

# final chemistry exam

## Chapter One

Define the following

- Experiment: an observation of natural phenomena carried out in a controlled manner so the results can be duplicated and rational conclusions obtained
- Law: is it concise statement, or mathematical equation about a fundamental relationship or regularity of nature
- Hypothesis: is a tentative explanation of some regularity of nature
- Theory: is it tested explanation of basic natural phenomena, example, molecular theory of gases

Principles of classify matter:

- 1) by its physical state, as a solid liquid or gas
- 2) by it's chemical constitution as a compound element or a mixture

## ① The physical state of matter,

★ solids: the forms matter characterized by rigidity

1) relatively incompressible

2) fix shape and volume

3) particles are close together and have restricted motion

★ Liquid : form of matter is relatively incompressible fluid. It has a fixed volume but not fixed shape.

1) takes the shape of the container

2) particles are close together

3) able to flow

★ Gases: form of matter that is easily compressible fluid

1) expand to fill the entire container

2) particles are separated by lots of space

## ② The chemical constitution

★ # physical change is a change in the form of matter, but not in its chemical identity

Example, melting of ice or dissolving sugar with water

Physical properties : melting, boiling, electrical, conductivity, etc...

★ # chemical reaction: attitude of materials into another new materials with different properties, and one or more than one new substance are formed

Example, rust formation or burning gas in oxygen

Define the following;

★ Substance : kind of matter that cannot be separated into another kind of matters

★ Mixture : kind of matter that can be separated into two or more substances.

Types of mixtures →

→ Heterogeneous mixtures:

Mixture that consists of physically distinct parts

Example: sand and iron fillings, cereal in milk

→ Homogeneous mixtures: a mixture that is uniform and its properties

Example: air, Rain, steel

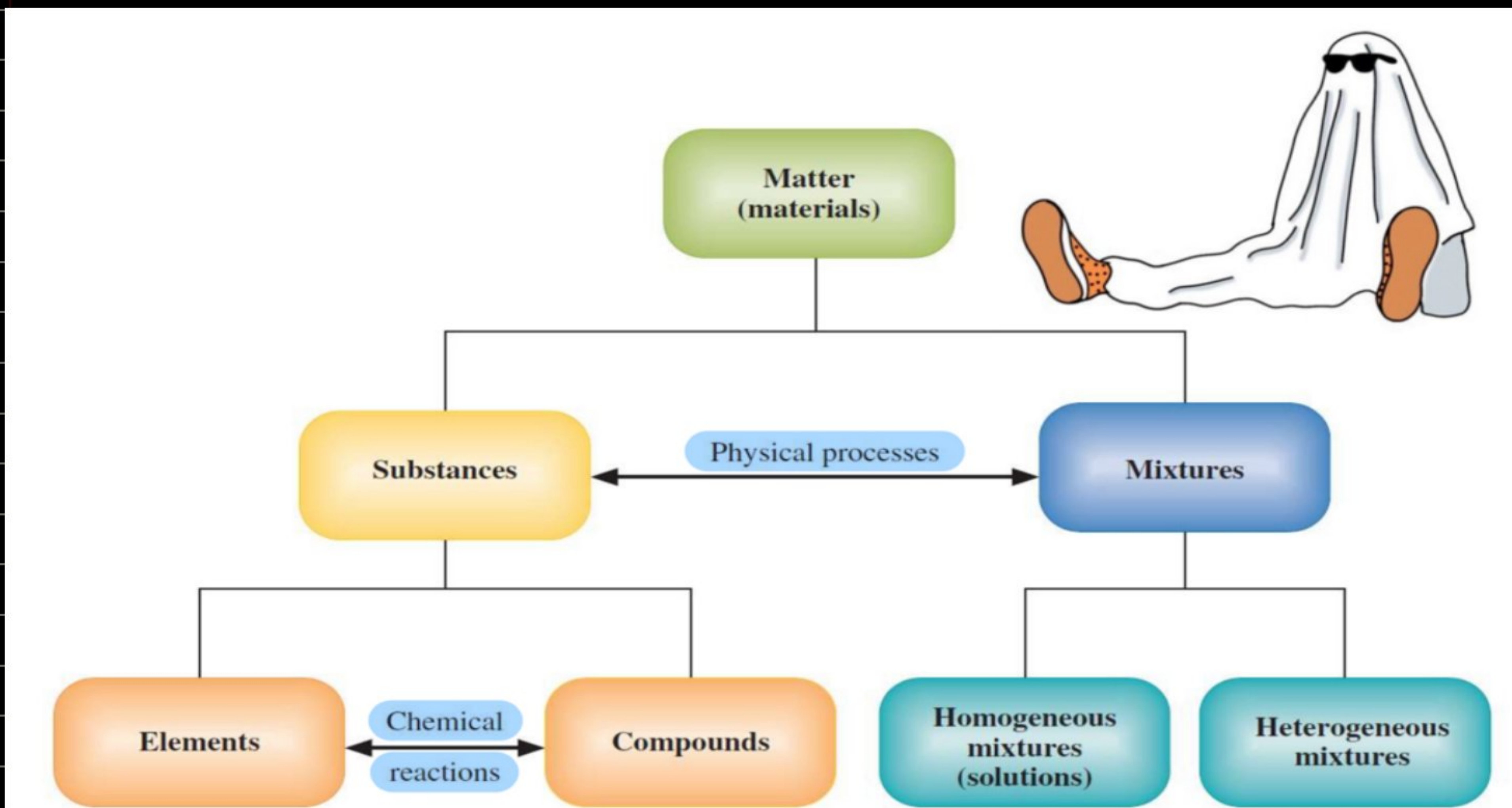
★ Element: substance that cannot be separated, or decomposed by any chemical reaction into simpler substances

Example; lithium, beryllium, hydrogen, sodium

★ Compound: substance that is composed of two or more elements joined together by a chemical reaction

Example; NaCl, MgO, CuSO<sub>4</sub>

# Mini summary 😊



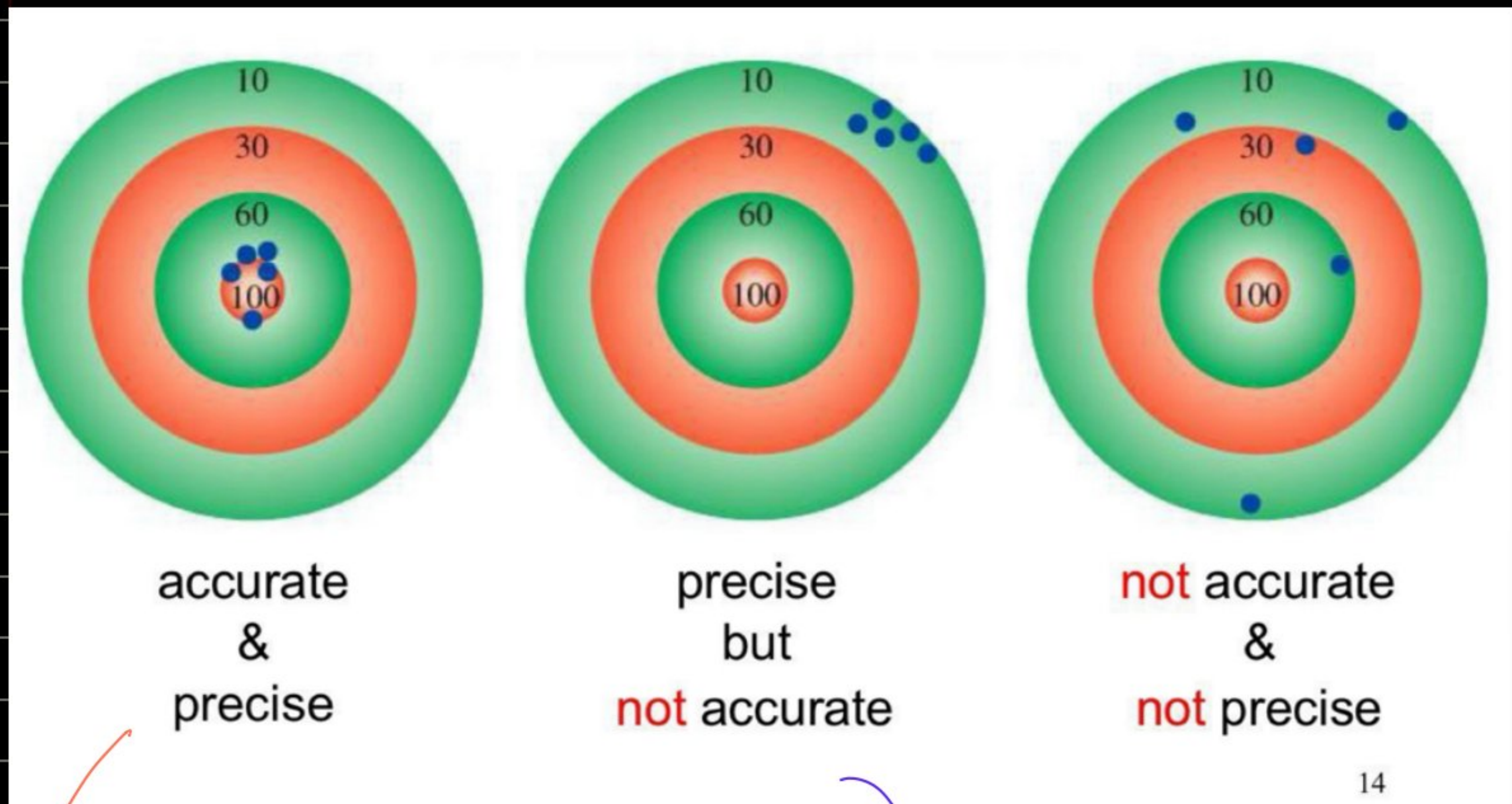
- \* 2 or more substances physically combined --- mixture
- \* Element + element chemically combined --- compound
- \* Element + element physically combined --- mixture
- \* Compound chemical process --- element + element
- \* Compound + compound physical process --- mixture

**New Topic**

# Measurements and significant figures

Accuracy: how close measurement is to the real value

Precision: how close a set of measurements are to each other



→ Precise → حيث ان جميع النتائج متقاربة إلى بعضها البعض  
 Accurate → حيث ان جميع النتائج قريبة جدًا للهدف (١٠٠)

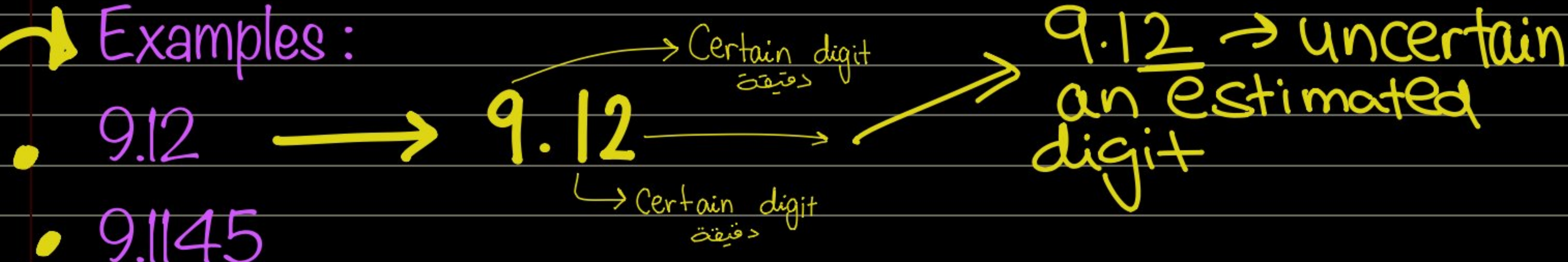
→ Precise → حيث ان النتائج متقاربة إلى بعضها البعض  
 NOT Accurate → حيث أن النتائج ليست قريبة إلى الهدف (١٠٠)

NOT Accurate  
 NOT Precise  
 حيث ان النتائج ليست متقاربة إلى بعضها و أيضا ليست قريبة إلى الهدف (١٠٠)

## ★ Significant Figures ★

→ Significance, figures are digits measured for a certain calculation it includes all certain digits plus a final digit that have some uncertainty

→ Examples :



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رقم مقرب  $\rightarrow$  it has some uncertainty  $\rightarrow$  9.1145  
 $\rightarrow$  certain digits

## RULES FOR SIGNIFICANT FIGURE

Copied from Ju medicine 🤖🤖

To count the number of significant figures, follow the following rules:

**Rules:**

- All digits from (1-9) are significant, no matter where the digit is located
- الصفر (0)
  - Zeros at the beginning of a number:  $0^2.02$   
 Zeros at the beginning of a number are always not significant.  
 $0.096$  2 sig. fig.
  - Terminal Zeros:  $9^{00}$ ,  $9^{00.0}$   
 Number with decimal point:  
 All terminal zeros are significant.  
 $9^{00.0}$  4 sig. fig.  
 $9^{00.}$  3 sig. fig.  
 $9^{00.00}$  5 sig. fig.
  - Zeros between non-zero numbers  
 All these zeros are significant.  
 $0.102$  4 sig. fig.  
 not significant      significant
  - Number with no decimal point:  $9^{00}$ ,  $72^0$   
 We don't know how many significant figures are in the number.  
 لا يمكن الجزم في significant figure  
 $9^{00} \rightarrow$  maybe 1, 2 or 3 significant figures, you can't decide  
 $823 \rightarrow$  3 significant figures

\* If the number is written in scientific notation, then the ten raised to the power  $n (10^n)$  is not included in the calculation of the number of significant figures.  
 $9 \times 10^2$  1 sig. fig.       $9.00 \times 10^2$  3 sig. fig.  
 $9.0 \times 10^2$  2 sig. fig.

### Examples $\rightarrow$ مع شرح

- $\ast 4139.7 \rightarrow 5$  Sig. Fig  $\rightarrow$  جميع الأرقام ما بين (9-1)
- $\ast 0.0008 \rightarrow 1$  Sig Fig  $\rightarrow$  لم تحتسب الأصفار significant figures

اعلم اننا بعد الفاصلة العشرية  
 لكننا على جبهة الشال من الرقم  
 6

- € 3.10056 → 6 significant figures  
حسبت الأصفار  
لأنها في الوسط

- € 90000 → More than one answer  
ليش؟

① من الممكن أنو → نعتبر ان الميزان → 9000  
الميزان بحسب  
الغرامات ما يعادل كغ 9 اعطانا الرقم 9...

② من الممكن أنو الميزان  
بحسب الكيلوغرام ما يعادل  
9 طن



تشكيلة الأجوبة  
١١

1 sig fig ← 9...

4 sig fig ← 9...

3 sig fig ← 9...

- € 3600. → 4 sig fig

حسبت  
الأصفار بسبب وجود الفاصلة العشرية

# Scientific notation

طريقة التامة

$1.99 \times 10^{-23}$

$N \times 10^n$

N is non zero  
Single digit number  
(1-10) 10 is not included  
 $1 \leq N < 10$

n is a positive or negative integer  
عدد صحيح

$1.2 \times 10^8$  ✓  
 $12 \times 10^7$  ✗

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Examples:

① Avogadro's constant

↓

6022000000000000000000000

↪  $6.022 \times 10^{23}$

②  $0.000000000019 \rightarrow 1.9 \times 10^{-10}$

القوة ↘  
بالسالب لأن تم تحريك الفاصلة  
المشرية من الشمال إلى اليمين



# Multiplication and division for significant figure calculations

The Rule: final answer must be given to the least number of significant figure.

## Examples

$$\rightarrow 10.54 \times 31.4 \times 16.987 = 5621.9 \rightarrow 562 \rightarrow 5.62 \times 10^3$$

4 sig fig      3 sig fig      5 sig fig → Answer to the least no. of sig fig = 3

$$\rightarrow 5.896 \div 0.008 = 737 \rightarrow 700 \rightarrow 7 \times 10^2$$

4 sig fig      1 sig fig → Answer to the least no. of sig fig = 1

$$\rightarrow \begin{array}{r} 4 \qquad \qquad \qquad 2 \\ 635.4 \times 0.0045 \Rightarrow \text{least no.} = 2 \text{ sig fig} \\ \hline 2.35895 \end{array}$$

~~A.~~ 1.212136 sig      ~~C.~~ 1.212132774  
~~B.~~ 1.212      ~~D.~~ 1.2  
4 sig      1 sig      2 sig fig

ANSWER: D

# Addition and multiplication for significant figures calculations

The Rule → Answer has the same number of decimal places as quantity with the fewest DECIMAL places

Examples:-

①

$$\begin{array}{r}
 + 12.9753 \rightarrow 4 \text{ d.p.} \\
 + 319.5 \rightarrow 1 \text{ d.p.} \\
 + 4.398 \rightarrow 3 \text{ d.p.} \\
 \hline
 336.9
 \end{array}$$

Answer to 1 d.p.

②

$$\begin{array}{r}
 - 397 \rightarrow 0 \text{ d.p.} \\
 - 273.15 \rightarrow 2 \text{ d.p.} \\
 \hline
 124
 \end{array}$$

Answer to 0 d.p.



Examples with BOTH (x, ÷ & - & +)

$$\rightarrow (71.359 - 71.357)$$

$$\left( \begin{array}{l} 3.2 \times 3.67 \\ \hline 2 \text{ sig fig} \quad 3 \text{ sig fig} \end{array} \right)$$

= ↓

$$\begin{array}{r}
 0.002 \\
 \hline
 11.744
 \end{array}$$

$$\rightarrow \begin{array}{l} 0.002 \rightarrow 1 \text{ sig} \\ \hline 12 \rightarrow 2 \text{ sig} \end{array}$$

Answer to the least no. of sig fig = 1

① منحل المسائل عادي

② ما من قرب اجاباتها من ا١٠٠٠ عشان ما تزيد نسبة الخطأ

قرب ا١٠٠٠ 3d.p

$$\begin{array}{r}
 0.002 \\
 \hline
 12
 \end{array}$$

قرب ا١٠٠٠ 2 sig fig

$$\frac{0.002}{12} = 1.666 \times 10^{-4} \rightarrow 2 \times 10^{-4}$$

1 sig fig ✓✓

$$\begin{array}{r} \xrightarrow{\text{5 sig}} \quad \text{3 sig} \quad \text{2 sig} \\ 13.467 \times 4.35 \times 0.35 \Rightarrow \frac{20.818665}{2387.1} \\ \hline \begin{array}{r} 856 \quad + \quad 1531.1 \\ \text{0 d.p.} \quad \quad \text{1 d.p.} \end{array} \end{array}$$

least no. of sig fig  $\rightarrow$  21 = 0.0088  
 least no. of d.p.  $\rightarrow$  2387

## Examples from JU medicine !

$$\frac{14.5 \times 12.334}{2.223 - 1.04} = \frac{3 \text{ sig. fig.} \times 5 \text{ sig. fig.}}{3 \text{ d.p.} - 2 \text{ d.p.}} = \frac{3 \text{ sig. fig.}}{2 \text{ d.p.}}$$

$$= \frac{178.843}{1.183} = \frac{3 \text{ sig. fig.}}{3 \text{ sig. fig.}} = 3 \text{ sig. fig.}$$

$$= 151.177 = 151$$

Q) For the following calculation, give the answer to the correct number of significant figures.

$$\frac{(14.5 \text{ cm} \times 12.334 \text{ cm})}{(2.223 \text{ cm} - 1.04 \text{ cm})}$$

A. 179 cm<sup>2</sup>  
 B. 1.18 cm  
 C. 151.2 cm  
 D. 151 cm  
 E. 178.843 cm<sup>2</sup>

**Rounding intermediate steps  $\rightarrow$**   
 $= 179 / 1.18$   
 $= 151.694$   
 $= 152$

**Note: Do not round intermediate answers !**