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 channel…

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

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

Ductal foot.....0.1mm

Palmer.....0.01mm

Mass: Libra.....0.1g

Time: Abacus .....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 letters

In the case of indirect measurement, we use the uncertainty calculation :

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

Where a and b Results of measuring previous physical expressions.

1-Addition and subtraction case: 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-Multiplication and division case: y = a × 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

It is important to draw the graphs very carefully and very accurately because the statement in general shows us the evolution of a physical phenomenon and allows us to understand it generally, it is better to draw the curve during the experiment because this can allow us to identify some values that we are unable to experimentally, whether in a complementary way :That is, we extend the curve while maintaining the path (value A) or limitation: that is, by reading between the points (value B) and also allowing us to detect reported some false points and remeasured them (value C) as in Figure 1.

2-Choose a ladder :

It is necessary to choose the ladder and the measurement point above each axis so that the curve is extended entirely above the millimeter paper, as the largest possible ladder should be chosen in order to obtain accuracy in the drawing, and do not forget to put the units of measurement on the axes and the means of measurement and every other clarification that allows reading the

3- Axis staging:

The axes show only the basic gradations and we do not assign experimental measurements.

4-Assign points:

Points are assigned by two perpendicular lines + or circle o

5- Uncertainty:

Before drawing the statement, we must put on each experimental point the barriers of errors, which is the field of uncertainty, the uncertainty may be considered in one of the expressions x or y only, and then it is represented by a straight segment with the middle of the measurement point and its length is $2\Delta x$ or $2\Delta y$, and the uncertainty may be significant in the expressions x and y alike, and then it is represented by two right intersecting segments aaround the measurement point with a side of $2\Delta x$ and $2\Delta y$ the measurement point, the length of each of them is $2\Delta x$ and $2\Delta y$, and it may be represented by a rectangle.

If the measurements are good, the curve should cross the error barriers as in Figure 2.

III- Theoretical questions: