

CompTIA A+ Objectives

220-901 Domain 1.0 Hardware

This domain comprises about 34 percent of the examination.

220-901 Objective 1.1

Given a scenario, configure settings and use BIOS/UEFI tools on a PC.

- Firmware upgrades/flash BIOS
- BIOS component information
 - RAM
 - Hard drive
 - Optical drive
 - CPU
- BIOS configurations
 - Boot sequence
 - Enabling and disabling devices
 - Date/time
 - Clock speeds
 - Virtualization support
 - BIOS security (passwords, drive encryption: TPM, LoJack, secure boot)
- Built-in diagnostics
- Monitoring
 - Temperature monitoring
 - Fan speeds
 - Intrusion detection/notification

- Voltage
- Clock
- Bus speed

220-901 Objective 1.2

Explain the importance of motherboard components, their purpose and properties.

- Sizes
 - ATX
 - Micro-ATX
 - Mini-ITX
 - ITX
- Expansion slots
 - PCI
 - PCI-X
 - PCIe
 - miniPCI
- RAM slots
- CPU sockets
- Chipsets
 - Northbridge
 - Southbridge
- CMOS battery
- Power connections and types
- Fan connectors
- Front/top panel connectors
 - USB
 - Audio
 - Power button

- Power light
- Drive activity lights
- Bus speeds
- Reset button

220-901 Objective 1.3

Compare and contrast various RAM types and their features.

- Types
 - DDR
 - DDR2
 - DDR3
 - SODIMM
 - DIMM
 - Parity vs. non-parity
 - ECC vs. non-ECC
 - RAM configurations
 - Single channel vs. dual-channel vs. triple channel
 - Single-sided vs. double-sided
 - Buffered vs. unbuffered
- RAM compatibility

220-901 Objective 1.4

Install and configure PC expansion cards.

- Sound cards
- Video cards
- Network cards
- USB cards
- Firewire cards
- Thunderbolt cards

- Storage cards
- Modem cards
- Wireless/cellular cards
- TV tuner cards
- Video capture cards
- Riser cards

220-901 Objective 1.5

Install and configure storage devices and use appropriate media.

- Optical drives
 - CD-ROM/CD-RW
 - DVD-ROM/DVD-RW/DVD-RW DL
 - Blu-ray
 - BD-R
 - BD-RE
- Magnetic hard disk drives
 - 5400rpm
 - 7200rpm
 - 10,000rpm
- Hot swappable drives
- Solid state/flash drives
 - Compact flash
 - SD
 - MicroSD
 - MiniSD
 - xD
 - SSD
 - Hybrid
 - eMMC

- RAID types
 - 0
 - 1
 - 5
 - 10
- Tape drive
- Media capacity
 - CD
 - CD-RW
 - DVD-RW
 - DVD
 - Blu-ray
 - Tape
 - DVD DL

220-901 Objective 1.6

Install various types of CPUs and apply the appropriate cooling methods.

- Socket types
 - Intel: 775, 1155, 1156, 1366, 1150, 2011
 - AMD: AM3, AM3+, FM1, FM2, FM2+
- Characteristics
 - Speeds
 - Cores
 - Cache size/type
 - Hyperthreading
 - Virtualization support
 - Architecture (32-bit vs. 64-bit)
 - Integrated GPU
 - Disable execute bit

- Cooling
 - Heat sink
 - Fans
 - Thermal paste
 - Liquid-based
 - Fanless/passive

220-901 Objective 1.7

Compare and contrast various PC connection interfaces, their characteristics, and purpose.

- Physical connections
 - USB 1.1 vs. 2.0 vs. 3.0
 - Connector types: A, B, mini, micro
 - Firewire 400 vs. Firewire 800
 - SATA1 vs. SATA2 vs. SATA3, eSATA
 - Other connector types
 - VGA
 - HDMI
 - DVI
 - Audio
 - Analog
 - Digital (Optical connector)
 - RJ-45
 - RJ-11
 - Thunderbolt
- Wireless connections
 - Bluetooth
 - RF

- IR
- NFC
- Characteristics
 - Analog
 - Digital
 - Distance limitations
 - Data transfer speeds
 - Quality
 - Frequencies

220-901 Objective 1.8

Install a power supply based on given specifications.

- Connector types and their voltages
 - SATA
 - Molex
 - 4/8-pin 12v
 - PCIe 6/8-pin
 - 20-pin
 - 24-pin
- Specifications
 - Wattage
 - Dual rail
 - Size
 - Number of connectors
 - ATX
 - MicroATX
 - Dual voltage options

220-901 Objective 1.9

Given a scenario, select the appropriate components for a custom PC configuration to meet customer specifications or needs.

- Graphic/CAD/CAM design workstation
 - Multicore processor
 - High-end video
 - Maximum RAM
- Audio/video editing workstation
 - Specialized audio and video card
 - Large fast hard drive
 - Dual monitors
- Virtualization workstation
 - Maximum RAM and CPU cores
- Gaming PC
 - Multicore processor
 - High-end video/specialized GPU
 - High-definition sound card
 - High-end cooling
- Home theater PC
 - Surround sound audio
 - HDMI output
 - HTPC compact form factor
 - TV tuner
- Standard thick client
 - Desktop applications
 - Meets recommended requirements for selected OS
- Thin client
 - Basic applications
 - Meets minimum requirements for selected OS
 - Network connectivity

- Home server PC
 - Media streaming
 - File sharing
 - Print sharing
 - Gigabit NIC
 - RAID array

220-901 Objective 1.10

Compare and contrast types of display devices and their features.

- Types
 - LCD
 - TN vs. IPS
 - Fluorescent vs. LED backlighting
 - Plasma
 - Projector
 - OLED
- Refresh/frame rates
- Resolution
- Native resolution
- Brightness/lumens
- Analog vs. digital
- Privacy/antiglare filters
- Multiple displays
- Aspect ratios
 - 16:9
 - 16:10
 - 4:3

220-901 Objective 1.11

Identify common PC connector types and associated cables.

- Display connector types
 - DVI-D
 - DVI-I
 - DVI-A
 - DisplayPort
 - RCA
 - HD15 (i.e., DE15 or DB15)
 - BNC
 - miniHDMI
 - miniDin-6
- Display cable types
 - HDMI
 - DVI
 - VGA
 - Component
 - Composite
 - Coaxial
- Device cables and connectors
 - SATA
 - eSATA
 - USB
 - Firewire (IEEE1394)
 - PS/2
 - Audio
- Adapters and convertors
 - DVI to HDMI
 - USB A to USB B

- USB to Ethernet
- DVI to VGA
- Thunderbolt to DVI
- PS/2 to USB
- HDMI to VGA

220-901 Objective 1.12

Install and configure common peripheral devices.

- Input devices
 - Mouse
 - Keyboard
 - Scanner
 - Barcode reader
 - Biometric devices
 - Game pads
 - Joysticks
 - Digitizer
 - Motion sensor
 - Touchpads
 - Smart card readers
 - Digital cameras
 - Microphone
 - Webcam
 - Camcorder
- Output devices
 - Printers
 - Speakers
 - Display devices

- Input & output devices
 - Touch screen
 - KVM
 - Smart TV
 - Set-top box
 - MIDI-enabled devices

220-901 Objective 1.13

Install SOHO multifunction device/printers and configure appropriate settings.

- Use appropriate drivers for a given operating system
 - Configuration settings
 - Duplex
 - Collate
 - Orientation
 - Quality
- Device sharing
 - Wired
 - USB
 - Serial
 - Ethernet
 - Wireless
 - Bluetooth
 - 802.11 (a/b/g/n/ac)
 - Infrastructure vs. ad hoc
 - Integrated print server (hardware)
 - Cloud printing/remote printing
- Public/shared devices
 - Sharing local/networked device via operating system settings
 - TCP/Bonjour/AirPrint
 - Data privacy

- User authentication on the device
- Hard drive caching

220-901 Objective 1.14

Compare and contrast differences between the various print technologies and the associated imaging process.

- Laser
 - Imaging drum, fuser assembly, transfer belt, transfer roller, pickup rollers, separate pads, duplexing assembly
 - Imaging process: processing, charging, exposing, developing, transferring, fusing and cleaning
- Inkjet
 - Ink cartridge, print head, roller, feeder, duplexing assembly, carriage, and belt
 - Calibration
- Thermal
 - Feed assembly, heating element
 - Special thermal paper
- Impact
 - Print head, ribbon, tractor feed
 - Impact paper
- Virtual
 - Print to file
 - Print to PDF
 - Print to XPS
 - Print to image

220-901 Objective 1.15

Given a scenario, perform appropriate printer maintenance.

- Laser
 - Replace toner, applying maintenance kit, calibrate, clean

- Thermal
 - Replace paper, clean heating element, remove debris
- Impact
 - Replace ribbon, replace print head, replace paper
- Inkjet
 - Clean heads, replace cartridges, calibrate, clear jams

220-901 Domain 2.0 Networking

This domain comprises about 21 percent of the examination.

220-901 Objective 2.1

Identify the various types of network cables and connectors.

- Fiber
 - Connectors: SC, ST, and LC
- Twisted Pair
 - Connectors: RJ-11, RJ-45
 - Wiring standards: T568A, T568B
- Coaxial
 - Connectors: BNC, F-connector

220-901 Objective 2.2

Compare and contrast the characteristics of connectors and cabling.

- Fiber
 - Types (single-mode vs. multi-mode)
 - Speed and transmission limitations
- Twisted pair
 - Types: STP, UTP, CAT3, CAT5, CAT5e, CAT6, CAT6e, CAT7, plenum, PVC
 - Speed and transmission limitations
 - Splitters and effects on signal quality

- Coaxial
 - Types: RG-6, RG-59
 - Speed and transmission limitations
 - Splitters and effects on signal quality

220-901 Objective 2.3

Explain the properties and characteristics of TCP/IP.

- IPv4 vs. IPv6
- Public vs. private vs. APIPA/link local
- Static vs. dynamic
- Client-side DNS settings
- Client-side DHCP
- Subnet mask vs. CIDR
- Gateway

220-901 Objective 2.4

Explain common TCP and UDP ports, protocols, and their purpose.

- Ports
 - 21 – FTP
 - 22 – SSH
 - 23 – TELNET
 - 25 – SMTP
 - 53 – DNS
 - 80 – HTTP
 - 110 – POP3
 - 143 – IMAP
 - 443 – HTTPS
 - 3389 – RDP
 - 137-139 – NetBIOS/NetBT

- 445 – SMB/CIFS
- 427 – SLP
- 548 – AFP
- Protocols
 - DHCP
 - DNS
 - LDAP
 - SNMP
 - SMB
 - CIFS
 - SSH
 - AFP
- TCP vs. UDP

220-901 Objective 2.5

Compare and contrast various Wi-Fi networking standards and encryption types.

- Standards
 - 802.11 (a/b/g/n/ac)
 - Speeds, distances, and frequencies
- Encryption types
 - WEP, WPA, WPA2, TKIP, AES

220-901 Objective 2.6

Given a scenario, install and configure SOHO wireless/wired router and apply appropriate settings.

- Channels
- Port forwarding, port triggering
- DHCP (on/off)
- DMZ

- NAT/DNAT
- Basic QoS
- Firmware
- UPnP

220-901 Objective 2.7

Compare and contrast Internet connection types, network types, and their features.

- Internet connection types
 - Cable
 - DSL
 - Dial-up
 - Fiber
 - Satellite
 - ISDN
 - Cellular
 - Tethering
 - Mobile hotspot
 - Line-of-sight wireless Internet service
- Network types
 - LAN
 - WAN
 - PAN
 - MAN

220-901 Objective 2.8

Compare and contrast network architecture devices, their functions and features.

- Hub
- Switch
- Router

- Access point
- Bridge
- Modem
- Firewall
- Patch panel
- Repeaters/extenders
- Ethernet over Power
- Power over Ethernet injector

220-901 Objective 2.9

Given a scenario, use appropriate networking tools.

- Crimper
- Cable stripper
- Multimeter
- Tone generator and probe
- Cable tester
- Loopback plug
- Punchdown tool
- Wi-Fi analyzer

220-901 Domain 3.0 Mobile Devices

This domain comprises about 17 percent of the examination.

220-901 Objective 3.1

Install and configure laptop hardware and components.

- Expansion options
 - ExpressCard /34
 - ExpressCard /54

- SODIMM
- Flash
- Ports/Adapters
- Thunderbolt
- DisplayPort
- USB to RJ-45 dongle
- USB to Wi-Fi dongle
- USB to Bluetooth
- USB Optical Drive
- Hardware/device replacement
 - Keyboard
 - Hard drive
 - SSD vs. hybrid vs. magnetic disk
 - 1.8in vs. 2.5in
 - Memory
 - Smart card reader
 - Optical drive
 - Wireless card
 - Mini-PCIe
 - Screen
 - DC jack
 - Battery
 - Touchpad
 - Plastics/frames
 - Speaker
 - System board
 - CPU

220-901 Objective 3.2

Explain the function of components within the display of a laptop.

- Types
 - LCD
 - TN vs. IPS
 - Fluorescent vs. LED backlighting
 - OLED
- Wi-Fi antenna connector/placement
- Webcam
- Microphone
- Inverter
- Digitizer

220-901 Objective 3.3

Given a scenario, use appropriate laptop features.

- Special function keys
 - Dual displays
 - Wireless (on/off)
 - Cellular (on/off)
 - Volume settings
 - Screen brightness
 - Bluetooth (on/off)
 - Keyboard backlight
 - Touch pad (on/off)
 - Screen orientation
 - Media options (fast forward/rewind)
 - GPS (on/off)
 - Airplane mode
- Docking station

- Physical laptop lock and cable lock
- Rotating/removable screens

220-901 Objective 3.4

Explain the characteristics of various types of other mobile devices.

- Tablets
- Smartphones
- Wearable technology devices
 - Smart watches
 - Fitness monitors
 - Glasses and headsets
- Phablets
- e-Readers
- Smart camera
- GPS

220-901 Objective 3.5

Compare and contrast accessories and ports of other mobile devices.

- Connection types
 - NFC
 - Proprietary vendor-specific ports (communication/power)
 - MicroUSB/miniUSB
 - Lightning
 - Bluetooth
 - IR
 - Hotspot/tethering
- Accessories
 - Headsets
 - Speakers

- Game pads
- Docking stations
- Extra battery packs/battery chargers
- Protective covers/water proofing
- Credit card readers
- Memory/MicroSD

220-901 Domain 4.0 Hardware and Network Troubleshooting

This domain comprises about 28 percent of the examination.

220-901 Objective 4.1

Given a scenario, troubleshoot common problems related to motherboards, RAM, CPU, and power with appropriate tools.

- Common symptoms
 - Unexpected shutdowns
 - System lockups
 - POST code beeps
 - Blank screen on bootup
 - BIOS time and settings resets
 - Attempts to boot to incorrect device
 - Continuous reboots
 - No power
 - Overheating
 - Loud noise
 - Intermittent device failure
 - Fans spin—no power to other devices
 - Indicator lights
 - Smoke
 - Burning smell

- Proprietary crash screens (BSOD/pin wheel)
- Distended capacitors
- Tools
 - Multimeter
 - Power supply tester
 - Loopback plugs
 - POST card/USB

220-901 Objective 4.2

Given a scenario, troubleshoot hard drives and RAID arrays with appropriate tools.

- Common symptoms
 - Read/write failure
 - Slow performance
 - Loud clicking noise
 - Failure to boot
 - Drive not recognized
 - OS not found
 - RAID not found
 - RAID stops working
 - Proprietary crash screens (BSOD/pin wheel)
 - S.M.A.R.T. errors
- Tools
 - Screwdriver
 - External enclosures
 - CHKDSK
 - FORMAT
 - File recovery software
 - Bootrec
 - Diskpart
 - Defragmentation tool

220-901 Objective 4.3

Given a scenario, troubleshoot common video, projector, and display issues.

- Common symptoms
 - VGA mode
 - No image on screen
 - Overheat shutdown
 - Dead pixels
 - Artifacts
 - Color patterns incorrect
 - Dim image
 - Flickering image
 - Distorted image
 - Distorted geometry
 - Burn-in
 - Oversized images and icons

220-901 Objective 4.4

Given a scenario, troubleshoot wired and wireless networks with appropriate tools.

- Common symptoms
 - No connectivity
 - APIPA/link local address
 - Limited connectivity
 - Local connectivity
 - Intermittent connectivity
 - IP conflict
 - Slow transfer speeds
 - Low RF signal
 - SSID not found

- Hardware tools
 - Cable tester
 - Loopback plug
 - Punchdown tools
 - Tone generator and probe
 - Wire strippers
 - Crimper
 - Wireless locator
- Command-line tools
 - PING
 - IPCONFIG/IFCONFIG
 - TRACERT
 - NETSTAT
 - NBTSTAT
 - NET
 - NETDOM
 - NSLOOKUP

220-901 Objective 4.5

Given a scenario, troubleshoot and repair common mobile device issues while adhering to the appropriate procedures.

- Common symptoms
 - No display
 - Dim display
 - Flickering display
 - Sticking keys
 - Intermittent wireless
 - Battery not charging
 - Ghost cursor/pointer drift

- No power
- Num lock indicator lights
- No wireless connectivity
- No Bluetooth connectivity
- Cannot display to external monitor
- Touchscreen non-responsive
- Apps not loading
- Slow performance
- Unable to decrypt e-mail
- Extremely short battery life
- Overheating
- Frozen system
- No sound from speakers
- GPS not functioning
- Swollen battery
- Disassembling processes for proper reassembly
 - Document and label cable and screw locations
 - Organize parts
 - Refer to manufacturer resources
 - Use appropriate hand tools

220-901 Objective 4.6

Given a scenario, troubleshoot printers with appropriate tools.

- Common symptoms
 - Streaks
 - Faded prints
 - Ghost images
 - Toner not fused to the paper
 - Creased paper

- Paper not feeding
- Paper jam
- No connectivity
- Garbled characters on paper
- Vertical lines on page
- Backed-up print queue
- Low memory errors
- Access denied
- Printer will not print
- Color prints in wrong print color
- Unable to install printer
- Error codes
- Printing blank pages
- No image on printer display
- Tools
 - Maintenance kit
 - Toner vacuum
 - Compressed air
 - Printer spooler

220-902 Domain 1.0 Windows Operating Systems

This domain comprises about 29 percent of the examination.

220-902 Objective 1.1

Compare and contrast various features and requirements of Microsoft Operating Systems (Windows Vista, Windows 7, Windows 8, Windows 8.1).

- Features:
 - 32-bit vs. 64-bit
 - Aero, gadgets, user account control, BitLocker, shadow copy, system restore, ready boost, sidebar, compatibility mode, virtual XP mode, easy transfer, administrative tools, defender, Windows firewall, security center, event viewer, file structure and paths, category view vs. classic view

- Side-by-side apps, Metro UI, Pinning, One Drive, Windows Store, multimonitor task bars, charms, Start Screen, PowerShell, Live sign in, Action Center
- Upgrade paths—differences between in-place upgrades, compatibility tools, Windows upgrade OS advisor

220-902 Objective 1.2

Given a scenario, install Windows PC operating systems using appropriate methods.

- Boot methods
 - USB
 - CD-ROM
 - DVD
 - PXE
 - Solid state/flash drives
 - Netboot
 - External/hot swappable drive
 - Internal hard drive (partition)
- Type of installations
 - Unattended installation
 - Upgrade
 - Clean install
 - Repair installation
 - Multiboot
 - Remote network installation
 - Image deployment
 - Recovery partition
 - Refresh/restore
- Partitioning
 - Dynamic
 - Basic

- Primary
- Extended
- Logical
- GPT
- File system types/formatting
 - exFAT
 - FAT32
 - NTFS
 - CDFS
 - NFS
 - ext3, ext4
 - Quick format vs. full format
- Load alternate third-party drivers when necessary
- Workgroup vs. domain setup
- Time/date/region/language settings
- Driver installation, software and Windows updates
- Factory recovery partition
- Properly formatted boot drive with the correct partitions/format

220-902 Objective 1.3

Given a scenario, apply appropriate Microsoft command-line tools.

- TASKKILL
- BOOTREC
- SHUTDOWN
- TASKLIST
- MD
- RD
- CD
- DEL

- FORMAT
- COPY
- XCOPY
- ROBOCOPY
- DISKPART
- SFC
- CHKDSK
- GPUPDATE
- GPRESULT
- DIR
- EXIT
- HELP
- EXPAND
- [*command name*] /?
- Commands available with standard privileges vs. administrative privileges

220-902 Objective 1.4

Given a scenario, use appropriate Microsoft operating system features and tools.

- Administrative
 - Computer management
 - Device manager
 - Local users and groups
 - Local security policy
 - Performance monitor
 - Services
 - System configuration
 - Task scheduler
 - Component services
 - Data sources

- Print management
- Windows memory diagnostics
- Windows firewall
- Advanced security
- MSCONFIG
 - General
 - Boot
 - Services
 - Startup
 - Tools
- Task Manager
 - Applications
 - Processes
 - Performance
 - Networking
 - Users
- Disk management
 - Drive status
 - Mounting
 - Initializing
 - Extending partitions
 - Splitting partitions
 - Shrink partitions
 - Assigning/changing drive letters
 - Adding drives
 - Adding arrays
 - Storage spaces

- Other
 - User State Migration tool (USMT)
 - Windows Easy Transfer
 - Windows Upgrade Advisor
- System utilities
 - REGEDIT
 - COMMAND
 - SERVICES.MSC
 - MMC
 - MSTSC
 - NOTEPAD
 - EXPLORER
 - MSINFO32
 - DXDIAG
 - DEFRAG
 - System Restore
 - Windows Update

220-902 Objective 1.5

Given a scenario, use Windows Control Panel utilities.

- Internet options
 - Connections
 - Security
 - General
 - Privacy
 - Programs
 - Advanced

- Display/display settings
 - Resolution
 - Color depth
 - Refresh rate
- User accounts
- Folder options
 - View hidden files
 - Hide extensions
 - General options
 - View options
- System
 - Performance (virtual memory)
 - Remote settings
 - System protection
- Windows firewall
- Power options
 - Hibernate
 - Power plans
 - Sleep/suspend
 - Standby
- Programs and features
- HomeGroup
- Devices and printers
- Sound
- Troubleshooting
- Network and Sharing Center
- Device Manager

220-902 Objective 1.6

Given a scenario, install and configure Windows networking on a client/desktop.

- HomeGroup vs. WorkGroup
- Domain setup
- Network shares/administrative shares/mapping drives
- Printer sharing vs. network printer mapping
- Establish networking connections
 - VPN
 - Dial-ups
 - Wireless
 - Wired
 - WWAN (Cellular)
- Proxy settings
- Remote Desktop Connection
- Remote Assistance
- Home vs. work vs. public network settings
- Firewall settings
 - Exceptions
 - Configuration
 - Enabling/disabling Windows firewall
- Configuring an alternative IP address in Windows
 - IP addressing
 - Subnet mask
 - DNS
 - Gateway
- Network card properties
 - Half duplex/full duplex/auto
 - Speed
 - Wake-on-LAN

- QoS
- BIOS (on-board NIC)

220-902 Objective 1.7

Perform common preventive maintenance procedures using the appropriate Windows OS tools.

- Best practices
 - Scheduled backups
 - Scheduled disk maintenance
 - Windows updates
 - Patch management
 - Driver/firmware updates
 - Antivirus/Anti-malware updates
- Tools
 - Backup
 - System restore
 - Recovery image
 - Disk maintenance utilities

220-902 Domain 2.0 Other Operating Systems and Technologies

This domain comprises about 12 percent of the examination.

220-902 Objective 2.1

Identify common features and functionality of the Mac OS (OS X) and Linux operating systems.

- Best practices
 - Scheduled backups
 - Scheduled disk maintenance
 - System updates/App Store

- Patch management
- Driver/firmware updates
- Antivirus/anti-malware updates
- Tools
 - Backup/Time Machine
 - Restore/snapshot
 - Image recovery
 - Disk maintenance utilities
 - Shell/Terminal
 - Screen sharing
 - Force Quit
- Features
 - Multiple desktops/Mission Control
 - Key Chain
 - Spot Light
 - iCloud
 - Gestures
 - Finder
 - Remote Disc
 - Dock
 - Boot Camp
- Basic Linux commands
 - ls
 - grep
 - cd
 - shutdown
 - pwd vs. passwd
 - mv
 - cp

- rm
- chmod
- chown
- iwconfig/ifconfig
- ps
- su/sudo
- apt-get
- vi
- dd

220-902 Objective 2.2

Given a scenario, set up and use client-side virtualization.

- Purpose of virtual machines
- Resource requirements
- Emulator requirements
- Security requirements
- Network requirements
- Hypervisor

220-902 Objective 2.3

Identify basic cloud concepts.

- SaaS
- IaaS
- PaaS
- Public vs. Private vs. Hybrid vs. Community
- Rapid Elasticity
- On-demand
- Resource pooling
- Measured service

220-902 Objective 2.4

Summarize the properties and purpose of services provided by networked hosts.

- Server roles
 - Web server
 - File server
 - Print server
 - DHCP server
 - DNS server
 - Proxy server
 - Mail server
 - Authentication server
- Internet appliance
 - UTM
 - IDS
 - IPS
- Legacy/embedded systems

220-902 Objective 2.5

Identify basic features of mobile operating systems.

- Android vs. iOS vs. Windows
 - Open source vs. closed source/vendor specific
 - App source (Google Play Store, App Store, and Store)
 - Screen orientation (accelerometer/gyroscope)
 - Screen calibration
 - GPS and geotracking
 - Wi-Fi calling
 - Launcher/GUI
 - Virtual assistant
 - SDK/APK

- Emergency notification
- Mobile payment service

220-902 Objective 2.6

Install and configure basic mobile device network connectivity and e-mail.

- Wireless/cellular data network (enable/disable)
 - Hotspot
 - Tethering
 - Airplane mode
- Bluetooth
 - Enable Bluetooth
 - Enable pairing
 - Find device for pairing
 - Enter appropriate pin code
 - Test connectivity
- Corporate and ISP e-mail configuration
 - POP3
 - IMAP
 - Port and SSL settings
 - Exchange, S/MIME
- Integrated commercial provider e-mail configuration
 - Google/Inbox
 - Yahoo!
 - Outlook.com
 - iCloud
- PRI updates/PRL updates/Baseband updates
- Radio firmware
- IMEI vs. IMSI
- VPN

220-902 Objective 2.7

Summarize methods and data related to mobile device synchronization.

- Types of data to synchronize
 - Contacts
 - Programs
 - E-mail
 - Pictures
 - Music
 - Videos
 - Calendar
 - Bookmarks
 - Documents
 - Location data
 - Social media data
 - eBooks
- Synchronization methods
 - Synchronize to the Cloud
 - Synchronize to the Desktop
- Mutual authentication for multiple services (SSO)
- Software requirements to install the application on the PC
- Connection types to enable synchronization

220-902 Domain 3.0 Security

This domain comprises about 22 percent of the examination.

220-902 Objective 3.1

Identify common security threats and vulnerabilities.

- Malware
 - Spyware
 - Viruses

- Worms
- Trojans
- Rootkits
- Ransomware
- Phishing
- Spear phishing
- Spoofing
- Social engineering
- Shoulder surfing
- Zero-day attack
- Zombie/botnet
- Brute forcing
- Dictionary attacks
- Non-compliant systems
- Violations of security best practices
- Tailgating
- Man-in-the-middle

220-902 Objective 3.2

Compare and contrast common prevention methods.

- Physical security
 - Lock doors
 - Mantrap
 - Cable locks
 - Securing physical documents/passwords/shredding
 - Biometrics
 - ID badges
 - Key fobs
 - RFID badge

- Smart card
- Tokens
- Privacy filters
- Entry control roster
- Digital security
 - Antivirus/Anti-malware
 - Firewalls
 - User authentication/strong passwords
 - Multifactor authentication
 - Directory permissions
 - VPN
 - DLP
 - Disabling ports
 - Access control lists
 - Smart card
 - E-mail filtering
 - Trusted/untrusted software sources
- User education/AUP
- Principle of least privilege

220-902 Objective 3.3

Compare and contrast differences of basic Windows OS security settings.

- User and groups
 - Administrator
 - Power user
 - Guest
 - Standard user

- NTFS vs. Share permissions
 - Allow vs. deny
 - Moving vs. copying folders and files
 - File attributes
- Shared files and folders
 - Administrative shares vs. local shares
 - Permission propagation
 - Inheritance
- System files and folders
- User authentication
 - Single sign-on
- Run as administrator vs. standard user
- BitLocker
- BitLocker-To-Go
- EFS

220-902 Objective 3.4

Given a scenario, deploy and enforce security best practices to secure a workstation.

- Password best practices
 - Setting strong passwords
 - Password expiration
 - Changing default user names/passwords
 - Screensaver required password
 - BIOS/UEFI passwords
 - Requiring passwords
- Account management
 - Restricting user permissions
 - Login time restrictions
 - Disabling guest account

- Failed attempts lockout
- Timeout/screen lock
- Disable autorun
- Data encryption
- Patch/update management

220-902 Objective 3.5

Compare and contrast various methods for securing mobile devices.

- Screen locks
 - Fingerprint lock
 - Face lock
 - Swipe lock
 - Passcode lock
- Remote wipes
- Locator applications
- Remote backup applications
- Failed login attempt restrictions
- Antivirus/anti-malware
- Patching/OS updates
- Biometric authentication
- Full device encryption
- Multifactor authentication
- Authenticator applications
- Trusted sources vs. untrusted sources
- Firewalls
- Policies and procedures
 - BYOD vs. corporate owned
 - Profile security requirements

220-902 Objective 3.6

Given a scenario, use appropriate data destruction and disposal methods.

- Physical destruction
 - Shredder
 - Drill/hammer
 - Electromagnetic (Degaussing)
 - Incineration
 - Certificate of destruction
- Recycling or repurposing best practices
 - Low-level format vs. standard format
 - Overwrite
 - Drive wipe

220-902 Objective 3.7

Given a scenario, secure SOHO wireless and wired networks.

- Wireless specific
 - Changing default SSID
 - Setting encryption
 - Disabling SSID broadcast
 - Antenna and access point placement
 - Radio power levels
 - WPS
- Change default usernames and passwords
- Enable MAC filtering
- Assign static IP addresses
- Firewall settings
- Port forwarding/mapping
- Disabling ports

- Content filtering/parental controls
- Update firmware
- Physical security

220-902 Domain 4.0 Software Troubleshooting

This domain comprises about 24 percent of the examination.

220-902 Objective 4.1

Given a scenario, troubleshoot PC operating system problems with appropriate tools.

- Common symptoms
 - Proprietary crash screens (BSOD/pinwheel)
 - Failure to boot
 - Improper shutdown
 - Spontaneous shutdown/restart
 - Device fails to start/detected
 - Missing DLL message
 - Services fail to start
 - Compatibility error
 - Slow system performance
 - Boots to safe mode
 - File fails to open
 - Missing NTLDR
 - Missing boot configuration data
 - Missing operating system
 - Missing graphical interface
 - Missing GRUB/LILO
 - Kernel panic

- Graphical Interface fails to load
- Multiple monitor misalignment/orientation
- Tools
 - BIOS/UEFI
 - SFC
 - Logs
 - System Recovery Options
 - Repair disks
 - Pre-installation environments
 - MSCONFIG
 - DEFRAG
 - REGSVR32
 - REGEDIT
 - Event viewer
 - Safe mode
 - Command prompt
 - Uninstall/reinstall/repair

220-902 Objective 4.2

Given a scenario, troubleshoot common PC security issues with appropriate tools and best practices.

- Common symptoms
 - Pop-ups
 - Browser redirection
 - Security alerts
 - Slow performance
 - Internet connectivity issues
 - PC/OS lock up
 - Application crash

- OS updates failures
- Rogue antivirus
- Spam
- Renamed system files
- Files disappearing
- File permission changes
- Hijacked e-mail
 - Responses from users regarding e-mail
 - Automated replies from unknown sent e-mail
- Access denied
- Invalid certificate (trusted root CA)
- Tools
 - Antivirus software
 - Anti-malware software
 - Recovery console
 - Terminal
 - System restore/Snapshot
 - Pre-installation environments
 - Event viewer
 - Refresh/restore
 - MSCONFIG/Safe boot
- Best practice procedure for malware removal
 1. Identify malware symptoms
 2. Quarantine infected system
 3. Disable system restore (in Windows)
 4. Remediate infected systems
 - a. Update anti-malware software
 - b. Scan and removal techniques (safe mode, pre-installation environment)

5. Schedule scans and run updates
6. Enable system restore and create restore point (in Windows)
7. Educate end user

220-902 Objective 4.3

Given a scenario, troubleshoot common mobile OS and application issues with appropriate tools.

- Common symptoms
 - Dim display
 - Intermittent wireless
 - No wireless connectivity
 - No Bluetooth connectivity
 - Cannot broadcast to external monitor
 - Touchscreen non-responsive
 - Apps not loading
 - Slow performance
 - Unable to decrypt e-mail
 - Extremely short battery life
 - Overheating
 - Frozen system
 - No sound from speakers
 - Inaccurate touch screen response
 - System lockout
- Tools
 - Hard reset
 - Soft reset
 - Close running applications
 - Reset to factory default
 - Adjust configurations/settings

- Uninstall/reinstall apps
- Force stop

220-902 Objective 4.4

Given a scenario, troubleshoot common mobile OS and application security issues with appropriate tools.

- Common symptoms
 - Signal drop/weak signal
 - Power drain
 - Slow data speeds
 - Unintended Wi-Fi connection
 - Unintended Bluetooth pairing
 - Leaked personal files/data
 - Data transmission overlimit
 - Unauthorized account access
 - Unauthorized root access
 - Unauthorized location tracking
 - Unauthorized camera/microphone activation
 - High resource utilization
- Tools
 - Anti-malware
 - App scanner
 - Factory reset/clean install
 - Uninstall/reinstall apps
 - Wi-Fi analyzer
 - Force stop
 - Cell tower analyzer
 - Backup/restore
 - iTunes/iCloud/Apple Configurator

- Google Sync
- One Drive

220-902 Domain 5.0 Operational Procedures

This domain comprises about 13 percent of the examination.

220-902 Objective 5.1

Given a scenario, use appropriate safety procedures.

- Equipment grounding
- Proper component handling and storage
 - Antistatic bags
 - ESD straps
 - ESD mats
 - Self-grounding
- Toxic waste handling
 - Batteries
 - Toner
 - CRT
- Personal safety
 - Disconnect power before repairing PC
 - Remove jewelry
 - Lifting techniques
 - Weight limitations
 - Electrical fire safety
 - Cable management
 - Safety goggles
 - Air filter mask
- Compliance with local government regulations

220-902 Objective 5.2

Given a scenario with potential environmental impacts, apply the appropriate controls.

- MSDS documentation for handling and disposal
- Temperature, humidity level awareness and proper ventilation
- Power surges, brownouts, blackouts
 - Battery backup
 - Surge suppressor
- Protection from airborne particles
 - Enclosures
 - Air filters/mask
- Dust and debris
 - Compressed air
 - Vacuums
- Compliance to local government regulations

220-902 Objective 5.3

Summarize the process of addressing prohibited content/activity, and explain privacy, licensing and policy concepts.

- Incident Response
 - First response
 - Identify
 - Report through proper channels
 - Data/device preservation
 - Use of documentation/documentation changes
 - Chain of custody
 - Tracking of evidence/documenting process
- Licensing/DRM/EULA
 - Open source vs. commercial license
 - Personal license vs. enterprise licenses

- Personally Identifiable Information
- Follow corporate end-user policies and security best practices

220-902 Objective 5.4

Demonstrate proper communication techniques and professionalism.

- Use proper language (avoid jargon, acronyms, and slang when applicable)
- Maintain a positive attitude/project confidence
- Actively listen (taking notes) and avoid interrupting the customer
- Be culturally sensitive
 - Use appropriate professional titles, when applicable
- Be on time (if late contact the customer)
- Avoid distractions
 - Personal calls
 - Texting/social media sites
 - Talking to co-workers while interacting with customers
 - Personal interruptions
- Dealing with difficult customer or situation
 - Do not argue with customers and/or be defensive
 - Avoid dismissing customer problems
 - Avoid being judgmental
 - Clarify customer statements (ask open-ended questions to narrow the scope of the problem, restate the issue or question to verify understanding)
 - Do not disclose experiences via social media outlets
- Set and meet expectations/timeline and communicate status with the customer
 - Offer different repair/replacement options if applicable
 - Provide proper documentation on the services provided
 - Follow up with customer/user at a later date to verify satisfaction

- Deal appropriately with customers' confidential and private materials
 - Located on a computer, desktop, printer, etc.

220-902 Objective 5.5

Given a scenario, explain the troubleshooting theory.

- Always consider corporate policies, procedures and impacts before implementing changes.
1. Identify the problem
 - Question the user and identify user changes to computer and perform backups before making changes
 2. Establish a theory of probable cause (question the obvious)
 - If necessary, conduct external or internal research based on symptoms
 3. Test the theory to determine cause
 - Once theory is confirmed, determine next steps to resolve problem
 - If theory is not confirmed, re-establish new theory or escalate
 4. Establish a plan of action to resolve the problem and implement the solution
 5. Verify full system functionality and if applicable implement preventive measures
 6. Document findings, actions, and outcomes