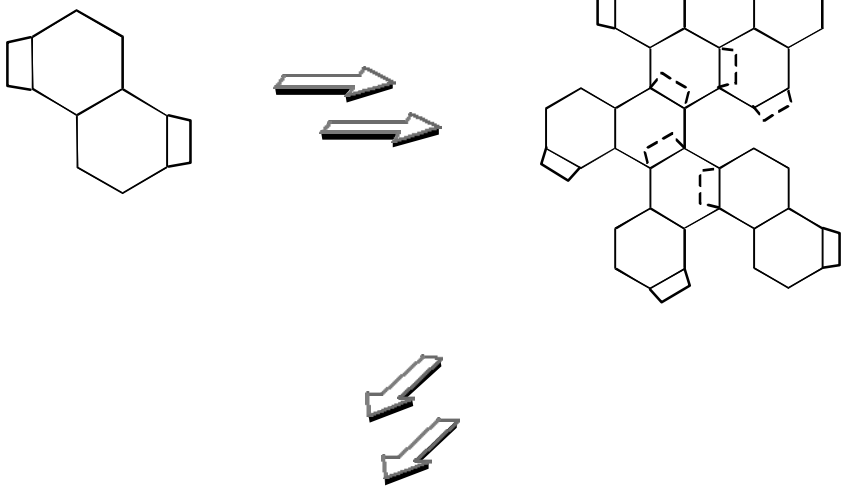
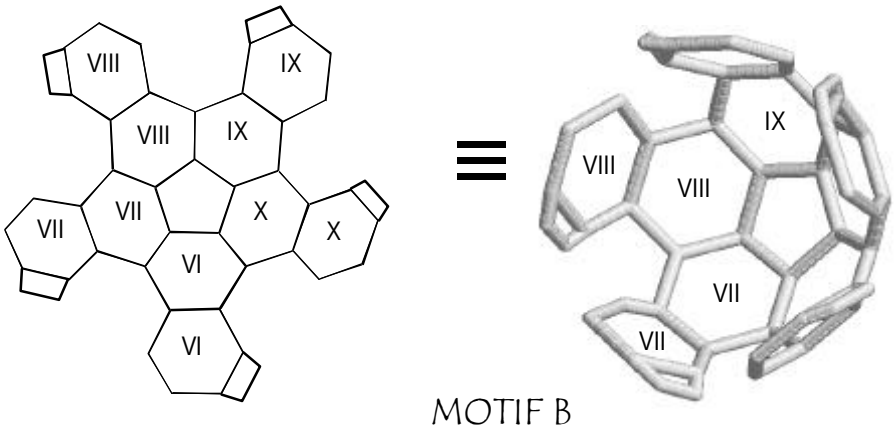
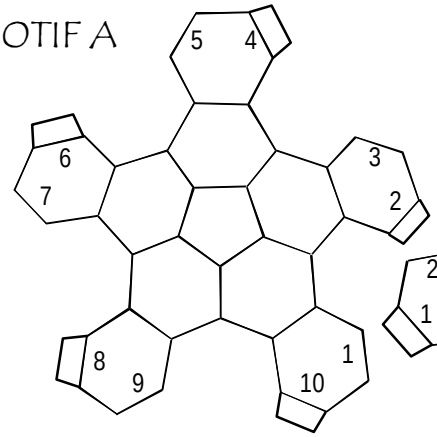
13



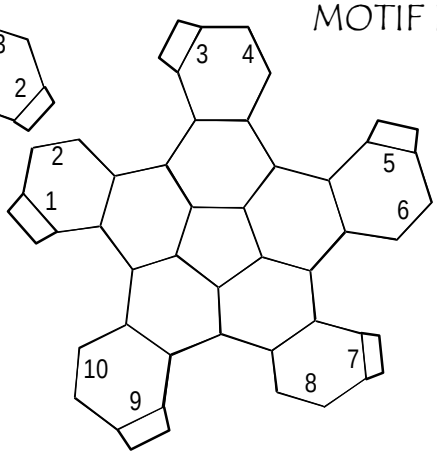


MOTIF B

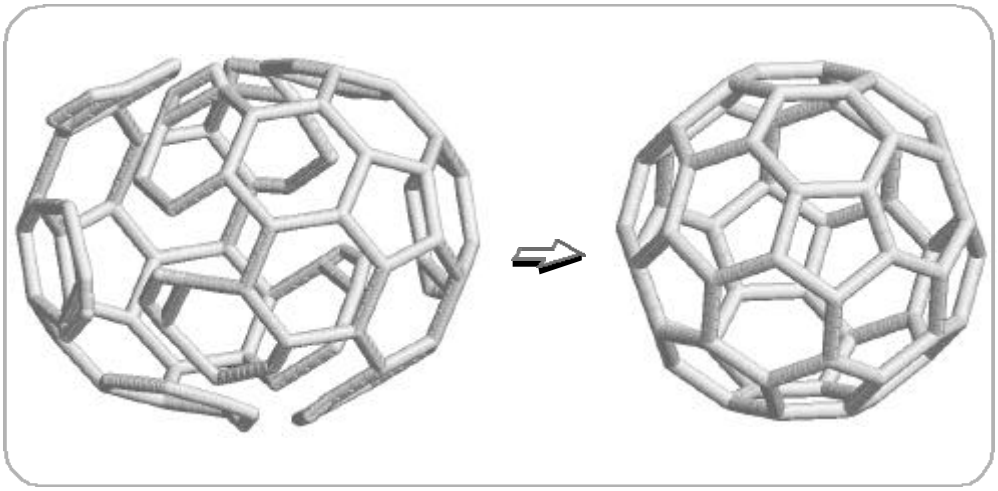
MOTIF A



MOTIF B

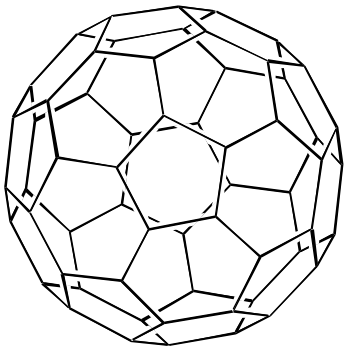


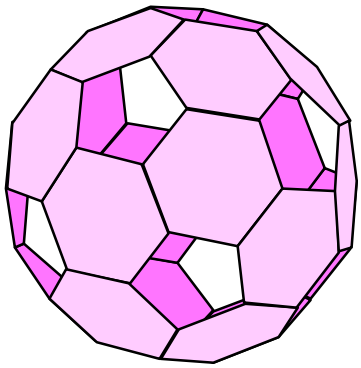
JOIN A AND B



15

MODULAR ASSEMBLY OF BUCKY FROM ENVELOPES





MODULAR ASSEMBLY OF BUCKY FROM ENVELOPES

We would like building a bucky where all the bonds are shown, just like you would make them from model sets. So we need a modular assembly for bucky. Modular assembly means small constructs, which have the complete information to produce the whole design on proper alignment. This is the principle of modular assembly, from the simplest platonic solids to the most complex enzymes. Here, to design a module that is related to a model, we have to go back to mathematics,

In bucky we have sixty carbon atoms that occupy nodal positions where three valencies meet. Using the simple equation,

$$\frac{\text{no. of nodes x no bonds meeting at that point}}{2} = \text{no. of modules} =$$

$$\frac{60 \times 3}{2} = 90$$

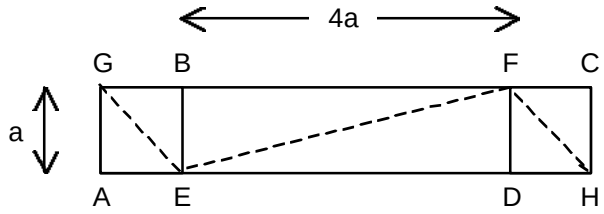
Lot of modules to make, but they can be made easily!

A module that connects two nodal positions should have pairs of,

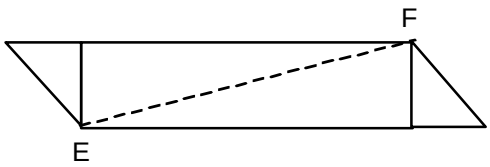
Angle controller- 120º in bucky; Donor/ insert;Acceptor/ pocket

Using simple principles of geometry and trigonometry, a design can be made from stout envelopes of the size 12 cm x ~24 cm. The construction of the module is shown in page 16. Arrange six of the modules as shown to form the hexagon (page 18).

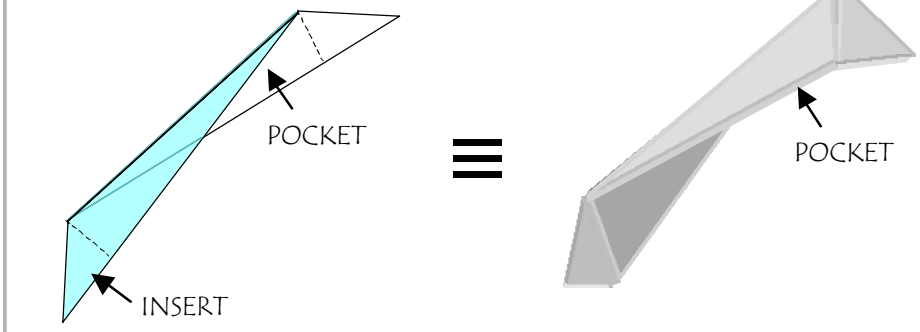
17



bring A to B along fold GE
bring C to D along fold FH



fold to front along EF
to complete the module



INSERTION: THROUGH THE NARROW WEDGE (PLACE INSERT SNUGLY INSIDE).

MODULAR ASSEMBLY OF BUCKY FROM ENVELOPES

Angle controller = GEF (for bucky, this should be 120°.

$\angle GEF = \angle GEB + \angle BEF$

tan (GEB) = GB / BE = a / a = 1, therefore $\angle GEB = 45^{o}$.

tan (BEF) = BF / BE = 4a / a = 4, therefore $\angle BEF = 74^{o}$ (~ 75°).

Therefore $\angle GEF = 45^{o} + 75^{o} = 120^{o}$.

By adding module by module reach motif **A**, a pentagon surrounded by five hexagons (corannulene). Make two of these (page 19-20). Using one of the A **modules**, build five more hexagons using open positions to give **B.** Refer to illustrations on page 20 for a 3D view of the assembly process. With a module each, connect * locations , which would give **C** (page 19 and 21).

Let us do a module count now:

A: 25; **B**:50; **C**: 55
A + **C** = 90!

Carefully couple **A** and **C** (1 →1, 2 → 2, 3→ 3…10→ 10) to complete the bucky (page 22). It is almost like placing a lid on top of a container (page 23). The bucky is now complete!

The assembly, in principle, is reversible. However in the case of this particular module both the inserts and pockets are narrow, when compared to the edge. Because of this it would be practical to apply a little bit of glue when each module is inserted and proceed to the next step when it has taken firm hold.