

Topic Check In - 3.02 Standard form

1. Write the number three million in standard form.
2. Write the number 0.000045 in standard form.
3. Write 7.13×10^3 as an ordinary number.
4. Write 2.5×10^{-6} as an ordinary number.
5. Write the numbers 3.2, 45×10^{-3} , 2400, 1.56×10^{-2} from smallest to largest, giving them all in standard form.
6. Malin is asked to calculate $2 \times 10^5 \times 6 \times 10^4$, giving the answer in standard form. His answer is 12×10^9 . Is he right? Give a reason for your answer.
7. A sunflower measuring 4×10^{-2} m grows to 2×10^{-1} m over 4 weeks. Explain in words how many times bigger the sunflower is after the 4 weeks.
8. Using the conversion **1 km = 1000 m**, write a rule in your own words for converting a distance in metres written in standard form to a distance in kilometres written in standard form.
9. The mass of one molecule of water is 2.99×10^{-23} g. Estimate how many molecules of water there are in a droplet of water weighing 0.0024 g.
10. The speed of light is 3×10^8 **metres per second**. The distance from the Earth to the Sun is 1.5×10^{11} **metres**. Find how long it takes a beam of light to travel from the Sun to the Earth.

Extension

The number $n!$ (called n factorial) is the product of the first n whole numbers, so:

$$3! = 1 \times 2 \times 3 = 6.$$

Scientific calculators have a factorial key. Find this on your calculator and use it to calculate, in standard form correct to 3 significant figures:

(a) $10!$

(b) $20!$

(c) Investigate the largest number n for which your calculator can calculate $n!$.



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Answers

- 3×10^6
- 4.5×10^{-5}
- 7130
- 0.0000025
- 1.56×10^{-2} , 4.5×10^{-2} , 3.2×10^0 , 2.4×10^3
- No, it should be 1.2×10^{10} .
- 10^{-2} to 10^{-1} is 10 times bigger
4 to 2 is 0.5 times bigger
Overall growth is $10 \times 0.5 = 5$ times bigger or
- Subtract 3 from the power of 10
- $0.0024 \text{ g} = 2.4 \times 10^{-3} \text{ g}$
 $2.4 \times 10^{-3} \div 3 \times 10^{-23}$
 $\approx 0.8 \times 10^{20}$
 $\approx 8 \times 10^{19}$ molecules
- $\frac{15 \times 10^{10}}{3 \times 10^8} = 5 \times 10^2 = 500$ seconds (or 8 minutes and 20 seconds)

Extension

- $10! = 3.63 \times 10^6$
- $20! = 2.43 \times 10^{18}$
- Calculators may vary, but most will get as far as $69! = 1.71 \times 10^{98}$, because $70!$ is over 10^{100} , which is too big for most calculators to handle.



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Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Write numbers expressed in words in standard form.			
AO1	2	Write numbers in standard form.			
AO1	3	Convert numbers in standard form to ordinary numbers.			
AO1	4	Convert numbers in standard form to ordinary numbers.			
AO1	5	Write and order numbers in standard form.			
AO2	6	Perform calculations in standard form and recognise that for $a \times 10^n$ a must be between 1 and 10.			
AO2	7	Interpret the size of numbers written in standard form.			
AO2	8	Use standard form for metric units of length.			
AO3	9	Perform real-world calculations involving small numbers using standard form.			
AO3	10	Perform real-world calculations involving compound units using standard form.			

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