

Year 7 & Year 8

1. Computer hardware & software
<https://www.computerhope.com/issues/ch000039.htm>
2. Computer inputs and outputs
<https://www.bbc.co.uk/bitesize/topics/zf2f9j6/articles/zx8hqv4#>
<https://www.bbc.co.uk/bitesize/guides/zqg9q6f/revision/1>
<https://www.bbc.co.uk/bitesize/guides/zqg9q6f/revision/4>
3. Binary to denary conversion
https://www.youtube.com/watch?time_continue=81&v=EjIn2Byg4g&feature=emb_logo
4. Denary to binary conversion
https://www.youtube.com/watch?time_continue=4&v=NI6SyF3bejw&feature=emb_logo
5. Adding two binary numbers together
https://www.youtube.com/watch?v=oj_eo5s4HJs&feature=emb_logo

1. Computer hardware & software

What are the differences between hardware and software?

Computer hardware is any physical device used in or with your machine, whereas software is a collection of programming code installed on your computer's hard drive. In other words, hardware is something you can hold in your hand, whereas software cannot be held in your hand. You can touch hardware, but you cannot touch software. Hardware is physical, and software is virtual.

Note: While software may come on a CD or DVD, the disc is the storage medium for the programming code that makes up the software. The disc is not the actual software.

For example, the computer monitor you use to read a document, and the mouse you use to navigate a web page are computer hardware. The Internet browser which allows you to view the page, and the operating system that the browser runs on are considered software. A video card is hardware, and a computer game is software. You can touch and feel the video card, and the computer uses it to play a computer game, but you cannot touch or feel the programming code that makes up the computer game.

All software utilises at least one hardware device to operate. For example, a video game, which is software, uses the computer processor (CPU), memory (RAM), hard drive, and video card to run. Word processing software uses the computer processor, memory, and hard drive to create and save documents.

Hardware is what makes a computer work. A CPU processes information and that information can be stored in RAM or on a hard drive. A sound card provides sound to speakers, and a video card provides an image to a monitor. Each of these are examples of hardware components.

Can a computer run without software?

In most situations, yes, a computer can run without software being installed. However, if an operating system or interpreter is not found, it either generates an error or doesn't output any information. A computer needs an operating system that allows both the user and software to interact with the computer hardware.

Installing programs onto the computer, in addition to an operating system, gives the computer additional capabilities. For example, a word processor is not required, but it allows you to create documents and letters.

Can a computer run without hardware?

Most computers require at least a display, hard drive, keyboard, memory, motherboard, processor, power supply, and video card to function properly.

If any of these devices are missing or malfunctioning, an error is encountered, or the computer doesn't start. Adding hardware, such as a disc drive (e.g., CD-ROM or DVD), modem, mouse, network card, printer, sound card, or speakers are not required, but give the computer additional functionality.

Tip: Hardware that is not required by the computer is referred to as a peripheral.

2. Computer inputs and outputs

An input device is something you connect to a computer that sends information into the computer. An output device is something you connect to a computer that has information sent to it.

The most common input devices are the keyboard and mouse. Other input devices include:

Concept keyboard	Each button on a concept keyboard relates to a particular item or function. Buttons can be labelled with text or a picture. Fast food restaurants often use concept keyboards because very little training is needed to operate them and they're efficient - a single button can order an entire meal.
Joystick	Joysticks used to be popular with gamers but have slowly been replaced by other types of game controller. In construction, joysticks are used to control machinery such as cranes.
Digital camera	A digital camera takes pictures and can usually record video too. The pictures it takes and the videos it records are stored in files. These files can be copied to a computer and later edited.
Microphone	Microphones are used to input sound. In computing they can be used with voice recognition software and a word processing application to enter text. Webcams commonly have microphones built-in too.
Touch screen	A touch-sensitive visual display unit (VDU) or screen has a grid of light beams or fine wires criss-crossing the screen that are used to detect touch. Many mobile phones use touch screens and do away with the keypad entirely. They're often used on cash machines and in shopping centres too. Touch screens are robust, easy to operate and easy to reprogram.
Scanner	A scanner can be used to digitise images. They're similar to a photocopier but they make a digital copy instead of a physical copy. They can also be used with optical character recognition (OCR) software to scan in text that is then editable.

Here are some examples of common output devices.

- Monitors: The most common output device is the monitor or VDU.
- Printers
 - Laser printers are quite expensive to buy and run but produce a high quality output and are quiet and fast.
 - Ink-jet printers offer black and white or colour printing with reduced levels of quality and speed. Colour ink jet printers are cheaper to buy than colour laser printers.
 - Dot matrix printers are not so common today. They are comparatively noisy and low quality but are cheap to run and are used when carbon copies or duplicates need to be made, such as for wage slips. Also, they are useful in dirty environments such as a garage because they are much sturdier than the other two types of printer.
- Speakers
- Buzzers
- Lights
- Mechanical devices, eg a robot arm

3. Binary to denary conversion

To convert the 8-bit number 1010 1000 from binary to denary, complete the following steps:

- a. Put the decimal values 128, 64, 32, 16, 8, 4, 2, 1 into a table...

Denary	128	64	32	16	8	4	2	1
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- b. Next, copy the binary number into the row below...

Denary	128	64	32	16	8	4	2	1
Binary	1	0	1	0	1	0	0	0

- c. Add all the denary values that have a corresponding binary value of 1 to get your result.

$$128 + 32 + 8 = 168$$

- d. So, the binary number 1010 1000 is 168 in denary.

4. Denary to binary conversion

Begin by writing out the denary table. This is ALWAYS the first thing to do.

Denary	128	64	32	16	8	4	2	1
Binary								

Say we want to convert the denary value 199 into binary. There is only ONE possible combination of the numbers in the table to make 199. We have to put 1s underneath those numbers.

Always start with the highest number in the table.

- Since 199 is higher than 128, 128 should be a 1. Write a 1 under the 128 value.
- If we subtract 128 from 199 we get $199 - 128 = 71$
- The next column is 64 which is less than 71, so we now know that is a 1 as well. $71 - 64 = 7$
- It is easy to see that 7 can be created by adding $4 + 2 + 1$, so these 3 values should also be 1s.
- All other values now become zero (0), and we end up with:

Denary	128	64	32	16	8	4	2	1
Binary	1	1	0	0	0	1	1	1

Do you see that $128 + 64 + 4 + 2 + 1 = 199$

We have successfully converted 199 into binary. The answer is 1 1 0 0 0 1 1 1

4. Adding two binary numbers together

There are four rules that need to be followed when adding two binary numbers. These are:

$0 + 0 = 0$	$1 + 0 = 1$	$1 + 1 = 0$ carry 1	$1 + 1 = 1$ carry 1
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Adding binary numbers together is just like adding normal numbers, it's just that you are only using 0s and 1s. Here is an example:

Example 1: Adding the binary numbers 011 and 100

0	1	1	
1	0	0	+
<hr/>			
1	1	1	
<hr/>			

The only complication is that you can ONLY use 0s and 1s, so 1+1 cannot equal 2. Instead, it equals 1 and you carry a 1 into the next column. Here is an example:

Example 2: Adding the binary numbers 0 1 1 0 1 1 and 0 1 1 0 1 0

	0	1	1	0	1	1	
	0	1	1	0	1	0	+
	<hr/>						
	1	1	0	1	0	1	
	<hr/>						
carry	1	1		1			