

# Important Covalent Bonding Formulas PDF



## Formulas Examples with Units

### List of 13 Important Covalent Bonding Formulas

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

Formula

$$\theta = \text{acos} \left( \frac{p-1}{p} \right)$$

Example with Units

$$109.4712^\circ = \text{acos} \left( \frac{0.75-1}{0.75} \right)$$

Evaluate Formula

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

Formula

$$\theta = \text{acos} \left( \frac{s}{s-1} \right)$$

Example with Units

$$109.4712^\circ = \text{acos} \left( \frac{0.25}{0.25-1} \right)$$

Evaluate Formula

#### 3) Bond Order for Molecules Showing Resonance Formula

Formula

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

Example

$$1.8333 = \frac{11}{6}$$

Evaluate Formula

#### 4) Formal Charge on Atom Formula

Formula

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

Example

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

Evaluate Formula

#### 5) Fraction of P Character given Bond Angle Formula

Formula

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

Example with Units

$$0.7497 = \frac{1}{1 - \cos(109.5^\circ)}$$

Evaluate Formula

#### 6) Fraction of S Character given Bond Angle Formula

Formula

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

Example with Units

$$0.2503 = \frac{\cos(109.5^\circ)}{\cos(109.5^\circ) - 1}$$

Evaluate Formula



### 7) Number of Bonding Electrons given Formal Charge Formula ↻

Formula

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

Example

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

Evaluate Formula ↻

### 8) Number of Nonbonding Electrons given Formal Charge Formula ↻

Formula

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

Example

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

Evaluate Formula ↻

### 9) Number of Valence Electrons given Formal Charge Formula ↻

Formula

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

Example

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

Evaluate Formula ↻

### 10) Percentage of P Character given Bond Angle Formula ↻

Formula

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

Example with Units

$$74.9734 = \left(\frac{1}{1 - \cos(109.5^\circ)}\right) \cdot 100$$

Evaluate Formula ↻

### 11) Percentage of S Character given Bond Angle Formula ↻

Formula

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

Example with Units

$$25.0266 = \left(\frac{\cos(109.5^\circ)}{\cos(109.5^\circ) - 1}\right) \cdot 100$$

Evaluate Formula ↻

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

Formula

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

Example

$$10.998 = 1.833 \cdot 6$$

Evaluate Formula ↻

### 13) Total Number of Resonating Structures given Bond Order Formula ↻

Formula

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

Example

$$6.0011 = \frac{11}{1.833}$$


Evaluate Formula ↻



## Variables used in list of Covalent Bonding Formulas above

- % **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<sub>bp</sub>** No. of Bonding Pair Electrons
- **n<sub>nb</sub>** No. of Non-Bonding Pair Electrons
- **n<sub>vs</sub>** 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 in list of Covalent Bonding Formulas above

- **Functions: acos**,  $\text{acos}(\text{Number})$   
*The inverse cosine function, is the inverse function of the cosine function. It is the function that takes a ratio as an input and returns the angle whose cosine is equal to that ratio.*
- **Functions: cos**,  $\text{cos}(\text{Angle})$   
*Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- **Measurement: Angle** in Degree (°)  
*Angle Unit Conversion* 



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