SOMA CUBE (3-Dimensional puzzle) Lab

WAMC Lab Template

Math Concept(s): 1) Geometric Measurement and Dimension (G-GMD): Visualize relationships between two-dimensional and three dimensional objects.
2) Modeling with Geometry (G-MG): Apply geometric concepts in modeling situations

Source / Text: Internet

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Date: Summer In-service 2013

Attach the following documents:

Lab Instructions: See attached

Student Handout(s): See attached

- Rubric and/or Assessment Tool: Formative: Monitoring the students in the room and ask questions as they start to assemble their 3-D rectangular prisms.
- Summative: Students will create a technical writing piece where they give instructions on how to assemble their puzzle cube and the teacher will read the instructions to assemble the cube. (An alternative would be to have students read each other's instructions and try to assemble the cube and then grade each other's instructions)

Short Description (Be sure to include where in your instruction this lab takes place):

Students will create the pieces of a soma cube, assemble the cube, and then write a set of instructions explaining how their cube is to be assembled. They will be given the net drawings of the 27 cubes needed to begin the process. They will be asked to cut them out, tape them and then assemble the 7 pieces. Once this is done, they will then go about putting their puzzle pieces together. They can experiment with different types of prisms and will hopefully settle on the 3x3x3 rectangular prism. Students will then need to write out instructions to explain how best to assemble their cube.

Lab Plan

Lab Title: Ferrets 'R Us

Prerequisite skills: 1) Concepts of surface area and volume
2) cross-sections and nets
3) two-dimensional vs. three-dimensional spatial relationships

Lab objective: 1)Student will be able to create the original 7 three-dimensional pieces to the soma cube using graph paper from two-dimensional cross sections 2) Student will be able to assembly

their soma cube using all 7 pieces. They are looking for the most compact structure to meet the physical constraint imposed on them (apartment building in an urban area where they want to maximize the number of cubic apartments – volume, while minimizing the overall space – surface area).

Standards:

CCSS-M:

- Geometric Measurement and Dimension (G-GMD): Visualize relationships between two-dimensional and three dimensional objects. Identify the shapes of two-dimensional cross-sections of three dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects (G-GMD 4)
- Modeling with Geometry (G-MG): Apply geometric concepts in modeling situations -- Apply geometric methods to solve design problems (G-MG 3)

Standards for Mathematical Practice:

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Model with mathematics.
- Look for and make use of structure

State Standards addressed (2008 Washington State Mathematics Standards):

- G.3.J Describe prisms, pyramids, parallelepipeds, tetrahedra, and regular polyhedra in terms of their faces, edges, vertices, and properties.
- G.3.K Analyze cross-sections of cubes, prisms, pyramids, and spheres and identify the resulting shapes.
- G.6.C Apply formulas for surface area and volume of three-dimensional figures to solve problems.

Reading:

- 3.2.2

Writing:

- 3.1.2

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

☒ Global Awareness ☐ Financial/Economic/Business/Entrepreneurial Literacy ☐ Civic Literacy
☐ Health/Safety Literacy ☒ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION
Creativity and Innovation
☒ Think Creatively
☐ Work Creatively with Others
☒ Implement Innovations
Critical Thinking and Problem Solving
☒ Reason Effectively
☐ Use Systems Thinking
☐ Make Judgments and Decisions
☒ Solve Problems
Communication and Collaboration
☒ Communicate Clearly
☐ Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS
Information Literacy
☐ Access and Evaluate Information
☐ Use and manage Information
Media Literacy
☐ Analyze Media
☐ Create Media Products
Information, Communications and Technology (ICT Literacy)
☐ Apply Technology Effectively

LIFE & CAREER SKILLS
Flexibility and Adaptability
☐ Adapt to Change
☒ Be Flexible
Initiative and Self-Direction
☒ Manage Goals and Time
☒ Work Independently
☐ Be Self-Directed Learners
Social and Cross-Cultural
☐ Interact Effectively with Others
☐ Work Effectively in Diverse Teams

Productivity and Accountability
☒ Manage Projects
☒ Produce Results
Leadership and Responsibility
☐ Guide and Lead Others
☐ Be Responsible to Others

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Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- Graph paper (templates for cubes provided), scissors, tape

Set-Up Required:

- Copy all documents for students and have supplies ready to go

Lab Organization Strategies:

Grouping/Leadership/Presentation Opportunities:

- Students will work independently on this activity and then work together in a think, pair, share in the share out portion of this activity.

Cooperative Learning:

- Think, pair, share in the share out portion of this activity.

Expectations:

- I expect students to use precision in the cutting, taping, and assembly of their cubes and 7 puzzle pieces.
- I expect kids to work independently, but they may discuss with others while building their own cuboid.

Timeline:

- The students will start cutting cubes out of a template and taping them together. While doing this I will be discussing the over-population of Japan and the "Fact sheet" on Japan. When they have finished all of the cubes and put their 7 puzzle pieces together, I will give them the letter that explains their task. Students will then begin to work on this task. I estimate this lab taking approximately 4 class periods.

Post Lab Follow-Up/conclusions:

Discuss real world application of learning from lab

- Spatial relationships
- Design using given constraints
- Net diagrams
- Factors of composite numbers
- Surface area and volume of prisms

Career Applications

- Game design, Architecture, Drafting, Art and design

Optional or Extension Activities

- Have students build other structures by changing the parameters of assignment
- Look more closely at composite numbers and how the dimensions of a rectangular prism would need to be the factors of the composite.
- Have students draw the two-dimensional net diagram for the 7 figures

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Attachments

S.T. Udent Architecture and Design, LLC
1720 Skool Way
Anytown, WA 97835

Mr. S. T. Udent,

First of all, we would like to thank you for taking on our design project with such short notice. We will expect the completed project by the end of this week.

As you may have ascertained, open real estate in Tokyo is almost nonexistent. In short, we have built structures or roads on virtually every square meter of our prosperous city. There are only a few square meters of land remaining that can hold a usable structure.

Per our conversation last week, you are well aware that the president of our company has twenty-seven pet ferrets that he prizes above all else. Each ferret must have its own living space of one meter squared (1 m^2). The amount of land available for your design is nine meters squared (9 m^2), and cannot deviate greater than this. We will rely on your efficiency, and assume that you will use every square centimeter of land to build your structure on. Remember, the sky is the limit on both structure and materials.

Your project must include all drawings and dimensions of your building design, and include your design report. The design report must include any problems that you had and how you solved the problems (if any).

Thank you again for your cooperation.

Respectfully Yours,

Shinzō Abe

Procurement Department
Ferrets R Us
Tokyo Central Post Office
1-5-3 Yaesu, Chuo-ku
Tokyo 100-8994

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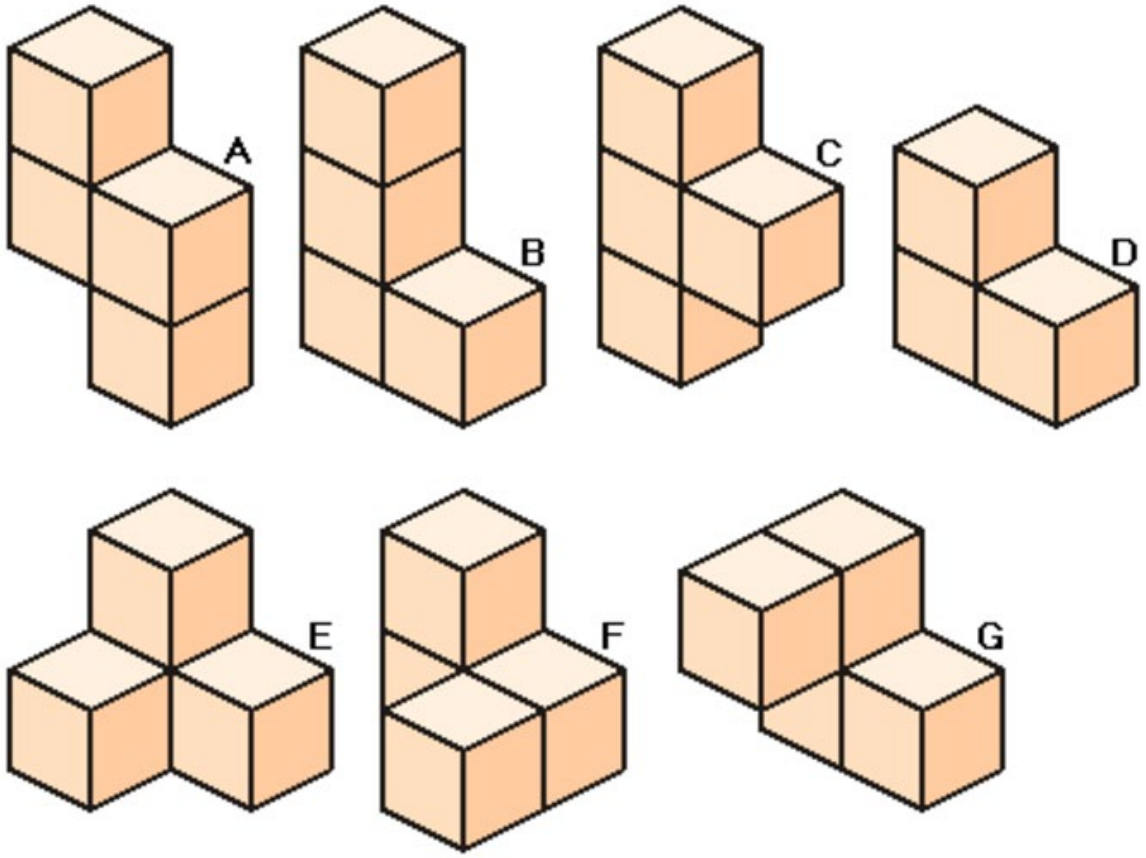
Build the following cuboids using the cube diagrams provided.



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