UNIVERSITY OF EDUCATION, WINNEBA

USING ACTIVITY APPROACH TO OVERCOME MANSOMAN SENIOR HIGH SCHOOL FORM THREE STUDENTS'DIFFICULTIES IN MENSURATION

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A THESIS IN THE DEPARTMENT OF MATHEMATICS EDUCATION, FACULTY OF SCIENCE EDUCATION, SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES, UNIVERSITY OF EDUCATION, WINNEBA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF EDUCATION DEGREE IN MATHEMATICS

July, 2014

DECLARATION

STUDENT'S DECLARATION

I hereby declare that this thesis is as a result of my own research and that no part has been presented for another degree in this University or elsewhere with the exception of quotations and references contained in published works which have been identified and acknowledged.

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SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this thesis was supervised in accordance with the guidelines for supervision of thesis laid down by the University of Education, Winneba.

SUPERVISOR'S NAME: Prof. D. K. MEREKU

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ACKNOWLEDGEMENT

My sincere thanks go to Almighty God for sailing me through the entire studies and most especially when this thesis was being carried out.

My profound gratitude also goes to my supervisor, Prof. D. K. Mereku, for his guidance and direction for the success of this thesis. I am very grateful for the time and resources he invested into this thesis, without him this would not have happened.

I also want to thank all the lecturers of the Department of Mathematics Education, especially Dr. C. Assuah, Dr. M. J. Nabie, Dr. P. O. Coffie, Prof. S. K. Asiedu – Addo, Dr. J. Nyala, Dr. C. A. Okpoti and all other lecturers of the department, for their advice and constructive criticisms given to me during the entire duration of my study.

Many thanks also go to all my M.Ed. Mathematics 2013 colleagues, especially Evans Atteh, Emmanuel Andam- Appoh, Amoako Johnson and Evelyn Donkoh. I thank you all for your company, advice, love and support shown me throughout the entire duration of the program. Not forgetting also is Joseph Manu, Alex Kwame Bonsu, Frank Anane, Emmanuel Oduro, Kwabena Gyamfi and Joana Aduamah.. I thank you all for the love you have shown me through my entire studies.

May the good Lord God bless you all.

DEDICATION

I dedicate this work to my son, Emmanuel K. Manu and my parents, the late Mr. Emmanuel Manu and Mrs. Grace Badu who are my source of inspiration.

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ABSTRACT

This research study was an action research which involved a sample of fifty-four (54) students of form 3 General Arts 'A' class of Mansoman Senior High School in the Amansie West District of Ashanti Region, selected purposely for the study. The study was aimed at improving the performance of students in mensuration tasks involving areas and volumes of cylinders, cones and spheres. Pre-test and post-test were used in data collection. Pre-test and post-test scores obtained by the students were analyzed quantitatively using descriptive statistics. It was observed in the pre-test that the lowest score was 12.50% and the highest was 55.00%; but the mean score was 30.00% which means that majority of the students' had marks around 30.00%. Considering the post-test, the lowest score was 35.00% whereas the highest score was 95.00%; and the mean score was around 67.69% which suggests that majority of the students did very well. These indicate that the intervention activities based on the activity approach helped the students to improve their performance on tasks related to cone, right circular cylinder and sphere. It is recommended that the activity approach to teaching and learning should be encouraged in all spheres of the mathematics classroom environments.

CHAPTER 1

INTRODUCTION

1.0 Overview

This chapter discusses the background to the study, statement of the problem, purpose of the study, research objective, research questions,significance of the study delimitations of the study, limitations of the study and organization of the study.

1.1 Background of the Study

Many Senior High School Students have serious challenges in understanding basic or fundamental concept and principles of mensuration with particular reference to cone, right circular cylinder and sphere. As a result, students' performance seems to be declining. The researcher own personal experience as a mathematics teacher over the past eight years testifies this point. My colleague teachers who teach in neighboring Senior High Schools in Amansie West District have equally observed the students' challenges in dealing with problems involving cone, right circular cylinder and sphere. Students are of the view that teachers do not take their time in teaching the cone, right circular cylinder and sphere. Moreover, teachers do not give enough assignments to test students' understanding on the topic and the few assignments they give are not marked on time. Students have preconceived mind that, the cone, right circular cylinder and sphere under mensuration as a Mathematical topic is very challenging.

The Chief Examiners reports of the West Africa Examination Council (2007: 2006: 2005) on candidate achievement in West Africa Secondary School Certificate Examination (WASSCE) and Senior Secondary School Certificate Examination (SSSCE) clearly outline candidate weakness and difficulties in solving problems on mensuration particularly cone, right circular cylinder and sphere. These reports

further stated that most candidate avoid problems involving cone,right circular cylinder and sphere, the few candidate that attempt questions on cone,right circular cylinder and sphere do not answer them satisfactory. The reports did not emphasize students' weakness in cone,right circular cylinder and sphere but also indicated that mathematics teachers contribute to students' weak performance in cone,right circular cylinder and sphere. The Chief Examiners reports stated that student inability to perform well in the aspect of mathematics is due to total neglect of the teaching of mensuration preferably cone and cylinder by Senior High School mathematics teachers or to the inability of mathematics teachers to use appropriate teaching methods in handling a cone, right circular cylinder and sphere.

The educational reform review committee in Ghana Anamuah- Mensah (2002), recommend problem solving curriculum for pre- university education. Problem solving encourages students in meaningful mathematics discussion which include analyzing various representation and justification of their solution. Problem solving enhances students' ability to become active participants in the learning processes and engages teachers to participate actively as learners in the classroom with their students. Problem solving makes mathematics more accessible to students since the activities allow students to take parts in the constructive of their own knowledge. Problem solving approach will also involve students in the use of their three domains namely, the cognitive, affective and psychomotor domain so that in the end students will not be learning facts or methods, but rather they will be investigating problems for themselves and learning.

The students' weakness in mensurationpreferably cone, right circular cylinder and sphere are of great concern to every mathematics teacher. Mathematics teachers

need to know the ideas with which students have challenges in and find ways to help bridge the common understanding.

1.2 Statement of the Problem

Mensuration pose great challenge to most students in Senior High School in Ghana, particular Mansoman Senior High School students often encounter challenges in solving problems involving cone, right circular cylinder and sphere. They lack basic skills in identifying the various formulas and this phenomenon is common with students of neighboring Senior High School in Amansie West District.

The mathematics syllabus for Senior High School students recommends the teaching of mathematics through activities methods. In order to fulfill this objective there is the need for mathematics teachers to inculcate in students problem solving skills.The students inability to use appropriate activity approach to solve problems in cone, right circular cylinder and sphere is the reflection of the teaching they encounter in the classroom. In view of this, the researcher must therefore develop interest to investigate the concept of cone, right circular cylinder and sphere to identify the ideas held by students in Senior High Schools.

This study is therefore designed to explore suitable problem solving techniques that will enhance conceptual understanding and skills development in mensuration preferably cone, right circular cylinder and sphere so that student's performance could improve.

1.3 The Purpose of the Study

The study aims at providing students the opportunities to explore mathematical ideas and to develop conceptual understanding of cone, right circular cylinder and sphere. The study will use activity approach as stipulated in the mathematics syllabus for

Senior High School. The study seeks to explore appropriate ways and means of assisting student improve upon their performance in mensuration using activity approach.

1.4 Research Objective

The specific objectives are that, students will be able to:

- Derive formulas of an area and volume of a cone, right circular cylinder and sphere using the activity approach
- Solve real-word and mathematics problems involving area and volume of cone, right circular cylinder and sphere.
- Explain and apply mensuration concepts and carry out mathematical procedures with precision and fluency.

1.5 Research Questions

It is the aim of this study to find out the ideas students in Mansoman Senior High School have in solving problems involving cone, right circular cylinder and sphere, and develop an intervention strategy as a way of helping students to remedy any challenges and misconception they might have.

Especially the study will address the following questions.

- How knowledgeable are SHS 3 students' about solving problems related to cone, right circular cylinder and sphere?
- What is the effect of activity approach on students' performance of problems related to cone, right circular cylinder and sphere?

1.6 Significance of the Study

The results of this would influence policy makers more about the problem solving curriculum, the finding of the study would guide curriculum developer for planning and designing mathematics curriculum for pre- university education.

The findings of the study would provide relevant literature to other researcher who wishes to conduct related work on the teaching of cone, right circular cylinder and sphere. Further study would serve as base for organizing in- service training courses for teachers who teach mathematics at Senior High School.

1.7 Delimitations of the study

In order to work successfully within the limited time frame available the researcher limit his works to cover a selected class of form 3 General Arts 'A' students in Mansoman Senior High in Amansie West District of Ashanti.

The study covers student's knowledge about cone, right circular cylinder and sphere and how to apply activity approach to improve students' performance.

1.8 Limitations of the study

Due to the short duration of M.Ed. program, time would not allow the researcher to extend the study to other schools. It is hoped that future study can include other schools.

This study is limited to Mansoman Senior High School due to inadequate resources as funds .

1.9 Organization of the Study

This write up is made up of five chapters. Chapter one is introduction and is consisting of background to the study, statement of the problem, purpose of the

study, research objectives, research questions, research hypothesis, the significant of the study, delimitations and limitations. Chapter two is literature review. Chapter three is methodology and includes research design, population and sample, research instruments, validity and reliability, data collection procedure, the intervention and scoring and data analysis procedure. Chapter four deals with results and discussions while chapter five deals with summary of the findings, conclusion, recommendations and suggestions for further research.

CHAPTER 2

LITERATURE REVIEW

2.0 Overview

This chapter reviews related literature to the study. It discusses definition, problem solving strategies, problem solving, causes of students' difficulties in mensuration, student knowledge aboutmensuration, student challenges in answering question related to mensuration and summary.

2.1 Definition

Mensuration is a core mathematics topic in Senior High School three (3) syllabus, which is largely use in our real-life situations. According to (onlinemath4all.com), mensuration is being defined as one of the branches of mathematics which means measurement. It is being done in our life in many situations. For example measuring the length of cloth we need for stitching, the area of a wall which is being painted, perimeter of circular garden to be fenced, quantity of water needed to fill the tank. For these kinds of activities, we are doing measurements. Conoid is a solid which is also known as cone, is defined as a rotation of a line segment which passes through a fixed point and making a constant angle with a fixed line. Also a right circular cylindrical solid is a geometrical shape with two parallel straight sides having two circular parts such that one is at the top and the other is at bottom. Finally, a sphere is a solid generated when a semicircle is being rotated about its diameter. In three-dimensional space, this is also known as perfect round geometrical object. A plane is at the center of the spherical solid divides the solid in to two equal parts. Each shape is called hemisphere. A very good example we can say for spherical shaped solid is

globe. Ball is another good example for spherical shaped solid. (onlinemath4all.com)

2.2 Problem Solving Strategies

According to (sitsofe@mathned.org), Ghana Mathematics Society has identified the teaching of mensuration as a problem and has called for massive professional development in content and pedagogy for teachers. They also advise that teachers must learn how to create a friendly atmosphere in the mathematics classroom, introduce practical mathematics, and show the relevance of all topics in mathematics to real life situations. The society further stated that in order to solve Senior High School students weakness in mensuration concept there is the need to have teachers trained in mathematics 'instead of the so-called general teachers' to teach mathematics at the basic levels, where the fear and dislike for mensuration concept begin, since when this than it will help Senior High School students to enjoy the concept of mensuration.

Teachers or facilitators should use reflective practices as a tool to improve their mathematical teaching methods especially when they are handling mensuration concept. According to Edwards, Gilroy, and Hartley (2002); Mena Marcos and Tillema(2006), the uses of reflection has been accepted widely and promoted in teaching practice. The practice of reflection is also involving critical thinking (Korthagen, 2004). However reflection provides a source of knowledge construction in teaching and promotes better understanding in both content and methods when solving a mathematical problem with students by teachers (Singh 2008; Boud 2007). Reflection is rooted in the understanding that teachers recognize teaching as a process that lies open to scrutiny and deliberation, which permits change in existing

practices(Van Manen, 1995; Schön, 1983; Elliot, 2001). For these reasons, Clarke (2006), stated that reflection has become a key strategy in solving many mathematical concepts. According to Whipp (2003), a number of guidelines and proposed models have been formulated to improve teachers' cognitive ability in mensuration concept. The ultimate goal of promoting reflective practices in teachers is to enable teachers to 'reconstruct local knowledge while working in the context of a practical teaching activity under mensuration, to become cognizant of their way of teaching the topic (Cousin, 2002). Internalizing this cognitive tool empowers teachers to solve mathematical problems through the uses of activity approach (Loughran, 2007).

Reflection has been essentially conceived as a cyclical and recursive process that is used to solve mathematical problems as indicated by these authors: Problem-Solving(Lewin, 1946; Robertson, 2008; Wetzstein and Hacker, 2004), which coincides with awareness of the problem (Schön, 1983; Stenhouse, 1985), in order to construct practical strategies in solving the mathematical problem (Zeichner and Liston, 1996; Garmann and Normann, 2004; Elliot, 1991). According to Elliot (2001), reflection models promoted through professional development programs have added significantly to the mathematical concept, especially with regard to:

(1) Teacher attributes mathematical concept attached to the use of reflection.

(2) Teaching practical mathematics processes involved in its adoption.

(3) Modes of applying reflection (i.e., limitations in conditions and settings).

It is stated as well that a reflective practitioner needs to:

(1) understand the content of mathematics (Smith, 2005);

(2) have experience in mathematics knowledge (Beijaard, Meijer and Verloop, 2004)

(3) be critical thinker (McLellan, 2004); and

(4) work collaboratively (Orland, 2001).

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There is a need for the teacher to determine how well substantiated reflective model will enhances his/her teaching concept, and whether program that disseminate reflection provide a clear conceptual framework to guide the teacher action (Baker El-Dib, 2007). According to Mamede and Schmidt(2004), the nature and extent of explication and empirical support given to a particular reflective model will determine whether the model provides a solid ground for reflective practice.

According to Ropo(2004), attention to the preconditions for implementing reflection seems to be emphasized in many studies. Furthermore, on this background the author indicated the significance of clarifying the concept of reflection in teachers' professional development which includes:

(1) What is being offered about reflection as relevant to teachers for improving their teaching of the subject?

(2) How is it supported as grounded in evidence, shared and built on valid experiences or empirical findings that can justify what is it said to be done?

(3) By what argumentative mode are teachers called upon to adopt reflection.

2.3 Problem Solving

According to Ale(1987), when solving a problem one needs to consider the psychology of the learner and societal values as necessary variables. In this respect, the author stated that all of the following questions need to be considered when solving a mensuration problem:

1. What is Mensuration?

2. Why do we teach Mensuration?

3. Has Mensuration got anything to do with the outside world; day to day activities and experiences of the physical world?

4. How can we show the students that Mensuration is not abstract or 'not absolutely abstract'?

According to Howard (1990), importance and use of basic Mensuration concept is widespread throughout history. The author indicated that Mensuration innovations interacted with new scientific discoveries to yield acceleration in understanding of scientific concepts. He stated that Mensuration is used in many fields including Science, Engineering, Medicine and Economics. Again he said application of Mensuration in such fields, often dubbed applied mathematics, inspires and make use of new mathematical discoveries and has sometimes led to the development of entirely disciplines.

Students are of the view that teachers do not take their time in teaching mensuration concept. Moreover, teachers do not give enough assignments to test students understanding on the topics and the few assignments they give are not marked on time. Students have preconceived mind that, the subject, Mathematics is very challenging.

According to WAEC chief examiner's reports (May/June, 2007) on student performance in SSSCE mathematics (core) suggested that students should be given adequate and effective teaching in the mensuration concepts and skills necessary to help them overcome these concept also tests and quizzes should be given to students periodically to review and reinforce mensuration concepts taught in Mathematics.

Schoenfeld(1992), defined problem solving as used in mathematics education as the process whereby students encounter a problem – a question for which they have no immediately apparent resolution, nor an algorithm that they can directly apply to get an answer but the student then read the problem carefully, analyze it for whatever information he has, and examine their own mathematical knowledge to see if they can come up with a strategy that will help them find a solution. The author further indicated that, the process forces the reorganization of existing ideas and the emergence of new ones as students work on problems with the help of a teacher who acts as a facilitator by asking questions that help students to review their knowledge and construct new connections.

Weber (2008),stated that problem solving emphasizes the role of the teacher in developing students' reasoning skills and to lead students to develop accurate criteria for what constitutes a good understanding of mensuration concept. But the author further indicated that the teacher must have a solid understanding of these concepts. Wheatley (1992), proposed that problem-centered learning is a teaching method that encourages student reflection, and presented examples demonstrating that encouraging reflection results in improved learning.

National Council for Teachers of Mathematics(2000), describes problem solving based teaching as using "interesting and well-selected problems to introduce a mensuration topic and engage students. In this way, new ideas, techniques and mathematical relationships emerge and become the focus of discussion. Good problems can inspire the exploration of important mensuration concepts, reinforce the need to understand and use various strategies in solving mensuration questions.

2.4 Causes of students' difficulties in mensuration

Several factors have generally been identified as causes of students' difficulties in mensuration, but to mention a few. Agyeman (1993), reported that a teacher who does not have both the academic and the professional teaching qualification would undoubtedly have a negative influence on the teaching and learning of mensuration concept.

Neagley and Evans (1970), were of the view that ineffective supervision of instruction

can adversely affect the quality of teaching and learning in the classroom, which in effect will affect performance of students in mensuration.

Inadequate and wrongly use of teaching and learning materials affect the effectiveness ofa teacher's lessons. According to Broom (1973), the creative use of a variety of teaching and learning materials increases students' learning probability, retain better what they learn and improve their performance in mensuration concept. Moreover, according to Ausubel (1973), students are capable of understanding abstract ideas if they areprovided with sufficient materials and concrete experiences.

Class sizes have also been identified as determinant of performance. Students are of the view that teachers do not give enough class exercises and even the few they give are not marked on time for discussion, this affect performance of students in mensuration as a topic. Studies have indicated that schools with smaller class sizes perform better in mensuration topic than schools with larger class sizes. Kraft (1994), in his study of the ideal class size and its effects on effective teaching and learning in Ghana concluded that class sizes above 40 have negative effects on students' performance in mensuration.

Some teachers lack the art of arousing students' interest in mensuration which in turns affects their performance. According to Aggarwal (1994), the best learning takes place when the teacher is successful in arousing the interest of the students. The guidance of the teacher is mainly a matter of giving the right kind of stimulus to help the students to understand the mensuration concept.

2.5 Students knowledge about Mensuration

According to Ale (1987), students always express their view about mensuration as "an abstract" topic in nature and presentation.

However, Okwonkwo(1994), indicated that, teachers should use practical approaches to teach mensuration since this can serve as a motivation factor for the learning of the topic. The author further indicated practical activities are possible within the Ghana secondary school mathematics from the section on Geometry and Mensuration as enumerated in the Schools' mathematics curricula. Also he is of the view that Mensuration has been found to be one of the most challenging areas of the mathematics topic for Senior High School Students in Ghana.

According to Githua and Mwangi(2003), mathematics is perceived by students as the foundation for scientific and technological knowledge that is cherished by societies worldwide. It is an instrument for political, socioeconomic, scientific and technological developments. Mathematics is a compulsory subject for all learners in Primary and Secondary schools in Kenya and other West African countries like Ghana (KIE, 2002).

A multiple of causes for the student's low achievement in mensuration has been attributed to: difficulty in understanding the specialized mathematical language (Barton, 2002; Oyaya andNjuguna, 1999; Battisa and Clements, 1996; O'connor, 2000), ineffective, teacher-centered teaching methods and learners' negative

attitudes towards the subject (Miheso, 2012; Ngeno, 2007), Learners lack of motivation to learn the subject (Githua and Mwangi, 2003) and lack of mathematics syllabus coverage (Shikuku, 2009).

According to Hamachek(1995), students' knowledge of mathematics referred to their opinions, feelings, emotions and judgments of the importance, usefulness and meaningfulness of teachers' actions, procedures, practices and social climate in which they assess and monitor students' mathematics learning. The author further indicated that evaluation of students' mathematical work involves teachers' qualitative judgment of how well or how satisfactorily a student is performing or progressing in learning mensuration tasks. According to Dembo (1994), there are different types of instructional evaluation that a teacher can carry out. They include: placement evaluation which is aimed at finding out students' entry behavior before beginning instruction; formative evaluation which provides ongoing feedback to teachers and students regarding successes and failures during instruction; diagnostic evaluation which attempts to find out specific learning difficulties that a student may have on specific mathematical facts, concepts, principles or problem solving.

Formative evaluation requires that the teacher collects a lot of information on learners' performance through observations, classroom oral questioning, homework assignments, quizzes as well as informal inventories (Ebee and Frisbie, 1991).

2.6 Students Challenge's in Answering Questions on Mensuration

According to West Africa Examination Council, chief examiner's reports (WAEC, 1995) on student performance in Senior Secondary School Certificate Examination (SSSCE) mathematics (core) most candidates avoided the questions on mensuration and the few who attempts it, many were unable to solve the problem accurately

because they were not able to write correct formulas needed to solve the problem. This may be attributed to student's inadequate knowledge of mensuration.

It was also stated in the chief examiner report (WAEC, 1997), that almost all the candidates avoided the problem involving mensuration. This was an indication that the topic was not taught in schools or the students do not understand the concept of mensuration very well. The report further indicated that most of the candidates who attempted the questions on mensuration could not do anything encouraging.

It was again indicated in the chief examiners report (May/June, 2007), that only a few students were able to solve questions on mensuration and even those few candidate were not able to answer those questions satisfactory. The report further stated that the student's inability to solve mensuration questions well can be that teachers do not teach the concept well enough to the understanding of students.

2.7 Summary

Problem solving is the process of accepting challenge and trying to solve it. Problem solving is an activity that requires reasoning skills, logic, trial and error and a variety of approaches to find a solution to problem. Problem solving requires brainstorming inventiveness to and creativity to successful performance. Problem solving strategies are methods that can be used to solve various types of problem.

They include models, patterns, guessing and logical reasoning. Students have negative perception of mensuration and wish it is remove from the syllabus. Student's challenges in answering questions in mensuration include their inability to recall the formulas of areas and volume of a cone, right circular cylinder and sphere.

CHAPTER 3

METHODOLOGY

3.0 Overview

This chapter discusses the research method. It includes the research design, population, sample, research instruments, pre and post test, validity and reliability of instrument, data collection procedure, the intervention and scoring and data analysis procedure.

3.1 Research Design

The design is basically action research. The researcher used activity approach strategies to enhance SHS three (3) students' knowledge and understanding of menstruation and their ability to apply their understanding in solving related problems. The researcher administered test on menstruation to SHS 3 students and they scored abysmally very low marks it was therefore imperative on the researcher to provide remedial tutorials using the activity approach as an appropriate intervention tool. The researcher thoroughly went through a cycle of processes to achieve a successful research report in action research. These include identification of the problem, researching on it, suggesting some actions, evaluating the results and revisiting the same problem. These are popularly term problem-pretest-intervention scheme-post test cycle. The problem of the division between theory and practical was this catered for after successfully completing the cycle (Quartey and Awoyenin, 2002, Noffke 2005, Awanta and Asiedu-Adddo 2008). This type of design gave the researcher many opportunities to revisit always the previews state of the problem as a prelude to the subsequent state(s).

3.2 Population

The population for the research was three hundred and twelve (312) third year students of Mansoman Senior High School in 2013/2014 academic year, this comprised student from Arts A, Arts B and Arts C, Business A and B and Science classes each class had average 50 students.

The choice of Mansoman Senior High School was based on the researchers' familiarity with the student as a tutor of the school and diversity of students which was the characteristics of mixed Senior High School in Ghana.

3.3 Sample

Menstruation is a core mathematics topic in SHS 3 syllabus and all SHS 3 students in Ghana are supposed to learn these menstruation. However, for the purpose of using the activity approach, SHS three (3) General Arts 'A' students in Mansoman Senior High School were purposively and conveniently selected for this study. The choice of this class was based on the researchers' preliminary observation and diagnosis of the students' level of understanding of the menstruation concept. It was evident that the SHS 3 General Arts A students had challenges in conceiving the concept under menstruation. All the fifty-four (54) students, comprises of twenty-four (24) girls and thirty (30) boys in SHS three (3) General Arts 'A' class were therefore included on the study.

3.4 Research instruments.

The researcher used test as an instrument in collecting data for the study. The test include pre-test and post-test. The pre-test was used to diagnose students' challenges in mensuration concept and the post-test to evaluate the effectiveness of the intervention.

3.5 Pre and Post Tests

Two tests were used to collect data on students' achievements before and after implementing the activity approach involving the challenges confronting students. The first test was a pre-test which was structured to diagnose and determine students' level of achievements in mensuration (See Appendix A). The second test was a post-test which was aimed at assessing students' level of achievements after implementation of the activity approach (See Appendix F). Both tests had the same structure and scope aimed at assessing students' level of achievements which is the main construct under investigation. The sub constructs of the students achievement considered in this study include students' knowledge and understanding, and application of their knowledge in solving problem related to menstruation. The test items on made up of 10 multiple choice and two (2) theory questions involving relationships between areas and volume of a cone, right circular cylinder and sphere. The questions were carefully designed to conform to the scope of mensuration concept in the SHS 3 syllabus and similar to those included in West African Senior School Certificate Examination.

3.6 Validity and Reliability of the instrument

The validity of a research instrument is determined by how well it measures the concept(s) it is intended to measure (Awanta and Asiedu-Addo, 2008; Ruland, Bakkkan and Roislen, 2007). In this study content and construct validities of the instruments were assessed by three senior mathematics tutors who are experts in mensuration concept. The suggestion was used to improve the validity of the instrument. Reliability concerns the degree to which an experiment test or any measuring procedure gives the same results on repeated trials (Ruland, Bakkan, and Roislen, 2007). In order to determine the reliability of the instrument, the test was

administered to SHS 3 General Arts students of Adubia Senior High School in Amansie west District of Ashanti and their reliability co-efficient were calculated using SPSS version 16. The reliability coefficients obtained ranged from 0.6-0.7 signifying that the instruments were reliable. Since the reliability coefficients is above 0.5.

3.7 Data Collection Procedure

Data collection procedures started with the administration of the pre-test to the sample. The researcher together with two other mathematics teachers supervised the students during the 45 minutes test period. This was done in order to ensure that each student did an independent work. The Head master of the school was contacted for permission.

The pre-test was followed by a two week teaching process involving the activity approach, the scope of the topic on mensuration concept as described in the SHS 3 core mathematics syllabus was covered within the two weeks period. In all, there were seven (7) lessons of 80 minutes in each case.

3.8 The intervention

Due to the low performance of the students in the Pre – test (see appendix D), the challenges they encountered when solving the word problems of mensuration concepts had to be addressed. Interventions were therefore put in place and implemented based on the outcome of the pre – test which revealed that most of the students had problems in the uses of various formulas of areas and volumes in mensuration correctly, which affect students' performance and hence translating them into solving the real word problems of mensuration concepts.

The researcher prepared an intervention (see appendix E) to remedy the challenges that students' face.

The activity approach of teaching typically makes good and extensive use of cooperative learning. New ways of learning emphasizes on active questioning and cooperative group activities that keep students with material they are learning. The students were made to group themselves into a group of eight by the researcher in order to help each other solve the prepared set of questions.

At this point of the intervention phase, the researcher took the students through various activities thoroughly. A lot of time and attentions was given to students to practically derive the various formulas of areas and volumes on a cone, right circular cylinder and a sphere with their own understanding and meaning. Emphasis was also based on helping students identifying and solve a real word problems under mensuration concepts correctly.

3.9 Scoring and Data Analysis procedure

Data were analyzed quantitatively based on the research questions formulated for this study. Cooper and Schindler (2006), are of the view that, quantitative research focuses on precise measurement of something and it determines facts and figures.in other words, quantitative analysis is used to figure out exactly what happened or how often things happened. Quantitative analysis collects data that is factual and can be measured and considered statistically (Cooper and Schindler, 2006). Frequency tables with percentages of students' performance in mensuration concept were constructed by the researcher based on the pre-test and post-test questions covered in the pre –test and post – test (see Tables 4.2 and 4.3).The scorefrom test was feed into SPSS for analysis.

Data was displayed using frequency table, description statistics including means, standard deviations,while frequency table was also used for students' knowledge about the learning of mensuration concepts.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.0 Overview

The main objective of this study was to explore a teaching intervention involving activity approach to enhance students' performance and ability to solve word problem-related tasks on the topics mensuration. The analysis was done based on the research questions under the following themes:

- Demographic profile of respondents;
- How knowledgeable the SHS 3 students are about problems related to cone, right circular cylinder and sphere;
- The effect of the use of activity approach onstudents' performance on word problem- related task on cone, right circular cylinder and sphere.

4.1 Demographic profile of respondents.

A study was conducted at Mansoman Senior High School on how to enhance the performance of form three (3) student's on word problem-related tasks on the topic mensuration.

The total number of students who were involved in the research was fifty-four (54), comprised of thirty (30) boys representing (56%) and the remaining twenty-four (24) representing (44%) of them were girls. (Table 4.1)

Table 4.1 Gender Profile of Students

Gender	Number of Students	Percentage (%)
Boy	30	56
Girl	24	44
Total	**54**	**100**

4.2 How knowledgeable are SHS 3 students about problems related to cone, right circular cylinder and sphere.

Inthe pre-test, the researcher sought to identify, diagnose and spot the difficulties encountered by students in learning the various concepts of mensuration. These results were meant to guide the researcher in planning and implementing the activity approach to deal with the challenges identified.

As described in Chapter 3, the pre-test consisted of ten (10) objective questions and two (2) theory questions which were marked out of forty (40) and was conducted for fifty-four (54) students. The marks obtained on the pre-test are presented inTable 4.2.

Table 4.2 Descriptive statistics of students' percentage score in the pre-test and post-test on mensuration.

		Percentage pre-test score	Percentage Post-test score
Number of students		54.00	54.00
Mean score		30.00	67.69
Median score		26.25	68.75
Mode score		17.50	65.00
Std. Deviation		11.57	16.37
Skewness		0.40	-0.19
Minimum		12.50	35.00
Maximum		55.00	95.00
Percentile	25	20.00	54.38
	75	40.00	80.63
	95	48.75	93.13

From Table 4.2 in the pre-test, the most percentage common mark (modal score) obtained by majority of the students was 17.05%, it can also be observed that the skewness of pre-test is (0.40) which is positive. The results in Table 4.2 indicate that,most of the students had little or no knowledge about mensuration. The mark scored by the bottom 25% of the students in the pre-test was very low which was less than half of the total marks required. It can also be realized that the score of first 95% of students (95% percentile) was less than 50% of the total marks in the pre-test which suggests that more 95% of the students lack the basic knowledge and procedural skill to tackles problems related to cone, right circular cylinder and sphere. In addition to that, (appendix C) explicitlyshows some samples of students'

marked script, these display how students' were not able to quote or state the various formulas precisely which resulted to the wrong answers and most questions not tackled. The inability of students' to use correct formulas was commonly observed when marking the scripts and this also indicates that students' have low or little knowledge about problems related to cone, right circular cylinder and sphere.

4.3 The effect of the use of activity approach on students' performance on word problem-related tasks on cone, right circular cylinder and sphere.

The participants of this study were led through an intervention procedure after the researcher found out that the students' knowledge about mensuration was very low. A post-test was conducted to see how the intervention activitieshelped the students to enhance their performance in understanding the concept of mensuration. Students who were involved in the post-test were the same as that of the pre-test. The scores obtained by the 54 students out of 40 marks for the post-test (see appendix H). The marks obtained on the both the post-test and pre-test are presented inTable 4.3

Table 4.3 Comparative scores on students' performance on mensuration pre-test and post-test

	Percentage pre-test score	Percentage Post-test score
Number of students	54.00	54.00
Mean score	30.00	67.69
Median score	26.25	68.75
Mode score	17.50	65.00
Std. Deviation	11.57	16.37
Skewness	0.40	-0.19
Minimum	12.50	35.00
Maximum	55.00	95.00
Percentile		
75	40.00	80.63
95	48.75	93.13

From Table 4.3, it can be observed in the pre-test that the lowest score was 12.50% and the highest was 55.00%; but the mean score was 30.00% which means that majority of the students' had marks around 30.00%. Considering the post-test, the lowest score was 35.00% whereas the highest score was 95.00%; and the mean score was around 67.69% which suggests that majority of the students did very well.

Comparing the mean scores of the pre-test and the post-test, it can be seen that majority of the students had gained much knowledge in solving problems related to mensuration after the implementation of the intervention. From the modal scores as in Table 4.3, the mark which was scored by most of the students in the pre-test and

post-test were 17.50% and 65.00% respectively, showing an increase in performance after theintervention.It was observed from the post-test scores that there was a change in the performance of the students as compared to that of the pre-test. This change in performance by the students can be credited to the teaching strategy and the numerous activities that the researcher exposed the students to during the intervention processes.

Further analysis was conducted to find out whether or not the difference in the means was statistically significant. The results of thet-test are in Table 4.4

Table 4.4 Descriptive statistics and results of the paired t-test for differences in means.

	N	Mean	Std. Deviation	Min.	Max.t	df	sig.
Pre-test	54	30.00	11.57	12.50	35.00		
	-13.05	53	0.00				
Post-test	54	67.69	16.37	55.00	95.00		

From Table 4.4, the differences in means showing (53df, t=-13.05, and p=0.00) indicate that the difference in means was significant at p=0.00, since p<0.05. Post-test score (M=67.69, SD=16.37) was higher than their pre-test scores, (M=30.00, SD=11.57), it can be argued that there was significant difference between the post-test and pre-test. Again, smaller the standard deviation the better indication of variation in the data set. I therefore conclude that there is a significant difference between the pre-test scores and that of the post-test which is in support of the post-test. And this is attributed to the intervention processes the researcher took the students through. It can therefore be argued that before the intervention most of the

students had little knowledge about mensuration but after the intervention, majority of them had gained significant knowledge in the topic mensuration.

4.4 Discussion of Results

This was explicitly shown in the improvement of students' achievements in the post-test as in (Table 4.3 and Table 4.4). In this study, the level of students achievement was one of the parameters used to determine the effectiveness of the activity approach in addressing students' inadequate knowledge of mensuration concepts. The improvement in the performance of the students, which was evident in the post-test scores they obtained, was not by chance, but through the practical teaching strategy that the researcher employed during the intervention activities. With the activity approach, the researcher designed a well-planned intervention activity in the lessons with the students. The activity approach to teaching enabled the students to participate actively in the lessons and also encouraged cooperative learning among the students. And in effect, each student in a group was not only responsible for learning what was being taught alone, but also helped group mates who were still having problems and thus created a good learning atmosphere.

In the event of all these, the researcher found out that the students were motivated and also inspired by the way the lessons were taught. This, they said, had helped them improved their ability to solve mensuration questions. The activity approach to teaching used in this research study enabled the students to comprehend the conceptual knowledge and the procedural understanding of mathematical word problems which the students were able to apply and solve them precisely. The activity approach to teaching and learning had a positive effect of the performance of the students in mensuration concepts and for that reason, mathematics as a whole.

The main difficulty of the students which resulted into the low performance in the pre-test was their inability to apply the concepts related to mensuration.The difficulties encountered by students were not different from those outlined by Strutchens, Lappan, Fey, Fitzgeraid, Friel and Philips (1996), when they proposed that students' difficulties were as a result of memorizing formulas rather than exploring to discover formulas and misuse of mensuration concept often leads to their low performance in mensuration concepts. The studentdifficulties in the pre-test leading to their low performance in mensuration are a clear manifestation of the Chief Examiner's Report (WAEC, 1995: 1997: 2005) about students' difficulties in answering mensuration questions.

However, after the uses ofactivity approach strategies in the implementation of the intervention, students can now practically derive formulas of an area and volume of a cone, right circular cylinder and sphere, solve real-word and mathematics problems involving area and volume of cone, right circular cylinder and sphere, explain and apply mensuration concepts and carry out mathematical procedures with precision and fluency, after the intervention. This has enhanced students' performance in mensuration.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Overview

This chapter provides the conclusion of the whole research study. The main objective of this study was to explore students' knowledge aboutmensuration and also to use an activity approach to enhance their performance in solving word-problem related to mensuration. The analysis was done based on the two research questions of the study. This chapter presents the summary of findings, conclusion and recommendations of the study.

5.1 Summary of Findings

The main objective of this study was to use an activity approach to teaching and learning to improve and enhance the students' performance in solving word-problem related to mensuration.

In all, fifty-four (54) students' from the form 3 General Arts ' A' class of Mansoman Senior High School were involved. The number comprised of thirty (30) boys and the remaining twenty-four (24) were also girls.

In attempted to solve the problem, the researcher gave the students a pre-test as described in Chapter 3, consisting of ten (10) objective questions and two (2) theory questions based on word-problem under mensuration. This was intended to determine their knowledge about problems related tomensuration.

The pre-test score (appendix D) and sample of students' marked script (appendix C) showed that students had challenges in understanding the concept of mensuration. The students had little or no knowledge about mensuration and as a result they were

finding difficulties in applying and solving mensuration related problems. Based on these outcomes, the researcher carried out intervention activities (appendix E) that aimed at helping the students overcome their challenges. The activities involved in the intervention were in various forms in other to address the various challenges in a step by step format and students were actively involved.

With the activities, the researcher guided the students in a practical approach of deriving various formulas such as area and volume aboutmensuration using the activity approach to teaching and learning. The activity approach to teaching and learning enabled the student to create their own understanding rather than being delivered to them in an organized form. The activity approach to teaching and learning makes use of cooperative learning, where students become more comfortable communicating among them and discuss the problem at hand. This approach promoted an active and interactive learning environment for the students as they worked in groups. The students were guided through the steps needed for them to arrive at their required solution by the researcher. Through the guidelines, the students were able to identify the various formulas of area and volume under mensuration thereby improving their knowledge about practical derivingof formulas of an area and volume of a cone, right circular cylinder and sphere, solving real-word and mathematics problems involving area and volume of cone, right circular cylinder and sphere, explaining and applying mensuration and carry out mathematical procedures with precision and fluency.

After the intervention activities, the students were giving post-test questions (appendix F). This was aimed at finding out the effectiveness of the intervention activities. The questions involved in the pre-test and the post-test were not exactly the same even though the post-test covered almost the same area as that of the pre-

test. This was because the students should be able to solve similar problems had the intervention activities been effective and had gone down well with them.

In all cases, the researcher noted and analyzed the responses given by students to find out why they got their answers wrong. Where necessary, the researcher had discussions with the students to find the cause of their wrong answers and help them overcome such challenges. Even though not all the students scored 100% in the post-test, there was an extremely good improvement in their performance as compared to the pre-test. This was attributed to the fact that the intervention activities adopted had been very successful in helping the students overcome their challenges in solving problems related to mensuration.

5.2 Conclusion

Mathematics has been an intimidating subject for many people, particularly in problems related to mensuration concepts. Understanding the concepts of formulas such as area and volume of mensuration concepts has been a challenge for many students and even teachers as well. However, once the formulas are practically understood, solving for the answer is relatively straightforward.

The main intervention for this study was the activity approach to teaching and learning. The statistical analysis showed that the intervention activities helped improve students' performance problems related to mensuration concepts. The research revealed that, until the intervention stage, students did not know that they could learn better from their classmates. In spite of all these from the findings of this study, regardless of the challenges associated, the activity approach to teaching and learning promoted students' active participation in the teaching and learning process and environment.

Lastly, the performance of the students in solving problems related to mensuration, through the use of the activity approach to teaching and learning as a teaching strategy by the researcher, had improved. The intervention also enhances the students' knowledge about problems related to mensuration.

5.3 Recommendations

Based on the challenges identified and the improvement in students' performance when the activity approach was used during the intervention stage, the researcher made the following recommendations;

1. It is recommended that the activity approach to teaching and learning should be encouraged in all spheres of the mathematics classroom environments so as to give learners the opportunity to find meaning to their own learning in order to explore new ideas and findings concerning their future. This will also promote the doing of mathematics as a creative, sense making activity that entails interpretation and exploration.
2. The researcher suggests that the activity approach to teaching and learning should be integrated into the mathematics curriculum. Based on this, emphasis would not be based on mensuration concepts only, but on the other topics under the other sections of the curriculum as well. This will help the students improve their performance in those areas of the mathematics curriculum as well.
3. For the benefit of all, educational programs, workshops and seminars should be organised for teacher on how to use the activity approach to teaching effectively and efficiently. These will need some sort of financial support and the government and other donor agencies should support these programs for it adequate implementation.

4. The teaching of mensuration concepts should reflect real life situations. For instance, the teaching of the concept of mensuration can be linked to funnel (cone), milo tin (right circular cylinder) and football (sphere).

5.4 Suggestions for Further Studies

This research study forms a useful platform for further studies to be conducted in this area. For the improvement of this study in future, the following suggestions are made by the researcher;

1. The study can be replicated by other researchers, as it can provide them with comprehensive information about the effectiveness of the activity approach to teaching and learning mathematics. Such researchers must take a look at other sections of mathematics, such as statistics, calculus, etc.
2. Future researchers should extend and cover more schools and increase the population and sample as well.

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APPENDIX A

PRE-TEST QUESTIONS FOR STUDENTS

These questions which you are kindly requested to answer are aimed at finding out your level of challenges in problems related to mensuration concept. The results will enable the researcher to develop an intervention strategy as a way assisting you to improve upon your problem solving skills and achievements in problems related to mensuration concept.

To ensure complete anonymity, please do not write your name on the question paper.

Part I Multiple Choice

Circle the correct answer

1. The volume of a cone with radius 6cm, is 132cm^3. Calculate the height of the cone. [Take π =22/7]

A. 21.0cm

B. 10.5cm

C. 3.5cm

D. 1.2cm

2. The volume of the cylindrical tank is 1,100m^3. If the diameter of its base is 10m, find its height. [Take π= 22/7]

A. 3.5m

B. 14.0m

C. 35.0m

D. 70.0m

3. A sector of a circle of radius 7cm subtends an angle of 54^0 at the centre of the circle. Find the area of the sector. [Take π= 3.142]

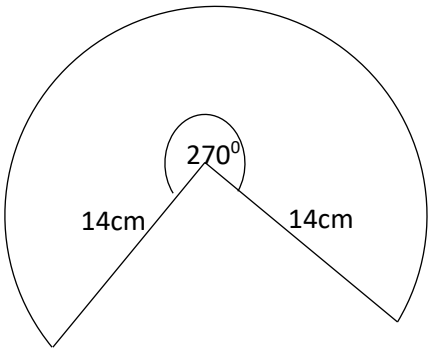
A. 23.1cm^2

B. 38.5cm^2

C. 77.0cm^2

D. 154cm^2

The diagram below shows a sector of a circle of radius 14cm. The angle at the centre is 270^0. The sector is folded to form a right circular cone. Use this information to answer questions 4 and 5 [Take π= 22/7]



4. Find the radius of the cone.

A. 73.5cm

B. 28cm

C. 14cm

D. 10.5cm

5. Find the surface area of the cone.

A. 462cm^2

B. 616cm^2

C. 1,232cm^2

D. 3,234cm^2

6. A sphere has the same volume as a cone of height H. If the radius, R, of the sphere is equal to the radius of the cone, express H in terms of R.

A. H=4R

B. H=3R

C. H=3R/2

D. H=R/3

7. The volume of a cone of height 10.5cm is 396cm^3. Find the radius of the cone. [Take π=22/7]

A. 3.4cm

B. 3.5cm

C. 6.0cm

D. 36.0cm

8. Find the area of a circle with diameter 17m. [Take $\pi = 3.142$]

A. $227m^2$

B. $125m^2$

C. $312m^2$

D. $100m^2$

9. Find the volume of cylindrical drum of diameter 28cm and height 50cm. [Take π = 22/7]

A. 31.8 liters

B. 30.8 liters

C. 29.5 liters

D. 28.8 liters

10. The radius of a sector of a circle is equal to the slant height of the cone.

A. True

B. False

Part II

[Application of Knowledge]

Answer all the questions. Show all necessary details of working.

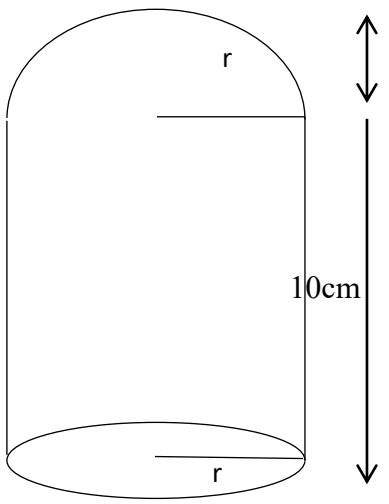
Pre-Test Questions

Q. 1 The solid below is a cylinder surmounted by a hemispherical bowl. Calculate its :

a) total surface area

b) volume

[Take π= 22/7]



Q. 2 The diagram below shows a hut made of a conical roof and a cylindrical wall. The height of the roof is 2m and its base is 3.5m. The cylindrical wall has a height of 2.5m and base area of 28.26m^2.

Calculate, correct to three significant figures

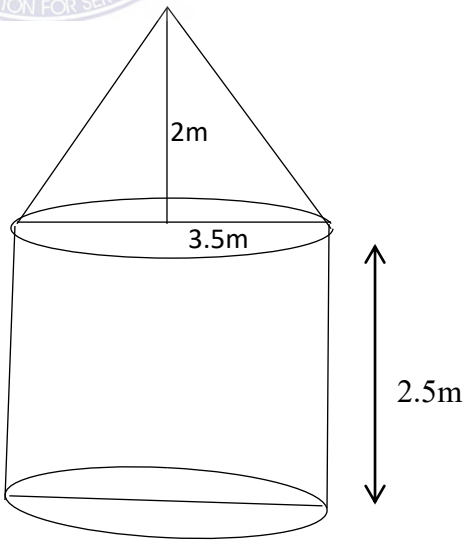
i. the slant height of the conical roof

ii. the surface area of the conical roof

iii. the external surface area of the wall

b) If the cost of painting a square meter of surface is GHC 450.00, calculate the total cost of painting the outer area of the wall and the roof the hut.

[Take π=3.14]



APPENDIX B

MARKING SCHEME FOR THE PRE-TEST QUESTIONS

OBJECTIVE QUESTIONS

1. C **6. A**

2. B **7. C**

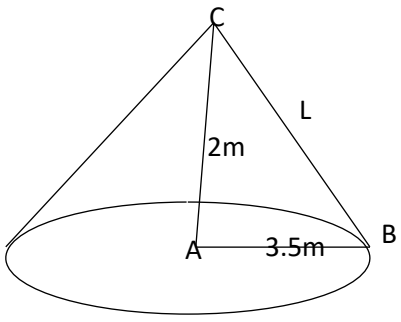
3. A **8. A**

4. D **9. B**

5. A **10. A**

THEORY QUESTIONS

Question	Steps	15 Marks
1.	a) Total Surface Area = Curved Surface Area of Hemisphere + Curved Surface Area of right circular cylinder	
	Curved-Surface Area of Hemisphere	
	$= 2\pi r^2$	M1
	$= 2 \times \frac{22}{7} \times 7cm^2$	M1
	$= 308cm^2$	A1
	Curved-Surface Area of right circular cylinder	
	$= 2\pi rh$	M1
	$= 2 \times \frac{22}{7} \times 7cm \times 10cm$	M1
	$= 440cm^2$	A1
	Total Surface Area	

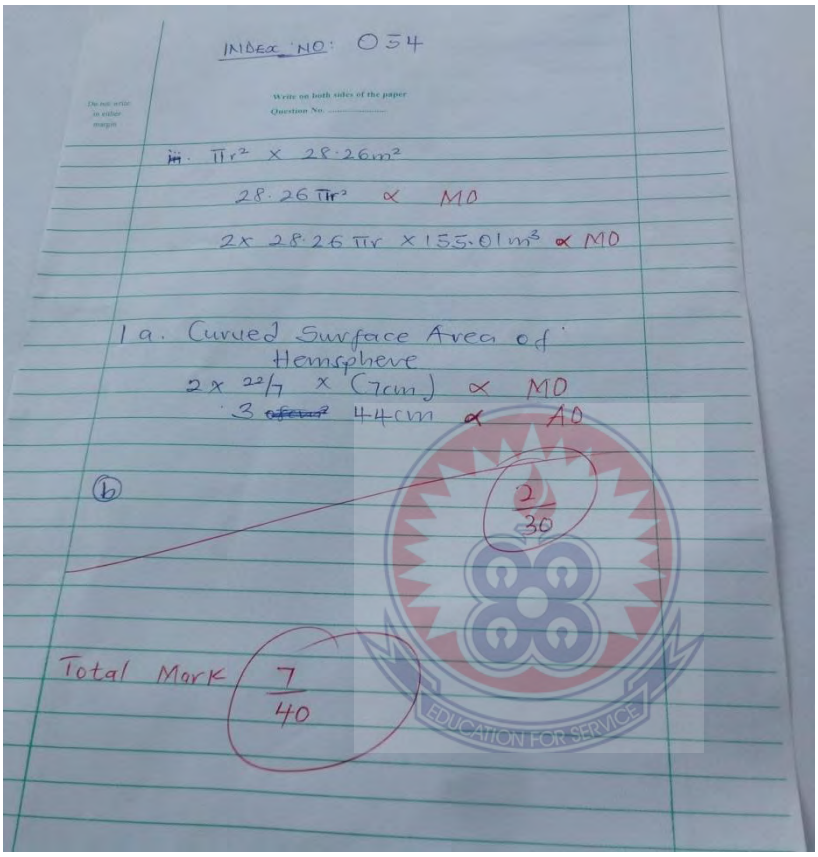
	$= 308cm^2 + 440cm^2$ $= 748cm^2$ b) Volume = Volume of Hemisphere + Volume of right circular cylinder Volume of Hemisphere $= \frac{2}{3}\pi r^3$ $= \frac{2}{3} \times \frac{22}{7} \times 7cm^3$ $= 718.69cm^3$	M1 A1 M1 M1 A1
	Volume of right circular cylinder $= \pi r^2 h$ $= \frac{22}{7} \times 7cm^2 \times 10cm$ $= 1540cm^3$ $Volume = 718.69cm^3 + 1540cm^3$ $= 2258.69cm^3$	M1 A1 M1 A1
2.	a)  Figure 1	

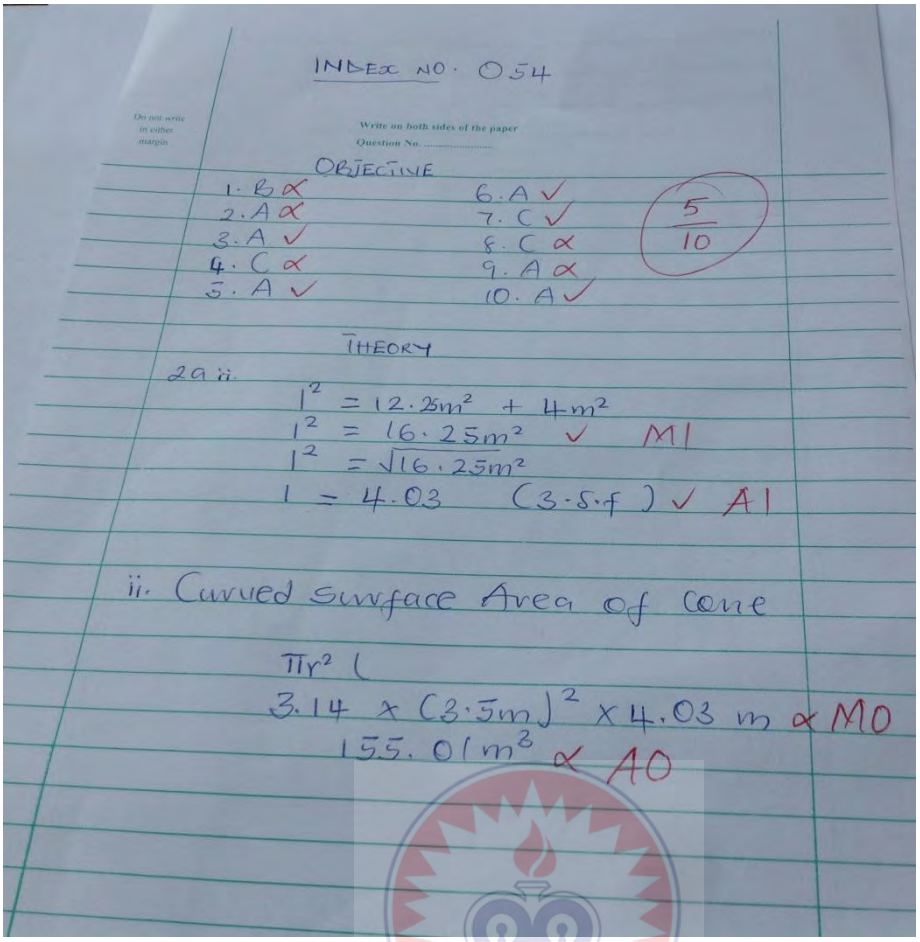
	i) From figure 1 $l^2 = \|AB\|^2 + \|AC\|^2$ $L^2 = 3.5m^2 + 2m^2$ $l^2 = 12.25m^2 + 4m^2$ $l^2 = 16.25m^2$ $l = \sqrt{16.25m^2}$ $Slant\ height, l = 4.03m \quad (3\ s.f.)$	M1 A1
	ii) Curved-Surface Area of cone $= \pi rl$ $= 3.14 \times 3.5m \times 4.03m$ $= 44.3m^2$ iii) Curved-Surface Area of right circular cylinder $= 2\pi rh$ Base Area of the right circular cylinder $\pi r^2 = 28.26m^2 \quad (from\ the\ question)$ $r^2 = \frac{28.26}{3.14}$ $r = \sqrt{9}$ $Radius\ of\ cylinder, r = 3m$ External Surface Area of the wall = Curved-Surface Area of the right circular cylinder $= 2 \times 3.14 \times 3m \times 2.5m$ $= 47.1m^2$ b) Total Surface Area = Curved-Surface Area of the cone + Curved-Surface Area of the right circular cylinder $= 44.3m^2 + 47.1m^2$	M1 A1 M1 M1 M1 A1 M1 M1 A1 M1

	$= 91.4m^2$ $if\ 1m^2 = GHC450$ $Then\ 91.4m^2 = 91.4m^2 \times GHC450$ $= GHC41130.00\ \ (cost\ of\ painting)$	A1 M1 A1 A1

APPENDIX C

SAMPLE OF STUDENTS' MARKED SCRIPT





INDEX NO. 054

Do not write in either margin

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Question No. .....

OBJECTIVE

1. B ✗
2. A ✗
3. A ✓
4. C ✗
5. A ✓
6. A ✓
7. C ✓
8. C ✗
9. A ✗
10. A ✓

5/10

THEORY

29 ii.

$l^2 = 12.25m^2 + 4m^2$

$l^2 = 16.25m^2$ ✓ M1

$l^2 = \sqrt{16.25m^2}$

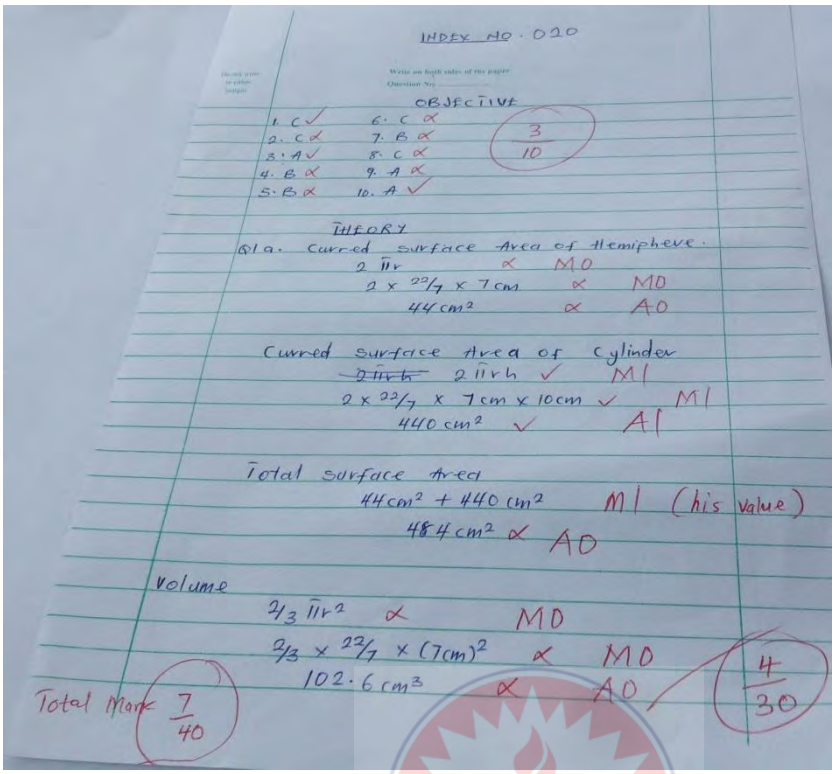
$l = 4.03$ (3.S.f) ✓ A1

ii. Curved Surface Area of cone

$\pi r^2 l$

$3.14 \times (3.5m)^2 \times 4.03\ m$ ✗ M0

$155.01m^3$ ✗ A0



INDEX NO. 020

OBJECTIVE

1. C ✓ 6. C ✗
2. C ✗ 7. B ✗
3. A ✓ 8. C ✗
4. B ✗ 9. A ✗
5. B ✗ 10. A ✓

3/10

THEORY

Q1a. Curved surface Area of Hemisphere.

$2\pi r$ ✗ M0

$2 \times 22/7 \times 7\text{cm}$ ✗ M0

44cm^2 ✗ A0

Curved surface Area of Cylinder

~~$2\pi rh$~~ $2\pi rh$ ✓ M1

$2 \times 22/7 \times 7\text{cm} \times 10\text{cm}$ ✓ M1

440cm^2 ✓ A1

Total surface Area

$44\text{cm}^2 + 440\text{cm}^2$ M1 (his value)

484cm^2 ✗ A0

Volume

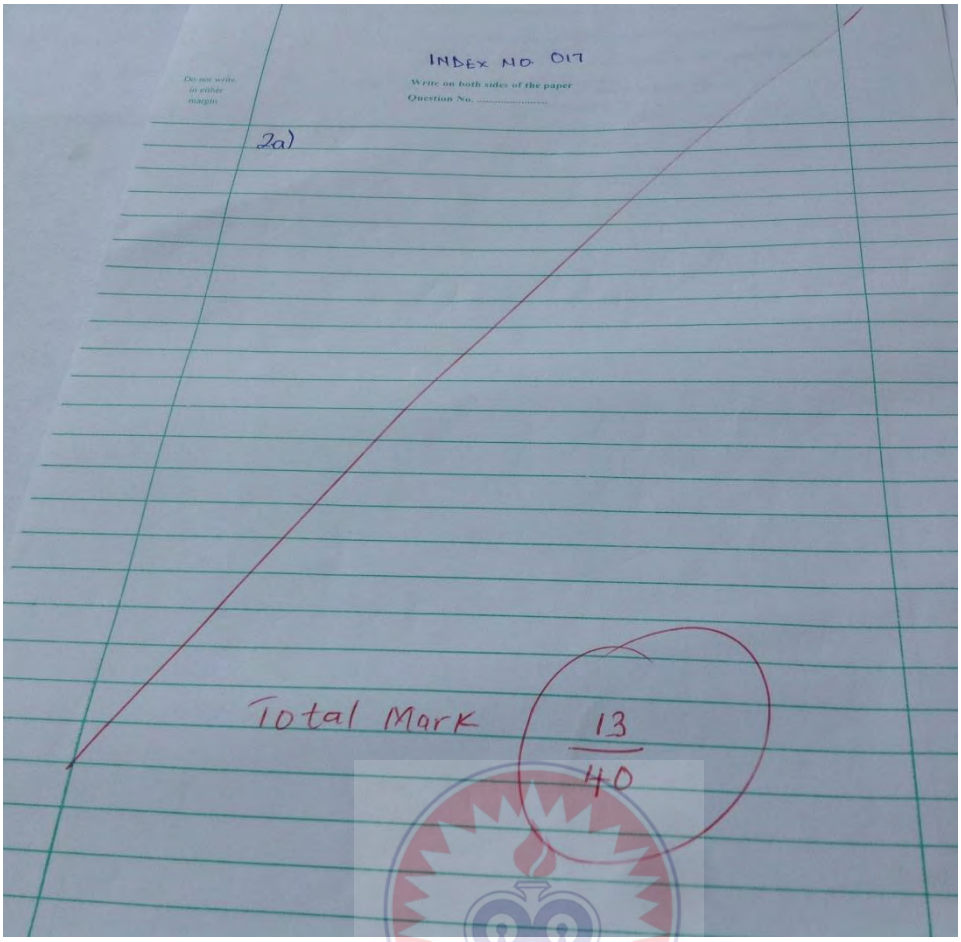
$2/3\ \pi r^2$ ✗ M0

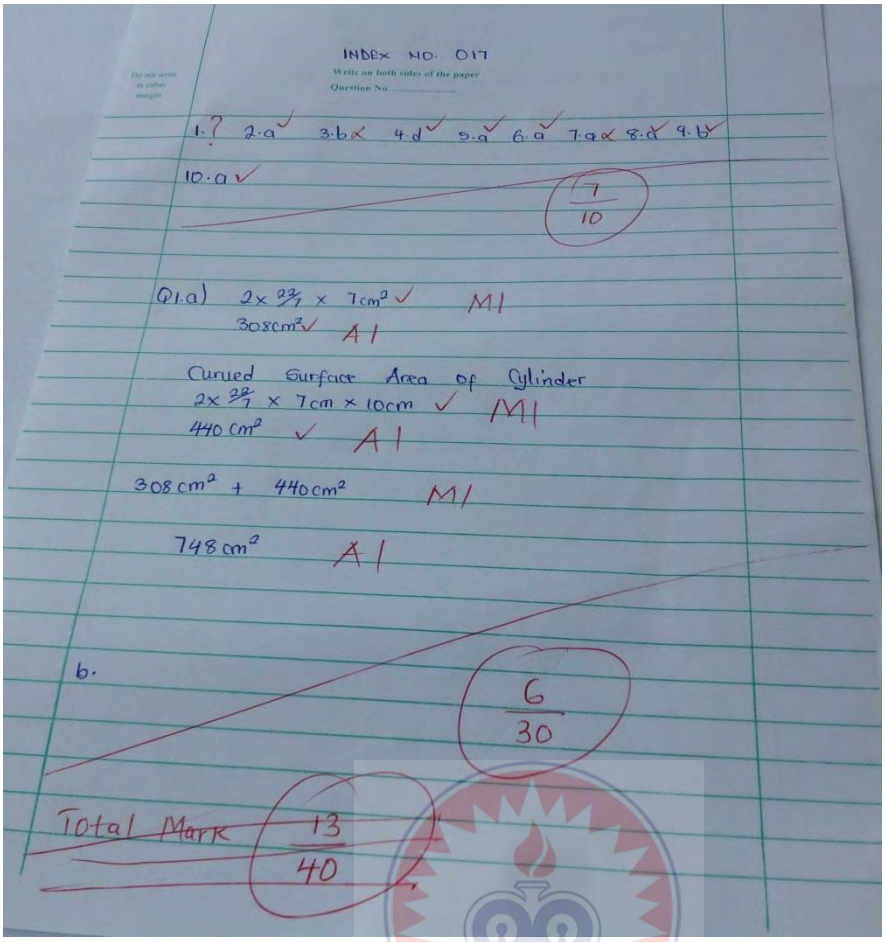
$2/3 \times 22/7 \times (7\text{cm})^2$ ✗ M0

102.6cm^3 ✗ A0

4/30

Total Mark 7/40





INDEX NO. 017

Write on both sides of the paper

Question No. .....

1.? 2.a ✓ 3.b ✗ 4.d ✓ 5.a ✓ 6.a ✓ 7.a ✗ 8.d ✓ 9.b ✓

10.a ✓

7/10

Q1.a) $2 \times \frac{22}{7} \times 7cm^2$ ✓ M1

$308cm^2$ ✓ A1

Curved Surface Area of Cylinder

$2 \times \frac{22}{7} \times 7cm \times 10cm$ ✓ M1

$440\ cm^2$ ✓ A1

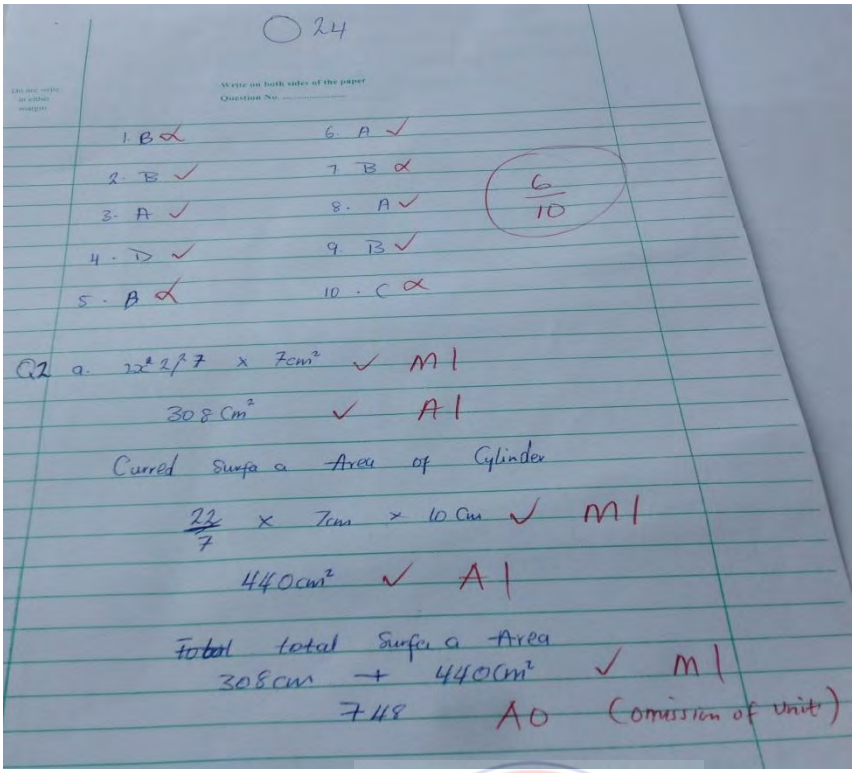
$308\ cm^2 + 440cm^2$ M1

$748\ cm^2$ A1

b.

6/30

Total Mark 13/40



24

Write on both sides of the paper
Question No. .....

1. B ✗
2. B ✓
3. A ✓
4. D ✓
5. B ✗
6. A ✓
7. B ✗
8. A ✓
9. B ✓
10. C ✗

6/10

Q2 a. $22^{2}/_{7} \times 7cm^2$ ✓ M1

$308\ Cm^2$ ✓ A1

Curved Surface Area of Cylinder

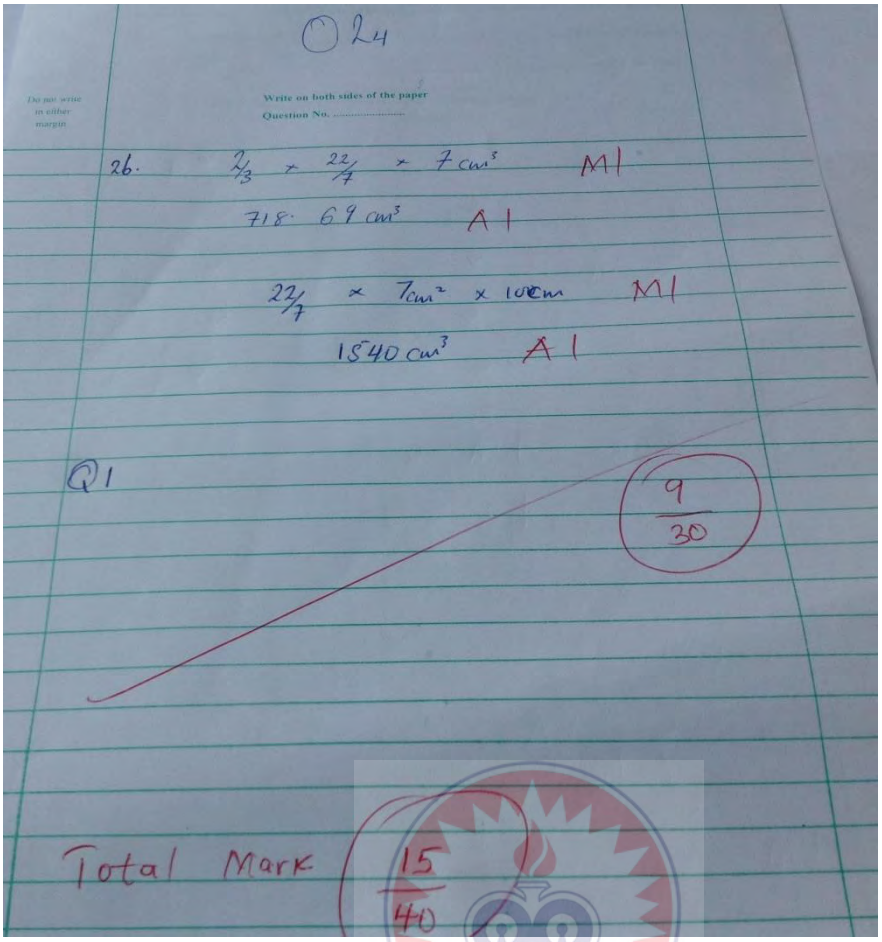
$\frac{22}{7} \times 7cm \times 10\ Cm$ ✓ M1

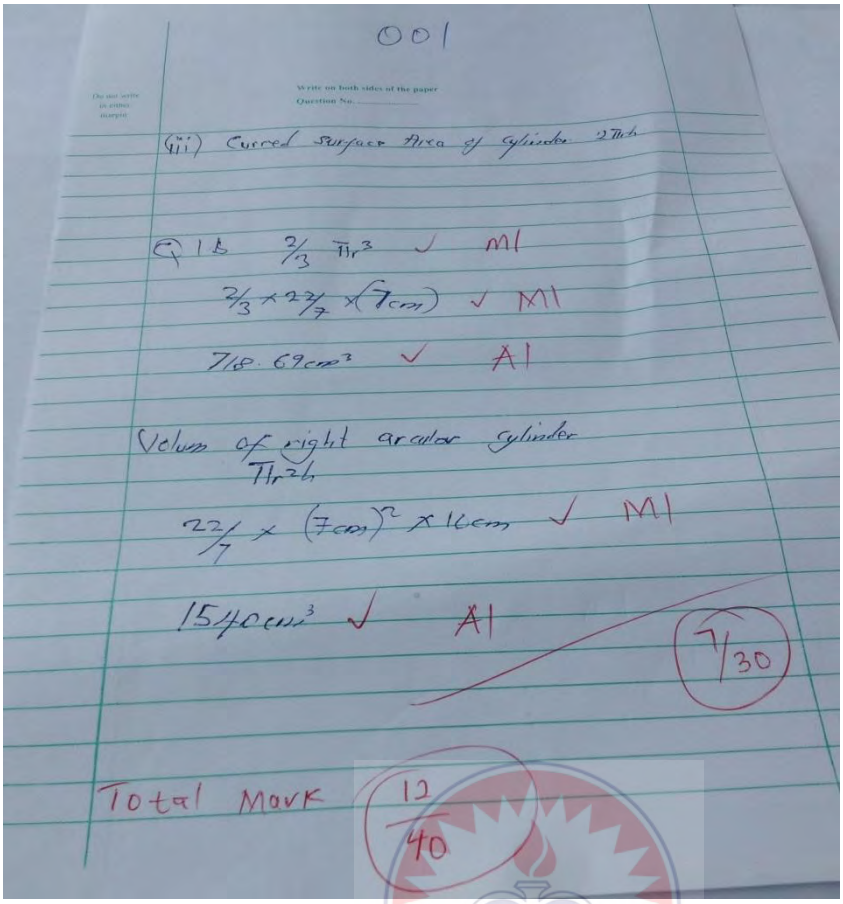
$440cm^2$ ✓ A1

~~Total~~ total Surface Area

$308cm + 440cm^2$ ✓ M1

748 A0 (Omission of unit)





001

Write on both sides of the paper
Question No. _____

(iii) Curved surface Area of Cylinder $2\pi rh$

Q1b $\frac{2}{3}\pi r^3$ ✓ M1

$\frac{2}{3} \times \frac{22}{7} \times (7cm)$ ✓ M1

$718.69cm^2$ ✓ A1

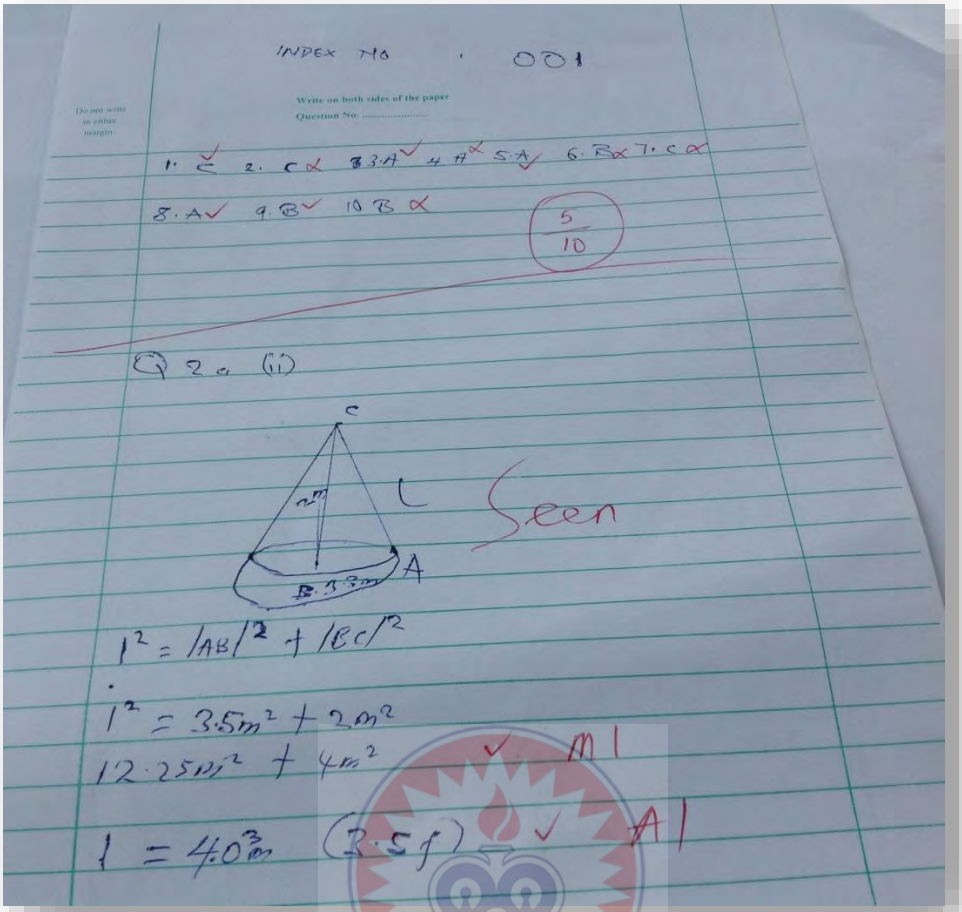
Volum of right circular cylinder
$\pi r^2 h$

$\frac{22}{7} \times (7cm)^2 \times 16cm$ ✓ M1

$1540cm^3$ ✓ A1

7/30

Total Mark 12/40



INDEX NO . 001

Write on both sides of the paper
Question No. .....

Do not write in either margin

1. C ✓ 2. C ✗ 3. A ✓ 4. A ✗ 5. A ✓ 6. B ✗ 7. C ✗
8. A ✓ 9. B ✓ 10 B ✗

5/10

Q 2. (i)

Seen

$l^2 = |AB|^2 + |BC|^2$

$l^2 = 3.5m^2 + 2m^2$ ✓ M1

$12.25m^2 + 4m^2$

$l = 4.0^3 m$ (2.s.f) ✓ A1

APPENDIX D

PRE – TEST SCORES OF THE STUDENTS

9	5	13	8	7	16	14	10149		
12	15	8	19	17	11	8	12	19	7
17	18	9	22	10	8	10	6	7	14
10	6	11	9	6	17	7	15	10	16
9	21	19	15	13	7	10	19	18	6
18	9	16	7						

APPENDIX E

THE INTERVENTION

Lesson one

By the end of the lesson students will be able to:

i) draw a circle and cut-out a circle

ii) identify all parts of the circle

iii) derive the formula of both the area and circumference of a circle

TLM: Cardboard

Activity

Students were assisted to carry out the following activities individually.

1. Students will draw a circle on the piece of a cardboard with center O

2. Students will cut-out a shape of a circle from the cardboard as shown in figure 1

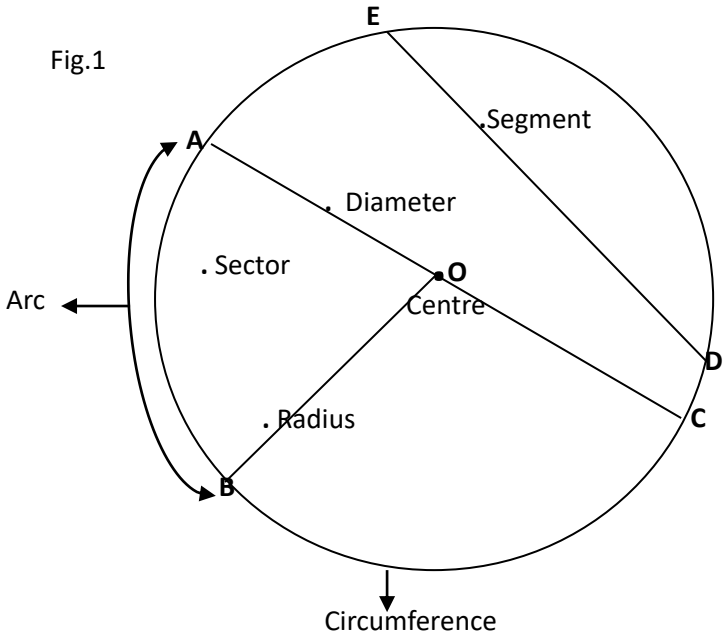
3. Students will rule a line from one end of the circle to the other end of the circle through the center O.(i.e. diameter)

4. Students will draw a line from the center of the circle to the end of the circle. (Radius)

5. Students will draw a line from the center O of the circle to A and B as shown in figure 1. (Sector)

PARTS OF CIRCLE

Fig.1



Definitions of the parts of the circle

- **Centre** – Point equidistance form a point.
- **Circumference** – the circular path traced by the points
- **Chord** – a line segment that has both end points on the circumference
- **Arc** – is the part of the circumference
- **Diameter** – a chord through the centre
- **Radius** – the line segment form the centre and an arc.
- **Sector** – the region enclosed by two radii and an arc.

The researcher guides student to establish that the area of the circle is πr^2, where π = pie, "r" is the radius of the circle.

The researcher guides student to establish that the circumference or length of a circle is $2\pi r$ or πd, where d is diameter of a circle.

Students' Observation

The first derivative of the area of a circle gives the one of the common formula of a circumference of circle. Thus

Let $y = \pi r^2$

$$\frac{dy}{dr} = 2\pi r$$

Lesson Two

By the end of the lesson students will be able to derive the formula of the volume of a cone.

TLM: Cardboard, funnel.

Activity

i) Students will be guided to cut-out shape of a circle from a piece of cardboard with center O

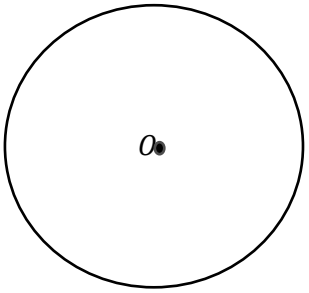


Figure 2

ii) Students will be guided to cut-out a minor sector from the circle, which is the shaded portion in figure 3

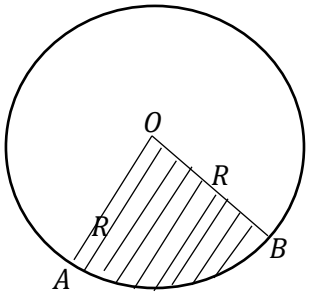


Figure 3

iii) Students will be guided by the researcher to fold the major sector into a cone.

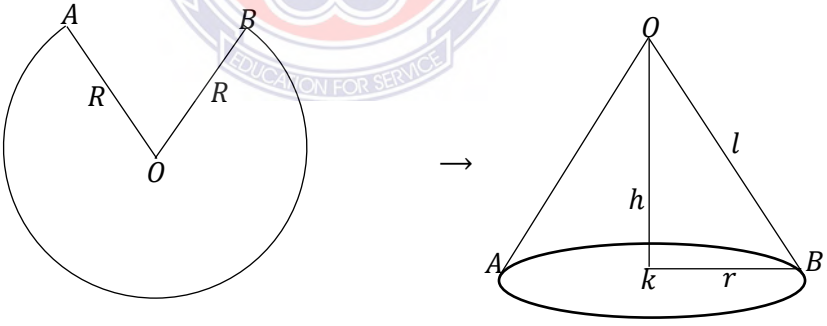


Figure 4 Figure 5

iv) Students will be guided by the researcher to establish that the base area of the cone is a circle, and the formula for the area of a circle is πr^2. Student pour water into the funnel and the level make by the water becomes the height, "h". Thus

volume of the cone is 1/3× base area × water level formed in the funnel (h). Volume, $v = \frac{1}{3}\pi r^2 h$.

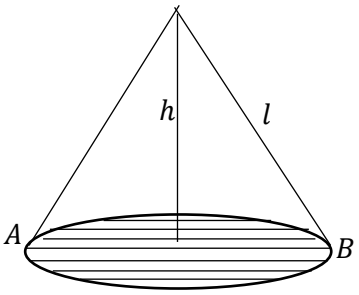


Figure 6

Students' Observation

a) The length or circumference of the sector in figure 4 is the same to the circumference of the base area of the cone.

b) The radius (R) of the sector OAB in figure is the same as the slant height (l) of the cone in figure 5

c) $|OA| = |OB|$are the radii in the sector, since point O is the center as shown in figure 4.

d) $|OB|$ = Slant height, $|KB|$ = radius of the cone and $|OK|$ = height of the cone as in figure 5.

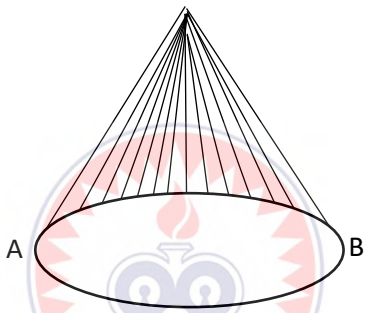
Lesson Three

By the end of the lesson students will be able to derive formula of both curved surface area and total surface area of a cone.

Activity

i) Students identify the curved surface area with the guide of the researcher and were shaded by the student as shown in figure 7.

Figure 7



ii) Students derive the formula of the curved surface area with the guide of the researcher as πrl.

iii) Students establish a total surface area with the guide of the researcher as, considering figure 9, we have two distinct areas.

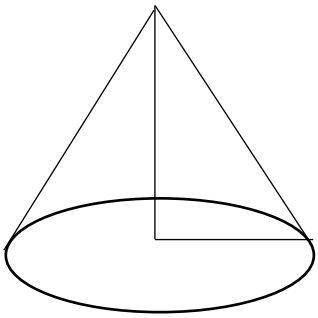
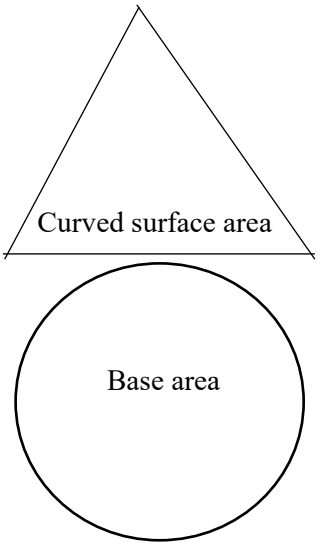


Figure 8

Figure 9



Total surface area

Curved-surface area + Base area (circle) $= \pi rl + \pi r^2$

$= \pi r(l + r)$Factorize

Total surface area $= \pi r(l + r)$

Students Observation

The base part of a funnel used (cone) is a circle.

Lesson Four

By the end of the lesson students will be able to derive the formula of semi-vertical angle under a cone.

Activity

Students derive the semi-vertical angle (α) with the guide of the researcher through,

Considering figure 10

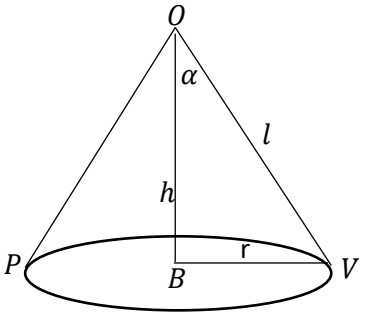


Figure 10

$|OV|$ = slant height (l)

$|OB|$ =height of the cone (h)

$|BV|$ = radius of the cone (r)

α = semi-vertical angle

Since angle OBV is a right angle triangle

Then

$$\sin\alpha = \frac{|BV|}{|OV|}$$

$$\sin\alpha = \frac{r}{l}$$

Or

$$\tan\alpha = \frac{|BV|}{|OB|}$$

$$\tan\alpha = \frac{r}{h}$$

Students Observation

The value of the vertical angle "α", is twice the α since the $|OB|$ divides the triangle POV into two equal parts.

Lesson Five

By the end of the lesson students will be able to derive formula of volume of a cylinder.

TLM: Milo tin, empty milk tin and cardboard

Activity

i) Students pour water into the empty milo tin to certain level; the water level formed in the cylinder is the height as shown in figure 12.

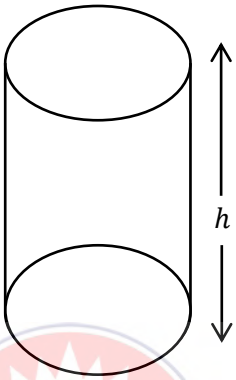


Figure 11

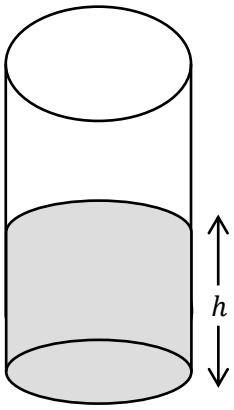


Figure 12

ii) Students establish that the base of the cylinder which keeps the water is a circle.

Then the volume of the cylinder is the base area × the height of the cylinder.

Volume $v = \pi r^2 h$

Where" r" is radius, "h" is height

Students Observation

a) Base part of the cylinder is a circle.

b) The water level in the cylinder is also the height "h".

Lesson Six

By the end of the lesson students will be able to derive formulas of both curved surface area and total surface area of a closed cylinder.

Activity

i) Students cut the molded cylindrical shape through vertical direction.

ii) Students cut both the upper and lower parts of the cylinder to get the net shape of a closed cylinder as in figure 14.

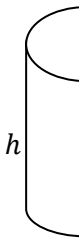


Figure 13: A Cylinder

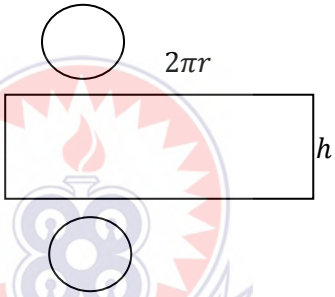
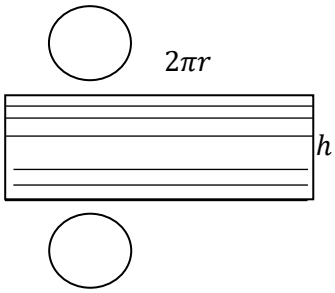


Figure 14: Net of a closed Cylinder

iii) Students establish that the curved-surface area is the shaded part with the guide of the researcher as shown in figure 15.

Figure 15



Thus the formula of the curved surface area is the circumference make by the curve to the two circles and its height. Curved surface area $= 2\pi rh$.

iv) Students establish that the total surface area of a closed cylinder is resulted from the areas of the two circles and the curved surface area with the guide of the researcher as shown in figure16.

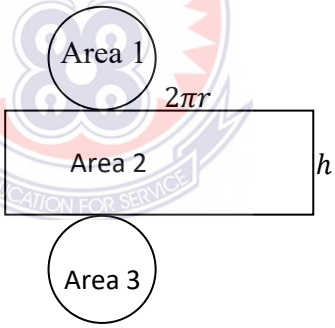


Figure 16

Thus

$$\text{Area 1} + \text{Area 2} + \text{Area 3} = \pi r^2 + 2\pi rh \ + \ \pi r^2$$

$$= 2\pi r^2 + 2\pi rh \quad \text{Grouping like terms}$$

$$= 2\pi r(r \ + \ h) \quad \text{Factorize}$$

The formula for the total surface area of a closed cylinder $= 2\pi r(r \ + \ h)$.

Lesson Seven

By the end of the lesson students will be able to:

i) draw a spherical shape

ii) derive the volume and the surface area of a sphere.

TLM : Football, cardboard

Activity

i) The researcher assists students to draw a shape of a sphere.

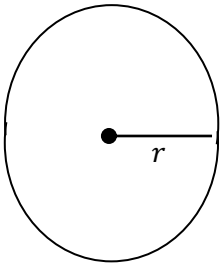
ii) The researcher will assist students to derive the formula of a volume of a sphere.

Thus $V = \frac{4}{3}\pi r^3$

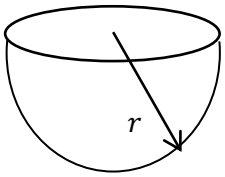
iii) Students derive the formula of a surface area of a sphere($4\pi r^2$), with the guide of the researcher. This is the first derivative of the volume of a sphere.

Let $y = \frac{4}{3}\pi r^3$

$$\Longrightarrow \quad \frac{dy}{dr} = 4\pi r^2$$



A Sphere



Hemisphere

NB: The volume of a hemisphere is half of the volume of a sphere, thus $\frac{1}{2} \times \frac{4}{3}\pi r^3 = \frac{2}{3}\pi r^3$

And

The curved surface area of a hemisphere is half of the surface area of a sphere, thus

$$\frac{1}{2} \times 4\pi r^2 = 2\pi r^2$$

APPENDIX F

POST- TEST QUESTIONS FOR STUDENTS.

This paper which you are requested to answer is aimed at finding out your level of challenges and achievements in problems related to mensuration concept after the intervention strategy.

Part I

To ensure complete anonymity, please do not write your name on the question paper.

[Knowledge and understanding]

Circle the correct answer

1. A cylindrical tin of diameter 13.2cm and height 20cm is half filled with water. Find the volume of water in the tin. [Take π= 3.142]

A. 1369cm^3

B. 1298cm^3

C. 2139cm^3

D. 1623cm^3

2. The volume of a cylindrical tank is 1,100m^3 if the radius of its base is 5m, find its height. [Take π = 3.142]

A. 20m

B. 15m

C. 14m

D. 10m

3. A closed cylinder has a radius of 3cm and height 7cm. Find its total surface area [Take $\pi = 22/7$]

A. 189cm^2

B. 238cm^2

C. 180cm^2

D. 346cm^2

4. The volume of a cone with base radius 8cm is 240cm^3. Calculate the height of the cone. [Take $\pi = 3.142$]

A. 10.0cm

B. 4.5cm

C. 2.3cm

D. 3.6cm

5. The volume of a right circular cone with height 10.5cm is 396cm^3. Calculate the radius of the cone. [Take $\pi = 22/7$]

A. 10cm

B. 11cm

C. 6cm

D. 20cm

6. Find the volume of a cone whose base radius is 5cm and height 21cm. [Take π = 22/7]

A. 550cm^3

B. 450cm^3

C. 670cm^3

D. 230cm^3

7. The base radius of a cone is 5cm and its height is 12cm. Calculate the total surface area of the cone with slant height 13cm. [Take π = 22/7]

A. 363cm^2

B.283cm^2

C. 184cm^2

D. 468cm^2

8. A sphere of radius rcm has the same volume as a cylinder of radius 3cm and height 4cn. Find the value of r.

A. 3cm

B. 5cm

C. 6cm

D. 10cm

9. Calculate the surface area of a sphere of radius 7cm. [Take π= 22/7]

A. 716cm^2

B. 616cm^2

C. 500cm^2

D. 600cm^2

10. The curved surface area of a hemisphere is half of the surface area of a sphere.

A. True

B. False

Part II

[Application of Knowledge]

Answer all the questions. Show all necessary details of working.

POST-TEST QUESTIONS

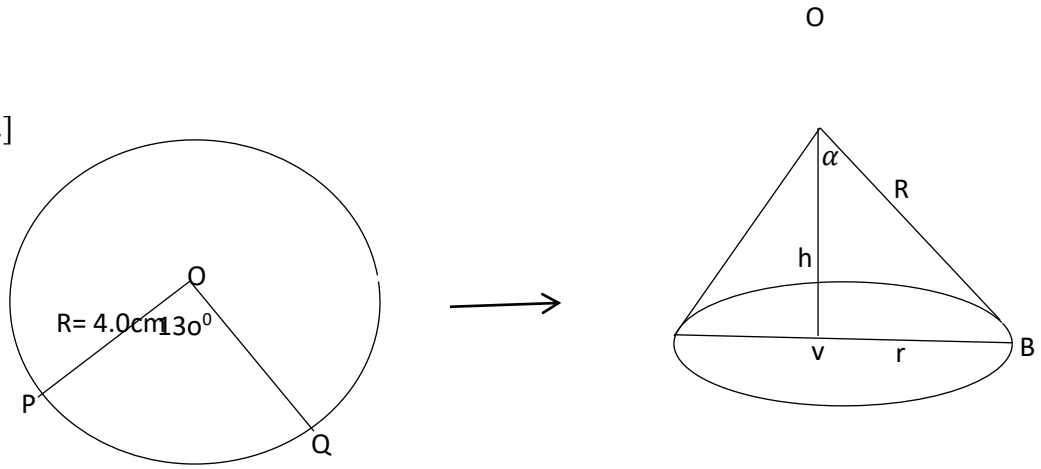
Q.1A sector of angle 130^0 is remove from a tin circular sheet of radius 4cm. It is then folded with the straight edges coinciding to form a right circular cone. Calculate

i) The base radius correct to 2 significant figure

ii) The semi-vertical angle

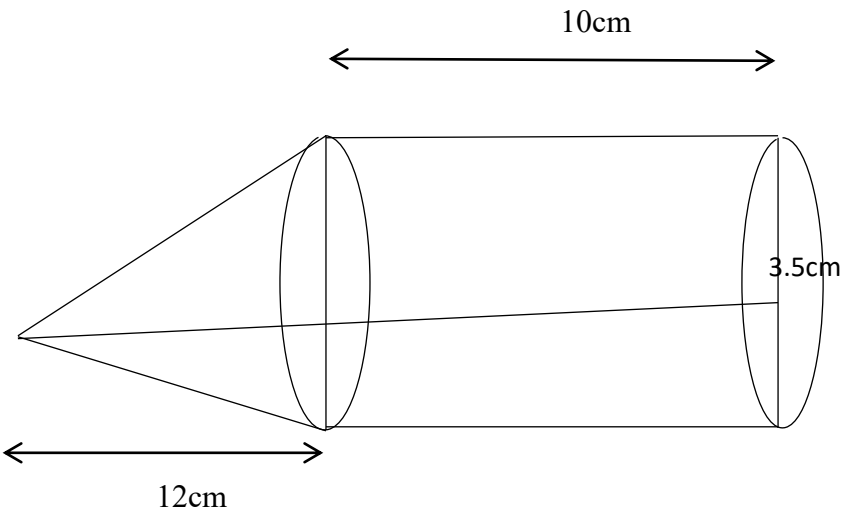
iii) The volume in cm^3

[Take ∏= 3.142]



Q.2 A toy is in the form of right circular cylinder with a hemisphere at the one end and a cone at the other end. The base radius measure 3.5cm, height of the cylindrical portion is 10cm and conical part measures 12cm. Find the total surface area of the toy.

[Take π= 3.142]



APPENDIX G

MARKING SCHEME FOR THE POST-TEST QUESTIONS

OBJECTIVE QUESTIONS

1A6A

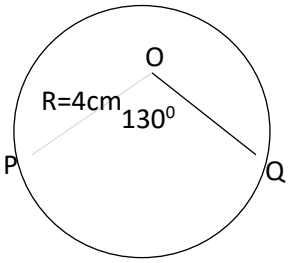
2. C **7. B**

3. A **8. A**

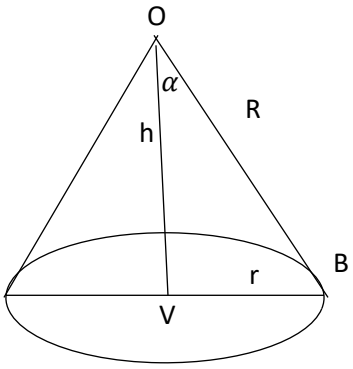
4. D **9. B**

5. C **10. A**

Theory Questions

Questions	Steps	15 Marks
1.	 i) Length of the manor arc PQ = Circumference of the base circle of the cone. $\frac{\theta}{360^0} \times 2\pi R = 2\pi r$ $r = \frac{\theta}{360^0} \times R$ But $\theta = 360^0$ $and\ R = 4.0cm$ $r = \frac{130^0}{360^0} \times 4.0cm$ $r = 14.4cm$ The base radius$= 14cm$ $(2\ s.f.)$	M1 M1 A1 A1

ii) $Let\ \alpha\ = the\ semi - vertical\ angle$



$$Sin\ \alpha = \frac{|VB|}{|OB|} = \frac{r}{R} = \frac{14.4cm}{40cm} = 0.36 \qquad figure\ above$$

M1

$$Sin\ \alpha\ = 0.36$$

$$\alpha\ = Sin^{-1}\ (0.36)$$ M1

$$\alpha\ = 21^0$$ A1

	iii) The volume of cone, $v = \frac{1}{3}\pi r^2 h$	M1
	From above figure in (ii)	
	$R^2 = h^2 + r^2$	M1
	$h^2 = R^2 - r^2$	M1
	$h = \sqrt{R^2 - r^2}$	
	$h = \sqrt{40cm^2 - 14.4cm^2}$	M1
	$h = \sqrt{1392.64cm^2}$	
	$h = 37.3cm$	A1
	$v = \frac{1}{3} \times 3.142 \times (14.4cm)^2 \times 37.3cm$	M1
	$v = 8102.2cm^3$	A1
	Volume of the cone $= 8100cm^3$	A1

2.	Curved Surface Area of hemisphere $= 2\pi r^2$ $= 2 \times 3.14 \times (3.5cm)^2$ $= 76.93cm^2$ Curved Surface Area of right circular cylinder $= 2\pi rh$ $= 2 \times 3.14 \times 3.5cm \times 10cm$ $= 219.8cm^2$ Slant height of a cone, l, $l^2 = r^2 + h^2$ $l^2 = (3.5cm)^2 + (12cm)^2$	M1 M1 A1 M1 M1 A1 M1

	$l^2 = 12.25cm^2 + 144cm^2$ $l = \sqrt{156.25cm^2}$ $l = 12.5cm$ Curved Surface Area of a cone $= \pi rl$ $= 3.14 \times 3.5cm \times 12.5cm$ $= 137.38cm^2$ Total Surface Area of the toy $= Curved\ Surface\ Area\ of\ (hemisphere + cylinder + cone)$	M1 M1 A1 M1 M1 A1
	$= 76.93cm^2 + 219.8cm^2 + 137.38cm^2$ $= 434.11cm^2$	M1 A1

APPENDIX H

POST – TEST SCORES OF THE STUDENTS

14	35	33	26	31	32	23	16	32	15
30	23	19	27	24	20	31	28	30	26
21	38	36	23	37	34	21	24	20	27
29	32	26	33	29	20	35	25	21	19
17	22	36	15	22	30	33	26	29	37
33	31	28	38						