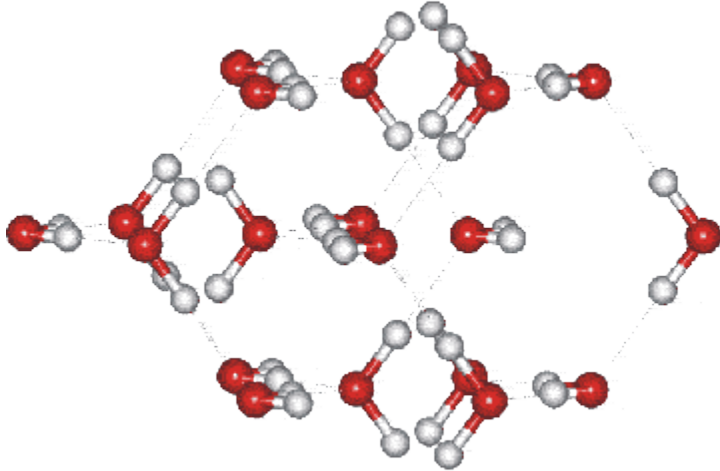
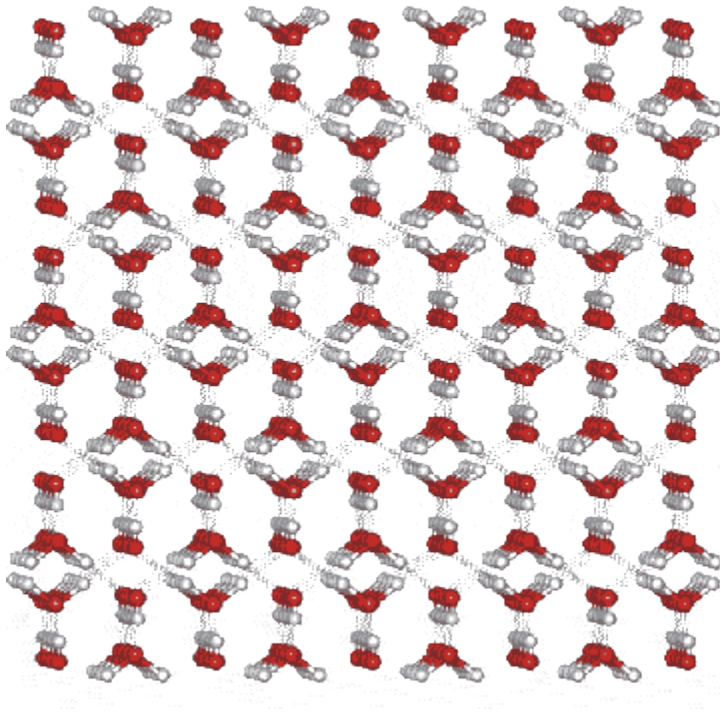


## Ice-eight (Ice VIII)



Ice-eight (ice VIII) is formed from ice-seven (ice VII) by lowering its temperature (see Phase Diagram). The hydrogen bonding is ordered and fixed as ice-seven undergoes a proton disorder-order transition to ice eight when cooled at about 5 °C; ice-seven and ice-eight having identical structures apart from the proton ordering. The proton ordering causes a slightly distortion in the ice-seven cubic lattice (a,b slightly shorter, c slightly longer) resulting in a tetragonal crystal structure ( $I_4/amd$ , **141**; Laue class symmetry 4/mmm) where all of the water molecules are hydrogen bonded to four others, two as donor and two as acceptor. Similarly to ice-seven, ice-eight consists of two interpenetrating cubic icelattices.



It has a density of about  $1.66 \text{ g cm}^{-3}$  (at 8.2 GPa and 223 K [8]), which is less than twice the cubic ice density as the intra-network O····O distances are longer to allow for the interpenetration. Ice-eight's molar volume is slightly smaller (by  $0.65 \text{ mm}^3 \text{ mol}^{-1}$ ) than that of ice-seven along the phase transition line. Ice-eight has triple points with ice-six and ice-seven (5 °C, 2.1 GPa) and ice-seven and ice-ten (100 K, 62 GPa). The dielectric constant of ice-eight is about 4.

The crystal (shown opposite) has cell dimensions  $a, b = 4.4493 \text{ \AA}$ ,  $c = 6.413 \text{ \AA}$  (90°, 90°, 90°; D<sub>2</sub>O, at 2.6 GPa and 22 °C [362]), containing eight water molecules per unit cell. All molecules experience identical molecular environments.

As the H-O-H angle does not vary much from that of the isolated molecule, the hydrogen bonds are not straight (although shown so in the figures).

Interactive Jmol structures are given.

Source:[http://www1.lsbu.ac.uk/water/ice\\_viii.html](http://www1.lsbu.ac.uk/water/ice_viii.html)