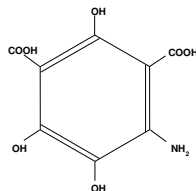


# Workshop for Necklaces and Chemicals

## Conjugacy Classes and Counting

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1. Compute the conjugacy classes of elements in  $G$  in **GAP** and determine whether elements of the same cycle structure are conjugate in  $G$  for
  - (a)  $G = S_5$ ,
  - (b)  $G = A_5$ ,
  - (c)  $G = D_{10}$ .
2. Implement a function in **GAP** which takes as input a permutation  $g$  and a point  $n$  and returns **false** if  $g$  moves a point not in  $\Omega = \{1, \dots, n\}$  and the number of cycles of  $g$  on  $\Omega$  otherwise.
3. Implement a function in **GAP** which takes as input a permutation group  $G$  which is the symmetry group of an object with  $n$  points and a number  $c$  of colours and returns the number of inequivalent ways in which the points  $\{1, \dots, n\}$  can be coloured in  $c$  colours.
4. Determine the number of distinct molecules which can be obtained from a hexagonal ring of six carbon atoms, if we allow one of the radicals  $\text{COOH}$ ,  $\text{NH}_2$ ,  $\text{OH}$  on each of the 6 carbon atoms.



5. In how many ways can a 9-bead necklace be coloured in 3 different colours?