University Mohamed Khider - Biskra
Faculty of Science and Technology

Academic Year: 2023/2024
Level: 1st Year ST-LMD
Module: PW Physics 1

Name	Surname :	Group :

Pratical works in Module Physics 1

ملاحظات هامة:

- ✓ لبس المئزر إجباري
- ✓ إحضار الأدوات اللازمة لانجاز العمل التطبيقي
- ✓ قراءة المطبوعة وتحضير التقرير
- ✓ يقدم لكل طالب أسئلة نظرية حول المطبوعة لتقييم مدي التحضير
- ✓ يتم دفع نتائج الأعمال التطبيقية في نهاية الحصة
- ✓ أي غياب في الأعمال التطبيقية يجب أن يتبع بتقديم التبرير في الأيام الثلاثة الموالية للغياب ويؤشر عليها من طرف مصلحة التدريس

Practical work number 0: calculating uncertainty

I-: Objective of the experiment

-How to calculate uncertainty

-How to draw a graph curve

II- Theoretical aspect:

1-Measurement uncertainties: Two types of Uncertainty can be distinguished.

-Systemic uncertainties: Resulting from the quality of measuring devices.

-Random uncertainty: They are mistakes that happen by chance without knowing in advance the reason for the mistake Depending on the relationship and to reduce the severity of errors, we take the rate of these following values:

$$x_m = \frac{\sum_{1}^{n} x_i}{n} = \frac{x_1 + x_2 + ... + x_n}{n}$$

2-Absolute uncertainty and relative uncertainty:

a- Direct measurement status: It is to compare the amount to be measured directly with a unit (standard) of the same nature. Example: Measuring a length using a ruler or a Palmer…

-The absolute uncertainty related to the measuring device is the smallest measurement of this device.

Examples :**Length: Ruler.....1mm**

Calipers.....0.1mm

Palmer 0.01mm

Mass: balance.....0.1g

Time: Chronometer .....10^{-4}s

Denotes the absolute uncertainty in measuring the magnitude of x with Δx and the measurement result is written as follows:

$$x = x_m \pm \Delta x$$

b-Indirect measurement status:

This type of measurement is used when direct measurement is impossible, measuring an amount (or other magnitudes) related to the amount to be measured.

Example: To measure the volume of a cube, we measure the length of one of its sides.

<u>In the case of indirect measurement, we use the uncertainty calculation :</u>

We consider a physical magnitude y related to physical expressions a and b

Where a and b Results of measuring previous physical expressions.

1-<u>Addition and subtraction case</u>: $y = a + b$ or $y = a - b$

In this case, the absolute uncertainty of the y scale is:

$$\Delta y = \Delta a + \Delta b$$

2-<u>Multiplication and division case</u>: $y = a \times b$ or $y = \frac{a}{b}$

The relative uncertainty of the y scale is:

$$\frac{\Delta y}{y} = \frac{\Delta a}{a} + \frac{\Delta b}{b}$$

Special cases

$$\begin{cases} y = a^n \Rightarrow \dfrac{\Delta y}{y} = n\dfrac{\Delta a}{a} \\ y = \sqrt[n]{a} \Rightarrow \dfrac{\Delta y}{y} = \dfrac{1}{n}\dfrac{\Delta a}{a} \\ y = \alpha a \Rightarrow \dfrac{\Delta y}{y} = \dfrac{\Delta a}{a} \end{cases}$$

Where α constant

Observation 1:

Every measure is far from x in value:

$$\Delta x_i = \left| X_i - X_{moy} \right|$$

This can then be taken as the uncertainty as the medial distance:

$$\Delta x_{moy} = \sum_{i=1}^{n} \frac{\left| X_i - X_{moy} \right|}{n}$$

Or we can take the uncertainty more precisely as follows:

$$\Delta x_{\max} = \sup \left| x_i - x_{moy} \right|$$

Then give the result as follows: $x = (x_{moy} \pm \Delta x_{moy})$

$x = (x_{moy} \pm \Delta x_{\max})$

-Relative uncertainty is what gives the measurement accuracy and expresses it in relation to:

$$\varepsilon(\%) = \frac{\Delta x}{x_m} \times 100$$

Observation 2:

How to draw graphs

1-Introduction

2-Choose a ladder :

3- Axis staging:

4-Assign points:

5- Uncertainty:

III- Theoretical questions: