

A+ (220-901)

Project Workbook

Presented By
LK LearnKey®

A+ (220-901)

First Edition

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Fill-in-the-Blanks

Instructions: While watching A+ (220-901) Domain 1: Hardware Training, fill in the missing words according to the information presented by the instructor. [References are found in the brackets.]

The BIOS

1. Depending on the computer's BIOS, devices can be enabled and disabled, _____ support can be utilized, and the computer's clock speed can be altered. [BIOS Diagnostics and Monitoring]

Everything about Motherboards

2. An _____ motherboard is usually 12 x 9.6 inches. [Motherboard Sizes]
3. A _____ chip interacts with the CPU, RAM, and a slot dedicated for graphics. [Chipsets]
4. Bus speeds are measured in _____. [Bus Speeds]

RAM Features

5. _____ RAM is only used in high-end machines since it is expensive. [RAM Characteristics]
6. In order to determine the PC speed, multiply the number of MHz by _____. [RAM Compatibility]

Install and Configure Expansion Cards

7. A storage card sometimes has built-in _____ support. [Other Expansion Cards]

Storage Devices

8. An optical disc can be _____ Memory or Rewritable. [Install an Optical Drive]
9. Magnetic hard disk drive speeds are measured in _____. [Magnetic Hard Drives]
10. A _____ drive uses traditional HDD technology, however it uses a solid-state drive for cache purposes to speed up overall performance. [Solid-State Drives]
11. One method of backing up data to tapes is the _____, _____, _____ method. [Tape Drive]

CPUs and Cooling

12. BGA and _____ are two types of CPU sockets. [Socket Types]
13. A CPU cache stores data the CPU will need again later in _____. [CPU Characteristics]
14. Multiple _____ in a computer device does not mean it has multiple processors. [CPU Characteristics]
15. _____ can be cleaned off of a CPU using isopropyl alcohol. [CPU Cooling]

PC Connection Interfaces

16. The shorter the _____ cable, the higher data transfer speeds can be. [Physical Connections]
17. A 6-pin or 9-pin _____ cable can be used to transfer data and provide power to a device. [Physical Connections]
18. _____ connectors can transfer both audio and video data digitally. [Audio, Video, and Network Connections]
19. Ethernet cables connect using 8-pin _____ connectors. [Audio, Video, and Network Connections]
20. Bluetooth devices are usually _____. [Wireless Connections]
21. Digital data is sent in _____ as 1s and 0s. [Interface Characteristics]

Install a Power Supply

22. _____ connectors are used to power hard disk drives. [Power Supply Connector Types]

Custom PC Configurations

23. A virtualization workstation utilizes VM software such as _____, VMware, or Virtual Box. [Choosing a Workstation]
24. Gaming PCs require a sound card which is compatible with at least a _____ surround system. [Choosing a Workstation]

Display Devices

25. LCD monitors use two types of monitor panels, Twisted Nematic or _____. [Types of Displays]
26. _____ resolution is the default and recommended resolution of a monitor. [Resolution]
27. Brightness is measured in _____. [Brightness]
28. _____ is the standard analog interface. [Analog vs. Digital]
29. Privacy filters are essential in _____ environments. [Privacy/Anti-Glare Filters]
30. Currently the most common aspect ratio is _____. [Aspect Ratios]

PC Connector Types

31. _____ is compatible with VGA. [Display Connector Types]
32. Up to _____ USB devices can be connected to one port using hubs. [Device Cables and Connectors]
33. USB A, _____, Mini, and _____ are USB connector types. [Device Cables and Connectors]

Peripheral Devices

34. A _____ is usually part of a multi-function printer. [Input Devices]
35. Apple TV and Chromecast are examples of a _____ device. [Input and Output Devices]

Install Printers

36. _____ can be used to connect a printer to a device up to 10 meters away. [Remote Printing]
37. A _____ is embedded memory which acts as a buffer between the computer and the platter used for storage. [Share Devices]

Printer Technologies and Processes

38. A laser printer consists of pickup rollers, separate pads, _____, transfer rollers and belts, and a fuser assembly. [Laser Printer Parts]
39. During the laser printer image process, toner is applied to the paper during the _____ step. [Laser Printer Process]
40. Inkjet printing can be performed using a thermal or a _____ process. [Inkjet Printer Processes]
41. _____ are used to heat the thermal paper used in a thermal printer. [Thermal Printer Processes]
42. An impact printer uses paper with _____ on the sides. [Impact Printer Processes]

Printer Maintenance

43. A thermal printer has a _____ which will need to be cleaned once in a while using isopropyl alcohol. [Thermal Printer Maintenance]
44. If the pins inside of an impact printer stop working, the _____ will need to be replaced. [Impact Printer Maintenance]

Checking for a Firmware Upgrade

Description:

Each BIOS manufacturer has a set way for upgrading the firmware on a machine. The most common reason for upgrading a BIOS is to get a feature enhancement only available in the BIOS. For example, a firmware upgrade may be necessary to support a larger hard drive or hard drive partition. Or a feature such as intrusion detection may be available as a result of a firmware upgrade.

The most important step in upgrading firmware is to follow the manufacturer's instructions for downloading and upgrading firmware. Some upgrades can only be done on a machine reboot. Others can be done right from Windows. Most of the time, the most important instruction given will be to not turn off or unplug the machine during the firmware upgrade.

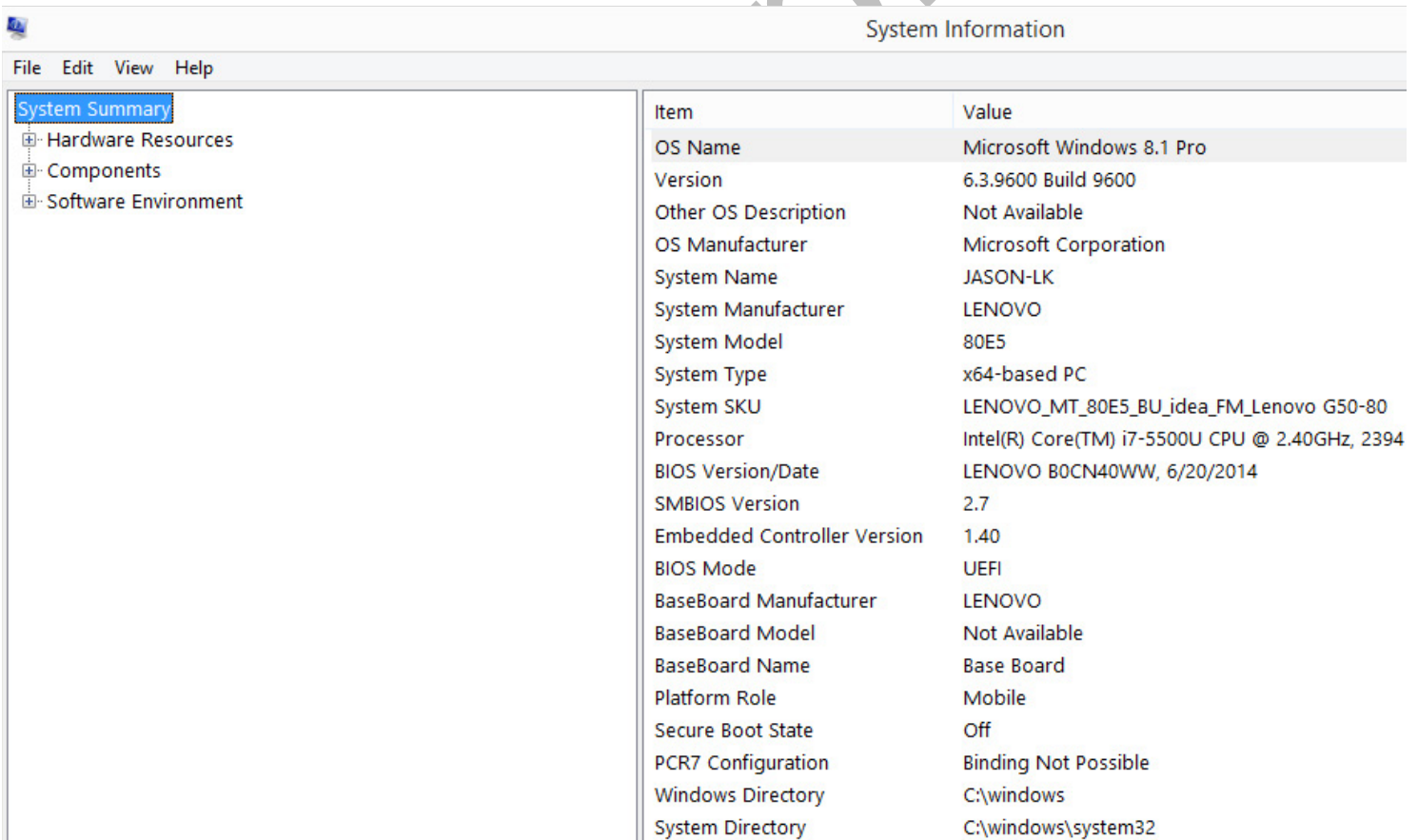
The most common steps for performing a firmware upgrade are:

1. Checking the version number of the current BIOS.
2. Going to the website of the BIOS manufacturer to see if there is an upgrade available. In this step, the version number of the BIOS is the key component.
3. If an upgrade is needed, downloading and installing the upgrade.

Given that manufacturers vary widely in how they handle a firmware upgrade, this project will focus primarily on obtaining the BIOS version on a computer and then checking the manufacturer's website to see if a newer version is available.

Steps for Completion:

1. On a Windows machine, click the Start button or press the Start key on the keyboard.
2. Type: msinfo32.
3. If you are on a Windows Vista or Windows 7 machine, press the Enter key. If you are on a Windows 8 machine, click the msinfo32.exe program link. You will see the following:



The screenshot shows the 'System Information' window in Windows. The left sidebar has a tree view with 'System Summary' selected. The main area displays a table of system information.

Item	Value
OS Name	Microsoft Windows 8.1 Pro
Version	6.3.9600 Build 9600
Other OS Description	Not Available
OS Manufacturer	Microsoft Corporation
System Name	JASON-LK
System Manufacturer	LENOVO
System Model	80E5
System Type	x64-based PC
System SKU	LENOVO_MT_80E5_BU_idea_FM_Lenovo G50-80
Processor	Intel(R) Core(TM) i7-5500U CPU @ 2.40GHz, 2394
BIOS Version/Date	LENOVO B0CN40WW, 6/20/2014
SMBIOS Version	2.7
Embedded Controller Version	1.40
BIOS Mode	UEFI
BaseBoard Manufacturer	LENOVO
BaseBoard Model	Not Available
BaseBoard Name	Base Board
Platform Role	Mobile
Secure Boot State	Off
PCR7 Configuration	Binding Not Possible
Windows Directory	C:\windows
System Directory	C:\windows\system32

4. Look for the BIOS Version/Date information in the middle of the screen.
5. Open Internet Explorer.
6. Navigate to the website of your computer manufacturer. Again, the actual website you browse to will vary.
7. Find a support section. In many cases, the site will be support.<your computer manufacturer>.com.

8. Find the area that contains the driver downloads for your particular device. Here is an example of what one looks like:

Component	BIOS/UEFI	Operating System	Windows 8.1 (64-bit)	keyword
Component	Title	Downloads	Date	Operating System
 BIOS/UEFI	BIOS Update for Windows 7 (32-bit, 64-bit), Windows 8 (64-bit), Windows 8.1 (64-bit), Windows 10 (64-bit) - Lenovo G40-80, G50-80, G50-80 Touch	  README for BIOS Update ver. 96	10/22/2015	Windows 7 (32-bit) Windows 7 (64-bit) Windows 8 (64-bit)
		  BIOS Update ver. 96	10/22/2015	Windows 8.1 (64-bit) Windows 10 (64-bit)

9. If the version number and/or date of the BIOS on the website is newer than the one on your computer, take the time to first read any instructions for updating the BIOS and then download and run the BIOS update.

Points to Remember:

- The first step in possibly upgrading firmware is finding out the current version of the computer BIOS.
- When upgrading firmware, be sure to follow the manufacturer's instructions exactly as stated.

Reference:

LearnKey's A+ 220-901 Training, Domain 1, Session 1
The BIOS: BIOS Flash Update

Difficulty: Intermediate

Estimated Time to Complete: 15 minutes [45 if one goes through with the BIOS update]

Required Materials: A Windows machine

Objectives:

1.0 Hardware

- 1.1 Given a scenario, configure settings and use BIOS/UEFI tools on a PC
 - 1.1.a Firmware upgrades – flash BIOS

BIOS Component and Configuration Information

Description:

The Basic Input Output System (BIOS) is code, embedded into a computer's hardware, which provides a computer with basic startup instructions. The BIOS is responsible for making sure a computer has the hardware it needs (CPU, RAM, hard disks, video, and in most cases, a network card) in order to start up and then load an operating system.

Occasionally, the BIOS needs to be configured. Sometimes, it is a matter of enabling a new hardware device or disabling one no longer in use. Sometimes, it is a matter of setting a password just to start up a computer or deleting a password when one is no longer needed just to start up a computer.

In this project, you will explore the basic components of a BIOS. Different computers will have different BIOS screens, so the actual project steps may vary. However, the different BIOS types do have the following in common:

- You will need to use the keyboard to navigate through the BIOS. The mouse will not work in a BIOS screen.
- The BIOS is reached through pressing a key (usually F2, F12, or Delete) when the computer starts up. If you see a Windows logo, it is too late. Shut down, restart the computer, and try again.
- For most BIOS settings, once the setting has focus, pressing the Enter key will open the setting options. Then the arrow keys or the plus or minus keys on the keyboard will allow for changes in those settings.

The screen shots for this project were taken from a virtual machine installation of Windows 8. Again, your screens may vary.

Steps for Completion:

1. Restart (or start) a Windows computer. When you see the splash screen, look for the key to press to enter the setup screen. If you press the key in time, the BIOS will appear. If not, restart the computer and try again. The BIOS startup screen will appear and will look similar to this:

PhoenixBIOS Setup Utility			
Main	Advanced	Security	Boot Exit
System Time: [09:58:53]		Item Specific Help <Tab>, <Shift-Tab>, or <Enter> selects field.	
System Date: [12/15/2015]			
Legacy Diskette A: [1.44/1.25 MB 3½"]			
Legacy Diskette B: [Disabled]			
▶ Primary Master [None]			
▶ Primary Slave [None]			
▶ Secondary Master [None]			
▶ Secondary Slave [None]			
▶ Keyboard Features			
System Memory: 640 KB			
Extended Memory: 2096128 KB			
Boot-time Diagnostic Screen: [Disabled]			
F1 Help	↑↓ Select Item	-/+ Change Values	F9 Setup Defaults
Esc Exit	↔ Select Menu	Enter Select ▶ Sub-Menu	F10 Save and Exit

2. The Main tab will tell you the system date and time, the hard disk(s) in use, the optical drives in use, and the amount of RAM on the machine. Sometimes the disks will not show unless the disk is selected. Press the arrow key downward until you see the Primary Master drive selected and then press the Enter key to see a screen similar to the screen on the right:
3. You may notice that the specifications for the disk appear, such as the type (regular hard drive or solid-state drive) and the disk size. Or, as seen in the screen above, the type may be set to Auto, as in an automatic detection of the hard drive. Press the Esc key on the keyboard to exit the hard drive screen.

PhoenixBIOS Setup Utility		
Main		
Primary Master [None]		Item Specific Help
Type:	[Auto]	User = you enter parameters of hard-disk drive installed at this connection. Auto = autotypes hard-disk drive installed here. 1-39 = you select pre-determined type of hard-disk drive installed here. CD-ROM = a CD-ROM drive is installed here. ATAPI Removable = removable disk drive is installed here.
Device:	Primary Master	
Multi-Sector Transfers:	[Disabled]	
LBA Mode Control:	[Disabled]	
32 Bit I/O:	[Disabled]	
Transfer Mode:	[Standard]	
Ultra DMA Mode:	[Disabled]	
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults		

PhoenixBIOS Setup Utility		
Main	Advanced	Security Boot Exit
Multiprocessor Specification: [1.4] Installed O/S: [Other] Reset Configuration Data: [No] ▶ Cache Memory ▶ I/O Device Configuration Large Disk Access Mode: [DOS] Local Bus IDE adapter: [Both] ▶ Advanced Chipset Control		Item Specific Help
		Configures the MP Specification revision level. Some operating systems will require 1.1 for compatibility reasons.

6. Press the Enter key to examine the I/O configuration screen, as seen here:

I/O Device Configuration		Item Specific Help
Serial port A:	[Auto]	Configure serial port A using options: [Disabled] No configuration [Enabled] User configuration [Auto] BIOS or OS chooses configuration
Serial port B:	[Auto]	
Mode:	[Normal]	
Parallel port:	[Auto]	
Mode:	[Bi-directional]	
Floppy disk controller:	[Enabled]	

4. Press the right arrow key on the keyboard to navigate to the Advanced screen. Here you will see processor, operating system (if applicable), and device configuration, as seen on the left:
5. Press the down arrow key on the keyboard until the I/O Device Configuration (meaning input/output device configuration) area is highlighted.

7. On this screen, you will see which ports are enabled and which ones are disabled. A common real-life setting to change here involves enabling or disabling USB ports. When you are done viewing this screen, press the Esc key on the keyboard to return to the Advanced screen.
8. Press the right arrow key on the keyboard to move to the Security tab. You will see the screen on the right:
9. On the Security tab, you will see information for setting up BIOS passwords, if applicable. You may also see information on intrusion/detection notification, which notifies a user that the cover has been removed from the computer. When you have finished examining the security area, press the right arrow on the keyboard to move to the Boot screen. You will see a screen that looks similar to the screen on the right:
10. On the Boot screen, you can control the boot order of the computer. For example, if Removable Devices is the first disk type listed in the boot order, and you want the hard drive to be the first disk in the boot order, press the minus key on the keyboard to move removable devices down in the boot order list (or the key the screen instructions tell you to press to move the disk type down in the boot order).
11. To move to the Exit screen, press the right arrow key on the keyboard. A typical exit screen looks like this:

	Item Specific Help
Supervisor Password Is: Clear User Password Is: Clear Set User Password [Enter] Set Supervisor Password [Enter] Password on boot: [Disabled]	Supervisor Password controls access to the setup utility.

words, if applicable. You may also see information
a notification, which notifies a user that the
ed from the computer. When you have finished
y area, press the right arrow on the keyboard to
en. You will see a screen that looks similar to the

Removable Devices +Hard Drive CD-ROM Drive Network boot from Intel E1000e
--

Item Specific Help	
Exit Saving Changes	Exit System Setup and save your changes to CMOS.
Exit Discarding Changes	
Load Setup Defaults	
Discard Changes	
Save Changes	

12. From this screen, you can save any changes to the BIOS or discard those changes. Press the down arrow key on the keyboard until the Exit Discarding Changes setting is highlighted.
13. Press the Enter key. If you are prompted to continue, press the Enter key again. Your system will reboot.

Points to Remember:

- BIOS settings vary from computer to computer.
- Take the time to go through the BIOS settings on one or more computers and make sure to experiment with topics under the test objectives.
- You always have a chance to discard BIOS changes before making them permanent.

Reference:

LearnKey's A+ (220-901) Domain 1: Hardware Training
The BIOS: BIOS Tour; BIOS Configuration

Difficulty: Beginner

Estimated Time to Complete: 30 minutes [This will depend upon how many changes one makes to the BIOS and then examines those changes after a restart.]

Required Materials: A computer

Objectives:

1.0 Hardware

- 1.1 Given a scenario, configure settings and use BIOS/UEFI tools on a PC
 - 1.1.b BIOS component information
 - 1.1.b.i RAM
 - 1.1.b.ii Hard drive
 - 1.1.b.iii Optical drive
 - 1.1.c BIOS configurations
 - 1.1.c.i Boot sequence
 - 1.1.c.ii Enabling and disabling devices
 - 1.1.c.iii Date/time

BIOS Configurations and Diagnostics

Description:

In addition to displaying component information, many computer BIOSes also provide for the ability to configure items such as clock speeds, virtualization support, and diagnostics. Here is an example of what one may find when in a BIOS:

Item	What it Does
Central Processing Unit (CPU)	Shows the speed of the CPU on the system. Some BIOS versions give people the ability to set clock speeds for the CPU. A faster clock speed can mean better performance but it also tends to dissipate more heat into the system, which could harm the computer's components.
Virtualization Support	If available and enabled, the computer can host 64-bit virtual machines. Without this, a computer can at best host 32-bit virtual machines.
Drive Encryption	Enabling drive encryption requires a password to access any data on the drive should the drive be moved to another machine. A Trusted Platform Module (TPM) chip is a chip that stores encryption keys for hardware authentication.
LoJack	A device that can makes a computer locatable should it be stolen.
Secure Boot	New in Windows 8. This will prevent a computer from starting up if the boot loader is not digitally signed by Microsoft. This feature is enabled by default on Windows 8 computers.
Diagnostics	On many computers, a memory diagnostics test can be run in the BIOS.

In this project, you will identify the feature that needs to be enabled in the BIOS given a situation.

Steps for Completion:

- For each situation, identify the BIOS feature that needs to be enabled:
 - A tester needs to install a 64-bit edition of Windows 7 as a virtual machine: _____
 - An executive wants to make sure a laptop can be located if it is stolen: _____
 - A technician needs to run a memory test on a PC: _____
- On a computer, boot into the BIOS and list each feature from the feature list described in this project:

Points to Remember:

- Changing the clock speed in the BIOS can have an adverse effect on the cooling inside of the computer.
- Drive encryption is usually made possible through a Trusted Platform Module (TPM) chip inside of the computer.
- Secure boot ensures that the boot loader in Windows 8 (or 8.1) is digitally signed.

Reference:

LearnKey's A+ (220-901) Domain 1: Hardware Training
The BIOS: BIOS Tour; BIOS Configurations; BIOS Diagnostics and Marketing

Difficulty: Beginner

Estimated Time to Complete: 20 minutes

Required Materials: A computer

Objectives:

1.0 Hardware

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

1.1.b BIOS component information

- 1.1.b.iv CPU
1.1.c BIOS configurations

1.1.c.iv Clock speeds

- 1.1.c.v Virtualization support
1.1.c.vi BIOS security (passwords, drive

encryption: TPM, LoJack, secure boot)

- 1.1.d Built-in diagnostics

LearnKey BIOS Monitoring

Description:

One function of the BIOS is the ability to monitor crucial computer functions. For example, many BIOSes can monitor temperature, fan speeds, bus speeds, voltage readings, and whether the cover has been removed from the computer case. Here are some details on what some BIOSes will display, and the settings to look for when viewing these monitoring features:

Feature	Details
Temperature Monitoring	Shows the degrees, usually in Celsius, of the CPU and the hard drive(s) in the computer. For most systems, 40 degrees Celsius or less is ideal. If the temperature is in Fahrenheit, subtract 32 and then divide by 1.8 to get the Celsius equivalent.
Fan Speeds	Shows the computer fans and the speeds at which they are operating. If one fan is much slower than the rest of the fans, it may be a sign that the fan needs to be cleaned or replaced.
Intrusion Detection/Notification	A feature to alert the next person who starts up the computer that the case cover has been lifted from the computer.
Voltage	Shows voltage settings for 3V (volts), 5V, and 12V wires in the computer. A voltage reading within five percent of the given standard for a wire is considered acceptable.
Clock	Shows the clock speed of the CPU. If the clock speed is faster than the advertised clock speed of the CPU, the system has been set to overclock and special attention needs to be paid to the system temperature to make sure it is not overheating the system.
Bus Speed	Shows the speed of the system bus. The bus speed x the multiplier = the overall CPU speed.

In the project exercise, you will explore real-life situations using the BIOS monitoring tools.

Steps for Completion:

1. For a 12V wire, what would be considered the lowest acceptable voltage? _____
2. For a 12V wire, what would be considered the highest acceptable voltage? _____
3. A system BIOS indicates the temperature of the CPU is 100 degrees Fahrenheit. Is this too high? _____
4. Explore the BIOS in a computer. Use the space below to write down any monitoring tools you discover.

Points to Remember:

- BIOS monitoring can monitor temperature, fan speeds, voltage, clock speeds, and bus speeds.
- BIOS monitoring can also contain an intrusion detection/notification feature to notify the person booting up the system that the case cover has been removed.

Reference:

LearnKey's A+ (220-901) Domain 1: Hardware Training
The BIOS: BIOS Tour; BIOS Diagnostics and Monitoring

Difficulty: Beginner

Estimated Time to Complete: 20 minutes

Required Materials: A computer

Objectives:

1.0 Hardware

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

1.1.e Monitoring

- 1.1.e.i Temperature monitoring
- 1.1.e.ii Fan speeds

1.1.e.iii Intrusion detection/notification

- 1.1.e.iv Voltage
- 1.1.e.v Clock

1.1.e.vi Bus speed

An Introduction to Motherboards

Description:

Motherboards (also known as system boards) are the electrical circuit boards which sit inside of computers of all types. Motherboards are found in desktops, laptops, home theater systems, tablets, smartphones, and many other types of computing devices. Motherboards get their power from the power supply in a computer. With that power, other peripherals, such as memory, hard drives, video cards, network cards, and other expansion cards can function. Without a functioning motherboard, a computer will cease to operate. There are four basic types of motherboards currently used in computing devices. These four types are also the focus of types of motherboards covered in the A+ exam. They are:

Advanced Technology Extended (ATX): The most common motherboard for desktop computers. These will typically have several expansion slots for video, network, and similar types of expansion cards. ATX motherboards are typically 12 x 9.6 inches dimension but can vary based on the case for which they are designed.

Micro-ATX: A smaller form of the ATX motherboard, typically 9.6 x 9.6 inches size. Because these motherboards are smaller than full-size ATX motherboards, they typically do not have as many expansion slots as the full-size ATX motherboards.

Information Technology eXtended (ITX): Small-form factor boards, also known as embedded boards. The main characteristic of these motherboards is their use of passive cooling. Passive cooling is a fan-less cooling system. ITX motherboards do not use much power, thus the lack of a need for cooling using fans.

Mini-ITX: Small-form factor ITX motherboards. These motherboards are usually found in home theater systems and thin client machines. Thin client machines are mini-computers that have the bare minimum needed for computing.

In the next project exercise, you will identify the motherboard needed for a given type of system.

Steps for Completion:

1. Which type of motherboard is seen on the right of the page?

2. Which type of motherboard would be used in a home theater system? _____
3. Which type of motherboard is usually square in size?

Points to Remember:

- ATX motherboards are the most common motherboards in desktop computers.
- ITX motherboards use passive cooling.
- Both ATX and ITX motherboards have miniature versions for smaller devices (Micro-ATX and Mini-ITX).

Reference:

LearnKey's A+ (220-901) Domain 1: Hardware Training
Everything about Motherboards: Motherboard Sizes

Difficulty: Beginner

Estimated Time to Complete: 5-20 minutes [if one has several motherboards to look at and examine their features]

Required Materials: As many motherboards as you can get to examine

Objectives:

- | | |
|---|--------------------|
| 1.0 Hardware | 1.2.a.iii Mini-ITX |
| 1.2 Explain the importance of motherboard components, their purpose, and properties | 1.2.a.iv ITX |
| 1.2.a Sizes | |
| 1.2.a.i ATX | |
| 1.2.a.ii Micro-ATX | |

