Lowenfeld

Poleidoblocs G

NES Arnold

Notes by Peter Patilla

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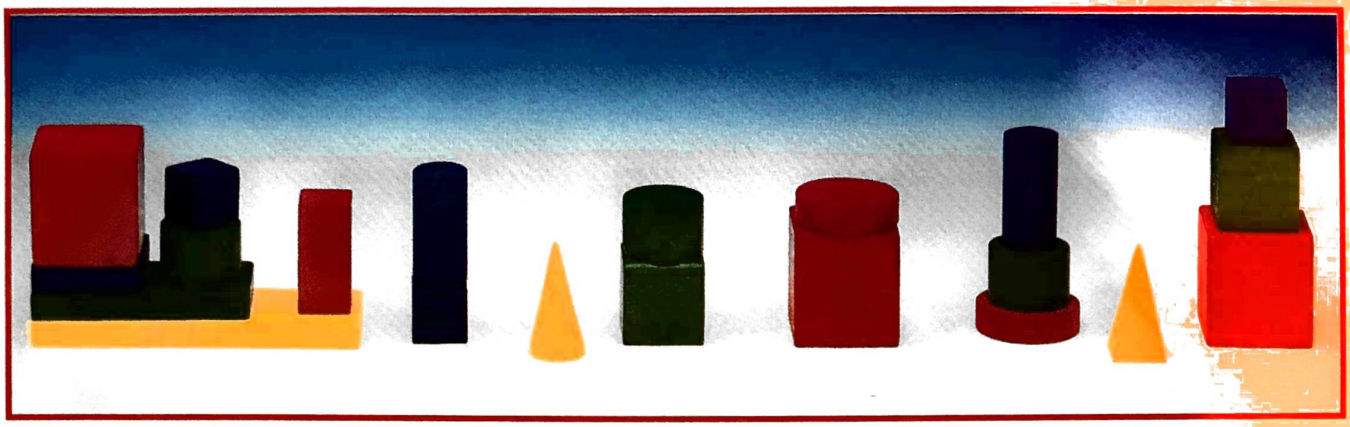
The contents of Poleidoblocs G



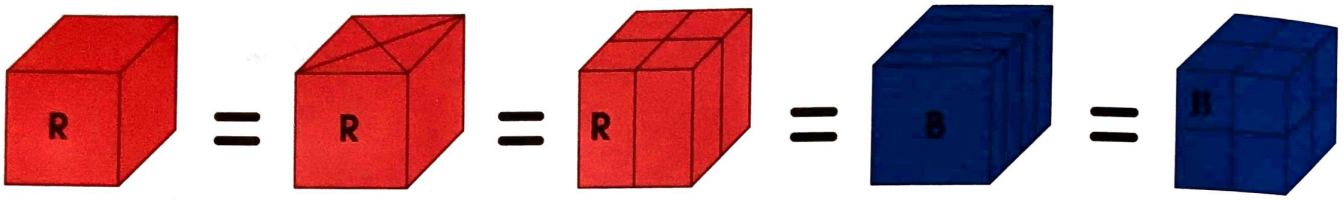
The individual blocks of Poleidoblocs G are cut into six basic shapes: cubes, cuboids, cylinders, triangular prisms, cones and pyramids.

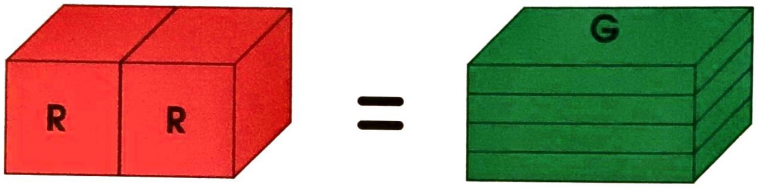
Shape	Colour	Quantity	Dimensions
cube	red	4	50 x 50 x 50mm
cube	green	4	37.5 x 37.5 x 37.5mm
cube	blue	8	25 x 25 x 25mm
cuboid	yellow	4	150 x 50 x 12.5mm
cuboid	green	4	100 x 50 x 12.5mm
cuboid	blue	4	50 x 50 x 12.5mm
cuboid	red	4	25 x 25 x 50mm
cylinder	blue	4	dia 25mm ht 50mm
cylinder	red	4	dia 50mm ht 12.5mm
cylinder	green	4	dia 37.5mm ht 25mm
cone	yellow	3	dia 25mm ht 50mm
pyramid	yellow	3	base 25 x 25 x 25mm ht 50mm
triangular prism	red	4	base 32.5 x 32.5 x45mm ht 50mm

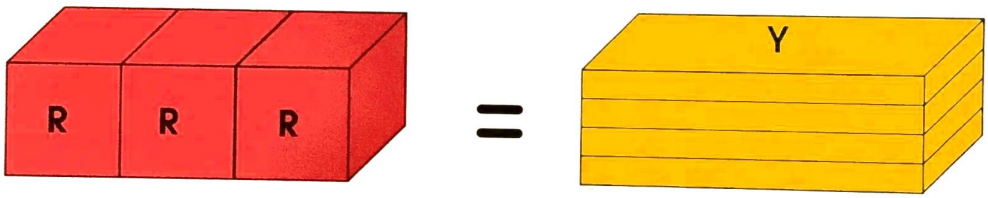
There are 54 shapes in each box of Poleidoblocs G.

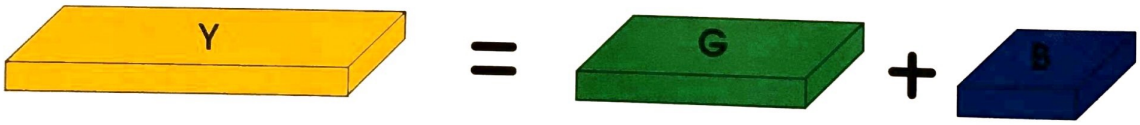
All the blocks are interrelated in a number of ways.

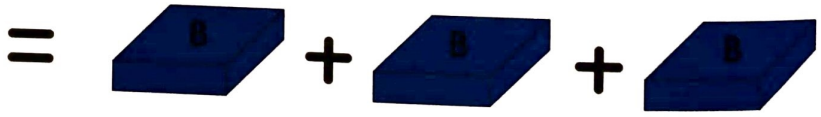
Poleidoblocs relate to each other in a large number of ways, some ways are more obvious than others. The diagrams which follow show some of the equivalences which can be found between the pieces.

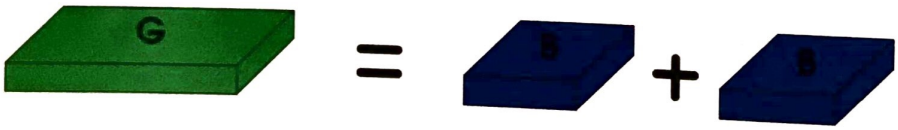




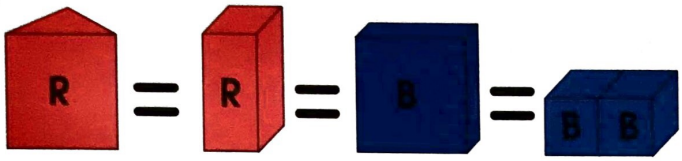


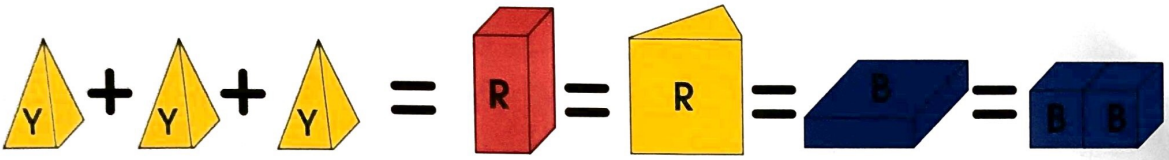


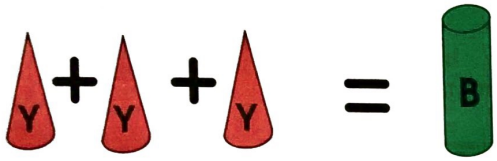


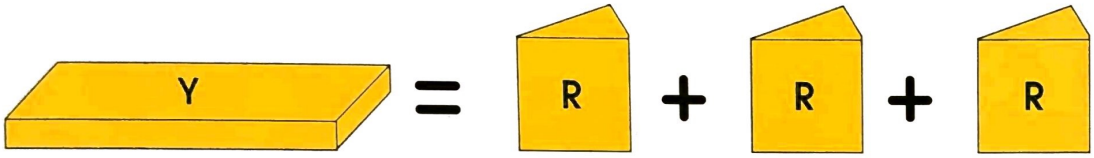


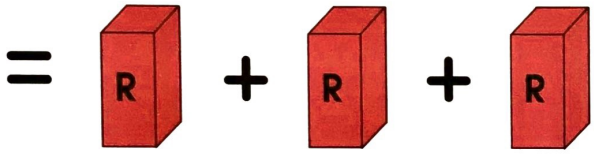
These equivalences are not so obvious and relate to the volumes of the pieces.

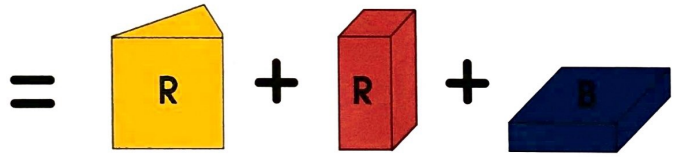


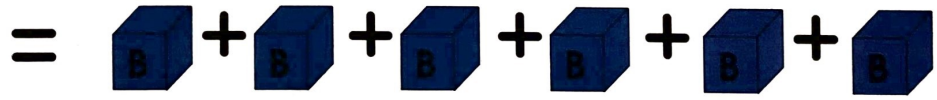


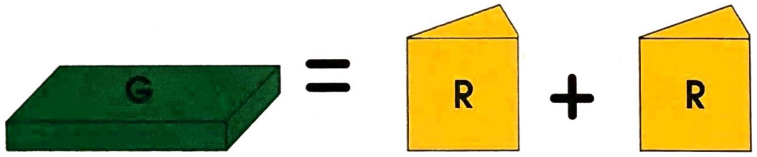


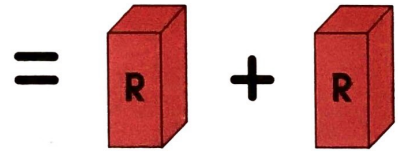


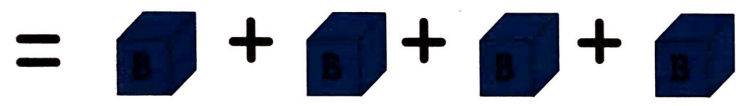












The Activities

Free construction

As with all new materials pupils need a period of time for free construction with the shapes. This period allows pupils to acquaint themselves with the shapes and to experiment with them.

During this time it is worthwhile observing the types of constructions which are made. These can take several forms which include:

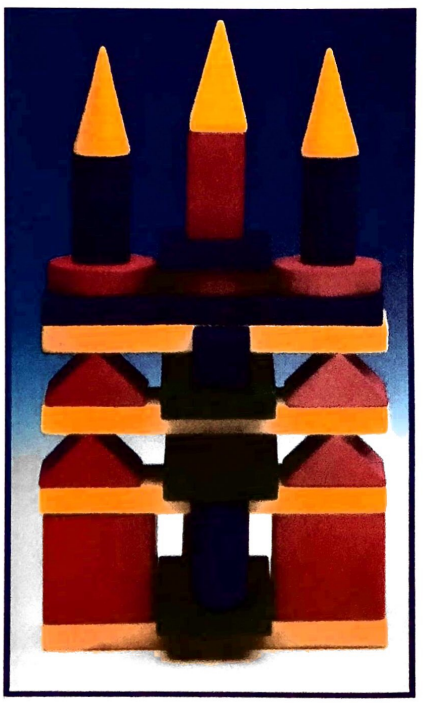
- constructions with height - building tall towers ....
- constructions with length or width - buildings trains, walls...
- constructions which are spread out - lots of houses, vehicles, streets ....
- constructions which are enclosures - a room, castle walls ....
- constructions which are experimental - imaginative, constantly changing ....

Pupils also enjoy making representational models with the shapes. These models often include cars, planes, furniture, machinery, houses, bridges ....

It is worth noting whether pupils:

- worked on their own or with another.
- created something of their own or whether they copied the model off someone else. Often pupils copy the names of models from each other but create their own individual structure - 'let's build a flying car'.
- create a really imaginative and original structure.

Through active listening encourage pupils to describe and talk about their constructions. This language will usually display some understanding of mathematical ideas such as length, height, width, size, position, colour, shape, symmetry, counting, matching, area ....

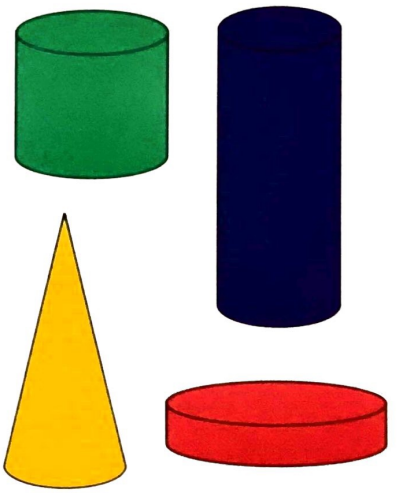


Construction with rules

After the free construction period pupils can be asked to make models which have rules or restrictions attached to them.

Examples include:
Making a model with a stated number of shapes.
Making a model from named types of shapes.
Making a bridge to go over a river.
Making a model which is balanced.
Making a castle wall which has turrets.
Making a tower taller than a chair.

Sorting



Pupils can sort the shapes for various criteria such as:
Sorting by colour.
Sorting shapes which have curves.
Sorting all the cubes.
Sorting all the cuboids.
Sorting all the shapes with a square face.
Sorting all the shapes which have a triangle face.

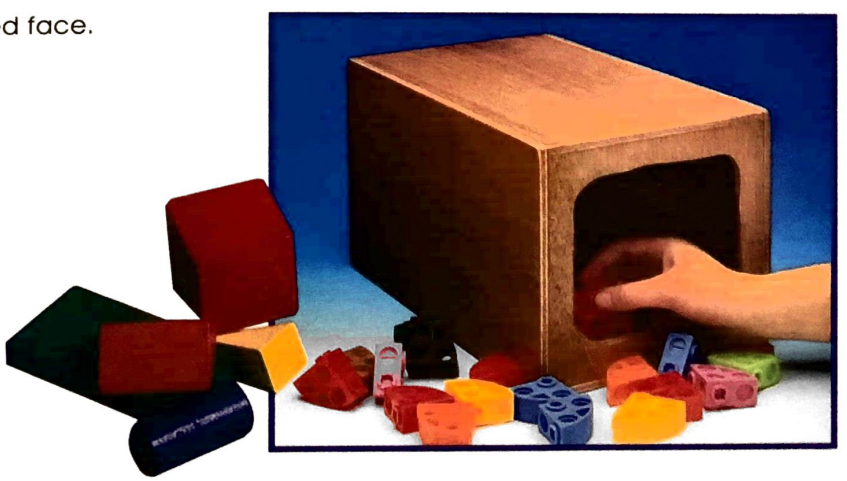
Feely box sorting

Place one of each shape in a feely box or bag. Pupils take turns to place their hands in the feely box and to find the 'hiding' shape.

- Hold up a shape and ask a pupil to find one which is exactly the same. Repeat with a different shape.

Ask pupils to:

- Find a shape which has a curved face.
- Find a cube.
- Find the smallest cube you can.
- Find a shape with a square face.
- Find a shape which has a triangle face.

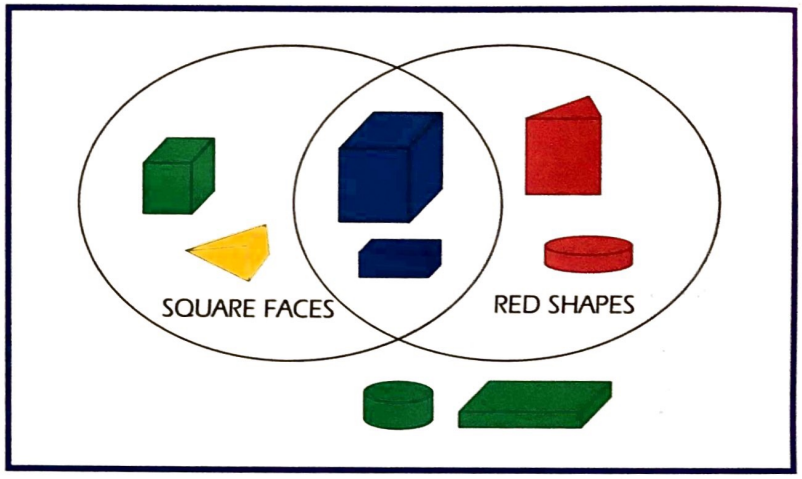


Venn diagrams

Poleidoblocs can be sorted onto Venn diagrams.

Criteria for the two sorting rings include:

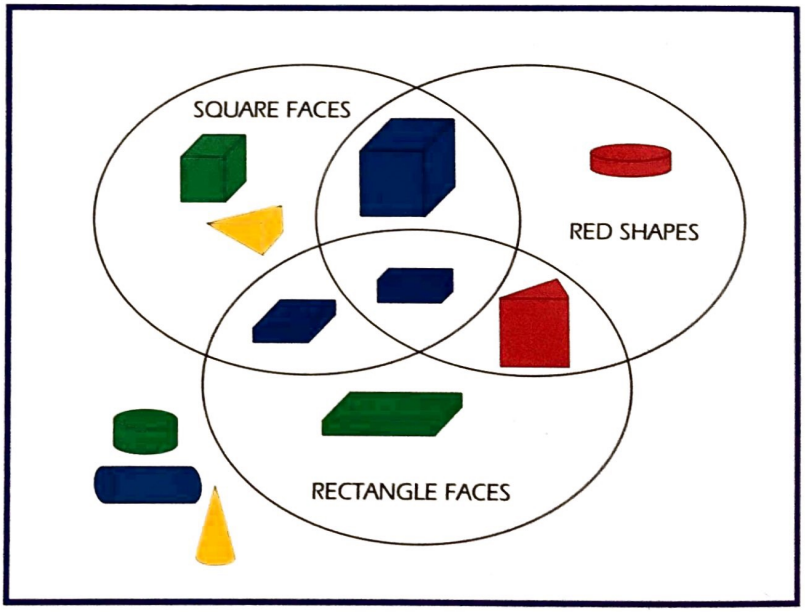
- square faces/red shapes
- triangle faces/yellow shapes
- rectangle faces/green shapes
- curved faces/blue shapes



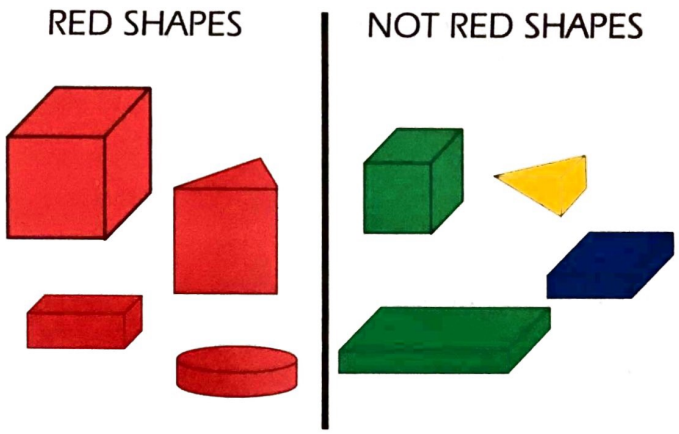
Criteria for three sorting rings include:

- square faces/red shapes/ rectangle faces
- triangle faces/ yellow shapes/ square faces
- circle faces/ red shapes/ triangle faces

When sorting onto Venn diagrams pupils should realise that the area outside the sorting rings is also a sorting area, which is why the rings are often bounded by a rectangle.



Carroll Diagrams



Poleidoblocs can be sorted onto Carroll diagrams.

Criteria for sorting include:

- square faces / not square faces
- triangle faces / not triangle faces
- rectangle faces / not rectangle faces
- curved faces / not curved faces

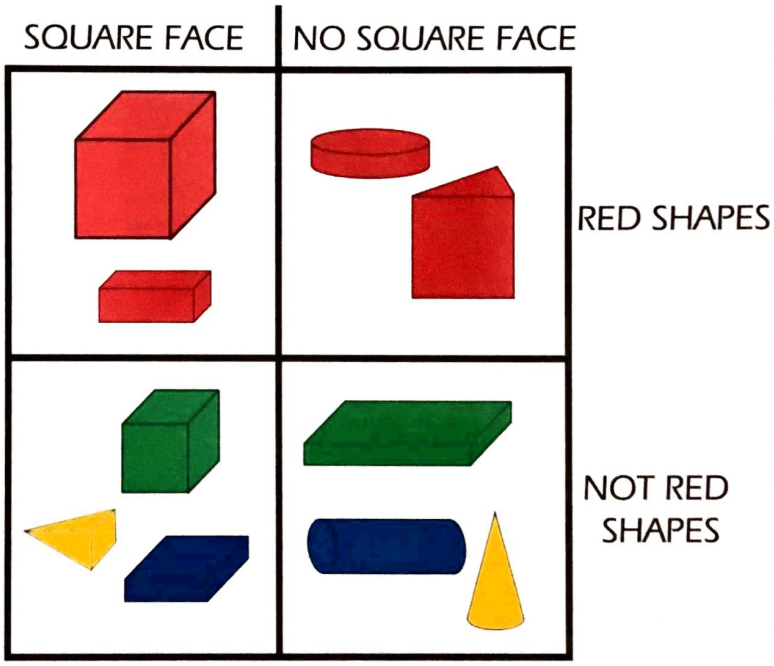
Criteria for a double sorting include:

square face/no square faces and red/ not red

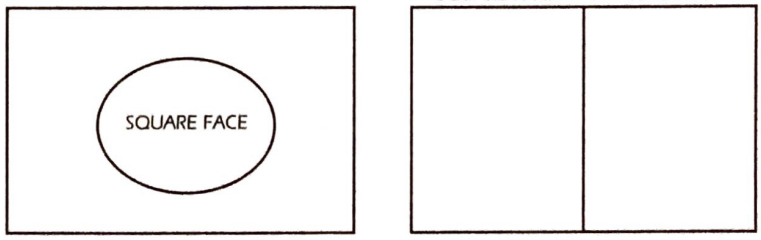
triangle face/no triangle faces and yellow/ not yellow

rectangle face/no rectangle faces and green/not green

When sorting onto Carroll diagrams pupils should realise that they are sorting for both the positive and negative aspects of the sort. This is why Carroll diagrams are labelled with both the "have" and "have not" criteria.



It is worthwhile for pupils to experience transferring shapes from a Venn diagram directly onto a Carroll diagram where the criteria are the same. They should describe the properties of the shapes in all the parts of each diagram.



Equivalences

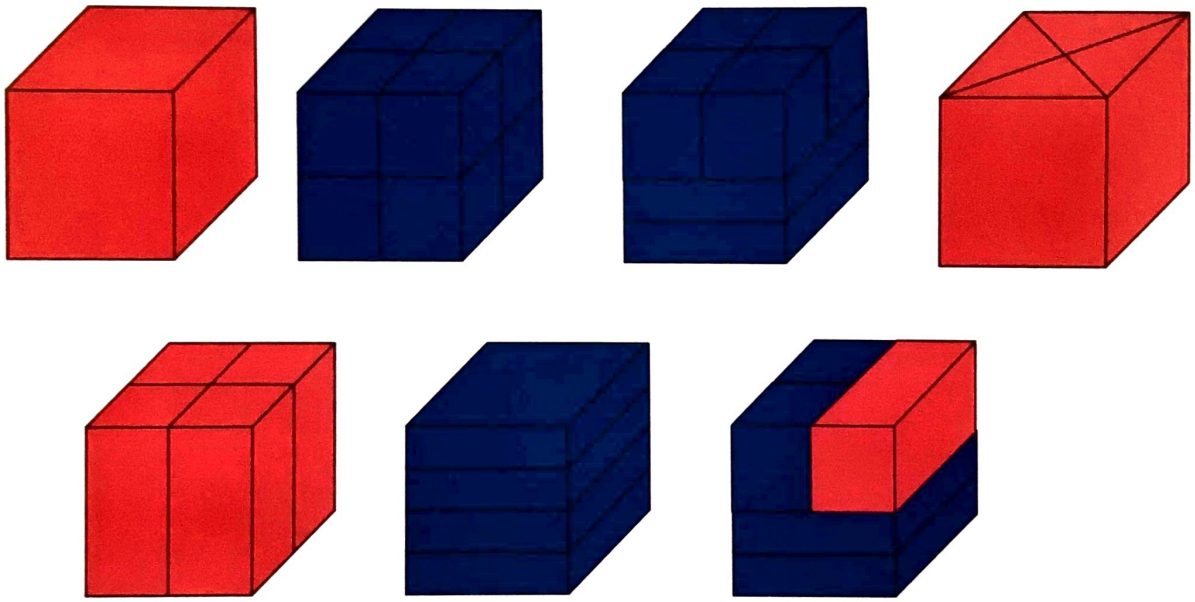
Equivalence is a vital mathematical idea. Without some understanding of equivalence pupils will find it impossible to grasp such basic mathematical ideas as: place value, exchanging coins, fractions, decimals, percentages ....

Poleidoblocs provide invaluable experience in helping pupils understand equivalence through simple games and activities involving 'fair swaps'. Refer to the diagrams on page 3 to see some of the equivalences possible with Poleidoblocs.

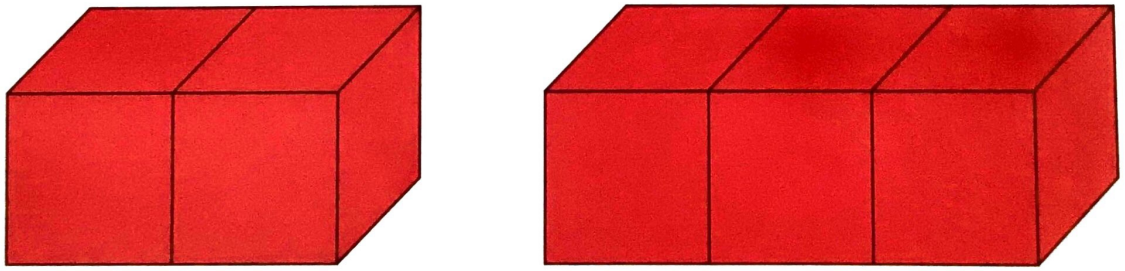
- Pupils start with the red cube.

Ask them to investigate ways of making another cube which is the same size using the other shapes.

Here are some examples.



- Pupils start with two red cubes, then three red cubes and investigate the equivalent models which can be made.

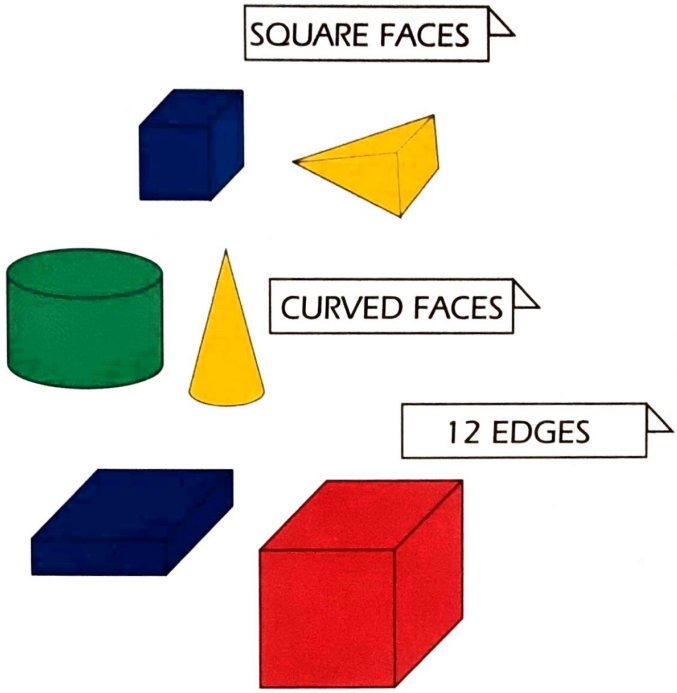


Vocabulary

Poleidoblocs can be used to develop vocabulary of shape and shape properties. Initially general descriptions such as: it has six faces; it has two flat faces and one curved face can be used before using specific mathematical language.

Make language labels for pupils to match to shapes. The labels can include:

- cubes
- cylinders
- pyramids
- vertices
- edges
- circle
- rectangle
- curved
- cuboids
- cones
- triangular prisms
- faces
- square
- triangle
- flat



Pupils may realise that cubes and cuboids are also prisms; they are square prisms and rectangular prisms.

Euler's formula

Using the Poleidoblocs with flat faces pupils can 'discover', or check, Euler's formula. This formula states the relationship which exists between the number of faces, edges and vertices of flat faced 3D shapes.

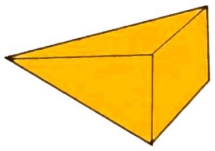
FACES + VERTICES = EDGES +2

Ask pupils to record the number of faces, vertices and edges on the shapes and to try and find a relationship between them.

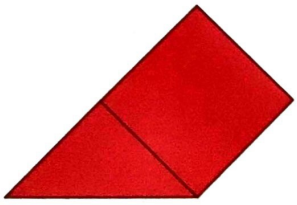
They can check whether this formula works for other 3D shapes not in the Poleidoblocs such as tetrahedrons, hexagonal prisms, dodecahedrons ....

Pupils may like to know that Euler was a famous Swiss mathematician who was born in 1707 and died in 1783.

F + V = E + 2
6 + 8 = 12 + 2



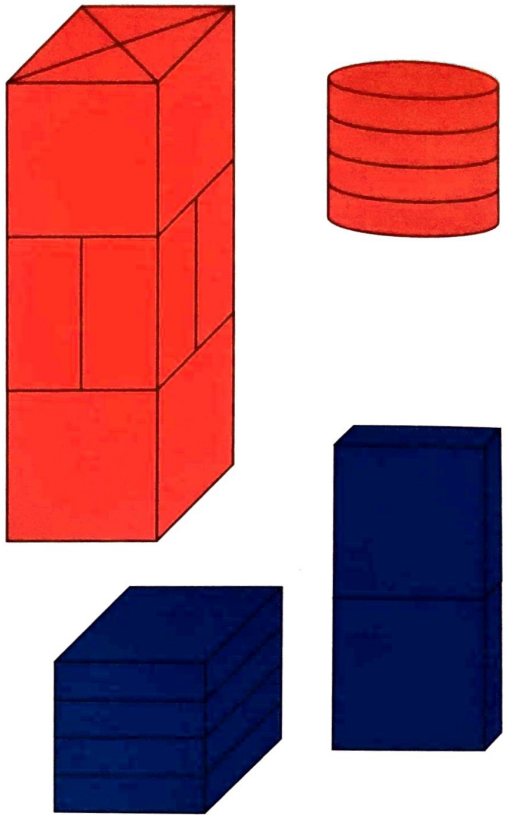
F + V = E + 2
5 + 5 = 8 + 2



F + V = E + 2
5 + 6 = 9 + 2

Rolling and stacking

Early work on shape property can be explored through finding out which shapes stack neatly and which shapes will roll.



Stacking

- Which shapes will not stack?
- Which shapes will make a tall tower?
- Which tower is most stable?
- Which four shapes make the tallest tower?
- Which four shapes make the shortest tower?
- Which shapes will stack in more than one way?
- Can you stack with more than one type of shape?
- How many of the shapes can you stack before the tower becomes unsteady?

Stacking triangular prisms can make an interesting discussion point.

Rolling

Pupils should use a sloping surface.

- Which shapes will not roll?
- Which shapes will roll?
- Which shapes roll in a straight line?
- Which shapes do not roll in a straight line?
- Which shapes roll fastest?
- Which shapes roll furthest?

Although it is normal to record that cubes do not roll, it can create a discussion point when we say roll the dice.

Symmetry

Building with Poleidoblocs allows pupils to explore 3D symmetry. Young children often build models which are symmetrical through a sense of intuition, because their model "looks right", rather than through direct teaching.

- Eventually pupil attention can be directed to lines of symmetry which divide their model exactly in half.
- Ask pupils to make a model which has one or two lines of symmetry.

Decide whether to use terms such as planes of symmetry and axes of symmetry rather than lines of symmetry.

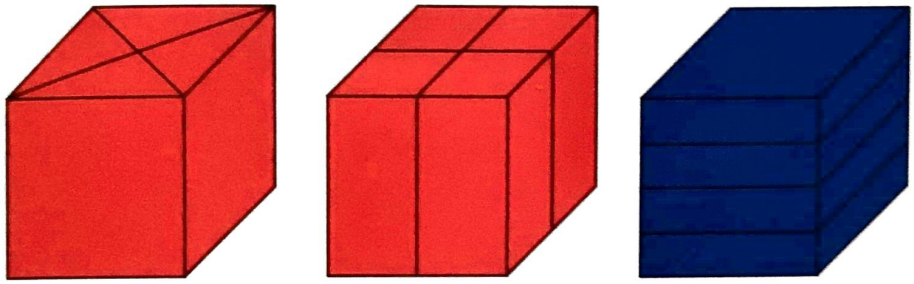
Volume

Equivalence of volume

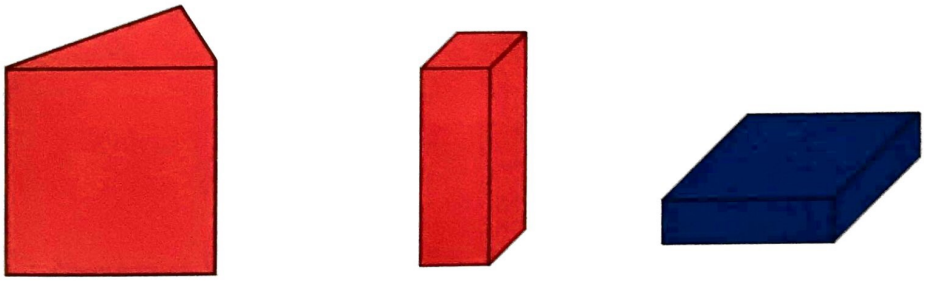
Poleidoblocs are excellent for investigating equivalent volumes.

Explaining that volume is the amount of air space an object takes up may help with pupil understanding of this difficult aspect of measurement.

These cubes each have the same volume:



Each cube is made up of quarters, which means these shapes must have the same volume.

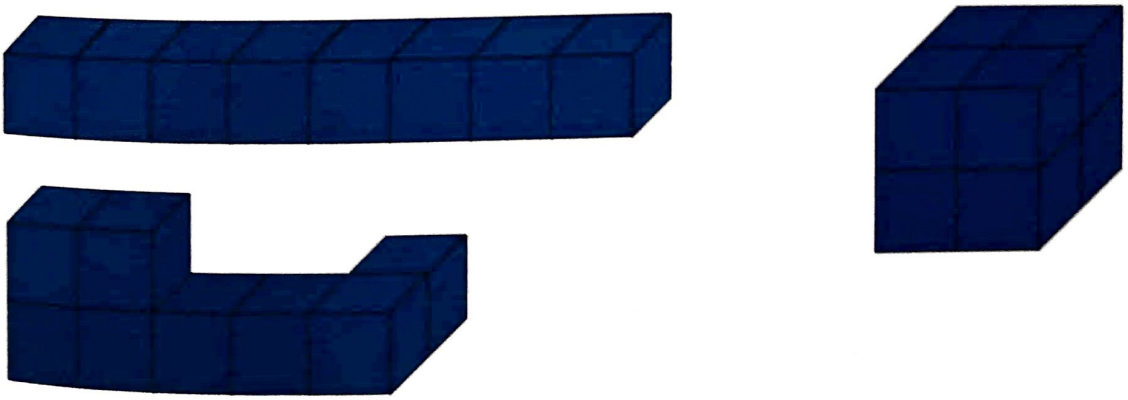


Using this principle pupils can investigate which pieces, or combination of pieces have the same volume as:

- one green cuboid
- one yellow cuboid
- two blue cubes

Conservation of volume

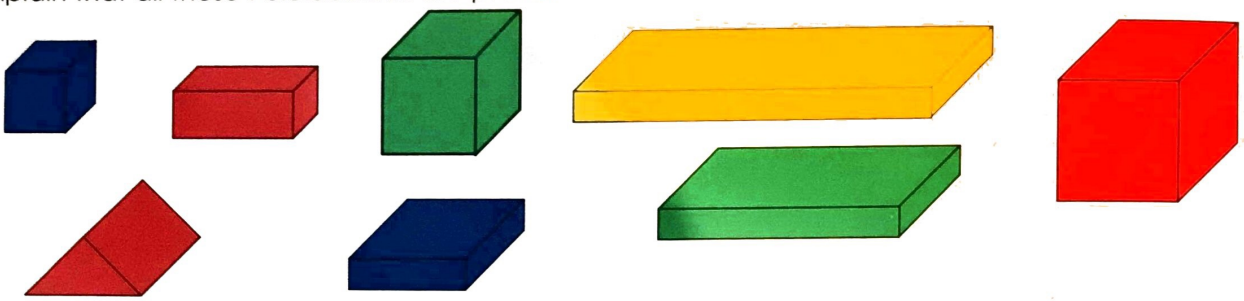
Pupils can explore the conservation of volume through activities such as making different models which have a volume of eight blue cubes.



Exploring Shape

Prisms

Explain that all these Poleidoblocs are prisms.



Ask pupils:

- How many prisms are in the box altogether?
- Can you build a solid cuboid using 20 prisms?
- Can you build the largest possible solid cuboid using prisms?

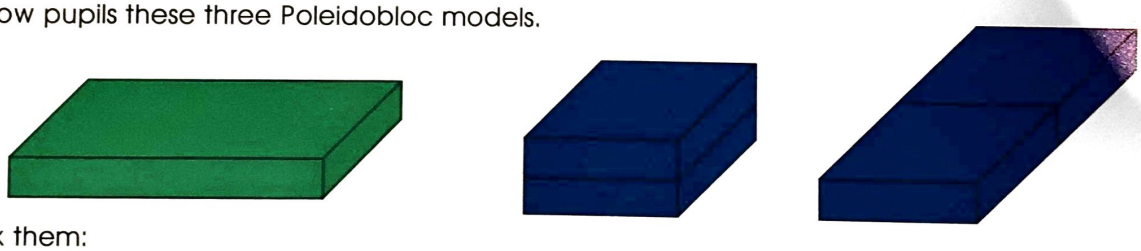
Area

Ask pupils to draw a rectangle which is 125mm by 200mm and to:

- Cover the rectangle with pieces so that only two colours are used.
- Cover the rectangle with blue shapes.
- Investigate covering the rectangle with different pieces.

Surface area

Show pupils these three Poleidobloc models.



Ask them:

- Do these models have the same volume?
- What can you find out about their surface areas?
- Do models with the same volumes have the same surface areas?

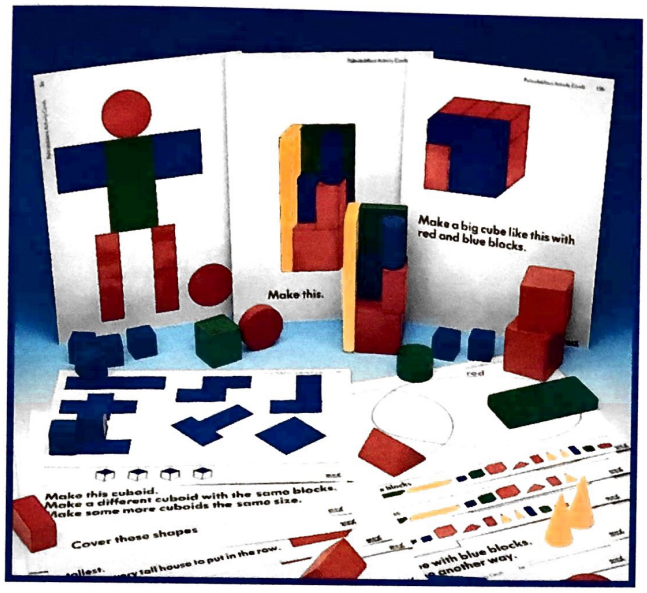
Plans

Pupils make a simple model from Poleidobloc pieces and then draw what it looks like from three views:

- top view
- front view
- side view

They then break up their model and ask another pupil to reconstruct it using only the plan to help them.

support materials for Poleidoblocs G



Activity Cards

Suitable for Key Stage One

Order Material E96121

Poleidoblocs A

There are 140 pieces in natural wood.
They can be used on their own or in conjunction with Poleidoblocs G
Order item D69688

NES Arnold

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