



# Powers of 10

Year 7 About 60 minutes No calculator 50 marks

Date \_\_\_\_\_

## A Do Now

Quick questions to start.

**A1** Needed today [1 mark]  
Write  $10^4$  as an ordinary number.

Answer .....

**A2** Needed today [1 mark]  
Work out  $3.6 \times 100$ .

Answer .....

**A3** Last lesson [1 mark]  
A plumber charges £40 to call plus £25 for each hour. Work out the charge for a 3-hour job.

Answer .....

**A4** From chapter 4 [1 mark]  
Work out 15% of £60.

Answer .....

## B Example, then your turn

Year 7

Your teacher works through each example with you. Then try the one beside it.

**EXAMPLE 1**

Work out

(a)  $6.284 \times 10^3$

(b)  $517 \div 10^2$ .

**Hint**  $10^3 = 1000$ . Multiplying by 1000 moves every digit 3 places to the left; dividing by 100 moves every digit 2 places to the right.**B1** Work out [2 marks]

(a)  $0.0473 \times 10^2$

(b)  $89.1 \div 10^3$ .

Answer (a) ..... (b) .....

**EXAMPLE 2**

Work out

(a)  $3.92 \times 10^{-2}$

(b)  $45 \times 10^{-3}$ .

**Hint**  $10^{-2} = 0.01$ , so multiplying by  $10^{-2}$  is the same as dividing by 100.**B2** Work out [2 marks]

(a)  $7.15 \times 10^{-1}$

(b)  $268 \times 10^{-3}$ .

Answer (a) ..... (b) .....

**EXAMPLE 3**

Work out

(a)  $5.18 \div 10^{-2}$

(b)  $0.063 \div 10^{-3}$ .

**Hint** Dividing by  $10^{-2}$  undoes multiplying by  $10^{-2}$ , so it is the same as multiplying by 100. The answer is bigger.

**B3** Work out

[2 marks]

(a)  $2.47 \div 10^{-1}$

(b)  $0.0915 \div 10^{-4}$ .

Answer (a) ..... (b) .....

**EXAMPLE 4**

(a) Write 0.0001 as a power of 10.

(b) Write 4800 in the form  $48 \times 10^n$ .(c) Write 0.0059 in the form  $59 \times 10^n$ .

**Hint** Count the places the digits move. Moving to the left is a positive power; moving to the right is a negative power.

**B4** (a) Write 0.00001 as a power of 10. [3 marks]

10.

(b) Write 930 000 in the form  $93 \times 10^n$ .(c) Write 0.071 in the form  $71 \times 10^n$ .

Answer (a) ..... (b) ..... (c) .....

**EXAMPLE 5**

One grain of sand has a mass of  $7 \times 10^{-4}$  grams. Work out the mass of 2 000 000 grains of sand. Give your answer in kilograms.

**Hint** Write  $7 \times 10^{-4}$  as a decimal first. Then multiply, and change grams to kilograms at the end.

**B5** One sheet of card is  $3 \times 10^{-1}$  mm thick. A stack has 240 sheets of this card. Work out the height of the stack in centimetres. [3 marks]

mm thick. A stack has 240 sheets of this card. Work out the height of the stack in centimetres.

Answer .....

**c Practice**

Year 7

**C1** Find the missing power:

[2 marks]

(a)  $6.3 \times 10^{\square} = 0.0063$

(b)  $2.4 \div 10^{\square} = 2400$ .

Answer (a) ..... (b) .....

**C2** Write these numbers in order of size. Start with the smallest. [2 marks]

$$5 \times 10^{-2}, \quad 0.6 \div 10, \\ 48 \times 10^{-3}, \quad 0.0049 \times 10$$

Answer .....

- C3** Write each answer in index form. [3 marks]
- (a)  $1 \div 10\,000\,000$
- (b)  $6 \div 1000$
- (c)  $3 \div 10\,000$
- C4** 1 millimetre =  $10^{-3}$  metres. [2 marks]
- (a) Write 2650 mm in metres.
- (b) Write 0.38 m in millimetres.

Answer (a) ..... m (b) ..... mm

Answer (a) ..... (b) ..... (c) .....

- C5** Work out  $0.36 \times 10^4 \div 10^{-2}$ . [2 marks]

Answer .....

## **D** Exam-style questions

GCSE Foundation

- D1** Answer each part.

- (a) Write  $10^{-2}$  as a decimal. [1 mark]

Answer .....

- (b) Work out  $2.85 \times 10^3$ . [1 mark]

Answer .....

- (c) Work out  $64 \times 10^{-3}$ . [1 mark]

Answer .....

Total for D1: 3 marks

- D2** Jamal says, "Dividing by  $10^{-2}$  makes a number smaller, so  $3.5 \div 10^{-2} = 0.035$ ." [2 marks]

Explain why Jamal is wrong. Work out the correct answer.

Answer .....

**D3** A bacterium is  $2 \times 10^{-3}$  mm long.

(a) Write  $2 \times 10^{-3}$  as an ordinary number.

[1 mark]

Answer .....

(b) How many of these bacteria, placed end to end, make a line 1 cm long? You must show your working.

[2 marks]

Answer .....

(c) A sample holds 3 000 000 of these bacteria. They are placed end to end. Work out the length of the line in metres.

[2 marks]

Answer .....

Total for D3: 5 marks

**D4** A grain of rice has a mass of 0.025 grams.

(a) Write 0.025 in the form  $25 \times 10^n$ .

[1 mark]

Answer .....

(b) A bag holds 48 000 grains of rice. Work out the mass of the rice in the bag. Give your answer in kilograms.

[3 marks]

Answer .....

Total for D4: 4 marks

**D5** Work out the value of  $n$  and the value of  $m$ .

(a)  $4.6 \times 10^n = 0.046$

[1 mark]

Answer  $n = \dots\dots$

(b)  $0.83 \div 10^m = 830$

[1 mark]

Answer  $m = \dots\dots$

Total for D5: 2 marks

**D6** Ruth writes these four numbers.

$$0.7 \times 10^{-1} \quad 70 \times 10^{-3} \quad 0.007 \times 10^2 \quad 7 \div 10^3$$

(a) Two of the numbers are equal. Write down these two numbers.

[2 marks]

Answer .....

(b) Which number is the largest?

[1 mark]

Answer .....

Total for D6: 3 marks

## **E** Extension

Stretch

No route is given. The hints are at the end of the sheet. Use one at a time.

**E1** A dripping tap loses one drop every half a second. One drop has a volume of  $5 \times 10^{-2} \text{ cm}^3$ . 1 litre = 1000  $\text{cm}^3$ . How many litres of water does the tap lose in one day? You must show your working. [4 marks]

Answer .....

### Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Work out how many drops fall in one day. There are 24 hours in a day, 60 minutes in an hour and 60 seconds in a minute.
- Hint 2** One day is  $24 \times 60 \times 60 = 86\,400$  seconds, so  $2 \times 86\,400 = 172\,800$  drops fall.
- Hint 3**  $172\,800 \times 0.05 = 8640 \text{ cm}^3$ , and  $8640 \div 1000 = 8.64$  litres.

### How did it go?

Colour one circle on each line: not yet, nearly, yes.

I can multiply and divide by positive and negative powers of 10.



I can write a number in index form, such as  $59 \times 10^{-4}$ .



I can use powers of 10 to change units and solve problems.

