National Student Team Contest (first stage)
Task 4. Nanopuzzles

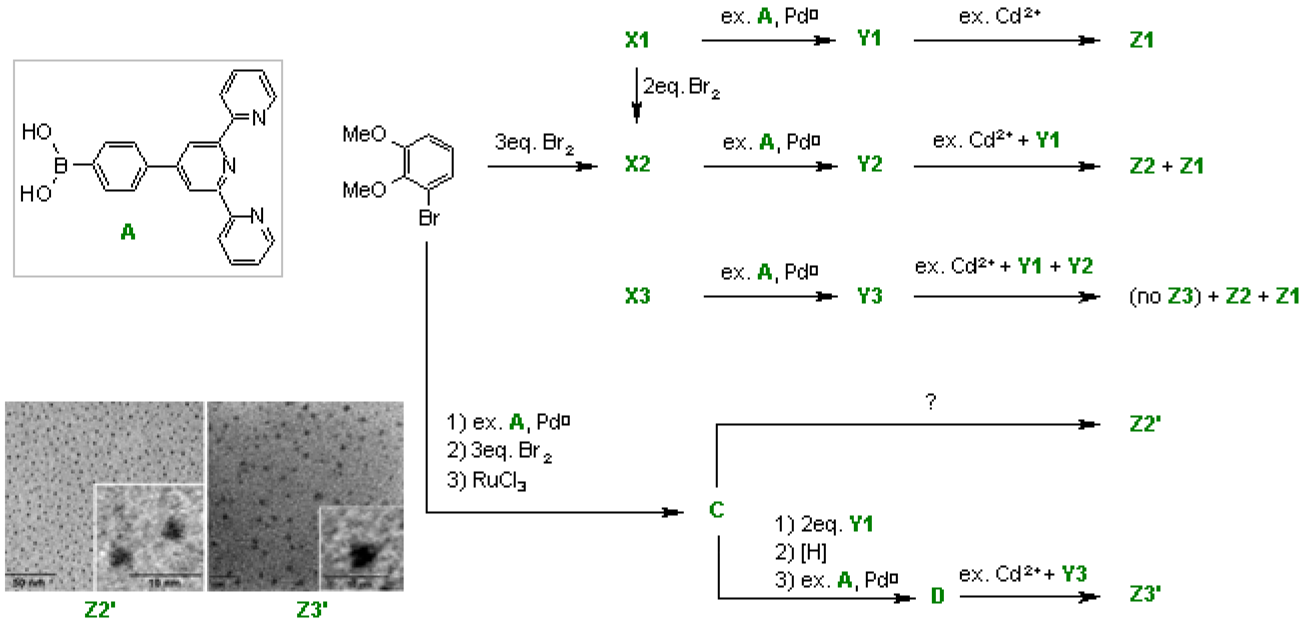

*Fig. 1. Scheme: ex. = excess, eq. = equivalents, Pd^0 = $Pd(PPh_3)_4$; [H] = reduction of transition metal to 2+; (no **Z3**) = only insoluble polymer was formed instead of expected **Z3**.*
*Inset: TEM images of **Z2’** and **Z3’**.*

The scheme above describes the synthesis of some kind of homologous nanoobjects **Z**, starting from simple compounds.

1. Schematically draw the structures of nanoobjects **Z1**, **Z2**, **Z3**. **(2 points)**
   What are the stoichiometries for their formation reactions and what are their charges? (**2 points**)
   Give the structures of **X1**, **X2**, and **X3** if **Z1** has no isomers. **(2 points)**
   What are the differences between **Z** and **Z’** in the pairs **Z2** / **Z2’** and **Z3** / **Z3’**? **(1 point)**

2. Explain the main ideas of **Z2’** and **Z3’** synthesis (compared to **Z2** and **Z3**) and propose the way to obtain **Z2’** from **C**. **(3,5 points)**

3. Using the bond lengths roughly estimate the sizes of **Z1**, **Z2**, **Z3** as the diameters of the circumscribed spheres. **(1,5 points)**

Total – 12 points