Name: _____
Period: _____

GEODESIC DOME

UNIT: MANUFACTURING_LEVEL 2

CASE STUDY:

Whether societies dwell in cold or hot climates, shelter from the elements is important for survival. Often the quest for a sheltering structure may not be a need, but a want, desire, or a means to achieve some other result. Whatever the reason, a building is normally designed to shelter people and their property.

Ancient civilizations built both small and massive structures to serve a variety of purposes. Some people-built temples or burial sites. Most all had the need for housing. Structures for entertainment or for the pursuit of knowledge were soon added to the list, and offered a unique twist to the typical structure. Materials used in the construction of these temples, palaces, homes, and businesses have ranged from coarse stone to marble, and from ice to sticks. Industrialization introduced metal and steel beams, and the use of glass and concrete eventually became popular.

How many different or unique structures can you think of? List them here:

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Consider ancient civilizations and contemplate how their structures compared to those today. Examine the dwellings of other living organisms and creatures. What do their homes look like and what factors influenced their choice of building materials?

Sketch what they look like here:

Look at each of the structures that you or your classmates have identified and imagine each as a basic shape. Eliminate the square and rectangular types of buildings and focus on those created from a triangle. Did you know that circular structures may be made from many, smaller triangles? For instance, a geodesic dome is actually comprised of triangles positioned in a specific pattern.

PROBLEM SOLVING PROCESS:

These steps may be helpful to you in approaching your activity:

- Form cooperative groups (2 to 3 people).
- Brainstorm for ideas.
- Sketch possible solutions.
- Decide how to build and finish the project.
- Decide on and gather materials.
- Construct your design.
- Test your design.
- Present your design.

CHALLENGE:

EXPLORATORY

Research and model at least three (3) structures that have been constructed from triangles. Write a brief paragraph that describes their construction and why a particular culture may have selected that shape.

INTERMEDIATE

Research, design, and model an icosahedron that incorporates a lesson from another discipline. Create a game using the structure as a die or template. Use information from the other discipline to develop a set of questions (e.g., Quiz Bowl).

ADVANCED

Design and make an icosahedral structure or geodesic dome that may be used as a mini-planetarium. The structure should be large enough to accommodate six to eight students comfortably as well as the Star Machine.

MATERIALS:

EXPLORATORY

- Bristol board
- Kite string
- Heavy weight paper, various colors
- Rulers
- Sand paper, other textured paper
- Scissors
- Pencils, markers, colored pencils
- Glue

INTERMEDIATE

- Bristol board
- Kite string
- Heavy weight paper, various colors
- Rulers
- Pencils and markers
- Colored pencils
- Scissors
- Materials from other disciplines related to questions, answers, terms
- Glue

ADVANCED

- Butcher paper
- Duct tape: 6 rolls
- Meter sticks
- Kite string
- 3 Rolls of 10' x 25' 3-mm black polyethylene
- Pencils and markers
- Scissors
- Star Machine
- Box Fan

Your success on this Challenge will be based on your completion of the activities below. Three general criteria for your performance will be your participation in the activity, the accuracy of your measurement and construction of the model, and the performance of your design. Your teacher will help you understand how your performance will be graded.

EXPLORATORY

- Locate and document at least three (3) examples of structures that have been constructed from triangles.
- Write a brief paragraph that summarizes the construction techniques and why the particular culture/society may have chosen the design.
- Construct a model of the structure showing the triangles used in design.
- Present your design.

INTERMEDIATE

- Research geometric shapes based upon an equilateral triangle.
- Research icosahedrons and the construction of this shape.
- Gather review materials from other classes or disciplines.

Compose questions/answers on a separate sheet of paper.

- Model an icosahedron with a height of 8 inches.
- Design a game that would utilize review materials and the icosahedral shape.
- Construct your design using the materials provided and approved.
- Test and present your design.

ADVANCED

- Research geometric shapes based upon an equilateral triangle.
- Research icosahedrons and geodesic domes and the construction of these shapes.
- Gather information about planetariums as well as astronomy facts.
- Design and create a fictitious, scientific company manufacturing a portable miniplanetarium that will travel from school to school.
- Create a brochure that will promote the new design.
- Calculate the size of the structure that will accommodate six to eight students comfortably. Remember, the Star Machine must be included in the structure.
- Construct your design using only the materials provided and approved.
- Test and present your design.

The following is an example of an integrated activity to show the possible Science, Math, and Technology (SMT) connections to the above challenges. Using the following equation, calculate the height of the dome at different scales (e.g., full size, half size, quarter size, 1/8th size.

Calculate proportions for each of the activities, whether small or large scale. Height of Dome = 1/3 length of a triangle's side x 5 example: Height dome = 1/3x(130 cm) x 5

Height dome = 216.70 cm

A dome of the size in the example equation will accommodate six to eight students plus the Star Machine. Smaller icosahedrons may be constructed for other applications.

Method of constructing an equilateral triangle:

1. Begin with selected base line AB. (Note that AB is the length of a triangle's side in the above equation.)
2. Place compass point on A and the pencil point on B; draw a vertical arc.
3. Place compass point on B and the pencil point on A; draw a second vertical arc.
4. The point where the two arcs intersect is point C or the third corner of the Equilateral Triangle.
5. Connect points A to C and B to C.