Cheatography

AE Concepts Cheat Sheet by WhiteSpade via cheatography.com/166754/cs/34906/

Definitions		De
Conduction	It is the transfer of heat through a material	Th dy
Radiation	It is energy transmitted directly through space	ar
Convection	It is the transfer of heat by the movement of fluids such as air or water	He
Emissi- vity(ε)	ratio of the radiation emitted by the surface at a given temperature to the radiation emitted by a blackbody at the same temperature.	Tr
blackbody	The idealized surface that emits radiation at this maximum rate	In [.] ra
Kirchhoff's Law (1860)	At the thermal equilibrium, the power radiated by an object must be equal to the power absorbed.	Ve at
Heat	It is the form of energy that can be transferred from one system to another as a result of temperature difference.	He Lo tu,

Definitions (cont)	
Thermo dyn- amics	We can determine the amount of heat transferred using a Thermodynamic analysis alone. It deals with equilibrium states and changes from one to another.
Heat Transfer	It deals with systems that lack thermal equilibrium. It is the science that deals with the determination of the rates of such energy transfers is called heat transfer. Unit is Btu/hr, or Watt (1 W = 3.41 Btu/hr)
Infilt- ration	s the accidental heat loss/gain due to air leaking through the envelope, doors, windows etc.
Ventil- ation	is the deliberate, designed introduction of air into/out of a space required for healthy buildings
Heat Loss(B- tu/hr)	The heat transfer through each element to outdoor in winter season.

Definitions (cont

Deminuons	(cont)
Peak Heating Loads(- Btu/hr)	the amount of heat lost to the outdoor environment at design outdoor and indoor conditions, which must be made up by the HVAC system to maintain occupant comfort.
Annual Heating Energy- (Btu)	The energy consumption during winter heating season. It will consider the heat gains from lights, human activities, applia- nces, etc.
When will the peak heating loads happen?	Lowest weather temperature • At night (no solar) • No internal gains • Ignore thermal mass
When will the peak cooling loads happen?	Highest weather temperature • Maximum solar gains (window orientation) • Maximum internal heat gains • Ignore thermal mass

Appropriate terms and questions

The heat (loss or gain) during a	B. Btu,
day is about #?	D. Joule
The heat flow rate in this	C. Btu/hr
situation is #?	

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Appropriate te	erms and questions (cont)
# (heating or cooling) loads for a year will be needed	B. MBtu, D. Joule
# peak heating loads are docume- nted.	B. MBtu, D. Joule
Rsubt	Total thermal resistance - Ability of a construction assembly to insulate heat, including air films
U	Overall coefficient of heat transmission - Ability of a construction assembly to transfer heat, including air films
When will the peak heating loads happen?	 Lowest weather temper- ature • At night (no solar) • No internal gains • Ignore thermal mass
When will the peak cooling loads happen?	 Highest weather temper- ature • Maximum solar gains (window orientation) • Maximum internal heat gains Ignore thermal mass
Why do we need to calculate Peak heating/c- ooling loads	To size the heating/cooling equipment, ducts, etc.

Appropriate terms and questions (cont)

Why do we	To estimate the annual
need to	energy use by a system so
calculate	we can tell the building
these	owners how much it will cost
Annual	to operate a building with a
heating/c-	proposed system.
ooling	
energy	

Thermal Gradien

Thermal Gradient Calculation Example Here's an example of a simple wall section with the thickness of each material provided (Outdoor = 0 C; and Indoor = 20 C): Step 1: Determine what units are being used. Step 2: Make a chart of all the materials in the assembly the chart include columns for Resistance of each layer. Find out is space Resistance - effective emissivity Find out interior and exterior surface coefficient Step 4: Calculate the total R value and U value. Step 4: Calculate the overall heat flow Q. Step 5: Calculate the total Resture change for each layer. Step 6: Draw or sketch a section for thermal gradient U=1/Sum<R>=Btu/h ft² U value calculation 0F Calculations U value U=1/Sum<R> calculation [Btu/hr ft² 0F] U=1/Sum<R> where R = U value with Rstud % area stud of sample + frames Rinsulation % area ins of [Btu/hr ft² sample 0F] Qemit = $\varepsilon \delta AT^4$ where ε = Emissivity emissivity of surface 1/E= 1/ɛsub1 + 1/ɛsub2 - 1 Air Space Heat Flow q = u x A x deltaT (q) [BTU/hr] q = u x A x deltaT Thermal Gradient [BTU/hr]

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Calculations (cont)

Calculations (cor	nt)
Heat loss through slab- on-grade floors	q= F2 x P x deltaT
Heat flow through windows	q = UA(Tin - Tout)
Heat flow through windows pt2	q = A <i>SHGC</i> Et
Heat flow by infiltration	qv = V x 1.08 x ΔT
Latent Heat by Infiltration or Ventilation	qlatent = 4840 x V x ΔW
Simple heat loss calcul- ation	total heat loss = Qwin + Qwalls + Qdoor ++ Qinfiltration
Annual Energy Estimation	E heating = UAref ×(HDD) ×(24) / k where UAref = Q heat loss / Δ T
Annual Energy Estimation pt2	Efuel = Eheating / V
F2 (this is not U-value)	heat loss coefficient from above (Btu/h-ft-F)
Eheating:	Annual heating energy in Btu
UAref : average heat loss rate from a building HDD: the degree days at the reference temperature k: heating system efficiency U = U-factors of window assemblies (Btu/h ft2 F) Q = rate of heat flow (Btu/hr) SHGC= solar heat gain coefficient Et= total incident irradiance deltaW is found on the psychometric chat in-out (right side) Efuel: Amount of fuel V: heat value of fuel	

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