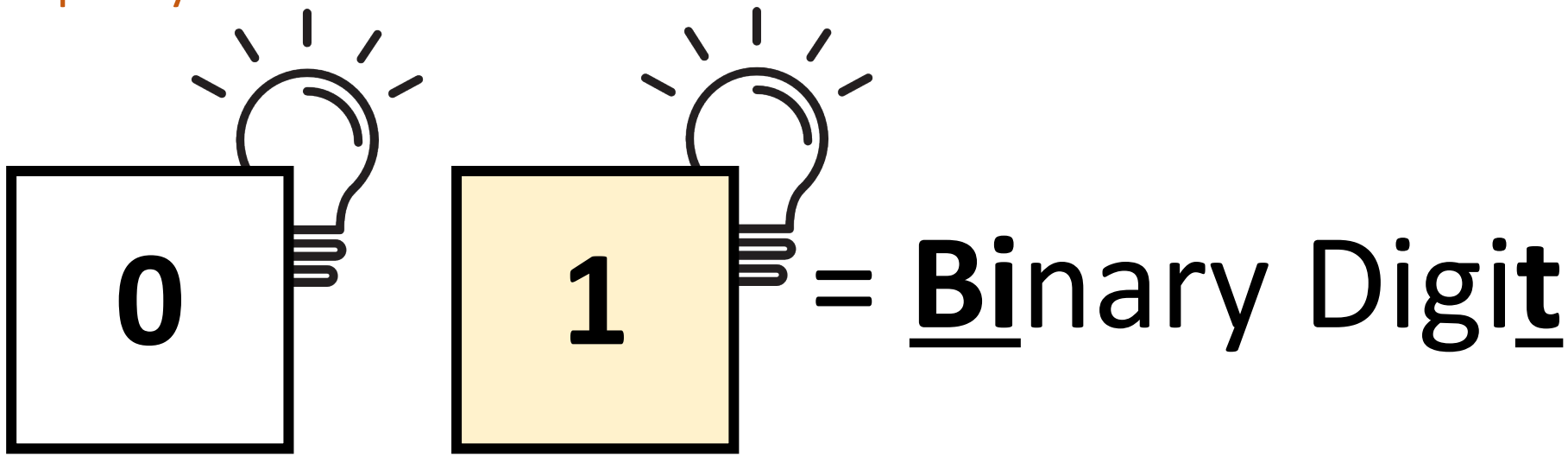
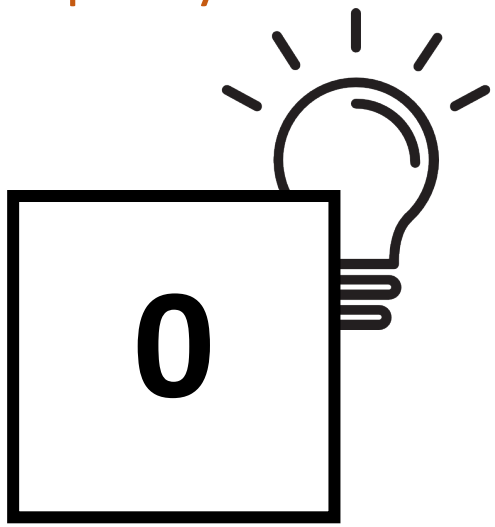
1.3 Text, sound and images

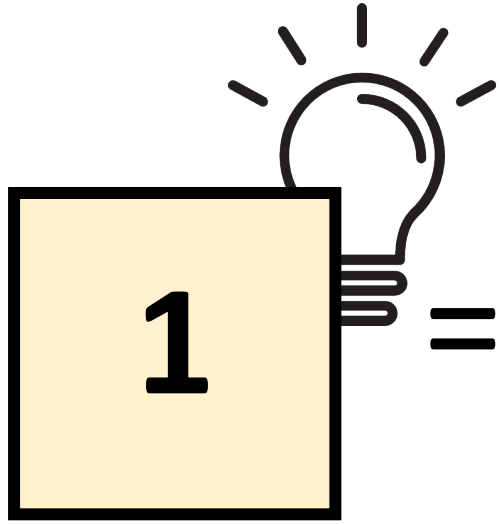
Units of data storage

Units of data capacity

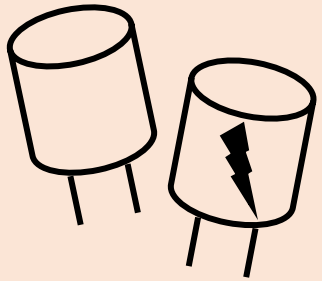


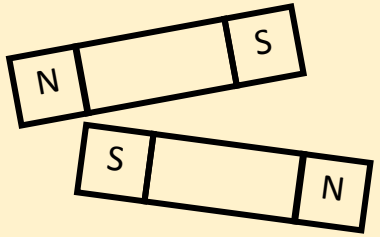
Units of data capacity

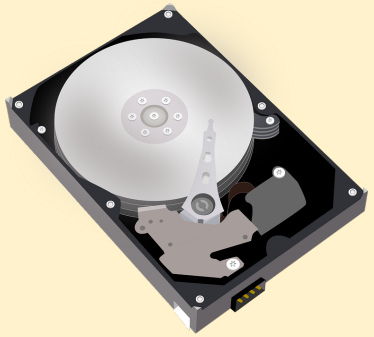


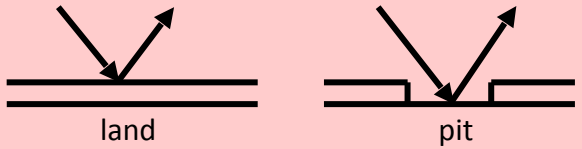


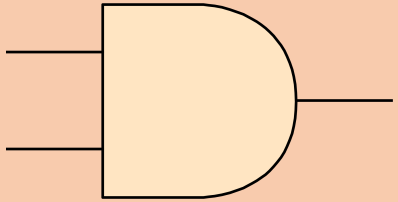
= **Bi**nary Digi**t**

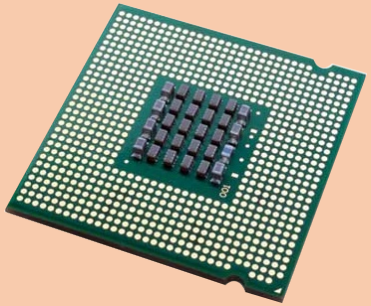




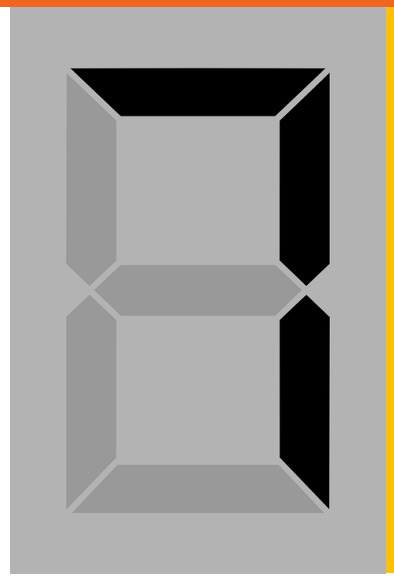






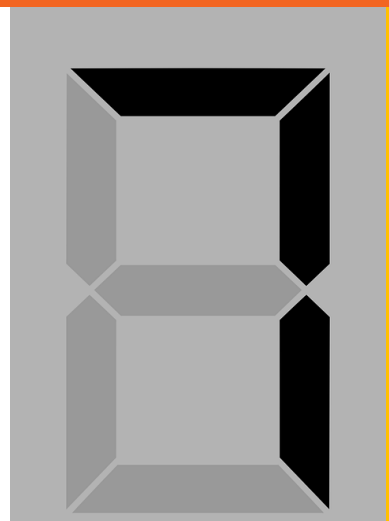


Units of data capacity



= 0111

Units of data capacity



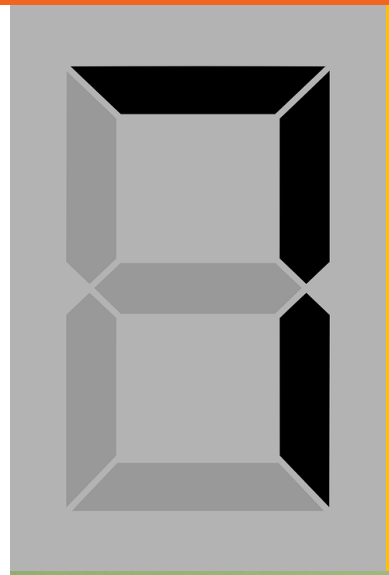
= 0111

Units of data capacity

1 byte = 8 bits = 00000111

00010011 = 19

01000001 = A



= 0111

Units of data capacity

1 byte = 8 bits = 00000111

00010011 = 19

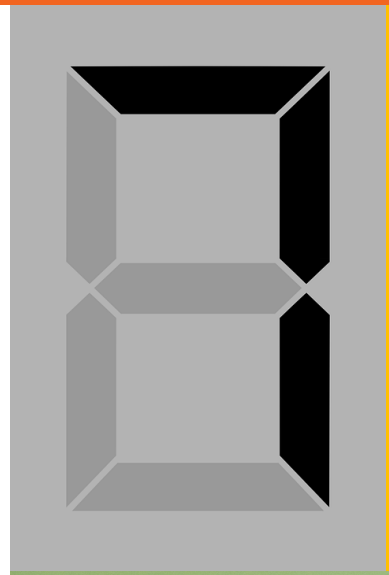
01000001 = A

1 kilobyte (KB)

= 2^{10}

= 1024 bytes

1000 ≈ bytes



= 0111

Unit sizes in denary

Unit	Symbol	Binary value	Decimal value	Approximation	Written
Bit	b	0 or 1			
Nibble		4 bits		½ byte	
Byte	B	8 bits		1 byte	
Kilobyte	KB	1024 bytes	10^3	1,000 bytes	Thousand bytes
Megabyte	MB	1024^2 bytes	10^6	1,000,000 bytes	Million bytes
Gigabyte	GB	1024^3 bytes	10^9	1,000,000,000 bytes	Billion bytes
Terabyte	TB	1024^4 bytes	10^{12}	1,000,000,000,000 bytes	Trillion bytes
Petabyte	PB	1024^5 bytes	10^{15}	1,000,000,000,000,000 bytes	Quadrillion bytes
Exabyte	EB	1024^6 bytes	10^{18}	1,000,000,000,000,000,000 bytes	Quintillion bytes

Megabyte vs mebibyte

When describing quantities of **bytes**, we can use both:

- **Binary** prefixes (representing powers of 2)
- **Decimal** prefixes (representing powers of 10)

Name	Symbol	Power	Value
Binary (Base 2)			
kibi	KiB	2^{10}	1,024
mebi	MiB	2^{20}	1,048,576
gibi	GiB	2^{30}	1,073,741,824
tebi	TiB	2^{40}	1,099,511,627,776

Name	Symbol	Power	Value
Decimal (Base 10)			
Kilo	KB	10^{3}	1000
Mega	MB	10^{6}	1,000,000
Giga	GB	10^{9}	1,000,000,000
Tera	TB	10^{12}	1,000,000,000,000

WATCH OUT!

The terms kilobyte, megabyte, etc. are often used to represent powers of 2. The International System of Units (SI units) uses these terms to refer to values based on powers of 10.

When referring to powers of 2, always use the terms kibi, mebi and so forth – these are the terms specified by the examination board.

Megabyte vs mebibyte

When describing quantities of **bytes**, we can use both:

- **Binary** prefixes (representing powers of 2)
- **Decimal** prefixes (representing powers of 10)

Name	Symbol	Power	Value
Binary (Base 2)			
kibi	KiB	2^{10}	1,024
mebi	MiB	2^{20}	1,048,576
gibi	GiB	2^{30}	1,073,741,824
tebi	TiB	2^{40}	1,099,511,627,776

Name	Symbol	Power	Value
Decimal (Base 10)			
Kilo	KB	10^{3}	1000
Mega	MB	10^{6}	1,000,000
Giga	GB	10^{9}	1,000,000,000
Tera	TB	10^{12}	1,000,000,000,000

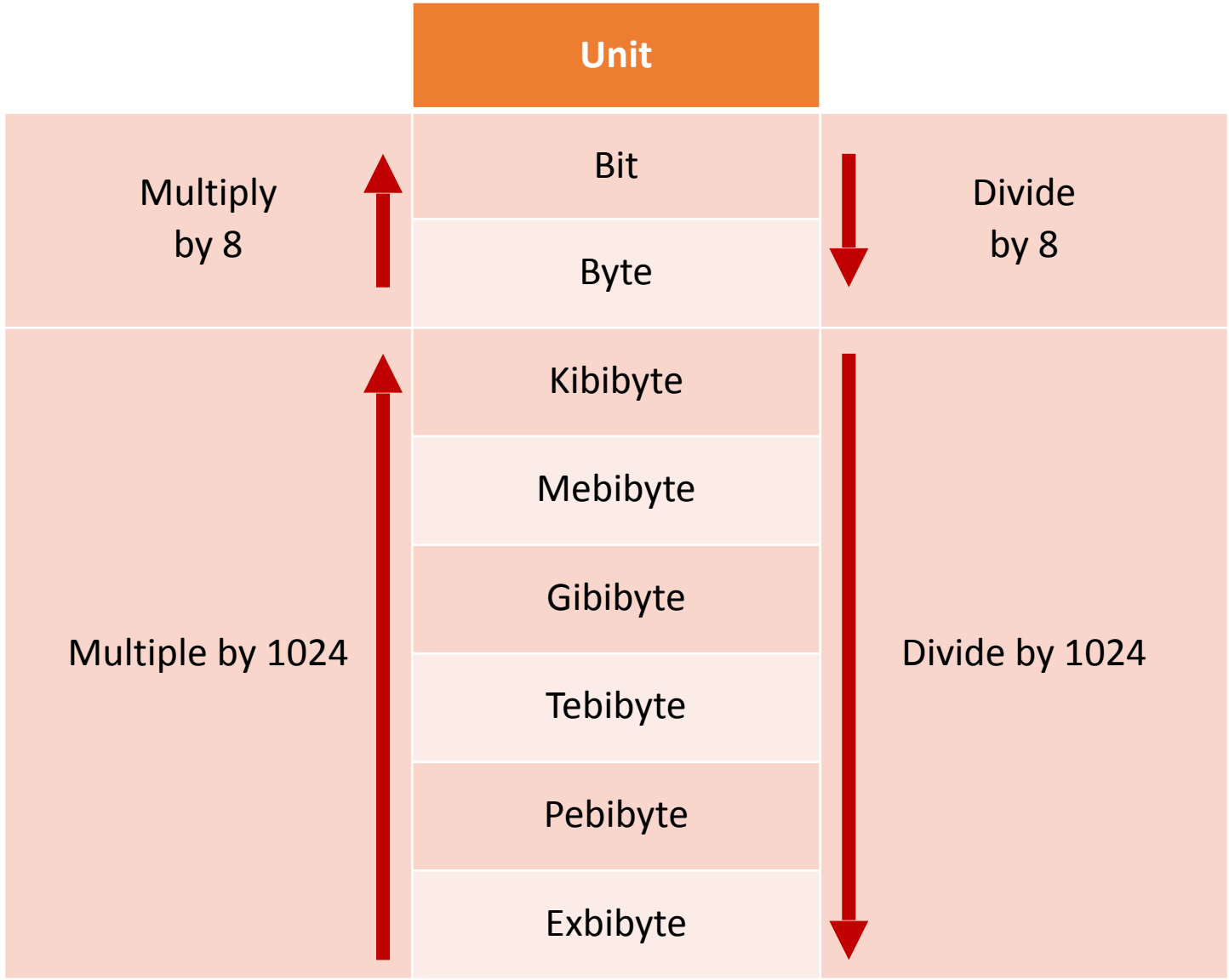
WATCH OUT!

While a megabyte is often estimated as 10^{6} or 1,000,000 bytes, a mebibyte is exactly 1,048,576 bytes – this is to avoid the ambiguity associated with the size of a megabyte.

Unit sizes in binary

Unit	Symbol	Binary value	Number of bytes	Equivalent denary value
Bit	b	0 or 1		byte
Nibble		4 bits		byte
Byte	B	8 bits		1 byte
Kibibyte	KiB	1024 bytes	2^{10}	1,024 bytes
Mebibyte	MiB	1024^2 bytes	2^{20}	1,048,576 bytes
Gibibyte	GiB	1024^3 bytes	2^{30}	1,073,741,824 bytes
Tebibyte	TiB	1024^4 bytes	2^{40}	1,099,551,627,776 bytes
Pebibyte	PiB	1024^5 bytes	2^{50}	1,125,899,906,842,624 bytes
Exbibyte	EiB	1024^6 bytes	2^{60}	1,152,921,504,606,846,976 bytes

Converting between units



Units of data capacity

Type	Size
Microsoft Word Document	1,470 KB
Adobe Acrobat Document	454 KB
Microsoft PowerPoint Presentation	665 KB
Microsoft Excel Worksheet	20 KB
Microsoft Excel Worksheet	20 KB
Microsoft PowerPoint Presentation	599 KB
Microsoft Excel Worksheet	22 KB
Microsoft Excel Worksheet	22 KB
Microsoft PowerPoint Presentation	740 KB
Microsoft Excel Worksheet	25 KB
Microsoft Excel Worksheet	25 KB
Microsoft Excel Worksheet	40 KB
Microsoft PowerPoint Presentation	479 KB

Units of data capacity

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Microsoft Excel Worksheet	22 KB
Microsoft PowerPoint Presentation	740 KB
Microsoft Excel Worksheet	25 KB
Microsoft Excel Worksheet	25 KB
Microsoft Excel Worksheet	40 KB
Microsoft PowerPoint Presentation	479 KB

WATCH OUT!

To confuse matters even further, if you look at the size of a file in Windows, you will see symbols such as KB and MB – this is because Windows is using the JEDEC 100B.01 standard for unit prefixes.

With this system, 1 KB (kilobyte) = 1024 bytes.

This is **not** the official SI unit for data storage.

Instead, you **must** use KiB (kibibyte) = 1024 bytes.

Units of data capacity

Type	Size
Microsoft Word Document	1,470 KB
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Microsoft PowerPoint Presentation	665 KB
Microsoft Excel Worksheet	20 KB
Microsoft Excel Worksheet	20 KB
Microsoft PowerPoint Presentation	599 KB
Microsoft Excel Worksheet	22 KB
Microsoft Excel Worksheet	22 KB
Microsoft PowerPoint Presentation	740 KB
Microsoft Excel Worksheet	25 KB
Microsoft Excel Worksheet	25 KB
Microsoft Excel Worksheet	40 KB
Microsoft PowerPoint Presentation	479 KB

= 1.47 MiB

Units of data capacity

Type	Size
Microsoft Word Document	1,470 KB
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Microsoft Excel Worksheet	22 KB
Microsoft PowerPoint Presentation	740 KB
Microsoft Excel Worksheet	25 KB
Microsoft Excel Worksheet	25 KB
Microsoft Excel Worksheet	40 KB
Microsoft PowerPoint Presentation	479 KB

= 1.47 MiB

= 0.74 MiB

Units of data capacity

Type	Size
Microsoft Word Document	1,470 KB
Adobe Acrobat Document	454 KB
Microsoft PowerPoint Presentation	665 KB
Microsoft Excel Worksheet	20 KB
Microsoft Excel Worksheet	20 KB
Microsoft PowerPoint Presentation	599 KB
Microsoft Excel Worksheet	22 KB
Microsoft Excel Worksheet	22 KB
Microsoft PowerPoint Presentation	740 KB
Microsoft Excel Worksheet	25 KB
Microsoft Excel Worksheet	25 KB
Microsoft Excel Worksheet	40 KB
Microsoft PowerPoint Presentation	479 KB

= 1.47 MiB

= 0.74 MiB

x 1000 = 25000B

x8 = 200000b

1.3 Data storage and compression | Units of data storage