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Covalent Bonding Formulas

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List of 13 Covalent Bonding Formulas

Covalent Bonding

1) Bond Angle between Bond Pair and Lone Pair of Electrons given P Character

Open Calculator

fx $$\theta = a\cos\left(\frac{\mathrm{p}-1}{\mathrm{p}}\right)$$

ex $$109.4712^\circ = a\cos\left(\frac{0.75-1}{0.75}\right)$$

2) Bond Angle between Bond Pair and Lone Pair of Electrons given S Character

Open Calculator

fx $$\theta = a\cos\left(\frac{\mathrm{s}}{\mathrm{s}-1}\right)$$

ex $$109.4712^\circ = a\cos\left(\frac{0.25}{0.25-1}\right)$$

3) Bond Order for Molecules Showing Resonance

Open Calculator

fx $$\mathrm{B.O.} = \frac{\mathrm{b}}{\mathrm{n}}$$

ex $$1.833333 = \frac{11}{6}$$

4) Formal Charge on Atom

Open Calculator

fx $$FC = n_{vs} - \left(\frac{n_{bp}}{2}\right) - n_{nb}$$

ex $$3 = 7 - \left(\frac{4}{2}\right) - 2$$

5) Fraction of P Character given Bond Angle

Open Calculator

fx $$p = \frac{1}{1 - \cos(\theta)}$$

ex $$0.749734 = \frac{1}{1 - \cos(109.5^\circ)}$$

6) Fraction of S Character given Bond Angle

Open Calculator

fx $$s = \frac{\cos(\theta)}{\cos(\theta) - 1}$$

ex $$0.250266 = \frac{\cos(109.5^\circ)}{\cos(109.5^\circ) - 1}$$

7) Number of Bonding Electrons given Formal Charge

Open Calculator

fx $$n_{bp} = (n_{vs} - FC - n_{nb}) \cdot 2$$

ex $$4 = (7 - 3 - 2) \cdot 2$$

8) Number of Nonbonding Electrons given Formal Charge

Open Calculator

fx $$n_{nb} = n_{vs} - \left(\frac{n_{bp}}{2}\right) - FC$$

ex $$2 = 7 - \left(\frac{4}{2}\right) - 3$$

9) Number of Valence Electrons given Formal Charge

Open Calculator

fx $$n_{vs} = FC + \left(\frac{n_{bp}}{2}\right) + n_{nb}$$

ex $$7 = 3 + \left(\frac{4}{2}\right) + 2$$

10) Percentage of P Character given Bond Angle

Open Calculator

fx $$\%\,p = \left(\frac{1}{1 - \cos(\theta)}\right) \cdot 100$$

ex $$74.97337 = \left(\frac{1}{1 - \cos(109.5^\circ)}\right) \cdot 100$$

11) Percentage of S Character given Bond Angle

Open Calculator

fx $$\%\,s = \left(\frac{\cos(\theta)}{\cos(\theta) - 1}\right) \cdot 100$$

ex $$25.02663 = \left(\frac{\cos(109.5^\circ)}{\cos(109.5^\circ) - 1}\right) \cdot 100$$

12) Total Number of Bonds between all Structures given Bond Order

Open Calculator

fx $$b = B.O. \cdot n$$

ex $$10.998 = 1.833 \cdot 6$$

13) Total Number of Resonating Structures given Bond Order

Open Calculator

fx $$n = \frac{b}{B.O.}$$

ex $$6.001091 = \frac{11}{1.833}$$

Variables Used

- **% p** Percentage of P-Character
- **% s** Percentage of S-Character
- **b** Total no. of Bonds between Two Atoms
- **B.O.** Bond Order for Molecules Showing Resonance
- **FC** Formal Charge
- **n** No. of Resonating Structures
- n_{bp} No. of Bonding Pair Electrons
- n_{nb} No. of Non-Bonding Pair Electrons
- n_{vs} No. of Valence Shell Electrons
- **p** Fraction of P-Character
- **s** Fraction of S-Character
- **θ** Bond Angle between Bond Pair and Lone Pair *(Degree)*

Constants, Functions, Measurements used

- Function: **acos**, acos(Number)
  Inverse trigonometric cosine function
- Function: **cos**, cos(Angle)
  Trigonometric cosine function
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion

Check other formula lists

- **Covalent Bonding Formulas**
- **Ionic Bonding Formulas**

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