FUNDAMENTAL CONSTANTS

Quantity	Value in SI units	Quantity	Value in SI units
Avogadro constant, N_A	$6.022\ 141\ 79 \times 10^{23}$ mol^{-1}	Molar volume of ideal gas (at 1 bar and 273.15 K), V_o	$2.241\ 399\ 6 \times 10^{-2}$ m^3 mol^{-1}
Bohr magneton, μ_B	$9.274\ 009\ 15 \times 10^{-24}$ J T^{-1}	Nuclear magneton, μ_N	$5.050\ 783\ 24 \times 10^{-27}$ J T^{-1}
Bohr radius, a_o	$5.291\ 772\ 0859 \times 10^{-11}$ m	Planck constant, h	$6.626\ 068\ 96 \times 10^{-34}$ J s
Boltzmann constant, k	$1.380\ 6504 \times 10^{-23}$ J K^{-1}	Planck constant, $\hbar$	$1.054\ 571\ 628 \times 10^{-34}$ J s
Elemental charge, e	$1.602\ 176\ 487 \times 10^{-19}$ C	Rydberg constant, R_∞	$1.097\ 373\ 156\ 852 \times 10^{7}$ m^{-1}
Faraday constant, F	$9.648\ 533\ 99 \times 10^{4}$ C mol^{-1}	Speed of light in vacuum, c	299 792 458 m s^{-1}
Gas constant, R	8.314 472 J K^{-1} mol^{-1}	Standard acceleration due to gravity, g_n	9.806 65 m s^{-2}
Gravitational constant, G	$6.674\ 28 \times 10^{-11}$ m^3 kg^{-1} s^{-2}	Electric constant, ε_o	$8.854\ 187\ 817 \times 10^{-12}$ F m^{-1}

COMMON UNIT CONVERSIONS

1 atm	101 325 Pa
1 bar	100, 000 Pa
1 torr (≈ 1 mmHg)	**≈ 133.322 Pa**
1 Å	10^{-10} m
1 eV	96.485 34 kJ mol^{-1}
T (K)	**T (°C) + 273.15**

CHARACTERISTIC INFRARED ABSORPTION FREQUENCIES

Bond	Compound Type	Frequency range, cm^{-1}	
C–H	Alkanes	2980-2850(m) stretch	1470-1360(m) bend
C–H	Alkenes	3095-2980(m) stretch	1000-665(s) bend
C–H	Aromatic Rings	3100-3000(m) stretch	
	Phenyl Ring Substitution Bands	900-650(s) bend	
	Phenyl Ring Substitution Overtones	2000-1660(w)	
C–H	Alkynes	3300-3250(m-s) stretch	680-580(s) bend
C=C	Alkenes	1690-1615(w-m) stretch	
C≡C	Alkynes	2250-2100(w-m) stretch	
C=C	Aromatic Rings	1630-1430(v) stretch	
C–O	Alcohols, Ethers, Carboxylic acids, Esters	1300-1000(s) stretch	
C=O	Aldehydes, Ketones, Carboxylic acids, Esters, Amides	1870-1650(s) stretch	
O–H	Alcohols, Phenols	3640-3250(s,br) stretch	
	Carboxylic acids	3550-3500(s) stretch	
N–H	Amines	3460-3280(m) stretch	1650-1590 (s) bend
C–N	Amines	1190-1130(m) stretch	
C≡N	Nitriles	2260-2220(w-m) stretch	
NO_2	Aliphatic Nitro Compounds	1570-1550(vs) stretch	1380-1360(vs) stretch
	Aromatic Nitro Compounds	1480-1460(vs) stretch	1360-1320(vs) stretch

STANDARD EQUATIONS

1. Moles relationship	Mols = MV (Vol in dm^3), Mols = Mass/M_r
2. Bragg's diffraction	$n\lambda = 2d\sin\theta$
3. Ideal gas equation	$pV = nRT$
4. Arrhenius equation	$k = Ae^{-Ea/RT}$
5. Arrhenius activation energy	$E_a = RT^2 (d\ln k/dT)$ J mol^{-1}
6. Nernst equation for EMF	$E = E^\ominus + RT/zF \ln$ [oxidised form]/[reduced form]
7. Gibbs free energy of reaction	$\Delta G^\ominus = \Delta H^\ominus - T\Delta S^\ominus$, $\Delta G^\ominus = -RT\ln K_{eq}$, $\Delta G^\ominus = -nFE^\ominus_{cell}$
8. Standard enthalpy of activation	$k(T) = kT/h \exp(\Delta^\ddagger S^\ominus/R) \exp(-\Delta^\ddagger H^\ominus/RT)$ J mol^{-1}

Key:

1. M = molarity, V = volume, M_r = relative molecular mass

2. λ = wavelength, d = interplanar distance, θ = scattering angle, n = an integer representing the order of the diffraction peak

3. p = pressure, V = volume, n = no. of moles, R = gas constant, T = temperature

4. and 5. k = rate constant, A = pre-exponential factor, E_a = activation energy

6. z = no. of electrons transferred in the reaction, F = Faraday constant, $E^\ominus$ = standard electrode potential, E = electrode potential

7. **$\Delta G^\ominus$ = standard Gibbs free energy change, $\Delta H^\ominus$** = standard enthalpy of reaction, **$\Delta S^\ominus$** = standard entropy of reaction, K_{eq} = equilibrium constant, n = no. of electrons F = Faraday constant, $E^\ominus_{cell}$ = electrochemical potential of the cell

8. $\Delta^\ddagger S^\ominus$ = standard entropy of activation, $\Delta^\ddagger H^\ominus$ = standard enthalpy of activation, h = Planck constant

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