

PREPARING FOR A+

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If you're planning to enter the field of PC troubleshooting and repair, you're going to want some industry-recognized certification behind you—this means you're going to want A+ certification before you sit down for that important interview. This appendix outlines the essential elements of the A+ certification and illustrates the major areas of knowledge that you'll need to master.

About A+ Certification

A+ is a testing program sponsored by the Computer Industry Technology Association (or CompTIA at www.comptia.com) that certifies the basic competency of “entry-level” service technicians (those with about six months experience) in the computer industry. There are no prerequisites for A+ certification, so the exam is open to anyone. Earning A+ certification tells prospective employers that you possess the knowledge and skills in technology and customer relations essential to start a career in computer service. These competencies have been defined by experts from companies across the industry. The computer industry has widely accepted the A+ exam as a fundamental measure of knowledge and, as of early 2001, there were over 350,000 A+ certified technicians. This number is growing daily.

The test itself (which is actually administered by Sylvan Prometric) was first available in July 1993, but the exam was completely reworked in July 1998, and subsequently upgraded in March of 2001. The

exam questions cover a broad range of hardware and software technologies—most of which are covered in this book—but the questions are not related to any vendor-specific products. To become certified, you must pass *two* parts: the A+ Core Hardware module, and the A+ OS Technologies (formerly DOS/Windows) module. When both the Core and the OS portions are passed within 90 calendar days, you will receive the A+ designation. Once you're A+ certified you do not need to retake the exam as it's updated.

Scheduling the Exam

Registering for the A+ exam is a relatively simple matter. You'll need to contact your local Sylvan Prometric (www.2test.com/index.jsp) location at 800-776-4276 and register. The exam code for the A+ Core Hardware exam is **220-201**, and the code for the A+ OS Technologies exam (formerly the DOS/Windows module) is **220-202**. The cost is \$82 (US) if you (or your employer) are a CompTIA member, or \$132 (US) if you're not. (Note that these prices have declined since the last edition of this book.) Have your credit card handy and plan on some lengthy hold times, but once you're registered, it's just a matter of studying until the exam day.

The Core Exam (Circa 2001)

The A+ Hardware Core examination tests the essential competencies for a break/fix computer hardware service technician with roughly six months of on-the-job experience. You must demonstrate the knowledge needed to properly install, configure, upgrade, troubleshoot, and repair microcomputer hardware. This includes basic knowledge of desktop and portable systems, basic networking concepts, and printers. You must also demonstrate a knowledge of safety and common preventive maintenance procedures.

INSTALLATION, CONFIGURATION, AND UPGRADING

You require the knowledge and skills to identify, install, configure, and upgrade microcomputer modules and peripherals while following established procedures for system assembly and disassembly of field-replaceable modules. This includes the ability to identify and configure IRQs, DMAs, and I/O addresses, and set switches and jumpers. The areas covered are outlined here:

- Identify basic terms, concepts, and functions of system modules, including how each module should work during normal operation and during the boot process including:
 - System board
 - Power supply
 - Processor /CPU
 - Memory
 - Storage devices
 - Monitor
 - Modem
 - Firmware
 - BIOS
 - CMOS
 - LCD (portable systems)
 - Ports
 - PDA (Personal Digital Assistant)

- Identify basic procedures for adding and removing field replaceable modules for desktop systems including:
 - System board
 - Storage device
 - Power supply
 - Processor /CPU
 - Memory
 - Input devices
 - Hard drive
 - Keyboard
 - Video board
 - Mouse
 - Network Interface Card (NIC)
- Identify basic procedures for adding and removing field replaceable modules for portable systems including:
 - AC adapter
 - Digital camera
 - DC controller
 - LCD panel
 - PC card
 - Pointing devices
- Identify available IRQs, DMAs, and I/O addresses and procedures for device installation and configuration including:
 - Standard IRQ settings
 - Modems
 - Floppy drive controllers
 - Hard drive controllers
 - USB ports
 - Infrared ports
 - Hexidecimal/addresses
- Identify common peripheral ports, associated cabling, and their connectors, such as:
 - Cable types
 - Cable orientation
 - Serial versus parallel
 - Pin connections
 - DB-9
 - DB-25
 - RJ-11
 - RJ-45
 - BNC
 - PS2/MINI-DIN
 - USB
 - IEEE 1394

- Identify proper procedures for installing and configuring IDE/EIDE devices including:
 - Master/slave
 - Devices per channel
 - Primary/secondary
- Identify proper procedures for installing and configuring SCSI devices such as:
 - Address/Termination conflicts
 - Cabling
 - Types (example: regular, wide, ultra-wide)
 - Internal versus external
 - Expansion slots, EISA, ISA, PCI
 - Jumper block settings (binary equivalents)
- Identify proper procedures for installing and configuring peripheral devices including:
 - Monitor/video card
 - Modem
 - USB peripherals and hubs
 - IEEE 1284
 - IEEE 1394
 - External storage
 - Docking stations
 - PC cards
 - Port replicators
 - Infrared devices
- Identify hardware methods of upgrading system performance, procedures for replacing basic subsystem components, unique components and when to use them. These include:
 - Memory
 - Hard drives
 - CPU
 - Upgrading BIOS
 - When to upgrade BIOS
 - Battery
 - Types I, II, III cards

DIAGNOSING AND TROUBLESHOOTING

You must apply your knowledge relating to the diagnosis and troubleshooting of common module problems and system malfunctions. This includes a knowledge of the symptoms relating to common problems. The principal problem areas are covered below.

- Identify common symptoms and problems associated with each module and how to troubleshoot and isolate the problems including:
 - Processor/memory symptoms
 - Mouse
 - Floppy drive
 - Parallel ports
 - Hard drives
 - CD-ROM

- DVD
- Sound card/audio
- Monitor/video
- Motherboards
- Modems
- BIOS
- USB
- NIC
- CMOS
- Power supply
- Slot covers
- POST audible/visual error codes
- Troubleshooting tools, e.g., multimeter
- Large LBA, LBA
- Cables
- Keyboard
- Peripherals

- Identify basic troubleshooting procedures and how to elicit problem symptoms from customers such as:
 - Troubleshooting/isolation/problem determination procedures
 - Determine whether hardware or software problem
 - Gather information from user regarding customer environment, symptoms/error codes, and the situation when the problem occurred

SAFETY AND PREVENTIVE MAINTENANCE

You'll require a working knowledge of safety and preventive maintenance. Safety includes recognizing the potential hazards to personnel and equipment when working with lasers, high-voltage equipment, ESD, and items that require special disposal procedures that comply with environmental guidelines. Preventive maintenance includes a knowledge of preventive maintenance products, procedures, environmental hazards, and precautions when working on microcomputer systems.

- Identify the purpose of various types of preventive maintenance products and procedures and when to use them. These may include:
 - Liquid cleaning compounds
 - Types of materials to clean contacts and connections
 - Non-static vacuums (chassis, power supplies, and fans)
- Identify issues, procedures, and devices for protection within the computing environment, including people, hardware, and the surrounding workspace, such as:
 - UPS (uninterruptible power supply) and suppressors
 - Determining the signs of power issues
 - Proper methods of storage of components for future use
- Potential hazards and proper safety procedures relating to devices such as:
 - High-voltage equipment
 - Power supply
 - CRT

- Special disposal procedures that comply with environmental guidelines including:
 - Batteries
 - CRTs
 - Toner kits/cartridges
 - Chemical solvents and cans
 - MSDS (Material Safety Data Sheet)
- Understand ESD (electrostatic discharge) precautions and procedures, such as:
 - What ESD can do, how it may be apparent, or hidden
 - Common ESD protection devices
 - Situations that could present a danger or hazard

MOTHERBOARDS, PROCESSORS, AND MEMORY

You must understand the specific terminology, facts, ways, and means of dealing with classifications, categories, and principles of motherboards, processors, and memory in modern microcomputer systems.

- Distinguish between the popular CPU chips in terms of their basic characteristics, such as:
 - Popular CPU chips (Intel, AMD, and Cyrix)
 - Characteristics
 - Physical size
 - Voltage
 - Speeds
 - Onboard cache or not
 - Sockets
 - SEC (single edge contact)
- Identify the categories of RAM (Random Access Memory), terminology, locations, and physical characteristics including:
 - EDO RAM (Extended Data Output RAM)
 - DRAM (Dynamic Random Access Memory)
 - SRAM (Static RAM)
 - RIMM (Rambus Inline Memory Module 184 Pin)
 - VRAM (Video RAM)
 - SDRAM (Synchronous Dynamic RAM)
 - WRAM (Windows Accelerator Card RAM)
 - Memory bank
 - Memory chips (8-bit, 16-bit, and 32-bit)
 - SIMMs (Single In-line Memory Module)
 - DIMMs (Dual In-line Memory Module)
 - Parity chips versus non-parity chips
- Identify the most popular type of motherboards, their components, and their architecture (bus structures and power supplies) such as:
 - AT (Full and Baby)
 - ATX
 - Communication ports
 - SIMM and DIMM
 - Processor sockets

External cache memory (Level 2)

Bus architecture

ISA

PCI

AGP

USB (Universal Serial Bus)

VESA local bus (VL-Bus)

Basic compatibility guidelines

IDE (ATA, ATAPI, ULTRA-DMA, EIDE)

SCSI—Wide, Fast, Ultra, LVD (Low-Voltage Differential)

- Identify the purpose of CMOS (Complementary Metal-Oxide Semiconductor), what it contains, and how to change its basic parameters:
 - Printer parallel port—Uni., bi-directional, disable/enable, ECP, EPP
 - COM/serial port—memory address, interrupt request, disable
 - Floppy drive—enable/disable drive or boot, speed, density
 - Hard drive—size and drive type
 - Memory—parity, non-parity
 - Boot sequence
 - Date/time
 - Passwords
 - Plug-and-play BIOS

PRINTERS

You'll require a knowledge of basic printer types, basic printer concepts, and printer components. You should know how printers work, how they print onto a page, how the paper path works, understand care and service techniques, and be familiar with common problems.

- Identify basic concepts, printer operations, and printer components including:
 - Paper feeder mechanisms
 - Laser printers
 - Inkjet printers
 - Dot matrix printers
- Types of printer connections and configurations such as:
 - Parallel
 - Network
 - USB
 - Infrared
 - Serial
- Identify care and service techniques and common problems with primary printer types including:
 - Feed and output
 - Errors (printed or displayed)
 - Paper jam
 - Print quality
 - Safety precautions
 - Preventive maintenance

BASIC NETWORKING

This part of the exam requires a knowledge of basic network concepts and terminology, the ability to determine whether a computer is networked, a knowledge of procedures for swapping and configuring network interface cards, and a knowledge of the ramifications of repairs when a computer is networked.

- Identify basic networking concepts, including how a network works and the ramifications of repairs on the network such as:
 - Installing and configuring network cards
 - Network access
 - Full-duplex, half-duplex
 - Cabling—twisted pair, coaxial, fiber optic, RS-232
 - Ways to network a PC
 - Physical network topographies
 - Increasing bandwidth
 - Loss of data
 - Network slowdown
 - Infrared
 - Hardware protocols

The OS Technologies Exam (Circa 2001)

The OS part of the A+ examination measures essential operating system competencies for a break/fix microcomputer hardware service technician with six months of on-the-job experience. You must demonstrate a basic knowledge of command line prompts, Windows 9x, and Windows 2000 for installing, configuring, upgrading, troubleshooting, and repairing microcomputer systems.

OPERATING SYSTEM FUNDAMENTALS

You'll require knowledge of underlying DOS (command prompt functions) in Windows 9x and Windows 2000 operating systems in terms of its functions and structure, as well as for managing files and directories and running programs. You must also navigate through the operating system from command line prompts and Windows procedures for accessing and retrieving information.

- Identify the operating system's functions, structure, and major system files to navigate the operating system, and how to get to needed technical information such as:
 - Major operating system functions such as creating folders and checking the OS version
 - Major operating system components including Explorer, My Computer, and Control Panel
- Know the contrasts between Windows 9x and Windows 2000
- Understand system, configuration, and user interface files including IO.SYS, BOOT.INI, WIN.COM, MSDOS.SYS, AUTOEXEC.BAT, CONFIG.SYS, and the command prompt
- Understand memory management including conventional, extended/upper, high, and virtual memory, along with a knowledge of HIMEM.SYS and EMM386.exe

- You'll need a knowledge of Windows 9x files including IO.SYS, WIN.INI, USER.DAT, SYSEEDIT, SYSTEM.INI, SETVER.EXE, SMARTDRV.EXE, MSCONFIG (98), COMMAND.COM, DOSSTART.BAT, REGEDIT.EXE, SYSTEM.DAT, RUN COMMAND, and DriveSpace
- You'll need a knowledge of Windows 2000 files including Computer Management, BOOT.INI, REGEDT32, REGEDIT, RUN CMD, NTLDR, NTDETECT.COM, and NTBOOTDD.SYS
- You'll need a knowledge of command line features and syntax including DIR, ATTRIB, VER, MEM, SCANDISK, DEFRAG, EDIT, XCOPY, COPY, FORMAT, FDISK, MSCDEX, SETVER, and SCANREG
- Identify basic concepts and procedures for creating, viewing, and managing files, directories, and disks. This includes procedures for changing file attributes and the ramifications of those changes (for example, security issues) including:
 - File attributes—Read Only, Hidden, System, and Archive attributes
 - File naming conventions (most common extensions)
 - Windows 2000 COMPRESS, ENCRYPT
 - IDE/SCSI
 - Internal/external
 - Backup/restore
 - Partitioning/formatting/file systems including FAT, FAT16, FAT32, NTFS4, NTFS5, and HPFS
 - Windows-based utilities including ScanDisk, Device Manager, System Manager, Computer Manager, MSCONFIG.EXE, REGEDIT.EXE (view information/back up registry), REGEDT32.EXE, ATTRIB.EXE, EXTRACT.EXE, DEFRAG.EXE, EDIT.COM, FDISK.EXE, SYSEEDIT.EXE, SCANREG, WSCRIPT.EXE, HWINFO.EXE, ASD.EXE (Automatic Skip Driver), and Cvt1.EXE (Drive Converter FAT16 to FAT32)

INSTALLATION, CONFIGURATION, AND UPGRADING

This area requires knowledge of installing, configuring, and upgrading Windows 9x and Windows 2000. You should also have a working knowledge of system boot sequences and minimum hardware requirements.

- Identify the procedures for installing Windows 9x and Windows 2000, and the steps needed to bring the software to a basic operational level including:
 - Starting up
 - Partitioning
 - Formatting drive
 - Loading drivers
 - Running appropriate setup utility
- Identify steps to perform an operating system upgrade such as:
 - Upgrading Windows 95 to Windows 98
 - Upgrading from Windows NT Workstation 4.0 to Windows 2000
 - Replacing Windows 9x with Windows 2000
 - Dual-boot Windows 9x/Windows NT 4.0/2000
- Identify the basic system boot sequences and boot methods, including the steps to create an emergency boot disk with utilities installed for Windows 9x, Windows NT, and Windows 2000:
 - Startup disk
 - Safe Mode

MS-DOS mode
 NTLDR (NT Loader), BOOT.INI
 Files required to boot
 Creating emergency repair disk (ERD)

- Identify procedures for loading/adding and configuring application device drivers, and the necessary software for certain devices including Windows 9x plug-and-play and Windows 2000
- Identify the procedures for installing and launching typical Windows and non-Windows applications. (Note: there is no content related to Windows 3.1.)
- Procedures for setting up and configuring Windows printing subsystem including setting the default printer, installing/spool setting, and network printing (with help of LAN admin)

DIAGNOSING AND TROUBLESHOOTING

You must apply knowledge needed to diagnose and troubleshoot common problems relating to Windows 9x and Windows 2000. This includes an understanding of normal operation and a knowledge of symptoms relating to common problems.

- Recognize and interpret the meaning of common error codes and startup messages from the boot sequence, and identify steps to correct the problems including:
 - Safe Mode
 - No operating system found
 - Error in CONFIG.SYS line XX
 - Bad or missing COMMAND.COM
 - HIMEM.SYS not loaded
 - Missing or corrupt HIMEM.SYS
 - SCSI
 - Swap file
 - NT boot issues
 - Dr. Watson
 - Failure to start GUI
 - Windows Protection Error
 - Event Viewer—Event log is full
 - A device referenced in SYSTEM.INI, WIN.INI, registry is not found
- Recognize common problems and determine how to resolve them, such as:
 - Eliciting problem symptoms from customers
 - Having customer reproduce error as part of the diagnostic process
 - Identifying recent changes to the computer environment from the user
 - Troubleshooting Windows-specific printing problems such as: print spool is stalled; incorrect/incompatible driver for printer; and incorrect parameter
- Troubleshooting other common problems including: general protection faults; illegal operation; invalid working directory; system lock up; option device will not function; application will not start or load; cannot log on to network (option – NIC not functioning); TSR (Terminate and Stay Resident) programs and virus problems; applications don't install; and network connection issues
- Understand viruses and virus types such as: what they are; sources (floppy or e-mails); and how to determine their presence

NETWORKS

This area requires knowledge of Windows network capabilities, and how to connect to networks on the client side—including what the Internet is about, its capabilities, basic concepts relating to Internet access, and generic procedures for system setup. The scope of this topic is only what is needed on the desktop side to connect to a network.

- Identify the networking capabilities of Windows including procedures for connecting to the network such as:
 - Protocols
 - IPCONFIG.EXE
 - WINIPCFG.EXE
 - Sharing disk drives
 - Sharing print and file services
 - Network type and network card
 - Installing and configuring browsers
 - Configuring OS for network connection
- Identify concepts and capabilities relating to the Internet and basic procedures for setting up a system for Internet access such as:
 - ISP
 - TCP/IP
 - IPX/SPX
 - NetBEUI
 - E-mail
 - PING.EXE
 - HTML
 - HTTP://
 - FTP
 - Domain names (Web sites)
 - Dial-up networking
 - TRACERT.EXE
 - NSLOOKUP.EXE

Taking the A+ Exam

If you're planning to take the A+ exam you should arrive at the testing center at least 15 minutes before the test is scheduled to begin. The administrator of the testing center will demonstrate how to use the computer-based testing system before the test begins. In most cases, two forms of identification are required—one must have a picture (such as a driver's license) and both must have a signature. One can be a major credit card. Books, calculators, laptop computers, or other reference materials are not allowed during any test. Also, since the test is computer-based, pens, pencils, or paper will not be needed.

The A+ exams now use a "scaled score" format. The scale score for the A+ Core Hardware and the A+ OS Technologies exams is 100-900. The minimum score required to pass the A+ Core Hardware is 683. The minimum score required to pass the A+ OS Technologies exam is 614. The A+ Core Hardware exam will have 70 questions. The A+ OS Technologies exam will also have 70 questions. You will be given a

maximum of 90 minutes to complete the A+ Core Hardware exam. You will be given a maximum of 90 additional minutes to complete the A+ OS Technologies exam. As soon as the test is finished, a final score will be generated, and this score will immediately show on the computer screen. A hard copy of the score report is also provided at the testing center. The score report shows whether you passed the examination or not. It will also show, by section, your performance on the test (please hold on to your score report).

After you pass the examination(s) successfully, your certificate and ID card will be forwarded to you by Sylvan Prometric in two to three weeks. Should you need a replacement (or a correction) to your certificate or ID card, contact Sylvan Prometric at 1-800-776-4276 if you live in the United States, Canada or Puerto Rico. If you live outside this area, call your regional Sylvan Prometric site. If you do not pass the examination, you can register at any time to take it again. You will be able to retest after payment has been made.