

C1.8 Standard form

Name: _____ Class: _____ Date: _____

Total: 20 marks**KEY WORDS** standard form 科学记数法 • decimal 小数 • power 幂 • integer 整数 • rate 比率

Objective

Use standard form to solve Core IGCSE Mathematics problems.

You must be able to:

- Write numbers in normalised standard form
- Calculate products and quotients in standard form
- Align powers of ten when adding quantities

1 Key knowledge and worked examples

■ Key knowledge: Standard form

Standard form is $A \times 10^n$ with $1 \leq A < 10$ and integer n . Large numbers have positive powers; small positive numbers have negative powers. For multiplication, multiply coefficients and add powers. For division, divide coefficients and subtract powers. Renormalise the coefficient at the end. Core standard-form calculations belong to calculator Paper 3.

■ Worked example: Standard form

ordinary 72000	coefficient 7.2	power 10 to 4
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Calculate $(6 \times 10^4)(3 \times 10^{-2})$.

- Multiply separately: $Q = (6 \times 3) \times 10^{4-2} = 18 \times 10^2$.
- The coefficient is too large: $Q = 1.8 \times 10^3$.
- Converting 0.00072 gives 7.2×10^{-4} ; the power restores the original decimal.

■ Method check

After calculating, check that the coefficient is at least 1 and less than 10. Addition needs equal powers of ten before combining coefficients.

2 Practice

2.1 Write 540000 in standard form. [2]

2.2 Write 3.8×10^{-3} as an ordinary decimal. [2]

2.3 Write 0.000091 in standard form. [2]

2.4 Calculate $(8 \times 10^6) \div (2 \times 10^2)$ in standard form. [2]

3 Exam-style questions

3.1 Apply the standard form methods below. Show working and include units where appropriate.

(a) A factory makes 2.5×10^4 buttons each day for 12 days. Find the total in standard form. [2]

(b) Each box holds 6×10^2 buttons. Find the number of full boxes. [2]

- (c) Write the total number of buttons as an ordinary integer. [2]

3.2 A storage device holds 3.6×10^9 bytes. Each image uses 4.5×10^6 bytes.

- (a) Find the maximum number of these images the device holds. State an assumption used. [3]

- (b) Two backups occupy 2.8×10^8 bytes and 7.5×10^7 bytes. Find their combined size in standard form. [3]

Solutions

Award method and answer marks as indicated; accept equivalent correct methods.

2.1

- Move the point five places: 5.4×10^5 .

2.2

- Divide by 1000: **0.0038**.

2.3

- The coefficient is 9.1; 9.1×10^{-5} restores the value.

2.4

- $Q = (8/2) \times 10^{6-2} = 4 \times 10^4$.

3.1

(a)

- $N = (2.5 \times 10^4) \times 12 = 30 \times 10^4 = 3 \times 10^5$.

(b)

- $B = (3 \times 10^5)/(6 \times 10^2) = 0.5 \times 10^3 = 500$.

(c)

- $N = 3 \times 100000 = 300000$.

3.2

(a)

- Use $N = \text{capacity}/\text{image size}$.
- $N = (3.6/4.5)10^{9-6} = 800$ images.
- Assume all the stated capacity is available for images, with no other storage used.

(b)

- Write the second size as 0.75×10^8 .
- Total $S = (2.8 + 0.75)10^8$, so $S = 3.55 \times 10^8$ bytes.