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Electronegativity Formulas

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List of 36 Electronegativity Formulas

Electronegativity

1) 100 percent Covalent Bond Energy as Arithmetic Mean

$$fx \quad E_{A-B(\text{cov})} = 0.5 \cdot (E_{A-A} + E_{B-B})$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$ex \quad 23.5J = 0.5 \cdot (20J + 27J)$$

2) 100 percent Covalent Bond Energy as Geometric Mean

$$fx \quad E_{A-B(\text{cov})} = \sqrt{E_{A-A} \cdot E_{B-B}}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$ex \quad 23.2379J = \sqrt{20J \cdot 27J}$$

3) 100 percent Covalent Bond Energy given Covalent Ionic Resonance Energy

$$fx \quad E_{A-B(\text{cov})} = E_{A-B} - \Delta$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$ex \quad 23.4J = 28.4J - 5J$$

4) Actual Bond Energy given Covalent Ionic Resonance Energy

$$fx \quad E_{A-B} = \Delta + E_{A-B(\text{cov})}$$

[Open Calculator !\[\]\(83bbbd261710c59db0214aa27b2edc0d_img.jpg\)](#)

$$ex \quad 28.35J = 5J + 23.35J$$



5) Covalent Ionic Resonance Energy

$$\text{fx } \Delta = E_{A-B} - E_{A-B(\text{cov})}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$\text{ex } 5.05\text{J} = 28.4\text{J} - 23.35\text{J}$$

6) Covalent Ionic Resonance Energy using Bond Energies

$$\text{fx } \Delta = E_{A-B} - \sqrt{E_{A-A} \cdot E_{B-B}}$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$\text{ex } 5.1621\text{J} = 28.4\text{J} - \sqrt{20\text{J} \cdot 27\text{J}}$$

7) Fractional Charge

$$\text{fx } \delta = \frac{\mu}{e \cdot d}$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$\text{ex } 0.208333 = \frac{10\text{E}^{-18}\text{stC} \cdot \text{cm}}{4.8\text{E}^{-10}\text{stC} \cdot 10\text{A}}$$

Allred Rochow's Electronegativity

8) Allred Rochow's Electronegativity from Mulliken's Electronegativity

$$\text{fx } X_{A.R} = (0.336 \cdot X_M) - 0.2 - 0.744$$

[Open Calculator !\[\]\(84f47badaad7772cd95667a7c387a639_img.jpg\)](#)

$$\text{ex } 6.448\text{J} = (0.336 \cdot 22\text{J}) - 0.2 - 0.744$$



9) Allred Rochow's Electronegativity from Pauling's Electronegativity

$$fx \quad X_{A.R} = X_P - 0.744$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 6.496J = 7.24J - 0.744$$

10) Allred Rochow's Electronegativity given IE and EA

fx

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$X_{A.R} = ((0.336 \cdot 0.5) \cdot (IE + E.A)) - 0.2 - 0.744$$

$$ex \quad 6.4984J = ((0.336 \cdot 0.5) \cdot (27.2J + 17.1J)) - 0.2 - 0.744$$

11) Allred Rochow's Electronegativity of Element

$$fx \quad X_{A.R} = \frac{0.359 \cdot Z}{r_{\text{covalent}}^2}$$

[Open Calculator !\[\]\(626ce8ac21792b9405bfddfea8e0c96a_img.jpg\)](#)

$$ex \quad 6.445705J = \frac{0.359 \cdot 25}{(1.18A)^2}$$

12) Allred Rochow's Electronegativity using Bond Energies

$$fx \quad X_{A.R} = \sqrt{E_{(A-B)}} - \sqrt{E_{A-A} \cdot E_{B-B}} - 0.744$$

[Open Calculator !\[\]\(c1168d6a8b365d11e842ece304635fa7_img.jpg\)](#)

$$ex \quad 6.483178J = \sqrt{75.47J} - \sqrt{20J \cdot 27J} - 0.744$$



13) Covalent Radius from Allred Rochow's Electronegativity

[Open Calculator !\[\]\(bd1a142de767a21e5362c595f844a4ff_img.jpg\)](#)

$$\text{fx } r_{\text{covalent}} = \sqrt{\frac{0.359 \cdot Z}{X_{\text{A.R}}}}$$

$$\text{ex } 1.175061\text{\AA} = \sqrt{\frac{0.359 \cdot 25}{6.5\text{J}}}$$

14) Effective Nuclear Charge from Allred Rochow's Electronegativity

[Open Calculator !\[\]\(830769b31eeeaca920791081939ff8ba_img.jpg\)](#)

$$\text{fx } Z = \frac{X_{\text{A.R}} \cdot r_{\text{covalent}} \cdot r_{\text{covalent}}}{0.359}$$

$$\text{ex } 25.21058 = \frac{6.5\text{J} \cdot 1.18\text{\AA} \cdot 1.18\text{\AA}}{0.359}$$

15) Electron Affinity of Element using Allred Rochow's Electronegativity

[Open Calculator !\[\]\(47734e4656765d20df4fdbd5b7aff048_img.jpg\)](#)

$$\text{fx } \text{E.A} = \left((X_{\text{A.R}} + 0.744 + 0.2) \cdot \left(\frac{2}{0.336} \right) \right) - \text{IE}$$

$$\text{ex } 17.10952\text{J} = \left((6.5\text{J} + 0.744 + 0.2) \cdot \left(\frac{2}{0.336} \right) \right) - 27.2\text{J}$$



16) Ionization Energy using Allred Rochow's Electronegativity 

fx

Open Calculator 

$$IE = \left((X_{A.R} + 0.744 + 0.2) \cdot \left(\frac{2}{0.336} \right) \right) - E.A$$

$$\text{ex } 27.20952J = \left((6.5J + 0.744 + 0.2) \cdot \left(\frac{2}{0.336} \right) \right) - 17.1J$$

Mulliken's Electronegativity 17) Covalent Radius given Mulliken's Electronegativity 

fx

Open Calculator 

$$r_{\text{covalent}} = \sqrt{\frac{0.359 \cdot Z}{(0.336 \cdot X_M) - 0.2 - 0.744}}$$

ex

$$1.17979A = \sqrt{\frac{0.359 \cdot 25}{(0.336 \cdot 22J) - 0.2 - 0.744}}$$

18) Effective Nuclear Charge given Mulliken's Electronegativity 

fx


Open Calculator 

$$Z = \frac{((0.336 \cdot X_M) - 0.2 - 0.744) \cdot (r_{\text{covalent}}^2)}{0.359}$$

ex

$$25.0089 = \frac{((0.336 \cdot 22J) - 0.2 - 0.744) \cdot ((1.18A)^2)}{0.359}$$



19) Electron Affinity of element using Mulliken's Electronegativity 

$$\text{fx } \text{E.A} = (2 \cdot X_M) - \text{IE}$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)


$$\text{ex } 16.8\text{J} = (2 \cdot 22\text{J}) - 27.2\text{J}$$

20) Ionization Energy of element using Mulliken's Electronegativity 

$$\text{fx } \text{IE} = (2 \cdot X_M) - \text{E.A}$$

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5_img.jpg\)](#)

$$\text{ex } 26.9\text{J} = (2 \cdot 22\text{J}) - 17.1\text{J}$$

21) Mulliken's Electronegativity from Allred Rochow's Electronegativity 

$$\text{fx } X_M = \frac{X_{A.R} + 0.744 + 0.2}{0.336}$$

[Open Calculator !\[\]\(c444627dab9fee9a1550c053ffaaaae2_img.jpg\)](#)

$$\text{ex } 22.15476\text{J} = \frac{6.5\text{J} + 0.744 + 0.2}{0.336}$$

22) Mulliken's Electronegativity from Pauling's Electronegativity 

$$\text{fx } X_M = \frac{X_P + 0.2}{0.336}$$

[Open Calculator !\[\]\(06a315363e7801bba8c7489a6694af19_img.jpg\)](#)


$$\text{ex } 22.14286\text{J} = \frac{7.24\text{J} + 0.2}{0.336}$$



23) Mulliken's Electronegativity given Bond Energies Open Calculator 

$$fx \quad X_M = \frac{\sqrt{E_{(A-B)}} - \sqrt{E_{A-A} \cdot E_{B-B}} + 0.2}{0.336}$$

$$ex \quad 22.1047J = \frac{\sqrt{75.47J} - \sqrt{20J \cdot 27J} + 0.2}{0.336}$$

24) Mulliken's Electronegativity given Effective Nuclear Charge and Covalent Radius Open Calculator 

$$fx \quad X_M = \frac{\left(\frac{0.359 \cdot Z}{r_{\text{covalent}}^2}\right) + 0.744 + 0.2}{0.336}$$

$$ex \quad 21.99317J = \frac{\left(\frac{0.359 \cdot 25}{(1.18A)^2}\right) + 0.744 + 0.2}{0.336}$$

25) Mulliken's Electronegativity of Element Open Calculator 

$$fx \quad X_M = 0.5 \cdot (IE + E.A)$$

$$ex \quad 22.15J = 0.5 \cdot (27.2J + 17.1J)$$



Pauling's Electronegativity

26) Covalent Ionic Resonance Energy using Pauling's Electronegativity

$$\text{fx } \Delta_p = X_P^2$$

[Open Calculator !\[\]\(d66ff64371a51729ac8c1cdaa685ba6f_img.jpg\)](#)

$$\text{ex } 52.4176\text{J} = (7.24\text{J})^2$$

27) Covalent Radius given Pauling's Electronegativity

$$\text{fx } r_{\text{covalent}} = \sqrt{\frac{0.359 \cdot Z}{X_P - 0.744}}$$

[Open Calculator !\[\]\(faf942dc3e59ce8eb64b4ac481eca7e0_img.jpg\)](#)

$$\text{ex } 1.175423\text{\AA} = \sqrt{\frac{0.359 \cdot 25}{7.24\text{J} - 0.744}}$$

28) Effective Nuclear Charge given Pauling's Electronegativity

$$\text{fx } Z = \frac{(X_P - 0.744) \cdot (r_{\text{covalent}}^2)}{0.359}$$

[Open Calculator !\[\]\(95b425611cbd2b8716a140cf67c81822_img.jpg\)](#)

$$\text{ex } 25.19507 = \frac{(7.24\text{J} - 0.744) \cdot ((1.18\text{\AA})^2)}{0.359}$$



29) Electron Affinity of element using Pauling's Electronegativity

$$\text{fx } E.A = \left((X_P + 0.2) \cdot \left(\frac{2}{0.336} \right) \right) - IE$$

[Open Calculator !\[\]\(0f848bbd71cef6b345273b16f905912a_img.jpg\)](#)

$$\text{ex } 17.08571J = \left((7.24J + 0.2) \cdot \left(\frac{2}{0.336} \right) \right) - 27.2J$$

30) Ionization Energy of Element using Pauling's Electronegativity

$$\text{fx } IE = \left((X_P + 0.2) \cdot \left(\frac{2}{0.336} \right) \right) - E.A$$

[Open Calculator !\[\]\(3211b5d1d968fc1665909b34f9f16010_img.jpg\)](#)

$$\text{ex } 27.18571J = \left((7.24J + 0.2) \cdot \left(\frac{2}{0.336} \right) \right) - 17.1J$$

31) Pauling's Electronegativity from Allred Rochow's Electronegativity

$$\text{fx } X_P = X_{A.R} + 0.744$$

[Open Calculator !\[\]\(9c2e8d1b5bd77cb5c9f83b7a9cff79fd_img.jpg\)](#)

$$\text{ex } 7.244J = 6.5J + 0.744$$

32) Pauling's Electronegativity from Mulliken's Electronegativity

$$\text{fx } X_P = (0.336 \cdot X_M) - 0.2$$

[Open Calculator !\[\]\(235bfe13ebf007ce2eea9e689707fac7_img.jpg\)](#)

$$\text{ex } 7.192J = (0.336 \cdot 22J) - 0.2$$




33) Pauling's Electronegativity given Bond Energies 

$$\text{fx } X_P = \sqrt{E_{(A-B)} - \left(\sqrt{E_{A-A} \cdot E_{B-B}} \right)}$$

Open Calculator 

$$\text{ex } 7.227178\text{J} = \sqrt{75.47\text{J} - \left(\sqrt{20\text{J} \cdot 27\text{J}} \right)}$$

34) Pauling's Electronegativity given Effective Nuclear Charge and Covalent Radius 

$$\text{fx } X_P = \left(\frac{0.359 \cdot Z}{r_{\text{covalent}}^2} \right) + 0.744$$

Open Calculator 

$$\text{ex } 7.189705\text{J} = \left(\frac{0.359 \cdot 25}{(1.18\text{A})^2} \right) + 0.744$$

35) Pauling's Electronegativity given IE and EA 

$$\text{fx } X_P = \left(\left(\frac{0.336}{0.5} \right) \cdot (IE + E.A) \right) - 0.2$$

Open Calculator 

$$\text{ex } 29.5696\text{J} = \left(\left(\frac{0.336}{0.5} \right) \cdot (27.2\text{J} + 17.1\text{J}) \right) - 0.2$$

36) Pauling's Electronegativity given Individual Electronegativities 

$$\text{fx } X = |X_A - X_B|$$

Open Calculator 

$$\text{ex } 0.2\text{J} = |3.6\text{J} - 3.8\text{J}|$$







Variables Used

- **d** Bond Length of Diatomic Molecule (*Angstrom*)
- **e** Charge of electron in Statcoulomb (*Statcoulomb*)
- **E_(A-B)** Actual Bond Energy given Electronegativity (*Joule*)
- **E_{A-A}** Bond Energy of A₂ Molecule (*Joule*)
- **E_{A-B}** Actual Bond Energy (*Joule*)
- **E_{A-B(cov)}** 100% Covalent Bond Energy (*Joule*)
- **E_{B-B}** Bond Energy of B₂ Molecule (*Joule*)
- **E.A** Electron Affinity (*Joule*)
- **IE** Ionization Energy (*Joule*)
- **r_{covalent}** Covalent Radius (*Angstrom*)
- **X_p** given Individual Electronegativities (*Joule*)
- **X_A** Electronegativity of Element A (*Joule*)
- **X_{A.R}** Allred-Rochow's Electronegativity (*Joule*)
- **X_B** Electronegativity of Element B (*Joule*)
- **X_M** Mulliken's Electronegativity (*Joule*)
- **X_p** Pauling's Electronegativity given I.E and E.A (*Joule*)
- **X_p** Pauling's Electronegativity (*Joule*)
- **Z** Effective Nuclear Charge
- **δ** Charge Fraction
- **Δ** Covalent Ionic Resonance Energy (*Joule*)
- **Δ_p** Covalent Ionic Resonance Energy for X_p (*Joule*)
- **μ** Dipole Moment (*Statcoulomb Centimeter*)



Constants, Functions, Measurements used

- **Function:** **abs**, abs(Number)
Absolut value function
- **Function:** **sqrt**, sqrt(Number)
Square root function
- **Measurement:** **Length** in Angstrom (A)
Length Unit Conversion 
- **Measurement:** **Energy** in Joule (J)
Energy Unit Conversion 
- **Measurement:** **Electric Charge** in Statcoulomb (stC)
Electric Charge Unit Conversion 
- **Measurement:** **Electric Dipole Moment** in Statcoulomb Centimeter (stC*cm)
Electric Dipole Moment Unit Conversion 



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