Soap Films (Y5)

Key:

Small print: extracts from Y8 notes

Large print: modifications for Y5/6

MP: motorway plates

Part 1

Each pair of you has a computer ready to use – where? – what? [tub of soapy water]

We want to use soap films to solve a problem:
What is the smallest total length of motorway needed to join n cities?
We use a ribbon of soap film of constant width to model a motorway.

We prepare the children for the 'motorway' experiments by showing them MP and describing how we are going to use the apparatus.

Angle as amount of turn as fraction of a whole turn: demonstrate with door, fingers, [legs, arms and whole body postponed to drinks break]
Whole turn divided into how many units?
360 a nice number: it divides by all the numbers from 1 to 10 except one: which is that? [7]

E3: 'Motorway' experiment no.1.

Apparatus: MP, spacers defining equilateral triangle, 3 dots placed similarly on central whiteboard.

Prediction: Child volunteer invited to draw figure expected. Rival figures drawn in different colours. Vote taken.

Test: Teacher's MP dipped in soap solution.

Observation: 120° trigon obtained, displayed on OHP.

E4: ‘Motorway’ experiment no.2.

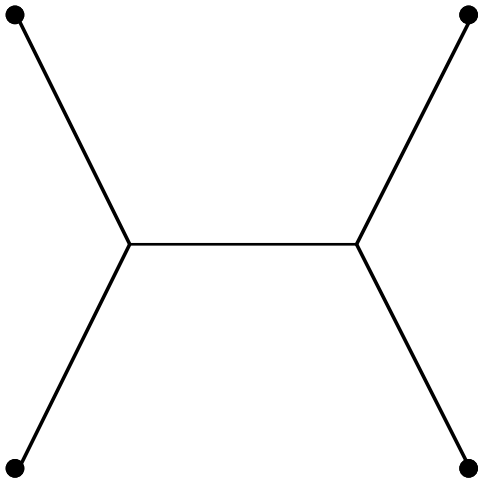
As above, triangle scalene but having no interior angle as great as 120°, and experiment performed by all pairs.

Observation: 120° trigon persists.

E7: ‘Motorway’ experiment no. 3.

A re-run of **E3** but for 4 cities in a square.

Observation:



Repeat **E3** and put result alongside **E7**. Children invited to compare. (We now have *two* 120° trigons.)

E8: Lengths measured on the whiteboard and compared with those which result by simply drawing diagonals to make an ‘X’.

[Ruler required]

E9: ‘Motorway’ experiment no.4.

A re-run of **E4**, i.e. irregular quadrilaterals tried.

Challenge: what will happen if an angle of your quadrilateral is 120° or greater?

Observations: 120° trigons persist. Where angle is 120° or more, junction ‘retreats’ to that city.

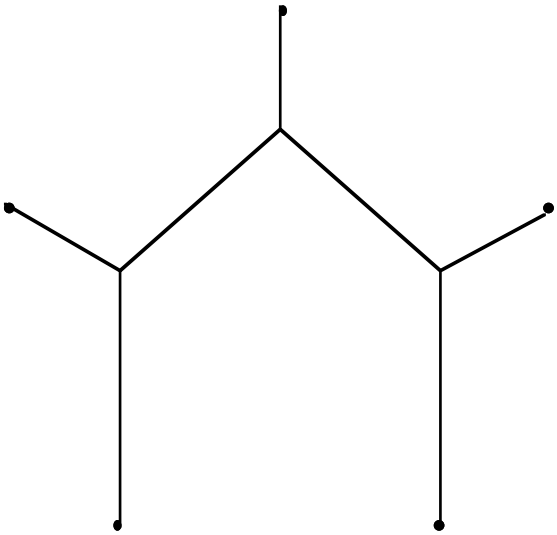
E 11: ‘Motorway’ experiment no.5.

A re-run of **E3** but for 5 cities forming a regular pentagon.

Challenge:
For the square we had 2 trigons. Will we have 3 this time? If so, how will they be arranged?

Mark the vertices on the whiteboard and invite volunteers to draw the solution.

Observation:



Drinks break

Find yourself a space and stick out your arms and legs so that your feet and hands are as far from each other as possible. That way, the angles between your arms, or your legs, or an arm and a leg, will be as large as possible and all equal. You’ll need to look out for these angles in the next experiments.

Part 2

E12: ‘Polyhedra’ experiments.

Apparatus: KB. The straws and connectors allow the children to build a selection of regular and semiregular polyhedra.

Test: The pairs of children build the polyhedra and dip them in the soap solution.

[Note: They must build one of the sides with two half-length straws and a white T-piece, so that they can fit a handle (full-length straw) on to it.

Suggested order:

1. Tetrahedron
4 corner pieces, 6 long straws, 2 short straws, T-piece

2. Triangular prism
6 corner pieces, 9 long straws, 2 short straws, T-piece

3. Cube
8 corner pieces, 12 long straws, 2 short straws, T-piece

4. Octahedron
6 corner pieces, 12 long straws, 2 short straws, T-piece]

Observation: Exhibit the results and ask the children if they notice any feature which is common to all the models *and which they were expecting from work with MP*.

With MP the angles between the walls were displayed automatically because the wall edge was perpendicular to the perspex plates. In three dimensions the children have to look for what are in fact the *dihedral* angles and spot that these are equal in all cases.
[They have to view the walls end-on.]

Then ask the children if they notice any other features which are common to all models. You may have to draw attention to the following:
1.) 4 edges meet in a point.
2.) Every angle between edges is the same.

Finally ask for features *not* common to all models. Notable here is the observation that not all edges are straight.