Indices and scientific notation - practice test 3

16 questions | 46 marks | 60 minutes

Apply powers and scientific notation to models, measurements and multi-step situations.

Equivalent correct methods earn the corresponding marks.

1. A rectangular array has 10^3 rows, each containing 10^2 cells. How many cells are there? [2 marks]

Multiply $10^3 \times 10^2 = 10^5$.

Answer: $10^5 = 100000$ cells

2. A machine doubles a quantity six times and then halves it four times. Write the net multiplier as a power of 2. [2 marks]

The net multiplier is $2^6 \div 2^4 = 2^{6-4} = 2^2$.

Answer: $2^2 = 4$

3. Write the reciprocal of 7^3 using a negative exponent. [1 mark]

$\frac{1}{7^3} = 7^{-3}$.

Answer: 7^{-3}

4. A rule gives $R = 4t^{-2}$ for $t \neq 0$. Find R when $t = 2$. [2 marks]

$R = 4 \times 2^{-2} = 4 \times \frac{1}{4} = 1$.

Answer: 1

5. A cube has side length $2x^2$ cm, where $x \neq 0$. Express its volume in simplest index form. [3 marks]

$V = (2x^2)^3 = 2^3 x^6 = 8x^6$.

Answer: $8x^6$ cm^3

6. An electronic component has mass 0.000038 kg. Write this in scientific notation. [2 marks]

$3.8 \div 100000 = 0.000038$.

Answer: 3.8×10^{-5} kg

7. A distance is recorded as 12.5×10^{6} m. Rewrite it in standard scientific notation. [2 marks]

Divide 12.5 by 10 and increase the exponent by 1.

Answer: 1.25×10^{7} m

8. Sensor A detects 8.6×10^{-5} m. Sensor B detects 1.2×10^{-4} m. Which detects the smaller length? [3 marks]

$1.2 \times 10^{-4} = 12 \times 10^{-5}$ m.

$8.6 < 12$, so A detects the smaller length.

Answer: Sensor A

9. A sheet has area 4×10^{-2} m^2. How much area do 300 sheets cover without overlap? [3 marks]

$300 = 3 \times 10^{2}$.

$(4 \times 10^{-2})(3 \times 10^{2}) = 12$ m^2.

Answer: 12 m^2

10. A tank contains 7.2×10^{5} mL. Each bottle holds 6×10^{2} mL. How many full bottles can be filled? [3 marks]

$\frac{7.2 \times 10^{5}}{6 \times 10^{2}} = 1.2 \times 10^{3} = 1200$.

Answer: 1200 bottles

11. Two measured distances are 3.6×10^{7} m and 8×10^{6} m. Find their sum in scientific notation. [3 marks]

$8 \times 10^{6} = 0.8 \times 10^{7}$.

$(3.6 + 0.8) \times 10^{7} = 4.4 \times 10^{7}$.

Answer: 4.4×10^{7} m

12. A model planet is 9 cm wide. The planet diameter is 1.8×10^7 m. Find the real-to-model diameter ratio. [4 marks]

$9\text{ cm} = 9 \times 10^{-2}$ m.

$\frac{1.8 \times 10^7}{9 \times 10^{-2}} = 0.2 \times 10^9 = 2 \times 10^8$.

Answer: $2 \times 10^8 : 1$

13. A craft covers 4.5×10^8 m at 1.5×10^5 m/s. Find its travel time in minutes at constant speed. [4 marks]

$t = \frac{4.5 \times 10^8}{1.5 \times 10^5} = 3 \times 10^3 = 3000$ s.

$3000 \div 60 = 50$ minutes.

Answer: 50 minutes

14. A digital image has 2.4×10^6 pixels. Each pixel uses 3 bytes. An album contains 250 images. Find its size in bytes, ignoring extra file data. [4 marks]

One image uses $(2.4 \times 10^6) \times 3 = 7.2 \times 10^6$ bytes.

Album size $= (7.2 \times 10^6)(2.5 \times 10^2) = 18 \times 10^8 = 1.8 \times 10^9$ bytes.

Answer: 1.8×10^9 bytes

15. A student multiplies $(2 \times 10^3)(6 \times 10^4)$ and writes 12×10^{12}. Correct both errors. [4 marks]

The powers multiply by adding exponents: $10^{3+4} = 10^7$, not 10^{12}.

12×10^7 is then normalised to 1.2×10^8.

Answer: 1.2×10^8

16. A model assumes that a download rate of 4×10^6 bytes/s stays constant. A file has 1.2×10^9 bytes. Find the predicted time and name one reason the real time could be longer. [4 marks]

$t = \frac{1.2 \times 10^9}{4 \times 10^6} = 0.3 \times 10^3 = 300$ s.

The calculation ignores connection delays, pauses and variation in transfer speed.

Answer: 300 s; pauses or a lower actual rate can increase it.