EA jnr club

Primary

TEACHER RESOURCE KIT

Construct a newspaper dome

This guide includes:

- Lesson ideas
- Project instructions
- What is engineering?
- Machines are all around us
- Know Want Learnt (KWL) Chart
- Think Want Learnt How (TWLH) Chart

ENGINEERS
AUSTRALIA

Construct a newspaper dome: *lesson ideas*

Science

- Students to complete the **'What is Engineering?'** activity sheet.
- Students to brainstorm a list of the materials used to create various structures (*buildings*, *bridges*, *landmarks etc.*). In small groups, discuss why these materials are used. What properties do they have that make them suitable?

Technologies

- In groups, students to design a building for a particular purpose. Which shapes will give the building the most strength? Which shapes seem to weaken the building? Which shapes might be used for effect only?
- Students to design a 'futuristic' house. What changes to current house designs can they make?
- Use pictures and key words to create a display in the classroom based on engineering, building and construction.
- Students to complete the **'Machines Are All Around Us'** activity sheet.
- Class discussion: Why do we need machines and tools?
- Students to research some famous structures from around the world. Display pictures of the structures around the room, or create a slideshow of images to be displayed on an IWB or through a data projector. Students could also investigate the purposes of these structures, and list interesting facts about them. Which shapes in these famous structures make them strong?

Mathematics

- Students to estimate the amount of newspaper they will need to construct their dome.
- Introduce 3D shapes, cubes and rectangular prisms. Students to create structures from these blocks. Students to design their own structure on grid paper using a maximum of three shapes. Shapes must be drawn accurately with a ruler.
- Discuss with students the concept of scale and ratio, using examples of model railways, buildings etc.
- Students to describe and illustrate the difference between 'concave' and 'convex'.

English

- Students to brainstorm as many engineering words as possible, then create a page in their Science books on which to record these words (with definitions). Students will add to this as they learn new words.
- Students to complete the **'KWL Chart'** or **'TWLH Chart'** activity sheet.
- Students to write a procedure outlining the process of making their newspaper dome.

Humanities and Social Sciences

History

- The invention of tools and simple machines had an enormous impact on the way humans lived, survived and developed. As a class, discuss how our lives would be different if we had no machines or tools. In groups, students to prepare a speech for the class in response to this discussion.

Geography

- Students to research indigenous cultures from around the world that use the dome principle for housing. Are there common features within the geographic locations of the cultures that make dome housing effective?

Civics and Citizenship

- Engineers are valuable members of society. Students to investigate ways in which engineers have contributed to their local community.
- Students to work together, each with defined roles throughout all steps of the design, construction, testing and critiquing stages of their newspaper dome.

The Arts

- Students to make a diorama of a scene containing a dome.
- Students to try and find artworks that use dome shapes in their composition.

Health and Physical Education

- Discuss why we need shelter. What are some other basic human needs? How different are our basic needs from those of people in other countries? Compare and discuss.

Languages

- Students to learn how to say and write words such as ‘dome’, ‘structure’ and ‘engineer’ in various languages.

Construct a newspaper dome: *Project instructions*

Important safety information

Allow plenty of time to discuss the safety precautions essential while assembling and testing the dome. As a class, discuss how students can keep themselves and others safe.

These ideas should be presented on a poster and displayed in the classroom. All students should agree with these rules before starting and the safety precautions and guidelines should always be observed.

Getting started - research activities

- Students to participate in the 'Construct a newspaper dome' lessons and complete the associated activity sheets.
- Students to investigate buildings and structures that have failed because their design was too weak.

Materials

To make the newspaper domes you will only need newspaper and adhesive tape (masking tape).

Broadsheet newspapers, such as *The Australian* are ideal as they will make longer 'poles'. To make the poles, roll a single sheet of newspaper along the shorter length. The sheet should be rolled as tightly as possible and secured in the middle and at each end with adhesive tape. This should be demonstrated to students. A sheet rolled from the shorter end will produce a pole of approximately 58cm in length.

To make the structure, join the poles together with adhesive tape.

The design stage

This design stage will produce the plans that are to be followed during construction.

Students can investigate how many sheets they need in order to produce a strong enough pole, without wasting unnecessary materials. They can investigate the consequences of using too few sheets (*the pole is too weak*) or too many sheets (*unnecessary waste of materials, and a structure that is too heavy*).

In a real-life situation, using too few materials means that the structure may fail and collapse, whilst using unnecessary materials adds to the cost of the structure.

Hint: approximately 5 sheets should be enough for each pole.

Creating a stable structure

Students can investigate the stability of three poles joined in a triangle, compared to four (or more) joined in a square.

This should lead to the conclusion that the triangle shape is self-bracing and is therefore much stronger than the square.

Making the base

How many poles are needed to form the base of the dome?

Students can investigate how many poles they will need to form the base from which the structure will rise by laying the poles out on the floor.

Hint: they will probably find that they will need at least six poles to form the base. This would give a final structure approximately 115cm across the base. Remember that the longest pole length is approximately 58cm, and that the final dome needs to be over 150cm high.

Making the dome at least 150cm high

Students will find that with a maximum pole length of 58cm, there will need to be at least three layers for the structure to reach a height of 150cm.

Drawing plans

Students can make a scale sketch of their design. Using a scale of 1 to 10 (*the drawing is 1/10 of the size of the real structure*) would mean that each 58cm pole would show in the sketch as being 58mm long.

Making a scale model

Drawing flat plans of 3-dimensional structures is difficult. One solution is to show the design by building a scale model. This can be easily done with lengths of bamboo satay sticks glued together using a hot melt glue gun. The satay sticks are easily cut to length using the side cutters on a pair of pliers. Again, using a scale of 1 to 10, each 58cm pole will be represented by a 58mm length of satay stick.

Note: some of the poles will need to be less than 58cm in length. This is best done by making the pole first, then measuring and trimming it. By constructing a scale model, these dimensions can be tested before the actual construction begins.

The construction stage

Following the design stage, each student team should have a reasonably accurate idea of the number of poles of each length required to make their dome.

The teams can then construct these from the sheets of newspaper.

The teams then cooperate to carry out the construction of their dome, following their chosen design. The poles will be joined at the appropriate points with masking tape.

As it will be necessary to support the partly completed dome during construction, a cooperative team approach will be required, with some members providing support to the structure whilst further components are added, until the structure becomes braced and self-supporting.

Critiquing the designs

The completed houses should now be tested:

- Is the house structurally strong?
- Does the doll/action figure fit inside the house?
- Does the house meet any mandatory requirements (*e.g. working lights, has windows, is weatherproof, is insulated and energy efficient, has rainwater collection etc.*)?

Critiquing the designs

After construction, each team should undertake a critiquing exercise where they critically evaluate their project.

Questions to be considered include:

- What did you learn while undertaking this project (about domes, construction or cooperative learning)?
- Which aspects of the project worked well?
- Which aspects of the project could be improved? What would you change if you did it again?
- How could your design be modified to make it stronger?
- What other materials could be used to build a similar or stronger structure?

What is engineering?

Name: _____

Draw a picture or write a paragraph to describe what you think each of these fields of engineering involves.

Civil engineering	Chemical engineering
Electrical engineering	Mechanical engineering
Transport engineering	Hydraulic engineering

Machines are all around us

Name: _____

Take a walk around your school and the playground. **List all the machines you see.**

Name of machine	Who uses it?	What for?	What else could be used to do the same job?

Know Want Learnt (KWL) Chart

Name: _____

What I **KNOW** about domes	What I **WANT** to know about domes	What I have **LEARNT** about domes

Think Want Learnt How (TWLH) Chart

Name: _____

What we **THINK** we know about domes	What we **WANT** to know about domes	What we have **LEARNT** about domes	**HOW** we learnt it