COMPETENCE BASED ASSESSMENT PHYSICS PRACTICAL WORK BOOK

"SCENARIO BASED PRACTICAL GUIDE"

BASED ON THE NEW LOWER SECONDARY CURRICULUM

By

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Preface

This Competence Based Assessment Physics Practical Work Book has been written to satisfactorily meet the demand of learners going through the Competency Based Curriculum at the New Ordinary Level in Preparation for their excellence in Uganda Certificate of Education{UCE} physics practical examination. It will also be helpful to teachers especially those who want to familiarize them selves with the new assessment of physics practicals in the new curriculum.

This practical work book consists of concise and precise notes in simple language and several examinable questions intended to reinforce and test the understanding of basic physics skills, all based on the requirement of the new physics syllabus and encompases all that is required for ordinary learners.

Teachers in various schools will have to provide learners with necessary apparatus required so as they can navigate through all the the practicals in this work book.

Proper utilization of this work book by learners will obviously make practical examinations easier to handle and enjoyable.

Lwanga Books Ltd feels confident that this Book will be of immense value to both the learners and the teachers.

Any suggestions for improvement of this book are most welcomed, thanks.

"It is not what We do for you but what We will teach you to do for and by yourselves that will eventually make you successful beings in the society"

Acknowledgement

Lwanga Books Limited is deeply indebted to all those who participated in the development of **Lwanga William S1-S4 Competence Based Assessment Physics Practical Work Book.**

Special thanks go to **Mr. Lwanga William**, the CEO Lwanga Books Ltd for his valuable insights and advice on all publishing matters.

We would like to express our sincere appreciation to all those who worked tirelessly towards the production of this CBA Physics Practical Work Book.

First and foremost, we would like to thank our families and friends for supporting all our initiatives both financially and spiritually, Lwanga William's parents; **Mr. William Lwanga** and **Mrs. Harriet Lwanga,** his brother; Mr. Nsubuga Grace.

The initiative and guidance of the publishing partners, Ministry of Education and Sports (MoES) and National Curriculum Development Centre (NCDC) in development and implementation of the New Lower Secondary Curriculum are highly appreciated.

We thank God for the wisdom He has given us to produce this volume of work.

May the Almighty God bless all the students that will use this book with knowledge to encounter all CBA Scenario Items incorporated in this Competence Based Assessment Physics Practical Work Book…….**AMEN**.

We welcome any suggestions for improvement to continue making our service delivery better.

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Introduction to Competence Based Assessment Physics Practicals

The Competence Based physics Assessment has two papers that is, 535/1(theory paper) and 535/2&3(practical paper).

In this guide, we are to focuss more on the practical paper.

CBA physics practical paper will comprise of two examination scenario items and the student is to do only one.

These scenario items will come from either "Mechanics and Light", "Mechanics and Electricity" or "Light and Electricity".

The duration of the paper will be strictly **two(2) hours** and candidates are not allowed to start working with the apparatus for the **first quarter of an hour**(15 minutes). This time is to enable candidates read the items thoroughly, checking for the apparatus they will need and plan appropriately.

Why Scenario items?

Physics is sometimes called the science of measurements because without observation and measurement it would not exist.

So, there is need to test the Scientific Investigation skills in the learners, help learners appreciate what they learn at school by seeing how applicable the knowledge they learn is in real life, to entice learners pay attention to what's happening in their country as they relate what they learn to what happening around them and the economy at large, to encourage self-reliance in the economy by producing citizens that can solve the economic problems without waiting for other countries to provide us solutions, to help learners learn to read, interpret, summarize and use information provided to and around them, to identify problems and hence solve them using learnt knowledge, to produce learners that not only know but can also do using both their brains and hands, to encourage learners, own their learning and knowledge through continuous Higher order Thinking(HOT) / critical thinking. This creates independency in them.

NB: The steps in a scientific investigation are;

- observing a situation,
- identifying a problem or question,
- identifying variables involved,
- formulating a hypothesis,
- designing and carrying out an experiment,

- collecting and tabulating data,
- writing a report for the investigation.

Points to note:

- ❖ Only the correctedness of the learner's responses must be considered.
- ❖ We are scoring competences not awarding marks.
- ❖ In the report, the learner's procedures must be in present tense.
- ❖ List of apparatus must be above procedure.
- ❖ Under procedure, coherence must be scored.
- ❖ Procedures must be neutral that's not individualised.
- ❖ Procedures should not be presented in an instructive(commanding) language.

Skills to be tested

Assessment Objective 3 (AO3)'Experimental and Investigative skills' of the UCE is about your ability to work as a scientist. Each aspect of the AO3 has been broken and listed for you below;

- ❖ Demonstrate knowledge of how to safely use techniques.
- ❖ Demonstrate knowledge of how to use apparatus and materials.
- ❖ Demonstrate knowledge of how to follow a sequence of instructions where appropriate.
- ❖ Plan experiments and investigations.
- ❖ Make and record estimates.
- ❖ Interpret experimental observations and data.
- ❖ Evaluate methods.
- ❖ Suggest possible improvements to methods.
- ❖ Constructing own table.
- ❖ Drawing/ analysing a graph.
- ❖ Planning safety of an investigation.
- ❖ Mathematical calculations.

Reliability, Accuracy and Precision

1. **Reliability** refers to the likelihood of getting the same results if you did the investigation again and being sure that the results are not just down to chance. For this reason, reliability is now often called **repeatability**. If you can repeat an investigation several times and get the same result each time, your investigation is said to be reliable.

You can improve the reliability of your investigation by:

- ✓ Controlling other variables well so they do not affect the results.
- ✓ Repeating the experiment until no anomalous results are achieved.

2. **Accuracy** is a measure of how close the measured value is to the true value. The accuracy of any results depends on the measuring apparatus used and the skill of the person taking the measurements.

You can improve the accuracy of your results by:

- ✓ Improving the design of an investigation to reduce errors
- ✓ Using more precise apparatus
- ✓ Repeating the measurement and calculating the average.

3. **Precision** relates to how accurately you take your measurements. Precise results have very little deviance from the mean(average).

You can improve the precision of your investigation by:

- ✓ Using apparatus that has smaller scale divisions.

Designing an investigation

When asked to design an investigation, you must think carefully about what level of detail to include.

The following is a way of how to create a method. Follow these steps to design reliable, accurate investigations.

1. Identify your independent variables and state the range of values that you are planning to use for them.

2. Identify the dependent variable and explain how you are going to measure it. Describe the equipment and apparatus.

3. To ensure that the experiment you are conducting is reliable you will need to identify and control a number of variables that may impact your results. List these and explain how you will keep them constant.

4. Outline the method in a series of numbered steps that is detailed enough for someone else to follow.

5. Remember to include repeated readings to help improve reliability.

6. You must also include any hazards and safety warnings, as well as safety equipment that should be used in the investigation.

7. You must also include a clean-up procedure, and this should depend on the experiment you are investigating.

Indicators for physics scientific investigation

The learner must write a practical work report which will includes the following;

(a) Aim of the scientific investigation (experiment).

(b) Variables of the experiment

- Independent variable
- Dependent variable
- Controlled variable

(c) Hypothesis

(d) List of apparatus and materials

(e) Procedure of the experiment and setup

(f) Presentation of data

- Table of results
- Graphs
- Calculation of the slope

(g) Sources of errors

(h) Precautions

(i) Conclusion; conclusions can come from the value of the graph, the value of the slope or intercepts etc.

Note:

The conclusion will either qualify or disqualify the hypothesis. It is the conclusion that shows that whether the hypothesis is correct or not.

Formulating a hypothesis

✓ The hypothesis is a concept or an idea that is to be tested through research and experiments.

OR:

A hypothesis is the prediction about what the scientific investigation will find.

OR:

It's simply a statement that is to be proven at the end of the scientific experiment or investigation.

✓ It shows the relationship between one dependent variable and a single independent variable.

Identifying variables involved

There are three (3) basic types of experimental variables that a learner must identify and note down while performing a scientific investigation in physics practicals. And these include;

Independent/Manipulated Variable

✓ This is a variable that we can change or control in a scientific experiment or investigation.

OR:

This is a variable which the experimenter (or investigator) changes to test its dependence on other variables.

Dependent variable/Responding variable

✓ This is the one which we can test in a scientific investigation in order to get results.

✓ The dependent variable depends on the independent variable.

✓ When taking data during a scientific investigation, the dependent variable is the one being measured.

Controlled/Fixed/Control variable

- This is the one the investigator/experimenter holds constant during a scientific investigation.
- The control variable is not part of an experiment, but it is important because it has an effect on the results.
- One of the most common control variables is ***temperature***, and if not taken account of it might nullify the correlation between the dependent and independent variable. Other control variables include; ***amount of light***, ***humidity***, ***wind speed***, ***duration of an experiment*** etc.

Whenever it is possible, control variables should be identified, measured and recorded.

In Summary;

The learner must write a practical work report which will include the following;

(i) Aim of the experiment
(ii) Variables of the experiment
- Independent variable
- Dependent variable
- Controlled variable

(iii) Hypothesis
(iv) List of apparatus and materials
(v) Procedure of the experiment and setup
(vi) Presentation of data
- Table of results
- Graphs
- Calculation of the slope

(vii) Sources of errors
(viii) Precautions
(ix) Conclusion

Structure of an experiment's report

:Mechanics Scenario Practical Items:

Item 7:

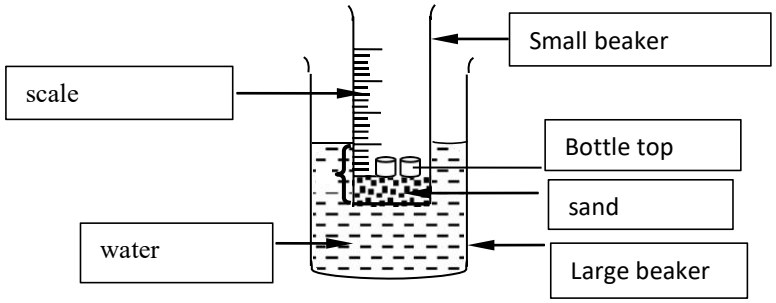
In brewing and beverage industry, understanding the density of water is essential for creating consistent products. Brewers use water density measurements to calculate sugar content, which affects the fermentation process and the final taste of the product. During your senior one, you recall that you visited a chemistry laboratory a saw a jerrycan having the following specifications**: the density of distilled water at standard temperature and pressure(STP), which is defined as 0 degrees celsius(32 degrees fahrenheit) and 1 atmosphere of pressure, is approximately 1000 kg/m^3 or 1 g/cm^3.** This value is commomly used as a reference point for density of liquids according to your experiences and since you are knowlegeable;

Task:

You are asked to carry out a scientific investigation that will assist the brewing and beverage industries in determining the density of water they are to use.

Hint:

- $2.5\ S = \rho\pi r^2$.(S, slope; r, radius of small beaker or can; ρ, density of water)

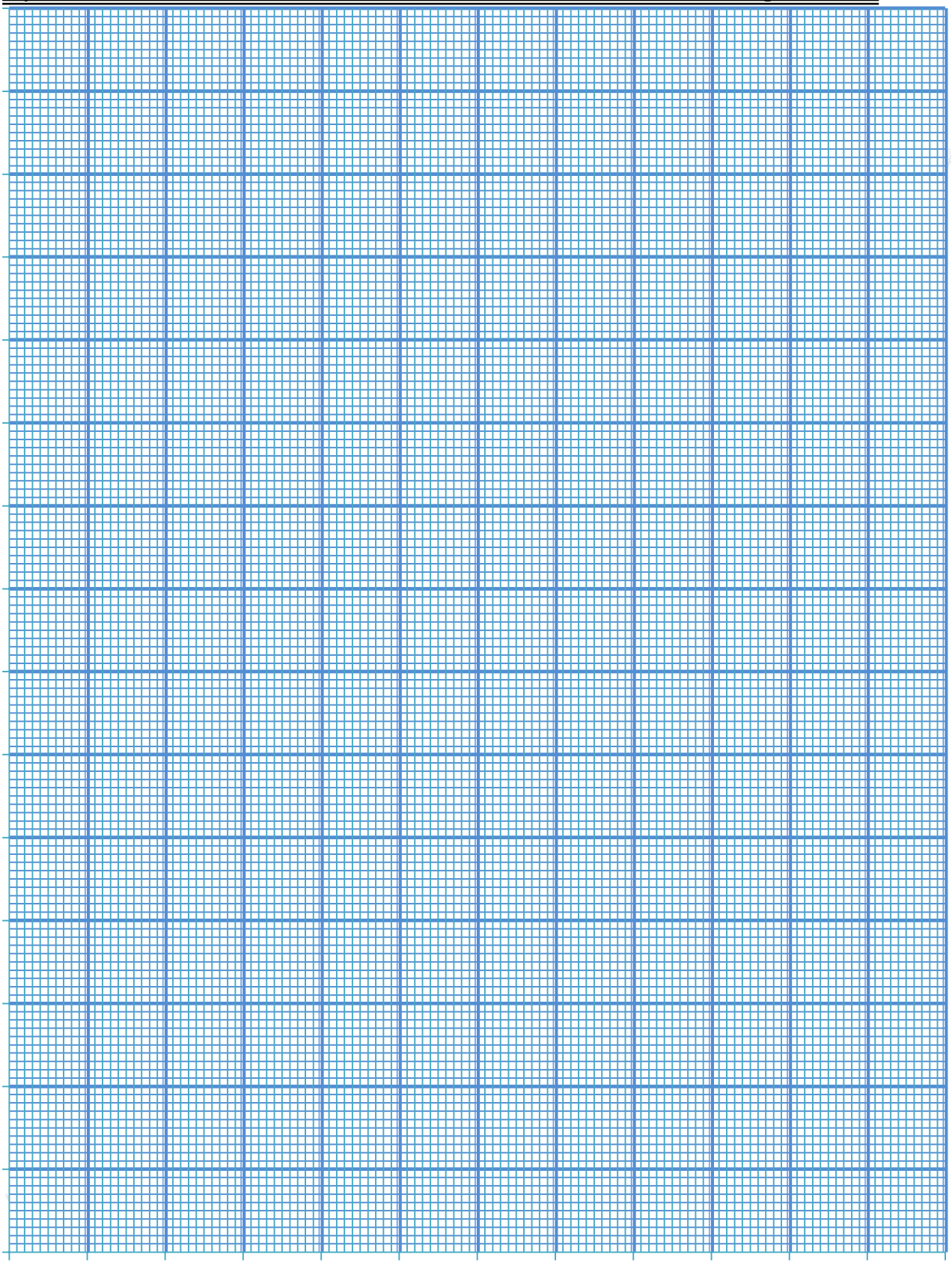


- **Apparatus**

*A small beaker with its radius **r** indicated and linear scale using a graph paper strip attached; a largebeaker; 15 soda bottle tops; small amount of sand and water.*

- Other experimental set ups may be used.

Learner's Responses



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