

**COMPUTER-AIDED LEARNING OF PHYSICS
(CALP)**

BY

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A PROJECT

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THE AWARD OF A POSTGRADUATE DIPLOMA IN
COMPUTER SCIENCE**

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CERTIFICATION

This project is carried out by James Adams in the Department of Mathematics /
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DEDICATION

I dedicate this work to the Only Sovereign, Invisible, Immortal, and Almighty God. I also dedicate the same work to my Darling wife to be, Miss Folashade Oluwakemi Adejugbe.

ACKNOWLEDGEMENT

My greatest appreciation goes to the Great God for His mercy, care, inspiration, and direction since the beginning of my new life.

I am also indebted to my supervisor Prof. K.R.Adeboye for his numerous support and understanding, and for sparing time to read through this project report over and over again. The effort of N.I.Ezeakor the Head of Department, and other members of Academic Staff of the Mathematics/ Computer Science Department, in the planning and execution of this work, is highly appreciated.

My unquantifiable thanks goes to Dear parents Mr. and Mrs.Oladejo Faniran(Adams), my loving fiancée Miss Folashade Adejugbe, my Darling cousin Mrs. Toyin Olubena for their prayers, moral, financial, and material support.

My postgraduate colleagues are not left out, most especially Sis. Mercy Balogun. I also want to acknowledge all members of staff of Ami-Tech Computer, Minna, for their cooperation and understanding in the course of this project work.

ABSTRACT

Computer-Aided Learning of Physics (CALP) is being developed in order to provide support to students who are presently having difficulty in understanding the Subject Physics (with emphasis on Electricity).

The scope of this work is limited to materials relevant to Senior Secondary School Examinations (SSCE), and the University Matriculation Examination's Syllabi. The package covers six main menu topics with Self Assessment Questions (SAQ) of multiple choice Answers.

Computers and the society are considered, and detailed discussion on the concept of Computer-Aided Learning (CAL) is defined. The prospects of CAL in Nigerian Secondary Schools are considered, and all indications point to a better future for its usage.

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CHAPTER ONE

GENERAL INTRODUCTION

1.1 COMPUTER AND THE SOCIETY

Our society comprises of different individuals ranging from the layman on the street to the Elite, each of who may have a different view of a computer and what it is capable of doing for them and the society at large. An average Nigerian is surely aware of the existence of computers, and that they are used for various purposes by individuals or groups. The ordinary people may not be aware of the capabilities and limitations of the computer, who actually can use it and what it is used for.

However, much have been said and done in the recent past to ensure computer literacy and appreciation, among the teaming population whose lives are affected directly or indirectly by computers. The issue now is to what degree or extent have this succeeded.

To access the success or otherwise, we should consider the following:

A trader who often use calculator to sum-up the goods bought by his customer, is yet to understand that, calculator itself is a form of computer. He will often refer to the microcomputer being used in the bank as the only class of computer.

However, the advent of GSM (global system mobile communication) in our society had really increased the awareness of computer communications. A truck-pusher can now seat back in his truck and call on his friend to inform him about a trailer load of rice that just arrived from the port for off-loading.

There is no controversy about the fact that, most Nigerians have begun to appreciate the ever increasing role of computer in their life. To fully comprehend the part an individual

There is no controversy about the fact that, most Nigerians have begun to appreciate the ever increasing role of computer in their life. To fully comprehend the part an individual can play, and what they can do or cannot do with the computer, there is need to adequately educate the people.

What is a computer? A computer can simply be define as a programmable machine/device that is capable of accepting data, store it, retrieve it, and process the data to give a meaningful information that is limited to the creativity of the individual who use it. The computer is such a fascinating device that with good programming skills a variety of jobs can be accomplished at high speeds.

This work is not intended to give detail classification and mode of operations of computers. It is however felt that, to appreciate the usefulness and potentials of computers, it is imperative to give some definite applications on a wide range in different field of human endeavour.

The uses of computers are as varied as we can imagine, but the following are some of the principal uses:

PAPER WORK- our present society runs on paper, and computers have revolutionized the way paper work is handled. Computer can be use to prepare manuals, documents, letters, memos, and other types of written communication.

BANKING-Computers have brought us to the age of doing it yourself banking, with Automatic Teller Machine (ATM) available for simple transactions. Computers have also

help in the widespread use of credit cards and instant credit checks by banks, department stores, and other retailers.

COMMERCE-Some petroleum marketing companies are using credit card-activated self-service pumps. Products from meats to magazines are now packaged with zebra-striped symbols, the universal product code, that can be read by computer scanners at supermarket checkout stands, to determine the price of the products.

INDUSTRY-Multi-national oil and energy companies use computers to detect cracks on pipelines, and to locate crude oil, coal, and natural gas. Computer-aided manufacturing e.g. robotics, computer-aided design and factory management.

TRANSPORTATION-Computers are used to help run rapid transit systems, load container ships. It is also use to keep track of railroad cars, fly and land Airplanes and prevent them from colliding. Computer is use to schedule Airline reservations.

EDUCATION-Computers are used in school administration, such as record keeping and accounting. However, the greatest area of growth is in the classroom, as we try to stress the need for computer-aided learning of physics in our secondary schools.

TRAINING-Computers are being used as training devices in industries and government establishments. It is cheaper and safer to teach aspiring pilots to fly in computerized "training cockpits" or simulators than in real Airplanes.

AGRICULTURE-A small microcomputer can be use in managing a farm. In area such as billing, crop data management, land record keeping, cost per acre of land, and fertilizer combinations.

RECREATION- Computer game and diaries.

Despite the above advances in the application of computers in improving our standard of living. There is need also to point out few horrors that accompany this revolution. The often-cited disadvantages are given below.

EMPLOYMENT OPPURTUNITIES- As computers are proving to be more efficient and accurate worker than man, more industries and businesses in the aim of earning greater Profits are now automating their business procedures. In Automobile manufacturing, the combination of robotics and computer technology has made it possible to employ robots in the whole process of manufacturing. Every success in Automation meant that some workers would have to be laid-off or be retrained for other jobs.

INCREASE IN SOPHISTICATED CRIME- The speed of operation of the computer and Automated banking have made it possible for Hi-tech criminals to commit their nefarious activities in equally blinding speed with less chance of being apprehended.

LACK OF PERSONAL PRIVACY- The building of mammoth databanks of information by government agencies and big business enterprises, if not control can threaten individual liberty of the citizen.

1.2 AIM AND OBJECTIVES OF THE PROJECT

The observed rate of failure of the subject physics in post-primary schools, calls for great concern. This project is aimed at reducing or if possible eliminating completely the continuous failure of the subject in question.

The computer-aided learning of physics "CALP" will not only provide student with additional study materials, but will equally expose them to the field of computing, and there by increase their appreciation of computer, not only as a tool but as a field of specialization. I hope this work will urge many professionals in our society to be interested in computer-aided learning "CAL" programs, and thereby proliferate in a guided manner, software applicable to CAL in different areas of study. This will go along way in enhancing the much needed computer appreciation and literacy, thus, widening our educational background.

1.2 COMPUTER AS AN AID TO LEARNING

We cannot ignore the importance of CAL in our schools and its possible effects in learning. For this reason, the educational sector cannot leave the evolution of computing technology to non-educationist. As computing have permeated so many activities in our lives, it has become necessary to prepare students for survival in this new world.

To effectively discuss how computer can aid learning, we need to consider three important areas of interest.

1.2.1 COMPUTER EDUCATION

Computer programming is considered a new fundamental resource for developing intellectual skills, such as structured thinking and problem solving. There is this general phenomenon that, a good knowledge of computer will help guarantee employment or good job.

1.2.2 COMPUTING TOOLS, FOR ADMINISTRATOR, TEACHER, AND LEARNERS.

It is widely accepted that with the aid of efficient tools, jobs can be performed in an easier and faster way, time and intellectual energy can be conserved by transferring necessary but routine task, of a tedious mechanical kind to computers.

There are general tools that can be used in schools. These tools include- word processor, database management system, electronic spreadsheets and statistical packages.

Two areas have been identified to need urgent use of computing tools in our schools.

SCHOOL ORGANIZATION-The use of computing tools in time-tabling, option selection, staff duty rooster, school records and examinations grading will not only enhance productivity but will also improve academic standard.

LIBRARY SERVICES-Electronic mail and web-browser are computing tools, which can connect Academic and Administrative departments, for effective communication and

service within the school community. Computer can maintain indexes and cross indexes to enable students and teachers to make better use of the library facilities.

1.2.3 COMPUTER-BASED LEARNING ENVIRONMENT

As indicated in the preceding paragraphs, the involvement of computer in learning is not only computing itself, but educational technology attached to the use of computers. Consequently, computer-based learning environment are seen to be another computer application in schools. This includes specific teaching-learning application that have been design and produced with aim of helping student to learn.

There are two major approaches to systematic creation and the use of instructional environment. These are *sigma system control or Algorithmic approach*, and *sigma learner control or Heuristic approach*.

A sigma system control is oriented towards defining pre-determined sequence of activities for obtaining pre-determined measurable objectives. This approach emphasizes on a major teaching model in which an efficient transmission of knowledge is intended by the designer. This may be called designer-controlled educational computing, as it transmits accumulated knowledge by the designer to the learner.

On the other hand, sigma learner control devices enable the users to tailor their approach to the subject matter, in order to get the maximum possible advantage from it. These may include- simulations, educational games, high level user-friendly computing languages like Q-basic and C++.

1.3 WHAT IS CAL

Computer-aided learning (CAL)- can be defined as a technique of using the computer to assist students in achieving their tasks. CAL is the concept used to describe nearly all learning activities promoted by a computer. While computer-aided instruction (CAI) by definition is an educational tool by which the computer usually prints textual information on a terminal, and then ask the student to respond to a series of questions. Depending on the accuracy of the responses, the computer will either proceed to a more advanced topic or else repeat the questions.

From the above definitions, it can be deduced that CAI is a subset of CAL. An efficient teaching system should strive to incorporate the strength of both CAL and CAI.

1.41 BENEFITS OF CAL

“There is this believe that says, people retain forty percent (40%) memory of what they see on the chalkboard, and 60%-80% of what they see on electronic screen”.

There are lots of benefits that make CAL desirable in our schools, some of these are briefly mention below:

- Interactive nature of many systems and screen display of text instructions make learning very attractive, and thereby help student not be bored as they find learning process more interesting.
- CAL system allow student to practice at his own pace. This system enables him to achieve specific instructional goals and provide instant feedback about his action in course of learning.

- CAL permits learning to take place out of the classroom. Whenever there is a terminal, a student can always log in to computer system to continue his learning. Leisure time can then be positively utilized.
- The use of computers in simulations of science experiments, modelling in economics, graphics in Art design, and accessing a large database.

1.4.2 PROSPECT OF CAL IN NIGERIAN SECONDARY SCHOOLS

What CAL is expected to accomplished or achieved in our secondary schools, is all we have mentioned in the preceding paragraphs. Moreover, if CAL is well implemented in our schools, it will enhance the foundational background of our school leavers, preparing them for higher institution of learning.

1.4 CHOICE OF PROGRAMMING LANGUAGE

BASIC is chosen as the programming language for this work. It is essential to say a word or two on what intimated the choice.

BASIC- an acronym for "Beginners All-purpose Symbolic Instructions Code", have been proved to be efficient for beginner. Besides that, it is a beginner language; it has been developed to be a powerful language capable of being used in almost every application. Infact, the following reasons make basic preferable for this work.

- Basic is user-friendly programming language. It is easy to learn and use, its syntax rules are less demanding than others.

- Most basic programs can be run on a variety of different computers with little or no modifications.
- Basis is also adequate in an interacting environment, as the work is intended to be interactive in nature.

1.5 SOFTWARE AND HARDWARE REQUIREMENTS

SOFTWARE- For easy application, 3.5" floppy diskettes were used to store the programs and relevant data.

HARDWARE- Having been involved in the teaching of the subject physics for quite sometime, it was not difficult for me to lay hand on recommended textbooks and additional relevant materials to suit the purpose of this work.

It is important to state here that; computer-aided learning of physics (CALP) was design to complement classroom instructions, and not to disregard them. Students are hereby strictly advised to still consult their recommended textbooks.

CHAPTER TWO

SYSTEM ANALYSIS (Electricity in focus)

2.1 MODULE 1

ELECTRICAL CIRCUITS

Electric current is simply electric charge in motion. In a solid conductor such as a wire the current consist of a swarm of moving electrons. Electric cells are chemical devices, which are capable of causing an electric current to flow. They do this by producing an electric force, which pushes the current along. A current will flow if there is a complete circuit of conductors, by which the current can leave from one terminal to another terminal of the cell.

The current is the same at any point in a given circuit, if the conducting line is broken at any point the current is switched off.

NOTE: current is a flow of electrons. Electrons are negatively charged; they flow from the negative terminal (cathode) of a cell to the positive terminal (anode). However, by a convention agreed upon before the discovery of electrons, we always assume that an electric current is a flow of positive charge from the positive terminal to the negative terminal. Thus, in fig. 2.1.1 the conventional current is marked with an arrow in the direction + to -, while what is actually happening in the metal conductors is that electrons are flowing the other way, form - to +.

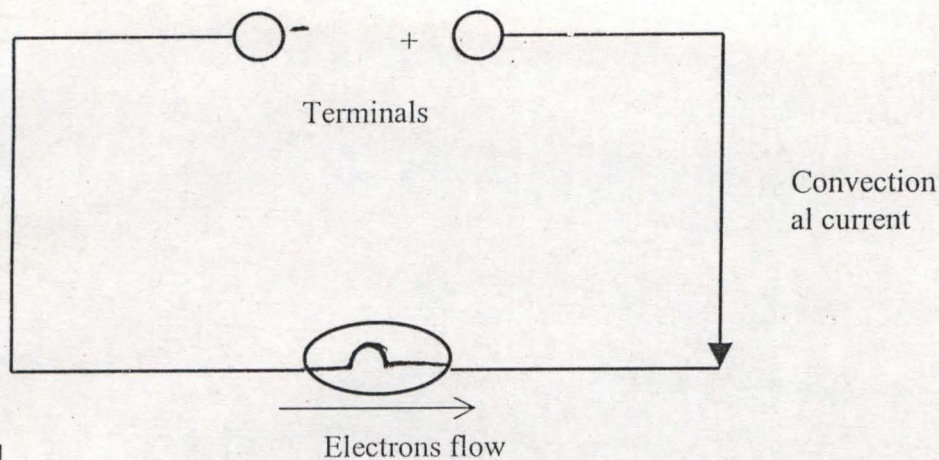


Fig. 2.1.1

Types of electric cell

Electric Cell may be divided into two main kinds, primary and secondary cells.

Primary cells are those which current is produced as a result of an irreversible chemical change.

The electrolyte and electrodes will have to be replaced when they wear out. There are two major types of primary cells: these are namely:

Daniell cell and leclanche cells, the leclanche cells are either wet or dry.

Secondary cells are those that can be recharged when they run down, by passing current backwards through them.

They can only give out electrical energy that has been put into them. There are two main kinds of secondary cell: the lead-acid accumulator, and the alkaline or nife accumulator

Defects of a simple voltaic cell

There are two serious defects of simple cell. These are known as polarization and local action.

Polarization- the working of a cell involves the release of hydrogen bubbles. These bubbles collect at the positive electrode and insulate it. This slows down and eventually stops the working of the cell. This defect is called polarization.

Polarization can be cut down either by occasionally brushing the plates, which is highly inconvenient, or by the use of what is called a depolarizer, such as manganese dioxide, which oxidizes hydrogen to form water and so remove the hydrogen bubbles.

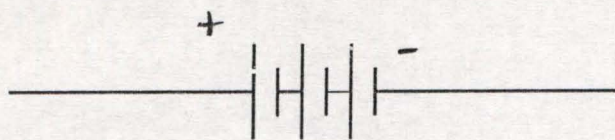
Local action- this results as using impure zinc in the cell. The presence of impurities in zinc results in the gradual wearing away of the zinc plate. One way of preventing local action is by cleaning the zinc with tetraoxosulphate (vi) acid (H_2SO_4) and then rubbing with some mercury. The plate is said to be amalgamated. The mercury zinc amalgam covers up the impurities and prevents their contact with the acid electrolyte.

Maintenance of lead-acid accumulators

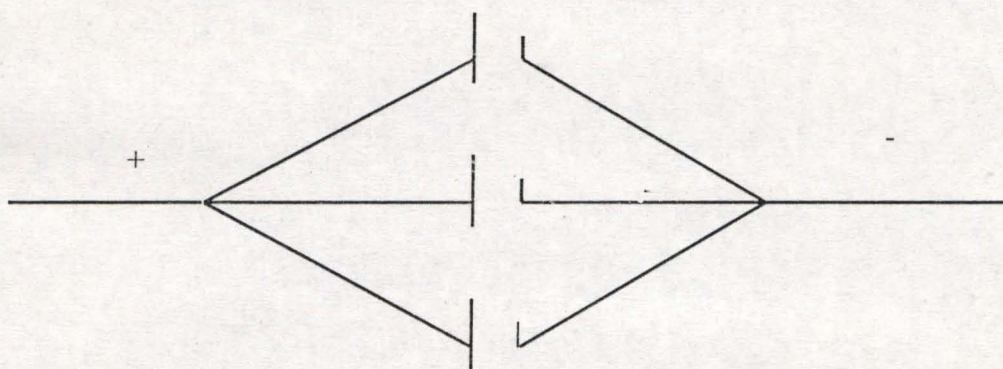
The lead-acid accumulator is the same as the car battery, and it needs to be carefully looked after.

- ☞ The liquid must be maintained by using distilled water.
- ☞ The cell should be charged if the relative density of the acid falls below 1.15. The cell is fully charged when the relative density of the acid is 1.25. This can be tested with a special instrument called hydrometer.
- ☞ They should be kept clean so that current does not leak away across the casing, the casing between the terminals.
- ☞ If an accumulator is not to be used for a very long time, it should be recharged from time to time or the acid should be removed and cells dried.

Arrangement of cells in series and parallel



Series connection of cells



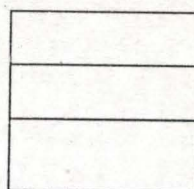
Parallel connection of cells.

2.2 MODULE 2

PRODUCTION OF ELECTRIC CURRENT

We recall that a flow of charge from one place to another constitutes an electric current. A steady current is produced through a continuous flow of charge. Such a continuous flow of charge can be generated from the following source:

- a) Chemical energy
- b) Mechanical energy
- c) Heat energy
- d) Solar energy



Electricity from chemical energy

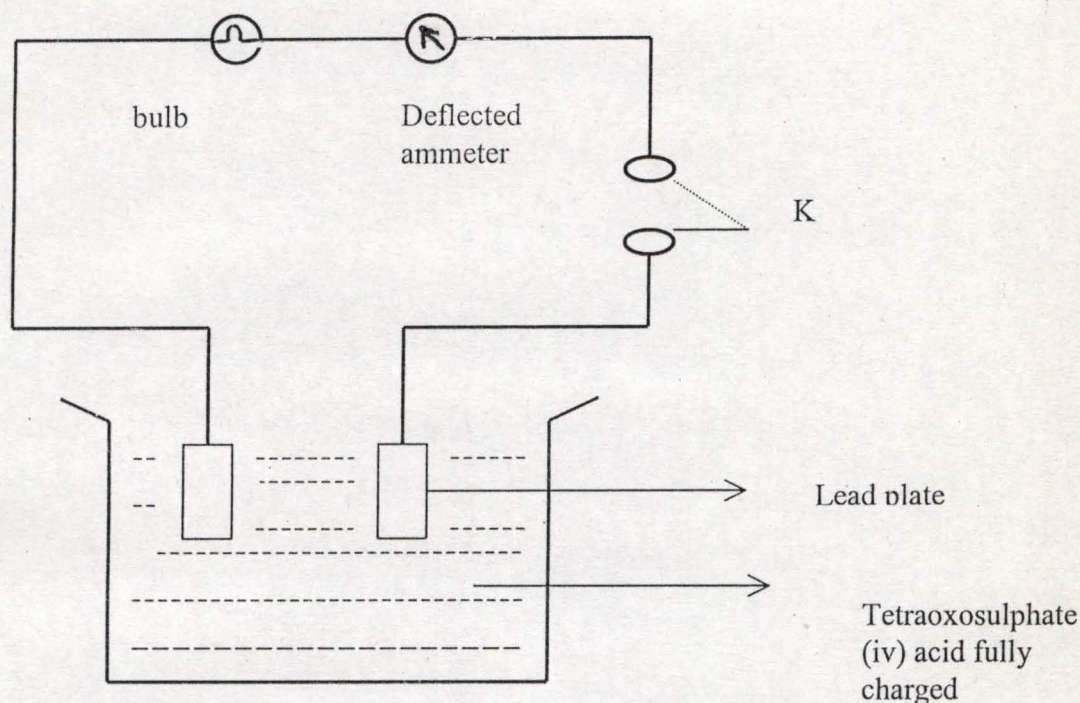


Fig.2.2.1

If the circuit in fig 2.2.1 is properly connected as shown in the diagram above. As soon as the key (k) is closed a current is seen to flow by the deflected ammeter, which in turn light up the bulb. The bulb will become dim and eventually goes off, as soon as the charges in the electrolyte are exusted. For continuous supply of current the electrolyte needs to be recharge again.

Electricity in mechanical energy

Electric generators produce most of the world electricity. Such generators produces electricity by the movements of coil of insulated wire (the amature) past lines of force in the magnetic field between two powerful magnets. The induced electric current

on the wire is picked up from the copper split ring commutators by means of graphite carbon brushes.

An example of this mechanism is seen in bicycle dynamo, which generate electricity for the headlamp of the bicycle. Here the conductor in the form of a coil is rotated round the magnetic field by the moving bicycle tyre with which it is in contact.

Electricity from heat energy

An electric current can be produced when the ends of two different metal wires (e.g. copper and iron) joined end to end are subjected to different temperatures.

Electricity flows round the circuit formed by the two wires. Such devices are known as thermocouples, which produces electricity by the thermoelectric effect of the two metal wires. This principle was discovered by Seebeck in 1821.

The greater the difference in temperature between the two junctions, the greater the electric current. This can be demonstrated by putting one junction in melting ice and the other in hot water, the temperature of which is gradually increased until the water boils.

The arm of the micro-galvanometer is seen to show greater deflection as the temperature of the hot water is increased. Fig. 2.2.2 below gives more clarification.

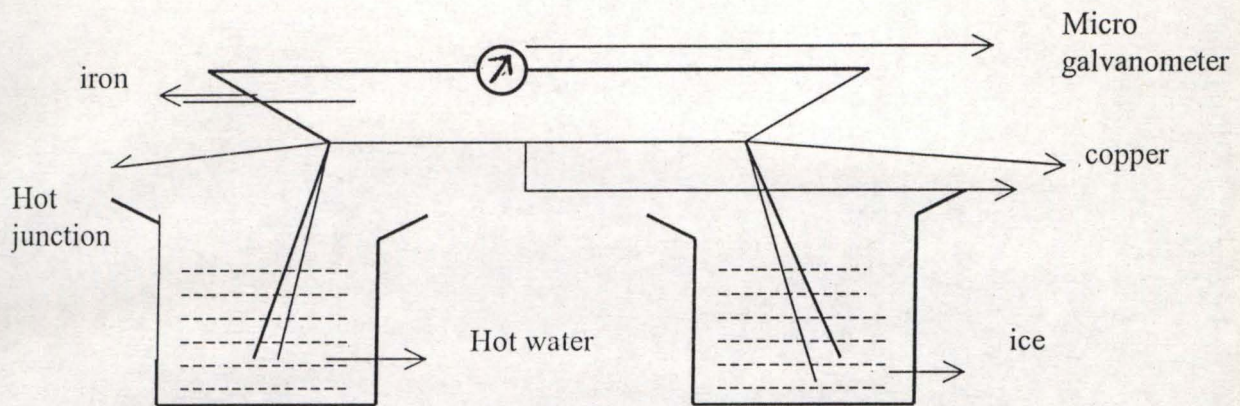


Fig.2.2.2 thermocouple.

Electricity from solar energy

Bright sunlight can deliver over one kilowatt (1kw) of power to each square metre it falls on. If solar energy is made to fall on a photoelectric cell, the solar energy is converted directly into electric energy as a result of photoelectric effect.

The existing photocells are very inefficient, so many of them are needed for a worthwhile output. They are also very expensive, so the cost of resulting electricity is greater than other sources. It is hoped that current research on solar cell technology will steadily solves these problems, so that a whole town can be electrified from solar energy.

This form of electricity supply (solar-electricity) is very relevant to African towns and villages because of the abundance of sunshine.

2.3 MODULE 3

BASIC ELECTRICAL QUANTITIES

The study of electricity is an important subject in physics because electricity plays a key part in the modern world. The working of most modern appliances such as radio,

television, computers, calculators, refrigerator, air-conditioners, sound system, and electric fans is possible as a result of electricity.

There are three basic quantities that must be understood before we can proceed with the subject of electricity. These are **electric current**, **potential difference**, and **electrical resistance**.

An electric current (I) is the rate of flow of charge round a circuit

The quantity of charge (**Q**) is measured in units called coulombs.

$$\text{Hence electric current} = \frac{\text{quantity of charge (coulombs)}}{\text{time (seconds)}}$$

$$\text{Symbolically, } I = \frac{Q}{t} \text{ (coulombs/sec.)}$$

The unit of current, one coulomb per second, is called the ampere (A). For example, if 8 coulombs of charge passes through wire at a steady rate of 2 seconds.

$$\text{The current } I = \frac{8}{2} = 4\text{A}$$

Current vary in magnitude from very large values of hundreds of amperes in electric motors to very small values, milliamperes mA or microamperes μA in transistor radios, digital watches and calculators.

$$1\text{mA} = 10^{-3}\text{A}$$

$$1\text{ u A} = 10^{-6}\text{A}$$

Current measuring instruments

Electric current can be detected by the use of sensitive instruments called galvanometers. It should be noted carefully that only a very small current can be allowed through this sensitive instrument, otherwise it will be damaged.

The measuring of the exact amount of current in the circuit, we use an instrument called an **ammeter** for large currents and a **milliammeter** for small currents.

The circuit symbols for these instruments are shown below:

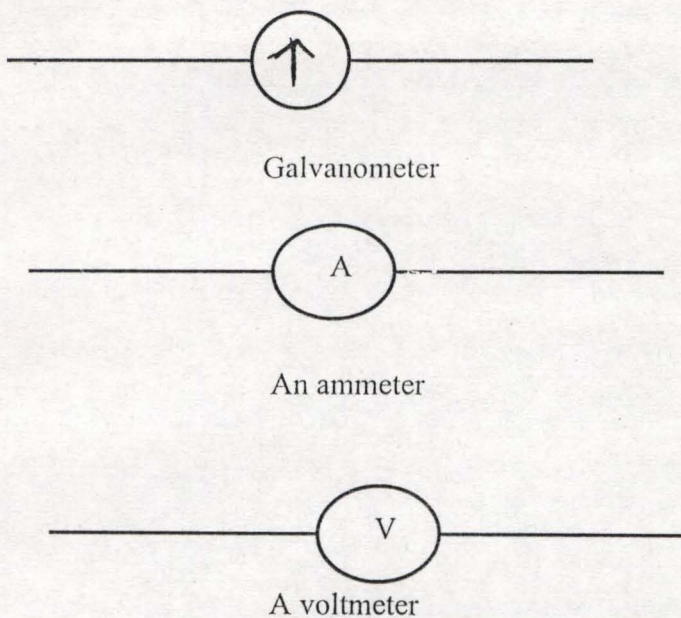


Fig. 2.3.0

In a circuit, an ammeter must always be connected so that the current to be measured flows directly through it. That is, it is connected in series in the circuit (see fig.2.3.1). Similarly ammeters placed at P and Q will record the same current since they are in series with the battery. But similar ammeters at R and S in (fig.2.3.2), in parallel to each other, will record different currents, while the one at T will record the main current flowing from the battery.

The current $I = I_1 + I_2$ as shown below:

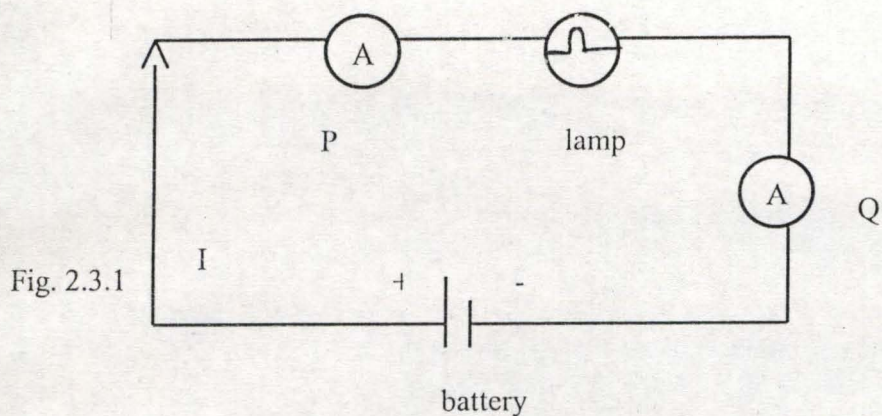


Fig. 2.3.1

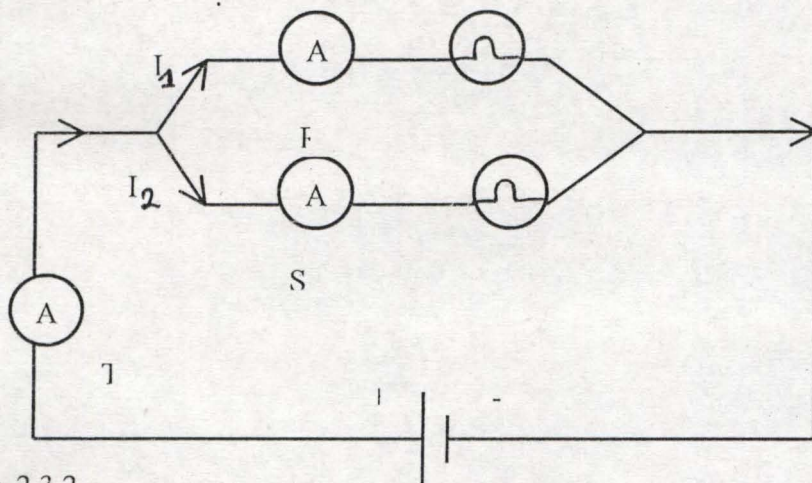


Fig. 2.3.2

Potential difference

Electrical potential difference (p.d) is a kind of electrical pressure difference between two points in an electrical circuit. When a current flows through a wire it does so because there is a potential difference between the ends of the wire.

The potential difference (p.d) between any two points in a circuit is the work done when one coulomb of charge moves from one point to another.

The unit of (p.d) is the volt (v)

Electrical cells also give an electrical force, or pressure, across its terminals, known as the electromotive force (e.m.f).

The e.m.f of a cell in volts is the p.d between the terminals of the cell when it is not delivering any current to the circuit.

It is often represented by the symbol (E)

Other large and small units of kilovolts (kv) and millivolts (mV)

$$1\text{kv} = 10^3 \text{V}$$

$$1\text{mv} = 10^{-3} \text{V}$$

Instruments for measuring p.d

The instrument for measuring p.d is known as voltmeter. It looks just like an ammeter except that it is graduated in volts or millivolts. The voltmeter is symbolically represented as shown previously in fig.2.3.0

The voltmeter is always connected across the two points where the p.d is required, i.e. it is connected in parallel. Voltmeter is a very high resistance instrument, and if it is mistakenly connected in series in a circuit, no measurable current will flow.

Fig.2.3.3 shows three voltmeters are connected in a circuit with three resistors, R_1 , R_2 and R_3 . The reading of V_1 is the same for the two resistors R_1 , and R_2 but the current I_1, I_2 through them are different. The p.d V_2 across R_3 will also be different. The p.d V across AB is given as $V = V_1 + V_2$

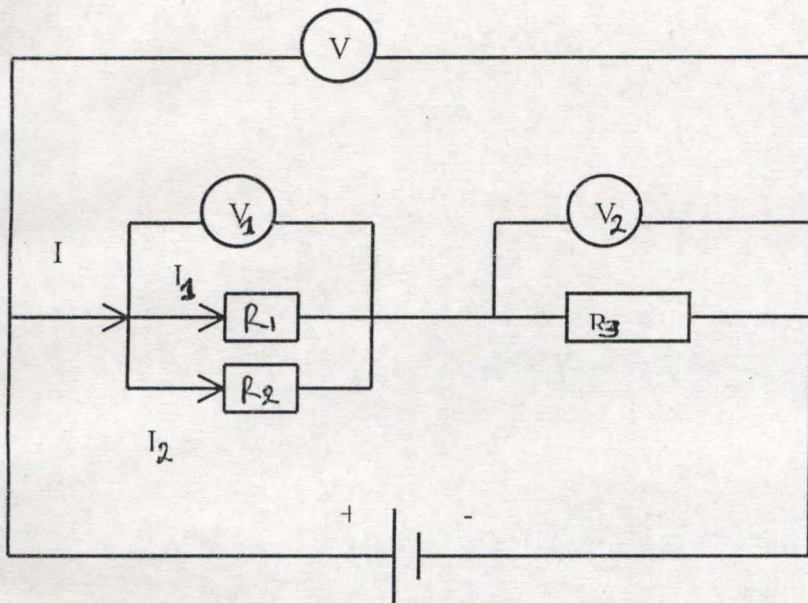


Fig.2.3.3 measuring potential difference.

Electrical resistance

Different substances have different conducting powers and they are known as good or bad conductors and insulators. In electricity we think in terms of the ability of a substance to resist the flow of electricity through it. A good conductor is therefore said to have a low resistance and a poor conductor has a high resistance. Very good insulators may be regarded as having infinite resistance. No current pass through an ideal insulator. Silver is the best conducting material, followed by copper; the latter is normally used for connecting wires and cables in electrical circuits.

When high resistance are specially needed in a circuit, wires made of special alloys such as constantan, manganin, and nichrome are used.

Ohm's law

In 1826, a German physicist, called George Simon ohm discovered that for a given conductor there is a relationship between the current flowing through it and the p.d across it. He found the following relationship.

The current passing through a metallic conductor at constant temperature is proportional to the potential difference across its ends. This is known as ohm's law.

If V represents p.d in volts and I represent current in amperes, ohm's law can be written symbolically as: $V \propto I$ or $V = IR$

Where R is a constant of proportionality that depends on the nature of the conductor and has been identified as the resistance of the conductor. By transformation of the formula, any of the following three versions defines ohm's law.

$V = IR$
$R = \frac{V}{I}$
$I = \frac{V}{R}$

For a given value of V you may see from the above relations that R is large when I is small. This mean that a high resistance conductor will allow only a small current to pass through it but a low resistance conductor will allow a large current to pass through.

The resistance Ω of a conductor is the ratio of the p.d across the conductor to the current flowing through it.

The unit of resistance is called the ohm (Ω).

The ohm is defined as the resistance of a conductor such that when a p.d of 1 volt is applied to its ends, a current of 1ampere flows through it.

Verification of ohm's law

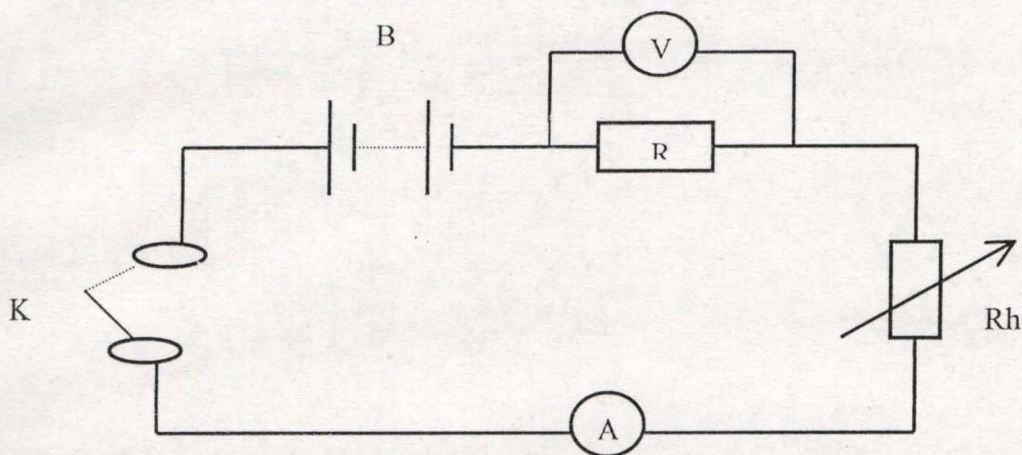


Fig 2.3.4 verification of Ohm's law.

One way of verifying ohm's law is by use of the circuit in fig.2.3.4 above.

The circuit consist of battery B, a key K, resistor R, a rheostat Rh, an ammeter A, and a voltmeter V, the circuit is connected as shown in the diagram. Starting the Rh as large as possible, the key k is switched on and the readings of V and A are noted. The setting of Rh is then gradually reduced so that a series of reading of V and A are obtained and tabulated as V (volt) and I (amperes). Since $V = IR$, according to ohm's law, we expect that a graph of V against I when plotted should be a straight line through the origin, within the limits of experimental error. If this is true then ohm's law is verified as shown below.

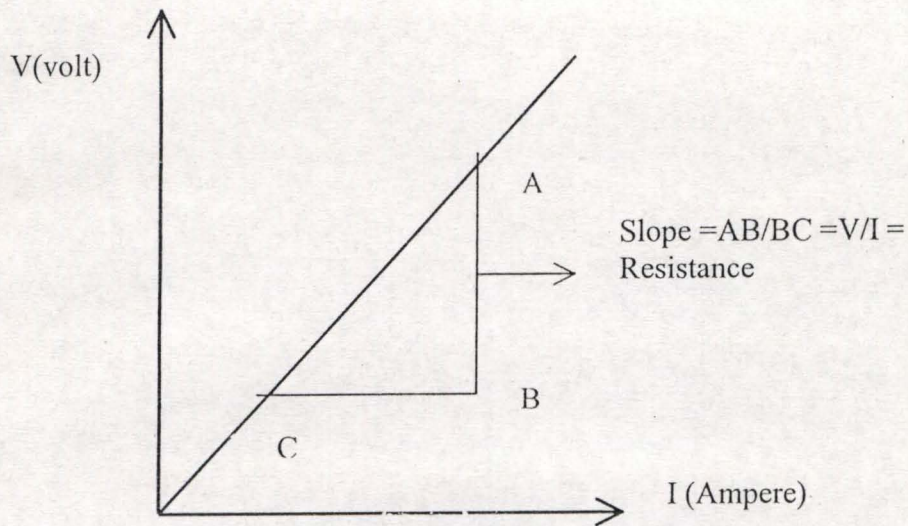


Fig.2.3.5 a graph to verify ohm's law.

2.4MODULE 4

STANDARD RESISTORS AND RHEOSTAT.

Pieces of equipment, which are connected in circuits, are usually known as components.

A components design to give resistance to the circuit is called resistor.

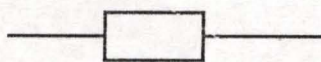
Standards resistors

These are components usually in the form of length of resistance wire or a piece of carbon of which the resistance is accurately known. They are sometimes called known resistors.

The values of these resistors can be measured and labelled. Standards resistors are usually available in the laboratory in the values of $1\ \Omega$, $2\ \Omega$, $3\ \Omega$, $4\ \Omega$, $10\ \Omega$ etc.

X-ohms

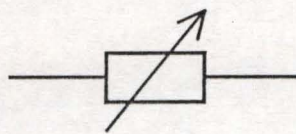
Resistors are symbolically represented as:



Rheostats

Apart from known resistors, variable resistors known as rheostats are used in electric circuits. They are used to adjust the current flowing in the circuit. The resistance introduced into the circuit depends on the length of coil in the circuit and this is determined by the position of a suitable slider.

Rheostats are symbolically represented as:



Resistors in series

If three resistors R_1 , R_2 and R_3 are connected end to end in such a way that the same current passes through each resistor when they are connected to source of e.m.f, they are said to be connected in series

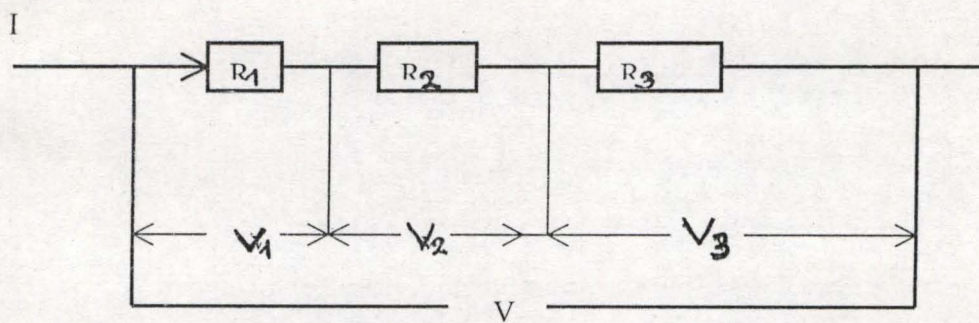


Fig. 2.4.1 resistors in series.

The equivalent or total resistance, R_T , of these resistors is given by $V = IR$ where V is the p.d across them and $V = V_1 + V_2 + V_3$.

Therefore, $IR = IR_1 + IR_2 + IR_3$

$$IR = I(R_1 + R_2 + R_3)$$

$$R_T = R_1 + R_2 + R_3$$

The total resistance of resistors connected in series is thus the sum of the resistances. The argument above applies to any number of resistors.

Resistors in parallel

Resistors are said to be in parallel if they are placed side by side with their ends joined together in such a way that the p.d across each resistor is the same. The current in each resistor will not be the same but will depend on the resistance of the resistor, with a smaller current passing through the resistor with larger resistance.

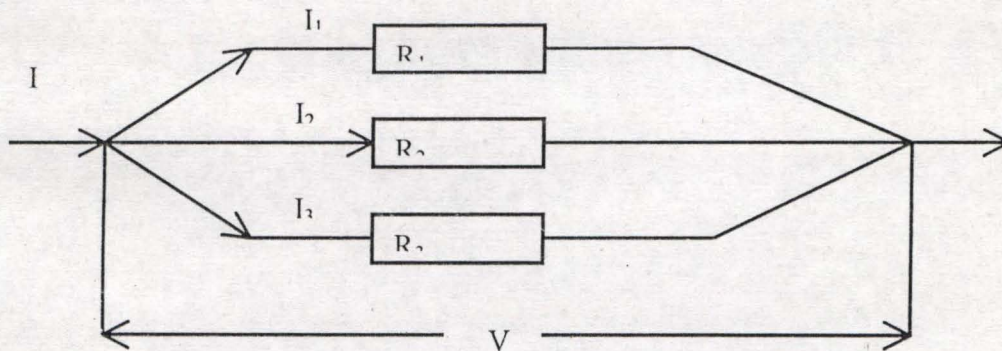


Fig.2.4.2 resistors in parallel.

If R_1, R_2, R_3 are the resistances of the resistors and I_1, I_2, I_3 are the corresponding currents in each resistor then the total resistance R_T is given by:

$$I = \frac{V}{R} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$I = V \left(\frac{1}{R} \right) = V \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \right)$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

This gives the total resistance of the combination. The equation can be extended to any number of resistors.

Internal resistance of a cell

The magnitude of current delivered by a cell depends not only on the e.m.f of the cell but also on what is called the *internal resistance* r of the cell.

This is the resistance offered by the electrolyte to the motion of current. If the internal resistance is low, a large current is obtained from the battery. The internal resistor is often shown in a circuit as a resistor next to the cell.

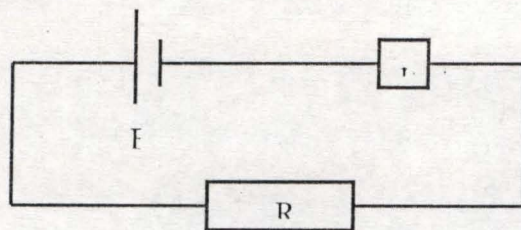


Fig. 2.4.3

If an external resistor of resistance R is connected in a circuit containing a source of e.m.f E then the current flowing will be:

$$I = \frac{E}{R+r}$$

Terminal p.d and e.m.f

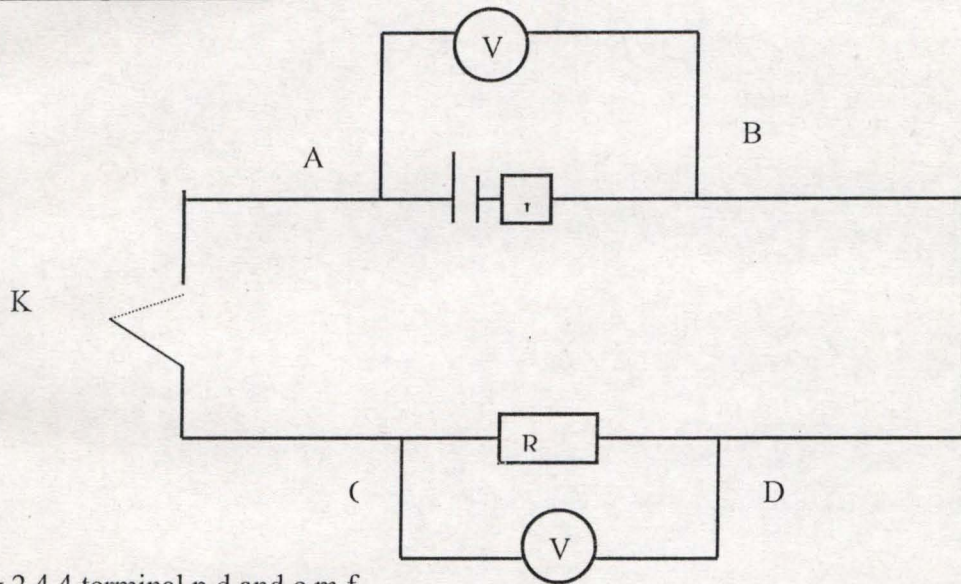


Fig.2.4.4 terminal p.d and e.m.f

The terminal p.d V of a cell delivering a current is the p.d across the terminals of the cell, it is also the p.d across the external resistor R (the p.d across the ends C and D), if the key k is closed and p.d across CD and AB are measured consecutively by a voltmeter V , the result will be the same. If the current is broken at k and the p.d across AB is again measured, a higher reading will be obtained. This reading gives the e.m.f of the cell, E .

Thus, *the terminal p.d is the p.d across the cell when the cell is delivering a current through an external circuit. The e.m.f is the p.d when the cell is not delivering current to an external circuit. (It is the p.d for an open circuit).*

The terminal p.d V and e.m.f E is related to the current I flowing in the circuit by:

$$I = \frac{V}{R} = \frac{E}{R+r}$$

From this have:

$$I(R+r) = E$$

$$IR + Ir = E$$

We recall that $V = IR$, we also have:

$$V = E - Ir$$

The (Ir) is sometimes referred to as the lost voltage.

2.5 MODULE 5

CIRCUIT CALCULATIONS

Example 1: A conductor has a resistance of 2Ω . If a current of $5A$ is flowing through it, what is the p.d across the terminals of the conductor?

Solution: given $V = IR$

$$V = 5 \times 2 = 10v.$$

Example 2: A cell of e.m.f $6v$ and internal resistance of 0.5Ω is connected across an external resistance of 2.5Ω . What is the current flowing in the circuit?

Solution:

$$\text{The current } I \text{ is given by: } I = \frac{E}{R+r} = \frac{6}{2.5+0.5} = \frac{6}{3} = 2.0A$$

Example 3: Two resistors each resistance $1\ \Omega$ are to be connected in a circuit containing a 2v battery of negligible internal resistance. Calculate the current flowing in the circuit when:

- a) The resistors are connected in series.
- b) The resistors are connected in parallel.

Solution:

- a) Total resistance in series: $R_T = R_1 + R_2 = 1 + 1 = 2\ \Omega$

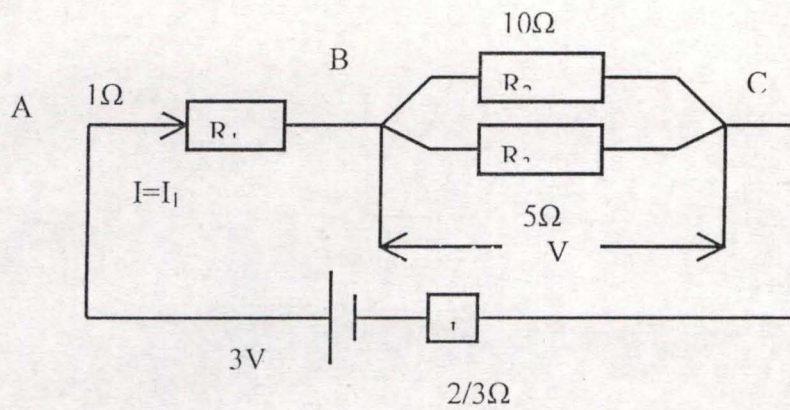
The current $I = \frac{E}{R+r} = \frac{2}{2} = 1A$ (where r is negligible).

- b) Total resistance in parallel: $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{1} + \frac{1}{1} = \frac{2}{1}$

$$\frac{R_T}{1} = \frac{1}{2} = 0.5\ \Omega$$

The current $I = \frac{E}{R} = \frac{2}{0.5} = 4A$

Example 4:



Calculate,

- a) The current in each external resistor
- b) The p.d across AB

Solution:

The total resistance in parallel $\frac{1}{R} = \frac{1}{10} + \frac{1}{5} = \frac{3}{10}; R = \frac{10}{3} \Omega$

The total external resistance in the circuit $R_T = 1 + \frac{10}{3} = \frac{13}{3} \Omega$

a) The current $I = I_1 = \frac{E}{R_T + r} = \frac{3}{\frac{13}{3} + \frac{2}{3}} = 0.6A$

The p.d across BC is: $V = I R_T = 0.6 * \frac{10}{3} = 2V$

The current $I_2 = \frac{V}{R_2} = \frac{2}{10} = 0.2A$

The current $I_3 = \frac{V}{R_3} = \frac{2}{5} = 0.4A$

b) The p.d across AB, $V = I_1 R_1 = 0.6 * 1 = 0.6V$

Example 5: A cell of e.m.f 1.08V is in series with a resistor of resistance 80Ω . A high resistance voltmeter is connected the cell, registers only 0.8V. What is the internal resistance of the cell?

Solution:

The current through the cell is given by: $I = \frac{E}{R+r} = \frac{V}{R}$

$$V(R+r) = ER; VR + Vr = ER; Vr = ER - VR; r = \frac{ER - VR}{V}; \frac{ER}{V} - R$$

$$r = \frac{80 * 1.08}{0.8} - 80 = 28 \Omega$$

Resistivity

The resistance of a material in the form of a wire is found to be directly proportional to the length of the wire and inversely proportional to the cross-sectional Area. If A is the cross-sectional area and l is the length, where ρ is a constant of proportionality shown as the resistivity of the material of the wire.

$$R \propto \frac{l}{A} \Rightarrow R = \frac{\rho l}{A}; \rho = \frac{R(\text{ohms}) * A(m^2)}{l(m)}$$

The unit of ρ ohmmeter. (Ωm) $\Omega \Omega$

If we take $A = \frac{\pi d^2}{4}$, where d is the diameter of the wire. Then we can write the resistance

$$\text{As: } R = \frac{4\rho l}{\pi d^2}$$

The values of ρ can be obtained from reference books and d can be measured accurately using a micrometer screw gauge.

Example 1: what is the length of resistance wire of diameter 0.3mm and resistivity $1.1 \times 10^{-6} \Omega m$?

$$\text{Solution: } R = \frac{4\rho l}{\pi d^2} \Rightarrow l = \frac{R\pi d^2}{4\rho} \text{ where } d = 0.3/1000 = 3 \times 10^{-4} \text{ m,}$$

$$l = \frac{14 \times 22 \times 9 \times 10^{-8}}{7 \times 4 \times 1.1 \times 10^{-6}} = 0.9 \text{ m}$$

2.6 MODULE 6:

ELECTRICAL ENERGY AND POWER

Electrical energy

Energy is used up when work is done. The unit of both work and energy are joules (J). We have seen earlier that the p.d between two points is the work done (in joules), when one coulomb of electricity moves from one point to another. Therefore if

the p.d applied is V (volts) and the quantity of electricity, which passes through, is Q (in coulombs), then the work done is VQ (in joules).]

$W = VQ$, where $Q = It$

$W = VIt$ where t is the time taken for the current to flows.

We recall that: $V = IR$ or $I = V/R$

$$\text{Thus, } W = VIt \Rightarrow W = \frac{V^2 t}{R} \Rightarrow W = I^2 R t$$

The energy of current in an electrical circuit can be converted into various forms of energy.

- i) It can be converted to mechanical energy if there are motors in the circuit. E.g. Electric fans and washing machines.
- ii) It can be converted into heat energy if a heating element is present, e.g. electric iron and cookers.
- iii) It can be converted into sound energy, e.g. Amplifiers and telephones.
- iv) It may be converted into light energy or radiation, e.g. filament lamps and x-rays.

Electric power

Power is define as the energy used or produced per second. In other word it is the rate at which work is done.

$$\text{Power} = \frac{\text{workdone}}{\text{timetaken}} = \frac{W}{t} \text{ (J / s)}$$

From the previous definition work, we can deduce that power can be written in any of these three forms.

$$P = VI \Rightarrow P = \frac{V^2}{R} \Rightarrow P = I^2 R$$

The unit of power, joules/second or volt-Ampere, is called the Watt. The larger units are kilowatts (KW) and megawatts (MW).

Consumption of electrical energy

Commercial power is consumed in kilowatt-hours (KWh). 1KWh is the energy supplied by a rate of working of 1000Watts for 1hr.

$$1\text{KWh} = 1000\text{W for 1hr.}$$

$$= 1000 * 60 * 60 \text{ J} = 3.6\text{MJ}$$

Most of the electrical energy used in Nigeria is produced at the Kainji dam. The National Electric Power Authority (NEPA) distributes this electrical energy and sells it in KWh units.

Example 1: How much heat is produced in one minute by an electric iron that draws 5.0A when connected to a 100V supply?

Solution:

Heat supplied = heat produced (assuming all is converted to heat)

Heat produced = $VIt = 100 \times 5 \times 60 = 30\text{KJ}$.

Example: 2 find the cost running a 60W lamp for 24hrs, if the electrical energy cost 5kobo per unit.

Solution:

Total power consumed = $60 \times 24 = 1440\text{Wh}$ or $1440/1000 = 1.44\text{KWh}$

But 1KW is one unit @ 5kobo

Therefore, the total cost of the lamp for 24hrs is: $1.44 \times 5 = 7.2\text{kobo}$.

CHAPTER THREE

SYSTEM DESIGN AND DEVELOPMENT

3.1 SYSTEM SPECIFICATION

A system can be regarded as set of interacting elements responding to input to produce output. This chapter gives the detailed documentation of the entire package, with a view to aiding evaluation, modification, and utilization. As we have said earlier in chapter one, this work is not intended to eliminate classroom teaching and textbooks. It is rather aimed at complementing all other existing teaching and learning procedures or aids.

The main advantage of this system is that, it is easy to use as a reference material for further studies, as well as its suitability for learners studying electricity for the first time. An effective use of the system is guaranteed for learners who are not competent in computer science, as well as those with previous knowledge of computer.

It is important to give a brief description of the system with particular reference to the system input and output.

3.1.1 SYSTEM INPUT

The notes on the topics constitute the major input into the system. There are six (6) different main menu topics on electricity and each is held in a text file on a diskette. The learner's choice is loaded into the memory of a personal computer with the view to extract necessary information on the topics on unit basis.

Each module is presented in lumps called lessons, and each lesson is subdivided into units. There are 24 units in all from 6 lessons.

The inputs also include the source program written to access the student's understanding of the subject in question. There are six groups of ten multiple-choice Self Assessment Question (SAQ), which is held in a SAQ file on a diskette.

3.1.2 SYSTEM OUTPUT

The major output from the system, is the result of the learner's performance in the Self Assessment Questions (SAQ), when the program is being run. The output could also be a piece-meal retrieval of the lump of information loaded into the computer.

3.2 SOURCE DOCUMENT AND OBJECT DOCUMENT

Source documents are generated using carefully selected textbooks on electricity, with scope relevant to Senior Secondary Certificate Examinations (SSCE) and University Matriculation Examinations (UME).

Object documents can be obtained by printing the screen on the display of each module or the Self Assessment Questions (SAQ), when the package is being utilized. These could also be used as additional reference materials, as they constitute the hard copy of the information displayed on the screen.

3.3 FILES AND PROCEDURES

There are 12 files in all, which are made up of text files, and program files. Each text files holds the lecture notes for a particular module, and there are six

modules in all. Therefore, there are six text-files, each named after the main menu topic(s) in the module. These are Electrical circuits.txt, Prod. Electric current.txt, Basic electrical quan.txt, Std.resistors & rheostat.txt, Circuit calculations.txt, and Electrical energy&power.txt.

The program files holds all the lines of instructions that constitute the program, as well as the data for the SAQ, and the respective options as the SAQ is of multiple choice in nature. The program files are code named CALELSAQ1-6 with a system generated extention*BAS. These are, CALELSAQ1*BAS, CALELSAQ2*BAS, CALELSAQ3*BAS, CALELSAQ4*BAS, CALELSAQ5*BAS, CALELSAQ6*BAS.

All the files are conveniently held by a 3.5" diskette with enough free space to allow for editing and modification.

The most sensitive of all the files are the program files, and their security is guaranteed. To avoid undue deletion or tampering with the program statements and thereby rendering the package useless, the package was converted into an executable file using a tb- compiler. Unauthorized users are also denied access to the package by the program itself through a password subroutine that is first activated. Only when the correct password is keyed in, could any one use the package.

CHAPTER FOUR

SYSTEM IMPLEMENTATION AND MAINTENANCE

4.1 COMPUTER-AIDED LEARNING ELECTRICITY (CALEL) UTILIZATION

To effectively utilize this package, it is necessary for the user to know how to access the system and acquired information on the facilities offered by the package. CALEL is the acronym used for Computer-Aided Learning of Electricity.

The Author recognizes the fact that, simple, flexible, and effective programs are better than complex and rigid ones. Therefore, the package is developed to be exceedingly flexible and implement able on personal computers.

Q-basic, a simple and powerful version of BASIC programming language is used to write the program. The package is held on a diskette, and can be copied to the hard disk of a personal computer, by changing directory to BASIC environment.

However, the package could also be utilized from drive A, since the diskette already contains all the files, including necessary Q-basic files. The user only needs to change directory to A: and open the CALEL files for execution.

To study a particular module, is to select the module from the main menu text files, and the topic (lesson) is accessed. There is no compulsion of going through the topics in any specific order, at the end of each module; the user can quit to another module of his/her choice.

For any user wishing to go through the program itself can do so, since adequate comments are included to explain the function of each subroutine.

It is necessary that, Computer science Teacher in each school, to be able to guide students to make effective use of the package. The user needs to be adequately thought on how to access the package, and to take good care of personal diskette containing the package.

It is also important to add that a series of demonstration be carried out by the Teacher, before the students are being left alone to continue its use.

4.2 CALEL PROGRAM FACILITIES

The CALEL programs utilized the following facilities with the view to make the whole package easy to use, educative, and interesting. The facilities are Assisted, Review, Testing, Debugging, and Exit facilities.

4.2.1 ASSISTED FACILITIES

This facility makes it possible for the learner to get Assistance from the subroutine by pressing the function key F1 as indicated on the screen and thereafter, he finds solution to his problem.

Having been through with this mode the learner then can press Escape (Esc) key to return to the main program.

4.2.2 REVIEW FACILITY

With the aid of this facility, the learner can review what he learned in the last unit by going back. This is restricted to the module or topic under consideration, and will not allow the learner to go the main menu. The facility is activated by pressing the Arrow key (↑)

4.2.3 TEST FACILITY

The important of this project work is to see that, the student fully understand the facts and figures in a module he just went through. A simple way of measuring the student's understanding is to test the student on the topic.

Each main module has ten (10) Self Assessment Questions (SAQ) with multiple-choice Answers. At the end of each module, the test on the module can be access and the test taken.

A subroutine grades the test and indicates how well or poorly the learner has performed. The test facility is so designed that a learner (user) who does not want to go through the lessons can access the SAQ for purely Academic relaxation. It can be access by changing directory to the BASIC environment.

4.3 DEBUGGING FACILITY

In the program there is an error trapping subroutine, this notifies the user of the occurrence of some likely errors and offers the user Assistance by telling him what to do, so that the program execution can continue.

4.4 EXIT FACILITY

This facility enables the learners to exit CALEL program at any point, while studying the module or taking the SAQ. It is accessed by pressing the function key (F10), after which the message, do you really want to exit? (Y/N) appears. Pressing Y (yes) ends the program, while pressing N (no) take one back to the main program.

CHAPTER FIVE

CONCLUSIONS, LIMITATIONS, AND RECOMMENDATIONS

5.1 CONCLUSIONS

CALEL has been developed as a support tool for students and any interested users studying the subject Physics. The onus is still on the student to take appropriate decision. CALEL also provides instant feedback to students in the form of a critical Assessment of their choices.

CALEL is simple, efficient, resourceful and adequate for the levels of students for which it was developed. I hereby conclude, by saying that the package is working according to intended specification.

5.2 LIMITATIONS

The limitations of the projects are to guide subsequent Researchers on this topic or related ones, on areas needing improvements.

The Absence of CAL materials in our Secondary Schools can be attributed to the limited availability of software, hardware, and lack of resources available for its development.

The scope of this work only covered Electricity, and the conventional Physics Syllabus is made up of different topics.

Another area needing improvement as far as this work is concerned, is the Self Assessment Questions (SAQ). As we can see from the implementation, each SAQ contains ten multiple-choice questions. It is felt that the package should be able to assess the student's performance on theoretical questions, so that adequate understanding of the subject can be guarantee.

5.3 RECOMMENDATIONS

With regards to the above limitations, it is strongly recommend that adequate human & capital resources should be invested in the use of computers as teaching and learning aids in our Secondary Schools among others.

There is need also, for a well-guided application of Computer-Aided Learning; I suggest that computer programmers and Educationists in various subjects should joined-hands to develop simple, resourceful and interesting software applicable to CAL.

REFERENCES

- Ahmed-Alawiye M.A: (1996) Computer Assisted Learning
(Applied to mechanics in Physics)
Project work, FUT, Minna, ~~1996~~
- Ambron S. & Hooper K. (1990): Learning with interactive multimedia
Microsoft Press, Washington
- Emuoyibofarhe .O.J & Sunday A.R: Fundamentals of Computer Science & Technology
- Lewis R. & Tagg.E.D: Computer Assisted Education
Blackwell Scientific Publications, Oxford.
- O'shea T. & Self. J (1983): Learning and Teaching with Computers.
The Harvesters Press, Brighton.
- O'Leary T.J & O'Leary L.I: (1997-1998) Computing Essentials
Multimedia Edition
- Okeke P.N & Anyakoha M.W: Senior Secondary Physics
Revised Edition.
- Ridgway J. (1987): Development & Evaluation of CAL materials.
Tool book users manual (1995), Microsoft Press.

Screen 9

Color 15, 0

PSet (320, 175), 4

SOUND 7000, 100

SLEEP 4

Print: Print: Print: SLEEP 3

LOCATE 4, 23: Color 14, 6: Print "ENTER PASSWORD": LOCATE 4, 39: Color 7: Print

LOCATE 4, 37: COLOR 6: INPUT PWS

CLS

If PWS = "EBE" Or PWS = "ebe" Then GoTo 9 Else GoTo 550

550 Color 19: Print "YOU ARE NOT AN AUTHORISED USER": GoTo 30

9 CLS: LOCATE 10, 13: Color 11, 8: Print "YOU ARE WELCOME TO COMPUTER AIDED
LEARNING OF PHYSICS"

LOCATE 15, 14: Print "WAIT WHILE THE PROGRAM LOAD.....": SLEEP 8: GoTo 4

4 CLS

Color 14, 0

GoTo 3310

3310 CLS: Print "SAQ 1. What is electric current.....?"

Color 14, 0

Print "A = Static charge": Print "B = Charge in motion": Print "C = Equilibrium charge"

Print "D = Linear charge"

INPUT "Please Enter Correct Option A - D"; ANS1\$

SLEEP 4

If ANS1\$ = "b" Then Print "Job well done" Else Print "You Enter the Wrong Answer"

SLEEP 5

GoTo 20

20 CLS: Print "SAQ 2. Electrons are _____?"

Print "A = Positively charge": Print "B = Neutral": Print "C = Negatively charge": Print "D = Null"

INPUT "Enter Correct Option A - D"; ANS1\$

SLEEP 2

If ANS1\$ = "c" Then Print "Job well done" Else Print "You Enter the Wrong Answer"

GoTo 400

400: Print "SAQ 3. Electrons flow from _____ to _____?"

Print "A = cathode to Anode": Print "B = Anode to cathode": Print "C = Cell to cell":

Print "D = Cathode to cell"

INPUT "Enter Correct Option A - D"; ANS1\$

SLEEP 2

If ANS1\$ = "a" Then Print "Job well done" Else Print "You Enter the Wrong Answer"

GoTo 800

800: Print "SAQ 4. Conventional direction of current is?....."

Print "A = -Ve to +Ve": Print "B = N to +Ve": Print "C = +Ve to N":

Print "D = +Ve to -Ve"

INPUT "Enter Correct Option A - D"; ANS1\$

SLEEP 2

If ANS1\$ = "d" Then Print "Job well done" Else Print "You Enter the Wrong Answer"

GoTo 150

150: Print "SAQ 5. Cells are divided into _____?"

Print "A = Three": Print "B = Four": Print "C = Two":

Print "D = One"

INPUT "Enter Correct Option A - D"; ANS1\$

SLEEP 2

If ANS1\$ = "c" Then Print "Job well done" Else Print "You Enter the Wrong Answer"

GoTo 360

360: Print "SAQ 6. Release of hydrogen bubbles in a cell causes?....."

Print "A = Polarization": Print "B = Local action": Print "C = Polarizer":

Print "D = Hydrogenation"

INPUT "Enter Correct Option A - D"; ANS1\$

SLEEP 2

If ANS1\$ = "a" Then Print "Job well done" Else Print "You Enter the Wrong Answer"

GoTo 123

123: Print "SAQ 7. Local action in cells is as a result of?"

Print "A = Impurities": Print "B = Purities": Print "C = Additives":

Print "D = Water"

INPUT "Enter Correct Option A - D"; ANS1\$

SLEEP 2

If ANS1\$ = "a" Then Print "Job well done" Else Print "You Enter the Wrong Answer"

GoTo 265

265: Print "SAQ 8. To prevent polarization we the plates?"

Print "A = Brush": Print "B = Wet": Print "C = Dry":

Print "D = Heat"

INPUT "Enter Correct Option A - D"; ANS1\$

SLEEP 2

If ANS1\$ = "a" Then Print "Job well done" Else Print "You Enter the Wrong Answer"

GoTo 199

199: Print "SAQ 9. We can stop local action by cleaning the plate with _____?"

Print "A = H₂ SO₃": Print "B = H₂ SO₄": Print "C = H₂ SO₂":

Print "D = H₂ SO₁"

INPUT "Enter Correct Option A - D"; ANS1\$

SLEEP 2

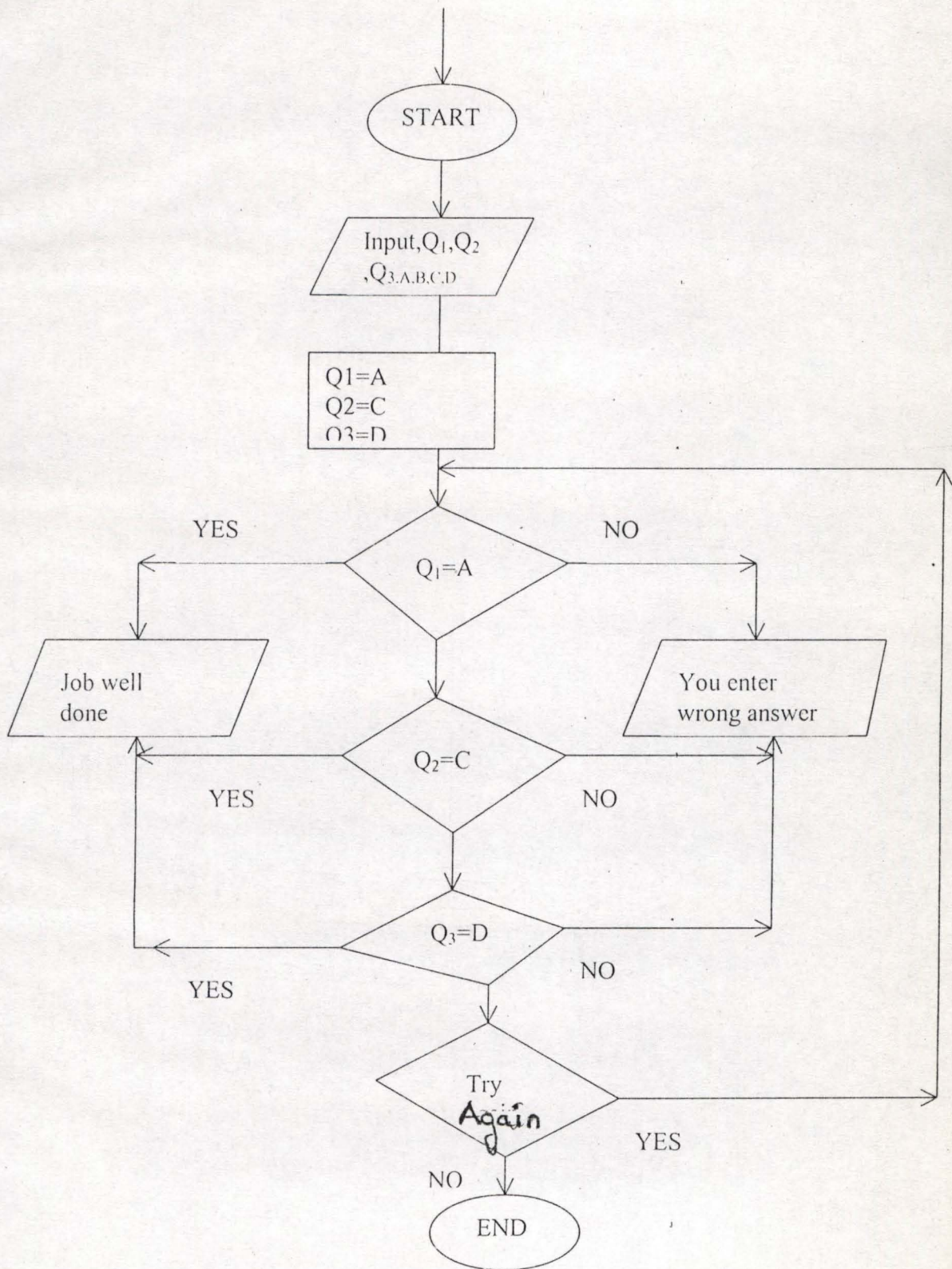
If ANS1\$ = "b" Then Print "Job well done" Else Print "You Enter the Wrong Answer"

GoTo 455


```
455: Print "SAQ 10. Secondary cells are _____?"
Print "A = Rechargeable": Print "B = Non-rechargeable": Print "C = Reversible":
Print "D = Non-reversible"
INPUT "Enter Correct Option A - D"; ANS1$
SLEEP 2
If ANS1$ = "a" Then Print "Job well done" Else Print "You Enter the Wrong Answer"

If K < 1 Or K >= 4 Then GoTo 600
Print: Print: Print
600 Print "END OF SELF ASSESMENT QUESTIONS": Print
INPUT "DO YOU WANT TO TRY ANOTHER QUESTION (Y/N)"; ANS
If AN$ = "N" Or AN$ = "Y" Then GoTo 899 Else GoTo 9
899 Color 10, 8: Print "THANKS FOR YOUR CO-OPERATION"
BEEP: BEEP: BEEP:
For I = 7 To 20: For J = 3 To 70
Color 10, 8: LOCATE I, J: Print "*": Next J: Next I: Print "THE END"
30 End
500 End
```

SYSTEM FLOWCHART



PROGRAMME OUTPUT

ENTER PASSWORD? EBE

YOU ARE WELCOME TO COMPUTER AIDED LEARNING OF PHYSICS

WAIT WHILE THE PROGRAM LOAD.....

SAQ 1. What is electric current.....?

- A = Static charge
- B = Charge in motion
- C = Equilibrium charge
- D = Linear charge

Please Enter Correct Option A - D? b

Job well done

SAQ 2. Electrons are_____?

- A = Positively charge
- B = Neutral
- C = Negatively charge
- D = Null

Enter Correct Option A - D? c

Job well done

SAQ 3. Electrons flow from_____to_____?

- A = cathode to Anode
- B = Anode to cathode
- C = Cell to cell
- D = Cathode to cell

Enter Correct Option A - D? ■

C = +Ve to N

D = +Ve to -Ve

Enter Correct Option A - D? d

Job well done

SAQ 5. Cells are divided into_____?

- A = Three
- B = Four
- C = Two
- D = One

Enter Correct Option A - D? a

You Enter the Wrong Answer

SAQ 6. Releade of hydroden bubbles in a cell caubes?.....

- A = Polarization
- B = Local action
- C = Polarizer
- D = Hydrogenation

Enter Correct Option A - D? g

You Enter the Wrong Answer

SAQ 7. Local action in cells is as a result of?

- A = Impurities
- B = Purities
- C = Additives
- D = Water

Enter Correct Option A - D? ■

Readme.project
QBASIC PROGRAMMING LANGUAGE

PROGRAM ON SELF ASSESMENT QUESTION

To start running this PROGRAM

Go to MS DOS PROMPT

C:\Qbasic

Press Esc key on the keyboard

Open File on the Bar

filename=== EBE.BAS===

Press on the F5 on the keyboard &

Enter current password "EBE or ebe"

Note: when entering your options A - D please enter in "Lowercase" e.g a,b,c,d.

==\to exit the program Type Y in Uppercase//

--\to continue the program Type n//