

# Computer Science



## Year 10 Knowledge Organisers

# GCSE Computer Science - Knowledge Organiser

## Actions of Malware

Deleting or modifying files.

**Scareware:** tells the user the computer is infected with viruses to scare them into following links/paying for problems to be Fixed.

**Ransomware:** encrypts all of the files on a computer until a large sum of money is paid for a key.

**Spyware:** secretly monitors user actions

**Brute Force Attack** - Used to gain information by cracking passwords through trial and error and use automated software to produce hundreds of likely password combinations.

## Types of Malware

**Virus** - attach themselves to files and copy themselves when the user copies or opens a file.

**Worm** - copy themselves without the user doing anything.

**Trojan** - malicious software pretending to be a legitimate program.



## Network Security

### Key Words

- Malware
- Virus
- DOS Denial of Service
- SQL Injection
- Phishing
- Social Engineering
- Trojan Horse Virus
- Brute Force Attack

## Key Terms

**Malware:** malicious software intended to cause harm.

**Penetration Testing:** Organisations employ professionals to try and hack their network so that they can find areas of weakness.

**User Access Levels:** Different employees have different levels of access to programs, websites and data.

**Encryption:** data is scrambled so that it cannot be understood if intercepted. It can only be decrypted with a key.

**Network Forensics:** Data packets are captured as they enter the network and analysed to find out the cause of a network attack.

## Social Engineering

Relies on human interaction (social skills)  
Commonly involves tricking users into breaking normal security procedures - does not revolve around technical cracking techniques such as worms or viruses

## Exam Questions

1. Describe what is meant by "Malware"
2. Describe how a brute force attack works and how to prevent it.
3. Explain how to keep a network secure.
4. Evaluate the benefits and drawbacks of a business using penetration testing

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## Ethical

Ethics is about what is considered right and wrong by society.

If a company does not behave in an ethical way it might make their customers lose trust in them. Issues such as cyberbullying, trolling and the use of social media can raise ethical issues.

**Privacy:** Users trust companies to keep their data private so companies need to take care of it

**Censorship:** is when a country or organisation controls what people can access on the internet.

**Surveillance:** surveillance is when someone is monitored using technology.



## Ethical, Legal, Cultural and Environmental Impacts of Technology

## Cultural

One cultural issue in computing is the **Digital Divide**. Some people do have access to technology, others don't. Not having access to technology can be a disadvantage as it limits access to information, online learning, online banking, communication etc.

The digital divide can be due to people not having enough money to buy devices or due to living in places without internet access, or not having the skills to use the technologies available.

Technology has also impacted how businesses run as many now use online shops and services

## Key Words

- Digital Divide
- CDAPA
- E-Waste
- DPA
- CMA
- WEEE
- Privacy
- Censorship
- Surveillance

## Legal

**Data Protection Act:** controls how personal data is used. For example: it has to be accurate and up to date, kept

secure, should not be kept longer than needed

**Freedom of information Act:** gives the public the right to see information about public organisations

**Computer Misuse Act:** makes it illegal to hack a network or create a virus.

**Copyright, Designs & Patents Act:** protects things you have created from being used without permission

**Creative Commons:** lets people release their work to be used and shared legally and sometimes modified.

## Environmental

Computing devices contain raw materials

Devices use lots of energy when turned on

**E-waste** is when we throw away devices because they are broken or because we want to upgrade

**E-waste** can lead to pollution

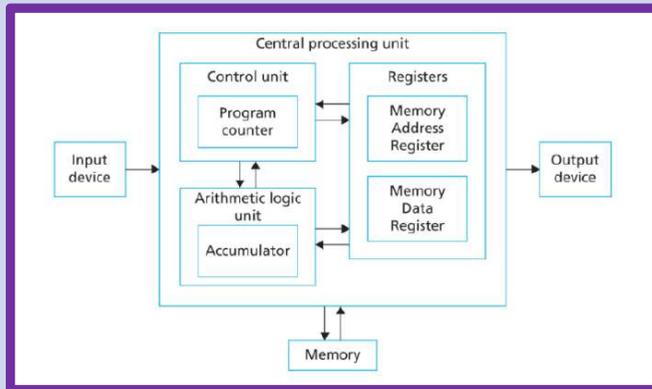
**The Waste Electric and Electronic Equipment (WEEE)**

directive has rules for how devices should be disposed so that they're recycled/disposed of safely

Devices can also have a positive impact on the environment - for example, video calls rather than travelling a long distance causing pollution.

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## The CPU



**Control Unit (CU):** executes instructions and controls the flow of data in the CPU.

**Program counter:** holds the memory address for the instruction of each cycle.

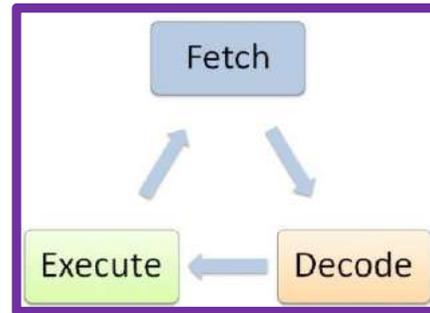
**Arithmetic Logic Unit (ALU):** does all of the calculations and logic operations.

**Accumulator:** holds the result of any calculations in the ALU.

**Cache:** very fast memory that stores regularly used data so that the CPU can access it quickly.

**MAR (Memory Address Register):** holds the address about to be used by the CPU.

**MDR (Memory Data Register):** holds the actual data or instruction being processed by the CPU.



## Systems Architecture

### Key Words

- CPU
- Clock Speed
- Cores
- Cache
- Registers
- Von Neumann Architecture
- Embedded Systems

## FDE Cycle

CPU **fetches** instruction from the RAM (Copies memory address to MAR, copies Instruction to MDR & adds 1 to PC. CU **decodes** the instruction from the MDR Instruction is **executed** by the CU. The next instructions is fetched and The cycle repeats.

## Key Concepts

Computer systems take data (input), process it and then output it. **Embedded systems** are computers built in to other devices like washing machines. They are dedicated to a single task so they are efficient.

**Clock speed:** the number of instructions a processor can carry out per/second. Higher clock speed = faster CPU.

**Number of Cores:** The more cores a CPU has the more instructions it can carry out at once (multitasking).

More cores = faster processing. **Cache size:** A larger cache gives the CPU faster access to more data

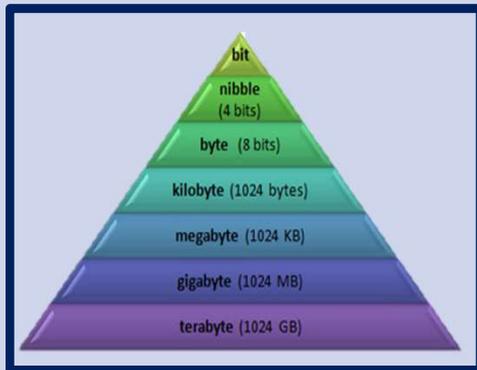
## Exam Questions

1. Explain how cache size, cores and clock speed affect the performance of the CPU.
2. Define what is meant by an embedded system.
3. What is the purpose of the ALU?
4. Explain the role of the CPU registers (MAR and MDR) .
5. Explain how the fetch decode execute cycle works.

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## The CPU

Some storage methods such as a HDD or SSD have a large capacity (they can store lots of data). Other devices such as CDs and SD cards have smaller capacity. Measurements of capacity are shown below:

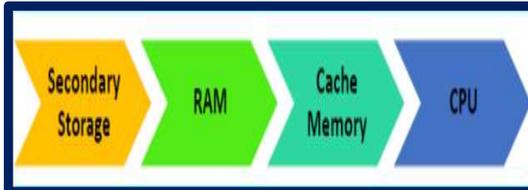


Hint:

1000 instead of 1024 could be used when doing your conversion calculations, because you will not be allowed a calculator in your exam.

## ROM - Read Only Memory

The ROM is on a chip build into the motherboard It contains the BIOS (boot up sequence for the computer) ROM is non-volatile (data still stored after power is off)



## Memory and Storage

### Key Words

RAM  
ROM  
Volatile  
Non-Volatile  
Secondary Storage  
Optical  
Magnetic  
Solid State

## RAM - Random Access Memory

**RAM** is the computer's main memory that holds the data, programs and files while they are being used. RAM is volatile (power off = the data is lost) The CPU will fetch instructions from the RAM in the fetch - decode - execute cycle. When the RAM is full the computer uses **VIRTUAL MEMORY**. It uses the secondary storage as temporary RAM so that the computer can continue running (but slowly).

## Types of Storage

**Secondary Storage:** where all data including the programs are stored when they are not being used.

**Hard Disk Drive (HDD)** Magnetic, has moving parts, large capacity, lower cost than SSD

**Solid State Drive (SSD)** Flash memory, no moving parts, more robust than HDD, faster and more expensive than HDD

**Flash memory** e.g. USB memory sticks, memory cards.

**Optical Storage** e.g. CDs, DVDs. Cheap, portable and fairly robust.

**Magnetic tape** Used for archive storage (backups). Very large capacity, low cost, slow.

## Exam Questions

1. Explain how the RAM works with the CPU in the fetch - decode - execute cycle
2. Explain the difference between volatile and non-volatile memory giving an example of each
3. Tom is buying a new laptop, he is not sure whether to get a magnetic HDD or SSD. Discuss the benefits and drawbacks of each.

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## Base 16 - Hexadecimal

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

### Base 10 - Decimal or Denary

1234567890

### Base 2 - Binary

1 0

## Data Representation

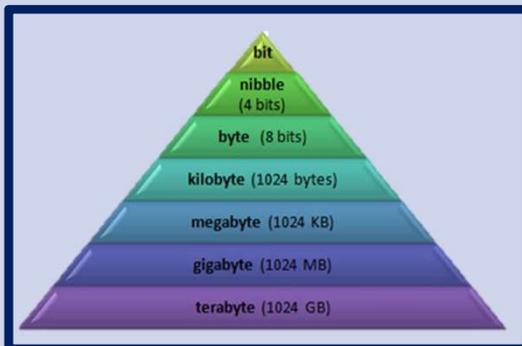
### Key Words

- Base 2
- Base 10
- Base 16
- Decimal or Denary
- Binary
- Bit
- Nibble
- Byte

### Denary to Binary

Denary number	Binary number
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001
10	1010

### Units of Storage



### Binary to Hexadecimal

Binary	Hex	Binary	Hex
0000	0	1000	8
0001	1	1001	9
0010	2	1010	A
0011	3	1011	B
0100	4	1100	C
0101	5	1101	D
0110	6	1110	E
0111	7	1111	F

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## Key Terms

**A network is where devices have been connected together so that they can share data and resources. Networks can be wired (Ethernet) or wireless (Wi-Fi).**

**Local Area Network (LAN)** Cover a small geographical area such as an office. Use their own infrastructure.

**Wide Area Network (WAN)** WANs connect LANs together over a large geographical area and make use of infrastructure from telecommunications companies.

**Bandwidth** The amount of data that can pass between network devices per second

**Server** A device that provides services for other devices (e.g. file server or print server)

**Client** A computer or workstation that receives information from a central server

**Peer to peer Network** All of the computers in the network are equal. They connect directly to each other.

**Standalone computers** A computer not connected to a network

## Network Hardware

**Network Interface Controller (NIC):** built in hardware that allows a device to connect to a network.

**Switches:** connect devices on a LAN

**Router:** Transmits the data (packets) between the networks (eg: the internet and your LAN)

**Wireless Access Point (WAP):** a switch that allows devices to connect wirelessly.

**Cables:** the cables in a network can be twisted pair cables, coaxial cables or fibre optic cables.



## Computer Networks

### Key Words

Network

Node

LAN

WAN

PAN

DNS

IP Address

Web Server

Internet and WWW

## Network Performance

**These factors can impact on network performance:**

**Bandwidth:** The more bandwidth, the more data that can be transferred at a time.

**Number of Users:** Having a lot of people using a network means lots of data is being transmitted which can slow it down.

**Transmission Media:** Wired connections are faster than wireless. Fibre optic cables are faster than copper cables.

**Wireless Factors:** wireless can be affected by walls, distance, signal quality and interference from other devices.

**Topology:** The layout of a network can impact on its performance.

## Virtual Networks

A virtual network is part of a LAN or WAN where only certain devices can "see" and communicate with each other usually connected remotely.

## Exam Questions

1. Give 3 items of hardware needed for a network
2. Explain the difference between a peer-to-peer network and a client server network.
3. The school's network has become very slow. Explain two different reasons why this might be.
4. Evaluate the benefits of using a wired connection rather than a wireless one.

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## Key Terms

**Operating Systems:** runs the computer, manages the hardware and applications e.g. IOS, Windows 10

**Device Drivers:** communicate with the peripherals and internal hardware.

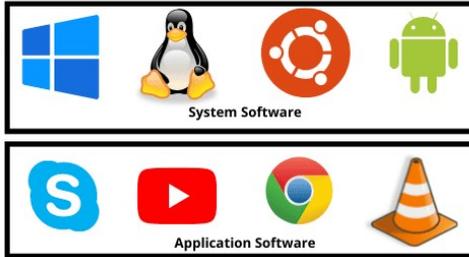
**User Interface:** allows the user to interact with the device. This can be a Graphical User Interface (GUI) which are visual and easy for someone to use or a command line interface where the user needs to type in commands to make it work.

**Multitasking:** The operating system manages the programs so that you can run several at the same time.

**File and Disk Management:** The operating system manages the movement, editing and deletion of data.

**User Accounts:** The operating system manages the accounts of the different users.

## Examples of System & Application Software



## Systems Software

### Key Words

- Operating Systems
- Defragmentation
- Multitasking
- Open Source
- Proprietary Software
- GUI

## Utilities Software

Utilities are the programs that help maintain and configure a program.

Most utility software is installed with the Operating system.

**Defragmentation:** Defragging a magnetic hard drive groups all of the files for each program together and all of the free space together.

This makes it read and write quicker.

**Back Up Utilities:** Schedules and manages backups. Full back ups = all data is backed up. Incremental = only files since the last back up are copied.

**Compression:** reduces the size of large files so that they take up less space. Files then need to be extracted before they are used.

**Encryption:** scrambles the data to protect it so that if someone else gets hold of it they cannot access it.

## Open Source

It's usually free and the source code is available so it can be adapted for individual needs

## Proprietary

Usually has to be paid for Only the compiled code is released so it cannot be edited

## Exam Questions

1. Evaluate the benefits and drawbacks of releasing a piece of software as open source rather than proprietary.
2. Explain three functions of the operating system in a computer
3. Evaluate the difference between doing an incremental back up and a full back up.