# NATIONAL OPEN UNIVERSITY OF NIGERIA

## SCHOOL OF EDUCATION

**COURSE CODE:** SED 313

**COURSE TITLE:** IMPROVISATION IN INTEGRATED SCIENCE

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**CREDIT UNIT** 2

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# MODULE 1 GENERAL PRINCIPLES AND PHILOSOPHY OF IMPROVISATON IN SCIENCE TEACHING

Unit 1 Meaning and Philosophy of Improvisation in Integrated Science

Unit 2 Sourcing for Producing a Catalogue of Science Teaching Materials in Immediate Environment

Unit 3 Sourcing for Producing a Catalogue of Science Teaching Materials in the Distant Environment

Unit 4 Utilisation of Science Instructional Materials

Unit 5 Selection and Utilisation of Improvised Materials

## UNIT 1 MEANING AND PHILOSOPHY OF IMPROVISATION IN INTEGRATED SCIENCE

**CONTENTS**



### 1.0 INTRODUCTION

In this unit, you will be taught the concept of improvisation and also its philosophy. The unit further discusses the need for improvisation.

### 2.0 OBJECTIVES

By the end of this unit, you should be able to:

- Explain the meaning of improvisation
- Define improvisation
- Explain the principles of improvisation

- Discuss the philosophy of improvisation
- Give five needs for improvisation in integrated science

## 3.0 MAIN CONTENT

### 3.1 Meaning of Improvisation

The teaching and learning of integrated science involves doing things – handling of materials and equipments. It is generally observed that no nation on the globe has all the required teaching and learning materials and equipment in its institutions of learning. Most of the teaching and learning materials are supplemented from locally made materials.

There are more than one definitions of improvisation. To some, it is the act of substituting for the real thing that is not available. Others see it as the use of substitute equipment where the real one is not available. Some also call it teaching aid. By these views, the act of substituting for the standard equipment or instructional material that is not available, or making it up for inadequate available materials with locally made equipment or instructional material from readily available natural resources.

By substitution form of improvisation, an already existing local material is used in place of a piece of equipment that is not available. This is a simple form of improvisation which resourceful science (integrated science) teacher should be able to carry out to enrich assorted empty things or cans as beakers.

**SELF ASSESSMENT EXERCISE 1**

What is your operational definition of improvisation?

### 3.2 The Principle of Improvisation in Integrated Science

The principle of improvisation in Integrated Science aims at revealing the way or manner improvised materials are integrated and applied into the teaching of the subject or course. Integration is the systematic step-by-step presentation or application of improvised materials in teaching. The application of the material has to be done carefully and tactfully with the lesson objectives as guide throughout. To integrate and apply improvised

instructional materials, certain basic steps should be followed. The steps to follow include:

a. Preparation of the teacher
b. Preparation of the learners
c. Actual presentation
d. Presentation of the following-up activities

In teacher preparation, effective application of improvised material is very crucial to objectives of the lesson. Therefore, the teacher has to:

- Plan the integration in the lesson and follow it
- Consider how the material can help in achieving the objectives
- Process the materials well ahead of time, that is, prepare and test them before the lesson commences

**Preparation of Learners**

- Learners must be prepared psychologically with some explanation and reasons for the particular materials to be used
- Clear guidance must be given to learners as to areas of importance to study. This involves step-by-step directions of what the students need to do during the lesson
- Where necessary, new words associated with the material must be clearly defined.

**Actual Presentation**

The improvised materials, must be appropriately applied at:

- Introductory stage
- Content presentation stage
- Summary stage

The teacher should be in control of every stage, directing and maintaining the learners' interest and attention. Learners should not be carried away at any stage whether or not they are directly involved in manipulation of the material(s). The whole lesson should be guided by the objectives.

In the preparation of the follow-up activities, the only way to evaluate the success or otherwise of an improvised instructional material is to obtain feedback from the learners. Therefore, the teacher must evaluate the integration and application of the material immediately. To this end, the teacher will do the followings:

- Ask questions that have direct bearing to the presentation
- Allow the learners to respond freely at every stage of the lesson
- Evaluate the presentation using instructional materials already used in the lesson, based on the objectives of the lesson
- Evaluate the lesson based on learners' interest

The improvised instructional materials should be preserved so that they can last long.

Improvisations may be damaged or destroyed due to learners' handling or repeated display, frequent retrieval or long period of storage. To preserve them from tear and wear, they may be laminated, mounted on harder materials like plywood or kept in boxes or special spaces created for them.

**SELF ASSESSMENT EXERCISE 2**

Explain the principles of improvisation.

## 3.3 Philosophy of Improvisation in Integrated Science

The philosophy of improvisation in integrated science seeks to clarify the objectives of improvisation, and the integration, application of improvised materials in the teaching of the subject. Improvisation requires a considerable development though, imaginative planning and good knowledge because it is expected to help, though in varying degrees the following aspects of learning:

i. Perception
ii. Understanding
iii. Transfer of training
iv. Provide reinforcement
v. Retention (Adamu, 2003; Atadoga & Onaolapo, 2008).

There are two aspects or approaches to improvisation, one is concerned with the methods of teaching and the other with the equipments. However, the need for improvisation sums up the two approaches because the two aspects are closely interwoven.

**SELF ASSESSMENT EXERCISE 3**

Give reasons for the needs of improvisation in integrated science.

There are numbers of need for improvisation in integrated science. Compare your reasons (points) to the followings:

1. A way of minimizing cost of equipment
2. Challenge to curiosity and productive application of intellect
3. A means of local application of universality of science
4. Inexpensive method of widening the scope of inquiry
5. Developing necessary science skills, process skills, attitudinal and practical skills needed to function effectively in the society as professional scientists
6. Enable the teachers to think and research for cheaper, better and faster methods of making the teaching-learning process easier for learners; hence, promote creativity and self-reliance
7. Provide a cognitive bridge to lead learners from abstraction and its attendant or mental indigestion to a nodding acquaintance with reality.

The need for improvisation in science teaching-learning process cannot be over-stressed

The place of practical activities in science lessons has been described as very fundamental at all levels of education like Dewey (1968) who opined and emphasized that experience is the source of all knowledge. Experience itself is not passive but it is a product of sensation and reaction of the child. Improvised materials when they are well designed and adequately presented stimulate creative expressions in learners and encourage active participation in a lesson.

Improvisation involves several skills such as:

i. Observation
ii. Measurement skills
iii. Manipulative skills using various tools in cutting, bending, joining, impelling wood, metals, to mention a few.

Generally speaking, improvisation can be derived either through substitution or construction. It is not always possible to find suitable substitute for every piece of science equipment in the school. The construction is always done from the available materials. It is a more difficult form of improvisation in science than substitution. Construction form of improvisation requires innovation and creativity. An aquarium can be improvised by construction.

## 4.0 CONCLUSION

For the learners to learn Integrated Science and teacher to teach the subject effectively and meaningfully in a situation where schools are inadequately equipped or instructional and learning materials and equipment are not there, improvisation is the option. For integrated science teacher to improvise, he/she must be resourceful, dedicated and full of initiative.

## 5.0 SUMMARY

In this unit, you have learnt the meaning of improvisation, principle and philosophy of improvisation. You have also learnt that improvisation can either be by construction or substitution. Also discussed in the unit are skills such as observation, measurement and manipulative skills which are required for improvisation.

## 6.0 TUTOR-MARKED ASSIGNMENTS

1. Explain what you understand by improvisation.
2. Discuss the principles and philosophy of improvisation.

## 7.0 REFERENCES/FURTHER READINGS

Adamu, A.I. (2003). The Importance of Teaching Aids Towards the Enhancement of Teaching/Learning Progress. Garkuwa Journal of Education, 1 (4), 98-104.

Alonge, E.I. (1983). Improvisation in Integrated Science: A Practical Demonstration. 24th processing of STAN, Lagos. 171-177.

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Ogunniyi, M.B. (1986). Teaching Science in Africa. Ibadan: Salem.

# UNIT 2 SOURCING FOR PRODUCING A CATALOGUE OF SCIENCE TEACHING MATERIALS IN IMMEDIATE ENVIRONMENT

## CONTENTS



## 1.0 INTRODUCTION

Science teaching requires a lot of equipment and materials that are not all found in the science laboratories. Therefore, to use them, they need to be sourced for within and outside our immediate environment: And Nigeria environment is blessed with natural resources that can be used to produce a catalogue of science teaching materials. In this unit you will be exposed to meaning of science teaching materials and sourcing for instructional materials for science teaching.

## 2.0 OBJECTIVES

## 3.0 MAIN CONTENT

### 3.1 Meaning of Science Teaching Materials

Science Teaching materials to some are called instructional materials while others tagged them as resources for science teaching. These differences in definitions have one thing in common and that is, they are the resources that are used in the teaching-learning process. They enhance effective and meaningful learning and encourage students' active participation in science lessons.

## SELF ASSESSMENT EXERCISE 1

What is your working definition of science teaching materials?

Science teaching materials as resources for teaching science can be broadly grouped into two: human and non human resources. The human resources include science teachers, laboratory technologists, laboratory assistants, gests (professionals in science and science related fields), and artisans. The non human resources include, laboratory, textual materials, reagents, charts, models, natural environment and assorted laboratory equipments. In the context of this course, immediate environment include school and home environments. It is the environment we live in – the dwelling place(s) of the teacher and the students. Also, immediate environment include roadside mechanic workshop, tailor workshop, blacksmith workshop.

## 3.2 Sourcing for production of a Catalogue of Science Teaching Materials in Immediate Environment

The Table 1 shows the sourcing for instructional materials in the immediate environment for their production and topics to be taught.

**Table 1: Sourcing Science Instructional Materials from Immediate Environment**

| s/No | Instructional Material | Where to Source for Materials |
|---|---|---|
| 1 | Sand bucket, pictures, charts | Improvised by the teacher by using simple production techniques learnt. |
| 2 | Bottle top, stone, | School compound, shops |
| 3 | Fan, battery, regulators, electric bulb, pieces of magnet | Roadside mechanic, and Radionic workshops |
| 4 | Posters on various science topics, gravel, grass, wood | Students can improve on topics such as model of houses as well as the teacher. Others from the community, school environment |
| 5 | First Aid Box | Improvised by students and teachers |
| 6 | Assorted empty cans and tins | From the community and school environments. |
| 7 | Lubricants, different metal or wood surfaces, students' palms, rugs | Roadside mechanic workshop, teacher/students' homes and school based technology workshop |
| 8 | Assorted fruits | From school farm and community |
| 9 | Old shaft of cars, brake, pictures and films, assorted knots | From community – pick materials among junks from mechanic workshops, teacher production. |

**SELF ASSESSMENT EXERCISE**

List twelve science instructional materials in your immediate environment.

## 4.0 CONCLUSION

Our immediate environment is blessed with various kinds of science instructional materials that can be sourced from. The sourcing for producing a catalogue of science teaching materials in the immediate environment involves the teacher and students.

## 5.0 SUMMARY

In this unit, instructional material was discussed and explained. Also discussed in this unit was sourcing science instructional materials from the immediate environment.

## 6.0 TUTOR-MARKED ASSIGNMENT

Mention at least six ways you can source for science materials for teaching science.

## 7.0 REFERENCES/FURTHER READINGS

NTI, (2010). Basic Science and Technology Training Manual. Kaduna: NTI Press.

UBE FCT, (2009). Manual on Capacity Building Workshop. Abuja: UBE.

# UNIT 3 SOURCING FOR PRODUCING A CATALOGUE OF SCIENCE TEACHING MATERIALS IN THE DISTANT ENVIRONMENT

## CONTENTS



## 1.0 INTRODUCTION

Our environment, either immediate or distant has almost all things and objects needed to produce science teaching materials. Therefore, this unit tries to look at sourcing for production of science teaching materials in the distant environment.

## 2.0 OBJECTIVES

By the end of this unit, you should be able to:

- Mention types of science teaching materials
- Identify locations of science teaching materials.

## 3.0 MAIN CONTENT

### 3.1 Sourcing for Production of Science Teaching Materials in the Distant Environment

We have immediate and distant environments. Immediate environment has been explained in Unit 2. In the context of this unit, distant environment connotes educational centre that is not within the location of the school and the students and teachers' community. To some it is called out door laboratory. By this, it implies that all forms of environments have one type of science resource material or the other.

All the teacher and students need is to identify them and use them for knowledge and skills acquisition.

Table 2 sows examples of science instructional materials and where they can be found.

**Table 2: Sourcing Science Instructional Materials from Distant Environment**

| S/No | Instructional Materials | Where to Source for Materials |
|---|---|---|
| 1 | Fire extinguishers | Sourced commercially |
| 2 | Various types of ceramic and glass products | Outdoor laboratory; ceramic/glass industries |
| 3 | Ammeter, galvanometer, voltmeter | Sourced commercially |
| 4 | Resonance kits, turning fork | Sourced commercially |
| 5 | Glass block, triangle prism | Sourced commercially |
| 6 | Models of hydraulic and hydraulic jack | Commercially bought and teacher made |
| 7 | Pressing iron, electric kettle, generators, cooker, refrigerator | Home economics laboratory, improvisation from an artisan |
| 8 | Scrap engines, levers, linkages, slides and slots, films containing use of levers | Teacher production educational centres |
| 9 | Bar magnet, iron filing, stop clock/watch | Commercially bought |
| 10 | Wild animals, e.g. lion, elephant | Zoo and game reserve – outdoor laboratory |

**SELF ASSESSMENT EXERCISE 1**

Identify any five distant environments and list science instructional materials that are found there in.

## 4.0 CONCLUSION

Distant environment is rich in science instructional materials. Some of their locations bring learners close to nature.

## 5.0 SUMMARY

The unit discussed instructional materials that could be used in the teaching of science and where to source for instructional materials for the teaching of the subject within distant environment.

## 6.0 TUTOR-MARKED ASSIGNMENT

Identify eight science instructional materials and their locations.

## 7.0 REFERENCES/FURTHER READINGS

Atadoga, M.M. & Onaolapo, M.A.O. (2008). A Handbook on Science Method. Zaria: Shola Press.

NTI, (2010). Basic Science and Technology Training Manual. Kaduna: NTI Press.

UBE FCT (2009). Manual on Capacity Building Workshop. ABUJA:

# UNIT 4 UTILISATION OF SCIENCE INSTRUCTIONAL MATERIALS

## CONTENTS



## 1.0 INTRODUCTION

This unit guides you to meaning of utilisation and its processes, human and physical material resources.

## 2.0 OBJECTIVES

By the end of this unit, you should be able to:

- Explain utilization
- Define utilization
- Identify the scientific thought process of utilisation in a science lesson
- List and discuss any four human and physical facilities as resources for the teaching of science.

## 3.0 MAIN CONTENT

### 3.1 Meaning of Utilisation

Utilisation to some is putting into use of what is available to achieve set goal(s). Others see it as action that makes use of something for purpose(s). Generally, all the definitions have action or doing as common factor. Therefore, acceptable definitions of utilisation should contain words such as action, doing and purpose, goal or objective.

**SELF ASSESSMENT EXERCISE 1**

What is your working definition of utilisation?

## 3.2 Science Thought Process of Utilisation in Science Lesson

In science, certain ordered steps or procedures are followed to arrive at a solution to a problem. These ordered steps are called scientific thought process or process skill. The process skills are used by scientists in the course of investigation to find out more about objects, things, events, situation or natural phenomenon. The scientific skills processes are many. The process skills include; observation, data collection, classification, measurement, communication, inference, prediction, making hypothesis, testing hypothesis, recording, manipulation, experimentation and questioning.

**Observation**: Students may look at goat and sheep without certain of its characteristics or details. They have to be trained to look out for every detail for similarities and differences. They should be trained and encouraged to distinguish between rough surfaces and smooth one; difference between and among colours. Plant a seed inside a room and another outside and observe how the two plants grow. Place a container of foam water of detergent under sun, stir it and allow them to carefully observe it.

**Data Collection**: We are enveloped all around us inside information. Students should be trained on how to assess information in their environment, in the internet and in textual materials. In other words, they should be taught sources of information. The information we have or get greatly influence the type of decision we take.

**Data Analysis**: After students have generated the data they need, their understanding of them is important. They should be taught and trained on the use of calculator and computer: How to enter information into system and generate result.

**Classification**: To be able to classify and analyse correctly, we should be good observers. This is so because classification is based on ability to sort things according to certain characteristics, such as size, colour, height, shape, to mention just a few. Assist the students to recognise the

similarities and differences; recognising properties and ordering skills which are relevant if one needs to classify properly.

**Measurement**: In measurement, different equipment, scale and units are used for different objects or things. Students should first be introduced to ungraded measuring activities; e.g. for length of table top, width of classroom, laboratory, use footmark, hand fingers. Thereafter, move to graded scale measurement, e.g. volume in cubic centimetre, cubic meter, or litres, length, height in millimetres, centimetre, meter or hectares, temperature in degree centigrade, Kelvin; time in seconds, minutes or hours. Measuring is a skill and so it should be handled carefully.

**Communication as Process Skill**: Talking, working, drawing and using gesture are vital communication process skill. All these can be grouped into three: Verbal (oral), non-verbal (written) and para-verbal (body movement). Science teacher must learn how to communicate and communicate well. The voice should be audible and clear. The teacher should learn to speak in simple and correct English. Writing on board should be bold, neat and readable. Students should be able to communicate their findings in simple correct writings; plotting of graphs, drawing of charts to illustrate their results.

**Inference**: This is to make deduction and translate into conclusion. At sighting some objects or beings or people, you could presume their situations or state of minds and pass judgement at their conditions. From background information of theories you make your opinion. Teach students how to judge or interpret appearance or situation. Train the students how to obtain clue or evidence and think critically for solutions.

**Prediction**: Students should be taught basic principles, scientific ideas and logics. When sound background is laid based on scientific principles, theories and laws, students will be able to suspect or guess the outcome of events or action before investigations are made into such situations or events.

**Making Hypothesis**: Hypothesis can be seen as an intellectual guess which can either be retained or rejected, based on experimental result. It gives direction to stated problem. Statement from hypothesis before study is carried out is tentative until data or information gathered on the problem or issue is subjected to statistical test using appropriate

statistic(s). Hypothesis is a skill. Science students should be exposed to it because they need it.

**Testing Hypothesis**: When hypothesis is formulated, the next step is that it must be tested if not it has no use. How it is carried out depends on students' knowledge of computer and data analysis. Therefore, students should be carefully taught how this is done because not everybody understands how it is done.

**Recording**: Observations are to be recorded correctly. Recording correctly is part of process skill. Wrong recording could lead to wrong report which will translate to wrong conclusion. To avoid this, students should be taught or trained to record results carefully and correctly. Wrong recording can be avoided or minimised when students learn to take repeated readings. Also, any observation made should be recorded immediately. The students should also be trained to concentrate on their work. They must learn to record their readings correctly.

**Manipulating**: Students should be given opportunity to handle equipment. Training should be given to them on how to operate equipment correctly without any damage to the equipment neither hurting themselves nor their mates. They should be provided with materials to manipulate, touch, push, pull and rub as the case may be. As they carry out these activities, they should be asked to explain or discuss their experiences.

**Experimenting**: Students are always faced with challenges. Challenges may come from what they observe in their environment, their teacher or books they read. The teacher should assist, guide them on how to go able the problems by approaching them scientifically and also through trial and error. The students should be exposed to various methods or strategies of solving problems.

**Questioning**: Students are naturally inquisitive, curious and wanting to know everything and thereby asking questions about what they see. They ask questions such as; "What?", "Why?" and "How?" These kinds of questions are scientific and should be encouraged. Therefore, students should be given opportunity to express their teachings. Teacher should train them on how to generate questions and ways to answer them

correctly. When answers are not coming after several efforts, then teacher should give them clue that leads to the answer.

**SELF ASSESSMENT EXERCISE 2**

Identify any other five scientific though processes.

## 3.3 Roles of Human and Physical Resources in Utilisation

Humans are resource materials for utilisation in teaching and learning of science at all levels of education. They include teachers, laboratories technologists, laboratory assistants, laboratory attendants, students, resource persons. Human as resources for utilisation must be knowledgeable in their subject areas, physically, mentally, socially and morally sound. They need to be familiar, firm and friendly for effective utilisation in the teaching and learning of science. For effective utilisation, the teacher must prepare himself/herself well before entering the class, a good classroom manager, respecting students' views and he/she must earn respect of the students. Provide students with activities that will give them opportunities to think, reason and work like scientists.

A resource person as part of human resources for utilisation may come from within the school from another department or unit or from the community or outside the community. A specialist in a field of study, a skilled personnel outside or within the school may be invited to come and give a talk on specific topic that will benefit the students and even the teachers. Examples of resource persons for utilisation in science teaching include; medical doctors, mechanics, plumbers, goldsmith, carpenters, hair dressers, pilots, to mention a few.

Physical resources for utilisation for science teaching refer to the entire school environment. The school environment comprises, classroom, furniture, building, laboratory, playground, school farm, botanic garden. The classrooms, laboratories should be well equipped with modern facilities and made conducive by the teacher and laboratory staff for effective science teaching and learning. The facilities should be well managed and organised. There should be routine check on the reagents, all laboratory materials should be correctly labelled. The students should be taught on how to maintain clean environment and given guidelines

and laboratory rules written to safeguard proper use of the facilities with little or no laboratory accidents.

## 4.0 CONCLUSION

It is not enough to have real or improvised science instructional materials. Their beauty lies in the effective utilisations. All the materials and processes involved must be well incorporated before we can achieve desired goals and objectives through proper utilisation.

## 5.0 SUMMARY

In this unit, we learnt the meanings of utilisation and process, human and physical facilities and resources. Utilisation and processes build up both the teacher and students to be creative and resourceful.

In this unit also, you are exposed to how you can utilise the components of both the human and physical facilities and resources for effective teaching of science.

## 6.0 TUTOR-MARKED ASSIGNMENTS

- As a science teacher in training, if you are to teach communication in science, what are the immediate resources you will use for your students to learn?
- When you come across a topic you cannot handle well in science, how best can you pass the expected knowledge to your students?

## 7.0 References/Further Readings

Ayoga, A.V. & Ozike, B.C. (1976). Improvisation in Science Training: A Book of Reading on Survival of Nigerian Education. Vol 17.

Nkom, A.A. (2006). Supervising Core Subject in Primary Education: A Manual. Zaria: Tamaza Publication.

Umudhe, S.E. (1998). A Guide Book for Science Teacher in Nigeria. Delta: Research Publishers.

# UNIT 5 SELECTION AND UTILISATION OF IMPROVISED MATERIALS

## CONTENTS



## 1.0 INTRODUCTION

For improvised teaching and learning materials to get effective meaning, some basic principles or guidelines must follow their selections and utilisation. If a teacher cannot utilise improvised material that will bring positive result in teaching-learning process then the aim of the lesson is defeated.

Therefore, this unit exposes you to guidelines for selection and utilisation of improvised materials. Also, the unit exposes you to advantages and limitations in the utilisation of improvisation.

## 2.0 OBJECTIVES

By the end of this unit, you should be able to:

- Identify the guiding principles in the selection and use of improved materials.
- Select appropriate improvised materials in the teaching of science.
- Identify the advantages and limitations of improvisation.

## 3.0 MAIN CONTENT

### 3.1 Guiding Principles in Selection and Use of Improvised Materials

For good success of anything or approach, there should be guiding principles to be followed. Selection is the process of choosing from among many things. In teaching-learning process, it is a careful choosing of instructional materials that will enable the teacher to teach his/her lesson within the stipulated period of time.

**SELF ASSESSMENT EXERCISE 1**

List three guidelines to follow in choosing improvised instructional materials.

Compare your points with the followings:

Although improvised materials have several purposes, for which they are selected, there are certain guidelines that must be followed for effective utilisation. The guidelines for selection include the followings:

1. The characteristics of the students should be analysed so that the improvised materials can be within their abilities and interest. The characteristics of the students include age, ability level, number in the class, gender and physical impairment.
2. Behavioural objectives of the lesson must agree with the improvised materials to be used. For instance, if the behavioural objective is to help students demonstrate static electricity, it is important to use ebonite rod or biro, small piece of paper and wooling piece of cloth or dry hair on the head.
3. The number of students should be considered as teacher selects and uses the materials. Some classes are very large while others are small. The teacher should bear in mind that whatever he/she selects should meet the desired purpose(s).
4. Constraints attached to the materials should also be considered. Improvised science instructional materials are not easily available.
5. Time is another factor when selecting. There should be sufficient time and daily routine.
6. Cost of materials involved in the improvisation.
7. Sourcing the materials; place of location should be considered.

8. The effectiveness of the materials is also an issue in the selection. Improvised materials selected must be suitable and their design must meet the aesthetic value.
9. Improvised materials selected must meet the policy of the immediate environment or culture of the students. This is so because not all materials are accepted by all cultures; as some materials are considered taboo. Therefore, to avoid friction, the teacher should confide with the authority and the community before such materials are brought out for use.
10. The safety, durability and visibility of the improvised materials must be considered during selection and usage.

## 3.2 Advantages of improvisation

Improvisation in science teaching and learning has some advantages and limitations as it is used in lesson delivery. The advantages include:

1. If managed effectively and appropriately, it will increase the rate of learning and will allow the teacher to use more on other useful activities
2. It encourages involvement of teachers in curriculum design and development
3. It allows for effective lesson planning from objective determination and evaluation
4. It encourages students' participation in the process of learning
5. It makes room for individualising education, as alternative paths and variety of resources available at the student's choice
6. Learning becomes real and immediate because improvised instructional materials utilisation emphasises understanding and practical activities. Improvisation provides bridge for the world outside and outside the classroom
7. Improvised instructional materials utilisation makes access to science education more equal and plentiful for all learners since improvised materials can be moved to any place
8. It provides various materials and procedure and therefore, it assists the student to discover himself/herself and he/she true ability
9. Visual support is very helpful in the teaching and consolidating vocabulary which in turn affects the reading ability of students and helps student to associate words of objects or comprehend what is happening in a particular concepts or area of study (Adamu, 2003).
10. Improvisations are very useful and dependable in capturing students' imagination if used correctly. If effective selection is made, it will

motivate students to learn and remember that is learnt, whenever there is need for recall.

11. An improvised materials can present the students with a more authentic picture of the real object, than the teacher can ever describe or explain.
12. The use of improvisation can also facilitate the repetition of an idea without becoming monotonous (Balogun, 1981).

**Limitations**

As important as improvised instructional materials are, they are not substitutes for the teaching rather, they depend on skilful employment by him (the teacher). Improvising science instructional materials are challenging as well as their effective usage. There are problems and shortcomings, which can be broadly, classified into two: non human and human. Non human can further be categorised into two:

i. Teaching factor and
ii. Financial factor.

i. Teaching Factor: Durability of the materials, cleanliness of compactness and convenience or otherwise at use of the materials are part of factors that relate to teaching. All these qualities may be found in the materials improvised, thus a limitation.
ii. Financial Factor: This is all about availability of funds for the purchase of raw materials and for handy simple workshop tools, though improvisations are expected to be made from cheap sources, there are basic tools and materials that require money in the school. Lack of such funds can frustrate the effort and interest of the science teacher.

Human factors take a critical look at the teachers' professional commitment, competence, creativity, mechanical skills, initiative and resourcefulness. Researchers and classroom experiences have shown that many classroom teachers are aware of the importance of improvisation but majority of them do not practice it. Some of the teachers exhibit negative attitude towards improvisation and claim that it is time consuming and fund depleting.

## 4.0 CONCLUSION

The value of improvisation among others is its ability to serve and achieve educational goal(s) or objective(s) meant for. But the goal may be far reaching

if careful selections are not made in them (improvisations). Therefore, in their selection for effectiveness, certain principles must be followed. These include, time factor, number of students in the class and lesson topic and objective. Improvisation advantages outweigh its limitations. Therefore, science teachers should be encouraged to practice improvisation.

## 5.0 SUMMARY

In this unit, you have learnt guiding principles in selection and utilisation of improvised materials. Advantages and limitations in the use of improvisation in teaching-learning process were highlighted in the unit. Improvisation cannot take the place of the teacher. The teacher uses it as an instructional material. Therefore, improvisation is an alternative to real object.

## 6.0 TUTOR-MARKED ASSIGNMENT

- Identify and discuss any five guiding principles in selection and use of improvised materials.
- Identify and explain any five advantages and two limitations of improvisation.

## 7.0 REFERENCES/FURTHER READINGS

Adamu, A.I. (2003). The Importance of Teaching Aids Towards the Enhancement of Teaching/Learning Process. Garkuwa Journal of Education, 1 (4), 98-104.

Atadoga, M.M. & Onaolapo, M.A.O. (2008). A Handbook on Science Method (vol. One). Zaria: Shola Press.

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## MODULE 2 IMPROVISABLE EXPERIMENT IN THE INTEGRATED SCIENCE CURRICULUM

Unit 1 Improvised Plane Mirror Experiment

Unit 2 Use of Local Fruits in Teaching Acids and Bases

Unit 3 Egg in the Bottle Experiment (Demonstration) on Pressure

Unit 4 Mathematics Experiment to Determine the Value of Constant pie ($\pi$)

Unit 5 Fish Pond and Aquarium – Lesson on Fish

## UNIT 1 IMPROVISED PLANE MIRROR EXPERIMENT

### CONTENTS



### 1.0 INTRODUCTION

In absence of real experimental materials, improvisation of such materials are made. The said improvised materials are used for the same experiment meant for the use of real materials. In this unit, you will learn how improvised materials can be used to demonstrate characteristics of images formed by plane mirror.

## 2.0 OBJECTIVES

By the end of this unit, you should be able to:

- Explain the meaning of improvisable experiment
- Define improvisable experiment
- Demonstrate how improvised mirror, straight pins and drawing board can be used to show characteristics of images formed by plane mirror
- Investigate laws of reflection

## 3.0 MAIN CONTENT

### 3.1 Meaning of Improvisable Experiment

In science (Integrated Science inclusive) formulae, laws and theories are postulated or arrived at through series of tasks, exercises, trial-and-error in laboratories. These series of scientific activities/exercises are carried out by scientists using equipments and apparatuses that are factory-made to obtain results. Experiment involves orderly procedure carried out with the goal of verifying, refuting, or establishing the validity of hypothesis. When an experiment involved control, it provides insights into cause and effect by demonstrating what outcome occurs when a particular factor is manipulated. There also exist natural experimental studies.

Experiments can vary from personal and inform natural comparisons (e.g. testing a range of improvised science instructional materials), to highly sophisticated (e.g. testing requiring complex – factory-made apparatus) by many scientists that hope if the results obtained from the two sets of instructional materials are the same. Experiments carried out using improvised instructional materials are referred to as improvisable experiments. Perhaps, there could be some experiments in integrated science curriculum that might be possible with improvised materials.

Self Assessment Exercise 1

What is your working definition of improvisable experiment?

### 3.2 Verification of Characteristics of Image Formed by Plane Mirror

Image formed by plane mirror has certain characteristics, which include the followings:

i. It is the same size as the object
ii. It is as far behind the mirror as the object is in front
iii. It is literally inverted
iv. It is virtual
v. It is upright

An example of plane mirror is dressing mirror.

**Required Improvisation Materials**

- A discarded broken mirror can often be cut into a number of small rectangular plane mirrors
- Pieces of ceiling board can be cut into a number of small rectangular drawing boards.
- Straight pins, popularly known as office pins. Straight pins substitute for optical pins

**Procedure**

**a. Finding the Image in a Plane Mirror**

To locate the image of a pin, a plane mirror is placed with its reflecting surface vertical on the surface of paper on a ceiling board. An object pin is placed a few centimetres in front of the mirror. If you look pass the object pin into the mirror, you will see an image of it. A second pin, called the search pin, or image pin, is now placed behind the mirror, so it appears to be in the same position as the image of the object pin. When the image pin is correctly placed, the top of the image pin should remain exactly in line with the bottom of the image of the first pin as you move your head from side to side. If the pins do not move together, but move relative to one another, there is parallax between them.

The image pin has to be adjusted to another position until there is no relative movement as you move your head from side to side. There is then no parallax between the image pin and the image of the object pin. The position of the second pin is marked and a line is drawn from this position to that of the object pin. If measured, the angle between this line and the mirror will be found to be $90^0$. It will also be found that object distance in front of the mirror equals the image distance behind the mirror.

**Nature of the Image Formed by a Plane Mirror**

You can repeat the experiment for finding the image in a plane mirror for nature of the image formed by a plane mirror but this time you draw a large capital **U** on a paper in front of the mirror to serve as the object. A pin is put at various points of **U**, such as at positions 1, 2, 3, 4 and 5 in turn, and each time the corresponding image is located by the method of no-parallax. The position of the image in each case is marked by a dot. In this way we plot the position of the image of the letter **U** as a set of dots, you observe that the **U** has been turned around, as shown in figure 1. From this, you will now say that the image in a plane mirror is laterally inverted. Because of literal inversion, you will notice in placing your left palm in front of a plane mirror that its image appears in the mirror as a right palm.

Lateral inversion arises from the fact that an object is perpendicularly opposite its image behind the mirror.

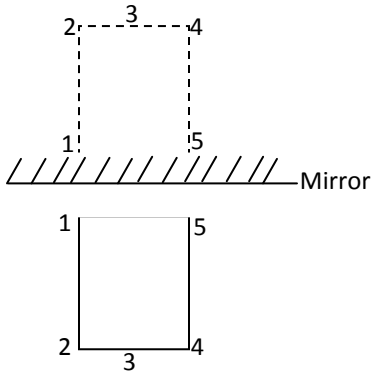



**Figure 1: Lateral Inversion**

**SELF ASSESSMENT EXERCISE**

Use improvised mirror to investigate the nature and position of letter **U**

## 3.3 Laws of Reflection

You can investigate the laws governing the regular reflection of light from a plane mirror. The laws known as laws of reflection states:

i. The incident ray, the reflected ray and the normal at the point of incidence all lie in the same plane

ii. The angle of incidence is equal to the angle of reflection

The experiment can also be done using improvised mirror, straight (office) pin, instead of optical pin, plane sheet and ceiling board is used instead, figure 2. Two pins are placed vertically at points P and Q along the incident ray. Two other pins R and S are placed to find the reflected ray by placing them in line with the images of P and Q as seen in the mirror. The angles of the incidence and reflection are measured as before. For each angle of incidence it is found that the angle of incidence is equal to the angle of reflection.

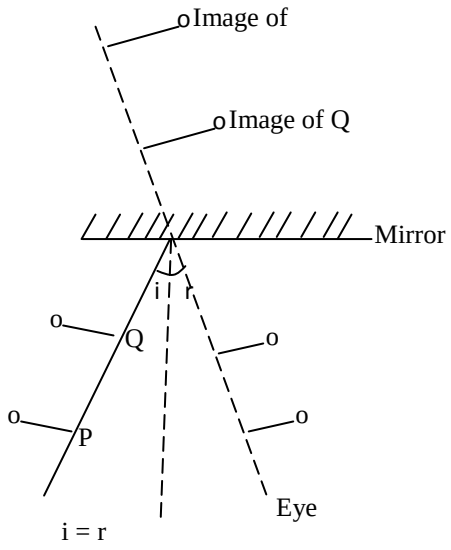



**Figure 2: Showing the Laws of Reflection Using Pins**

The two experiments in figures 1 and 2 have proved the reliability of improvisable experiments.

## 4.0 CONCLUSION

Improvised plane mirror, straight pins, and ceiling board were used to investigate laws of reflection, and characteristics of image formed by plane mirror. The results got are same to using real (factory-made or imported) materials or equipment. Therefore, a carefully selected and appropriate improvised materials, can adequately serve as good alternatives to real or imported science equipment on some topics.

## 5.0 SUMMARY

Improvisable experiments in Integrated Science are possible in the investigation of characteristics of image formed by plane mirror and laws of reflection using plane mirror instead of ray box. The exercise requires teacher's high level of commitment, resourcefulness and hard work. It is time consuming.

## 6.0 TUTOR-MARKED ASSIGNMENTS

1. By the use of improvised mirror, straight pins and ceiling board, investigate:
   a. Characteristics of image formed by plane mirror
   b. Laws of reflection

## 7.0 REFERENCES/FURTHER READINGS

Okeke, P.N. & Anyakoha, M.W. (2006). Senior Secondary Physics (Revised Edition). Enugu: Macmillan.

National Primary Education Commission, (1998): Training Hand Book for Nigeria Primary School Teachers: Primary Science. Kaduna: Kazzy-Ana Printing and Publishing.

STAN. (2011). Nigerian Basic Science Project: Pupils; Textbook Two (New Edition). Lagos: HEBN Publishers Plc.

# UNIT 2 USE OF LOCAL FRUITS IN TEACHING ACIDS AND BASES

## CONTENTS



## 1.0 INTRODUCTION

Acids and Bases are important ingredients in the production of foods and other items in life. Some of the acids and bases could be produced locally using some local fruits and materials.

## 2.0 OBJECTIVES

After successfully learning the content of the present unit, you should be able to:

i. Produce citric acid, lactic acid and ascorbic acid using locally available materials
ii. Produce calcium hydroxide, and potassium hydroxide using locally available materials

## 3.0 MAIN CONTENT

### 3.1 Making some acids and bases using local fruits and materials.

Acids and bases may be required for teaching and learning about acids and bases. Some of the acids found in food could be extracted for use in the lesson. The following are procedure for extracting the following acids.

### i. Citric Acid

**Materials**: 10 lime juice or orange fruits, beaker, funnel, cloth or wool

Procedure:

- Wash fruits with clean water
- Cut fruit into two and squeeze juice into beaker
- Filter extracted juice using cloth, cotton wool and funnel

The extracted liquid juice is the citric acid that could be used for science activities.

### ii. Lactic Acid

**Material**: Milk

**Procedure**: Open a tin of milk and leave it overnight. The milk would be covered with a liquid content in the form of lactic acid

### iii. Ascorbic Acid

**Materials**

- 10 big tomatoes
- Beaker
- Cloth or cotton wool
- Funnel

**Procedure**

- Wash fruits with clean water
- Cut tomatoes into two squeezes out fruit extract into beaker.
- Filter extracted juice using cotton wool or cloth
- Filtered liquid content ascorbic acid that could be used in teaching acid and bases

### iv. Potassium Hydroxide

**Materials**

- Dry cassava peels
- Dry Plantain peel
- Dry Cocoa peel
- Filter, Beaker, Water, Stirrer

**Procedure**

- Burn any of the above peels alone into ash
- Put ash into beaker
- Stir mixture very well
- Filter mixture using cloth or cotton wool through funnel
- The filtered liquid is potassium hydroxide which could be used for science activities

### v. Calcium Hydroxide

**Materials**: Quick lime for white washing boiling Spoon, bottle, water

**Procedures**

- Put five spoon full of powdered lime into bottle containing about 100ml of water
- Stir the mixture for some time
- Allow the mixture to settle
- Filter content
- Clear filtered liquid is calcium hydroxide.

**SELF ASSESSMENT EXERCISE**

What sort of acid or base do Quick Lime and Orange provide?

## 3.2 Using Local Fruits for Teaching Acids and Bases

Teaching of Acids and Bases require the use of indicators inform of blue or red litmus papers or PH strips for testing. The Indicator can be made using red cabbage extract.

**Materials**: Cut red Cabbage, grind it in blender, Sieve the red liquid and add some water

The red liquid content could be used as indicator instead of red litmus paper.

Pour the red fluid into five beakers. Pour the following liquids and note the change of colour of the red liquid.

| | **Observation** |
|---|---|
| 1 pour vinegar | |
| 2 pour base | |
| 3 pour egg York | |
| 4 pour 7 up soft drink | |

## 4.0 CONCLUSION

Acids and bases are important ingredients in the production of foods and other items some of which could be produced locally using fruits and some materials.

## 5.0 SUMMARY

Acids and Bases being produced locally could be used as teaching aids in teaching basic science. Teaching acids and bases require the use of indicators which could also be produced locally using some local materials such as red cabbage, Blender, water etc. The local indicator changes colour for different materials added to it.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. What kind of local materials could you extract lactic and citric acids from?
2. Compare and contrast the sensitivities of the indicators produced locally with the conventional indicators.

## 7.0 REFERENCES/FURTHER READINGS

Parker J. (2011). Investigating the use of improvised Instructional Materials in Teaching Acids and Bases concepts among Diploma in Basic Education Students in Enchi College of Education.

# UNIT 3 EGG IN THE BOTTLE EXPERIMENT (DEMONSTRATION) ON PRESSURE

## CONTENTS



## 1.0 INTRODUCTION

Air has weight and thus exerts pressure. One way of showing the power of air pressure is the use of egg in glass bottle demonstration.

## 2.0 OBJECTIVES

After successfully studying this unit you should be able to:

- Demonstrate egg in the bottle experiment
- Give some reasons behind your observations

## 3.0 MAIN CONTENT

### 3.1 Demonstration of Egg in Bottle Experiment

**Materials needed**

- 3 peeled hard-boiled egg
- A glass bottle of flask with an opening slightly smaller than the diameter of the egg
- Paper/lighter or very hot water or very cold liquid

**Method 1**

- Set a piece of paper on fire and drop it into the bottle
- Set the egg on top of the bottle with the smaller side downward
- When the flame goes out the egg will be pushed or sucked into the bottle.

**SELF ASSESSMENT EXERCISE 1**

Why does the egg get sucked into the bottle?

**Method 2**

Set the egg on the bottle

Run the bottle under very hot water

Warmed air will escape around the egg

Set the bottle on the counter

As the bottle cools, the egg will be pushed into the bottle

**SELF ASSESSMENT EXERCISE 2**

What makes the egg to be pushed into the bottle?

**Method 3**

- Set egg on bottle
- Immerse the bottle in very cold water
- When the bottle is chilled, the egg is pushed into the bottle.

Self Assessment What makes the egg o be pushed into the bottle?

## 4.0 CONCLUSION

The change of temperature of air in or around air affects the pressure of air which makes it push or pull item.

## 5.0 SUMMARY

When you change the temperature of the air inside the bottle, you change the pressure of the air. If you cool the air, the pressure decreases. The change in

pressure causes the sucking and pushing of the egg. You have learnt about effect air pressure and some factors affecting air pressure.

## 6.0 TUTOR-MARKED ASSIGNMENT

How can you get the egg out from the bottle?

## 7.0 REFERENCES/FURTHER READINGS

Anne Marie Helmenstine

Chemiistry.about.com

# UNIT 4 MATHEMATICS EXPERIMENT TO DETERMINE THE VALUE OF CONSTANT pi (∏)

## CONTENTS



## 1.0 INTRODUCTION

In Mathematics and Sciences there a term that is used in formula for determination of area or volume circle or sphere. This term is pi. How was the value of the constant determined?

## 2.0 OBJECTIVES

After going through the content of present unit you should be able to:

Determine the value pi using available local resources material required.

- Five empty tins of different diameters
- Ruler
- Thread

### Procedure

i. Measure the circumference and Diameter of the five different tin and record in the table below
ii. Divide the value of the circumference with value of the diameter(C/D)
iii. What do you observe about the calculated value of ratio of circumference to diameter of the tins?

| Tin number | Circumference(C) | Diameter (D) | C/D | Remark |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

## 4.0 CONCLUSION

The ratio of circumference to diameter of tins of various sizes is expected to be constant

## 5.0 SUMMARY

The ratio of circumference to the diameter of tins gives a constant value equal to the value of pi. Pi is used in determination of circumference and area of circle and spheres.

## 6.0 TUTOR-MARKED ASSIGNMENT

Determine the ratio of circumference and radius of the given tins and compare with ratio of circumference and diameter.

## 7.0 REFERENCES/FURTHER READINGS

Wilson R. (2014) The history of pi, www.math.rutgers.edu (14/02/2015).

# UNIT 5: FISH POND AND AQUARIUM – LESSON ON FISH

## CONTENT



## 1.0 INTRODUCTION

In a situation where science teacher is forced to construct a piece of science equipment in the laboratory, he/she must be well prepared. The construction is done from available local materials. When a teacher improvises a piece of science equipment by making an entirely new material from locally available resources or tries to modify an existing instrument to serve the same purpose, he/she is improvising through a construction process. In this unit, you are introduced to glass fish pond and aquarium which are improvised for the teaching of Lesson on Fish.

### SELF ASSESSMENT EXERCISE 1

List materials required for the construction of glass fish pond.

## 2.0 OBJECTIVES

By the end of this unit, you should be able to:

- List materials required for the construction of glass fish pond
- Identify materials required for the construction of aquarium
- Describe how glass fish pond and aquarium are constructed
- Identify differences between glass fish pond and aquarium

## 3.0 MAIN CONTENT

### 3.1 A Lesson on Fish I

Assuming you want to teach a lesson requiring the use of a glass fish pond but it is not available in your class, then you need to improvise. Then you need to be resourceful. The materials you need for improvised glass fish pond include the followings:

- Cellophane bag
- An empty sugar carton
- Water
- Fish tadpoles

**Procedure**: You can improvise glass fish pond from a cellophane bag well tucked into an empty sugar carton to hold water. Some life tadpoles can be caught and put in it. This will serve a substitute for a glass fish pond. And with a glass fish pond now constructed can be used to teach lessons on fish; features, movement, types of fish, among others.

### 3.2 A Lesson on Fish II

Suppose you want to teach a lesson on the fish and you do not have an aquarium in your school and there are no nearby stream then you need to improvise aquarium.

**Materials required**: Materials required for a construction of aquarium include the followings:

i. A small or medium sized strong cardboard box
ii. A large transparent plastic bag or sheet of plastic bag enough to hold the box
iii. A razor blade or very sharp knife
iv. Market pen
v. Paper clips
vi. Masking tape

**Procedure**

The procedure to be followed in the construction is as follows:

1. With the top flaps of the box sticking out, mark and cut two windows in each short side

2. Fold the top flaps inside and cut off any bits that cross the windows you have cut.
3. Tape down the top flaps firmly inside the box
4. Place plastic bag or sheet in the box pressing it firmly right down into the corners, making neat folds.
5. Drape it over the top of the box and temporarily fasten it down with paper clip.
6. Put a layer of sand in the bottom making sure that the plastic is in contact with cardboard at all points, particularly in the corners.
7. Move box to its permanent home position since it cannot be moved once it is filled.
8. Fill carefully with water and adjust plastic as necessary.
9. Trim off the excess plastic and fasten it down with tape. The improvised aquarium is now completed and can be used to preserve some fishes. The preserved fishes can then be used for science lesson when needs arise.

**SELF ASSESSMENT EXERCISE 2**

Identify all the materials required for the construction of aquarium.

## 4.0 CONCLUSION

Construction of glass fish pond and aquarium are possible. They can be used to teach fish in Integrated Science (Science) lesson. A teacher needs to be innovative and creative to try this form of improvisation (i.e. construction).

## 5.0 SUMMARY

In this unit, you have learnt that:

- Improvisable experiment is very possible. Therefore, improvisation is a very important technique concerned with substituting, replacing or modifying a science apparatus or requirement for a particular function.
- The procedures for improvisation include substitution and construction
- Science teachers are advised to encourage students' participation in the making of improvised materials so that they can get maximum educational benefits from them.

## 6.0 TUTOR-MARKED ASSIGNMENTS

- Describe how glass fish pond and aquarium are constructed.
- Identify differences between glass fish pond and aquarium.

## 7.0 REFERENCES/FURTHER READINGS

Ango, M. (1990). Basic Science Laboratory. Jos: Ehindero (Nig) Ltd.

National Primary Education Commission (1998). A Training Handbook for Nigeria Primary School Teachers: Primary Science. Kaduna: Kazzy-Ana Printing and Publishing

Ministry of Education Jamaica (1981). Improvisation in Science: A Handbook for Teachers. Kingston: The Gleaner Co. Ltd.

# MODULE 3 DEVELOPMENT OF IMPROVISED APPARATUS IN INTEGRATED SCIENCE

## INTRODUCTION

Teaching and learning of Integrated Science require the use of teaching and learning materials. Conventional teaching aids may not be available when needed as such improvisation of the required teaching aid becomes necessary.

In this module, the development of some teaching aids are treated under the following units:

Unit 1 Developing of apparatus for Biological aspects of Integrated Science

Unit 2 Developing of apparatus for Chemical aspect of Integrated Science

Unit 3 Developing of apparatus for Physics aspects of Integrated Science

Unit 4 Developing of apparatus for Mathematical aspects of Integrated Science

Unit 5 Developing of apparatus for Geography aspects of Integrated Science

## UNIT 1 DEVELOPING OF APPARATUS FOR BIOLOGICAL ASPECTS OF INTEGRATED SCIENCE: RESPIRATORY SYSTEM (LUNGS)

## CONTENTS

## 1.0 INTRODUCTION

Constructing a lung is a very good way to learn about the respiratory system and how the lung works.

## 2.0 OBJECTIVES

By the end of this unit, you should be able to:

- Construct a model of a lung using local resources
- Explain how the lung works

## 3.0 MAIN CONTENT

### 3.1 Improvised Lung

The lung provides an avenue for gas exchange between air from the outside and gases in the blood. Lung controls breathing. To construct a lung model, the following materials are required:

**Materials**

1. Plastic bottle – 2 liter,
2. Rubber band
3. Plastic tubing,
4. Scissors
5. Y-shaped connector,
6. Electrical tape
7. Balloons (3 large ones)

**Procedures**

- Fit the plastic tubing into one of the openings of the hose connector.
- Make airtight seal around tubing and hose connector using electrical tape
- Place a balloon around each of the remaining two (2) openings of the connectors
- Wrap rubber tightly around balloons when the balloons and hose connector meet
- Measure two inches from bottom of 2 liter bottle and cot bottom off.

- Place the balloons and hose connector structure inside the bottle, threading the plastic tubing through the neck of bottle.
- Use tape to seal the opening where the plastic tubing goes through the narrow opening of the bottle at the neck. The seal should be airtight.
- Tie a knot at the end of the remaining balloon and cut the large part of the balloon in half horizontally.
- Using the balloon half with knot, stretch the open end over the bottom of the bottle
- Gently pull down the balloon from the knot. This should cause air to flow into the balloons within your long model
- Release the balloon with the knot and watch as the air is expelled from your lung model.

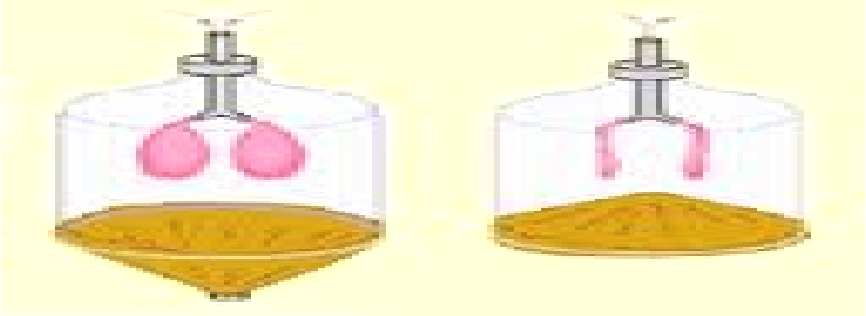


Fig. 2 Schematic diagram of improvised lungs when breathing in and out

**SELF ASSESSMENT EXERCISE**

How does the lung work?

## 4.0 CONCLUSION

Lung regulates breathing. It provides an avenue for exchange for air from the outside environment and gases in the lungs.

## 5.0 SUMMARY

Lung is the measure organ of respiration. Constructing it using local materials is an avenue for learning about the respiratory system

## 6.0 TUTOR-MARKED ASSIGNMENT

Find what the various component of the model lung are representing in real lung.

## 7.0 REFERENCES/FURTHER READINGS

Bailey, R. (2015). Improvised Lungs, biology.about.com visited 8/2/2015

# UNIT 2 DEVELOPING OF APPARATUS FOR CHEMICAL ASPECT OF INTEGRATED SCIENCE

CONTENT



## 1.0 INTRODUCTION

Thermometer measures the temperature of liquids, gases and solids when it is heated or cooled.

## 2.0 OBJECTIVE

After successfully studying this unit, you should be able to:

- Identify local materials required for the construction of thermometer
- Construct thermometer using local materials

## 3.0 MAIN CONTENT

### 3.1 Improvised Thermometer

**Materials**

The materials needed for construction of improvised thermometer are as follows:

- Plastic Water bottle
- Marker
- Clean plastic straw
- Food colouring
- Water
- Flash board

- Clay or Plasticize

**Procedure**

i. Put few drops of food colouring into water
ii. Fill water bottle with coloured water
iii. Insert plastic straw some length into bottle and mold the clay to seal the bottle air tight
iv. Use a marker to mark level of the water
v. Set the bottle in a bowl of boiling water, watch the level and mark
vi. Set the bottle in a bowl of ice water, watch the level and mark.
vii. Divide the separation between the marked level for hot boiling water and that for ice into one hundred bits
viii. Observe the freezing and boiling points for water several times to get better points
ix. Fix the labeled straw on a flash board

This thermometer could be used for observing change in temperature but not for measuring temperature accurately.

**Figure 2: Improvised thermometer**

**SELF ASSESSMENT EXERCISE**

Identify local materials apart from the ones in this unit for the construction of thermometer.

## 4.0 CONCLUSION

A thermometer could be improvised using straw, plastic bottle with coloured water inside.

## 5.0 SUMMARY

A thermometer measures temperature .It could be improvised for showing change in temperature using transparent straw, plastic bottle and coloured water

## 6.0 TUTOR-MARKED ASSIGNMENT

What behavior of the coloured water in the thermometer is used to show change in change in temperature?

## 7.0 REFERENCES/FURTHER READINGS

Make thermometer (2014) Home Training Tools Ltd

# UNIT 3 DEVELOPING OF APPARATUS FOR PHYSICS ASPECTS OF INTEGRATED SCIENCE

## CONTENTS



## 1.0 INTRODUCTION

Electric energy can be converted into useful work or mechanical energy using simple machines called Electric Motor.

## 2.0 OBJECTIVES

By the end of the unit, you should be able to:

- Identify materials needed for the construction of electric motor.
- Construct a simple electric motor using local materials around.

## 3.0 MAIN CONTENT

### 3.1 Improvised Electric Motor

Electric motor works due to the interaction of current and magnetic fields. To construct electric motor you need the followings:

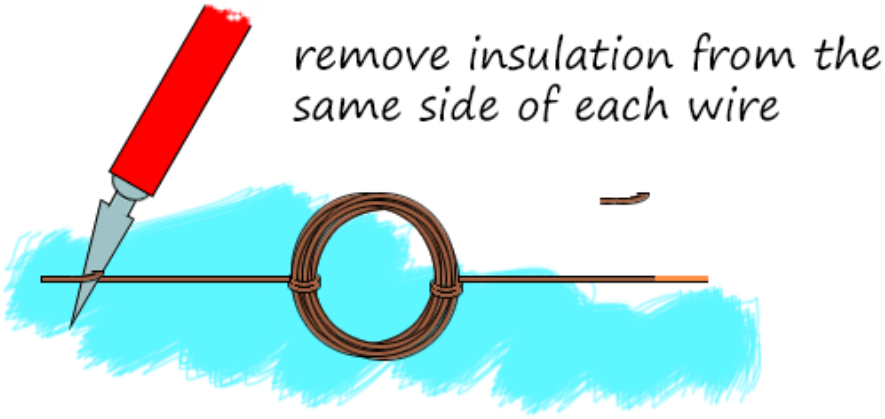
**Materials**

- 2 long metal sewing needles
- 1.5 volt battery
- Electric tape
- Small Circular Magnets
- Plasticine or Molding clay

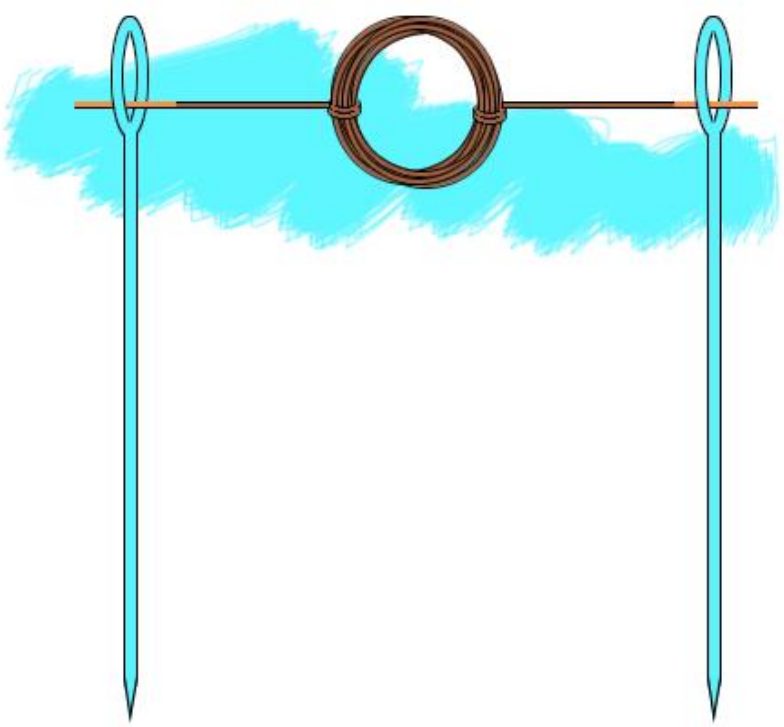
- Knife
- Marker

**Procedure**

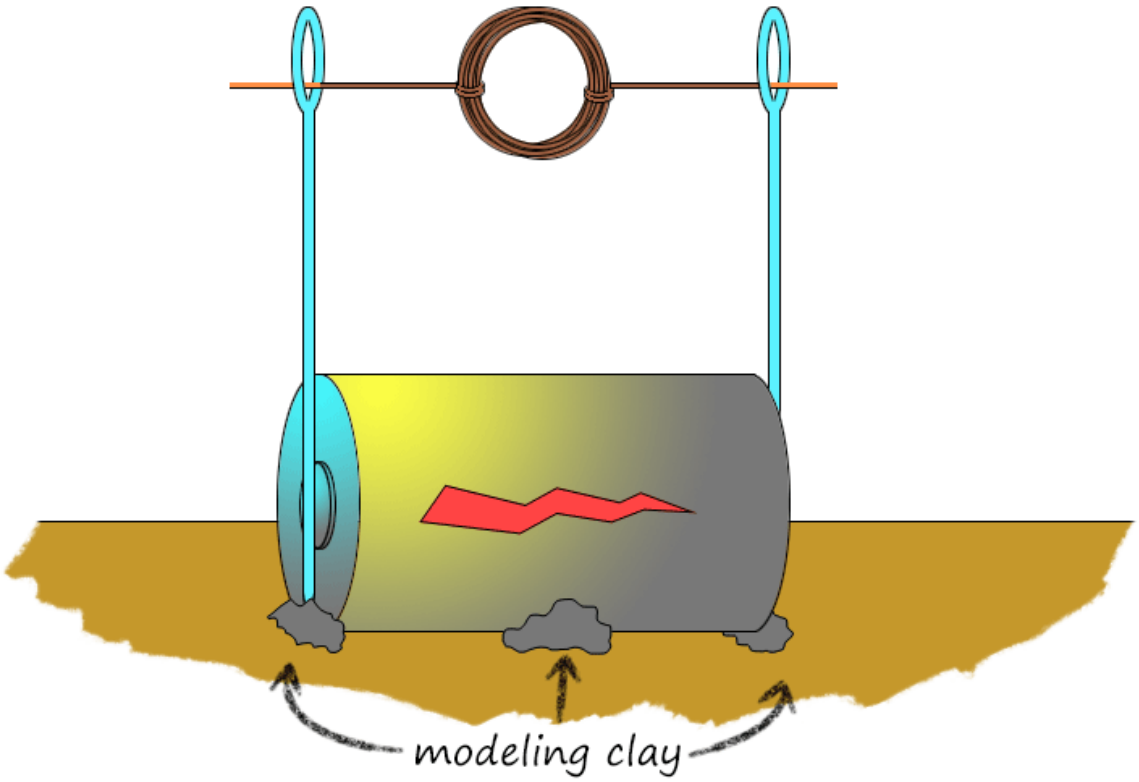
i. Starting from center of the wire, wrap the wire tightly around the battery 30 times.
ii. Slide the coil off the battery
iii. Wrap each loose end of the wire round the coil a few times to hold it together, then point the wires away from the loop
iv. Remove top-half of the wire insulations on each of free end of coil



v. Thread each loose end of the wire through the large eye of the napkin safety pin keeping coil as straight as possible



vi. Lay battery sideways on a flat surface
vii. Stick some clay/plasticine either sides of the battery to stop it rolling away
viii. Place the safety pins upright next to the terminals of each side of the battery
ix. Use elastic tape to paste the needle to each end of the battery. Your coil should be hanging above the battery
x. Tape the small magnet to the side of the battery so that it is at the centered underneath the coil




xi. Give the coil a spin, the spin is expected to spin round continuously in one direction

**SELF ASSESSMENT EXERCISE**

As a would be science educator, identify materials required for the construction of electric motor outside the one listed in this unit.

## 4.0 CONCLUSION

Energy comes in different forms. Electric energy can be converted into mechanical energy by electric motor.

## 5.0 SUMMARY

Electric motion is due to the interaction of electric current and magnetic field. Electric motor is one way of showing energy conversion from electrical to mechanical energy.

## 6.0 TUTOR-MARKED ASSIGNMENT

- Identify the material needed for construction of an improvised motor.
- Explain what makes the coil to spine continuously

## 7.0 REFERENCES/FURTHER READINGS

# UNIT 4 DEVELOPMENT OF APPARATUS FOR MATHEMATICAL ASPECTS OF INTEGRATED SCIENCE

## CONTENTS



## 1.0 INTRODUCTION

In teaching number which is needed in foundation science abacus is one instrument commonly used. It is used in the place values of numbers. Several forms of abacus have been developed and one cheaper and effective one is the square column paper abacus.

## 2.0 OBJECTIVES

By successfully studying this unit, you should be able to:

- Construct square column paper abacus
- Describe how to use the paper abacus

## 3.0 MAIN CONTENT

### 3.1 Square Column Paper Abacus

Number more than nine and less than hundred are represented by two digits numerals. Numbers more than ninety nine and less than thousand are represented by three digits numbers and so on. The place values from the right are respectively units, tens, hundreds, thousands, millions and so on.

An instrument for teaching the place value has been the abacus. There are wooden base, rods, beads, spikes abacuses. Every time ten objects are placed in a spike,

they are removed and one object is placed in the spike to the immediate left to represent ten removed objects.

Square graph paper could now be used as the abacus. A column is assigned to place values and dots that could be used instead of the spikes, beads used in other forms of the abacus. It is cheaper and safer to use paper abacus than other forms.

| | | | |
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## SELF ASSESSMENT EXERCISE

Describe how you can use paper abacus.

## 4.0 CONCLUSION

Abacus is used for teaching place values.

## 5.0 SUMMARY

Abacus has made using variety of materials some of which is the square paper which could be easier, cheaper and effective to use.

## 6.0 TUTOR-MARKED ASSIGNMENT

Construct the square paper abacus and compare its effectiveness with one made of beads.

## 7.0 REFERENCES/FURTHER READINGS

Srinivasan , S.P.K.(2014). Square Column Paper Abacus, Manual of Mathematics Teaching Aids for Primary School, National Council of Education Research and Training, New Delhi.

# UNIT 5 DEVELOPING OF APPARATUS FOR GEOGRAPHY ASPECTS OF INTEGRATED SCIENCE

## CONTENTS



## 1.0 INTRODUCTION

Many instruments for teaching integrated science can be improvised using local materials. Procedure for improvisation of rain gauge is described in this unit.

## 2.0 OBJECTIVES

By the end of this unit you should be able to:

- Identify local materials that can be used to improve rain gauge.
- Improvise a simple rain gauge.

## 3.0 MAIN CONTENT

### 3.1 Improvised Rain Gauge

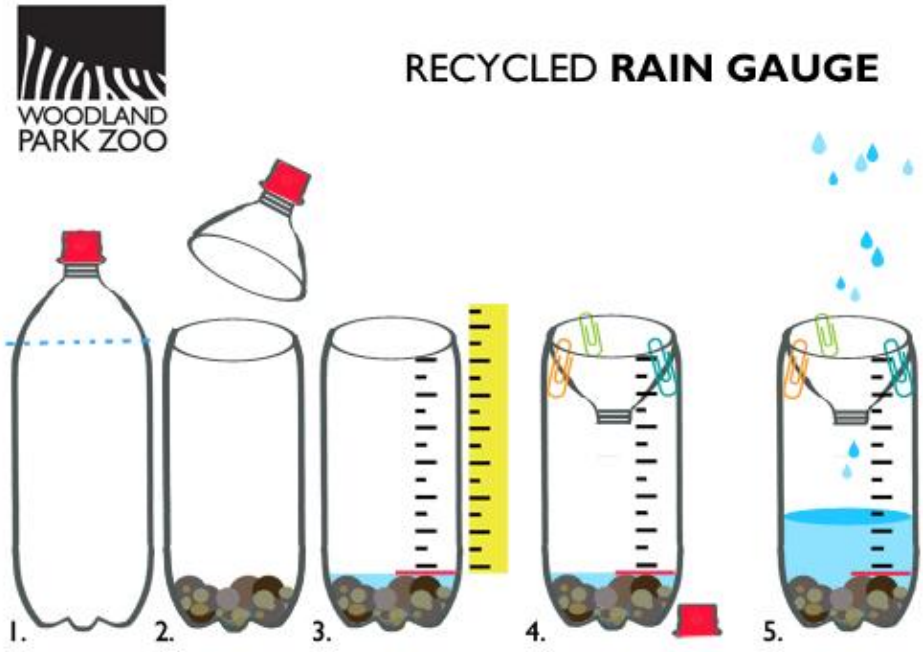


**Figure 5.1: Procedure for construction of improvised rain gauge adopted from Indian Weatherman.**

**Materials**

- An empty big water bottle
- A knife
- Masking tape
- Ruler
- Permanent Marker

**Procedure**

i. Cut the bottle from top shoulder of the bottle.
ii. Place some gravel and little water to form zero base measurement of height
iii. Run a line of masking tape along the height of the bottle base
iv. Using marker and a ruler mark every centimeter and millimeter along the tape

v. Remove the cover and turn the top part of the bottle upside down into the base of the marked bottle. Stick with tape or pin if needed.
vi. Place the improvised gauge outside when it is raining to catch the rain.

## SELF ASSESSMENT EXERCISE

Identify local materials that can be used to improvise rain gauge apart from the ones listed in this unit.

## 4.0 CONCLUSION

Rain gauge is used for measuring the amount of rainfall per given time.

## 5.0 SUMMARY

Rain gauge could be locally improvised using clean 2 litre plastic bottle. When the bottle is cut into two, the base serves as the collector while the upper part serves as the funnel. Using the gauge will assist students learn measurement, capacity, change in volume, rain, water cycle, weather, seasons and many other related concepts.

## 6.0 TUTOR-MARKED ASSIGNMENT

- Compare the accuracy of your improvised rain gauge with conventional type and determine its percentage accuracy.

## 7.0 REFERENCES/FURTHER READINGS

www.wikihow.com/Build-a-Rainguage

Indian Weatherman.com