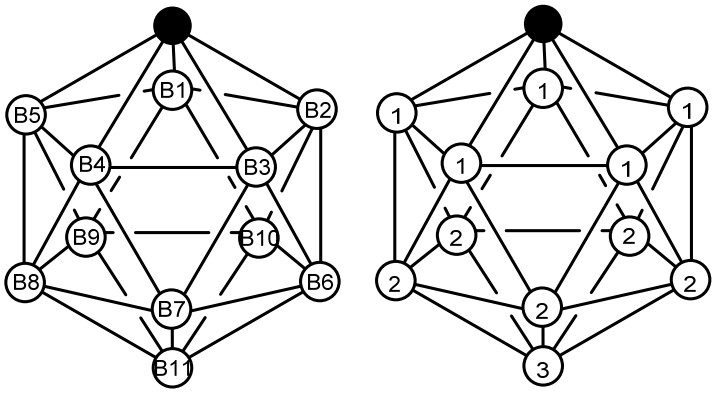
Ch112 Inorganic Chemistry
October 9th, 2018
In-Class Problem A

Boranes, compounds of B and H, can exhibit a variety of structures. One interesting borane form is the dodecaborane dianion, $[B_{12}H_{12}]^{2-}$, which adopts an icosahedral structure. Replacement of one BH unit in $[B_{12}H_{12}]^{2-}$ with a CH moiety gives rise to a monoanion carborane $[B_{11}CH_{12}]^{-}$. On the left, each boron is given a unique label. On the right, symmetry equivalent borons are given identical numerical labels.

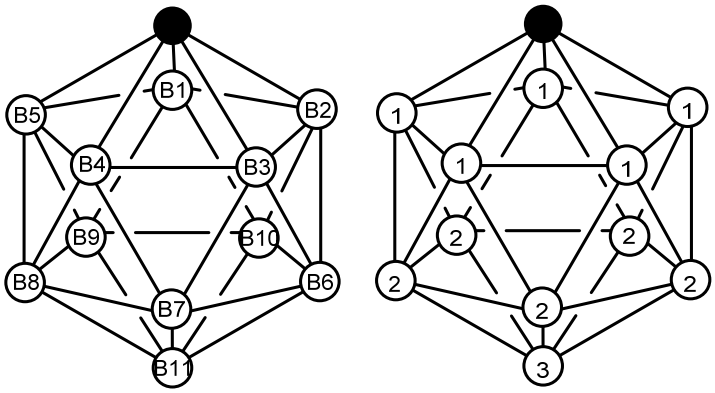


Using the eleven boron atoms as the basis set, fill out the transformation matrix for the C_5^2 operation (clockwise rotation).

$$\begin{bmatrix} & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \end{bmatrix} \cdot \begin{bmatrix} B1 \\ B2 \\ B3 \\ B4 \\ B5 \\ B6 \\ B7 \\ B8 \\ B9 \\ B10 \\ B11 \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \end{bmatrix}$$

Ch112 Inorganic Chemistry
October 9th, 2018
In-Class Problem B

Boranes, compounds of B and H, can exhibit a variety of structures. One interesting borane form is the dodecaborane dianion, $[B_{12}H_{12}]^{2-}$, which adopts an icosahedral structure. Replacement of one BH unit in $[B_{12}H_{12}]^{2-}$ with a CH moiety gives rise to a monoanion carborane $[B_{11}CH_{12}]^{-}$. On the left, each boron is given a unique label. On the right, symmetry equivalent borons are given identical numerical labels.



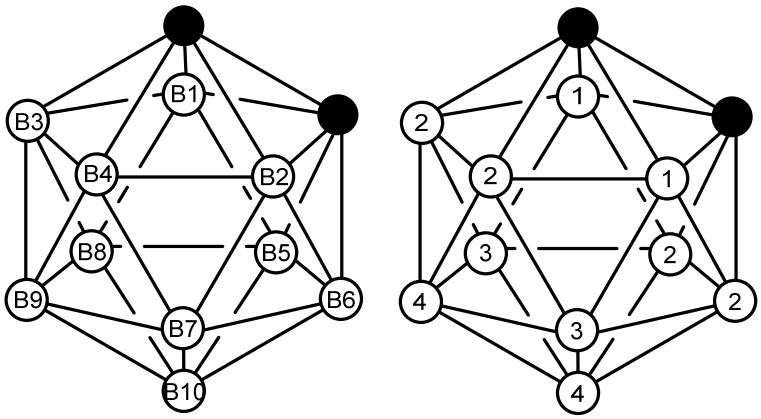
Using the eleven boron atoms as the basis set, fill out the transformation matrix for the σ_v operation through the plane perpendicular to the page.

$$\begin{bmatrix} & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \end{bmatrix} \cdot \begin{bmatrix} B1 \\ B2 \\ B3 \\ B4 \\ B5 \\ B6 \\ B7 \\ B8 \\ B9 \\ B10 \\ B11 \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \end{bmatrix}$$

Ch112 Inorganic Chemistry
October 9th, 2018
In-Class Problem C

Boranes, compounds of B and H, can exhibit a variety of structures. One interesting borane form is the dodecaborane dianion, $[B_{12}H_{12}]^{2-}$, which adopts an icosahedral structure. Replacement of two BH units in $[B_{12}H_{12}]^{2-}$ with CH moieties gives rise to neutral compounds called carboranes $[B_{10}C_2H_{12}]$.

The *ortho* isomer is shown below. On the left, each boron is given a unique label. On the right, symmetry equivalent borons are given identical numerical labels.



Using the ten boron atoms as the basis set, fill out the transformation matrix for the C_2 operation.

$\cdot$

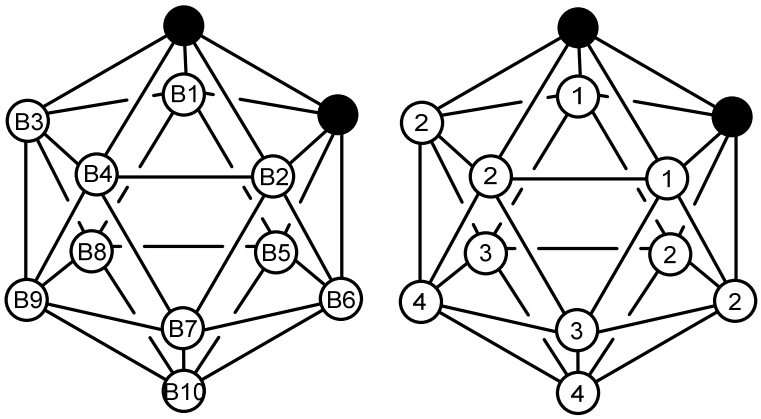
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10

$=$

Ch112 Inorganic Chemistry
October 9th, 2018
In-Class Problem D

Boranes, compounds of B and H, can exhibit a variety of structures. One interesting borane form is the dodecaborane dianion, $[B_{12}H_{12}]^{2-}$, which adopts an icosahedral structure. Replacement of two BH units in $[B_{12}H_{12}]^{2-}$ with CH moieties gives rise to neutral compounds called carboranes $[B_{10}C_2H_{12}]$.

The *ortho* isomer is shown below. On the left, each boron is given a unique label. On the right, symmetry equivalent borons are given identical numerical labels.



Using the ten boron atoms as the basis set, fill out the transformation matrix for the σ_v operation through the plane containing both carbon atoms.

$$\begin{bmatrix} & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \end{bmatrix} \cdot \begin{bmatrix} B1 \\ B2 \\ B3 \\ B4 \\ B5 \\ B6 \\ B7 \\ B8 \\ B9 \\ B10 \end{bmatrix} = \begin{bmatrix} & \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ & \end{bmatrix}$$