



Hardware & Software

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Hardware

Hardware

What is hardware?

- Hardware is the physical components of a computer system
- Hardware can be divided into three categories:
 - Internal components
 - Internal memory
 - Hardware components

Internal components

- Internal components include:
 - Central Processing Unit (CPU) brain of the computer
 - Processors electronic circuits that process information
 - Motherboard connects all important components together allowing them to communicate

Internal memory

- Internal memory include:
 - Random Access Memory (RAM) fast, working memory
 - Read-Only Memory (ROM) holds start-up instruction for the computer

Hardware components

- Hardware components include:
 - Graphics card (GPU) processes images and video
 - Sound card processes audio
 - Network Interface Card (NIC) provides wired connection to a network
 - Camera captures images or video
 - Internal/external storage devices stores data permanently e.g. hard drive, USB memory stick
 - Input devices allow user input e.g. mouse & keyboard
 - Output devices output results of processing e.g. monitor





Worked Example

A computer contains internal hardware.

Write down the most appropriate item of internal hardware to match the descriptions.

a. This handles all the system instructions [1]

Processor / CPU [1]

b. A printed circuit board that contains the main components of the computer [1]

Motherboard [1]

c. This generates output for the speaker [1]

Sound card [1]

d. A type of memory where data is lost when the computer is switched off [1]

RAM / Random Access Memory [1]





Software

Software

What is software?

- Software is the set of programs that control the hardware; they live on the computer system but cannot be physically touched
- Software can be broken down in to two categories:
 - Application software
 - System software



What is application software?

- Application software (abbreviated 'apps') is software chosen by a user to help them carry out a specific task
- Application software is installed on top of system software and is user-chosen to best suit industry requirements
- Common categories of application software include:
 - Word processing: creating and editing text documents
 - Spreadsheet: organising and analysing data in a grid format
 - Database management systems: storing, retrieving and managing data in databases
 - Control/measurement: uses sensors to measure and control a system
 - Video editing: creating and modifying video files



- Graphics editing: creating and modifying images
- Audio editing: creating and modifying sound files
- Computer-Aided Design (CAD): designing and modelling objects in 2D or 3D

What is system software?

- System software is software essential for the operation of a computer system
- Without system software, a user has **no starting point** for giving a computer instructions
- System software gives users a platform to run applications and carry out tasks
- Essential services carried out by system software include:
 - Compilers: translating high-level programming languages into machine code
 - Linkers: combining object files into a single executable program
 - Device drivers: controlling hardware components and peripherals
 - **Operating systems**: managing the computer's resources and providing a user interface
 - Utilities: tools for maintaining and optimising the computer's performance



Worked Example

Tick whether the following are examples of **applications software** or **system software**

[2]

	Applications	Systems
Control software		
Compiler		
Word processor		
Device driver		

Answers

	Applications (✓)	System (√)
Control software	✓	
Compiler		✓
Word processing	✓	
Device drivers		✓





2 marks for 4 correct ticks 1 mark for 2 or 3 correct ticks 0 marks for 0 or 1 tick



0

Examiner Tips and Tricks

A common misconception is that control software is system software—it's actually application software!

Operating Systems

What is an operating system?

- An operating system (OS) is software that provides an interface between the user and the hardware in a computer system
- An operating system enables a system to function by:
 - Controlling input/output devices
 - Oversees loading, running and storage of application software
 - Deals with errors
 - Maintains security
 - Keeps a log of events

What is a user interface?

- A user interface is how the user interacts with the operating system
- Examples of user interfaces include:
 - Command Line Interface (CLI)
 - Graphical User Interface (GUI)
 - Dialogue-based
 - Gesture-based







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Feature	CLI	GUI	Dialogue- based	Gesture-based
How do users interact?	Text-based commands	Visual elements (WIMP)	Spoken word	Human interaction (hands, fingers, head or feet)
Examples	MSDOS, Raspbian	Windows and Mac OS	Amazon Alexa, Siri	Smartphones (swiping, pinching, and zooming)

Advantages and disadvantages of user interfaces

Interface	Advantages	Disadvantages
Command line (CLI)	 Uses fewer system resources Useful for automation of tasks Commands are often faster to type than navigating menus 	 Requires users to remember commands Typing errors are common Less intuitive than GUI
Graphical (GUI)	 Intuitive and user-friendly Requires no previous knowledge to use Information is visual, making it easier to understand 	 Uses more system resources It can be slower to find and execute commands Can be frustrating when doing repetitive tasks
Dialogue- based	 Can be used by people with disabilities Intuitive 	 Not always reliable Privacy concerns



Gesture-	 Intuitive 	 Precision 	
based	 Can be used by people with 	 Recognition errors 	Your notes
	disabilities	 Can lead to discomfort 	
	 Immersive 	 Limited support 	
	 Faster for certain tasks 		



Analogue & Digital Data

Your notes

Analogue & Digital Data

What is analogue data?

- Analogue data is **continuous data** created from non-digital devices
- Analogue data can change gradually and smoothly
- Examples of analogue data include:
 - sound waves produced when you talk
 - data collected by sensors (output)

What is digital data?

- Digital data is data represented in a binary format (1s and 0s)
- Digital data is created and/or stored using digital devices
- Examples of digital data include:
 - software
 - documents/files

Characteristics of analogue & digital data

Analogue	Digital
Values change smoothly and gradually	Values are limited (1s and 0s)
Quality can be lost during storage/transmission	Quality is maintained during storage/transmission
Needs to be converted to digital to be used in digital devices	Needs to be converted to analogue to use in analogue devices
	Easily manipulated

Analogue to digital conversion (ADC)

- Analogue data must be converted to digital data so that it can be processed by a computer
- The ADC process involves taking samples (measurements) of the analogue signal and converting it to a binary code
- The sample rate and a higher number of binary digits used in the conversion leads to a more accurate representation of the original signal, but, takes up more space on



secondary storage
Digital to analogue conversion (DAC)
Digital data must be converted to analogue data so that it can be used to control devices

- The DAC process involves **converting discrete digital values** (1s and 0s) back into a continuous analogue signal
- The quality of the analogue signal after conversion is **based on the original sample rate** and **number of bits** used in the digital data



Worked Example

A greenhouse is used to grow plants and is computer controlled. Give **two** reasons why data from the sensors needs to be converted for use by a computer.

Answer

Two of:

So that the data from the sensor can be understood by the computer [1]

The output from a sensor is analogue [1]

The input to the computer is digital [1]



[2]

