

GLOSSARY

Absolute humidity – the weight of water vapour per unit volume.

Absorbent – a material which due to an affinity for certain substances, extracts one or more such substances from a liquid or gaseous medium with which it contacts, and which changes physically or chemically or both during the process. Calcium chloride is an example of a solid absorbent, while solutions of lithium chloride, lithium bromide, and ethylene glycol are liquid absorbents.

Absorber – the blackened surface in a solar collector that absorbs solar radiation and converts it to heat.

Absorptance – the ratio of the radiation absorbed by a surface to the total energy falling on that surface.

Active solar energy system – a system that requires auxiliary energy for its operation, e.g., energy to operate fans and pumps.

Activated alumina – a form of aluminium oxide which adsorbs moisture readily and is used as a drying agent.

Adfreezing – the process whereby wet soils freeze to below grade materials such as fountains, walls or insulation, forcing movement of the material.

Adiabatic process – a thermodynamic process during which no heat is extracted from or added to the system.

Adsorbent – a material which has the ability to cause the molecules of gases, liquids, or solids to adhere to its internal surfaces without changing itself physically or chemically. Certain solid materials such as silica gel and activated alumina have this property.

Air barrier – a material carefully installed within a building envelope assembly to minimize the uncontrolled passage of air into and out of a dwelling.

Air change – the replacement of a quantity of air in a volume within a given period of time. This is expressed in number of changes per hour. If a house has 1 air change per hour, all the air in the house will be replaced in a 1-hour period.

Air change per hour (ach) – a unit that denotes the number of times a house exchanges its entire volume of air with outside air in an hour.

Air cleanser - a device used to remove airborne impurities.

Air leakage – the uncontrolled flow of air through a component of the building envelope, or the building envelope itself, when a pressure difference is applied across the component. Infiltration refers to inward flowing air leakage and exfiltration refers to outward flowing air leakage.

Air permeability – the property of a building component to let air pass when it is subjected to a differential pressure.

Air pressure – the pressure exerted by air. This may refer to static (atmospheric) pressure, or dynamic components of pressure arising from airflow, or both acting together.

Air sealing – the practice of sealing unintentional gaps in the building envelope (from the interior) in order to reduce uncontrolled air leakage.

Air tightness – the degree to which unintentional openings have been avoided in a buildings structure.

Air, ambient –surrounding air.

Air, saturated – moist air in which the partial pressure of water vapour equals the vapour pressure of water at the existing temperature. This occurs when dry air and saturated water vapour co-exist at the same dry-bulb temperature.

Air, standard – dry air at a pressure of 101.325 kPa at a temperature of exactly 20 °C. Under these conditions, the density is 1.2041 kg/m³

Altitude angle – the angular height of a point above the horizontal plane, i.e. solar altitude – the angle between the line joining the center of the sun and its projection on the horizontal plane.

Anemometer – an instrument for measuring the velocity of air.

Angle of incidence – the angle that the sun's rays subtend with a line perpendicular to a surface.

Atomize – reduce to fine spray.

Attached sunspace – solar collector that doubles as useful building space; also attached greenhouse, solarium. The term 'attached' specifically implies a space that shares one common wall with the associated building. Compare with semi-enclosed sunspace.

Awning – an exterior, movable and usually flexible element. Protects detaining or diffusing solar radiation at certain angles.

Azimuth angle, solar – the angle on a horizontal surface between true south and the projection of sun's ray on the horizontal surface (negative before noon, positive after noon.)

Backdraft – (flow reversal) the reverse flow of chimney gases into the building through the barometric damper, draft hood, or burner unit. This can be caused by chimney blockage or it can occur when the pressure differential is too high for the chimney to draw.

Beam or direct radiation – radiation coming directly from the sun without its direction undergoing any change.

Berm – a man-made mound or small hill of earth.

Bimetallic element - an element formed of two metals having different coefficients of thermal expansion, used as a temperature control device.

Black body – a perfect absorber and emitter of radiation. A cavity is a perfect black body. Lampblack is close to a black body, while aluminium (polished) is a poor absorber and emitter of radiation.

Brightness – the subjective human perception of luminance.

Building orientation – the siting of a building on a plot, generally used to refer to solar orientation.

Calorific value – the energy content per unit mass (or volume) of a fuel, which will be released in combustion. (kWh/kg, MJ/kg, kWh/m³, MJ/m³)

Candela (cd) – an SI unit of luminous intensity . An ordinary candle has a luminous intensity of one candela .

Chimney effect – the tendency of air or gas in a duct or other vertical passage to rise when heated, due to its lower density in comparison with that of the surrounding air or gas. In buildings, the tendency towards displacement (caused by the difference in temperature) of heated internal air by unheated outside air, due to the difference in their densities.

Clear sky – A sky condition with few or no clouds, usually taken as 0-2 tenths covered with clouds. Clear skies have high luminance and high radiation, and create strong shadows relative to more cloudy conditions. The sky is brightest nearest the sun, whereas away from the sun, it is about three times brighter at the horizon than at the zenith.

Clerestory – a window that is placed vertically (or near vertical) in a wall above one's line of vision to provide natural light in a building.

Clo – clothing factor , a measure of the insulating value of clothing. For example, 0.3 clo is typical for light summer clothing and 0.8 is typical for heavy winter clothing.

Collector, flat plate – an assembly containing a panel of metal or other suitable material, usually a flat and black in colour on its sun side, that absorbs sunlight and converts it into heat. This panel is usually in an insulated box covered with glass or plastic on the sun side to take advantage of the greenhouse effect. In the collector, the heat transfers to a circulating fluid such as air, water, oil or antifreeze.

Collector, focusing – a collector that has a parabolic or other reflector which focuses sunlight onto a small area for collection. A reflector of this type can obtain considerably higher temperatures but will only work with direct beam sunlight.

Collector, solar – a device for capturing solar energy, ranging from ordinary windows to complex mechanical devices.

Combustion air – the air required to provide adequate oxygen for fuel burning appliances in the building. The term 'combustion air' is often used to refer to the total air requirement of a fuel

burning appliance including both air to support the combustion process and air to provide chimney draft (dilution air).

Comfort chart – a chart showing dry-bulb temperatures and humidities (and sometimes air motion) by which the effects of various air conditions on human comfort may be compared.

Comfort zone – on the bioclimatic chart, the area of combined temperatures and humidities that 80% of people find comfortable. People are assumed to be in the shade, fully protected from wind, engaged in light activity, and wearing moderate levels of clothing that increases slightly in winter.

Condensation – the process of vapour changing into the liquid state. Heat is released in the process.

Conditioned and unconditioned spaces - conditioned spaces need air treatment such as heat addition, heat removal, moisture removal, or pollution removal. Unconditioned spaces do not need such air conditioning, and no effort is made to control infiltration.

Conductance (C) - a measure of the ease with which heat flows through a specified thickness of a material by conduction. Units are $W/m^2 \text{ } ^\circ C$.

Conduction – the process by which heat energy is transferred through materials (solids, liquids or gases) by molecular excitation of adjacent molecules.

Conductivity – the quantity of heat that will flow through one square metre of material, one metre thick, in one second, when there is a temperature difference of $1^\circ C$ between its surfaces.

Convection – the transfer of heat between a moving fluid medium (liquid or gas) and a surface, or the transfer of heat within a fluid by movements within the fluid.

Cooling load – a load with net cooling required.

Cross ventilation – ventilative cooling of people and spaces driven by the force of wind. When the outside air is cooler than the inside air, heat can be transferred from the space to the ventilation air. Cross ventilation also removes heat from people by convection and by increasing the rate of sweat evaporation. The cooling rate from cross ventilation is determined by wind speed, opening sizes and temperature difference between the inside and outside. See also, stack ventilation.

Daylight – illuminance from radiation in the visible spectrum from the diffuse sky, reflected light, and direct sun that lights a room.

Daylight envelope – the maximum buildable volume on a site that will not unduly restrict daylight available to adjacent buildings.

Daylight factor (DF) – the proportion of interior horizontal illuminance (usually taken on the work plane) to exterior horizontal illuminance under an unobstructed sky. It is sum of the sky component and the internal reflected component. The range is 0-100%, but for most rooms it is usually limited to 1-10%.

Decrement factor – ratio of the maximum outer and inner surface temperature amplitudes taken from the daily mean.

Density – the mass of a substance, expressed in kilograms per cubic metre.

Diffuse radiation – radiation that has travelled an indirect path from the sun because it has been scattered by particles in the atmosphere such as air molecules, dust and water vapour. Indirect sunlight comes from the entire skydome.

Direct gain – the transmission of sunlight through glazing directly in to the spaces to be heated, where it is converted to heat by absorption on interior mass surfaces.

Direct sunlight – the component of visible spectrum radiation that comes directly from the sun without being diffused or reflected.

Direct radiation – the component of solar radiation that comes directly from the sun without being diffused or reflected.

Diffuse reflectance – reflectance is the ratio of reflected radiation to incident radiation. Diffuse reflectance spreads the incident flux over a range of reflected angles/directions.

Diurnal – relating to a 24-hr cycle. A diurnal temperature swing is the cycle of temperatures over the course of one 24-hr period.

Downdraft evaporative cooling tower - a cooling system that humidifies and cools warm dry air by passing it through a wetted pad at the top of a tower. The cooled air being denser, falls down the tower and into the occupied spaces below, drawing in more air through the pads in the process. Consequently, no distribution fans are required.

Dry bulb temperature – the temperature of a gas of mixture or gases indicated by an accurate thermometer after correction for radiation.

Earth-air heat exchangers – a strategy of pre-tempering fresh air for ventilation, and in some cases, providing building cooling by passing incoming air through buried ducts.

Earth contact - the strategy of placing building surfaces in contact with the ground to reduce the temperature difference between inside and outside, reduce infiltration, and /or use the subsurface soil temperature to cool the building.

Emissivity – the property of emitting heat by radiation, possessed by all materials to a varying extent. “Emittance” is the numerical value of this property.

Envelope heat gain or loss – heat transferred through the skin of a building or via infiltration /ventilation.

Equinox – meaning equal light. The dates during the year when the hours of daylight are equal to the hours of darkness. On the equinox, the sun rises from the horizon at due east and sets due west. The equinoxes fall on March 21 and September 21.

Evaporation – phase change of a material from liquid to vapour at a temperature below the boiling point of the liquid. Cooling occurs during the process of evaporation.

Evaporative cooling - A heat removal process in which water vapour is added to air, increasing its humidity while lowering its temperature. The total amount of heat in the air stays constant, but is transferred from sensible heat in the air to latent heat in the moisture. In the process of changing from liquid to vapour (evaporating), the water must absorb large amount of heat.

Evaporative cooling, Direct – a cooling process where the warm and dry air moves through a wetted medium to evaporate moisture in the air. The cool humid air is then used to cool a place.

Evaporative cooling, Indirect – a cooling process where the evaporative process is remote from the conditioned space. The cooled air is then used to lower the temperature of the building surface, such as in a roof spray, or is passed through a heat exchanger to cool indoor air. The indirect process has the advantage of lowering temperatures without adding humidity to the air, thus extending the climate conditions and regions in which evaporative cooling is effective.

Glare – the perception caused by a very bright light or a high contrast of light, making it uncomfortable or difficult to see.

Glazing – Transparent or translucent materials, usually glass or plastic, used to cover an opening without impeding (relative to opaque materials) the admission of solar radiation and light.

Greenhouse effect – refers to the characteristic tendency of some transparent materials such as glass to transmit shortwave radiation and block radiation of longer wavelengths.

Heat exchanger – a device usually consisting of a coiled arrangement of metal tubing used to transfer heat through the tube walls from one fluid to another.

Heat gain – an increase in the amount of heat contained in a space, resulting from direct solar radiation and the heat given off by people, lights, equipment, machinery and other sources.

Heat island – the increased temperatures, relative to surrounding open land, found in the centre cities and areas of high development density. Heat islands are caused by concentrations of heat sources, decreased vegetation cover, increased massive and dark surfaces, decreased wind flows, and narrow sky view angles.

Heat loss – a decrease in the amount of heat contained in a space, resulting from heat flow through walls, windows, roof and other building envelope components.

Heat pump – a thermodynamic device that transfers heat from one medium to another; the first medium cools while the second warms up.

Humidity – water vapour within a given space.

HVAC – mechanical system for heating, ventilating and air-conditioning that controls temperature, humidity, and air quality.

Hybrid system – a solar heating or cooling system that combines active and passive elements.

Hygroscopic – absorptive of moisture, readily absorbs and retains moisture.

Illuminance – the measure of light intensity striking a surface. Specifically, the concentration of incident luminous flux, measured in foot-candle(I-P) or Lux(SI).

Illumination – lighting of the surface by daylight or electric light.

Index of refraction – a property of glazing materials that determines the reflection/refraction characteristics of the glazing.

Infiltration – the uncontrolled movement of outdoor air into the interior of a building through cracks around windows and doors or in walls, roofs and floors. This may work by cold air leaking in during winters, or the reverse in summers.

Infrared radiation – Electromagnetic radiation having wavelength above the wavelength range of visible light. This is the predominant form of radiation emitted by bodies with moderate temperatures such as the elements of a passive building.

Internal gains – the energy dissipated inside the heated space by people and appliances. A portion of this energy contributes to the space heating requirement.

Isothermal – an adjective used to indicate a change taking place at constant temperature.

Jalousie (jali) – an exterior fixed element made up of a perforated frame which covers the whole window. It allows natural ventilation and protects against direct solar radiation and view from the exterior.

Latitude – the angular distance north(+) or south (-) of the equator, measured in degrees of arc.

Latent heat – change of enthalpy during a change of state, usually expressed in J/kg(Btu per lb). With pure substances, latent heat is absorbed or rejected at constant temperature at any pressure.

Lighting, diffused – lighting in which the light on a working plane or on an object is not incident predominantly from a particular direction.

Longwave radiation – radiation emitted between roughly 5 and 30 μ m wavelength, as in thermal radiation from the surface of a room, or from the outside surface of the roof.

Longitude – the arc of the equator between the meridian of a place and Greenwich meridian measured in degrees east or west.

Louvre - an assembly of sloping vanes intended to permit air to pass through and to inhibit transfer of water droplets

Lumen – SI unit of luminous flux; it is the luminous flux emitted in unit solid angle by a uniform point source having a luminous intensity of 1 candela.

Lux – SI unit of illuminance; it is the illuminance produced on a surface of unit area (square metre) by a luminous flux of 1 lumen uniformly distributed over that surface.

Masonry – concrete, concrete block, brick, adobe, stone, and similar other building materials.

Negative pressure – a pressure below the atmospheric. In residential construction, negative pressure refers to pressure inside the house envelope that is less than the outside pressure. Negative pressure will encourage infiltration.

Night insulation – movable insulation that covers a glazing at night and is removed during the day.

Night ventilation of mass - a cooling process whereby a building is closed during the hot daytime hours. Its heat gains are stored during that time in the building's structure or other thermal mass. At night, the building is opened and cooler outdoor air is used to flush heat from the mass, lowering its temperature, to prepare for another cycle.

Night sky radiation - a reversal of the day time insolation principle. Just as the sun radiates energy during the day through the void of space, so also heat energy can travel unhindered at night from the earth's surface back into space. On a clear night, any warm object can cool itself

by radiating longwave heat energy to the cooler sky. On a cloudy night, the cloud cover acts as an insulator and prevents the heat from travelling to the cooler sky.

Opaque - not able to transmit light; for example, unglazed walls.

Passive system - a system that uses non-mechanical and non-electrical means to satisfy heating, lighting, or cooling loads. Purely passive systems use radiation, conduction, and natural convection to distribute heat, and daylight for lighting.

Pond, spray – arrangement for lowering the temperature of water in contact with outside air by evaporative cooling of the water. The water to be cooled is sprayed by nozzles in to the space above a body of previously cooled water and allowed to fall into it by gravity.

Positive pressure – a pressure above atmospheric. In residential construction, this refers to pressure inside the house envelope that is greater than the outside pressure; a positive pressure difference will encourage exfiltration.

Pressure – the normal force exerted by a homogenous liquid or gas, per unit area, on the wall of container.

Pressure difference – the difference in pressure between the volume of air enclosed by the building envelope and the air surrounding the envelope.

Pressure , vapour – the pressure exerted by the molecules of a given vapour.

Radiant heat transfer – the transfer of heat by radiation. Heat radiation is a form of electromagnetic radiation. Radiant heating due to infrared radiation is commonly employed in passive systems.

Radiant temperature - the average temperature of surfaces surrounding a person or surface, with which the person or surface can exchange thermal radiation.

Reference design – a detailed specification of the passive solar features of a hypothetical passive solar building used as the subject of performance analysis.

Reflectance - the ratio of radiation reflected by a surface to the radiation incident on it. The range is 0-1.0.

Reflection – process by which radiation is returned by a surface or a medium, without change of frequency of its monochromatic component.

Relative humidity - the percentage of water vapour in the atmosphere relative to the maximum amount of water vapour that can be held by the air at a given temperature.

Resistivity – the thermal resistance of unit area of a material of unit thickness to heat flow caused by a temperature difference across the material.

Reverse thermocirculation – thermocirculation in the reverse direction, that is, from the heated space to the solar collector. This can occur at night when the heated space is warmer than the collector. In the reference design, the process is assumed to be prevented by dampers.

Roof pond system - an indirect gain heating and cooling system in which the mass, which is water in plastic bags, is located on the roof of the space to be heated or cooled and covered with a movable insulation. A roof pond system absorbs solar radiation for heating in the winter and radiates heat to the sky for cooling in the summer.

Selective coating – finishes applied to materials to improve their performance in relation to radiation of different wavelengths. Those applied to solar absorbers have a high absorptance of solar radiation accompanied by a low emittance of long wave radiation, while those for glazing have a high transmittance to solar radiation and high reflectance of long wavelengths.

Selective surface - a surface used to absorb and retain solar heat in a solar heating system such as a Trombe wall or in a solar collector. Selective surfaces have high absorptance and low emittance.

Sensible heat - heat that results in a change in air temperature, in contrast with latent heat.

SI units - Standard International units; the metric system.

Sky component - the portion of the daylight factor (at a point indoors) contributed by luminance from the sky, excluding direct sunlight.

Sky cover - a measure of the fraction of the sky covered in clouds. Range is 0-10 tenths.

Skylight - a roof window, horizontal or sloped.

Sol-air temperature – an equivalent temperature which will produce the same heating effect as the incident radiation in conjunction with the actual external air temperature.

Solar absorptance - the fraction of incident solar radiation that is absorbed by a surface. The radiation not absorbed by an opaque surface is reflected. The range is 0-1.0.

Solar gain - heat transferred to a space by solar radiation through glazing.

Solar heat gain coefficient (SHGC) - the fraction of incident solar radiation (for the full spectrum) which passes through an entire window assembly, including the frame, at a specified angle. Range is 0-0.85. A higher SHGC is preferred in solar heating applications to capture maximum sun, whereas in cooling applications, a low SHGC reduces unwanted solar heat gain.

Solar load - the demand for energy required at any moment to compensate for the difference between desired indoor conditions and heat gains from solar radiation.

Solar radiation - radiation emitted by the sun, including infrared radiation, ultraviolet radiation, and visible light. The radiation received without change of direction is called beam or direct radiation. The radiation received after its direction has been changed by scattering and reflection is called diffuse radiation. The sum of the two is referred to as global or total radiation.

Specific heat – a measure of the ability of a material to store heat. Specifically, the quantity of heat required to raise the temperature of unit mass of a substance by one degree. (kJ/kg °C).

Stack ventilation - the cooling process of natural ventilation induced by the chimney effect, where a pressure differential occurs across the section of a room. Air in the room absorbs heat gained in the space, loses density, thus rising to the top of the space. When it exits through high outlet openings, a lower pressure is created low in the space, drawing in cooler outside air from low inlets.

Sunlight - beam daylight from the sun only, excluding diffuse light from the sky dome.

Surface resistance – the surface resistance is the resistance to heat flow at the surface of a material. It has two components, the surface resistance for convection and for conduction.

Task light - lighting on a specific area used for a specific task. Task lighting is usually from an electric source and is of a higher illuminance level than the surrounding ambient light level. It is a good strategy to combine task light with ambient daylight.

Temperature swing – the range of indoor temperatures in the building between the day and night.

Thermal break (thermal barrier) – an element of low thermal conductivity placed within a composite envelope construction in such a way as to reduce the flow of heat across the assembly.

Thermal bridge - an element of high thermal conductivity within a construction of otherwise low thermal conductivity. Small areas of materials that conduct heat at high rates can substantially reduce the insulating effectiveness of an assembly. Examples are metal frame windows without thermal breaks and metal stud walls, where the metal conducts heat at a much higher rate than the insulation in between.

Thermal conductivity (k) - a measure of the ease with which heat flows through a unit thickness of a material by conduction; specifically, the heat flow rate in Watt per metre of material thickness, and degree of temperature difference. Units is W/m-°C

Thermal radiation - energy transfer in the form of electromagnetic waves from a body by virtue of its temperature, including infrared radiation, ultraviolet radiation, and visible light.

Thermal resistance - a measure of the insulation value or resistance to heat flow of building elements or materials; specifically, the reciprocal of the thermal conductance.

Thermal storage mass - high-density building elements, such as masonry or water in containers, designed to absorb solar heat during the day for later release when heat is needed.

Thermal storage wall - a Trombe wall or water wall.

Thermocirculation - the circulation of a fluid by convection. For example, the convection from a warm zone (sunspace or Trombe wall air space) to a cool zone through openings in a common wall.

Thermosyphon – the convective circulation of a fluid which occurs in a closed system where warm fluid rises and is replaced by a cooler fluid in the same system.

Tilt – the angle of a plane relative to a horizontal plane.

Time-lag – the period of time between the absorption of solar radiation by a material and its release into a space. Time-lag is an important consideration in sizing a thermal storage wall or Trombe wall.

Transmittance – the ratio of the radiant energy transmitted through a substance to the total radiant energy incident on its surface.

Ultraviolet radiation – electromagnetic radiation having wavelengths shorter than those of visible light. This invisible form of radiation is found in solar radiation and plays a part in the deterioration of plastic glazing materials, paint and furnishing fabrics.

U-value (coefficient of heat transfer) - the number of Watts that flow through one square metre of building component (e.g. roof, wall, floor, glass), in one second, when there is a 1 °C difference in temperature between the inside and outside air, under steady state conditions. The U-value is the reciprocal of the resistance.

Ventilation load - the energy required to bring outdoor air to the desired indoor conditions. In this book, ventilation load refers to fresh air ventilation, which may be provided either naturally or by a mechanical system. The rate of required ventilation varies with the use of the space and the number of occupants. Ventilation load depends on the rate of fresh air ventilation and on the temperature difference between inside and outside. It may be reduced by pre-tempering or the use of heat exchangers.

Ventilation losses – the heat losses associated with the continuous replacement of warm, stale air by fresh cold air.

Ventilation (natural) - air flow through and within a space stimulated by either the distribution of pressure gradients around a building, or thermal forces caused by temperature gradients between indoor and outdoor air.

Visible spectrum – that part of the solar spectrum which is visible to the human eye; radiation with wavelength roughly between 380 and 700 nm.

Visible transmittance (VT) - the fraction of incident visible light that passes through glazing.

Watt (W) - a measure of power commonly used to express heat loss or heat gain, or to specify electrical equipment. It is the power required to produce energy at the rate of one joule per second.

Weather stripping – narrow or jamb-width sections of thin metal or other material to prevent infiltration of air and moisture around windows and doors.

Wet-bulb temperature - the air temperature measured using a thermometer with a wetted bulb moved rapidly through the air to promote evaporation. The evaporating moisture and changing phase lowers the temperature measured relative to that measured with a dry bulb. Wet bulb temperature accounts for the effects of moisture in the air. It can be used along with the dry-bulb temperature on a psychrometric chart to determine relative humidity.

Zenith - the top of the sky dome. A point directly overhead, 90° in altitude angle above the horizon.

SI Units

Quantity	SI Unit	Symbol
Base units		
amount of substance	mole	mol
electric current	ampere	A
length	metre	m
luminous intensity	candela	cd
mass	kilogram	kg
thermodynamic temperature	Kelvin	K
time	second	s
Supplementary units		
plane angle	radian	rad
solid angle	steradian	sr
Some derived units		
area	square metre	m ²
density	kilogram per cubic metre	kg/m ³
energy	joule	J (N m)
force	Newton	N (kg m/s ²)
power	Watt	W (J/s)
pressure	Pascal	Pa (N/m ²)
velocity	metre per second	m/s
volume	cubic metre	m ³

SI Prefixes

Prefix	Symbol	Multiplication factor
tera	T	10 ¹²
giga	G	10 ⁹
mega	M	10 ⁶
kilo	k	10 ³
milli	m	10 ⁻³
micro	μ	10 ⁻⁶
nano	n	10 ⁻⁹
pico	p	10 ⁻¹²

Greek Alphabets

A	α	Alpha	N	ν	Nu
B	β	Beta	Ξ	ξ	Xi
Γ	γ	Gamma	Ο	ο	Omicron
Δ	δ	Delta	Π	π	Pi
E	ε	Epsilon	Ρ	ρ	Rho
Z	ζ	Zeta	Σ	σ	Sigma
H	η	Eta	Τ	τ	Tau
Θ	θ	Theta	Υ	υ	Upsilon
I	ι	Iota	Φ	φ	Phi
K	κ	Kappa	Χ	χ	Chi
Λ	λ	Lambda	Ψ	ψ	Psi
M	μ	Mu	Ω	ω	Omega

Conversion Factors

Unit	Multiplying Factor	Resulting Unit	Physical Quantity
Acre	$4.356\ 0 \times 10^4$	Square feet	Area
Acre	$4.046\ 9 \times 10^{-1}$	Hectares	Area
Acre	$4.046\ 9 \times 10^3$	Square meters	Area
Acre	$1.562\ 5 \times 10^{-3}$	Square miles	Area
Acre	$4.840\ 0 \times 10^3$	Square yards	Area
Atmosphere	$7.600\ 0 \times 10^1$	Centimeters of mercury	Pressure
Atmosphere	$2.992\ 1 \times 10^1$	Inches of mercury	Pressure
Atmosphere	$1.033\ 2 \times 10^4$	Kilograms/square meter	Pressure
Atmosphere	$1.013\ 3 \times 10^5$	Newtons/square meter	Pressure
Atmosphere	$1.469\ 6 \times 10$	Pounds/square inch	Pressure
Bar	$9.869\ 2 \times 10^{-1}$	Atmospheres	Pressure
Bar	$1.000\ 0 \times 10^6$	Dynes/square centimeter	Pressure
Bar	$7.500\ 6 \times 10^2$	Millimeters of mercury	Pressure
Bar	$1.000\ 0 \times 10^5$	Newtons/square meter	Pressure
Bar	$1.450\ 4 \times 10$	Pounds/square inch	Pressure
Barrel (U.S.)	$3.150\ 0 \times 10$	Gallons	Volume
Barrel (U.S.)	$1.192\ 4 \times 10^{-1}$	Cubic meters	Volume
British thermal unit (Btu)	$2.518\ 0 \times 10^2$	Calories	Energy
British thermal unit (Btu)	$7.781\ 7 \times 10^2$	Foot-pounds	Energy
British thermal unit (Btu)	$1.055\ 1 \times 10^{10}$	Ergs	Energy
British thermal unit (Btu)	$3.930\ 1 \times 10^{-4}$	Horsepower-hours	Energy
British thermal unit (Btu)	$1.055\ 1 \times 10^3$	Joules	Energy
British thermal unit (Btu)	$1.055\ 1 \times 10^3$	Newton-meters	Energy
British thermal unit (Btu)	$2.930\ 2 \times 10^{-4}$	Kilowatt-hours	Energy
British thermal unit (Btu)	$1.055\ 1 \times 10^3$	Watt-seconds	Energy
British thermal unit/minute (Btu/min)	4.199 9	Calories/second	Power
British thermal unit/minute (Btu/min)	$1.754\ 8 \times 10^8$	Ergs/second	Power
British thermal unit/minute (Btu/min)	$1.297\ 0 \times 10$	Foot-pounds/second	Power
British thermal unit/minute (Btu/min)	$2.358\ 1 \times 10^{-2}$	Horsepower	Power
British thermal unit/minute (Btu/min)	$1.754\ 8 \times 10$	Joules/second	Power
British thermal unit/minute (Btu/min)	1.793 1	Kilogram-meters/second	Power
British thermal unit/minute (Btu/min)	$1.754\ 8 \times 10$	Watts	Power
Calorie (cal)	$3.968\ 3 \times 10^{-3}$	British thermal units	Energy

Calorie (cal)	3.088 0	Foot-pounds	Energy
Calorie (cal)	$4.186\ 8 \times 10^7$	Ergs	Energy
Calorie (cal)	4.186 8	Joules	Energy
Calorie (cal)	$1.163\ 0 \times 10^{-6}$	Kilowatt-hours	Energy
Calorie (cal)	4.186 8	Watt-seconds	Energy
Centimeter (cm)	$3.280\ 8 \times 10^{-2}$	Feet	Distance
Centimeter (cm)	$3.937\ 0 \times 10^{-1}$	Inches	Distance
Centimeter (cm)	$1.000\ 0 \times 10^{-5}$	Kilometers	Distance
Centimeter (cm)	$1.000\ 0 \times 10^{-2}$	Meters	Distance
Centimeter (cm)	$1.093\ 6 \times 10^{-2}$	Yards	Distance
Centipoise	$6.719\ 7 \times 10^{-4}$	Pounds(mass)/second-foot	Viscosity
Centipoise	3.600 0	Kilograms/hour-meter	Viscosity
Cord	$1.280\ 0 \times 10^2$	Cubic feet	Volume
Cubic centimeter (cm ³)	$1.000\ 0 \times 10^{-3}$	Cubic decimeters	Volume
Cubic centimeter (cm ³)	$3.531\ 5 \times 10^{-5}$	Cubic feet	Volume
Cubic centimeter (cm ³)	$6.102\ 4 \times 10^{-2}$	Cubic inches	Volume
Cubic centimeter (cm ³)	$1.000\ 0 \times 10^{-6}$	Cubic meters	Volume
Cubic centimeter (cm ³)	$1.308\ 0 \times 10^{-6}$	Cubic yards	Volume
Cubic inch (in ³)	$1.638\ 7 \times 10$	Cubic centimeters	Volume
Cubic inch (in ³)	$1.638\ 7 \times 10^{-2}$	Cubic decimeters	Volume
Cubic inch (in ³)	$5.787\ 0 \times 10^{-4}$	Cubic feet	Volume
Cubic inch (in ³)	$1.638\ 7 \times 10^{-5}$	Cubic meters	Volume
Cubic inch (in ³)	$2.143\ 3 \times 10^{-5}$	Cubic yards	Volume
Curie	$3.700\ 0 \times 10^{10}$	Disintegrations/second	Radioactivity
Degree (deg)	$6.000\ 0 \times 10$	minutes	Angle
Degree (deg)	$1.745\ 3 \times 10^{-2}$	radians	Angle
Degree (deg)	$2.777\ 8 \times 10^{-3}$	revolutions	Angle
Degree (deg)	$3.600\ 0 \times 10^3$	seconds	Angle
dyne	$1.019\ 7 \times 10^{-3}$	grams	Force
dyne	$1.019\ 7 \times 10^{-6}$	kilograms	Force
dyne	$1.000\ 0 \times 10^{-5}$	newtons	Force
dyne	$3.597\ 0 \times 10^{-5}$	ounces	Force
dyne	$2.248\ 1 \times 10^{-6}$	pounds	Force
dyne/square centimeter	$2.953\ 0 \times 10^{-5}$	inches of mercury	Pressure
dyne/square centimeter	$1.019\ 7 \times 10^{-2}$	kilograms/square meter	Pressure
dyne/square centimeter	$7.500\ 6 \times 10^{-4}$	millimeters of mercury	Pressure
dyne/square centimeter	$1.000\ 0 \times 10$	newtons/square meter	Pressure
dyne/square centimeter	$1.450\ 4 \times 10^{-5}$	pounds/square inch	Pressure
electron volt (eV)	$3.826\ 8 \times 10^{-20}$	calories	Energy
electron volt (eV)	$1.602\ 2 \times 10^{-12}$	ergs	Energy
erg	$9.478\ 2 \times 10^{-11}$	British thermal units	Energy

erg	$2.388\ 5 \times 10^{-8}$	calories	Energy
erg	1.000 0	dyne-centimeters	Energy
erg	$7.375\ 6 \times 10^{-8}$	foot-pounds	Energy
erg	$1.000\ 0 \times 10^{-7}$	joules	Energy
erg/second	$5.68\ 69 \times 10^{-9}$	British thermal units/minute	Power
erg/second	$2.388\ 5 \times 10^{-8}$	calories/second	Power
erg/second	$7.375\ 6 \times 10^{-8}$	foot-pounds/second	Power
erg/second	$1.000\ 0 \times 10^{-7}$	joules/second	Power
erg/second	$1.000\ 0 \times 10^{-7}$	watts	Power
flow rate, fuel (lb/h)	$4.535\ 9 \times 10^{-1}$	kilograms/hour	Mass Flow
foot-pound (ft-lb)	$1.285\ 1 \times 10^{-3}$	British thermal units	Energy
foot-pound (ft-lb)	$1.355\ 8 \times 10^7$	ergs	Energy
foot-pound (ft-lb)	$5.050\ 5 \times 10^{-7}$	horsepower-hours	Energy
foot-pound (ft-lb)	1.355 8	joules	Energy
foot-pound (ft-lb)	$3.766\ 2 \times 10^{-7}$	kilowatt-hours	Energy
foot-pound (ft-lb)	1.355 8	newton-meters	Energy
furlong	$1.000\ 0 \times 10$	chains	Distance
furlong	$2.200\ 0 \times 10^2$	yards	Distance
furlong	$2.011\ 7 \times 10^2$	meters	Distance
US gallon (gal)	$1.336\ 8 \times 10^{-1}$	cubic feet	Volume
US gallon (gal)	3.785 4	liters	Volume
US gallon (gal)	$3.785\ 4 \times 10^{-3}$	cubic meters	Volume
US gallon (gal)	8.000 0	pints	Volume
US gallon (gal)	4.000 0	quarts	Volume
Gram (g)	$1.000\ 0 \times 10^{-3}$	kilograms	Mass
Gram (g)	$3.527\ 4 \times 10^{-2}$	ounces	Mass
Gram (g)	$2.204\ 6 \times 10^{-3}$	pounds	Mass
Gram (g)	$9.806\ 7 \times 10^2$	dynes	Mass
Gram (g)	$9.806\ 7 \times 10^{-3}$	newtons	Mass
hectare	2.471 1	acres	Area
hectare	$1.000\ 0 \times 10^2$	ares	Area
hectare	$1.000\ 0 \times 10^4$	square meters	Area
hectare	$3.861\ 0 \times 10^{-3}$	square miles	Area
Horsepower (hp)	$4.243\ 6 \times 10$	British thermal units/minute	Power
Horsepower (hp)	$5.500\ 0 \times 10^2$	foot-pounds/second	Power
Horsepower (hp)	$3.300\ 0 \times 10^4$	foot-pounds/minute	Power
Horsepower (hp)	$7.457\ 0 \times 10^2$	joules/second	Power
Horsepower (hp)	$7.604\ 0 \times 10$	kilogram-meters/second	Power
Horsepower (hp)	$7.457\ 0 \times 10^2$	watts	Power
imperial gallon	2.7742×10^2	cubic inches	Volume
imperial gallon	1.2009	US gallons	Volume

imperial gallon	4.546	liters	Volume
Joule (J)	$9.477\ 1 \times 10^{-4}$	British thermal units	Energy
Joule (J)	$2.388\ 9 \times 10^{-1}$	calories	Energy
Joule (J)	$1.000\ 0 \times 10^7$	dyne-centimeters	Energy
Joule (J)	$1.000\ 0 \times 10^7$	Ergs	Energy
Joule (J)	$7.375\ 6 \times 10^{-1}$	foot-pounds	Energy
Joule (J)	1.000 0	newton-meters	Energy
Joule (J)	1.000 0	watt-seconds	Energy
Kilogram (kg)	$1.000\ 0 \times 10^3$	Grams	Mass
Kilogram (kg)	$3.527\ 4 \times 10$	Ounces	Mass
Kilogram (kg)	2.20 46	Pounds	Mass
Kilogram (kg)	$6.852\ 1 \times 10^{-2}$	Slugs	Mass
Kilogram (kg)	9.806 7	Newtons	Mass
Kilogram (kg)	$7.929\ 0 \times 10$	Poundals	Mass
km/h	$9.113\ 0 \times 10^{-1}$	feet/second	Speed
km/h	$5.396\ 0 \times 10^{-1}$	knots	Speed
km/h	$6.213\ 7 \times 10^{-1}$	miles/hour	Speed
km/h	$2.777\ 8 \times 10^{-1}$	meters/second	Speed
kW/h	$3.412\ 8 \times 10^3$	British thermal units	Energy
kW/h	$2.656\ 0 \times 10^6$	foot-pounds	Energy
kW/h	1.341 4	horsepower-hours	Energy
kW/h	$3.600\ 0 \times 10^6$	joules	Energy
kW/h	$3.672\ 1 \times 10^5$	kilogram-meters	Energy
kW/h	$3.600\ 0 \times 10^6$	watt-seconds	Energy
Liter (l)	$6.102\ 4 \times 10$	cubic inches	Volume
Liter (l)	$3.531\ 5 \times 10^{-2}$	cubic feet	Volume
Liter (l)	$2.641\ 7 \times 10^{-1}$	gallons	Volume
Liter (l)	$1.000\ 0 \times 10^{-3}$	cubic meters	Volume
meter/second	3.280 8	feet/second	Speed
metric horsepower	$9.863\ 2 \times 10^{-1}$	horsepower	Power
metric horsepower	$7.355\ 0 \times 10^{-1}$	kilowatts	Power
mile/hour	1.466 7	feet/second	Speed
Newton (n)	$1.000\ 0 \times 10^5$	dynes	Force
pound (mass) (lb)	$4.535\ 9 \times 10^2$	grams	Mass
pound (force) (lbf)	4.448 2	newtons	Force
pound/square inch (psi)	$6.804\ 6 \times 10^{-2}$	atmospheres	Pressure
pound/square inch (psi)	$6.894\ 8 \times 10^4$	dynes/square centimeter	Pressure
pound/square inch (psi)	2.036 0	inches of mercury	Pressure
pound/square inch (psi)	$2.768\ 1 \times 10$	inches of water	Pressure
pound/square inch (psi)	$7.030\ 7 \times 10^2$	kilograms/square meter	Pressure

pound/square inch (psi)	$6.894\ 8 \times 10^3$	newtons/square meter	Pressure
Radian (rad)	$5.729\ 6 \times 10$	degrees	Angle
Radian (rad)	$3.437\ 8 \times 10^3$	minutes	Angle
Radian (rad)	$1.591\ 6 \times 10^{-1}$	revolutions	Angle
Radian (rad)	$2.062\ 6 \times 10^5$	seconds	Angle
Revolution (rev)	$3.600\ 0 \times 10^2$	degrees	Angle
Revolution (rev)	$2.160\ 0 \times 10^4$	minutes	Angle
Revolution (rev)	6.283 2	radians	Angle
Revolution (rev)	$1.296\ 0 \times 10^6$	seconds	Angle
Second (angle) (sec)	$2.777\ 8 \times 10^{-4}$	degrees	Angle
Second (angle) (sec)	$4.848\ 1 \times 10^{-6}$	radians	Angle
Watt (joule/second) (W)	3.412 1	British thermal units/hour	Power
Watt (joule/second) (W)	$2.390\ 0 \times 10^{-1}$	calories/second	Power
Watt (joule/second) (W)	$1.000\ 0 \times 10^7$	ergs/second	Power
Watt (joule/second) (W)	$7.375\ 6 \times 10^{-1}$	foot-pounds/second	Power
Watt (joule/second) (W)	$1.341\ 0 \times 10^{-3}$	horsepower	Power
Watt (joule/second) (W)	$1.019\ 7 \times 10^{-1}$	kilogram-meters/second	Power