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Constructing and Testing a Simple Boat for Maximum Weight Capacity

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An Engineering Lesson Plan Built for Worcester Polytechnic Institute, Implemented at Shepherd Hill Regional High School

By:

Domenic Giancola: ____________________

Genesis Quemuel: ____________________

John Bubriski: ____________________

Advisors:

Martha Cyr, K-12 Outreach Director: ____________________

Professor Yiming Rong, M.E. Department: ____________________

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Abstract

This project was designed to create a lesson plan for high school students that would teach them basic engineering skills. The lesson plan we created focuses on teaching the students simple design process concepts. We have incorporated a project that will teach buoyancy as part of the lesson plan. For the project, the students will have to build a boat and test it for maximum weight capacity in water. The boats were of two different designs and constructed of three different materials.

We created a project that would be fun for the students and also give them a taste of what engineering is about. With the help of Professor Cyr, we plan to submit this to an online database of other engineering projects and to have it published.

Authorship

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Acknowledgments

We would like to thank Professor Martha Cyr and Professor Kevin Rong for all their help and guidance during the course of our project. We would also like to thank Mr. Skrocki from Shepherd Hill Regional High School for allowing us to test and implement our lesson plan in his class.

Executive Summary

Background

In June of 1993, Governor Weld passed the Massachusetts Education Reform Act of 1993. This bill created a lot of changes in the Massachusetts education system. Schools in Massachusetts started to focus on technology/engineering (T/E) courses to better prepare their students for the MCAS's technology section. The 1996 Educational Technology Bond Bill helped to provide the funding necessary to put this change into effect. It gave money to schools that were dedicating courses to technology education.[1]

With all of these changes in the Massachusetts Curriculum Framework, Shepherd Hill Regional High School (SHRHS) asked that students attending Worcester Polytechnic Institute help in creating a lesson plan for developing basic engineering skills. SHRHS wanted the students to be exposed to topics like the design process and more in-depth drawing/schematic analysis. Our project focused on developing these skills. There were several goals set forth at the beginning of the project, one of them being to create a spark of interest in possible future engineers.

Methodology

Our project went through three major stages since we first started in A term of WPI's 2004-2005 school year. Our original project involved pressure testing a submarine model that the students built during the course of the lesson plan. This lesson plan focused mainly on material selection and designing the internal structure of the submarine. As part of this lesson plan, we wanted to be able to test the submarines in a tank of water. Shortly after completing our first prototype submarine, we realized that the amount of water necessary for this testing made the whole hands-on project of the lesson plan impractical.

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[1] *Education Reform.* (n.d.) Retrieved September 1, 2004, from http://www.doe.mass.edu/edreform/

We then moved to trying to create an air pressure tank that could break the submarine. After talking with our advising professors, we agreed that this lesson plan would be too complicated since the construction steps and background material was too advanced for a 9^{th} grade engineering course. This is when we moved into the second major stage of development.

We moved the project from submarine construction to something that focused more on how submarines were built historically and a history of technology. We were still looking to test the submarine that they would build for this project with an air pressure tank. It was at this point that we decided that the lesson plan was still too complicated for the students and needed to be rethought. This is when we began developing the final lesson plan.

The final lesson plan involved material selection and the design of a boat. It focused on teaching the students about buoyancy and how it relates to the amount of weight a boat can hold before sinking. We created the lesson plan with the goal of teaching the students buoyancy and engineering design principles with a boat project at the end of the lesson. The boat project entailed the students creating a boat from three different materials and two different designs. At this stage of development, it took us some time to rewrite the lesson plan so that students of all educational levels could understand the material it contained. We did more work with the advising professors to bring the lesson plan to the educational level of the average first year high school student.

Results and Analysis

We measured the success of our project in various ways. One way we decided if the project was a success or not was by talking to Mr. Skrocki, our SHRHS liaison. Mr. Skrocki is a teacher in the Technology/Engineering department at SHRHS. We asked him if the students had fun, if they found the project interesting, and if they took away a better understanding of buoyancy and engineering design principles after going through the lesson plan. Another way we considered the success of the project was by looking at the student grades from the pretest versus the posttest. If all of the scores went down or stayed the same, then it was safe to assume the lesson plan wasn't very effective. However, if the scores went up from the pretest to the posttest, then we considered the project a success.

The implementation of our lesson plan was broken up into two parts. The first part was the actual creation and original implementation of the lesson plan with Mr. Skrocki's first semester class. This was done in order to gain some feedback on the original plan itself. The first implementation took 8 school days and occurred in the middle of December, towards the end of WPI's B term, 2004. We had a pretest and a posttest administered in order to see what the students had learned. The pretest and posttest were identical. Instead of giving us the names of the students, Mr. Skrocki gave us numbers that we used instead of names in our analysis of both test results.

In general, the results of the first implementation were quite positive. Most of the students showed much improvement from their pretest to their posttest. Only a few students lost points once they finished the lesson plan, but even this loss of points was minor. The students seemed to have some problems with the test itself, leading them to leave a lot of their test questions unanswered. One possible explanation for the low average test score could be the level of the students' education. We felt that the level of these students was lower than the lesson plan required.

The second implementation occurred in late January midway through WPI's C term, 2005. After talking to the professors and to Mr. Skrocki, we made revisions to the lesson plan as they suggested. One of the changes made was to make the sketches easier to read. There were some angle measurements on the schematics that were added to make it easier to understand the construction of the boats. Also, the method of testing the boats was changed around according to the ideas of Mr. Skrocki. He used bags of sand during the weight testing instead of using the originally suggested Physics department's weights.

Another change we made was in the pretest and posttest questions. The questions emphasized, more so than the first time, when there was a need for multiple answers.

Conclusions

After completing two implementations, we feel that the lesson plan works well and met the goals we originally set forth. These goals were to spark the interest of possible future engineers and to develop a new advanced T/E course. One of our major problems in the second implementation was that the pretest and posttest given was the test from the first implementation. This brought about the same confusion that some students had during the first implementation. This confusion was that some of them only answered half of the two-part mathematics questions. This single problem alone caused a lot of the students to miss several points on that section of the test. This problem was the difference between doing well and doing poorly. The same ambiguity arose in the free response question. We weren't specific enough about what kind of answers we were looking for in this section. This was one problem that we have now fixed in our documents. However, there were a couple of things that we could not control so easily, or at all.

One thing that we could not control was the level of education that the students had going into the lesson plan. There were basic fundamental concepts that the students needed to understand in order to get through this lesson plan successfully. Students without a clear understanding of these concepts were not likely to do as well in the lesson as students with the necessary background.

If these basic prerequisites are met before the students go through the lesson plan, then we believe that they will definitely learn from our curriculum. The lesson plan teaches the design process in a fairly easy method and even includes a hands-on project. This hands-on project is what we hope will spark the interest of the "kid on the fence" and better prepare students for further education in a technology/engineering field.

Table Of Contents:

1. Introduction

The aim of this project was to develop a Technology/Engineering lesson plan for Shepherd Hill Regional High School. This lesson plan met various Massachusetts Science and Technology/Engineering Curriculum Framework standards.[2] The project defines the costs, both time and monetary, for the lesson plan. It even defines the technology/engineering strands (disciplines) that are emphasized within the lesson plan. This lesson plan was implemented at Shepherd Hill Regional High School (SHRHS). We worked on this project for a total of 3 terms: A, B, and C term of the 2004-2005 school year.

Our lesson plan for SHRHS took about 1.5-2 weeks of class time. We expect this was about 6.5 hours of total in-class time. Our first implementation of this lesson plan was in B-term, 2004. The second implementation took place in C-term, 2005. The students of both implementations were able to complete the hands-on project that we built into the lesson plan.

The project taught the students about engineering design and in the process they learned more about buoyancy. We wanted the lesson plan to enhance their understanding of why and how a boat is able to float on water. Teaching the students what buoyancy is and what it does furthered their understanding of how a boat works. At the conclusion of the project, the students made a boat and tested it for how much weight it could hold before sinking.

There was a test at the beginning and at the conclusion of the lesson plan. The tests were identical. These tests were one of the ways we judged the success or failure of

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[2] *Learning Standards for a Full First-Year Course*, (May 2001), pg 82-83, Massachusetts Science and Technology/Engineering Curriculum Framework

Grade 9-10 Learning Standards, (November 2000), pg 72-75, Massachusetts Mathematics Curriculum Framework the lesson plan. There were no student names written on the tests, instead Mr. Skrocki gave us numbers that he substituted in for the students' names. These numbers are what we used when we analyzed the scores of the tests.

To conclude the project, a report was written for the www.teachengineering.com website and submitted to them for addition to their current archive of lesson plans. There was also a written report submitted to the advising professors, the WPI Registrar's office, and to Mr. Skrocki.

2. Background

2.1 History of Changes in Massachusetts Education

On June 18, 1993 the current Massachusetts Governor William Weld signed the Massachusetts Education Reform Act of 1993. This bill brought about many changes to the entire educational system of Massachusetts. Specifically, we focused on the changes that affected technology/engineering education. The major catalyst of change within this area was the MCAS testing program. It highlighted the weaknesses within the current curriculum at the time.

These weaknesses inspired an increase in funding for technology in the classroom. According to the 1996 Educational Technology Bond Bill, the state would provide $30 per student with the district matching said funds in a 3:1 ratio, with this funding only available if the district had a local technology plan. This allowed districts to dedicate more resources towards technology, and thus technology education. [3]

With the increases in science and technology funding and increases in educational standards, each school was forced to implement their own science/technology curriculums to meet these higher standards. Schools have also started to develop their own courses for students planning on getting a higher education in a technical background such as mechanical, electrical, and manufacturing engineering. There are also classes that prepare students for higher education in computer science and other information technology fields.

The courses that focus on mechanical and manufacturing engineering are geared towards the engineering design process and computer-aided drafting. The courses that give students a background in electrical engineering revolve around teaching kids Ohm's

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[3] *Education Reform.* (n.d.) Retrieved September 1, 2004, from http://www.doe.mass.edu/edreform/

Law and exposing them to simple circuits. When it comes to giving students a background in computer science, there are courses that teach programming in Visual Basic, C++, and HTML.

These are the types of courses that high schools have started to develop and integrate into their curriculum so that students will be better prepared for a future education in a technical or engineering field. Shepherd Hill Regional High School is trying to further develop and integrate more courses like these into their curriculum.

Currently, Shepherd Hill Regional High school has classes that teach students CAD, Architectural Drawing, and Technical Drafting. These classes teach the use of various CAD software packages and understand physical drawings. In the Electricity and Electronics class, students learn about circuit configuration and component design. The computer classes at SHRHS focus on teaching students networking, pc repair, and webpage construction.[4]

This is the main historical reason why Shepherd Hill Regional High School has a need for this project, as it allows them to draw from the engineering/technology background that Worcester Polytechnic Institute students possess.

This project also allows the same WPI students to apply their background to a situation that they will not necessarily encounter very often, especially after graduating from WPI. It will challenge the students to work together as a group and put their different backgrounds together to create a project that will be beneficial for those who are just starting an education in technology and engineering related fields.

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[4] *Shepherd Hill Regional High School,* http://www.dc-regional.k12.ma.us/SHcourses.html

2.2 Future Goals of the SHRHS/WPI Interactive Qualifying Project

In our conversations with Mr. Skrocki (our SHRHS liaison), he expressed the desire to "capture that kid on the fence". He felt that by expanding their current T/E courses, they would be better at preparing students for a future in engineering or even any technical profession as technology slowly integrates itself into every facet of the marketplace.

Faculty goals for Shepherd Hill Regional High School

1. *Increase focus on electricity, CAD, and engineering questions within the Massachusetts Comprehensive Assessment System test*

With the increased technology/engineering questions on the MCAS test, Mr. Skrocki wanted this project to help the students learn more about the engineering design process. By helping them learn the design process, they would be better prepared for the new MCAS questions.

2. *Spark the interest of possible future engineers and allow them to prepare for further education in engineering/technology*

Another aim of this project was to expose students to engineering and technology topics that they wouldn't regularly receive in their high school careers. It also gave them a better idea of some of the basic skills that engineers must possess.

3. *Develop new advanced T/E courses*

With the implementation of this project, there is a chance that the correct authority figures at SHRHS will start a process to further develop the technology/engineering courses at Shepherd Hill.

4. *Work away from using the course as a place to put problem students, but also to adjust the curriculum to capture the interest of those same problem students.*

Mr. Skrocki feels that his current technology class has become somewhat of a dumping ground for the trouble students in the school. He would like to move away from this situation and turn his class into a course where the students want to be there to learn about engineering and technology.

Project goals for the WPI Interactive Qualifying Project

1. *To have a report to submit to http://www.teachengineering.com.*

Professor Cyr would like to submit the finished product of our report to this website that she is currently helping to develop. It is a site that posts projects that teachers can use in their curricula.

2. *To have a report to submit to the correct authorities at Shepherd Hill Regional High School*

We wanted to create a report that Mr. Skrocki could submit to the higher authority figures at Shepherd Hill Regional High School. This report will show the results of the IQP and how the IQP affected Mr. Skrocki's technology course. Hopefully, this will lead to the types of changes in the course that were discussed in the previous section.

3. *To have a report to submit to Worcester Polytechnic Institute*

A report is needed to submit to the advising professors and to the school to complete the Interactive Qualifying Project requirement.

3. Methodology

The lesson plan underwent three major stages during its development. These stages were the initial submarine lesson plan focusing on pressure testing, the modified submarine lesson plan with much more emphasis on historical building methods and history of technology components, and the final boat lesson plan focusing on buoyancy and maximum weight capacity.

The first stage, the initial submarine lesson plan, focused primarily on material selection and building design and specifically how each choice affected the maximum pressure the submarine could be exposed to prior to breaking. For the pressure testing, it was first thought that we could test the submarines inside of a water tank, but it was quickly learned that this would not provide enough pressure to crush the submarines. The solution that we were able to come up with was that we would test the submarines within an air pressure tank of our own construction. This air pressure tank was to be constructed using Lexan or Plexiglas and then hooked up through a system of hoses and nozzles to an air compressor. The advising professors felt that this lesson plan might be a little too complicated for the students. The construction steps and the overall design for the submarines were believed to be too difficult for a 9th grade level engineering class. The necessary formulas and background material was also much more difficult than we originally anticipated. In response to this we then focused on simplifying their construction and design steps. This simplification slowly moved our project towards the second stage of its development.

The second stage, the modified submarine lesson plan, had much more of an emphasis on historical building methods and history of technology than the first design. The main focus of this stage was to further simplify the construction and design methods while still tying the submarine construction and lesson plan together. A great deal of research was done into the history of submarines and how construction methods had changed greatly over the course of their development. This background material was to be incorporated early into the lesson plan to help guide the students in selecting construction materials and creating their designs. Even after the connection between the construction and the lesson plan was complete, we still had the problem of the air pressure testing. We were not sure if the material necessary to fully explain the math and science behind the testing was too complicated for the students. It was at this point in time that we met with the other WPI IQP project team working at Shepherd-Hill Regional High School. During this meeting it was made quite evident that we needed to simplify our lesson plan to a much greater degree than we first thought to match the level of students currently taking the course. After a long meeting it was then decided that we would move away from the submarine construction towards a new boat construction lesson. This allowed us to simplify the lesson plan while still reusing the background material and resources that we had gathered for the submarine lesson plan.

This third and final stage of lesson plan construction then moved along quite smoothly but rigorously. There was not much time left between when the changes were made to when we were originally planning on having our first in class implementation of our lesson plan. The lesson plan was to focus on material and design selection, buoyancy, and how they relate to a boat's maximum weight capacity in water. After a few meetings and revision after revision of the lesson plan, it was decided that the students would be using three different materials, cardboard, aluminum foil, and manila folders, and two different sample designs, a regular tanker design and a catamaran design. These design options would then be presented and assigned to the students who would work in groups to construct their given design from their assigned material.

One of the major issues during this design stage was expressing instructions, procedures, and diagrams to enough explicit detail so as not to confuse the students. Coming from a different educational background, it was difficult for us as a project group to understand what level of detail was necessary. This stage of development caused our group a lot of frustration but eventually, an acceptable level was attained through constant encouragement by Professor Cyr and revision after revision being made to the lesson plan.

After the lesson plan was finalized it went through two separate implementation tests, one during B-Term 2004 and one during C-Term 2005. These implementation tests allowed us to find the strengths and weaknesses in our lesson plan and make corrections and changes to match.

Over the course of the three terms developing the lesson plan, our project team also developed greatly. At first, we were very excited about making a lesson plan that we thought would be fun to design and would be fun for the students. Although we had education in mind, we still overlooked major aspects of the project that would later lead to complications. As time progressed, we began to focus more on creating something that would be fun and educational for the students yet simple enough to be able to measure the success of the students and the lesson plan itself.

Our initial lesson plan would have had the students constructing primitive submarines. The focus was more on the project itself, and not the lesson. Also, there were many issues concerning the construction and testing methods, as well as cost. As a group we had to make a decision on whether to try and salvage the submarine project, or to go in another direction. After much deliberation, we came up with the idea for the buoyancy lesson plan. We incorporated many of the same concepts and education standards that were in the original lesson plan, but now it is simpler, more cost effective, and on par with an average high school education.

We've grown as a team from being an average student project group, to becoming more of a professional project team. By the last term of our project, we had made a full set of individual deadlines for ourselves, which allowed us to work without having to worry about the final deadline. We also have learned a great deal about the Shepherd Hill Regional High School engineering curriculum, the Massachusetts Education Standards, and lesson plan design and implementation. Overall, we have progressed much and we are happy with the product of our efforts.

4. Results and Analysis

4.1 Implementation During First Semester 2004

Implementation #1

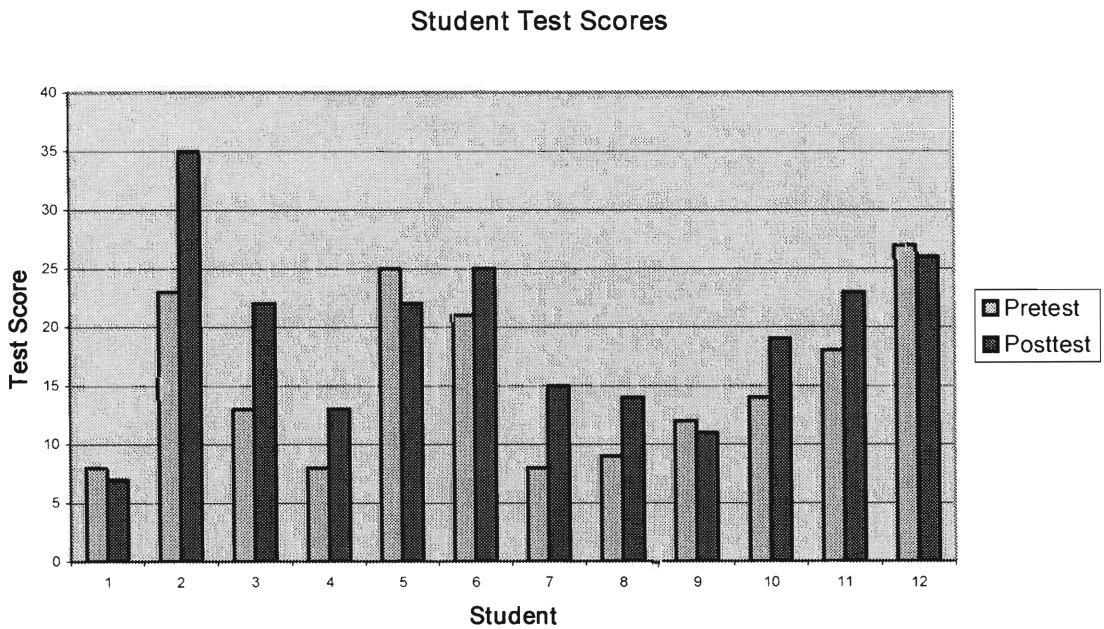
Implementation of the lesson plan was done in two phases. The first phase consisted of drafting the lesson plan and having Mr. Skrocki teach it to his Introductory Engineering classes at Shepherd Hill Regional High School. The goal of the first phase was to create the lesson plan, test it in a real-world environment, and receive feedback. The second phase consisted of analyzing the results of the first phase, revising the lesson plan, and having Mr. Skrocki teach it to a different class. The goal of the second phase was to refine the lesson plan, test it with another set of students, and make it ready for use by other teachers.

After a first draft of the lesson plan was created, it was brought to Mr. Skrocki in B Term '04 (Mid December, 2004). The first part of the implementation took 10 school days, which was 11 periods about 45 to 50 minutes long each. The lesson plan began with the pretest, which was not graded but tested the students' knowledge prior to the lesson plan. Mr. Skrocki then taught the lesson, beginning with the math formulas and worksheets, then moving on to the buoyancy concepts and formulas. During this time, the students learned all the formulas and concepts necessary to complete the project.

The next part of the lesson plan was the boat construction project. Mr. Skrocki had the students construct their boats from the provided design schematics, using materials outlined in the "materials" section of the lesson plan. Directions for construction were also provided for the students. After the boats were constructed, the students calculated the maximum weight capacity using the formulas they learned. Then the boats were tested in a tub of water for their actual maximum weight capacity, and the results were compared to the calculated capacity. Finally, the students took the posttest. The posttest was identical to the pretest and was used to determine how much the students learned from the lesson plan.

After the lesson plan was completed, we were able to obtain copies of the students' pretest and posttest. The tests only had each student's ID number, and not their name. By using the ID numbers, the names of the students were kept confidential, and were not available to us. Each posttest was matched to a student's corresponding posttest, using their ID numbers. Since the pretest and posttest were exactly the same, we were able to measure how much each student learned during the lesson.

Results and Analysis #1



In general most students did better on the posttest than they did on the pretest. This is a good sign that they did in fact learn during the lesson. Some made mistakes though on questions they had previously answered correctly which shows that they did not fully understand the topic since they wavered in their answers.

Students, on average, lost the most points in the mathematics section, closely followed by the engineering design section, then the open response section, and then finally the matching section. The poor performance in the mathematics section can be attributed to the fact that this is a 9th grade engineering course and the students have not yet taken Geometry so this could have been their first exposure to the topics covered.

The open response section though was also one of the sections that most students improved quite a lot on when they took the posttest. We believe that this shows that the students learned and retained the information taught regarding the engineering and design of boats. In this improvement we feel that the lesson plan was a success.

We believe the general poor performance can be based on the level of the students taking the course. Mr. Skrocki himself mentioned that they were much worse, on average, than his normal classes. This is not a definite though because we do not yet have another class to concretely compare against to make such a conclusion so at this point it is merely speculation.

Many of the students also seemed to be confused by the questions in that they only answered half of what was asked. We believe this problem can be remedied by making the multiple portions of each question stand out more, possibly by bolding the text. This should make it much easier for the students to see that there are multiple parts to some of the questions.

Some possessed a general knowledge of boats and boat design, though on average the information was very basic. Such as the general design for a sailboat or rowboat and that there must not be holes in a boat for it to stay afloat. On average though on the posttest, most of the students portrayed a greater working knowledge of boat designs and materials so some gain in knowledge was definitely achieved.

4.2 Implementation During Second Semester 2005

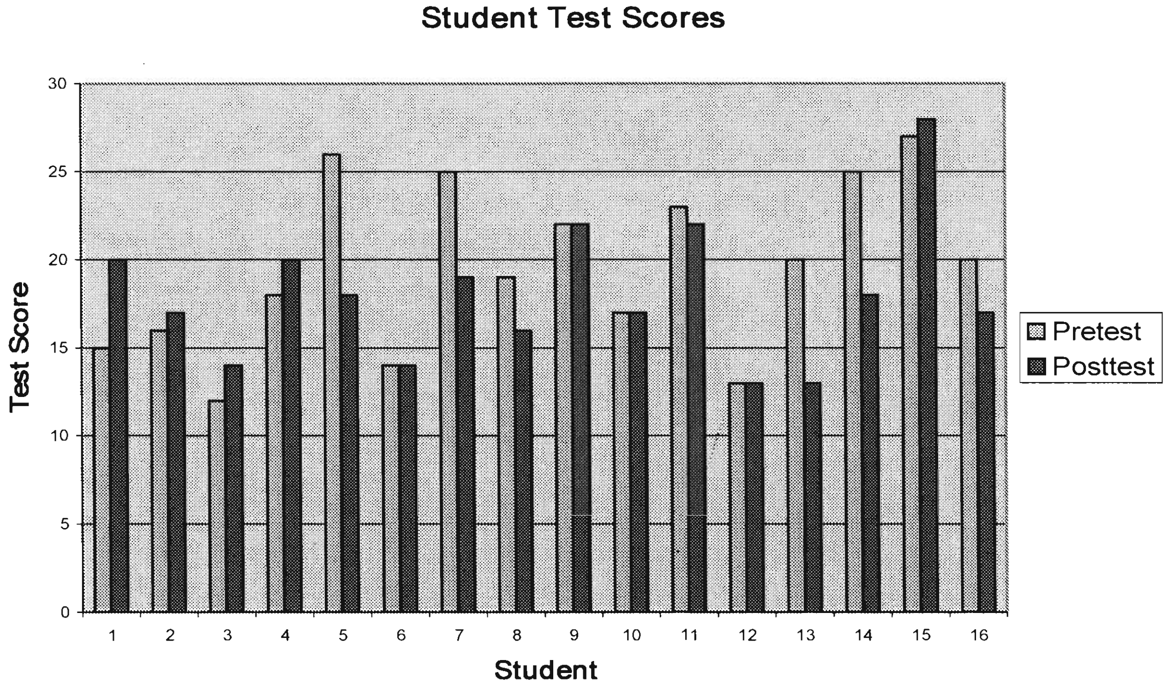
Implementation #2

After taking suggestions and comments from Mr. Skrocki, Professor Cyr and Professor Rong, the lesson plan was revised and resubmitted to Mr. Skrocki for the second implementation, during C Term '05 (Late January, 2005). For the second implementation, a different group of students was used, but they were enrolled in the same class (Introductory Engineering) as the previous group. Also, the second implementation took half the time (one week) of the first implementation.

The second implementation followed the same structure as the first implementation except for the following changes. The lesson plan was revised to include design schematics and directions that were more comprehensible. Specifically, the schematics were updated to show the angle between the front flaps. The construction steps were updated to specify that the flaps are rectangles which on top of the first change should help the students double check their angles and measurements when marking out the front portion of the boat designs.

There were also some changes made to the boat testing phase and the pretest and posttest. During the testing phase of the project, the boats were weighted down with plastic bags filled with sand, instead of metal weights, in order to balance the boats more easily. The pretest was updated to distinctly show that there are two answers expected for each of the geometric figure questions. This change was made because many of the students only put down one answer for each question instead of the two-part answer expected during the first implementation.

Results and Analysis #2



In general students did worse on the posttest than they did on the pretest. This is a sign that they did not learn the lesson plan material, although there were factors that may have prevented their improvement. Possible problems may have arisen from the fact that the lesson plan was completed in half the time of the first implementation, meaning that the students did not have as much time to review and absorb the knowledge.

Students on average lost the most points in the open response section, closely followed by the engineering design section, mathematics section, and then finally the matching section. Many of the students failed to grasp the basic concepts of the lesson plan involving the construction of the boats. They clearly did not understand the goals of the project. Although the responses were poor, there was little change from the pretest to the posttest.

The engineering design section also proved to be difficult for the students. Many of the students confused answers similarly to their classmates', and failed to correct their mistakes on the posttest. We feel this is largely due to the fact that the engineering design process may not have been explicitly stated throughout the lesson plan, and during the boat project.

The poor performance in the mathematics section can mostly be attributed to the fact that many of the students failed to answer both parts of the questions on the posttest. Some students even answered both parts on the pretest, while only answering one on the posttest. This was also a problem in the first implementation and it was corrected, but Mr. Skrocki did not use the updated test documents. In addition, this is a 9^{th} grade engineering course and the students have not yet taken Geometry so this may have been their first exposure to the topics covered.

Very few of the students possessed a previous general knowledge of boats and boat design, and on average the information was very basic. Such as the general design for a sailboat or rowboat and that there must not be holes in a boat for it to stay afloat. On average the students did not show any improvement on the posttest and did not appear to have gained any knowledge of boats.

Comparing the second group of students' scores versus the first group of students' scores comes up with some interesting results. The first group, on average, did worse on the pretest than the average score in the second group. The second group though, on average, did worse on the posttest than the students in the first group. The shows us that the first group of students, while knowing less entering the lesson, learned more and performed at a higher level when they finished the lesson.

5. Conclusions and Recommendations

It was our assumption during the creation of this lesson plan that it would be used to capture the interest of "those kids on the fence"; students facing academic problems at school and lacking interest in the normal curriculum of liberal arts based classes. Throughout the design process, we kept this assumption in mind but didn't limit ourselves to it. We made sure that the lesson plan could be taught to many different levels of students and students with different interests. The average student might take an interest in the project and possibly engineering as a basis for a future education.

During the first implementation it was our understanding that the class was comprised mostly of lower level students. Upon analyzing the results, we found that the majority of students showed improvement from the pretest to the posttest. While there was a portion of students who declined in performance after completing the lesson plan, it was a small percentage, and the declines were minimal. As a whole, the first implementation was a success, though there was still room for improvement and fine tuning within the lesson plan. Most of the difficulties experienced by the students revolved around the construction of the boats and interpreting the design schematics.

To help the students perform better on their projects and the lesson plan as a whole, we modified the schematics and the construction documents. We specified and added more dimensions and angles to make everything clearer to the students as they were building their boats. In general, we wanted to make sure that there was very little room for possible error as far as the schematics and construction directions went.

The second implementation was given to, what Mr. Skrocki described as, higher-level students. This time the lesson plan was taught within a much faster time frame than the first implementation. Instead of taking two weeks to finish the lessons, the second class took only a week. Also, Mr. Skrocki said that the class seemed to really enjoy the lesson plan and the testing of the boats went much smoother the second time around. He used bags of sand for the weight testing which helped distribute the weight much better.

Unfortunately, this second class did not learn as much from the lesson plan according to the test scores. There are several variables that could have affected this new class's performance on the tests.

A major variable of the success of any lesson plan is the teacher of the lesson plan. If the teacher does not teach the lesson plan very well, it would not matter how good the lesson plan is, the students just will not learn as much. However, if the teacher is absolutely fantastic, then the students will learn a lot from even an average lesson plan.

One reason we believe the scores on the tests went down is that the students did not fully understand some of the questions on it. On a lot of the posttests, when there were two answers required for the question (such as perimeter and area) the second answer was left blank. This would happen several times on the test, causing students to lose many points. We fixed this by adding answer boxes that clearly show the number of answers required.

One recommendation we have for future implementations of this lesson plan is that the teacher explicitly state the importance of the engineering design process. The teacher should also mention which design stages the students are currently in during the various sections of the lesson plan. This will be very beneficial to the students because it will reinforce their connections between the actual project steps they are taking and the engineering design process itself.

We feel that with the basics of this lesson plan taught to the students, it will start them thinking on a more technical plane of thought. We believe they will begin to draw more relationships between technology and items in their everyday life. They may even start to question how technology, such as a microwave or a television, was first designed and how it evolved from that first design to what it is today. This is the kind of thinking that will better prepare the students for the technology/engineering section of their upcoming MCAS tests.

This lesson plan will also expose them to new material about technology and engineering and will also make them more comfortable with engineering concepts in general. So once they see these same concepts on the MCAS, they will not become as confused in that section because it will be something that they have already worked with and are comfortable doing.

After completing the lesson plan, with all the necessary revisions, we feel that it can benefit high school students with an interest in engineering, as well as other students interested in learning. It gives students a chance to explore the basic concepts of engineering, as well as more specific knowledge about buoyancy, and how to apply them in a realistic situation. It is our opinion that a hands-on project is able to capture the minds of students and creates a more effective learning situation if presented appropriately. Although it may not be the most challenging project for some students, the engineering concepts learned throughout the lesson are a foundation for future classes, and the project demonstrates one application of these skills. We believe that given the opportunity to explore an attractive career field, a problem student can become more successful and interested in the learning process. This lesson plan gives those students the opportunity to explore the basics of engineering and will hopefully inspire them to further pursue education in a related field.

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Appendices

Constructing and Testing a Simple Boat for Maximum Weight Capacity

By:
Domenic Giancola
Genesis Quemuel
John Bubriski

For:
Shepherd Hill Regional High School
Worcester Polytechnic Institute

Lesson Plan Summary

The students have been commissioned by a freight company to create a new design for their line of ocean freighters. The freight company would like the design to maximize weight capacity while maintaining cost effectiveness and structural stability.

Learning Objectives

After completing this project, students will have gained an understanding of basic engineering and design concepts and practices, as well as knowledge about stress analysis, statics, and physics. Students will also have constructed a simple boat built to carry the maximum weight capacity for its size. After a weight capacity test, the students will analyze the results of this test. This analysis will help show the students the strengths and weaknesses of their materials and designs. As an additional benefit, they will gain the experience of working in groups to complete a project.

Standards

Engineering Design

1.1- Identify and explain the steps of the engineering design process, i.e., identify the problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.

How it applies:
Students will be learning about the engineering design process and how it applies as they are given materials and designs to use for this project.

1.2- Demonstrate knowledge of pictorial and multi-view drawings (e.g., orthographic projection, isometric, oblique, perspective) using proper techniques.

How it applies:
Students will have to construct their boat from given designs and schematics.

1.4- Apply scale and proportion to drawings, e.g., 1/4" = 1'

How it applies:
The students will be required to apply the given design measurements and scales to their boat during construction.

1.5- Interpret plans, diagrams, and working drawings in the construction of a prototype.

How it applies:
The students will have to be able to follow the supplied designs and schematics for use in constructing their boat.

Construction Technologies

2.1-Distinguish among tension, compression, shear, and torsion, and explain how they relate to the selection of materials in structures.

How it applies:
Students will have to be able to know which materials have a better compression resistance as it applies to their boat's hull.

2.2- Identify and explain the purposes of common tools and measurement devices used in construction, e.g., spirit level, transit, framing square, plumb bob, spring scale, tape measure, strain gauge, venturi meter, pitot tube.

How it applies:

Students will be using certain tools to build their boats.

Mathematics

10.G.1 - Identify figures using properties of sides, angles, and diagonals. Identify the figures' type(s) of symmetry.

How it applies:
Students will be taught these principles as they apply to the supplied designs and schematics.

10.G.10 - Demonstrate the ability to visualize solid objects and recognize their projections and cross sections.

How it applies:
Students will need to visualize their boat after analyzing the supplied designs and schematics.

10.M.2 - Given the formula, find the lateral area, surface area, and volume of prisms, pyramids, spheres, cylinders, and cones, e.g., find the volume of a sphere with a specified surface area.

How it applies:
Students will need to calculate the surface area of their boat for use in calculating the overall pressure applied within the container upon their boat. Students will also need to calculate the overall weight and volume of water within their boat.

Procedures/Activities

Organization

The students should be split into groups of 2-3, with each group assigned a different material and design. If possible it is optimal to have groups for each material and design combination so as to allow the students to see the strengths and weaknesses of each material and design.

For this lesson the students will be using three different materials for construction: cardboard, aluminum foil, and manila folders. These materials will be used to construct boats from two simple designs, one following a basic rowboat design and the other following a basic catamaran design. So overall there should be at least six groups arranged as such:

Group Number	Material	Design
1	Cardboard	Basic
2	Cardboard	Catamaran
3	Aluminum Foil	Basic
4	Aluminum Foil	Catamaran
5	Manila Folders	Basic
6	Manila Folders	Catamaran

At this point you should introduce the design schematics to the students and review the construction steps.

Boat Construction (Regular)

1. Measure and cut out a 32cm x 44cm piece of your group's assigned material
2. Measure and mark out each flap (left, right, back, top left, and top right) onto your piece of material following the scale and construction layout shown within the design schematic for your group's design. ***NOTE*** All flaps are rectangles
3. Now that everything is measured out and marked, cut out the measured piece of material along the outer measured edge to match your boat to the unfolded view of the design
4. Make a slight crease along the inner surface of each seam of each wall of the boat to allow for easier folding. DO NOT CUT COMPLETELY THROUGH THE MATERIAL.
5. Fold the walls into place to crease the seam
6. Fold up and secure the walls at a 90 degree angle from the boat bottom using tape
7. Now with the bottom hull sections completed, you will create the Boat Cover. Measure out a 18cm x 31cm piece of your group's assigned material
8. Measure and mark out the Boat Cover onto this piece of material according to the scale and construction layout shown within the design schematic
9. Cut out the shape of the Boat Cover. This cover should fit over the bottom section that you just built
10. Tape the cover in place covering the bottom section

Boat Construction (Catamaran)

1. Measure out a 23cm x 44cm piece of your group's assigned material
2. Measure and mark out each flap (left, right, back, top left, and top right) onto your piece of material following the scale and construction layout shown within the design schematic for your group's design. ***NOTE*** All flaps are rectangles
3. Now that everything is measured out and marked, cut out the measured piece of material along the outer measured edge to match your boat to the unfolded view of the design
4. Make a slight crease along the inner surface of each seam of each wall of the boat to allow for easier folding. DO NOT CUT COMPLETELY THROUGH THE MATERIAL.
5. Fold the walls into place to crease the seam
6. Fold up and secure the walls at a 90 degree angle from the boat bottom using tape
7. Repeat steps 1-6 again to create the second hull portion of the catamaran
8. Now with the bottom hull sections completed, you will create the Catamaran Cover. Measure out a 27cm x 31cm piece of your group's assigned material
9. Measure and mark out the Catamaran Cover onto this piece of material according to the scale and construction layout shown within the design schematic
10. Cut out the shape of the Catamaran Cover. This cover should fit over both of the bottom sections that you just built, at the same time
11. Tape the cover in place covering both bottom sections

After constructing their boats the students will have to weight test their boat within a container filled with water. This will help show the students some of the strengths and weaknesses of their assigned materials and designs.

Boat Testing

1. Fill a container ¾ full with water. The container must be at least 60cm x 50cm x 30cm (length x width x height)
2. Place the boat within the container so that it floats on top of the water.
3. Slowly add weights to the boat, evenly distributed, until the boat is about to be submerged. The total weight now within your boat is roughly the max weight capacity of the boat
4. Record this maximum weight onto your analysis worksheet

Note If you are having difficulty with the boats becoming unbalanced as you add weights, fixed weighted amounts of sand in waterproof bags could be used instead to help evenly distribute the weight.

After the testing process the students will analyze their findings and follow the buoyancy formulas given to them within the analysis worksheet to see how closely their boat came to the true maximum weight capacity for their boat design.

Materials and Equipment

Cardboard
Aluminum Foil
Manila Folder

Duct Tape – One roll for each group
Ruler – One for each group
Protractor – One for each group
Pencil – At least one for each group
Container for Water (at least 50cm x 40cm x 30cm)
Cutting tools (Scissors, box cutter) – One for each group
Scale – One per testing station
Weights – Standard Kilogram/Gram weight set

Total Duration

Periods	Description
1	**Pretest** – Give the students pretest, inform them that they will not be graded on it, it's simply a test of their knowledge.
2	**Area, Volume and Angles** – Have the students use their buoyancy resource packet to help them understand the concept and formulas for calculating areas, volumes, and angles. Afterwards, give them the worksheets for more practice.
3	**Buoyancy Resource** - Have the students use their buoyancy resource packet to help them understand the concept and formulas for calculating buoyancy.
4	**Engineering Design Process** – Have students follow along with their engineering design process worksheets.
5	**Boat Construction** – Have the students construct their boats from the design schematics.
6	**Boat Construction/Finalization** – Make sure all the students have finished constructing their boats.
7	**Boat Testing/Analysis** – Test the boats. If time is left over, start the boat analysis.
8	**Analysis/Material Review** – Have the students fill out the project analysis worksheet, and review all material for the posttest.
9	**Posttest** – Have the students take the posttest, make sure they understand that it WILL be graded.

Additional Notes

Extension

1. The students could be given a limited "budget" with costs assigned to each construction material to mimic construction budgets and engineering projects in the working world.
2. The students could design and implement additional functions for their boat, i.e. implementing a system of motion for their boat so it can actually carry the "freight" across the testing tank. This could be expanded into a race where the students could be given points depending on how fast their boat carried a certain amount of weight.

Constructing and Testing a Simple Boat for Maximum Weight Capacity

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Lesson Plan Summary

You have been commissioned by a freight company to create a new design for their line of ocean freighters. The freight company would like the design to maximize weight capacity while maintaining cost effectiveness and structural stability.

Learning Objectives

After completing this project, you will have gained an understanding of basic engineering and design concepts and practices, as well as knowledge about stress analysis, statics, and physics. You will also have constructed a simple boat built to carry the maximum weight capacity for its size. After a weight capacity test, you will analyze the results of this test. This analysis will help show you the strengths and weaknesses of your materials and designs. As an additional benefit, you will gain the experience of working in groups to complete a project.

Procedures/Activities

Organization

The students should be split into groups of 2-3, with each group assigned a different material and design. If possible it is optimal to have groups for each material and design combination so as to allow the students to see the strengths and weaknesses of each material and design.

For this lesson the students will be using three different materials for construction: cardboard, aluminum foil, and manila folders. These materials will be used to construct boats from two simple designs, one following a basic rowboat design and the other following a basic catamaran design. So overall there should be at least six groups arranged as such:

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5	Manila Folders	Basic
6	Manila Folders	Catamaran

At this point your instructor should introduce the design schematics to you and review the construction steps with you.

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After constructing your boat, you will have to weight test your boat within a container filled with water. This will help show some of the strengths and weaknesses of your assigned material and design.

Boat Testing

1. Fill a container ¾ full with water. The container must be at least 60cm x 50cm x 30cm (length x width x height)
2. Place the boat within the container so that it floats on top of the water.
3. Slowly add weights to the boat, evenly distributed, until the boat is about to be submerged. The total weight now within your boat is roughly the max weight capacity of the boat
4. Record this maximum weight onto your analysis worksheet

After the testing process you will analyze your findings and follow the buoyancy formulas given to you within the analysis worksheet to see how closely your boat came to the true maximum weight capacity for your boat design.

Materials and Equipment

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Cutting tools (Scissors, box cutter) – One for each group
Scale – One per testing station
Weights – Standard Kilogram/Gram weight set

Total Duration

Periods	Description
1	**Pretest**
2	**Area, Volume and Angles**
3	**Buoyancy Resource**
4	**Engineering Design Process**
5	**Boat Construction**
6	**Boat Construction/Finalization**
7	**Boat Testing/Analysis**
8	**Analysis/Material Review**
9	**Posttest**

Buoyancy Resource

Name________________

During this project, you will learn about buoyancy and how it relates to things in real life. Buoyancy is the force that keeps boats afloat. You will be able to determine if an object will float or sink and possibly how to improve upon boat designs. You will use one of two basic boat designs in this project: a basic tanker, and a catamaran. The boats will be constructed from one of three materials: cardboard, manila folders, and tin foil. You will construct your boat, measure and test them for the maximum amount of weight they can hold, and then compare the outcome of each test. Since each boat will have a different design or material, each outcome should differ to some extent.

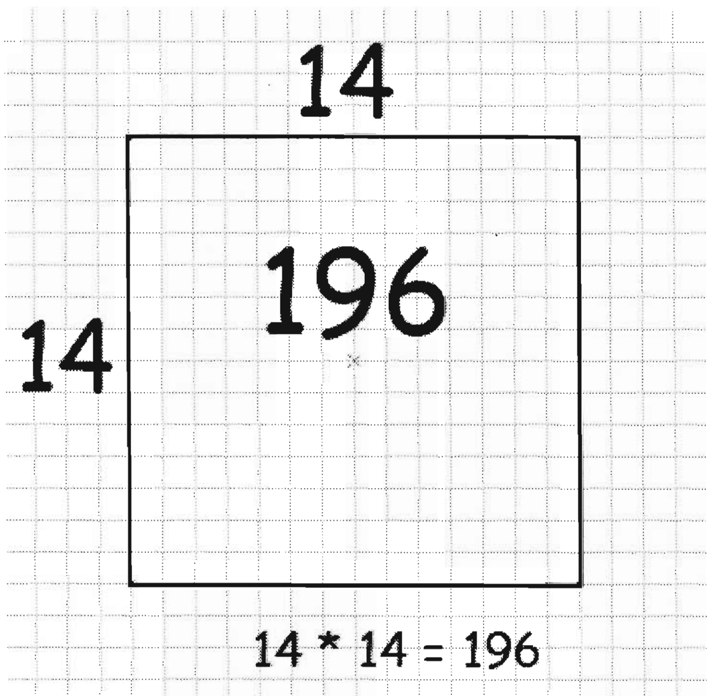
Area

Before we get to the construction of the boats, we must first learn about how they work. In order to understand how they work, there are some mathematic formulas used in buoyancy. **Area** is defined as "the total enclosed area, expressed in units squared." Different shapes have different formulas.

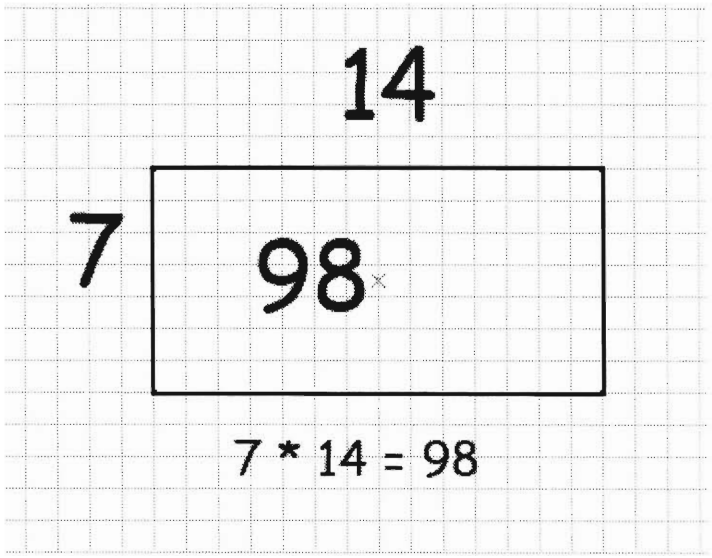
Squares or Rectangles:	length * width
Triangles:	½ * height * base
Trapezoids:	(Base1 + Base 2) / 2 * height

EXAMPLES:

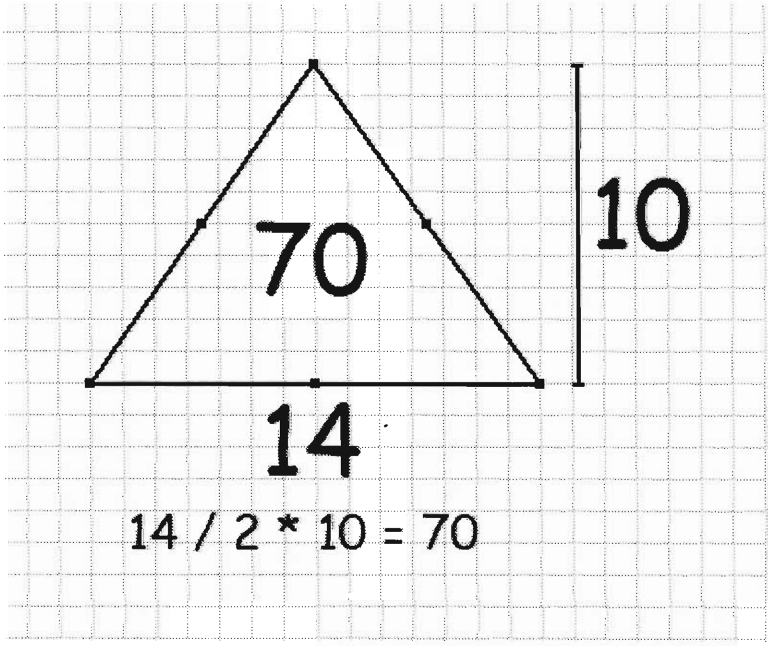
For a square with sides of length 14, you multiply 14 by 4:



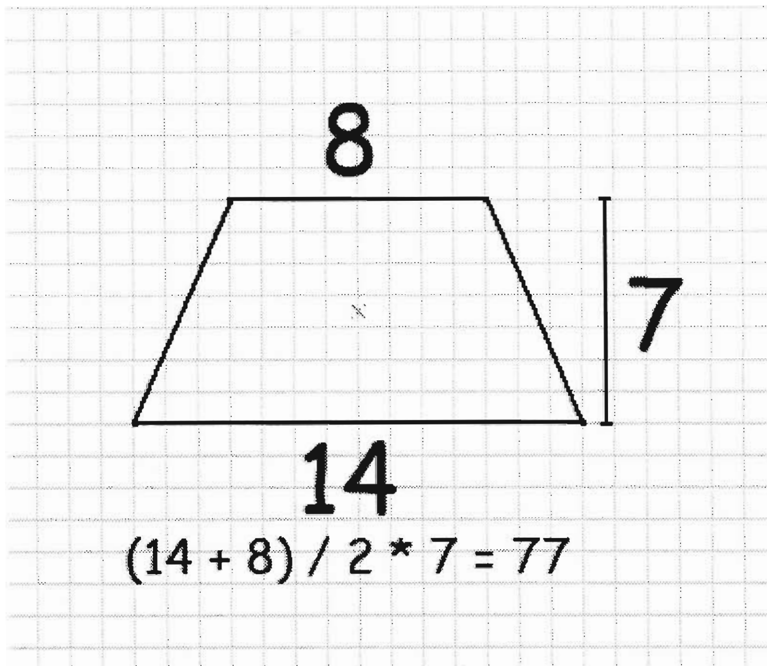
For a rectangle with sides of length 14 and 7 you multiply 14 by 7:



For a triangle with height of 10 and base of 14, you multiply half of 14 by 10:



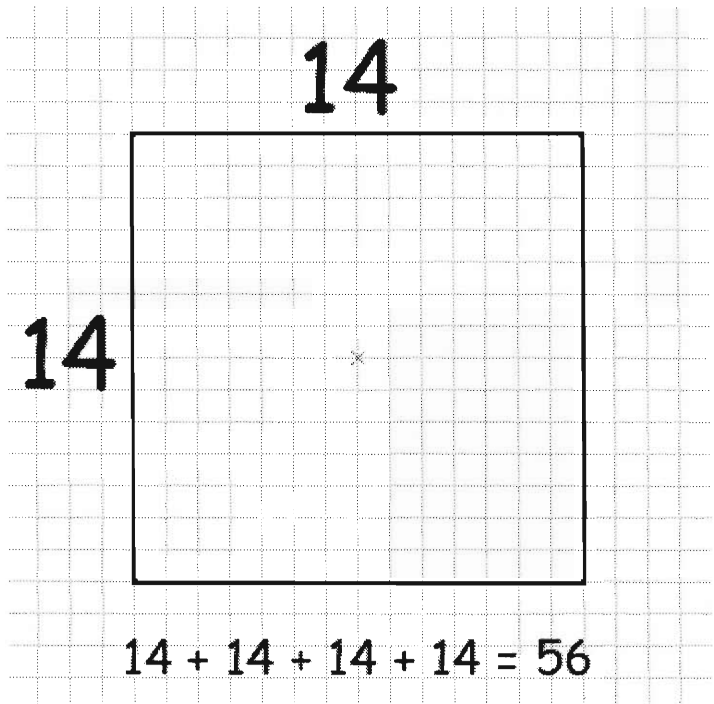
For a trapezoid with height 7 and bases of 8 and 14, you add the bases together, divide by 2, and multiply by 7:



Perimeter

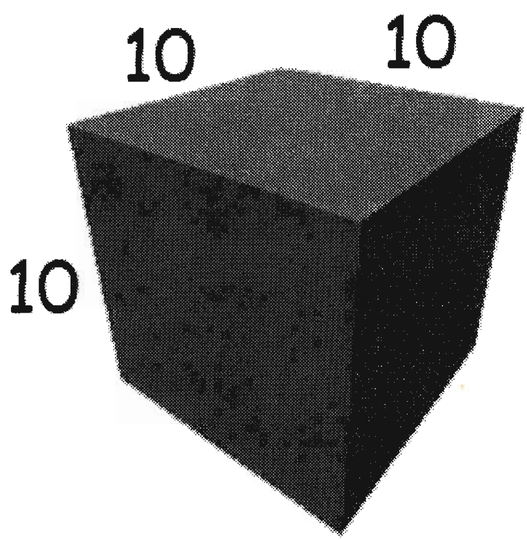
Another formula is the **Perimeter** of an object. Perimeter is defined as "the distance around the outside of a 2 dimensional object, expressed in units." When we refer to the perimeter of a circle, we call it the **Circumference**. To find the perimeter of an object, add up the lengths of the sides of the object.

EXAMPLES:



Now we move on to the three-dimensional objects and formulas. The **Surface Area** is defined as “the sum of the areas of the sides of a three-dimensional object, expressed in units squared.” To find the surface area of an object, first calculate the area of each side, and then add them all together.

EXAMPLES:



10 * 10 = 100

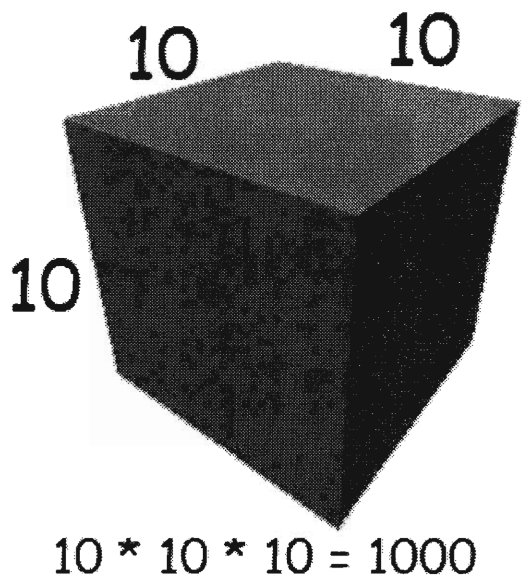
100 * 6 sides = 600

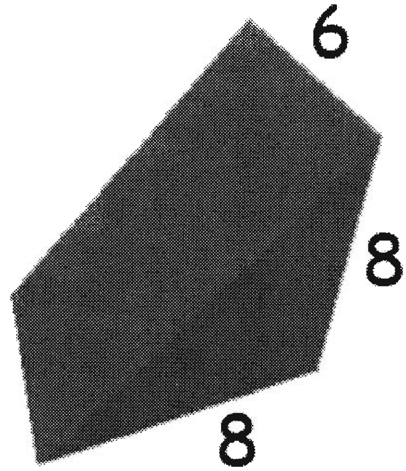
Volume

Volume is the most important formula when it comes to buoyancy. It is defined as "the total space contained within a three-dimensional object, expressed in cubic units."

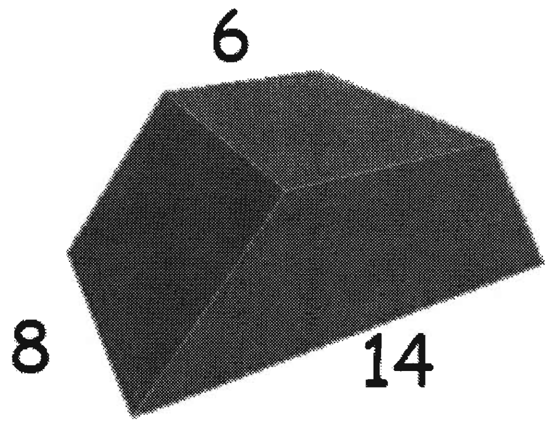
Square or Rectangle:	length * width * height
Triangular prism:	½ * height * base*length
Trapezoidal prism:	(Base1 + Base 2) / 2 * height * length

EXAMPLES:





(8 / 2) * 8 *6 = 192

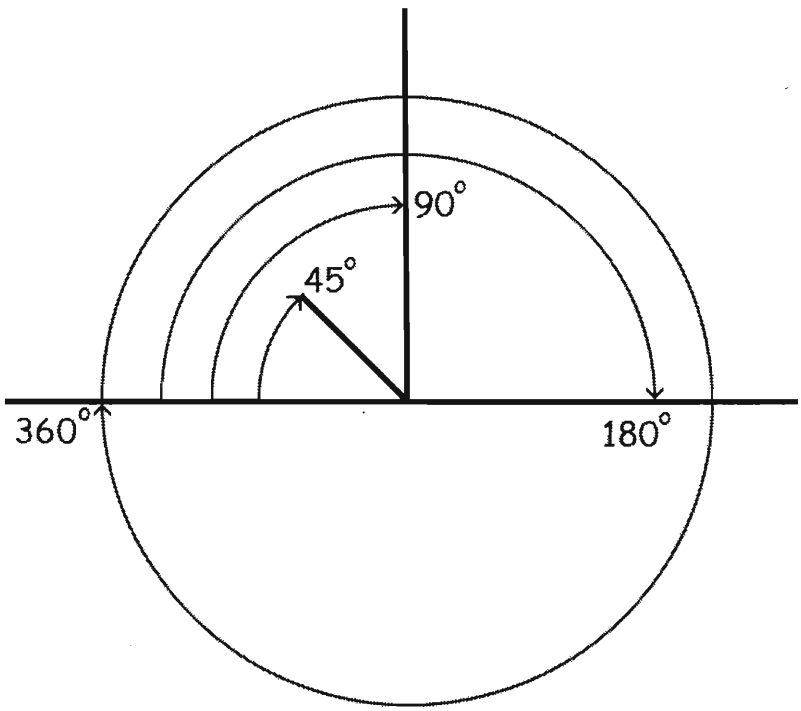


Height = 5

(14 + 6) / 2 * 5 * 8 = 400

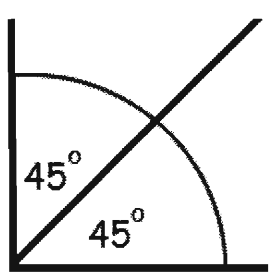
Angles

This picture shows 4 commonly seen angles. Angles are denoted by the " ° " symbol. 90 degree angles are also called **right** angles.

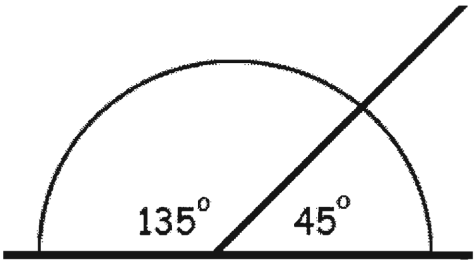


Angles Less than 90° are called **Acute** angles. Angles between 90° and 180° are called **Obtuse** angles.

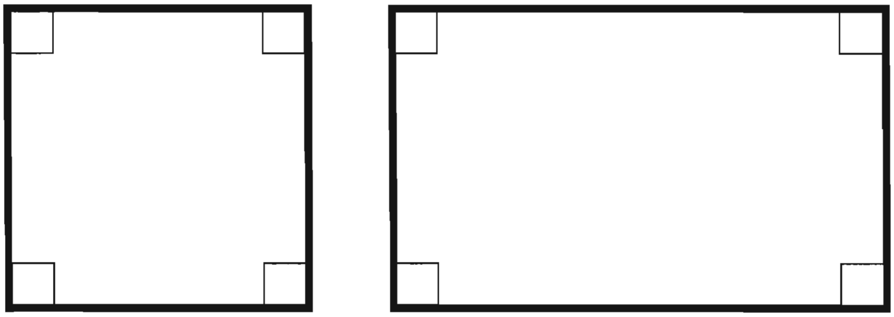
When the sum of two angles is equal to 90 degrees, they are called **Complimentary** angles. The following picture shows an example. This information can be used to determine an angle, if one is unknown.



When the sum of two angles is equal to 180 degrees, they are called **Supplementary** angles. The following picture shows an example. This information can be used to determine an angle, if one is unknown.

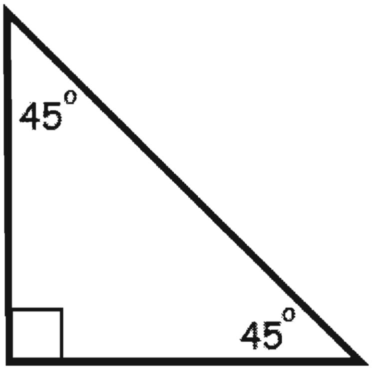


Squares and rectangles have 4 right angles, denoted by the L shapes in the corners. The sum of the angles of any square of rectangle is equal to 360 degrees.



90 + 90 + 90 + 90 = 360

Triangles have 3 angles, which total 180 degrees each. The sum of the angles of any triangle will equal 180 degrees.



45 + 45 + 90 = 180

Application / Project Analysis

Now, using these formulas, we can determine if an object will float or sink. Buoyancy is defined as "the upward pressure exerted upon a floating body by a fluid, which is equal to the weight of the body; hence, also, the weight of a floating body, as measured by the volume of fluid displaced." Basically, if a boat weighs less than the amount of water that would fit inside of it, it will float.

For example, a new tanker weighs 100 kilograms and has a volume of 5 m^3 (cubic meters). The density of pure water is 1000 kg/m^3. If you multiply the density of water by the volume of the boat, you get the amount of water the boat can carry (Total Maximum Weight). Also, the boat weighs 100 kilograms, so we subtract that from the Total Maximum Weight. This will give us how much the boat can carry (Maximum Weight Capacity):

Boat = 100 kg
Volume = 5 m^3
Density = 1000 kg/m^3

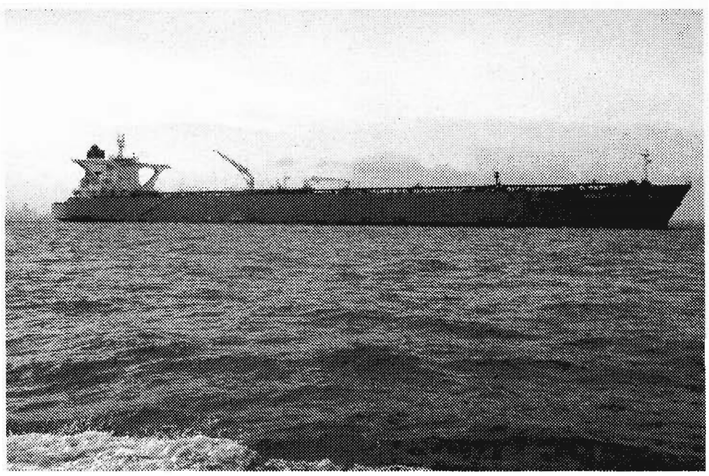
Volume * Density = Total Maximum Weight
Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

$5\ m^3 * 1000\ kg/m^3 = 5{,}000\ kg$
$5{,}000\ kg - 100\ kg = 4{,}900\ kg$

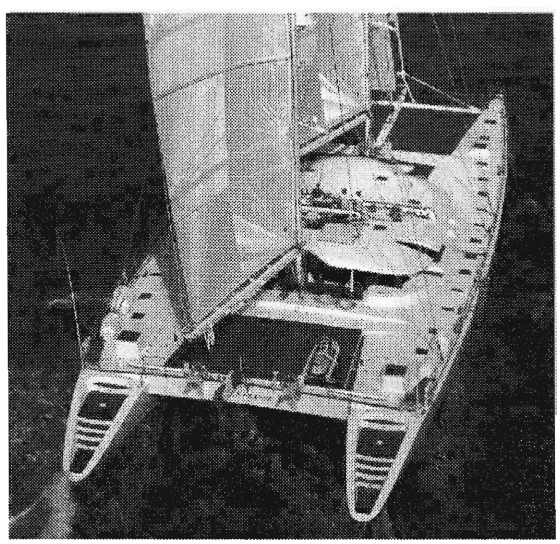
This means that the boat can hold a maximum of 4,900 kilograms. If more than 4,900 kg is put into the boat, it will sink.

Boat Designs

The tanker design is similar to an open-box, but has some slight differences. It is made from one solid piece of material, making the seams strong. The simplicity makes construction easy and straightforward. It provides the largest possible cargo space.


[1]

The Catamaran design is essentially two tankers on the bottom, with a platform on the top holding the boat together. The wide catamaran design provides more stability in rough waters. The one in the picture is slightly different, with a sail attached to the top


[2]

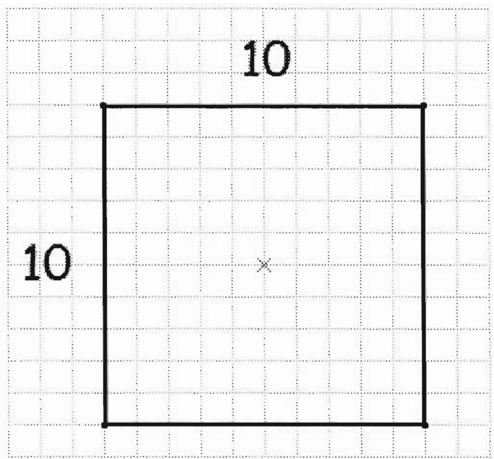
[1] http://www.worldvoyaging.com/photo_gallery/singapore_gallery/

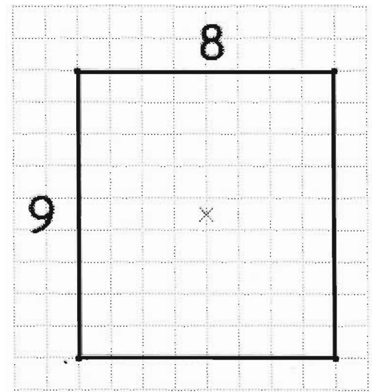
[2] http://www.yachtcharterclub.com/douce-francdk1.htm

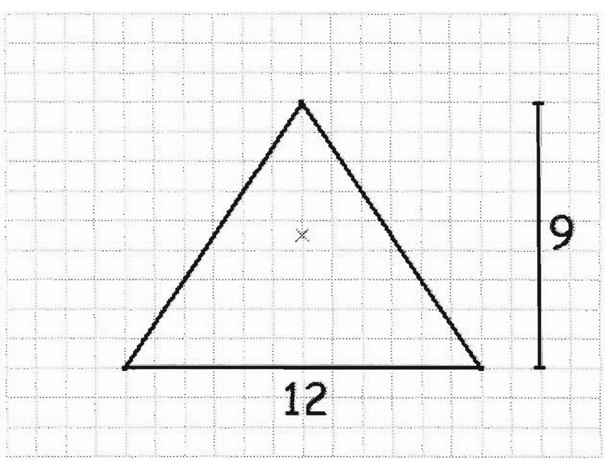
Area Worksheet

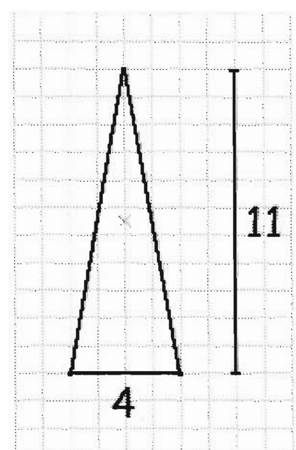
Name________________

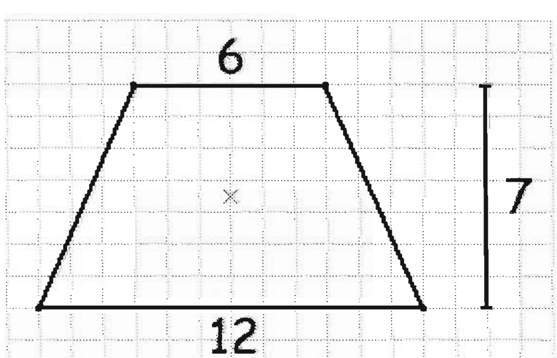
Compute the area of the following shapes:

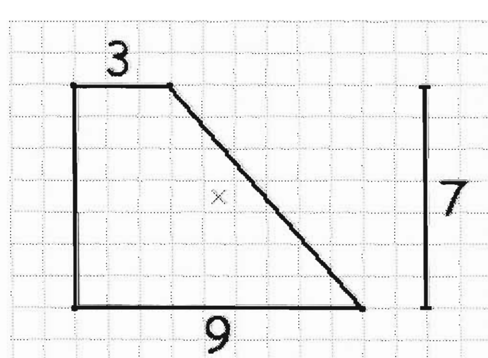








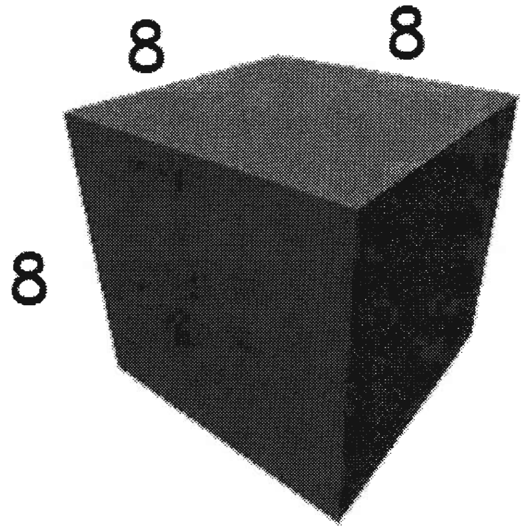




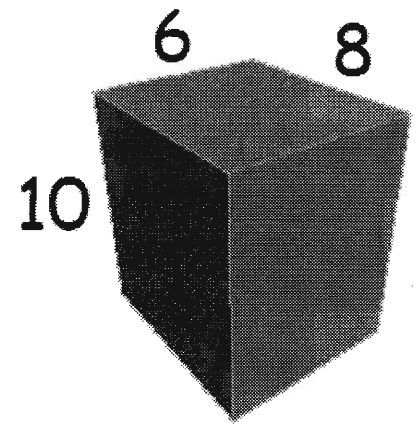
Volume Worksheet

Name________________

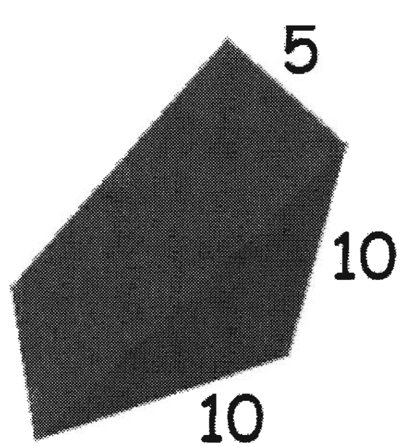
Compute the area of the following shapes:



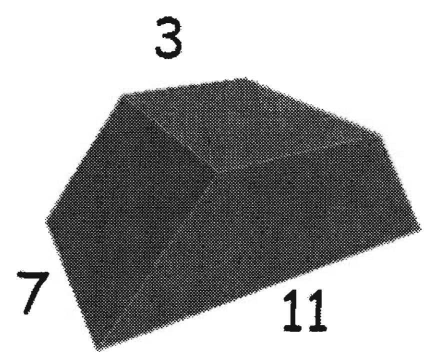
____



____



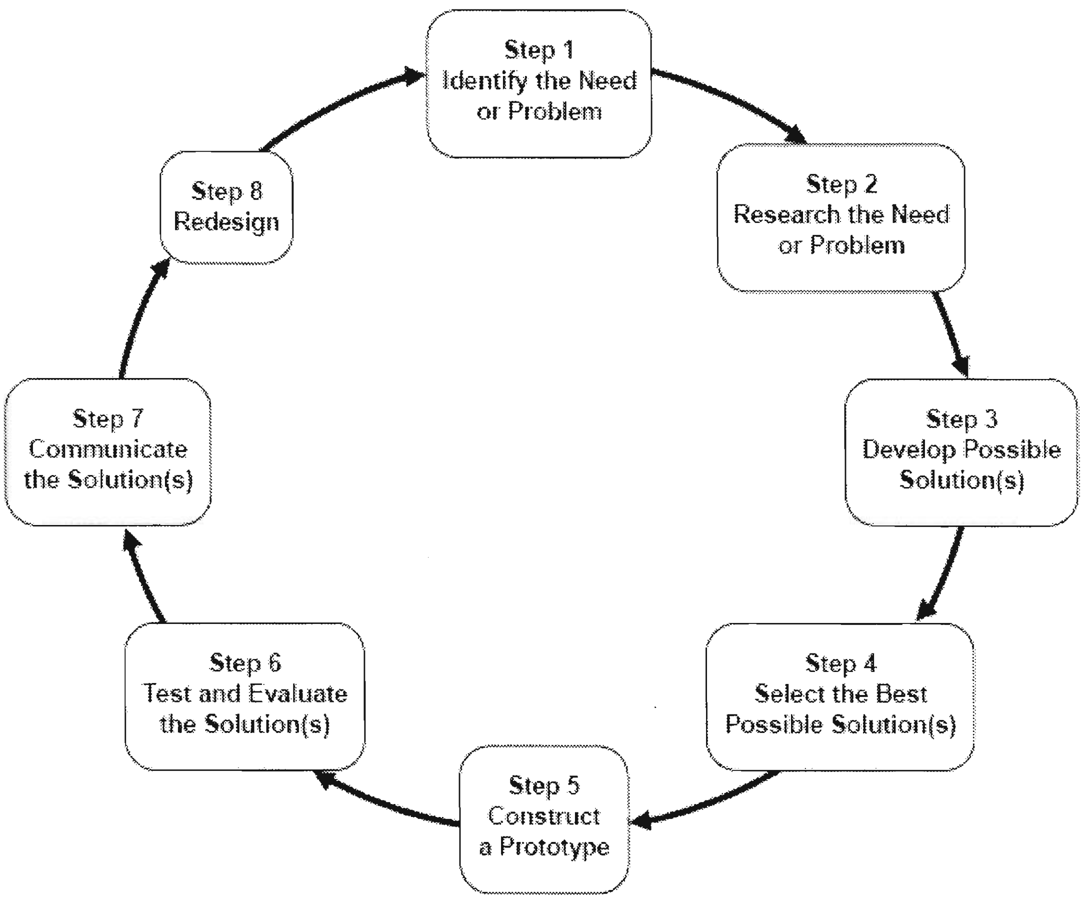
____



Height = 6

____

The Engineering Design Process



According to the Massachusetts Science and Technology/Engineering Curriculum Framework (May 2001), these are the steps to the engineering design process.

1. Identify the need or problem

2. Research the need or problem
- Talk about current state of the issue and current solutions
- Look up other options via the internet, library, interviews, etc.

3. Develop possible solution(s)
- Brainstorm possible solutions
- Draw out the possible solutions in two and three dimensions
- Refine the possible solutions

4. Select the best possible solution(s)
- Determine which solution(s) best meet(s) the original requirements

5. Construct a prototype

- Model the chosen solution(s) in two and three dimensions

6. Test and evaluate the solution(s)
- Does it work?
- Does it meet the original design constraints?

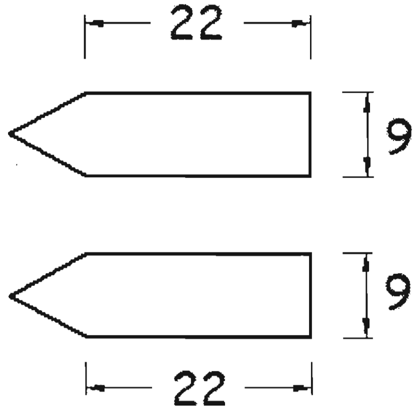
7. Communicate the solution(s)
- Make a presentation that includes a discussion of how the solution(s) best meet(s) the needs of the initial problem, opportunity, or need

8. Redesign
- Overhaul the solution(s) based on information gathered during the tests and presentation

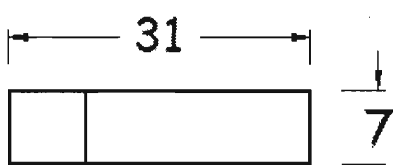
Boat Construction (Catamaran)

1. Measure out a 23cm x 44cm piece of your group's assigned material
2. Measure and mark out each flap (left, right, back, top left, and top right) onto your piece of material following the scale and construction layout shown within the design schematic for your group's design. ***NOTE*** All flaps are rectangles
3. Now that everything is measured out and marked, cut out the measured piece of material along the outer measured edge to match your boat to the unfolded view of the design
4. Make a slight crease along the inner surface of each seam of each wall of the boat to allow for easier folding. DO NOT CUT COMPLETELY THROUGH THE MATERIAL.
5. Fold the walls into place to crease the seam
6. Fold up and secure the walls at a 90 degree angle from the boat bottom using tape
7. Repeat steps 1-6 again to create the second hull portion of the catamaran
8. Now with the bottom hull sections completed, you will create the Catamaran Cover. Measure out a 27cm x 31cm piece of your group's assigned material
9. Measure and mark out the Catamaran Cover onto this piece of material according to the scale and construction layout shown within the design schematic
10. Cut out the shape of the Catamaran Cover. This cover should fit over both of the bottom sections that you just built, at the same time
11. Tape the cover in place covering both bottom sections

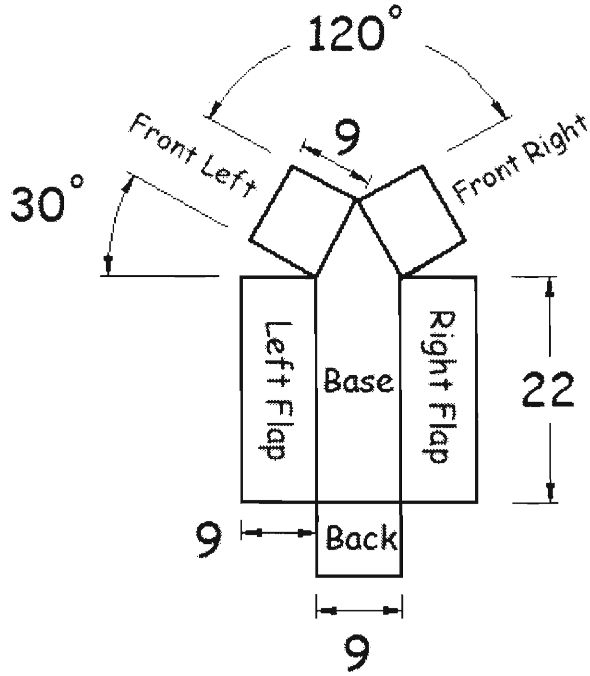
Notes: All lengths are in centimeters and all angles are in degrees.



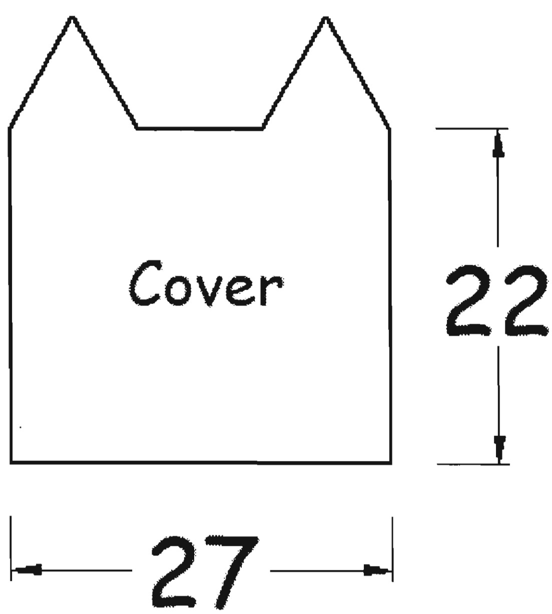
Top View



Front View



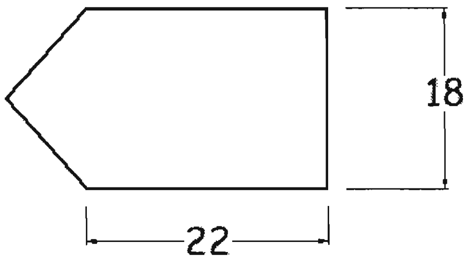
Construction Layout



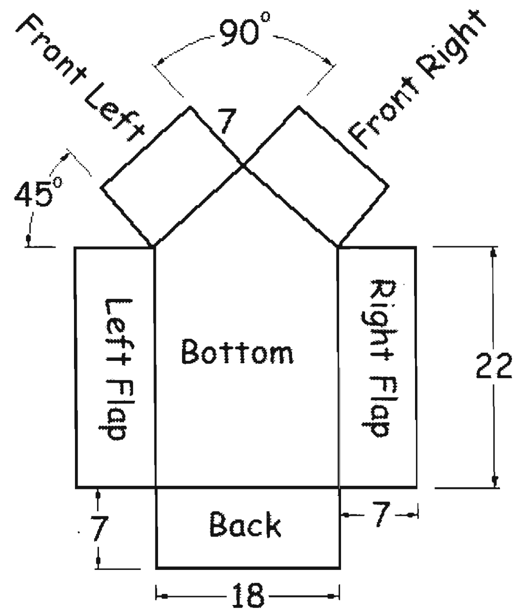
Boat Construction (Regular)

1. Measure and cut out a 32cm x 44cm piece of your group's assigned material
2. Measure and mark out each flap (left, right, back, top left, and top right) onto your piece of material following the scale and construction layout shown within the design schematic for your group's design. ***NOTE*** All flaps are rectangles
3. Now that everything is measured out and marked, cut out the measured piece of material along the outer measured edge to match your boat to the unfolded view of the design
4. Make a slight crease along the inner surface of each seam of each wall of the boat to allow for easier folding. DO NOT CUT COMPLETELY THROUGH THE MATERIAL.
5. Fold the walls into place to crease the seam
6. Fold up and secure the walls at a 90 degree angle from the boat bottom using tape
7. Now with the bottom hull sections completed, you will create the Boat Cover. Measure out a 18cm x 31cm piece of your group's assigned material
8. Measure and mark out the Boat Cover onto this piece of material according to the scale and construction layout shown within the design schematic
9. Cut out the shape of the Boat Cover. This cover should fit over the bottom section that you just built
10. Tape the cover in place covering the bottom section

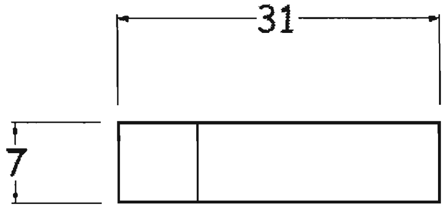
Notes: All lengths are in centimeters and all angles are in degrees.



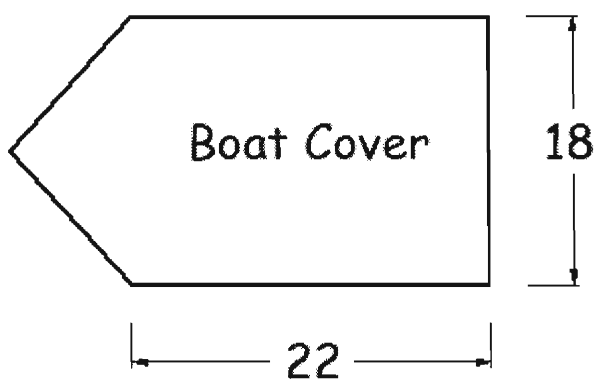
Top View



Construction Layout



Front View



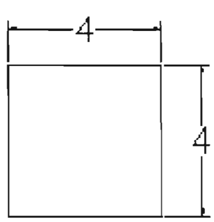
Pre-Test for Boat Buoyancy Lesson Plan

Matching

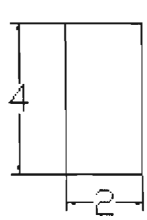
1. ___ Perimeter 2. ___ Area 3. ___ Volume 4. ___ Mass 5. ___ Density 6. ___ Surface Area 7. ___ Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

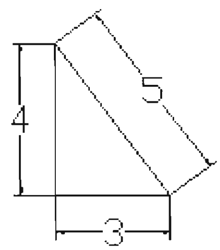
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



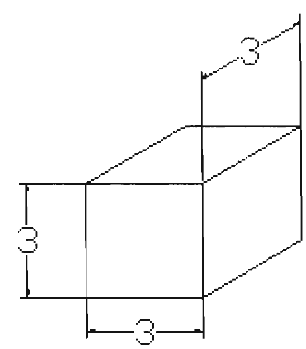
   b. A simple 2x4 rectangle



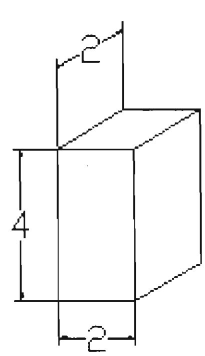
c. A simple 3x4x5 triangle



2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



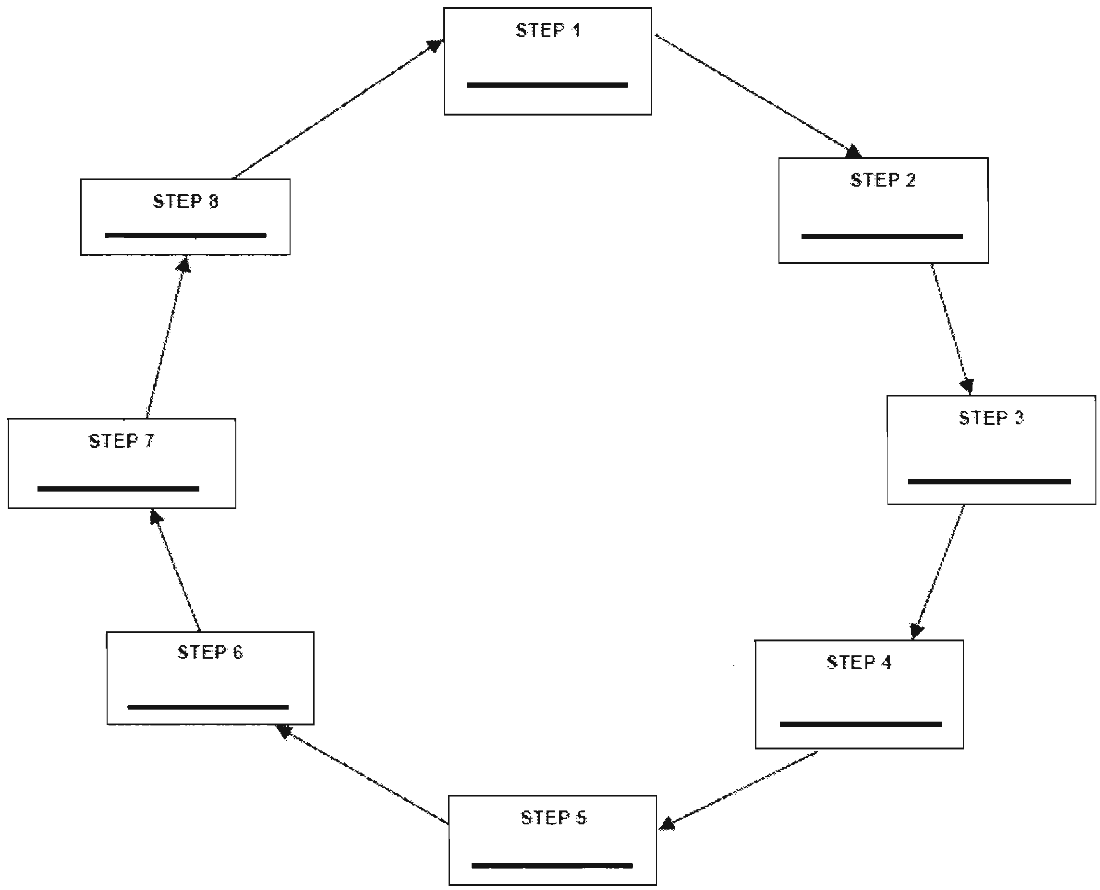
   b. A simple 2x4x2 cuboid



Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Pre-Test for Boat Buoyancy Lesson Plan

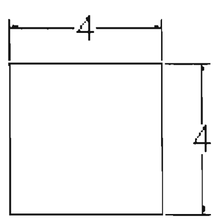
Matching

1. ___ Perimeter
2. ___ Area
3. ___ Volume
4. ___ Mass
5. ___ Density
6. ___ Surface Area
7. ___ Buoyancy

a. The amount of space occupied by a three-dimensional object or region of space
b. The mass per unit volume of a substance at a specified pressure and temperature
c. The upward pressure exerted upon a floating body by a fluid
d. The outer limits of an area
e. The sum of the areas of the sides of a three-dimensional object
f. The measure of the quantity of matter that a body or an object contains
g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

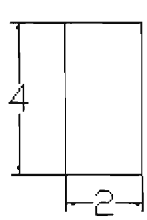
1. Find the **perimeter <u>and</u> area** for each of these simple shapes
   a. A simple 4x4 square



<u>Perimeter</u> : ____________________

<u>Area</u> : ____________________

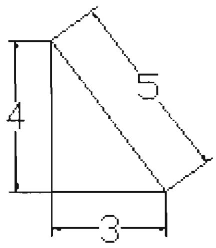
   b. A simple 2x4 rectangle



Perimeter : ________________________

Area : ________________________

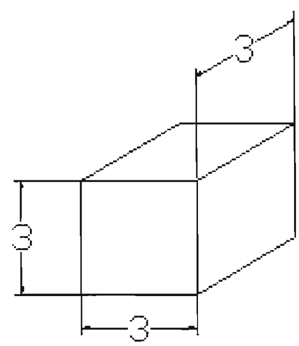
c. A simple 3x4x5 triangle



Perimeter : ______________________

Area : ______________________

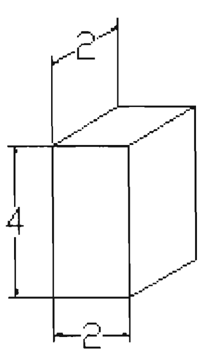
2. Find the **volume <u>and</u> surface area** of these simple shapes
   a. A simple 3x3x3 cube



Volume : ______________________

Surface Area : ______________________

b. A simple 2x4x2 cuboid



Volume : ______________________

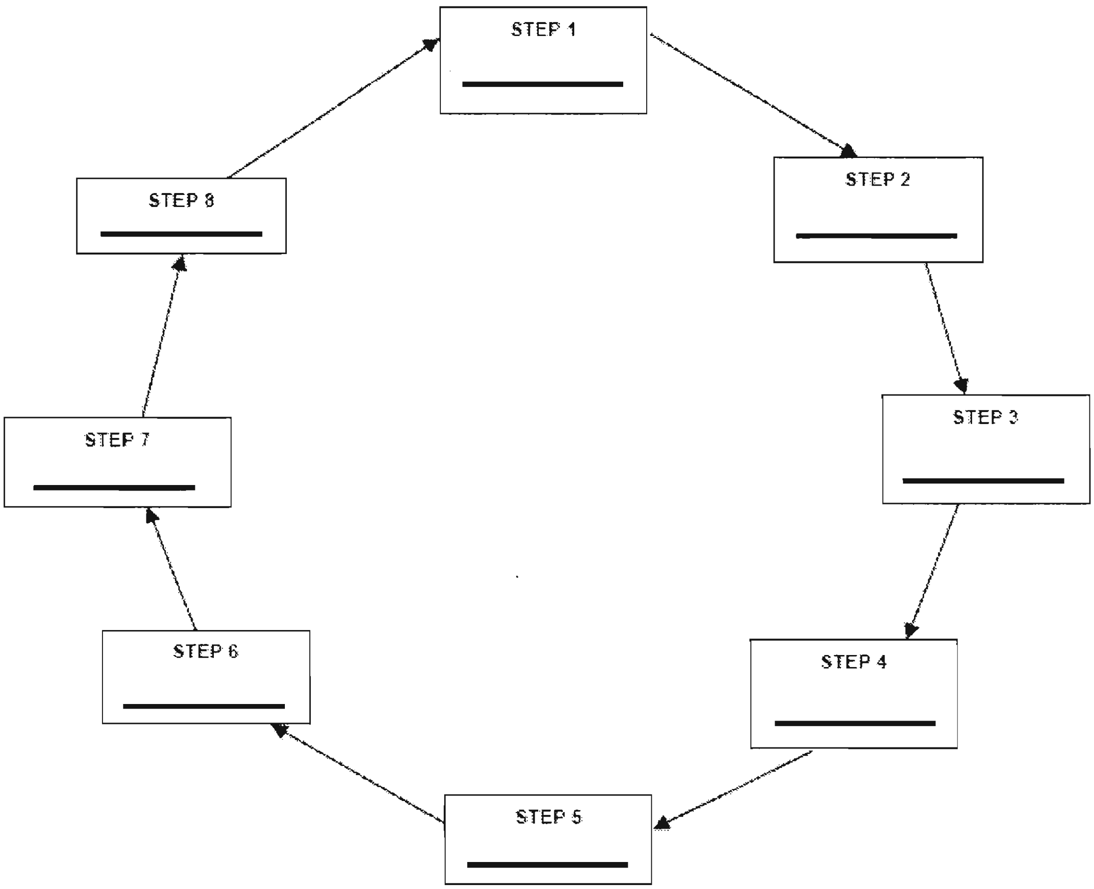
Surface Area : ______________________

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs.

Additional points given for –
Material strengths and weaknesses
General boat and buoyancy knowledge

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Post-Test for Boat Buoyancy Lesson Plan

Matching

1. ___ Perimeter 2. ___ Area 3. ___ Volume 4. ___ Mass 5. ___ Density 6. ___ Surface Area 7. ___ Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

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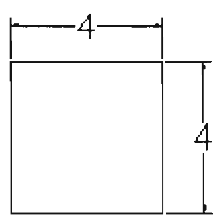
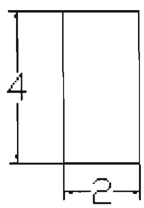
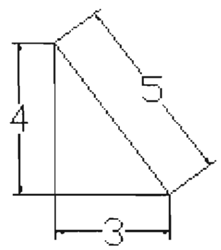


   b. A simple 2x4 rectangle



c. A simple 3x4x5 triangle



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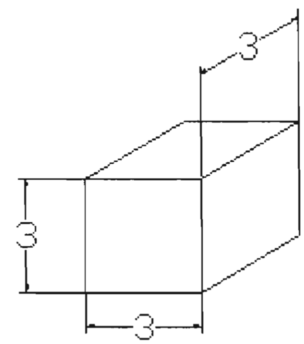
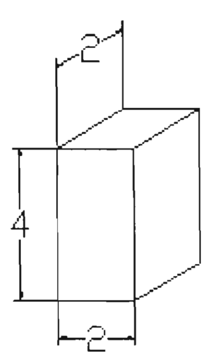


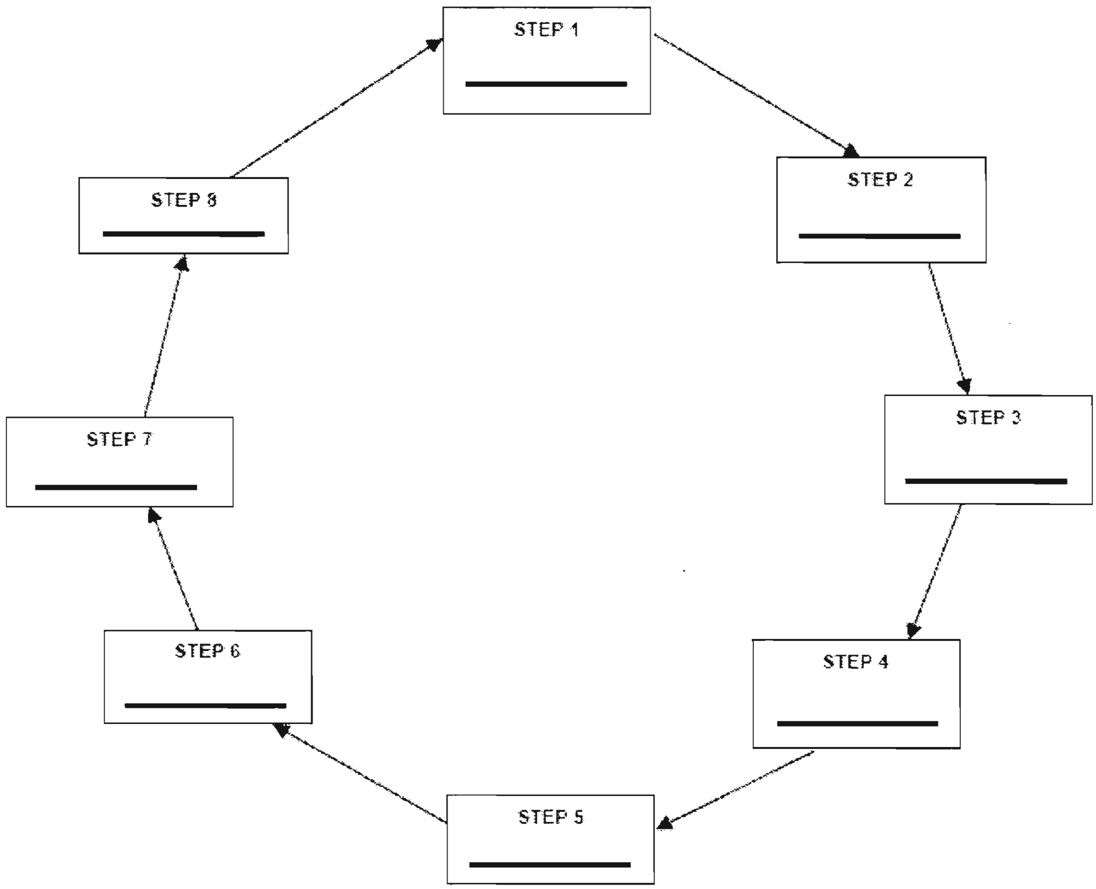
   b. A simple 2x4x2 cuboid



Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Please identify each step within the engineering design process-



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B. Research the problem
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E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Post-Test for Boat Buoyancy Lesson Plan

Matching

1. ___ Perimeter 2. ___ Area 3. ___ Volume 4. ___ Mass 5. ___ Density 6. ___ Surface Area 7. ___ Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

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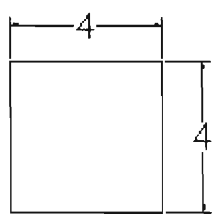
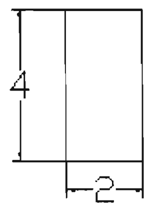


<u>Perimeter</u> : ____________________

<u>Area</u> : ____________________

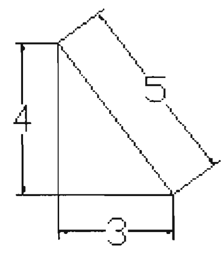
   b. A simple 2x4 rectangle



Perimeter : ____________________

Area : ____________________

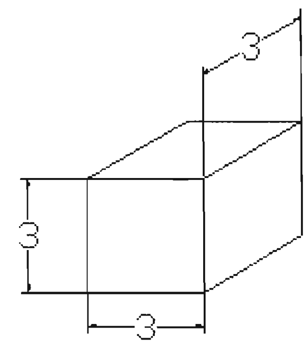
c. A simple 3x4x5 triangle



Perimeter : ____________________

Area : ____________________

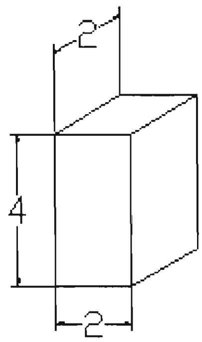
2. Find the **volume <u>and</u> surface area** of these simple shapes
   a. A simple 3x3x3 cube



Volume : ____________________

Surface Area : ____________________

b. A simple 2x4x2 cuboid



Volume : ____________________

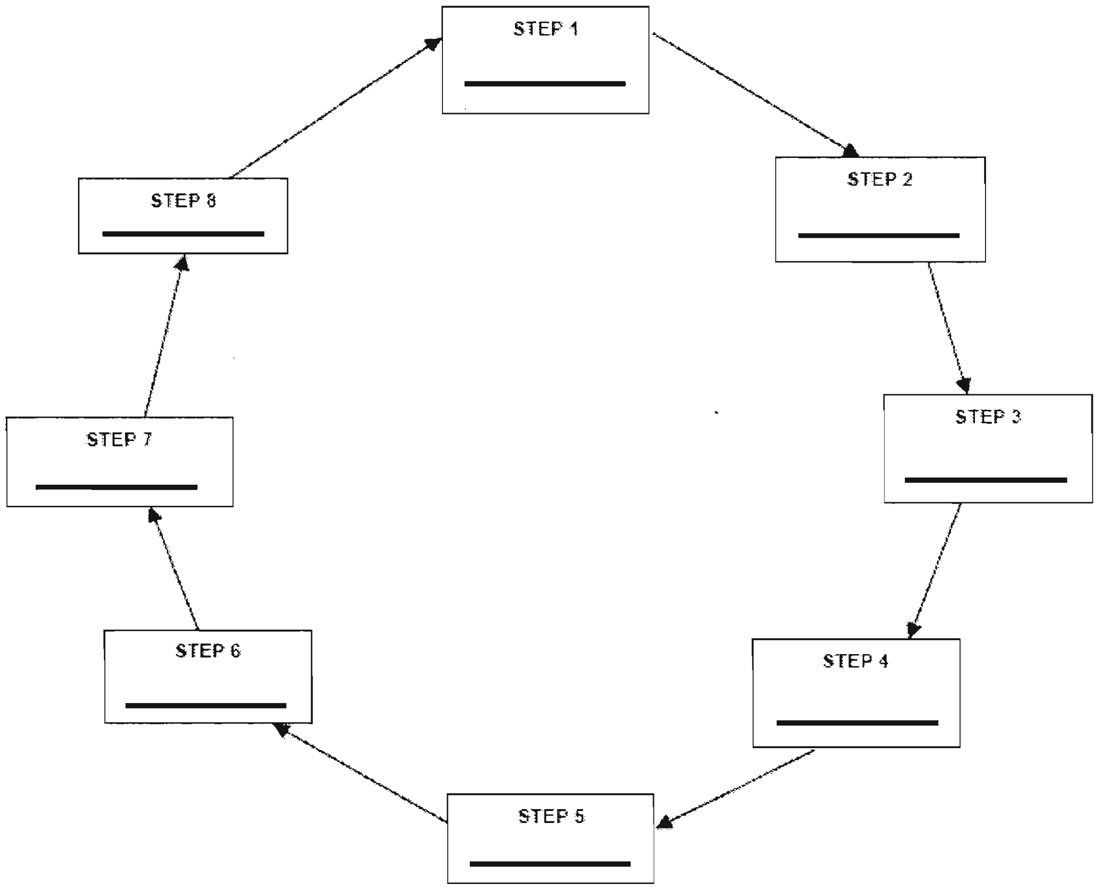
Surface Area : ____________________

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs.

Additional points given for –
Material strengths and weaknesses
General boat and buoyancy knowledge

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
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D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

	Correct Answers	3523		50323		30215	
MATCHING		**1**	**2**	**1**	**2**	**1**	**2**
1	**D**	E	C	D	D	D	D
2	**G**	B	A	G	G	F	E
3	**A**	A	F	A	A	A	A
4	**F**	F	D	F	F	G	F
5	**B**	D	G	B	B	B	B
6	**E**	G	E	E	E	E	G
7	**C**	C	B	C	C	C	C
Mathematics							
1a	**16**	X	X	16	16	16	16
AREA	**16**	256	30	16	16	4	16
1b	**12**	X	X	12	12	12	12
AREA	**8**	64	30	8	8	8	8
1c	**12**	X	X	12	12	X	12
AREA	**6**	X	60	6	6	60	60
2a	**54**	X	X	54	54	X	9
VOLUME	**27**	X	37	27	27	27	27
2b	**40**	X	X	40	40	X	8
VOLUME	**16**	X	24	16	16	16	16
Steps							
1	E	A	A	E	E	A	E
2	**B**	B	E	B	B	B	B
3	**H**	C	B	H	H	C	F
4	**F**	D	F	F	F	D	G
5	**A**	E	G	G	A	E	H
6	**D**	F	D	A	D	F	C
7	**G**	G	C	D	G	G	A
8	**C**	H	H	C	C	H	D
Free Response	out of 10	4	4	1	10	1	8
Project Analysis							
Subtotals	7	3	1	7	7	5	5
	10	0	0	10	10	5	7
	8	1	2	5	8	2	2
	10	4	4	1	10	1	8
Total	out of 35	**8**	**7**	**23**	**35**	**13**	**22**

20375		30313		30263		20468		20380		20092
1	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**
D	G	D	D	D	D	D	D	D	D	E
A	E	G	E	F	G	G	A	A	E	D
E	D	A	A	A	F	B	E	E	B	A
B	F	F	F	G	A	A	F	B	F	B
F	B	B	B	B	B	F	B	F	G	F
G	A	E	G	E	E	C	G	G	A	G
C	C	C	C	C	C	C	C	C	C	C
16	16	16	16	16	16	X	256	16	X	X
X	256	16	16	16	16	16	16	X	16	16
12	12	12	12	12	12	X	64	12	X	X
X	64	8	8	8	8	8	8	X	8	8
X	12	12	27	X	12	X	X	X	X	7
60	60	12	60	60	60	60	60	60	6	X
X	9	54	54	18	54	X	X	X	X	X
27	27	27	27	27	27	27	27	27	27	27
X	8	30	40	24	40	X	X	X	X	X
16	16	16	16	16	16	16	16	16	16	X
A	E	E	E	E	E	A	E	A	E	E
B	G	B	B	B	B	D	B	B	B	B
D	F	H	H	H	H	E	H	E	H	H
E	H	D	D	F	G	B	G	G	F	F
G	B	F	F	G	F	C	F	H	G	G
F	D	C	A	D	A	G	C	F	C	A
H	C	A	C	A	D	H	A	D	A	D
C	A	G	G	C	C	F	D	C	D	X
1	3	7	7	4	7	1	3	1	2	3
2	3	7	5	5	5	3	4	2	3	2
4	5	8	8	6	9	4	4	4	5	3
1	2	3	3	6	4	0	3	2	4	4
1	3	7	7	4	7	1	3	1	2	3
8	**13**	**25**	**22**	**21**	**25**	**8**	**15**	**9**	**14**	**12**

	50847		30322		50285	
2	**1**	**2**	**1**	**2**	**1**	**2**
G	D	D	D	E	D	D
A	A	A	B	D	G	G
F	E	F	A	A	A	A
B	F	E	F	F	F	F
D	B	B	E	B	B	B
E	G	G	C	G	E	E
C	C	C	G	C	C	C

16	X	256	16	16	16	16
X	16	X	16	16	16	16
X	X	64	12	12	12	12
8	8	X	8	8	8	8
X	X	X	12	12	12	12
X	15	60	60	12	6	6
9	24	81	39	18	54	54
X	9	27	27	27	27	27
X	18	64	32	16	40	40
16	8	16	16	16	16	16

E	E	E	E	E	E	E
D	B	B	B	B	B	B
F	H	H	G	H	H	H
G	F	F	H	F	G	G
H	G	G	F	G	F	F
B	A	A	A	A	A	A
C	D	D	D	D	D	D
A	C	C	C	C	C	C
5	3	8	5	7	6	5

2	4	3	3	4	7	7
3	2	3	7	7	10	10
1	5	5	3	5	4	4
5	3	8	5	7	6	5
11	**14**	**19**	**18**	**23**	**27**	**26**

50847 20092

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 113 ~~kg~~ g.

The Volume of your Boat = ~~2898~~ 1852.5 ~~kg~~ g. g cm³

Density of water = 1 ~~kg/m³~~

Volume * Density = Total Maximum Weight

2,898 m³ * 1 ~~kg/m³~~ g cm³ = ~~2,898~~ 1852.5 ~~kg~~

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

2,846 kg – 113 kg = ~~2,783~~ 1739.5 ~~kg~~ g

Actual Maximum Weight Capacity (how much your boat held before it sank) =

______ kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

______

______

______

______

______

______

#2. 20092

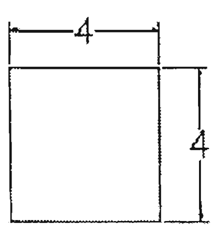
Post [redacted]Test for Boat Buoyancy Lesson Plan

Matching

1. g Perimeter X 2. A Area X 3. E Volume X 4. B Mass X 5. ___ Density X 6. ___ Surface Area 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

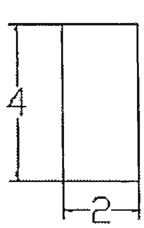
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



16 = P ✓

A = ? X

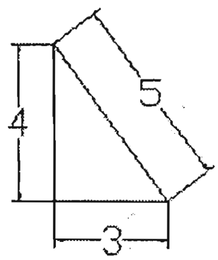
b. A simple 2x4 rectangle



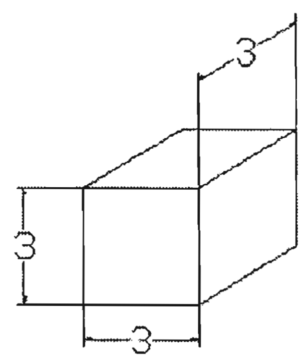
8 = A ✓

P = ? X

c. A simple 3x4x5 triangle

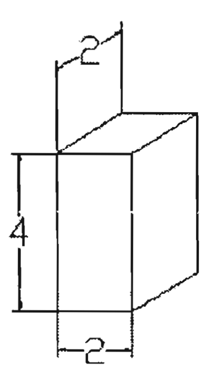


2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



9^3

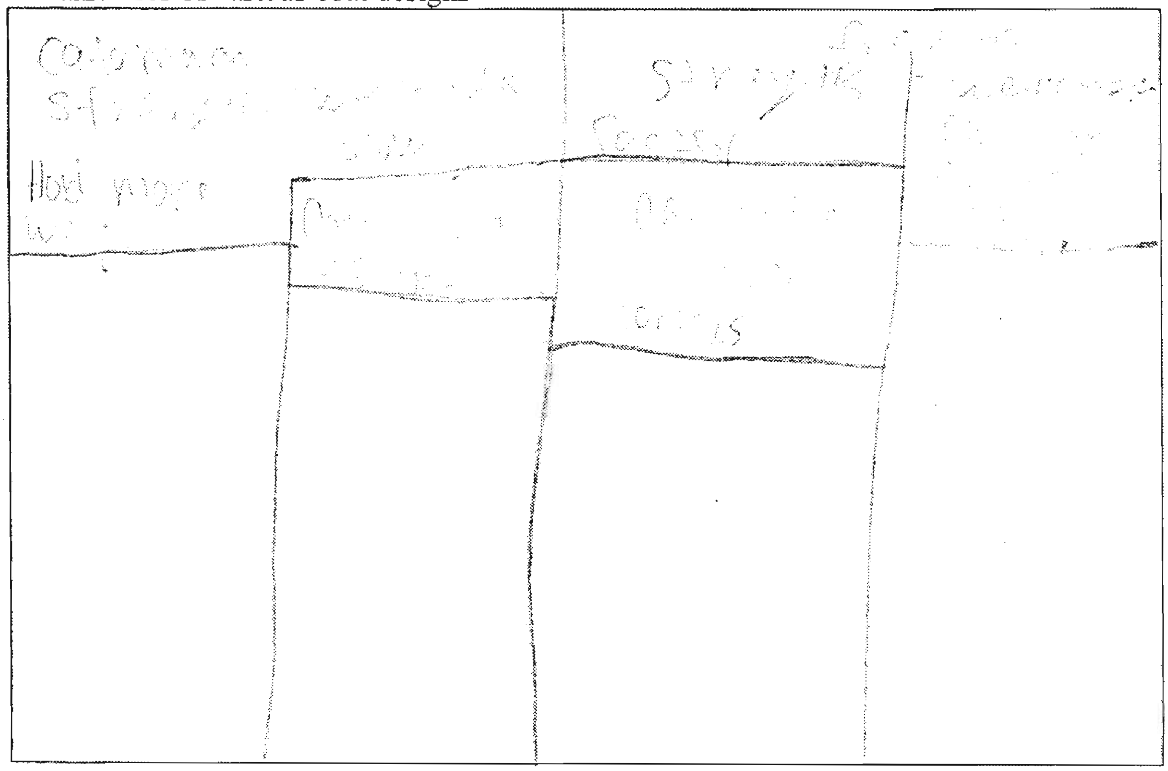
b. A simple 2x4x2 cuboid



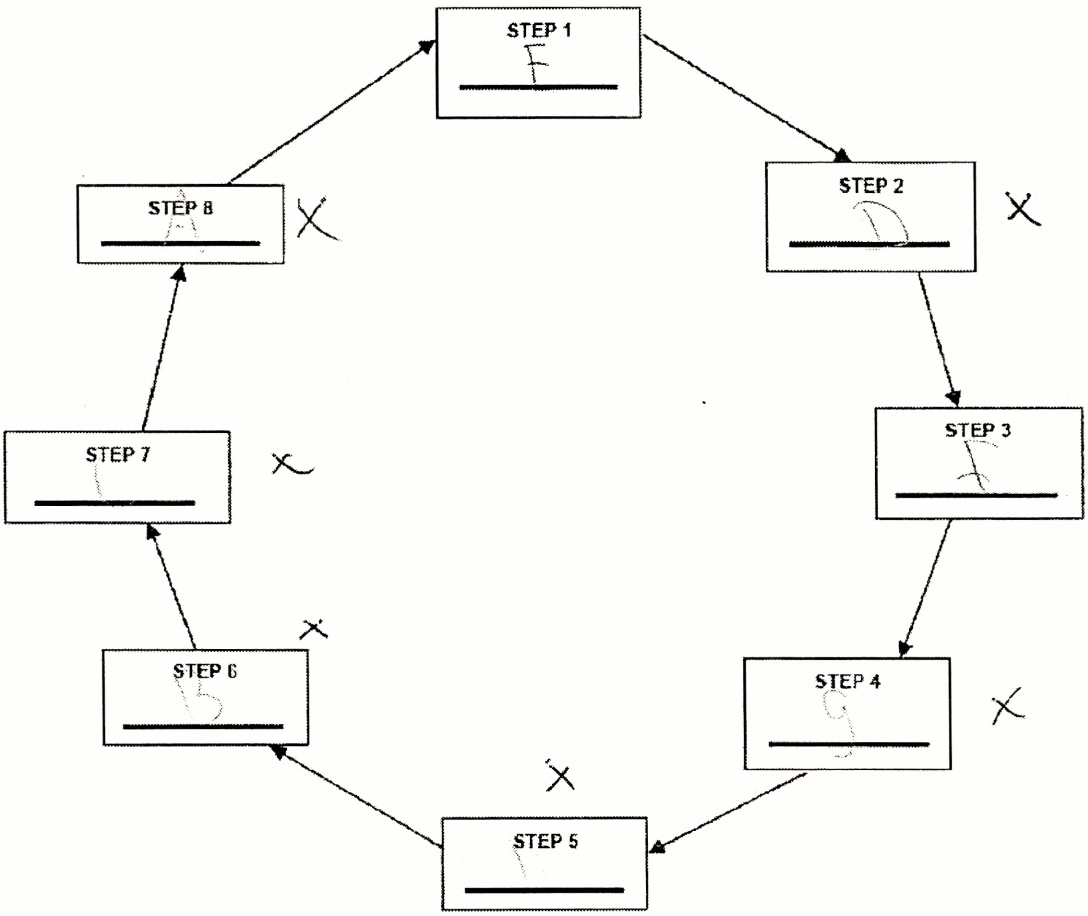
16 =

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-



Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

[redacted]

#2 Post ID# 50847

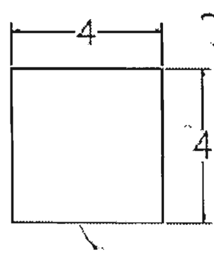
~~Pre~~-Test for Boat Buoyancy Lesson Plan

Matching

1. d Perimeter 2. A Area 3. f Volume × 4. C Mass × 5. b Density 6. a Surface Area 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

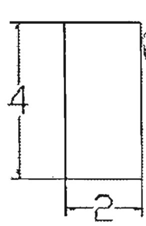
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



P=256 ×

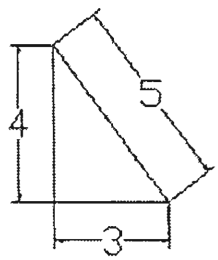
   b. A simple 2x4 rectangle



P=64 ×

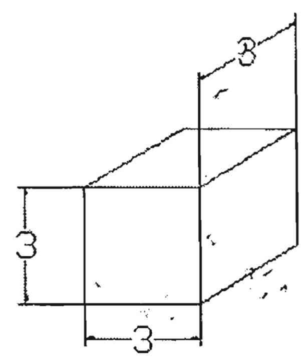
[redacted]

c. A simple 3x4x5 triangle



P=60 ×

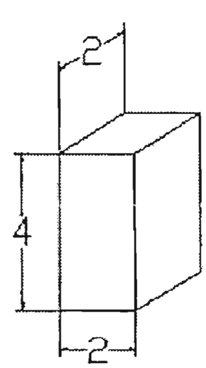
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



V=27 ✓

SA=81 ×

   b. A simple 2x4x2 cuboid



V=16 ✓

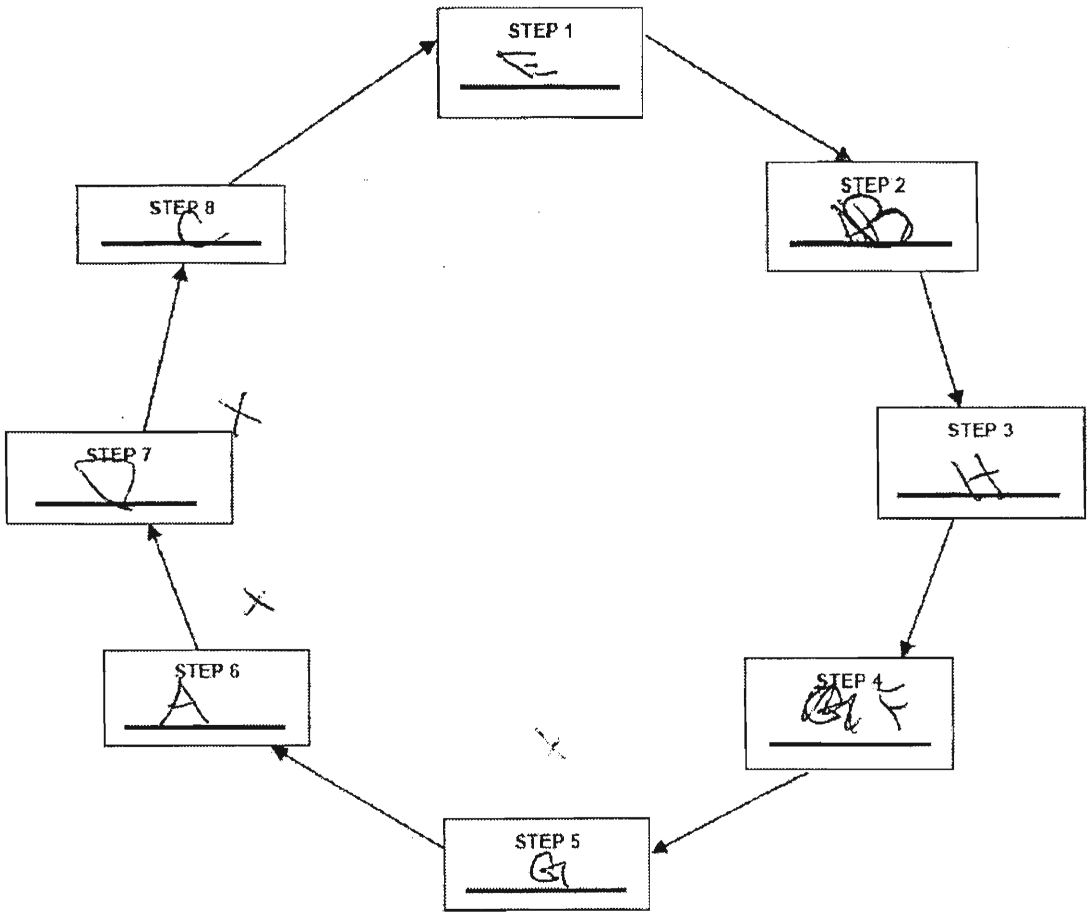
SA=64 ×

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

A regular ~~hulls~~ hull of a boat is better for turning and Speed ~~[illegible]~~ and can hold more weight. A catermeran has two baleced out hulls with a canopy inbetween them. It is a wider turning slower boat that cant hold as much weight.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

50847 20092

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 113 ~~kg~~ g.

The Volume of your Boat = ~~2898~~ 1852.5 ~~kg~~ g. g cm³

Density of water = 1 ~~kg/m³~~

Volume * Density = Total Maximum Weight

2,898 m³ * 1 ~~kg/m³~~ g cm³ = ~~2898~~ 1852.5 ~~kg~~

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

2,846 kg – 113 kg = ~~2,783~~ 1739.5 ~~kg~~ g

Actual Maximum Weight Capacity (how much your boat held before it sank) =

__________ kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

50323

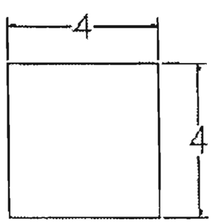
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. G Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. A Volume	c. The upward pressure exerted upon a floating body by a fluid
4. F Mass	d. The outer limits of an area
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. E Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

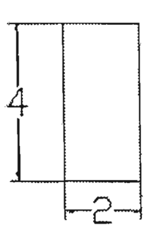
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



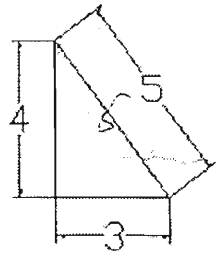
P = 16 units
A = 16 units^2

   b. A simple 2x4 rectangle P = 12 units



A = 8 units^2

c. A simple 3x4x5 triangle



Area = ½ b*h

A=(1/2) 3*4

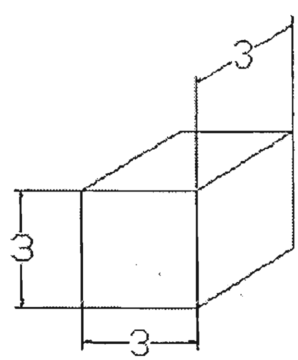
A= 1.5*4

A= 6 units²

P= 12 units

2. Find the volume and surface area of these simple shapes

a. A simple 3x3x3 cube



L*w*h

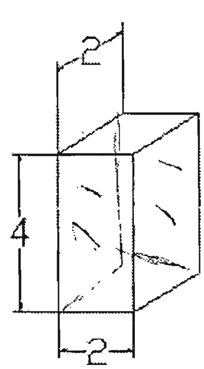
3*3*3 = 3³

Volume= 27 units³

(9)(6) =

SA= 54 units²

b. A simple 2x4x2 cuboid



L*w*h

2*2*4

4*4

Volume = 16 units³

SA= 40 units²

4)x2= 8(4) 32+

(2)(2) = (4)(2)

50323

Engineering/Design

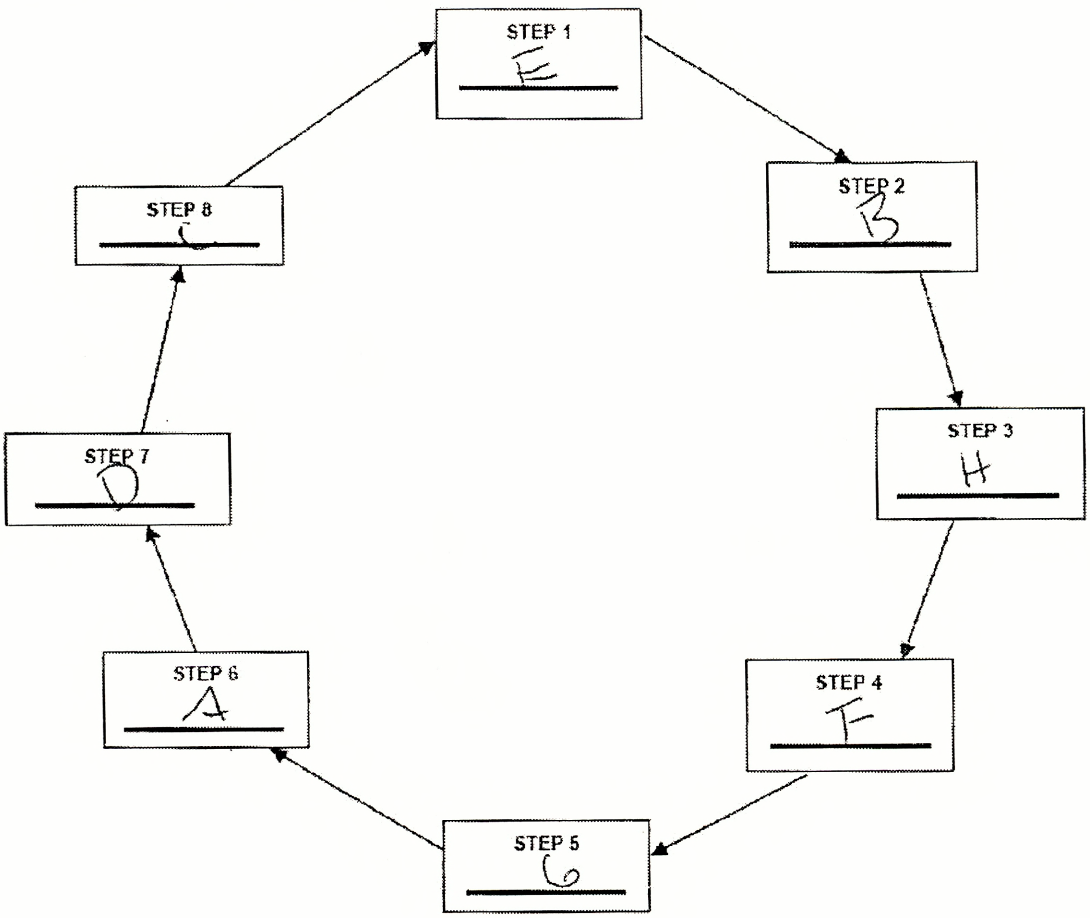
Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

boats with holes sink.

~~[illegible]~~

thy float on water.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

[redacted]

2

#50323

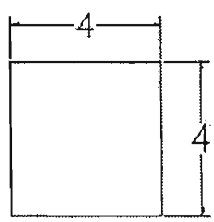
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter 2. G Area 3. A Volume 4. F Mass 5. B Density 6. E Surface Area 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

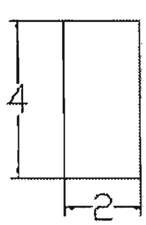
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



per. = 16 units
area = 16 units^2

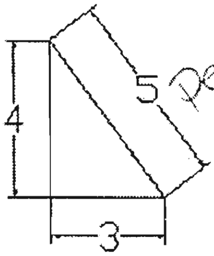
b. A simple 2x4 rectangle



per. = 12 units
area = 8 units^2

c. A simple 3x4x5 triangle

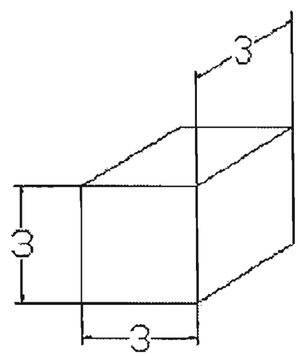
½ b*h



per.=12
12units

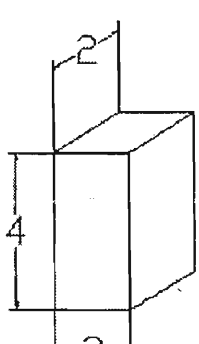
area=6units²

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



Volume= 27 units³
Surface area= 54 units²

   b. A simple 2x4x2 cuboid



Volume=16units³
Surface area= 40units²

4

8+32

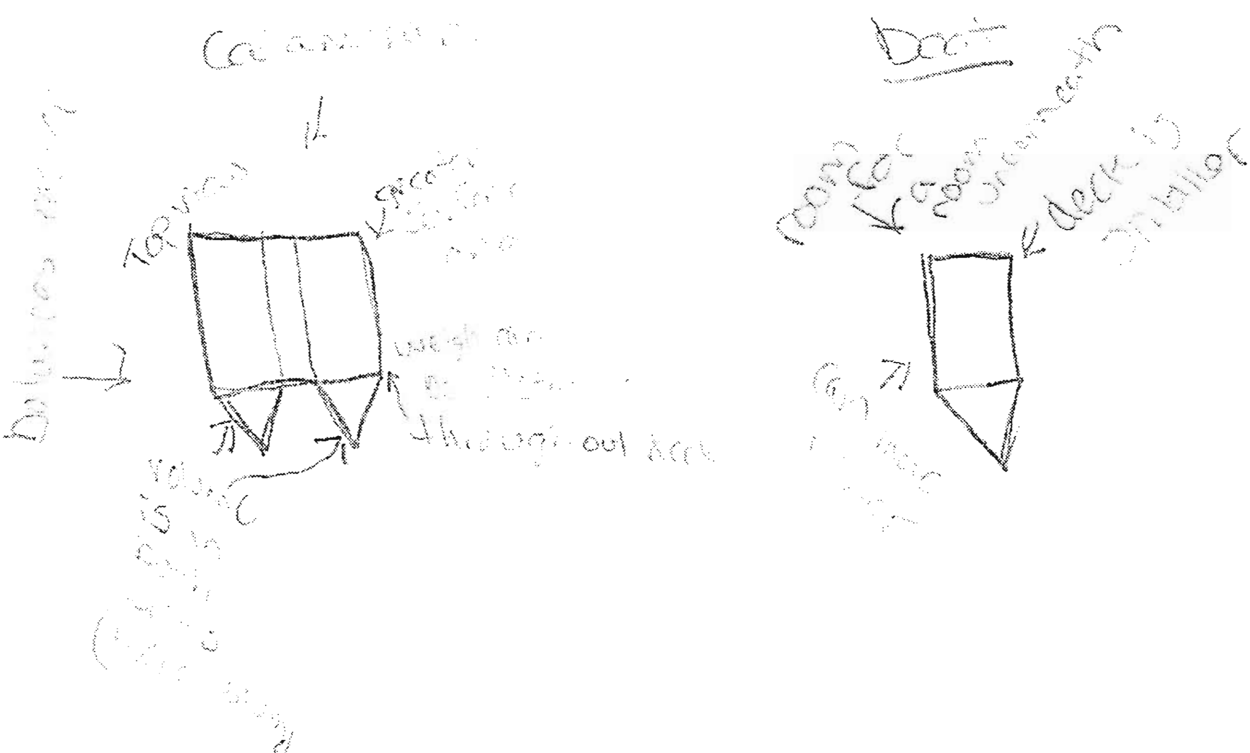
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

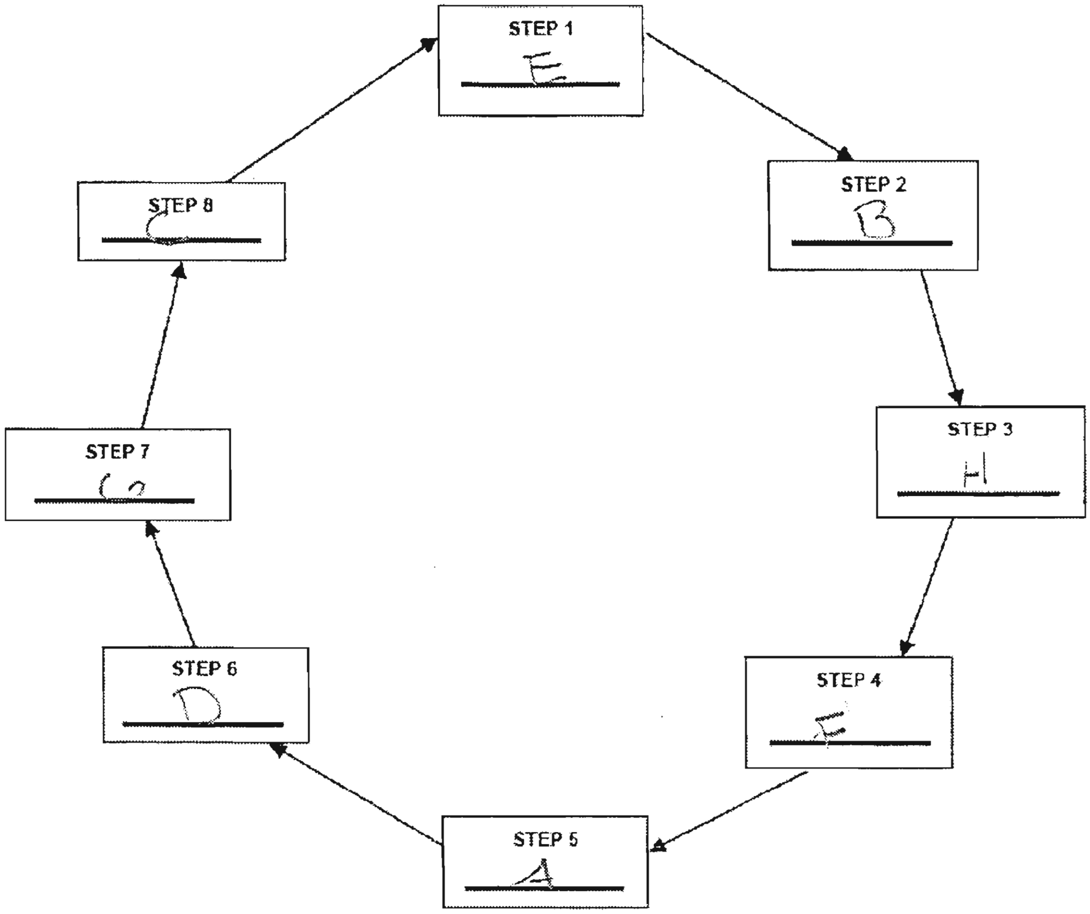
Strengths - If a boat has more volume and has a small mass the more weight it can hold. A catamaran has a larger deck so the weight can be [illegible]

weaknesses - If there is not enough volume the [illegible]

[illegible]



Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

50323 3253

Project Analysis

Name______________

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

Cup = 64.5 g

The Weight of your Boat = ~~125~~ 120 ~~kg~~ g

The Volume of your Boat = ~~3510~~ 3846.0 ~~kg~~ cm3

Density of water = 1 ~~kg/m3~~ g/cm3

7 cups

3510
−440
3070

Volume * Density = Total Maximum Weight

3510 cm3 * 1 kg/m3 = ~~3510~~ 3846.0 kg

3846
− 120
3720

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

~~3510~~ 3846 kg – ~~125~~ 120 kg = ~~3385.5~~ kg ~~3724.5~~ 3720

Actual Maximum Weight Capacity (how much your boat held before it sank) =

all weight kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

____

____

____

____

____

____

50285

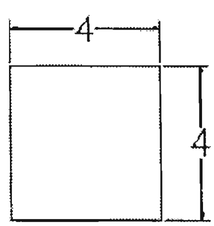
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter 2. G Area 3. A Volume 4. F Mass 5. b Density 6. ___ Surface Area 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

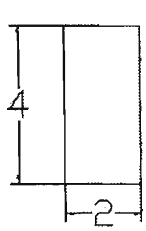
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



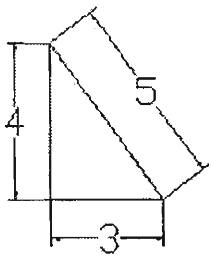
P = 16 ✓
A ✓

   b. A simple 2x4 rectangle



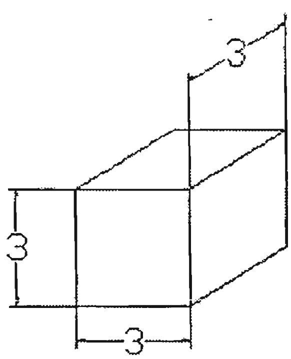
✓
A = ✓

c. A simple 3x4x5 triangle



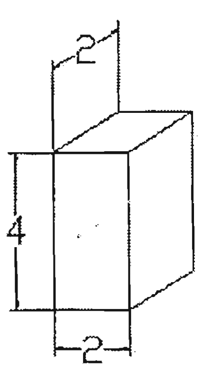
P= 12 units ✓
A= 6 units² ✓

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



V= 27 units³ ✓
SA = 9×6 = 54 units² ✓

   b. A simple 2x4x2 cuboid



V = 16 units³ ✓
SA = 8×4 + 4
32 + 8 = 40 units² ✓

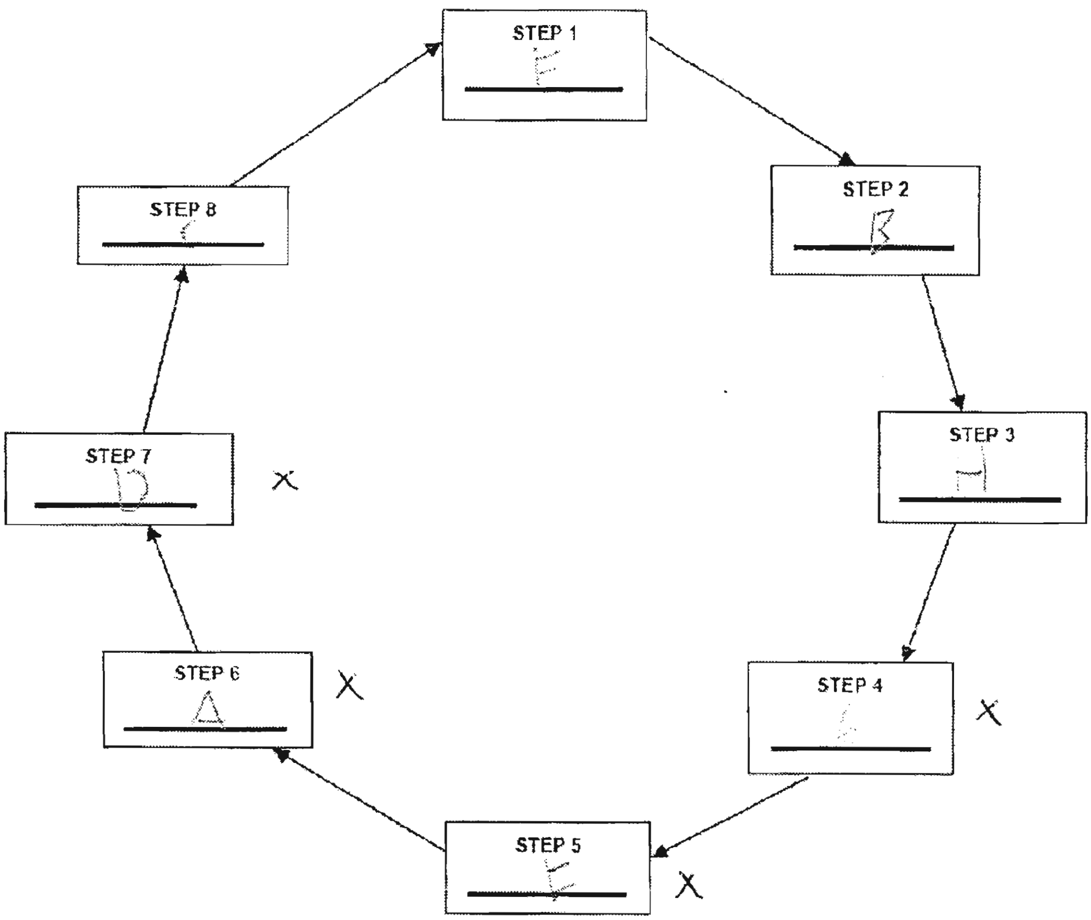
50285

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

[illegible] shape [illegible] this has [illegible] surface area [illegible] [illegible] distributes [illegible] weight and [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] it has the boat [illegible] [illegible] [illegible] be water tight. The [illegible] [illegible] have to allow [illegible]

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

502-35

~~Pre~~ Post Test for Boat Buoyancy Lesson Plan

2

Matching

1. d Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. g Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. a Volume	c. The upward pressure exerted upon a floating body by a fluid
4. f Mass	d. The outer limits of an area
5. b Density	e. The sum of the areas of the sides of a three-dimensional object
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Mathematics

1. Find the perimeter and area for each of these simple shapes
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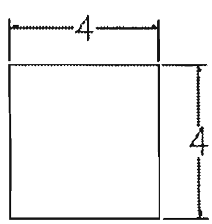
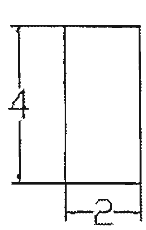


Area [illegible] ✓

[illegible] ✓

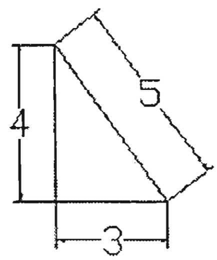
   b. A simple 2x4 rectangle



[illegible] ✓

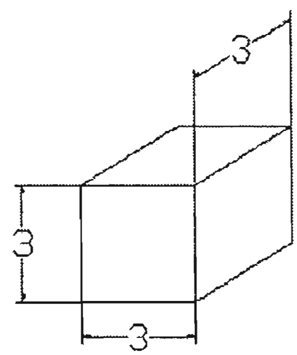
Perimeter = 12 [illegible] ✓

c. A simple 3x4x5 triangle



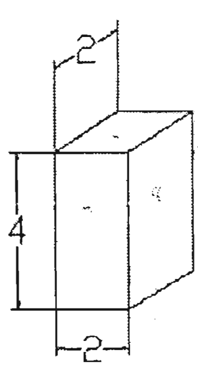
perimeter = 12 units ✓
area = 6 units^2 ✓

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



Volume = 27 units^3 ✓
surface area = 54 units^2 ✓

   b. A simple 2x4x2 cuboid



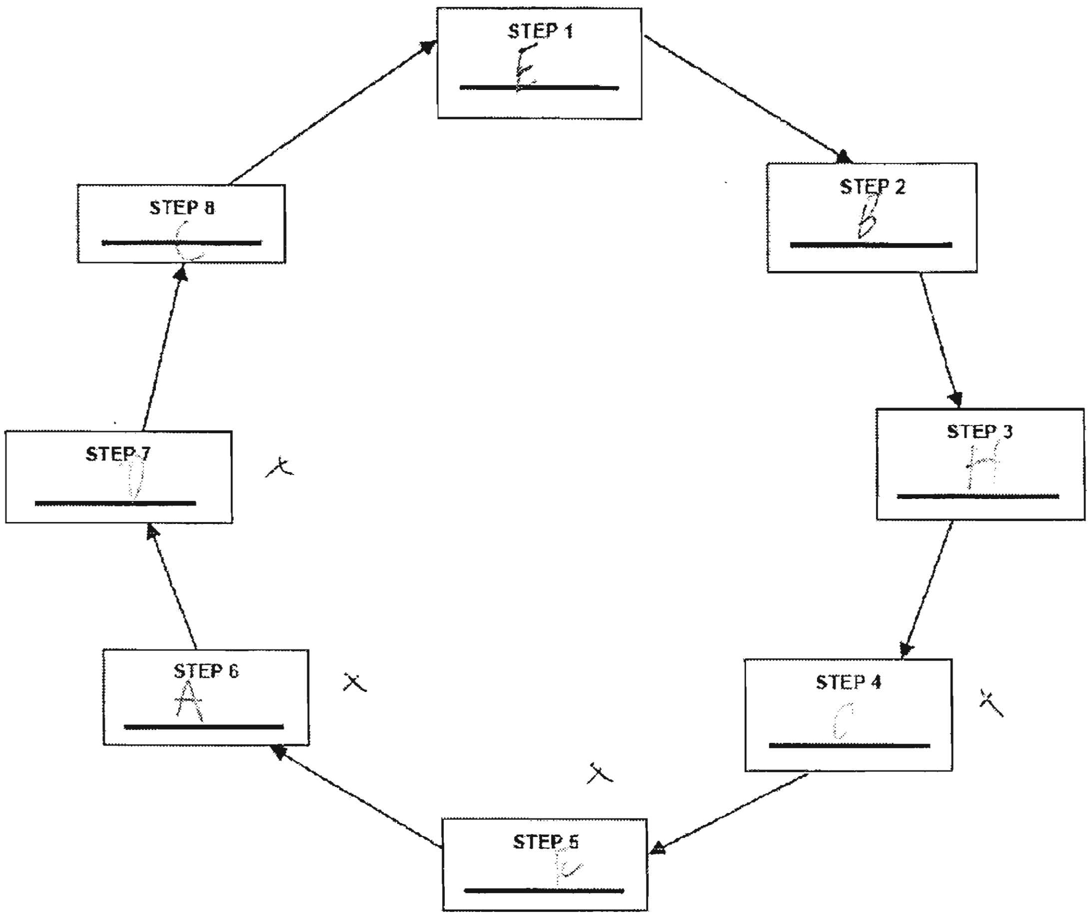
volume = 16 units^3 ✓
surface area = [illegible] units^2 ✓

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Ponton boats are lighter ~~and~~ have less [illegible]
Then a [illegible] hull, Also [illegible]
[illegible] then [illegible] boats

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

50285 30322

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = ~~.050~~ 49 .05 kg

The Volume of your Boat = ~~1071~~ kg cm 3825 g

17 × 9 = 153 ; 153 × 7 = 10.71 cm³

Density of water = 1 kg/m³

Volume * Density = Total Maximum Weight

10.71 m³ * 1 kg/m³ = ~~10.71~~ 3825 g kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

3825 ~~10.71~~ kg – .0544 kg = 10.66 kg 3.776 g

3.77 Kg

Actual Maximum Weight Capacity (how much your boat held before it sank) =

_____________ kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

____

____

____

____

____

____

[redacted] [redacted]

#2 Post 50242

~~Pre~~-Test for Boat Buoyancy Lesson Plan

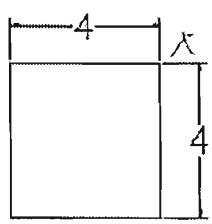
only one

Matching

1. d Perimeter 2. e Area 3. a Volume 4. f Mass 5. b Density 6. a Surface Area 7. c Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

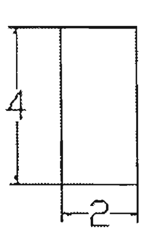
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



perimeter: 16

area: 16

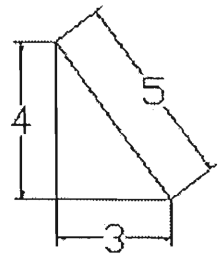
   b. A simple 2x4 rectangle



perimeter: ~~0~~ 12

area: 8

c. A simple 3x4x5 triangle

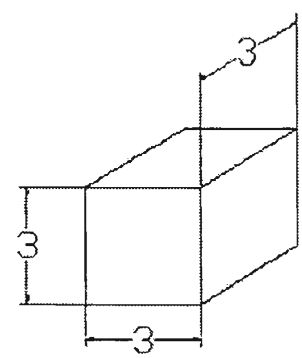


perimeter - 12

area - 60

2. Find the volume and surface area of these simple shapes

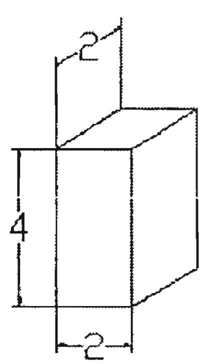
a. A simple 3x3x3 cube



volume: 27

surface - 9

b. A simple 2x4x2 cuboid



volume - 16

surface - 8

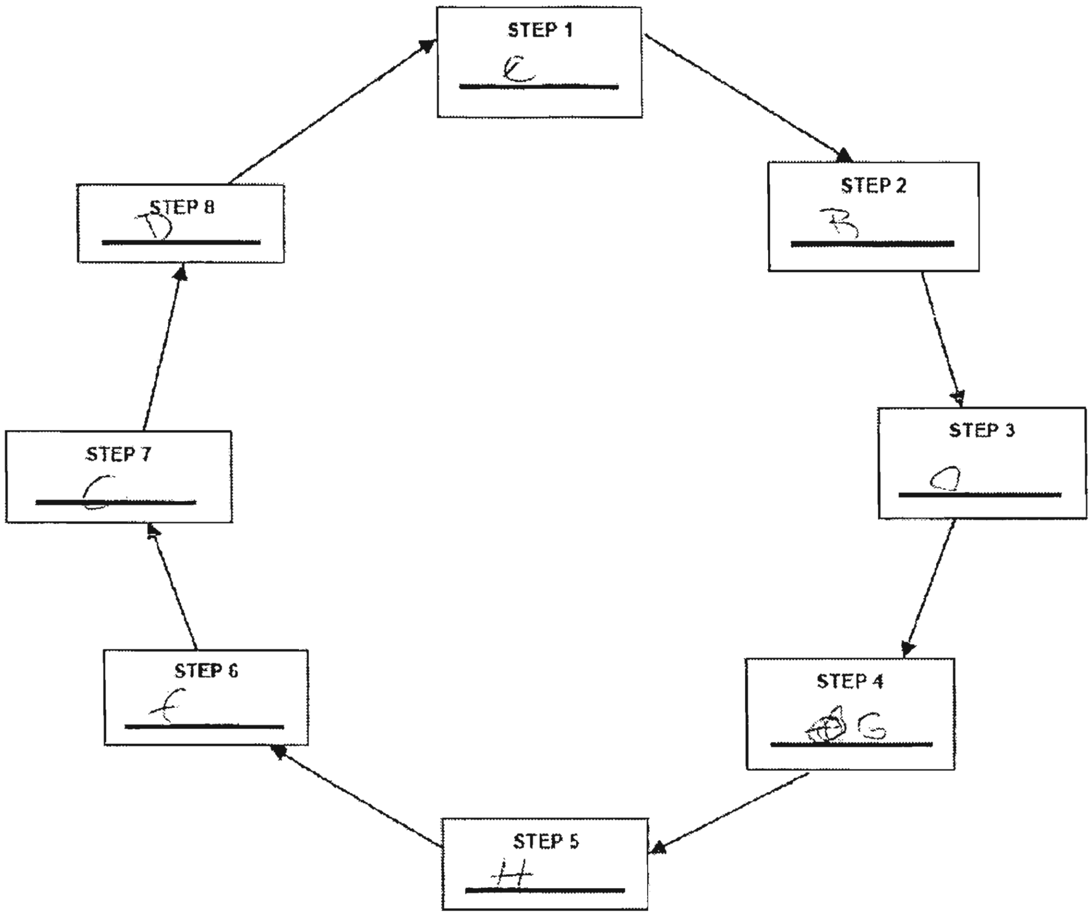
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

A cadamaran is pretty strong it has two pontoons on each side of it but in the middle of it, it's weak

A sailboat is sturdy but it's always on its side and it's easier to flip than a cadamaran

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

50242 30214

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

~~61.5~~ 68.2 V 1883 1225

The Weight of your Boat = ~~59.5~~ kg g

The Volume of your Boat = 1527.75 ~~kg~~ g

Density of water = 1 kg/m^3 g/cm^3

Volume * Density = Total Maximum Weight

1527 ~~m^3~~ * 1 kg/m^3 = 1527 kg

g/cm^3 g/cm^3

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity 2

1527 ~~kg~~ g – 68.2 ~~kg~~ g = 1459.55 ~~kg~~ g 1.460 kg.

Actual Maximum Weight Capacity (how much your boat held before it sank) = did not sink

______kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

3/2
26.7
26.5

______

______

______

______

______

______

Buoyancy Reference

Name_______________

During this project, you will learn about buoyancy and how it relates to things in real life. Buoyancy is the force that keeps boats afloat. You will be able to determine if an object will float or sink and possibly how to improve upon boat designs. You will use one of two basic boat designs in this project: a basic tanker, and a catamaran. The boats will be constructed from one of three materials: cardboard, manila folders, and tin foil. You will construct your boat, measure and test them for the maximum amount of weight they can hold, and then compare the outcome of each test. Since each boat will have a different design or material, each outcome should differ to some extent.

#3253

Pre-Test for Boat Buoyancy Lesson Plan

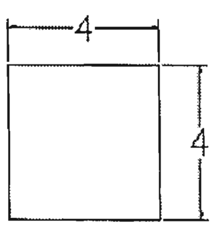
Matching

1. e Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. b Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. a Volume	c. The upward pressure exerted upon a floating body by a fluid
4. c Mass	d. The outer limits of an area
5. d Density	e. The sum of the areas of the sides of a three-dimensional object
6. a Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. c Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square

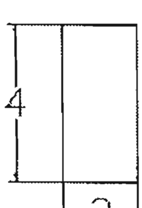
helped by David



4x4+4x4=

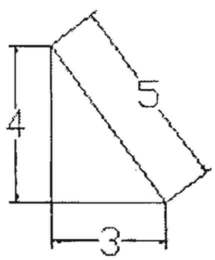
area=256

   b. A simple 2x4 rectangle



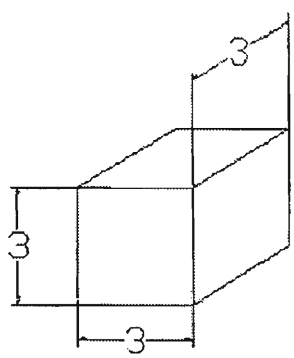
2x2x4=

c. A simple 3x4x5 triangle



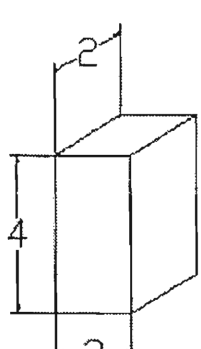
no clue

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



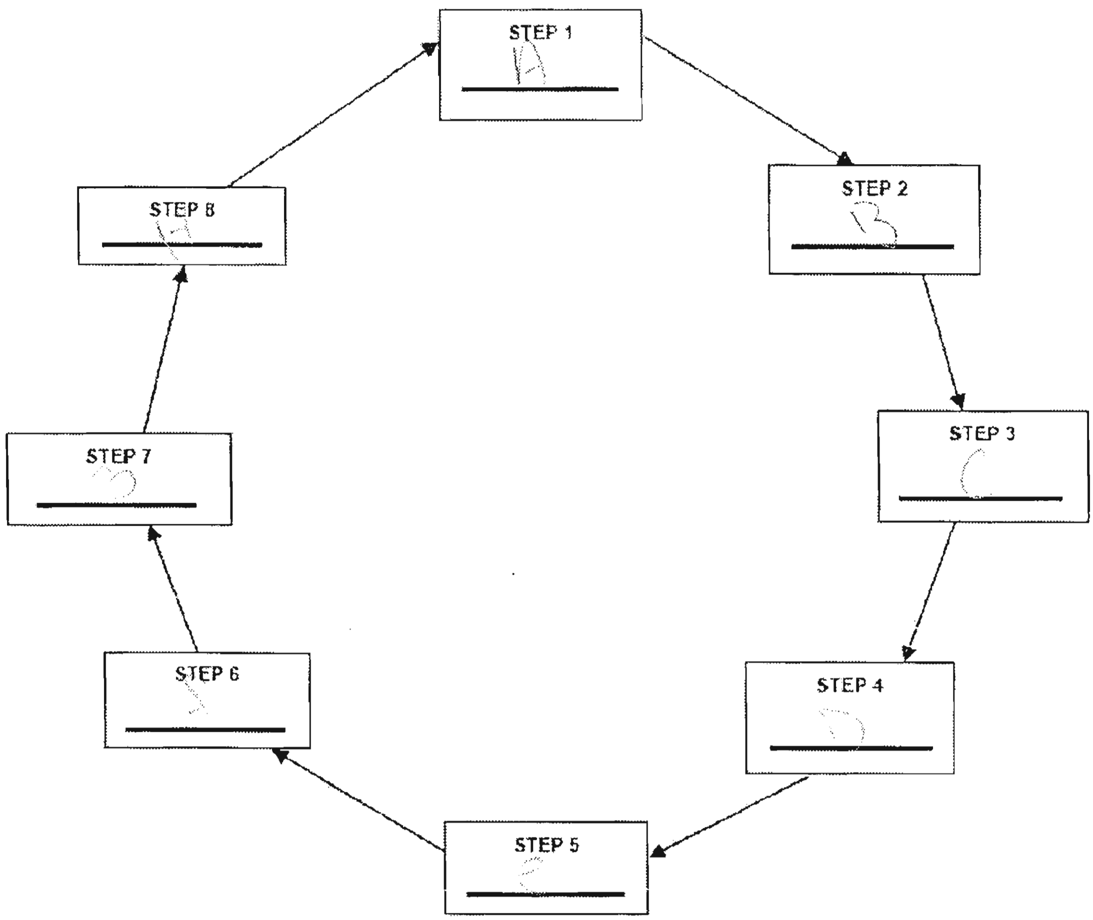
no clue

   b. A simple 2x4x2 cuboid



no clue

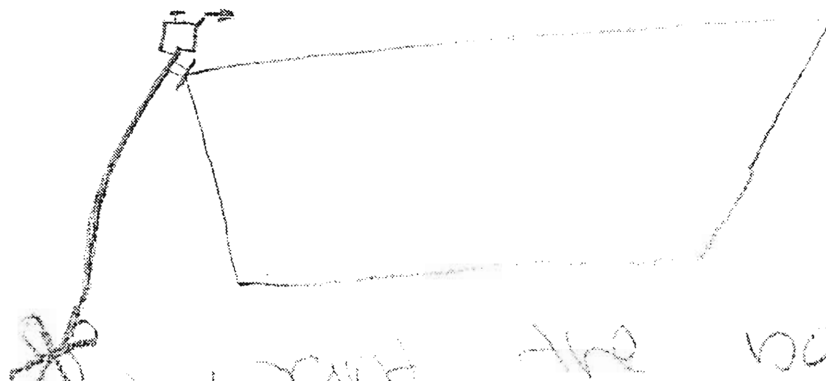
Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-



U want the boat on long as possible so u can spread the wait and root more on. but u a want [illegible] to, so u can root a lot of wait on it [illegible] hold [illegible]

2 3253

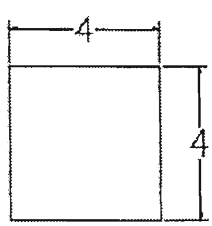
Post Test for Boat Buoyancy Lesson Plan

Matching

1. C Perimeter 2. A Area 3. f Volume 4. D Mass 5. g Density 6. e Surface Area 7. B Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

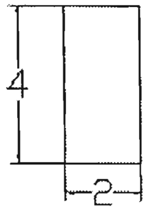
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



Area - 30

Perimeter -

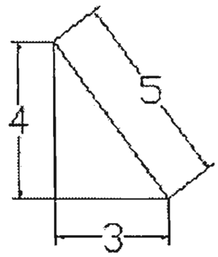
   b. A simple 2x4 rectangle



Area - 30

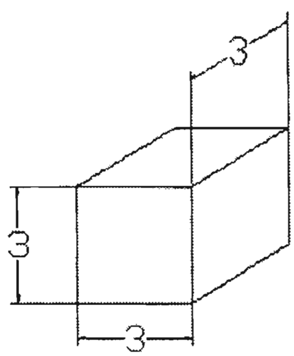
Perimeter -

c. A simple 3x4x5 triangle



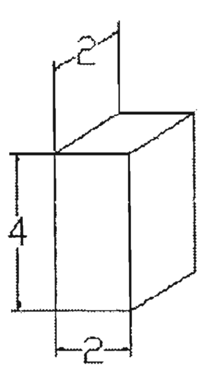
Area-60

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



Area-37

   b. A simple 2x4x2 cuboid



Area-24

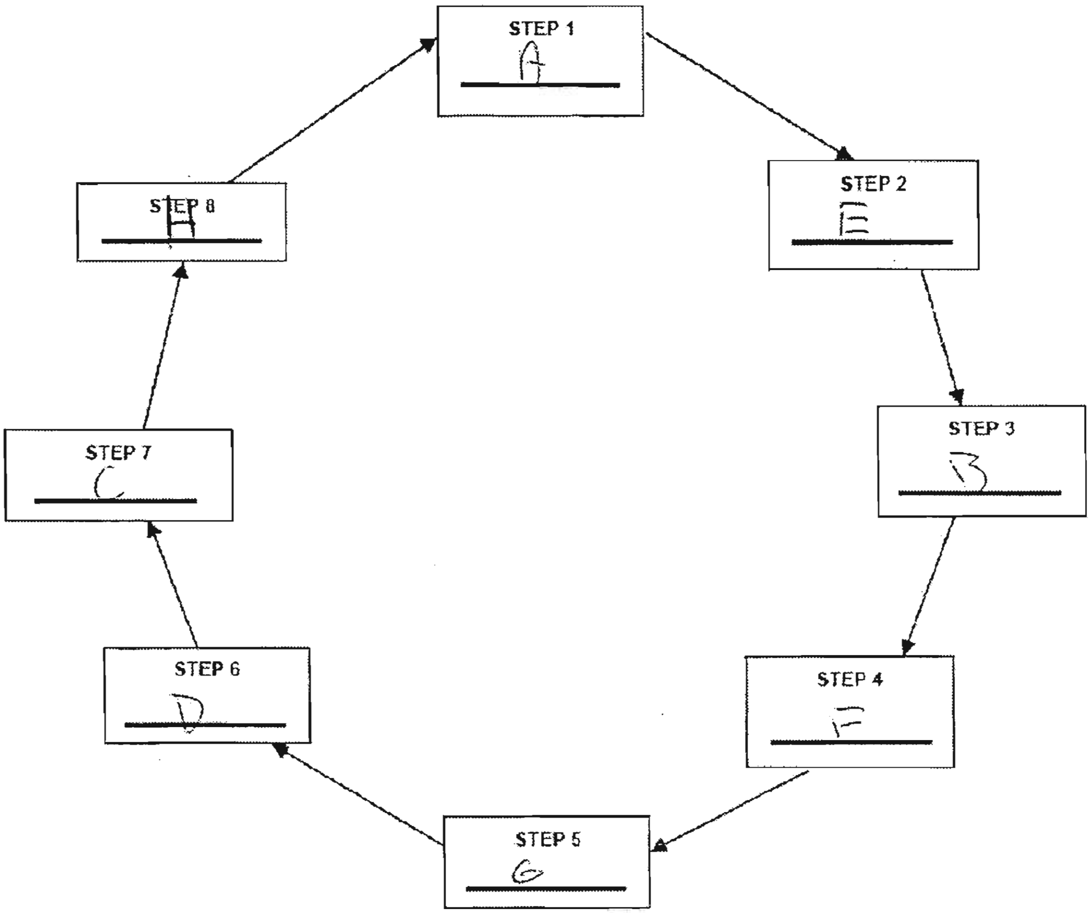
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

If u have a regular boat It Is weaker, because there is onley one floting device.

But If u have a catamaran It is better because It can hold more wate, because there are two floting devices.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

50323 3253

Project Analysis

Name________________

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

Cup = 64.5 g

The Weight of your Boat = ~~125~~ 120 ~~kg~~ g

The Volume of your Boat = ~~3510~~ 3846.0 ~~kg~~ cm3

Density of water = 1 ~~kg/m3~~ g/cm3

7 cups

3510
440
3070

Volume * Density = Total Maximum Weight

3510 ~~m3~~ cm3 * 1 ~~kg/m3~~ = ~~3510~~ 3846.0 ~~kg~~

3846
− 120
3720

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

~~3510~~ 3846 ~~kg~~ – ~~125~~ 120. ~~kg~~ = ~~3372.5~~ ~~kg~~ ~~3721.5~~ 3720

Actual Maximum Weight Capacity (how much your boat held before it sank) =

all weight ~~kg~~

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

____

____

____

____

____

____

30322

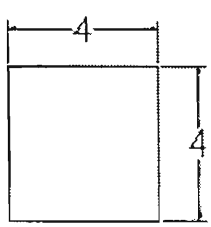
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. _d_ Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. _b_ Area X	b. The mass per unit volume of a substance at a specified pressure and temperature
3. _a_ Volume	c. The upward pressure exerted upon a floating body by a fluid
4. _f_ Mass	d. The outer limits of an area
5. _e_ Density X	e. The sum of the areas of the sides of a three-dimensional object
6. _c_ Surface Area X	f. The measure of the quantity of matter that a body or an object contains
7. _g_ Buoyancy X	g. The extent of a 2-dimensional surface enclosed within a boundary

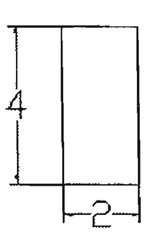
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



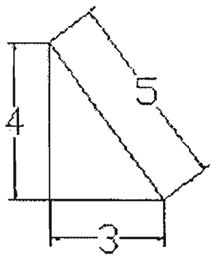
perimeter - 16 ✓
area - 16 ✓

   b. A simple 2x4 rectangle

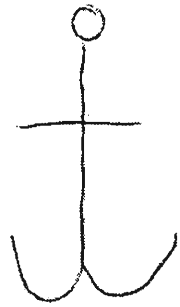


perimeter - 12 ✓
area - 8 -

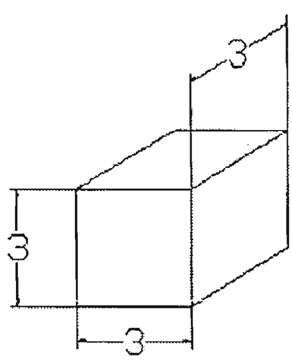
c. A simple 3x4x5 triangle



perimeter - 12 ✓
area - 60 ×

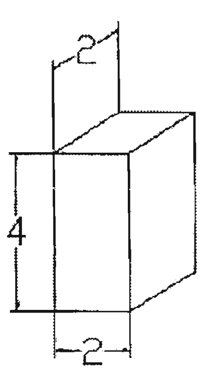


2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



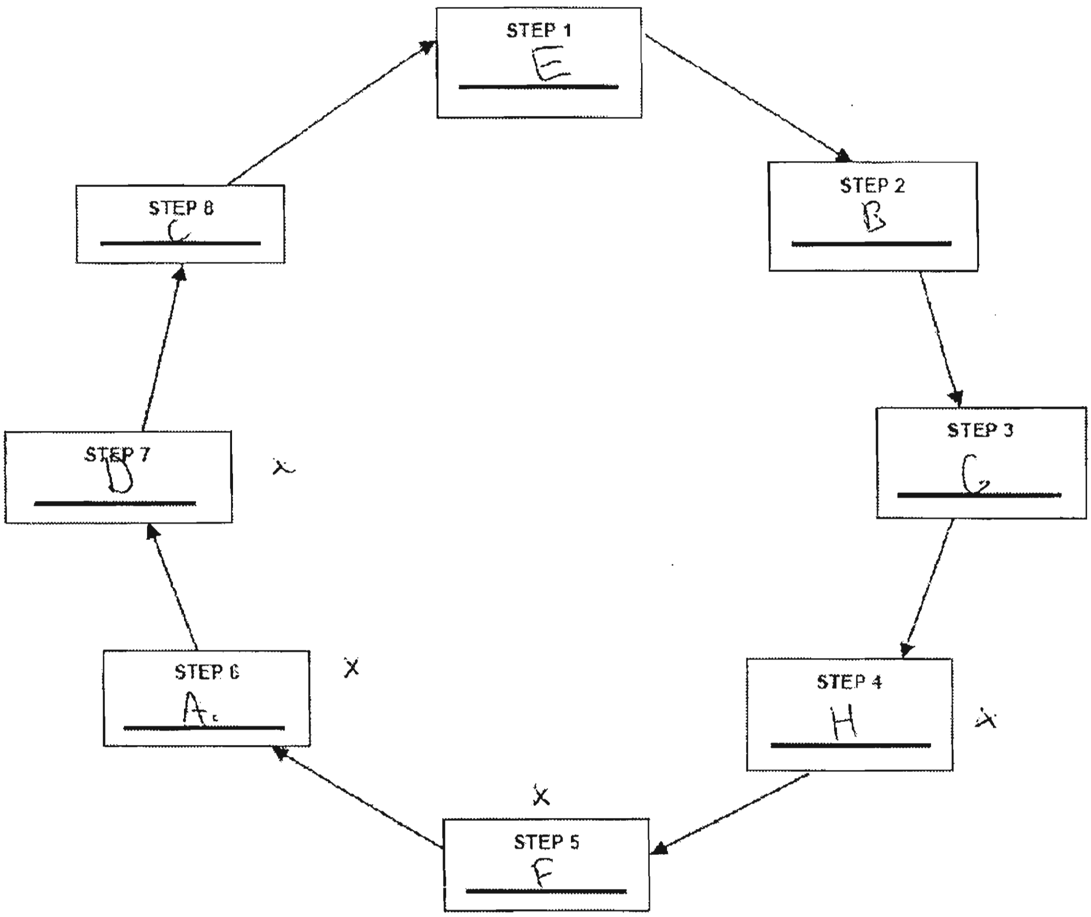
V = 27 ✓
s.a = 39 ×

   b. A simple 2x4x2 cuboid



V = 16 ✓
s.a = 32 ×

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Strengths	weaknesses
• Stay above water	• can sink
• go fast	• can hit an ice burg
• menauver quickly	

#2 [redacted] [redacted] 30322

Post Test for Boat Buoyancy Lesson Plan

Matching

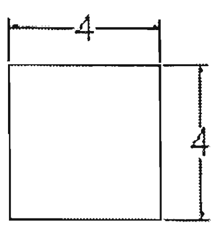
1. E Perimeter X 2. D Area X 3. A Volume 4. F Mass 5. B Density 6. G Surface Area X 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

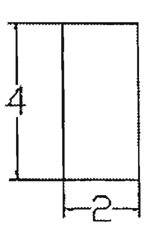
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square

p: 16 in

a: 16 in^2



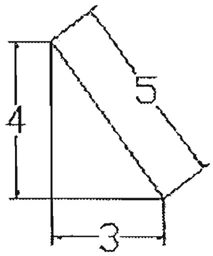
   b. A simple 2x4 rectangle



p: 12 in

a: 8 in^2

c. A simple 3x4x5 triangle

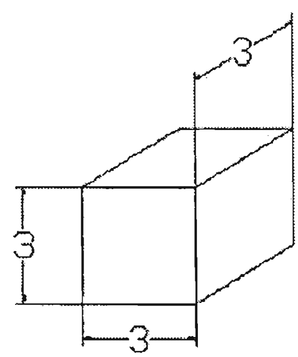


p: [illegible] in ✓

a: 12 in² x

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube

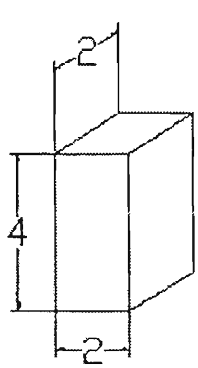
V: 27 in³ ✓



S.a.: 18 in x

b. A simple 2x4x2 cuboid

v: 16 in³ ✓



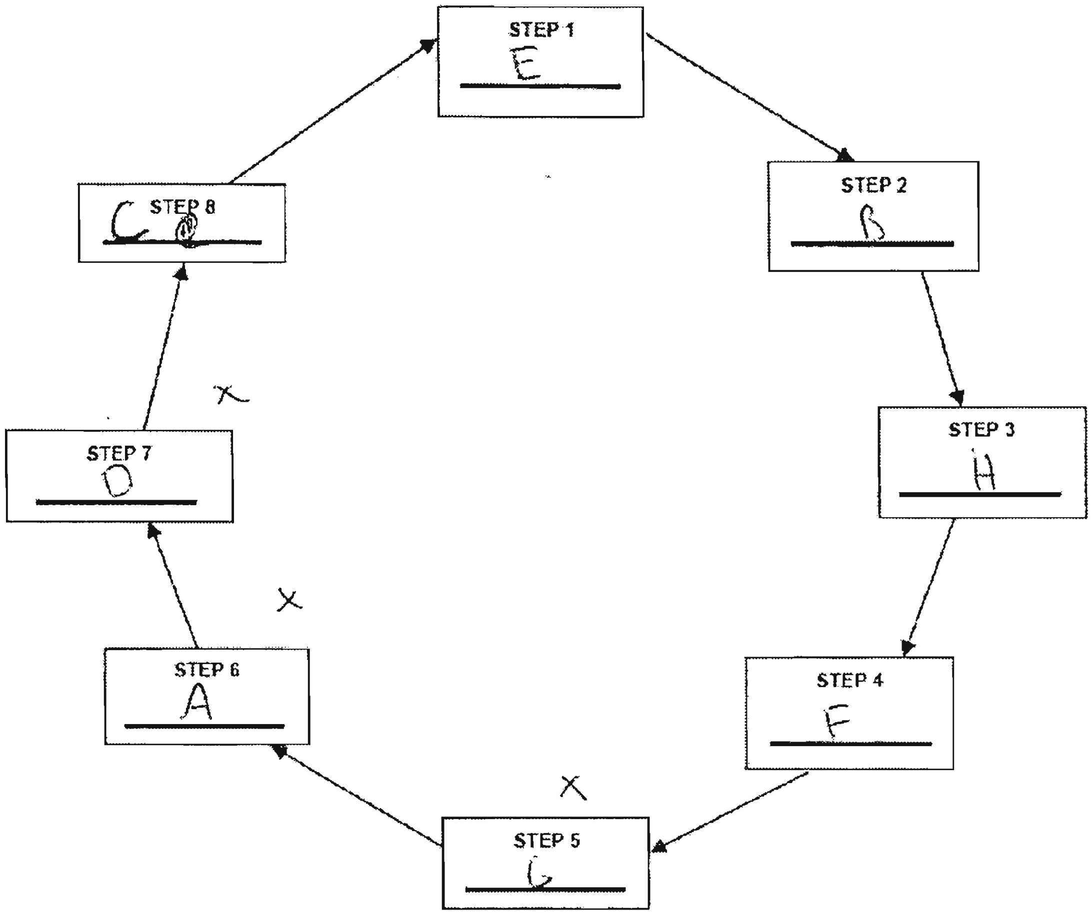
S.a.: 16 in x

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Catamaran		Freight	
Strengths	weaknesses	Strengths	weaknesses
• more balance	• Can't hold that much ~~extra~~ weight	• Can hold a lot of weight	• less balance

Please identify each step within the engineering design process-



A. ~~Construct a prototype~~
B. ~~Research the problem~~
C. ~~Redesign~~
D. ~~Test and evaluate~~
E. ~~Identify the problem~~
F. ~~Select the best possible solution(s)~~
G. ~~Communicate the solution(s)~~
H. ~~Develop possible solutions~~

50285 30322

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

6
17
~~X1~~
153

7 2
153
7
10.71 cm^3

The Weight of your Boat = ~~050~~ 49.05 ~~kg~~ g

The Volume of your Boat = ~~1071~~ ~~kg~~ cm 3825 g

Density of water = 1 kg/m^3

Volume * Density = Total Maximum Weight

10.71 m^3 * 1 kg/m^3 = ~~10.71~~ 3825 g ~~kg~~

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

3825 ~~10.71~~ kg – .0544 kg = 10.66 kg 3.776 g

3.77 Kg

Actual Maximum Weight Capacity (how much your boat held before it sank) =

__________ kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

30313

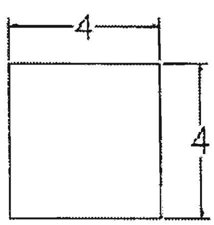
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. G Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. A Volume	c. The upward pressure exerted upon a floating body by a fluid
4. F Mass	d. The outer limits of an area
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. E Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

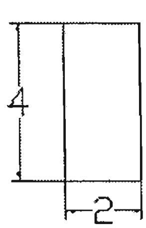
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



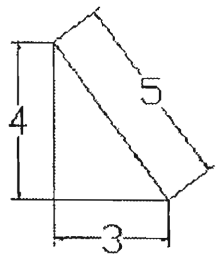
A= 16 in.²
P= 16 in.

   b. A simple 2x4 rectangle



P= 12 in.
A= 8 in.²

c. A simple 3x4x5 triangle

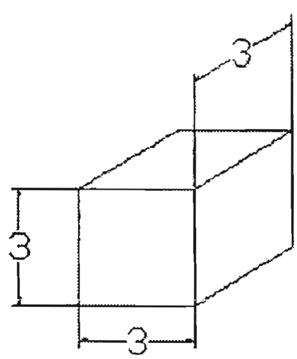


P= 12 in.

x A= 12 in.^{2}

2. Find the volume and surface area of these simple shapes

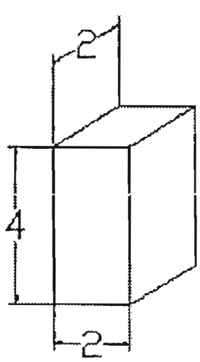
a. A simple 3x3x3 cube



V= 24 in.^{3}

SA= 54 in.

b. A simple 2x4x2 cuboid



V= 16 in.^{3}

x SA= 30 in.

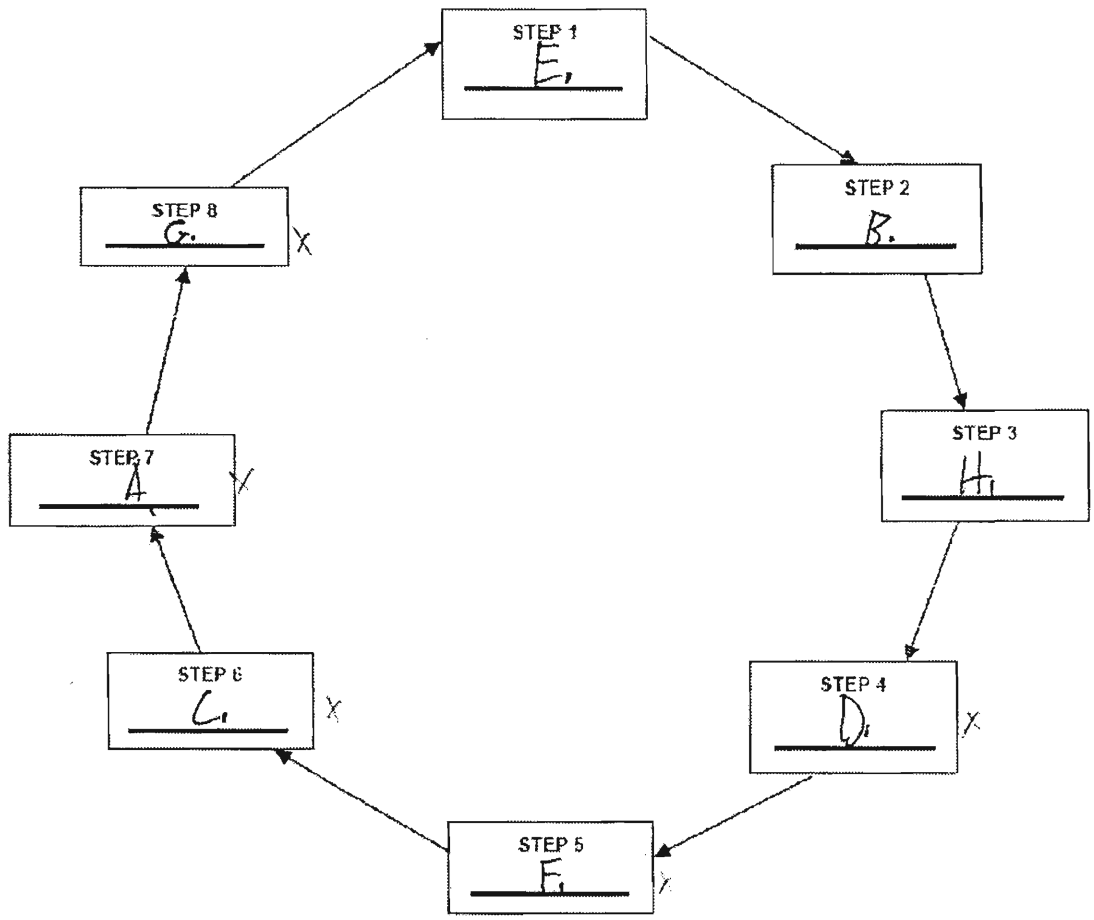
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Various boat designs

Strong	Weak
• metal	• wood
• engines	• Oars
• able to be altered /fixed	• not able to be altered /fixed
• perfect condition	• holes
• horn or some type of communication system	• no communication system
• Storage place for life Jackets.	• no Storage places for life jackets
• good gas mileage	• poor gas mileage
• rounded boats	• boats that aren't rounded
• enough seats for a certain amount of people.	• not many seats at all

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

#2 Post

30513 [redacted]

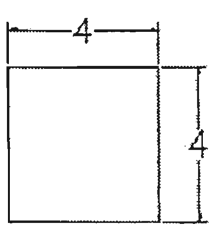
[redacted] Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. E Area X	b. The mass per unit volume of a substance at a specified pressure and temperature
3. A Volume	c. The upward pressure exerted upon a floating body by a fluid
4. F Mass	d. The outer limits of an area
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. G Surface Area Y	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

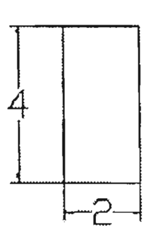
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



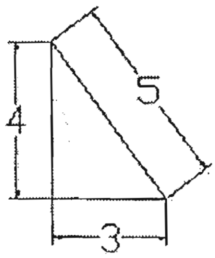
P= 16 units
A= 16 units^2

   b. A simple 2x4 rectangle



P= 12 units
A= 8 units^2

c. A simple 3x4x5 triangle

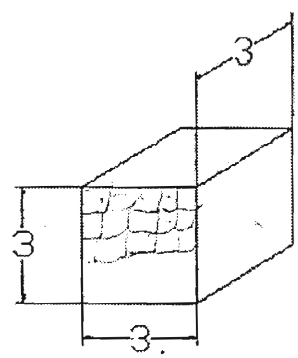


P= 24 units

A= 60 units^2

2. Find the volume and surface area of these simple shapes

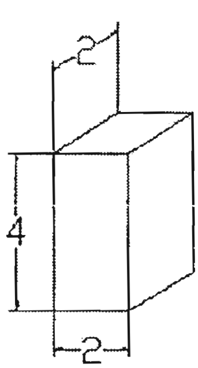
a. A simple 3x3x3 cube



V= 27 units^3

SA= 54 units

b. A simple 2x4x2 cuboid



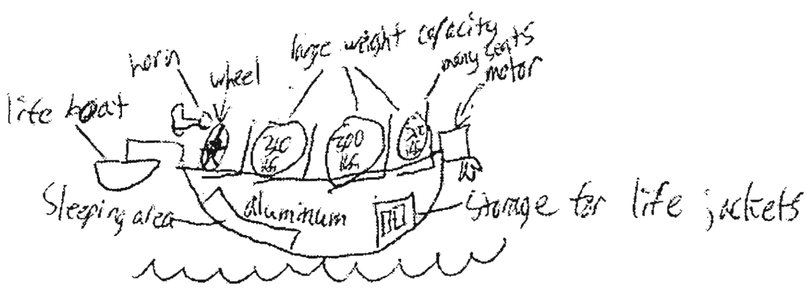
V= 16 units^3

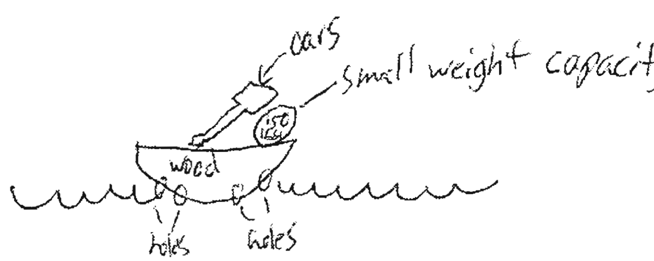
SA= 40 units

Engineering/Design

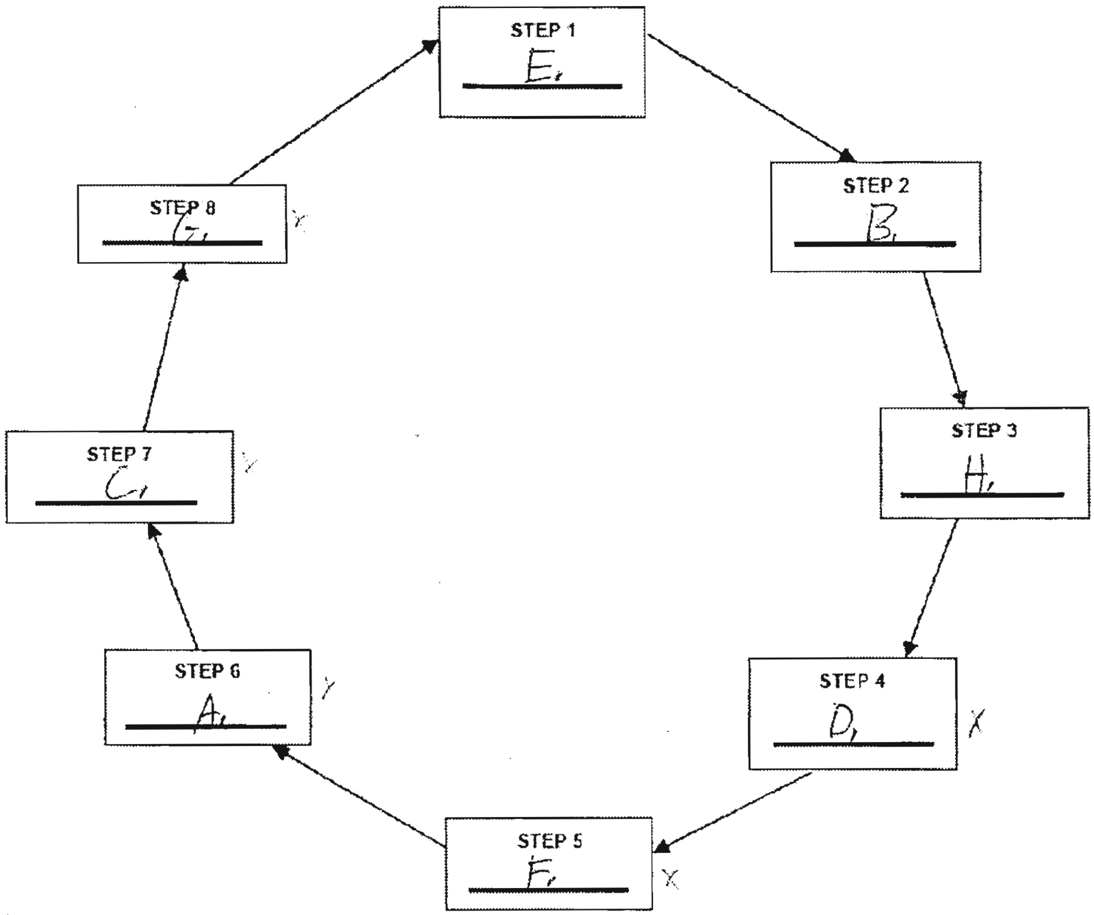
Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Strong	Weak
motor	oars
no holes	holes
large weight capacity	Small weight capacity
hard to sink	easy to sink
modern (aluminum)	old fashioned (wood)
many Seats	few Seats
Storage for life jackets	no Storage for life jackets
horn	no horn
Wheel	no wheel
~~Strong covering~~	no Sleeping area (no rooms)
Sleeping area (rooms)	no life boat or dingy
life boat or dingy	
Strong	weak





Please identify each step within the engineering design process-



A. Construct a prototype
~~B.~~ Research the problem
~~C.~~ Redesign
~~D.~~ Test and evaluate
~~E.~~ Identify the problem
~~F.~~ Select the best possible solution(s)
~~G.~~ Communicate the solution(s)
~~H.~~ Develop possible solutions

30263 30313

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 86.18 Kg

The Volume of your Boat = ~~[illegible]~~ kg. cm³ 2670.25 ~~3485.65~~ cm³

Density of water = 1 ~~kg/m³~~ g/cm³

Volume * Density = Total Maximum Weight

2670.25

~~[illegible]~~ m³ * = ~~[illegible]~~ g

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

Kg – 86.18 kg = ~~[illegible]~~ kg 2584.17

Actual Maximum Weight Capacity (how much your boat held before it sank) =

2584.17 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

[redacted]

Buoyancy Reference Name________________

During this project, you will learn about buoyancy and how it relates to things in real life. Buoyancy is the force that keeps boats afloat. You will be able to determine if an object will float or sink and possibly how to improve upon boat designs. You will use one of two basic boat designs in this project: a basic tanker, and a catamaran. The boats will be constructed from one of three materials: cardboard, manila folders, and tin foil. You will construct your boat, measure and test them for the maximum amount of weight they can hold, and then compare the outcome of each test. Since each boat will have a different design or material, each outcome should differ to some extent.

[redacted]

Pre-Test for Boat Buoyancy Lesson Plan 30263

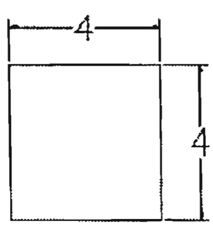
Matching

1. D Perimeter 2. F Area X 3. A Volume 4. G Mass X 5. B Density 6. E Surface Area 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

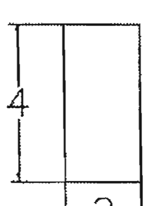
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square

16 in^2 16 in

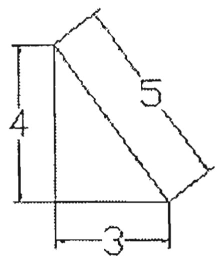


   b. A simple 2x4 rectangle



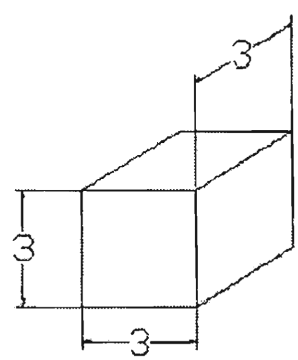
8 in^2 12 in.

c. A simple 3x4x5 triangle



60 in^2

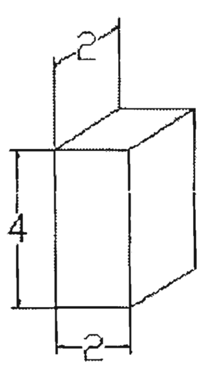
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



27 in.^{2}

18 in^3

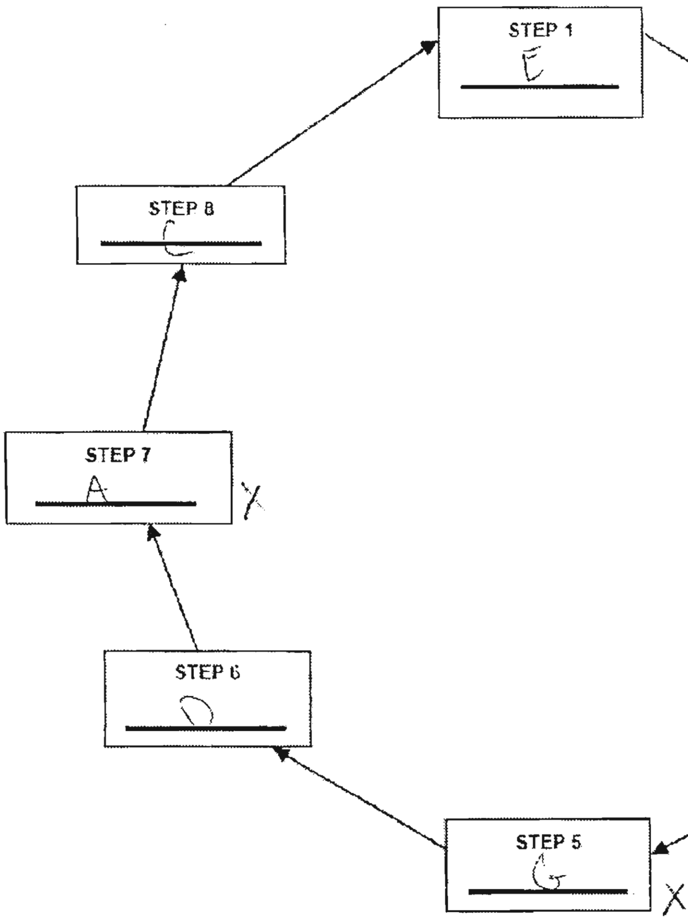
b. A simple 2x4x2 cuboid



16 in.^{2}

24 in^3

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

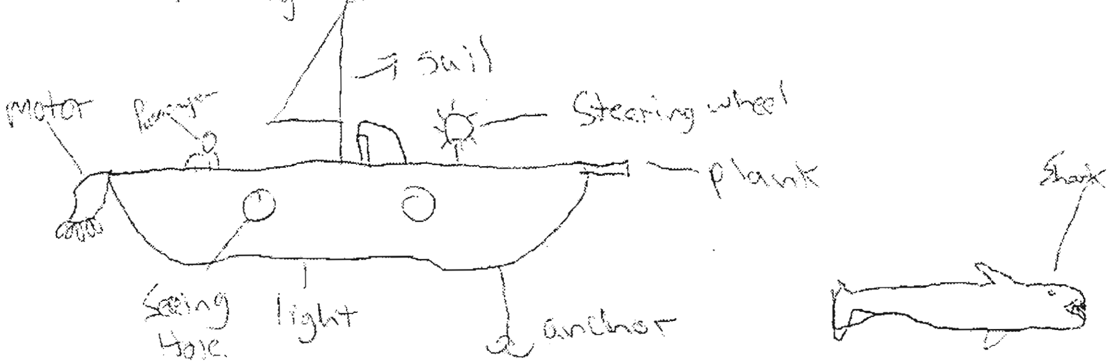
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

I know that

Heavy are bad

the lighter



[redacted]

Post

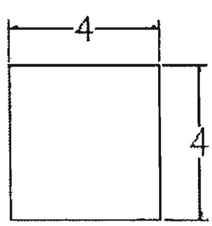
~~Pre~~-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. G Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. F Volume X	c. The upward pressure exerted upon a floating body by a fluid
4. A Mass X	d. The outer limits of an area
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. E Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

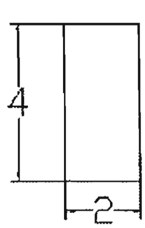
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



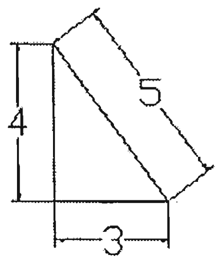
16 inches²
16 inches

   b. A simple 2x4 rectangle



12 inches²
8 inches

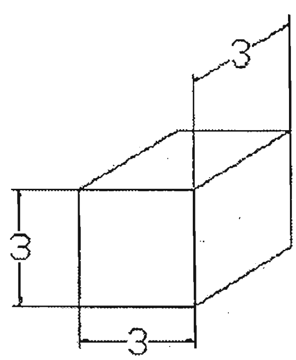
c. A simple 3x4x5 triangle



12 inches^2

x 60 inches^3

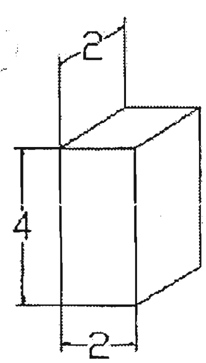
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



27 inches^3

54 inches

   b. A simple 2x4x2 cuboid



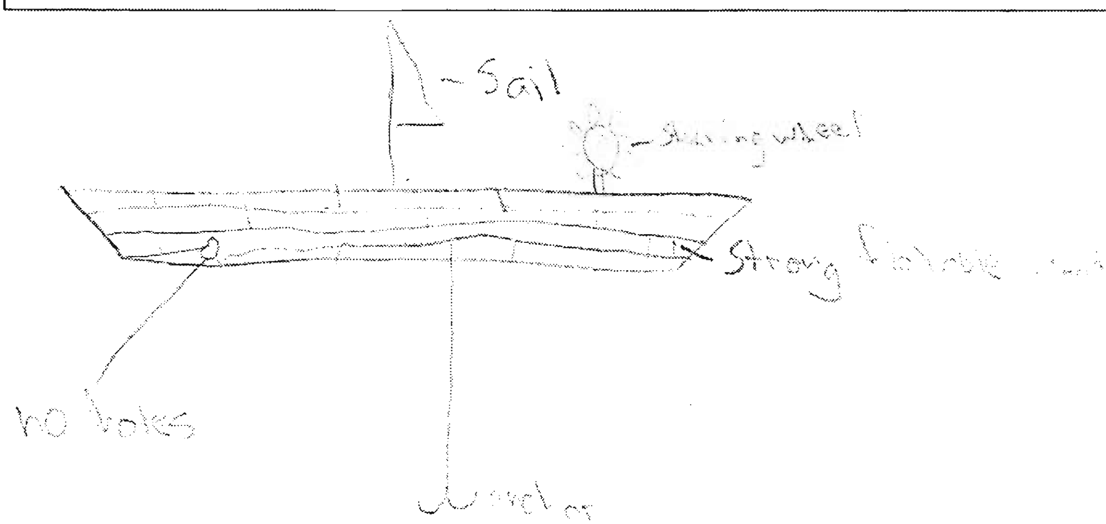
16 inches^3

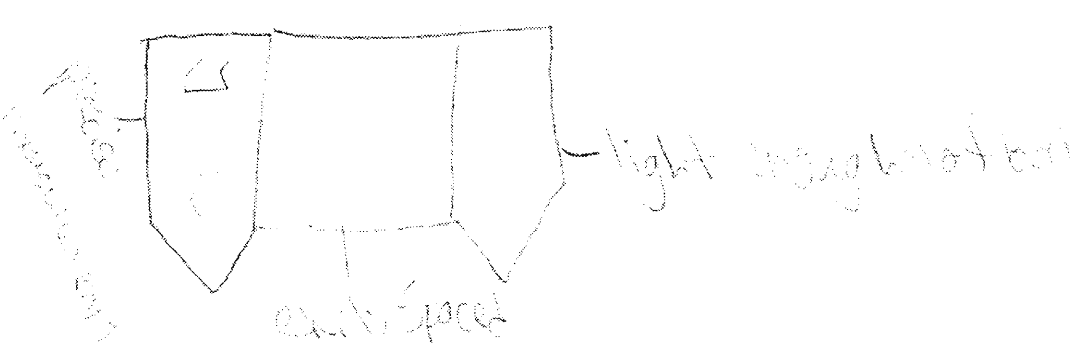
40 inches

Engineering/Design

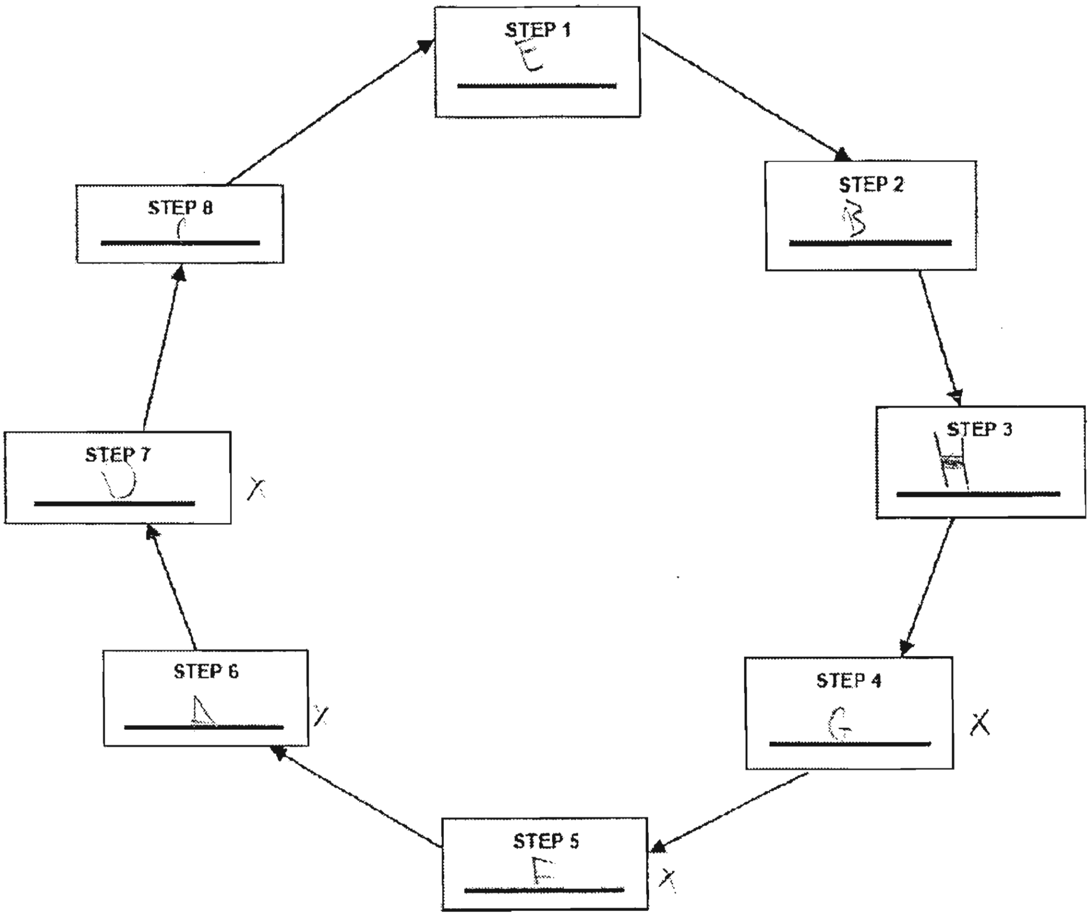
Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Strengths	Weaknesses
must be strong	Cannot be weak
must be light	Cannot be too heavy
Has to be able to float	Holes
No holes or spaces	Catamaran-
Catamarans	measurements must
big, evenly spaced	be precise, can't be
heavier than regular and	too heavy
floatable.	Regular measurem-
Regular-	ents must be precise
Big, lighter than catamarans,	must be able to
floats well. Strong	float.





Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

30263 30313

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 86.18 ~~kg~~ g

The Volume of your Boat = ~~3485.65~~ ~~kg~~ cm^3

2670.25

~~3485.65~~ cm^3

Density of water = 1 ~~kg/m^3~~ g/cm^3

Volume * Density = Total Maximum Weight

2670.25

~~3485.65~~ cm^3 * ~~m~~ = ~~3485.65~~ g

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

~~kg~~ – 86.18 ~~kg~~ = ~~3399.47~~ ~~kg~~ 2584.17

Actual Maximum Weight Capacity (how much your boat held before it sank) =

2584.17 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

[redacted]

Buoyancy Reference Name_______________

During this project, you will learn about buoyancy and how it relates to things in real life. Buoyancy is the force that keeps boats afloat. You will be able to determine if an object will float or sink and possibly how to improve upon boat designs. You will use one of two basic boat designs in this project: a basic tanker, and a catamaran. The boats will be constructed from one of three materials: cardboard, manila folders, and tin foil. You will construct your boat, measure and test them for the maximum amount of weight they can hold, and then compare the outcome of each test. Since each boat will have a different design or material, each outcome should differ to some extent.

30215

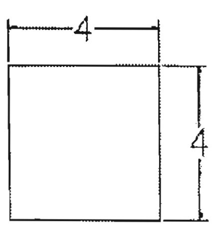
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. F Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. A Volume	c. The upward pressure exerted upon a floating body by a fluid
4. 9 Mass	d. The outer limits of an area
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. E Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

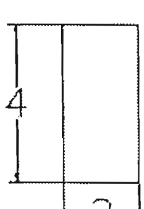
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



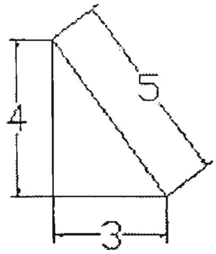
Perimeter: 16
area: 4

   b. A simple 2x4 rectangle



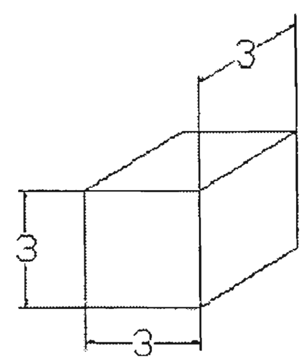
Perimeter: 12
area: 8

c. A simple 3x4x5 triangle



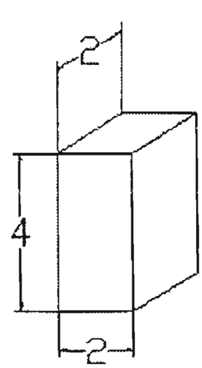
68

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



27

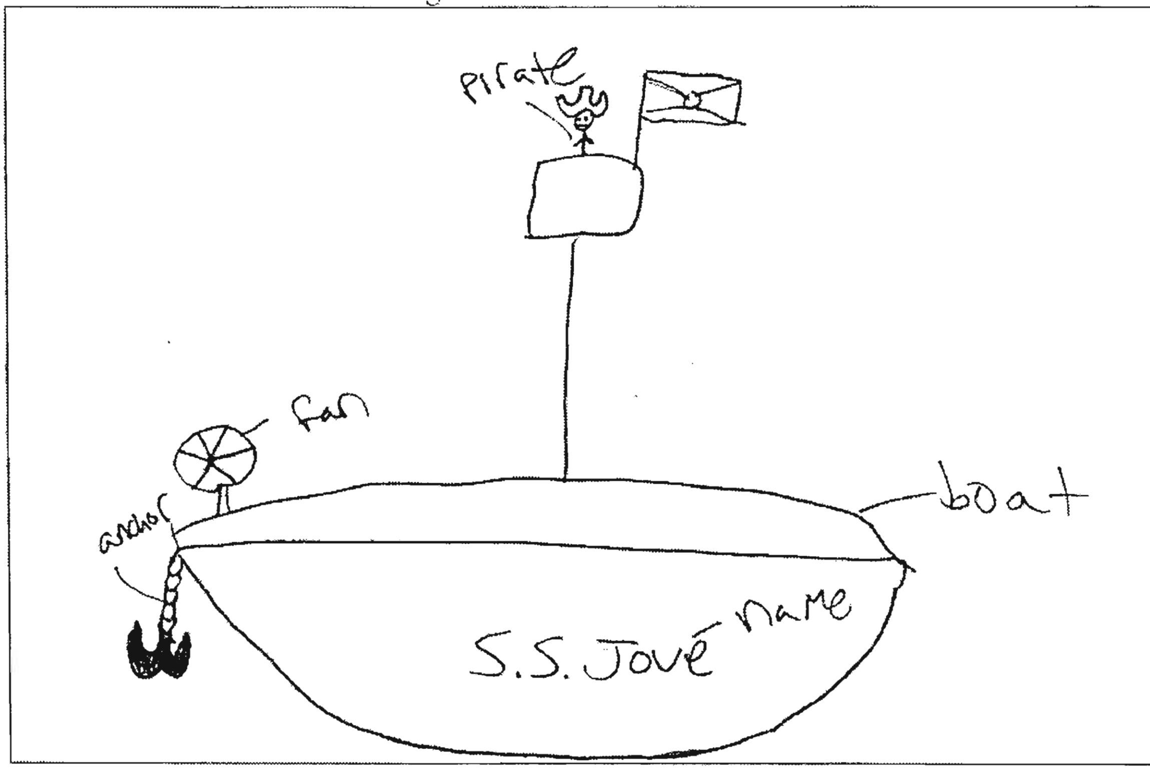
   b. A simple 2x4x2 cuboid



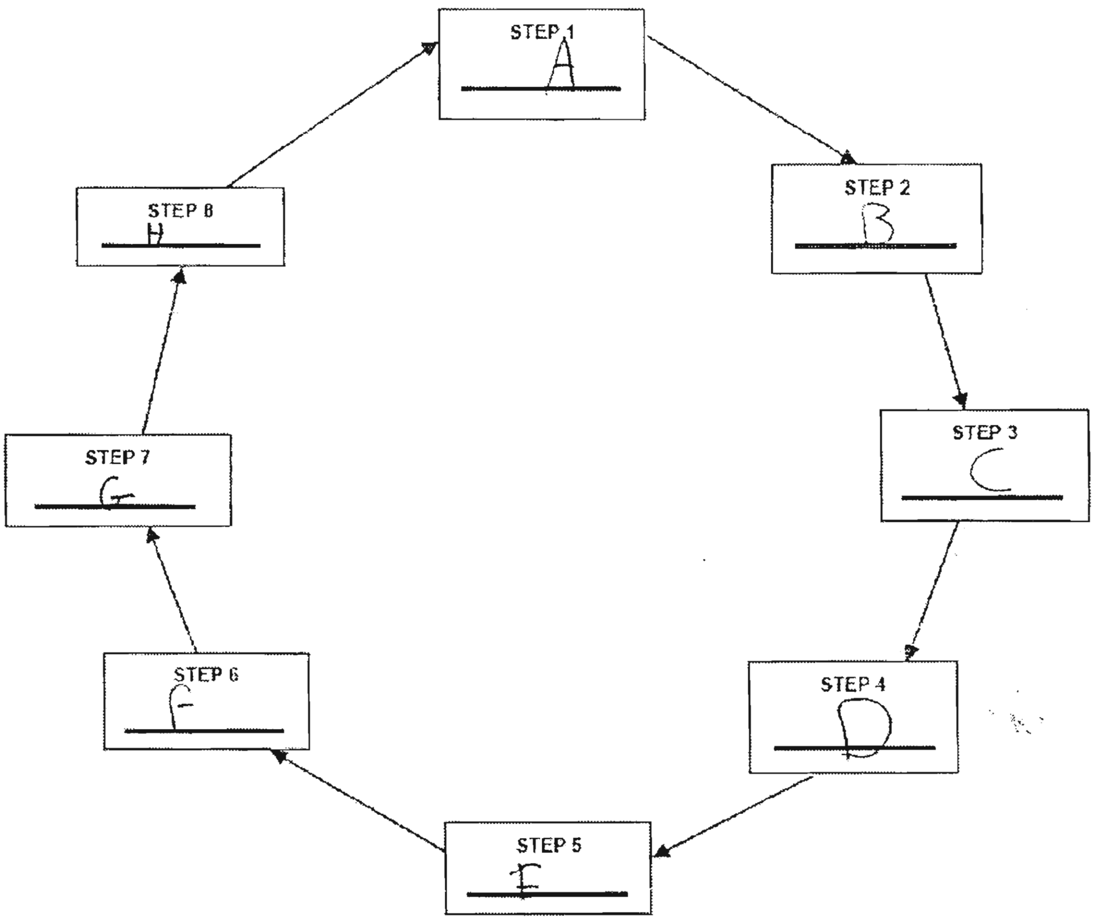
16

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-



Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

[redacted] 30215

2

Post

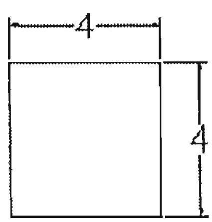
-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter 2. E Area 3. A Volume 4. F Mass 5. B Density 6. G Surface Area 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

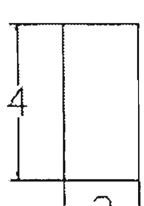
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



Perimeter = 16

Area = 16

   b. A simple 2x4 rectangle



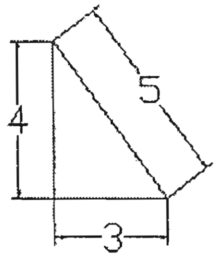
Perimeter = 12

Area = 8

[redacted]

test

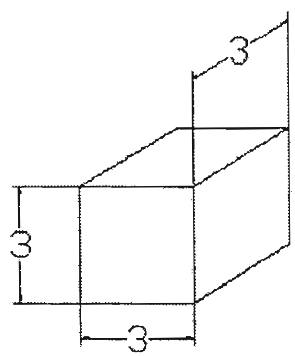
c. A simple 3x4x5 triangle



Perimeter=12

Area=60

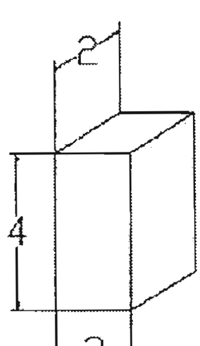
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



volume=27

surface Area=9

b. A simple 2x4x2 cuboid

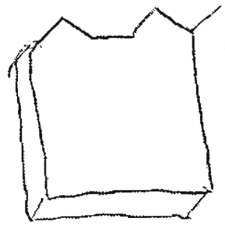


volume=16

Surface Area=8

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

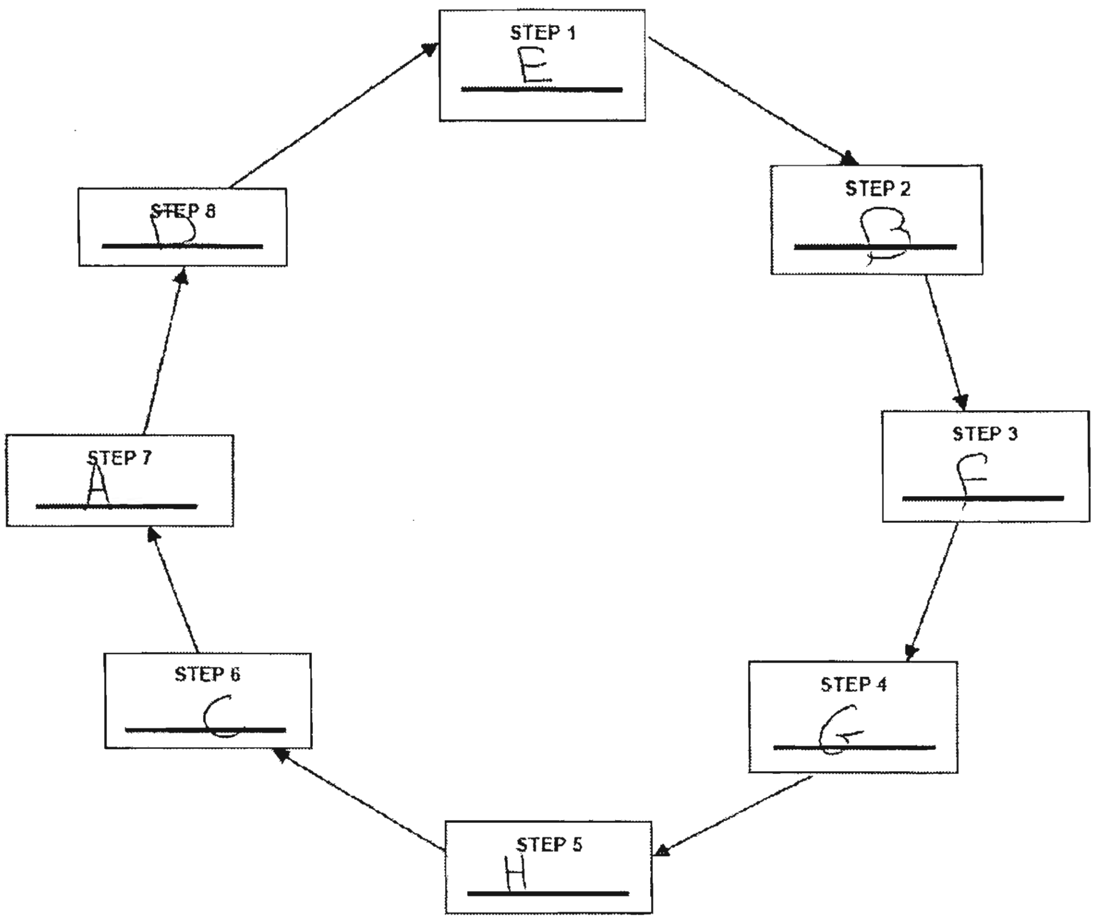


Catanaran:
with a cataMaran, you can put weights between the 2 points and it will be level.

regular:
with a regular boat it is harder to find the Middle to get the weight centered.

In conclusion: a catanaran is a better boat than a regular because the boat will be even with weights in the Middle

Please identify each step within the engineering design process-



~~A.~~ Construct a prototype
~~B.~~ Research the problem
~~C.~~ Redesign
~~D.~~ Test and evaluate
~~E.~~ Identify the problem
~~F.~~ Select the best possible solution(s)
~~G.~~ Communicate the solution(s)
~~H.~~ Develop possible solutions

30215 20375

Project Analysis Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 84.5 kg

The Volume of your Boat = 4256 kg 32×19×7

Density of water = 1 ~~kg/m³~~ g cm^2

Volume * Density = Total Maximum Weight

4256 m³ * 1 kg/m³ = 4256 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

4256 kg – 84.5 kg = 4171.5 kg

Actual Maximum Weight Capacity (how much your boat held before it sank) =

__________ kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

2-4168

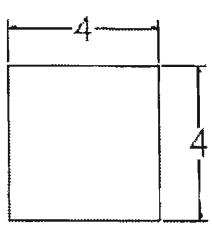
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. b Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. b Volume	c. The upward pressure exerted upon a floating body by a fluid
4. a Mass	d. The outer limits of an area
5. E Density	e. The sum of the areas of the sides of a three-dimensional object
6. C Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

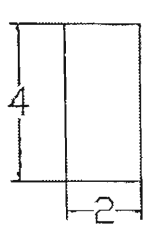
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



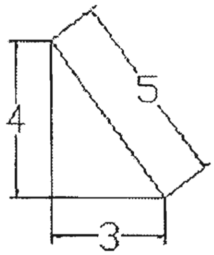
16

   b. A simple 2x4 rectangle



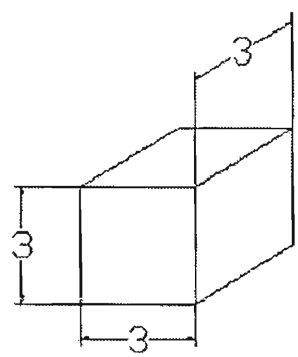
8

c. A simple 3x4x5 triangle



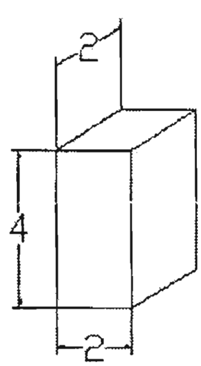
60

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



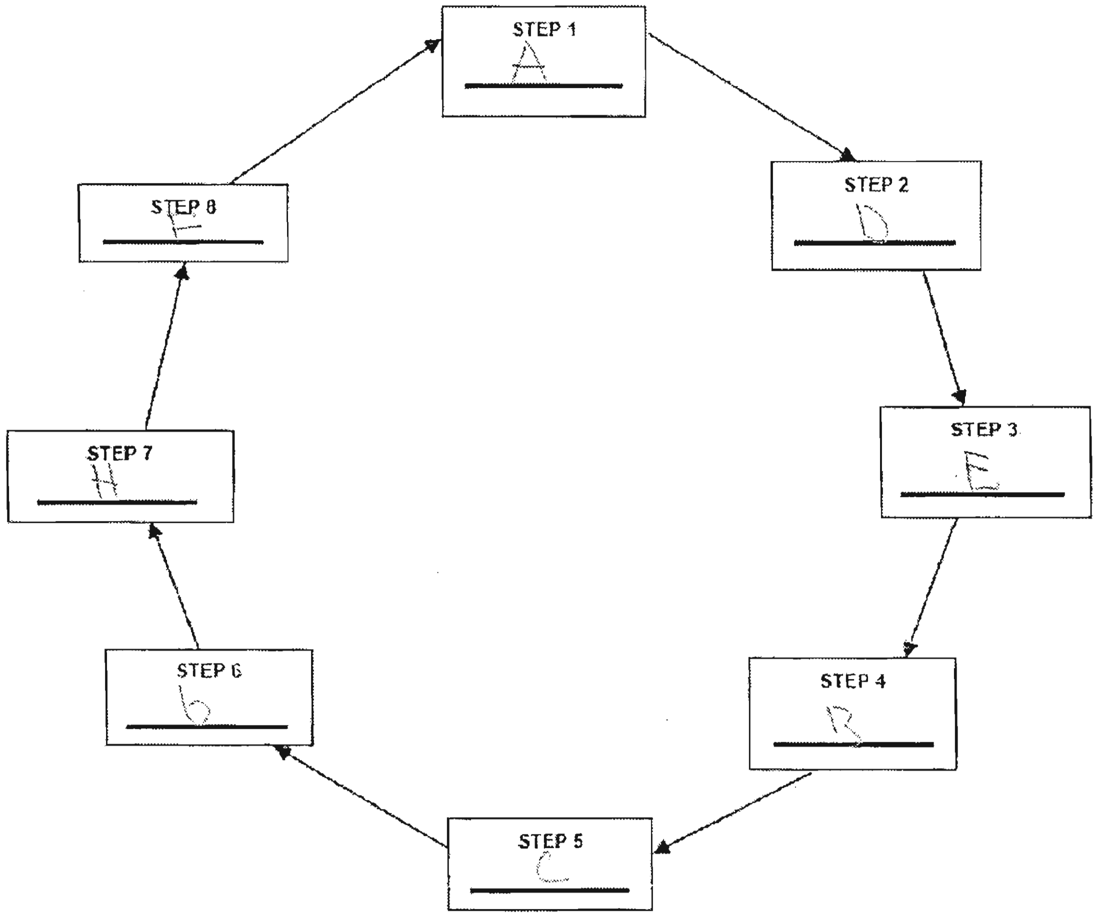
27

   b. A simple 2x4x2 cuboid



16

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

You Should make the [illegible]
[illegible] in the [illegible]
[illegible]

2

20468

Post

~~Pre~~-Test for Boat Buoyancy Lesson Plan

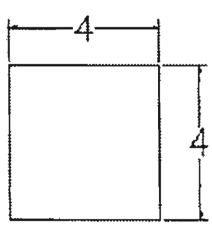
Matching

1. D Perimeter
2. A Area
3. E Volume
4. F Mass
5. B Density
6. G Surface Area
7. C Buoyancy

a. The amount of space occupied by a three-dimensional object or region of space
b. The mass per unit volume of a substance at a specified pressure and temperature
c. The upward pressure exerted upon a floating body by a fluid
d. The outer limits of an area
e. The sum of the areas of the sides of a three-dimensional object
f. The measure of the quantity of matter that a body or an object contains
g. The extent of a 2-dimensional surface enclosed within a boundary

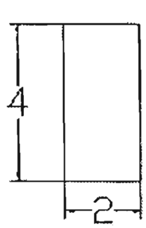
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



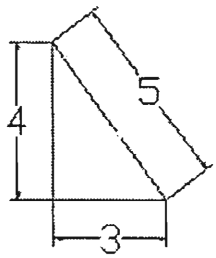
4x4 = 16
16x4 = 64
64x4 = 256

   b. A simple 2x4 rectangle



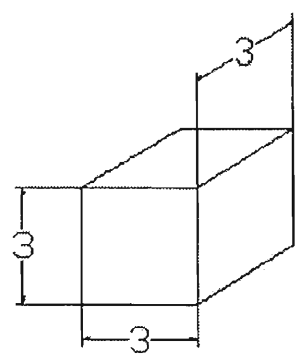
4x2 = 8
8x4 = 32
32x2 = 64

c. A simple 3x4x5 triangle



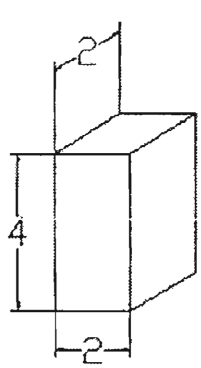
$3 \cdot 4 \cdot 5 = 60$

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



$3 \times 3 = 9$
$9 \times 3 = 27$

   b. A simple 2x4x2 cuboid

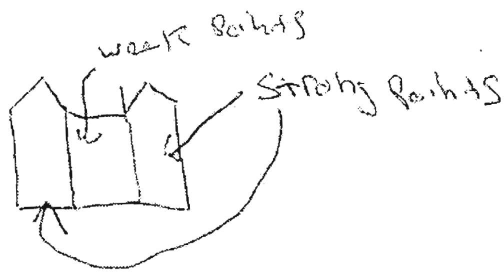


$4 \times 2 = 8$
$8 \times 2 = 16$

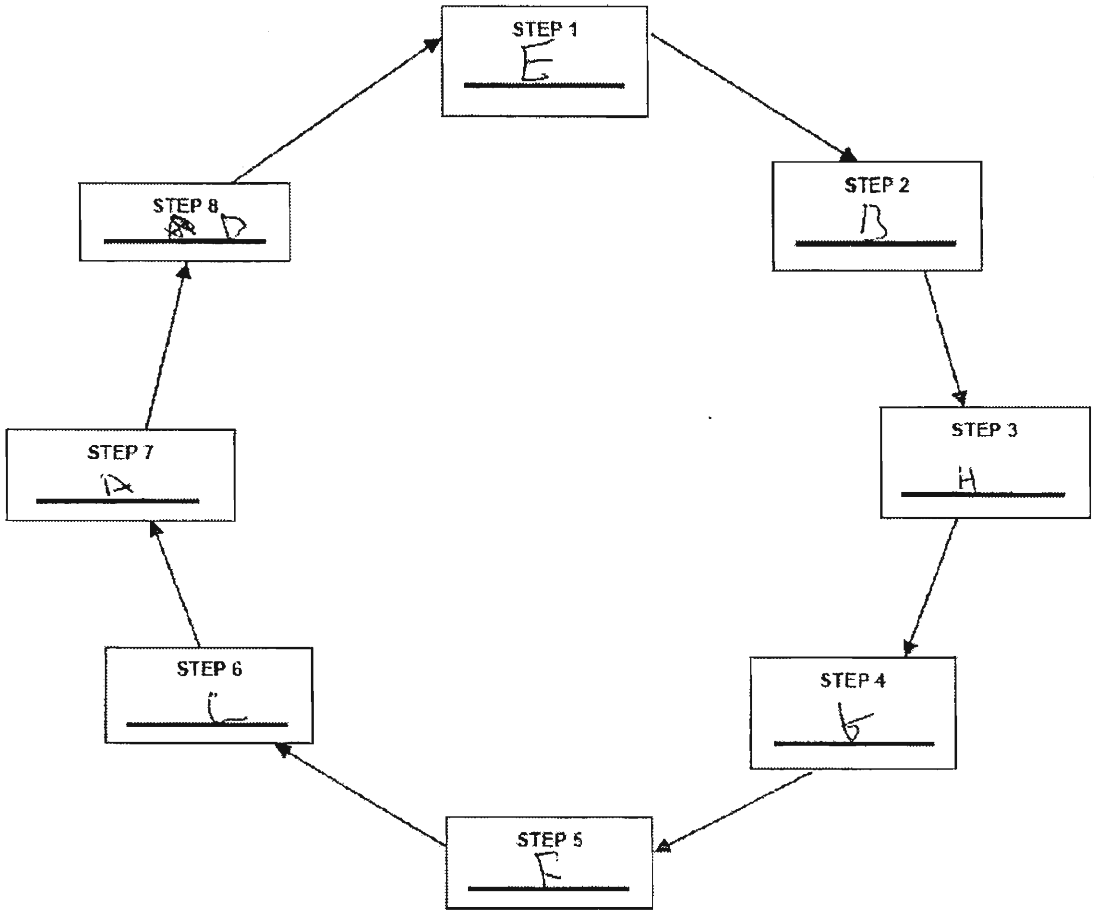
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

The Strengths of a Catermeran is on its side were most of the weight is. Its weakness is in the middle whe it is just cardboard going across. So if there is to much weight It will cave in.



Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

20380 20468

Project Analysis

Name [redacted]

[redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 112.7 kg

The Volume of your Boat = ~~5101.25~~ 3500 kg

Density of water = 1 kg/m³

Volume * Density = Total Maximum Weight

5101.25 m³ * 1 kg/m³ = ~~5101.25~~ 3500 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

5101.25 kg – 112.7 kg = ~~4988.55~~ 3387.3 kg

Actual Maximum Weight Capacity (how much your boat held before it sank) =

________ kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

Buoyancy [redacted]ence   Name_______________

During this project, you will learn about buoyancy and how it relates to things in real life. Buoyancy is the force that keeps boats afloat. You will be able to determine if an object will float or sink and possibly how to improve upon boat designs. You will use one of two basic boat designs in this project: a basic tanker, and a catamaran. The boats will be constructed from one of three materials: cardboard, manila folders, and tin foil. You will construct your boat, measure and test them for the maximum amount of weight they can hold, and then compare the outcome of each test. Since each boat will have a different design or material, each outcome should differ to some extent.

20380

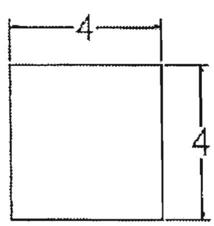
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. A Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. E Volume	c. The upward pressure exerted upon a floating body by a fluid
4. B Mass	d. The outer limits of an area
5. F Density	e. The sum of the areas of the sides of a three-dimensional object
6. G Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

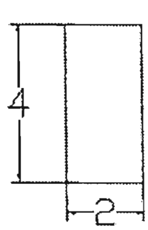
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



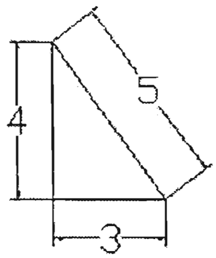
16

   b. A simple 2x4 rectangle



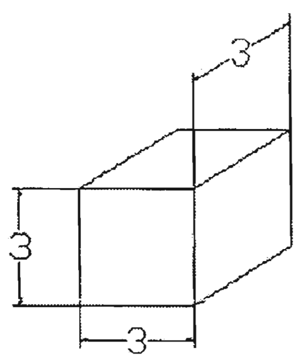
12

c. A simple 3x4x5 triangle



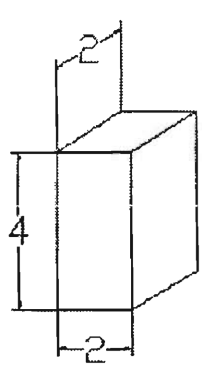
60

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



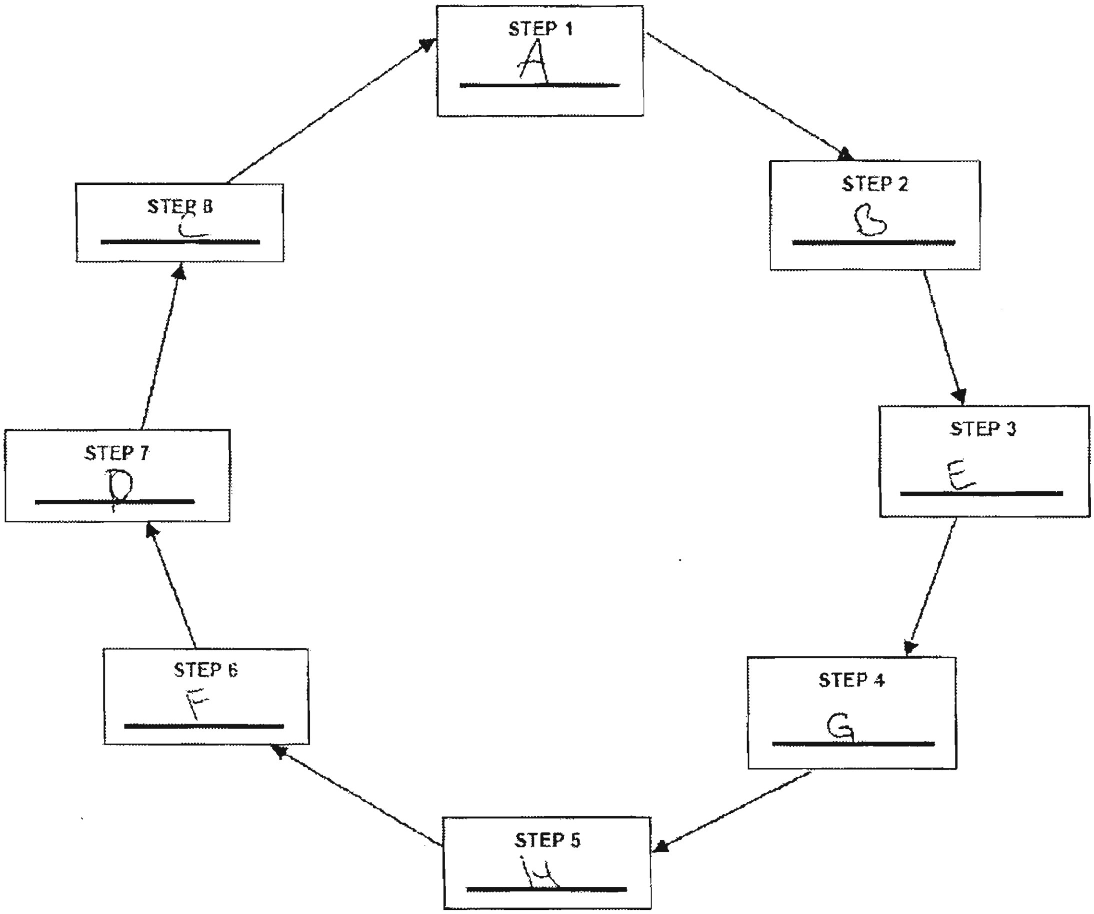
27

b. A simple 2x4x2 cuboid



16

Please identify each step within the engineering design process-



~~A~~. Construct a prototype
~~B~~. Research the problem
~~C~~. Redesign
~~D~~. Test and evaluate
~~E~~. Identify the problem
~~F~~. Select the best possible solution(s)
~~G~~. Communicate the solution(s)
~~H~~. Develop possible solutions

20380

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Some strengths I know is the type of material they are built out of.

Some weakness I know one is that the type of water they are [illegible] out of

[redacted]

20380

Post

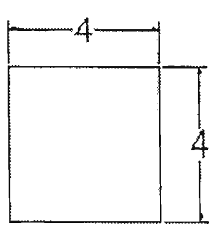
~~Pre~~Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter 2. E Area 3. B Volume 4. F Mass 5. G Density 6. A Surface Area 7. C ~~F~~ Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

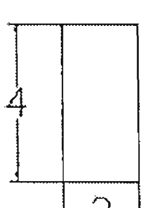
Mathematics

1. Find the perimeter and area for each of these simple shapes
    a. A simple 4x4 square



A = l·w
A = 4·4
A = 16

b. A simple 2x4 rectangle

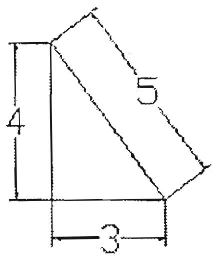


A = l·w
A = 4·2
A = 8

[redacted]

+20

c. A simple 3x4x5 triangle



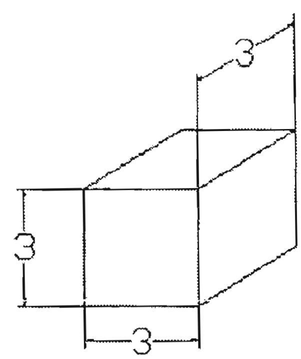
$A = \frac{1}{2}bh$

$A = \frac{1}{2}(3)(4)$

$A = \frac{1}{2}(12)$

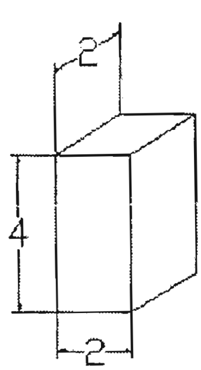
$A = 6$

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



$A = 27$

b. A simple 2x4x2 cuboid



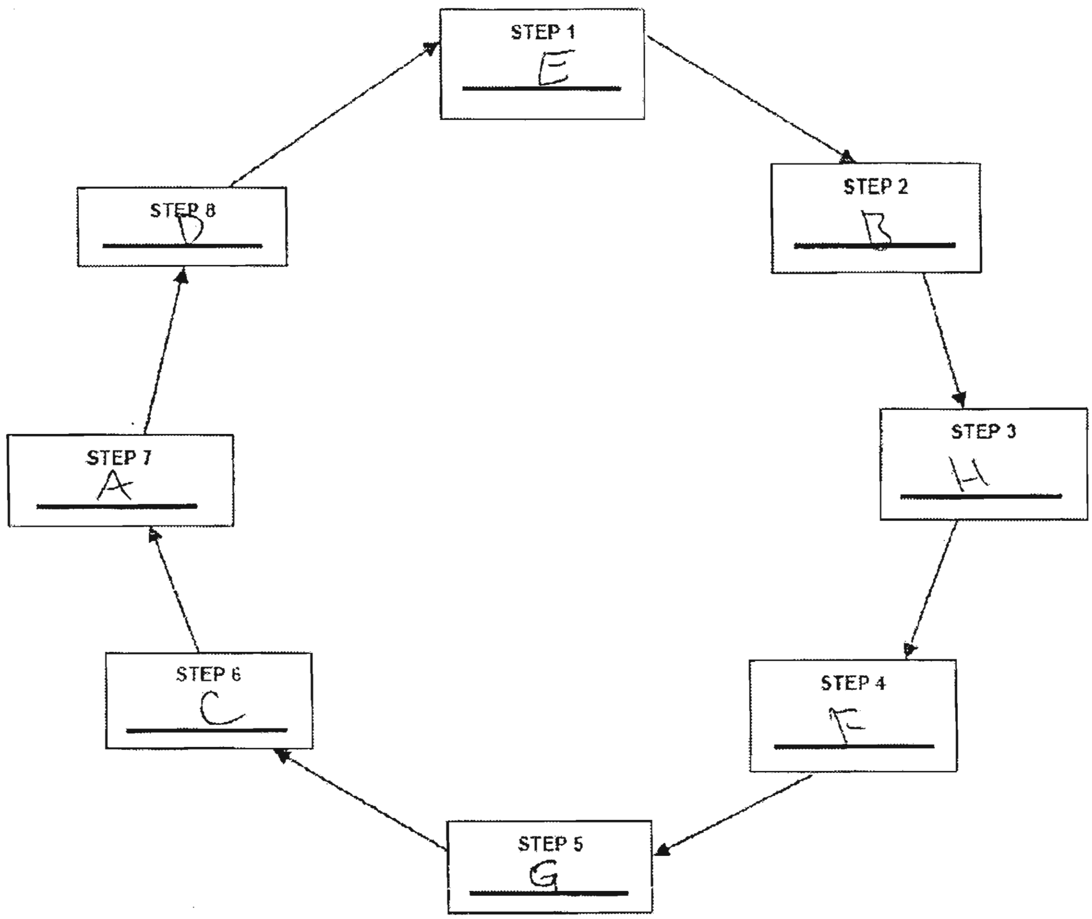
$A = 16$

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Boat designs varie on where they are going to be sailed. Boats have to be tested for sever weather conditions out on the ocean. Also some strengths are thet they can hold a lot of cargo and surpplies. some weakness are that boats can not with stand the weather on the ocean

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

20380 20468

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 112.7 kg

The Volume of your Boat = ~~5101.25~~ kg 3500

Density of water = 1 kg/m^3

Volume * Density = Total Maximum Weight

5101.25 m^3 * 1 kg/m^3 = ~~5101.25~~ kg 3500

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

5101.25 kg – 112.7 kg = ~~4988.55~~ kg 3387.3

Actual Maximum Weight Capacity (how much your boat held before it sank) =

__________ kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

~~Buoyancy Refe~~rence　　　　Name_______________

During this project, you will learn about buoyancy and how it relates to things in real life. Buoyancy is the force that keeps boats afloat. You will be able to determine if an object will float or sink and possibly how to improve upon boat designs. You will use one of two basic boat designs in this project: a basic tanker, and a catamaran. The boats will be constructed from one of three materials: cardboard, manila folders, and tin foil. You will construct your boat, measure and test them for the maximum amount of weight they can hold, and then compare the outcome of each test. Since each boat will have a different design or material, each outcome should differ to some extent.

[redacted] 20375

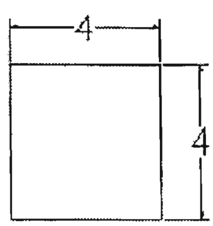
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. P Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. A Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. E Volume	c. The upward pressure exerted upon a floating body by a fluid
4. b Mass	d. The outer limits of an area
5. F Density	e. The sum of the areas of the sides of a three-dimensional object
6. G Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

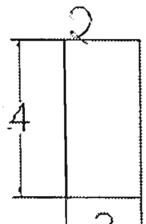
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



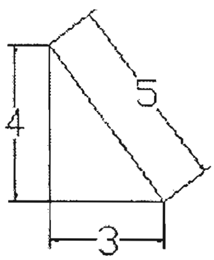
16

   b. A simple 2x4 rectangle



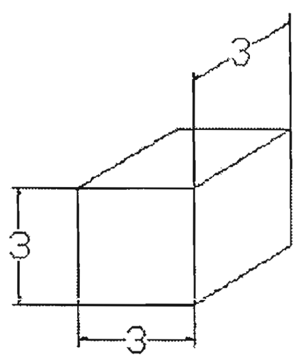
4 12

c. A simple 3x4x5 triangle



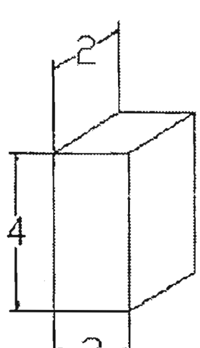
2
15
15
15
12
60

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



9
9
9
27

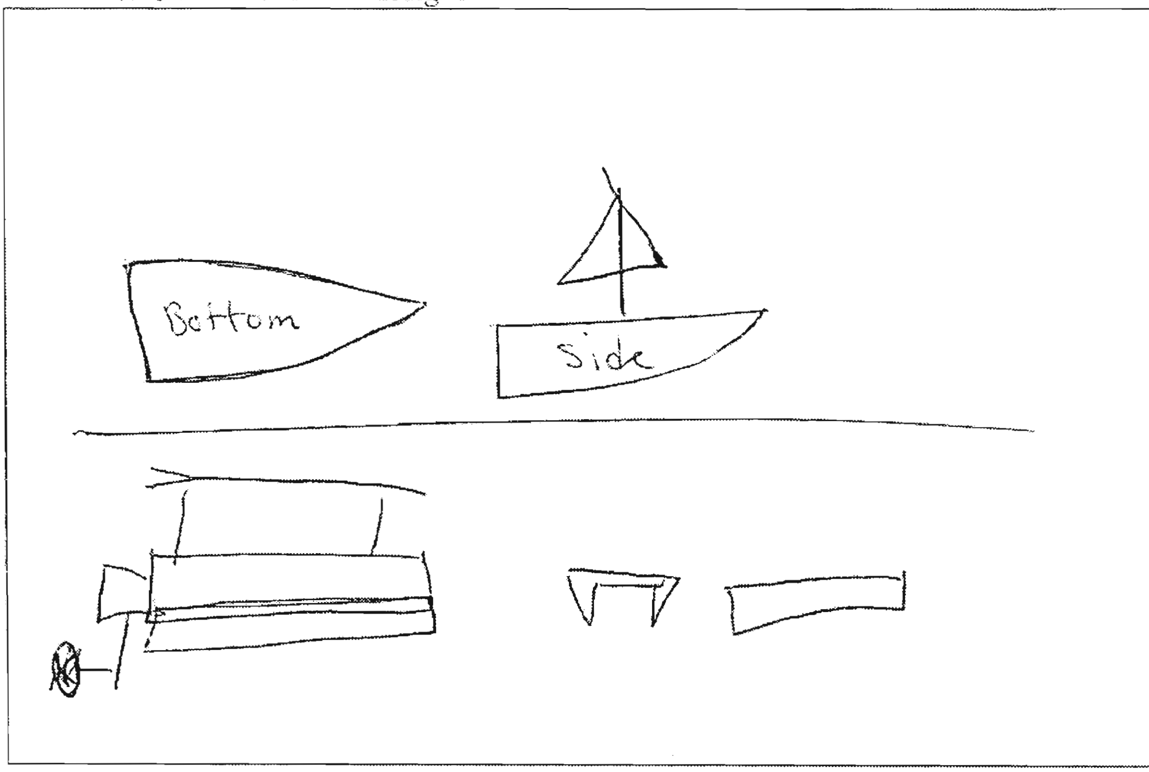
   b. A simple 2x4x2 cuboid



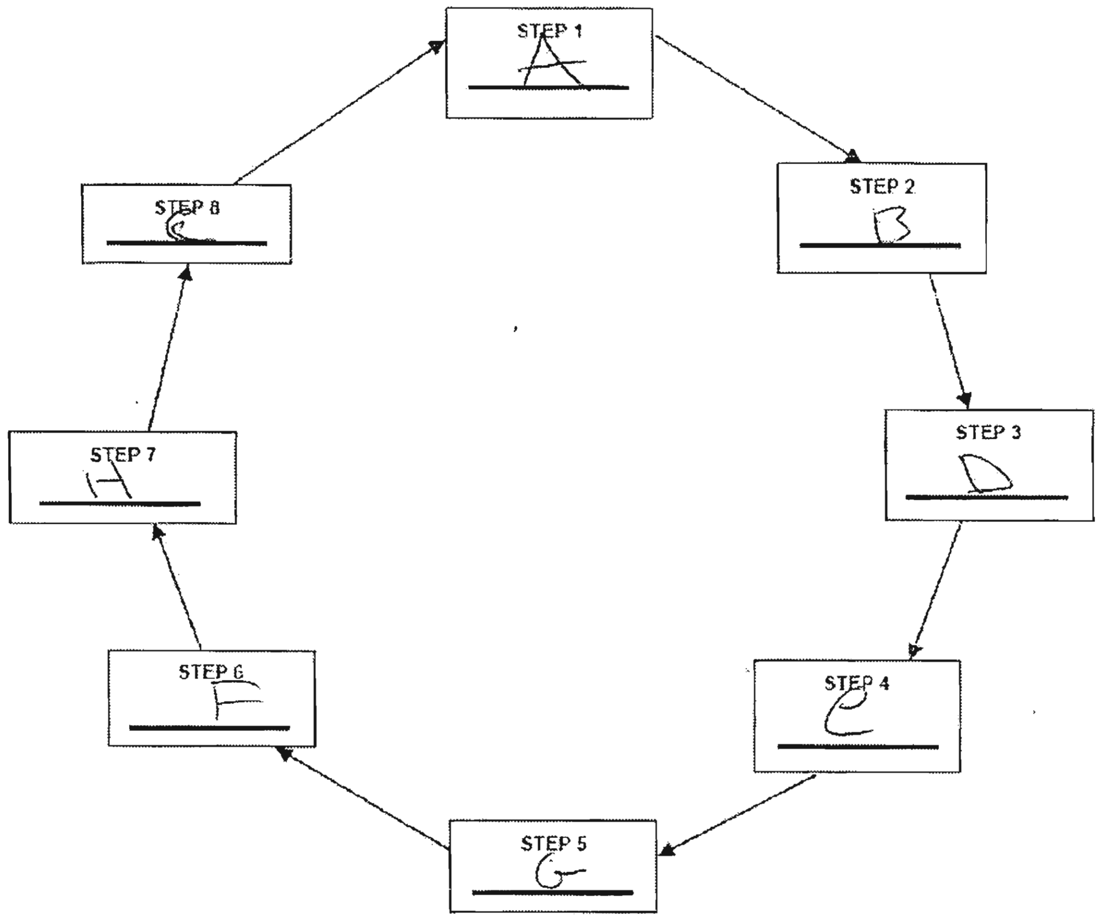
16

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-



Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

NO. 2 ID# 20375 [redacted]

Post ~~Pre~~ Test for Boat Buoyancy Lesson Plan

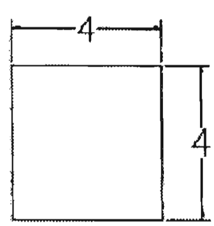
Matching

1. g Perimeter
2. e Area
3. d Volume
4. f Mass
5. b Density
6. A Surface Area
7. C Buoyancy

a. The amount of space occupied by a three-dimensional object or region of space
b. The mass per unit volume of a substance at a specified pressure and temperature
c. The upward pressure exerted upon a floating body by a fluid
d. The outer limits of an area
e. The sum of the areas of the sides of a three-dimensional object
f. The measure of the quantity of matter that a body or an object contains
g. The extent of a 2-dimensional surface enclosed within a boundary

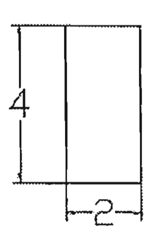
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



~~Pre~~
Perimeter = 16
area - 256

   b. A simple 2x4 rectangle

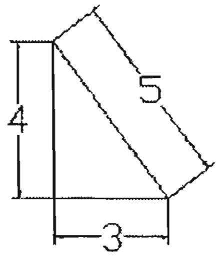


Perimeter - 12
area - 64

[redacted]

[redacted]

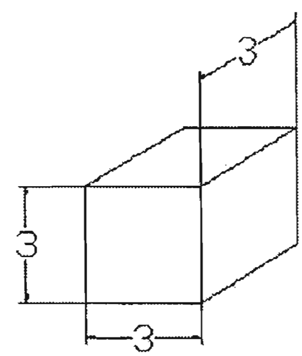
c. A simple 3x4x5 triangle



Perimeter- 12

area- 60

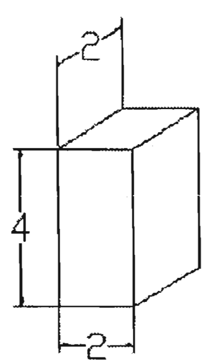
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



Sf= 9

area- 27

   b. A simple 2x4x2 cuboid

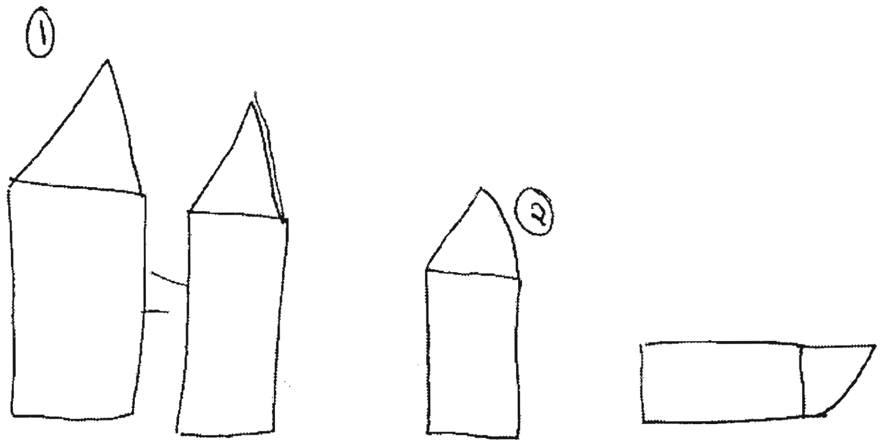


sf= 8

area- 16

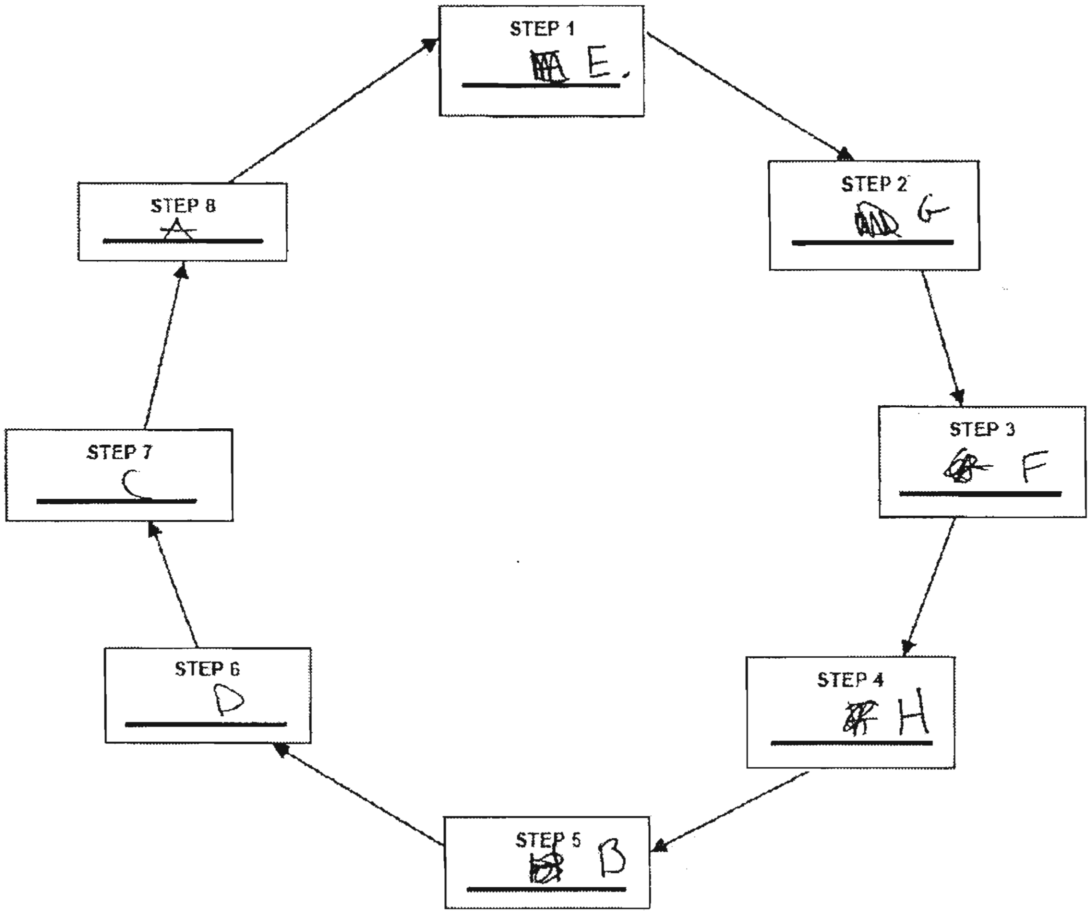
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-



Strenghts in example one are more likey to hold more weight then in two. Because of No.1 ~~ha~~ has more Surface area in the water than No. 2, meaning it takes less weight to sink No. 2 than No. 1.

Please identify each step within the engineering design process-



A. Construct a prototype
~~B~~. Research the problem ✓
C. Redesign
D. Test and evaluate
~~E~~. Identify the problem ✓
~~F~~. Select the best possible solution(s) ✓
~~G~~. Communicate the solution(s) ✓
~~H~~. Develop possible solutions ✓

30215 20375

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 84.5 kg

The Volume of your Boat = 4256 kg 32×19×7

Density of water = 1 ~~kg/m³~~ g cm²

Volume * Density = Total Maximum Weight

4256 m³ * 1 kg/m³ = 4256 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

4256 kg – 84.5 kg = 4171.5 kg

Actual Maximum Weight Capacity (how much your boat held before it sank) =

__________ kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

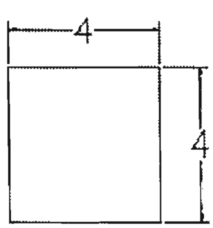
Pre-Test for Boat Buoyancy Lesson Plan

Matching

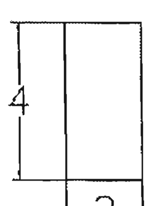
1. e Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. ___ Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. A Volume	c. The upward pressure exerted upon a floating body by a fluid
4. ___ Mass	d. The outer limits of an area
5. ___ Density	e. The sum of the areas of the sides of a three-dimensional object
6. ___ Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

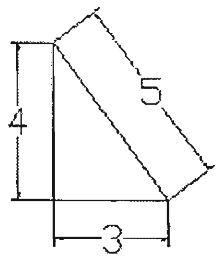
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



   b. A simple 2x4 rectangle

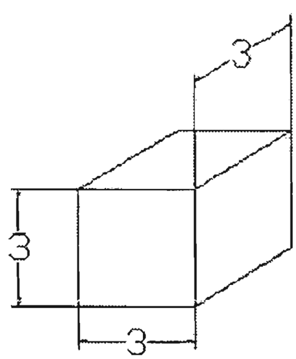


c. A simple 3x4x5 triangle



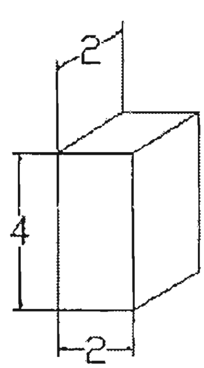
7

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



27 = A

b. A simple 2x4x2 cuboid



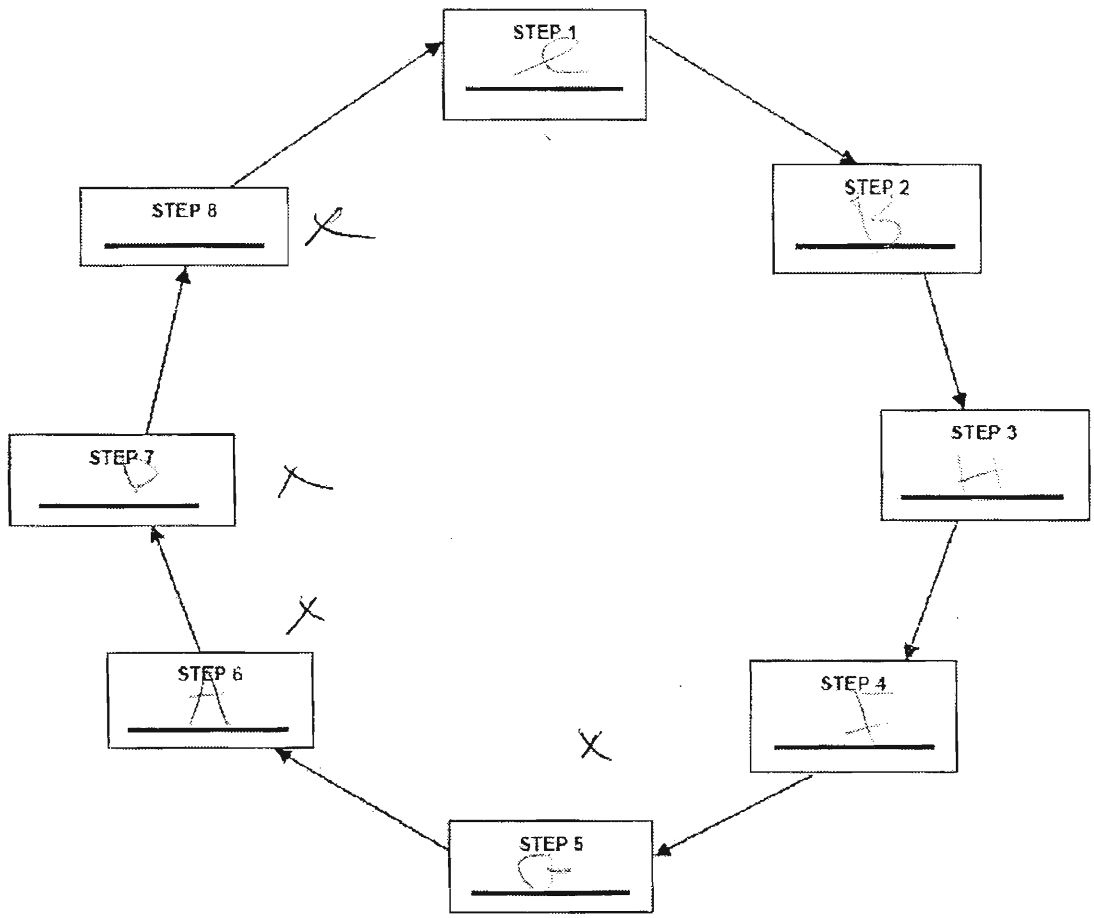
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Speed Boat

Something wrong you could [illegible] your boat

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

508417

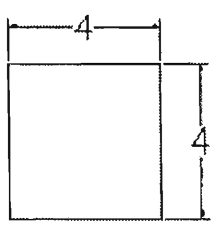
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter 2. A Area × 3. E Volume × 4. F Mass 5. B Density 6. g Surface Area × 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

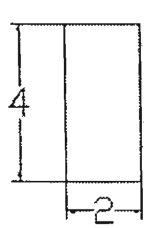
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



A=16 ✓

p= ×

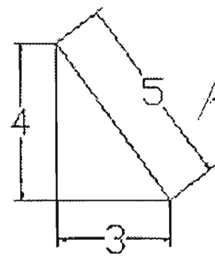
   b. A simple 2x4 rectangle



A=8 ✓

p=12 ×

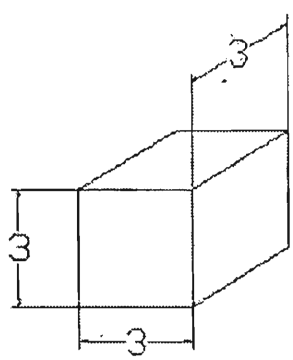
c. A simple 3x4x5 triangle



A=15 x

P=? x

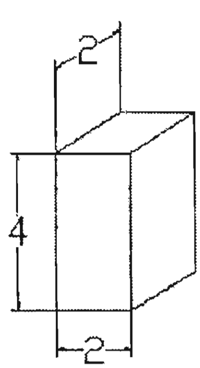
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



V=24 x

SA=9 x

b. A simple 2x4x2 cuboid



V=16 x

SA=8 x

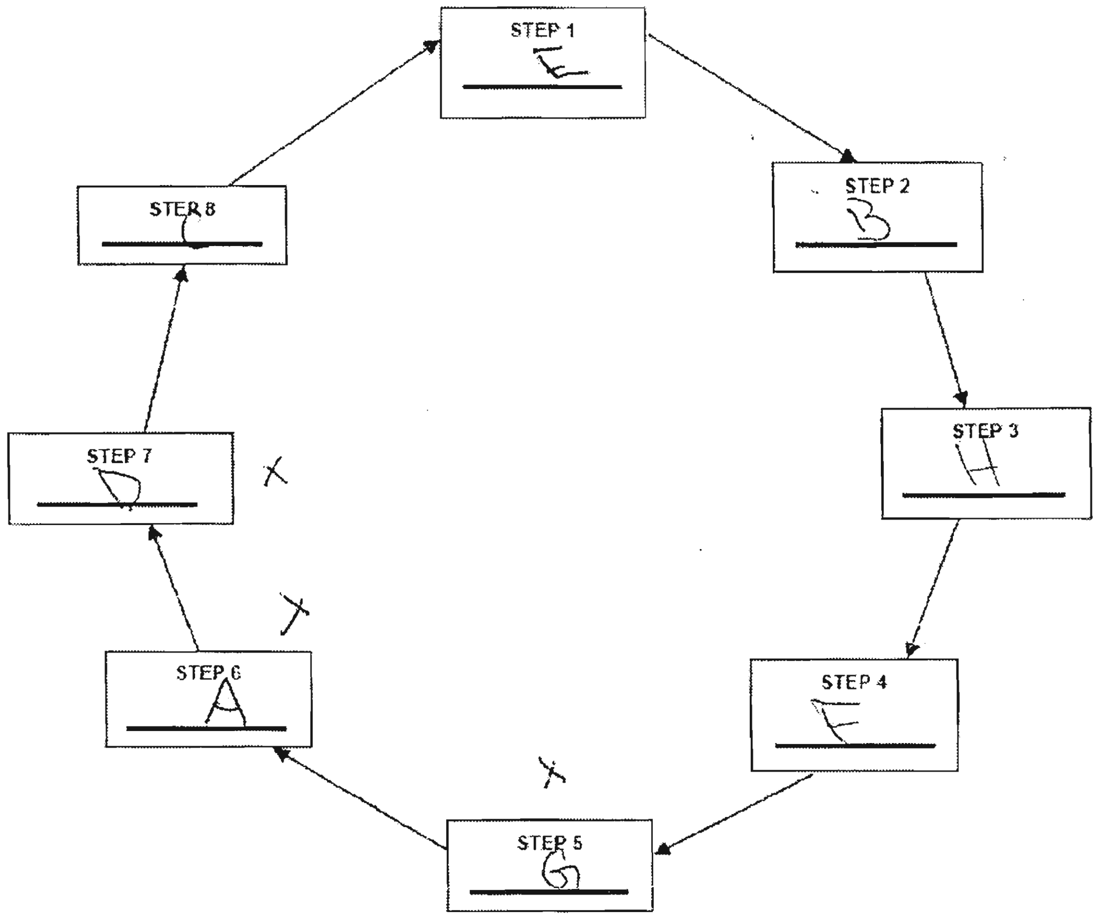
50847

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

I think that alumnum foil would be the best to make a boat. I am going to use a V hull for my boat.

Please identify each step within the engineering design process-



A. Construct a prototype
~~B. Research the problem~~
C. Redesign
D. Test and evaluate
~~E. Identify the problem~~
~~F. Select the best possible solution(s)~~
G. Communicate the solution(s)
~~H. Develop possible solutions~~

	Correct Answers	20467		3780		50330	
MATCHING		1	2	1	2	1	2
1	D	D	D	E	E	D	D
2	G	G	A	G	G	A	A
3	A	A	E	A	A	E	F
4	F	F	F	F	F	F	E
5	B	B	B	B	B	B	B
6	E	E	G	D	D	G	G
7	C	C	C	C	C	C	C
Mathematics							
1a	16	16	X	16	16	16	8
AREA	16	16	16	16	16	8	X
1b	12	12	X	12	12	6	12
AREA	8	8	12	8	8	8	X
1c	12	12	X	12	12	12	X
AREA	6	12	24	12	3.5	60	60
2a	54	72	X	54	27	3	9
VOLUME	27	27	27	27	27	27	27
2b	40	16	X	40	20	4	8
VOLUME	16	16	16	16	16	16	16
Steps							
1	E	E	E	B	E	E	E
2	B	B	B	E	B	B	B
3	H	A	H	C	C	A	A
4	F	D	G	D	A	D	H
5	A	C	F	A	D	C	G
6	D	H	A	H	H	H	F
7	G	G	D	G	G	G	D
8	C	F	C	F	F	F	C
Free Response	out of 10	4	4	1	1	2	3
Project Analysis							
Subtotals	7	7	4	5	5	4	3
	10	7	3	9	7	5	3
	8	2	4	2	3	3	3
	10	4	4	1	1	2	3
Total	out of 35	20	15	17	16	14	12

50328		**30300**		**50224**		**50237**		**50786**		**30273**
1	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**
D	D	D	D	D	D	D	D	D	D	D
G	E	G	A	E	E	G	G	G	G	G
A	A	F	G	F	F	A	A	A	A	A
F	F	A	F	A	A	F	F	F	F	F
B	B	B	B	B	B	B	B	B	B	B
E	G	E	E	G	G	E	E	E	E	E
C	C	C	C	C	C	C	C	C	C	C
8	32	16	16	16	8	16	16	X	X	16
16	16	16	14	16	16	16	16	16	16	16
6	12	12	12	12	12	12	12	X	X	12
8	8	8	8	8	8	8	8	8	8	8
12	12	23	12	12	12	12	12	X	X	12
6	30	X	6	12	8.5	5.5	6	27	6	60
9	54	27	54	72	72	27	27	27	27	27
27	27	X	27	27	27	54	54	9	X	54
8	32	16	40	32	68	16	16	16	16	16
16	16	X	16	16	16	32	56	8	X	40
E	E	E	E	E	E	E	E	E	E	E
B	B	B	B	B	B	B	B	B	B	B
A	A	H	H	H	H	A	H	H	H	H
H	C	F	F	G	G	H	G	G	G	G
C	H	G	A	F	F	G	F	F	F	A
F	F	A	D	A	A	D	A	A	A	D
G	D	D	G	D	D	F	D	D	D	C
D	G	C	C	C	C	C	C	C	C	F
4	4	4	4	0	0	0	5	1	3	1
7	5	5	5	3	3	7	7	7	7	7
6	7	4	9	7	6	8	9	4	5	9
3	2	5	8	4	4	4	4	4	4	5
4	4	3	4	0	0	0	5	1	3	1
20	**18**	**18**	**26**	**14**	**14**	**19**	**25**	**16**	**19**	**22**

	4771		**30250**		**50327**		**30547**		**50375**	
2	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
D	D	D	G	D	D	D	D	D	D	D
E	E	E	D	E	X	G	F	E	E	A
A	F	F	A	A	X	F	E	A	G	E
F	A	A	F	F	A	A	X	F	F	F
B	B	B	B	B	X	E	B	B	B	B
G	G	G	E	G	X	B	G	G	A	G
C	C	C	C	C	C	C	C	C	C	C
16	16	16	16	16	16	16	18	16	18	16
16	16	16	16	16	16	112	X	X	18	X
12	12	12	12	12	12	12	12	12	12	12
8	8	8	8	8	X	X	X	X	8	X
12	12	12	12	12	12	5	60	12	12	30
6	6	6	X	6	X	15	X	X	12	X
27	27	27	27	9	12	X	27	27	27	27
56	72	72	X	56	X	18	X	X	9	X
16	16	16	16	8	20	16	16	16	16	16
40	56	64	X	64	X	20	X	X	8	X
E	A	A	E	E	X	A	E	E	E	E
B	D	D	B	B	X	C	B	B	B	B
H	E	E	H	H	X	D	G	G	C	H
G	B	B	F	F	X	E	H	H	H	F
F	H	H	G	A	X	B	F	A	F	A
A	G	G	A	D	X	F	A	D	A	D
C	F	F	C	C	X	B	D	C	D	G
D	C	C	D	G	X	H	C	F	G	C
5	5	5	6	6	7	7	4	6	7	9
5	3	3	5	5	2	3	3	5	4	4
9	8	8	7	6	4	3	3	5	5	4
3	1	1	4	6	0	0	3	4	2	8
5	5	5	6	6	7	7	4	6	7	9
22	**17**	**17**	**22**	**23**	**13**	**13**	**13**	**20**	**18**	**25**

50320		**50223**	
1	**2**	**1**	**2**
D	D	D	D
G	G	E	E
A	A	F	A
F	F	A	F
B	B	B	B
E	E	G	G
C	C	C	C
16	16	16	16
16	16	16	X
12	12	12	12
8	8	8	X
12	12	12	12
6	6	12	X
27	27	28	27
54	54	9	9
16	16	16	16
40	40	8	8
E	E	E	B
B	B	B	B
H	H	A	H
G	G	H	G
F	F	F	F
A	A	G	A
D	D	D	D
C	C	C	C
8	7	5	7
7	7	3	5
9	9	6	5
4	4	3	3
8	7	5	7
28	**27**	**17**	**20**

Cat.

Project Analysis

Name [redacted]

22259

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 91.5 kg

The Volume of your Boat = 3870 kg

Density of water = 1 kg/m^3

Volume * Density = Total Maximum Weight

3,870 m^3 * 1 kg/m^3 = 3,870 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

3,870 kg – 91.5 kg = 3,778.5 kg 3.8 kg.

Actual Maximum Weight Capacity (how much your boat held before it sank) =

4.3 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

The maximum weight capacity is 3.8 kg, which my floated with. The actual maximum capacity is 4.3 kg, which should sink my boat, but it didn't.

20259 [redacted]

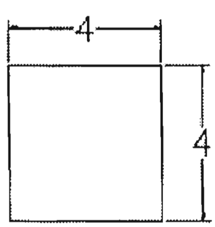
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter 2. F Area 3. B Volume 4. F Mass 5. A Density 6. G Surface Area 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

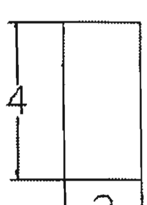
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



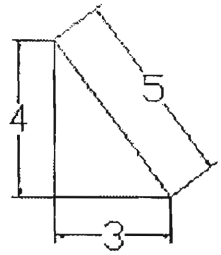
A: 16
P: 16

   b. A simple 2x4 rectangle



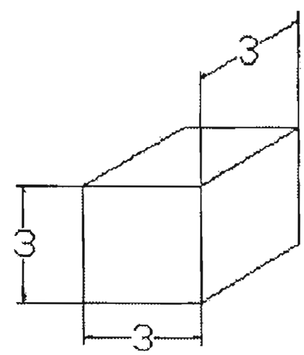
A: 8
P: 12

c. A simple 3x4x5 triangle



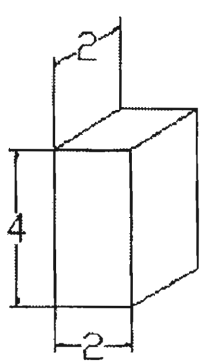
A =
P =

2. Find the volume and surface area of these simple shapes
    a. A simple 3x3x3 cube



A =
P =

b. A simple 2x4x2 cuboid

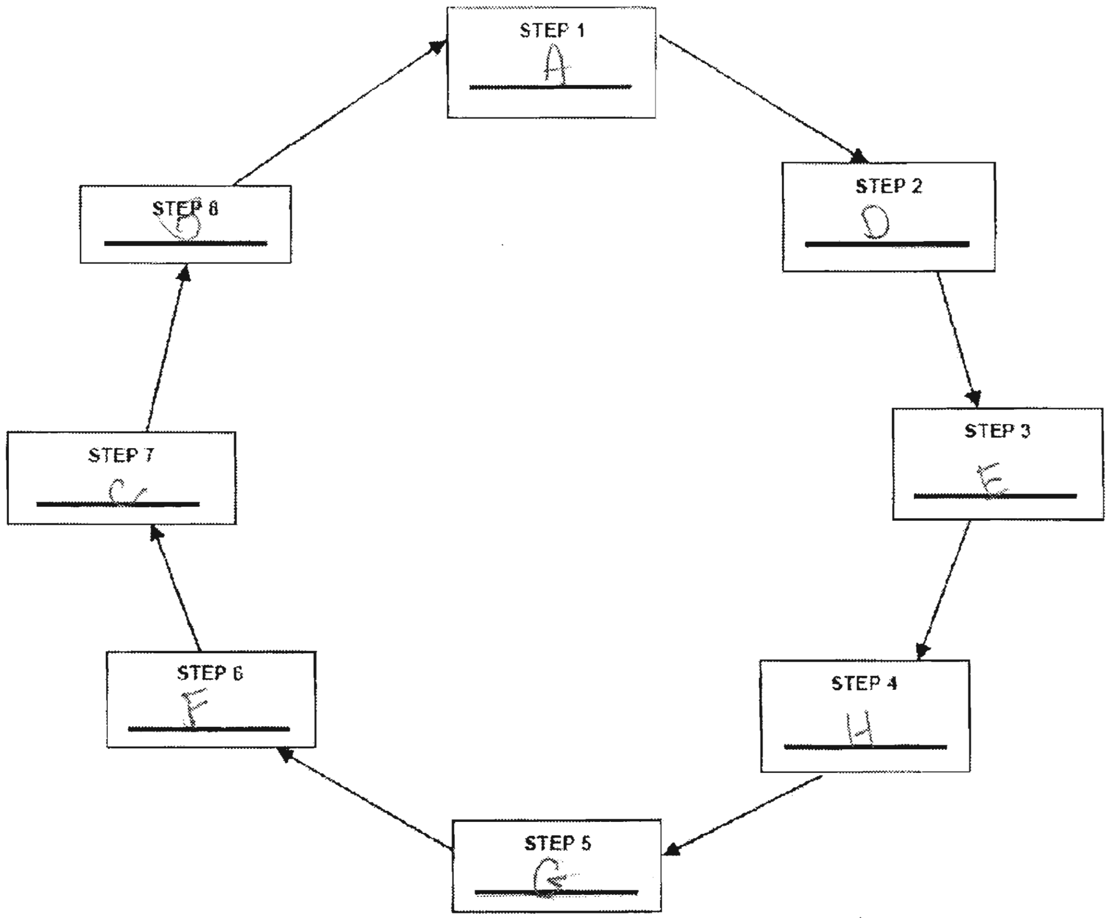


A =
P =

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

[redacted]50786

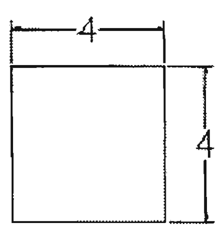
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. d Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. g Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. a Volume	c. The upward pressure exerted upon a floating body by a fluid
4. f Mass	d. The outer limits of an area
5. b Density	e. The sum of the areas of the sides of a three-dimensional object
6. e Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

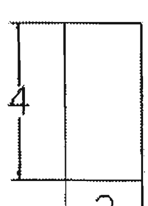
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



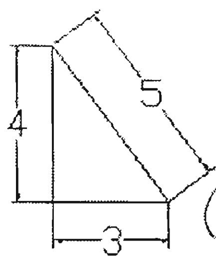
16

b. A simple 2x4 rectangle



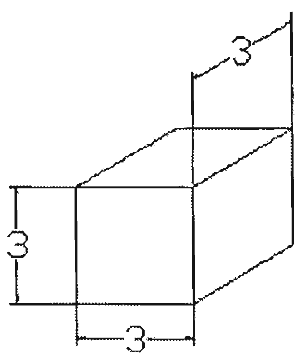
8

c. A simple 3x4x5 triangle



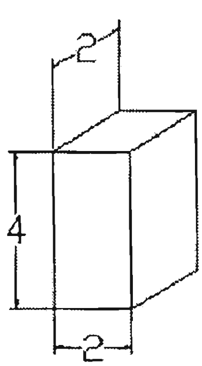
6

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



27

   b. A simple 2x4x2 cuboid



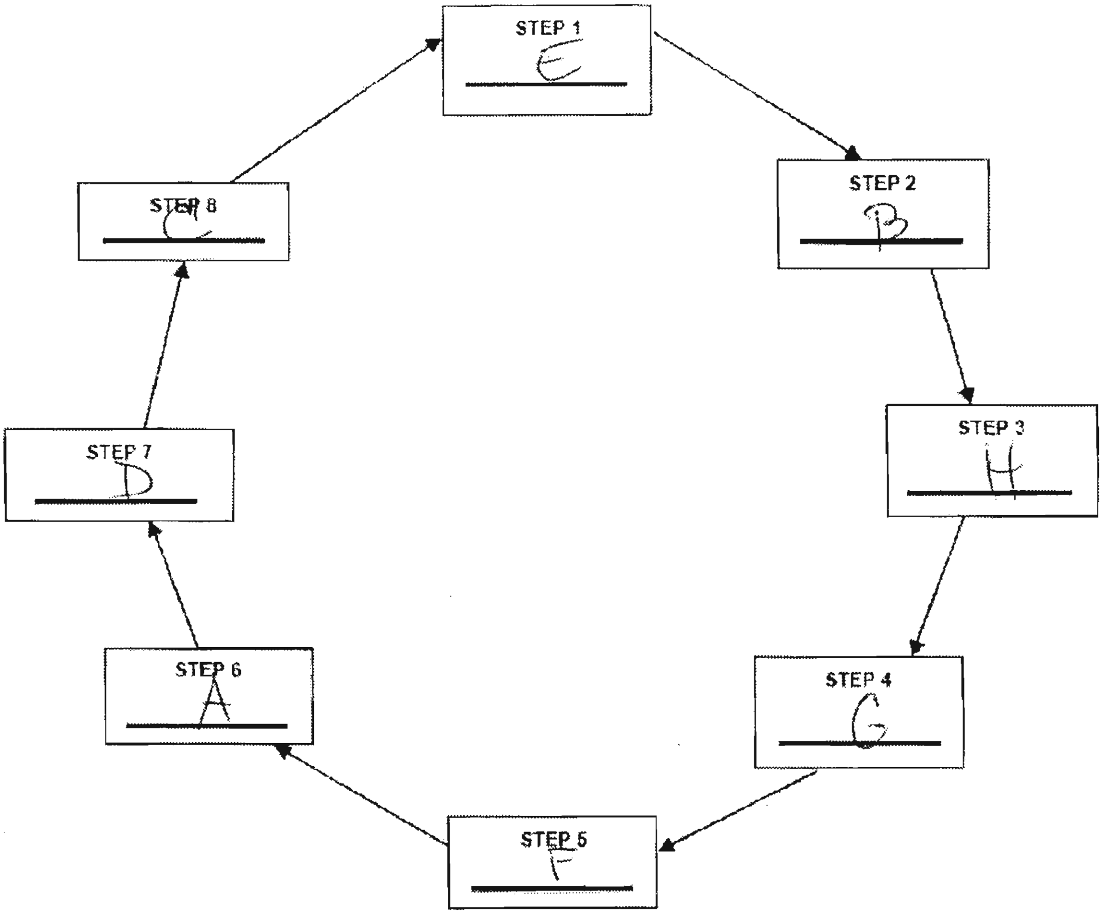
16

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Seemed that Catamarans Could Hold more weight than the tankers.
Sometimes the platforms on catamarans could fold in half.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

ⓑ Cat. 50786

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = ~~0.12116125~~ kg 122 g.

The Volume of your Boat ≈ 136642.25 kg 3834

Density of water = 1 kg/m^3

Volume * Density = Total Maximum Weight

3834 m^3 * 1 kg/m^3 = 3834 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

3834 kg – 122 kg = 3712 kg 3.7 kg.

Actual Maximum Weight Capacity (how much your boat held before it sank) =

3.7 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

they were the same

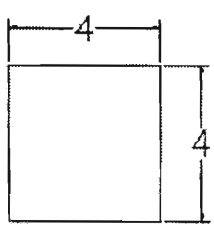
Pre-Test for Boat Buoyancy Lesson Plan 50375

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. E Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. G Volume	c. The upward pressure exerted upon a floating body by a fluid
4. F Mass	d. The outer limits of an area
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. A Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

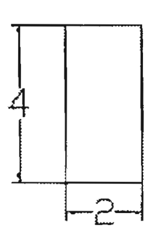
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



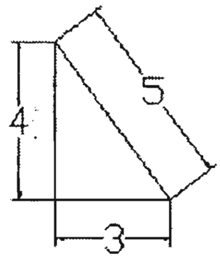
P = 18
A = 18

   b. A simple 2x4 rectangle



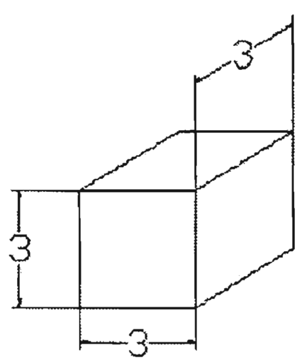
P = 12
A = 8

c. A simple 3x4x5 triangle



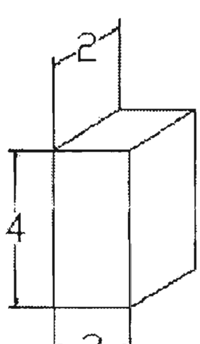
P=12
A=12

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



V=27
A=9

   b. A simple 2x4x2 cuboid



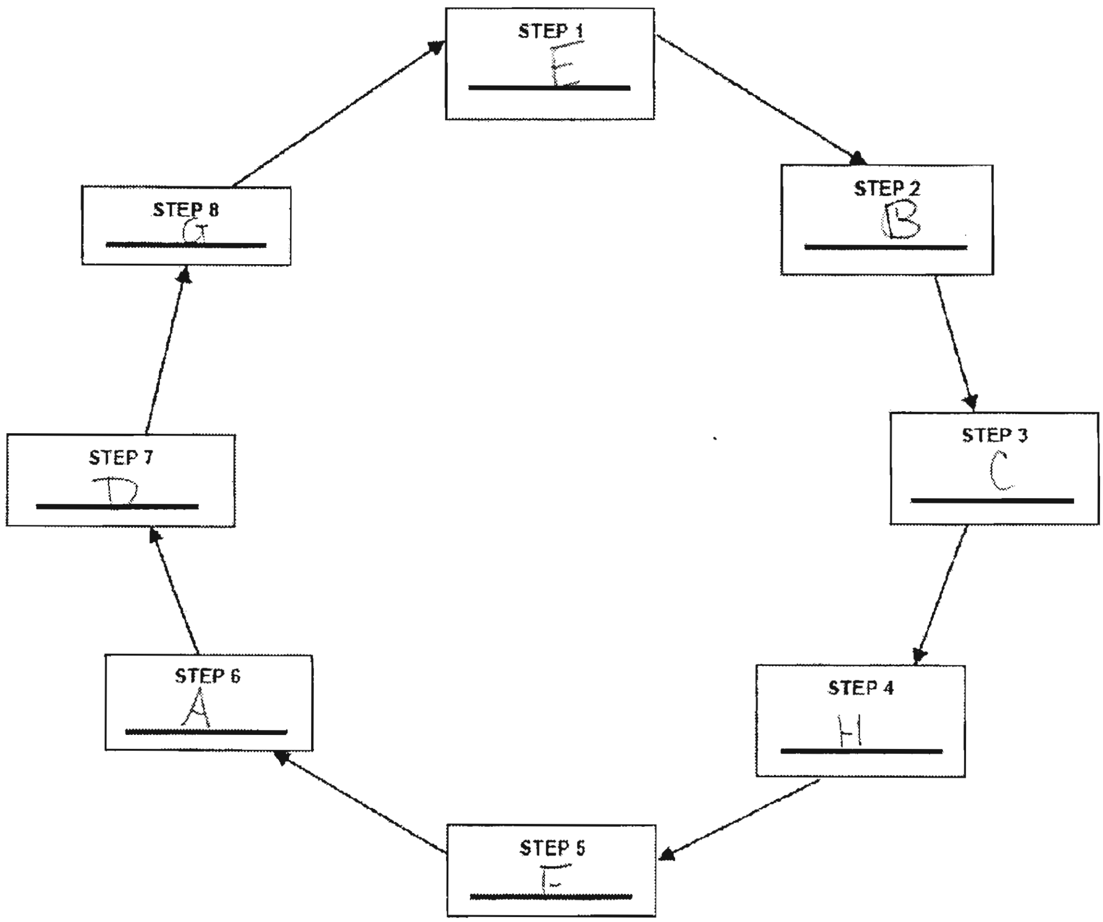
V=16
A=8

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

I know that a catamarane boat has more stability Then a regular boat. and that most catamaran boats are [illegible] boats.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
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D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Post-Test for Boat Buoyancy Lesson Plan

Matching

1. d Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. a Area	b. The mass per unit volume of a substance at a specified pressure and temperature
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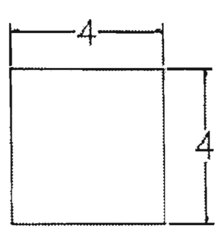
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. g Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

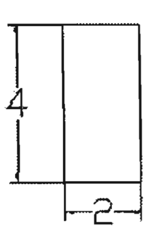
Mathematics

1. Find the perimeter and area for each of these simple shapes
    a. A simple 4x4 square



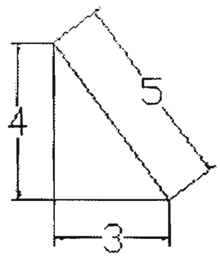
16

b. A simple 2x4 rectangle



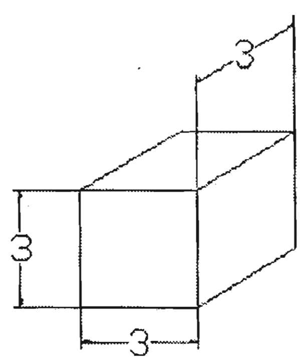
12

c. A simple 3x4x5 triangle



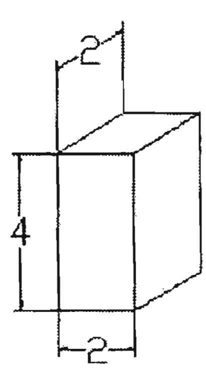
30

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



27

   b. A simple 2x4x2 cuboid



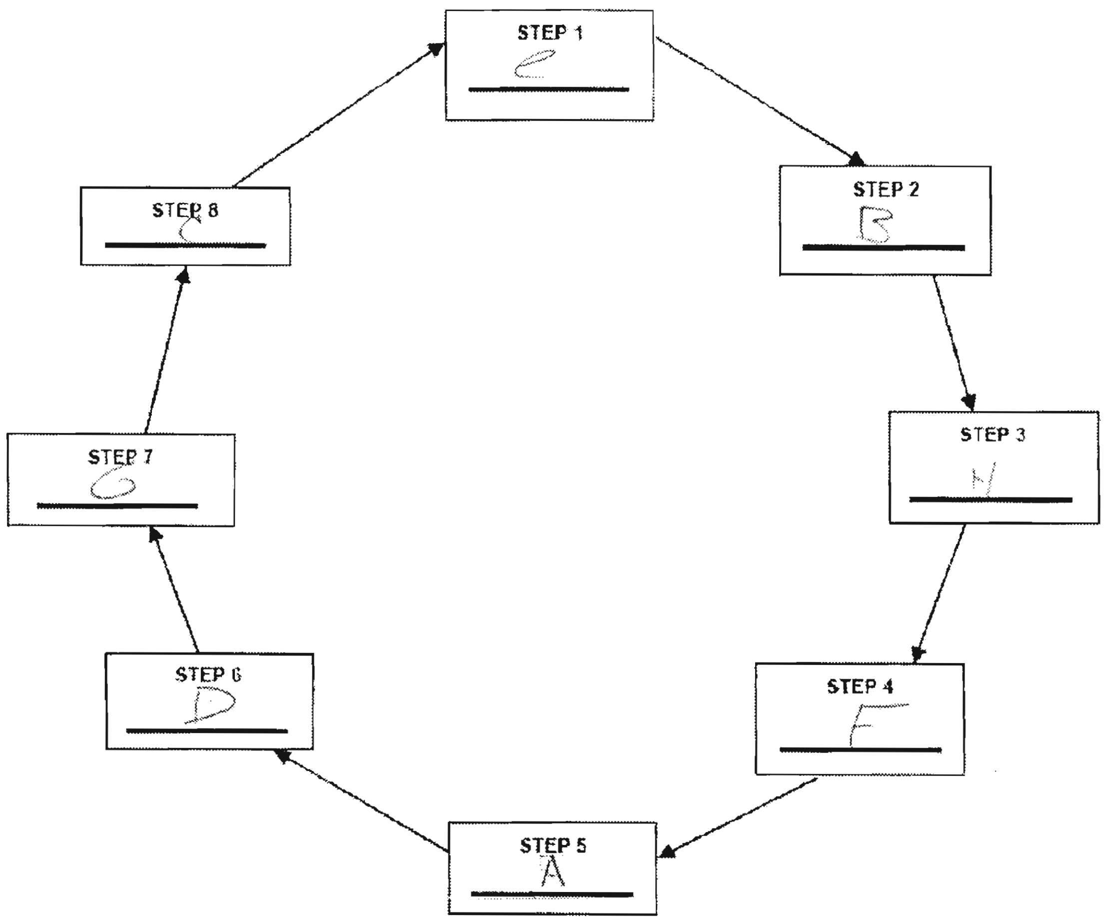
16

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

I Know that the regular Boat is good but is able to be rolled over very easily. The submarine is very flimsy in the middle but is very hard to roll over.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

√Key. 50375 SANK

Project Analysis Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed. 47.8

~~47.8~~ 47.8

The Weight of your Boat = ~~47.8~~ kg

The Volume of your Boat = ~~3559.5~~ kg ~~2853~~ 3559

Density of water = ~~1~~ 1 ~~Kg/m³~~ g/cm

Volume * Density = Total Maximum Weight

~~2853~~ cm³ * ~~1000~~ 1 ~~kg/m³~~ g/cm³ = ~~2853~~ 3,559 kg

3559

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

~~2853~~ 3559 kg – 47.8 kg = ~~2805.2~~ 3511.2 kg ~~2.81 Kg.~~ 3.51 Kg

Actual Maximum Weight Capacity (how much your boat held before it sank) =

~~2805.2~~ kg 3.51 Kg Sank

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

The numbers are very different ~~and my~~ because my calculations were off.

50330

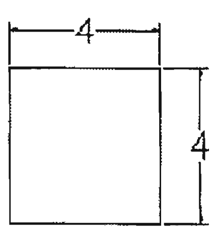
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. A Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. E Volume	c. The upward pressure exerted upon a floating body by a fluid
4. F Mass	d. The outer limits of an area
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. G Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

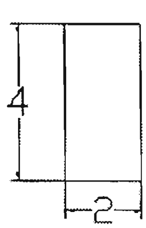
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



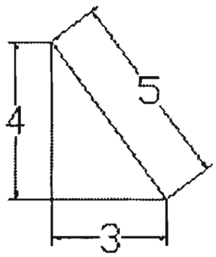
16
8

   b. A simple 2x4 rectangle



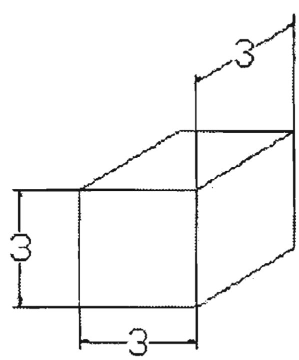
8
6

c. A simple 3x4x5 triangle



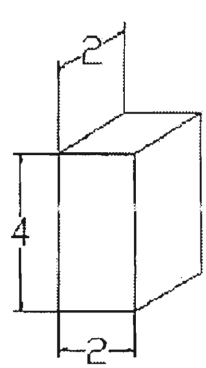
60
12

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



27
3

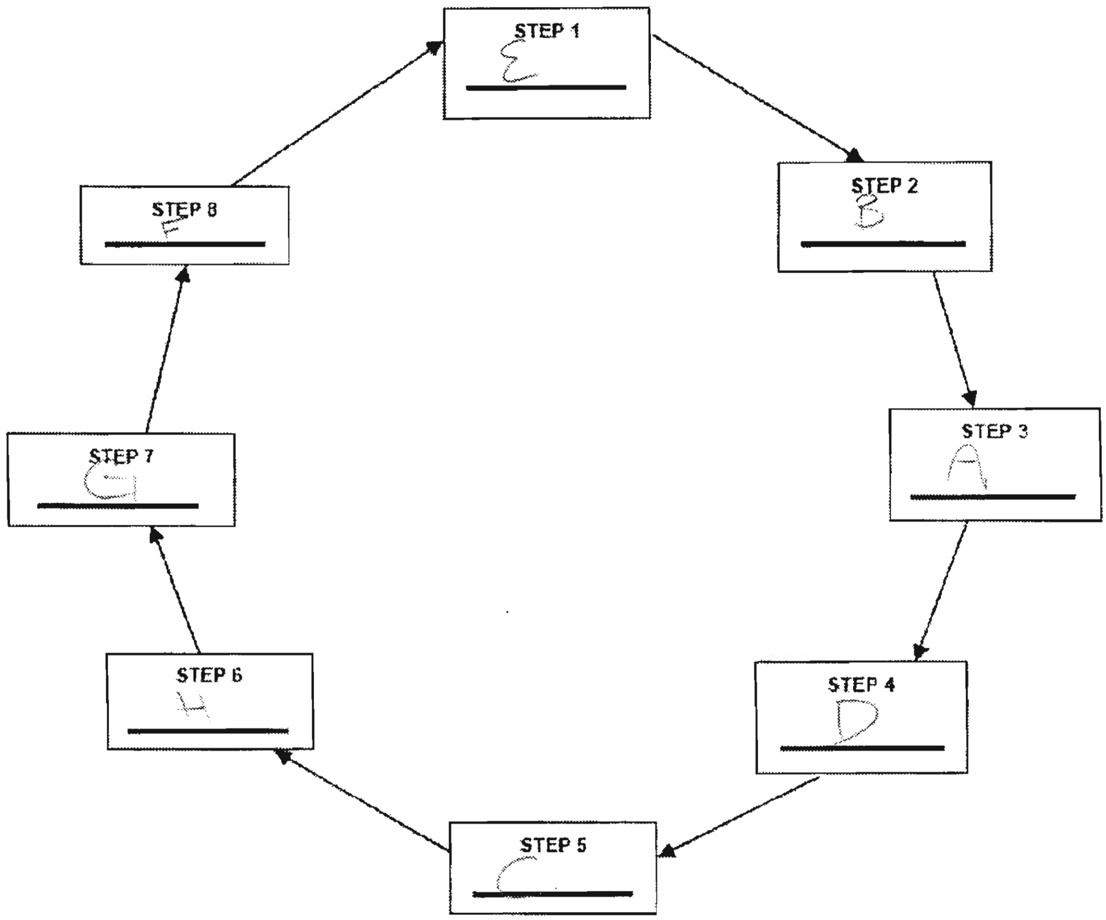
   b. A simple 2x4x2 cuboid



16
4

50330

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

- Needs to be balanced
- Parts need to fit into eachother

30330

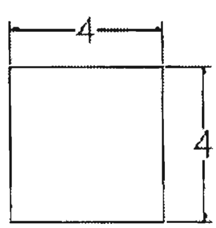
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter 2. A Area 3. F Volume 4. E Mass 5. B Density 6. G Surface Area 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

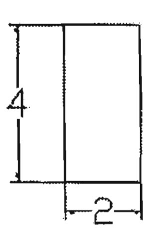
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



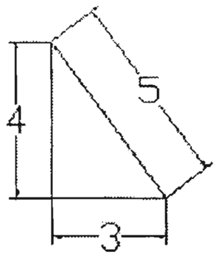
8

b. A simple 2x4 rectangle



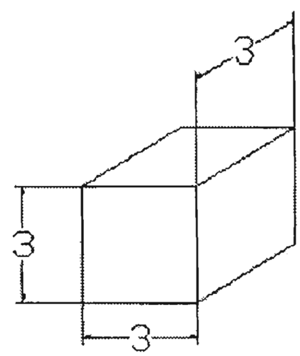
12

c. A simple 3x4x5 triangle



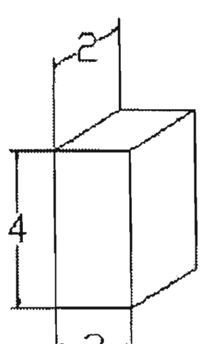
60

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



9 27

   b. A simple 2x4x2 cuboid



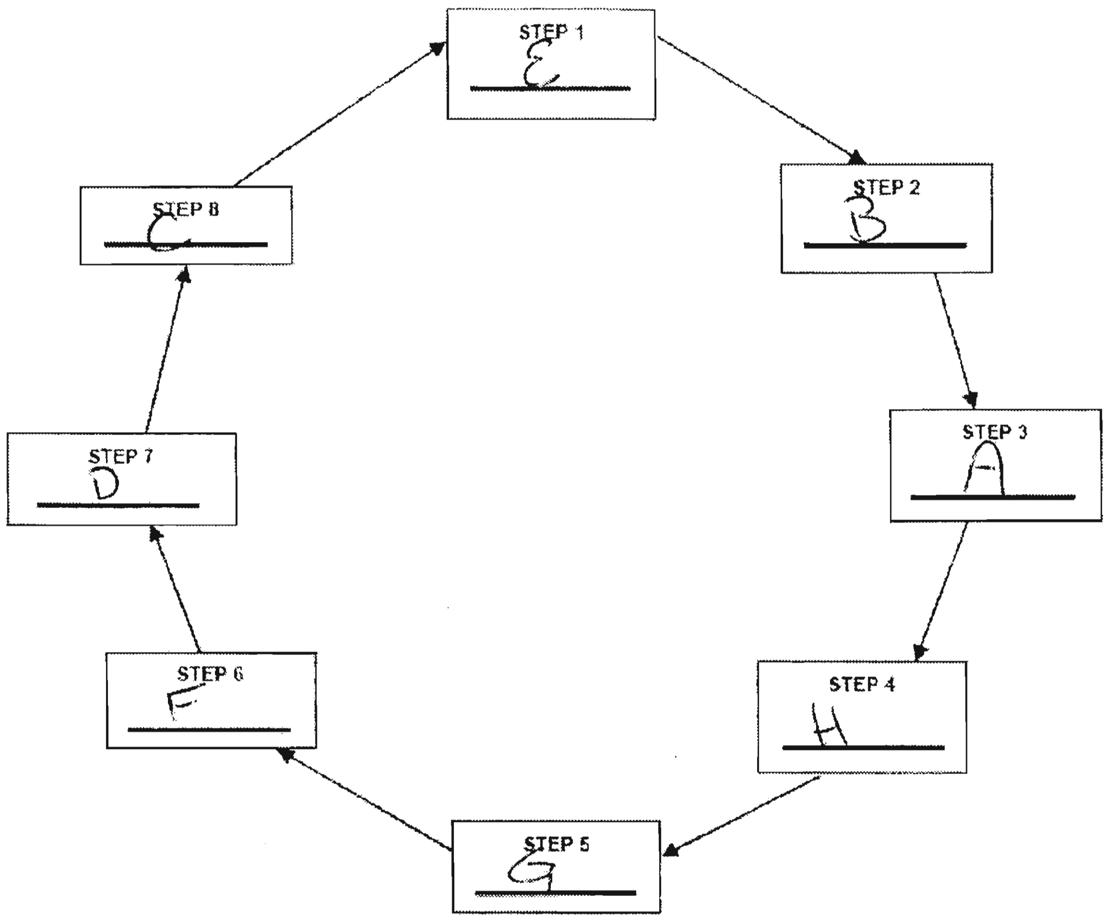
16 8

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Tanker	Catamaran
weighs less	Weight is distributed to two sides weighs more

Please identify each step within the engineering design process-



~~A.~~ Construct a prototype
~~B.~~ Research the problem
~~C.~~ Redesign
~~D.~~ Test and evaluate
~~E.~~ Identify the problem
~~F.~~ Select the best possible solution(s)
~~G.~~ Communicate the solution(s)
~~H.~~ Develop possible solutions

50390

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 83.2 ~~k~~g

The Volume of your Boat = 3222 ~~k~~g 3222

Density of water = 1 ~~kg/m³~~ g/cm³

Volume * Density = Total Maximum Weight

3222 cm³ * 1 ~~kg/m³~~ g/cm³ = 3222 Kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

3222 kg – 83.2 kg = 239.0 kg 2.69 Kg

Held 3 Kg

Actual Maximum Weight Capacity (how much your boat held before it sank) =

3 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

- My boat was supposed to hold 2.69 Kg, but ended up holding 3 Kg. This may have happened because of a miscalculation when I weighed my boat on the scale.

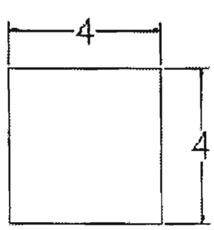
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. d Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. g Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. a Volume	c. The upward pressure exerted upon a floating body by a fluid
4. f Mass	d. The outer limits of an area
5. b Density	e. The sum of the areas of the sides of a three-dimensional object
6. e Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. c Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

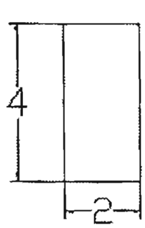
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



Perimeter· 8

Area- 16

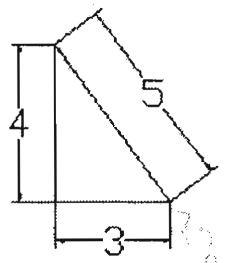
   b. A simple 2x4 rectangle



Perimeter - 6

Area- 8

c. A simple 3x4x5 triangle

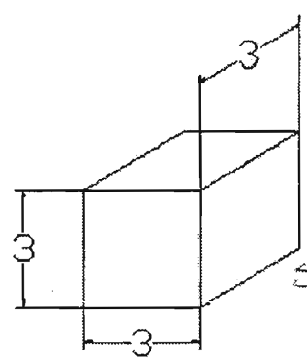


Perimeter - 12

Area - 6

½b·h

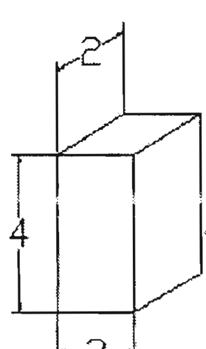
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



volume - 27

surface Area - 9

   b. A simple 2x4x2 cuboid



volume - 16

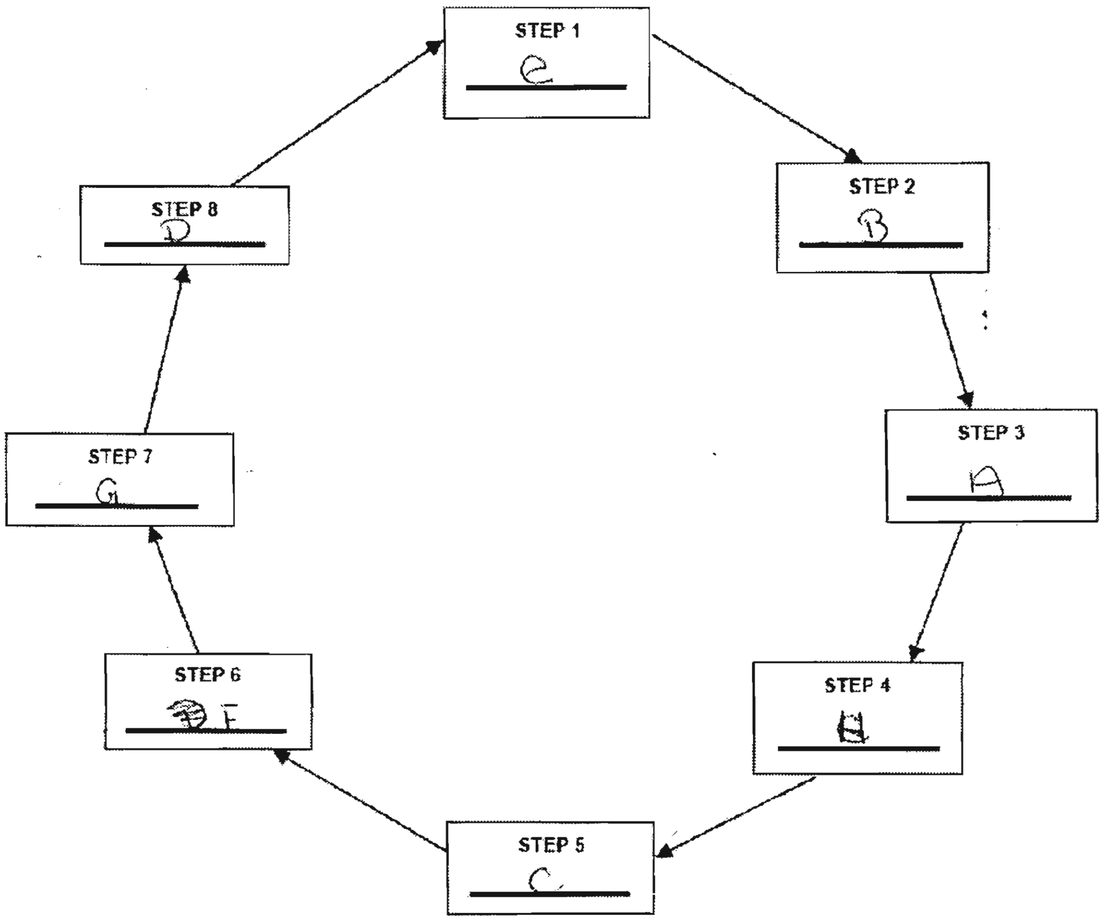
surface Area - 8

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

The boat needs to have weight distributed evenly so it can stay afloat. The boat also needs to have a well constructed bottom.

Please identify each step within the engineering design process-



- A. Construct a prototype
- B. Research the problem
- C. Redesign
- D. Test and evaluate
- E. Identify the problem
- F. Select the best possible solution(s)
- G. Communicate the solution(s)
- H. Develop possible solutions

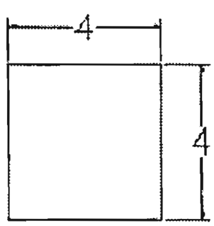
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. d Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. e Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. a Volume	c. The upward pressure exerted upon a floating body by a fluid
4. f Mass	d. The outer limits of an area
5. b Density	e. The sum of the areas of the sides of a three-dimensional object
6. g Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. c Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

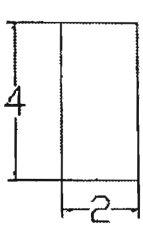
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



Perimeter - 32
4+4+4+4=32

Area - 16

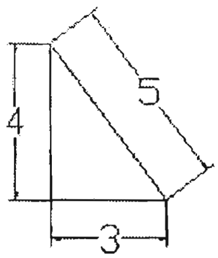
   b. A simple 2x4 rectangle



Perimeter - 12

area - 8

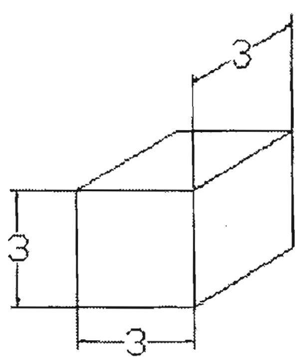
c. A simple 3x4x5 triangle



Perimeter - 12

area - 30

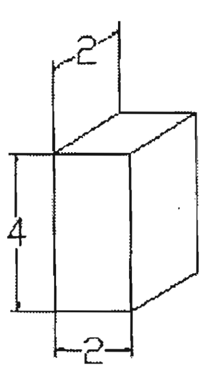
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



volume - 27

surface area - 54

   b. A simple 2x4x2 cuboid



volume - 16

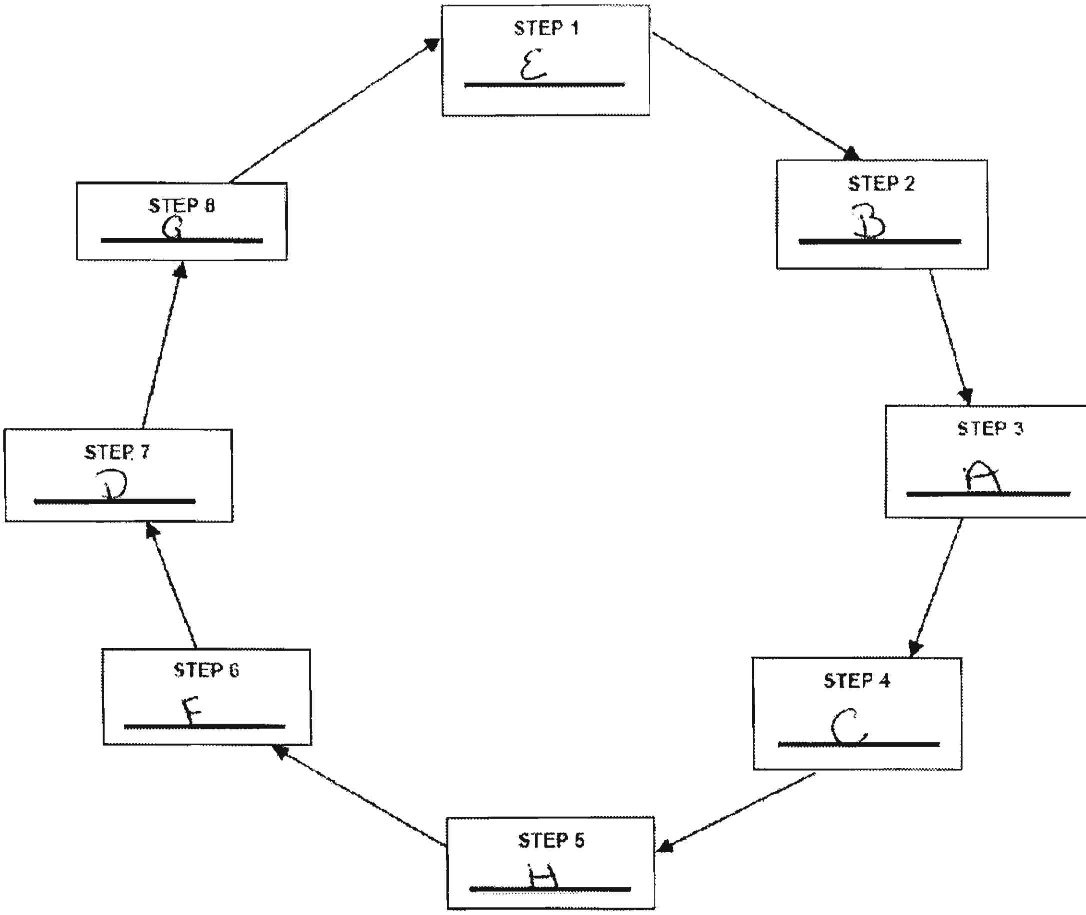
surface area - 32

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Various boat designs need different elements. The catamarans would be stronger if there supports between the bottom part. The regular boats would be ok with supports inside

Please identify each step within the engineering design process-



3 ~~A~~. Construct a prototype
2 ~~B~~. Research the problem
4 ~~C~~. Redesign
7 ~~D~~. Test and evaluate
1 ~~E~~. Identify the problem
6 ~~F~~. Select the best possible solution(s)
8 ~~G~~. Communicate the solution(s)
5 ~~H~~. Develop possible solutions

18g

50328

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 95 ~~kg~~g

The Volume of your Boat = 3382 kg

Density of water = 1 kg/m^3

Volume * Density = Total Maximum Weight

3382 m^3 * 1 kg/m^3 = 3382 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

3382 ~~kg~~g – 95 ~~kg~~g = 3287 ~~kg~~g 3.3 Kg.

Actual Maximum Weight Capacity (how much your boat held before it sank) =

3 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

The two numbers could be different because of the way it was constructed or because I measured weight wrong. If I weighed it wrong the Maximum weight capicity would be lower.

[redacted] 50327

Pre-Test for Boat Buoyancy Lesson Plan

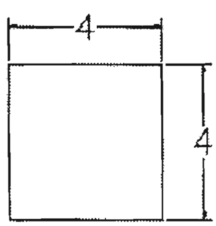
Matching

1. d Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. ___ Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. ___ Volume	c. The upward pressure exerted upon a floating body by a fluid
4. a Mass	d. The outer limits of an area
5. ___ Density	e. The sum of the areas of the sides of a three-dimensional object
6. ___ Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. c Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

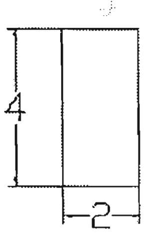
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square

The perimitor around is 16 in



   b. A simple 2x4 rectangle

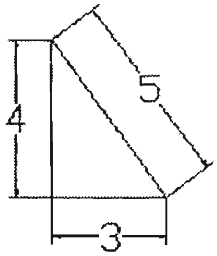
The perimiture around is 12



[redacted]

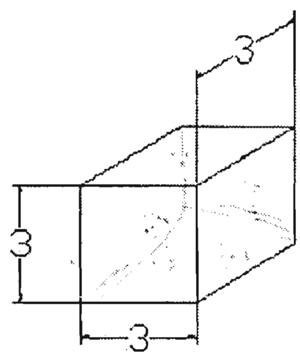
c. A simple 3x4x5 triangle

The perimiture around is 12

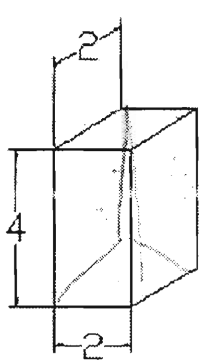


2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube

the perin itor around is

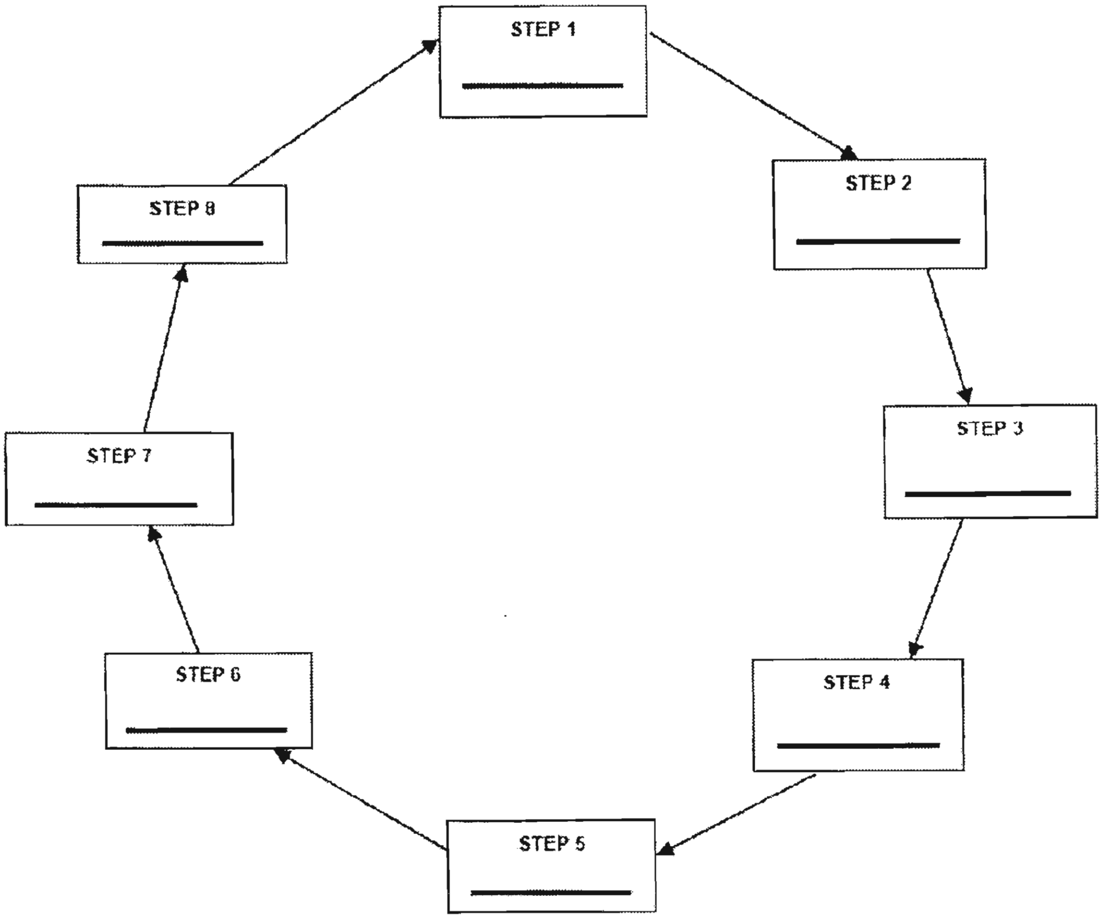


   b. A simple 2x4x2 cuboid



The perimiturcaround is 20

Please identify each step within the engineering design process-



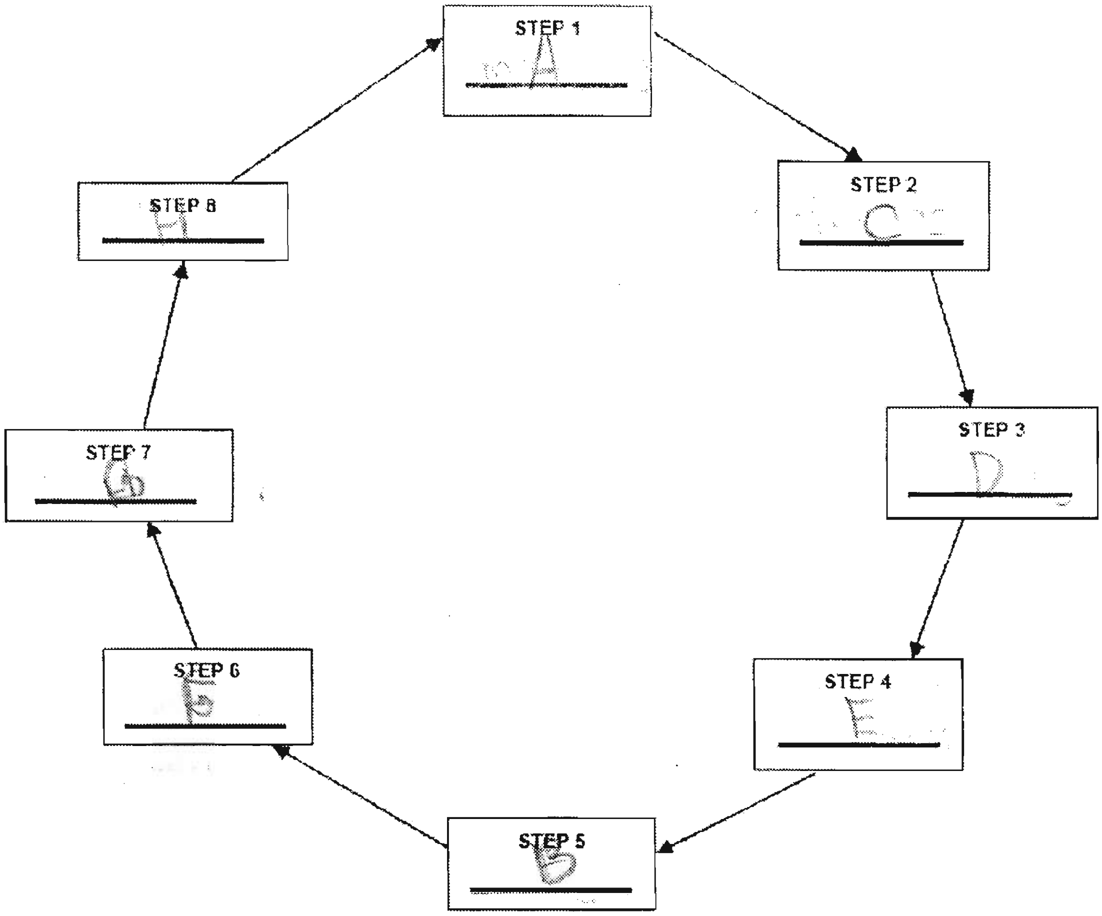
A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

the stronth of my boat was
~~hadgh~~ there were to pads insted
of on
my weeknes was the
middle of my boat.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

CAt 50321

Project Analysis Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 60.7 kg

The Volume of your Boat = 4252.5 kg

Density of water = 1 ~~kg/m³~~ g/cm³

Volume * Density = Total Maximum Weight

4252.5 cm³ * 1 ~~kg/m³~~ g/cm³ = 4252.5 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

4252.5 kg – 60.7 kg = 4191.8 kg 4.1

Actual Maximum Weight Capacity (how much your boat held before it sank) =

__________ kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

#50320

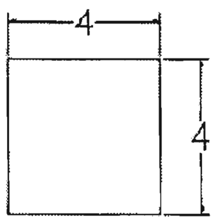
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. d Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. g Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. a Volume	c. The upward pressure exerted upon a floating body by a fluid
4. f Mass	d. The outer limits of an area
5. b Density	e. The sum of the areas of the sides of a three-dimensional object
6. e Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. c Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

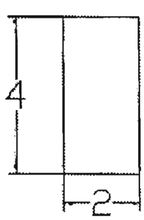
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



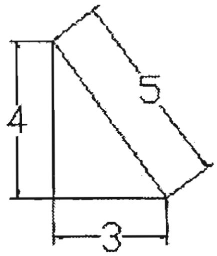
16-perimeter
area-16

   b. A simple 2x4 rectangle



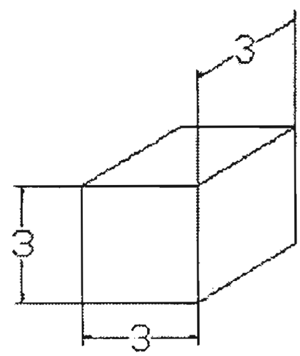
12 -perimeter
area-8

c. A simple 3x4x5 triangle



12 - perimeter
6 - area

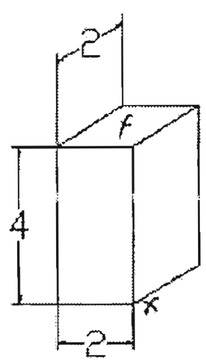
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



volume - 27
Surface area - 54

9+9+9+9+9+9

   b. A simple 2x4x2 cuboid



volume - 16
Surface area - 40

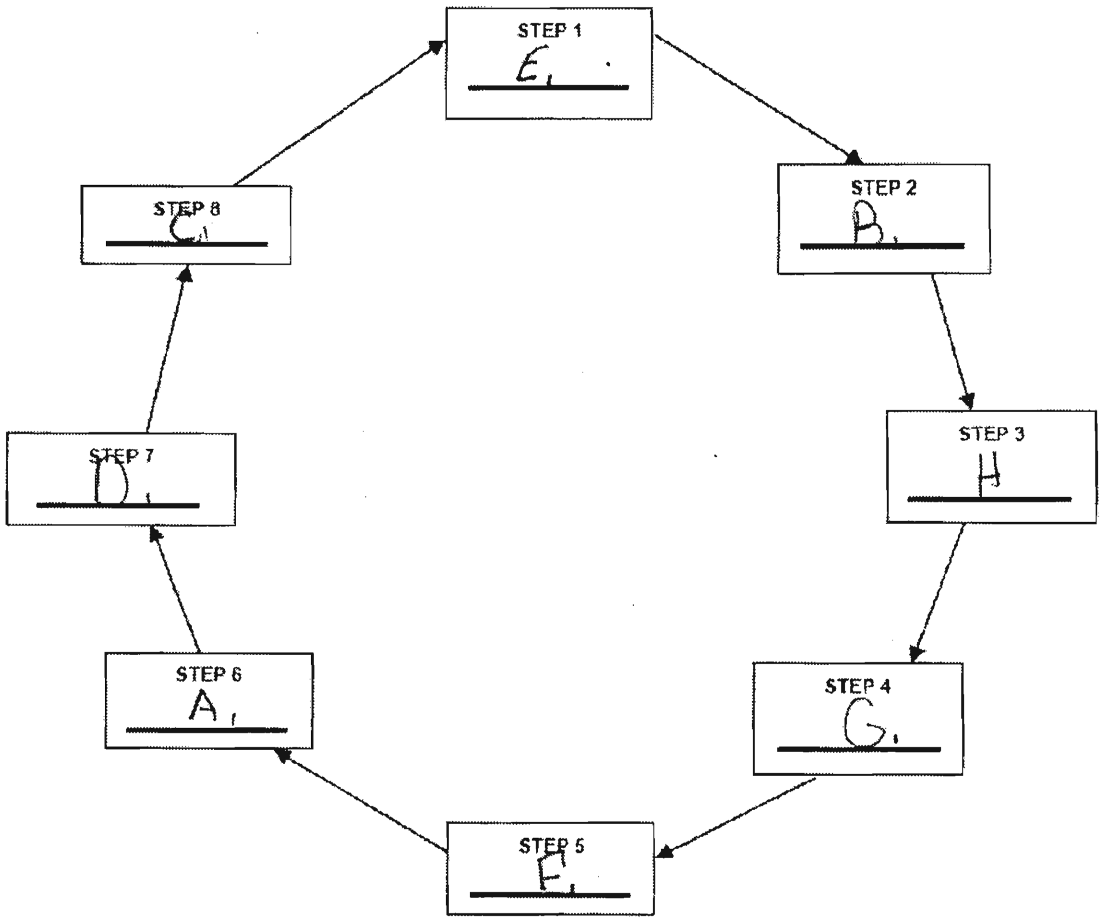
4+4+16+
4+4+8+8+8+8
8+8(4)

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

flat bottom boats are bad, they ~~don't~~ ~~do~~ sink in deep water. A deep rounded hull with the rudder in the back is the best design. A ~~[illegible]~~ boat most be able to cut through the water so the front should be pointed.

Please identify each step within the engineering design process-



A. Construct a prototype
~~B. Research the problem~~
C. Redesign
~~D. Test and evaluate~~
~~E. Identify the problem~~
~~F. Select the best possible solution~~(s)
~~G. Communicate the solution(s)~~
~~H. Develop possible solutions~~

30320

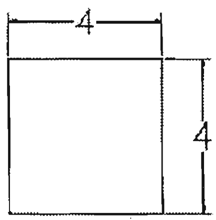
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. d Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. g Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. a Volume	c. The upward pressure exerted upon a floating body by a fluid
4. f Mass	d. The outer limits of an area
5. b Density	e. The sum of the areas of the sides of a three-dimensional object
6. e Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. c Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

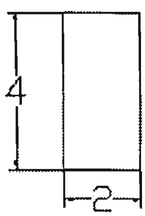
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



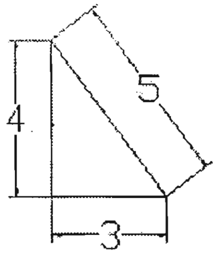
16 - Area
16 - Perimeter

   b. A simple 2x4 rectangle



Area - 8
Perimeter - 12

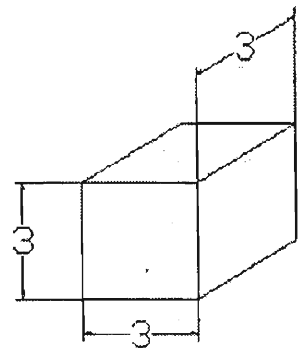
c. A simple 3x4x5 triangle



~~Perimeter~~

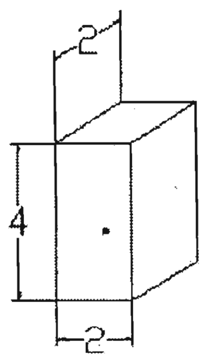
Perimeter - 12
Area - 6

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



~~A~~
Volume - 27
Surface Area - 54

   b. A simple 2x4x2 cuboid



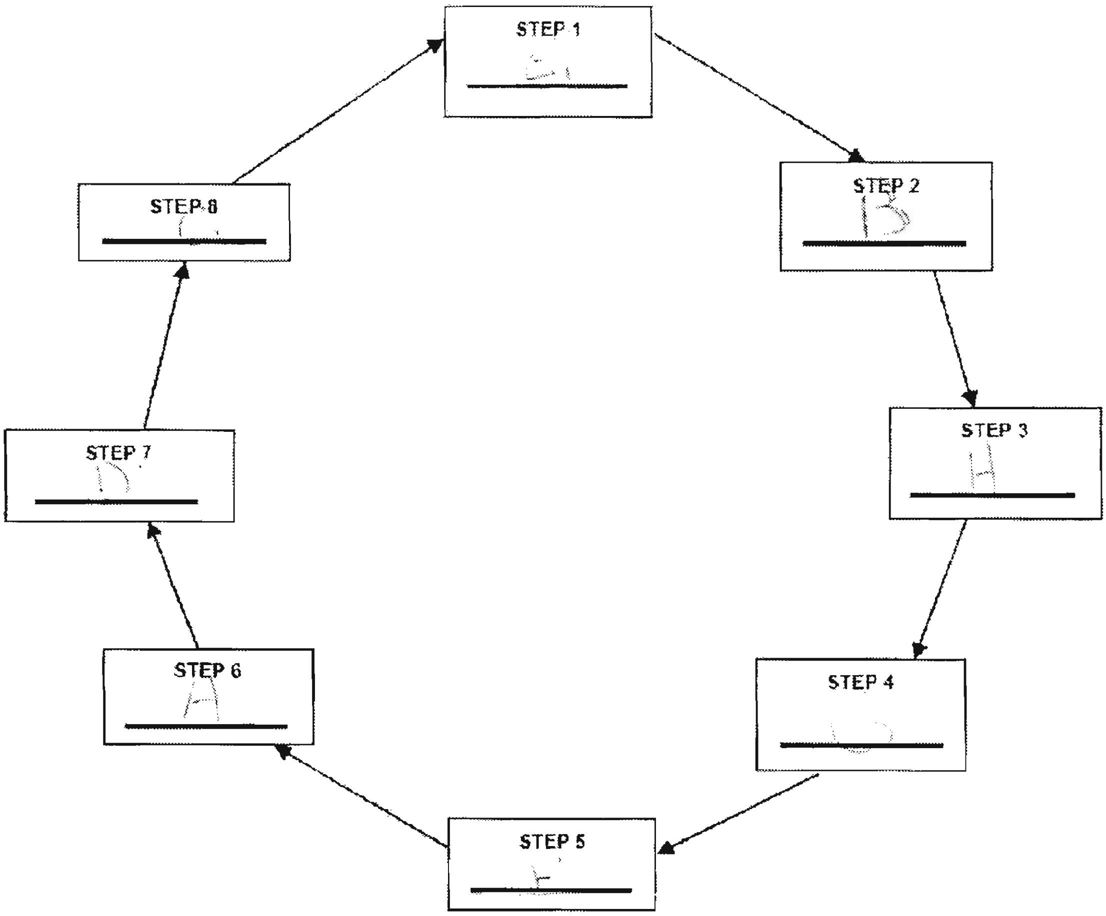
Volume - 16
Surface Area - 40

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Catamarans can support more weight than a regular boat design. Both are good and stable. ~~but~~ A catamaran is large than a regular boat so it can support more weight.

Please identify each step within the engineering design process-



A. Construct a prototype
~~B. Research the problem~~
C. Redesign
~~D. Test and evaluate~~
~~E. Identify the problem~~
F. Select the best possible solution(s)
G. Communicate the solution(s)
~~H. Develop possible solutions~~

Reg.

Project Analysis Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 91.5 g ~~kg~~ 3126.8

The Volume of your Boat = ~~2912~~ ~~kg~~ 3900 cm^3

Density of water = 1 kg/m^3

Volume * Density = Total Maximum Weight

~~2912~~ 3126.8 m^3 * 1 kg/m^3 = ~~2912~~ 3126.8 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

~~2912~~ 3126.8 kg – 91.5g kg = ~~2820.5~~ 3035.3 kg 3.0 kg

Actual Maximum Weight Capacity (how much your boat held before it sank) = 3 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

These numbers are the same. ~~They both~~ The math was right & the actual amount of weight it held was the ~~same as~~ weight I predicted it would hold.

18 × 31 = 3900

18 × 7 = 126, 126 × 31 = 126 + 3780 = 3900 = 3900 cm

2912.0 − 91.5 = 2820.5

2912

50237

Pre-Test for Boat Buoyancy Lesson Plan

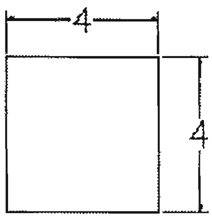
Matching

1. d Perimeter
2. g Area
3. a Volume
4. f Mass
5. b Density
6. e Surface Area
7. c Buoyancy

a. The amount of space occupied by a three-dimensional object or region of space
b. The mass per unit volume of a substance at a specified pressure and temperature
c. The upward pressure exerted upon a floating body by a fluid
d. The outer limits of an area
e. The sum of the areas of the sides of a three-dimensional object
f. The measure of the quantity of matter that a body or an object contains
g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

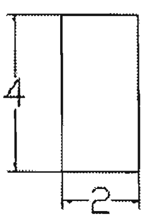
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



Perimeter = 16 in

Area = 16 in²

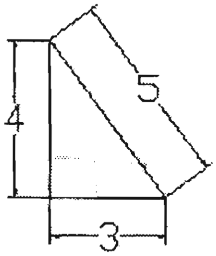
   b. A simple 2x4 rectangle



Perimeter = [illegible] in

Area = 8 in²

c. A simple 3x4x5 triangle

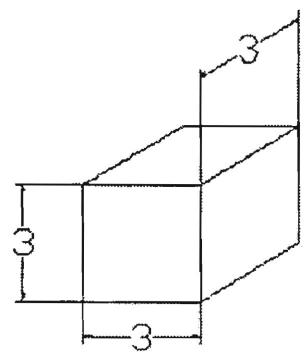


Perimeter= 12un

Area= 5.5un²

2. Find the volume and surface area of these simple shapes

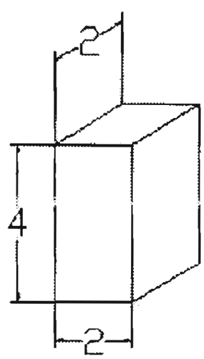
a. A simple 3x3x3 cube



Volume= 27un3

Surface Area: 54un²

b. A simple 2x4x2 cuboid



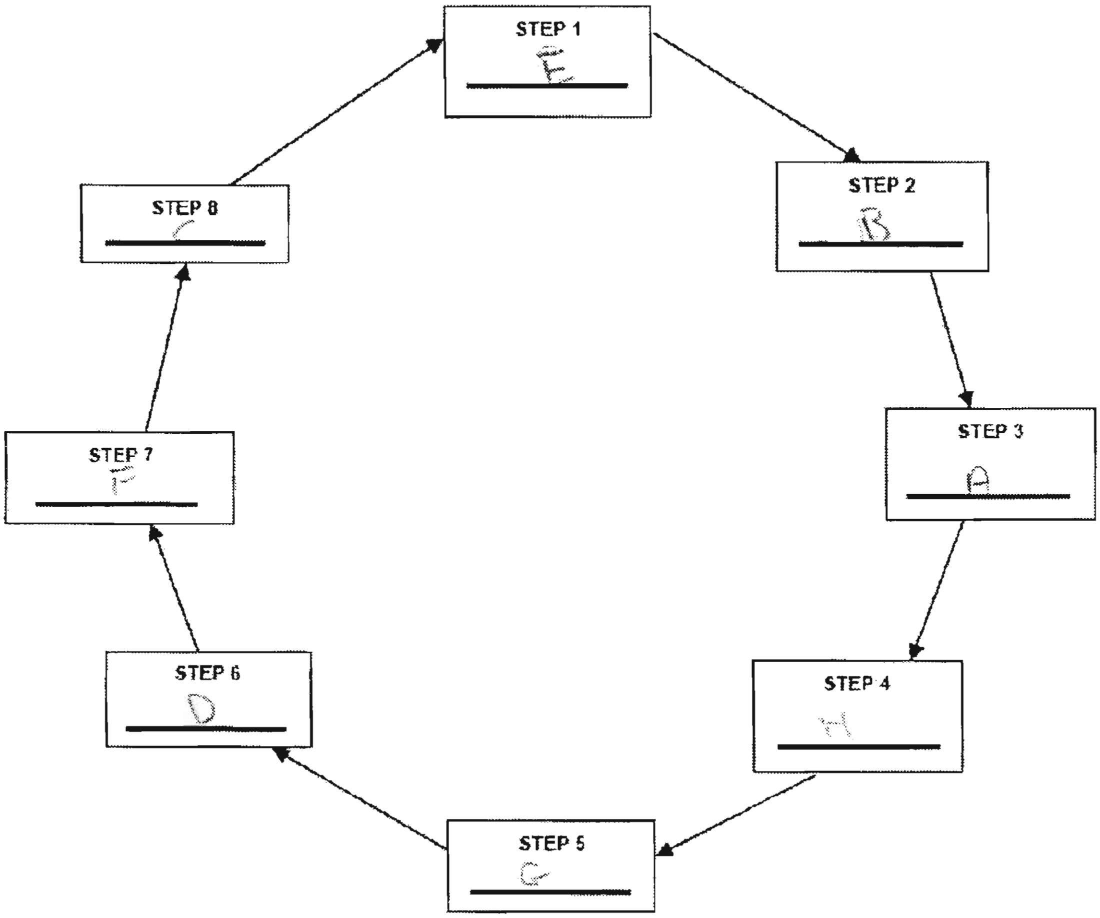
Volume= 16un³

Surface area= 32un²

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

50237

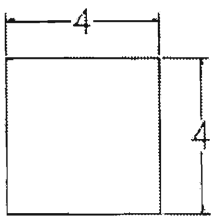
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. d Perimeter 2. g Area 3. a Volume 4. f Mass 5. b Density 6. e Surface Area 7. c Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

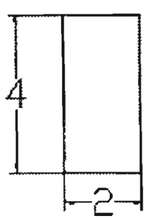
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



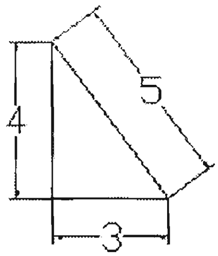
Perimeter = 16un
area = 16un²

   b. A simple 2x4 rectangle



Perimeter = 12un
area = 8un²

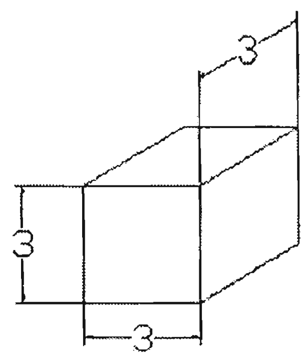
c. A simple 3x4x5 triangle



Perimeter = 12un

Area= 6un^2

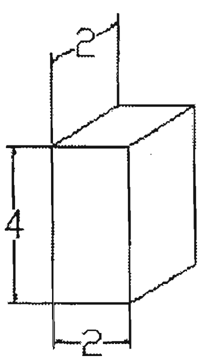
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



Volume= 27un^3

surface area: 54un^2

   b. A simple 2x4x2 cuboid



volume= 16 un^3

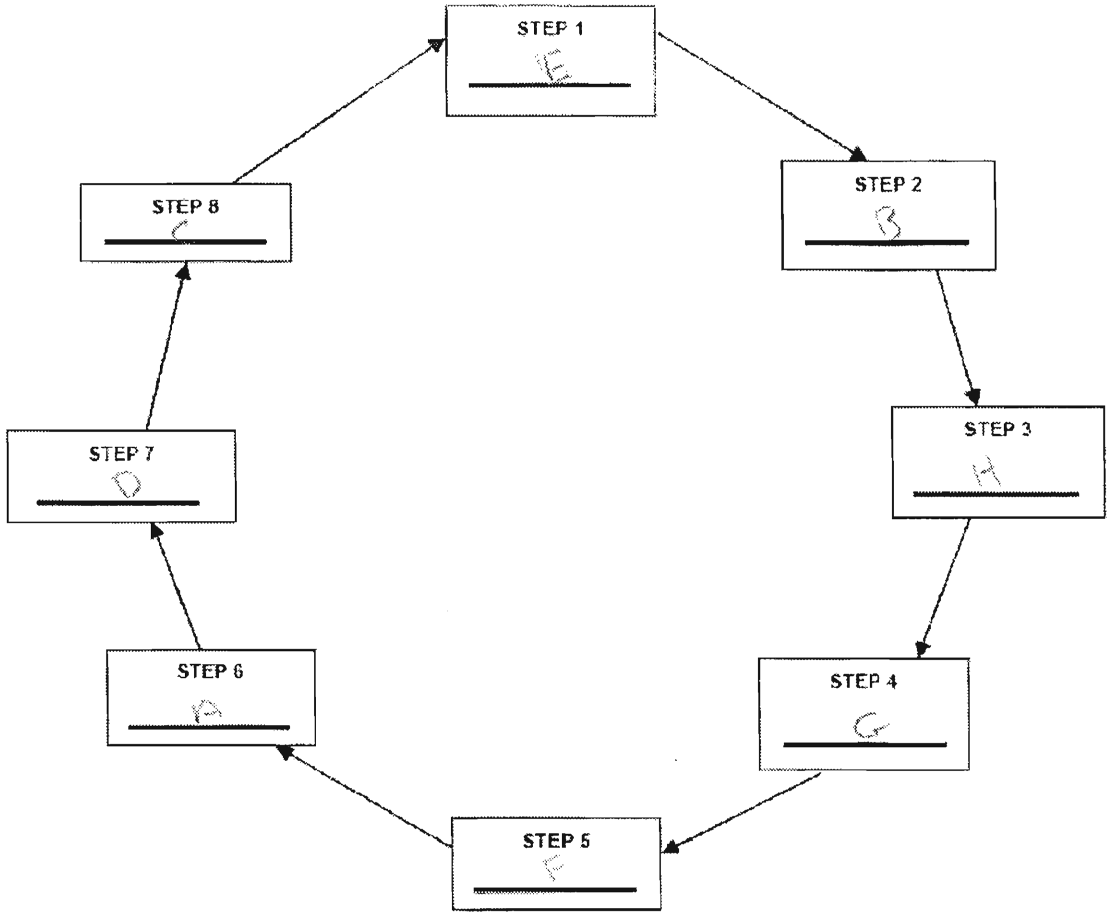
surface area = 56un^2

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

The strenghts of a tankur are it is easier to build and is more sturdy. The strenght of a catamaran is that it can hold more weight.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Freeght 50237

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 82.2 kg

The Volume of your Boat = ~~2235~~ kg 2596.5

Density of water = 1 kg/m^3

Volume * Density = Total Maximum Weight 2596.5

2596.5 ~~2235~~ m^3 * 1 kg/m^3 = ~~2235~~ kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity 2.51

2596.5 ~~2235~~ kg – 82.2 kg = 2514.3 ~~2152.8~~ kg 2.75

Actual Maximum Weight Capacity (how much your boat held before it sank) =

3 kg kg

Compare the “Maximum Weight Capacity” to the “Actual Maximum Weight Capacity.” If these numbers are very different, explain possible causes.

- My Actuall weight is .5 kg less than it really did.

[redacted] 50224

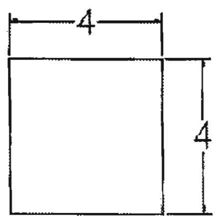
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. d Perimeter 2. e Area 3. f Volume 4. a Mass 5. b Density 6. g Surface Area 7. c Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

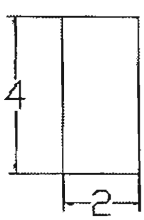
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



perimeter = 16
Area = 16

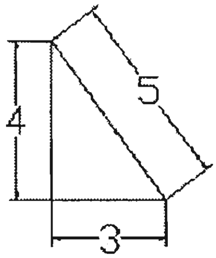
   b. A simple 2x4 rectangle



perimeter = 12
Area = 8

[redacted]

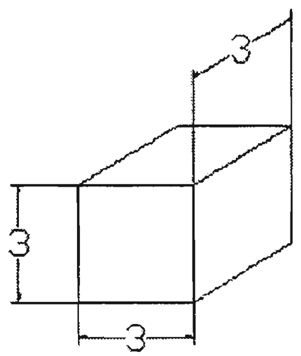
c. A simple 3x4x5 triangle



perimeter = 12

Area = 12

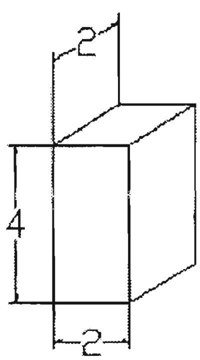
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



volume = 27

S.A. = 72

   b. A simple 2x4x2 cuboid



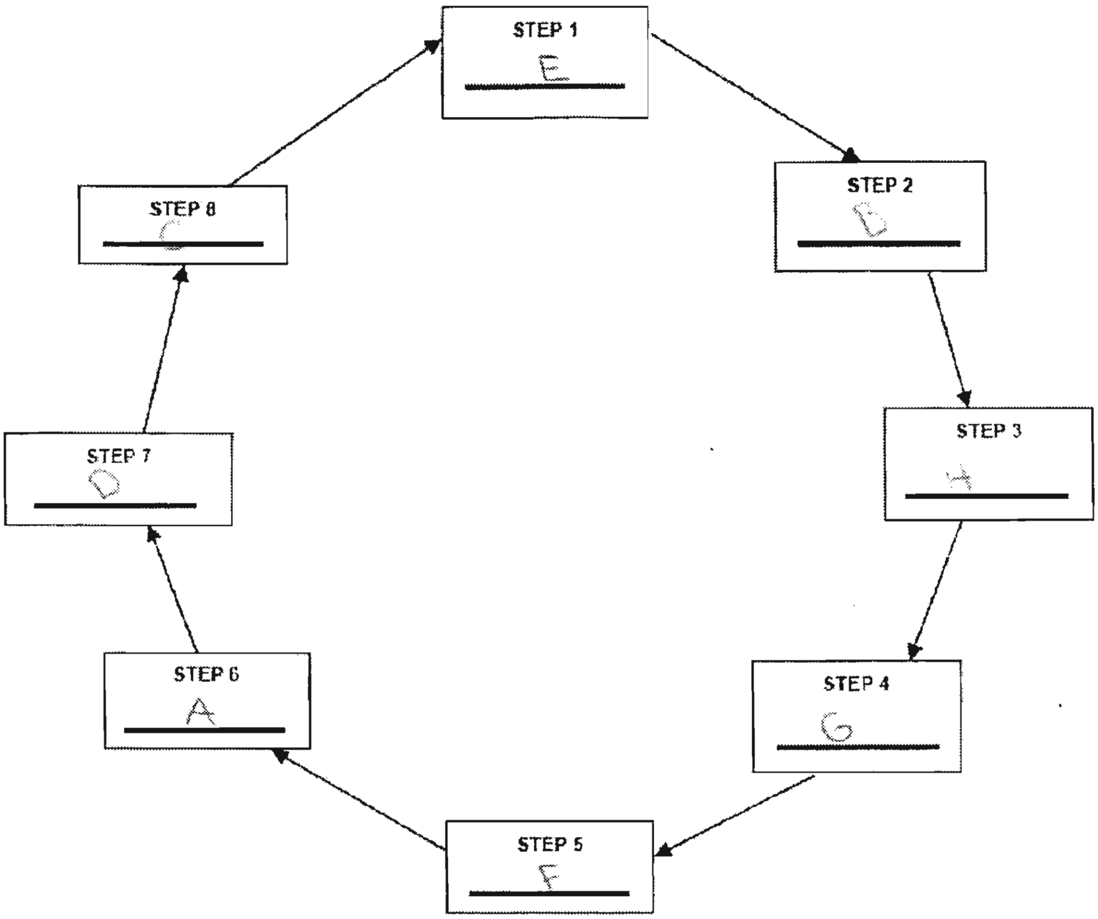
V = 16

S.A = 32

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

50224

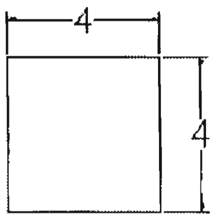
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. d Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. e Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. f Volume	c. The upward pressure exerted upon a floating body by a fluid
4. a Mass	d. The outer limits of an area
5. b Density	e. The sum of the areas of the sides of a three-dimensional object
6. g Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. c Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

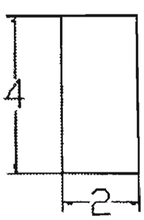
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



P=8

A=16

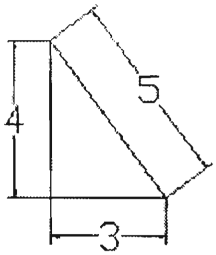
   b. A simple 2x4 rectangle



P=12

A=8

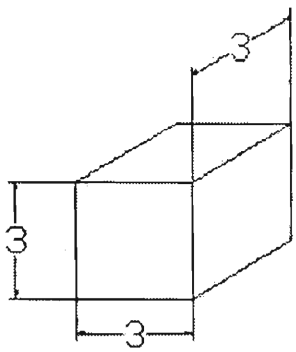
c. A simple 3x4x5 triangle



P= 12

A= 8,5

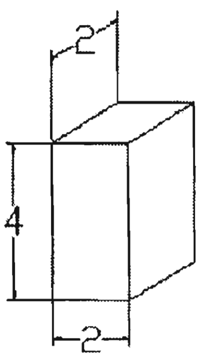
2. Find the volume and surface area of these simple shapes
    a. A simple 3x3x3 cube



V= 27cm^3

SA= 72

b. A simple 2x4x2 cuboid



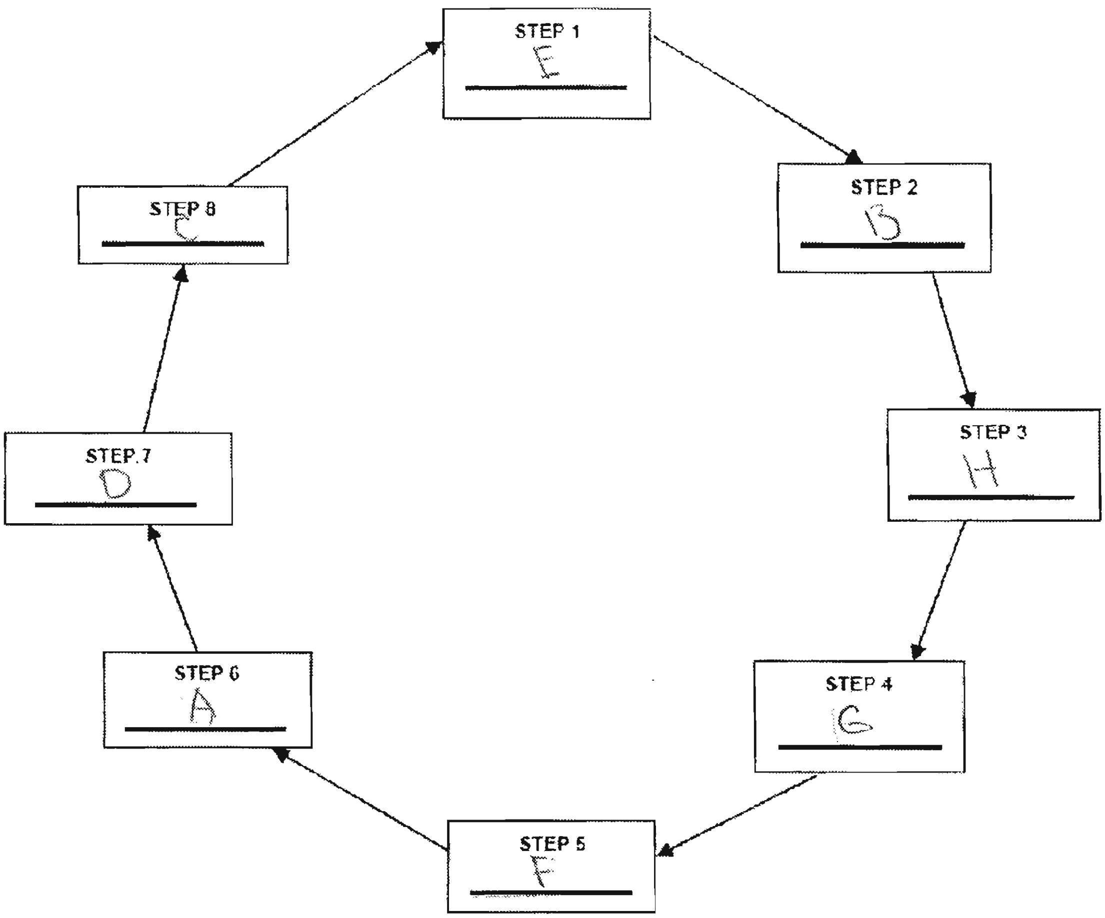
V= 16

SA= 68

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Rey. 50224

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 89.4 kg

The Volume of your Boat = ~~3064.86~~ kg 3074

Density of water = 1 kg/m^3

Volume * Density = Total Maximum Weight

3074 m^3 * 1 kg/m^3 = 3074 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

3074 kg – 88.41 kg = 2985.6 ~~kg~~ 2.99 2.98 kg.

Actual Maximum Weight Capacity (how much your boat held before it sank) =

3 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

- My calculations were correct and it stayed a float at 3 kg. Then it sunk with 4 kg.

Id=50223

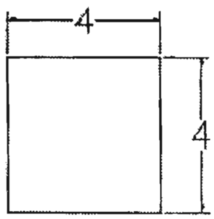
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. E Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. F Volume	c. The upward pressure exerted upon a floating body by a fluid
4. A Mass	d. The outer limits of an area
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. G Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

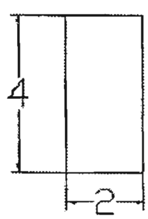
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



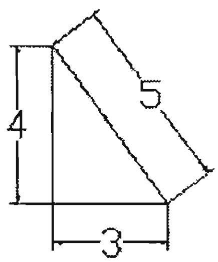
A=16
P=16

   b. A simple 2x4 rectangle



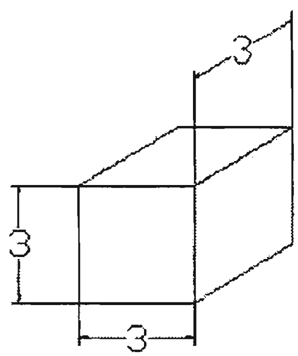
A=8
P=12

c. A simple 3x4x5 triangle



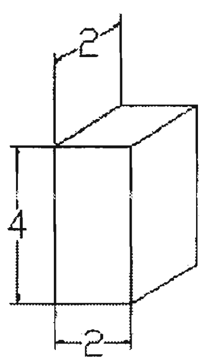
A=12
P=12

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



V=28
Sa=9

   b. A simple 2x4x2 cuboid



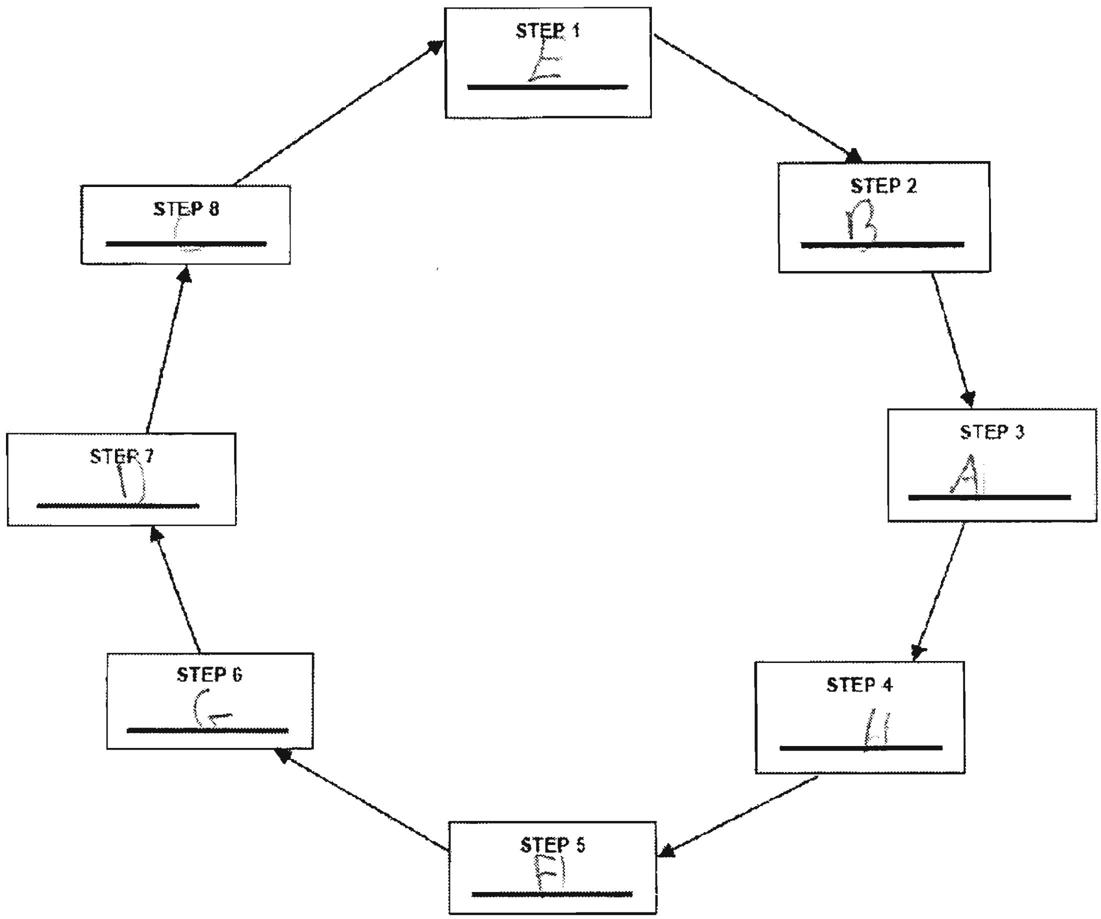
V=16
Sa=8

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Wooden boats are lighter but not a strong
Ships made of metal are heavier stronger and faster.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

LJ- 30223

Post-Test for Boat Buoyancy Lesson Plan

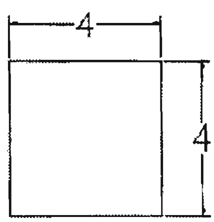
Matching

1. D Perimeter
2. E Area
3. A Volume
4. F Mass
5. B Density
6. G Surface Area
7. C Buoyancy

a. The amount of space occupied by a three-dimensional object or region of space
b. The mass per unit volume of a substance at a specified pressure and temperature
c. The upward pressure exerted upon a floating body by a fluid
d. The outer limits of an area
e. The sum of the areas of the sides of a three-dimensional object
f. The measure of the quantity of matter that a body or an object contains
g. The extent of a 2-dimensional surface enclosed within a boundary

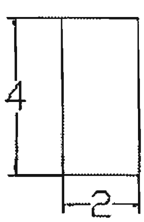
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



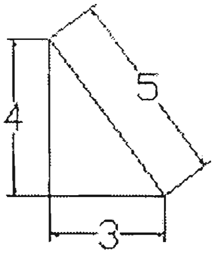
A=16

   b. A simple 2x4 rectangle



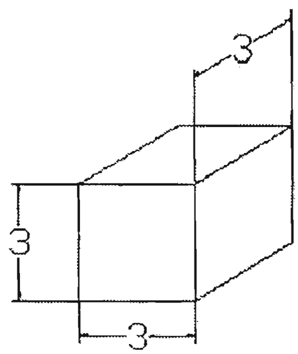
A=12

c. A simple 3x4x5 triangle



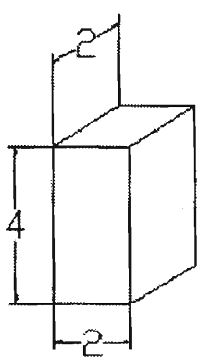
A=12

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



V=27
SA=9

   b. A simple 2x4x2 cuboid



V=16
SA=8

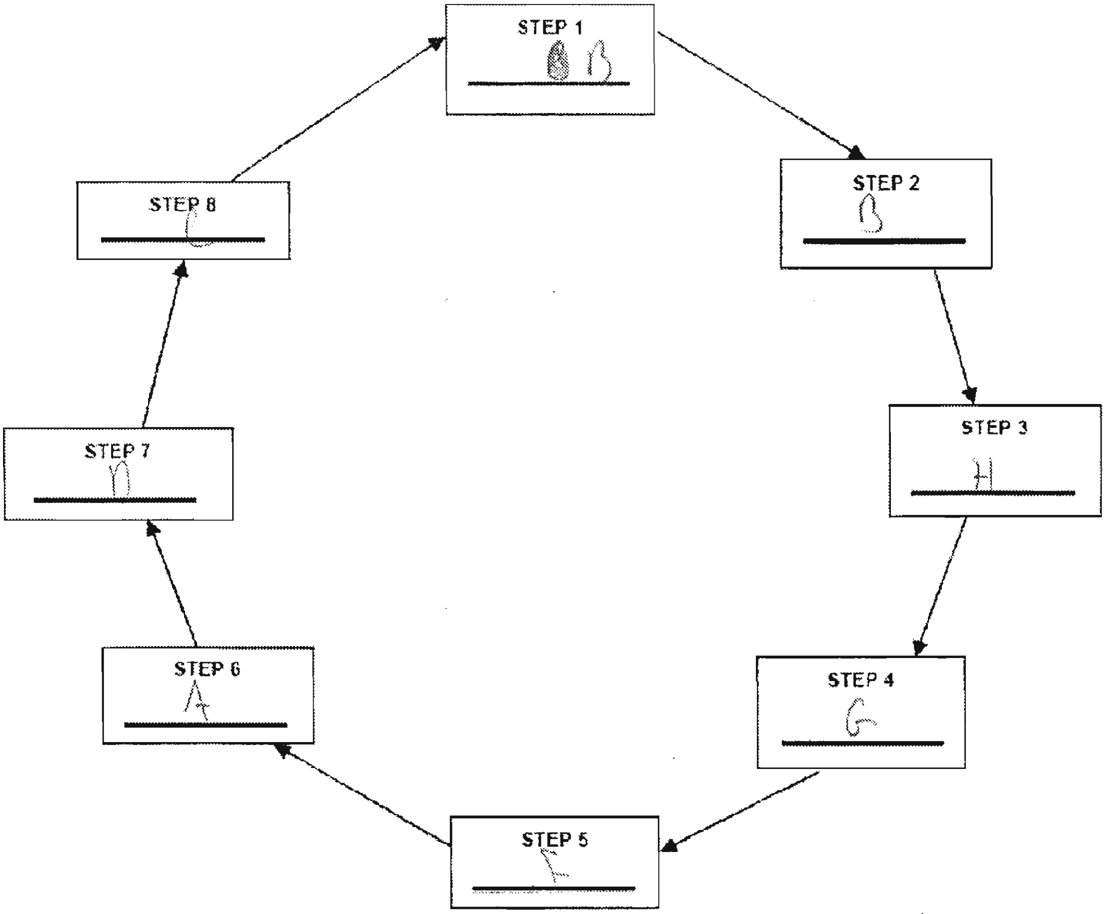
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

A freiet boat is sturdier but a catamaran is able to hold more weight

A steel boat is more able to [illegible] [illegible] Cu board.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Freight

ID-50223

Project Analysis

Name: [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 865 kg

The Volume of your Boat = ~~3037.5~~ ~~3039~~ 3074 kg

Density of water = 1 kg/m^3

Volume * Density = Total Maximum Weight

~~3037.5~~ 3074 cm^3 * 1 ~~kg/m^3~~ g/cm^3 = ~~3037.5~~ 3074 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

~~3037.5~~ 3074 kg – ~~96.3~~ 865 kg = ~~2941.2~~ 2987.5 kg

~~2.95 kg~~ ~~2.94 Kg.~~ 2.99 kg

Actual Maximum Weight Capacity (how much your boat held before it sank) =

3 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

My boat was able to hold the amount of weight it was Suppose to When more weight was added it Sank like it was Supposed to.

7 + A

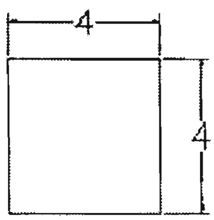
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. E Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. f Volume	c. The upward pressure exerted upon a floating body by a fluid
4. A Mass	d. The outer limits of an area
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. G Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

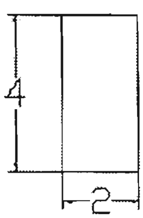
Mathematics

1. Find the perimeter and area for each of these simple shapes
    a. A simple 4x4 square



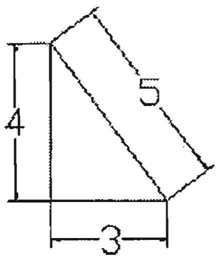
PERIMETER: 16
AREA: 16

    b. A simple 2x4 rectangle



PERIMETER: 12
AREA: 8

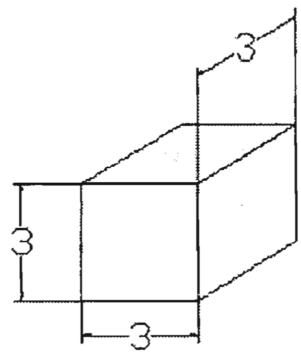
c. A simple 3x4x5 triangle



Perimeter: 12

Area: 6

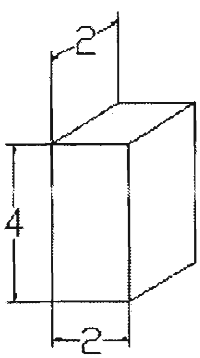
2. Find the volume and surface area of these simple shapes
    a. A simple 3x3x3 cube



Volume: 27

Surface Area: 72

b. A simple 2x4x2 cuboid



Volume: 16

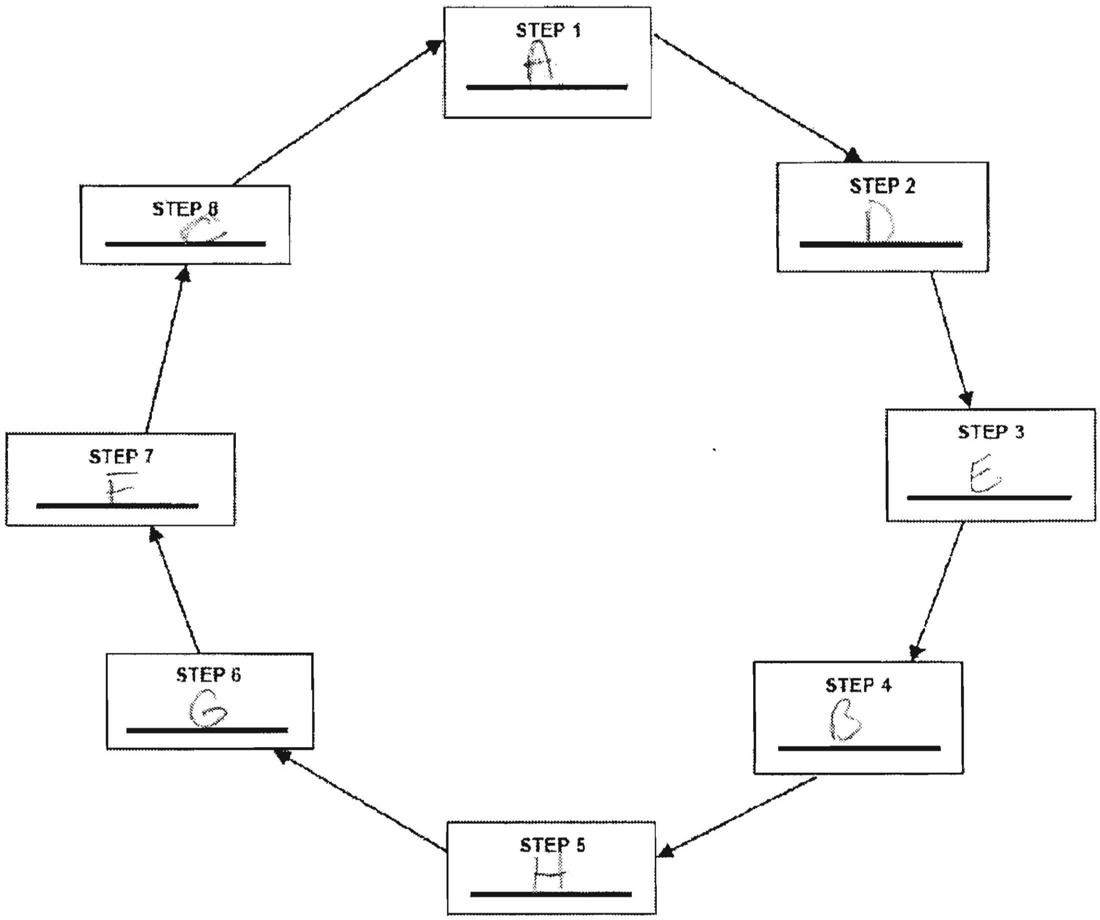
Surface Area: 56

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

- TOP-HEAVY BOATS ARE MORE LIKELY TO BE UNSTABLE
- THE SHAPE OF THE BOTTOM-SIDE OF A BOAT AFFECTS ITS STABILITY
- WIDER BOATS TEND TO BE MORE STABLE AND BUOYANT.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

4/11

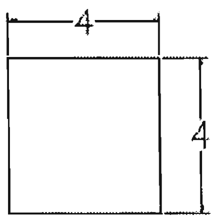
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter 2. E Area 3. F Volume 4. A Mass 5. B Density 6. G Surface Area 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

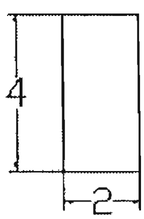
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



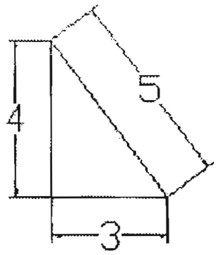
Perimeter: 16
AREA: 16

   b. A simple 2x4 rectangle



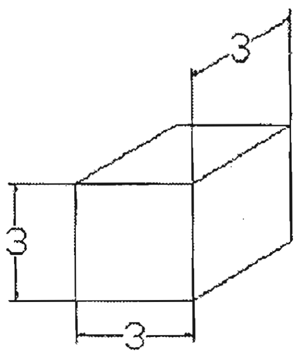
Perimeter: 12
AREA: 8

c. A simple 3x4x5 triangle



Perimeter: 12
Area: 6
½ l·H

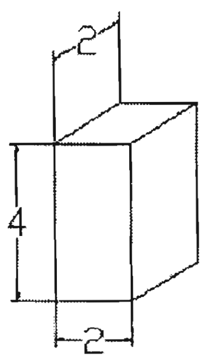
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



Surface area: 72

volume: 27

b. A simple 2x4x2 cuboid



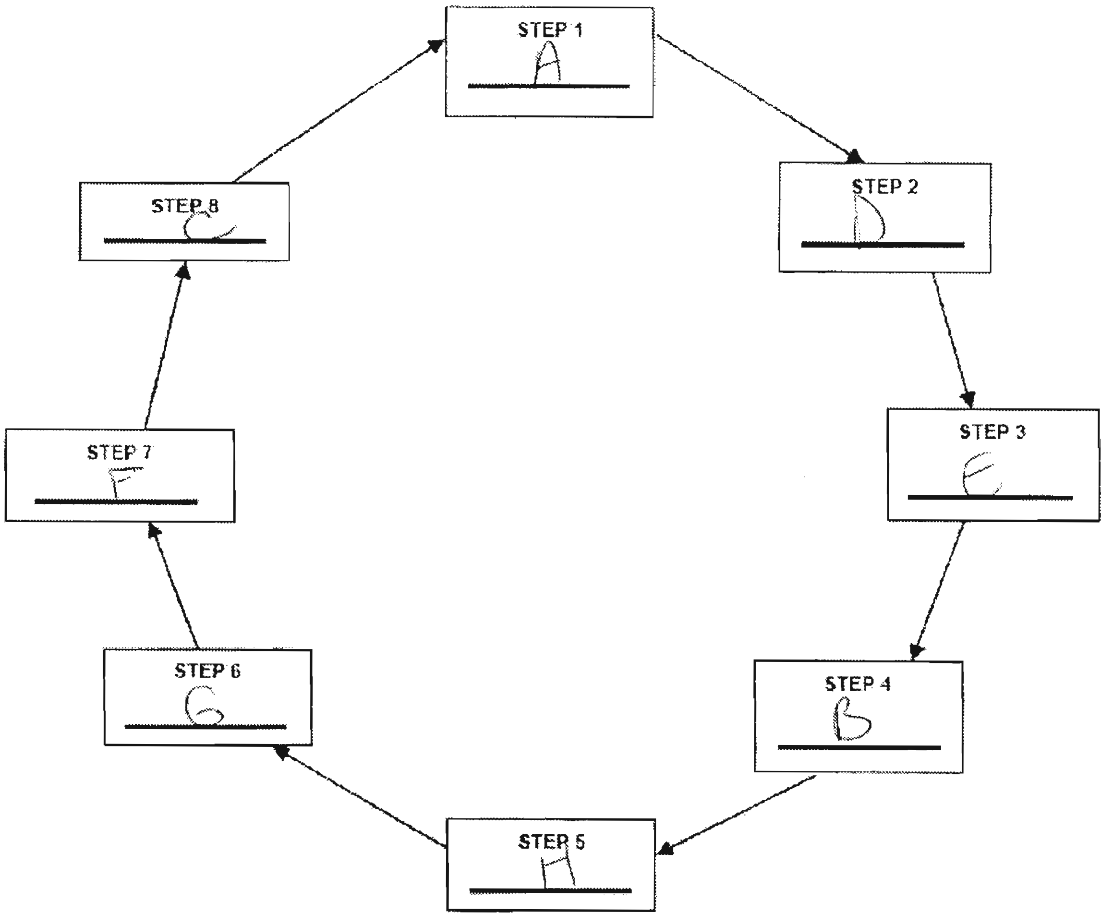
surface area: 64
volume: 16

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

- TANKERS have a tendency to roll over or flip
- Catamarans weakness would be the cover; middle
- Catamarans carry more of a load.

Please identify each step within the engineering design process-



1 A. Construct a prototype
4 B. Research the problem
8 C. Redesign
2 D. Test and evaluate
3 E. Identify the problem
7 F. Select the best possible solution(s)
6 G. Communicate the solution(s)
5 H. Develop possible solutions

4/11

Cat.

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

1782.2

564 + 81

22.9.9 + 4.5.9.2

The Weight of your Boat = 65 ~~k~~g

3645 → The Volume of your Boat = ~~3645~~ ~~k~~g 3834

Density of water = 1 ~~k~~g/m³

Volume * Density = Total Maximum Weight

~~3645~~ m³ * 1 ~~k~~g/m³ = 3645 ~~k~~g 3834

3834

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

~~3645~~ ~~k~~g – ~~65~~ ~~k~~g = ~~3580~~ ~~k~~g 3.8 Kg.

3834 - 65 = 3769

Actual Maximum Weight Capacity (how much your boat held before it sank) =

3.8 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

- MY BOAT FLOATED AT 3.8 KG BUT WHEN AN ADDITIONAL .5 KG WAS ADDED MY BOAT SANK. THEREFORE THE MAXIMUM WEIGHT CAPACITY AND ACTUAL WEIGHT CAPACITY WERE THE SAME

4272

No Post Test
Absent

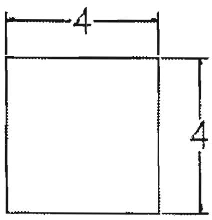
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. d Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. g Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. a Volume	c. The upward pressure exerted upon a floating body by a fluid
4. f Mass	d. The outer limits of an area
5. b Density	e. The sum of the areas of the sides of a three-dimensional object
6. e Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. c Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

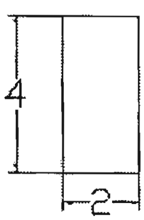
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



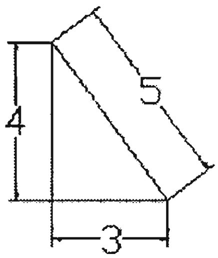
perimeter = 16
Area = 16

   b. A simple 2x4 rectangle

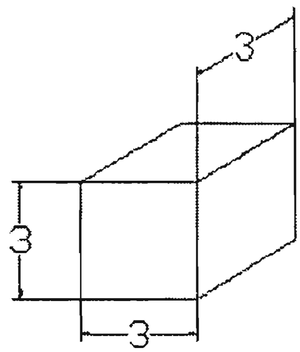


perimeter = 12
Area = 8

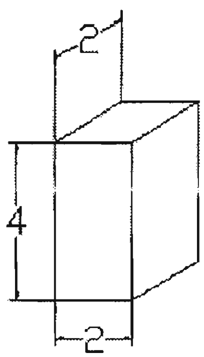
c. A simple 3x4x5 triangle



2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



   b. A simple 2x4x2 cuboid



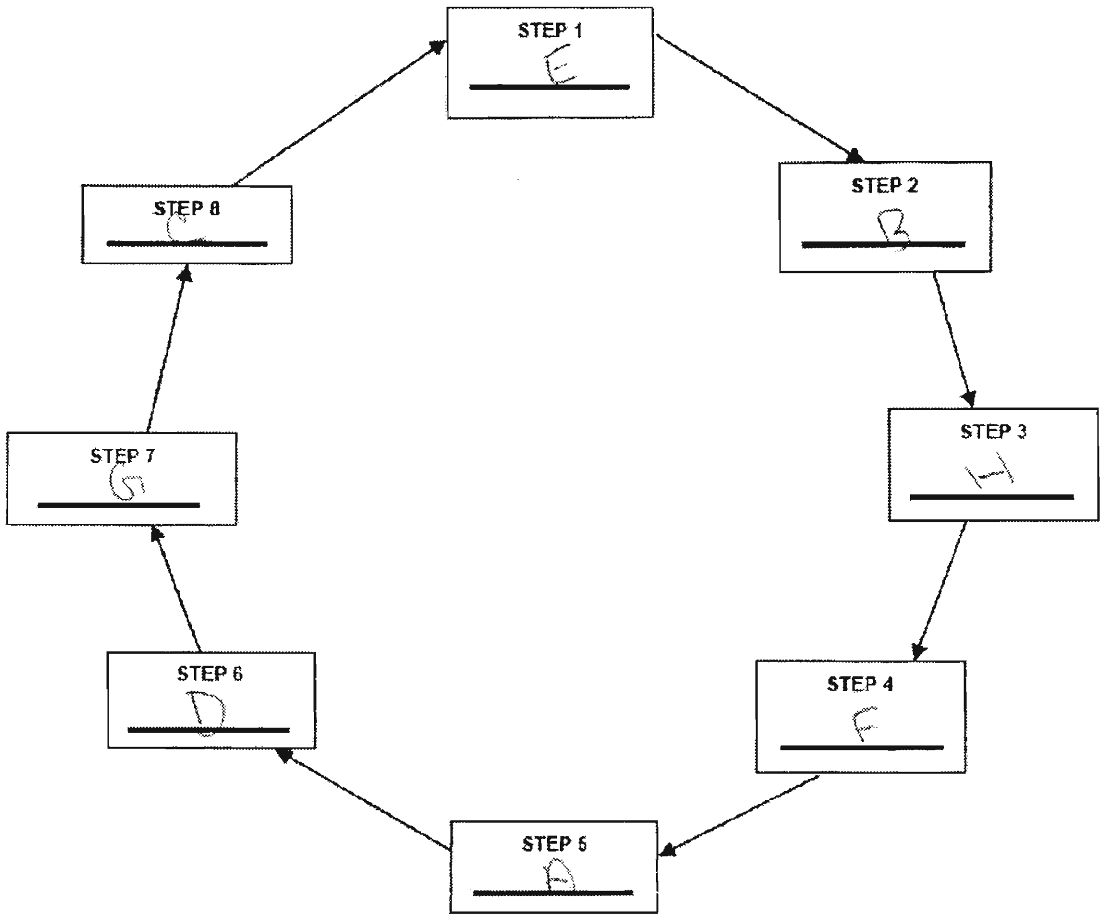
4272

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

The regular boat design is very simple to make, but it's smaller volume wouldn't hold a lot and it would sink. A catemoran is harder boat to make but it is steadier and can hold more weight.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Keg.

Project Analysis 4272 Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 89 kg

The Volume of your Boat = ~~[illegible]~~ 3182.5 kg

Density of water = 1 kg/m³

Volume * Density = Total Maximum Weight

~~[illegible]~~ 3182.5 m³ * 1 kg/m³ = ~~[illegible]~~ 3182.5 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

~~[illegible]~~ 3182.5 kg – 89 kg = ~~[illegible]~~ 3093.5 kg 3.1 kg.

Actual Maximum Weight Capacity (how much your boat held before it sank) =

31 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

the Maximum weight capacity is [illegible]

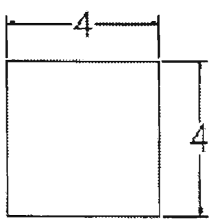
Pre-Test for Boat Buoyancy Lesson Plan [redacted] 3780

Matching

1. E Perimeter 2. G Area 3. A Volume 4. F Mass 5. B Density 6. D Surface Area 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

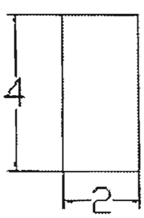
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



A = 16

P = 16

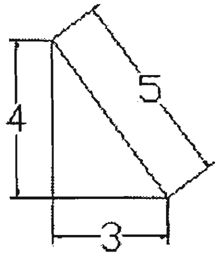
b. A simple 2x4 rectangle



A = 8

P = 12

c. A simple 3x4x5 triangle

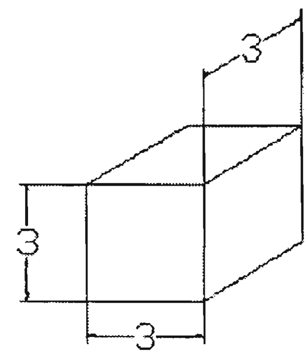


A 12

P 12

12

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube

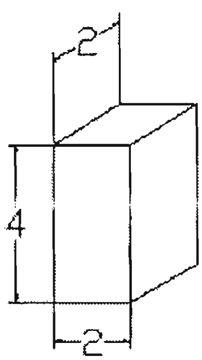


SA: 54

V: 27

36
18

   b. A simple 2x4x2 cuboid



SA: 40
V: 16

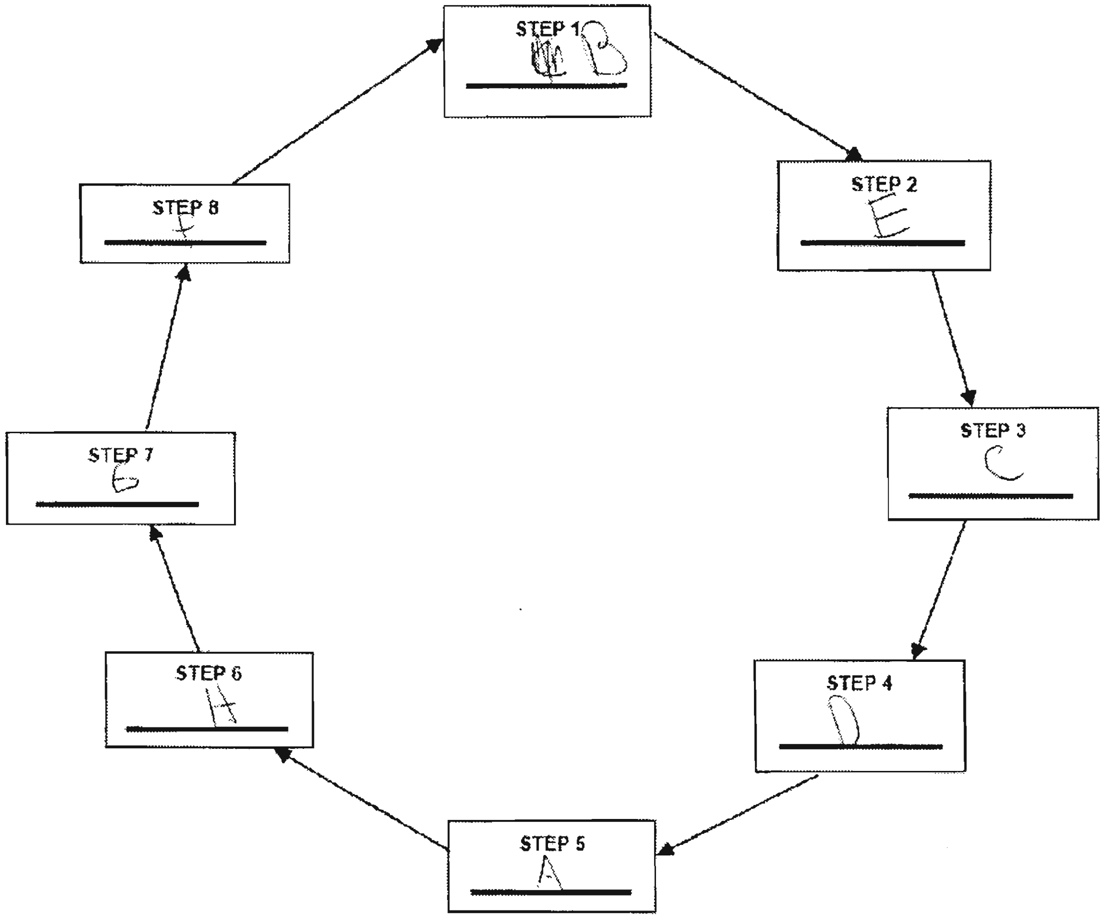
32
8

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

the wider the easter to float and
the skinier harder to float

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

3780

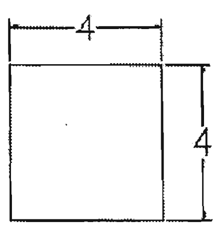
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. e Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. g Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. A Volume	c. The upward pressure exerted upon a floating body by a fluid
4. f Mass	d. The outer limits of an area
5. b Density	e. The sum of the areas of the sides of a three-dimensional object
6. D Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

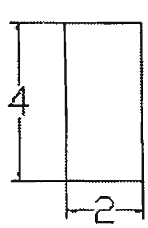
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



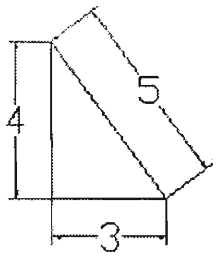
16 = perimeter
16 = Area

   b. A simple 2x4 rectangle



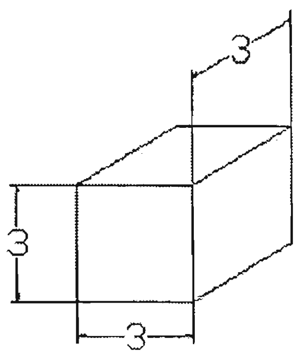
12 = perimeter
8 = area

c. A simple 3x4x5 triangle



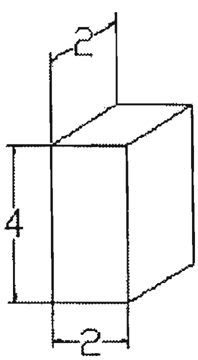
12 = perimetr
~~####~~ = area
3.5

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



27 = volume
27 = surface area

   b. A simple 2x4x2 cuboid



16 = volume
20 = surface area

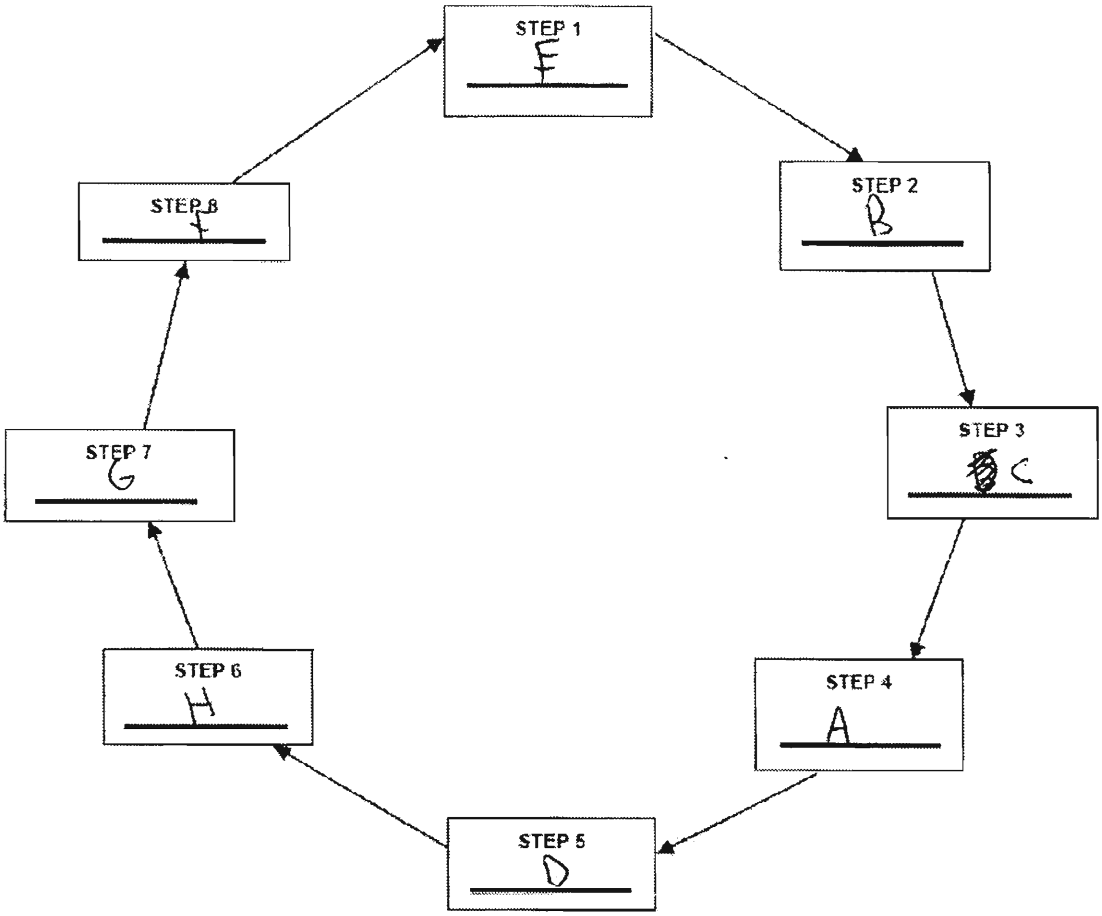
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

the strength of aboat is one with a wider hull and a longer hull and one that is low to the water

the weakesses are if its skinny, short, or too tall.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Cak.

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 161.8 ~~k~~g

The Volume of your Boat = ~~k~~g 3924.0

Density of water = 1 ~~k~~g/m³

Volume * Density = Total Maximum Weight

3924 m³ * 1 ~~k~~g/m³ = 3924 ~~k~~g

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

3924 ~~k~~g – 161.8 ~~k~~g = 3762.2 ~~k~~g 3.76kg

Actual Maximum Weight Capacity (how much your boat held before it sank) =

3762.2 ~~k~~g

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

It floated with the 3.8kg weight on it and when I put an additional amount of weight on it it sank. all of my numbers were right for the boats calculations. the weight capacity is 3.8kg and its weight is 161.8 g so the combined numbers equal

30 of 47

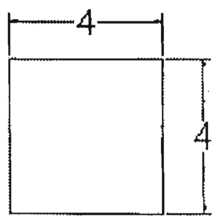
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. ~~G~~ d Perimeter 2. ~~A~~ F Area 3. E Volume 4. A Mass 5. B Density 6. C Surface Area 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

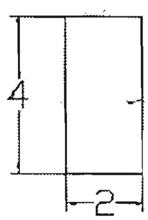
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



~~18~~

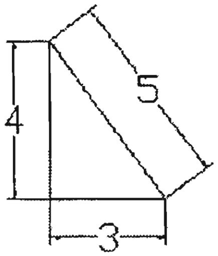
18

   b. A simple 2x4 rectangle



12

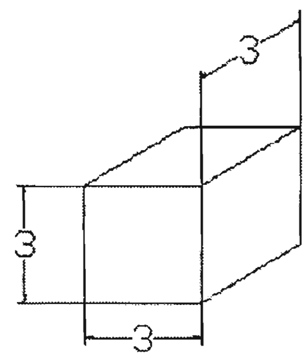
c. A simple 3x4x5 triangle



60

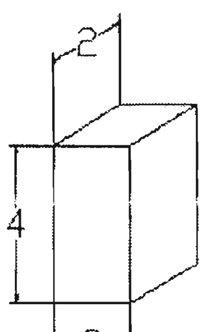
20
3

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



27

   b. A simple 2x4x2 cuboid



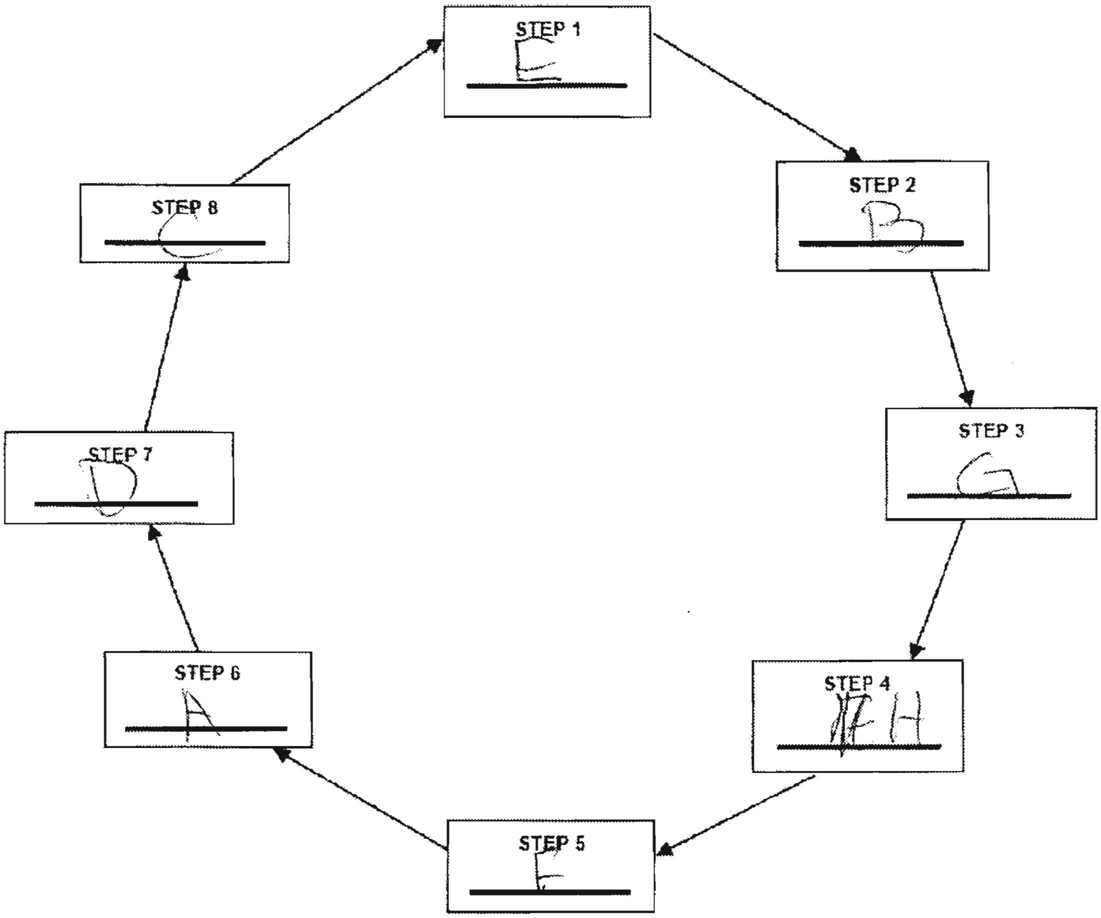
16

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

I dont know alot about the strengths and weaknesses of various boat designs just that they need to be hollow to float better.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

30547

Post-Test for Boat Buoyancy Lesson Plan

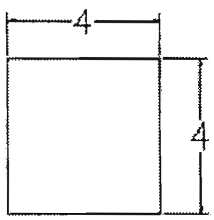
Matching

1. D Perimeter
2. E Area
3. ~~[illegible]~~ Volume A
4. F Mass
5. B Density
6. G Surface Area
7. C Buoyancy

a. The amount of space occupied by a three-dimensional object or region of space
b. The mass per unit volume of a substance at a specified pressure and temperature
c. The upward pressure exerted upon a floating body by a fluid
d. The outer limits of an area
e. The sum of the areas of the sides of a three-dimensional object
f. The measure of the quantity of matter that a body or an object contains
g. The extent of a 2-dimensional surface enclosed within a boundary

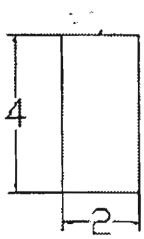
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



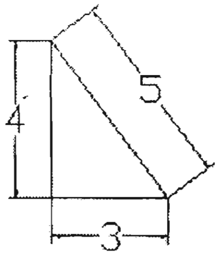
16

   b. A simple 2x4 rectangle



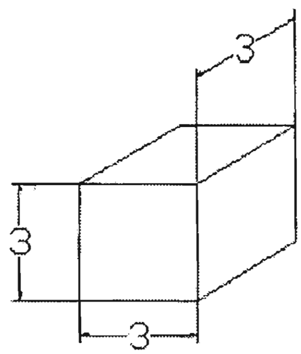
12

c. A simple 3x4x5 triangle



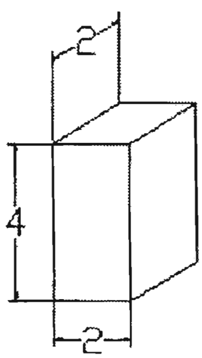
12

2. Find the volume and surface area of these simple shapes
    a. A simple 3x3x3 cube



27

    b. A simple 2x4x2 cuboid



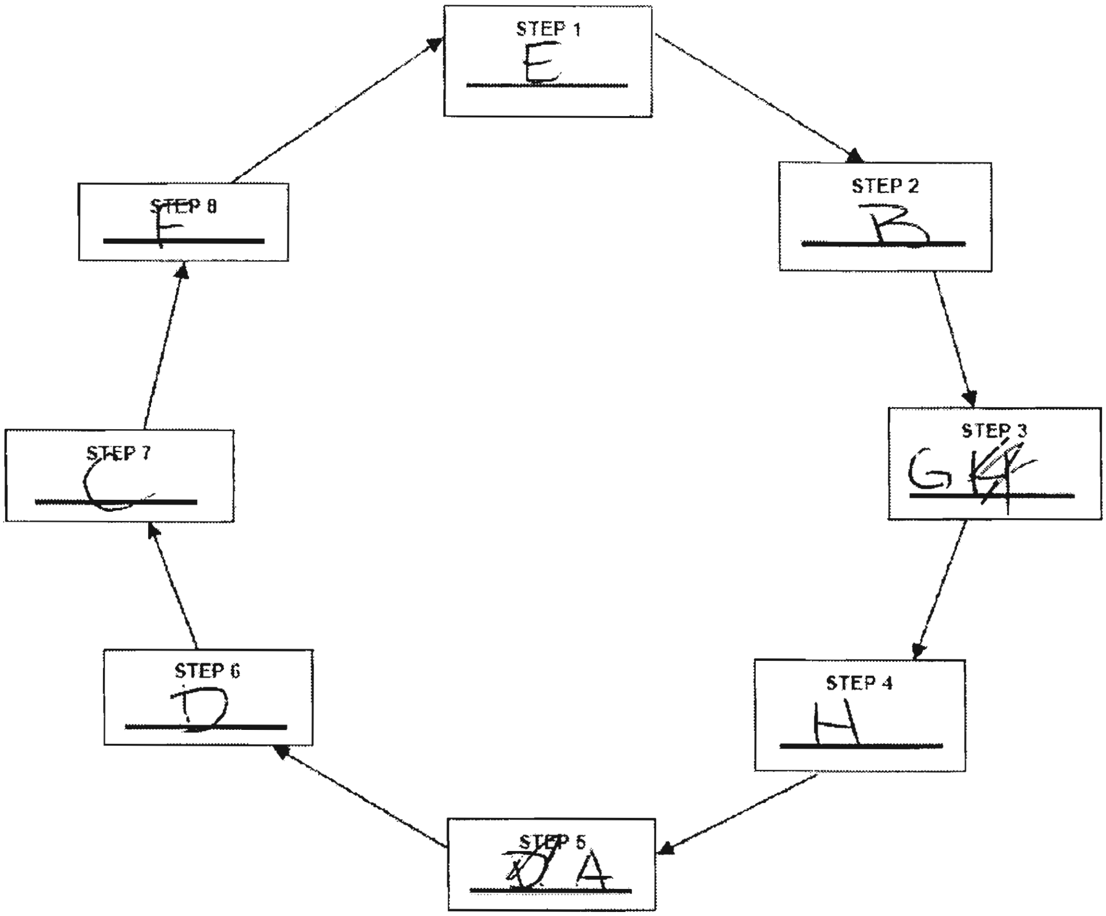
16

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

The bigger the boat the more mass it can hold. Cateramerans don't hold as much. as tankers

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Reg.

Project Analysis

Name 30547 [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 55 $\frac{7}{10}$ kg

The Volume of your Boat = ~~4,014.5~~ kg 3173

Density of water = 1 ~~kg/m³~~ g/cm³

Volume * Density = Total Maximum Weight

~~4,014.5~~ 3173 m³ * ~~55.7~~ 1 g/cm³ ~~kg/m³~~ = ~~4,014.5~~ 3173 ~~kg~~

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

~~4,014.5~~ 3173 ~~kg~~ – 55.7 ~~kg~~ = ~~3958.8~~ 3117.3 kg

~~3.96 kg~~

~~2.8 kg~~

4,014.5
$-$ 55.7
3958.8

3.1 kg

Actual Maximum Weight Capacity (how much your boat held before it sank) =

______ kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

My Boat held up all of the [illegible] and didn't sink. This means that I didn't measure it right.

~~[illegible]~~ 30300

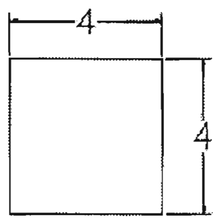
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. d Perimeter	~~a.~~ The amount of space occupied by a ~~three-dimensional~~ object or region of space
2. g Area	~~b. The mass per unit volume of a substance at a specified~~ pressure and ~~temperature~~
3. ~~f~~ a Volume	~~c. The upward pressure exerted~~ upon a ~~floating body by a fluid~~
4. a Mass	~~d.~~ The outer limits of an area
5. b Density	~~e. The sum of the areas of the si~~des of a three-dimensional object
6. e Surface Area	~~f.~~ The measure of the quantity of matter that a body or an object contains
7. c Buoyancy	~~g.~~ The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

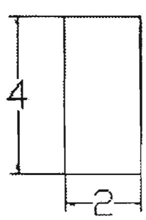
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



4x4 4/4

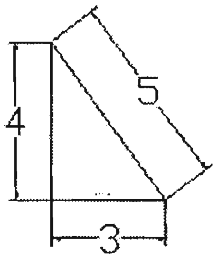
~~Pa~~ P: 16
A: 16

   b. A simple 2x4 rectangle



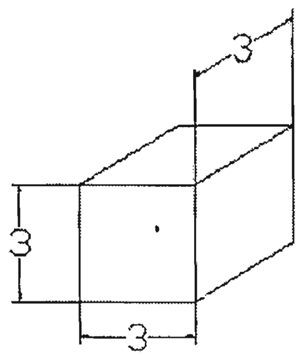
P: 12
A: 8

c. A simple 3x4x5 triangle



P:23

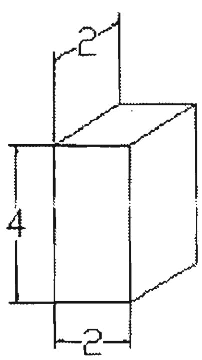
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



SA: 27

9
7

   b. A simple 2x4x2 cuboid



SA: 16

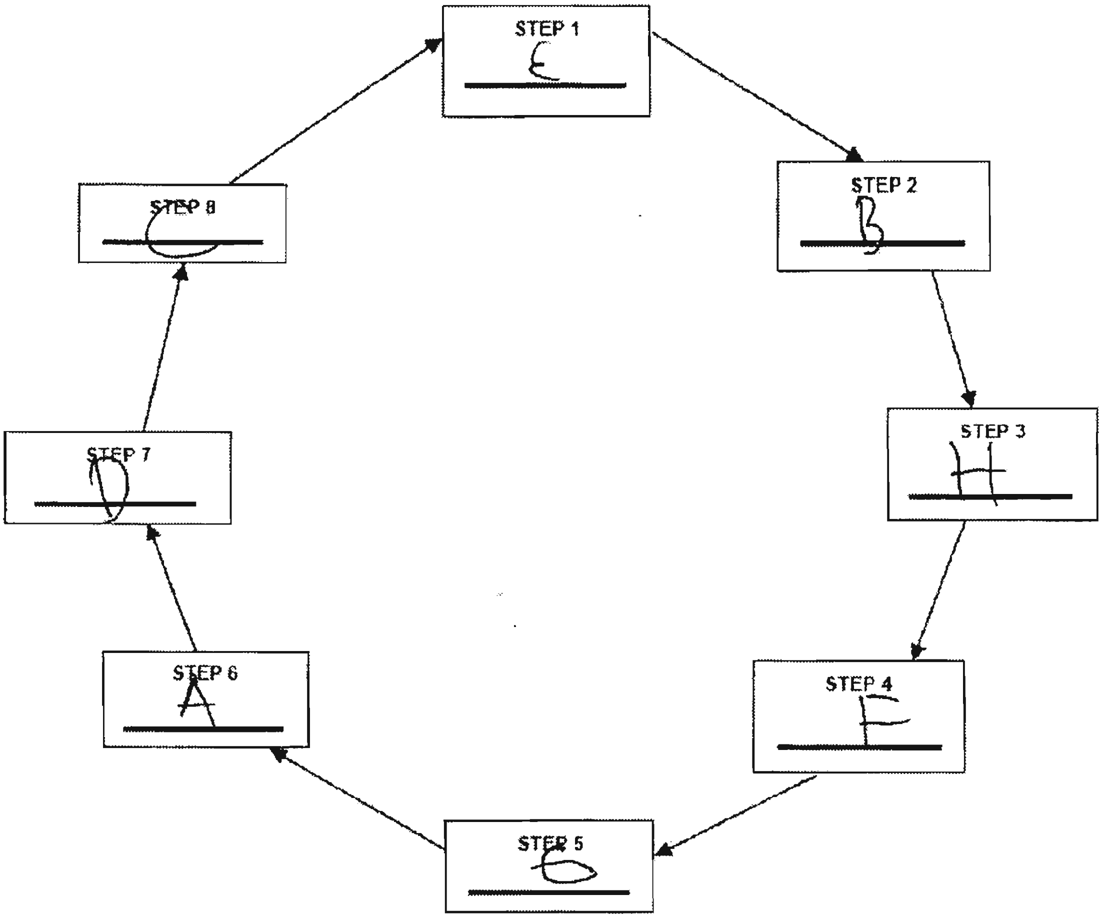
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Catemaran more balance can go faster holds less volume harder to turn

Regular ~~fas~~ slower essier to turn less balance can hold more

Please identify each step within the engineering design process-



A. ~~Construct a prototype~~
B. ~~Research the problem~~
C. Redesign
D. Test and evaluate
E. ~~Identify the problem~~
F. ~~Select the best possible solution(s)~~
G. ~~Communicate~~ the solution(s)
H. ~~Develop possible solutions~~

-30300

Post-Test for Boat Buoyancy Lesson Plan

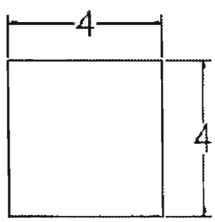
Matching

1. g Perimeter
2. a Area
3. a g Volume
4. f Mass
5. b Density
6. e Surface Area
7. c Buoyancy

a. The amount of space occupied by a three-dimensional object or region of space
b. The mass per unit volume of a substance at a specified pressure and temperature
c. The upward pressure exerted upon a floating body by a fluid
d. The outer limits of an area
e. The sum of the areas of the sides of a three-dimensional object
f. The measure of the quantity of matter that a body or an object contains
g. The extent of a 2-dimensional surface enclosed within a boundary

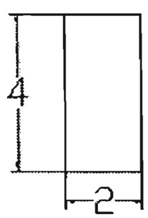
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



16,14

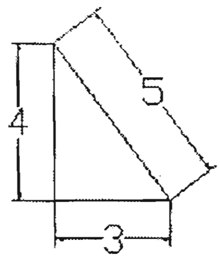
   b. A simple 2x4 rectangle



12,8

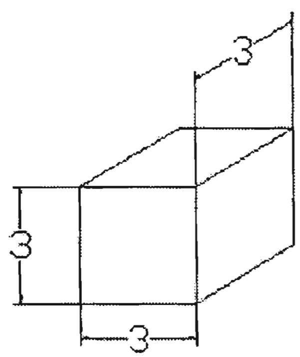
c. A simple 3x4x5 triangle

7.5
4
6.0



12,6

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



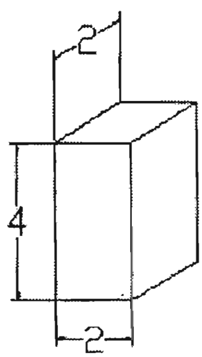
9
3

27, 54

b. A simple 2x4x2 cuboid

8+8+8+8+8

16
16
8
40



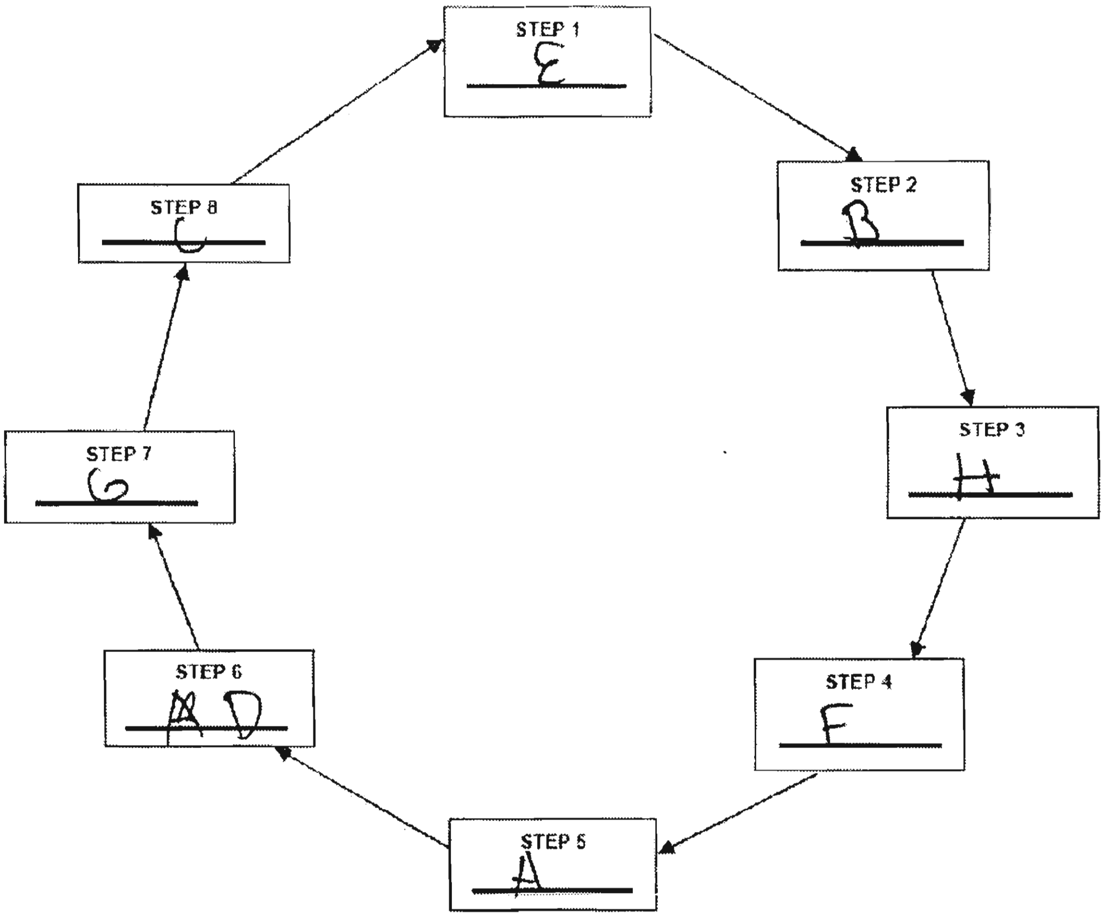
16, 40

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

The streghths about the Ponton is they can hold alot of waght the weakness is the cover is bad the reglars strenghts are they ~~can~~ have a good cover strenghts they can't holdabt

Please identify each step within the engineering design process-



A. Construct a prototype
~~B.~~ Research the problem
~~C.~~ Redesign
D. Test and evaluate
~~E.~~ Identify the problem
~~F.~~ Select the best possible solution(s)
~~G.~~ Communicate the solution(s)
~~H.~~ Develop possible solutions

Keq. 30300

Project Analysis Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 92.3 kg

The Volume of your Boat = ~~2853~~ 3434.25 kg

Density of water = 1 kg/m³

Volume * Density = Total Maximum Weight

2853 m³ * 1 kg/m³ = 2853 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

2853 kg – 92.3 kg = ~~2760~~.7 kg 3341.95

~~2776 kg~~ 3.3 Kg

Actual Maximum Weight Capacity (how much your boat held before it sank) = 3.3 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

it works

2853.0
92.3
2760.7

3434.25
92.30
3341.95

2772
63
2835
18
35
90

22
18
176
220
396
81
477

22
16
176
220
277

30273

Pre-Test for Boat Buoyancy Lesson Plan

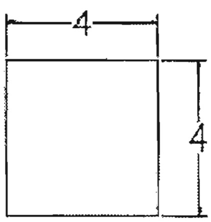
Matching

1. G Perimeter
2. D Area
3. A Volume
4. F Mass
5. B Density
6. E Surface Area
7. C Buoyancy

a. The amount of space occupied by a three-dimensional object or region of space
b. The mass per unit volume of a substance at a specified pressure and temperature
c. The upward pressure exerted upon a floating body by a fluid
d. The outer limits of an area
e. The sum of the areas of the sides of a three-dimensional object
f. The measure of the quantity of matter that a body or an object contains
g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

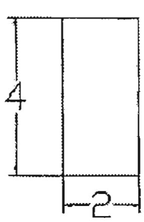
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



p=16

a=16

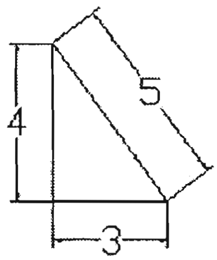
   b. A simple 2x4 rectangle



p=12

a=8

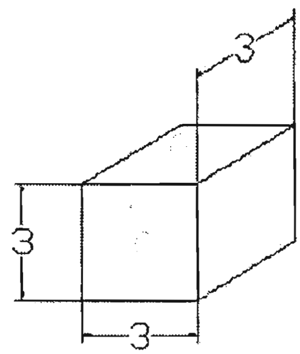
c. A simple 3x4x5 triangle



p = 12

a = 60

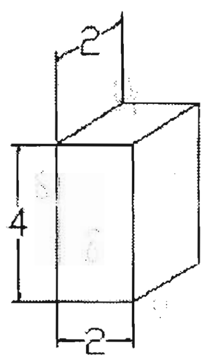
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



V = 27

sa = 54

   b. A simple 2x4x2 cuboid



v = 16

sa = 40

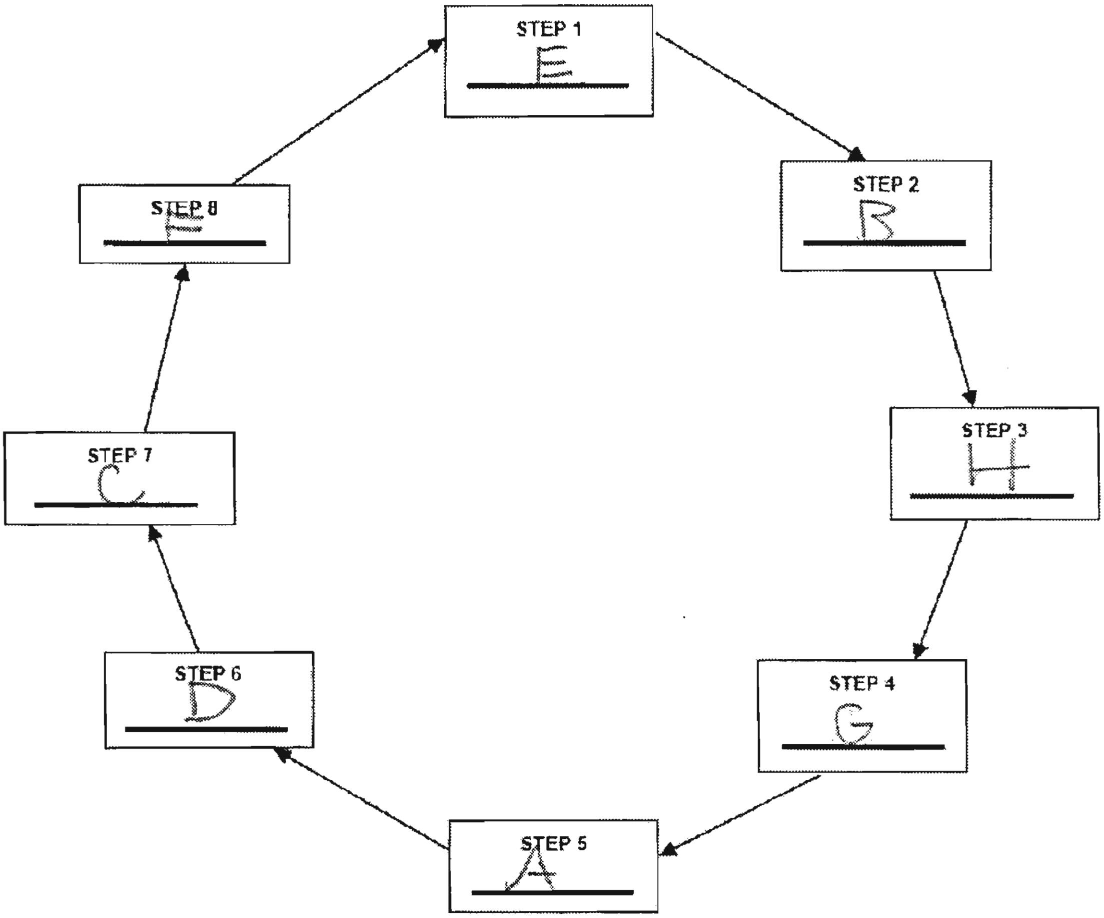
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

The catamaran has more surface area and therefor can hold more weight before sinking.

A regular boat has less mass and is more aerodynamic which makes it faster.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

30273

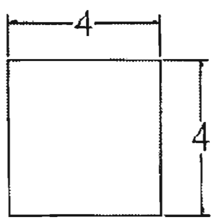
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. E Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. A Volume	c. The upward pressure exerted upon a floating body by a fluid
4. F Mass	d. The outer limits of an area
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. G Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

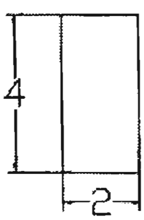
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



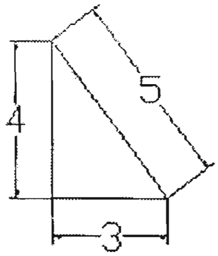
P= 16
A=16

   b. A simple 2x4 rectangle



P=12
A=8

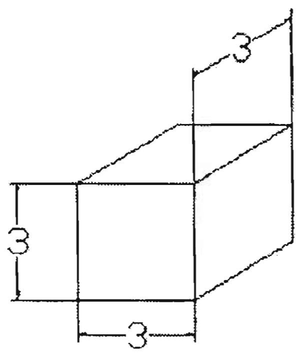
c. A simple 3x4x5 triangle



P=12

A=6

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



V=27

SA=56

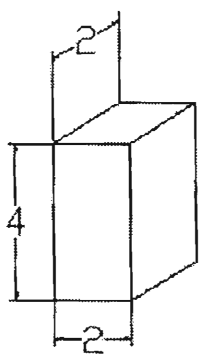
b. A simple 2x4x2 cuboid

4

4

32

40



V=16

SA=40

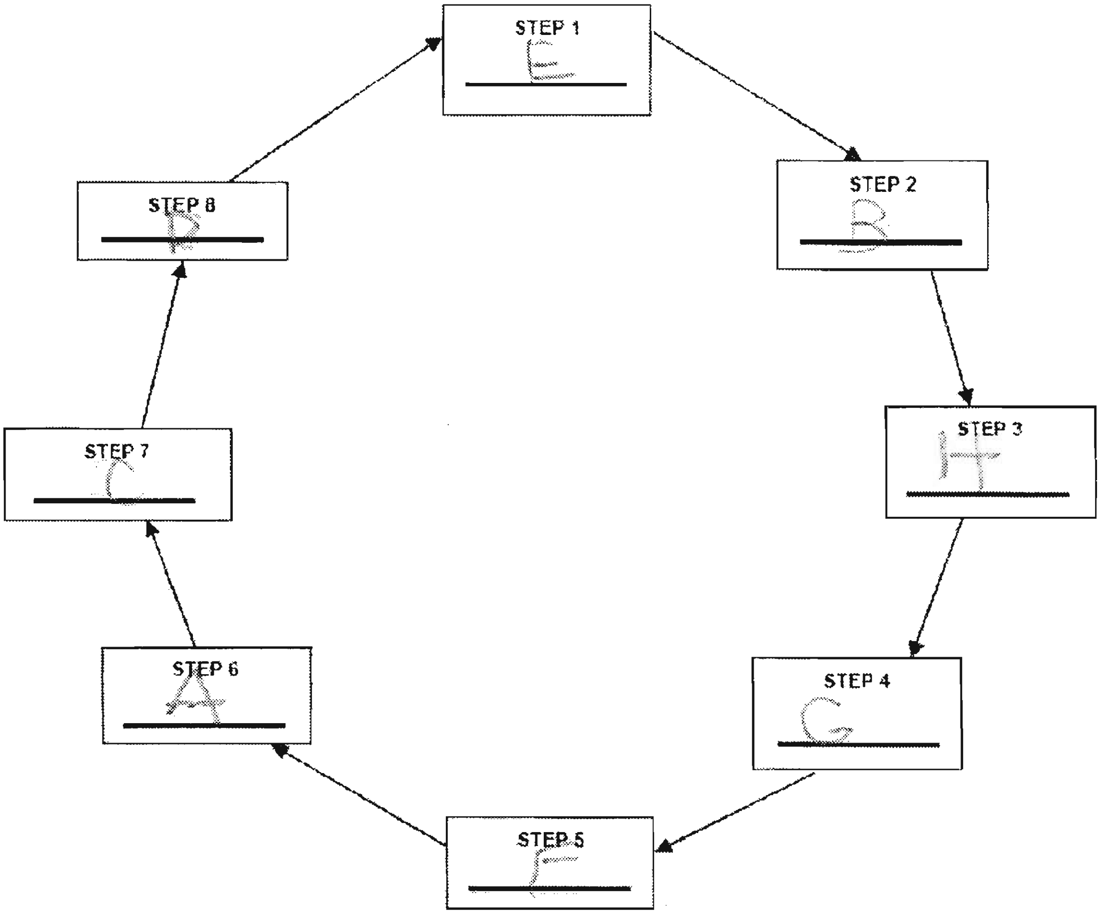
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

Tanker weighs more than the catamarran but can hold more weight. The Tanker is also more structually intack.

The catamarran has more surface area but needs support to keep the cover from folding in.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
~~E. Identify the problem~~
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Key. 30213

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 88.6 kg   3563.3

The Volume of your Boat = ~~2835~~ kg

Density of water = 1 kg/m^3

Volume * Density = Total Maximum Weight

~~2835~~ m^3 * 1 kg/m^3 = ~~2835~~ 3563.3 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

~~2835~~ 3563 kg – 88.6 kg = ~~2746.4~~ 3474.7 kg   3.5 kg.

Actual Maximum Weight Capacity (how much your boat held before it sank) =

3 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

The MWC was 500 grams more than the AMW. Some Possible causes for this problem are the material I used, my boat wasn't sealed well, or that the weight of my boat was wrong.

30250

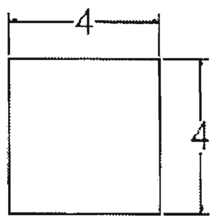
Pre-Test for Boat Buoyancy Lesson Plan

Matching

1. G Perimeter 2. D Area 3. A Volume 4. F Mass 5. B Density 6. E Surface Area 7. C Buoyancy	a. The amount of space occupied by a three-dimensional object or region of space b. The mass per unit volume of a substance at a specified pressure and temperature c. The upward pressure exerted upon a floating body by a fluid d. The outer limits of an area e. The sum of the areas of the sides of a three-dimensional object f. The measure of the quantity of matter that a body or an object contains g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

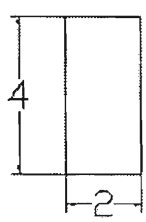
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



$p = 16$

$a = 16^2$

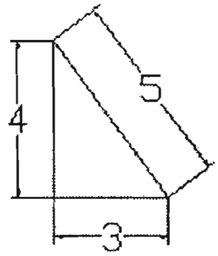
   b. A simple 2x4 rectangle



$p = 12$

$a = 8^2$

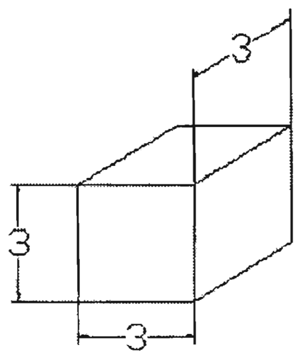
c. A simple 3x4x5 triangle



P = 12

a =

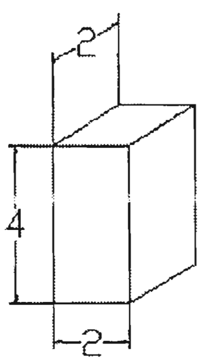
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



$V = 27^3$

s.a. =

   b. A simple 2x4x2 cuboid



$V = 16^3$

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

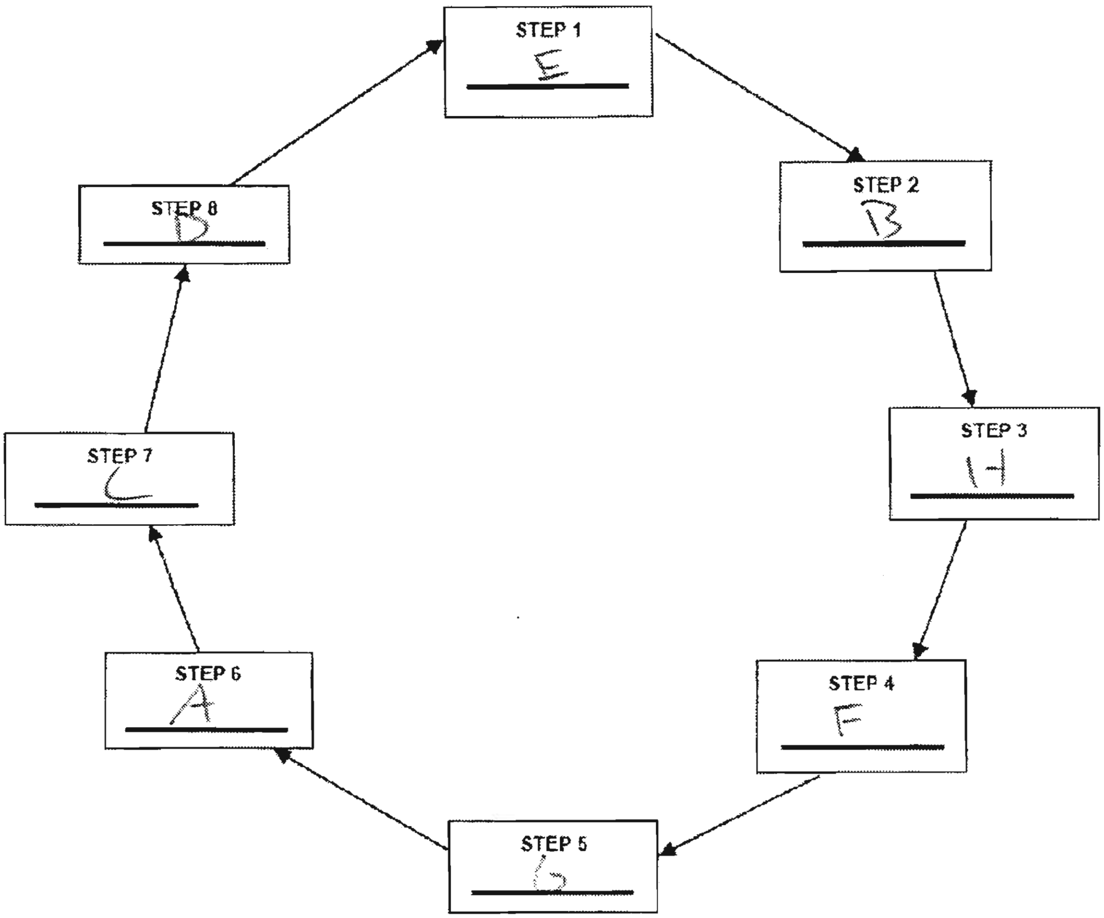
Catamaran

- Strengths
  - Weight spread out
- Weakness
  - middle could collapse

Regular

- strength
  - all the weight in one spot
- Weakness ~~weight~~
  - weight is not distributed

Please identify each step within the engineering design process-



~~A. Construct a prototype~~
B. ~~Research the problem~~
~~C.~~ Redesign
~~D.~~ Test and evaluate
~~E. Identify the problem~~
~~F.~~ Select the best possible ~~solution~~(s)
G. ~~Communicate~~ the solution(s)
~~H.~~ Develop possible solutions

30250

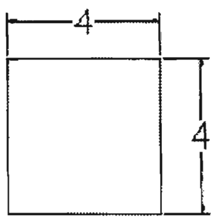
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. E Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. A Volume	c. The upward pressure exerted upon a floating body by a fluid
4. F Mass	d. The outer limits of an area
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. G Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

Mathematics

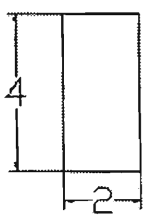
1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



P = 16

A = 16

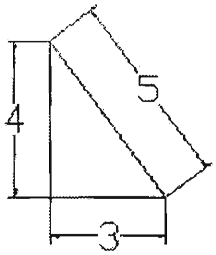
   b. A simple 2x4 rectangle



A = 8

P = 12

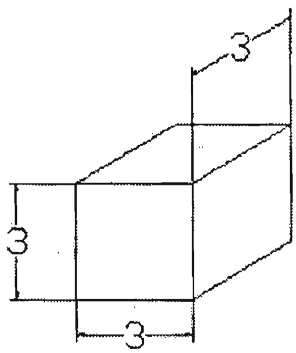
c. A simple 3x4x5 triangle



P=12

A=6

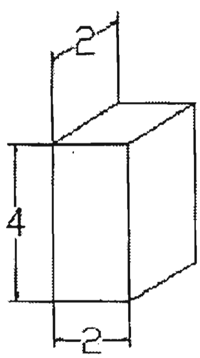
2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



V= 9

S.A.=56

b. A simple 2x4x2 cuboid



SA=64

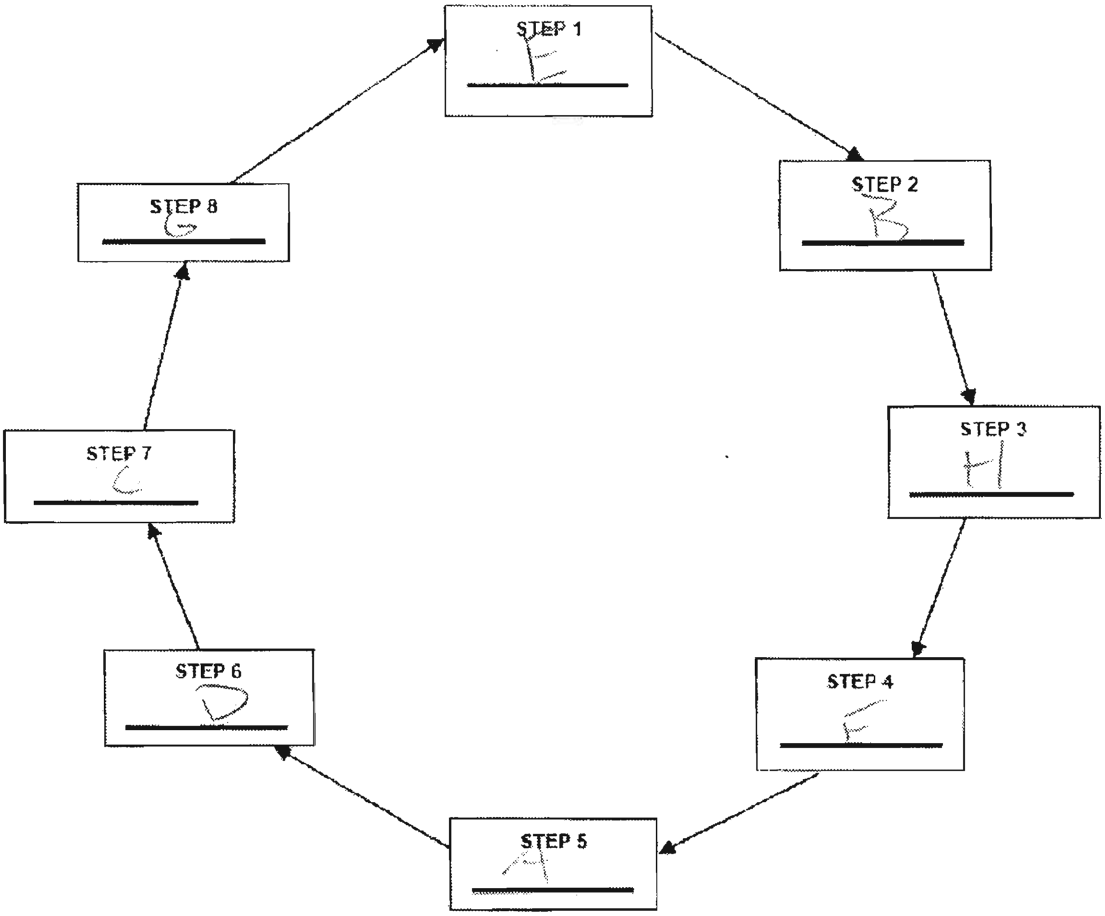
V=8

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

The Catamaran ~~is~~ distributes the weight more than the regular. It also can hold more. A weakness is that it bent in the middle

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Cat. 20250

Project Analysis

Name [redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 70.5 ~~k~~g ~~4477~~ ~~1765~~

The Volume of your Boat = ~~7204~~ ~~k~~g ~~4983.5~~ ~~3554~~ 3834

Density of water = 1 kg/m^3

Volume * Density = Total Maximum Weight

~~4983.5~~ 3834 m^3 * 1 kg/m^3 = ~~4983.5~~ 3834 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity 3.8 kg

~~4983.5~~ 3834 kg – 70.5 ~~k~~g = ~~4913~~ 3763.5 kg ~~4.9 kg~~

Actual Maximum Weight Capacity (how much your boat held before it sank) =

3.8 kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

The Maxium Weight Capacity and the Actual Maximum Weight Capacity were the same.

20467

Pre-Test for Boat Buoyancy Lesson Plan

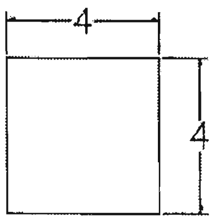
Matching

1. D Perimeter
2. G Area
3. A Volume
4. F Mass
5. B Density
6. E Surface Area
7. C Buoyancy

a. The amount of space occupied by a three-dimensional object or region of space
b. The mass per unit volume of a substance at a specified pressure and temperature
c. The upward pressure exerted upon a floating body by a fluid
d. The outer limits of an area
e. The sum of the areas of the sides of a three-dimensional object
f. The measure of the quantity of matter that a body or an object contains
g. The extent of a 2-dimensional surface enclosed within a boundary

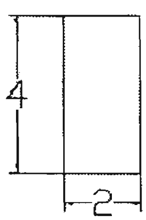
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



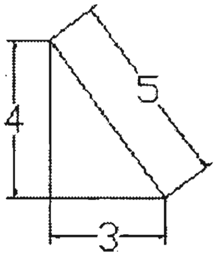
P=16
A=16

   b. A simple 2x4 rectangle



P=12
A= 4

c. A simple 3x4x5 triangle

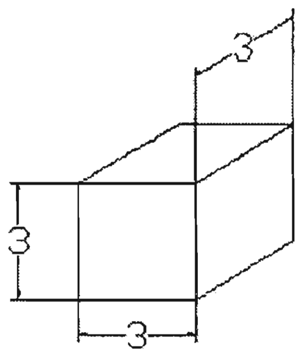


P = 12
A = 12

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube

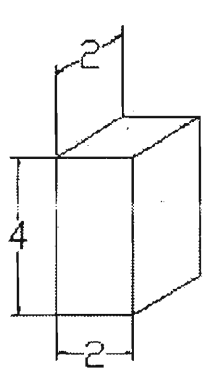
P = 72
A = 27

24
×3
72



   b. A simple 2x4x2 cuboid

P = 16
A = 16

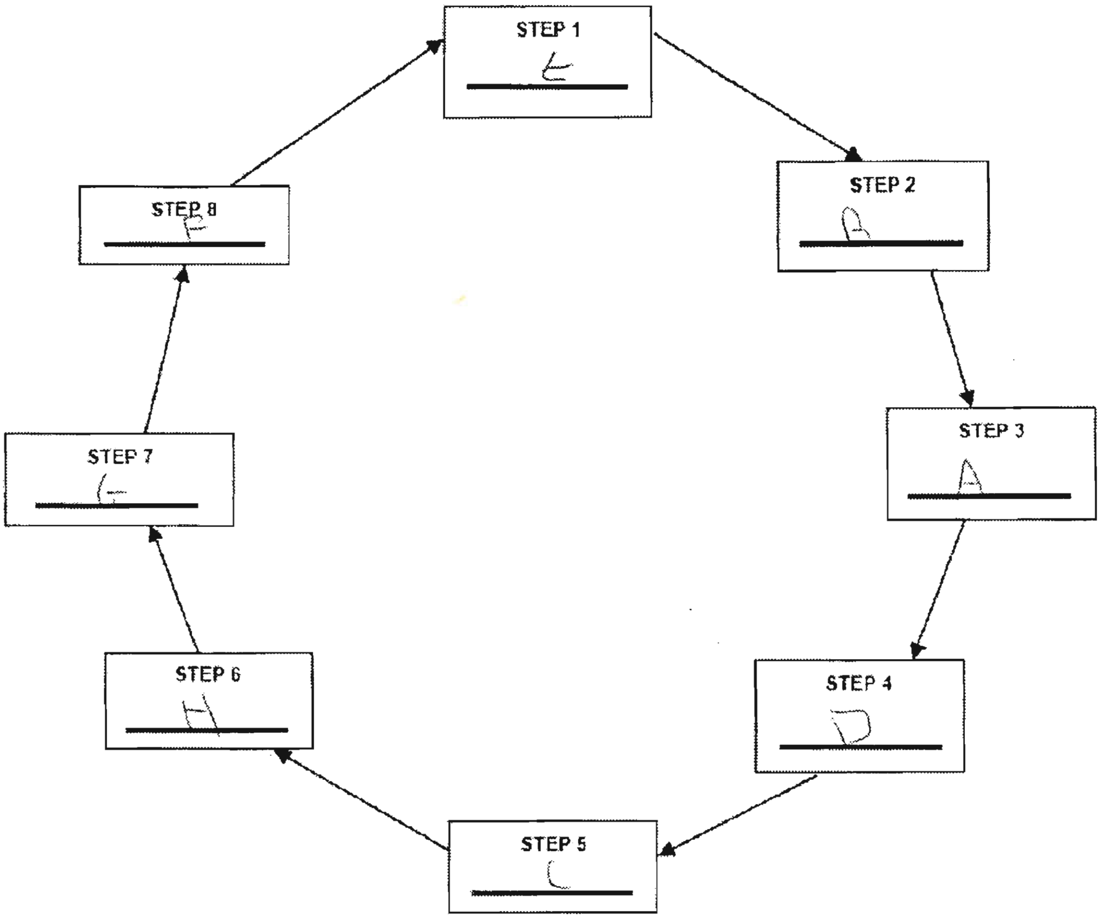


Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs.

The strength and weaknesses of various boat designs are that depending on the shape the boat might not bestable. The bottom how it curves helps the boat cut through the water easier. The shape has to be exactly measured or their might be a problem in how it stays afloat.

Please identify each step within the engineering design process-



A. Construct a prototype 3
B. Research the problem 2
C. Redesign 5
D. Test and evaluate 4
E. Identify the problem 1
F. Select the best possible solution(s) 8
G. Communicate the solution(s) 7
H. Develop possible solutions 6

20467

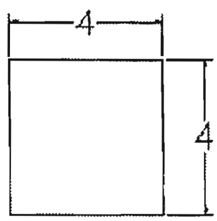
Post-Test for Boat Buoyancy Lesson Plan

Matching

1. D Perimeter	a. The amount of space occupied by a three-dimensional object or region of space
2. A Area	b. The mass per unit volume of a substance at a specified pressure and temperature
3. E Volume	c. The upward pressure exerted upon a floating body by a fluid
4. F Mass	d. The outer limits of an area
5. B Density	e. The sum of the areas of the sides of a three-dimensional object
6. g Surface Area	f. The measure of the quantity of matter that a body or an object contains
7. C Buoyancy	g. The extent of a 2-dimensional surface enclosed within a boundary

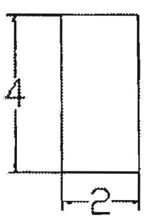
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



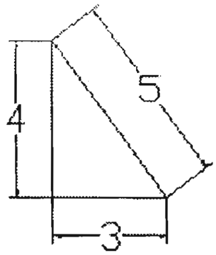
16

   b. A simple 2x4 rectangle



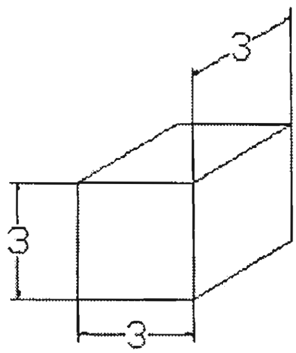
12

c. A simple 3x4x5 triangle



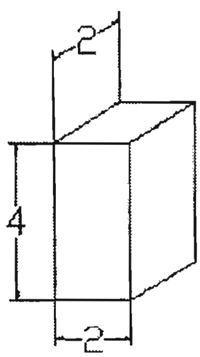
24

2. Find the volume and surface area of these simple shapes
   a. A simple 3x3x3 cube



27

   b. A simple 2x4x2 cuboid



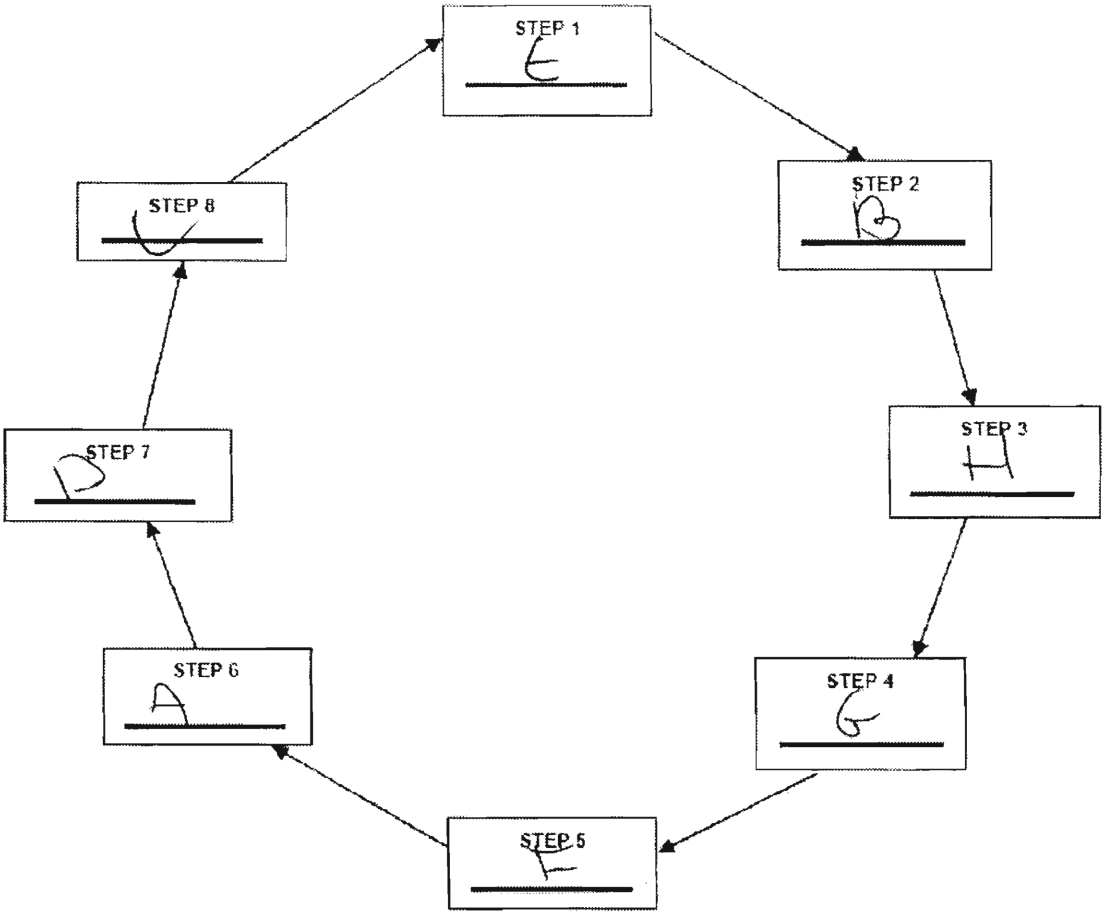
16

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

The differenies in strengths and weakness is how the boat is shaped. If the front has to much area then it would be uneven compared with the back. Also if the weight is disproportionate then the boat is allmessed up.

Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

Reg. 20461

Project Analysis

Name [redacted]

[redacted]

Input your data into the appropriate sections and this will give you a better understanding of how your boat performed.

The Weight of your Boat = 99.8 kg

The Volume of your Boat = 2850.2 kg

Density of water = 1 kg/m^3

Volume * Density = Total Maximum Weight

2850.2 m^3 * 1 kg/m^3 = 2850.2 kg

Total Maximum Weight – Weight of Boat = Maximum Weight Capacity

2850.2 kg – 98.8 kg = 2751.4 kg   275 kg.

Actual Maximum Weight Capacity (how much your boat held before it sank) =

~~2751~~ kg

Compare the "Maximum Weight Capacity" to the "Actual Maximum Weight Capacity." If these numbers are very different, explain possible causes.

The #s are the same be cause it sank when it was sup oobe to sink and so I was. My numbers were calculated right.

20259

Pre-Test for Boat Buoyancy Lesson Plan

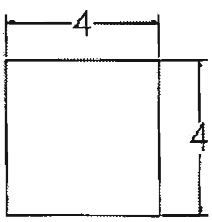
Matching

1. D Perimeter
2. E Area
3. A Volume
4. F Mass
5. B Density
6. G Surface Area
7. C Buoyancy

a. The amount of space occupied by a three-dimensional object or region of space
b. The mass per unit volume of a substance at a specified pressure and temperature
c. The upward pressure exerted upon a floating body by a fluid
d. The outer limits of an area
e. The sum of the areas of the sides of a three-dimensional object
f. The measure of the quantity of matter that a body or an object contains
g. The extent of a 2-dimensional surface enclosed within a boundary

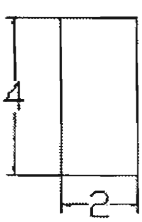
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square



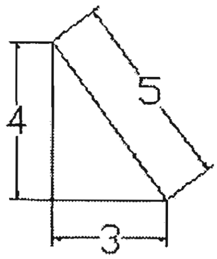
16 = Area
16 = Perimeter

   b. A simple 2x4 rectangle



7 = Area
12 = Perimeter

c. A simple 3x4x5 triangle

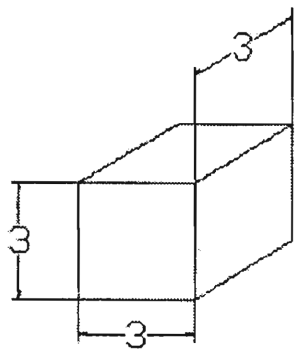


A= 17.5

P=12

2. Find the volume and surface area of these simple shapes

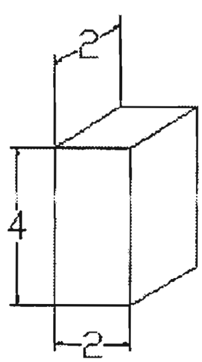
   a. A simple 3x3x3 cube



A=27

P=9

   b. A simple 2x4x2 cuboid



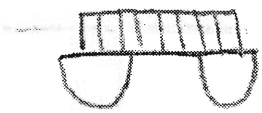
A=16

P=8

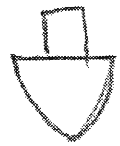
Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

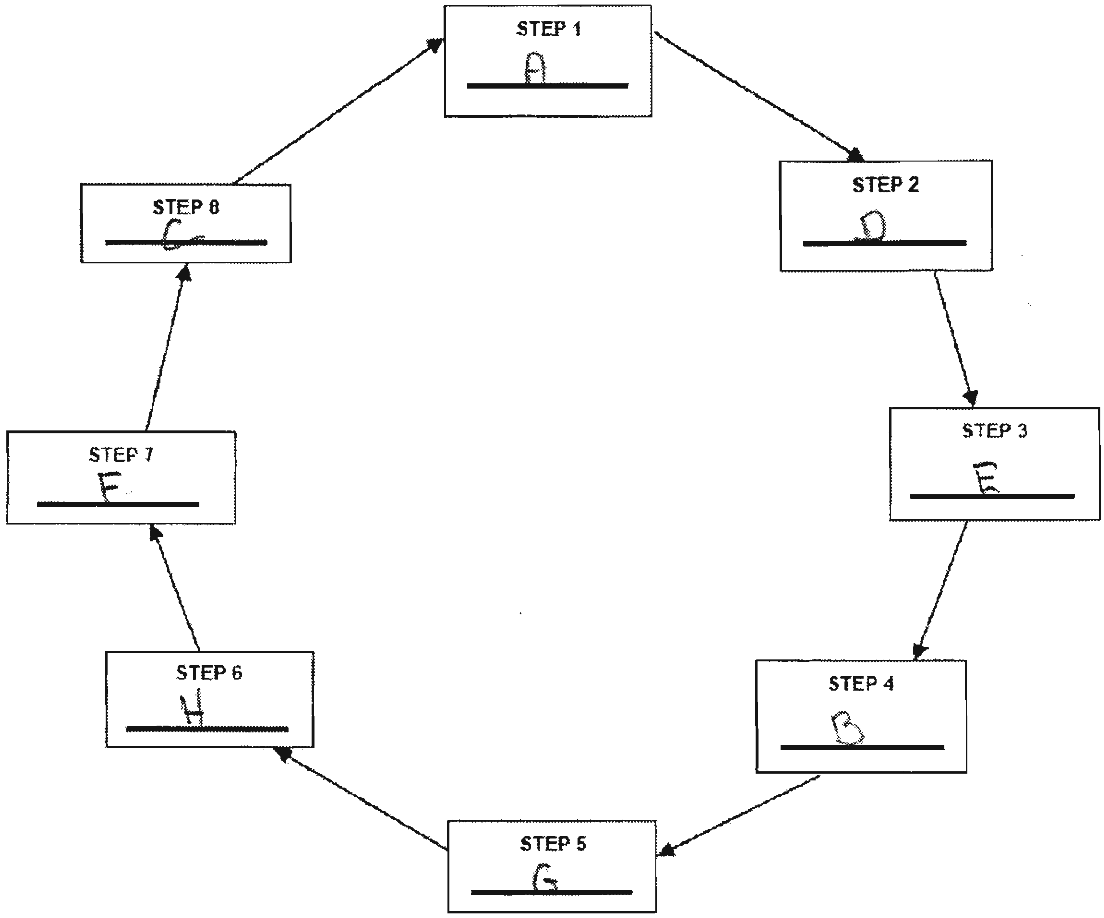
pontun



v-botton



Please identify each step within the engineering design process-



A. Construct a prototype
B. Research the problem
C. Redesign
D. Test and evaluate
E. Identify the problem
F. Select the best possible solution(s)
G. Communicate the solution(s)
H. Develop possible solutions

507860

Pre-Test for Boat Buoyancy Lesson Plan

Matching

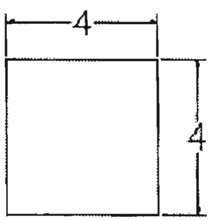
1. d Perimeter
2. g Area
3. A Volume
4. f Mass
5. B Density
6. e Surface Area
7. C Buoyancy

a. The amount of space occupied by a three-dimensional object or region of space
b. The mass per unit volume of a substance at a specified pressure and temperature
c. The upward pressure exerted upon a floating body by a fluid
d. The outer limits of an area
e. The sum of the areas of the sides of a three-dimensional object
f. The measure of the quantity of matter that a body or an object contains
g. The extent of a 2-dimensional surface enclosed within a boundary

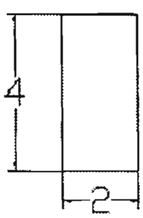
Mathematics

1. Find the perimeter and area for each of these simple shapes
   a. A simple 4x4 square

16

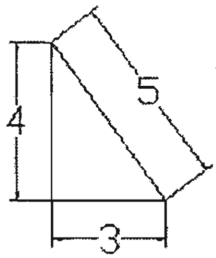


   b. A simple 2x4 rectangle



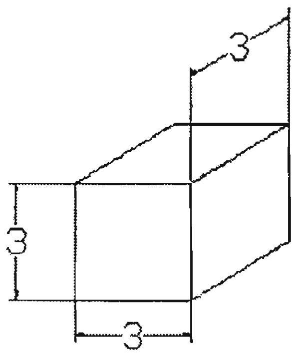
8

c. A simple 3x4x5 triangle



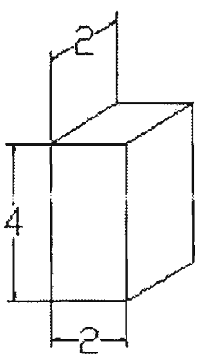
27

2. Find the volume and surface area of these simple shapes
    a. A simple 3x3x3 cube



27
9

b. A simple 2x4x2 cuboid



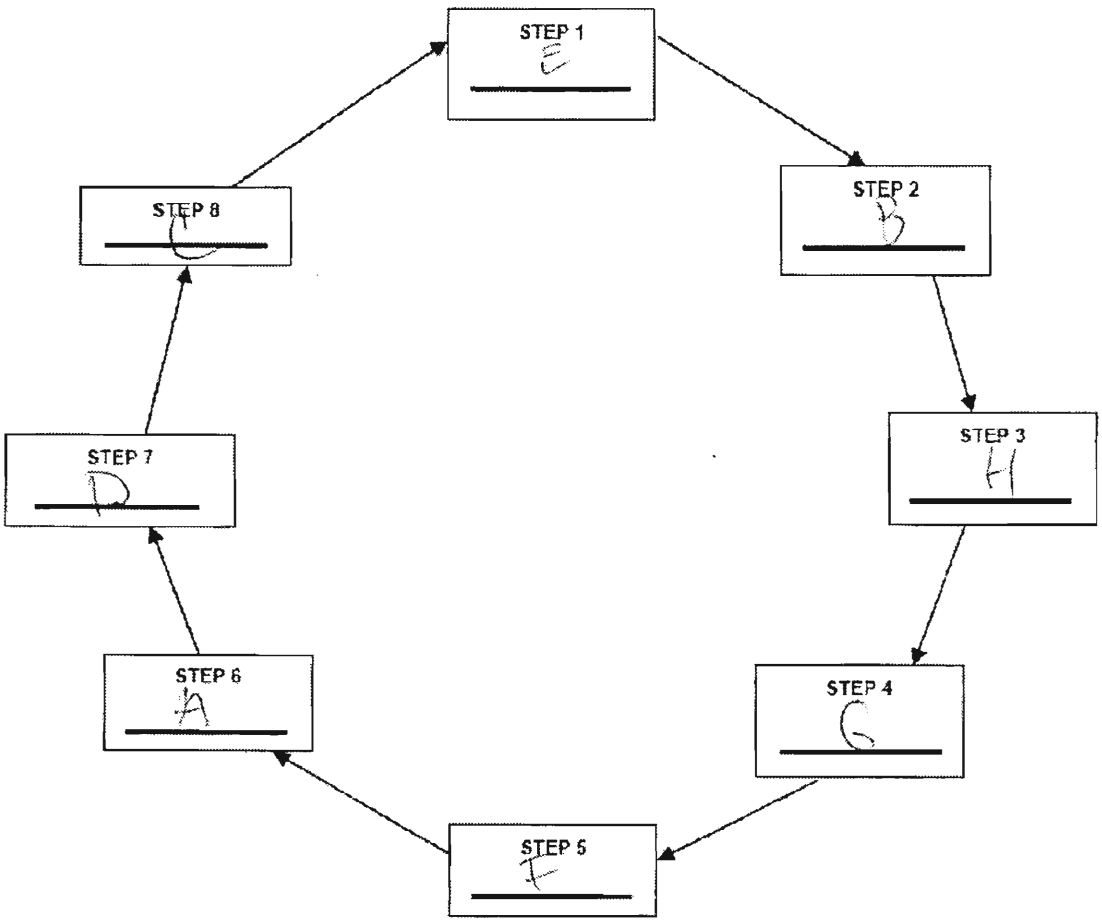
16
8

Engineering/Design

Please use this space provided to discuss what you know about the strengths and weaknesses of various boat designs-

wider more weight & ~~flat~~ balance

Please identify each step within the engineering design process-



A. Construct ~~a prototype~~
~~B. Research the problem~~
~~C. Redesign~~
~~D. Test and evaluate~~
E. Identify ~~the problem~~
~~F. Select the best possible solution(s)~~
~~G. Communicate the solution(s)~~
~~H. Develop possible solutions~~