



IGCSE ICT CHAPTER 3: **STORAGE DEVICES AND MEDIA**

CAIE IGCSE ICT (0417) THEORY-REVISION For Exams from 2023



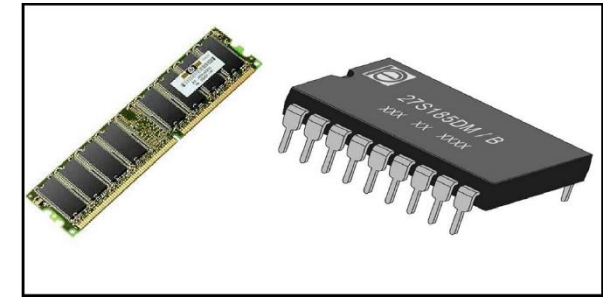
IGCSE ICT Chapter 3: Storage devices and media

- 3.1 Understand the characteristics, advantages and disadvantages of different magnetic media and devices; magnetic disk and tapes.
- 3.2 Understand the characteristics, advantages and disadvantages of different Optical media and devices; CD, DVD and Blu-ray.
- 3.3 Understand the characteristics, advantages and disadvantages of different Solid state media and devices; SD cards, flash disk, SSD etc.
- 3.4 Cloud storage

Intro to Storage devices

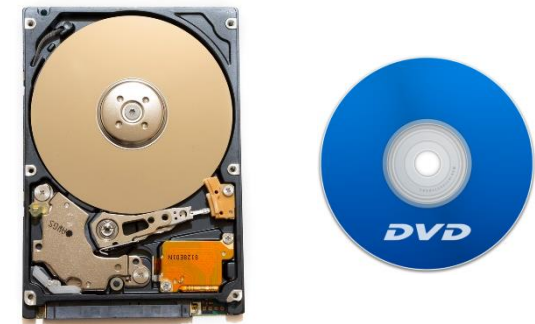
□ Primary storage or internal memory (RAM & ROM)

- RAM temporarily holds data (volatile), instructions and programs as they are being processed by the CPU.
- Data can be read from and written to them very fast,
- ROM stores boot instructions of the computer permanently (non-volatile).



□ Secondary or permanent storage

- Secondary or backing storage devices store data, applications, files etc. permanently (non-volatile).
- Include hard drives, CDs & DVDs, magnetic tapes etc.



What are they?

- ❑ **Storage media** is the **hardware on which data is actually stored permanently**, e.g. CDs, DVD, etc.
- ❑ **A storage device** is the **hardware used to read from or write to the storage medium**, e.g. CD/DVD reader, the HDD read/write head etc.



Magnetic media rely on properties of **magnetism** for electronic data storage; **magnetized area is a binary 1-value, demagnetized area is a binary 0-value.**

Optical media rely on the optical properties of **laser light to read data from or write data** on the surface of a disk.

Solid state media employs **solid state technology** for data storage by **controlling the movement of electrons within NAND** (logic gate) chips.

How do we measure storage capacity?

□ Storage capacities or file sizes are measured in:
Kilobytes(KB), Megabytes(MB), Gigabytes (GB) and Terabytes (TB)

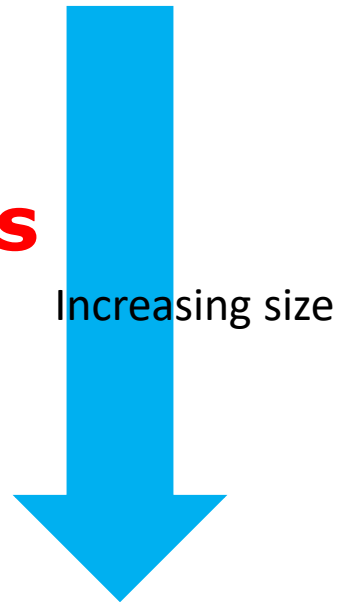
1 byte = 8 bits

1 KB = 1000 bytes

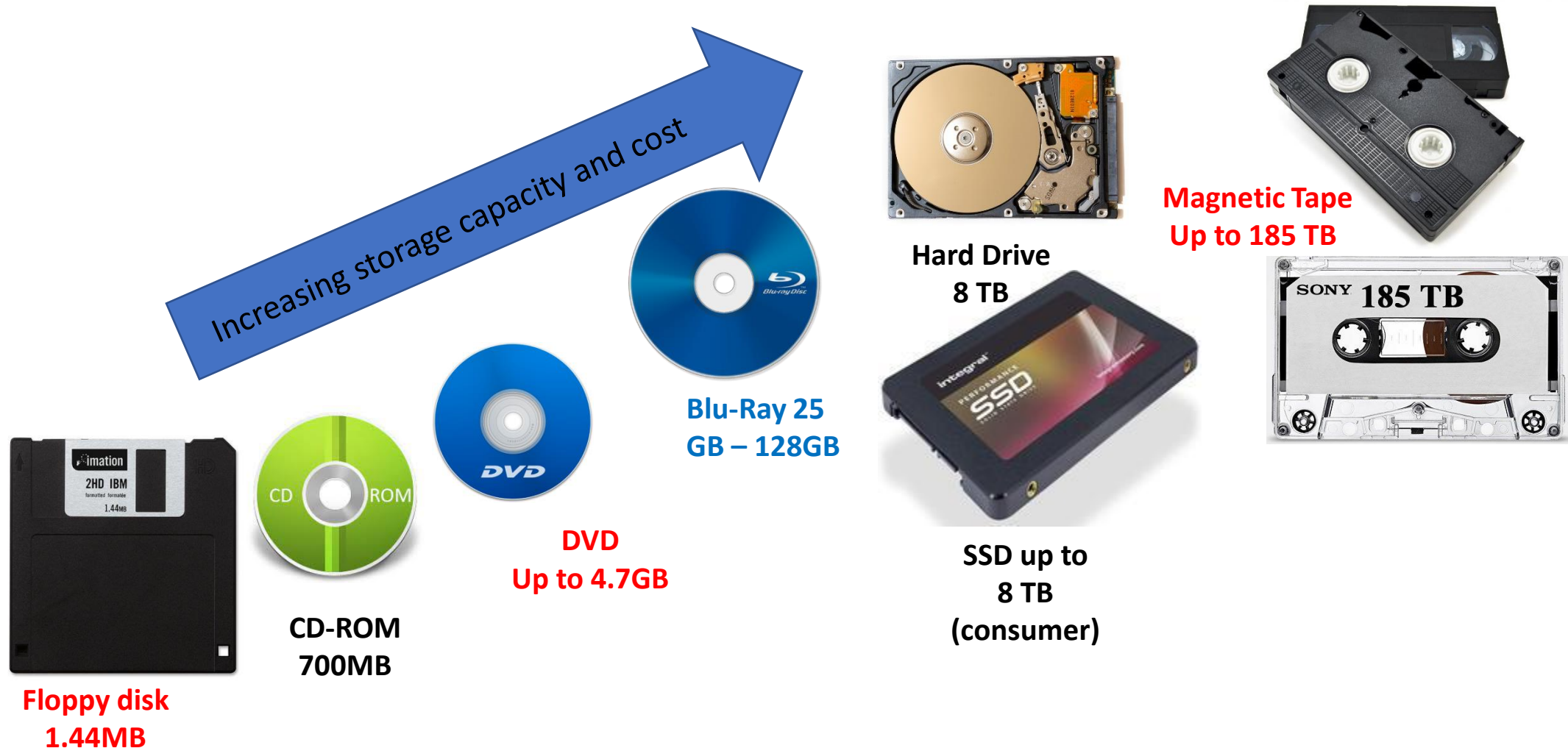
1 MB = 1000 KB

1 GB = 1000 MB

1 TB = 1000 GB



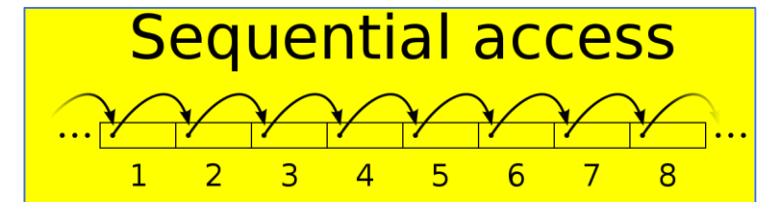
Classification of storage media according to size



How is data accessed from these drives?

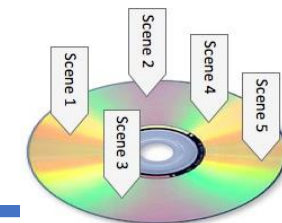
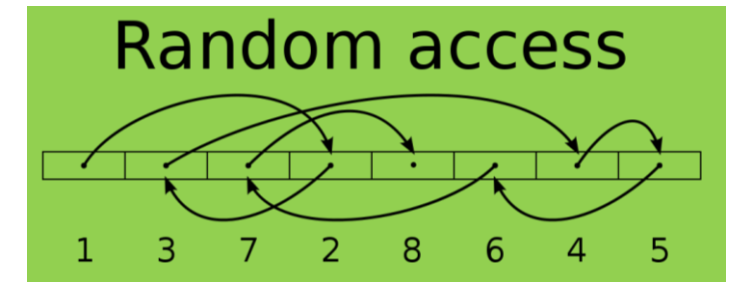
❑ Serial (Sequential) access

- Data is **read from** the device **sequentially** in the **same order in which it was written** to the device. e.g: **Magnetic tapes use serial access.**



❑ Direct (random) access

- Data is **read instantly**; the required data is **read directly from the storage location** without following any hierarchy. e.g: **HDDs, DVDs, Blu-ray, flash drives** use direct access.



3.1 Different magnetic media and magnetic storage devices; magnetic disk and tapes

□ Magnetic tape drives

- A thin **strip of plastic coated in thin magnetic** (iron oxide) layer.
- Has **vast storage capacities (up to 185 TB)** and suitable for offline or batch processing.
- Used by **large organizations for long-term vast data storage**



Advantages of Magnetic tapes

- Less expensive per byte than HDDs
- Very robust technology
- Vast data storage capacities
- Fast data transfer rates

Disadvantages of magnetic tapes

- Uses serial access, thus very slow data access time.
- Strong magnetic fields can lead to corrupt data.

3.1 Different magnetic media and magnetic storage devices; magnetic disk and tapes

❑ Hard disk drives (HDD)

- Most common **fixed storage device** in computers with large storage capacities.
- Actuators are used to move the read/write head during operation.
- **Used to store:** **operating system, system software, and files or data.**



• Advantages of fixed HDDs	• Disadvantages of fixed HDDs
<ul style="list-style-type: none">• Very fast data transfer rates• Fast data access times; uses direct access• Large storage capacities	<ul style="list-style-type: none">• Fragile; they can easily get damaged• Many moving parts which can affect reliability of the device• They can be quite noisy compared to SSDs

3.1 Different magnetic media and magnetic storage devices; magnetic disk and tapes

□ Portable hard disk drive

- Portable **external** HDDs that can be **connected to the computer via USB**
- Used as **back up devices to prevent data loss**
- In some cases, **they are used for transfer of large software/information between computers.**



• Advantages of portable HDDs

- Large storage capacities
- Handy for large software/information transfer between computers

• Disadvantages of portable HDDs

- Fragile; they can easily get damaged if not properly ejected or if dropped.
- They can be quite noisy compared to SSDs

Exam Question!



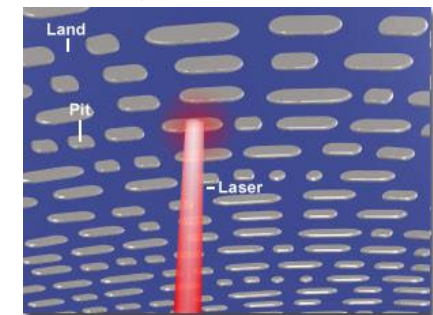
Tick (✓) the most appropriate storage medium that should be used in each scenario.

Scenario	Magnetic tape (✓)	RAM (✓)	ROM (✓)
To store the current instructions in use by a computer		✓	
To back up data from a school network server	✓		
To store data temporarily		✓	
To store the start-up instructions of a computer			✓

3.2 Optical media and optical storage devices

CDs and DVDs

- Red laser light is used to read from and write on the optical disk.
- Data is stored in pits and lands on spiral tracks
- For improved storage capacities like in DVDs, dual-layering technology is used.
- DVDs generally have larger storage capacities than CDs



3.2 Optical media and optical storage devices

CDs and DVDs

□ CD-R (Compact disk-Recordable) and DVD-R (Digital Video Disk-Recordable)

- Can only be **written to once** and they become **Read only**.
- **Used for home audio/video recordings.**
- **Used for data storage.**



Advantages of CD-R and DVD-R

- Cheaper than RW disks
- Permanent storage medium.

Disadvantages of CD-R and DVD-R

- Recording is done just once.
- if an error occurs disk will be thrown away.

3.2 Optical media and optical storage devices CDs and DVDs

□ CD-RW and DVD-RW

- RW-disk can be **written to, read, erased and rewritten many times.**
- Uses: **recording of TV programs, CCTV systems for recordings, Backing up of files.**



Advantages of CD-RW and DVD-RW

- Can be reused (written) many times.
- Can store different file formats, and not wasteful like R formats

Disadvantages of CD-RW and DVD-RW

- Relatively expensive technology
- Data can be accidentally overwritten

3.2 Optical media and optical storage devices

CDs and DVDs

□ CD-ROM/DVD-ROM

- Read-only memory which **can not be written** but **can only be read from**.
- Can **store data permanently** especially to prevent deletion or copying.
- **CD-ROM** is **used for storage of music files, software** etc.
- **DVD-ROM** are **used for storing films, files and games**



Advantages of CD-ROM and DVD-ROM	Disadvantages of CD-ROM and DVD-ROM
<ul style="list-style-type: none">• Less expensive than HDDs• Permanent storage device	<ul style="list-style-type: none">• Slower data transfer rates and access times• Compared to HDDs

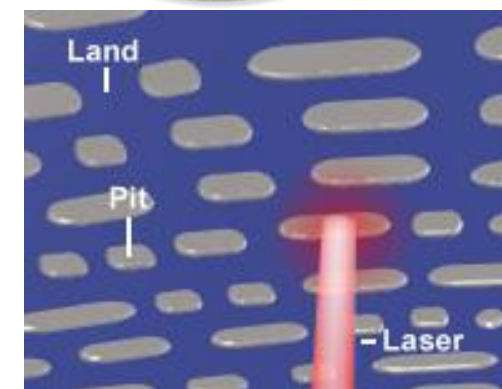
3.2 Optical media and optical storage devices

□ Blu-ray discs

- Data is **read from or written** to these discs using **blue laser light** on Blu-ray optical storage device.
- They can **store up to five times more data than DVDs** due to **smaller pits** and **lands** for data storage **and use of blue light**.
- Have **secure encryption** system to **prevent piracy** and **copyright infringement**.
- Used in **home video consoles, storing movies and backing up data**.



Advantages of Blu-ray discs	Disadvantages of Blu-ray discs
<ul style="list-style-type: none">• Very large storage capacities• Fast data transfer rate and access speeds• Secure encryption to prevent piracy	<ul style="list-style-type: none">• Relatively expensive• Encryption challenges when used to store videos.



3.3 Solid-state media and solid-state storage devices

□ Solid-state drives (SSD)

- Stores data as **1s and 0s** in millions of **tiny transistors** by controlling the **movements of electrons within NAND chips**.
- Use **solid-state media** for backing up, storage of files, software and computer applications.
- Mostly used as storage media in laptops, smartphones, tablets etc.



Advantages of solid-state drives

- More reliable than HDDs; no moving parts
- They consume less power
- very fast access times; only 0.1 milliseconds compared to 10 milliseconds for HDD.

Disadvantages of solid-state drives

- SSD endurance; most SSDs have limited write operations over a period of about 3 years limiting their use in areas with high numbers of write operations.
- Expensive per GB

3.3 Solid-state media and solid-state storage devices

□ Pen Drives (memory sticks)

- Very **small, lightweight portable solid state storage** devices mainly use for backup and file transfer between computers.
- **Used as security device in some cases to prevent software piracy.**



Advantages of pen drives	Disadvantages of pen drives
<ul style="list-style-type: none">• Small, lightweight and very portable• Very robust• Not affected by magnetic fields.	<ul style="list-style-type: none">• Due to small size it is easy to lose• Might get damaged or data corrupted if not well ejected from a computer.

3.3 Solid-state media and solid-state storage devices

□ Memory cards

- Uses solid-state technology and comes in various formats:
- SD cards (secure digital card); used in most portable devices (e.g phones)
- XD cards (extreme digital card); design for use in digital cameras
- CFast card (compactfast card); use in digital cameras with higher-end digital photo and video.



Advantages of memory cards	Disadvantages of memory cards
<ul style="list-style-type: none">• They are very compact, can be easily removed and used in other devices• Very durable; no moving parts	<ul style="list-style-type: none">• They are expensive per gigabyte• Short life span due to limited read and write operations.

Exam question



- Modern laptop computers use Solid State Drives (SSD) rather than Hard Disk Drives (HDD). State three advantages of using SSDs rather than HDDs in a laptop computer

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Advantages of SSDs

- ✓ Faster startup of laptops
- ✓ SSDs consume less power compared to HDDs
- ✓ They are lighter than HDDs so they reduce the weight of the laptop.
- ✓ No moving parts making them more durable than HDDs since.

Exam question



- Laptop computers use Solid State Drives (SSD) rather than Hard Disc Drives (HDD). Describe two disadvantages of using an SSD rather than an HDD in a laptop computer. [2]

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Disadvantages of SSDs compared to HDDs

- ✓ Limited number of read/write operations
- ✓ SSDs are more expensive per GB than HDDs.

☐ Cloud storage

- It is simply storage of data in a remote location online.
- The cloud storage system makes use of servers to store data which can be accessed by users through the internet.
- People can now stream their favorite music, movies, TV programs from cloud storage.



Advantages of cloud storage

- Data can be accessed anywhere with internet connection
- Storage space can be upgraded easily without investing in hardware

Disadvantages of cloud storage

- Data can be hacked if not properly secured.
- Lack of internet can limit data access
- Your data can be sold to third parties.

Exam question



- A developer is writing a program to record the results of examinations taken by students in a school.

The program collects a large amount of data and this could be stored using either a fixed solid-state drive (SSD) or cloud storage. The developer is planning to use cloud storage.

- (i) Describe four advantages to the school of using cloud storage rather than using the SSD.
- (ii) Describe three disadvantages to the school of using cloud storage rather than using the SSD.

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i) Advantages of using cloud storage

1. Automatic backup of data after every new entries
2. Cloud has a larger storage capacity
3. The school only pays for the amount of storage space used
4. Data can be easily shared with many people.
5. Storage capacity can easily be increased without buying any physical devices

ii) Disadvantages of using cloud storage

1. The school does not have complete control over their data.
2. Cloud storage is costly
3. Users must have internet connection to access files or data
4. Security issues as data can be hacked