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METHODOLOGICAL INITIATION OF EXPERIMENTATION SHEETS FOR FUNDAMENTAL TEACHING OF PHYSICS IN THIRD YEAR OF SCIENTIFIC HUMANITIES IN THE CITY OF KISANGANI IN DR Congo.

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ABSTRACT

The intention of this study is to provide teachers with a few models of didactic sheets to ensure physics instruction based on observation and experimentation. They must be presented to the higher students from the observation of natural phenomena adapted to their level and need. Theoretical lessons are not to be ruled out; rather, they should act as deepening interpretations of experimental data.

The main concern is to bring together above all precision instruments to properly carry out measurements of magnitudes in order to give students not only a taste for physical science, but also good training with the hope and certainty of producing eminent scientific researchers and technicians for the construction of the nation.

KEYWORDS: initiation; methodological; Sheet; Experimentation; Physical scientific humanity; DR Congo.

INTRODUCTION

The glaring lack of textbooks in accordance with the Official Program in our schools in the Democratic Republic of Congo sometimes pushes some physical science teachers into the third scientific sciences classes, giving courses too hollow, contenting themselves with notes picked up left to right. This proves sufficiently that the teacher uses exhibition methods where there are no adequate teaching materials. We also find that most high school teachers who teach physics in schools are under-qualified and do not master the National Physics Program. This gap leads to students being given subjects that are sometimes not compliant. These are some of the reasons why students are disinterested in physics at the level of three classes mentioned above; It is therefore understanding that this course is so difficult for students to assimilate.

The choices of the third classes of the scientific humanities, are not a coincidence, because the school legislator has planned at this level of study some sessions of experiments following the availability in the laboratory.

To increase the level of scientific training of students in the above classes, it is more than opportune to:

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- Improve the quality of physics teaching, especially with regard to experimental practice;
- Present and exploit some of the physics as presented in the National Programme;
- Present and propose the methodological approach to be followed in the teaching of these concepts. These are the objectives assigned in this study.

We have consulted books that deal with the physical sciences method as well as textbooks for teaching physics at the high school level.

In this study, some work required measurements of physical magnitudes. It is in this context that we have experienced many difficulties related mainly to the lack of adequate experimental equipment since the materials we have collected sometimes clumsily have provided us with imprecise results.
Our study focuses on six key points including:

- General criteria for selecting topics
- Identification and justification of subjects;
- Experimental method;
- Principles of physical science education;
- Handling sheet and;
- Implications and recommendations

1. GENERAL CRITERIA OF THE CHOICE OF SUBJECTS

Given the essentially practical nature of our study we selected six subjects in electromagnetics in accordance with the National Programme such as:

a) Easy: because they are consistent with the mental level of the students;
b) Simple: the assembly and handling of experimental devices should not make it too difficult for students;
(c) Adapt: that is, the teaching materials that have been used in our teaching experiences have been chosen in their environment, in their environment so that the lessons are attractive;
(d) Practices: that is, subjects are common; it is easy to find models of applications that are familiar to students;
(e) Relevant: they cannot contain any title term for students' abilities;
(f) Achievable: they agree to ensure that what is asked of the student can actually be accomplished in time and under fixed conditions;
(g) Objective: they must be able to observe the behaviour expected in the students; behaviour that results in external manifestations.

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2. IDENTIFICATION AND JUSTIFICATION OF SUBJECTS

The five themes that form the backbone of our study are:

- The phenomenon of electrification by:

a. Rubbing;
b. Contact;
c. Influence.

- Effect of magnetic current

a. Heat effect;
b. Magnetic effect.

- Electromagnetic induction

2 .1 ELECTRISATION PHENOMENA

It is a phenomenon by which certain bodies acquire the property of attracting light bodies such as: beards, feathers, fragments, papers. They are said to be electrified and the name electricity is given because of the phenomena they present.

This can occur through friction, contact and influence.

2.1.1 By rubbing

Let's blow a plastic comb through the hair several times, they become able to attract fragments of papers, feather beards etc.

2.1.2. By contact

Electrification manifests itself not only on the entire extent of a driver, but on a second driver, held by means of a glass handle, for example, which is put in contact with the first; if we separate the drivers, they are both electrified. Hence, a second way to electrify a conductive body; put it for a moment by holding it by a glass handle in contact with an already electrified body.

2.1.2 By influence

Anybody placed in the vicinity of an electrified body is itself electrified. This is the fundamental phenomenon of electrical influence. Electricity is a property of matter that explains natural phenomena such as:

- The light body attraction by a rubbed body;

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- Lightning, thunder and lightning that cause sometimes terrifying or deadly effects.

2.2. EFFECTS OF THE ELECTRIC CURRENT

The electric current is a very complex phenomenon. In practice, when we make an electrical circuit using a battery of batteries or batteries, the observation made leads us to the following conclusion: In a closed circuit, the passage of the current is manifested by heat and light effects, magnetic effects and chemical effects. These different properties allow the general study of electrical current.

2.2.1. CALORIFIC EFFECT OR JOULE EFFECT OF THE CURRENT

The passage of the current in a light bulb carries the filament incandescent and makes it bright.
In general, the electrical current releases heat into the driver where it is travelling. This heating property of the electric current is called the joule effect.

In practical life, the housewife squeezes electric iron, electric boilers, electric radiators and water heaters, etc.

The thermal amp is also an application of the joule effect.

2.1.2. MAGNETIC EFFECT

Any electrical current produces a magnetic field in the surrounding space. This property is fundamental to electromagnetics. The behaviour of the needle powered under the passage of electrical current is the basis of the operation of electrical measuring devices and electric motors.

The rotation of the needle fed in front of a graduated dial is proportional to the intensity of the current: the dial constitutes either an ammeter or a volt, being. The mechanical rotational motion of the needle can perform mechanical work: by replacing the magnetized needle with an electromagnet, a rotor can be obtained, i.e. a continuously rotating part is an electric motor.

2.3. MAGNETIC INDUCTION

- Under the magnetic effect of the current established by the Oersted experiment, a current produces around it a magnetic induction field. As with magnetic field time, one can materialize the lines of forces by a specter of iron chip on a sheet of cardboard that the common thread crosses perpendicularly.
- Each chip line materializes a magnetic field induction force line around the conductor.
- The spatial distribution of the lines differs depending on whether the current is straight, circular, or circulates in a solenoid. This is the phenomenon of induction that is used in most

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electromagnetic devices ranging from electric ringing to television through the telephone, the radio, the electron microscope to name a few.

3. EXPERIMENTAL METHODE

The experimental method is a global approach where it is a question of observing the facts, proposing a speculative explanation, and returning to the experiment to verify hypothesis.
The starting point of scientific research is the observation of facts that can be defined as "careful preservation of facts in order to know it better".

The hypothesis thus presents itself as an invention of intelligence to solve the contradiction posed by this fact-problem of matter.

Any method of experimental science, the first approach is the observation of the natural phenomena of which one seeks the existing laws, where possible, then causes the phenomena under specific conditions by varying these conditions to finally discover their influences; it's experimentation.

3.1 ESSENTIAL CHARACTERISTICS OF THE EXPERIMENTAL METHOD

After describing the experimental science method, it is a good way to identify the four essential characteristics of this method:

- The first is the experimental origin of the applicants put to the basis of all sciences;
- The second is the overriding experimental verification of any scientific theory; that is, verifying its consequences;
- The third characteristic is the need to admit the free examination of fundamental assumptions. In other words, it must be recognized that some assumptions replace the former, which are only individuals of limited value. In the scientific method, the postulates can never be considered absolute and this method is essentially dogmatic;
- Finally, the scientific method is objective and universal. This comes from the experienced basis of the scientific method where all the measurements, all the checks made with a given device, are more independent of the observer: each can therefore, on the one hand, control the reasoning that followed to build the theories to reach the same conclusions as long as the experimental conditions remained identical to the previous ones and on the other hand, redo the experiments that were carried out elsewhere. (JACQUES FRANEAU, 1968, P8-9).

4. PRINCIPLES OF PHYSICAL SCIENCE EDUCATION

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Everyone knows that secondary education called "humanities" offers young people a general formation of mind and heart, teaching them to express their thoughts with clarity, brevity and coherence.

The study of the physical sciences must be an element of culture, not a matter of being reduced to learning a technique. What is important is not to take students with a more or less encyclopedic background but to introduce them to the scientific spirit. The physics course must not only contribute to the discovery of nature, but also and above all to the exploration of the paths that led the human mind to this discovery. The teaching of this discipline must therefore, in a way, be focused on the very history of science.
Physics is an experimental science; its teaching must be based on observation guided by reasoning. The experimentation will generally be preceded by the presentation of the problem, which it is called upon to provide the solution. In some because, it is better to solve the problem beforehand by deductive way; the experiment will then come to control the solution found. It should not be forgotten that, for much discovery, the educational reasoning, culminating in a hypothesis was the starting point of experimental research.

4.1. THE OPERATIONAL OBJECTIVES ASSIGNED IN THIS STUDY

Teaching is a process of knowledge transmission and should not be carried out by anyone, how, but while following a certain appropriate pedagogical method so that at the end of this teaching, the assigned operational objectives are achieved. Thus, the third student of the scientific humanities, who has followed this teaching well will be able to:

- See qualitative properties
- Establish the classic formulas if not, discover them by translating the quantitative properties.
- Check the results of calculation, problem solving and practical work.

4.2. SCHEMA EXPERIMENTALE'S STEPS ARE RECOMMENDED TO BE APPLIED IN THE TARGET CLASSES BY OUR STUDY

In the following lesson sheets, we have reduced the experimental scheme to at least five steps that we recommend applying to the teaching of physics in the third-year classes of the scientific humanities:

- Introducing the topic and defining lesson objectives;
- Description of the devices used and their role in experimentation;
- Counting all operations to be performed with or on devices;
- This is the conclusion or end of the experimentation or we will state the laws in the form of proposals;
- Application: it is an optional step to explain mechanism of a few devices including the common use to justify the choice of the subject in question.

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5. HANDLING SHEETS

The last point is devoted to the description of some sessions of practical work based on laboratory manipulation. Some sessions consist of simple observations or are not made of instrumental measurements; the scientific ideas that have emerged are only quantitative laws without a qualitative term, or a definition describing more or less immediate properties of phenomena.

Subject No.1 ELECTRISATION

A. By rubbing

1. Goals: The goal of this experiment is to show that by rubbing two bodies, they become able to attract light bodies, it is the electrification by friction.

2. Experimental devices used

a) Composition

- A working table on which the experiments will take place;
- A glass rod;
- A plastic rod;
- A sleeveless copper rod;
- A copper rod with wooden handle;
- A piece of woollen cloth;
- Fragments of paper;
- Feather beards.

b) Roles

- The work table, where we will work to present our experiences;
- All the stems composed by the different materials will be rubbed on a wool cloth, the consequence of this friction is to pull the light bodies, such as paper fragments or feather beards. But copper when it is not on the market at one of its ends it does not attract light bodies.

3. EXPERIMENTAL STEPS

- Let's rub a plastic or glass rod with a piece of woolen cloth;
- Approach the stem of paper fragments or feather beards.

Let's ask the students: What does the stem do with light bodies? Here's the answer the students gave me:

- ❖ The glass rod attracts light bodies.

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- This time, let's replace the glass with a copper rod held by hand rubbed on a wool fabric. Let's ask the students the same question: What does the copper rod do after rubbing with light horns?

❖ There is no attraction to light bodies.

- In sleeves this rod of a piece of wood at one of its ends and let's start the experiment again;
- The finding made in front of the students the light bodies are attracted on all points of the stem.

4. RESULTS OBTAINED

Experiments show that all bodies, at least solid bodies can electrify by friction.
What is the difference between the plastic and copper rods?

- For the plastic or glass rod, the electrical property remains located at the point where it was developed.
- For the copper rod, it appears on the whole body. This is what expresses that plastic, or glass is a bad conductor of electricity while copper is a good conductor of electricity.

5. CONCLUSION

Bodies acquire by friction the property of attracting light bodies: they are said to be electrified. This property attracts light bodies is called electricity.

B. ELECTRISATION PAR CONTACT

1. Objective:

We will show a second way to electrify an initially neutral B-driving body by putting it in contact with another electrified A body beforehand.

2. EXPERIMENTAL DEVICES USED

a) COMPOSITION

The same devices used for the friction electrification experience will serve us again this time.
We will only add the electric pendulum it is a small ball suspended from a wire hanging from support.

b) ROLES (Friction Electrisation)

The electrified pendulum has only one role to know whether a body is electrified or not by approaching the pendulum: if the ball is attracted the body is electrified.

3. EXPERIMENTALE ETAPES (Friction electrization for stem A)

- The A-stem is already electrified.

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- The B-stem is neutral, i.e. not electrified.
- Let's connect A and B in wooden handles.
- Let's separate them.
- B has become able to attract light bodies.
- Let's get to the electric pendulum B.
- The electric pendulum is attracted to the B-stem.

4. RESULTS

Electricity manifests not only on the entire extent of a conductor but on a second conductor held by a wooden handle that is put in contact with the first, if one separates the two conductors, they are both electrified.

5. CONCLUSION

Neutral bodies are electrified on contact with electrified bodies.

SUJET No.2 THE EFFECTS OF THE COURANT

MOTIVATION

We want to show and explain with a few examples the importance of the effects of electric current in the practical life of man. Its effects are: calorific, magnetic and chemical.

A. CALORIFIC EFFECT OR JOULE EFFECT

1. Objective:

In this manipulation, we will use as a source or electric generator to show the manifestations of the joule and light effect of the electric current.

2. EXPERIMENTAL DEVICES USED

a) Composition

- A flashlight;
- A small tungsten bulb or filament;
- Three ordinary batteries.

b) Roles

- A flashlight is an ordinary lamp for common use that uses batteries as a source or generator. Its manipulation is mundane adopted to everyone.
- A small tungsten bulb or filament that will often be turned on or off depending on the user's wishes.

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- Batteries act as an electric source or generator because chemical energy is converted into electrical energy.

3. EXPERIMENTAL STEPS

- In the torch, we will classify the batteries in series that is to say we will bring together the negative pole of the first generator to the positive pole of the second, the negative pole of the second to the positive pole of the third.
- Although we have classified the batteries, then we have to move the switch by pushing it forward, as the circuit is closed already, the current passes the bulb lights up, the filament reddens.
- When the switch is pushed backwards the circuit is said to be open, the bulb goes out.

4. RESULTS

Man prefers light to darkness:

- The bulb: there is the heating of the tungsten filament; the dilation of the gases in the bulb render the bulb unusable.

- Batteries: following common use, they polarize, this effect is a consequence of this transformation of chemical energy into electrical energy. It produces a continuous current.

5. CONCLUSION

The passage of the current is manifested by the heat and light effects. Other appliances exploit these effects of the current, such as irons, water heaters, electric kettles, etc.

B. MAGNETIC EFFECTS

Motivation

This experiment is to show that in an electric field, the electric current is also able to act on a magnet.

1. Objectives:

The objectives are to explain by showing students the links between magnetic phenomena and electrical phenomena:

2. EXPERIMENTAL DEVICES USED

a) Composition

- Three batteries at 1.5V each,
- A regular 1.5V bulb
- A 30cm long copper wire.
- A magnetized needle.

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- A work table

b) Roles

- Piles, light bulbs, work table, common thread (Effect of the current).
- The deviation of the magnetized needle is proportional to the intensity of the current the greater the intensity, the greater the deviation and if the intensity and less, the deviation is less. In an electric field, any object is carried out by the effects of the current. The variation also depends on the direction of the current in the electrical circuit.

3. EXPERIMENTATION STEPS

- Let's assemble the three batteries in series with bulb to reassure us if the current passes at the time of the experiment.
- When open-circuited, let's place the magnetized needle so that it is parallel to the copper wire.
- Let's close the circuit, while waiting to attach the core of the bulb to the positive terminal of the last battery, the bulb lights up.
- When the bulb lights up there is a passage of current, the magnetized needle tends to cross with the common thread. The deviation of the needle depends on the direction of the current.
- If the intensity of the current is increased, the deviation increases.
- If the current is cut, the magnetized needle returns to its original position.

4. Results

As long as the circuit is open and the current intensity is high, the deviation of the needle is proportional to the intensity of the electric current and the direction of the current. If the electrical circuit is open the detour stops.

5. CONCLUSION

The electric current creates around it a magnetic field that deflects the magnetized needle. The meaning of the magnetic field is given by the Man rule of Ampere. The North Pole of the magnetized needle always deviates to the left of the Ampere observer.

SUJET No.3: MAGNETIC INDUCTION OF A COURANT

3.1. MAGNETIC FIELD OF A UNIFORM CURRENT

Motivation

His experiments will allow us to observe carefully the distribution of the field lines around the common thread in the different cases we will have to study (the magnetic field of a uniform, circular current, in a solenoid).

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In this sheet, we study exclusively the magnetic field of a uniform current.

1. Objective

View the magnetic field lines of a straight current.

2. Experimental devices used

a) Composition

- A work table;
- A generator (batteries or batteries)
- A cardboard sprinkled with iron chip;
- A common thread;
- A magnetized needle;
- An Ampere man.

b) Roles

- A work table on which we deposit all experimental devices.
- A generator (batteries or batteries) as a source of electrical energy.
- A cardboard sprinkled with iron chip to visualize the magnetic field lines in a straight current.
- A common thread in which the electrical current circulates will be connected to the source through the cardboard center, the wire is made of copper.
- An Ampere man to determine the direction of magnetic induction lines.
- A needle magnetized by its deviation as the current passes indicates the pole which is the direction of induction lines.

3. EXPERIMENTAL STEPS

- A vertical copper wire will find a cardboard sprinkled with iron chip. Let's get the power through.
- We find that the grains are arranged in concentric lines around point O, where the wire crosses the cardboard.
- Let's place a small P-magnate needle along a chip line, it takes a tangential direction at the chip line, its North Pole gives us the sense of induction line thus materialized.
- Let's apply the ampere man rule: The North Pole of the magnetized needle is to his left; in other words, the left arm of the ampere man gives us the meaning of the induction lines.
- The negative terminal and the positive terminal is the exit terminal.
- Let's load the direction of the current, the north tip of the needle rotates in an in reverse direction.

4. Results

The observation made in this experiment consists of visualizing the lines of force by a specter of iron chip on a cardboard sprinkled with iron chip that is crossed in the middle by a common thread.

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Closed circuit, concentric circles form around the common thread, and each line of chip materializes a line of induction of the magnetic field.

5. CONCLUSION

A straight current creates around it a perpendicular magnetic field to the common thread.
The lines of force (or induction) are circular. At point P they are directed to the left of the ampere man who looks at this point. They change with the direction of the current.

What is most important in this study is the didactic procedure and not the numerical results, since these are not the results of an original research to be presented to the public. Nevertheless, those of our colleagues who have the opportunity could take back and rectify these raw values.

6. IMPLICATIONS ET RECOMMENDATIONS

- That the recruitment of physics teachers to the humanities take into account their qualification pathway;
- That the Congolese state equip not only the schools, but also the Higher Educational Institute (ISP) that must materialize the notions of physics;
- That school leaders try to increase the number of classroom visits and strengthen the physics teaching units by organizing model lessons and educational animation services for the benefit of teachers.
- That provincial inspectors increase the number of physics inspectors to regularly visit schools to see how the national program is being implemented.

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