

**Physical Constants and Conversion Factors**

Avogadro constant  $N_A$  (or  $L$ ) =  $6.02214 \times 10^{23} \text{ mol}^{-1}$   
 Faraday constant  $F$  =  $9.64853 \times 10^4 \text{ C/mol}$   
 molar gas constant  $R$  =  $8.31451 \text{ J} \cdot \text{mol}^{-1} \cdot \text{K}^{-1}$   
 molar volume (ideal gas)  $V_m$  =  $2.2414 \times 10^1 \text{ L/mol}$   
 (273.15 K, 101325 Pa)

Planck constant  $h$  =  $6.62608 \times 10^{-34} \text{ J} \cdot \text{s}$   
 elementary charge  $e$  =  $1.60218 \times 10^{-19} \text{ C}$   
 electron mass  $m_e$  =  $9.10939 \times 10^{-31} \text{ kg}$   
 proton mass  $m_p$  =  $1.67262 \times 10^{-27} \text{ kg}$

1 kg = 2.205 pounds  
 1 m =  $3.937 \times 10^1$  inches = 3.281 feet  
 1 m<sup>3</sup> =  $2.642 \times 10^2$  gallons (U.S.)  
 1 m<sup>3</sup> =  $2.200 \times 10^2$  gallons (Imperial)

Force	N	dyn	kp
1 N	1	$10^5$	$1.019716 \times 10^{-1}$
1 dyn	$10^{-5}$	1	$1.019716 \times 10^{-6}$
1 kp	9.80665	$9.80665 \times 10^5$	1

Pressure	Pa	bar	kp/m <sup>2</sup>	at	atm	Torr	lb/in <sup>2</sup>
1 Pa = 1 N/m <sup>2</sup>	1	$10^{-5}$	$1.019716 \times 10^{-1}$	$1.019716 \times 10^{-5}$	$9.86923 \times 10^{-6}$	$7.50062 \times 10^{-3}$	$1.450378 \times 10^{-4}$
1 bar = $10^6$ dyn/cm <sup>2</sup>	$10^5$	1	$1.019716 \times 10^4$	$1.019716$	$9.86923 \times 10^{-1}$	$7.50062 \times 10^2$	$1.450378 \times 10^1$
1 kp/m <sup>2</sup> = 1 mm H <sub>2</sub> O	9.80665	$9.80665 \times 10^{-5}$	1	$10^{-4}$	$9.67841 \times 10^{-5}$	$7.35559 \times 10^{-2}$	$1.422335 \times 10^{-3}$
1 at (technical)	$9.80665 \times 10^4$	$9.80665 \times 10^{-1}$	$10^4$	1	$9.67841 \times 10^{-1}$	$7.35559 \times 10^2$	$1.422335 \times 10^1$
1 atm = 760 Torr	$1.01325 \times 10^5$	1.01325	$1.033227 \times 10^4$	1.033227	1	$7.60 \times 10^2$	$1.469595 \times 10^1$
1 Torr = 1 mm Hg	$1.333224 \times 10^2$	$1.333224 \times 10^{-3}$	$1.359510 \times 10^1$	$1.359510 \times 10^{-3}$	$1.315789 \times 10^{-3}$	1	$1.933678 \times 10^{-2}$
1 lb/in <sup>2</sup> = 1 psi	$6.89476 \times 10^3$	$6.89476 \times 10^{-2}$	$7.03069 \times 10^2$	$7.03069 \times 10^{-2}$	$6.80460 \times 10^{-2}$	$5.17149 \times 10^1$	1

<b>Work, Energy, Heat</b>	J	kW·h	kcal	Btu	eV
1 J = 1 W·s = 1 N·m = 10 <sup>7</sup> erg	1	2.778 × 10 <sup>-7</sup>	2.39006 × 10 <sup>-4</sup>	9.4781 × 10 <sup>-4</sup>	6.242 × 10 <sup>18</sup>
1 kW·h	3.6 × 10 <sup>6</sup>	1	8.604 × 10 <sup>2</sup>	3.41214 × 10 <sup>3</sup>	2.247 × 10 <sup>25</sup>
1 kcal	4.1840 × 10 <sup>3</sup>	1.1622 × 10 <sup>-3</sup>	1	3.96566	2.6117 × 10 <sup>22</sup>
1 Btu (British thermal unit)	1.05506 × 10 <sup>3</sup>	2.93071 × 10 <sup>-4</sup>	2.5164 × 10 <sup>-1</sup>	1	6.5858 × 10 <sup>21</sup>
1 eV	1.602 × 10 <sup>-19</sup>	4.450 × 10 <sup>-26</sup>	3.8289 × 10 <sup>-23</sup>	1.51840 × 10 <sup>-22</sup>	1
	1 cm <sup>-1</sup> ≅ 1.239842 × 10 <sup>-4</sup> eV		1 Hz ≅ 4.135669 × 10 <sup>-15</sup> eV		
	2 Rydberg (Ry) = 1 hartree = 27.2114 eV		1 eV ≅ 23.0578 kcal/mol		
<b>Power</b>	kW	hp	kp·m·s <sup>-1</sup>	kcal/s	
1 kW = 10 <sup>3</sup> J/s	1	1.35962	1.01972 × 10 <sup>2</sup>	2.39006 × 10 <sup>-1</sup>	
1 hp (horsepower, metric)	7.3550 × 10 <sup>-1</sup>	1	7.5 × 10 <sup>1</sup>	1.7579 × 10 <sup>-1</sup>	
1 kp·m·s <sup>-1</sup>	9.80665 × 10 <sup>-3</sup>	1.333 × 10 <sup>-2</sup>	1	2.34384 × 10 <sup>-3</sup>	
1 kcal/s	4.1840	5.6886	4.26650 × 10 <sup>2</sup>	1	

**References:**  
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