

MATHS



MODEL ANSWERS

BINARY NUMBERS

SCORE

/92

PERCENTAGE

%

STEMUP

1 Write the number 14 in binary.

$$8 + 4 + 2 = 14$$

binary 1110

1110

1 / 1

2 Here is a binary number: 10001

What is the place value of the first digit (on the left)?

5 digits, so the left digit has place value $2^4 = 16$

16

1 / 1

3 Write the binary number 1111 as a decimal number.

$$8 + 4 + 2 + 1 = 15$$

15

1 / 1

- 4 Write the number 16 in binary.

$$16 = 16$$

binary 10000

10000

1 / 1

- 5 A binary number has 5 digits.

Write down the place value of each digit, starting from the left.

Place values double each time moving left,
starting at 1 on the right

16, 8, 4, 2, 1

1 / 1

- 6 Write the binary number 1110 as a decimal number.

$$8 + 4 + 2 = 14$$

14

1 / 1

7 Write the number 26 in binary.

$$16 + 8 + 2 = 26$$

binary 11010

11010

1 / 1

8 Sinead writes her age in binary as 101110.

How old is Sinead?

$$32 + 8 + 4 + 2 = 46$$

46 years old

1 / 1

9 Write the binary number 10111 as a decimal number.

$$16 + 4 + 2 + 1 = 23$$

23

1 / 1

10 Write the number 27 in binary.

$$16 + 8 + 2 + 1 = 27$$

binary 11011

11011

1 / 1

11 Ryan writes his age in binary as 101000.

How old is Ryan?

$$32 + 8 = 40$$

40 years old

1 / 1

12 Write the binary number 11010 as a decimal number.

$$16 + 8 + 2 = 26$$

26

1 / 1

13 Write the number 32 in binary.

$$32 = 32$$

binary 100000

100000

1 / 1

14 The binary number 111 is followed by the next binary number in the counting sequence.

Write down the next binary number.

$$111 = 7$$

$$7 + 1 = 8 = 1000$$

1000

1 / 1

15 Write the binary number 10010 as a decimal number.

$$16 + 2 = 18$$

18

1 / 1

16 Write the number 62 in binary.

$$32 + 16 + 8 + 4 + 2 = 62$$

binary 111110

111110

1 / 1

17 The binary number 10011 is followed by the next binary number in the counting sequence.

Write down the next binary number.

$$10011 = 19$$

$$19 + 1 = 20 = 10100$$

10100

1 / 1

18 Write the binary number 10011 as a decimal number.

$$16 + 2 + 1 = 19$$

19

1 / 1

- 19 The table shows the place values for an 8-digit binary number.
Use the table to write 180 as a binary number.

128	64	32	16	8	4	2	1

$$128 + 32 + 16 + 4 = 180$$

digits 1 under 128, 32, 16, 4

10110100

1 / 1

- 20 The binary number 1100 is followed by the next binary number in the counting sequence.
Write down the next binary number.

$$1100 = 12$$

$$12 + 1 = 13 = 1101$$

1101

1 / 1

- 21 Write the binary number 11100 as a decimal number.

$$16 + 8 + 4 = 28$$

28

2 / 2

- 22 The table shows the place values for an 8-digit binary number.
Use the table to write 107 as a binary number.

128	64	32	16	8	4	2	1

$$64 + 32 + 8 + 2 + 1 = 107$$

digits 1 under 64, 32, 8, 2, 1

01101011

2 / 2

- 23 Without converting to decimal, say whether the binary number 10001 is even or odd.
Give a reason for your answer.

$$10001 = 17$$

Odd, because the last digit is 1 (every other place value is even, and the last place value is 1)

2 / 2

- 24 A computer stores a number as the 8-digit binary number 11011001.
What is the number in decimal?

$$128 + 64 + 16 + 8 + 1 = 217$$

217

2 / 2

- 25 The table shows the place values for an 8-digit binary number.
Use the table to write 116 as a binary number.

128	64	32	16	8	4	2	1

$$64 + 32 + 16 + 4 = 116$$

digits 1 under 64, 32, 16, 4

01110100

2 / 2

- 26 Without converting to decimal, say whether the binary number 1101 is even or odd.
Give a reason for your answer.

$$1101 = 13$$

Odd, because the last digit is 1 (every other place value is even, and the last place value is 1)

2 / 2

- 27 A computer stores a number as the 8-digit binary number 10000001.
What is the number in decimal?

$$128 + 1 = 129$$

129

2 / 2

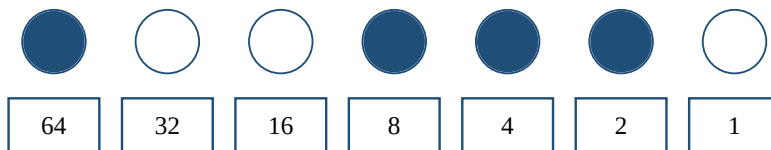
- 28 A computer uses 3 bits (binary digits) to store a whole number.
What is the largest number it can store? Give your answer in decimal.

All 3 digits are 1: $111 = 7$ (that is $2^3 - 1$)

7

2 / 2

- 29 A row of lights shows a binary number. A filled circle means the light is on (1) and an empty circle means it is off (0).
The number under each light is its place value.
Work out the number shown by the lights.



*Lights on: 64, 8, 4, 2
 $64 + 8 + 4 + 2 = 78$ (binary 1001110)*

78

2 / 2

- 30 The binary number 100?0 is equal to 16 in decimal.
What digit does the ? stand for?

*The missing digit has place value 2
the 1s must add up to 16, so the ? is 0*

0

2 / 2

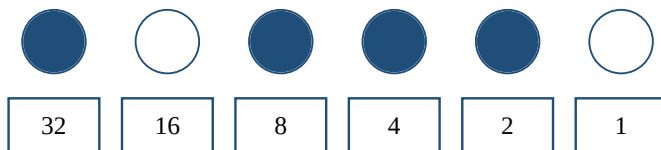
- 31 A computer uses 8 bits (binary digits) to store a whole number.
What is the largest number it can store? Give your answer in decimal.

All 8 digits are 1: 11111111 = 255 (that is $2^8 - 1$)

255

2 / 2

- 32 A row of lights shows a binary number. A filled circle means the light is on (1) and an empty circle means it is off (0).
The number under each light is its place value.
Work out the number shown by the lights.



Lights on: 32, 8, 4, 2

$32 + 8 + 4 + 2 = 46$ (binary 101110)

46

2 / 2

- 33 The binary number 1001?1 is equal to 39 in decimal.
What digit does the ? stand for?

The missing digit has place value 2

the 1s must add up to 39, so the ? is 1

1

2 / 2

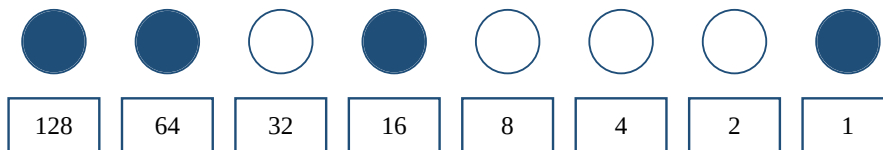
- 34 (a) Write down the largest binary number with 4 digits.
 (b) Work out the value of this number in decimal.

$$8 + 4 + 2 + 1 = 15$$

(a) 1111 (b) 15

2 / 2

- 35 A row of lights shows a binary number. A filled circle means the light is on (1) and an empty circle means it is off (0).
 The number under each light is its place value.
 Work out the number shown by the lights.



Lights on: 128, 64, 16, 1

$$128 + 64 + 16 + 1 = 209 \text{ (binary 11010001)}$$

209

2 / 2

- 36 Sam says the binary number 11001 is greater than 21.
 Is Sam correct? Show how you decide.

Convert 11001 to decimal

Yes. Sam is correct: $11001 = 25$, which is greater than 21

2 / 2

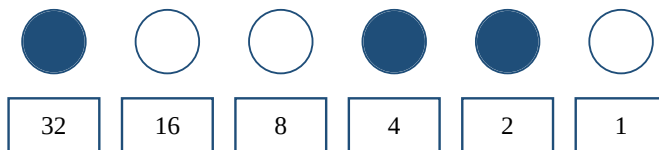
- 37 (a) Write down the largest binary number with 6 digits.
 (b) Work out the value of this number in decimal.

$$32 + 16 + 8 + 4 + 2 + 1 = 63$$

(a) 111111 (b) 63

2 / 2

- 38 A row of lights shows a binary number. A filled circle means the light is on (1) and an empty circle means it is off (0).
 The number under each light is its place value.
 Work out the number shown by the lights.



Lights on: 32, 4, 2
 $32 + 4 + 2 = 38$ (binary 100110)

38

2 / 2

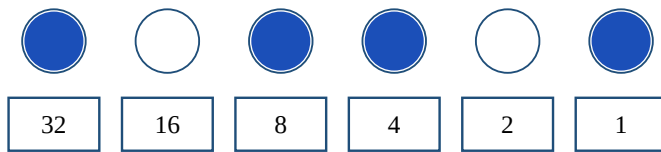
- 39 Sam says the binary number 11110 is greater than 29.
 Is Sam correct? Show how you decide.

Convert 11110 to decimal

Yes. Sam is correct: $11110 = 30$, which is greater than 29

3 / 3

- 40 A row of 6 lights shows a binary number. The number under each light is its place value. Draw a filled circle on the lights that should be on to show the number 45.



$$32 + 8 + 4 + 1 = 45$$

Lights on: 32, 8, 4, 1 (binary 101101)

3 / 3

- 41 Write these binary numbers in order, smallest first.

11000 101011 100

$$11000 = 24$$

$$101011 = 43$$

$$100 = 4$$

100, 11000, 101011

3 / 3

- 42 A control panel has 8 switches. Each switch is either on or off.

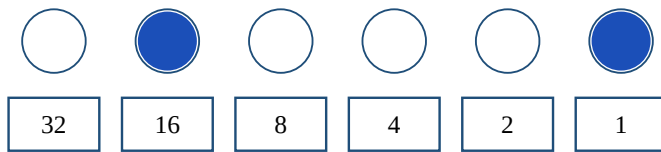
How many different settings are there? (All off counts as one setting.)

Each switch has 2 choices: $2^8 = 256$ (these are the numbers 0 to 255)

256

3 / 3

- 43 A row of 6 lights shows a binary number. The number under each light is its place value. Draw a filled circle on the lights that should be on to show the number 17.



$$16 + 1 = 17$$

Lights on: 16, 1 (binary 010001)

3 / 3

- 44 Work out $10010 + 110$ in binary.
Give your answer as a binary number.

$$10010 = 18 \text{ and } 110 = 6$$

$$18 + 6 = 24 = 11000$$

11000

3 / 3

- 45 In binary, 29 is 11101.
(a) Write 2×29 in binary, without converting from decimal.
(b) Explain how you worked out your answer.

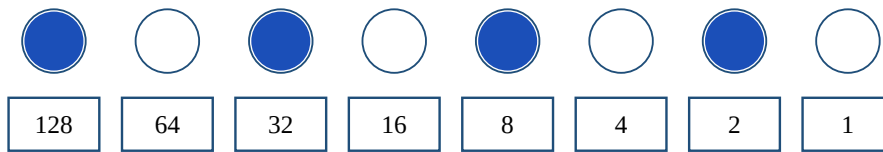
Each place value is twice the one on its right

(a) 111010

(b) Doubling moves every digit one place to the left, so a 0 is added on the right

3 / 3

- 46 A row of 8 lights shows a binary number. The number under each light is its place value. Draw a filled circle on the lights that should be on to show the number 170.



$$128 + 32 + 8 + 2 = 170$$

Lights on: 128, 32, 8, 2 (binary 10101010)

3 / 3

- 47 Work out $101 + 110$ in binary. Give your answer as a binary number.

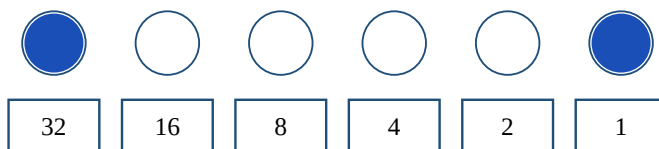
$$101 = 5 \text{ and } 110 = 6$$

$$5 + 6 = 11 = 1011$$

1011

3 / 3

- 48 A row of 6 lights shows a binary number. The number under each light is its place value. Draw a filled circle on the lights that should be on to show the number 33.



$$32 + 1 = 33$$

Lights on: 32, 1 (binary 100001)

3 / 3

- 49 Work out $101 + 100$ in binary.
Give your answer as a binary number.

$$101 = 5 \text{ and } 100 = 4$$
$$5 + 4 = 9 = 1001$$

1001

3 / 3

- 50 Work out $10011 + 1001$ in binary.
Give your answer as a binary number.

$$10011 = 19 \text{ and } 1001 = 9$$
$$19 + 9 = 28 = 11100$$

11100

3 / 3