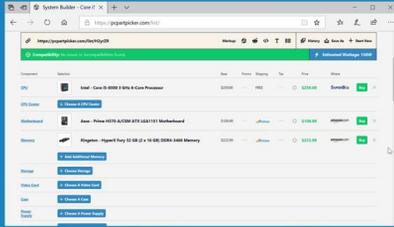


# ITFreeTraining



## Motherboard Picking Installation

For the free video please see  
<http://itfreetraining.com/ap/1b95>

In this video from ITFreeTraining I will look at picking and installing a motherboard. The motherboard is one of the most important parts of a computer because ultimately it determines what else the computer can support.

# Purpose of The Computer



Basic applications  
E-Mail/Internet/Office



Gaming



Workstation/Server

0:12 The first decision you will need to make is what is the purpose of the computer that you will be putting together. Computers can be used for many things; however, they generally fall into three different categories. The first is being used for basic applications like e-mail, internet and office work. These computers, since they don't require too much performance generally don't cost too much.

The second category is gaming computers. These computers tend to have higher specifications than the basic computers and also may include a powerful video card. It is possible to purchase a cheap gaming computer, but if you want some good performance, you are going to have to spend more money, particularly for the graphics card.

The last category is workstation or server. These can be cheap or cost a lot of money and generally cost more than your basic computer. The high-power workstation generally has more processing power. This can include things like more memory or specialized memory, additional CPUs and multiple monitors. All these features require a motherboard that can support these features. Thus, workstation and server motherboards cost more money due to having to support additional features.

# Intel/AMD



- \* Intel products <https://ark.intel.com>
- \* AMD <https://www.amd.com/en/products/specifications/processors>
- \* CPU Benchmarks <https://www.cpubenchmark.net>

1:33 The first choice you will need to make when selecting a motherboard is, are you are going to use an Intel or an AMD CPU? Motherboards will only support one type of CPU of one socket type. You will also find that it is not uncommon for motherboards to only support certain CPUs of that socket type.

Intel and AMD have come up with very different solutions for accessing memory. Each CPU will also have different features. For example, some CPUs will have video support so the computer will not require a graphics card. For these reasons, Intel and AMD motherboards are built very differently.

Nowadays, the CPU is also tied into how much memory the system can support. Choosing the right CPU will determine what features the motherboard will be able to support. To compare Intel CPUs, Intel has the Ark website. This site will also allow you to compare Intel's other products.

AMD also has a similar website that will allow you to compare AMD CPUs with each other. There are so many components in a computer system. Since Intel and AMD have different approaches on how to design a CPU, the motherboards designs are very different. Because of this, it can be difficult to compare CPUs because it depends on what software and hardware you are using. Memory intensive applications may run better on some motherboards while CPU intensive applications may run better on other motherboards.

To get some idea which CPU may meet your needs, the CPU benchmark website compares a lot

of different systems together. This will give you an idea of which CPU you should choose. Once you select which CPU you want to use, the next step is to select a motherboard that will work with your CPU.

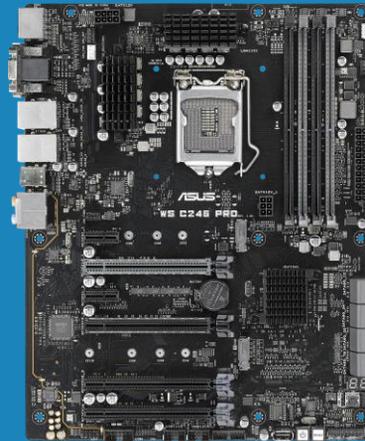
# Features

## Asus - ROG STRIX Z390-E GAMING



- 15 USB ports
- Wireless
- Bluetooth
- Overclocking
- AIO Header

## Asus - WS C246 PRO



- 9 USB ports
- 2 Network adapters
- Remote management
- ECC memory
- Supports Xeon CPU

3:31 To select a motherboard, you should start considering what features you need and what you don't. You don't want to pay for features that you are never going to use. Motherboards are designed with a specific purpose in mind. Let's consider two motherboards to understand why.

At the time this video was created, both these motherboards cost around about the same, but designed with a different purpose in mind. The first motherboard was designed for gaming, while the second was designed with business in mind.

If I compare the features, the gaming computer has 15 USB ports and the business one has 9 USB ports. The business computer is designed for a high-end workstation or a server so it is anticipated that it will not need as many USB ports.

The gaming computer has a built-in wireless and Bluetooth adapter. A business computer generally does not need this unless the computer is a laptop. However, the business motherboard has two network adapters where the gaming computer only has the one. The motherboard also supports remote management where the gaming motherboard does not. This gives the administrator the choice to use one network card for general use and the other for remote management. Remote management allows the computer to be controlled from a remote location which is useful in business, but not something the average gamer would be interested in.

The gaming motherboard comes with overclocking. Overclocking is popular in the gaming

industry and you can see why this option is included. The motherboard also includes an AIO header. AIO stands for All-in-one and is used for liquid cooling. If you want to overclock, you may want to consider liquid cooling to keep the computer from getting too hot.

The business motherboard on the other hand, supports ECC memory and Xeon CPU. ECC is error correcting memory. Memory errors are rare, but if you are using ECC memory it will hopefully be able to correct the error or detect it and stop the computer. If the computer is being used in a business environment, you would most likely want reliable memory over performance. For example, in the banking industry you don't want an amount in a transaction to change due to a memory error.

Xeon CPUs are designed with business in mind. The Xeon processors have advanced features like more cache, more cores and extra reliability compared with consumer CPUs.

So, when you are selecting a motherboard, consider what market the motherboard is aimed at. If this meets your needs then this may be the motherboard you are after. The more expensive motherboards will tend to have more features, but if you don't need these features you may be able to find a cheaper motherboard that does not have those features.

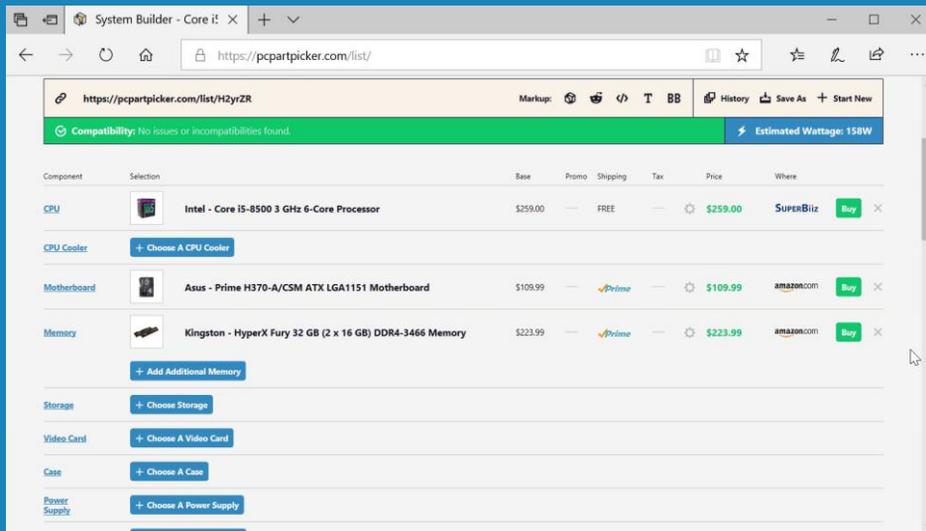
# Computer Case



6:27 The next point to consider is buying a computer case that will work with your motherboard. Most motherboards use the ATX standard and will fit in a standard computer case. The computer case you choose will determine how many components can be installed in the computer.

In the case of a server, you may want additional space for components. For example, a server may require a lot of storage. For this extra storage you need additional space. You can always get a small computer case as well. The small computer cases will often only be able to house a smaller motherboard. The point to remember is, whatever motherboard you purchase, make sure you purchase a computer case that can use that motherboard. The next thing is to work out what to buy.

# PCPartPicker.com



7:16 One tool that I like to use to assist me purchasing equipment is the website PCPartPicker.com. This site allows you to select components to build your computer system. The advantage of using this site is that it checks each part to make sure they are compatible with each other.

The site also gives you online stores that will sell you the components. I generally use this site to check my builds to make sure I have not missed anything. For example, when I purchased my first 2011 CPU I did not know that you were required to purchase your own CPU cooler. The website quickly informed me a CPU cooler was required with that CPU. The website also highlights other possible problems like requiring a BIOS update before a CPU or memory will work.

Before I purchase components, I will first check my build using this web site. When possible, ask the store you are purchasing the components from to confirm that the components that you have purchased will work together. If you find that a motherboard needs a BIOS update in order to work, if you have that confirmation before you buy, hopefully the store will upgrade the BIOS for you for free. Just having that confirmation also may help you return the items if they do not work together without having to pay additional fees like a restocking charge.

To build your system, press the button "System Builder". You will notice that you have a lot of options to choose the components that you want. To start with, I will select the option "Choose A CPU".

This will show you a very long list of all the CPUs that are currently on the market. If I scroll down, you will notice there are a lot of filtering options which will reduce the list of CPUs. In this case, I want to build a computer for running virtual machines and server activities. For this reason, I don't want to install a video card, so I will select the option "Intel UHD Graphics 630". This will limit the CPUs down to the ones that have this feature. This feature means the CPU has built-in graphics capability so you won't need to install a video card in this computer. I could have also selected a motherboard with a built-in graphics card.

Next, I will select the socket LGA1151. This socket is pretty popular at the moment and is a reasonably powerful CPU. I will then select the option "Intel Core i5". The i5 core CPUs are mid-range CPUs. They have a lot of good features and will meet the budget I have set aside for this computer.

You will notice the list has reduced down a great deal. You can also reduce the list based on a lot of other filters, for example if price was your number one concern. Once you have worked out which CPU you want, it is just a matter of pressing the add button to add it to your build.

You will notice the next option is to add a CPU cooler. In this case I will just use the CPU cooler that is shipped with the CPU.

Next, I will select the option "Choose A Motherboard". You will notice that if I scroll down, there are a lot of motherboards listed and a huge number of filtering options to choose from. Since I am purchasing a CPU with video capabilities, I will select the onboard video option of "Depends on CPU". I want a motherboard that can use the onboard video. When selecting components for a system, you don't want to waste money on features that you are not going to use. For this reason, I want to remove motherboards from the list that also have a built-in video card since I won't be needing it.

I will now scroll up and select the number of memory slots as a minimum of four. I want the option to be able to install a decent amount of memory in this computer, so four slots will give me some room to expand.

I will select a minimum of two M.2 slots as I want this system to have good storage performance. Two slots will allow me to have one used for the operating system and the second used for data.

You will notice that, under chipset, there are a lot of different chipsets listed. Most are grayed out because the other options have filtered these chips out of the list. I only chose this chipset as I know my local store is stocking some motherboards with

this chipset at the moment.

Next, I will choose the form factor of “ATX”. Most motherboards on the market are ATX form factor, but it is best not to assume. I am choosing this option as I already have a computer case and I want to make sure the motherboard will fit in that particular case. Keep in mind this site only checks the basic computer case features like the form factor. It does not check things like if the computer case is large enough to fit a large aftermarket CPU cooler. So, some additional checking for the computer case may be required.

In this case, I will select the Asus Prime motherboard. I will select this one as I know my local store has this motherboard currently in stock.

Next, I will need to buy some memory for the computer. To do this, I will select “Choose Memory”. You will see that, when I scroll down, there are a lot of filtering options and a lot of memory to choose from. Much of the list has already been filtered down based on the motherboard I selected, but you can see there is still a lot of choice.

In this case, I want to purchase 16 Gigabytes so I will select the option for two 8 Gigabyte memory modules. Generally, buying two memory modules at once is the cheaper way to do it. I will go up to Manufacturer and select the manufacturer “Kingston”. You may have a particular manufacturer that you like buying from or maybe you go for the manufacturer with the lowest price, the choice is up to you.

I will choose the Kingston HyperX fury memory from the list. Once selected, I am free to add additional components if I wish. Since I already have a computer case and will be purchasing the storage later on, I am done with my build for the moment. At the top right you can see an estimate of the watt usage for this computer is 185 watts. This site is useful at estimating what sort of power supply you will need. Remember that if you want to use this feature, you need to enter in all the components that the computer is using to get an accurate estimate.

I will scroll down to the bottom and you can see the most important part is the price of the order. Now that I know what I want and I know it will work, I just need to go out and buy it. Back in a moment.

# Demonstration

14:08 Now that I have the parts I need, I will install the motherboard. In this video I will focus on installing the motherboard, but in later videos I will look at installing components like the CPU and memory. However, you will find that the motherboard is the hardest part to install and upgrade. This is because everything else is attached to it and thus everything has to be plugged into it, or unplugged to remove it. Generally, this is the most time-consuming part.

I have the computer case that I want to install the motherboard into on my anti-static mat. The first step is to attached the mat to the case. Nowadays, most computer cases are painted and thus this makes it difficult to attach an anti-static clip to. The motherboard is attached to the computer case using what is called a standoff. More on that later in the video. This computer case has some standoffs pre-installed, so I will use one of the standoffs for the anti-static strap. I know I can use this standoff as the standoff is only used with larger motherboards and the motherboard I am using is a smaller motherboard.

So, I will attach my anti-static mat to the standoff. Next, I will attach my anti-static strap to the standoff. Even if you don't have an anti-static mat, you can still attach your anti-static strap to the computer case. Although it is not ideal to work on a computer without an anti-static mat, the computer case will be able to collect some static electricity. There is some debate about leaving the power cable in to ground the computer and switching the power supply off, but this increases the risk of electrocution if something was to go wrong. So general best practice is to unplug the computer when working on it, even if you don't have any anti-static mat or equipment.

The first step to installing the motherboard is installing the IO shield. The IO shield is a piece of metal that is attached to the back of the computer. It prevents dust from getting into the computer and helps with electronic interference.

One trick to make it easier to install is to bend some of the clips back a little so they are close to right angles. This makes it easier to get the motherboard in later on. The next step is to place the IO shield into the case. They can be a little tricky to get into place. If you are having trouble try pushing in on the corners until you hear it click into place.

You can see that there are six standoffs in the computer case pre-installed. The next step I like to do is to put the motherboard in place to make sure the standoffs are installed and the IO shield is correct.

You can see the IO shield is installed correctly as the connections at the back of the computer line up with the IO shield.

You can see in this motherboard there are eight screw holes for standoffs. A standoff is essentially a separator that is made to a defined length. Its job is to raise the motherboard from the computer case by a defined height so it does not come in contact with the computer case, which risks shorting the motherboard. Remember, computer equipment is made to a specific standard. Everything needs to be of the right measurements to ensure that all components of a computer fit together.

We can use four of the existing standoffs and two we cannot. If the additional standoffs are in contact with the motherboard they need to be removed. In this case, the two extra standoffs are not touching the motherboard so they can stay where they are. So, another four standoffs will need to be installed for this motherboard.

The next step is to remove the motherboard and install the additional standoffs. To install the standoffs, a nut driver can be used, which is found in most computer tool kits. It is just a matter of putting the standoff in the nut driver and then screwing the standoff in. When screwing the standoff in, like all the other screws in the computer, they are pre-threaded. You only need to screw it in until it is finger tight. When you feel it has got to the end of thread stop screwing it in. If you attempt to screw it in any harder, you risk damaging the thread. Also remember you may want to get the standoff out again one day so you don't want it in too tight.

If you don't have the nut driver, you can just screw the standoffs in by hand and again just screw them in until they are finger tight. In some computer cases, you may need to use a little force, particularly if the case is new. This is because the thread may be a little blocked with material or incomplete when manufactured. When you feel that

the standoff is screwed in all the way, stop screwing it in. If it is only partially screwed in, try turning it a bit harder. If you are having no luck, remove the standoff and try again. If that does not work, try a different standoff, as maybe the thread in that standoff is damaged.

We can now put the motherboard in the computer, but at this stage I prefer not to. Some techs do, some do not. The reason for this is that I prefer to install as many things as I can on the motherboard before putting it in the computer case. This is for two reasons. First, once the motherboard is in the computer case it can be difficult to reach certain parts of the motherboard. The second reason is to install items on the motherboard while in the computer case can cause what is called flexing. Flexing is when the motherboard physically flexes when additional components are put in. This can damage the motherboard. Putting all the standoffs in reduces the chance of flexing occurring.

In this case, I have the motherboard on an anti-static mat. If this is not available, one option you have is to place the motherboard on the anti-static package that it came in. The next option is to use the cardboard box that the motherboard came in. Either solution will help prevent static electricity getting to the motherboard. Also, if you are working on a hard surface, the box will help prevent damage to the bottom of the motherboard. In this case, I will leave the motherboard on the anti-static mat since it gives me anti-static protection and, as the mat is quite soft, it will not damage the motherboard.

The next step is to plug your components into your motherboard. If I was installing a CPU and memory, I would do this before installing the motherboard. It is a lot easier to install these components before putting the motherboard into the computer.

I will look at how to install these in later videos. After installing the components, the next step is to plug in all the cables from the computer case into the motherboard.

This computer case has a built-in power supply. In later videos I will look at how to install a power supply if you need to. To start with, I will connect the power supply to the motherboard. There are two connectors that need to be connected. The first is the larger 20 or 24-pin connector, otherwise known as the P1 connector. Older motherboards used a 20-pin connector, but that was found not to deliver enough power, so an extra four pins were added to provide the extra power. Your power supply may have a single 24-pin connector or a four-pin and 20-pin connector that can be combined together or broken apart. Even if your connector cannot be broken apart, you can still plug a 24-pin connector into a 20-pin connector, the extra pins will just hang over the side of the connector. You will only find a 20-pin connector on older motherboards.

To install the P1 connector, it is just a matter of locating the 24 or 20-pin plug on the motherboard. On each motherboard it will be in a different location, but it should be easy to locate and most of the time it will be near the CPU or memory. Once you find it, it is just a matter of pushing the connector down into the plug. The plug has a latch on it, so when it goes into place, you will hear a click. The connector is keyed so that it will only go in the one way. Pretty much all connectors in the motherboard are keyed nowadays, so don't force a connector into a plug. If you are finding it is not going in, you probably have the connector the wrong way around.

Your motherboard will most likely have a four or eight-pin connector. This is called the P4 or EATX12V connector. Very old motherboards may not have either of these connectors; older motherboards may have the four-pin while newer motherboards should have an eight-pin connector.

Once you locate the plug on the motherboard, plug the connector in just like the P1. When you plug it in, you should hear a click. The connector could be anywhere, but is generally located somewhere near the CPU. In particular, the four-pin connector can be difficult to locate.

If you have trouble locating the connector or any other connectors on the computer, your motherboard manual will have a diagram with the location of all the connectors on it. This is good for locating connectors that are hard to find, but also useful to look at to know what your motherboard supports and what it does not.

The connector that I am interested in is the audio connector. This is located at the bottom left of the motherboard. This will connect the audio plugs found in the computer case to the motherboard. You will notice that, on most motherboards, the connector will be labeled. In this case it is labeled as AAFP. This stands for analog audio front panel. Sometimes the connectors will be labeled like this and, unless you know what to look for, they are difficult to find.

If you are having trouble finding the plug, you can look at the diagram in the manual or you can look at the connections themselves. Each connector is keyed, meaning that each connector will have a different pin missing. You can see in this case a pin at the top left is missing. The connector will have this pin filled in rather than a hole preventing the connector being put in the wrong plug or upside down.

Now that I have located the plug, it is a simple matter to plug the connector into the motherboard. Now the audio plugs in the computer case are connected.

This computer case has a USB 2 and a USB 3 connector. I will first locate the USB 2

connector. You will notice that it is a small connector. This connector is black, while USB 3 connectors are usually blue and have more pins.

Like the audio connector, it is just a matter of plugging the connector into the motherboard. Your motherboard may have multiple USB 2 plugs, so it is just a matter of choosing one as they all perform the same function.

The next connector I will connect is the USB 3 connector. You will notice that it is a larger connector and is generally blue in color. There is a second connector attached to the same connector. This is a USB 2 connector. Use only one. If the motherboard supports USB 3, use the USB 3 connector. If the motherboard does not support USB 3, use the USB 2 connector.

The USB 3 connector, like the other one, just clicks into place. You will notice that it has a blue notch that can be seen in the middle of the black plug. This notch prevents the USB 3 cable from being plugged in the wrong way.

The last connectors that need to be connected are what are referred to as the front panel connectors. These control the LED lights and switches on the computer case. For example, the light for hard disk activity and the power switch.

On this motherboard, you can see that they are found in the corner. Generally speaking, the front panel connectors on most motherboards are in the same place. However, on some motherboards, the pins for the front panel connectors may be separated, although this is rare.

If I have a closer look, you will notice there is writing on the motherboard to tell you which pin is which. The features the motherboard has will determine which pins you will have on the motherboard. For example, some motherboards will have pins to detect if the computer case has been opened and others will not. Some computer cases have a switch to detect this and others do not. In this case, the motherboard supports this feature but my computer case does not.

The writing can be quite hard to read and the pins can be difficult to get to when the motherboard is in the computer case. One more reason I prefer to connect them while the motherboard is not in the computer case.

Since the writing is so small, one trick I like to do is take a photo I can look at. The motherboard manual will also have a diagram of the front panel connectors. This will be easier to read than on the motherboard itself, you just need to make sure you have it orientated the same way as the motherboard.

I will start by plugging in the LED light for hard disk activity. It is important, when you plug in a connector which is attached to an LED light, that positive and negative are connected correctly. If they are swapped around the wrong way, the LED light will not work.

Computer cases generally indicate the positive and negative wires in two different ways. The first way is that a white wire is used for the negative wire and the positive wire will be a different color.

The second way is that both wires will be black and positive and negative will be written or imprinted on the connector. In this case, the wires are both black and the connector has a positive and negative imprinted on it. Now all I need to do is connect the connector to the pin, making sure the positive and negative line up with the pins.

The next connector that I will attach is the power switch. Since the power switch is a switch it does not matter which way you connect it. In this case, the power switch is not labeled with a positive and negative wire. Generally, when in doubt, I will plug the connector in the same direction as the others. That is, the writing on the connector faces us just like the hard disk connector. Although the manufacturer of the motherboard is free to put the pins in the front panel connector anyway they want, they generally follow this trend of having the negative wire on one side and the positive on the other side. If this is the case with your motherboard, if you put them all in the same direction, they will all be correct or they will all be wrong!

The next connector I will put in is the reset switch. Again, as it is a switch, it does not matter which direction it is put in, but I will put it facing the same direction as the others.

The next one is an interesting one, it is the power LED. It is interesting because it is split into single connectors. The reason for this is that you can see that there is a two and a three-pin connector on the motherboard. The history behind this is that some motherboard manufacturers use two pins and others three pins for the power LED. To accommodate which is being used, the computer case manufacturer split the pins into single pins so they could be used in a two or three-pin connector. Nowadays, motherboard manufacturers tend to provide the two and three-pin versions in their front panel header. It does not matter which one you choose as they will both work the same.

In this case I will use the three-pin making sure that the positive connector is connected to the positive pin and the negative connector is connected to the negative pin.

The last connector that I will attach is the PC speaker. This used to be part of the computer case, but nowadays you will generally find that the PC speaker is a small speaker that is attached directly to the motherboard.

The PC speaker will generally have a black wire which is the negative wire. The positive wire will generally be red or yellow. Make sure that it is plugged in the correct way otherwise it may not work. That is the last of the connectors from the computer case that need to be plugged into the motherboard.

The next step is to pick up the motherboard and place it in the computer case. Due to the limited length of the cables I need to turn the motherboard 180 degrees in order to put it in the computer case.

You will notice that, when I attempt to place it in the computer case, the motherboard will not go in. This is because part of the IO shield is blocking it. So, I will bend the metal up a little to help the motherboard go in.

I will attempt to put the motherboard in again, with a small angle downward to get under the clips of the IO shield. It can be difficult to get the motherboard in with the clips on the IO shield; however, if you force it in, this risks bending the clips downwards which can block the connector. If you have trouble putting the motherboard in, bend some of the clips upwards just a little bit and try again. You don't want to bend them up too far, as this will affect how it will seal the connector, but if you tilt the motherboard when installing it, this helps get under the clips and helps you put the motherboard into place.

The last step is to screw the motherboard into place. I'll start by screwing in a corner screw. Once this screw is in place, I will adjust the motherboard so the other screw holes are in line with the standoffs. Once done, I will screw in the opposite corner screw of the motherboard.

Screwing the opposite corner screws in first helps prevent the motherboard from being installed misaligned. I will next screw in the other two corner screws. Once this is done, I will screw in the last remaining four screws for a total of eight.

Each screw only needs to be in finger tight. Don't over tighten them. This can cause damage and if the thread is broken will make it hard to remove the screw later on if required. I will put in all eight screws which I recommend that you do. If you don't have enough screws, at least put in the corner screws, which helps to keep the motherboard stable. Some screws are better than none, but you should put all the screws in whenever possible.

The next step in the process would be, of course, to switch the computer on and test it. In this case I have not installed the CPU or memory which I will cover later in the course. Given that the missing CPU and memory will prevent the computer from working there is no point switching the computer on.

That covers it for picking and installing a motherboard in a computer. Later in the course I will look at installing the other components of the computer system. I hope to see you in those videos. Until then, I would like to thank you for watching.

#### References

“CompTIA A+ Certification Exam Guide Tenth Edition” pages 233-240

“Picture of game controller” <https://www.pexels.com/photo/white-reflection-happy-game-59966/>

“Picture of monitor” <https://unsplash.com/photos/ncOQxZe8Krw>

“Picture of workstation two monitors” <https://unsplash.com/photos/p-xSl33Wxyc>

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