[5.2] - Derived Quantities and Significant Figures

What is a derived quantity?

- A **derived quantity** is a number made by **combining two or more other values**.
- A **derived unit** is a unit which is made by **combining two or more units.**
- A derived quantity is usually found in formulas as a variable.

Examples: Density (g/mL), Velocity (m/s)

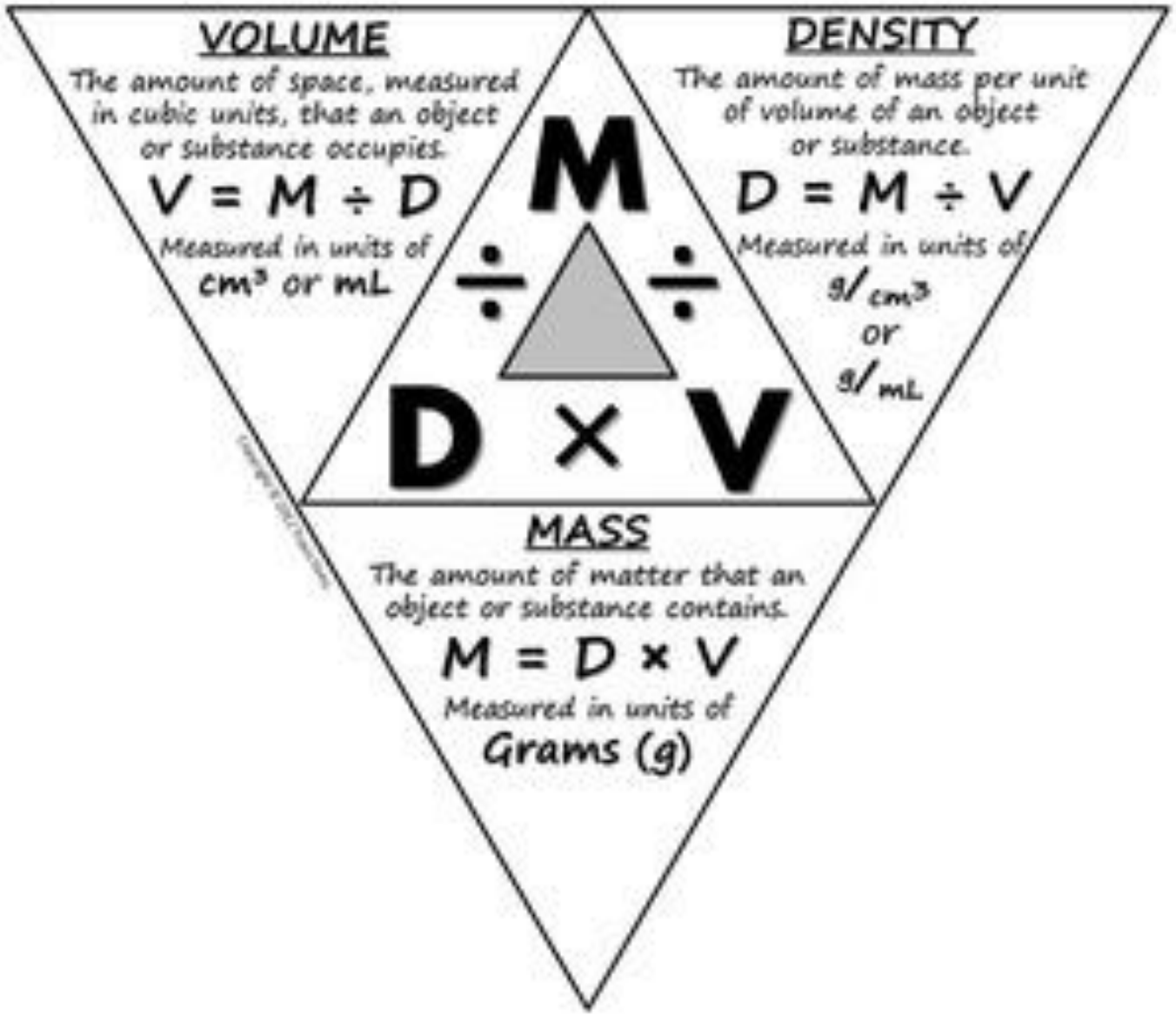
Steps to solve for derived quantities:

1. Rearrange equation as in math.
2. The units that remain in the final answer are combined as the derived unit.

Common SI Units

Quantity	Written Unit	Unit Symbol
Length	Meter	m
Mass	gram, kg	g, kg
Time	Second	s
Amount of substance	Mole	mol
Volume	Liter	L

Solving for Density



The formula for density can be rearranged to solve for for the required unit.

Density (g/mL)
Mass (g)
Volume (mL)

D = m/v

Practice Problem #1

A rock has a mass of 0.35 kg and a volume of 500 mL. What is its density in g/L? (Show your work)

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A rock has a mass of 0.35 kg and a volume of 500 mL. What is its density in g/L? (Show your work)

$$0.35\ \text{kg} \times \frac{1000\ \text{g}}{1\ \text{kg}} = 350\ \text{g}$$

$$500\ \text{mL} \times \frac{1\ \text{L}}{1000\ \text{mL}} = 0.5\ \text{L}$$

$$\text{Density} = \frac{\text{g}}{\text{L}}$$

$$= \frac{350\ \text{g}}{0.5\ \text{L}}$$

$$= 700\ \text{g/L}$$

Practice Problem #2

Convert 5.00 g/cm^3 into kg/m^3

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$$5.00\ \frac{g}{cm^3} \times \frac{1kg}{1000g} \times \frac{100cm}{1m} \times \frac{100cm}{1m} \times \frac{100cm}{1m} = 5000\frac{kg}{m^3}$$

OR

$$5.00\ \frac{g}{cm^3} \times \frac{1kg}{1000g} \times \frac{1 \times 10^6 cm^3}{1m^3} = 5000\frac{kg}{m^3}$$

Practice Problem #3

Convert a velocity of 40.0 miles per hour to kilometers per hour.

(1 mile = 5280 ft, 1 ft = 12 in, 1 in = 2.54 cm)

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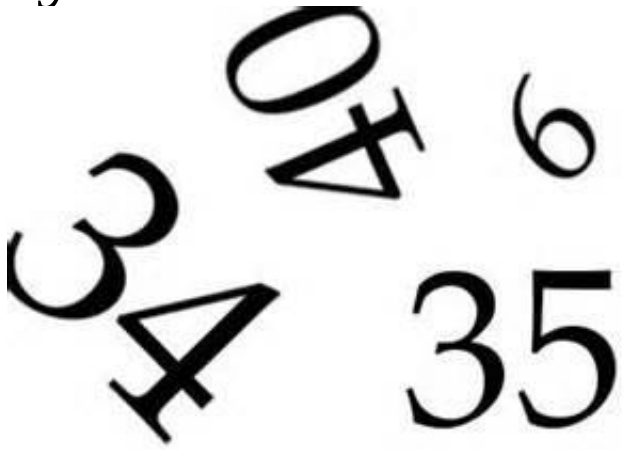
$$40.0\ \frac{mi}{hr} \times \frac{5280ft}{1mi} \times \frac{12\ in}{1ft} \times \frac{2.54cm}{1in} \times \frac{1m}{100cm} \times \frac{1km}{1000m} = 64.37\ \frac{km}{hr}$$

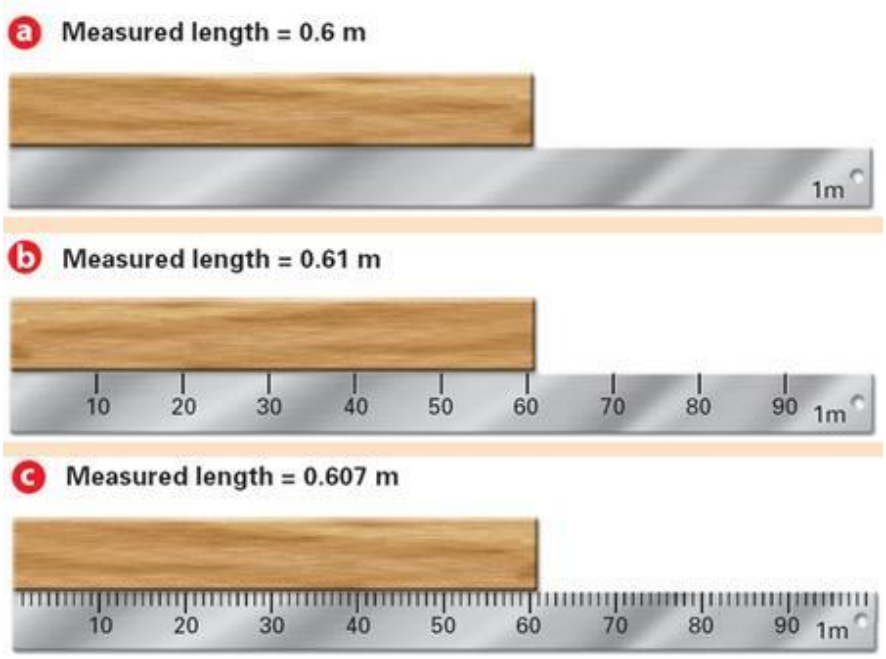
How do we write our answers?

- We use what is known as significant figures
- A **significant figure**
  - is a measured or meaningful digit.
  - is the **total** number of digits needed to write a given value without losing certainty



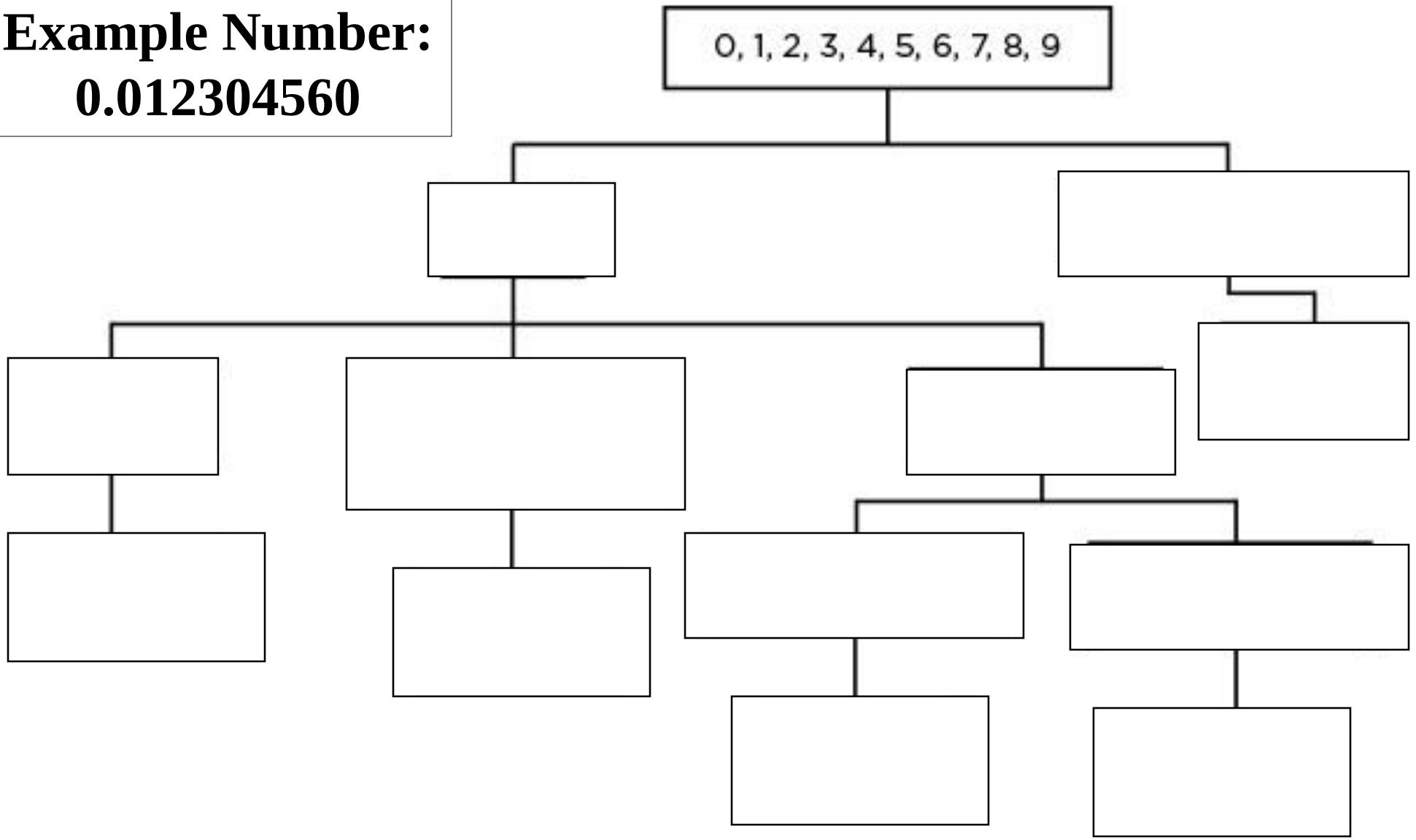
Purpose of Significant Figures

- We need use them because:
  - Each measurement may have different **accuracy**
  - Numbers we record using different measurements have different accuracy



Significant Figure Rules

Example Number:
0.012304560



Significant Figure Rules

Example Number:
0.012304560
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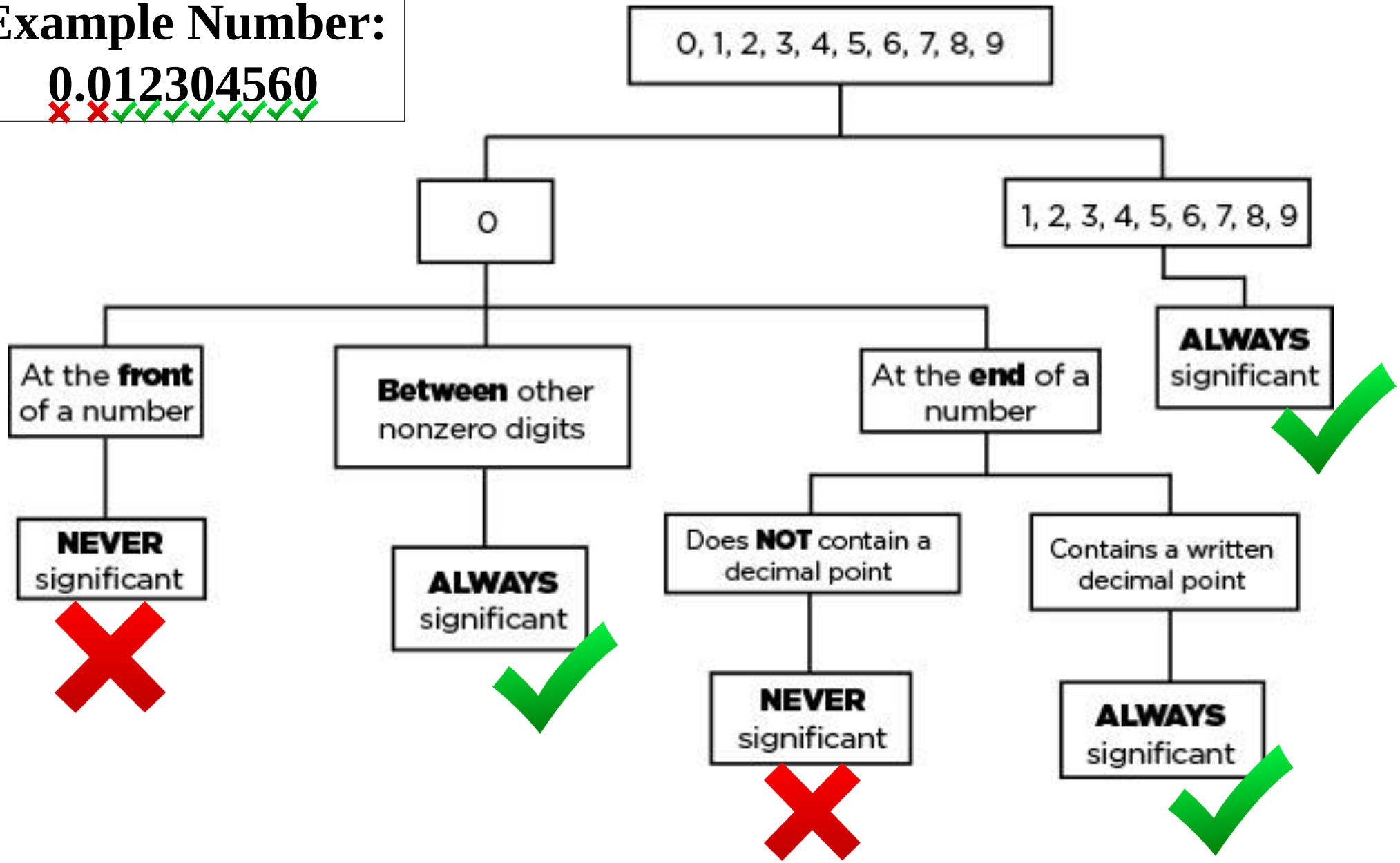

Practice Problem #4

- **Underline the significant figures in the following examples:**

a) 5 600	**b) 8 060**	**c) 3.090**	**d) 0.0112**
e) 0.002	**f) 4.007**	**g) 0.0040**	**h) 0.0390**
i) 0.00700	**j) 8 000**	**k) 0.06**	**l) 120.0**

Practice Problem #4

- Underline the significant figures in the following examples:

- a) 5 600
- b) 8 060
- c) 3.090
- d) 0.0112
- e) 0.0002
- f) 4.007
- g) 0.00040
- h) 0.0390
- i) 0.00700
- j) 8 000
- k) 0.06
- l) 120.0

Practice Problem #5

- Round the number 840.556 and write it with…

a) five sig figs = _____

b) four sig figs = _____

c) two sig figs = _____

d) one sig fig = _____

Practice Problem #5

- Round the number 840.556 and write it with…

a) five sig figs = 840.56

b) four sig figs = 840.6

c) two sig figs = 840

d) one sig fig = 800

HOMEWORK

HOMEWORK [5.2]

- Page 26 - Questions: 31 - 37
- Page 28 – Question: 42 (a – h)
- Page 37 – Question: 55 (a – j)