



F8.1 Bits, bytes and units

Data representation · GCSE · OCR J277 1.2.3, AQA 8525 3.3.3, Edexcel
1CP2 2.1.1 · about 12 min

What this lesson is about

Why computers use binary, and the units from bits to petabytes.

- Why binary
- Units
- How big is a picture?

Questions

6 marks in all

1. Why do computers store data in binary?

[1 mark]

- ☐ A Their circuits are made of switches that are either on or off
- ☐ B Binary uses less electricity than denary
- ☐ C Binary numbers are shorter
- ☐ D It was the first number system invented

Answer: A. Transistors reliably hold two states, so two symbols are used.

2. Put the units in order from smallest to largest.

[1 mark]

Number the lines 1 to 7 to put them in the right order.

- ___ nibble
- ___ terabyte
- ___ megabyte
- ___ gigabyte
- ___ kilobyte
- ___ bit
- ___ byte

Answer:

bit
nibble
byte
kilobyte
megabyte
gigabyte
terabyte

Each step up the list is bigger.

3. How many bits are in a byte?

[1 mark]

Answer: 8. A byte is 8 bits; a nibble is 4.

4. How many different patterns can 5 bits make?

[1 mark]

Answer: 32. 2 to the power 5 is 32.

5. What does this program print?

[1 mark]

```
frame_bytes = 320 * 240 * 3
print(frame_bytes, frame_bytes / 1000)
```

Answer:

230400 230.4

$320 \times 240 \times 3$ bytes is 230,400 bytes, or 230.4 kB.

6. How many bytes is a kibibyte?

[1 mark]

- ☐ A 1,024
- ☐ B 1,000
- ☐ C 8
- ☐ D 1,000,000

Answer: A. Binary prefixes step up by 1,024; the decimal kilobyte is 1,000 bytes.

The task: frame sizes

The robot's camera can also capture a small 64 by 48 frame with 3 bytes per pixel. Work out and print three lines: bits: <n>, bytes: <n> and kB: <n> (kilobytes of 1,000 bytes, as a decimal). Store the width, height and bytes per pixel in variables and calculate each line; do not type the answers.

```
# the two lines every program starts with: the commands, then the robot
from bugbot import *
connect()

width = 64
```

The hint students can ask for: Multiply the pixels by the bytes each one takes. Bits are eight times the bytes, and the larger unit divides by a thousand.

A solution

```
from bugbot import *
connect()
width = 64
height = 48
bytes_per_pixel = 3
bytes = width * height * bytes_per_pixel
print('bits:', bytes * 8)
print('bytes:', bytes)
print('kB:', bytes / 1000)
```

Any program that meets the task's checks is marked correct in the simulator; this is one way, not the only way.

