G.C.E. O/L Grade 10 ICT · Lesson 3

3.4 Data Storage Units – Bit, Byte, KB, MB, GB, TB

How big is a photo, a song or your phone's storage? In this note you will learn the **units of storage** – bit, byte, kilobyte, megabyte, gigabyte and terabyte – how to **convert between them** using **1 KB = 1024 bytes**, and how to **compare the capacity** of cache, RAM, ROM, SSD/hard disk, CD/DVD, USB drives, memory cards and cloud storage.

1. Bit and byte

A **bit** (0 or 1) is the smallest unit. **8 bits = 1 byte**. One byte can store one character such as 'A' (in ASCII). 4 bits = 1 **nibble**.

2. The storage unit ladder

Unit	Equal to	In bytes	Roughly holds
1 Byte (B)	8 bits	1	One letter
1 Kilobyte (KB)	1024 bytes	2^{10} = 1024	A short text message / half a page
1 Megabyte (MB)	1024 KB	2^{20} = 1,048,576	A 1-minute MP3 song
1 Gigabyte (GB)	1024 MB	2^{30} = 1,073,741,824	About 1 hour of HD video
1 Terabyte (TB)	1024 GB	2^{40} = 1,099,511,627,776	About 250,000 photos

💡 **Rule:** going to a **bigger** unit → **divide by 1024**. Going to a **smaller** unit → **multiply by 1024**. Bits ↔ bytes → × or ÷ **8**.

3. Worked calculations

Question	Working	Answer
2 KB in bytes	2 × 1024	2048 bytes
3 MB in KB	3 × 1024	3072 KB
16 GB in MB	16 × 1024	16,384 MB
2048 GB in TB	2048 ÷ 1024	2 TB
5 bytes in bits	5 × 8	40 bits
4 KB in bits	4 × 1024 × 8	32,768 bits
512 MB in bytes	512 × 1024 × 1024	536,870,912 bytes

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Worked example: how many photos fit?

A 64 GB memory card stores photos of 4 MB each. 64 GB = 64 × 1024 MB = 65,536 MB. Photos = 65,536 ÷ 4 = **16,384 photos**.

> 💡 **Optional note – KB vs KiB:** in the O/L exam, 1 KB = 1024 bytes. Strictly, the international standard calls 1024 bytes a **kibibyte (KiB)** and uses **kB = 1000 bytes**. That is why a '1 TB' disk shows about 931 GB in Windows.

4. Comparing storage devices

Device	Typical capacity (2026)	Notes
Cache memory	a few MB (e.g. 8–64 MB)	Inside the CPU; fastest, smallest
ROM (firmware)	a few MB (e.g. 16–32 MB)	Holds BIOS/UEFI start-up program
RAM	8 – 16 GB (PC), 4 – 12 GB (phone)	Main memory, volatile
CD / DVD	700 MB / 4.7 GB	Optical, now rarely used
USB flash drive / memory card	32 GB – 1 TB	Portable flash storage
SSD / NVMe	256 GB – 2 TB	Fast flash secondary storage
Hard disk (HDD)	1 – 20 TB	Magnetic, cheap per GB
Cloud storage	15 GB free – many TB	Online, needs internet

Order of capacity (smallest → largest, typical): Cache < ROM < CD < DVD < RAM < USB flash drive < SSD < hard disk. Speed is almost the opposite: cache is the fastest.

> NEW 2026 **2026 update:** floppy disks are history. Most new laptops use **NVMe SSDs**, phones use built-in flash (128 GB – 1 TB), and students save work to **cloud storage** such as Google Drive or OneDrive.

Key Words

Byte – A group of 8 bits; stores one character.

Nibble – Half a byte = 4 bits.

Kilobyte (KB) – 1024 bytes (2^{10}).

Megabyte (MB) – 1024 KB = 1,048,576 bytes.

Gigabyte (GB) – 1024 MB; used for RAM and phone storage.

Terabyte (TB) – 1024 GB; used for hard disks and large SSDs.

Storage capacity – The amount of data a device can hold.

Cache memory – Very fast, small memory inside the CPU (a few MB).

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SSD – Solid State Drive – fast flash storage with no moving parts.

Memory card – Small flash card (SD/microSD) used in phones and cameras.

Cloud storage – Saving files on internet servers, e.g. Google Drive.

Kibibyte (KiB) – Standard name for exactly 1024 bytes; kB means 1000 bytes.

Sample Q&A

1. How many bits are in one byte?

> **Answer:** 8 bits.

2. Convert 3 MB to KB.

> **Answer:** 3 × 1024 = 3072 KB.

3. Convert 4096 MB to GB.

> **Answer:** 4096 ÷ 1024 = 4 GB.

4. Arrange cache, hard disk, RAM and DVD from smallest to largest capacity.

> **Answer:** Cache < DVD (4.7 GB) < RAM (8–16 GB) < hard disk.

5. Why does a 1 TB disk show less than 1024 GB on a PC?

> **Answer:** Makers count 1 TB as 1,000,000,000,000 bytes, but the PC divides by 1024, so it shows about 931 GB.

6. Give two advantages of cloud storage.

> **Answer:** Access files from any device anywhere; automatic backup; easy sharing.

MCQ

1. How many bits make one byte?

A. 8
B. 1024
C. 4
D. 16

2. 1 KB is equal to:

A. 1024 bits
B. 1024 bytes
C. 8 bytes
D. 1000 bits

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3. How many KB are in 2 MB?

A. 512
B. 2000
C. 2048
D. 1024

4. How many MB are in 16 GB?

A. 16000
B. 8192
C. 16384
D. 1600

5. 2048 GB is equal to:

A. 0.5 TB
B. 20 TB
C. 2 MB
D. 2 TB

6. How many bits are in 4 bytes?

A. 4096
B. 12
C. 32
D. 4

7. Which is the correct order from SMALLEST to LARGEST?

A. KB, bit, byte, GB, MB, TB
B. Byte, bit, KB, MB, TB, GB
C. Bit, KB, byte, MB, GB, TB
D. Bit, byte, KB, MB, GB, TB

8. Which memory usually has the SMALLEST capacity?

A. Cache
B. RAM
C. SSD
D. Hard disk

9. A typical 2026 student laptop has RAM of about:

A. 8 – 16 MB
B. 8 – 16 GB
C. 640 KB
D. 8 – 16 TB

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10. A 64 GB memory card stores 4 MB photos. About how many photos fit?

A. 16,384
B. 256
C. 1,600
D. 16

11. Which storage has the LARGEST capacity among these?

A. DVD
B. CD
C. RAM
D. Hard disk (4 TB)

12. A CD can store about:

A. 4.7 TB
B. 7 KB
C. 700 MB
D. 700 GB

13. Which storage needs an internet connection to use?

A. Cloud storage
B. Cache
C. SSD
D. USB flash drive

14. In the international standard, 1 kB (small k) means:

A. 1024 bytes
B. 1000 bytes
C. 8 bytes
D. 1000 bits

15. How many bytes are in 1 MB?

A. 1,024
B. 1,048,576
C. 1,000
D. 1,073,741,824

Structured Questions

1. Fill in the blanks: (i) 1 byte = ___ bits (ii) 1 KB = ___ bytes (iii) 1 GB = ___ MB (iv) 1 TB = ___ GB (4 marks) *(4 marks)*

> (i) 8 (ii) 1024 (iii) 1024 (iv) 1024

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2. Convert: (i) 5 KB to bytes (ii) 8192 MB to GB (iii) 3 bytes to bits. Show working. (3 marks) *(3 marks)*

> (i) 5 × 1024 = 5120 bytes (ii) 8192 ÷ 1024 = 8 GB (iii) 3 × 8 = 24 bits

3. A student has a 32 GB USB drive. Each video is 512 MB. (i) Convert 32 GB to MB. (1 mark) (ii) How many videos can be stored? (2 marks) *(3 marks)*

> (i) 32 × 1024 = 32,768 MB (ii) 32,768 ÷ 512 = 64 videos

4. Arrange these in ascending order of typical capacity: RAM, cache, SSD, DVD, ROM. (3 marks) *(3 marks)*

> Cache (MB) < ROM (MB) < DVD (4.7 GB) < RAM (8–16 GB) < SSD (256 GB–2 TB).

5. A text file has 2000 characters. Each character uses 1 byte. (i) What is the size in bytes? (1 mark) (ii) Is it more or less than 2 KB? Explain. (2 marks) *(3 marks)*

> (i) 2000 bytes (ii) Less – 2 KB = 2 × 1024 = 2048 bytes, and 2000 < 2048.

6. (i) Give one advantage and one disadvantage of cloud storage. (2 marks) (ii) Why is an SSD preferred over a hard disk in new laptops? (2 marks) *(4 marks)*

> (i) Advantage: access from anywhere / backup / sharing. Disadvantage: needs internet / privacy risk / monthly cost for large space. (ii) Faster start-up and loading, no moving parts so tougher, lighter and uses less power.

Summary

- 1 byte = 8 bits; 1 nibble = 4 bits.
- 1 KB = 1024 bytes; 1 MB = 1024 KB; 1 GB = 1024 MB; 1 TB = 1024 GB.
- Bigger unit → divide by 1024; smaller unit → multiply by 1024.
- Bytes ↔ bits: multiply or divide by 8.
- Capacity: cache < ROM < CD < DVD < RAM < USB < SSD < HDD (typical).
- 2026: RAM 8–16 GB, SSD 256 GB–2 TB, cache a few MB.
- Cloud storage keeps files online and needs the internet.
- kB = 1000 bytes and KiB = 1024 bytes (optional standard).

MCQ answer key – 3.4

1. **A** – 1 byte = 8 bits.
2. **B** – O/L: 1 KB = 1024 bytes.
3. **C** – 2 × 1024 = 2048.
4. **C** – 16 × 1024 = 16384.
5. **D** – 2048 ÷ 1024 = 2.
6. **C** – 4 × 8 = 32.

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7. **D** – Each step × 1024 (byte = 8 bits).
8. **A** – Cache is only a few MB.
9. **B** – Modern RAM is measured in GB.
10. **A** – 64 × 1024 ÷ 4 = 16,384.
11. **D** – HDDs reach many TB.
12. **C** – CD ≈ 700 MB; DVD ≈ 4.7 GB.
13. **A** – Cloud files live on internet servers.
14. **B** – kB = 1000 bytes; KiB = 1024 bytes.
15. **B** – 1024 × 1024.

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