Grade 6 Computing

Unit 5 · Zeros and Ones

ANSWER KEY · FOR TEACHERS

Full marks 31

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. transistors
2. bit
3. byte
4. binary
5. place value
6. pixels
7. resolution
8. kilobyte

K · 4

Each carries 0.5 mark.

2 Label the diagram

1. ×1,024
2. kilobyte
3. megabyte
4. gigabyte

K · 2

Each carries 0.5 mark.

3 Multiple choice

i. **b.** a single binary digit, 0 or 1 — K · 1

A bit is one binary digit: 0 or 1. A group of 8 bits is a byte; a small part of the screen is a pixel.

ii. **d.** 16 — U · 1

1 byte = 8 bits, so 2 bytes = 2 × 8 = 16 bits.

iii. **c.** 6 — U · 1

The place values from the right are 1, 2, 4. 110 has 1s in the fours and twos places: 4 + 2 = 6. (3 is 11 in binary; "110" read as a decimal number is one hundred and ten, which is the trap.)

iv. **c.** 31 — A · 1

Five bits, all 1: 11111 = 16 + 8 + 4 + 2 + 1 = 31. Five bits make 32 patterns, but one of them is 00000 for 0, so they count from 0 to 31.

v. **b.** 32 — A · 1

16 × 16 = 256 pixels, one bit each: 256 bits. 256 ÷ 8 = 32 bytes.

4 Binary numbers

a. MARKING SCHEME — U · 2

✓ i. 101 = 4 + 1 = 5; ii. 1100 = 8 + 4 = 12.

✓ iii. 10011 = 16 + 2 + 1 = 19; iv. 11111111 = 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 = 255.

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b. ANSWER A · 2

Number	32	16	8	4	2	1
6	0	0	0	1	1	0
13	0	0	1	1	0	1
20	0	1	0	1	0	0
45	1	0	1	1	0	1

6 = 110, 13 = 1101, 20 = 10100, 45 = 32 + 8 + 4 + 1 = 101101. (The 0s in front may be left blank.)

MARKING SCHEME

✓ 6 = 110 and 13 = 1101.
✓ 20 = 10100 and 45 = 101101.

c. ANSWER U · 3

Number of bits	Number of patterns	Biggest number
2	4	3
3	8	7
4	16	15
8	256	255

The biggest number is always one less than the number of patterns, because one pattern (all 0s) is used for 0.

MARKING SCHEME

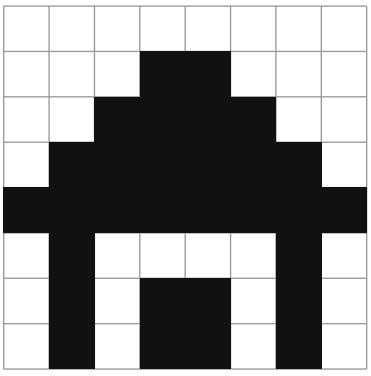
✓ 2 bits: 4 patterns; 3 bits: biggest number 7.
✓ 4 bits: 16 patterns, biggest number 15.
✓ 8 bits: 256 patterns, biggest number 255.

d. MARKING SCHEME U · 2

✓ A computer is made of switches (transistors), and a switch has two states, on and off, which fit 1 and 0.
✓ Two states are easy to tell apart, so a small wobble in the electricity can't turn one into the other; with ten levels close together it could.

5 Pictures made of pixels

a. ANSWER A · 2



A house: a roof that gets wider from row 2 to row 5, then the two walls, and a dark door in the middle.

MARKING SCHEME

✓ Rows 1 to 5 colored right: an empty top row, then a roof that gets wider.
✓ Rows 6 to 8 colored right (two walls, a door in the middle), and the picture named: a house.

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b. MARKING SCHEME A · 2

✓ 10001 · 10001 · 11111 · 10001 · 10001.

✓ The letter H.

6 Calculations

a. ANSWER A · 3

i. 40 × 30 = **1,200 pixels.**

ii. One bit for each pixel: **1,200 bits.**

iii. 1,200 ÷ 8 = **150 bytes.**

MARKING SCHEME

✓ 40 × 30 = 1,200 pixels.

✓ One bit a pixel: 1,200 bits.

✓ 1,200 ÷ 8 = 150 bytes.

b. ANSWER A · 2

16 GB = 16 × 1,024 MB = 16,384 MB.

16,384 ÷ 4 = **4,096 songs**, about four thousand.

MARKING SCHEME

✓ 16 GB = 16 × 1,024 = 16,384 MB.

✓ 16,384 ÷ 4 = 4,096 songs.

7 Think

ANSWER HA · 2

No. Mbps is **megabits** per second (small b), but MB is **megabytes** (big B), and a byte is 8 bits. 10 Mbps is about 10 ÷ 8 = 1.25 MB each second, so a 10 MB video takes about 10 ÷ 1.25 = **8 seconds**, eight times longer than she thinks.

MARKING SCHEME

✓ No: Mbps is megabits (small b), MB is megabytes (big B), and a byte is 8 bits.

✓ 10 Mbps is about 1.25 MB a second, so the video takes about 8 seconds.

8 Activity: Binary cards

(not marked)

WHAT STUDENTS SHOULD FIND

9 = 8 + 1: only the 8 card and the 1 card face up, 01001. 21 = 16 + 4 + 1: 10101. 31: every card face up, 11111, the most five cards can show. An age is checked by adding the dots that show: for example 12 = 8 + 4, 01100.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	7	9	13	2	**31**

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