Practical lesson No1

Topic: Development of computer technology. Classification of electronic computers

Purpose of the lesson

To study the historical stages of the development of computer technology from mechanical devices to modern systems. To master the principles of classification of electronic computers (computers) by generations, power and purpose. Develop skills in analyzing the evolution and forecasting trends for 2025.

Objectives

- Get acquainted with the chronology of development: from the 19th century to 2025.
- To analyze computer generations and their characteristics.
- Complete practical tasks on creating timelines and comparison tables.
- Master the classification: according to the principle of operation, power and application.

Materials Needed

- A computer with a browser (for videos and online resources).
- The program Draw.io (online) for diagrams and timelines.
- Notepad for tables, calculator (optional for performance calculations).

Theoretical part

Development of computer technology

The development began in the 19th century with mechanical devices (Charles Babbage, 1822 - Difference Engine for Tables). In the 1930s and 1940s, he studied electromechanics (arithmometers on relays). 1940s — the first lamp computers (ENIAC, 1945, USA — 18 thousand tubes, weight 30 tons, for ballistics). 1950s - transistors (UNIVAC, 1951 - commercial). 1960s - Integrated circuits (IBM System/360). 1970s – Microprocessors (Intel 4004, 1971 – first chip). 1980s - PC (IBM PC, 1981). 1990s — Internet and multimedia. The 2000s are mobile and cloud-based. By 2025, AI accelerators (NVIDIA H100), quantum (IBM Quantum), and energy-efficient chips (ARM for 6G) will be available.

Example explanation: Think of development as a ladder: 1st generation – bulky "giants" on lamps (like a tube TV, energy-consuming, but revolutionary). By 2025 – "smart" chips with AI, where one processor replaces thousands of lamps, consuming less power (from 100 kW to 300 W).

Example of a table (computer generation):

Generation	Years	Element base	Examples	Features
1st	1945–1955	Vacuum tubes	ENIAC, BESM-1	Size: Rooms, Speed: 10^3 ops
2nd	1955–1965	Transistors	IBM 1401, M-20	Reliability ↑, speed: 10^5 rps
3rd	1965–1975	Integrated Circuits	IBM System/360	Miniaturization, OS (multitasking)
4th	1975–1990	Microprocessors	Intel 8080, PC	Personal, GUI, Speed: 10^9 fps
5th	1990–present	AI, concurrency	IBM Quantum	AI, Cloud, 10^18 op/s (Supercomputing)

Example diagram (evolution of computers; description for Draw.io): Horizontal timeline: X-axis - years (1822–2025). Vertical blocks: 1822 - "Babbage: Mechanics" (gears). 1945 - "ENIAC: Lamps" (columns of lamps, weight 30 tons). 1971 - "Intel 4004: Chip" (small square). 2025 - "AI chips" (neural network with cloud). Right arrows: "Miniaturization → Speed ↑ → Energy ↓".

Classification of computers

By the principle of operation: analog (AVM - continuous signals, for modeling), digital (DVM - discrete, universal), hybrid (GVM - combined). In terms of power: super (10^18 ops, Frontier 2022), large (mainframes), mini (servers), micro (PCs, smartphones). By purpose: universal (PC), specialized (medical scanners).

Example explanation: Classification as sorting: By "action" – analog as a thermometer (analog), digital as a clock (numbers). By power – supercomputers as "giants" for the climate, PCs as "workhorses".

Example of a table (classification by power):

Class	Performance	Examples	Application
Super	>10^18 ops	Frontier, Fugaku	Modeling, AI
Large	10^12–10^15 ips	IBM z16	Banks, databases
Mini	10^9–10^12 op/s	Dell Servers	Web, offices
Micro	10^6–10^9 op/s	Intel Core i9	Home PCs, Mobile

Practical part

Demo 1: Creating a timeline development

Description: In Draw.io, build a chronology from ENIAC to 2025.

Steps:

1. Open the Draw.io and create a horizontal timeline.
2. Add 5 blocks: 1945 (ENIAC: lamps, 30 t), 1971 (microprocessor), 1981 (IBM PC), 2010 (smartphones), 2025 (AI chips: energy efficiency).
3. Sign: Arrows with "Speed Increase x10^6".
4. Export to PNG.

Expected result: Timeline with 5 key points, showing miniaturization.

Analysis: Why is Gen 5 focusing on AI? (Concurrency for Big Data).

Demo 2: Comparing Computer Classes

Description: Complete the classification table for modern devices.

Steps:

1. Open Google Docs or Notepad, create a spreadsheet (like above).
2. Fill in: Super – Frontier (1.1 exaflops), Micro – iPhone 16 (2024, but for 2025 – with 6G).

3. Add the "Trends 2025" column: AI accelerators, quantum.

4. Discuss: Why are supercomputers power-intensive?

Expected result: Table with 4 rows, analysis: Micro – 90% of the market.

Analysis: Hybrid is the future of simulation (analog + digital).

Independent Assignments for Students

1. **Task 1:** Create a generation table (5 rows, as an example), add 2025 as the 6th (quantum + AI). Calculate the increase in velocity (from 10^3 to 10^18 – x10^15).

Example table (expand):

Generation	Years	Increase in speed
1st	1945	x10^3 op/s
6th	2025	x10^20 op/s

2. **Task 2:** In the Draw.io, draw a classification scheme: Circle "Computer" → branches "By action" (AVM/DVM/GVM), "By power" (super/micro). Add examples (ENIAC - 1st, digital).

3. **Task 3:** Analyze the trend 2025: Write a paragraph about quantum computers (advantages over classical ones: factorization of ciphers).

Control: The teacher checks the tables and diagrams on the screen.

Final questions and assignments for students

Questions for self-examination (10 questions, answer in writing)

1. When was the first mechanical machine for calculations invented?

2. What characterizes the 1st generation of computers?

3. Name an example of the 2nd generation.

4. What is the essence of the 4th generation?

5. What are supercomputers in power classification?

6. The difference between analog and digital computers?

7. Give an example of a hybrid computer.

8. How has energy efficiency changed by 2025?
9. What is 6G in the context of development?
10. Why is classification important for design?

Homework (5 tasks)

1. Report (1 page) on the role of ENIAC in history (size, application).
2. Create a 2020–2025 timeline (AI, quantum) in Draw.io, PNG export.
3. Comparison Table Between PC 1981 and 2025 (Speed, Size).
4. Analyze the impact of microprocessors on society (1 page).
5. The "Evolution: From Lamps to AI" scheme with 3 key stages.