EXAM✓CRAM

The CompTIA A+ Cram Sheet

This cram sheet contains the distilled, key facts about the CompTIA A+ 220-901 and 220-902 exams. Review this information as the last step before you enter the testing center, paying special attention to those areas in which you think you need the most review.

220-901

1. Motherboards connect everything. Typical form factors include ATX (most common), microATX, and ITX. Types of expansion buses include PCI Express (PCIe) and PCI. Intel chipsets connect to the CPU via DMI or QPI. AMD CPU-to-chipset connection is HyperTransport.

   BIOS/UEFI identifies, tests, and initializes components and boots to hard drive, optical disc, USB flash drive, or network via PXE. CMOS stores time/date and passwords. CR2032 lithium battery provides power to CMOS.

   BIOS/UEFI configurations: time/date, boot device priority (boot order), passwords, power management, WOL, monitoring, clock and bus speeds, virtualization support (Intel VT or AMD-V), enable/disable devices, diagnostics, security, and intrusion detection. For BIOS/UEFI update, flash it with new firmware.

2. The central processing unit (CPU) or processor takes care of most calculations. Intel CPUs use LGA775, 1150, 1155, 1156, 1366, and 2011 sockets. AMD CPUs use AM3, AM3+, FM1, FM2, and FM2+ sockets. L1/L2 cache in each core. L3 cache is shared among entire CPU.

   Thermal compound (paste) is required whenever heat sink is installed. Heat sinks are either active (with powered fan) or passive (without). Liquid-based cooling systems can dissipate heat very efficiently.

3. Random Access Memory (RAM) DIMMs include DDR (184 pins), DDR2 (240 pins), DDR3 (240 pins), and DDR4 (288 pins). RAM SODIMMs include DDR (200 pin), DDR2 (200 pin), DDR3 (204 pin), and DDR4 (260 pin). Example of DDR3-1600 data transfer calculation: 1600 MT/s × 8 = 12,800 MB/s. Dual-channel is double width, 128-bit bus. Triple-channel is 3x the width, 192-bit bus. Quad-channel is 4x the width, 256-bit bus. Latency measured as CL or CAS.

4. ATX 12V 2.x power supplies connect to the motherboard by way of 24-pin cable + 4-pin/8-pin for CPU and 6- or 8-pin for PCIe video.

   The purpose of a "dual-rail" PSU is to separate and limit the current through each wire to avoid overheating.

5. Hard drives are nonvolatile devices that store data. Types of hard drives include
   - **HDD:** Hard disk drive (magnetic-based)
   - **SSD:** Solid-state drive (flash-based)
   - **SATA:** Serial ATA uses a 15-pin power connector and 7-pin data connector. Rev 1 (1.5 Gb/s), Rev 2 (3 Gb/s), Rev 3 (6 Gb/s), Rev 3.2 (SATA Express) (16 Gb/s).

6. RAID stands for Redundant Array of Independent (or Inexpensive) Disks. RAID 0 is striping, RAID 1 is mirroring, and RAID 5 is striping with parity. RAID 10 is mirrored sets in a striped set. RAID 0 is not fault-tolerant. If RAID 1 uses two disk controllers, it is disk duplexing.

7. Optical disc drives use removable media to store and retrieve data, typically 5.25". Types of optical discs include
   - **CD-ROM:** Data CDs can typically hold 700 MB, can read and write at up to 52x (7.8 MB/s), and can rewrite at up to 32x (4.8 MB/s).
   - **DVD-ROM:** DVDs have a capacity ranging from 4.7 GB (DVD-5) to 17 GB (DVD-18 dual-sided and dual-layered). Recording technologies include DVD+R, DVD-R, DVD+RW, and DVD-RW.
   - **Blu-ray:** Blu-ray discs (BDs) are used for HD and games and have a capacity of 25 to 128 GB (mini-discs 7.8 or 15.6 GB) and a write speed of 1x to 16x (36 Mb/s to 576 Mb/s).

8. Solid-state media includes solid-state hard drives (SSDs), USB flash drives, CompactFlash, and Secure Digital (SD) cards.

9. Laptops are smaller versions of desktop PCs. They have replaceable items such as keyboards, touchpads, SODIMM RAM, displays, inverters, batteries, optical disc drives, smart card readers, and 2.5" or 1.8" hard drives (SSD, HDD, or hybrid). Laptops use M.2, Mini PCIe, and Mini PCI (internal) and ExpressCard /34 and /54 (external) technologies. They have a Fn key for implementing secondary key functions.

10. Video cards connect to motherboards by way of x16 PCIe or PCI (uncommon) expansion slots. Video connector types and cables include DVI, VGA, HDMI, Mini-HDMI, DisplayPort, Mini DisplayPort, S-Video, Component Video/RGB, and Composite. Common color depths include 16-bit, 24-bit, and 32-bit. Common resolutions include 1280×720 (720p 16:9, aspect ratio), 1920×1080 (HD 1080p, 16:9 aspect ratio), 1366×786 (16:9), 1680×1050 (WSXGA+, 8:5 aspect ratio), 1920×1200 (WUXGA, 8:5), and 640×480 (VGA, 4:3). TN is twisted nematic; IPS is in-plane switching; IPS has wider viewing angle.

11. Sound cards connect as x1 PCIe or PCI cards and normally have PC 99 color-coded 1/8" mini-jacks for I/O and speakers and optical I/Os known as S/PDIF (example: TOSLINK).

12. USB (Universal Serial Bus) can have up to 127 devices. USB 1.1 (full speed) runs at 12 Mb/s with a max cable length of 3 meters; USB 2.0 (high-speed) runs at 480 Mb/s with a max cable length of 5 meters. USB 3.0 (SuperSpeed) runs at 5 Gb/s. USB 3.1 (SuperSpeed+) runs at 10 Gb/s. Version 3.x ports are blue. Type A/Type B connectors are used by desktops/laptops, mini- and micro-connectors are used by tablets/smartphones, etc. Type C: one-third the size of a Type A plug; pairs well with USB 3.1 standard.

13. IEEE 1394a (aka FireWire) runs at 400 Mb/s. IEEE 1394b runs at 800 Mb/s. IEEE 1394 chains can have up to 63 devices.

14. Thunderbolt: Ver 1 = 10 Gb/s and uses DisplayPort; Ver 2 = 20 Gb/s (also DisplayPort); Ver 3 = 40 Gb/s and uses USB Type C.

15. The laser-printing imaging process is Processing, Charging, Exposing, Developing, Transferring, Fusing, and Cleaning.

16. Printer configuration settings: duplexing = printing on both sides; collating = printing multiple jobs in sequence; orientation = portrait or landscape; quality = DPI (600 or 1200).

17. Custom PCs include audio/video workstations (need special A/V cards, fast hard drives, multiple monitors); CAD/CAM workstations (need powerful multicore CPUs, high-end video cards, maximized RAM); home server PCs (gigabit NIC, RAID arrays, print sharing, file sharing, media streaming); HTPCs (compact form factor, surround sound, HDMI output, TV tuner); gaming PCs (multicore CPU, high-end video, high-def sound, high-end cooling); thin clients (low resources, meets minimum requirements for OS, relies on server, diskless, embedded OS, network connectivity); virtualization workstations (powerful CPU and lots of RAM). Type 1 hypervisor is native or bare metal. Type 2 is hosted; runs on top of OS.

18. LAN = local area network. WAN = wide area network. MAN = metropolitan (municipal) area network. PAN = personal area network.

19. Switches connect computers in a LAN. Routers connect two or more LANs and connect LANs to the Internet. Firewalls protect individual computers and networks from unwanted intrusion. IDS = intrusion detection system. IPS = intrusion prevention system. UTM = unified threat management.

20. Networking connectors: twisted pair (RJ45, RJ11); fiber optic (SC, ST, and LC); coaxial (F-connector, BNC).

21. 568B standard: 1. White/orange, 2. Orange, 3. White/green, 4. Blue, 5. White/blue, 6. Green, 7. White/brown, 8. Brown.

22. IPv4 addresses are 32-bit dotted-decimal numbers (example: 192.168.1.1) and can be statically (manually) inputted or dynamically assigned (DHCP). IP classes include
    - Class A range: 1–126, subnet mask: 255.0.0.0. Private: 10.x.x.x
    - Class B range: 128–191, subnet mask: 255.255.0.0. Private: 172.16.0.0–172.31.255.255
    - Class C range: 192–223, subnet mask: 255.255.255.0. Private: 192.168.x.x

    Loopback is 127.0.0.1

    APIPA is 169.254.x.x (also known as link-local)

    CIDR: Classless Inter-Domain Routing addresses use a prefix (example: 10.150.23.58/24). The /24 indicates a subnet mask of 255.255.255.0

23. IPv6 addresses are 128-bit hexadecimal numbers (example: 2001:7120:0000:8001:0000:0000:0000:1F10).

    ::1 is the loopback address. Unicast IPv6 addresses are assigned to a single interface and are the most common type.

24. Common network speeds are 1000 Mb/s (gigabit Ethernet) and 10 Gb/s (10 Gb Ethernet).

25. Networking protocols include
    - FTP (File Transfer Protocol). Port 21
    - SSH (Secure Shell). Port 22
    - Telnet. Port 23
    - SMTP (Simple Mail Transfer Protocol). Port 25 (can use port 587)
    - DNS (Domain Naming System). Port 53
    - HTTP (Hypertext Transfer Protocol). Port 80
    - POP3 (Post Office Protocol). Port 110
    - IMAP (Internet Message Access Protocol). Port 143
    - HTTPS (HTTP Secure). Port 443
    - SMB (Server Message Block). Port 445, 137–139
    - AFP (Apple Filing Protocol). Port 548 (or 427)
    - RDP (Remote Desktop Protocol). Port 3389

26. Cabling standards include
    - **Category 3:** Rated for 10 Mb/s
    - **Category 5:** Rated for 100 Mb/s
    - **Category 5e:** Rated for 100 Mb/s and gigabit networks
    - **Category 6/6a:** Rated for gigabit and 10 Gb/s networks
    - **Category 7:** Rated for gigabit and 10 Gb/s networks
    - **Plenum-rated cable:** Fire-resistant cable designed for airways, conduits, and areas sprinklers cannot reach

27. Wireless Ethernet versions, including their name, data transfer rate, frequency, and modulation used:
    - 802.11a, 54 Mb/s, 5 GHz
    - 802.11b, 11 Mb/s, 2.4 GHz
    - 802.11g, 54 Mb/s, 2.4 GHz
    - 802.11n, 300/600 Mb/s, 5 and 2.4 GHz
    - 802.11ac, 1.7 Gb/s and beyond, 5 GHz

28. Bluetooth is a short-range technology aimed at simplifying communications and synchronization among network devices.

    Bluetooth is divided into three classes: Class I has a maximum transmission range of 100 meters; Class II (the most common) has a range of 10 meters; Class III is short range and hardly used at 1 meter. Bluetooth Version 1 has a maximum data transfer rate of 721 Kb/s; Version 2 is 2.1 Mb/s, version 3 is 24 Mb/s.

29. NAT (Network Address Translation): process of modifying an IP address as it crosses a router. Translates from one network to another.

30. Port forwarding forwards an external network port to an internal IP address and port.

31. Port triggering enables you to specify outgoing ports that your computer uses for special applications; their corresponding inbound ports open automatically when the sessions are established.

32. DMZ (demilitarized zone): Area of network for servers, not within LAN but between it and the Internet. Connects by third leg of firewall.

33. QoS (Quality of Service): Attempts to prioritize streaming media (VoIP, video playback, etc.)

34. UPnP (Universal Plug and Play): Enables network-ready devices to discover each other automatically.

35. PoE (Power over Ethernet): 802.3af devices that send Ethernet data *and* power over twisted-pair cable to compliant devices (for example, a PoE injector).

36. Power is good but no display? Check the big four: video, CPU, RAM, and motherboard.

37. Time/date resets to January 1, 2000? Check lithium battery.

38. Trouble with CPU? Check CPU fan, heat sink and thermal compound, overclocking setting in BIOS, and whether CPU is secure.

39. Noisy computer? Check CPU fan, case fan, power supply fan, and use compressed air and vacuum.

40. RAM issue? Reseat modules; clean with compressed air. Overheating? Try RAM heat sinks. BIOS beep codes or displayed errors? Consult motherboard docs and use POST card tester.

41. Power issues? Test AC outlet with receptacle tester or multimeter. Test power supply with PSU tester or multimeter: A power supply tester tests 3.3 V, 5 V, -5 V, 12 V, and -12 V. Do not open power supply; it is a FRU (field replaceable unit).

42. Slow hard drive? Defrag it, use disk cleanup, and scan drive with AV software. Drive isn't recognized? Check connections, check in BIOS/UEFI, initialize, partition, and format in Disk Management.

43. No second screen on laptop? Check Fn key. Laptop display blank? Check resolution settings, inverter, backlight, or damage to LCD.

44. Printer paper jam? Power cycle, check paper tray, rollers, paper type, fuser, and entire paper path. Blank paper? Check toner cartridge and transfer corona wire. Lines or smearing? Check drum, primary corona wire, and replace toner cartridge. Toner not staying on paper? Check fusing assembly. Garbage printout? Check driver. Ghosted image? Check drum and toner cartridge. No connectivity? Check power, network connection, whether printer is shared, proper IP address, and whether printer is set up as default in Windows.

45. Test network connections with patch tester, LAN cable tester, tone, and probe. Test NIC or RJ45 jack/switch port with loopback plug.

46. Common Windows networking command-line tools include
- **Ipconfig**: Displays current TCP/IP network configuration values; **Ipconfig/all** shows additional Information such as MAC address.
- **Ping**: Tests whether another host is available over the network (example: ping 192.168.1.1). Ping 127.0.0.1 or ping ::1 to test the local computer. Ping -t is continuous, ping -n is a set of pings. ping -l changes the size of each ping, ping -a resolves IP address to hostname.
- **Tracert**: Sends packets to test destinations beyond the local computer's network.
- **Netstat**: Shows the network statistics for the local computer. Displays TCP and UDP sessions by computer name (or IP) and port.
- **Nbtstat**: Shows network protocol statistics that use NetBIOS over TCP/IP connections. Shows core services running on local or remote machines.
- **Nslookup**: Used to query DNS servers to find out DNS details, including the IP address of hosts.
- **Net**: Used to map network drives (net use), view computers (net view), start/stop services (net start and net stop), and synchronize time (net time).
- **Netdom**: Used to control active directory, add hosts to domain, etc.
- Linux/OS X tools:
  Ifconfig: Linux and OS X wired equivalent of ipconfig.
  Iwconfig: Linux wireless equivalent of ifconfig.
  ls: Lists directory contents; **chmod** modifies permissions; **ps** displays process information; **apt-get** installs packages; **sudo** executes commands as admin; **vi** opens text editor; **passwd** changes password; **shutdown** brings system down, highly configurable.

47. No network connectivity? Check link light, patch cable, disabled NIC, wireless switch is off, IP configuration, and Windows Network Diagnostics. Limited connectivity? Ping localhost, then move outward and use ipconfig/all. Poor wireless signal? Check distance, placement, antennas, and update hardware and software. APIPA? Ipconfig/release and /renew; check DHCP server.

1. CompTIA 6-step Troubleshooting Theory
   1. Identify the problem.
   2. Establish a theory of probable cause. (Question the obvious.)
   3. Test the theory to determine cause.
   4. Establish a plan of action to resolve the problem and implement the solution.
   5. Verify full system functionality and, if applicable, implement preventative measures.
   6. Document findings, actions, and outcomes.

2. Windows 8.1 min. requirements: CPU = 1 GHz; RAM = 1 GB for 32-bit, 2 GB for 64-bit; free disk space = 16 GB for 32-bit, 20 GB for 64-bit.

3. Windows 7 min. requirements: CPU = 1 GHz; RAM = 1 GB for 32-bit, 2 GB for 64-bit; free disk space = 16 GB for 32-bit, 20 GB for 64-bit.

4. Windows Vista min. requirements: CPU = 800 MHz; RAM = 512 MB; free disk space =15 GB.

5. Setuperr.log contains setup errors during an installation of Windows.

6. Command Prompt is the command-line utility in Windows. To run in elevated mode: (Windows 8) Right-click start button and select Command Prompt (Admin); (Windows 7/Vista) Click Start > All Programs > Accessories, right-click Command Prompt, then select Run as administrator. All versions: Type **CMD** in search field, then select by pressing Ctrl+Shift+Enter.

7. Snap-ins are console windows that can be added to a Microsoft Management Console (MMC). Example: Computer Management and Performance Monitor.

8. Libraries in Windows 8 and 7 logically represent user-defined collections of folders (Documents, Music, Pictures, Videos).

9. Common system tools include Device Manager, System Information tool, Task Manager, and **Msconfig**.

10. User data can be migrated using Windows Easy Transfer and the User State Migration Tool (USMT).

11. The Registry is a database that stores the settings for Windows. It can be accessed by opening the Run prompt and typing **regedit.exe**. Hives store settings; a commonly modified hive is HKEY_LOCAL_MACHINE.

12. Remote Desktop software enables a user to see and control the GUI of a remote computer.

13. The %windir% (or %systemroot%) in Windows 8/7/Vista is C:\Windows by default.

14. Windows 8/7/Vista boot files include Bootmgr, Winload.exe, BCD.
    Bootrec /fixboot repairs Bootmgr, **Bootrec /fixmbr** rewrites the master boot record, and **Bootrec /rebuildbcd** rebuilds the boot configuration data store.

15. In Windows, **DIR** is the directory command. Directories can be added with the **MD** command, removed with the **RD** command, and navigated to with the **CD** command.

16. Files can be manipulated with **del** (deletes), **copy** (copies files), **xcopy** (copies multiple files and directory trees), **robocopy** (robust file copy, replaces **xcopy**).

17. Drives can be manipulated with **format** (writes new file system) or **diskpart** (does everything Disk Management does but in the Command Prompt).

18. File checking command-line tools that can be used in Windows include Chkdsk (/F fixes errors; /R locates bad sectors and recovers info) and SFC (System File Checker). SFC /scannow is common.

19. A hard drive using MBR (master boot record) can have four partitions: up to four primary partitions but only one extended partition. Logical drives are sections of an extended partition. The Active partition is the one that is booted from; it usually contains the OS. Any section of a drive with a letter is called a volume.
    A hard drive using GPT (GUID Partition Table) can have 128 partitions and go beyond MBR's 2 TB limit. GPT is stored in multiple locations. Requires UEFI-compliant motherboard.

20. File systems include NTFS (main FS in Windows), FAT32 (older Windows FS), CDFS (Compact Disc File System), exFAT (Extended FAT, optimized for flash drives), NFS (Network File System, Unix/Linux systems), ext3 and ext4 (extended file systems, common in Linux).

21. A service pack (SP) is a group of updates, bug fixes, updated drivers, and security fixes installed from one downloadable package or from one disc. Windows 8 and 8.1 do not use service packs.

22. Windows Update can be accessed from the Control Panel and Start > All Programs > Windows Update (Windows 7/Vista).

23. Backups can be accomplished in Windows 8 with File History, in Windows 7 with Backup and Restore, and in Vista with Backup Status and Configuration.

24. System Restore can fix issues caused by defective hardware or software by reverting back to an earlier time.

25. F8 brings up the Advanced Boot Options Menu (ABOM) that includes options such as Safe Mode, Enable low-resolution video, and Last Known Good Configuration. Safe Mode boots the system with minimal drivers. (Must be enabled in Windows 8 if possible.)

26. The Windows Recovery Environment (Windows RE) includes system recovery options such as Startup Repair, System Restore, and Command Prompt.

27. The Event Viewer warns about possible issues and displays errors as they occur within three main log files: System, Application, and Security. Security displays auditing information.

28. A stop error (also known as a Blue Screen of Death or BSOD) completely halts the operating system and displays a blue screen with various text and code. Can be caused by faulty hardware or bad drivers.

29. Processes can be stopped in Task Manager or with the **taskkill** command in the Command Prompt. **Tasklist** displays a list of currently running processes.

30. Wireless encryption protocols include
- WEP (Wired Equivalent Privacy), 64-bit key size, deprecated
- WPA (Wi-Fi Protected Access), version 2 is 256-bit
- TKIP (Temporal Key Integrity Protocol), 128-bit, deprecated
- AES (Advanced Encryption Standard), 128-bit, 192-bit, and 256-bit
- Best combination is WPA2 with AES (as of writing of this book).

31. **Cloud types:** SaaS (software as a service), IaaS (infrastructure as a service), PaaS (platform as a service).

32. **Malicious software:** Known as malware, this includes
- **Virus:** Code that runs on a computer without the user's knowledge; it infects the computer when the code is accessed and executed. Types include Boot Sector, Macro, Program, Polymorphic, Stealth, and Multipartite.
- **Worms:** Much like viruses except they self-replicate whereas a virus does not.
- **Trojan Horses:** Appear to perform desired functions but are actually performing malicious functions behind the scenes.
- **Spyware:** Type of malicious software that is either downloaded unwittingly from a website or installed along with some other third-party software.
- **Rootkit:** Software designed to gain administrator-level access to the core of a system without being detected.
- **Ransomware:** Software designed to hold the computer hostage, encrypting files or locking the computer until the user pays the attacker. Often propagated by a Trojan.

33. Best practice for malware removal:
   1. Identify malware symptoms
   2. Quarantine infected system
   3. Disable System Restore (in Windows)
   4. Remediate infected system (update antimalware, use Safe Mode or pre-installation environment, or Windows RE)
   5. Schedule scans and run updates
   6. Enable System Restore and create restore point (in Windows)
   7. Educate end user

34. **Social engineering:** The act of manipulating users into revealing confidential information or performing other actions detrimental to the user. Know phishing, shoulder surfing, and tailgating.

35. **Network attacks:** Know MITM, spoofing, zero-day, dictionary, and brute force.

36. **Authentication:** The verification of a person's identity; helps protect against unauthorized access.
    Broken down into: 1. Something the user knows (password or PIN); 2. Something the user has (a smart card or other security token); 3. Something the user is (biometric reading: fingerprint or retina scan); or 4. Something a user does (signature or voice print).
    UAC (User Account Control) in Windows requires administrative login to perform higher tasks.

37. **Encryption:** The act of changing information using an algorithm known as a cipher to make it unreadable to anyone except users who possess the proper "key" to the data.
    - **Encrypting File System (EFS):** Encrypts one or more files or folders directly within the Properties page. Makes files appear green.
    - **BitLocker:** Encrypts an entire drive, available only on Windows 8 Pro and Enterprise, Windows 7 Ultimate/Enterprise, and Vista Ultimate/Enterprise. Requires TPM (Trusted Platform Module). BitLocker To Go encrypts USB drives and other removable devices.

38. **Hard drive disposal:** Clearing (drive to be reused in-house), purging (sanitizing, DoD 5220.22-M seven pass standard, degaussing), and destruction (pulverizing, drilling holes in platters, incineration).

39. BIOS security includes supervisor (administrator) and user (power-on) passwords, drivelock passwords, disabling removable media, and LoJack. UEFI Secure Boot (helps prevent rootkit access) and setting the boot device priority to hard drive first.

40. **Permission Inheritance:** If you create a folder, the default action it takes is to inherit permissions from the parent folder. If you move a folder within the same partition, it retains the permissions. If you move or copy a folder to another partition, the (new) folder inherits from the new parent.

41. **Mobile devices use ARM CPUs, flash memory, common OSes:** Android (open-source) and iOS (closed-source), multitouch displays. Applications downloaded from Google Play and App Store.

42. GPS and Geotracking provide location information about mobile devices.

43. Mobile devices connect to Internet via cellular WWAN (example: GPRS, EDGE, 4G, LTE) and Wi-Fi (WLAN).

44. **Mobile device security:** Screenlocks (pattern, PIN, password), invalid attempts lockout, remote wipe, remote backup, and antivirus. Rooting and jailbreaking: removing limitations to Android and iOS to gain super-user capabilities.

45. **Safety:** Do not open power supplies, test AC outlets before use, use Class C CO_2-based BC fire extinguisher on electrical fires, and call 911. Employ cable management, MSDS = material safety datasheets, and consult when encountering a product with chemicals (toner cartridges, cleaners).

46. ESD = electro-static discharge. Prevent with antistatic strap, mat, touch chassis, antistatic bags, unplug computer, and increase humidity.

47. **Incident response:** First response, identify what happened, report through proper channels, preserve data and devices, document, and set up chain of custody (chronological paper trail).

48. **Professionalism:** Punctuality, listen to customer, take notes, clarify problems, positive attitude, speak clearly, project confidence, set and meet expectations, avoid distractions (phone calls, texting, social media), and avoid confidential data.