Third Grade
Mathematics
Design Brief

Geometric Creatures

Background: We have been learning about geometric shapes, such as squares, triangles, rectangles, circles, cubes, rectangular solids, spheres, pyramids, cones, and cylinders.

Design Challenge: Design and build an imaginary geometric creature using both plane and solid geometric shapes. Your geometric creature must stand by itself and have at least two moving parts.

Criteria:
Your creature must

- have at least five plane shapes
- have at least three solid shapes
- have two moving parts (use levers, pneumatics, and/or pulleys)
- stand by itself
- be attractive.

Materials: You may select from the items below.

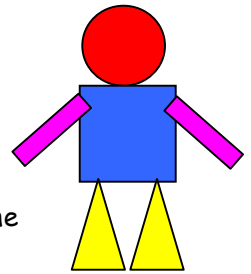
- rulers
- construction paper
- brads
- poster board
- craft sticks
- cardboard cylinders
- glue
- straws
- tag board
- plastic tubing
- empty containers
- 12 inches of string or yarn
- spools
- paint
- general art supplies
- syringes
- 12 inches of tape
- balloons

Targeted Standard of Learning: Mathematics 3.18
Supporting Standards of Learning: Mathematics 3.14, Science 3.1, 3.2, English 3.1, 3.2, 3.4

Targeted Standard for Technological Literacy: 9
Supporting Standards for Technological Literacy: 8, 10, 11

Tips for Teachers

Geometric Creatures



Targeted Standard of Learning: Mathematics 3.18

- The student will analyze two-dimensional (plane) and three-dimensional (solid) geometric figures (circle, square, rectangle, triangle, cube, rectangular solid [prism], square pyramid, sphere, cone, and cylinder) and identify relevant properties, including the number of corners, square corners, edges, and the number and shape of faces, using concrete models.

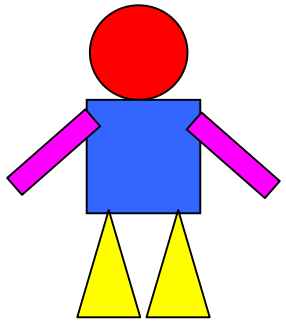
Targeted Standard for Technological Literacy: Standard 9

- Students will develop an understanding of engineering design.

Prior Knowledge & Skill	Materials & Preparation	Safety Issues	Class Management	Materials Provided	Time Management
• Exposure to targeted Mathematics Standard of Learning 3.18 including constructing solid shapes • Some under-standing of the design process • Exposure to pneumatic systems if materials are available • Exposure to simple machines (Science Standard of Learning 3.2)	• Check Design Brief for recommended materials. • Teacher may substitute materials. • In advance, collect empty food packaging, paper towel and toilet paper rolls, and tissue boxes.	• Use only syringes provided by the teacher.	• Small groups • Each student keeps own Guided Portfolio.	• Design Brief • Guided Portfolio • Rubric Assessments	• Session 1: Introducing Design Brief and Portfolio (45 min.) • Session 2: Building (60 min.) • Session 3: Building (45 min.) • Session 4: Sharing and evaluating (45 min.)

Guided Portfolio—1
Name _____

Geometric Creatures



Group Members: _____

_____ _____ _____

1. What is the problem? State the problem in *your own words*.

_____

_____

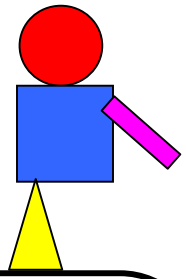
_____

_____

_____

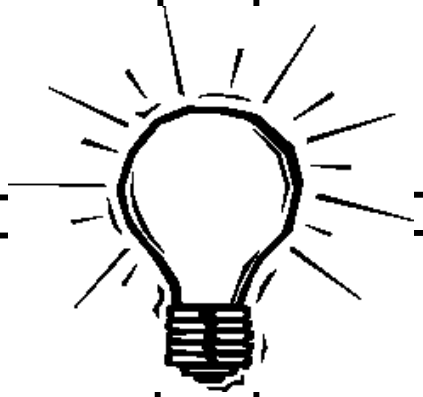
Targeted Standard of Learning:	Mathematics 3.18	Targeted Standard for Technological Literacy:	9
Supporting Standards of Learning:	Mathematics 3.14 Science 3.1, 3.2 English 3.1, 3.2, 3.4	Supporting Standards for Technological Literacy:	8, 10, 11

Guided Portfolio—2
Name _____

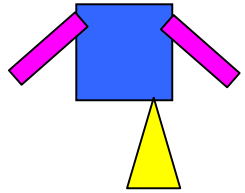


2. Brainstorm solutions.

Draw or describe some possible solutions.



Guided Portfolio—3
Name _____



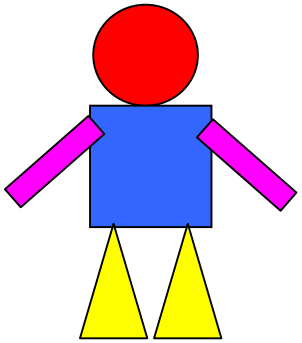
3. Create the solution you think is best.

Keep notes below about the problems you have and how you solve them.

Guided Portfolio—4
Name _____

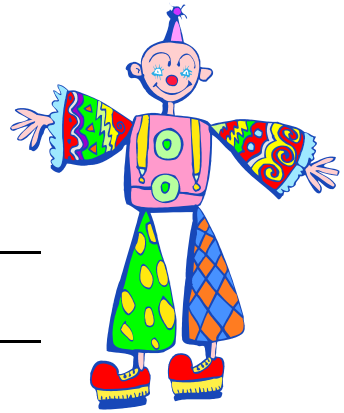
4. Test your solution.

- Does your creature have at least five plane shapes? YES NO
- Does your creature have at least three solid shapes? YES NO
- Does your creature have two parts that use levers, pneumatics, or pulleys to move? YES NO
- Does your creature stand by itself for at least five minutes? YES NO
- Does your creature remain standing when its parts are moving? YES NO
- Is all of your work colorful and neatly done? YES NO



Guided Portfolio—5
Name _____

5. Evaluate your solution.



Was it the best solution? Would one of your other ideas have been better? Why or why not?

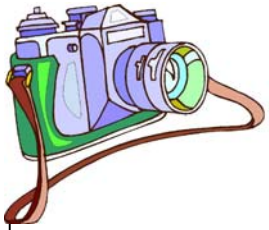
What would you have done differently?

Could you add to it to make it better? What would you add to it?

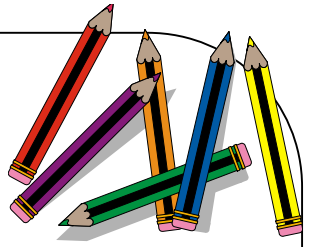
Guided Portfolio—6

Name _____

Attach a photograph of your final project here. If you do not have a photograph, draw a picture of your final project.

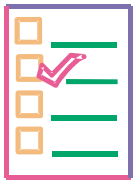


How would you make your project better? Draw a picture showing how it would look after you have made changes to it.



Rubric for *Geometric Creatures*

Name_____ Date _____



Design Brief Rubric	no evidence 0	limited understanding 1	some understanding with room for improvement 2	good understanding with room for improvement 3	substantial understanding 4
The student restated the problem in his/her own words.					
The student brainstormed more than one idea.					
The student created and labeled a sketch to use as a "blueprint."					
The student included notes about problems that occurred and their solutions.					
The student tested the creature					
• for at least five different plane shapes					
• for at least three solid shapes					
• for two parts that use levers, pneumatics, or pulleys to move					
• to see if it could stand alone for at least five minutes					
• to see if it remained standing when its parts were moving					
• to see if the work was colorful and neatly done.					
The student evaluated how he/she could make it better next time.					
The student spoke clearly and confidently during oral presentation.					

Rubric for *Geometric Creatures*

Name_____ Date _____

Oral Communication Rubric	no evidence 0	limited understanding 1	some understanding with room for improvement 2	good understanding with room for improvement 3	substantial understanding 4
3.1 The student will use effective communication skills in group activities.					
a) Listen attentively by making eye contact, facing the speaker, asking questions, and summarizing what is said.					
b) Ask and respond to questions from teachers and other group members.					
c) Explain what has been learned.					
3.2 The student will present brief oral reports.					
a) Speak clearly.					
b) Use appropriate volume and pitch.					
c) Speak at an understandable rate.					
d) Organize ideas sequentially or around major points of information.					
e) Use grammatically correct language and specific vocabulary to communicate ideas.					

Standards of Learning

English (2002)

Oral Language

3.1 The student will use effective communication skills in group activities.

a) Listen attentively by making eye contact, facing the speaker, asking questions, and summarizing what is said.
b) Ask and respond to questions from teachers and other group members.
c) Explain what has been learned.

3.2 The student will present brief oral reports.

a) Speak clearly.
b) Use appropriate volume and pitch.
c) Speak at an understandable rate.
d) Organize ideas sequentially or around major points of information.
e) Use clear grammatically correct language and specific vocabulary to communicate ideas.

Reading

3.4 The student will use strategies to read a variety of fiction and nonfiction materials.

a) Preview and use text formats.
b) Set a purpose for reading.
c) Apply meaning clues, language structure, and phonetic strategies.
d) Use context to clarify meaning of unfamiliar words.
e) Read fiction and nonfiction fluently and accurately.
f) Reread and self-correct when necessary.

Science (2003)

Scientific Investigation, Reasoning, and Logic

3.1 The student will plan and conduct investigations in which

a) predictions and observations are made;
b) objects with similar characteristics are classified into at least two sets and two subsets;
c) questions are developed to formulate hypotheses;
d) volume is measured to the nearest milliliter and liter;
e) length is measured to the nearest centimeter;
f) mass is measured to the nearest gram;
g) data are gathered, charted, and graphed (line plot, picture graph, and bar graph);
h) temperature is measured to the nearest degree Celsius;

Science (2003) continued

Scientific Investigation, Reasoning, and Logic

i) time is measured to the nearest minute;
j) inferences are made and conclusions are drawn; and
k) natural events are sequenced chronologically.

Force, Motion, and Energy

3.2 The student will investigate and understand simple machines and their uses. Key concepts include
a) types of simple machines (lever, screw, pulley, wheel and axle, inclined plane, and wedge);
b) how simple machines function;
c) compound machines (scissors, wheelbarrow, and bicycle); and
c) examples of simple and compound machines found in the school, home, and work environment.

Mathematics (2001)

Measurement

3.14 The student will estimate and then use actual measuring devices with metric and U.S. Customary units to measure
a) length–inches, feet, yards, centimeters, and meters;
b) liquid volume–cups, pints, quarts, gallons, and liters; and
c) weight/mass–ounces, pounds, grams, and kilograms.

Geometry

3.18 The student will analyze two-dimensional (plane) and three-dimensional (solid) geometric figures (circle, square, rectangle, triangle, cube, rectangular solid [prism], square pyramid, sphere, cone, and cylinder) and identify relevant properties, including the number of corners, square corners, edges, and the number and shape of faces, using concrete models.

Standards for Technological Literacy

Standard 8: Students will develop an understanding of the attributes of design.
Standard 9: Students will develop an understanding of engineering design.
Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
Standard 11: Students will develop the abilities to apply the design process.