A REPORT ON

STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES)

FROM AUGUST TO OCTOBER 2024

UNDERGONE AT

NATIONAL INSTITUTE OF MEDICAL RESEARCH, YABA, LAGOS STATE

CENTRE FOR HUMAN VIROLOGY AND GENOMICS

MICROBIOLOGY DEPARTMENT

BY

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APPRECIATION

I give thanks to God Almighty the one who gives life and sustains it, for his protection, mercy and kindness for the successful completion of my industrial training

I also thank God for my family members for their unwavering support during the period of my training

ACKNOWLEDGEMENT

I am grateful to the HOD of the Center for Human Virology and Genomics Dr Olufemi Amoo for granting my placement in the department and also my guardians and sisters for making this possible. I also appreciate my Pilot Trainer Mr Tobiloba for supervising my activities in the Department, I also appreciate all the focal person on each Laboratory bench for lectures and guidance in the laboratory

And to all my fellow IT student, it was a great pleasure working with you at NIMR

And to my Supervisors and Head of Department, Mrs Olaitan and Dr Farounbi, I appreciate you for your unwavering support.

CERTIFICATION

This is to certify that Oyeyele Oyetomiwa Sandra ,with matric number 23/10BSM030 carried the Student Industrial Work Experience Scheme(SIWES) at the National Institute Of Medical Research(NIMR) Yaba, Lagos State between August and October 2024,

Head of Department

SIWES Coordinator

TABLE OF CONTENT

TITLE	PAGE
Appreciation	i
Acknowledgement.	ii
Certification	iii
Table of content	iv
Chapter ONE :INTRODUCTION TO SIWES	
Introduction to the training program	1
Purpose of training	2
Objectives of the SIWES program	3
Organization profit	4
Chapter Two: SAFETY RULES IN THE LABORATORY	
2.0 Safety rules in the laboratory	5
2.1 Laboratory equipment and their uses	6
2.2 Picture of some equipment and their uses	7
Chapter Three: DEPARTMENT AND THEIR FUNCTION	
3.0 The laboratory sections and various tests performed	8
3.1 Phlebotomy	9-10
3.1.1 Sample collection technique	10-11
3.1.2 Picture of materials and activities in phlebotomy	11-12
3.2.0 Sample Sorting 1	13
3.2.1 Procedures for Sample Sorting 1	14
3.3.0 Sample Sorting 2	15
3.3.1 Procedures for Sample Sorting 2	16
3.4.0 Serology	17
3.4.1 Common serological tests performed	18
3.5.0 Molecular Diagnostics	19
3.5.1 Techniques in molecular diagnostics	20
3.6.0 Cluster of Differentiation 4 (CD4) Testing	21

Chapter Four : SUMMARY

4.0 Summary of attachment and its relationship with microbiology 21-22
4.1 Challenges encountered 22-23
4.2 Conclusion 24

CHAPTER ONE

1.1 INTRODUCTION TO SIWES

The Student Industrial Work Experience Scheme (SIWES), also known as Industrial Training is a planned and supervised training intervention based on stated and specific learning and career objectives and geared towards developing the occupational competencies of the participants. It is a program required to be undertaken by all students of the tertiary institutions in Nigeria pursuing courses in specialized engineering, technical, business, applied sciences and applied arts (ITF,2004a).

The scheme also affords students the opportunity of familiarizing and exposing themselves to the needed experience in handling equipment and machinery that are usually not available in their institution.

SIWES introduction, initiation and design was done by the Industrial Training Fund (I.T.F) in 1993 to acquaint students with the skills of handling employer's equipment and machinery. The Industrial Training Fund (I.T.F) solely funded the scheme during its formative years. However, due to financial constraints, the fund withdrew from the scheme in 1978. The Federal Government, noting the significance of the skills training, handed the management of the scheme to both the National Universities Commission (N.U.C) and the National Board for Technical Education (N.B.T.E) in 1979.

1.2 AIM AND OBJECTIVE OF SIWES.

The Industrial Training Fund's policy document No. 1 of 1973 (ITF,1973) which established SIWES outlined the objectives of the scheme. The objectives are :

• Provides the avenue for students in institutions of higher learning to acquire industrial skills and experiences in their course of study.

• Prepares the students for the industrial work situation they are likely to meet after graduation.

• Exposes students to work methods and techniques in handling equipment and machinery that may not be available in their institutions.

• Makes the transition from school to the world of work easier and enhance students' contact for later job placement.

• Provides students with an opportunity to apply their knowledge in real work situations thereby bridging the gap between theory and practice.

• Enlists and strengthens employers' involvement in the entire educational process and prepares students for employment after graduation.

• To keep students abreast of the latest developments and innovations in their disciplines.

• To expose students to sophisticated machineries they don't have access to in their institutions.

• To prepare students for the likely challenges they will face in the labor market.

• To help students make reasonable choices in their fields of specialization.

• To also bring students of different institutions, ethnic backgrounds, mentalities and of course, religion
under the same umbrella in which they learn to tolerate one another, work together, be of their best behavior, share ideas and make good friends with each other, within a very short period of time.

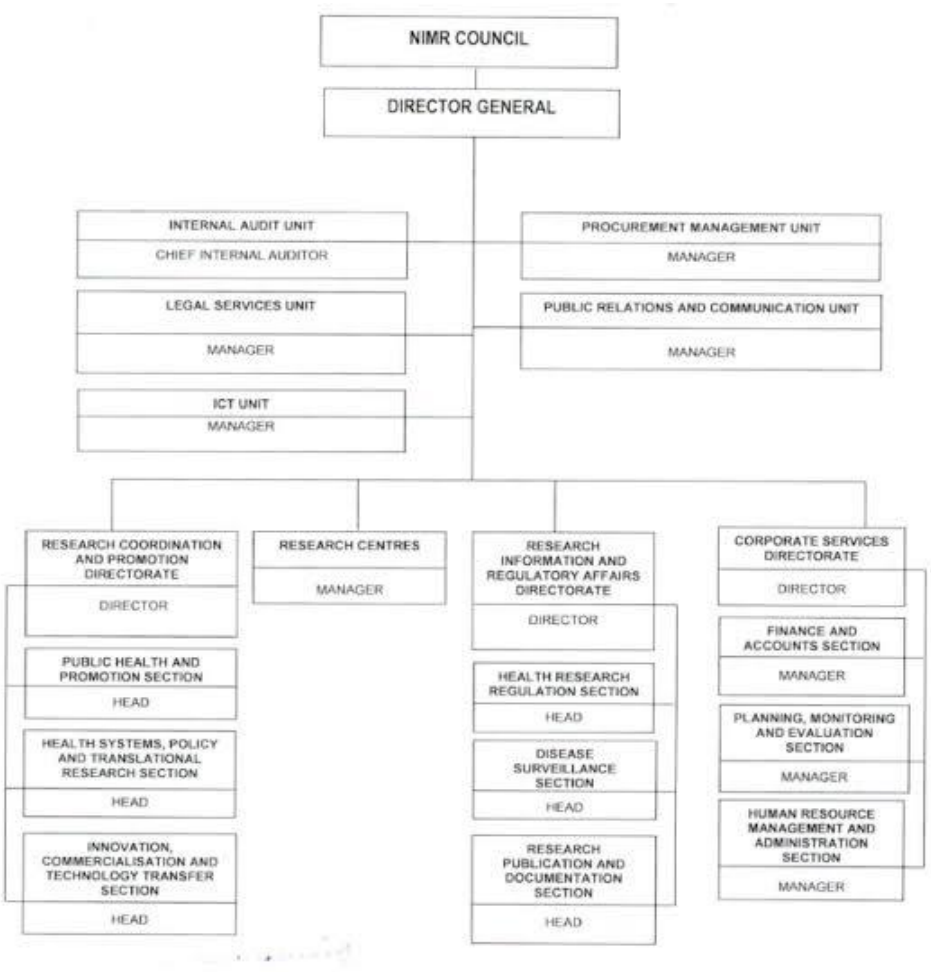
1.3 BRIEF HISTORY ABOUT NIMR (National Institute of Medical Research)

The National Institute for Medical Research (NIMR) has a rich history that dates back to its founding in 1920 in the United Kingdom. It was established to conduct medical research that would contribute to public health, particularly in relation to infectious diseases.

Over the decades, NIMR has been involved in numerous significant health initiatives and studies, including research on malaria, HIV/AIDS, tuberculosis, and other communicable diseases. The institute has played a pivotal role in developing vaccines, conducting clinical trials, and improving diagnostic methods.

In 2002, NIMR was restructured to enhance its focus on applied medical research and strengthen its collaboration with global health organizations. Today, NIMR continues to be at the forefront of biomedical research, contributing to advancements in public health policies and practices both nationally and internationally.

1.4 ORGANISATIONAL CHART OF NIMR



1.5 MISSION STATEMENT

The mission of the Nigerian Institute of Medical Research (NIMR) is to advance national health through impactful research on critical diseases affecting Nigeria, promoting solutions and innovations for healthcare improvements

1.6 VISION STATEMENT

The vision of the Nigerian Institute of Medical Research (NIMR) is to be a leading institution in high-quality research that enhances health outcomes, addressing Nigeria's critical public health challenges.

CHAPTER TWO

BIOSAFETY RULES

Biosafety rules in microbiology laboratories are essential to ensure the safety of personnel, the environment, and the community. Here are some key biosafety rules:

- Personal Protective Equipment (PPE):
    1. Always wear appropriate PPE, including lab coats, gloves, goggles, and face shields when necessary.
- Access Control:
    1. Restrict access to the laboratory to authorized personnel only. Use signage to indicate restricted areas.
- Hygiene Practices:
    1. Wash hands thoroughly before and after handling microorganisms. Use hand sanitizers as needed.
- Proper Waste Disposal:
    1. Dispose of biohazardous waste in designated containers. Follow local regulations for disposal of sharps and infectious materials.
- Decontamination:
    1. Regularly decontaminate work surfaces and equipment with appropriate disinfectants after experiments and spills.
- Use of Biological Safety Cabinets:
    1. Work with potentially infectious materials in a biological safety cabinet (BSC) to contain aerosols and prevent exposure.
- Emergency Procedures:
    1. Familiarise yourself with emergency procedures, including spill response and exposure protocols. Keep emergency contact information accessible.
- Training and Compliance:
    1. Ensure all personnel are trained in biosafety practices and understand the risks associated with the microorganisms being handled.
- Labelling:
    1. Clearly label all cultures, samples, and hazardous materials with appropriate hazard symbols and information.
- Avoid Eating and Drinking:
    1. Do not eat, drink, or apply cosmetics in the laboratory to prevent accidental ingestion of harmful agents.
- Minimise Aerosol Generation:
    1. Use techniques that minimise the generation of aerosols, such as centrifuging samples with sealed lids.
- Report Incidents:
    1. Report any spills, exposures, or accidents immediately to the appropriate authorities within the institution.

Following these biosafety rules helps maintain a safe working environment in microbiology laboratories.

EQUIPMENT IN DIFFERENT LABORATORIES AND THEIR USES

CLUSTER OF DIFFERENTIATION 4 (CD4)

1.CYFLOW COUNTER

The Cyflow Counter is a flow cytometer used to measure the number and percentage of CD4+ lymphocytes in the blood of people with HIV:

Function

The CyFlow Counter is used to diagnose and monitor the immune status of people with HIV.
It can also be used to help with treatment initiation, monitoring, or follow-up.

How it works

The CyFlow Counter uses a green laser to excite fluorescent dyes linked to stained cells. The emitted light is detected as the blood sample passes through the instrument, and the integrated software calculates the concentration of the cell populations**.**

Features

The CyFlow Counter is a compact benchtop flow cytometer that can perform fluorescence analysis and True Volumetric Absolute cell Counting (TVAC). It has a built-in printer and can analyze up to three optical parameters.

Ease of use

The CyFlow Counter is designed to be easy to use and provide fast, accurate results. It can be used in local health care centres, district hospitals, and regional hospitals.

2.MICRO PIPETTE : a laboratory tool designed to accurately transport a measured volume of liquids in the microliter range.

3. SAMPLE TUBES：used to handle chemicals, especially for qualitative essays.

4. DECONTAMINATION SOLUTION: used to disinfect cyflow counter to prevent contamination and ensure accurate results. These solutions typically remove biological contaminants, including proteins, cells, and other residues.

5. CLEANING SOLUTION; they are specialised cleaning solutions to ensure that the instruments are free from contaminants, which is crucial for accurate results.

6. SHEATH FLUID: It is a buffer solution used in flow cytometry to focus cells and particles into a single-file stream so they can be analysed by a laser beam

7. PIPETTE TIP : They are used to accurately transfer small amounts of liquid in research, diagnostics and other scientific applications.

8. GLOVES : They are used to cover our hands to prevent them from getting contaminated while carrying out laboratory activities

9.LABORATORY COAT: They are used to prevent our skin from hazardous materials and to also prevent the spread of the contamination outside the laboratory

10. RACKS: They are used to hold and protect the samples before using them.

PHLEBOTOMY

1. EDTA BOTTLES: are used for blood sample collection. The EDTA in these bottles acts as an anticoagulant, preventing blood from clotting by binding to calcium ions in the blood, which are necessary for the clotting process

2.PLAIN BOTTLES: are used for blood collection without any added anticoagulants or additives. These bottles allow blood to clot naturally,

3.TOURNIQUET: a band or strap used to temporarily restrict blood flow in the arm to make veins more prominent and easier to access for blood collection.

4. SYRINGE: is often used for drawing blood when the vein is small, fragile, or difficult to access. Unlike vacuum collection systems that apply consistent suction, a syringe allows the phlebotomist to manually control the pressure.

SAMPLE SORTING 1

1. CENTRIFUGE MACHINE: used to separate components of blood or other fluids based on their density. When a blood sample is placed in a centrifuge and spun at high speeds, the red blood cells move outward to the bottom of the tube, while lighter components, such as plasma or serum, remain at the top.

2. REFRIGERATOR: used to store samples before they are used.

3. PIPETTE: used to remove serum/plasma from the red blood cell

4. GLOVES:They are used to cover our hands to prevent them from getting contaminated while carrying out laboratory activities

5. RACKS:They are used to hold and protect the samples before using them.

SEROLOGY

1. INCUBATOR: used to maintain blood samples, cultures, or reagents at a constant, controlled temperature to support biochemical reactions or cell growth necessary for specific tests

2. RACKS:They are used to hold and protect the samples before using them.

3. PIPETTE: used to remove serum/plasma from the red blood cell

4. PIPETTE TIPS: an essential attachment used with pipettes to transfer precise volumes of liquid, such as blood serum, reagents, or other solutions, without contamination.

5. ELISA WASHER: is a specialised tool used to rinse microplates in Enzyme-Linked Immunosorbent Assay (ELISA) tests. The ELISA washer automates the washing steps, removing unbound substances.

6. GLOVES:They are used to cover our hands to prevent them from getting contaminated while carrying out laboratory activities

MOLECULAR DIAGNOSTICS

1. COBAS MACHINE: performs high-throughput testing for detecting viral RNA or DNA. COBAS machines are typically used for PCR (polymerase chain reaction) testing, which amplifies and detects viral genetic material in a sample, making it possible to identify the presence and load of specific viruses, such as HIV, hepatitis B, hepatitis C, SARS-CoV-2, and others.

2. CENTRIFUGE MACHINE: used to separate components of blood or other fluids based on their density. When a blood sample is placed in a centrifuge and spun at high speeds, the red blood cells move outward to the bottom of the tube, while lighter components, such as plasma or serum, remain at the top.

3. RACKS:They are used to hold and protect the samples before using them.

4. PIPETTE TIPS: an essential attachment used with pipettes to transfer precise volumes of liquid, such as blood serum, reagents, or other solutions, without contamination.

DIAGRAM OF SOME EQUIPMENT

THE CENTRIFUGE MACHINE

A MICROPIPETTE

THE COBAS 8800 MACHINE

CHAPTER THREE

3.0 THE LABORATORY SECTION AND VARIOUS TESTS PERFORMED

SECTION ONE

PHLEBOTOMY

This is where we interact with the patient directly to collect blood samples from them .We also ensure that these blood samples are distributed to various laboratory considering the test that need to be carried out

We also ensure to document and label the ID correctly. The phlebotomy laboratory is a pre-examination laboratory which means all processes takes place in that laboratory before samples are being tested , which means 70% of errors that could occur in the result would be from this Laboratory

SECTION TWO

SAMPLE SORTING ONE

This laboratory is where separation takes place ,the aim in this laboratory is to separate the plasma or serum from the blood. This is because most of the laboratories make use of the plasma to carry out tests.

SECTION THREE

SAMPLE SORTING TWO

This is where samples that are brought outside the institute are being manually arranged into the racks following the ID provided to us. There is no form of test that we carry out in this laboratory.

SECTION FOUR

SEROLOGY

This laboratory is where series of tests takes place to check for the antibody or antigens in a blood sample.Some of the tests carried out are the ; HBSurface antigen,HBe antibody,Hepatitis B which comes in three form;the E, surface and core(HBe,HBs,HBc) and also HBeIgm and we make use of the ELISA to wash the microplate.

SECTION FIVE

MOLECULAR DIAGNOSTICS

This laboratory is where we count the amount of virus present in an HIV blood sample by using the COBAS 8800 or COBAS 6800 which carries out most of the process. We also make use of the centrifuge to homogenise a sample when it is clotted

SECTION SIX

CLUSTER OF DIFFERENTIATION 4(CD4)

This laboratory is where the accurate amount of CD4 cells present in a sample is being counted using the Cyflow counter machine by following the procedure accurately.or by using the visitect device.

3.1 PHLEBOTOMY

The phlebotomy laboratory activities typically involve a range of tasks related to the collection, processing and analysis of blood samples .Some of the activities include;

1. Patient Preparation: Ensuring patients are informed about the procedure and any necessary pre-test preparations like taking an appropriate amount of water.

2. Blood Collection: It involves selecting appropriate venipuncture sites and using sterile technique to collect blood samples using needles, Vacutainer,Tourniquet and the collection tubes.

3. Sample Handling ; It involves labelling samples accurately and ensuring proper storage conditions for different types of samples.

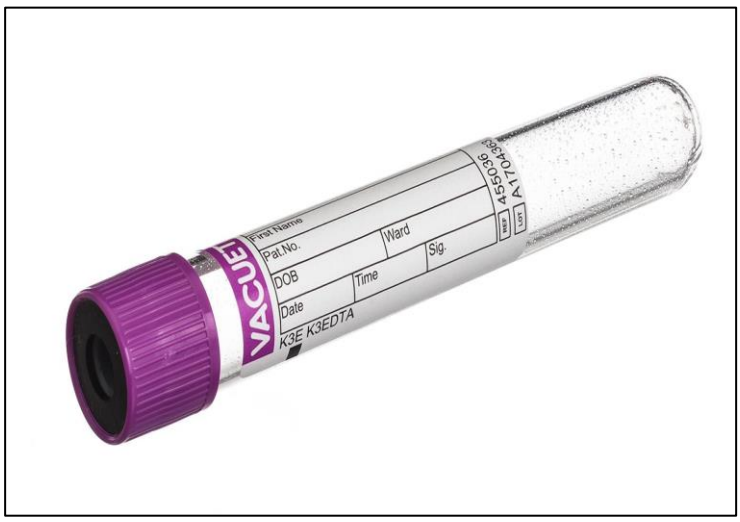
4. Documentation : It involves maintaining accurate records of sample collection , processing and result and ensuring compliance with regulatory standards and protocols.

5. Safety Procedure : It involves following biosafety protocols to handle blood and Biohazard materials and proper disposal of sharp and other hazardous waste

These are the activities that are essential for ensuring accurate diagnostic result and maintaining patient safety within the laboratory setting.

3.2 PICTURES OF SOME EQUIPMENT IN THE PHLEBOTOMY LABORATORY

ETHYLENEDIAMINETETRAACETIC ACID



THE VACUTINER HOLDER

3.3 SAMPLE SORTING ONE

Sample Sorting One laboratory Involves organising and separating blood samples for efficient processing and analysis. Some of the activities include;

1. Receiving Samples: It involves accepting samples from various sources like the phlebotomy laboratory and the clinical department and verifying the samples and then documenting the samples.

2. Label Verification : It involves confirming that all samples are correctly labelled with the patient information on two sample bottles,one for storage and one for running and avoiding cross contamination.

3. Centrifugation: This is the main technique in the laboratory and the procedure includes;

- Place samples in the centrifuge tube inside the centrifuge machine
- Balance the centrifuge by placing tubes opposite each other
- Set the centrifuge to the appropriate speed which is 200 rpm for 20 minutes
- After centrifugation observe the layer formed in the tube ; plasma at the top, the buffy coat at the middle layer containing the white blood cells and platelets and then the red blood cell at the bottom
- Then we pipette the plasma from the blood into the sample tube that we labelled previously
- Then we store the samples.

4. Documentation : We also ensure to write out the patient samples ID and the test into the file for reference purposes.

5. Safety Precaution: We ensure to follow the biosafety rules by making use of our hand gloves , laboratory coats, and ensuring to make use of the clean area in the laboratory .

3.4 SAMPLE SORTING TWO

The activities in this laboratory simply involves the arrangement of samples into the racks.We get samples from the institute into this laboratory then we manually separate them by following the samples ID and arranging them accordingly into the racks.

The equipments used are the hand gloves and the laboratory coat

3.5 SEROLOGY

The serology laboratory focuses on the study of serum and other bodily fluids to diagnose diseases and assess the immune responses. It simply involves the testing of antibodies and antigens in a sample. The procedure varies depending on the test we are to carry out by following the procedure on the kit.

Procedure for Hepatitis B surface antigen

Materials Needed:

1. Blood sample (serum)
2. HBsAg ELISA test kit (including reagents, controls, and microtiter plates)
3. Pipettes and tips
4 Microplate reader
5 Centrifuge
6 Test tubes
7 Wash buffer
8 Substrate solution
9 Stop solution
10 Personal protective equipment (gloves, lab coat, goggles)

Procedure Steps:

- Sample Collection:
    1. Collect blood via venipuncture.
    2. Allow the blood to clot, then centrifuge at 3000 rpm for 10 minutes to separate serum from blood cells.
    3. Transfer the serum to a labelled test tube.
- Preparation of Reagents:

1. Prepare the wash buffer as specified in the kit instructions.
2. Reconstitute any dried reagents if necessary.

- Setup of the ELISA Plate:
    1. Label the wells of the microtiter plate for samples and controls.
    2. Add 100 µL of serum sample to designated wells.
    3. Include positive and negative controls as per kit guidelines.
- Incubation:
    1. Cover the plate and incubate at room temperature (or as specified) for 1-2 hours.
- Washing:
    1. Wash the wells 3-5 times with a wash buffer to remove unbound substances.
- Adding Detection Antibody:
    1. Add 100 µL of enzyme-conjugated secondary antibodies to each well.
    2. Incubate for an additional hour at room temperature.
- Second Washing:
    1. Wash the wells again 3-5 times with a wash buffer.
- Substrate Addition:
    1. Add 100 µL of substrate solution to each well.
    2. Incubate in the dark at room temperature for 15-30 minutes until colour develops.
- Stopping the Reaction:
    1. Add 50 µL of stop solution to each well.
- Reading the Results:
    1. Measure the optical density (OD) at 450 nm using a microplate reader.
    2. Compare OD values against the controls.
- Interpretation of Results:
    1. A positive result indicates the presence of HBsAg; a negative result indicates its absence.
    2. Document and report findings according to laboratory protocols.
- Quality Control:
    1. Ensure that positive and negative controls yield expected results to validate the assay.

3.6 MOLECULAR DIAGNOSTICS

The molecular diagnostics laboratory which is also known as viral load is where we count the amount of virus present in an HIV or Hepatitis B blood sample. We make use of the plasma while running this test. The technique involved in this laboratory is the COBAS 8800 and the COBAS 6800 machine and the difference between them is that the COBAS 6800 has one processing module and one analytical module while the COBAS 8800 has two processing modules and four analytical modules .

COMPARTMENT AND FUNCTION IN THE COBAS MACHINE

1. SAMPLE SUPPLY

The sample supply is where the samples are placed for scanning and it detects any form of error in the barcoding or the samples

2. SAMPLE TRANSFER MODULE

The transfer module is where secondary aliquoting takes place, the machine need only 500 microliter of the sample so while doing the primary aliquoting we ensure that the volume is more than 500 microliter and then three controls which are the ; Negative control, High positive control, Low positive control and the purpose of these controls is for ensuring accuracy, reliability and validity of test results.The total amount of samples that the machine can run is 93 samples added with the controls giving it a total of 96 samples.

3. SAMPLE PROCESSING MODULE

The sample processing module is where DNA or RNA extraction takes place .We have lysing reagent, the washing reagent and the waste product. The lysing reagent helps to break down the cell component and it breaks it in a way that the DNA or RNA remains intact and then we have the magnetic glass particles (MGPS) that binds to the nucleus of the cell or the RNA to prevent it from being lysed and then the wash will take off any other cell component that has been broken down, we then use the eluent buffer to separate the RNA from the MGPS and the end product of the processing module is known as the ELUENT which is going to move to the analytical module.

4. ANALYTICAL MODULE

In this module, polymerase chain reaction takes place(PCR).If the sample is in DNA form the PCR takes place directly but if it in RNA form, it goes through the reverse transcription process where the RNA is reversed to a complementary DNA .We also have the Master mix that contains the Deoxynucleotide triphosphate (DNTP),primers and magenisium

chloride and taq polymerase The DNTP serves as an energy source and the resultis called AMPLICON .

INTERPRETATION OF RESULT

1. Level of Quantification: This is when the machine can quantify the amount of the virus which is above 20
2. Level of Detection : This is when the machine detects the sample but cannot quantify it, and it is less than the titre minimum
3. Target Not Detected: This is between the level of detection and no virus being present.It means the patient is virally suppressed or the sample is negative.
4. Less than Titer minimum: This is when the sample is lower than 20, it is between the level of detection and level of quantification.

3.7 CLUSTER OF DIFFERENTIATION 4 (CD4)

The CD4 test is a blood test that measures the number of CD4 cells (a type of white blood cell) in the blood, which are crucial for the immune system, especially in individuals with HIV.The benchmark for the test 200 which means any value we get that is lower than 200 is called a PANIC VALUE .

PROCEDURE FOR CD4 TEST

1. We ensure to clean our Cyflow counter machine by making use of the decontamination fluid, cleaning solution and sheath fluid by placing a certain amount inside the sample pot then allowing the machine to run it and the result should be lower than 5
2. We prepare our CD4 kit and the samples on the clean area and other equipment like the rohen tubes and micropipette
3. Then we measure 20 microliter of the blood sample into the tube and also 20 microliter of the Monoclonal antibody(mAb) inside the same tube, then we incubate in dark space for 15 minutes
4. After incubation, we add 800 microliter of the no lyse buffer solution with the sample and then we mix for homogeneity.
5. Then we place the tube containing the sample and the solution inside the sample pot and we set the machine to run it
6. Then we allow the machine to run the sample, then we read the result
7. Once the machine is done running the sample, it prints out a graph with the result one it
8. If the result is less than 200 then it is known as the panic value and the patient is at higher risk of having AIDS.
9. We also carry out this test by ensuring that we follow the biosafety rules by using our gloves, laboratory coat and ethanol.

3.8 SUMMARY OF ATTACHMENT ACTIVITIES AND ITS RELATIONSHIP MICROBIOLOGY

At the NIMR,I began my SIWES from the CD4 laboratory where i spent 2 weeks and i was taught about the whole process and also read the Standard Operation Procedure(SOP), then i was moved to Sample Sorting One where i learnt how to centrifuge and separate blood samples and i spent one week there and then i moved to separation two where i learnt how to arrange samples and store them which i also spent one week, then i was moved to the phlebotomy department where i learnt about the principle on how to collect blood samples, and i spent 2 weeks there, then i was moved to the serology laboratory where i learnt how to test for the antibodies and antigens in a sample which i also spent 2 weeks then i spent the last three weeks in the molecular diagnostics laboratory where i learnt about the principle of the COBAS machine and how it counts the viral load of a sample.

Virology is a part of microbiology that is quite important because the whole world is filled with virus of different species and people get infected every time, which makes the microbiology department bring awareness and treatment for these viral diseases.

4.2 CHALLENGES ENCOUNTERED

Adapting to the long hours of work during the weekdays was a great challenge coupled with tedious transportation and traffic . But in all the process made me stronger and prepared me for what is to come in the future

4.3 CONCLUSION

National Institute of Medical Research (NIMR) has widened my analytical skills and exposed me to various analysis, i acquired the necessary skills in blood collection and how to carry out different test and I understood the principle of some of the machines .