1:

Motherboard : The main board in a computer that connects parts (CPU. Memory. Storage) and let them work together.

CPU : The brain of a computer. It thinks and decides how to run programs.

RAM : The computer's memory but the data on it gets removed when we turn off the computer. The data gets stored on it temporarily.

Storage Drives : Unlike RAM, they store information permanently.

RAID Controller : Helps storage drives work together and improve their performance and protects data. Lets you use multiple drives as one unit which improves performance.

Power Supply Unit: Provides servers with electricity and power so it can work.

Network Interface Card : Connects the server to the networks and internet.

Cooling System : Keeps the server cool.

Expansion Slots : We can add extra parts like graphic cards.

Chassis : The case where all server parts are in.

BIOS/UEFI Firmware : Starts server and connects software and hardware.

Backplane: Connects storage drives to the motherboard.

2: We can control and monitor servers remotely with IPMI and iLO. They operate independently and can function even when the system is powered off or the OS is unavailable.

3: They run on dedicated service processors while BIOS/UEFI runs on the main CPU.
They can monitor, configure, and interact with BIOS/UEFI remotely.
They initialize before BIOS/UEFI during power-on.
They provide remote access to BIOS/UEFI settings and consoles.

4: They are the slots on the motherboard where CPUs can be installed.

5: To provide a simple interface between the kernel and user space. The use of pseudo file systems in Linux is a smart way of following the Unix/Linux idea that "everything is a file."

6: **Pseudo file system**: Shows information from the system (like memory, CPU), not real files.
Normal file system: Stores real files on disk.

7: Details about hardware, devices, drivers, kernel settings, and power management.

8: DMA lets hardware move data to memory without using the CPU and makes things faster.
It reduces CPU overhead during data transfers, enables parallel processing , improves throughput for high-bandwidth devices like network cards, storage controllers, and GPUs and reduces latency in time-sensitive applications.

9: It shows all block devices .
No. `lsusb:` Lists USB devices connected to your system. It shows information about USB ports and any devices connected to them.
`lspci`: Lists PCI devices, which are components connected to your motherboard's PCI/PCIe buses. This includes graphics cards, network adapters, storage controllers, and other internal hardware components.
`lshw`: Lists hardware in a more comprehensive manner. It provides detailed information about the entire hardware configuration of your system, including CPU, memory, storage, network interfaces, and other components. It's more thorough than both lsusb and lspci and covers a wider range of hardware.

10: echo poweroff > /sys/power/state
echo 1 > /proc/sys/kernel/sysrq
echo o > /proc/sysrq-trigger

11: **Monolithic**: The entire operating system works in kernel space. All core functions operate in privileged mode. Linux is a monolithic kernel, though it can dynamically load/unload modules. Benefits include better performance due to direct hardware access and function calls, while drawbacks include larger size and potential instability.
Microkernel: Only essential functions run in kernel space, while device drivers, file systems, and other services run in user space. Benefits include improved stability and security, but they often have lower performance due to increased context switching and message passing.
Hybrid: Combines elements of both designs.

12: The first sector is the very first data the BIOS can read when starting the computer. Having the MBR at a fixed, known location means the BIOS always knows where to look for boot information.

13: The MBR contains a small amount of executable code that serves as the first stage of the bootloader. This code is extremely basic due to size constraints. When GRUB is installed, it places its first stage in the MBR, and this code contains hardcoded information about where to find the next stage . The MBR code knows specifically where to look for the next bootloader stage.

14: .efi files are bootable programs used by UEFI to start the OS. GRUB also loads from a .efi file in UEFI mode.

15: It's a special partition that stores .efi boot files. UEFI firmware reads from this partition to start the OS. When the system boots, the UEFI firmware reads the ESP, finds the appropriate bootloader (according to boot order settings), and executes it. The bootloader then finds and loads the operating system kernel.

16: This creates a menu item called Ubuntu in the boot menu. Keeps track if the system failed to boot last time. Sets up graphics mode. Supports compressed files . Loads support for GPT partitioning and ext2 filesystem. Sets the root partition to the second GPT partition on the first hard drive. Tells GRUB to find the right disk using UUID (a unique ID) and set it as the root. Loads the Linux kernel and tells it where the root filesystem is. Loads the initial RAM disk, which contains drivers and tools needed during early boot.