UNIVERSITY OF CAPE COAST

INFLUENCE OF CHEMISTRY TEACHERS ON STUDENTS' PERFORMANCE IN LEARNING HYDROCARBONS IN SENIOR HIGH SCHOOLS

BY

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Thesis submitted to the department of Science Education of the Faculty of Science and Technology Education, University of Cape Coast, in partial fulfillment of the requirement for award of Master of Philosophy Degree in Science Education.

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: ……………………………………… …... Date: 25/09/2023 ………………

Name: David Osei Mensah

Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature………………………………. Date: ………………

Name: Dr. Kenneth Adu-Gyamfi

ABSTRACT

Hydrocarbon, an aspect of organic chemistry, is an important part of the school curriculum, yet student performance in it is still quite poor across the world, including Ghana. Hence, this research studied teacher influence on students' performance in learning hydrocarbons in selected senior high schools (SHS) in Jaman North District of the Bono Region of Ghana. Through explanatory sequential mixed methods design, 298 SHS2 science students selected by census from four schools participated in the research to find out the teacher influence on their learning of hydrocarbons. Three research instruments, Form Two Students' Questionnaire, Form Two Students' Achievement Test, and Form Two Students' Interview Guide, were used as a guide to gather both the quantitative and qualitative data. The quantitative data were analyzed using exploratory factor analyses and multiple regression whereas the qualitative data was analyzed using themes. The study discovered that teacher competency, teacher attitude, and teacher methodology all had an impact on students' academic achievement. Furthermore, among the teacher characteristics, teacher competency had the greatest effect on students' academic routines when studying hydrocarbons. Qualitatively, the problems teachers encountered which affect students in learning hydrocarbons were teacher encouragement, teacher guidance, teacher classroom management, and teacher time management. Some recommendations were made including the Department of Education through the Education Service in Ghana in collaboration with the teacher education universities should organise short courses to enrich the competence of the teacher's teaching chemistry in the SHS's in the Jaman North District.

KEYWORDS

Attitude

Competence

Hydrocarbon

Methodology

Students' performance

Teachers

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DEDICATION

To my beloved parents, Pastor Abraham Burns Mensah and Mrs. Rosemary Mensah.

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CHAPTER ONE

INTRODUCTION

Ghana like other developing countries invests heavily in the teaching and learning of organic chemistry. However, this high input of resources does not seem to reflect in the performance of students. This chapter introduces the study on teacher influence on the performance of students in hydrocarbons by giving the background to the study and the statement of the problem. Also included in this chapter are purpose of the study, research questions, significance of the study, limitations, delimitation, and organisation of the rest of the study.

Background to the Study

One of the most exciting areas in modern sciences is organic chemistry, with particular applications in new materials, future drugs, and nanotechnology (Graham, 2008). This is evident in the spectrum it covers. The areas which are found in organic chemistry are: hydrocarbons, alkanols, and alkanoates alkanoic acids, and their derivatives. Hydrocarbons are broad class of organic chemical compounds that are found as petroleum deposits in the forms of oil and gas in different reservoirs, bitumen in oil sands, coal, and clathrate hydrates (Hazen, 2013). A few of the most important gaseous hydrocarbons are methane (CH_4), one of the natural gases, butane (C_4H_{10}), propane (C_3H_8), ethane (C_2H_6), and among many others. Petroleum is primarily composed of two types of hydrocarbons: paraffin waxes, which are solid hydrocarbons, and a complex combination of linear and cyclic hydrocarbons from C_5 to C_{17}, as well as countless other molecular species (typically from C_{18} to C_{40}). Hazen again claims that organic minerals and a variety of rare pure crystalline hydrocarbon phases can occasionally be found in coal deposits.

The molecules that make up the organic substances known as hydrocarbons are made of carbon and hydrogen atoms (Bergman, 2007). The homologous series that hydrocarbons make up exhibit's regular variations in their starting structure, general formulas, and chemical and physical characteristics (Wilkes & Schwarzbauer, 2010). According to Bergman (2007), hydrocarbons can be found in nature in gaseous, liquid, and solid phases. Depending on the kinds of carbon-carbon bonds that are present, there are numerous sorts of hydrocarbons. In other words, there are three primary groups of hydrocarbons: saturated hydrocarbons, unsaturated hydrocarbons, and aromatic hydrocarbons. These different hydrocarbon kinds are all employed for a variety of human-beneficial purposes.

Hydrocarbons are essential to our everyday life. They act as a natural gas and fuel source. Compounds like methane, propane, butane, and hexane are examples of hydrocarbons. Their chemical formulations contain just carbon and hydrogen atoms in different ratios and chemical combinations (Schobert, 2013). Zhang, Xu, and Champagne (2010) posit that the natural compound (hydrocarbons) can be used as fuel in our homes and industries to release energy, which is relatively cheaper and environmentally friendly. Hydrocarbons provide energy quickly and are moderately reliable. Since hydrocarbons are a naturally occurring substance, the quantity of carbon dioxide emitted can be managed. Further refinement can also minimize the quantity of other gases emitted, such as sulphur contaminants (Aaron & Tsouris, 2005).

According to Clark and York (2005), carbon dioxide is a greenhouse gas and a major component of hydrocarbon, when they undergo combustion, it accumulates radiations of heat on the earth surface and serves as a major cause of global warming, which is a major world problem. Burning a hydrocarbon with insufficient air (oxygen) causes incomplete combustion, which results in the emission of the toxic gas which is carbon monoxide. Carbon can be discharged as soot and smoke when the air supply is severely constrained. The solid particles may irritate the airways of the respiratory system of humans and other living organisms. The particles in soot reflect the sun's rays back away from earth, contributing to global darkening or dimming. It is important to remember that larger problems demand larger molecules, which need more oxygen to burn (Clark & York, 2005).

According to Morris and Wheatley (2008), oil and coal which are examples of natural fuel (hydrocarbon) contain sulphur compounds. When hydrocarbons are burnt, they release sulphur dioxide, which causes irritant to the respiratory system of living organism. The sulfide dioxide that is released into the atmosphere may be absorbed by rain, which results in acid rain that erodes limestone structures and alters the pH of the soil, making it less productive for farming.

Hydrocarbons serve as the source of most items and artifacts used in our daily activities. Some of these items include plastics, fibers, rubbers, solvents, and explosives. From Rubin (2008), Numerous polymers or plastics that we use on a daily basis and in industry are made from lengthy monomer chains that are generated from petrochemicals. These hydrocarbons, which come in various chemical forms, are what these petrochemicals are. Paraffin wax is a different hydrocarbon product that is used to make a variety of products, including ceramics, carbon paper, stylus paper, accurate casting and absorbing decorative plates, packaging, electronics, textiles, candles, crayons, and matches (Jetter & Kunst, 2008). Additionally, paraffin may be used as a starting material, an additive, or a modifier when creating luxury candles as well as many types of candles for industrial or domestic usage. It can also be utilized as a starting material when creating face cream and other types of numerous cosmetics (Blanc, 2007). Asphalt, which is the chemical that most people are most familiar with, is actually tar, a heated hydrocarbon. It is then mixed with other crucial industrial ingredients to create the combination that makes up the road's surface (Tan & Guo, 2013). In light of the above characteristics associated with hydrocarbons, it is positioned as a very important aspect of organic chemistry. Hydrocarbon is related to the economic heart of every highly developed industrialised and technologically advanced society (Burmeister et al., 2012). The teaching and learning of hydrocarbons in the classroom have significant and important roles towards technological development of a developing nation. Due to the fact that economic, ecological, and sociological aspects all depend on hydrocarbons, they are a part of our everyday lives (Hofstein et al; 2011).

Hydrocarbons as a topic needs to be guided by a curriculum to enable the student acquire the necessary knowledge and skills (Duggan & Gott, 2002). According to the Ministry of Education [MOE] (2010), the chemistry curriculum provides a laid down procedure to the learning of hydrocarbon and depicts what the students should learn and be able to demonstrate after being taught in the classroom. Students should acquire the structural equations, systematic naming of hydrocarbons, and an introduction to a few homologous series of hydrocarbons from the curriculum. After going through the introduction to hydrocarbons, student should be able to provide systematic names, general formulas, condensed formulae, and structural formulae for alkanes, alkenes, and alkynes. They should also be able to recognize certain hydrocarbons by their common (trivial) names, derive the structures of hydrocarbon compounds from their systematic names, and comprehend how functional groups and the length of carbon chains affect the physical characteristics of hydrocarbons.

From MOE (2010), Students should also be taught about the structural isomerism of hydrocarbons, the cis and trans isomerism of hydrocarbons, which is illustrated by acyclic carbon compounds with one C=C link, and the enantiomerism of hydrocarbons, which is illustrated by hydrocarbon compounds with one chiral carbon. After learning about the isomerism of hydrocarbons, students should be able to: identify and anticipate structural isomerism, such as isomers with the same functional group and isomers with different functional groups, after studying about the isomerism of hydrocarbons; detect the occurrence of cis and trans isomerism in acyclic hydrocarbon compounds as a consequence of two or more compounds having the same molecular formula but different structures; recognize the existence of enantiomerism in compounds with just one chiral carbon; forecast the structures of the isomers of certain given hydrocarbon compounds; and utilize structural formulas and molecular models to depict the arrangement of atoms in isomers of hydrocarbon compounds (MOE, 2010).

The student should also study from the curriculum about the usual reactions of the several functional groups of hydrocarbons, including alkanes, alkenes, alkynes, and haloalkanes. Then, using reagents, reaction conditions, and observations, students should be able to explain the following reactions:

i. alkanes: substitution with any given halogens.

ii. alkenes: the addition of hydrogen, halogens, and hydrogen halides.

iii. haloalkanes: replacement with OH(aq). (MOE, 2010, pp. 51-53)

After completing the SHS chemistry curriculum's section on hydrocarbons, students are encouraged to demonstrate their learning through a number of learning opportunities. The students should be able to perform experiments like making 2-chloro-2-methylpropane from 2-methylpropan-2-ol and build molecular models of compounds with various functional groups, compare the physical properties of propane, butane, and pentane, look up common trivial names for common hydrocarbons, and predict the structures of their isomers. (MOE, 2010, pp. 51-53).

Students are expected to acquire certain values and attitudes, such as an understanding of how science and technology help us create useful products, an understanding of the versatility of synthetic materials and the limitations of their use, an understanding of the risks associated with the use and disposal of carbon compounds in laboratories and the precautions that must be taken, an understanding of the importance of environmental conservation, and a sense of shared responsibility for sustainable development (MOE, 2010, pp. 51-53)

These ideas and attitudes may be fostered by teachers, and student achievement in science-based classes like chemistry is directly tied to their theoretical and practical understanding. While some subjects are taught independently of the discovery process or conceptual applications, others depend only on the subject being covered in different courses and specific elements both within and outside of the teaching and learning environment (Ejidike & Oyelana, 2015). This suggests that a teacher is not the only factor affecting a student’s success.

As an aspect of organic chemistry, hydrocarbons consist of sub-topics that can be verified experimentally with an objective to create enabling environment to stimulate students’ learning about organic chemistry (Read & Kable, 2007). That is, to say with a firm foundation and proper understanding in hydrocarbons students can undertake the study of organic chemistry on their own due to the practical nature of the subject. When the teaching of hydrocarbons is effective, it will ensure the creation of a scholastically rich and rewarding environment for the students to learn the basic tools of science (Frank & Saxe, 2012).

One of the elements affecting how well students are educated is the quality of their teachers. As a result, educators and academics have been quite concerned about the effect of teachers (Avramidis & Norwich, 2002). In a sociological sense, a teacher influence serves as a type of social control in addition to being important for reputation and differentiating students from students in other professions (Johnson, 2013). It is abundantly obvious that in order for students to succeed in a learning environment, emphasis must be made on the caliber and competency of the instructor and his or her impact on the academic lives of students. Therefore, choosing an effective teacher is crucial for everything from student success rates to the general classroom climate. Kwok (2007), asserts that the teacher's influence contributes to the creation and maintenance of a positive learning environment, effective classroom management, and high standards of instruction.

If a teacher is to abide by the stated objectives and guidelines in the MOE (2010), students ought to be well equipped to properly understand, appreciate and well prepared to answer questions on hydrocarbons. The reality, however, is the WAEC Chemistry Chief Examiner reports (WAEC 2011; 2012; 2013; 2014; 2015; 2016; 2017) on students' consistent below average performance on organic chemistry. Since hydrocarbon marks as one of the significant and major components of organic chemistry, it seemed appropriate to investigate how SHS chemistry students perform in this area during their examination and the influence their teachers have on their performance.

Statement of the Problem

Poor academic performance, according to Aremu (2003), is a performance that is adjudged by the examiner and some other significant personnel as falling below an expected standard. With reference to the curriculum for chemistry (MOE, 2010), organic chemistry is typically taught in SHS 2. Before the WASSCE examination, chemistry students are supposed to grasp the concepts, yet persistent reports from the WAEC chief examiner show that a significant portion of WASSCE candidates are unable to respond to questions on hydrocarbons in the final examination of the chemistry subject. (WAEC 2011; 2012; 2013; 2014; 2015; 2016; 2017; 2018; 2019; 2020). The results of a research done in Ghana by Adu-Gyamfi (2011), which corroborated the conclusions of the chief examiner's report from the WAEC on the general weakness of SHS chemistry students, showed that students experienced difficulties in understanding the IUPAC nomenclature of organic compounds. According to Adu-Gyamfi, the students have difficulties to name and write the structural equations for the hydrocarbon's alkenes and alkynes according to IUPAC standards.

In addition, Kwarteng (2014) revealed that the students cumulative pass at grades of D7- E8 in 2013, in chemistry, was 53%. Only 31% of candidates at that time had grades from A1 – C6. The grades for 2014 and 2015 were not much different from the previous year. According to the chief examiner's report (WAEC, 2011), the trend of the performance of students who tackled hydrocarbons questions was very poor. Students were not able to give the effect of CH_4 in question 6d. The 2011 report indicates that most students who answered that hydrocarbon question were confused in answering (WAEC, 2011, pp. 29, 37). According to the Chief Examiner's report (WAEC, 2012), the students were unable to construct or draw the required diagram to demonstrate the formation of the C=C double bond in an alkene (p. 32). In addition to the inability of students to effectively answer questions on hydrocarbons, students were unable to explain the terms given and the characteristics of the homologous series (WAEC, 2013) (pp. 227-230). The situation was no better in 2014. This is because only few students attempted the questions on hydrocarbons. This indifference to the hydrocarbon questions could be attributed to the inadequate preparation of the students or the usual fear of organic chemistry (WAEC, 2014, p. 13).

From the reports, most students defined isomerism as a compound instead of a phenomenon. In 2015, students were asked to give the appropriate name to the procedure by which lighter or less heavier hydrocarbons are obtained from heavier ones, most of them named the process as cracking and in the same report most of the students were not able to deduce the total mass of carbon that was burnt in 30 minutes. Hence, went through the calculation with 0.5g of carbon that made their subsequent determinations wrong when a given sample or amount of carbon was burnt at a rate of 0.5g per second (WAEC, 2015, pp. 23-25). In 2017, the report further indicated the inability of students to draw and name the isomers of C_4H_8 that was represented by X in question 3a (WAEC, 2017, p. 258). According to the report from 2018, the majority of candidates could not even write the formula for the geometric isomer of cis-but-2-ene, which produces a trans isomer in question 5dii, much alone describe what geometric isomerism is. (WAEC, 2018, p. 298). In 2020, the candidates were asked to provide an explanation for why the energy of the C=C bond is more but not twice as much as the energy of the C-C bond in question 4ei. According to the report, the candidate was unable to provide this explanation. The same assessment noted that the candidate did not understand that the sigma bond is stronger than the pi bond and that one of the bindings in C=C is pi and the other is sigma (WAEC, 2020, p. 391).

An achievement was conducted and marked on the hydrocarbon and the results that was obtained by the respondents was not different from the chief examiner's report from the WAEC on the general weakness of SHS chemistry students (Appendix E). From the achievement test, only few students were able to complete the equation of one mole of ethane (C_2H_6), ethene (C_2H_4) and ethyne (C_2H_2) but were not able to write a balanced equation to complete the combustion of one mole of each, hence were not able explain why ethyne was the most economical to be used as fuel in question 1a. Most of the students were not able to write the isometric alkanols of the molecular formular C_6H_{14} in question 1b. In the achievement test majority of the respondents were not able to deduced the empirical formular of a compound which gave the following elemental analysis C=56%, H=3.9% and Cl=27% by mass in question 1cii. Again, in the achievement test on question 2b, four compounds were wrongly named and the respondents were asked to draw their structural formulae and give the IUPAC names and the majority of the respondents could not even draw their structural formulae likewise able to give the correct IUPAC name.

A critical consideration of the WAEC chemistry chief examiner's reports and the achievement test presented above show that students have difficulties in learning hydrocarbons which have led to the poor performance in the concept. These difficulties could be that schools lack teaching and learning resources, teachers' inability to complete the content of the curriculum, time availability, lack of school facilities, overloaded curriculum, students background, bad reading habits, student lack of interest and mind-set, and too much engagement in one activity or the others (Danili & Reid, 2004). Hence, there was the need to study the influence of teachers on the academic performance of students in hydrocarbons. This is true because education involves social impact. Students' learning is influenced by teachers. Teachers must devise strategies for altering the attitudes, beliefs, and behaviors of their students if they are to motivate them to learn. Teachers have a significant influence on how well students are doing overall. A facilitator who inspires students to realize their greatest potential is a teacher. either via exuberance, demonstration, or encouragement.

Teachers are much more than just people who are driven to keep everything in line. Teachers have the second largest influence on students' lives after their immediate families and serve as their "parents" while they are in school. Beyond test results, teachers have an impact on students' lives because they impart life skills and encourage positive attitudes. As a result, different teaching philosophies, attitudes, and content comprehension can affect students' self-efficacy in particular domains, classroom happiness, and classroom behavior.

Many of the students in the class lack confidence in themselves. A student's academic interests and ability to participate in class may be affected by self-esteem problems. Teachers may help end this issue once and for all by therapeutically training and motivating students with kind gestures, compliments, one-on-one tutoring, and other little advantages like positive feedback on assignments. It is the responsibility of the instructor to arouse and sustain a student's interest in a subject. A teacher who encourages students to develop a passion for particular subjects in order to assist them overcome academic obstacles is nothing short of brilliant. Students will learn more effectively when their teachers include them in activities and use creative teaching techniques.

Purpose for the Study

The main purpose for this study was to find out the teacher influence on students' performance in learning hydrocarbons in selected SHS in Jaman North District. Specifically, this study aimed at:

1. exploring the teacher factors that influence students' performance in hydrocarbons.
2. examining the teacher factors that influence most the academic performance of students in hydrocarbons.

3. exploring the teacher factors that students encounter as learning challenges in hydrocarbons.

Research Questions.

The study sought to answer the following research questions in order to make decision and recommendations for policy makers:

1. What teacher factors influence students' academic performance on hydrocarbons?
2. What teacher factors do students encounter as learning challenges on hydrocarbons?

Hypothesis

H_1: Teacher factors have influence on students' academic performance on hydrocarbons

H_0: Teacher factors have no influence on students' academic performance on hydrocarbons

Significance of the Study

The findings on teacher factors that influence the learning of hydrocarbons by students will aid teachers in the various SHS to understand and properly appreciate their influence in the teaching and learning process. This would help teachers to adopt classroom management practices that influence student learning positively. The Ghana Education Service could organise professional development programmes that would train teachers in modern and positive classroom management styles that suit the Ghanaian context and would have positive effects on student learning chemical concepts.

In addition to this, the study would be beneficial to teachers to adapt effective teaching environment in their instructional period so that their attitudes and competence could have positive influence on the performance of their students in hydrocarbons. This is because the performance of students in hydrocarbons is expected to be influenced by the learning environment created as a result of teacher's attitudes and competence.

Once again, the conclusions regarding the factors that most accurately predict students' performance in hydrocarbons could serve as the foundation for future research by other scientists who would pursue additional investigations into why students in senior high schools perform poorly academically in organic chemistry. This is an opportunity for chemistry instructors and teachers to give their students the scaffolds they need to learn chemistry.

Delimitation

Since organic chemistry encompasses a wide range of topics, it will be extremely challenging, if not impossible, to cover all in one academic term. This led to the study being restricted to an introduction, IUPAC nomenclature, reactions, and the synthesis of alkanes, alkenes, and alkynes.

Also, the study was delimited to only six public schools in the Jaman North District since they were the institutions offering the General Science programme.

Furthermore, due to the fact that the factors that determine teacher influence are many, the study was delimited to only those that could be experience during the teaching and learning process.

Limitation

The study was conducted in only one district assembly in the Bono Region of Ghana. Hence, the findings from the study cannot be generalised to all schools in even the Bono and Ahafo Regions and let alone to be generalised to all Ghanaian SHS.

Organisation of the Study

This research was divided into five chapters. In other words, Chapter One and the four succeeding chapters are designed to explain the concerns raised in the prior chapter. Chapter Two covers earlier research that is relevant to this topic. The areas are concept of influence, concept and importance of hydrocarbons, teacher factors in the academic performance of students, teacher influence on students' performance, and conceptual framework for the study.

In Chapter three, the research design, variables, study location, target population, sampling methods, and sample size are all taken into account. Additionally, it offers research tools, methods for gathering data, software for processing and analyzing data, and ethical considerations.

Chapter Four presents the data analysis findings. Chapter Four also includes descriptions of the research findings that came from the outcomes.

This chapter will follow the research questions and any ensuing hypotheses as a guide. The thesis's fifth and final chapter is titled Chapter 5. It considers summary of the research, conclusions, recommendations, and suggestions for further studies.

CHAPTER TWO

LITERATURE REVIEW

This chapter reviews literature that could help in making decisions on teacher influence on students' performance in hydrocarbons. This chapter is divided into three main parts namely; theoretical review of related literature, empirical review of related research works and the conceptual framework. The main areas in this chapter are;

1. Concept and importance of hydrocarbons,
2. Concept of influence,
3. Teacher factors in academic performance of students,
4. Teacher influence on students' performance, and
5. Conceptual framework of the study.

Concept and Importance of Hydrocarbons

Hydrocarbons are organic molecules consisting entirely of carbon and hydrogen (Denniston, 2004). Depending on the type of bonding they have, hydrocarbons have various chemical and physical characteristics (Green & Wittcoff, 2003). There might be one or more of these ties. The Earth's crust is made of hydrocarbon gas, often known as natural gas, which results from the breakdown of organic materials (Anastas & Warner, 2000). It is a mixture of different hydrocarbons that condense into liquids at different temperatures. However, it's interesting to note that once united, hydrocarbons also form bonds with other atoms to produce organic molecules. (Serrano-Ruiz & Dumesic, 2011).

In all but a few instances, a chemical compound must contain carbon in order to be termed organic; the inclusion of a hydrocarbon adds even more support for this classification. This is due to the fact that there are a few inorganic compounds that contain carbon but not hydrogen (Tro, 2010). In contrast to the bonds in inorganic compounds and organic compounds without a carbon atom, the presence of a hydrocarbon in an organic molecule indicates that the bonds between the atoms are exceptionally strong. Hydrocarbons are categorized as either impure (hydrogen or carbon attached to other atoms as well) or pure (just hydrogen and carbon) based on the presence of other atoms (Anastas & Warner, 2000).

Among all known organic molecules, hydrocarbons are the most widely used and are essentially what propelled Western civilisation (Denniston, 2004). The majority of hydrocarbons are used as fuel for combustion, mostly in heating and in the motors of cars and other vehicles. Natural gas mostly consists of methane and ethane. Gas grills, lights, heating systems (modern ovens), and internal combustion engines all run on propane as fuel. The fuel butane, which comes in the shape of a pocket lighter, is likewise easily accessible. With pentane, the saturated hydrocarbons move into the world of room-temperature liquids. As a result, they can be used as organic solvents, cleaners, and transportation fuels. The combustion properties of gasoline for internal combustion engines in cars, trucks, tractors, and lawnmowers are rated in relation to octane. It is actually a blend of liquid hydrocarbons ranging from hexanes to decanes. (Ritchie et al., 2001).

Kerosene or jet fuel, diesel fuel, and heating oil are examples of slightly larger hydrocarbons. Lubricating oil and greases are made from even larger hydrocarbon molecules. Eventually, the materials reach a point where they are solids at room temperature. The waxes are as follows. Heavy greases and tars with hydrocarbon molecules larger than those of waxes are commonly used in roofing applications and highway construction (Read & Whiteoak, 2003). The majority of hydrocarbons are produced by thermal cracking and fractional distillation of crude oil. Another significant source is the industrial conversion of ethanol to ethylene. The ethylene thus produced is used as a feedstock in the industrial synthesis of other hydrocarbons, including polyethylene. (Olah, 2005).

Science is generally viewed as being important to the economic well-being of nations and also in relation to the need for a scientifically literate citizenry (Laugksch, 2000). Knowledge of science in all its aspects, specifically hydrocarbons, is a requirement in almost all countries due to the numerous challenges of mankind (Norgaard, 2010). Science as an instrument of development plays a dominant role in bringing about societal changes by advancing development, promoting national wealth, improving health and industrialization (Phillips & Shonkoff, 2000). A fair and in-depth idea about the concept of hydrocarbons contributes immensely to national development. A typical case in study is the utilization of the various components of crude oil and its various by-products. The various types and uses of hydrocarbons have rendered the teaching of hydrocarbons a core necessity in the science education of the society (Bridge, 2008).

Approximately 10 million chemicals, including compounds derived from live beings and those created by chemists, are listed in the largest database of organic compounds. (Da Silva & Williams, 2001). According to estimates, there are 1060 possible chemical compounds, which is an absurdly large amount. Because carbon atoms can make up to four strong bonds with other carbon atoms, creating chains and rings of various sizes, forms, and complexity, which make up a large number of organic compounds (Steiner, 2002).

Hydrocarbons are the most basic organic molecules, consisting merely of the atoms carbon and hydrogen (Da Silva & Williams, 2001). Even though there are only two types of atoms in hydrocarbons, they can have a broad variety of lengths, branching chains, rings of carbon atoms, or a mix of these structures. McCarthy and Thaddeus

(2001), also point out that several carbon-carbon bond types may be found in hydrocarbon compounds. This results in different geometries and hybridization of the carbon orbitals. Numerous hydrocarbons have been found in plants, animals, and their fossilized forms. Other hydrocarbons have also been created in laboratories. Alkanes, also known as saturated hydrocarbons, are hydrocarbons in which the carbon atoms only have one covalent bond (Williams & Da Silva, 2001). In an alkane, each carbon atom possesses four additional atoms that are either carbon or hydrogen atoms and are connected to them through sp^3 hybrid orbitals. Figure 1 shows the methane, ethane, and pentane of Lewis structures and models.

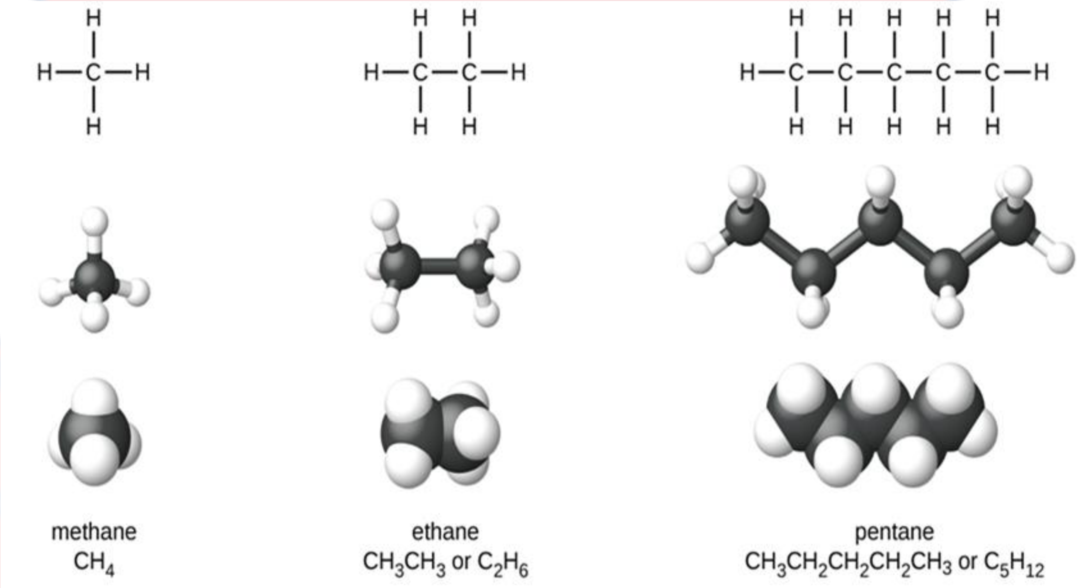

Figure 1. Drawings of Lewis structures, ball-and-stick models, and pentane, ethane, and methane space-filling models.

Lewis structures typically depict carbon chains as straight lines, but it's important to keep in mind that they are not meant to represent the molecular geometry. (Da Silva & Williams, 2001). It should be noted that the carbon atoms in the pentane molecule's structural models (the ball-and-stick and space-filling models) do not lay in a straight line. Due to the sp^3 hybridization, carbon chains in an alkane have bond angles that are about 109.5°, giving them a zigzag shape.

Condensed structural formulae can also be used to express the structures of alkanes and other organic compounds less precisely, according to Da Silva and Williams (2001). To convey the bonding in the molecule, a condensed formula is used rather than the typical style for chemical formulae, in which each element symbol appears just once. These formulae resemble a Lewis structure that has had most or all of its bond symbols deleted.

Organic chemists frequently employ a skeletal structure, also known as a line-angle structure, to streamline the representation of bigger molecules in their drawings (Da Silva & Williams, 2001). The carbon atoms in this kind of arrangement aren't represented by a 'C' but rather by the ends or bends of lines instead. Atoms of hydrogen that are bound to a carbon atom are not depicted. The elemental symbols for atoms other than carbon and hydrogen stand in for those atoms. Figure 2 depicts the same structure in three distinct ways.

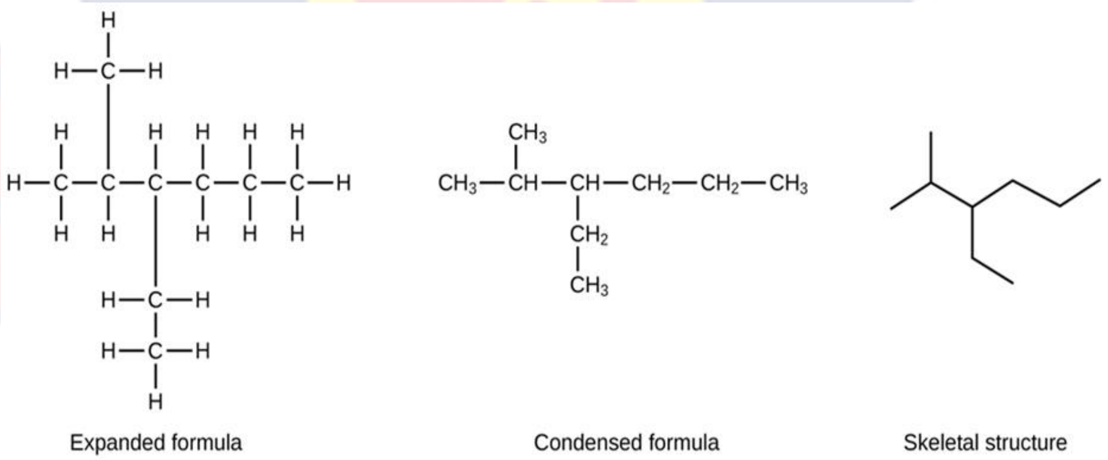

Figure 2: Three different ways of representing a hydrocarbon by condensed formula, and a skeletal structure.

According to Potoff and Siepmann (2001), an alkane may contain an unlimited number of carbon atoms. Stronger intermolecular attractions (dispersion forces) are produced when molecules have more atoms, which changes the physical characteristics of the molecules. As the amount of carbon and hydrogen atoms in a molecule varies, the melting and boiling temperatures of most compounds typically fluctuate smoothly and predictably (Williams & Da Silva, 2001).

According to Da Silva and Williams (2001), hydrocarbons having the same formula, such as alkanes, can have various structures. Structures with the same molecular formula called structural isomers (the term constitutional isomers are also commonly used). Constitutional isomers have various atom spatial configurations in their molecules despite having the same chemical formula (Da Silva & Williams, 2001). It is harder than it seems to isolate isomers from Lewis structures. Lewis structures that look different might really be the identical isomers (Da Silva & Williams, 2001).

Concept of Influence

Influence, as defined by Weiner (2010), is "the ability to have an impact on the behavior, character, or developmental trajectory of someone or something, or the effect itself" (p. 29). Every encounter, discussion, response, attitude, and action a person takes has the potential to impact other people. Weiner categorizes influence into four main types as; negative, neutral, positive, and life changing influence.

Negative influence: is the first and most damaging form. Anyone with this kind of influence has a propensity to be selfish, arrogant, and self-centered. The individuals are often egocentric and prideful. It may be quite difficult to persuade others to follow, respect, or pay attention to these kinds of leaders. They have a negative or detrimental effect on the team or organization, primarily by the poor outcomes they produce. The most harmful kind of influence is this one (Lauther, 2011).

Neutral influence: Because this kind of influence has little to no impact on followers' productivity and performance, a person with this kind of influence wouldn't necessarily take any actions that would make them stand out or be recognized as the group's leader. The person does not aggressively take the lead, assist, or manage. These are the people who hold the job or title but do not use it to the team's or organization's advantage. In many cases, the other person (personnel) must take the initiative and inspire themselves to generate outcomes because the leader is not persuading them to do so (Wong & Law, 2002). When educating high school students about hydrocarbons, keep in mind that the first two types of influence should be avoided.

Positive influence: A person who possesses this kind of influence gives value to others and makes them feel better as a result of his or her activities and attitude. In an effort to motivate, coach, and guide people to achieve greater achievements, the person takes the initiative to lead, cultivate connections with others, and be present. The people who lead them will wish to have a good influence on those people's lives and aid in their achievement in all facets of life. Although it takes a lot of intentionality, energy, and work to have a good effect, the benefits will be that everyone will be and perform better as a consequence (Goleman, Boyatzis, & McKee, 2013).

Life changing influence: This is the last and most ideal sort of impact that has the potential to change someone's life. The highest and most useful kind of influence is this one. There aren't many people with this kind of power or influence. To have a life-changing impact, one must lead properly and with good influence over years or decades (Keller, 2001). A life-changing influence is when your actions and words have such a profound effect on a person that they are forever transformed. Long after you have left them, those you have positively influenced continue to be positively impacted. To have a life-changing impact, you must devote your entire life and your entire attention to serving and assisting others in achieving victory and success in both their personal and professional endeavors. Putting aside your own needs and interests in order to provide value to others is what it takes to have a life-changing effect. You will have devoted and devoted others who are prepared to do everything for you, thus the sacrifice is worth it (Hamel, 2001).

Apart from the four main types of influence which have been discussed so far, others have also dealt with the concept of influence. According to Ashkanasy (2006), self-influence is the personal or independent type of influence in which the individual involved has influenced on himself or herself. It is the ability of the individual involved to make changes in his or her life as and when the need be. Another type of influence is the Individual Task Influence. According to Goodwin and Cannon-Bowers (2000), individual task influence has to do with members' roles within a given team and what they do as a team member to help the team (organization, firm, or institution) function. Even though individual efforts are frequently unnoticed, the group effort can have a profound impact. Individual interpersonal influence is viewed by Baron and Morin (2010), as a type of one-on-one parenting, coaching, managing, and mentoring. Everyone has a great chance to change the world by making a good influence in the lives of others. Bringing something into the world that did not previously exist is how Trivedi (2009) defined a professional individual creative influence, a sub-type of professional individual interpersonal influence. This impact is that of a professional therapist or professional coach. High-impact examples of an individual's creative influence include a researcher who discovers a treatment or an inventor who makes a device that improves quality of life.

According to Phelps (2006), organizational leadership influence is the quality that a leader imparts to a group of people (strategy, vision and decision-making). This includes groups of various sizes, from a small club to a sizable nation. Among those with this form of influence are chief executive officers, ministers, managers, board members, and elected politicians.

It is obvious that the various forms of influence play different roles in affecting the performance and overall output of other individuals. For the purpose of this research, the study will consider positive influence because it is the one which has the highest propensity to affect the output of students. O'Connor (2008) revealed that in this modern world teacher's role has become more challenging and demanding. Teachers are more than entrusted with the task of molding the character of students and making them productive members of the society. Learners in their early stages are still in the process of physical and mental development due to the myriads of influences exerted on them (Sroufe, 2005). Caprara, Barbaranelli, Steca, and Malone (2006), revealed that teachers serve as role models for their students, and they have a special opportunity to shape and direct their performance and overall output. Students will understand the significance of the taught good qualities and values if they play their roles properly.

From Sanger (2008), students perform better when they have a teacher with a positive influence on their character. The positive influence of teachers plays a central role in the transmission of virtues to learners (Campbell, 2012). Positive influence of teachers helps to eliminate what is bad and strengthen what is good. At the University of Cambridge, Ashwell (2000), discovered that a teacher's support or encouragement had a favorable effect on students who are on the fringes of university attendance. The study, which is the first to examine the role of student-teacher rapport in university access, utilized big data methodologies to investigate the long-term effects of student-teacher interaction. Additionally, Ashwell thinks that putting greater focus on the relational components of teacher-student interactions might help with policies for education and social mobility. Conrad (2004) discovered that in policy discussions about higher education, teachers are frequently relegated to the roles of course deliverers and classroom managers. However, it is clear that teachers have a greater influence on inequality than is currently recognized.

Hargreaves (2000) asserts that when individuals speak of a positive educational experience, they typically refer to a close connection with a teacher and the support they got. In tackling social mobility in particular, Ashwell (2000) measured the impact and illustrated its significance. The influence of the instructor on the students might be overwhelmed by exam statistics or the fervor of political discourse.

In order to match and compare students with similar attainment, experience, and life histories, Ashwell (2000) employed mathematical modeling, which helped to regulate these disparities. This enables the measurement of the positive teacher influence alone. According to Ashwell (2000), the method makes it plausible for us to predict the long-term impact of instructors' positive influence on students' commitment to attending school. The average rate of entrance into post-16 education was eight percentage points higher among students who said their instructors had a good impact on them (74%) than it was among those who said they didn't (66%) across all backgrounds and abilities (Ashwell, 2000).

According to examination results in the past, a teacher's encouragement and other positive influences had the biggest impact on students who had average academic success. For students in the middle third of the outcome's rankings, positive influence was associated with a 10% increase in the chance of entering a university, but had no impact on students in the upper and bottom thirds. Depending on their backgrounds, students responded differently to good teacher support. Post-16 education enrollment increased 12 percentage points among those who received teacher encouragement (64%) compared to those who did not (52%) for students whose parents lack any type of formal education (Ashwell, 2000).

This first encouragement increased the chance of joining a university by 10%, or one-fifth more, than students from comparable circumstances who did not report getting encouragement. The impact of a helpful instructor appeared to last throughout higher education. Teachers’ encouragement raised students whose parents had some education but none beyond the age of compulsory schooling’s post-16 education by 13 percentage points (67% compared to 54%) and university enrolment by 7 percentage points. However, teacher encouragement had a far smaller impact on children whose parents had university degrees, increasing by just six percentage points and having no effect at all on university enrollment (Choy, 2001).

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Nevertheless, Ashwell (2000) discovered that students that happened to be found in more privileged families were more likely to say that a teacher had motivated them to continue their studies. As an illustration, 22% of students who received support had a parent who had completed their education, as opposed to 15% of those who did not. Comparably, 12% as opposed to 9% of leaners who do not report and account on encouragement are more likely and easily to have a parent who is unemployed. These findings imply that instructors themselves and their interactions with students serve as genuine social mobility engines. In an effort to help students continue learning even after they leave the classroom, many teachers take the initiative to encourage them. It's critical for teachers to understand how their actions affect their students' future achievement.

Teacher Factors in the Academic Performance of Students

From Jennings and Greenberg (2009), teachers constantly contribute significantly to their students' intellectual and moral growth by utilizing a variety of teaching strategies, evaluation tools, and tactics to raise academic success levels. Effective classroom teaching, according to Irvine (2003), demands professional dedication. Exciting encounters might happen unexpectedly, but they are the exception instead of the rule. If teachers want to maintain a success-oriented atmosphere by fostering student learning throughout the academic year, they must consistently and comprehensively address the teaching act, which is predicated on the design and implementation of instructional activities as well as the assessment of students' performance. Planning, execution, and assessment are all components of a continual process in which professional instructors aim to enhance the quality of their education in order to increase student learning. (Danielson, 2011). Teachers' services and working conditions could be one of several factors affecting students' performance. The ability of teachers to perform well professionally and influence students involve a number of factors as; attitude, methodology, and competence. These encompass some of the key factors in achieving high academic performance in schools (Akinfe, Olofinniyi, & Fashiku, 2012).

Teacher Attitude

Meenakashi (2008) argued that a teacher's attitude and motivation have a direct impact on students' ability to learn. If a teacher is enthusiastic about the material being taught, students will learn more readily. Important factors that influence student accomplishment include the behavior and attitude of the teacher (Bernaus & Gardner, 2008). Two very different professors may make the syllabus look differently in the perspective of the students who are studying, according to Boardman as stated in Achola (2003). According to Makena (2011), instructors' attitudes about their work will influence their teaching methods in a way that highlights differences in their students' academic achievement. According to Morgan, Gelbgiser, and Weeden (2013), instructors' behavior and attitudes are significant factors that affect student progress.

According to Mills (2000), improving positive attitude not only increases teacher effectiveness but also aids in making the school more appealing to students. One of the most important aspects of education is the attitude of the teachers. The ability to oversee a friendly and instructive classroom environment while choosing appropriate teaching and learning strategies that will engage and encourage students is the key quality of a competent teacher resulting in improved performance. According to Tavris and Aronson (2008), the unfavorable attitude of students toward the study of hydrocarbons may result from the fact that certain teachers do not exhibit a particularly positive attitude when instructing the topic, which in turn renders the study of it unappealing to students. The way teachers approach teaching any topic depends on their interactions with their students (Teacher-student relationship) and their personalities. According to Tschannen-Moran and Hoy (2007), teacher beliefs and attitudes greatly improve student success and educational efficiency.

Teacher-student relationship: One of the key determinants of attitude of teachers is how they relate to students. This is termed as the teacher-student relation (Van den Bergh, Denessen, Hornstra, Voeten, & Holland, 2010). Students do best in settings where they feel supported, cared for, and respected. When students are physically at ease, cognitively engaged, and emotionally encouraged they may succeed regardless of their personal problems or learning impairments (Tomlinson, 2014). The classroom setting should be engaging and relaxing since it directly affects how students' study. The task of making the classroom setting pleasant falls on the instructor. (Flores & Day, 2006). This can be made possible through the teacher's ability and attitude to create a cordial teacher-student relationship. In light of this, the chemistry teacher should be knowledgeable about how students learn and how to using instructional techniques to create a learning environment that is student, knowledge, assessment, and community based. (Zeidler & Howes, 2005). Teachers need to know how to create and keep a physically and emotionally supportive learning environment. According to Och and Indoshi (2011), educational change, whether brought on by more creative practices or the creation of curricula, almost always involves the teacher in a new position. This makes it necessary for the instructor to be ready for the new role.

Teacher personality: Personality is a very important trait or factors for consideration in the life of every business or institution. Personality is the dynamic and organized set of characteristics of a person that uniquely influences his or her cognitions, motivations and behaviors (Deci & Ryan, 2000, p. 229). A person's personality provides a better understanding of their behavior or outward manifestations in a certain setting (Pfeffer & Salancik, 2003). These imply that there is a connection between conduct and personality. Personality traits might be advantageous in any situation (Iversen & Rundmo, 2002). Thus, a teacher's personality is what sets them apart from other people (Azoulay & Kapferer, 2003).

It is worthy of notice that most classroom problems are people-centered problems and therefore, requires insights into the behavioral pattern of students in this context in order to teach successfully. Personalities most at times do conflict among individuals. It is not enough to only know yourself when working in and for an organization. This is because personality definitely affects us in diverse ways. This demonstrates the need for a teacher to understanding his or her students (Loughran, 2013). Lee (2005) opines that understanding the personality helps in better assessing and dealing with student related problems in the classroom. The personality of the teacher which forms a part of his or her attitude adds to the overall classroom effectiveness and the eventual output or performance of students. Hinchey (2004) asserts that teachers who are oblivious and mindless of this reality often a times create a toxic environment filled with underperforming students with low self-esteem. Contrary to this assertion, an inspirational teacher with an outstanding personality creates good students with positive self-esteem to perform well in class and to deal with difficult challenges in life (Mruk, 2013).

Olubukola (2018) performed research on teachers' professional attitudes and students' academic performance in secondary schools in the Ilorin Metropolis of Kwara State. His research looked on the connection between secondary school students' academic achievement and teachers' professional attitudes in the Ilorin Metropolis of Kwara State. He finds that, at the 0.05 significance level, there was a significant correlation between teachers' professional attitudes and students' academic performance in secondary schools in the Ilorin Metropolis. This correlation was strongest for teachers' communication attitudes (r=0.201), classroom management attitudes (r=0.288), pedagogical attitudes (r=0.199), and subject knowledge (r=0.211). The positive correlation suggests that the aforementioned professional attitude sub-variables have a significant impact on students' academic achievement.

In addition, Abudu and Gbadamosi (2014) studied how student academic success in senior secondary school chemistry in Ogun State's Ijebu-Ode and Odogbolu

Local Government Areas was correlated with instructor attitude. Their study aimed to determine teachers' attitudes toward teaching chemistry and how this affects students' achievement or learning outcomes, as well as how teachers' attitudes affect students' learning of chemistry and other science subjects generally. They also wanted to identify the factors that influence teachers' attitudes, whether positive or negative, toward teaching chemistry or science as a field in which chemistry plays a key role. They demonstrate a connection between instructors' dispositions and their students' success in SHS chemistry. The correlation coefficient (r) is significant at $P < 0.05$, according to their study ($r = -.340$ $P < .05$). They came to the conclusion that teachers' teaching philosophies influence student success in chemistry.

Based on the results of these investigations, it is inferred that students' performance in chemistry, one of the science courses, is significantly impacted by the attitude of instructors who teach hydrocarbons in our senior high schools. Students should be inspired by the fact that the chemical topics of hydrocarbons is highly promising, straightforward, and uncomplicated. It must be understood that student accomplishment will be higher than what it is now in our senior high schools if teachers have a good attitude toward teaching hydrocarbon chemistry.

Teaching methodology

According to Ayeni (2011), teaching is a continual process that entails bringing about desired changes in students through effective techniques. Adunola (2011) asserts that teachers' teaching strategies should be appropriate for the material being covered in order to have the intended impact on pupils. Additionally, according to Bharadwaj and Pal (2011), successful teaching strategies are ones that address the requirements of the students, as every student understands and responds to questions differently. As a consequence, aligning teaching strategies to students' requirements and chosen learning preferences affects students' academic progress. (Zeeb, 2004).

Teacher-centered methods; in these approaches, teachers only provide information to their students without making an effort to increase their degree of interest in the subject being covered (Boud & Feletti, 1999). Less or few practical, highly theoretical, and memorization-based is the strategy (Teo & Wong, 2000). It does not render any encouragement to students to acquire applicable knowledge-based real-world challenges through activity-based learning. The instructor can aim to optimize information delivery while requiring the least amount of time and effort since they have control over how knowledge is transmitted and shared. As a result, the interest and comprehension of the students can decline. According to Zakaria, Chin, and Daud (2010), teaching should actively involve students as well as focus on imparting rules, definitions, and processes for them to learn in order to remedy these weaknesses.

Student-Centered Method; Since the notion of discovery learning was first introduced, several academics have adopted additional student-centered techniques to enhance active learning (Greitzer, 2002). Today's teachers often adopt a student-centered methodology to foster their curiosity, analytical inquiry, critical thinking, and enjoyment (Hesson & Shad, 2007). The teaching approach is seen as more successful since it does not centralize the flow of knowledge from the instructor to the student (Lindquist, 1995). Because it encourages students to act in a goal-oriented manner, the technique is also particularly successful at raising student achievement (Slavin, 1996).

Teacher-Student Interactive Method; This style to teaching incorporates a few special techniques or ideas from both the teacher-centered and student-centered perspectives. When compared to knowledge given to students by teachers, students' subject output is more easily recalled (Jacoby, 1978; McDaniel, Friedman, & Bourne, 1978; Slamecka & Graf, 1978). Instead of lecturers controlling all of the content that is taught to students, this approach encourages students to seek out relevant knowledge on their own. As a consequence, research data on teaching ways reveals that this teaching style is beneficial in boosting students' academic achievement (Damodharan & Rengarajan, 1999).

Akinfe et al. (2012) define methodology as the process teachers employ to try to have an influence on students' understanding. A teaching technique, according to Omotosho (2001), is a plan that specifies the tactics instructors intend to use to accomplish the intended results. The term methodology describes how educators arrange and employ subject-specific strategies, teaching aids, and instructional resources to meet learning goals.

According to Akinfe et al. (2012), when students are unable to perform the expected behavior at the end of a lesson or examination, most untrained teachers point accusing fingers at them rather than at themselves. As a result, teachers' plans should include: selecting an appropriate teaching method, selecting appropriate teaching materials, conducting extensive research on the topic to be taught, and determining the lesson objectives. According to Black and Wiliam (2004), only effective teaching methods can result in effective learning. As a result, teachers must be innovative and dynamic in order to improve average student performance in their subject areas.

In research on the influence of teaching strategies on secondary school students' academic performance in Nigeria, Isa, Mammam, and Bala (2020) found that there is a positive correlation between academic achievement and the efficacy of various teaching strategies for 75% of the students. There was a considerable correlation between students' impressions of teaching techniques and their academic achievement, as evidenced by the 23.5% of students who thought teaching methods had no impact on their academic performance and the 1.5% of students who were unsure. According to their findings, there is a statistically significant relationship between discussion method and students' academic performance (X^2= 55.9 > p =5.991). This demonstrates that there was a significant relationship between method and academic performance among students. Furthermore, the findings indicate a significant relationship between the demonstration method and student academic performance (X^2 = 47.1, r = 5.991). Their findings suggest that a student-centered activity stimulating strategy, like the demonstration method, should be used instead of a conventional approach, like the lecture method. It provides a real-life situation of course of study as students acquire skills in real-life situations using tools and materials. It serves as an incentive to students when carried out by competent teachers, and it is nice in showing the appropriate approaches in doing it. This saves time and supports material economy, and it is also an attention inducer and a powerful motivator in teaching sessions. Their findings demonstrated that the demonstrative technique significantly affects students' academic performance. They came to the conclusion that discussion and demonstration methods encourage learner participation and help students to develop the necessary level of reasoning. They also concluded that discussion and demonstration methods help teachers to plan more, talk less, and students learn more while interacting with groups.

According to a study by Elvis (2013) on teaching methods and students' academic performance, the teacher-student interactive strategy yielded the greatest mean score (mean=1.87), which was then followed by the student-centered approach (mean=1.79), while the teacher-centered approach yielded the lowest mean score (mean=1.36). The teacher-centered strategy had the lowest mean score (mean=1.36), according to their study's marginal mean estimations. The three instructional approaches' respective 95% confidence intervals around their respective mean estimations.

The results show that a blending the teacher-centered with the student-centered teaching strategies is the most effective strategy for improving student outcomes. The expected mean score (mean=1.79) of the student-centered technique is marginally lower than the teacher-student interactive approach. This illustrates that using student-centered strategies, which encourage greater topic mastery rather than centralizing information transmission as a one-way conduit from the teacher to the student, is also an effective teaching strategy. Results were considerably worse (mean=1.36) when teacher-centered strategies were applied than when teacher-student interactive and student-centered methods were demonstrating that they are not actively engaged in the learning process, which might have a negative impact on both their academic performance and achievements.

Teaching is a complex and multifaceted in that it requires many different kinds of knowledge. Among these are the content knowledge, pedagogical knowledge and teaching skills. According to Mustafa and Salim (2012, p. 81), one can't teach what he or she doesn't know. The number of hours the instructors spend in liberal arts classes as well as courses in their major and minor programs at school determines how much content they know. However, Knowledge of the subject matter by itself is not enough for being competent inside the classroom or even for the capacity to express that knowledge (Mishra & Koehler, 2006). Teachers should also be capable of breaking down tough and complicated concepts into terms that students can comprehend easily.

Oke (2020) also carried out research on the instructional methods used by instructors and the academic performance of the students in secondary schools in the Ibarapa East Local Government Area. His research's major objective was to ascertain the relationship between various teaching strategies and students' academic performance. According to the estimated marginal mean estimates based on the teaching methods employed, the teacher-student interactive approach produced the highest mean score (mean=1.98), followed by the student-centered approach (mean=1.74), and the teacher-centered approach produced the lowest mean score (mean=1.26). The .05 confidence intervals surround the mean values of all three teaching strategies. The findings demonstrate that using a combination of teacher-centered and learner-centered instructional methods when instructing students yields the best results for student performance. Additionally, the results demonstrate that student-teacher interaction during the process of instruction and learning inspires students to focus on finding knowledge and insight instead of having the lecturer monopolize information transmission to the students. The predicted mean score for the student-centered strategy (mean=1.74) is somewhat lower than that for the teacher-student interactive approach. Instead of centralizing the information or knowledge flow as a one-way conduit from the teacher to the students, this technique encourages increased mastery of the subject matter, illuminating the fact that student-centered approaches are also a successful teaching strategy. Results from teacher-centered techniques were considerably worse (mean=1.26) than those from student-centered and teacher-student interactive approaches, indicating that students' lack of engagement in the learning process may contribute to subpar academic achievement. This accomplishment gap may be explained by the fact that apps for teaching and learning that are focused on student-centered learning and teacher-student interaction are seen as a successful substitute for conventional teaching techniques since they give students a wealth of chances to show that they have mastered the material being taught.

Another essential teaching skill is pedagogical knowledge, which includes understanding how classrooms function and how to facilitate learning (Koehler & Mishra, 2009). Levels of learning in the cognitive domain, instructional aims and objectives, lesson planning, inquiry rules and processes, and criterion-referenced exams are a few examples of notions that are rooted in the field of pedagogical knowledge (Driscoll & Driscoll, 2005). Loewenberg, Thames, and Phelps (2008), identify teaching skills, or the capacity to strategically use information to advance student learning, as a third category of teacher knowledge. According to Grafi-Sharabi (2009), one of the most important teacher responsibilities in promoting students' learning is to increase student enthusiasm to learn. To do this, one must become familiar with their students well enough to be able to provide them with educational experiences that they will find valuable, interesting, challenging, and gratifying (Perry, Hondeghem, & Wise, 2010). You can reach and teach your students more successfully if you have a deeper understanding of their needs, interests, and ability levels. According to Afadil, Suyono, and Poedjiastoeti (2017), using a systematic approach to instruction can also help students perform better. This method of instruction is straightforward, clear, usable, and practical. The three main components of the three-phase method to instruction are preparation, execution, and evaluation. Assessment of pedagogical content knowledge (PCK), constructivism, and instructional planning are some of the techniques that can be used to compensate teachers for their time spent teaching.

Assessment: During this phase, the instructor makes an effort to compile data in order to ascertain whether and what kind of learning has taken place. Several methods exist for doing this, such as through giving examinations, marking homework, or seeing how students respond to assessments or remarks (Carini, Kuh, & Klein, 2006). The teacher can utilize each of these techniques to decide whether the objective set during the planning step was attained (Romiszowski, 2016). The teacher questions, how will I know precisely if the students knew or learned, understood, or attained the goal I established in the previous? during the evaluation process. The answer to this query offers strategies for evaluating students' comprehension with a variety of assessment tools (Cronbach, 2000). According to the specified goals and selected implementation techniques, teachers' evaluation processes are determined (Hill & Hannafin 2001).

According to Hill, Rowan, and Ball (2005), pedagogical content knowledge (PCK) is the intersection of topic knowledge, or understanding of the material being taught, and pedagogic knowledge, or understanding of how to teach (that is planning and assessment). Despite having a thorough grasp of a subject, a teacher must also be able to help students to understand the material or concepts. This is what Shulman (1987) calls PCK. PCK covers the subjects that are most frequently taught in one's field, the most effective ways to illustrate those concepts, and the strongest analogies, examples, explanations, and demonstrations in other words, the ways to convey the material that help others understand it (Loughran, Mulhall, & Berry, 2004). It also entails being aware of the factors that influence how simple or challenging a certain subject is to learn as well as the assumptions and prejudices that learners of all ages and backgrounds bring to the classroom (Shulman, 1987).

According to Park and Chen (2012), a teacher's views and methods form the foundation of their pedagogical subject knowledge. Along with conceptual and procedural knowledge, it also comprises a repertory of diverse procedures or activities (that cater to various learning preferences or types), knowledge of strategies for testing and evaluating, and knowledge of a number of resources that are readily available for use in the classroom. "PCK represents a class of knowledge that is fundamental to teachers job and would not normally be held by nonteaching subject matter specialists or by instructors who know little about that topic" according to research (Marks, 1990, p. 9).

Being a teacher requires a number of talents, including foundational competencies, subject-matter expertise, and general pedagogical competencies (Jones & Turner, 2006). The teacher's expertise in the subject matter is even more crucial in a classroom where learning is focused on inquiry. PCK is a fascinating field to follow since it describes the numerous bodies of knowledge for teaching and contains the qualities that a teacher should possess in order to help students in the classroom to grasp certain subject matter, like hydrocarbons.

According to Park and Oliver (2008), PCK has several components, one of which is content knowledge, which refers to what is typically taught directly in classes. It could be, for example, hydrocarbon nomenclature and isomerism, the concept concerned with hydrocarbon naming (alkanes, alkenes and alkynes). The educator's method of teaching a subject is related to their pedagogical knowledge. It might involve being aware of the misconceptions or simplistic beliefs that students may have when they are initially learning a subject. It may also involve in determining which concepts can be taught to which students or at which grade levels. Contextual awareness is the third category. Contextual knowledge encompasses the broader information, such as comprehension of the scientific process and how it pertains to the lesson. The 'what' being taught is 'content knowledge,' while the 'how' is the 'pedagogical knowledge.' Contextual knowledge is the fundamental framework (for example, the scientific method). A superset of pedagogical topic knowledge comprises these numerous fields.

The development of pedagogical subject knowledge is seen as a continuum, with educators learning more of it via suitable preparation and experience (Niess, 2005). Educators acquire it before they start teaching, during pre-service training, and during the course of their careers as teachers. The fundamental expectation from the perspective of educational improvement is that improvements in teacher pedagogical topic understanding will lead to improvements in student learning. A teacher who is more knowledgeable about the subject and is more qualified or experienced should be able to get more out of their students than a teacher who is less knowledgeable or less prepared. However, once educators start working with students, it becomes quite difficult to provide them the additional training they need. Less time is available due to the position's daily needs for expanding material knowledge and acquiring new pedagogically beneficial techniques.

A complementary approach to improved better teaching both within the classroom and outside of it is the use of instructional resources that help teachers develop their PCK (Coburn, 2001). This approach emphasizes the development and use of excellent instructional materials. Naturally, further professional development and training could be advantageous, so one technique does not preclude the other. If instructional resources feature tried-and-true concepts and top techniques from knowledgeable and successful teachers, then it's possible that the PCK of the teachers who employ these materials will advance. Coburn (2001) defined educative curriculum materials as teaching resources that help teachers develop their PCK. Teachers can improve their instruction by expanding their material and pedagogical expertise by using resources that represent best practices across the whole PCK.

Constructivism: Constructivism is essentially a hypothesis about how people learn that is founded on observation and research in science (Brandon & All, 2010). According to Dirkx (2001), learners create knowledge and understanding based on their personal encounters with objects and reflections on those experiences in the real world. Constructivist classrooms have existed for as long as there have been people asking one another questions. “Constructivism, the study of learning, is still primarily concerned with how each of us interprets the environment” (Brooks & Brooks, 1999, p. 29). The constructivist approach to learning in the classroom can refer to a range of different teaching strategies. In its broadest definition, it usually entails encouraging students to use active strategies (experiments and real-world problem solving) to generate new information and then to reflect and talk about what they are doing and how their understanding is developing. The instructor makes sure she is aware of the students’ existing assumptions and designs the activity to firstly address and then build upon them. According to Applefield, Huber, and Moallem (2000), constructivist believed that as students interact with the physical, social, and mental words they construct meaning out of them. Gallagher (2000) said that whenever students are thought any specific concept, they should be able to construct their own knowledge. In terms of education, the teacher should make an effort to promote students’ independent discovery of concepts. There should be active communication between the teacher and the student (Socratic learning). The instructor’s job is to provide the material in a way that corresponds to the learner's level of comprehension at the moment.

According to Reigeluth (2013), Bruner states that a theory of instruction should address four major aspects:

1. predisposition towards learning,
2. the ways in which a body of knowledge can be structured so that it can be most readily grasped by the learner,
3. the most effective sequences in which to present material, and
4. the nature and pacing of rewards and punishments.

Knowledge should be simplified, new ideas should be generated, and information manipulation should increase as a result of good knowledge structure techniques. The philosophical and scientific view known as constructivism holds that knowledge is created actively (Liu & Matthews, 2005, p. 368). Constructivism places a strong emphasis on how well students produce knowledge in the social, physical, and mental domains.

Social constructivism: According to Huang (2002), social constructivism is a learning theory that emphasizes learners and encourages their active engagement as they successfully create their own knowledge based on their own realities. Gergen (2009), claims that social constructionism is a theory of knowledge in sociology and communication theory that investigates the growth of collectively produced worldviews that serve as the foundation for presumptions about reality. The theory's central tenet is that meanings evolve collaboratively with others rather than independently within each person. Social constructivists concur that by their interactions and relationships with others as well as how they interact with their social environment, students may generate their own knowledge and understanding.

According to Ask and Haugen (2008), Lev Vygotsky, a post-revolutionary Soviet psychologist, established social constructivism. He was a cognitivist, but he disagreed with the notion that learning could be separated from its social environment, as held by Piaget and Perry. According to Ask and Haugen (2008), Vygotsky believed that all cognitive functions have their origins in social interactions and that learning involved more than just the assimilation and accommodation of new information by learners. Instead, cognitive functions were the means by which learners were integrated into a community of scholars. The foundational principle of constructivism is that learners create new information on top of prior knowledge and that human learning is built. Contrary to the notion that learning is the passive transfer of knowledge from one person to another, the emphasis here is on receiving rather than creation. Vygotsky's social constructivist theory, according to Jones and Brader-Araje (2002), can provide adult students the ability to create their own meanings through critical thought. Swam (2005), opines that according to Vygotsky, construction of knowledge by leaners includes the construction of knowledge by leaners socially and adopting it on their own. The importance of social and cultural interactions in the learning process is highlighted by Vygotsky's sociocultural learning theory. Social constructivism may be used to describe the theory's claim that knowledge is co-constructed and that people learn from one another since Vygotsky felt that the learner must actively participate in the learning process. People could teach one another, enhancing the idea's social aspect (Bonk & King, 2012). One of the pillars of Vygotsky's theory is the Zone of Proximal Development. This includes a "spectrum of tasks that are too difficult for an individual to do alone, but may be accomplished with assistance from adults or more experienced peers." (Webb & Mastergeorge, 2003, p. 73). Scaffolding, or providing the learner with the appropriate level of support at the appropriate moment, is another aspect of this idea. The learner is closer to mastering a task if they can do it with some help.

There are various methods to use this notion in the classroom. The students can be divided into groups so that those who comprehend the material work with those who do not. For instance, I may ask another student to explain the nomenclature of hydrocarbons (a method for identifying carbon compounds) to a student who didn't comprehend it. In order to ensure that the student has a solid understanding of the subject, a skilled constructivist teacher will challenge students' responses without considering whether they are correct or incorrect (Shepard, 2000).

Social constructivism teaches that all knowledge develops as a result of social interaction and language use, and is therefore a shared, rather than an individual experience. Knowledge is additionally not a result of observing the world, it results from many social processes and interactions (Jones & Brader-Araje, 2002). Constructivist learning places equal emphasis on the acquisition of new information and the learning process itself. Alternatively said, the trip is equally as significant as the final goal.

Cognitive constructivism: Piaget's theory of cognitive development, according to Kalina and Powell (2009), suggests that individuals cannot be given knowledge that they instantly grasp and apply. Learners must instead generate their own knowledge through gaining information via experience. The instructor is seen as a facilitator of the learner's active process of knowledge construction, in which the student actively participates. Constructivist viewpoints support the notion of learner-centered instruction (Kalina & Powell, 2009).

Cognitive constructivism is based on two distinct types of construction. First, consider the notion that people learn by actively creating new knowledge rather than having information pumped into their minds. Furthermore, constructivism claims that people learn more effectively when they are involved in creating personally meaningful things (Kalina & Powell, 2009). According to Applefield, Huber, and Moallem (2000), cognitive constructivists demonstrated that knowledge construction should be based on the internal development of mental structures. The cognitive constructivists placed a strong emphasis on students' knowledge, convictions, and internal selves. a method of constructivism that is based on the theories of cognitive development and the work of Swiss psychologist Jean Piaget. Human knowledge, in Piaget's view, is created via experience rather than from information that is handed to them (Applefield et al., 2000).

According to Amineh and Asl (2015), Jean Piaget's theories provide the foundation for cognitive constructivism. The two main components of Piaget's theory are a theory of development that explains how learners acquire cognitive skills and an ages and stages component that forecasts what children can and cannot grasp at certain ages. According to Piaget's theory of cognitive development, people cannot be taught information that they can apply right away. Learners must create their own knowledge instead (Ültanr, 2012). Learning occurs through experience, and it is through these experiences that learners are able to develop schema (mental models of the world). Assimilation and accommodation are two complementary processes that adapt, expand, and refine these schemas. Swan (2005), asserts that the reason cognitive constructivism is so important to us is because it maintains that in order for pupils to create new knowledge, they must engage with the outside world.

Instructional Planning

"Act or process of formulating or carrying out plans" is what planning refers to (Goette, Woodard, & Young, 2008, p. 32). As part of the planning process, the teacher employs the necessary instructional techniques, curriculum, data, and resources to address the many needs of the students (Erickson, 2002). Before the student enters the classroom, instruction has already begun. Teachers prepare the subject of instruction, choose teaching materials, create learning activities and grouping strategies, establish the pace and allocation of instructional time, and identify learning opportunities for students prior to each lesson, unit, semester, or school year. Hew and Brush (2007), note that teachers use state or district curriculum standards, school district curriculum goals and objectives, and learning outcomes released by professional organizations to map the breadth and chronology of subject matter. Additionally, educators create instructional approaches and procedures using their knowledge of research-based practices. However, it is important to keep in mind that the student is the most useful source for any instructional preparation.

Teachers consider the caliber of the materials that are easily accessible while developing a unit or lesson. Teachers use tactics and materials that are age appropriate, aligned to national, state, or local standards, accurate with regard to the content, allocated time for the lesson or unit, and the learning benefits of the resource (National Research Council, 2001). According to Archer and Hughes (2010), instructors should maximize the educational value of materials while limiting time spent on less relevant or unneeded content. The following are the main questions that instructors must examine for effective instructional planning, according to Archer and Hughes:

1. What should I teach?
2. How should I teach?
3. How do you evaluate instruction and student learning?

What should I teach? Successful student learning requires a progressive and constant set of learning requirements, according to Archer and Hughes (2010). Effective teachers are excellent at expressing the goals of each session and the actions or behaviors that students should be able to perform after participating in the learning process. Competent instructors simultaneously design lessons in two dimensions, according to Archer and Hughes. Here are a few instances:

1. the teacher's own behaviors, thoughts, and habits; and
2. the students' thinking and comprehension of the topic or content.

Effective instructors plan not just what they are going to teach, but also for whom they are going to educate. They make an attempt to think and act outside of their disciplinary comfort zone in order to include their students' learning preferences (Haberman, 2010).

How should I teach? Evidence reveals that expert instructors struggle more than non-expert teachers in turning their instructional plans into actions (Cope & Kalantzis, 2015). Furthermore, good teachers stick to the predetermined plan while staying flexible and constantly altering their education based on student requirements. Furthermore, competent teachers anticipate the obstacles that students may encounter when learning the lesson's topic. They evaluate the effectiveness of the lesson plan by taking into account students' thinking, and they then adjust their instruction as quickly as they can.

A lesson plan does not guarantee that the actual lesson will be carried out as planned (Kennedy, 2016). There are ebbs and flows in the classroom. Instructors must thus be opportunistic and draw on their pedagogical and material resources in a fluid and flexible way if they want the class to get through without a hitch.

How do you evaluate instruction and student learning? When connecting activities to goals, teachers must link the assessment plan to the learning objectives. Any good instructional design must have the curriculum, the learning activities, and the assessment all in line. The term opportunity to learn is used to describe this alignment (Martone & Sireci, 2009). Before commencing instruction, teachers must choose precise and trustworthy assessment methods that will elicit data on student learning and gauge how well the instructional strategy is working (Heritage, 2007). Additionally, once students participate in learning activities, teachers need to explain to them what they are expected to do and how they will be evaluated. Teachers must take a lot of factors into account while organizing lessons, including how to pace the content delivery in the classroom (Summers, Waigandt, & Whittaker, 2005).

Student aptitude and diversity, topic goals and mandated objectives, time and material resources, and other factors all have a significant impact on how feasible a class is (Stein, Remillard, & Smith, 2007). Many of these problems impose restrictions on instructors that they are unable to change right away. For instance, formal schooling is given a particular amount of time each day. A legislative body, school board, or school administration may designate specific hours of the day to be devoted to the study of a certain subject or discipline. But throughout such intervals, teachers have traditionally had a great deal of freedom and autonomy. Thus, there was a great deal of student autonomy over how they used their class time.

Teachers report a curriculum that is becoming more condensed and prioritizes evaluated items and breadth of content at the expense of depth. Teachers are sometimes expected to follow strict pacing rules that outline how much time should be spent on certain topics or courses (Jewitt, Moss, & Cardini, 2007). The purpose of pacing guidelines is to give educators tools to gauge how much time is spent teaching a subject in relation to the overall quantity of material that has to be covered. When properly applied, pacing guidelines are tools for directing daily instructional decisions within the bounds of the broader curriculum. Regardless of student aptitude, improper application of pacing standards can impede the natural ups and downs of the classroom and the pace of learning. There are times when giving pace guidelines is a good idea. Their layout and how district and school administrators employ them influence how effective they are (Biggs, 2011). The best pace recommendations put instructional direction before prescriptive pacing (Glatthorn, ABoschee, Whitehead, & Boschee, 2018). These guidelines highlight important ideas and provide access to outstanding curricular materials, courses, and teaching strategies. Therefore, pacing is an essential component of instructional design. It helps teachers to view the curriculum holistically and avoid the pitfall of favoring one body of knowledge over another. Since there is a limited amount of instructional time with pupils, teachers must respect class time. Throughout the classroom teaching process, a teacher must regularly make decisions on how to divide instructional time and pace learning activities. According to Black and Wiliam (2009), "the teacher must make a fundamental decision about whether the group as a whole can or cannot complete the objectives of a lesson at some point within the class" (p. 11). When should a teacher opt to seek fresh goals? Should the instructor hold off until each and every student in the class has mastered the new subject or skill? Should the teacher change the course's focus as long as 50% of the students meet the learning objective? According to Lyster (2007), in an ideal world, students would allocate their study time properly, giving more time to more difficult learning. They would also be attentive to the difficulty of the material and objectives to be taught.

Biggs (2011), asserts that despite their best efforts, students frequently fail to extend their study sessions enough to meet their increasingly difficult learning objectives. The creation of adaptive learning techniques that evaluate students' learning requirements in particular subject areas, the creation of learning activities that are appropriate for the student's changing skill level, and the adjusting of time and pace on a topic area based on student performance constitute an ideal learning methodology. This intentional scheduling and rescheduling of the learning process, together with the adaptable inclusion of extra practice and review, may significantly increase the study time devoted to challenging subject areas and boost student learning outcomes. The idea that learning is a mechanistic method by which information is transmitted to students from textbooks through hearing, reading, and memorization is one prevalent myth or misperception about education (Biggs, 2011). In actuality, a learner's prior information, experiences, and beliefs have an impact on how they engage with new material. They often fail to remember, understand, and apply new information that has no connection to them and no context for acquiring meaning. Materials and equipment serve as a supportive rather than a central role in the curriculum and instruction (Patterson & Patterson, 2004). In other words, the fundamental curriculum of schools and the teaching methods used by teachers shouldn't be influenced by textbooks. On the one hand, each student's academic achievement depends heavily on curriculum-aligned materials and instruction.

More than just acting out scripts provided by textbook and test publishers is required for effective instruction (Schank & Abelson, 2013). Students' attitudes about learning by doing are generally conditioned in teacher-centered, textbook-driven classrooms. Boaler (2002) asserts that common textbooks are fact-oriented as opposed to process-oriented. Instead, than emphasizing 'how' and 'why,' textbooks focus on only 'what'. Teachers are unlikely to meet today's educational aims and objectives for critical thinking, problem-solving skills, skills enhancement, and real-world inquiry if textbooks are the primary source of instruction. Additionally, some situations are too specific to be treated in textbooks, while others are too recent to be included (Mead, 2017). To improve students' learning, teachers must be knowledgeable and creative researchers, and they need to expect their students to develop these qualities as well.

To prepare pupils for the world outside of the classroom, teachers must provide mechanisms for young people to learn from knowledge as they would confront in real-life settings, stuff that is not predigested, carefully chosen, or rationally ordered (Hertel & Millis, 2002). Planning involves action preparation, as demonstrated by Claxton, McCarty, and Keen (2009). Without careful planning and preparation, ongoing evaluation and adjustment as the plan is carried out in practice, and reflection on what worked and what did not and how to do it better, teachers seldom improve practice. Consequently, planning is a crucial tool for effective teaching (Harden, 2001). Teaching is a challenging activity that needs careful planning and preparation for both immediate and long-term learning goals.

Teachers must offer opportunities for 'students' to learn from knowledge that they would encounter in real-world contexts, stuff that is not predigested, carefully chosen, or rationally structured in order to prepare them for life outside of the classroom and the school (Hertel & Millis, 2002). Planning is the preparation for action, as shown by Claxton, McCarty, and Keen (2009). Without careful planning and preparation, ongoing evaluation and adjustment as the plan is carried out in reality, and reflection on what worked and what did not and how to do it better, teachers seldom improve their practices. Planning is a crucial tool for successful teaching, it's true (Harden, 2001).

Teaching is a challenging activity that requires careful planning and preparation for both immediate and long-term learning goals. For instance, Stronge (2011) compares the planning methods used by 10 effective and ten ineffective teachers, whose effectiveness is gauged by improvements in student accomplishment. Stronge found that the majority of excellent teachers collaborated with one or more other teachers while creating their lesson plans. Conversely, less successful teachers claimed that they always created their own lesson plans. Less effective teachers depended on pre-made resources, but top teachers developed their own activities that went beyond published materials and were not bound by pace rules. Additionally, the most effective teachers used student evaluation data to organize their classes. Based on information from frequent assessments, teachers make data-driven decisions about what aims and objectives to address. Allington and Johnston (2002) found that the best teachers used a variety of sources to train their students. Effective educators were more likely to deviate from the reading and writing tasks found in textbooks. Despite the fact that skilled teachers routinely used required textbooks, they seldom ever adhered to the standard lesson plans for these materials. Effective teachers, for instance, used materials from the Internet and journals, historical fiction, biographies, and other unusual content sources while planning a class (Allington & Johnston, 2002). To investigate pedagogical expertise in instructional planning, Hall and Smith (2006) compare novice instructors to experienced teachers. They found that novice planners were more time-consuming and ineffective. They were inclined to deviate from predetermined lesson plans in an effort to pay attention to the students while carrying out the scheduled lessons. When it came to putting their lesson ideas into action, experienced teachers were more effective than newbie ones. The parts of a course where students were most likely to struggle were better predicted by experienced teachers, as where the misconceptions students would have and the areas of learning these misconceptions were most likely to affect.

Teacher Competence

A key factor in determining the success or failure of a teaching session in the teaching and learning process is the instructor's expertise. Students' active participation in the learning process will be directly impacted by teachers' skill and intelligence in handling learning activities. As a result, students develop a positive outlook on their learning process as a result of the rise in instructor competency. According to Gibbs and Coffe (2004), improving teacher competency is a crucial objective for strengthening the teaching profession and ensuring significant development in education quality in many nations.

The skills and knowledge that enable a teacher to be effective may be summed up as teacher competency (Lampert, 2010). Instructors must possess a broad variety of competencies in order to improve student learning in a highly complex environment where hundreds of critical decisions must be made each day (Biggs, 2011). Teaching is one of the few professions that requires both good professional judgment and the application of evidence-based skills.

It may seem intuitively obvious that there is a link between teaching and students' academic progress, and research supports this generally held assumption. This connection illustrates that instructors have the greatest influence on student accomplishment of all the factors that can be controlled by a school (Wolters & Daugherty, 2007).

Competence, according to Fernandez and Boucher (2012), involves knowledge, abilities, attitudes, and experiences that ensure one's capacity to do or carry out defined activities in a specific environment at a high degree of excellence. A competent teacher is a leader who succeeds in gaining students' hearts and minds. Such a teacher actively seeks out opportunities for professional collaboration both inside and outside of the school because they understand the value of growing and collaborating with others, including parents and peers.

To ascertain the effect of instructors' ability on students' performance in chemistry, Jacobson (2012), conducted a study titled Teachers' Competency and Students' Academic Performance in Senior Secondary School Chemistry. At the $p<.05$ alpha level, he found that the computed t-value of 16.07 is higher than the significant t-value of 1.96. This shows that students studying chemistry who are taught by qualified teachers do significantly better academically than those who are taught by inexperienced teachers. According to Jacobson, this could be the case since a teacher's intellectual capacity or competency has a significant role in the caliber of the education that students get in the classroom. The remarkable academic performance of the students in chemistry would be considerably aided by a chemistry teacher who is skilled and competent in his field and has the personality attributes necessary to inspire and cultivate the latent potential of his students. Students do better when teachers are competent in terms of creativity, superior teaching skills, and proper evaluation. Jacobson came to the conclusion that there is a substantial correlation between instructors' competency and students' academic achievement in chemistry. Chemistry students who were taught by qualified teachers outperformed those who were taught by incompetent teachers, and students who were taught by experienced teachers outperformed those who were taught by inexperienced teachers.

Planning, decision making, and implementation are some of the variables and tactics that contribute to a teacher's competency in their field of work. What do I want my students to know, understand, appreciate, and be able to accomplish? is the first question a teacher asks while beginning each lesson, according to Wiseman and Hunt's (2013), description of planning. The objective of the instructor is the answer to this query, and establishing a goal is the first step in the planning stage. This goal may be as straightforward as teaching students' basic arithmetic or history concepts, or it could be as lofty as fostering students' moral or spiritual values. Regardless of the driving force, Wiseman and Hunt contend that setting a goal or purpose is the most important issue in education. They claim that a teacher's objectives might be either philosophical or practical.

The next steps in the planning phase are to select an instructional strategy, create learning activities, and gather supplementary materials. According to Jacobson (2012), a teacher's feelings of uneasiness may be significantly reduced if they thoroughly organize their lesson before entering the classroom, which will lead to a good delivery.

Putnam and Borko (2000), contend that effective instructional planning extends much beyond developing learning objectives and does not always occur prior to the student's arrival in the classroom. For instance, establishing norms in the classroom is a crucial planning concern, and research supports incorporating students in this process.

Azzarito and Ennis (2003), claim that constructivist classrooms place a strong emphasis on working together with students to jointly create the rules for the classroom as a meaningful learning experience that fosters engagement, introspection, meaningful connections, respect for the rules, a sense of community, problem resolution via negotiation, collaboration, higher-order thinking abilities, and ownership.

Teacher as decision maker: The capacity to make wise decisions and judgements is one of the qualities that define a teacher's competency. Borg (2003), asserts that teachers take a number of actions that directly affect the caliber of their classroom education. Making decisions implies making choices; some of the most notable examples are deciding what to teach, how to teach it, and how to rate students' achievements. Using education as an example, a multitude of factors, including the conviction that a certain approach is the most effective way to impart knowledge and the existence of case studies and valid research data, have an impact on decision-making.

One strategy to avoid these important choices is to use the advice, strategies, and tests provided in the instructors' manuals and instructional materials that frequently accompany textbooks. These resources could offer the best instruction for a certain lesson, but we think that everything we do in the classrooms should be carefully considered in relation to alternative possibilities. The ability to make wise judgments is essential to a teaching tool's success, according to Loewenberg Ball, Thames, and Phelps (2008). Good instructors draw on a wide variety of knowledge when they are faced with a wide variety of decisions in the classroom.

Research, practice and experience, and context are just a few of the factors that might affect teachers' perceptions.

According to Kaylor (2014), a growing corpus of research offers useful knowledge on the connection between teacher actions and student learning and performance. Experience is a second factor that affects the professional decision-making process, according to Eggen and Kauchak (2007). Veteran educators make judgments based on their prior knowledge. This has a number of effects on recently certified teachers. Studies on the productive strategies of seasoned teachers has to be taken into consideration first. Second, as they develop their teaching skills, rookie instructors should observe and interact with seasoned educators. In order to learn from their successes and failures, beginning teachers must take time to evaluate their own development as they go.

Leithwood and Jantzi (2000) claim that the third factor influencing teachers' decision-making is context. No two students or learning environments are same. Additionally, the resources available, the kind of subject being taught, the time of day, and even the season of the school year all have an impact on instructional decision-making. When learning about different teaching strategies and instructional techniques, teachers must continuously ask themselves, Will they work for me? and how successfully will they aid in the learning and performance of the students?

Implementation: A teacher should decide on a goal and choose an efficient way to attain it, according to Sisler (2013), before carrying out the plan. This requires both instructors and students to engage in a range of educational activities and make decisions as a group. According to Zimmerman (2002), the implementation phase's success is reliant on a set of objectives. Unexpectedly, a surprising number of instructors participate in events with little thought given to the final outcome. Although implementing effective goal-oriented programs is not always done in a methodical fashion, the results can be outstanding. When selecting activities, a teacher's most crucial consideration is 'How can I help my students reach the aim or perform extremely well?' Zimmerman (2002) asserts that the method or technique used for instruction will determine the response to the query. The goal, the students' backgrounds and needs, the resources available, the teacher's personality, abilities, and teaching style all play a role in choosing the appropriate strategy. A teaching strategy must be established in order to accomplish a specified objective, and teachers must organize and manage their classrooms to facilitate learning. To build effective learning settings, management can range from something as basic as verbally reminding a student to pay attention to the development of a complicated system of rules and procedures.

Teacher Influence on Students' Performance

The researcher has thus far investigated several key elements and dimensions of the notion of hydrocarbons, influence, and the factors that lead to students' performance. The researcher will now look at some of the work that has been done by various persons in connection to instructor effect on student performance.

Kalagbor (2016), looked at the elements that affect chemistry students' academic performance in secondary public and private schools in Rivers State, Nigeria. The frequency counts, percentages, and means of 489 SHS 3 public secondary school students and 213 SHS 3 private secondary school students were gathered. The study's findings suggested that students in public secondary schools, with a mean of 38.0%, were more impacted by the quality of teaching personnel.

Additionally, Kalagbor (2016), found that at private secondary schools as opposed to public secondary schools, the teacher-student connection component had a larger positive impact on students' academic achievement. This factor's features that private secondary school students benefit from include: a sense of humour, constant support (with high standards), active listening, and allowing space for learner-centered activities. Approximately 87% of respondents stated they appreciated it when their professors actively listened and encouraged them, as well as providing a pleasant, supportive, yet demanding environment in which the entire class could learn; and 78%

of respondents described their teacher-student interactions as having closeness, warmth, and optimism with their instructors.

On the other hand, the study found that students in public secondary schools do not seem to like their professors' actions and friendly treatment, but they do notice physical appearance of the instructors, which does not matter to them in their academic activities; and 75% of public senior high school respondents claimed they do not have positive teacher-student connections. It is important to note that via respectful teacher interactions with students, the teacher significantly influences the course of students all across the formal school experience (Bartolome, 2004). In addition, kids who get along well with their teachers view them as a secure place to explore the classroom and take on academic challenges (Mazer, Murphy, & Simonds, 2007).

Similar to this, Hassan, Ali, Salum, Kassim, and Elmoge (2015), looked at the factors affecting students' performance in Chemistry in Zanzibar Secondary Schools using a Case Study approach. Examining the chemistry performance of pupils in secondary schools in Zanzibar was the aim of this study. Officials from the Ministry of Education were present, and it was hosted in secondary public and private schools all throughout Zanzibar. The aim of the investigation was to identify the reasons behind poor chemical performance. The study used the views, opinions, and ideas of instructors and students to enhance student performance in chemistry, as well as a descriptive survey. Two hundred students together with 45 instructors were randomly selected from 15 secondary schools in Zanzibar, and 10 Ministry of Education representatives were also picked at random. The main instruments utilized to collect pertinent data from respondents were questionnaires and open-ended interview schedules. The findings indicated a scarcity of qualified teachers. This resulted in poor subject matter delivery and, as a result, awful performance This study suggests that the provision of qualified, competent, and efficient teachers be given priority in light of the findings. Students were dissatisfied with their chemistry instructors. They stated that they were short on chemistry professors. They went on to say that they were having difficulty with the methods employed by teachers to teach chemistry. During the questioning, it was determined that some of the teachers at these schools were not certified teachers (Hassan et al., 2015).

The students stated that they scored badly in chemistry since chemistry as a science topic was not as simple as other courses given to them, such as Religious Education, History, Kiswahili, and others. Seventy percent (70%) of respondents claimed their low performance might be attributed to inadequate laboratories, libraries, and instructional techniques. (Akinfe, Olofinniyi, & Fashiku, 2012). They had difficulty expressing themselves in English during chemistry courses, either in replying to the teacher's inquiries or in inquiring when they did not understand the key topics. This also related to their daily revisions and retaining chemical topics. However, various factors, according to the students, contributed to low academic achievement in chemistry. There are a lot of untrained teachers. The information acquired, on the other hand, demonstrated that the majority of the teachers discovered in these selected institutions had minimal credentials. More over half (64%) of Chemistry teachers were untrained, 49% had a diploma, and just 9% had a bachelor's degree or above.

Akinfe et al. (2012), looked into the effectiveness of teachers in Ondo State senior secondary schools as determinants of students' academic success in Chemistry. The inquiry was guided by four research questions. Data from (200) teachers were gathered using a multi-stage sampling strategy. Using simple frequency counts and percentages, an analysis of a validated questionnaire titled Teacher Quality as Correlates of Student Academic Performance was conducted. The study discovered that professional training and qualifications have a crucial influence in improving students' academic performance in Chemistry and that teachers' instructional strategies have a big impact on achieving behavior goals. The survey also found that capacity building is an important part of teachers' experiences that has not received appropriate attention. According to the study, 60% of participants thought their teacher effectively managed their class during lectures, whereas 40% disagreed. Once more, 47.5% of respondents said they receive assignments frequently, while 52.5% disagreed. Twenty-five percent (25%) of respondents disagreed, while 75% claimed they understood the lesson note that their instructor had supplied. While 45% of respondents disagreed, 55% of respondents said their lecturer had encouraged them to study chemistry. The final finding was that 62.5% of respondents thought their Chemistry lectures were boring, while 37.5% disagreed. Professors unquestionably have a significant impact on students' academic performance or productivity.

Conceptual Framework

Greene, Caracelli, and Graham (1989), define a conceptual framework as an analytical instrument with numerous versions and settings. It is employed to separate concepts and organize ideas or thoughts. Strong conceptual frameworks accurately represent reality in a way that is simple to memorize and use.

When the autonomous variable is manipulated, changed, controlled or varied by a given factor in a given environment, it will have a direct effect either negative or positive on the reliant variable. When these factors are assigned with possible interventions, a deserved outcome will be attained after being tested and measured. A constructive interference on an autonomous variable will always create a conducive environment (Tsai et al., 2008).

The overall goal of the study was to shed light on how teachers may have influenced students' hydrocarbon performance. This study concluded that a variety of factors, including teaching methods, teacher attitudes, and instructor competency about hydrocarbons, might have an impact on students' subpar performance in this subject. According to this study, if these problems are resolved, students' performance in organic chemistry would also increase. Figure 3 summarizes and presents the connections between these variables and students' performance in organic chemistry.

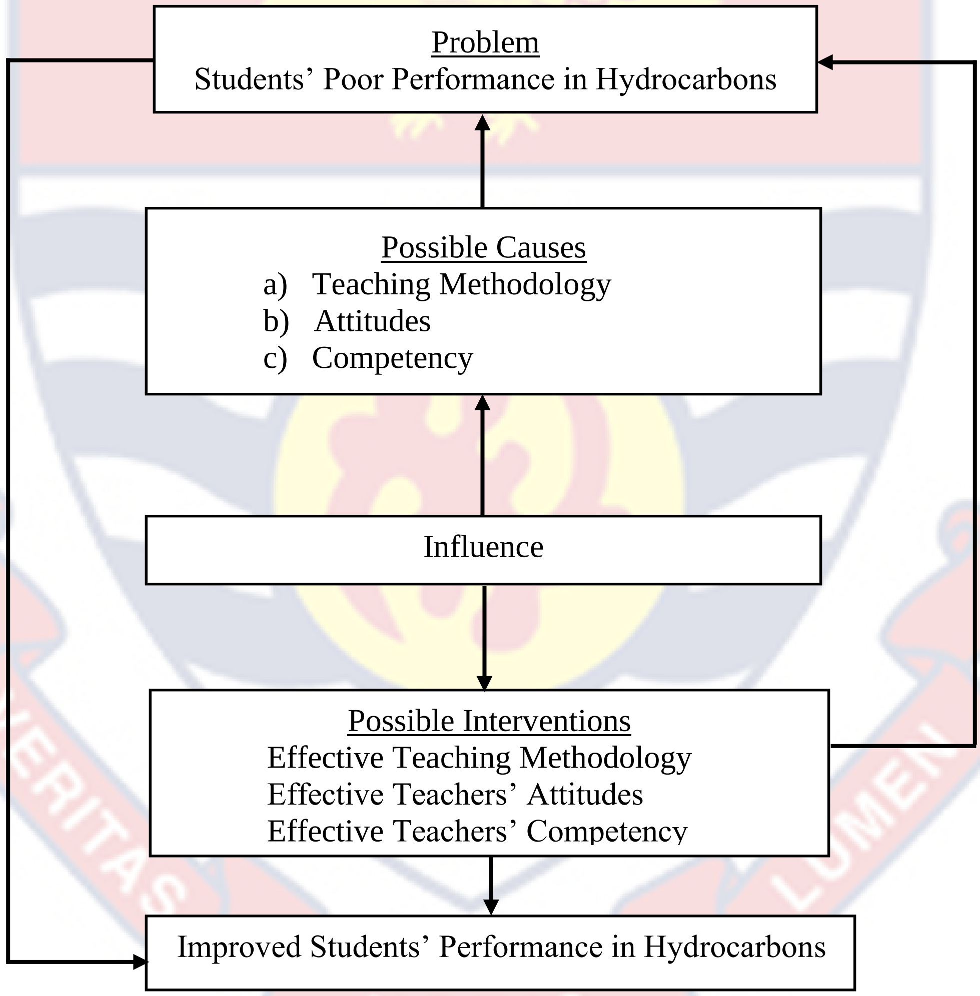

Figure 3 - Conceptual framework adapted for the for the study on teacher influence on students' performance (Tsai et al., 2008).

The characteristics that affect students' success in hydrocarbons are summarized in Figure 3. The autonomous variables in this study and according to the conceptual framework represented in the diagram above is the teacher influence. This framework reveals by contacting the students the factors that influence their academic performance on hydrocarbons and also the factors that the students encounter as learning challenges on hydrocarbons. In addition to this, the diagram reveals that teacher influence can further be expanded into teacher's methodology, teacher's attitudes and teacher's competency towards the teaching of hydrocarbons. These elements or factors were thought to be the ones that catalyzed the improvement of the outcomes and are recognized as the intervening factors that provide the potential solutions. By extension, a good influence results in a good students' performance while a bad influence results in poor performance. Students' improved performance is shown as the possible outcome.

Summary of the Reviewed Literature

This chapter presented the study's theoretical framework and emphasized the key ideas of hydrocarbons maintaining that as a molecular combination of carbon and hydrogen existing in gas and liquid forms, it is broadly used and drives most western civilizations in both economic and scientific perspectives. The chapter underscored the concept of influence revealing four basic types of influence and how it affects performance or output as well as other influence constructs such as self-influence and organizational leadership influence.

More so, the chapter underscores the factors that affect academic performance. Teacher attitude as maintained by Tschannen-Moran and Hoy (2007), contributes to enhancing educational effectiveness and achievement. Teacher attitude is depicted in the context of teacher-student relationship and teacher personality. Teacher methodology as a factor affecting academic performance highlights pedagogical knowledge and content, the diversity of teacher knowledge and the essence of instructional planning in the methodological process of teaching as asserted by Afadil, Suyono, and Poedjiastoeti (2017), that the importance of using a systematic approach to education in raising students' performance cannot be understated. Theoretically, the chapter also identifies constructivism both social and cognitive which underscores active student participation both in environment and knowledge. Competence as review in this chapter, is seen as the knowledge, skill and experiences exhibited in planning, decision making and implementation that facilitate smooth teaching and learning experience both in the classroom and outside the classroom. Both empirical and conceptual perspectives of the study were also added by identifying the problem of poor student performance, its possible causes and the role of teaching methods, attitudes and competences in influencing student performance in hydrocarbons.

CHAPTER THREE

RESEARCH METHODS

This research is intended to investigate the influence of the teacher on the students' performance in hydrocarbons. This chapter discusses the research design, population, sample and procedures of sample selection to help achieve this purpose of the study. This chapter further describes the research instruments, the reliability and the validity of the instruments, and the data collection procedures and how the data was analyzed through the explanatory sequential design.

Research Design

The research methodology employed in the study was mixed methods. The inquiry therefore employed the explanatory sequential design type of mixed approaches. The explanatory sequential mixed methods design is distinguished, in accordance with Creswell, Plano Clark, Gutmann, and Hanson (2003), by a first stage of quantitative data collection and analysis, followed by a stage of qualitative data collection and analysis, and finally connected to the outcomes of the first, quantitative stage, as seen in Figure 4. The explanatory sequential mixed methods design's objective was to employ qualitative information to interpret and make sense of quantitative research results.

Quantitative stage

A self-developed and pilot-tested instrument was used in the quantitative stage of the study to determine the likelihood of a link between the selected variable of instructor influence and students' academic performance (achievement test on hydrocarbons). This step evaluated if there was a significant relationship between the aforementioned variables using the correlation statistic. The study of the quantitative data gave a broad understanding of the problem of academic performance and the importance of instructors.

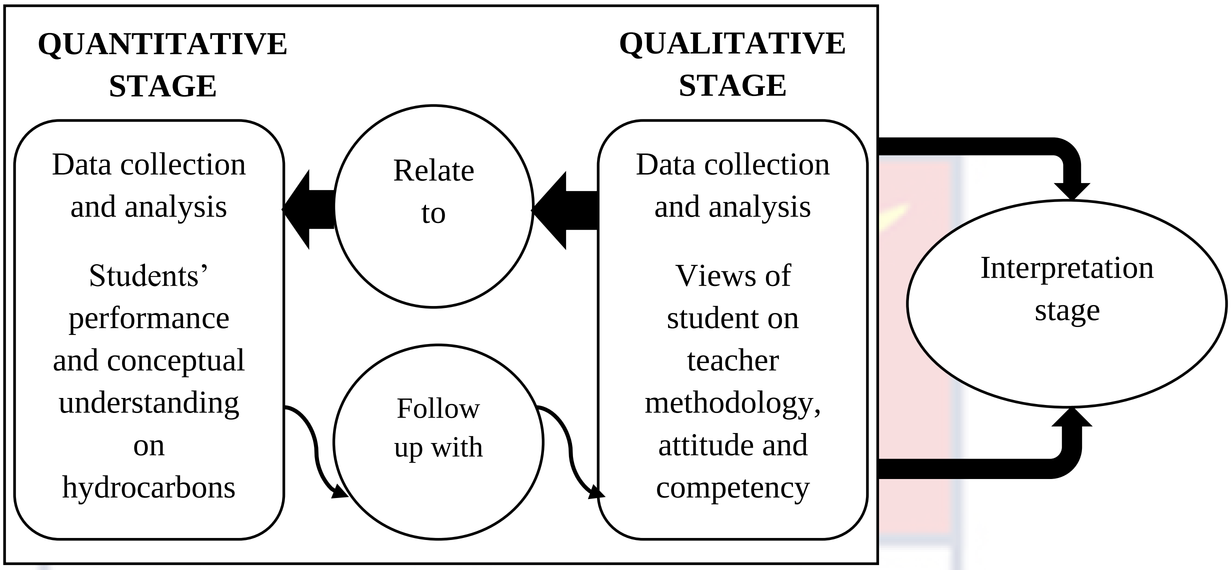

Figure 4: Explanatory sequential mixed methods design adapted for the study (Creswell et al., 2003).

Qualitative stage

The study adopted a qualitative approach of research in the second stage of the mixed methods design as it involved the interpretation of instances of the phenomenon. This involved interacting with students, and focusing on explanations and interpretations of their experiences on how they view their teachers' methodology, competence, and attitude during the instructional hours on hydrocarbons. The qualitative method was adopted for a number of reasons, one of which was to allow for detailed investigations of individuals and groups to focus on understanding the particular case in its complexity (Link & Scott, 2005) being teacher influence on students' performance in hydrocarbons. In this case, students' views, on why they did not perform well in the achievement test on hydrocarbons, were investigated through qualitative methods.

A semi-structured interview guide was used by the mixed techniques to incorporate the qualitative approaches. The intention was to provide students the freedom to openly share their opinions and beliefs on the impact of their instructor on their understanding of hydrocarbons. Combining quantitative and qualitative research and data has the advantage of providing a thorough knowledge and verification while balancing the drawbacks of each method with regard to instructor influences on SHS students' learning of hydrocarbons.

Interpretation stage

At this point, the researcher combined the findings from the qualitative and quantitative phases to describe the overall study's findings. Combining the quantitative and qualitative findings made it easier to understand the outcomes of the statistical tests, which highlighted the importance of using an explanatory sequential mixed-methods design (Creswell et al., 2003). Having carefully constructed the instruments in both stages to complement each other, the outcomes were merged to completely comprehend the impact of teachers on students' hydrocarbon performance. The researcher began by interpreting the study's main or major objective, which was to determine the link between instructors' influence and students' performance using quantitative methodologies. The concerns of how and the live-in-reality in terms of teacher impact were addressed from the perspective of the students in this style of interpretation, which was combined with the qualitative findings of the study. In essence, this enabled the researcher to use the qualitative stage's findings to better clarify and explain the statistical findings from the explanatory sequential mixed techniques' first stage on the impact of teachers on students' overall performance.

Study Area

The study was carried out in the Jaman North district with Sampa as its district capital in the Bono Region of Ghana. This study was conducted in this district because, from to the report of the director of education in the district, most of the final year students (WASSCE candidate) do not perform well in their final examination (WASSCE) in recent times which is in line with the statistical report of the chief examiner from 2011 up to date that majority of the candidate do not perform well and all the senior high schools in Jaman North are within this range and also their performance in general science and mathematics quiz are always below average in all their competitions. This district that the study was conducted was highly populated. The Population and Housing Census (PHC) for 2021 in Ghana pegged the total populace of the district at 117,909 with a population growth rate of 0.38%. The district had 58623 males representing 49.72% and 59286 females representing 50.28% with the highest percentage living in urban areas (PHC, 2021). In the district, there were 54 junior high schools, including 45 public and 9 private institutions. Six institutions made up the second cycle, but only one was a private school, and the district had just one nursing training college.

Population

All SHS 2 elective chemistry students in the four senior high schools in the Jarman North District of the Bono Region of Ghana participated in the research, which was conducted during the 2017-2018 academic year. In the district, there were five senior high schools that were public and one that was private. Four of these institutions offered General Science as a curriculum, whilst the others did not. The study was conducted at these four institutions. The study's accessible population consisted of 298 students, all of whom were enrolled in SHS 2's optional chemistry course during the 2017–2018 school year.

Sampling Procedure

The study's participants were chosen using the census approach. All of the population's students were utilized as the sample in the census approach. By using this technique, the researcher was able to contact every participant in the study. The sample was highly representative of the target demographic, which had the benefit that the results could be generalized to the public. In each of the chosen schools, there was only one optional chemistry class, and these courses were employed for the study. Table 1 lists the schools that were chosen as well as how many students attended each.

Table 1: Proportions of Students in Selected Schools

School	**Male**		**Female**		**Total**
	N	**%**	**N**	**%**	
School A	41	73.21	15	26.79	56
School B	46	54.76	38	45.24	84
School C	53	64.63	29	35.37	82
School D	68	89.47	8	10.53	76
Total	208	69.80	90	30.20	298

Source: Field Survey (Osei, 2018).

From Table 1, 208 males were sampled representing 69.80% of the total sample size while 90 students representing 30.20% were females. The total number of the students who were engaged to respond to the achievement test was 298 and questionnaire was 297. The differences with the sample size in the questionnaire was that one of the questionnaire papers was left blank during the submission and this was detected during the entry of the data. Out of the 298, 90.95% of the students responded to the test and their scores were below average in the achievement test, and responded to the interview guide. These enabled the researcher to explore more in the teacher influence on students' performance in hydrocarbons. In school A, out of 56 students who responded to the test, 19.39% (32) of the students scored below 30 marks of the total mark of 60. The researcher intended to use all the 19.39% students for the interviews in school A but the interviews got to a point where similar responses were circulating among the respondents. Such prevalence was detected in the rest of the schools which were selected for the study. In school A, the same responses started circulating from the 7th student up to the 14th student where the researcher marked as the saturated point. In school B, 84 students responded to the test and 30.30% (50) of the students scored low marks. The researcher decided to use all the 30.30% students for the interview but the same responses started circulating from the 9th student up to the 17th student where the researcher marked as the saturated point. In school C, 82 students responded to the test and 59.75% (49) of the students scored low marks. The researcher desired to use all the 59.75% students for the interview, but the same responses started circulating from the 7th student up to the 18th student where the researcher marked as the saturated point. Finally, in school D, 76 students responded to the test and 20.60% (34) of the students scored low marks. The researcher anticipated using all the 20.60% students for the interviews but the same responses started circulating from the 8th student up to the 19th student where the researcher marked as the saturated point.

Data Collection Instruments

Three research instruments were used to collect data from the students. These instruments were:

1. **FTSQ:** Form Two Students' Questionnaire

2. **FTSAT:** Form Two Students' Achievement Test
3. **FTSIG:** Form Two Students' Interview Guide

FTSQ: A close ended questionnaire constructed by the researcher was administered to the students. These questionnaires were constructed by using the WASSCE chemistry past question on hydrocarbons and chemistry text books that is used as a teaching and learning material which is in line with the WAEC syllabus. FTSQ was divided into three sections, A, B and C. The first section (Items 1 to 19) centered on the teacher's competency. The second section (Items 20 to 29) concentrated on teacher's attitude, and the third section (items 30 to 35) centered on the teacher's methodology that was used by the various elective chemistry teachers during the instructional periods (Appendix A).

These closed-ended questionnaire (FTSQ) were given to some experienced chemistry instructors at two SHS in another district as well as the researcher's supervisor for review. They were developed based on teacher factors impacting the students' performance. The required adjustments were made, and the FTSQ was properly certified as a result. The FTSQ was moderated in accordance with their feedback and recommendations in order to fulfill the purpose of the study. Prior to the actual data collection in this investigation, the researcher carried out a pilot study. The pilot study's goal was to evaluate the instrument's dependability. It was conducted in a school that was selected at random from a different district that wasn't involved in the first research. The researcher randomly selected 30 students in one of the schools who offer general science as a course in Jaman south district which is close to the district that this study was conducted to respond to FTSQ. The purpose of the pilot research was to assess both the appropriateness of the language used in the questionnaire and the degree of difficulty of the instrument components. This made it possible for the researcher to update the study tools by making modifications and revisions in light of the observations made. Data were collected and analyzed after the pilot research. The split-half method was used to assess the FTSQ's dependability, and the Pearson Product Moment Formula was then used to estimate the correlation between the two sets of data. The dependability of the instruments was judged to be strong enough with a correlation value of .75.

AFTSAT was created by the researcher. There were two sections of FTSAT. The first segment had 20 multiple-choice questions where the students were required to select the best option from the available possibilities for each question. Two essay questions were included in the second part of the FTSAT, and students were required to answer them in the space allotted on the test paper. Only hydrocarbons, including alkanes, alkenes, alkynes, and their derivatives, were allowed for any of the FTSAT items (Appendix B). This instrument's ease of analysis in an immediately accessible form was a significant benefit (Gupta, 2014). The cost-effectiveness of using accomplishment examination led to the selection of FTSAT as a data gathering tool. In addition to being affordable and adaptable, its use was a useful method of data collection.

There are several sorts of validity, according to De Vos (2005), however for the purposes of this study, the researcher focused on content validity. According to Foxcroft, Paterson, Le Roux, and Herbst (2004), the content validity of the test or the items may be improved by utilizing individuals who are more qualified to evaluate the items or test specifications and the selection of things. Major portion of FTSAT was extracted and modified from the West African Examinations Council question bank (from 1993 to 2015). This is to ensure that their appropriateness measures to the West African academic content standards on hydrocarbons in organic chemistry. To ensure face validity of FTSAT prior to its final printing, it was given to two SHS chemistry teachers and one chemistry lecturer in the University of Cape Coast for critiquing and making suggestions. Thereafter, corrections were made and the instrument pilot-tested. FTSAT was pilot-tested with 30 students. The [KR 21] coefficient of reliability of FTSAT was .99. Of the starting 30 multiple choice questions, 10 were deleted and the three theory questions were scaled down to two theory questions after the review by the evaluators. Thus, the total number of test items on the achievement test sent to the field was 20 objective questions and two theory questions.

The researcher created a semi-structured interview (FTSIG, in Appendix C) to investigate in further depth the impact of teachers on students' performance. This interview was conducted to learn why these students weren't able to reply to the questions about hydrocarbons very effectively. The FTSIG items were unrestricted. The same questions were asked to the students in the same sequence. The opportunity to autonomously voice their opinions was offered to the students. Prior to final printing, the interview guide items (FTSIG) were submitted to two SHS chemistry instructors and one chemistry educator from the University of Cape Coast for review, criticism, and recommendations in order to assure their validity and dependability. Following the examination by the assessors, three of the seven interview questions were eliminated. On FTSIG, the required modifications were performed. To fulfill the study's goals, the FTSIG was scaled back. As a result, a total number of four items on FTSIG were sent to the field for data collection.

Data Collection Procedures

Nwana (1996) stipulates that pre-arrangement should be made with respondents so that there would be precision in the information given. A request letter was made to the Faculty of Science and Technology Education's Department of Science Education, and the department provided me with an introduction letter that I addressed to each of the schools chosen for the research. In order to establish a connection with the chemistry teachers and the SHS 2 chemistry students, the researcher visited the schools after presenting the letter of introduction to the several Headmasters. The majority of the hydrocarbon topics in organic chemistry have been covered, according to the researcher's inquiries to the various chemistry teachers.

The test was self-administered on the 16^{th} of January, 2018. Due to time schedules, the researcher first administered **FTSAT** to the students to investigate the understanding of the students on hydrocarbons after which **FTSQ** to all the students who took part in responding **FTSAT** which was scheduled on the week that followed. This study followed up and supported with a semi-structured interviews conducted by the researcher on the students who scores were below average to find out their experiences on how these students view their teachers' methodology, competence, and attitude during the instructional hours on hydrocarbons in the selected schools.

Data Processing and Analysis

Data from **FTSQ** were collected and coded as follows; Strongly Disagree = 1, Disagree = 2, Undecided = 3, Agree = 4, Strongly Agree = 5. The data were analysed based on the research questions using exploratory factor analysis and Multiple regression were used for the analysis. By comparing the magnitudes of the observed correlation coefficients in relation to the magnitudes of the partial correlation coefficients that were used to determine the degree to which the explanations in the dependent variable in the study owed to the independent variable, Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity were used to measure the sampling adequacy. Thematic analysis was used to analyse the **FTSIG**. Themes were constructed by the researcher to allow the respondents to voice out freely on the factors that they encounter as a learning challenge on hydrocarbons the hinders their performance.

Ethical Consideration

In this study, an ethical issue was taken into account. First, permission was obtained from the students to determine whether or not they were interested in taking part in the study. The information gathered was kept private and will only be utilized for study.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

This chapter addresses the findings in connection to the study questions and gives the outcomes of the data obtained using the data collecting tools. Confirmatory factor analysis and multiple regression were employed to analyze the quantitative data since the study utilized an explanatory sequential mixed methods design, while thematic analysis was used to analyze the qualitative data.

Research Question One: What teacher factors influence students' performance on hydrocarbons?

Teacher Factors Influencing Students' Performance in Hydrocarbons

Research Question One initially aimed to investigate the teacher factors influencing SHS students' hydrocarbons performance. The FTSQ responses from the students helped the researcher to accomplish this. Though FTSQ was designed along some identified construct, exploratory factor analysis procedure was employed to determine the teacher factors that influence students' hydrocarbons academic performance. The dependability of the data was first determined using an exploratory factor analysis of the instructor factors, followed by the KMO and Bartlett's test. Table 2 presents the outcomes.

Table 2: KMO and Bartlett's Test of Sphericity Results

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.558
Bartlett's test of sphericity	Approx. Chi-Square	49.068
	Df	21
	Sig.	.000

Source: Field data (Osei, 2018)

Kaiser-Meyer-Olkin (KMO), which compares the magnitudes of the observed correlation coefficient in proportion to the magnitudes of the partial correlation coefficient, was used to assess sampling adequacy. Large KMO values were beneficial because they allowed for the other variables to adequately account for correlations between pairs of variables, or possible causes. From Table 2, the KMO value, .558 was significant ($p < .05$). This showed that the variables for the correlation's pairs were strong. Bartlett's test of sphericity was used to find out that the correlation matrix was an identity matrix (all diagonal terms were one and all off-diagonal terms were zero). An observed correlation matrix was compared to the identity matrix using Bartlett's test of sphericity. Essentially, it was useful in determining whether there was any redundancy among the variables that were condensed into a small number of elements. It was permissible for tests to have a significant value of. 05 or less. As shown in the Table 2, $p < .05$ and hence, the data from FTSQ on teacher factors influencing students' performance in hydrocarbon was good for the factor analysis.

The initial solution is depicted in Table 3. Any factor that had an eigenvalue of less than 1.0 was ignored since it did not have enough total variance explained to be a unique factor.

Table 3: Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings [a]
	Total	% of variance	Cumulative %	Total	% of Variance	% Cumulative	Total
1	1.406	20.087	20.087	1.406	20.087	20.087	1.352
2	1.248	17.833	37.920	1.248	17.833	37.920	1.266
3	1.020	14.570	52.490	1.020	14.570	52.490	1.077
4	.903	12.900	65.389				
5	.869	12.416	77.805				
6	.815	11.643	89.448				
7	.739	10.552	100.000				

Source: Field data (Osei, 2018)

Components 4 to 7 were taken out of the study since it was seen from Table 3 that they had eigenvalues below 1.0. Take note that the cumulative percentage was below 100%. This was due to the fact that not all of the variance could be explained in the final analysis when just part of the components was kept.

To further establish the teacher factors to be retained as influencing students' performance on hydrocarbons, the principal component analysis was conducted. The outcomes of the communalities of the factors are presented in Table 4.

Table 4: Communalities

	Initial	Extraction
The teacher explains concepts to my understanding	1.000	.614
The teacher is able to guides students to sources of information on hydrocarbon	1.000	.536
The teacher is able to help students develop hypothesis on the subject	1.000	.530
The teacher involves students in real problems related to the lesson of hydrocarbon	1.000	.579
The teacher organized experiments during the lessons	1.000	.422
The teacher demonstrates understanding of chemical structure and bonding in hydrocarbon	1.000	.549
The teacher exhibits understanding of the structure, properties and basic classes of hydrocarbons	1.000	.446
The teacher develops students' skills of applying hydrocarbon knowledge to real life situation.	1.000	.622
The teacher explains concepts clearly on hydrocarbons	1.000	.631
The teacher teaches concepts in hydrocarbons without using charts and other supporting materials.	1.000	.726
The teacher uses charts, models and other material to teach concepts effectively.	1.000	.649
Teacher is able to teach students how to learn and solve problems on hydrocarbons.	1.000	.672
The teacher makes effective use of time for teaching hydrocarbon	1.000	.540

The teacher asks questions that stimulate students' attention and interest.	1.000	.602
The teacher teaches hydrocarbons to my satisfaction	1.000	.703
The teacher asks open ended questions that help students form defensible answers	1.000	.426
The teacher helps students raise their own questions and explanations on hydrocarbon. Lessons	1.000	.584
The teacher motivates students through reward and reinforcement in hydrocarbon. Lessons	1.000	.584
The teacher stimulates and challenge student to think through relevant questions.	1.000	.670
The teacher is friendly during lessons	1.000	.706
The teacher is supportive in teaching lessons	1.000	.583
The teacher marks and returns assignments before the next lesson.	1.000	.674
The teacher gives exercises and assignments and marks them	1.000	.569
The teacher insists that students do correction of exercises and remarks them	1.000	.499
The teacher believes I can perform well in organic chemistry	1.000	.448
The teacher always come to class and teach	1.000	.610
The teacher always comes to class on time and leaves on time	1.000	.542
The teacher ends his/her lessons before his/her lesson is over	1.000	.615
The teacher shows a lot of interest in teaching hydrocarbon	1.000	.655
The chemistry teacher uses models, charts and equipment to support teaching	1.000	.635

The teacher allows students to ask and answer questions	1.000	.666
The teacher allows students to handle material, charts and models during teaching of concepts	1.000	.617
The teacher designs activities e.g., mixing and testing of chemical to support the teaching of hydrocarbon.	1.000	.737
The teacher uses discussion to present concepts in hydrocarbon	1.000	.669
The teacher mostly discloses the topics to be discussed to students in advance to enable them prepare.	1.000	.645

Source: Field data (Osei, 2018)

The proportion of variance explained by a variable's common factors—also known as communality was referred to as communality. There are 0 to 1 communalities. One indicated that all the variation was explained by the common components, and zero meant that none of the variance was explained by the common factors. The communality demonstrated the percentage of shared variation present in the variables, as seen in Table 4. These values implied that student academic performance on hydrocarbons is influenced by teacher factors. The number of teacher factors that were expected to have an influence on students' performance in hydrocarbons was also confirmed using the scree plot. Figure 5 displays the outcomes of the scree plot.

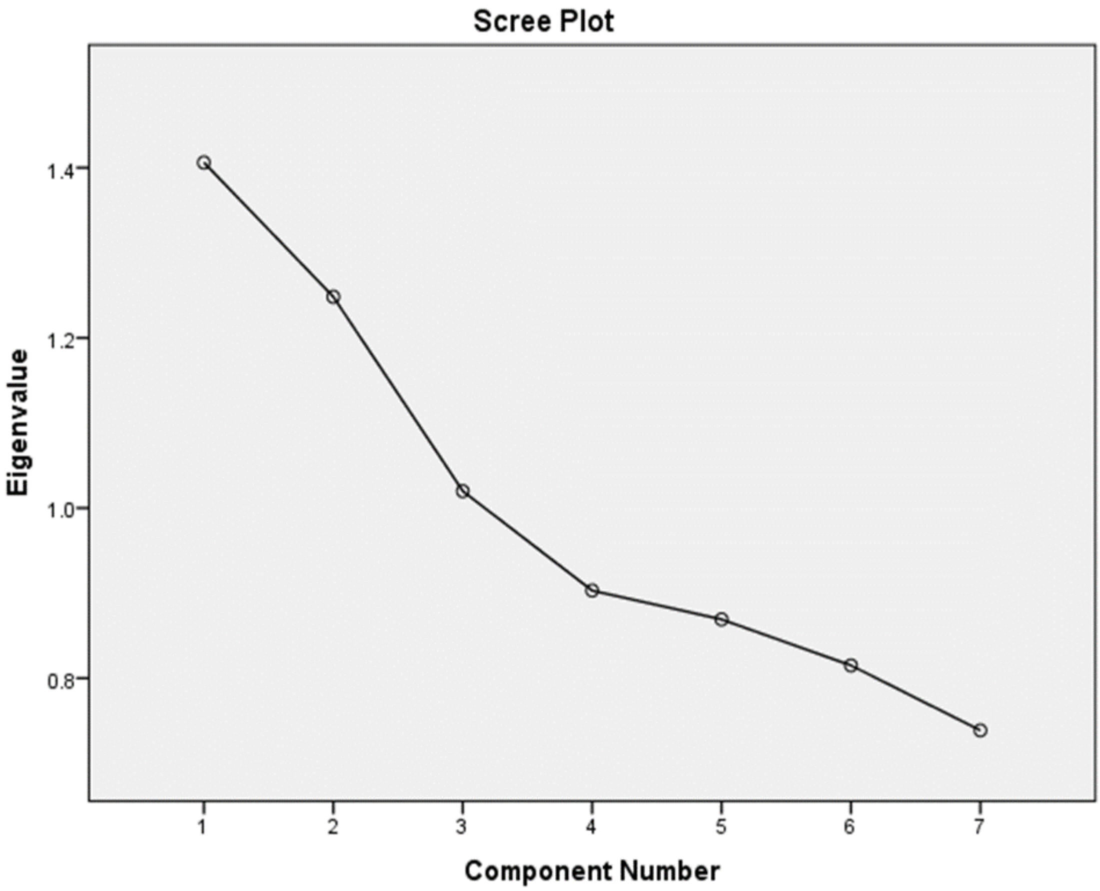

Figure 5 – A scree plot of the teacher factors influencing students' performance in hydrocarbons.

Source: Field data (Osei, 2018)

The number of teacher factors that should be produced by the analysis was suggested by the point in Figure 5 when the slope of the curve was clearly leveling off. The eigenvalue that accounted for variability was ≥ 1.0. Because a factor with an eigenvalue of 1.0 accounted for as much variance as a single variable, and the logic was that only factors that explain at least the same amount of variance as a single variable was worth keeping. However, in Figure 5, a cut-off of an eigenvalue ≥ 1 was likely to result in four factors. The scree plot seemed to have disconfirmed that teacher factors that influenced students' performance in hydrocarbons in Table 5.

To make a strong case for the number of teacher factors to be retained as influencing students' performance in hydrocarbons, the principal component analysis was conducted. The results of the principal component analysis are presented in Table 6.

Table 5: Component Matrix from the Principal Component Analysis

	Component		
	1	2	3
the teacher is able to help students develop hypothesis on the subject	.667	-.287	
the teacher exhibits understanding of the structure, properties and basic classes of hydrocarbons.	.603	-.120	.260
the teacher organised experiments during the lessons	.550	-.155	.309

Source: Field data (Osei, 2018)

Extraction Method: Principal Component Analysis.

a. 3 components extracted.

The findings in Table 5 provided insight into how the items and factors link. This component matrix showed the correlations between each analysis item and each of the three factors that were kept. A perfect correlation is stated to exist if the value is close to ± 1. The tendency was for the other variable to either decrease (if negative) or increase as one did (if negative). If the coefficient value lies between ± 0.50 and ± 1, then it is said to be a strong correlation. Therefore, the values suggested that the items positively correlate with the teacher factors. The first component correlated positively with the items, but the second and third components were lowly corrected. Hence, the first component has a higher correlation than the other two.

The Pattern Matrix for oblique rotations, which reflects the factor loadings for each variable on the components or factors after rotation, is illustrated in Table 6. The rotated solution clearly shows how each item's relationship to each element.

Table 6: Pattern Matrix[a]

	Component		
	1	2	3
The teacher is able to help students develop hypothesis on the subject	.687		
The teacher exhibits understanding of the structure, properties and basic classes of hydrocarbons.	.665		
The teacher organized experiments during the lessons	.648		
The teacher demonstrates understanding of chemical structure and bonding in hydrocarbons		.737	
The teacher is able to guide students to sources of information on hydrocarbons		.723	
The teacher explains concepts to my understanding		.289	.726
The teacher involves students in real problems related to the lesson of hydrocarbons		.329	-.683

Source: Field data (2018)

Table 7 shows the structure matrix. The structure matrix held the correlations between the variables and the factors.

Table 7: Structure Matrix

	Component		
	1	2	3
The teacher is able to help students develop hypothesis on the subject	.696		-.245
The teacher exhibits understanding of the structure, properties and basic classes of hydrocarbons.	.664		
The teacher organized experiments during the lessons	.642		
The teacher demonstrates understanding of chemical structure and bonding in hydrocarbon		.734	
The teacher is able to guides students to sources of information on hydrocarbon		.725	.103
The teacher explains concepts to my understanding		.297	.727
The teacher involves students in real problems related to the lesson of hydrocarbon	.107	.325	-.683

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization

The component correlation matrix was displayed in Table 8. Component loadings, or the correlations between the variable and the component, were contained in it. Possible values for these correlations range from -1 to +1. Thus, it was clear from the component matrix that teacher-related factors had a direct influence on students' academic performance.

Table 8: Component Correlation Matrix

Component	1	2	3
1	1.000	.050	-.061
2	.050	1.000	.010
3	-.061	.010	1.000

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalisation.

The results of this study revealed that one of the key elements influencing students' academic performance is teacher competency. This conclusion is consistent with Jacobson's (2012) research, who investigated at students' academic achievement or performance in senior secondary school chemistry and teachers' competence in the subject chemistry. The results of this study showed that teachers' attitudes and students' academic achievement are positively correlated. This confirms Meenakashi's (2008) work that teachers' attitudes have an impact on students' learning. The results of this study also revealed that teaching methods had an impact on students' academic achievement. This supports Elvis' (2013) research, which examined the relationship between instructional method and students' academic achievement and found that teaching methods had an influence on how students learned.

Teacher Factors Influencing Most of Students' Performance in Hydrocarbon

Research Question One looked more closely at the teacher factors (competence, attitude, and methodology) that had the greatest influence on SHS students' academic performance in hydrocarbons. To achieve this the students responded to FTSAT and FTSQ. To determine which teacher factors had the most influence on students' academic performance in hydrocarbons, a multiple regression analysis was conducted. Multiple linear regression aids in assumption testing to ensure that independent variables and dependent variables are correlated. Making sure there was no multi-collinearity between the independent variables was the first presumption to be evaluated. Regression analysis considers variables to be multi-collinear if their correlation is larger than 0.7, hence this would not be accepted. The findings of the tests of the correlation and regression assumptions are shown in Table 9.

Table 9: Correlations

		Academic Performance	Teacher Competence	Teacher Attitude	Teacher Methodology
Pearson Correlation	Academic Performance	1.000	.171	.035	.111
	Teacher Competence	.171	1.000	.679	.583
	Teacher Attitude	.035	.679	1.000	.592
	Teacher Methodology	.111	.583	.592	1.000
Sig. (1-tailed)	Academic Performance	.	.002	.273	.029
	Teacher Competence	.002	.	.000	.000
	Teacher Attitude	.273	.000	.	.000
	Teacher Methodology	.029	.000	.000	.
N	Academic Performance	297	297	297	297
	Teacher Competence	297	297	297	297
	Teacher Attitude	297	297	297	297
	Teacher Methodology	297	297	297	297

It can be seen from the results that there was no multi collinearity between the predictor variables since from the regression the values between the predictor variables are less than 0.7. Looking at the variables, Teacher competence correlates with Teacher attitude which is within the boundary (0.679), and Teacher methodology which is 0.583. Also, Teacher attitude correlates with teacher methodology which is also within bounds (0.592). Therefore, it can be concluded that none of the predictor variables is multi-collinear. Hence the variables are acceptable for the correlation.

The probability plot was also used to determine the correlation between the independent factors and the dependent variable, which was another assumption that was evaluated. To satisfy this presumption, the probability plot's relationship with the independent and dependent variables must be linear.

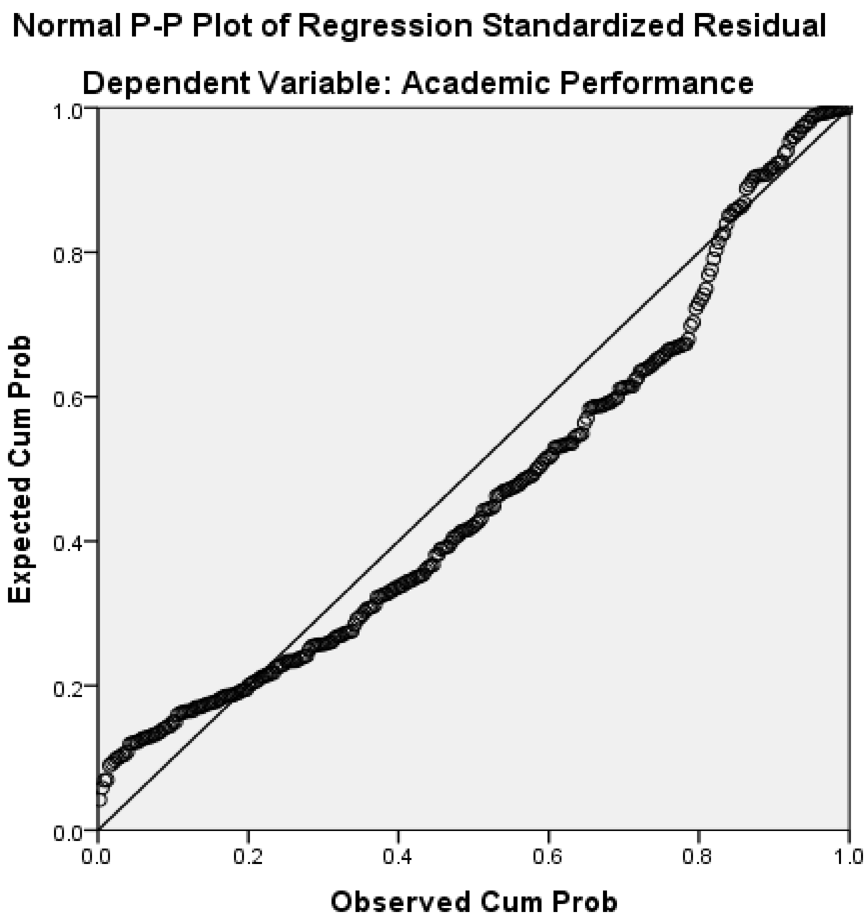

Figure 6 - Probability plot of regression standardized residual.

From Figure 6, it can be seen from the probability plots that although there appear to be some deviations in the points, they are more or less generally falling in the line. It can, therefore, be said that there is correlation between independent variables and the dependent variable. As a result, there is a connection between students' academic performance while learning about hydrocarbons and the competence, attitude, and methodology of their teachers.

Once more, an assumption was tested using the scatter plot. The scatter plots need that no points fall beyond the range of -4 and +4 on both the x-axis and the y-axis in order for there to be a correlation between the independent variables and the dependent variable. Figure 7 presents the outcomes.

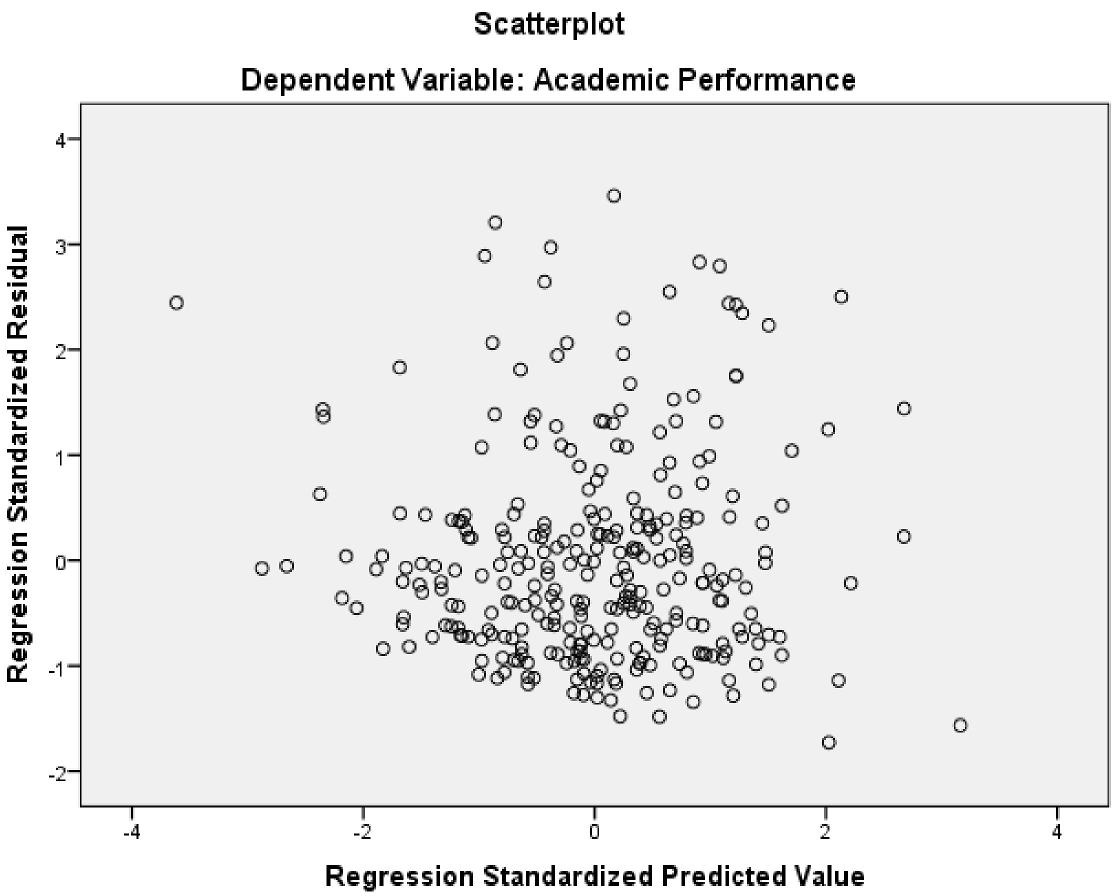

Figure 7 - Scatterplot of the correlation between teacher factors and students' performance in hydrocarbon.

SOURCE: Field data (Osei, 2018)

From Figure 7 it can be seen from the scatterplot that none of the points fall outside of - 4 to + 4 either on the x-axis which is the Regression Standardised Residual or the y-axis which is the Regression Standardised Predicted value. As a result, the plot is ideal for depicting the relationship between the independent and dependent variables. As a result, there is a connection or correlation between students' academic performance while learning about hydrocarbons and the competence, attitude, and methodology of their teachers. Table 10 presents the findings.

Table 10: Residual Statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	18.78	40.19	30.21	3.160	297
Std. Predicted Value	-3.616	3.161	.000	1.000	297
Standard Error of Predicted Value	.886	4.729	1.618	.581	297
Adjusted Predicted Value	14.67	42.07	30.19	3.240	297
Residual	-25.602	51.265	.000	14.735	297
Std. Residual	-1.729	3.461	.000	.995	297
Stud. Residual	-1.749	3.485	.000	1.002	297
Deleted Residual	-26.216	51.960	.014	14.963	297
Stud. Deleted Residual	-1.755	3.553	.002	1.008	297
Mahal. Distance	.062	29.183	2.990	3.439	297
Cook's Distance	.000	.189	.004	.013	297
Centered Leverage Value	.000	.099	.010	.012	297

a. Dependent Variable: Academic Performance

Source: Field data (Osei, 2018)

With regards to Table 10, the Residual Statistics, the standard residual values range from -1.729 to +3.461 which are within range since they are not outside of -4 and +4 and therefore suggestions a connection or correlation that exist between the independent variables and the dependent variable. Additionally, for there to be a correlation between the independent variables and the dependent variable, Cook's distance must not be greater than 1. From Table 10, it can be seen that, Cook's distance fall within the range from minimum 0.000 and maximum 0.189. The correlation between the independent and dependent variables is acceptable because the values do not exceed 1. Table 11 provides the model's executive summary.

Table 11: Model Summary

				Std Error	Change Statistics				
		R	Adjusted	Of the	R Square				Sig. F
Model	R	R Square	R Square	Estimated	Change	F Change	df1	df2	Change
1	.210[a]	.044	.034	14.811	.044	4.490	3	293	.004

a. Predictors: (Constant), Teacher Methodology, Teacher Competence, Teacher Attitude

b. Dependent variable: Academic performance

SOURCE: Field data (Osei, 2018)

Since the dependent variable is normally distributed, the R square value can be used to describe the variation in the correlation. According to the model summary, the model explains 4.4% of the variation in the dependent variable, which is statistically significant at a level of 0.004, with a R Square value of 0.044. Table 11 displays the outcomes for the predictors.

Table 12: ANOVA[b] statistics

Model		Sum of Square	Df	Mean Square	F	Sig
1	Regression	2954.968	3	984.989	4.490	.004[a]
	Residual	64271.503	293	219.357		
	Total	67226.471	296			

a. Predictors: (Constant), Teacher Methodology, Teacher Competence, Teacher Attitude

b. Dependent Variable: Academic Performance

From Table 12, the ANOVA tests the null hypothesis that the slope to the line is zero, which was statistically significant at 0.004. The calculated coefficients are presented Table 13.

Table 13: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
(Constant)	16.643	6.002		2.773	.006
Teacher Competence	.362	.119	.249	3.049	.003
Teacher Attitude	-.450	.212	-.174	-2.118	.035
Teacher Methodology	.267	.291	.068	.917	.360

a. Dependent Variable: Academic Performance

b. Independent variables: Teacher competence, Teacher Attitude and Teacher Methodology

SOURCE: Field data (Osei, 2018)

A standardised beta coefficient was used to compare the magnitude of each independent variable's effect on the dependent variable. The beta coefficient's absolute value rises in proportion to the strength of the effect. The standardized coefficient values signify the contribution of all three variables on academic performance of students in hydrocarbons. It can be seen that the contribution of teacher competence to students' academic performance in hydrocarbons was higher than teacher attitude and teacher methodology. Teacher competence and teacher attitude were statistically significant with values of 0.003 and 0.035 ($p < 0.05$) respectively but teacher methodology was not statistically significant with value of 0.360 ($p > 0.05$).

The notion that teacher factors influence students' academic performance has been proven correct by the regression findings and correlation between the independent variables and the dependent variable. Therefore, it can be said that there is a correlation between the teacher factor and academic performance. A positive coefficient means that the dependent variable's mean tends to rise when the independent variable's value rises and a negative coefficient means that the dependent's variable mean tends to fall when the independent variable's value decreases. The standardized coefficients for the variables for teacher competence and teacher attitude are 0.249 and -0.174, respectively. This means that for every one-unit increase in teacher competence, student academic performance is predicted to increase by 0.249 units, after taking into account the variation in the other independent variables. Similarly, for every one-unit decrease in teacher attitude, student academic performance is predicted to decrease by 0.174 units, after taking into account the variation in the other independent variables. The standardized coefficient for teacher methodology is 0.068. This means that teacher methodology is not a significant predictor of student achievement. A standardized beta coefficient measures how strongly each independent variable has an impact on the dependent variable. The greater the absolute value or number of the beta coefficient, the greater the effect. This also shows that teacher competence has more influence on academic performance, followed by teacher attitude and then teacher methodology.

The purpose of the study was to determine which teaching variables competence, attitude, and methodology influence students' academic achievement in hydrocarbons the most. The study's conclusions indicated that, teacher competence has the most influence on academic performance of students, followed by teacher attitude and the teacher methodology. This was identified by comparing the strength of each independent variable's standardized beta coefficient with the dependent variable. The higher the absolute value of the beta coefficient, the stronger the effect. A higher value of .249 was assigned to teacher competence, -.174 to teacher attitude, and. 068 to teaching methodology. Therefore, it can be inferred that teacher competency has the greatest influence on students' academic success followed by teacher attitude and teaching approach and with this the null hypothesis is rejected because all the teacher factors have influence on students' academic performance on hydrocarbons.

Results from the Student Achievement Test

In this study, an achievement test examination was employed as an evaluation to determine if the students had highly developed knowledge or expertise regarding hydrocarbons. The standardized aptitude test was the kind of accomplishment exam that was utilized for the evaluation. This accomplishment exam was created specifically to evaluate students' understanding of the hydrocarbons based on numerous classroom lessons. Following the completion of the examination by the students, the scripts of the test was marked, and the results for each of the schools were recorded and tubulated (Appendix D). The aptitude test had a total score of 60 marks. The table below shows the distribution of marks obtained by the students within the various schools.

Table 14: Marks Obtained by Students in each Schools

Mark Range	Number of students in the various schools				
	No. of students	**A**	**B**	**C**	**D**
51-60	5	0	3	2	0
41-50	10	3	4	2	1
31-40	12	2	5	2	3
21-30	128	28	39	42	19
11-20	82	15	10	9	48
00-10	61	8	23	25	5
TOTAL	298	56	84	82	76

Source: Field Survey (Osei, 2018).

distribution of marks obtained by the students in all the schools that was used for the study.

Table 15: Percentage Mark Distributions in the Test

Mark Range	Percentage of student passed in the achievement test		
	No. of students	Percentage for all the four Schools	
51-60	5	1.67%	
41-50	10	3.35%	9.05%
31-40	12	4.03%	
21-30	128	43.0%	
11-20	82	27.52%	90.95%
00-10	61	20.46%	
TOTAL	298		

Source: Field Survey (Osei, 2018).

From the table above 1.67% of the students obtained a mark ranging from 51 to 60, 3.35% of the student obtained a mark ranging from 41 to 50, 4.03% of the student obtained a mark ranging from 31 to 40, 43.0% of the student obtained a mark ranging from 21 to 30, 27.52% of the student obtained a mark ranging from 11 to 20 and 20.46% of the student obtained a mark ranging from 0 to 10 in the achievement test administered in the schools used for the study.

Overall, 9.05% of all students attained a score over 30 out of a possible 60 on the achievement exam, while 90.95% of all students had a score below 30 out of a possible 60. The students who failed to get above 30 marks (90.95% of the students) were selected randomly by the help of the teachers for an interview to discuss their performance on the accomplishment exam. In school A, the number of students that were interviewed was 14 before the interview got the saturated point. In school B, the total number of students that were interviewed was 17 before the interview got the saturated point. In school C, the total number of students that were interviewed was 18 before the interview got the saturated point. In school D, the total number of students that were interviewed was 19 before the interview got the saturated point. In total, 68 of the students were interviewed.

After using the quantitative analysis to determine the teacher factors that affects students' performance in hydrocarbons, the qualitative analysis was used to provide valuable insights into the phenomenon as the qualitative analysis helps to understand the meaning of things by capturing the students' experiences and perspectives in their own words.

Research Question Two: What teacher factors do students encounter as learning challenges on hydrocarbons?

Teacher Factors Encountered Students Learning Hydrocarbons

Research Question Two sought to explore teacher factors that students encounter as learning challenges on hydrocarbons. As this aspect of the study adopted a qualitative approach, involving the interpretation of instances of the phenomenon, the students who were not able to obtained the mark of 30 (90.95% of the students) in the achievement test were interviewed using the semi-structured interview guide to find out some of their teachers' factors they experience on the teachers' methodology, competence and attitude during the instructional hours on hydrocarbons that influence their performance in the concept because they may have a lot of story to tell why they did not do well. A thematic analysis was used to identify teacher factors that students face when learning hydrocarbons. In analysing the data collected through interviews, four major themes where generated. These were teacher encouragement; teacher guidance; teacher classroom management; and teacher time management.

Teacher Encouragement

This theme reflects teachers' lack of encouragement to students while teaching hydrocarbons. The students mentioned so many ways by which lack of encouragement affect their learning and understanding of hydrocarbons. Some of the students revealed their concerns about the teacher issues that affect their learning and understanding of hydrocarbons as:

Creation of a threat-free environment in teaching hydrocarbons: Although students understood that their choices had repercussions, they found that positive affirmations were much more motivating than threats. When teachers created a secure, supportive environment for their students, supporting their conviction in their abilities rather than outlining the consequences of not completing assignments, students were much more likely to become and remain motivated to complete their work. The students were asked whether their teacher creates a threat-free environment in teaching hydrocarbons. The responses of the students provided evidence to teacher problems they encounter on learning hydrocarbons. Some of the responses from the students are:

'Whenever I ask a question, which my teacher thinks it is trivial, he does not respond to it which makes me unhappy in the class, so with this I normally don't ask question in class' (ST 1,4,10,14, SCH A,).

'My teacher sometime says, I am not serious whenever I get a question wrong which he expects me to get it correct when learning organic chemistry and this makes me low-spirited in class' (ST 9,17,18,20,34, SCH D).

*'My teacher most at times doesn't create a treat free environment in teaching hydrocarbons and with this he sometimes speaks harsh on us when we are not getting the concept' (*ST. 15,17, 27 SCH. C).

'My teacher sometimes uses unpleasant words for me such as I reason like tortoise whenever I delay in answering question in hydrocarbon class' (ST 13,20, 28 SCH B).

'My teacher sometimes makes me feel bad in the presence of my classmates and this always prevents me from either asking or answering questions in class. As you know organic is difficult' (ST. 18,46, 68; SCH. D).

With regards to the above statements from some of the students, it could be seen that not creating a threat-free environment for students by teacher affects the students making them withdrawn and therefore, this poses a challenge to their learning and conceptual understanding of hydrocarbons.

Helping to manage anxiety of students on learning hydrocarbons: Some students grew so anxious about the idea of failing that became a nightmare. Teachers may discover that teaching those students that failing a subject is not the end of the world motivates them the most. It is, therefore, important for teachers to help manage anxiety of students, and make sure students are not so overwhelmed by expectations that they give up. In this regard, students were asked if their teachers help them in managing their anxiety regarding the learning hydrocarbons. The following responses from some of the students are reflective of teacher problems they face in learning hydrocarbons:

> *'During the onset of the hydrocarbon lessons, my teacher told us that if we are not serious, we will all fail'* (ST. 19,33, 56; SCH. A).
>
> *'No, my teacher did not do anything to help us to manage the anxieties we had in learning hydrocarbons. He only made it worse by always reminding us how difficult the subject was and how it was easy to fail'* (ST. 82,67, 81,74; SCH. C).
>
> *'My teacher sometimes pushes us into fear and panic that if we don't learn we will fail'* (ST. 45,16, 84, 21; SCH. B).
>
> *'At the beginning of the hydrocarbon lesson, my teacher said the lesson is not difficult but if we don't take care we will fail, and I was not happy when he made that comment'* (ST. 7,16, 20, 21; SCH. A).
>
> *'My teacher didn't clear the misconception we had on the course during the onset of the course'* (ST. 21, 39, 41, 45; SCH. B).

In brief, when teachers do not help in managing anxiety of students, creating psychological problems which affect students' learning. Hence, teachers unable to help manage students' anxiety is a teacher problem that affects students' learning of hydrocarbons.

Teacher's feedback to help improve on learning hydrocarbons: Students who struggle with their coursework or classwork can experience discouragement and depression, which would sap their motivation. In these situations, teachers must provide students the proper learning feedback in order to help them comprehend what went wrong and how to avoid it in the future. The students were asked if their teachers give them feedback to help them improve on their learning and understanding of hydrocarbons. The responses from some of the students are as follows:

> *'My teacher give feedback but not always'* (ST. 3, 7, 9, 14, 15, 35; SCH. A).
>
> *'Sometime he gives feedback but not always as we will expect it to be'* (ST. 2,19, 52, 73, 76; SCH. D).
>
> *'When the needs arise that he sometimes gives feedback'* (ST. 41,36, 32, 3; SCH. B).
>
> *'When I request for feedback on task that are challenging to me, he refers me to see my classmates'* (ST. 2, 6, 31, 17, 23, 14, 19; SCH. C).
>
> *'The teacher gives us feedback on assignment and task but these feedbacks are not enough for us to broaden our knowledge and understanding on hydrocarbon. Because he will not discuss with us'* (ST. 2, 14, 17, 34, 19, 49; SCH. B).

From the responses of students above, it could be seen that not providing appropriate feedback to students dips their morale which affects their learning. This is therefore, a teacher problem that affects students in learning hydrocarbons.

Teacher Guidance

This theme highlights the short falls of teachers in providing guidance to students while teaching hydrocarbons. It was revealed that lack of guidance from teachers to students in learning hydrocarbons affect the students in so many ways. The following sub-themes and responses from the students lay more credence to the effects of lack of teacher guidance.

Teachers helping students to plan their learning of hydrocarbons: Planning in most cases is the first step in accomplishing a task. Proper planning lays the foundation on which the rest of the activities are based. Lack of proper planning mostly results in bad outcomes or inadequate results. It is therefore very crucial for teachers to render proper help to their students to guide them in planning their learning activities in order to make learning very effective. In similar line, the students were questioned on their teachers' assistance in developing a strategy for their study of hydrocarbons. The following are some of the responses from the students:

> *'No, my teacher didn't help me to plan how to learn hydrocarbons. He just gave us the course outline and that was all'* (ST. 32, 46, 16, 54 84; SCH. B).
>
> *'I learn hydrocarbon on my own without the guidance from the teacher as to how to learn it'* (ST. 3,16, 23, 75, 21; SCH. D).
>
> *'The teacher doesn't show or give us any lay down procedures of how to learn hydrocarbon'* (ST. 13, 14, 31,16, 51, 21; SCH. A).
>
> *'I wish that teacher gives us the guidelines for learning hydrocarbon but he doesn't do that when he is teaching'* (ST. 1,3,6, 42,51, 82; SCH. C).

It could be seen that lack of guidance from teachers to students affects their learning as they do not know which direction to take in learning to make things easy for them. Thus, lack of teacher guidance is a hindrance to students learning hydrocarbons.

Teacher assuming students understand what is being taught*:* Some teachers make the assumption that their students are already knowledgeable about the content being taught though they are not. There will always be a significant gap in the foundation of students if teachers start building on knowledge that students do not have. Of course, some students may have an advantage, but the teacher must make sure that the entry behaviour of students is similar to build on. The teacher can always give students specific instructions to make sure they are all on the same page. In line of this, students were asked if their teachers always assume that what he or she is teaching is being understood by all the class. The following are some of the responses from some of the students:

> *'Yes, because he always makes the comments silence means consent when we are not talking'* (ST. 28 35 37 48, 52, 53; SCH. A).
>
> *'Yes, because he doesn't go over the previous lesson whenever he begins with a new subtopic'* (ST. 41,7, 38, 21; SCH. B).
>
> *'Yes, because some areas where he need to elaborate well, he just brushes through assuming that we already understand what he she is teaching'* (ST. 6,16,12, 72, 68, 14, 43,25; SCH. C).
>
> *'Yes, because when he is teaching a subtopic which has a link with the previous lessons on hydrocarbon, he tries to skip some of the steps thinking that we already have the knowledge'* (ST. 1,42, 16; 30; 12; 19; 13; SCH. D).

It could be noted that teachers assuming students already have knowledge of a topic their teaching is a problem that teachers must look at especially those teaching hydrocarbons. If students must understand well a new concept, then the instructional approach should take advantage of students' knowledge and previous experiences.

Teachers making teaching hydrocarbons simple and clear: It is very important that teachers make sure their instructions are easy to understand. It poses great disadvantage to students when they move on with conceptual difficulties in the previous lessons. In relation to this, students were asked if their teachers make the teaching of hydrocarbons simple and clear? These are what the students have to say:

> *'Not always, sometimes the explanations my teacher gives when teaching hydrocarbons are not clear but he doesn't break it down or relate it to every day experiences for us to understand. So, we go into the next lesson with difficulties'* (ST. 14,17, 23, 42, 53; SCH. A).

'Anytime my teacher uses explanation method (that is talking and talking) throughout the whole period of the lesson, I find it very difficult to understand some aspect of the concept especially when he doesn't involve us' (ST. 1, 19, 31,18, 26, 21; SCH. C).

'Whenever the teacher randomly put us into groups to solve a given problem, I become very confused and does not get a clear understanding especially when I find myself in a group of weak students' (ST. 3, 7,16, 19, 39, 56, 21; SCH. D).

'I always don't get the scenario and the lesson becomes boring and not clear to me when my teacher relating the topic to real life events that are not familiar with me' (ST. 4, 9, 11, 13, 14, 21, 55; SCH. B).

'Sometimes I hardly get the concept and also loses focus when the teacher uses questions and answers throughout the lesson' (ST. 7, 8, 13, 15, 21; SCH. C).

'I face a lot of difficulties when my teacher gives us the topics and the subtopics that is going to be discussed the next instructional period to read and after reading and making the necessary preparation, the teacher will use questions and answers instead of teaching the topic by making use of models and illustrations' (ST. 2,19, 43, 46; SCH. A).

Taking into account the statements from the students, it could be seen that when teachers do not make teaching hydrocarbons simple and clear, it puts students in a disadvantaged position. Therefore, that counts as a teacher problem that affects students' learning hydrocarbons.

Teaching with familiar examples: When learning, it is simpler to understand new material in the context of our prior knowledge. To communicate a subject effectively, teachers must take into account the knowledge and experiences of their students. In order to help students to learn about hydrocarbons, it is crucial for teachers to ensure that their teaching strategies or instructional methods make use of students' prior experiences and knowledge. However, the students interviewed felt their teachers were not taking advantage of. In this light, the students were asked if their teachers explain the concept of hydrocarbons by using examples that they are familiar with. The following are the responses from some of the students:

> *'Sometimes the examples are simple to understand but other times too, the examples are not clear and it makes it difficult to understand. Because they are not familiar to us'* (ST. 11,16, 21, 24, 29; SCH. B).
>
> *'The examples my teacher gives are too abstract and don't have anything to do with everyday live so understanding it becomes a problem'* (ST. 7, 12, 15, 16, 21; SCH. A).
>
> *'My teacher tries to explain the concept with examples but he explains the concept as if he is teaching university students so the examples are not all that simple for me to understand. You see the examples should be our everyday experiences'* (ST. 15,16, 18, 24, 53; SCH. B).

It could be seen that when teachers do not teach hydrocarbons with clear examples from everyday life that students are familiar with, it poses a challenge to the students which affects their learning hydrocarbons.

Teacher Classroom Management

The activities that have an impact or influence on how hydrocarbons are taught and learned in the classroom are discussed below. The students who participated in the interviews stressed that how their teachers run the classroom and its activities had an influence on how hydrocarbons were taught and learned. The following sub-themes and student responses serve as proof of the influence of teacher classroom management on students' understanding of hydrocarbon.

Developing positive teacher-student interaction: By adopting mistake correction procedures to deal with inappropriate behaviour, adding praise comments to recognise excellent behaviour, and engaging in active monitoring, teachers can enhance connections with their students (for example, circulating, scanning, encouraging). This would help enhance students' academic performance, reduce chronic absenteeism, encourage self-discipline, improve self-control, and enhance goal-setting abilities. In this regard, students were asked if their teachers develop positive teacher-student interactions with them. The following are the responses of some of the students:

> *'Sometimes my teacher interacts with us, other times too he is just too focused on what he is teaching just to finish and leave the class'* (ST. 17, 22, 24, 53; SCH. D).
>
> *'Not always, it is like all my teacher is concern about is to teach and go so he doesn't really open up to us and interact with us'* (ST. 20, 22, 44, 2, 3; SCH. B).
>
> *'My teacher only interacts with us when the need arises but if he does this regularly, it will encourage us to be punctual in class and perform well'* (ST 18, 24, 43, 46, 50; SCH. C).

These show there is lack of everyday functional teacher-student interactions in teaching hydrocarbons. This could be one of the reasons affecting to a large extent students' learning and understanding of hydrocarbons.

Teachers adapting to cooperative learning approaches: Learning in small groups encourages sharing information and thoughts about a topic and problem among students. In line of this, students were asked if their teachers encourage small group discussions in learning hydrocarbons. These are the responses given by some of the students:

> *'Sometimes my teacher puts us into groups of small circles to discuss some of the topics but this does not happen often, he only puts us into groups when he is busy with other engagements like staff meetings'* (ST. 1, 6, 24, 33, 35, 43 49; SCH. A).
>
> *'My teacher doesn't put us into small groups to discuss anything, he always comes to teach, asks few questions and that is all'* (ST.16, 18, 24, 53; SCH. B).
>
> *'My teacher groups us when the need arises. For example, when he is not feeling well, he groups us to discuss the topic before he leaves for hospital.'* (ST. 15, 16, 28, 54, 55; SCH. C)

It is clear that teachers barely adapt to teaching hydrocarbons using cooperative learning approaches. However, students wish they are taught with cooperative learning approaches to learn from their colleagues but not as an emergency situation management technique.

Teacher creating a friendly atmosphere in teaching hydrocarbons: The teacher's ability to create an atmosphere where students may learn and progress in their understanding of hydrocarbons is discussed here. The importance of both students and teachers working together to learn as a learning community is emphasized. An inviting setting where students may work toward specific objectives defined in the course objectives characterizes the ideal classroom. To help students develop a scientific understanding of hydrocarbons, the teacher has to be upbeat, organized, self-assured, and compassionate. With this in mind, students were asked if their teacher creates a friendly atmosphere when teaching hydrocarbons. Below are some of the responses given by students:

> *'Whenever the teacher explains concepts in hydrocarbons in class which is not to my understanding and I ask more questions for clarifications, he gets angry'* (ST. 5,6, 13,18, 24, 51; SCH. A).

> *'Whenever the teacher explains concepts in hydrocarbons in class and I see it in an abstract form, I fear to ask questions because when you ask too many questions it puts him off'* (ST. 11, 17, 25, 35, 40, 46; SCH. D).

> *'Whenever the teacher explains concepts in hydrocarbons in class and when we are not able to link it to real life problem, he gets infuriate and sometimes insult us'* (ST. 2,17, 18, 21, 49; SCH. C).

> *'Whenever the teacher explains concepts in hydrocarbons in class and we are not getting the concept and we ask questions he would say, "Keep quiet and suffer'*. (ST. 35,43, 18, 45; SCH. B)

It is evident that due to the attitude of the teachers, they do not create conducive learning environment for students. That is, during teaching hydrocarbons, teachers do not create a friendly atmosphere, and students tend to feel uneasy, consequently affecting their learning and understanding of hydrocarbons.

Teacher Time Management

This is about how teachers manage the available time for the process teaching and learning of hydrocarbons. The students interviewed mentioned that there was lack of proper time management in teaching hydrocarbons and this have a significant results or effects on students' learning and understanding of hydrocarbons. The following sub-themes and responses from the students as evidence to the above theme.

Teachers Scoring assignments and giving feedback on time: There are two reasons for giving scores to students' learning outcomes. That is, it helps students, respond to comments and improve with time; and to get students engage with feedback practices to improve their learning. Students who receive regular feedback are better able to focus their attention and energy, steer clear of serious mistakes and dead ends, and avoid picking up knowledge that they will later have to undo at significant price. Hence, students were asked if their teachers score assignments and provide feedback on time.

The following responses from the students presents evidence to the above:

> *'My teacher sometimes gives us assignment, marks and gives us feedback but not on the time that we will be expecting it'* (ST. 6, 15, 18, 32, 52, 75; SCH. D).

> *'My teacher does not always give us assignment, but whenever he gives assignment, it takes him longer period of time before he marks it and does not give us the necessary feedback as we expect'* (ST. 3, 9, 18, 20, 25; SCH. C).

It can be seen that the assessment practices of teachers teaching hydrocarbons (in terms of scoring and providing feedback on students' assignments) are not as effective as students expect. That is, teachers barely give students assignments and feedback to enhance learning hydrocarbon in the schools. Hence, another teacher problem that students face in learning and understanding hydrocarbons is ineffective assessment and feedback practices.

Teachers utilising effectively the time assigned for hydrocarbons: Since their attention is well-focused, students who practice effective time management may do more in less time. Additionally, efficient time management enables students to maximize their talents and experience a sense of success. That is, teachers use most of the assigned time to maximise students' learning hydrocarbon. In view of this, students were asked if their teachers utilise effectively the time assigned for chemistry (hydrocarbon). The following responses from the students as evidence of teacher's ineffective use of time:

> *'My teacher mostly comes to class 10 to 20 minutes late during chemistry (hydrocarbon) lessons'* (ST. 16, 18, 24, 47; SCH. B).
>
> *'The teacher mostly makes us to spent a lot of time on a given task on the hydrocarbon lesson whiles we could have use some of the time do other activities'* (ST. 24, 25, 37, 39, 48, 51; SCH. A).
>
> *'The teacher mostly spent a lot of time on receiving response from a lot of students in the class on particular question on hydrocarbon lesson whiles we could have use some of the time do other activities'* (ST. 4,19, 22, 29; SCH. C).
>
> *'The teacher mostly makes us to spend a lot of time when he put as into small groups to work on a given task on the hydrocarbon lesson whiles we could have use some of the time do other activities'* (ST. 1, 5, 6, 8, 17, 23, 76; SCH. B).
>
> *'The teacher mostly makes us spend a lot of time to search for information using references materials in class when he put as into small groups on the hydrocarbon lesson whiles we could have use some of the time do other activities'* (ST. 25,16, 18, 24, 51; SCH. D).

It can be seen that students view their teachers not making effective usage of time that is allocated for teaching and learning chemistry (hydrocarbon). That is, students believe that their teachers strategically avoid using all the assigned time for effective teaching and learning. Teachers intentionally delay teaching and learning which hinders better understating of the subject by students.

Teacher absenteeism in class during hydrocarbon lessons: Uncontrolled teacher absenteeism has a negative impact on the smooth operation of the school. Because it affects students' learning and effective coverage of the content of the curriculum. In view of the above, the students were asked if their teachers are usually punctual to use the assigned time for teaching hydrocarbons. The following responses from the students as evidence to the above:

> *'My teacher is not always regular in class as we expect him to be regular with respect to our timetable because he is engaged in a lot of responsibilities in the school'* (ST. 2, 14, 40, 44, 51; SCH. D).
>
> *'My teacher is not always regular in class because he attends a lot of meetings and make a lot of travels which prevents him from engaging us during chemistry (hydrocarbon) lessons* (ST. 5, 6, 18, 42, 47, 48; SCH. C).

It can be seen that teachers are not punctual and that they ineffectively use the time assigned for teaching chemistry (hydrocarbon). That is, most often than not teachers are absent. This is another teacher problem that affects students learning and understanding of hydrocarbons is teacher absenteeism.

In conclusion, the findings of this study and the responses from some of the students showed that some of the teacher problems that students encounter in learning and understanding of hydrocarbons include a lack of teacher encouragement, a lack of teacher guidance, a lack of classroom management, and a lack of time management.

From the thematic analysis, the study revealed that when teachers do not create a study environment that is conducive for students, it affects the students which poses a challenge to their learning and conceptual understanding of hydrocarbons.

Again, the study found that anxiety creates psychological problems which affect students' learning. Therefore, when teachers are not able to help manage students' anxiety, it becomes a problem that affects students learning of hydrocarbon.

In addition, the study showed that not providing appropriate feedback to students dampens their morale which affects their learning. This is therefore, a teacher problem that affects students in learning hydrocarbons.

Also, the study revealed that lack of guidance from teachers to students affects their learning as they do not know which direction to take in learning to make things easy for them.

Furthermore, the study revealed that teachers assuming students already have knowledge of a topic their teaching is a problem that teachers must look at especially those teaching hydrocarbons. If students must understand a new concept very well, then the teaching strategy should draw on students' prior learning and experience.

To add to that, the study revealed that when teachers do not make teaching hydrocarbons simple and clear, it puts students in a disadvantaged position. This becomes a problem that affects students' learning hydrocarbons.

More so, the study showed that when teachers do not teach hydrocarbons with clear examples from everyday life that students are familiar with, it poses a challenge to the students which affects their learning of hydrocarbons.

The study showed that there is lack of everyday functional teacher-student interactions in teaching hydrocarbons. This affects to a large extent students' learning and understanding of hydrocarbons.

From the study, it was discovered that, teachers barely adapt to teaching hydrocarbons using cooperative learning approaches. However, students wish they are taught with cooperative learning approaches to learn from their colleagues but not as an emergency situation management technique.

The study revealed that due to the attitudes of some of the teachers, they do not create a friendly atmosphere conducive for learning. This makes students feel uneasy, consequently affecting their learning and understanding of hydrocarbons.

According to the study, some teachers are not utilizing their time to teach and learn chemistry in an efficient manner (hydrocarbon). It is thought that some teachers purposefully delay teaching and learning in order to avoid spending the entire allotted time for effective teaching and learning, preventing pupils from understanding the material more fully.

The out of the study on the quantitative analysis was juxtaposed with the qualitative analysis's outcome for in-depth understanding of the teacher factors the influence students' performance in hydrocarbons. The quantitative results show that teacher competence and teacher attitude significantly influence academic performance, whereas teacher methodology does not have a statistically significant effect. The qualitative findings provide possible explanations for these results, as students reported facing challenges related to teacher encouragement and anxiety management, which are aligned with teacher competence and teacher attitude. Given that teacher competence was found to have the most substantial standardized beta coefficient (0.249) and the highest influence on academic performance, it aligns with the qualitative finding that students faced challenges related to teacher encouragement. A competent teacher is likely to create a supportive and motivating learning environment, which can positively impact students' performance. Similarly, the negative standardized beta coefficient for teacher attitude (-0.174) suggests that a negative teacher attitude can hinder students' performance. The qualitative findings on anxiety management support this, as students reported feeling demotivated and anxious when their teachers used negative language or conveyed a lack of belief in their abilities. On the other hand, the insignificant standardized beta coefficient for teacher methodology (0.068) concurs with the qualitative findings that did not highlight teacher methodology as a significant factor affecting students' learning challenges in hydrocarbons. In conclusion, the quantitative and qualitative findings converge, indicating that teacher competence and attitude play crucial roles in influencing students' academic performance in hydrocarbons. The results highlight the importance of supportive and encouraging teachers in enhancing students' understanding and success in the subject.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The study's summary is provided in this chapter along with its main results, recommendations, and implication for further investigation. The suggestions and conclusion are based on the study questions, and the implications are provided to assist in research, policy, and decision-making.

Summary

The WAEC chief examiner for chemistry has noted that student performance in hydrocarbon is unsatisfactory (Kenni, 2020). So, at a selected SHS in the Jaman North District, the study set out to determine the impacts of teacher influence on students' performance in hydrocarbons (a topic in organic chemistry). Explanatory sequential design was the selected mixed method for this investigation, which used a mixed method approach. Consequently, 297 students who were sampled through the census technique were used to gather both quantitative and qualitative data. The teacher component or factor that most accurately predicted students' hydrocarbon deficiencies was discovered using exploratory factor analysis and multiple regression statistics. And the primary method for examining teacher issues that students experienced as obstacles to studying hydrocarbon in the SHS was theme analysis.

Key findings

1. a. The Teacher competence, teacher attitude, and teacher approach or methodology used were shown to be the teacher qualities that had the greatest impact on students' academic performance.

   b. The findings from the examination of the factors predicting most of the students' academic performance in learning hydrocarbon show that students perceived that teachers' competence has the most influence on their academic performance when learning hydrocarbons. This was followed by teachers' attitude and then teachers' methodology.

2. The findings on the exploration of teacher problems that students encounter in learning hydrocarbons show that students viewed teacher encouragement, teacher guidance, teacher classroom management, and teacher time management.

Conclusion

The major goal of this study was to determine how 297 SHS students in the Jaman North District performed when learning about hydrocarbons under the influence of their teachers. According to the results, the three most important variables that affect students' performance in learning about hydrocarbons are instructor competency, teacher attitude, and teacher methodology. The three main variables that affect students' learning of hydrocarbons are teacher competency, teacher attitude, and teacher methodology and among these factors' teacher competence has the greatest impact. This has added to the body of knowledge on teaching and learning organic compounds, showing that while there are many factors influencing students' learning of hydrocarbons, teacher competency is the primary factor causing students' subpar or poor academic achievement in hydrocarbons

Notwithstanding teacher competence, teacher attitude, and teacher methodology being reported here as the factors affecting students' academic performance in hydrocarbons, qualitatively other teacher problems were identified as challenges facing students learning hydrocarbon in the SHS. The teacher problems were teacher encouragement, teacher guidance, teacher classroom management, and teacher time management which are not effectively managed to create conducive learning environment for students. Thus, this study has contributed to the literature by demonstrating that there are specific teacher issues that students see as impeding their ability to learn about and effectively use hydrocarbons.

Recommendation

Based on the study's findings, the following suggestions and recommendations were made:

1. Since teacher factor such as teacher competence, teacher attitude, and teacher methodology affect students' academic performance in hydrocarbon, teacher education institutions should consider their curriculum for training pre-service teachers to assure the stakeholders in teacher education that these teacher factors are taken care of in their teacher preparation.
2. Since teacher competence is the main factor affecting students' academic performance in hydrocarbons, the Ghana Education Service together with the universities that train teachers, should organise short courses to enrich the competence of the teachers teaching chemistry in the SHS in the Jaman North District schools to deepen their knowledge to improve their competence in teaching organic chemistry.
3. As one of the teacher problems students consider as a challenge is lack of teacher encouragement in teaching hydrocarbons, the headteachers of the schools in the Jarman North District should organise seminars for experts in learner psychology to share best practices with the teachers.
4. Since teacher absenteeism and ineffective use of instructional time contributed to students' weaknesses in chemistry (hydrocarbon), headteachers through their heads of science department and chemistry unit should put measures in place for effective supervision of the activities of chemistry teachers during the instructional hours.

Suggestion for further research

The study investigated teacher influence on academic performance of students in hydrocarbon but could not investigate the conceptual difficulties of teachers in hydrocarbons. It is, therefore, recommended that future research should study the conceptual difficulties of teachers teaching chemistry in the SHS, in hydrocarbon.

Also, this study reported on teacher factor (such as teacher methodology, teacher attitude, and teacher competence) as influencing students' academic performance in hydrocarbon but not classroom teaching and assessment practices. It is, therefore, recommended that future research should study the influence of teaching and assessment practices of chemistry teachers on the academic performance of students in hydrocarbons.

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APPENDICES

APPENDIX A

INTRODUCTION

I'm a Master of Philosophy candidate at the University of Cape Coast's Department of Science Education. This study aims to determine the teacher's influence on senior high school students' hydrocarbon performance at Diamono Senior High School.

This research is solely for academic purposes.

Please be sure to answer all of the questions on this form truthfully. Please know that your privacy is respected.

Please do not provide your name on the questionnaire.

SECTION A

Kindly tick [√] in the appropriate boxes provided for each of the items, the extent to which you agree or disagree to the assertions.

(**Strongly Agree=SA, Agree= A, Undecided=UN, Disagree= D, Strongly Disagree=SD**)

THE EXTENT TO WHICH THE TEACHERS' COMPETENCE INFLUENCE STUDENTS' PERFORMANCE IN ORGANIC CHEMISTRY

No.	**Teacher's competence**	**SA**	**A**	**UN**	**D**	**SD**
1	The chemistry teacher is able to explain to my understanding concepts in hydrocarbons.					
2	The chemistry teacher has the ability to guide students to source of information on hydrocarbon.					
3	The chemistry teacher has the ability to involve students to develop hypothesis on the lesson of hydrocarbon.					
4	The chemistry teacher has the ability to involve students' real problems related to the lesson of hydrocarbon.					
5	The chemistry teacher is able to organize variety of experiments during hydrocarbon lessons.					
6	The chemistry teacher demonstrates understanding of chemical structure and bonding in hydrocarbon.					

No.	**Teacher's competence**	**SA**	**A**	**UN**	**D**	**SD**
7	The chemistry teacher exhibits understanding of the structure, properties and basic classes of hydrocarbons					
8	The chemistry teacher is able to develop students' skills of applying hydrocarbon knowledge to practical realities of life.					
9	The chemistry teacher is able to explain concepts clearly on hydrocarbon lessons.					
10	The chemistry teacher is able to teach concepts in hydrocarbon without using charts, and other supporting materials.					
11	The chemistry teacher is able to use charts, models, and other supporting materials to teach concepts in hydrocarbon effectively.					
12	The chemistry teacher is able to teach the students how to learn and solve problems on hydrocarbons.					
13	The chemistry teacher makes effective use of time for teaching hydrocarbon.					
14	The chemistry teacher is able to ask questions that stimulate students' attention and interest during hydrocarbon lessons.					
15	The chemistry teacher is able to teach hydrocarbon concepts to my satisfaction.					

No.	**Teacher's competence**	SA	A	UN	D	SD
16	The chemistry teacher is able ask open ended questions that lead the student's formation of defensible answers.					
17	The chemistry teacher is able to encourage students to raise their own questions and explanation on hydrocarbon lessons.					
18	The chemistry teacher has the ability to motivate students through reward and reinforcement in hydrocarbon lesson.					
19	The chemistry teacher is able to stimulate and challenge students to think through the use of appropriate questions.					

SECTION B

Kindly tick [√] in the appropriate boxes provided for each of the items the extent to which you agree or disagree to the assertions.

(**Strongly Agree=SA, Agree= A, Undecided=UN, Disagree= D, Strongly Disagree=SD**)

Teachers' Attitude Towards His Students In The Teaching Of Organic Chemistry.

No.	**Teacher's attitude**	SA	A	UN	D	SD
20	The chemistry teacher is friendly during the teaching of hydrocarbon.					

No	**Teacher's attitude**	**SA**	**A**	**UN**	**D**	**SD**
21.	The chemistry teacher is supportive in the teaching of hydrocarbon.					
22	The chemistry teacher promptly marks and returns assignments and exercises done before the next lesson.					
23	The Chemistry teacher usually gives students exercises, take home assignments and marks them promptly.					
24	The chemistry teacher usually insists that students do correction of exercises, assignments, and remarks them.					
25	The chemistry teacher believes that I can perform well in hydrocarbon.					
26	The chemistry teacher always comes to class and teach.					
27	The chemistry teacher always comes to class on time and lives on time.					
28	The chemistry teacher always ends his lessons before his lesson is over.					
29	The chemistry teacher shows a lot of interest in teaching hydrocarbon.					

SECTION C

Kindly tick [√] in the appropriate boxes provided for each of the items the extent to which you agree or disagree to the assertions.

(**Strongly Agree=SA, Agree= A, Undecided=UN, Disagree= D, Strongly Disagree=SD**)

Teachers' Methodology In The Teaching Of Organic Chemistry.

	Teacher's Methodology	**SA**	**A**	**UN**	**D**	**SD**
30	The chemistry teacher uses models, charts, real materials and equipment to support the teaching of hydrocarbon.					
31	The chemistry teacher gives opportunity to students to ask and answer questions in class					
32	The chemistry teacher usually allows students to handle materials, charts and models during teaching of concepts in hydrocarbon.					
33	The chemistry teacher usually designs activities such as mixing and testing of chemicals to support the teaching of concepts in hydrocarbon.					
34	The chemistry teacher mostly uses discussion to present concepts in hydrocarbon class.					
35	The chemistry teacher mostly discloses the topics to be discussed on the next lesson to the student to do advance preparation.					

APPENDIX B

ACHIEVEMENT TEST ON CARBON COMPOUNDS

(Hydrocarbons)

Form Two (2)

Research No.	
Class	
Date	

INSTRUCTIONS

1. Write your **Research Number, Date** and **Class** on space provided **above** on the question paper.

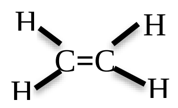
2. This paper is partitioned into two sections, **'A'** and **'B'. Section 'A'** consists of 20 Multiple Choice items, **section 'B'** consists of 2 theory questions.

3. Respond to the **Section 'A'** by circling the options provided that is suitable for each item on the question paper provided.

4. Respond to all the two **(2) theory questions** in **section 'B'** in the space provided on the question paper.
5. All the **theory questions** provided carry equal marks.

Section A

Answer **all** *the questions.*

1. What is the total number shared pair electrons in the compound represented by structure below? 

   A. 5 B. 6 C. 10 D. 12

2. All the following compounds will exhibit geometric isomerism **except**

   A. $CH_3CH=CHCH_3$ C. $CH_3CH_2CH=CHBr$

   B. $COOHCH=CHCOOH$ D. $CH_3CH_2CH_2CH_2Br$

3. which of the following pairs of compounds belongs to the same homologous series?

   A. CH_4 and C_2H_6 C. CH_4 and C_2H_4

   B. C_2H_4 and C_2H_2 D. C_2H_6 and C_3H_6

4. A compound contains 7.75% of hydrogen, 37.2% of carbon and 55.04% of chlorine. What is its empirical? Relative atomic mass (Cl=35.5, C=12.0, H=1.0)

   A. C_2H_5Cl C. $C_2H_4Cl_2$

   B. $C_3H_8Cl_2$ D. C_5H_2Cl

5. The IUPAC name for the compound $CH_3CH(CH_3)CHClCH(CH_3)CH_2CH_3$ is

   A. 2,4-dimethyl-3-chlorohexane C. 4-chloro-3,5-dimethylhexane

   B. 3,5-dimethyl-4-chlorohexane D. 3-chloro-2,4-dimethylhexane

6. Ethyne is used in

   A. Making shoe polish C. the extraction of iron

   B. hunters lump D. the generation of electricity

7. Which of the following pairs of compounds will delocalize acidified $KMnO_4$?

   A. Butane and propane C. Propane and ethyne

   B. Butane and methane D. Propene and ethyne

8. Consider the following hydrocarbons

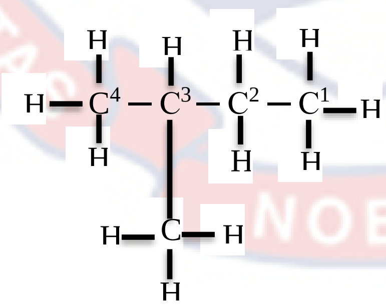
   I. C_2H_6 II. C_2H_4 III. C_2H_2

   Which of them will not undergo addition reaction?

   A. I only C. III only

   B. II only D. I and II only

9. Which of the following carbon atoms numbered 1 to 4 in the structure below is a secondary carbon atom?



   A. 1 C. 3

   B. 2 D. 4

10. What is the molecular formula of 2,2,3-trimethylpentane?

A. $(CH_3)CCH_2CH_2CH_3$
C. $(CH_3)_2CHCH(CH_3)CH_2CH_3$
B. $CH_3C(CH_3)_2CH_2(CH_3)CH_3$
D. $CH_3C(CH_3)_2CH(CH_3)CH_2CH_3$

11. The gas produced when water is added lumps of calcium carbide is

A. Ethane
C. Ethene
B. Ethyne
D. Methane

12. The melting point of $CH_3CH(CH_3)CH_2CH_3$ is higher than that of $CH_3C(CH_3)_2CH_3$, because $CH_3CH(CH_3)CH_2CH_3$

A. Has stronger hydrogen bonding
B. Has higher molecular mass
C. Molecules have more points of contact with each other
D. Is more polarize

13. Ethene can be produce from paraffin oil by the process known as

A. Polylmerization
C. Vulcanization
B. Cracking
D. Hydrogenation

14. What is the hydrocarbon in the equation $2C_xH_y + 7O_2 \rightarrow 4CO_2 + 6H_2O$?

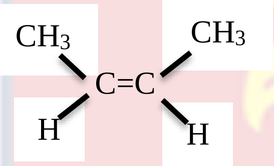
A. Methane
C. Butane
B. Ethane
D. Ethene

15. A compound X does not decolorize bromine water but reacts with bromine in the presence of sunlight. What homologous series does X belong to?

A. Alkynes C. Alkanes

B. Alkenes D. Alkanoic acids

16. What is the IUPAC name of the structure below?



A. 1,2-dimethylethene C. Trans-but-2-ene

B. Cis-but-2-ene D. 2,2-dimethylethene

17. How many moles of hydrogen atoms should be added to 1 mol of an alkyne to convert it to saturated hydrocarbon

A. 2mol C. 6mol

B. 4mol D. 8mol

18. In the equation

$2CH_2H_{6(g)} + xO_{2(g)} \rightarrow YCO_{2(g)} + 6H_2O_{(g)}$

The value of x and y respectively are

A. 2 and 6 C. 6 and 2

B. 4 and 7 D. 7 and 4

19. Which of these compounds will exhibit intermolecular hydrogen bonding?

A. CH_3CH_2CN C. $CH_3CH_2CH_3$

B. $CH_3CH_2NH_2$ D. $CH_3CH=CH_2$

20. Which of the following observations suggest that a given substance is impure?

A. Low melting point C. Colour of the substance

B. Low solubility in water D. Wide range of melting point

Section B

1. a). Ethane (C_2H_6), ethene (C_2H_4), and ethyne (C_2H_2) are separately burnt completely in air to give carbon (IV) oxide and water.

i. Write a balance equation for the complete combustion of one mole of each of the hydrocarbons………………………………………………………………………… 6 marks

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ii. Hence explain why ethyne is the most economical to be use a fuel each of the hydrocarbons contributes equally to the greenhouse effect …………………… 2 marks

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b. Write the structures for the isometric alkanols of molecular formulae C_6H_{14}

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c. i. Define the term empirical formulae ……………………………………………... 2 marks

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ii. A certain compound gave the following elemental analysis C=56%, H=3.9% and Cl=27.6% by mass. Deduce it empirical formulae. 6 marks

Relative atomic number of the element (C=12, H=1.0, O=16, Cl=35.5)

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2. a. Write the structural formulae for:

i. 2,2-dimethylpentane 2 marks

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ii. 1,1,2,2-tetrachloroethane. 2 marks

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b. The compounds have been wrongly named. Draw their structural formulae and give the correct I.U.PA.C. names.

i. 1-methylpropane 2 marks

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ii. 3,3-dimethylbutane………………………………………………………... 2 marks

…………………………………………………………………………………

iii. 2,2-dimethylethane ……………………………………………………….. 2 marks

…………………………………………………………………………..

iv. Cyclohexatriene. ………………………………………………………….. 2 marks

…………………………………………………………………………………

c. Arrange the following compounds in order of increasing boiling points and give your reasons. 8 marks

CH_4, $CH_3CH_2CH_2CH_3$, CH_3CH_3

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Appendix C

Form three students' interview questions

INTRODUCTION

I'm a Master of Philosophy candidate at the University of Cape Coast's Department of Science Education. This study aims to determine the teacher's influence on senior high school students' hydrocarbon performance at Diamono Senior High School.

This research is solely for academic purposes.

Please be sure to answer all of the questions on this form truthfully. Please know that your privacy is respected.

Please do not provide your name on the questionnaire.

FORM THREE STUDENTS' INTERVIEW GUIDE. QUESTIONS

1. How does your teacher encourage you to learn hydrocarbons?
    - ✓ Does the teacher give you a sense of control by allowing you to choose the type of assignment you do or which problem to work on in hydrocarbon?
    - ✓ Does the teacher create a threat-free environment in teaching hydrocarbons?
    - ✓ Does the teacher change scenery in teaching hydrocarbon?
    - ✓ Does the teacher offer rewards and give praises when you earn in teaching and learning of hydrocarbon?
    - ✓ Does the teacher help you manage your anxiety in learning of hydrocarbons?
    - ✓ Does the teacher give feedback and offer chance to improve on learning hydrocarbons?
2. Lack of teacher guidance on students on studying of hydrocarbons
    - ✓ Does the teacher help you to plan how to learn hydrocarbons?

- ✓ Does the teacher guide you to solve challenging tasks on hydrocarbons?
- ✓ Does your teacher assume that you understand what he or she is teaching?
- ✓ Does the teacher make teaching of hydrocarbons simple and clear?
- ✓ Does your teacher explain concept in hydrocarbons by using examples that are easily to understand?

3. Lack of classroom management by the teacher in teaching hydrocarbons
   - ✓ Does the teacher develop positive student interaction?
   - ✓ Does the teacher encourage group discussing?
   - ✓ Does the teacher encourage group assignment?
   - ✓ Does the teacher create a friendly atmosphere in teaching hydrocarbon?
   - ✓ Does the teacher ensure discipline in teaching hydrocarbons?
   - ✓ Does the teacher give room for the student to express their mind in hydrocarbons?
4. Lack of time management by the teacher in teaching hydrocarbons
   - ✓ Does the teacher mark assignment and give feedback on time?
   - ✓ Does the teacher utilize effectively the time assigned for hydrocarbons?
   - ✓ Is the teacher regular in class during hydrocarbon lessons?
   - ✓ Does the teacher allocate time for practical on hydrocarbons?

Appendix D

Achievement test scores

School A

SN	Research Number	Score	SN	Research Number	Score
1	SCH/A/01	12	20	SCH/A/20	24
2	SCH/A/02	26	21	SCH/A/21	16
3	SCH/A/03	17	22	SCH/A/22	22
4	SCH/A/04	15	23	SCH/A/23	26
5	SCH/A/05	22	24	SCH/A/24	06
6	SCH/A/06	22	25	SCH/A/25	24
7	SCH/A/07	21	26	SCH/A/26	22
8	SCH/A/08	16	27	SCH/A/27	44
9	SCH/A/09	46	28	SCH/A/28	29
10	SCH/A/10	23	29	SCH/A/39	26
11	SCH/A/11	25	30	SCH/A/30	23
12	SCH/A/12	22	31	SCH/A/31	22
13	SCH/A/13	10	32	SCH/A/32	10
14	SCH/A/14	09	33	SCH/A/33	14
15	SCH/A/15	28	34	SCH/A/34	32
16	SCH/A/16	11	35	SCH/A/35	16
17	SCH/A/17	18	36	SCH/A/36	28
18	SCH/A/18	29	37	SCH/A/37	08
19	SCH/A/19	08	38	SCH/A/38	10

SN	Research Number	Score
39	SCH/A/39	28
40	SCH/A/40	12
41	SCH/A/41	42
42	SCH/A/42	23
43	SCH/A/43	12
44	SCH/A/44	29
45	SCH/A/45	26
46	SCH/A/46	22
47	SCH/A/47	11

SN	Research Number	Score
48	SCH/A/48	24
49	SCH/A/49	21
50	SCH/A/50	13
51	SCH/A/51	12
52	SCH/A/52	19
53	SCH/A/53	23
54	SCH/A/54	36
55	SCH/A/55	25
56	SCH/A/56	22

School B

SN	Research Number	Score	SN	Research Number	Score
1	SCH/B/01	22	23	SCH/B/20	24
2	SCH/B/02	11	24	SCH/B/21	29
3	SCH/B/03	25	25	SCH/B/22	41
4	SCH/B/04	08	26	SCH/B/23	31
5	SCH/B/05	16	27	SCH/B/24	50
6	SCH/B/06	18	28	SCH/B/25	09
7	SCH/B/07	16	29	SCH/B/26	33
8	SCH/B/08	08	30	SCH/B/27	26
9	SCH/B/09	27	31	SCH/B/28	24
10	SCH/B/10	30	32	SCH/B/39	37
11	SCH/B/11	09	33	SCH/B/30	23
12	SCH/B/12	43	34	SCH/B/31	24
13	SCH/B/13	08	35	SCH/B/32	09
14	SCH/B/14	22	36	SCH/B/33	34
15	SCH/B/15	09	37	SCH/B/34	30
16	SCH/B/16	26	38	SCH/B/35	09
17	SCH/B/17	08	39	SCH/B/37	28
18	SCH/B/18	07	40	SCH/B/38	30
19	SCH/B/19	24	41	SCH/B/39	08
20	SCH/B/20	54	42	SCH/B/40	30
21	SCH/B/21	24	43	SCH/B/41	22
22	SCH/B/22	44	44	SCH/B/42	30

SN	Research Number	Score
45	SCH/B/45	08
46	SCH/B/46	08
47	SCH/B/47	07
48	SCH/B/48	22
49	SCH/B/49	09
50	SCH/B/50	24
51	SCH/B/51	08
52	SCH/B/52	45
53	SCH/B/53	08
54	SCH/B/54	35
55	SCH/B/55	13
56	SCH/B/56	07
57	SCH/B/57	24
58	SCH/B/58	22
59	SCH/B/59	08
60	SCH/B/60	27
61	SCH/B/61	21
62	SCH/B/62	22
63	SCH/B/63	07
64	SCH/B/64	29
65	SCH/B/65	30
66	SCH/B/66	29

SN	Research Number	Score
67	SCH/B/67	26
68	SCH/B/68	28
69	SCH/B/69	09
70	SCH/B/70	23
71	SCH/B/71	30
72	SCH/B/72	28
73	SCH/B/73	19
74	SCH/B/74	18
74	SCH/B/75	21
76	SCH/B/76	16
77	SCH/B/77	-8
78	SCH/B/78	27
79	SCH/B/79	19
80	SCH/B/80	50
81	SCH/B/81	12
82	SCH/B/82	21
83	SCH/B/83	30
84	SCH/B/84	09

SCHOOL C

SN	Research Number	Score
1	SCH/C/01	13
2	SCH/C/02	25
3	SCH/C/03	14
4	SCH/C/04	22
5	SCH/C/05	20
6	SCH/C/06	28
7	SCH/C/07	19
8	SCH/C/08	23
9	SCH/C/09	28
10	SCH/C/10	18
11	SCH/C/11	21
12	SCH/C/12	08
13	SCH/C/13	10
14	SCH/C/14	09
15	SCH/C/15	10
16	SCH/C/16	28
17	SCH/C/17	08
18	SCH/C/18	29
19	SCH/C/19	10
20	SCH/C/20	08
21	SCH/C/21	10
22	SCH/C/22	28

SN	Research Number	Score
23	SCH/C/23	27
24	SCH/C/24	22
25	SCH/C/25	29
26	SCH/C/26	22
27	SCH/C/27	29
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29	SCH/C/29	21
30	SCH/C/30	52
31	SCH/C/31	09
32	SCH/C/32	23
33	SCH/C/33	24
34	SCH/C/34	07
35	SCH/C/35	24
36	SCH/C/36	36
37	SCH/C/37	09
38	SCH/C/38	27
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42	SCH/C/42	27
43	SCH/C/43	08
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SN	Research Number	Score
45	SCH/C/45	08
46	SCH/C/46	11
47	SCH/C/47	09
48	SCH/C/48	24
49	SCH/C/49	12
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54	SCH/C/54	24
55	SCH/C/55	21
56	SCH/C/56	25
57	SCH/C/57	08
58	SCH/C/58	26
59	SCH/C/59	28
60	SCH/C/60	22
61	SCH/C/61	08
62	SCH/C/62	10
63	SCH/C/63	45
64	SCH/C/64	10
65	SCH/C/65	09
66	SCH/C/66	08

SN	Research Number	Score
67	SCH/C/67	24
68	SCH/C/68	10
69	SCH/C/69	13
70	SCH/C/70	22
71	SCH/C/71	25
72	SCH/C/72	21
73	SCH/C/73	27
74	SCH/C/74	23
74	SCH/C/75	21
76	SCH/C/76	32
77	SCH/C/77	26
78	SCH/C/78	12
79	SCH/C/79	22
80	SCH/C/80	08
81	SCH/C/81	21
82	SCH/C/82	27

SCHOOL D

SN	Research Number	Score
1	SCH/D/01	20
2	SCH/D/02	20
3	SCH/D/03	20
4	SCH/D/04	17
5	SCH/D/05	16
6	SCH/D/06	18
7	SCH/D/07	27
8	SCH/D/08	10
9	SCH/D/09	16
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11	SCH/D/11	16
12	SCH/D/12	30
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14	SCH/D/14	10
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18	SCH/D/18	17
19	SCH/D/19	27
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21	SCH/D/21	08
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SN	Research Number	Score
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24	SCH/D/24	20
25	SCH/D/25	12
26	SCH/D/26	18
27	SCH/D/27	17
28	SCH/D/28	20
29	SCH/D/29	18
30	SCH/D/30	08
31	SCH/D/31	19
32	SCH/D/32	28
33	SCH/D/33	30
34	SCH/D/34	34
35	SCH/D/35	14
36	SCH/D/36	22
37	SCH/D/37	18
38	SCH/D/38	44
39	SCH/D/39	11
40	SCH/D/40	11
41	SCH/D/41	30
42	SCH/D/42	12
43	SCH/D/43	21
44	SCH/D/44	17

SN	Research Number	Score
45	SCH/D/45	19
46	SCH/D/46	22
47	SCH/D/47	11
48	SCH/D/48	18
49	SCH/D/49	20
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59	SCH/D/59	16
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61	SCH/D/61	08
62	SCH/D/62	11
63	SCH/D/63	12
64	SCH/D/64	28
65	SCH/D/65	16
66	SCH/D/66	24

SN	Research Number	Score
67	SCH/D/67	23
68	SCH/D/68	18
69	SCH/D/69	22
70	SCH/D/70	18
71	SCH/D/71	25
72	SCH/D/72	16
73	SCH/D/73	21
74	SCH/D/74	31
75	SCH/D/75	20
76	SCH/D/76	25

Appendix E

Achievement test scripts

24/60

ACHIEVEMENT TEST ON CARBON COMPOUNDS

(Hydrocarbons)

Form Two (2)

Research No.	SCH/15/66
Class	2 SCIENCE
Date	16th/01/2018

INSTRUCTIONS

1. Write your **Research Number, Date** and **Class** on space provided **above** on the question paper.

2. This paper is partitioned into two sections, '**A**' and '**B**'. **Section 'A'** consists of 20 Multiple Choice items, **section 'B'** consists of 2 theory questions.

3. Respond to the **Section 'A'** by circling the options provided that is suitable for each item on the question paper provided.

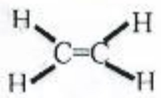
4. Respond to all the two **(2) theory questions** in **section 'B'** in the space provided on the question paper.

5. All the **theory questions** provided carry equal marks.

1

Section A

Answer **all** *the questions.*

1. What is the total number shared pair electrons in the compound represented by structure below? 

A. 5 B. 6 C. 10 D. 12

2. All the following compounds will exhibit geometric isomerism **except**

A. $CH_3CH{=}CHCH_3$ C. $CH_3CH_2CH{=}CHBr$

B. $COOHCH{=}CHCOOH$ D. $CH_3CH_2CH_2CH_2Br$

3. which of the following pairs of compounds belongs to the same homologous series?

A. CH_4 and C_2H_6 C. CH_4 and C_2H_4

B. C_2H_4 and C_2H_2 D. C_2H_6 and C_3H_6

4. A compound contains 7.75% of hydrogen, 37.2% of carbon and 55.04% of chlorine. What is its empirical? Relative atomic mass (Cl=35.5, C=12.0, H=1.0)

A. C_2H_5Cl C. $C_2H_4Cl_2$

B. $C_3H_8Cl_2$ D. C_5H_2Cl

5. The IUPAC name for the compound $CH_3CH(CH_3)CHClCH(CH_3)CH_2CH_3$ is

A. 2,4-dimethyl-3-chlorohexane C. 4-chloro-3,5-dimethylhexane

B. 3,5-dimethyl-4-chlorohexane D. 3-chloro-2,4-dimethylhexane

6. Ethyne is used in

A. Making shoe polish C. the extraction of iron

B. hunters lump D. the generation of electricity

7. Which of the following pairs of compounds will delocalize acidified $KMnO_4$?

A. Butane and propane C. Propane and ethyne

B. Butane and methane D. Propene and ethyne

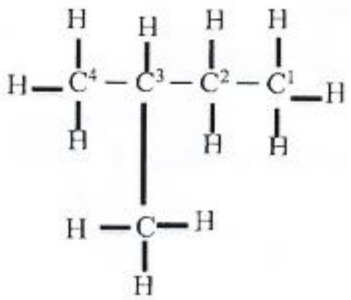
8. Consider the following hydrocarbons

I. C_2H_6 II. C_2H_4 III. C_2H_2

Which of them will not undergo addition reaction?

A. I only
B. II only
C. III only
D. I and II only

9. Which of the following carbon atoms numbered 1 to 4 in the structure below is a secondary carbon atom?



A. 1
B. 2
C. 3
D. 4

10. What is the molecular formula of 2,2,3-trimethylpentane?

A. $(CH_3)CCH_2CH_2CH_3$
B. $CH_3C(CH_3)_2CH_2(CH_3)CH_3$
C. $(CH_3)_2CHCH(CH_3)CH_2CH_3$
D. $CH_3C(CH_3)_2CH(CH_3)CH_2CH_3$

11. The gas produced when water is added lumps of calcium carbide is

A. Ethane
B. Ethyne
C. Ethene
D. Methane

12. The melting point of $CH_3CH(CH_3)CH_2CH_3$ is higher than that of $CH_3C(CH_3)_2CH_3$, because $CH_3CH(CH_3)CH_2CH_3$

A. Has stronger hydrogen bonding
B. Has higher molecular mass
C. Molecules have more points of contact with each other
D. Is more polarize

13. Ethene can be produce from paraffin oil by the process known as

A. Polylmerization C. Vulcanization

B. Cracking D. Hydrogenation

14. What is the hydrocarbon in the equation $2C_xH_y + 7O_2 \rightarrow 4CO_2 + 6H_2O$?

A. Methane C. Butane

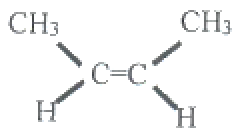
B. Ethane D. Ethene

15. A compound X does not decolorize bromine water but reacts with bromine in the presence of sunlight. What homologous series does X belong to?

A. Alkynes C. Alkanes

B. Alkenes D. Alkanoic acids

16. What is the IUPAC name of the structure below?



A. 1,2-dimethylethene C. Trans-but-2-ene

B. Cis-but-2-ene D. 2,2-dimethylethene

17. How many moles of hydrogen atoms should be added to 1 mol of an alkyne to convert it to saturated hydrocarbon

A. 2mol C. 6mol

B. 4mol D. 8mol

18. In the equation

$2CH_2H_{6(g)} + xO_{2(g)} \rightarrow YCO_{2(g)} + 6H_2O_{(g)}$

The value of x and y respectively are

A. 2 and 6 C. 6 and 2

B. 4 and 7 D. 7 and 4

19. Which of these compounds will exhibit intermolecular hydrogen bonding?

A. CH_3CH_2CN C. $CH_3CH_2CH_3$

B. $CH_3CH_2NH_2$ D. $CH_3CH{=}CH_2$

20. Which of the following observations suggest that a given substance is impure?

A. Low melting point C. Colour of the substance

(B.) Low solubility in water D. Wide range of melting point

Section B

1. a). Ethane (C_2H_6), ethene (C_2H_4), and ethyne (C_2H_2) are separately burnt completely in air to give carbon (IV) oxide and water.

i. Write a balance equation for the complete combustion of one mole of each of the hydrocarbons........ 6 marks

$C_2H_6 + O_2 \rightarrow CO_2 + H_2O$ (1)

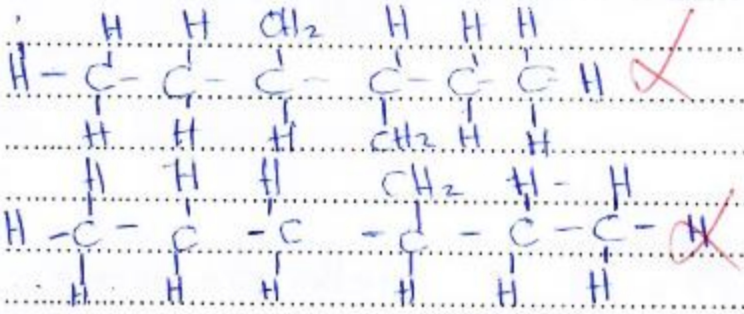
$C_2H_4 + O_2 \rightarrow CO_2 + H_2O$ (1)

$C_2H_2 + O_2 \rightarrow CO_2 + H_2O$ (1)

ii. Hence explain why ethyne is the most economical to be use a fuel each of the hydrocarbons contributes equally to the greenhouse effect .... 2 marks

carbondyoxide gives heat which leads to global warming

b. Write the structures for the isometric alkanols of molecular formulae C_6H_{14} 4 marks



c. i. Define the term empirical formulae Is a chemical formula showing the simplest ratio of element in a compound rather than the total number of atoms in the molecule 2 marks (2)

ii. A certain compound gave the following elemental analysis C=56%, H=3.9% and Cl=27.6% by mass. Deduce it empirical formulae. 6 marks

Relative atomic number of the element (C=12, H=1.0, O=16, Cl=35.5)

Empirical formulae = $\frac{\text{Mass of the element}}{\text{Number of atoms}}$

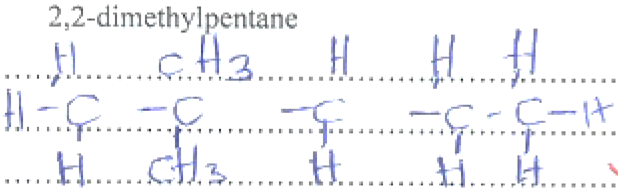
$\Rightarrow \frac{56}{12} + \frac{3.9}{1.0} + \frac{27.6}{35.5} + \frac{12.5}{16}$

$= \frac{\frac{14}{3}}{3} + \frac{\frac{39}{10}}{3} + \frac{\frac{276}{355}}{3} + \frac{\frac{25}{32}}{3}$

$14 + \frac{117}{10} + \frac{828}{355} + \frac{75}{32}$

2\. a. Write the structural formulae for:

i. 2,2-dimethylpentane 2 marks



ii. 1,1,2,2-tetrachloroethane. 2 marks

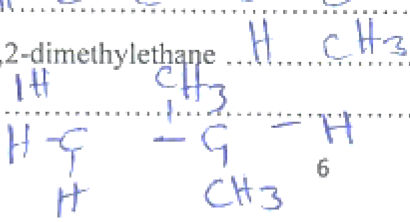
b. The compounds have been wrongly named. Draw their structural formulae and give the correct I.U.PA.C. names.

i. 1-methylpropane 2 marks

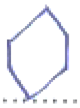
methylpropume

ii. 3,3-dimethylbutane 2 marks

iii. 2,2-dimethylethane 2 marks



6

iv. Cyclohexane.  2 marks

c. Arrange the following compounds in order of increasing boiling points and give your reasons. 8 marks

CH_4, $CH_3CH_2CH_2CH_3$, CH_3CH_3

$CH_4 < CH_3CH_3 < CH_3CH_2CH_2CH_3$

22/60

ACHIEVEMENT TEST ON CARBON COMPOUNDS

(Hydrocarbons)

Form Two (2)

Research No.	SCH/A 106
Class	2C
Date	16th January, 2018

INSTRUCTIONS

1. Write your **Research Number, Date** and **Class** on space provided **above** on the question paper.

2. This paper is partitioned into two sections, '**A**' and '**B**'. **Section 'A'** consists of 20 Multiple Choice items, **section 'B'** consists of 2 theory questions.

3. Respond to the **Section 'A'** by circling the options provided that is suitable for each item on the question paper provided.

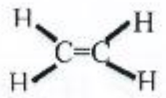
4. Respond to all the two **(2) theory questions** in **section 'B'** in the space provided on the question paper.

5. All the **theory questions** provided carry equal marks.

Section A

Answer **all** *the questions.*

1. What is the total number shared pair electrons in the compound represented by structure below?



A. 5 B. 6 C. 10 D. 12

2. All the following compounds will exhibit geometric isomerism **except**

A. $CH_3CH{=}CHCH_3$ C. $CH_3CH_2CH{=}CHBr$

B. $COOHCH{=}CHCOOH$ D. $CH_3CH_2CH_2CH_2Br$

3. which of the following pairs of compounds belongs to the same homologous series?

A. CH_4 and C_2H_6 C. CH_4 and C_2H_4

B. C_2H_4 and C_2H_2 D. C_2H_6 and C_3H_6

4. A compound contains 7.75% of hydrogen, 37.2% of carbon and 55.04% of chlorine. What is its empirical? Relative atomic mass (Cl=35.5, C=12.0, H=1.0)

A. C_2H_5Cl C. $C_2H_4Cl_2$

B. $C_3H_8Cl_2$ D. C_5H_2Cl

5. The IUPAC name for the compound $CH_3CH(CH_3)CHClCH(CH_3)CH_2CH_3$ is

A. 2,4-dimethyl-3-chlorohexane C. 4-chloro-3,5-dimethylhexane

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I. C_2H_6 II. C_2H_4 III. C_2H_2

Which of them will not undergo addition reaction?

A. I only C. III only

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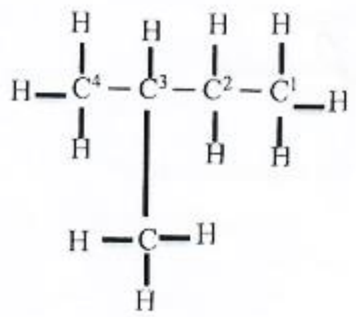
9. Which of the following carbon atoms numbered 1 to 4 in the structure below is a secondary carbon atom?



A. 1 C. 3

B. 2 D. 4

10. What is the molecular formula of 2,2,3-trimethylpentane?

A. $(CH_3)CCH_2CH_2CH_3$

B. $CH_3C(CH_3)_2CH_2(CH_3)CH_3$

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B. Cracking D. Hydrogenation

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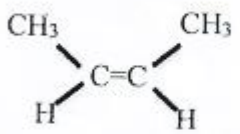
16. What is the IUPAC name of the structure below?



A. 1,2-dimethylethene C. Trans-but-2-ene

B. Cis-but-2-ene D. 2,2-dimethylethene

17. How many moles of hydrogen atoms should be added to 1 mol of an alkyne to convert it to saturated hydrocarbon

A. 2mol C. 6mol

B. 4mol D. 8mol

18. In the equation

$2CH_2H_{6(g)} + xO_{2(g)} \rightarrow YCO_{2(g)} + 6H_2O_{(g)}$

The value of x and y respectively are

A. 2 and 6 C. 6 and 2

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1. a). Ethane (C_2H_6), ethene (C_2H_4), and ethyne (C_2H_2) are separately burnt completely in air to give carbon (IV) oxide and water.

i. Write a balance equation for the complete combustion of one mole of each of the hydrocarbons............ 6 marks

$C_2H_6 + O_2 \longrightarrow CO_2 + H_2O$ (1)

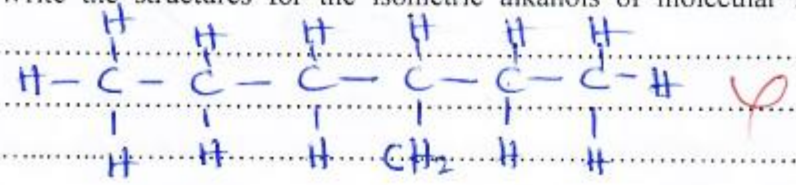
$C_2H_4 + O_2 \longrightarrow CO_2 + H_2O$ (1)

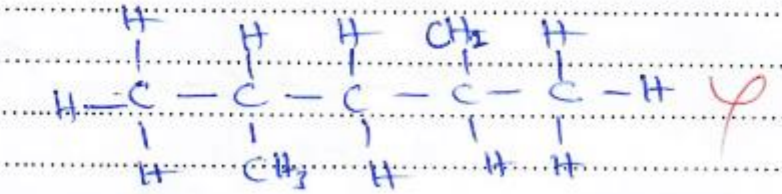
$C_2H_2 + O_2 \longrightarrow CO_2 + H_2O$ (1)

ii. Hence explain why ethyne is the most economical to be use a fuel each of the hydrocarbons contributes equally to the greenhouse effect .... 2 marks

?

b. Write the structures for the isometric alkanols of molecular formulae C_6H_{14} 4 marks





c. i. Define the term empirical formulae This is a formula of a compound that gives the proportions of element present in the compound but not the actual of the atom 2 marks

(2)

5

ii. A certain compound gave the following elemental analysis C=56%, H=3.9% and Cl=27.6% by mass. Deduce it empirical formulae. 6 marks

Relative atomic number of the element (C=12, H=1.0, O=16, Cl=35.5)

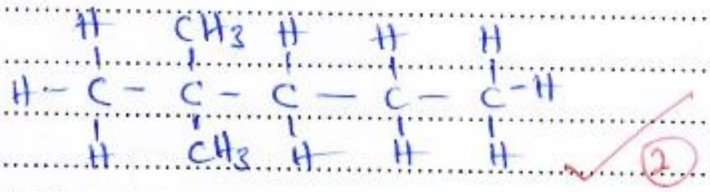
C = 56%, H = 3.9, Cl = 27.6

C	H	Cl	O
$\frac{56}{12}$	$\frac{3.9}{1}$	$\frac{27.6}{35.5}$	$\frac{12.5}{16}$

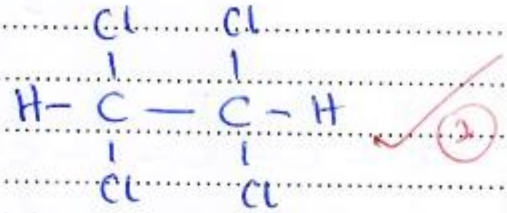
(1)

2. a. Write the structural formulae for:

i. 2,2-dimethylpentane 2 marks

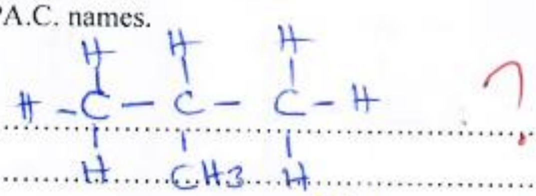


ii. 1,1,2,2-tetrachloroethane. 2 marks

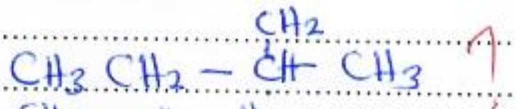


b. The compounds have been wrongly named. Draw their structural formulae and give the correct I.U.P.A.C. names.

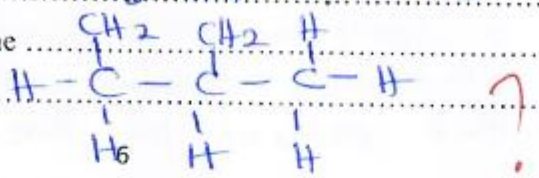
i. 1-methylpropane 2 marks



ii. 3,3-dimethylbutane 2 marks



iii. 2,2-dimethylethane 2 marks



iv. Cyclohexane. .... 2 marks

....

c. Arrange the following compounds in order of increasing boiling points and give your reasons. 8 marks

CH_4, $CH_3CH_2CH_2CH_3$, CH_3CH_3

....

$CH_3CH_3 < CH_3CH_2CH_3 < CH_4$

....

....

18/60

ACHIEVEMENT TEST ON CARBON COMPOUNDS

(Hydrocarbons)

Form Two (2)

Research No.	SCH/B/06
Class	2C
Date	16th/01/2018

INSTRUCTIONS

1. Write your **Research Number, Date** and **Class** on space provided **above** on the question paper.

2. This paper is partitioned into two sections, '**A**' and '**B**'. **Section 'A'** consists of 20 Multiple Choice items, **section 'B'** consists of 2 theory questions.

3. Respond to the **Section 'A'** by circling the options provided that is suitable for each item on the question paper provided.

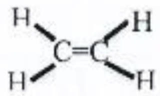
4. Respond to all the two **(2) theory questions** in **section 'B'** in the space provided on the question paper.

5. All the **theory questions** provided carry equal marks.

Section A

Answer **all** *the questions.*

1. What is the total number shared pair electrons in the compound represented by structure below?



A. 5 B. 6 C. 10 D. 12

2. All the following compounds will exhibit geometric isomerism **except**

A. $CH_3CH{=}CHCH_3$ C. $CH_3CH_2CH{=}CHBr$

B. $COOHCH{=}CHCOOH$ D. $CH_3CH_2CH_2CH_2Br$

3. which of the following pairs of compounds belongs to the same homologous series?

A. CH_4 and C_2H_6 C. CH_4 and C_2H_4

B. C_2H_4 and C_2H_2 D. C_2H_6 and C_3H_6

4. A compound contains 7.75% of hydrogen, 37.2% of carbon and 55.04% of chlorine. What is its empirical? Relative atomic mass (Cl=35.5, C=12.0, H=1.0)

A. C_2H_5Cl C. $C_2H_4Cl_2$

B. $C_3H_8Cl_2$ D. C_5H_2Cl

5. The IUPAC name for the compound $CH_3CH(CH_3)CHClCH(CH_3)CH_2CH_3$ is

A. 2,4-dimethyl-3-chlorohexane C. 4-chloro-3,5-dimethylhexane

B. 3,5-dimethyl-4-chlorohexane D. 3-chloro-2,4-dimethylhexane

6. Ethyne is used in

A. Making shoe polish C. the extraction of iron

B. hunters lump D. the generation of electricity

7. Which of the following pairs of compounds will delocalize acidified $KMnO_4$?

A. Butane and propane C. Propane and ethyne

B. Butane and methane D. Propene and ethyne

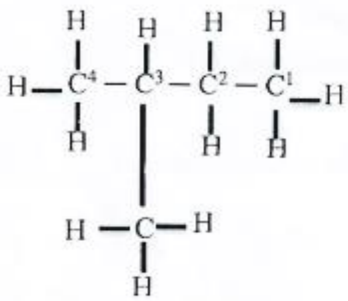
8. Consider the following hydrocarbons

I. C_2H_6 II. C_2H_4 III. C_2H_2

Which of them will not undergo addition reaction?

A. I only
B. II only
C. III only
D. I and II only

9. Which of the following carbon atoms numbered 1 to 4 in the structure below is a secondary carbon atom?



A. 1
B. 2
C. 3
D. 4

10. What is the molecular formula of 2,2,3-trimethylpentane?

A. $(CH_3)CCH_2CH_2CH_3$
B. $CH_3C(CH_3)_2CH_2(CH_3)CH_3$
C. $(CH_3)_2CHCH(CH_3)CH_2CH_3$
D. $CH_3C(CH_3)_2CH(CH_3)CH_2CH_3$

11. The gas produced when water is added lumps of calcium carbide is

A. Ethane
B. Ethyne
C. Ethene
D. Methane

12. The melting point of $CH_3CH(CH_3)CH_2CH_3$ is higher than that of $CH_3C(CH_3)_2CH_3$, because $CH_3CH(CH_3)CH_2CH_3$

A. Has stronger hydrogen bonding
B. Has higher molecular mass
C. Molecules have more points of contact with each other
D. Is more polarize

13. Ethene can be produce from paraffin oil by the process known as

A. Polylmerization C. Vulcanization

B. Cracking D. Hydrogenation

14. What is the hydrocarbon in the equation $2C_xH_y + 7O_2 \rightarrow 4CO_2 + 6H_2O$?

A. Methane C. Butane

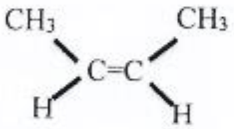
B. Ethane D. Ethene

15. A compound X does not decolorize bromine water but reacts with bromine in the presence of sunlight. What homologous series does X belong to?

A. Alkynes C. Alkanes

B. Alkenes D. Alkanoic acids

16. What is the IUPAC name of the structure below?



A. 1,2-dimethylethene C. Trans-but-2-ene

B. Cis-but-2-ene D. 2,2-dimethylethene

17. How many moles of hydrogen atoms should be added to 1 mol of an alkyne to convert it to saturated hydrocarbon

A. 2mol C. 6mol

B. 4mol D. 8mol

18. In the equation

$2CH_2H_{6(g)} + xO_{2(g)} \rightarrow YCO_{2(g)} + 6H_2O_{(g)}$

The value of x and y respectively are

A. 2 and 6 C. 6 and 2

B. 4 and 7 D. 7 and 4

19. Which of these compounds will exhibit intermolecular hydrogen bonding?

A. CH_3CH_2CN C. $CH_3CH_2CH_3$

B. $CH_3CH_2NH_2$ D. $CH_3CH{=}CH_2$

20. Which of the following observations suggest that a given substance is impure?

A. Low melting point C. Colour of the substance

B. Low solubility in water D. Wide range of melting point

Section B

1. a). Ethane (C_2H_6), ethene (C_2H_4), and ethyne (C_2H_2) are separately burnt completely in air to give carbon (IV) oxide and water.

i. Write a balance equation for the complete combustion of one mole of each of the hydrocarbons.......... 6 marks

$C_2H_6 + O_2 \rightarrow CO_2 + H_2O$ (1)

$C_2H_4 + O_2 \rightarrow CO_2 + H_2O$ (1)

$C_2H_2 + O_2 \rightarrow CO_2 + H_2O$ (1)

ii. Hence explain why ethyne is the most economical to be use a fuel each of the hydrocarbons contributes equally to the greenhouse effect .... 2 marks

Because Carbondioxide is abundant in the atmosphere and it produce heat.

b. Write the structures for the isometric alkanols of molecular formulae C_6H_{14} 4 marks

$CH_3 \; CH_2 \; CH_2 \; CH_2 \; CH_2 \; CH_3$

$CH_3 \; CH_2 \; (CH_2) \; CH_2 \; CH_3$

$CH_3 \; CH_2 \; CH_2 \; C(CH_2)_2 \; CH_3$

c. i. Define the term empirical formulae ...is a chemical formular showing the simplest ratio of element in a compound rather than the total number of atoms in the molecule (2) 2 marks

5

ii. A certain compound gave the following elemental analysis C=56%, H=3.9% and Cl=27.6% by mass. Deduce it empirical formulae. 6 marks

Relative atomic number of the element (C=12, H=1.0, O=16, Cl=35.5)

Soln.

C = 56%, H = 3.9% and Cl = 27.6% (C=12, H=1.0, O=16, Cl = 35.5

= $\frac{\text{mass of the element}}{\text{number of atoms}}$ (1)

= C H Cl

$\frac{56}{12}$ $\frac{1.9\%}{1.0}$ $\frac{27.6\%}{35.5}$

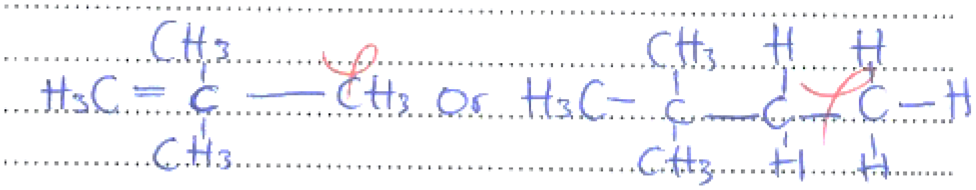
C H, Cl

$\frac{4.67}{35.5}$ $\frac{3.9}{35}$ 0.78

2. a. Write the structural formulae for:

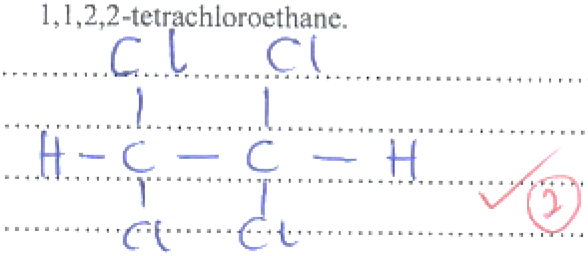
i. 2,2-dimethylpentane

2 marks



ii. 1,1,2,2-tetrachloroethane.

2 marks



b. The compounds have been wrongly named. Draw their structural formulae and give the correct I.U.P.A.C. names.

i. 1-methylpropane

2 marks

$CH_3CH(CH_3)CH_2CH_3$

ii. 3,3-dimethylbutane

2 marks

$CH_3CH_2CH_2(CH_3)CH_2CH_3$

iii. 2,2-dimethylethane

2 marks

$CH_2(CH_2)CH_2(CH_2)CH_2CH_3$

iv. Cyclohexane.  ✓ (1) 2 marks

c. Arrange the following compounds in order of increasing boiling points and give your reasons. 8 marks

CH_4, $CH_3CH_2CH_2CH_3$, CH_3CH_3

$CH_4 < CH_3CH_3 < CH_3CH_2CH_2CH_3$ ✓ (2)