

Higher Check In - 3.02 Standard form

Do not use a calculator for questions 1-5.

- Calculate $(1.2 \times 10^{-3}) \div 20^3$ giving your answer in standard form.
- Each edge of a cube is (4×10^2) mm long. Find the volume of the cube in m^3 , giving your answer in standard form.
- Work out $\frac{1.5 \times 10^4}{2.3 \times 10^{-2} + 2.0 \times 10^{-3}}$, giving your answer in standard form.
- How many times bigger is 20^3 compared to $(0.2)^3$? Give your exact answer in standard form.
- Write the following expressions in order from smallest to largest.

$$\left(\frac{(2 \times 10^3) \times (6 \times 10^{-2})}{3 \times 10^2} \right) \quad (2 \times 10^{-2})^3 \quad \sqrt{(6.4 \times 10^{-5})} \quad \left(\frac{(6 \times 10^{-2}) \times (3 \times 10^4)}{1.8 \times 10^3} \right)$$

- The UK population is rising by 7% each decade. In 2010 the UK population was 6.277×10^7 . A newspaper headline in 2010 said, "UK population will be 72 million by 2030". Show that the headline is correct.
- Alan works out $(3.2 \times 10^5) \div (8.0 \times 10^{-2})$ and gives the answer 4×10^2 . Without doing the calculation, explain how you know the answer is wrong.
- A bus company wants to buy a large quantity of fuel. Two companies are selling the fuel at the below prices.

Fuel Solutions	Value Fuels
3×10^3 dekalitres for £1239 (1 dekalitre = 10 litres)	1.2×10^3 hectolitres for £4980 (1 hectolitre = 100 litres)

Which company is offering the best value for money? Show all your working.

- A grain of sand has radius 3.1×10^{-3} mm. Use the formula for the volume of a sphere, $V = \frac{4 \times \pi \times r^3}{3}$, to estimate the number of grains of sand in a 1 m^3 bag.
- The Earth travels approximately 9.4×10^8 km in its orbit around the sun. Calculate the average speed of the Earth around the sun in metres per second.

Extension

The speed of light is 6.7×10^8 miles per hour.
Show that this is approximately the same as 3.0×10^5 m/s.
[1 mile = 1.609 km]

Answers

1. 1.5×10^{-7}
2. $6.4 \times 10^{-2} \text{ m}^3$
3. 6×10^5
4. 1×10^6
5. $(2 \times 10^{-2})^3 = 8 \times 10^{-6}$ [smallest]

$$\sqrt{(6.4 \times 10^{-5})} = 8 \times 10^{-3}$$

$$\left(\frac{(2 \times 10^3) \times (6 \times 10^{-2})}{3 \times 10^2} \right) = 4 \times 10^{-1}$$

$$\left(\frac{(6 \times 10^{-2}) \times (3 \times 10^4)}{1.8 \times 10^3} \right) = 1 \times 10^0 \text{ [largest]}$$

6. $6.277 \times 10^7 \times 1.07^2 = 71\,865\,373 \approx 72$ million so it is correct to 2sf.
7. E.g. The divisor is much smaller than 3.2×10^5 so will go into it many times. However, the answer is smaller than 3.2×10^5 ($10^2 < 10^5$) so it cannot be correct.

E.g. $10^5 \div 10^{-2} = 10^7$ so Alan's answer looks too small oe.

8. $\frac{1239}{3 \times 10^4} = 0.0413$ and $\frac{4980}{1.2 \times 10^5} = 0.0415$ oe. Fuel Solutions is better value at 4.13p per litre.

9. Number of grains of sand (N) = $\frac{\text{Total volume}}{\text{Volume of one grain}}$

$$N = \frac{(1 \times 10^3)^3}{\left(\frac{4 \times \pi \times (3.1 \times 10^{-3})^3}{3} \right)} = 8.01 \times 10^{15} \text{ (3sf)}$$

10. $\frac{9.4 \times 10^8 \times 10^3}{365 \times 24 \times 60 \times 60} = 2.98 \times 10^4 \text{ m/s (3sf)}$

GCSE (9–1)

MATHEMATICS

Extension

$$\frac{6.7 \times 10^8 \times 1.609 \times 10^3}{60 \times 60} = 299452777.8 = 3.0 \times 10^8 \text{ m/s}$$

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Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Divide numbers in standard form			
AO1	2	Cube a number in standard form, ensuring answer in standard form			
AO1	3	Divide numbers in standard form			
AO1	4	Compare numbers using standard form			
AO1	5	Order numbers in standard form			
AO2	6	Calculate with standard form and percentage			
AO2	7	Use standard form in estimations			
AO2	8	Use a calculator to perform calculations with numbers in standard form			
AO3	9	Use standard form in standard unit measurement calculations			
AO3	10	Use standard form in compound unit measurement calculations			

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