

Useful and Necessary Formulas

http://www2.ucdsb.on.ca/tiss/stretton/Database/formulas_content.html

1. Electromagnetic Radiation

- a) Speed of Light
- b) Wavelength
- c) Frequency
- d) Energy in a photon

$$\begin{aligned}c &= \lambda * v \\ \lambda &= c / v \\ v &= c / \lambda \\ E &= h * v\end{aligned}$$

2. Concentration and Molar Mass

- a) Density (D)
- b) Moles (n)
- c) Moles (# of particles)
- d) Moles (solution)
- e) Moles (gas equation)
- f) Molarity (M)
- g) Molar mass (mm)

$$\begin{aligned}D &= m / V \\ n &= g / mm \\ n &= \text{number of particles / Avogadro's number} \\ n &= \text{concentration} \cdot \text{volume} \\ n &= PV / RT \\ M &= n / \text{volume} \\ mm &= m / n\end{aligned}$$

3. Gases

- a) Boyle's Law
- b) Charles' Law
- c) Combined Gas Law
- d) Ideal Gas Law
- e) Dalton's Law of Partial Pressures

$$\begin{aligned}P_1 \cdot V_1 &= P_2 \cdot V_2 \\ V_1 \cdot T_2 &= V_2 \cdot T_1 \\ P_1 \cdot V_1 / T_1 &= P_2 \cdot V_2 / T_2 \\ PV &= nRT \\ P_T &= P_1 + P_2 + P_3 + \dots + P_n\end{aligned}$$

4. Acids and Bases

- a) pH
- b) pOH
- c) $[H_3O^{+1}]$
- d) $[OH^{-1}]$

$$\begin{aligned}pH &= -\log[H^+] \\ pOH &= -\log[OH^-] \\ [H_3O^{+1}] &= 10^{-pH} \\ [OH^{-1}] &= 10^{-pOH}\end{aligned}$$

5. Heat

- a) Quantity of Heat (Q)
- b) Quantity of Heat (fusion)
- c) Quantity of Heat (vaporization)
- d) Celsius to Kelvin
- e) Kelvin to Celcius

$$\begin{aligned}Q &= m \cdot c \cdot \Delta t \\ Q &= m \cdot L_f \\ Q &= m \cdot L_v \\ K &= {}^\circ C + 273.15 \\ {}^\circ C &= K - 273.15\end{aligned}$$

6. Mathematics

- a) Quadratic Equation

$$x = \frac{-b \pm (b^2 - 4ac)^{1/2}}{2a}$$

Common Physical and Chemical Constants

<http://www2.ucdsb.on.ca/tiss/stretton/Database/constants.htm>

Avogadro's Number	6.02217×10^{23} things/mole
Planck's Constant	$6.6260755 \times 10^{-34}$ Js
1 atmosphere (atm)	$101,325$ Pascals (Pa) = 101.325 kPa = 760 mm of Hg = 760 Torr = 1.01325 bar
1 mole of any gas at STP	22.4 L (0°C , 1 atm)
1 mole of any gas at SATP	24.8 L (25°C , 1 atm)
Ideal Gas Law Constant (R)	0.0821 L atm mol $^{-1}$ K $^{-1}$ = 8.31430 L kPa mol $^{-1}$ K $^{-1}$ = 8.31441 J mol $^{-1}$ K $^{-1}$
1 calorie (cal)	4.184 J
1 Cal	1 kcal = 1000 calories
1 atomic mass unit (amu)	$1.6605665 \times 10^{-24}$ g
1 tonne(t)	1000 kg = 1 Mg
Speed of light in a vacuum	299792458 m s $^{-1}$ (3.0×10^8 m s $^{-1}$)
Rest mass of an electron (m _e)	0.000548712 u = $9.1093897 \times 10^{-28}$ g
Rest mass of a proton (m _p)	1.00727605 u = $1.67262305 \times 10^{-24}$ g
Rest mass of a neutron (m _n)	1.008665 u = 1.674954×10^{-24} g
1 kiloWattHour(kWh)	3.6 MJ
1 Joule (J)	1 kg m 2 s $^{-2}$ = 1.0×10^7 erg
1 Coulomb(C)	6.24×10^{18} e $^-$
Electronic charge on an electron	$1.60217733 \times 10^{-19}$ C
1 Ampere(A)	1 Coulomb/s
1 Volt(V)	1 J/C = 96.5 kJ/mole
1 electron volt (eV)	1.60219×10^{-19} J
Faraday's Constant	$96,486.7$ C/mole e $^-$