail mechanically

### **Solid State Drive (SSD)**

No moving parts

Much faster than HDD

More expensive than HDD

More reliable and durable

Silent operation

Lower capacity for same price

Example: 256GB, 512GB, 1TB SSD

### **USB Flash Drive (Pen Drive)**

Portable storage

Connects via USB port

Capacities: 4GB - 512GB

Small and convenient

Affordable

Can be easily lost

### **Memory Cards**

Used in cameras, phones, tablets

Types: SD, MicroSD, CF

Capacities: 4GB - 1TB

Small and portable

### **External Hard Drive**

Portable HDD or SSD

Connects via USB

Used for: Backup, extra storage

Capacities: 500GB - 5TB

### **CD (Compact Disc)**

Optical storage

Capacity: ~700MB

Types: CD-R (write once), CD-RW (rewritable)

Read by laser

Becoming obsolete

### **DVD (Digital Versatile Disc)**

Optical storage

Capacity: 4.7GB (single layer), 8.5GB (dual layer)

Types: DVD-R, DVD-RW

Used for: Movies, software

### **Blu-ray Disc**

High-capacity optical disc

Capacity: 25GB - 128GB

Used for: HD movies, large data storage

### **Cloud Storage**

Online storage

Access from anywhere with internet

Examples: Google Drive, Dropbox, iCloud, OneDrive

Capacities: 5GB free - unlimited (paid)

Advantages: Accessible anywhere, automatic backup

Disadvantages: Requires internet, privacy concerns

## **F. COMPARISON OF STORAGE DEVICES**

<b>Device</b>	<b>Type</b>	<b>Capacity</b>	<b>Speed</b>	<b>Cost</b>	<b>Portability</b>
RAM	Primary	4-32GB	Fastest	High	No
ROM	Primary	Few MB	Fast	N/A	No
HDD	Secondary	500GB-10TB	Moderate	Low	No
SSD	Secondary	256GB-2TB	Very Fast	High	No
Flash Drive	Secondary	4-512GB	Fast	Medium	Yes
Memory Card	Secondary	4GB-1TB	Fast	Medium	Yes
External HDD	Secondary	500GB-5TB	Moderate	Low	Yes
CD/DVD	Secondary	700MB-8.5GB	Slow	Very Low	Yes
Cloud	Secondary	Unlimited	Variable	Medium	N/A

## **G. HOW ALL COMPONENTS WORK TOGETHER**

### **Example: Typing and Saving a Document**

**INPUT:** You type on keyboard

**PROCESSING:** CPU processes the text

**OUTPUT:** Text appears on monitor

**STORAGE:** You save file to hard disk

### **Step-by-Step Process:**

User types "Hello" on **keyboard** (INPUT)

Keyboard sends signal to **CPU** (PROCESSING)

CPU stores in **RAM** temporarily

CPU sends display signal to **monitor** (OUTPUT)

"Hello" appears on screen

User clicks "Save"

CPU transfers data from RAM to **hard disk** (STORAGE)

## **H. CONNECTIVITY DEVICES (Supporting Hardware)**

### **1. Network Interface Card (NIC)**

- Enables network connection
- Connects computer to network
- Can be wired (Ethernet) or wireless (WiFi)

### **2. Modem**

- Modulates and demodulates signals •
- Connects computer to internet
- Types: Dial-up, DSL, Cable, Fiber

### **3. Router**

- Directs network traffic
  - Creates local network (LAN)
- Shares internet connection  
Can be wired or wireless (WiFi router)

### **Bluetooth Adapter**

- Enables wireless Bluetooth connection  
Connects peripherals wirelessly
- Short-range communication

## **EVALUATION QUESTIONS**

### **Essay Questions:**

- List and explain the four main functional units of a computer system.  
Differentiate between RAM and ROM with three points each.  
Name five input devices and state their uses.  
Explain how the CPU processes data with a simple example.  
Compare HDD and SSD storage devices (give 4 differences).

### **Objective Questions:**

The brain of the computer is the \_\_\_\_\_ (a) Monitor (b) CPU (c) Keyboard (d) Mouse

**Answer: B**

Which device is used to input text? (a) Monitor (b) Printer (c) Keyboard (d) Speaker **Answer: C**

RAM stands for \_\_\_\_\_ (a) Read Access Memory (b) Random Access Memory (c) Run All Memory (d) Read All Memory **Answer: B**

Which is NOT an output device? (a) Monitor (b) Printer (c) Scanner (d) Speaker **Answer: C**

The ALU performs \_\_\_\_\_ operations (a) Input (b) Output (c) Arithmetic and Logic (d) Storage **Answer: C**

Which storage device has the largest capacity? (a) RAM (b) Flash drive (c) Hard disk (d) CD **Answer: C**

\_\_\_\_\_ memory is temporary (a) ROM (b) RAM (c) Hard disk (d) Flash drive **Answer: B**

A printer produces \_\_\_\_\_ (a) Soft copy (b) Hard copy (c) Digital copy (d) Screen copy **Answer: B**

Which is faster? (a) HDD (b) SSD (c) CD (d) DVD **Answer: B**

Cloud storage requires \_\_\_\_\_ (a) Monitor (b) Printer (c) Internet (d) Speaker **Answer: C**

### **Fill in the Blanks:**

The \_\_\_\_\_ controls all computer operations. (Control Unit)

A \_\_\_\_\_ converts sound into digital data. (Microphone)



\_\_\_\_\_ is the permanent memory in a computer. (ROM)  
A \_\_\_\_\_ is used to point and click on the screen. (Mouse)  
\_\_\_\_\_ printers use ink cartridges. (Inkjet)

---

## **CLASS ACTIVITIES**

### **Practical Activity 1: Hardware Identification**

Visit the computer lab

In groups of 4, identify and label: ○ 5  
input devices

○ 3 output devices ○

2 storage devices

○ The CPU/System unit

Take photos or draw sketches

### **Practical Activity 2: Computer System Exploration** With teacher supervision:

Open a computer system unit (desktop)

Identify: Motherboard, CPU fan, RAM slots, Hard drive, Power supply

Draw and label what you see

DO NOT TOUCH internal components

### **Group Discussion:**

1. What happens when you click the mouse?

Trace the path of data from keyboard to monitor

Why do we need both RAM and hard disk?

### **Hands-on Exercise:**

Type a paragraph in MS Word (input via keyboard)

Observe it on monitor (output)

Save to flash drive (storage)

Print the document (output)

Explain what happened at each stage

## **ASSIGNMENT**

1. Create a chart showing:

10 input devices with pictures and uses

8 output devices with pictures and uses

6 storage devices with capacity and uses

Draw a labeled diagram showing how all four functional units work together

Research Project:

Visit a computer shop

Find out current prices of:

8GB RAM

1TB HDD

256GB SSD

32GB Flash drive

Compare prices and write a short report

Practical Assignment:

At home or school, identify all input and output devices

Make a list with their functions

Take photos if possible

Write a short story (150 words): "A Day in the Life of a CPU" - describe what the CPU does from when computer starts to when it shuts down

## **WEEK 5: IDENTIFICATION AND FUNCTIONS OF HARDWARE PARTS**

### **Learning Objectives**

By the end of this lesson, students should be able to:

- Identify major internal computer components
- Explain the function of each component
- Understand how components are interconnected
- Recognize components by appearance

### **TOPIC: Identification and Functions of Hardware Parts**

Now we'll look deeper inside the computer system unit to understand the main components.

#### **A. THE MOTHERBOARD (System Board/Mainboard)**

**Definition:** The motherboard is the main circuit board of the computer. It connects all hardware components together and allows them to communicate.

##### **Description:**

- Large green or black printed circuit board
- Contains circuits, chips, and slots
  - Everything connects to the motherboard
- Located inside the system unit

##### **Functions of Motherboard:**

- Central Connection:** Connects all computer components
- Power Distribution:** Distributes power to components
- Data Transfer:** Provides pathways for data flow
- Component Housing:** Holds CPU, RAM, expansion cards
- Communication:** Enables communication between components

##### **Major Components on Motherboard:**

###### **CPU Socket**

- Where processor (CPU) is installed
- Types: LGA (Intel), PGA (AMD)
- Usually covered by heat sink and fan

###### **RAM Slots (DIMM Slots)**

- Slots for RAM modules
- Usually 2 or 4 slots
- Color-coded for dual-channel configuration
- Located near CPU

###### **Expansion Slots**

- For adding expansion cards
- Types:
  - **PCI (Peripheral Component Interconnect)**
  - **PCIe (PCI Express)** - faster, modern
  - **AGP** - old, for graphics cards
- Used for: Graphics cards, sound cards, network cards

###### **Chipset**

- Set of chips controlling data flow
- Two main chips:

- **Northbridge:** Fast components (CPU, RAM, Graphics)
- **Southbridge:** Slower components (USB, SATA, Audio)

Modern systems integrate these into CPU

### **BIOS Chip**

Contains Basic Input/Output System

Firmware that starts computer

Small chip with battery nearby

### **CMOS Battery**

Small round battery (like watch battery)

Powers BIOS settings

Maintains date/time when computer is off

Typically CR2032 (3V)

### **Power Connectors**

**Main Power (24-pin or 20-pin):** Powers motherboard

**CPU Power (4-pin or 8-pin):** Powers processor

**SATA Power:** Powers drives

### **SATA Ports**

Connect hard drives and optical drives

Usually 4-8 ports

- Faster than old IDE/PATA

SATA versions: SATA I, II, III (fastest)

## **9. USB Headers**

Internal USB connections

Connect to front panel USB ports

USB 2.0 and USB 3.0 headers

### **Front Panel Connectors**

Small pins for case connections

Power button

Reset button

LED lights

Hard drive activity light

### **Back Panel I/O (Input/Output)**

Ports on back of motherboard:

- **PS/2 Ports:** Old keyboard/mouse (purple/green)
- **USB Ports:** USB 2.0, 3.0, 3.1
- **Audio Jacks:** Microphone, speakers, line-in/out
- **Ethernet Port:** Network connection (RJ-45)
- **Video Ports:** VGA, DVI, HDMI, DisplayPort
- **Other:** eSATA, Thunderbolt (on some boards)

## **THE CENTRAL PROCESSING UNIT**

### **(CPU/Processor) Physical Description:**

Small square chip (about 2-4 cm)

Metal cover with numbers/text

Pins or contacts underneath

Generates heat (needs cooling)

### **Major CPU Manufacturers:**

**Intel:**

- Core i3 (entry level)
- Core i5 (mid-range)
- Core i7 (high performance)
- Core i9 (enthusiast/professional)
- Pentium, Celeron (budget)

**AMD:**

- Ryzen 3, 5, 7, 9
- Athlon (budget)
  - o EPYC (servers)

**CPU Specifications:****Clock Speed**

Measured in GHz (Gigahertz)  
Example: 3.6 GHz = 3.6 billion cycles per second  
Higher = faster (generally)

**Number of Cores**

**Single-core:** One processing unit  
**Dual-core:** Two cores (2x speed for multi-tasking)  
**Quad-core:** Four cores  
**Hexa-core:** Six cores  
**Octa-core:** Eight cores  
**More cores = better multi-tasking**

**Cache Memory**

L1 Cache: Smallest, fastest (32-64 KB per core)  
L2 Cache: Medium (256 KB - 1 MB per core)  
L3 Cache: Largest, shared (2-32 MB)

**Socket Type**

Must match motherboard socket  
Intel: LGA 1151, 1200, 1700  
AMD: AM4, AM5

**TDP (Thermal Design Power)**

Heat generated in Watts  
Example: 65W, 95W, 125W  
Higher TDP = more heat = better cooling needed

**CPU Cooling:****Heat Sink**

Metal (aluminum/copper) fins  
Draws heat away from CPU  
Must make contact with CPU

**Thermal Paste**

Fills microscopic gaps  
Improves heat transfer  
Applied between CPU and heat sink

**CPU Fan**

Attached to heat sink  
Blows air through fins  
Usually 2-pin, 3-pin, or 4-pin connector

### **Liquid Cooling (Advanced)**

- Water cooling system
- Better than air cooling
- Quieter operation
- More expensive

## **WEEK 5: IDENTIFICATION AND FUNCTIONS OF HARDWARE PARTS**

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**SATA Power:** Powers drives

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Connect hard drives and optical drives

Usually 4-8 ports

Faster than old IDE/PATA

SATA versions: SATA I, II, III (fastest)

## USB Headers

Internal USB connections

Connect to front panel USB ports

USB 2.0 and USB 3.0 headers

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Power button

Reset button

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Hard drive activity light

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**Octa-core:** Eight cores  
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#### **Cache Memory**

L1 Cache: Smallest, fastest (32-64 KB per core)  
L2 Cache: Medium (256 KB - 1 MB per core)  
L3 Cache: Largest, shared (2-32 MB)

### **4. Socket Type**

Must match motherboard socket  
Intel: LGA 1151, 1200, 1700  
AMD: AM4, AM5

#### **TDP (Thermal Design Power)**

Heat generated in Watts  
Example: 65W, 95W, 125W  
Higher TDP = more heat = better cooling needed

### **CPU Cooling:**

#### **Heat Sink**

Metal (aluminum/copper) fins  
Draws heat away from CPU  
Must make contact with CPU

#### **Thermal Paste**

Fills microscopic gaps  
Improves heat transfer  
Applied between CPU and heat sink

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- Blows air through fins
- Usually 2-pin, 3-pin, or 4-pin connector

### **Liquid Cooling (Advanced)**

- Water cooling system
- Better than air cooling
- Quieter operation
- More expensive

## **E. SOLID STATE DRIVE (SSD)**

### **Physical Description:**

- Similar shape to 2.5" HDD
- Much lighter (no moving parts)
- Can be circuit board only (M.2 form)
- Silent operation

### **Technology:**

- Uses flash memory chips
- Similar to USB flash drives
- No moving parts
- Stores data in memory cells

### **Types of SSDs:**

#### **2.5" SATA SSD:**

- Looks like laptop HDD
- Uses SATA connection
- Easy upgrade from HDD
- Up to 550 MB/s read speed

#### **M.2 SSD:**

- Small stick shape
- Plugs directly into motherboard
- No cables needed
- SATA M.2:** 550 MB/s (same as 2.5" SATA)
- NVMe M.2:** Up to 7000+ MB/s (very fast!)

#### **PCIe SSD:**

- Plugs into PCIe slot
- Very fast
- Usually NVMe protocol
- Expensive

### **SSD Specifications:**

#### **Capacity:**

- 120GB, 240GB, 256GB (entry level)
- 480GB, 512GB (mid-range)
- 1TB, 2TB (high-end)
- 4TB+ (enthusiast/professional)

#### **Interface:**

- SATA III:** 6 Gbps (up to 550 MB/s)
- NVMe (PCIe 3.0):** Up to 3500 MB/s
- NVMe (PCIe 4.0):** Up to 7000 MB/s
- NVMe (PCIe 5.0):** Up to 14000 MB/s (newest)



**Endurance (TBW - Terabytes Written):**

How much data can be written before wear

Example: 300 TBW = 300 terabytes total writes

Higher = longer lifespan

**DRAM Cache:**

Some SSDs have DRAM chip

Improves performance

More expensive

**Advantages of SSD:**

**Much faster** than HDD (3-20x)

No moving parts (reliable)

Silent operation

Lightweight

- Shock resistant

Lower power consumption

Faster boot times

Cooler operation

**Disadvantages:**

More expensive per GB

- Smaller capacities for same price

Limited write cycles (though very high)

Data recovery harder if fails

**Common Uses:**

**SSD:** Operating system, programs (fast access needed)

**HDD:** Documents, photos, videos (bulk storage)

**F. POWER SUPPLY UNIT (PSU)**

**Definition:** The power supply converts AC (Alternating Current) from wall outlet to DC (Direct Current) needed by computer components.

**Physical Description:**

Metal box (usually at top or bottom of case)

Fan on one side

Multiple cables coming out

Power switch (sometimes)

AC power socket

**Functions:**

Converts AC (220V-240V in Nigeria) to DC (3.3V, 5V, 12V)

Distributes power to all components

Protects against power surges

Regulates voltage

**Power Connectors:****24-pin Main Power (20+4)**

Powers motherboard

Largest connector

Sometimes 20-pin on older boards

**4-pin/8-pin CPU Power**

Powers processor

Usually near CPU socket

4+4 pin design (can split)

### **6-pin/8-pin PCIe Power**

Powers graphics card

High-end cards need 1-3 connectors

6+2 pin design

### **SATA Power**

Flat L-shaped connector

Powers HDDs, SSDs, optical drives

15 pins

### **Molex (4-pin peripheral)**

Old-style connector

Powers old drives, fans

Being phased out

### **Berg (Floppy power)**

Small 4-pin

For floppy drives

Rare now

## **PSU Specifications:**

### **Wattage:**

Power output capacity

Common: 400W, 500W, 600W, 750W, 850W, 1000W+

Must be sufficient for all components

**Basic system:** 400-500W

**Gaming system:** 600-750W

**High-end gaming:** 850W+

### **Efficiency Rating (80 PLUS):**

How efficiently converts AC to DC

Ratings (good to best):

**80 PLUS:** 80% efficient

○ **80 PLUS Bronze:** 82-85%

○ **80 PLUS Silver:** 85-88% ○

**80 PLUS Gold:** 87-90%

○ **80 PLUS Platinum:** 90-92%

○ **80 PLUS Titanium:** 92-94%

Higher = less wasted electricity = lower bills

### **Modularity:**

**Non-modular:** All cables permanently attached

**Semi-modular:** Some cables removable

**Fully modular:** All cables removable

Modular = better cable management

### **Form Factors:**

**ATX:** Standard desktop size

**SFX:** Small form factor

**TFX:** Thin form factor

## **Safety Features:**

**OVP:** Over Voltage Protection

**UVP:** Under Voltage Protection

**OCP:** Over Current Protection  
**OPP:** Over Power Protection  
**SCP:** Short Circuit Protection  
**OTP:** Over Temperature Protection

### **Warning Signs of PSU Failure:**

Random shutdowns  
Burning smell  
Strange noises  
Won't power on  
Crashes under load

## **G. GRAPHICS PROCESSING UNIT (GPU/Graphics Card)**

**Definition:** The GPU processes graphics and video, reducing load on CPU for visual tasks.

### **Types:**

#### **1. Integrated Graphics:**

Built into CPU  
Shares system RAM  
Lower performance  
No extra cost  
Sufficient for basic tasks

- Examples: Intel UHD, AMD Radeon Vega

#### **2. Dedicated/Discrete Graphics:**

Separate card  
Own RAM (VRAM)  
Much more powerful  
Required for gaming, video editing, 3D work  
Expensive  
Requires PSU power connectors

### **Physical Description:**

Circuit board  
Large heat sink and fans  
Inserts into PCIe x16 slot  
Multiple display outputs  
Power connectors (6-pin, 8-pin)

### **Major Manufacturers:**

#### **NVIDIA:**

GeForce RTX series (high-end)  
GeForce GTX series (mid-range)  
Examples: RTX 4090, RTX 4080, RTX 4070, GTX 1660

#### **AMD:**

Radeon RX series  
Examples: RX 7900 XTX, RX 7800 XT, RX 6600

### **GPU Specifications:**

#### **VRAM (Video RAM):**

Dedicated graphics memory  
Common: 4GB, 6GB, 8GB, 12GB, 16GB, 24GB  
More = can handle higher resolutions/settings

#### **Clock Speed:**

Base clock and boost clock

Measured in MHz

Higher = faster

### **CUDA Cores (NVIDIA) / Stream Processors (AMD):**

Parallel processing units

More = better performance

Not directly comparable between brands

### **Memory Type:**

GDDR6X (faster, NVIDIA high-end)

HBM2 (high bandwidth, professional cards)

### **Memory Bus Width:**

128-bit, 192-bit, 256-bit, 384-bit

- Wider = more data transfer

Affects performance

### **TDP (Thermal Design Power):**

Power consumption in Watts

Example: 150W, 220W, 320W, 450W

Higher = more power needed = more heat

### **Display Outputs:**

**HDMI:** Most common, supports audio

**DisplayPort:** Higher bandwidth, gaming monitors

**DVI:** Older standard

**VGA:** Very old, analog (rare on modern cards)

### **Uses of Dedicated GPU:**

Gaming (high FPS, high settings)

Video editing and rendering

3D modeling and animation

CAD/CAM software

Machine learning/AI

Cryptocurrency mining

Professional photo editing

Multiple monitor setups

## **H. OPTICAL DRIVES**

**Definition:** Optical drives read and write data on optical discs using laser technology.

### **CD Drive**

Reads CDs only

700 MB capacity

Slow data transfer

Rarely used now

### **DVD Drive**

Reads CDs and DVDs

DVD capacity: 4.7GB-8.5GB

Common types:

**DVD-ROM:** Read only

**DVD-RW:** Read and write

### **Blu-ray Drive**

Reads CDs, DVDs, and Blu-ray

Blu-ray capacity: 25GB-128GB

Expensive

Used for HD movies, large backups

### **Physical Description:**

Rectangular metal box

Front has tray that opens

Eject button on front

SATA connection (modern)

IDE connection (old)

### **Specifications:**

**Read speed:** 24x, 48x, 52x (CDs)

**Write speed:** For RW drives

**Interface:** SATA (current), IDE (old)

**Form factor:** 5.25" (standard)

**Note:** Optical drives are becoming rare as:

USB drives more convenient

Cloud storage more popular

Downloads replace physical media

Laptops no longer include them

## **I. SOUND CARD (Audio Card)**

**Definition:** Processes audio input and output for the computer.

### **Integrated/Onboard Audio:**

Built into motherboard

Sufficient for most users

Common chips: Realtek ALC series

Free (included with motherboard)

### **Dedicated Sound Card:**

Separate expansion card

Better audio quality

More features

For audiophiles, musicians, content creators

### **Physical Description:**

PCIe card (modern)

PCI card (older)

Multiple audio jacks

Sometimes has optical output

### **Audio Jacks (Color Coding):**

**Green:** Front speakers/headphones (line out)

**Pink:** Microphone input

**Blue:** Line in (aux input)

**Orange:** Subwoofer/center speaker

**Black:** Rear speakers

**Gray:** Side speakers

**Features:**

**Channels:** 2.0 (stereo), 5.1, 7.1 (surround)

**SNR (Signal-to-Noise Ratio):** Higher = clearer

**Sampling Rate:** 44.1 kHz, 48 kHz, 96 kHz, 192 kHz

**Software:** Audio control panel, effects

**Uses:**

Music production

Gaming (positional audio)

Home theater systems

Professional audio work

Streaming/podcasting

## **J. NETWORK INTERFACE CARD (NIC)**

**Definition:** Enables computer to connect to networks and internet.

**Wired NIC (Ethernet):**

RJ-45 port

Usually integrated into motherboard

- **Speeds:** 10/100/1000 Mbps (Gigabit most common)

Reliable, fast, secure

**2. Wireless NIC (WiFi):**

Can be integrated or expansion card

Standards:

**802.11n (WiFi 4):** Up to 300 Mbps

    ◦ **802.11ac (WiFi 5):** Up to 1300 Mbps

    ◦ **802.11ax (WiFi 6):** Up to 9600 Mbps

Frequency: 2.4 GHz and/or 5 GHz

Requires WiFi router

**Physical Description:**

**Integrated:** RJ-45 port on motherboard back panel

**PCIe Card:** Expansion card with antenna

**USB Adapter:** External dongle

**Specifications:**

**Speed:** 10 Mbps, 100 Mbps, 1000 Mbps (Gigabit), 2.5 Gbps, 10 Gbps

**Duplex:** Full-duplex (simultaneous send/receive)

**Wake-on-LAN:** Can wake computer remotely

## **K. COMPUTER CASE (Chassis/Tower)**

**Definition:** The enclosure that houses all internal components.

**Types by Size:**

**Full Tower:**

Largest size

Multiple drive bays

Excellent cooling

For enthusiasts/workstations

Heavy

**Mid Tower:**

- Most popular size
- Good balance of size and features
- Fits most components
- Standard ATX motherboard

**Mini Tower:**

- Smaller than mid tower
- Micro-ATX or Mini-ITX motherboard
- Fewer expansion slots
- More portable

**Small Form Factor (SFF):**

- Very compact
- Mini-ITX motherboard
- Limited expansion
- Portable

**Desktop Case:**

- Lies horizontally
- Less common now
- Can place monitor on top

**Components of Case:****Front Panel:**

- Power button
- Reset button (optional)
- USB ports (2.0 and 3.0)
- Audio jacks (headphone, mic)
- LED lights (power, HDD activity)
- Optical drive bays (5.25")

**Drive Bays:**

- 5.25" External:** Optical drives (front access)
- 3.5" Internal:** Hard drives
- 2.5" Internal:** SSDs, laptop HDDs
- Modern cases have fewer bays

**Expansion Slot Covers:**

- Metal covers on back
- Remove to install expansion cards
- Usually 7-8 slots

**Cable Management:**

- Holes/grommets for routing cables
- Space behind motherboard tray
- Velcro straps or ties
- Better airflow and appearance

**Cooling:**

- Fan mounts (front, top, rear, bottom)
- Dust filters
- Ventilation holes
- Support for liquid cooling radiators

**Materials:**

**Steel:** Cheap, sturdy, heavy

**Aluminum:** Lightweight, expensive, better cooling

**Plastic:** Front panels, accents

**Tempered Glass:** Side panels (to show components)

### **Features:**

**Tool-less design:** Easy component installation

**RGB Lighting:** Colored LEDs

**Sound dampening:** Quieter operation

**PSU shroud:** Hides cables and PSU

## **L. COOLING SYSTEMS**

### **Why Cooling is Important:**

Components generate heat

Overheating causes:

Reduced performance (thermal throttling)

- System crashes
- Shortened lifespan
- Component failure

### **Types of Cooling:**

#### **Air Cooling:**

##### **a) Case Fans:**

**Intake fans:** Bring cool air in (front, bottom)

**Exhaust fans:** Push hot air out (rear, top)

Sizes: 80mm, 120mm, 140mm, 200mm

Larger = quieter, more airflow

Speed: 800-2000 RPM

**Airflow direction matters!**

#### **CPU Cooler:**

Stock cooler (included with CPU) - basic

Aftermarket coolers - better performance

Types:

**Tower coolers:** Vertical heat sink

**Low-profile coolers:** For small cases

**Top-down coolers:** Blow air onto motherboard

#### **GPU Cooling:**

Integrated with graphics card

1-3 fans

Large heat sink

#### **Liquid Cooling (Water**

##### **Cooling): a) All-in-One (AIO):**

Pre-filled, sealed system

Pump, radiator, fans, tubing, cold plate

Sizes: 120mm, 240mm, 280mm, 360mm

Easy installation

No maintenance

More expensive than air

Quieter and cooler



**Custom Loop:**

DIY water cooling  
Individual components  
Very expensive  
Requires maintenance  
Best cooling performance  
For enthusiasts

**Thermal Management:**

**Thermal paste:** Between CPU and cooler

**Thermal pads:** For other components

**Good airflow:** Positive or negative pressure

**Cable management:** Don't block airflow

**Regular cleaning:** Remove dust

**M. EXPANSION CARDS (Summary)**

Besides graphics and sound cards, other expansion cards include:

**WiFi/Bluetooth Card:**

Adds wireless connectivity  
PCIe x1 slot  
• Antennas on back

**USB Expansion Card:**

Adds more USB ports  
USB 3.0, 3.1, or 3.2  
PCIe card

**SATA Expansion Card:**

Adds more SATA ports  
For additional drives  
PCIe card

**Capture Card:**

Records video from consoles/cameras  
For streamers, content creators  
PCIe or external (USB)

**Thunderbolt Card:**

Adds Thunderbolt 3/4 ports  
Very fast data transfer  
Expensive

**N. COMPONENT INTERCONNECTION****How Components Connect:**

**Motherboard** = Central hub

**CPU** → CPU socket on motherboard

**RAM** → DIMM slots on motherboard

**GPU** → PCIe x16 slot on motherboard

**Storage (HDD/SSD)** → SATA port on motherboard

**PSU** → Powers all components via cables

**Case fans** → Fan headers on motherboard or PSU

**Front panel** → Connectors on motherboard

**Data Paths:**

**System Bus:** Between CPU and RAM (fastest)  
**PCIe Bus:** Between CPU and expansion cards  
**SATA Bus:** Between motherboard and drives  
**USB Bus:** Between motherboard and peripherals

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## EVALUATION QUESTIONS

### Essay Questions:

Describe the motherboard and list eight components found on it.  
Explain the difference between HDD and SSD with five points each.  
What is the function of the power supply unit? List six types of power connectors.  
Describe the CPU and explain its three main components.  
Why is cooling important in a computer? Describe two cooling methods.

### Objective Questions:

The main circuit board of a computer is called \_\_\_\_\_. (a) CPU (b) Motherboard (c) RAM (d) Hard disk **Answer: B**  
Which component is the "brain" of the computer? (a) RAM (b) Hard disk (c) CPU (d) GPU  
**Answer: C**  
SSD stands for \_\_\_\_\_. (a) Solid State Drive (b) Super Speed Disk (c) System Storage Device  
Standard State Drive **Answer: A**  
The battery on the motherboard powers the \_\_\_\_\_. (a) CPU (b) RAM (c) BIOS (d) Hard disk  
**Answer: C**  
Which is faster? (a) HDD at 5400 RPM (b) HDD at 7200 RPM (c) SATA SSD (d) NVMe SSD **Answer: D**  
DDR4 is a type of \_\_\_\_\_. (a) Hard disk (b) RAM (c) CPU (d) Power supply **Answer: B**  
The PSU converts \_\_\_\_\_ to \_\_\_\_\_. (a) DC to AC (b) AC to DC (c) DC to DC (d) AC to AC  
**Answer: B**  
SATA is used to connect \_\_\_\_\_. (a) Monitor (b) Keyboard (c) Hard drive (d) Speaker  
**Answer: C**  
The chipset controls \_\_\_\_\_. (a) Data flow (b) Display (c) Sound (d) Network **Answer: A**  
Which generates the most heat? (a) RAM (b) Hard disk (c) CPU (d) Case fan **Answer: C**  
The standard size for desktop RAM is \_\_\_\_\_. (a) SO-DIMM (b) DIMM (c) SIMM (d) RIMM  
**Answer: B**  
PCIe slots are used for \_\_\_\_\_. (a) RAM (b) CPU (c) Expansion cards (d) Power cables  
**Answer: C**  
Thermal paste is applied between CPU and \_\_\_\_\_. (a) Motherboard (b) Heat sink (c) RAM  
Case **Answer: B**  
Which component stores data permanently? (a) RAM (b) Cache (c) Hard disk (d) Registers  
**Answer: C**  
The GPU is responsible for \_\_\_\_\_. (a) Sound processing (b) Graphics processing (c) Network  
processing (d) Power distribution **Answer: B**

### Fill in the Blanks:

The \_\_\_\_\_ provides power to all computer components. (Power Supply Unit/PSU)  
\_\_\_\_\_ is temporary memory that loses data when power is off. (RAM)  
The \_\_\_\_\_ connects all components together. (Motherboard)  
\_\_\_\_\_ cooling uses liquid to cool components. (Water/Liquid)  
A \_\_\_\_\_ has no moving parts and is faster than HDD. (SSD/Solid State Drive)

## CLASS ACTIVITIES

### Practical Activity 1: Component Identification

**Materials needed:**

- Old/non-working computer system unit
- Screwdrivers
- Anti-static wrist strap (if available)
- Camera/phone for photos

**Procedure:****SAFETY FIRST:**

- Unplug from power
- Wait 5 minutes for capacitors to discharge
- Work on non-conductive surface
- Don't force components
- Teacher supervision required

**Opening the case:**

- Remove side panel screws
- Slide off side panel
- Observe internal layout

**Identify components:**

- Motherboard
- CPU (under heat sink)
- RAM sticks
- Hard drive/SSD
- Power supply
- Graphics card (if present)
- Case fans
- Cables

**Documentation:**

- Take photos
- Draw and label diagram
- Note brand/model numbers
- Measure components

**Careful disassembly (optional, with teacher):**

- Remove RAM (push clips outward)
- Disconnect SATA cables
- Remove expansion cards (unscrew, lift straight up)
- Observe how components connect

**Reassembly:**

- Put everything back carefully
- Ensure all connections  
secure ○ Close case

**Practical Activity 2: Component Research**

In groups of 4, research and create a presentation on ONE component:

- Group 1: CPU
- Group 2: RAM
- Group 3: Storage (HDD/SSD)
- Group 4: Power Supply
- Group 5: Graphics Card
- Group 6: Motherboard

**Include:**

- Current market prices (3 examples: budget, mid-range, high-end)
- Specifications explained
- Pictures/diagrams
- Brands/manufacturers
- Installation tips
- Common problems

---

**Practical Activity 3: Virtual Build**

Using PCPartPicker website or similar:

- Select components for a complete system
- Ensure compatibility
- Stay within ₦200,000 budget
- Create a parts list with prices
- Justify your choices

**Requirements:**

- CPU
- Motherboard (compatible socket)
- RAM (compatible with motherboard)
  - Storage (HDD or SSD)
- Power supply (adequate wattage)
- Case
- Graphics card (optional, for gaming)
- Monitor, keyboard, mouse

**Group Discussion Topics:****SSD vs HDD Debate:**

- When would you choose HDD?
- When is SSD worth the extra cost?
- Can you use both?

**Upgradeability:**

- Which component should you upgrade first for:
  - Gaming?
  - Video editing?
  - General speed improvement?

**Troubleshooting:**

- Computer won't turn on - what could be wrong?
- Computer is very slow - possible causes?
- Strange noises from system unit - diagnosis?

**ASSIGNMENT**

**Assignment 1: Component Identification Sheet** Create a detailed chart with:

- Component name
- Picture/drawing
- Function (2-3 sentences)
- Location in computer
- Connection type

Price range in Nigeria

Do this for:

Motherboard

CPU

RAM

HDD

SSD

Power Supply

Graphics Card

CPU Cooler

### **Assignment 2: Component Shopping**

Visit a computer shop (Computer Village Lagos, Wuse Market Abuja, or local shop) or check online stores (Jumia, Konga, Slot): ●

**Task 1: Price Survey** Record current prices for:

3 different CPUs (Intel or AMD)

3 RAM modules (different capacities)

2 HDDs (500GB, 1TB)

2 SSDs (256GB, 512GB)

• 2 Power supplies (different wattages)

1 Graphics card

**Task 2: Shop Interview** Ask the shop owner/technician:

Which component fails most often?

Which brands do they recommend?

What do most customers upgrade?

What's the most popular RAM size?

Average cost to build a basic computer?

Write a report (300 words) on your findings.

### **Assignment 3: Component Research Project**

Choose ONE component and write a detailed report (500 words) covering:

**History:** How has it evolved?

**Current technology:** Latest developments

**How it works:** Technical explanation

**Types/variations:** Different options available

**Buying guide:** What to look for

**Future trends:** What's coming next?

**Nigeria market:** Availability and prices

Include:

• Diagrams/photos •

Comparison tables

• Personal recommendations

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### **Assignment 4: Build Planning**

**Scenario:** Your school wants to build 20 computers for the ICT lab.

**Your task:**

1. Design TWO system configurations:

**Budget build:** ₦150,000 per system

**Performance build:** ₦300,000 per system

For each build, list:

- All components with model numbers

- Individual prices

- Total cost per system

- Total cost for 20 systems

- Justification for each choice

Compare the two builds:

- What can the performance build do that budget can't?

- Which is better value for money?

- Which would you recommend for your school? Why?

Create a presentation (PowerPoint or poster) to present to class.

### **Assignment 5: Troubleshooting Scenarios**

For each scenario, identify the likely faulty component and explain your reasoning:

**Scenario 1:** Computer turns on, fans spin, but no display on monitor. Motherboard LED lights are on.

**Scenario 2:** Computer randomly restarts, especially when running games or heavy programs. Sometimes it shuts down completely. ●

**Scenario 3:** Computer is very slow. Takes 5 minutes to boot. Programs take forever to open. Constant hard drive activity light.

**Scenario 4:** Computer won't turn on at all. No lights, no fans, no sounds. Power button does nothing.

**Scenario 5:** Computer works fine for 10 minutes, then freezes or crashes. CPU temperature is very high (90°C+).

Write your answers with:

- Most likely cause

- How to diagnose

- How to fix

- Prevention tips

## **WEEK 6: TOOLS AND EQUIPMENT FOR COMPUTER AND GSM REPAIRS**

### **Learning Objectives**

By the end of this lesson, students should be able to:

- Identify common tools used in computer and GSM repairs

- Explain the function of each tool

- Demonstrate proper handling of repair tools

- Understand when to use each tool

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### **TOPIC: Tools and Equipment for Computer and GSM Repairs**

Professional repair work requires proper tools. Using the right tool makes work easier, faster, and safer.

---

## **A. BASIC HAND TOOLS**

### **1. Screwdrivers**

#### **Phillips Head Screwdriver:**

Cross-shaped (+) tip  
Most common in computers and phones  
Sizes: #0 (very small), #1 (small), #2 (standard)  
Uses: Most computer and phone screws

#### **Flat Head Screwdriver:**

Single blade (–) tip  
Less common in electronics  
• Various sizes  
Uses: Some old computer screws, prying (carefully)

#### **Torx Screwdriver:**

Star-shaped tip  
Common in laptops and phones  
Sizes: T5, T6, T8, T10, etc.  
Uses: Apple devices, modern smartphones, Xbox controllers

#### **Precision Screwdriver Set:**

Very small screwdrivers  
Essential for phone repairs  
Usually includes: Phillips, Flathead, Torx  
Often color-coded  
Magnetic tips helpful

#### **Pentalobe Screwdriver:**

Five-pointed star  
Used by Apple (iPhone, MacBook)  
Sizes: P2, P5, P6  
Security screw to prevent easy opening

#### **Hex/Allen Key:**

Hexagonal tip

Less common in electronics  
Sizes: 1.5mm, 2mm, 2.5mm, etc.  
Uses: Some laptop and phone parts

### **Important:**

Match screwdriver to screw exactly  
Wrong size damages screw head  
Magnetic tips prevent lost screws  
Keep organized (screws are tiny!)

## **Pliers and Cutters**

### **Needle-Nose Pliers:**

Long, thin, pointed tip  
Excellent for gripping small objects  
Uses:

- Picking up small screws
- Bending wires
- Holding connectors
- Retrieving dropped parts

### **Flat-Nose Pliers:**

Flat, square jaws  
Good grip surface  
Uses:

- Gripping flat objects
- Bending metals
- General holding

### **Tweezers (Precision):**

Various styles:  
Straight tip  
Curved tip  
Angled tip (best for phones)

Anti-static versions available

Uses:

- Handling tiny screws
- Placing small components
- Phone connector work
- Precision work

### **Wire Cutters:**



Cuts wires cleanly

Different types:

- Flush cutters (flat cut)

- Diagonal cutters

Uses:

- Cutting cables

- Trimming zip ties

- Wire preparation

## **Wire Strippers:**

Removes insulation from wires

Adjustable for different wire sizes

Uses:

- Preparing cables

- Wire repairs

- Custom cable making

## **Spudgers and Prying**

### **Tools Plastic Spudger:**

Plastic prying tool

Won't damage or scratch

Various shapes:

- Flat end

- Pointed end

- Curved end

Uses:

- Opening phone cases

- Disconnecting ribbon cables

- Prying apart components ○

- Removing adhesive parts

### **Metal Spudger:**

Thin metal tool

Stronger than plastic

More risk of damage

Uses:

- Stubborn adhesive

- Tight spaces

- Scraping

**Caution:** Can scratch and cause shorts!

### **Opening Picks (Guitar Picks):**

Thin plastic picks  
Various thicknesses

Uses:

- Sliding between glued parts
- Opening phone screens
- Separating cases

Very safe (won't damage)

### **Pry Tools/Opening Tools:**

Usually plastic or nylon  
Various shapes and sizes

Uses:

- Opening laptop cases
- Removing bezels
- General prying

### **Cutting and Trimming**

#### **Tools Scissors:**

Good quality, sharp

Uses:

- Cutting tape
- Trimming materials
- Opening packages

#### **Craft Knife/Utility Knife:**

Replaceable sharp blade

Uses:

- Precise cutting
- Scraping adhesive
- Opening sealed parts

**Caution:** Very sharp!

#### **Desoldering Braid/Wick:**

Copper braid for removing solder  
Used with soldering iron

Uses:

- Removing solder from joints
- Cleaning PCB pads

---

## **MEASURING AND TESTING TOOLS**

## Digital Multimeter

### (DMM) Description:

- Essential testing device
- Measures electrical properties
- Digital display
- Various ranges and settings

### What It Measures:

#### Voltage (V - Volts):

- DC Voltage (DCV): Batteries, power supplies
- AC Voltage (ACV): Wall outlets (220V in Nigeria)
- Uses:
  - Test battery voltage
  - Check power supply outputs
  - Verify phone charging voltage (5V)
  - Measure laptop adapter output (19V typical)

#### b) Current (A - Amperes):

- DC Current (DCA): Electronics
- AC Current (ACA): Less common
- Uses:
  - Measure device power draw
  - Check charging current
  - Detect short circuits (excessive current)

#### Resistance ( $\Omega$ - Ohms):

- Measures opposition to current flow
- Uses:
  - Test component functionality
  - Check continuity (connections)
  - Identify blown fuses
  - Test resistors

#### Continuity Testing:

- Beeps when circuit is complete
- Uses:
  - Check cable integrity
  - Verify connections
  - Find broken traces on PCB
  - Test switches and buttons

## **Diode Testing:**

- Tests diodes and transistors
- Shows voltage drop
- Identifies component polarity

## **How to Use Multimeter:**

- Select correct function (V, A,  $\Omega$ )
- Select correct range (if manual ranging)
- Connect probes correctly:
  - Black (COM) to negative/ground
  - Red to positive/test point
- Touch probes to test points
- Read display

## **Safety:**

- Never measure AC voltage without training
- Start with highest range
- Check probe integrity
- Don't exceed meter ratings
- Be careful with live circuits

## **Common Voltages in Electronics:**

- USB charging: 5V DC
- Laptop adapters: 19V DC (varies by brand)
- Computer PSU: 3.3V, 5V, 12V DC
- Phone battery: 3.7V (nominal)
- AA battery: 1.5V
- 9V battery: 9V
- Car battery: 12V
- Nigeria mains: 220-240V AC (**DANGEROUS!**)

## **Power Supply Unit (Bench**

### **PSU) Description:**

- Provides adjustable DC power
- Variable voltage and current
- Used instead of batteries/adapters during repairs

### **Features:**

- Voltage adjustment: 0-30V typical

Current limiting: Prevents damage  
Digital or analog display  
Multiple outputs (some models)

**Uses:**

Power device without battery  
Test components at different voltages  
Diagnose power-related issues  
Safe testing environment  
Current monitoring (detect shorts)

**Example Usage:**

Testing phone motherboard: Set to 3.8V  
Testing laptop component: Set to 19V  
Set current limit low (e.g., 0.5A) to protect from shorts

**USB Tester/Power Meter**

**Description:**

Small device that plugs between charger and device  
Displays real-time charging data

**What It Shows:**

Voltage (V)  
Current (A)  
Power ( $W = V \times A$ )  
Total energy (mAh or Wh)  
Charging time

**Uses:**

Test charger quality  
Verify charging speed  
Detect fake chargers (low current)  
Diagnose slow charging  
Monitor battery health

**Example Reading:**

Good phone charger: 5V, 2A = 10W  
Fast charger: 9V, 2A = 18W  
Poor charger: 5V, 0.5A = 2.5W (slow!)

---

## **Battery Tester**

### **Description:**

Tests battery voltage and condition  
Simple device with display or LED indicators

### **Types:**

**Universal:** Tests multiple battery sizes  
**Specific:** For laptop/phone batteries  
**Load tester:** Tests under load (more accurate)

### **Uses:**

Check if battery is good or dead  
Measure voltage  
Determine remaining capacity  
Identify weak cells

## **C. SOLDERING EQUIPMENT**

### **Soldering Iron**

### **Description:**

Heated tool for soldering  
Melts solder to join components  
Essential for advanced repairs

### **Components:**

Handle (cool to touch)  
Heating element  
Tip (replaceable)  
Power cord  
Sometimes temperature control

### **Types:**

#### **Basic Soldering Iron:**

Fixed temperature (usually 40W-60W)  
Cheap (₦2,000-₦5,000)

Good for learning  
No temperature control

### **Temperature-Controlled Soldering Station:**

Adjustable temperature (200°C-450°C)  
More expensive (₦15,000-₦100,000+)  
Better for delicate electronics  
Digital display  
Professional choice

### **Hot Air Rework Station:**

Blows hot air  
For SMD (Surface Mount Device) components  
Desolders chips from PCBs  
Professional/advanced use  
Expensive (₦30,000+)

### **Soldering Iron Tips:**

Various shapes:

- **Conical (pointed):** Fine work
- **Chisel:** General purpose
- **Bevel:** Angled work

Must be clean and tinned (coated with solder)  
Replaceable when worn

### **Temperature Settings:**

Lead solder: 350°C-370°C  
Lead-free solder: 380°C-420°C (melts higher)  
Too low: Doesn't melt properly  
Too high: Damages components

## **Solder**

### **Description:**

Metal alloy that melts to join components  
Comes on spools (wire)

### **Types:**

a) **Lead Solder (60/40 or 63/37):**

60% tin, 40% lead (or 63/37 ratio)  
Lower melting point (183°C-190°C)  
Easier to work with  
Better flow  
Shiny joint when cooled  
**Health warning:** Lead is toxic (wash hands!)

### **Lead-Free Solder:**

Various alloys (SAC305 common: tin/silver/copper)  
Higher melting point (217°C-220°C)  
Environmentally friendly  
Required by regulations (RoHS compliant)  
Harder to work with  
Dull joint appearance

### **Wire Diameter:**

0.5mm: Fine electronics, phones  
0.8mm: General electronics  
1.0mm: Larger joints  
Thinner = more control

### **Flux Core:**

Solder wire contains flux inside  
Flux cleans and helps solder flow  
Essential for good joints

### **Soldering Accessories Solder**

### **Wick/Braid:**

Copper braid  
Absorbs molten solder  
Uses:

- Desoldering (removing solder)
- Cleaning excess solder
- Fixing solder bridges

### **How to use:**

Place wick on joint  
Heat with soldering iron  
Solder soaks into wick  
Remove wick (cut used portion off)



### **Solder Sucker (Desoldering Pump):**

Spring-loaded vacuum tool

Sucks up molten solder

Manual operation

Uses:

Removing through-hole components

Clearing solder from holes

Quick desoldering

### **How to use:**

Prime/cock the pump (push plunger down)

Heat solder joint with iron

When molten, place pump tip near joint

Press button to release vacuum

Solder gets sucked into pump

Empty pump periodically

### **Flux (Additional):**

Liquid, paste, or pen form

Cleans oxidation

Helps solder flow

Types:

**Rosin flux:** Common, mild

**No-clean flux:** Doesn't need cleaning after

- **Water-soluble flux:** Stronger, must clean

Apply before soldering for better joints

### **Tip Cleaner:**

**Wet sponge:** Traditional

Dampen (not soaking wet)

Wipe hot tip to clean

Causes thermal shock

**Brass wool:** Modern, better

Dry cleaning

No thermal shock

- Longer tip life
- Just wipe tip through it

### **Soldering Stand/Holder:**

Holds hot iron safely

Often includes cleaning sponge

Essential safety item  
Prevents burns and fires

### **Helping Hands/PCB Holder:**

Multiple adjustable arms with clips  
Holds work in place  
Magnifying glass (some models)  
Frees both hands for soldering

### **Heat-Resistant Mat:**

Silicone mat for work surface  
Protects desk  
Heat resistant (400°C+)  
Easy to clean  
Magnetic versions hold screws

### **Magnifying Glass/Loupe:**

Magnifies tiny components  
Essential for SMD work

Types:

- Handheld

- Clip-on (helping hands)

- Headband magnifier

- USB microscope (digital)

Magnification: 2x-10x typical

## **D. SPECIALIZED COMPUTER REPAIR**

### **TOOLS 1. Compressed Air/Air Blower**

Types:

**Canned air:** Pressurized spray can

**Electric blower:** Reusable, battery or plug-in

**Air compressor:** Professional (requires moisture trap)

Uses:

Cleaning dust from components  
Blowing out vents and fans  
Cleaning keyboards  
Removing debris from ports  
Cooling hot components during work

## **Proper Use:**

- Hold can upright (if canned air)
- Short bursts
- Hold fans still (don't let them spin freely)
- Use outdoors or well-ventilated area
- Keep away from face/eyes

## **Anti-Static Tools**

### **Anti-Static Wrist Strap:**

- Worn on wrist
- Connects to ground
- Prevents static discharge (ESD)
- Essential for sensitive electronics
- Cost: ~~¥~~500-~~¥~~2,000

### **How to use:**

- Wrap around wrist snugly
- Attach clip to:
  - Computer case (metal, unplugged)
  - Grounded metal object
  - ESD mat ground point
- Wear throughout repair

### **Anti-Static Mat:**

- Work surface mat
- Dissipates static
- Often has ground point
- More protection than strap alone
- Professional setup

### **Why Anti-Static is Important:**

- Static electricity (ESD) can:
  - Instantly destroy components
  - Damage you might not notice immediately
  - Affect RAM, CPU, motherboard
  - Particularly dangerous when dry
- You won't feel discharges that damage electronics (as low as 10V can damage, humans feel 3,000V+)

### **Preventing Static:**

Use anti-static wrist strap  
Touch grounded metal before handling components  
Work on non-carpeted floors  
Avoid synthetic clothing  
Don't shuffle feet  
Work in humid environment (if possible)  
Keep components in anti-static bags when not in use

## **Thermal Paste/Compound**

### **Description:**

Gray paste applied between CPU and heat sink  
Fills microscopic gaps  
Improves heat transfer

### **Types:**

**Standard:** Basic thermal paste (~~¥~~1,000-~~¥~~2,000)

**High-performance:** Better conductivity (~~¥~~3,000-~~¥~~8,000) ○

- Arctic Silver 5
- Noctua NT-H1
- Thermal Grizzly Kryonaut

### **When to Apply:**

Installing new CPU cooler  
CPU overheating (old paste dried out)  
Every 2-3 years for maintenance

### **How to Apply:**

Clean old paste (isopropyl alcohol)  
Apply small amount (rice grain size)  
Spread evenly (or let pressure spread it)  
Install cooler  
Don't use too much!

Clearing solder from holes  
Quick desoldering

### **How to use:**

Prime/cock the pump (push plunger down)  
Heat solder joint with iron  
When molten, place pump tip near joint

Press button to release vacuum  
Solder gets sucked into pump  
Empty pump periodically

### **Flux (Additional):**

Liquid, paste, or pen form  
Cleans oxidation  
Helps solder flow  
Types:

**Rosin flux:** Common, mild

**No-clean flux:** Doesn't need cleaning after

- **Water-soluble flux:** Stronger, must clean

Apply before soldering for better joints

### **Tip Cleaner:**

**Wet sponge:** Traditional

Dampen (not soaking wet)

Wipe hot tip to clean

Causes thermal shock

**Brass wool:** Modern, better

Dry cleaning

No thermal shock

- Longer tip life
- Just wipe tip through it

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---

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Every 2-3 years for maintenance

### How to Apply:

Clean old paste (isopropyl alcohol)  
Apply small amount (rice grain size)  
Spread evenly (or let pressure spread it)  
Install cooler  
Don't use too much!

## 4. Cable Tester

### Description:

Tests cable continuity and wiring  
LED indicators show results

### Types:

**Ethernet cable tester:** Tests network cables (RJ-45)

**USB cable tester:** Tests USB cables

**Universal cable tester:** Multiple cable types

### Uses:

Verify cable functionality  
Check for breaks  
Identify wiring errors  
Confirm proper pin connections

---



## **POST Card/Debug**

### **Card Description:**

Diagnostic card for motherboards  
Plugs into PCIe slot  
Shows POST (Power-On Self-Test) codes

### **Uses:**

Diagnose boot failures  
Identify faulty components  
Professional troubleshooting  
When computer won't boot

### **How it works:**

Displays hexadecimal codes  
Codes indicate where boot process stops  
Consult manual to interpret codes  
Identifies: RAM, CPU, GPU, storage issues

## **6. SATA/USB to SATA Adapter**

### **Description:**

Connects internal drives externally via USB  
No need to install drive in computer

### **Uses:**

Test hard drives outside computer  
Data recovery  
Clone drives  
Test old drives  
Quick access to internal drives

### **Types:**

USB to SATA only  
USB to SATA and IDE (older drives)  
Docking stations (holds drive upright)

---

## **USB Bootable Drive Creator Tools**

**Software + USB Drive:**

Rufus, Balena Etcher, etc.  
Creates bootable USB drives  
8GB+ USB recommended

**Uses:**

Install operating systems  
Boot into repair environments  
Run diagnostic tools  
Create recovery drives

**E. SPECIALIZED GSM/PHONE REPAIR****TOOLS 1. Phone Opening Kit****Typical Contents:**

Multiple screwdriver bits (Phillips, Pentalobe, Torx)  
Plastic prying tools  
Metal spudgers  
Suction cup (for screens)  
Guitar picks/opening picks  
Tweezers  
SIM eject pin

**Cost:** ~~¥2,000-¥10,000~~ depending on quality

**Uses:**

Opening phone cases  
Removing screens  
Disassembly  
General phone repairs

**Screen Separator Machine****Description:**

Heated platform  
Separates LCD from glass/digitizer  
Uses controlled heat  
Professional tool

**Process:**

Place screen face down  
Heat to specific temperature (80-120°C)  
Use wire or tool to separate layers  
Slowly work around edges

**Uses:**

LCD/digitizer separation  
Glass-only replacements (cheaper than full assembly)  
Professional screen repairs

**Cost:** ₦15,000-~~₦~~100,000+ depending on features

**Alternative Method (for beginners):**

Heat gun (careful - can overheat!)  
Hair dryer (safer but slower)

- Playing cards for separation

**3. Hot Air Rework Station (for phones)****Description:**

Precision hot air tool  
For SMD component work  
Temperature and airflow control

**Uses:**

Removing chips from phone motherboard  
Soldering tiny components  
IC replacement  
BGA (Ball Grid Array) rework  
Advanced repairs

**Temperature:** 200°C-450°C typical **Cost:** ₦30,000-~~₦~~200,000+

**Caution:** Requires skill and practice!

---

**UV Light and UV Glue****(LOCA) UV Light/Lamp:**

Cures UV-sensitive adhesive  
Various wavelengths (365nm common)  
Portable or desktop units

### **LOCA (Liquid Optically Clear Adhesive):**

Special glue for screens  
Bonds glass to digitizer/LCD  
Transparent when cured  
Cures under UV light

#### **Uses:**

Glass-only screen replacements  
Rebonding separated screens  
Professional screen repairs

#### **Process:**

Clean surfaces  
Apply thin layer of LOCA  
Position glass carefully  
Remove bubbles  
Cure with UV light (2-5 minutes)

#### **Cost:**

UV lamp: ₦5,000-~~₦50,000~~  
LOCA glue: ₦1,000-~~₦5,000~~ per bottle

### **Phone Motherboard Test Fixture/Jig**

#### **Description:**

Custom connector board for each phone model  
Connects to phone motherboard without case  
Allows testing without full assembly

#### **Uses:**

Test motherboard functionality  
Diagnose issues before reassembly  
Professional repair efficiency  
Connect battery, screen, buttons for testing

**Cost:** ~~₦5,000-₦20,000~~ per phone model

---

## **Battery Tester (Phone-**

### **Specific) Description:**

- Tests phone battery health
- Shows voltage, capacity, resistance
- Some show charge cycles

### **Uses:**

- Determine if battery needs replacement
- Verify battery quality
- Check for counterfeit batteries
- Measure actual vs. stated capacity

## **Flashing Box/Dongle**

### **Description:**

- Hardware device for phone software work
- Connects phone to computer
- Proprietary software included

### **Popular Brands:**

- Miracle Box:** Android and Chinese phones
- Z3X Box:** Samsung specialist
- Infinity Box:** Chinese brands
- UFS Box:** Various brands
- Easy JTAG:** Advanced, for dead phones

### **Uses:**

- Flash/reinstall phone operating system
- Unlock phones (SIM unlock, FRP bypass)
- Repair IMEI (where legal)
- Backup and restore
- Fix software issues

**Cost:** ₦15,000-~~₦~~100,000 depending on brand and features

### **Software Included:**

- Firmware files

Flashing tools  
Drivers  
Usually requires activation/license

---

## **Phone Testing Equipment**

### **DC Power Supply (Phone-Specific):**

Adjustable voltage (0-5V typically)  
Current measurement  
Tests phones without battery  
Diagnose power issues

### **Ammeter (Inline):**

Measures current draw  
Helps diagnose shorts  
Normal vs. abnormal current  
Professional diagnostic tool

### **Oscilloscope (Advanced):**

Visualizes electrical signals  
Advanced troubleshooting  
Very expensive (¥50,000+)  
Professional/expert level

## **F. CLEANING SUPPLIES**

### **Isopropyl Alcohol (IPA)**

#### **Concentration:**

90%+ preferred  
99% best for electronics  
Higher = faster evaporation

#### **Uses:**

Cleaning thermal paste residue  
Removing adhesive  
Cleaning PCBs  
Removing flux residue  
General electronics cleaning  
Disinfecting phones

**Application:**

- Cotton swabs (Q-tips)
- Lint-free cloth
- Spray bottle
- Small brush

**Safety:**

- Flammable!
- Use in ventilated area
- No open flames
- Let evaporate before powering on

**Contact Cleaner****Description:**

- Specialized spray cleaner
- Dissolves oxidation and dirt
- Fast-drying
- Non-conductive when dry

**Uses:**

- Cleaning connectors
- Card edge connectors (RAM, PCIe)
- Phone charging ports
- Button contacts
- Volume rockers

**Popular Brands:**

- WD-40 Contact Cleaner
- CRC Contact Cleaner
- Servisol

**Compressed Air (mentioned earlier)**

---

**Microfiber Cloths****Description:**

- Soft, lint-free cloths

Won't scratch  
Reusable

**Uses:**

Cleaning screens  
Wiping components  
Applying cleaners  
General cleaning

**Types:**

Standard microfiber  
Anti-static versions  
Screen-specific

**Soft Brushes**

**Types:**

**Anti-static brush:** For PCBs and sensitive components  
**Toothbrush (soft):** General cleaning, hard-to-reach areas  
**Paint brush (soft):** Dusting  
**Specialized electronics brush:** Professional

**Uses:**

Dusting components  
Cleaning heatsinks  
Removing debris  
Applying cleaning solutions

**Cotton Swabs (Q-**

**tips) Uses:**

Precision cleaning  
Applying isopropyl alcohol  
Cleaning ports  
Removing old thermal paste  
Small area cleaning

**Tip:** Buy quality ones (less lint)

---



## **G. ORGANIZATIONAL TOOLS**

### **Magnetic Parts**

#### **Tray/Mat Description:**

Holds small screws and parts  
Magnetic surface keeps parts in place  
Various sizes

#### **Benefits:**

Won't lose tiny screws  
Keeps workspace organized  
Easy to see all parts

#### **Alternative:**

Ice cube tray  
Egg carton  
Small containers  
Magnetic tool mat with sections

## **2. Screw Organizer**

#### **Description:**

Multiple compartments  
Label sections for different screw types  
Some phone repair mats have screw patterns printed

#### **Uses:**

Keep screws organized during disassembly  
Remember screw locations  
Avoid mixing different screws

#### **Pro Tip:**

Take photos during disassembly  
Label bags for different sections  
Draw diagram of screw locations

---

### **Tool Organizer/Bag**

**Description:**

Case for storing tools  
Keeps tools protected  
Portable for field work

**Types:**

Hard case  
Soft bag/pouch  
Tool roll  
Drawer organizers

**Work Bench/Mat****Description:**

Dedicated repair surface  
Often has compartments for parts  
Some have printed grids/measurements

**Features (good repair mat):**

Heat resistant (silicone)  
Anti-static  
Magnetic sections  
Screw compartments  
Ruler/measurements  
Easy to clean

**Cost:** ₦2,000-~~₦~~15,000

**H. SAFETY EQUIPMENT****Safety Glasses/Goggles****Uses:**

Protect eyes from: ○  
Flying debris  
○ Solder splatter  
○ Chemical splashes ○  
Broken screen glass  
○ Component fragments

**Required when:**

- Soldering
- Using compressed air
- Opening screens
- Grinding/cutting

**Gloves****Types:****Nitrile Gloves:**

- Protect hands from chemicals
- Prevent oils from contaminating components
- Good grip
- Disposable

**Anti-static Gloves:**

- Prevent ESD
- Conductive fingertips
- Professional use

**Cut-resistant Gloves:**

- When handling broken screens
- Sharp metal edges

**Ventilation/Fume Extractor****Description:**

- Fan with filter
- Removes solder fumes
- Protects lungs

**Uses:**

- Soldering work area
- Chemical cleaning
- Professional workshops

**Alternative:**

Work near open window  
Fan pointing away  
Well-ventilated room

**Why Important:**

Solder fumes are toxic  
Prolonged exposure harmful  
Lead solder especially dangerous

**Fire Extinguisher**

**Type:** Class C (electrical fires)

**Why:**

Soldering irons are hot  
Batteries can catch fire  
Electrical shorts  
Safety requirement

**Location:** Easy access in workshop

**First Aid Kit**

**Should include:**

Band-aids (cuts from tools)  
Burn gel (soldering burns)  
Antiseptic  
Gauze  
Medical tape  
Emergency contact numbers

**I. DIAGNOSTIC SOFTWARE TOOLS**

**For Computers:**

**Bootable Diagnostic USB:**

Memtest86+ (RAM testing)  
HD Tune (hard drive testing)  
Prime95 (CPU stress test)  
FurMark (GPU stress test)

CrystalDiskInfo (drive health)

### **Operating System Installation Media:**

Windows 10/11 USB  
Linux Live USB (for data recovery)

### **Driver Pack Solutions:**

Offline driver collections  
For when internet unavailable

### **For Phones:**

#### **ADB (Android Debug Bridge):**

Command line tool  
Communicate with Android devices  
Free from Google

#### **Flashing Software:**

Odin (Samsung)  
SP Flash Tool (MediaTek)  
QFIL (Qualcomm)  
Mi Flash Tool (Xiaomi)  
Usually free downloads

### **3. Diagnostic Apps:**

Phone INFO (shows device info)  
AIDA64 (system information)  
Battery health checkers  
Screen test apps  
Sensor test apps

## **J. CONSUMABLES (Items that get used**

### **up) 1. Thermal Paste (covered earlier)**

#### **Thermal Pads:**

For components other than CPU  
Various thicknesses (0.5mm, 1mm, etc.)  
Pre-cut or sheet form

### **Cable Ties/Zip Ties:**

- Cable management
- Various sizes
- Reusable versions available

### **Electrical Tape:**

- Insulation
- Temporary fixes
- Wire management

### **Double-Sided Tape (3M):**

- Mounting components
- Phone screen adhesive
- Various thicknesses

### **Adhesive Strips:**

- Phone battery adhesive
- Screen adhesive
- Pre-cut for specific models

### **Replacement Screws:**

- Easy to strip or lose
- Buy assortment kits
- Phone screw kits available

### **Rubber Feet/Pads:**

- Bottom of devices
- Prevent sliding

## **NICE-TO-HAVE TOOLS (Not essential but helpful)**

### **1. Label Maker:**

- Label cables
- Organize storage
- Professional appearance

### **Digital Calipers:**

- Precise measurements

0.01mm accuracy  
Useful for custom work

### **Ultrasonic Cleaner:**

Cleans PCBs  
Removes flux residue  
Professional tool  
Uses ultrasonic vibrations in cleaning solution

### **Hot Plate/Preheater:**

Preheats phone motherboards  
Easier chip removal  
Professional rework

### **Microscope (Digital/USB):**

Extreme magnification  
See tiny solder joints  
SMD component work  
Connect to computer  
Record repairs

### **Soldering Fume Extractor:**

Better than just ventilation  
Filters solder fumes  
Protects health

## **L. TOOL MAINTENANCE**

### **Screwdrivers:**

Keep tips clean  
Check for damage  
Replace worn tips  
Magnetize if needed

### **Soldering Iron:**

Clean tip regularly while using  
Tin tip before storing  
Replace worn tips  
Check cord for damage

### **Multimeter:**

- Check calibration periodically
- Replace batteries
- Inspect test leads
- Verify continuity beep works

### **General:**

- Store tools properly
- Keep organized
- Clean after use
- Prevent rust (dry environment)
- Inspect regularly for damage

## **M. BUILDING A REPAIR KIT ON A BUDGET**

### **Starter Kit (~~₦10,000~~-~~₦15,000~~):**

- Precision screwdriver set (~~₦2,000~~)
- Plastic prying tools (~~₦500~~)
- Tweezers (~~₦500~~)
- Basic multimeter (~~₦3,000~~)
- Anti-static wrist strap (~~₦500~~)
- Isopropyl alcohol & swabs (~~₦1,000~~)
- Compressed air (~~₦1,500~~)
- Small parts organizer (~~₦1,000~~)

### **Intermediate Kit (~~₦30,000~~-~~₦50,000~~):**

- All starter items plus:
- Soldering iron (temperature controlled) (~~₦10,000~~)
- Solder and flux (~~₦2,000~~)
- Helping hands (~~₦2,000~~)
- Better multimeter (~~₦8,000~~)
- Phone opening kit (~~₦3,000~~)
- Heat-resistant mat (~~₦3,000~~)
- USB power meter (~~₦2,000~~)
- Tool bag (~~₦2,000~~)

### **Professional Kit (~~₦100,000~~+):**

- All intermediate items plus:
- Hot air rework station (~~₦35,000~~+)
- Bench power supply (~~₦20,000~~+)
- Digital microscope (~~₦15,000~~+)



Professional soldering station (₦25,000+)  
Screen separator machine (₦20,000+)  
Flashing box (₦20,000+)  
Ultrasonic cleaner (₦15,000+)  
Full tool chest (₦10,000+)

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## EVALUATION QUESTIONS

### Essay Questions:

List and explain the functions of five essential tools for computer repair.  
Describe the multimeter and explain four things it can measure.  
What is the importance of anti-static protection? How do you prevent static damage?  
Explain the soldering process and list five tools needed for soldering.  
Describe ten tools specifically used for GSM/phone repairs.

### Objective Questions:

Which screwdriver is most common in phone repairs? (a) Flathead (b) Phillips (c) Torx (d) Hex  
**Answer: B**

What does a multimeter measure? (a) Only voltage (b) Only current (c) Voltage, current, and resistance (d) Only resistance **Answer: C**

Anti-static wrist straps prevent \_\_\_\_\_ (a) Electric shock (b) ESD damage (c) Burns (d) Cuts  
**Answer: B**

Thermal paste is applied between CPU and \_\_\_\_\_ (a) Motherboard (b) RAM (c) Heat sink Case **Answer: C**

Isopropyl alcohol is used for \_\_\_\_\_ (a) Drinking (b) Cleaning electronics (c) Soldering (d) Testing **Answer: B**

A spudger is used for \_\_\_\_\_ (a) Soldering (b) Cutting (c) Prying (d) Measuring **Answer: C**

LOCA glue is cured using \_\_\_\_\_ (a) Heat (b) UV light (c) Pressure (d) Air **Answer: B**

Which tool removes solder? (a) Screwdriver (b) Solder wick (c) Pliers (d) Tweezers **Answer: B**

Compressed air is used to \_\_\_\_\_ (a) Solder (b) Cut (c) Clean dust (d) Measure voltage  
**Answer: C**

The safest tip cleaner for soldering iron is \_\_\_\_\_ (a) Water (b) Brass wool (c) Sandpaper (d) Knife **Answer: B**

Pentalobe screws are commonly found in \_\_\_\_\_ devices (a) Samsung (b) Nokia (c) Apple Tecno **Answer: C**

A POST card is used to \_\_\_\_\_ (a) Send mail (b) Diagnose boot problems (c) Clean components (d) Measure voltage **Answer: B**

Phone screen separator machines use \_\_\_\_\_ (a) Cold (b) Pressure (c) Heat (d) Magnetism  
**Answer: C**

The concentration of isopropyl alcohol for electronics should be \_\_\_\_\_ (a) 50% (b) 70% (c) 90%+ (d) 10% **Answer: C**

Which is NOT a safety equipment? (a) Safety glasses (b) Gloves (c) Hammer (d) Fire extinguisher  
**Answer: C**

**Fill in the Blanks:**

A \_\_\_\_\_ holds small screws in place magnetically. (magnetic parts tray/mat)  
\_\_\_\_\_ is used to separate screen layers in phone repair. (Screen separator machine/Heat)  
The \_\_\_\_\_ sucks up molten solder. (solder sucker/desoldering pump)  
\_\_\_\_\_ gloves protect from chemicals and contamination. (Nitrile)  
A \_\_\_\_\_ box is used for flashing phone software. (Flashing/Miracle/Z3X)

**CLASS ACTIVITIES****Practical Activity 1: Tool Identification****Setup:**

Display various repair tools on table  
Give each tool a number

**Activity:**

Students rotate in groups  
Identify each tool by name  
State one use for each tool  
Handle tools carefully  
Complete identification worksheet

**Tools to include:**

Phillips screwdriver  
Flathead screwdriver  
Needle-nose pliers  
Tweezers  
Spudger  
Multimeter  
Soldering iron (cold/unplugged)  
Solder  
Anti-static wrist strap  
Compressed air  
Thermal paste  
Opening picks

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**Practical Activity 2: Multimeter Practice****Safety First:**

Use batteries only (no mains power!)

Teacher supervision required  
Check leads before use

### **Exercises:**

#### **Measure Battery Voltage:**

- Test AA battery (should be ~1.5V)
- Test 9V battery
- Test phone battery (if available)
- Record readings

#### **Continuity Testing:**

- Test a wire (should beep)
- Test cut wire (should not beep)
- Test resistor (should not beep)
- Test switch in different positions

#### **Resistance Measurement:**

- Measure resistors
- Compare with color code values
- Test open circuit (infinite resistance)
- Test short circuit (zero resistance)

#### **Create measurement log:** ○

- Record all readings
- Note meter settings used
- Compare results with classmates

## **Practical Activity 3: Tool Safety Demonstration**

### **Teacher demonstrates:**

- Proper screwdriver use (correct size, straight insertion)
- Safe handling of soldering iron (never touch tip, use stand)
- Anti-static strap connection
- Compressed air proper technique (short bursts, hold fans)
- Multimeter probe placement
- Chemical safety (alcohol use, ventilation)

### **Students practice:**

- Each student demonstrates one safety procedure
- Class observes and provides feedback
- Create safety checklist

---

## **Group Activity: Tool Kit Planning**

**Scenario:** You're starting a small repair business with ₦20,000 budget.

**Task:**

- Form groups of 4-5
- Research tool prices (online or visit shop)
- Create shopping list staying within budget
- Prioritize essential tools
- Calculate total cost
- Justify choices

**Presentation:**

- Each group presents their tool kit
- Explain why each tool was chosen
- Class votes on best-planned kit

**ASSIGNMENT****Assignment 1: Tool Research Report**

Choose FIVE tools from the lesson and create a detailed report including:

- Tool name and picture
- Detailed description
- Main functions/uses
- Price range in Nigeria
- Safety precautions
- Maintenance requirements
- Alternative tools (if any)
- Where to buy in your area

Minimum 300 words total.

**Assignment 2: Virtual Shopping Exercise**

Visit an online store (Jumia, Konga, AliExpress) or physical store:

**Task 1: Price Survey** Record prices for:

- 3 different screwdriver sets
- 2 multimeters (basic and advanced)
- 1 soldering iron
- 1 phone opening kit
- 1 anti-static wrist strap
- Thermal paste
- Isopropyl alcohol

## **Task 2: Comparison**

Compare features vs. price  
Which offers best value?  
What would you buy with ₦10,000?

Write a report with your findings and recommendations.

## **Assignment 3: Tool Identification Quiz**

Create your own tool identification quiz:

Find or draw pictures of 10 repair tools  
Create multiple choice questions for each  
Include:

- Tool name
- Function
- When to use it
- 4. Trade quizzes with classmates
- 5. Grade each other's answers

## **Assignment 4: Safety Poster**

Create a colorful safety poster for the repair workshop including:

At least 5 safety rules  
Illustrations/pictures  
Clear, large text  
Use of safety colors (red for danger, yellow for caution)  
Emergency contact information

Topics to cover:

Soldering safety  
Anti-static precautions  
Chemical safety  
Tool handling  
Emergency procedures

Best posters will be displayed in the lab!

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## **Assignment 5: Tool Maintenance Schedule**

Create a maintenance schedule chart for a repair workshop:

**Include:**

Tool name  
Daily maintenance (if any)  
Weekly maintenance  
Monthly maintenance  
Signs of wear/damage to watch for  
When to replace

**Format:** Table or chart **Tools to include:** At least 10 different tools

**CONTINUED NEXT WEEK...****Coming up in Week 7:****Safety Precautions in Computer and GSM Repair Workshops**

Electrical safety  
Fire safety  
• Chemical safety  
Workshop organization  
Emergency procedures  
Personal protective equipment  
Hazard identification  
Safe work practices

**Prepare for next class:**

Review this week's notes on tools  
Practice tool identification  
Complete all assignments  
Bring questions about tool usage

**End of Week 6 E-Notes****Remember:**

Right tool for the right job  
Safety first, always!  
Maintain your tools properly  
Organize your workspace  
Practice makes perfect  
Ask questions if unsure

**Study Tips:**

Create flashcards for tool identification  
Practice with actual tools when possible  
Watch video tutorials online (YouTube)  
Visit repair shops to see tools in action

- Start building your own basic tool kit

## WEEK 7: Safety Precautions in Computer and GSM Repair Workshops

Safety in the repair workshop is crucial to protect the technician from injury and the electronic components from damage.

### 1. Electrostatic Discharge (ESD) Protection

**ESD** is the sudden flow of electricity between two electrically charged objects caused by contact, an electrical short, or dielectric breakdown. It is a major risk to delicate electronic components.

#### Precautions:

- Use a **grounded anti-static mat** on the workbench.
- Wear an **anti-static wrist strap** (grounding yourself) before touching any electronic device or component.
- Handle components and circuit boards by their edges to avoid touching the contacts or components.
- Transport sensitive components in an anti-static container or packaging.

### General Workshop Safety

**Workspace:** Ensure the work surface is **flat and clean**.

**Tools:** Use **professional and good quality tools** dedicated to the repair job. Handle hot tools like **soldering irons and hot air stations** with care to prevent burn risks and damage to phones.

**Power and Cables:** Disconnect equipment from the electrical outlet before cleaning or working inside. Ensure cables are not located where they can be stepped on or tripped over.

**Liquids/Heat:** Keep liquids, food, and heat sources (like radiators) away from equipment. Do not use equipment in a wet environment.

### Essential Safety Equipment

**Fire Extinguisher:** For putting out electrical fires.

**First Aid Box:** For treating minor injuries.

**Protective Gear:** Safety goggles/eyewear and gloves are recommended when disassembling/re-assembling a device.

**Respirators/Nose Guard:** To protect against fumes from soldering.

### Battery Handling Safety

**Discharge:** Always fully discharge batteries before working on them.

**Damage: DO NOT** proceed with repairs if the battery shows signs of damage (e.g., leaking, expansion, or folds).

**Abuse:** Do not heat, puncture, mutilate, or drop a lithium-ion battery.

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## WEEK 8: GSM Technology Overview

### Meaning and Definition

**GSM** stands for **Global System for Mobile Communications**.

It is a widely accepted family of standards used to describe the protocols for **Second-Generation (2G)** digital cellular networks.

It is a cellular system that uses a combination of **Time Division Multiple Access (TDMA)** and **Frequency Division Multiple Access (FDMA)** to allow multiple users to share the same frequency channel.

### 2. Evolution (Brief History)

The concept emerged in the early 1970s from Bell Laboratories.

The standardization group, **Groupe Spécial Mobile (GSM)**, was established in 1982 by CEPT to create a common Pan-European mobile telephone standard.

The responsibility was later transferred to the European Telecommunications Standards Institute (ETSI) in 1989.

The first commercial GSM services were launched in 1991.

GSM evolved to include **General Packet Radio Service (GPRS)** (packet-switched data) and **Enhanced Data Rates for GSM Evolution (EDGE)** (higher data rates).

### Importance and Advantages

Advantage	Description
<b>Global Compatibility/Roaming</b>	Allows users to use their devices in many locations worldwide, primarily through the use of <b>Subscriber Identity Module (SIM)</b> cards.
<b>Improved Voice Quality</b>	Offers clear voice communication due to advanced signal processing and digital technology.
<b>Enhanced Security</b>	Communications are protected by <b>encryption</b> techniques, ensuring the integrity and confidentiality of calls and data.
<b>Support for Data Services</b>	Supports services like <b>SMS (Short Message Service)</b> , which is essential for text communication, and other data services for internet access.
<b>Efficient Bandwidth Use</b>	Uses TDMA to divide a channel into eight time slots, enabling multiple users to share a single radio channel efficiently.

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## WEEK 9: GSM Hardware Components



Mobile phones, or GSM devices, contain several small, yet critical, components that work together to enable communication.

Component Name	Alternative Name	Function
<b>Printed Circuit Board (PCB)</b>	Motherboard, Logic Board	The most important part; all integrated circuits (ICs) and other components are fixed onto this board.
<b>Battery</b>	Power Source	Supplies the necessary <b>DC current (e.g., 3.7V or 3.8V)</b> to the entire mobile phone.
<b>Screen/Display</b>	Visual Display	The output unit that displays images, text, and videos (can be LCD or TFT). The <b>Touch</b> digitizer sits on top and allows touch input.
<b>Microphone (Mic)</b>	Mouth Piece	An <b>input device</b> that converts the user's voice/sound into electrical signals to be transmitted.
<b>Speaker</b>	Earpiece, Receiver	Converts electrical signals back into sound signals, allowing the user to hear the person on a call.
<b>Ringer</b>	Buzzer, Loud Speaker	Plays loud sound for ringtones, alarms, and music playback.
<b>Charging Port/Connector</b>	Charging Jack	The socket where an external charger is plugged in to transfer voltage and recharge the battery.
<b>SIM Card Connector</b>	SIM Socket	Connects the <b>Subscriber Identity Module (SIM)</b> card to the PCB, which is necessary for the phone to make or receive calls.

## WEEK 10: Practical: Identification and Labeling of Hardware and GSM Parts

### 1. Objective

To correctly identify and label the various components of a computer system and a GSM phone.

#### Procedure (Example: Disassembling a Mobile Phone)

**Safety First:** Wear the anti-static wrist strap and work on an anti-static mat.

**Power Down:** Switch off the mobile phone and disconnect the battery (if removable).

**Disassemble:** Use the appropriate tools (e.g., specialized screwdriver set, pry tools) to carefully open the phone casing.

**Identify Components:** Systematically identify and list the location of the components learned in Week 9, such as the PCB, Battery Connector, Screen Connector, Charging Port, Microphone, and Speaker.

**Reassemble:** Carefully reassemble the phone, ensuring all connectors and screws are secured in their correct positions.

#### Expected Outcome

Students should be able to:

Identify the **Motherboard, CPU, RAM, and Hard Drive** in a computer casing.  
Identify the **PCB, Battery, Screen, Speaker, and Microphone** in a GSM device.  
Label the location and state the function of each identified part accurately.