



Equations:

Temperature Conversions: $T_f = \frac{9}{5} \cdot T_c + 32$ $T_c = \frac{5}{9}(T_f - 32)$ $T_K = T_c + 273$

Heat: $Q = m \cdot c \cdot \Delta T$

Q = heat to change temperature

m = mass

c = specific heat

ΔT = change in temperature

Length Expansion: $\Delta L = \alpha \cdot L_0 \cdot \Delta T$

ΔL = change in length

L_0 = original length

α = coefficient of linear expansion

ΔT = change in temperature

Heat of Fusion: $Q = m \cdot H_f$

Q = heat to change solid/liquid states

m = mass

H_f = heat of fusion

Heat of Vaporization: $Q = m \cdot H_v$

Q = heat to change liquid/gas states

m = mass

H_v = heat of vaporization

Heat Conversions:

1 calorie = 4.184 Joules

1 kilocalorie (Calorie) = 1000 calories

<u>Name</u>	<u>Symbol</u>	<u>Unit</u>	<u>Notes</u>
Temperature	T or ΔT	°F, °C or K	
Mass	m	gram or kilogram	
Heat	Q	calorie or Joule	
Specific Heat	c	cal/g·°C or J/kg·°C	
Heat of Fusion	H_f	cal/g or J/kg	
Heat of Vaporization	H_v	cal/g or J/kg	
Length	ΔL or L_0	meters, cm, etc	
Coefficient of Linear Expansion	α	°C ⁻¹	

Helpful Equations:

$$F_f = \mu \cdot F_N$$

$$W = F \cdot d$$

$$PE = mgh$$

$$KE = \frac{1}{2} m \cdot v^2$$

Specific Heats

<u>Material</u>	<u>Specific Heat</u> (cal/g·°C)
Aluminum	.216
Beryllium	.47
Brass	.09
Cadmium	.055
Copper	.091
Glass	.20
Gold	.031
Human Body (average)	.85
Ice	.50
Iron	.11
Lead	.031
Mercury	.033
Nitrogen	.25
Silver	.056
Steam	.48
Sugar	.27
Tin	.054
Water	1.0
Wood	.42
Zinc	.093

Linear Expansion Coefficients

<u>Material</u>	<u>Coefficient</u> (°C ⁻¹)
Aluminum	23 x 10 ⁻⁶
Brass	19 x 10 ⁻⁶
Copper	16 x 10 ⁻⁶
Glass	3.2 x 10 ⁻⁶
Gold	14 x 10 ⁻⁶
Iron (Soft)	12 x 10 ⁻⁶
Lead	29 x 10 ⁻⁶
Quartz	.40 x 10 ⁻⁶
Steel	11 x 10 ⁻⁶

Heat of Fusion

<u>Material</u>	<u>Heat of Fusion</u> (cal/g)
Ethyl alcohol	16.4
Copper	49.0
Gold	15.1
Hydrogen	14.0
Iron	66.0
Mercury	2.82
Nitrogen	6.09
Oxygen	3.30
Silver	25.1
Water	79.7

Heat of Vaporization

<u>Material</u>	<u>Heat of Vaporization</u> (cal/g)
Ethyl alcohol	204
Copper	1152.0
Gold	392.0
Hydrogen	108
Iron	1503.3
Mercury	70.6
Nitrogen	47.6
Oxygen	50.9
Silver	564.1
Water	539.6

Melting & Boiling Points

<u>Material</u>	<u>Melting Point</u> (°C)	<u>Boiling Point</u> (°C)
Ammonia	-77.8	-33.4
Benzene	5.5	80.1
Copper	1084	2567
Ethyl alcohol	-114.4	78.3
Lead	327.3	1750
Nitrogen	-210.0	-195.8
Platinum	1774	4300
Water	0.0	100.0