Fun Physics Fact of the Day

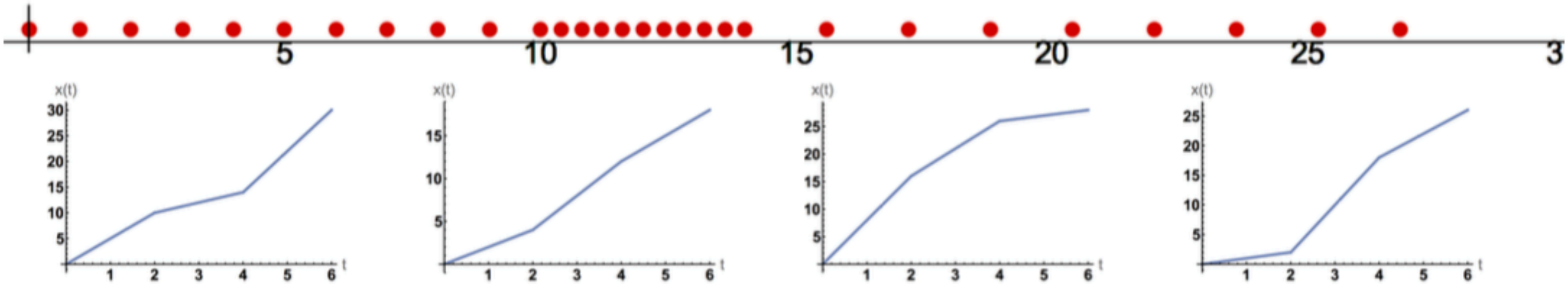
In a 1 mm-thick slice of typical household copper wire, there are

$$3.51 \times 10^{20}$$

copper atoms. Roughly, this is equal to the number of grains of sand on Earth.

Question #13 From motion diagram to graph

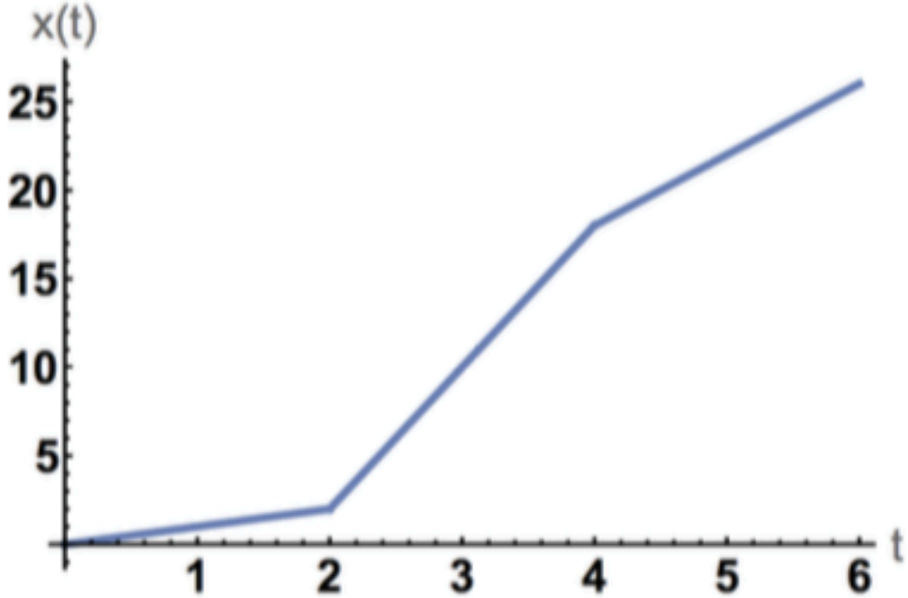
Below you will see a simple motion diagram. Which of the position vs. time graphs below is correct?



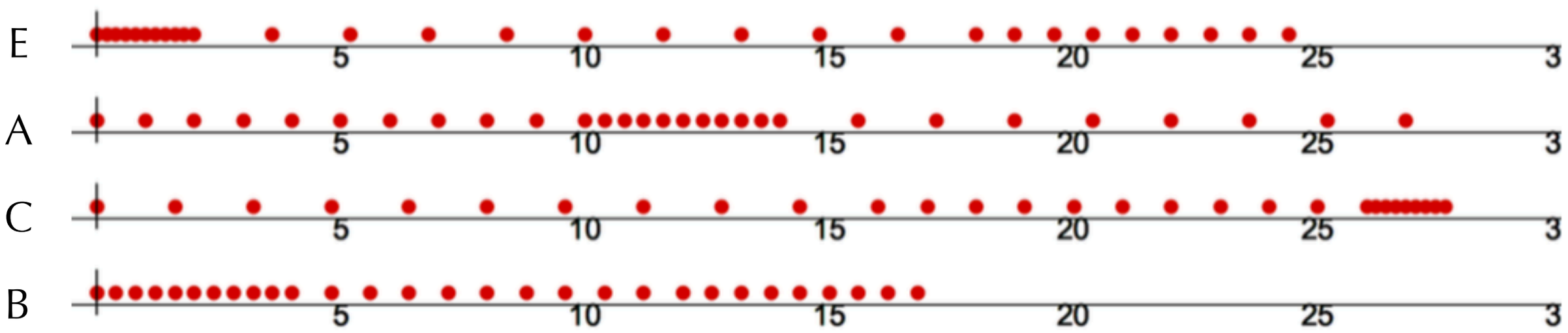
D B A C

From graph to diagram **Question #14**

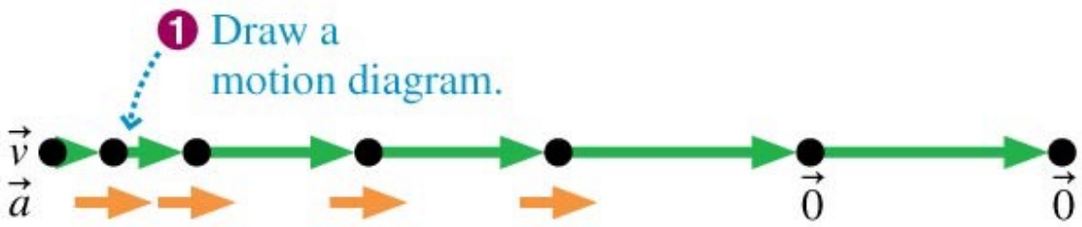
A position vs. time graph is shown below.

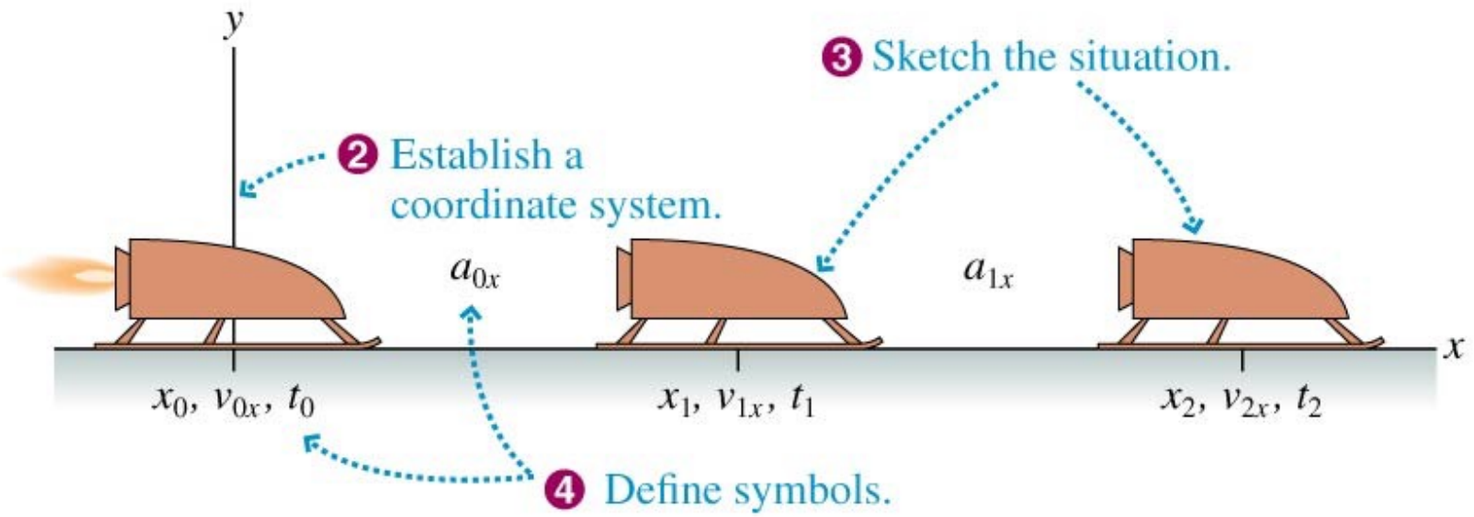


What is the corresponding motion diagram.



Solving Problems in Physics





5 List known information.

Known
$x_0 = 0$ m $v_{0x} = 0$ m/s
$t_0 = 0$ s
$a_{0x} = 50$ m/s^2
$t_1 = 5.0$ s
$a_{1x} = 0$ m/s^2
$t_2 = t_1 + 3.0$ s $= 8.0$ s

6 Identify desired unknown.

Find
x_2

Unit Conversions

Show your neighbor how to convert 2.00 ft to meters

Useful unit conversions

$1\ \text{in} = 2.54\ \text{cm}$

$1\ \text{mi} = 1.609\ \text{km}$

$1\ \text{mph} = 0.447\ \text{m/s}$

$1\ \text{m} = 39.37\ \text{in}$

$1\ \text{km} = 0.621\ \text{mi}$

$1\ \text{m/s} = 2.24\ \text{mph}$

Unit Conversions

Show your neighbor how to convert 2.00 ft to meters

$$2.00\ \text{ft} \times \frac{12\ \text{in}}{1\ \text{ft}} \times \frac{2.54\ \text{cm}}{1\ \text{in}} \times \frac{10^{-2}\ \text{m}}{1\ \text{cm}} = 0.610\ \text{m}$$

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Unit Conversions

Question #15

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1 m/s = 2.24 mph

Convert 5 ft/min^2 to meters/s^2

C $0.0254\ \text{m/s}^2$

E $4.2 \times 10^{-4}\ \text{m/s}^2$

A $2.54\ \text{m/s}^2$

B $1.760 \times 10^{-4}\ \text{m/s}^2$

D $0.39\ \text{m/s}^2$

Unit Conversions **Question #15**

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D $0.39\ \text{m/s}^2$

$$5\frac{\text{ft}}{\text{min}^2} \times \frac{12\ \text{in}}{1\ \text{ft}} \times \frac{0.0254\ \text{m}}{1\ \text{in}} \times \frac{1\ \text{min}^2}{60^2\ \text{s}^2} = 4.2 \times 10^{-4}\frac{\text{m}}{\text{s}^2}$$

Track your units

$$x_f = x_i + v_i \Delta t + \frac{1}{2} a \Delta t^2$$

m/s s m/s²

m s

What will be the units of your result?

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Track your units

$$x_f = x_i + v_i \Delta t + \frac{1}{2} a \Delta t^2$$

x_f: m, x_i: m, v_i: m/s, Δt: s, a: m/s²

What will be the units of your result?

$$x_f = x_i + v_i \Delta t + \frac{1}{2} a \Delta t^2$$

x_f: cm, x_i: cm, v_i: m/s, Δt: h, a: cm/s²

What will be the units of your result?

Units tracking as a way to check your work.

Use unit tracking to determine which equation is correct.

B $v_f^2 = v_i^2 + 2a\Delta t$

A $v_f^2 = v_i^2 + 2a\Delta x$

C $v_f^2 = v_i^2 + 2a\Delta x^2$

Question #16

Significant figures

What is the difference between these numbers?

3.654

3.65473921956

Significant figures

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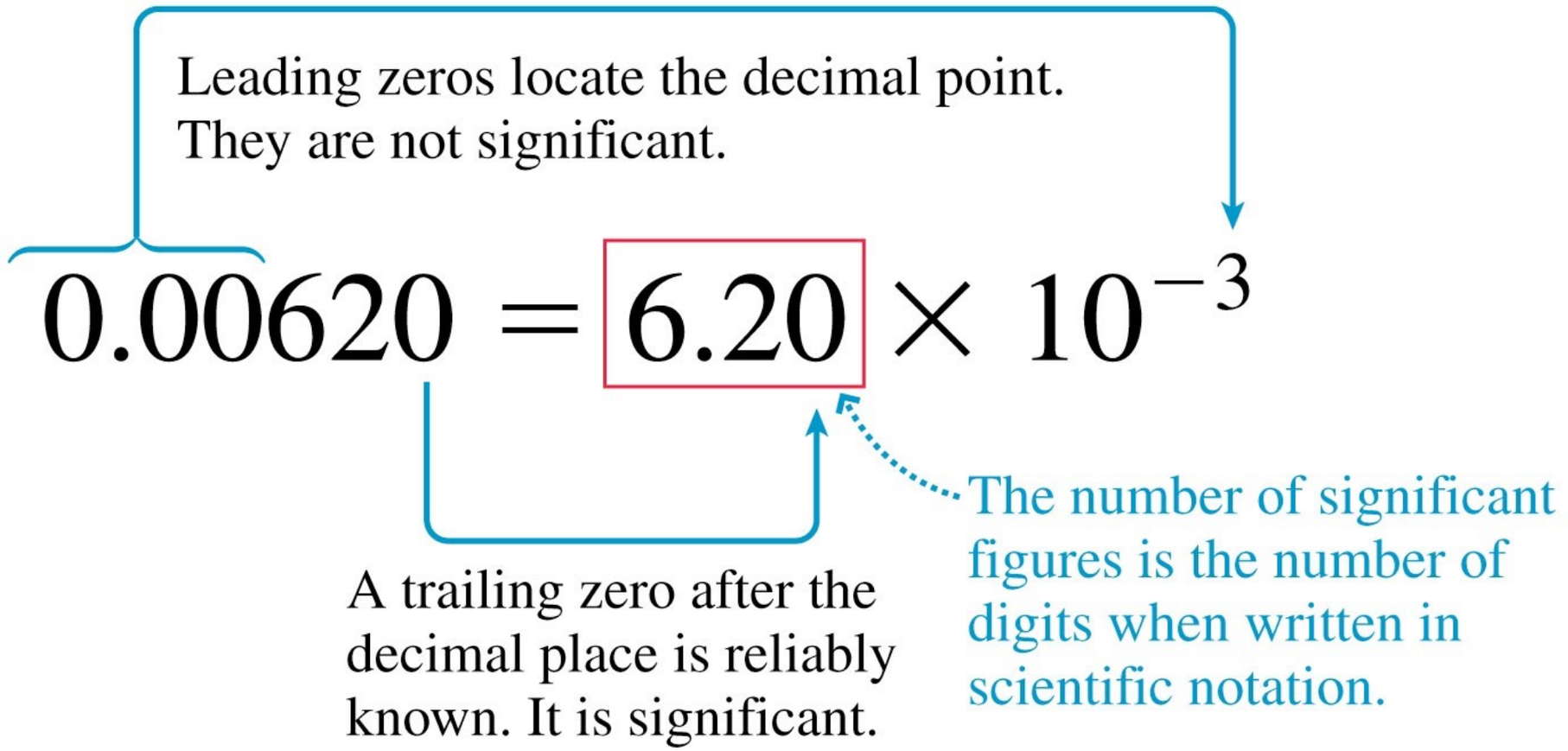
$$3.654$$

$$3.654 \pm .0005$$

$$3.65473921956$$

$$3.65473921956 \pm .000000000005$$

Significant Figures



- The number of significant figures ≠ the number of decimal places.
- In whole numbers, trailing zeros are not significant. 320 is 3.2×10^2 and has 2 significant figures, not 3.
- Changing units shifts the decimal point but does not change the number of significant figures.

Significant Figures

Rank in order, from the most to the least, the number of significant figures in the following numbers. For example, if b has more than c, c has the same number as a, and a has more than d, you would give your answer as $b > c = a > d$.

a. 8200 b. 0.0052 c. 0.430 d. 4.321×10^{-10}

a. $a = b = d > c$
b. $d > c > b = a$
c. $b = d > c > a$
d. $d > c > a > b$
e. $a = d > c > b$

Significant Figures

Question #17

Rank in order, from the most to the least, the number of significant figures in the following numbers. For example, if b has more than c, c has the same number as a, and a has more than d, you would give your answer as $b > c = a > d$.

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Quiz

Rank in order, from the most to the least, the number of significant figures in the following numbers. For example, if b has more than c, c has the same number as a, and a has more than d, you would give your answer as b > c = a > d.

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2? Ambiguous 2 3 4

a. b = d > c > a
b. a = b = d > c
c. d > c > b = a
d. d > c > a > b
e. a = d > c > b

Significant Figures Rules

1. When multiplying or dividing numbers, or taking roots, the number of significant figures in the result should match the number of significant figures in the least precisely known number used in the calculation.
2. When adding or subtracting numbers, the number of decimal places in the answer should match the smallest number of decimal places of any number used in the calculation.
3. To eliminate round-off error it is acceptable to keep a few extra digit for intermediate calculations and truncate the final answer to the correct number of significant figures.

Question # 18

Consider the following simple calculation: $5.27 + 1.1$. What should you report for the answer?

A. 6.4

B. 6.37

C. 6.5

D. 7

E. 6.370

Question # 18

Consider the following simple calculation: $5.27 + 1.1$. What should you report for the answer?

D 6.4

C 6.37

A 6.5

E 7

B 6.370

Question # 19

Consider the following simple calculation: 5.27 x 1.1. What should you report for the answer?

a) 5.80
b) 6.0
c) 5.797
d) 5.7970
e) 5.8

Question # 20

Consider the following simple calculation: $5.27 \times (1.1 + 2.056)$. What should you report for the answer?

A. 17
B. 16.6
C. 16.63
D. 16.632
E. 16.6320

Question # 20

Consider the following simple calculation: $5.27 \times (1.1 + 2.056)$. What should you report for the answer?

C 17

E 16.6

A 16.63

B 16.632

D 16.6320

Why do we do significant figures?

$$3.5932 \quad + \quad 8.1$$

$$3.5932 \pm .0001 + 8.1 \pm .1$$

What is the max/min/mid value this sum could be?

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$$3.5933 + 8.2 = 11.7933 \text{ (max)}$$

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$$3.5931 + 8.0 = 11.5931 \text{ (min)}$$

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$$3.5932 \pm .0001 + 8.1 \pm .1$$

What is the max/min/mid value this sum could be?

$$3.5933 + 8.2 = 11.7933 \ (\text{max})$$

$$3.5932 + 8.1 = 11.6932 \ (\text{mid})$$

$$3.5931 + 8.0 = 11.5931 \ (\text{min})$$

To what decimal place should we round our answer?

Example

An object consists of two pieces. The mass of one piece has been measured to be 6.47 kg. The volume of the second piece, which is made of aluminum, has been measured to be 4.44×10^{-4} m^3. A handbook lists the density of aluminum as 2.7×10^3 kg/m^3. What is the total mass of the object?

Recall that $\rho = \frac{m}{V}$