Powers of 10

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$$3140000000000$$

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Multiplying with Exponents

Recall that

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And that

$$(p \cdot x) \cdot (q \cdot y) = (p \cdot q) \cdot (x \cdot y)$$

It follows that

$$(3.1 \times 10^{11}) \cdot (2 \times 10^{-4}) = 6.2 \times 10^{7}$$

Multiplying with Exponents

Try the following problems:

1. $3 \times 10^8 - 2 \times 10^8$
2. $3.0 \times 10^8 - 2 \times 10^7$
3. $(4 \times 10^4) \cdot (2 \times 10^5)$
4. $(3.3 \times 10^6) \cdot (2 \times 10^{-9})$
5. $(5 \times 10^5) \cdot (7 \times 10^{11})$
6. $(3 \times 10^{-6}) \cdot (6 \times 10^{-14})$

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Try the following problems:

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Orders of Magnitude

$$7.33 \times 10^{19}$$

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is 9 orders of magnitude larger than

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is 9 orders of magnitude larger than

$$8.91 \times 10^{10}$$

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$$m = 1.67 \times 10^{-27}$$

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n is on the order of 10^{24}

$376.73031\ldots$ is on the order of 10^{2}

Metric Prefixes

- Prefixes are power-of-10 multipliers

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- $1\text{kg} = 1 \times 10^3\text{g}$
- $1\text{TB} = 1 \times 10^{12}\text{Bytes} = 1000\text{GB}$

Metric Prefixes

In 2003, IBM was making a cutting edge 64 MB flash drive.

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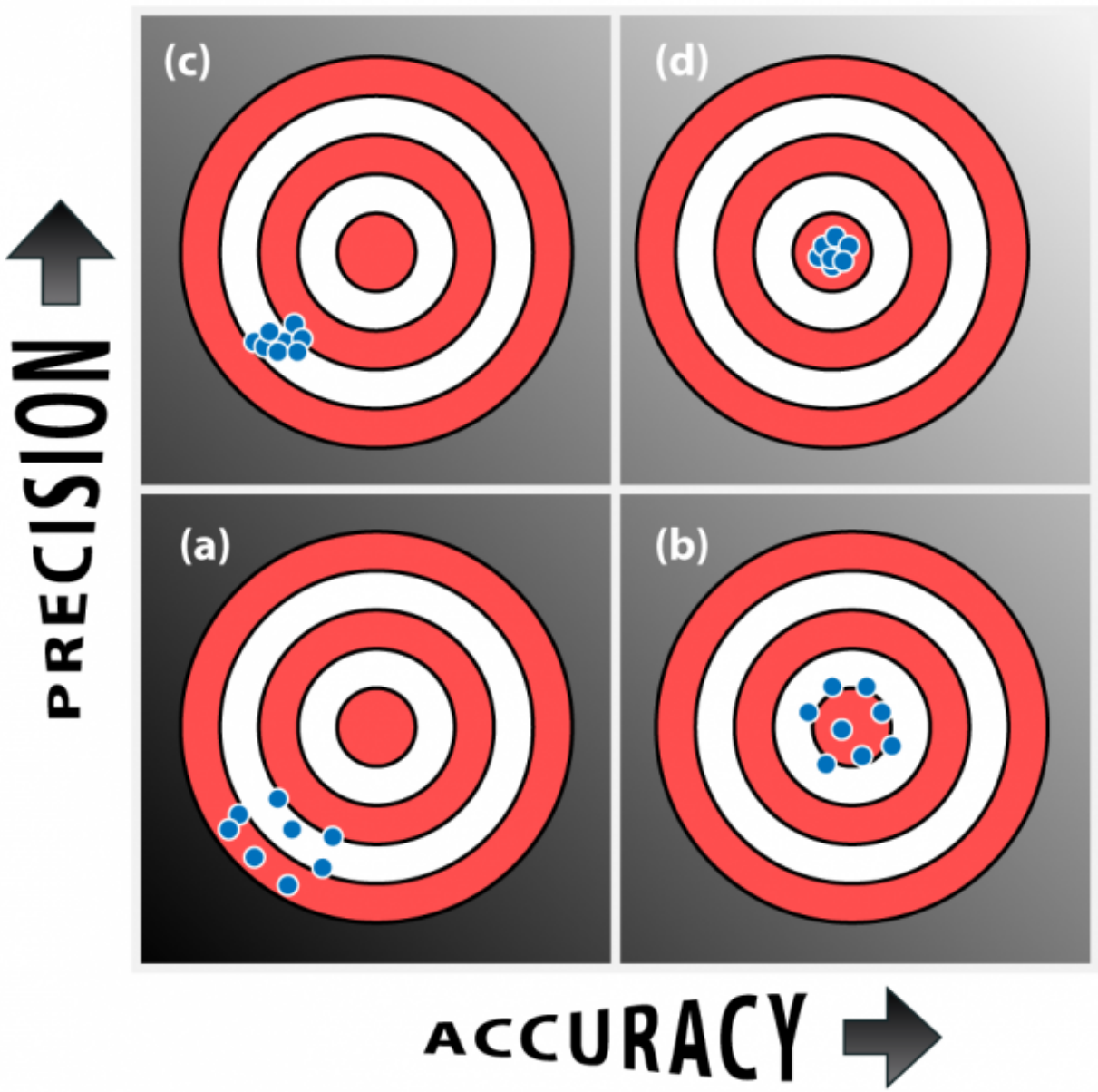
(a) How many Bytes is this?

(b) How many 64 MB drives would you need to equal the capacity of an 8 GB drive?

Measurement



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Answer: 28.125 mg

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Timmy drinks 3 shots of the stuff.

How much caffeine did Timmy consume?

(Hint: A shot is about 1 oz)

Answer: 28.125 mg
What is wrong with this answer?

Significant Figures

Scientists use *significant figures* keep track of uncertainty.

Number	Sig Figs
34 s	2
101 m	
9.77 °C	
2 dogs	
2000 kg	
20. cal	
20.00 mL	
0.0003 g	
0.020000 s	
0.02006 ft	
π radians	

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Number	Sig Figs
34 s	2
101 m	3
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2 dogs	∞
2000 kg	1
20. cal	
20.00 mL	
0.0003 g	
0.020000 s	
0.02006 ft	
π radians	

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101 m	3
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π radians	∞

Conversions and Dimensional Analysis

To convert from one unit to another, you must use a *conversion factor*.
Conversion factors come from equivalencies like:

$$1.00 \text{ kg} = 2.20 \text{ lb}$$

$$1 \text{ nm} = 1 \times 10^{-9} \text{ m}$$

$$1 \text{ ft} = 30.48 \text{ cm}$$

Conversions and Dimensional Analysis

Example Conversions:

Conversions and Dimensional Analysis

Example Conversions:

1. How does a 5'9", 150 lb person measure up in standard SI units?
2. How many nanometers are in 13 m?
3. How many square centimeters are in a square mile?
4. How many m/s is 80 km/h?