3D Paper Model Project

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Overview:

In this project, students will design and construct a 3D paper model using nets of geometric solids. Students will combine multiple shapes to create an original structure such as an animal, house, vehicle, or abstract sculpture.

Students must calculate the surface area and volume of the shapes used in their model and explain how these shapes combine to form their final structure.

The goal of this project is to explore geometry through hands-on design, spatial reasoning, and creative problem solving.

Student Instructions:

Step 1: Choose a design idea

Think of a 3D object you want to build.

Examples: Animal, House or building, Vehicle, Robot, Abstract geometric sculpture

Your model must be built from **geometric solids** with **at least 3 different shapes**.

Step 2: Plan your model

Before building, complete a **design plan**.

Your plan must include:

- A sketch of your model
- The geometric shapes you will use
- The dimensions of each shape
- A net (2D template) for each shape

Step 3: Calculate surface area and volume

For each shape used in your model:

- Calculate the **surface area and volume**

Then determine:

- Total surface area used and Total volume of your model

Students should clearly show **all calculations**.

Step 4: Construct your model

Using your nets, cut and fold paper to construct the shapes and assemble them into your final design.

You may decorate your model before or after construction.

Step 5: Present your model

Students will briefly present their project and explain:

- What shapes they used
- How they calculated surface area and volume
- Any design challenges they encountered

Material Constraints (Important!)

Each student receives:

- **ONLY 5 sheets of paper**, scissors, glue/tape, ruler, pencil

The limited materials encourage students to **think carefully about surface area and design efficiency**.

Students may not use additional paper without permission.

Grading Rubric

Criteria	Extending (4)	Proficient (3)	Developing (2)	Emerging (1)
Mathematical Accuracy	Surface area and volume calculations are correct and clearly shown	Minor errors	Several errors	Calculations missing or incorrect
Use of Geometric Shapes	Model uses multiple shapes effectively	Uses required shapes	Limited variety of shapes	Shapes unclear
Design & Construction	Model is well-built and stable	Mostly well constructed	Some construction issues	Model incomplete
Mathematical Explanation	Clear explanation of shapes and calculations	Explanation mostly clear	Limited explanation	Explanation missing
Creativity & Effort	Highly creative design	Creative design	Some creativity	Minimal effort

Total: **/20**

Project Proposal Draft Worksheet

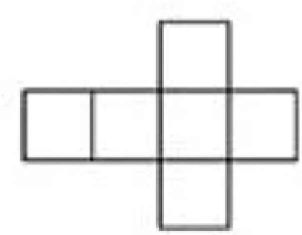
Name: **Date:**

Step 1: What will you build?

Describe your 3D model idea. Example: *A small house with a chimney.*

____

Step 2: Identify shapes you will use

Shape	How many?	2D Net with measurement (Length, width, radius)
i.e Cube	1	 Side Length: 10 cm

Step 3: Sketch your model

Draw your design and label the shapes.

Step 4: Surface Area Calculations

Shape	**Formula**	**Surface Area**

Total Surface Area: ___________

Step 6: Volume Calculations

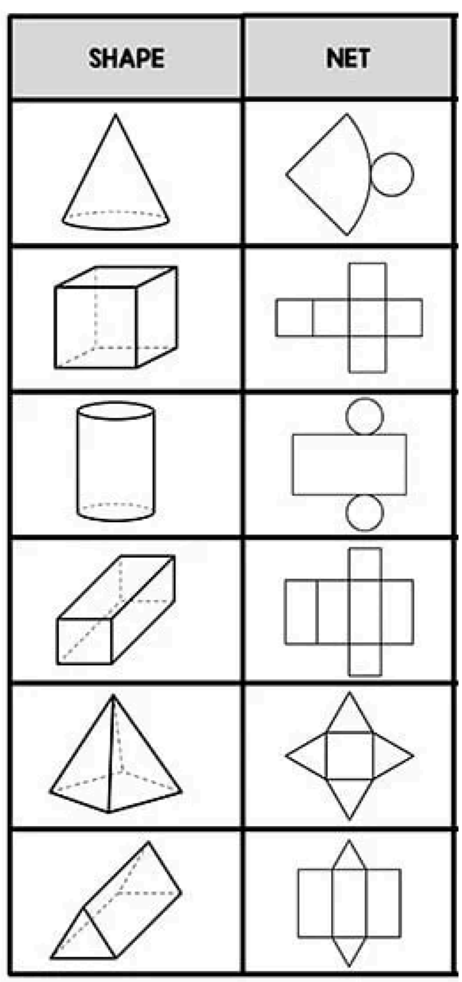
Shape	Formula	Volume

Total Volume: __________

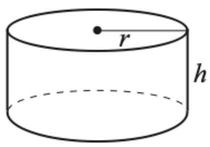
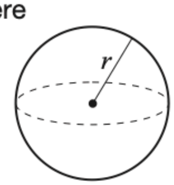
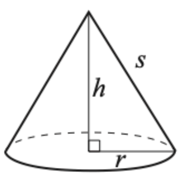
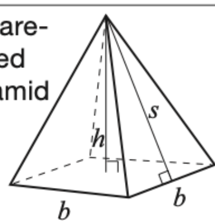
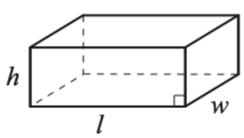
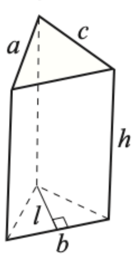
Reflection

What challenge did you encounter while designing your model?

Resources:Common shapes and their nets



Formulas for surface area and volume

Geometric Figure	Surface Area	Volume
Cylinder 	$A_{\text{base}} = \pi r^2$ $A_{\text{lateral surface}} = 2\pi rh$ $A_{\text{total}} = 2A_{\text{base}} + A_{\text{lateral surface}}$ $= 2\pi r^2 + 2\pi rh$	$V = (A_{\text{base}})(\text{height})$ $V = \pi r^2 h$
Sphere 	$A = 4\pi r^2$	$V = \frac{4}{3}\pi r^3$ or $V = \frac{4\pi r^3}{3}$
Cone 	$A_{\text{base}} = \pi r^2$ $A_{\text{lateral surface}} = \pi rs$ $A_{\text{total}} = A_{\text{lateral surface}} + A_{\text{base}}$ $= \pi rs + \pi r^2$	$V = \frac{(A_{\text{base}})(\text{height})}{3}$ $V = \frac{1}{3}\pi r^2 h$ or $V = \frac{\pi r^2 h}{3}$
Square-based pyramid 	$A_{\text{base}} = b^2$ $A_{\text{triangle}} = \frac{1}{2}bs$ $A_{\text{total}} = 4A_{\text{triangle}} + A_{\text{base}}$ $= 2bs + b^2$	$V = \frac{(A_{\text{base}})(\text{height})}{3}$ $V = \frac{1}{3}b^2 h$ or $V = \frac{b^2 h}{3}$
Rectangular prism 	$A = 2(wh + lw + lh)$	$V = (A_{\text{base}})(\text{height})$ $V = lwh$
Triangular prism 	$A_{\text{base}} = \frac{1}{2}bl$ $A_{\text{rectangles}} = ah + bh + ch$ $A_{\text{total}} = A_{\text{rectangles}} + 2A_{\text{base}}$ $= ah + bh + ch + bl$	$V = (A_{\text{base}})(\text{height})$ $V = \frac{1}{2}blh$ or $V = \frac{blh}{2}$