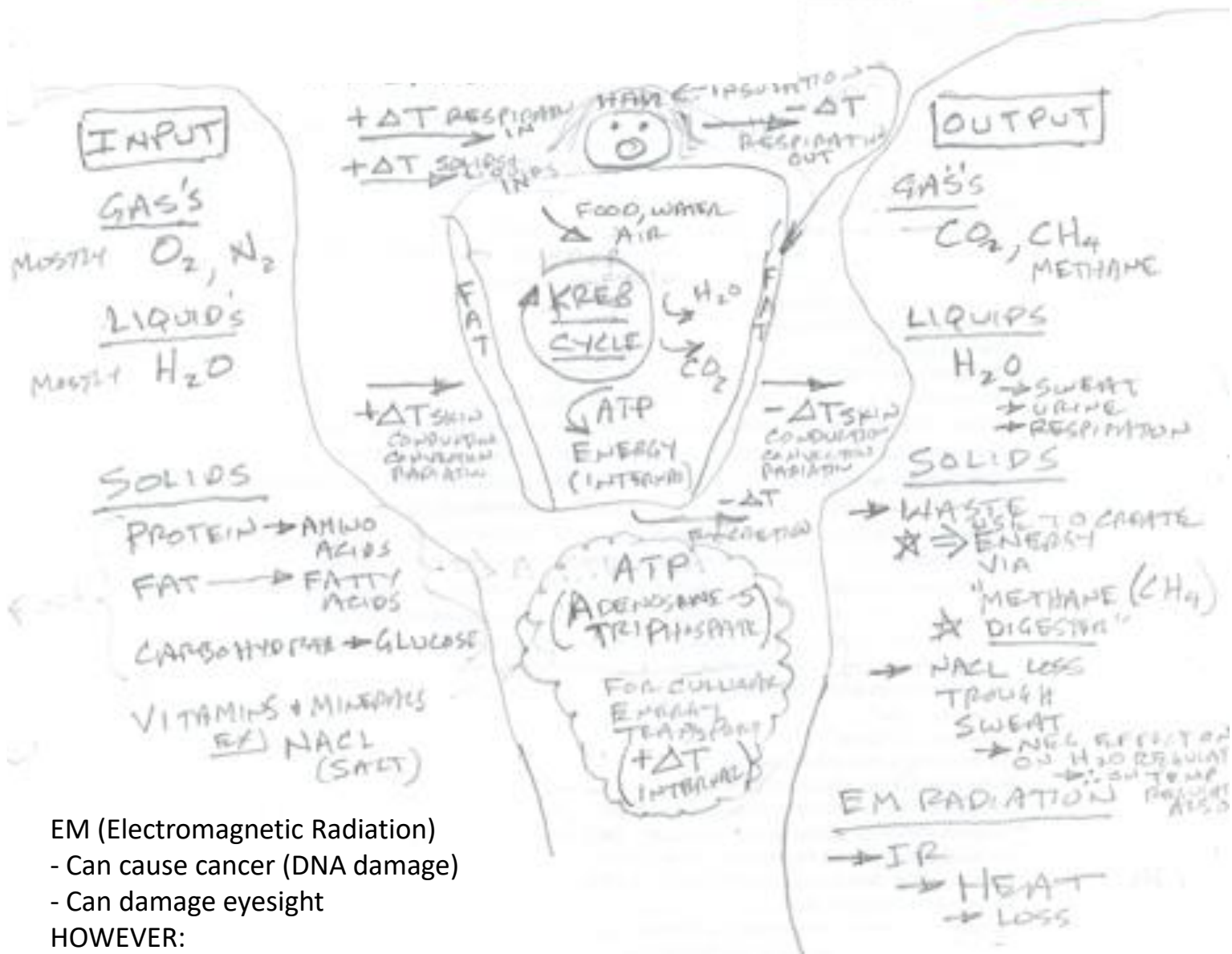


A&E COMFORT, and health



EGR343 Green
Architectural
Engineering
Lecture Notes
Chapter 4



EM (Electromagnetic Radiation)

- Can cause cancer (DNA damage)
- Can damage eyesight

HOWEVER:

- + UV-C can kill EBOLA! ... and COVID?
- + UV made into Vitamin D by body's skin
- COULD MAYBE help prevent COVID infection and Mortality

EM (Electromagnetic Radiation)

+ UV made into Vitamin D by body's skin *COULD MAYBE* help prevent COVID infection and Mortality

2020 research is ongoing !! -- look for PEER-REVIEWED publications from SCHOLARLY SOURCES:

https://scholar.google.com/scholar?hl=en&as_sdt=0,39&q=%22vitamin+d%22++and+covid

Google Scholar

"vitamin d" and covid

Articles About 27,600 results (0.07 sec)

Any time
Since 2020
Since 2019
Since 2016
Custom range...

Sort by relevance
Sort by date

include patents
 include citations

Create alert

[HTML] Mechanisms in endocrinology: **Vitamin D** and **COVID-19** [HTML] bioscientifica.com
JP Bilezikian, D Bikle, M Hewison... - European journal of ..., 2020 - eje.bioscientifica.com
The SARS-CoV-2 virus responsible for the **COVID-19** pandemic has generated an explosion of interest both in the mechanisms of infection leading to dissemination and expression of this disease, and in potential risk factors that may have a mechanistic basis for disease ...
☆ ⓘ Cited by 11 All 9 versions ⓘ

[HTML] **Vitamin D** for **COVID-19**: a case to answer? [HTML] thelancet.com
AR Martineau, NG Forouhi - The Lancet Diabetes & Endocrinology, 2020 - thelancet.com
Interest in a potential role for **vitamin D** in the prevention or treatment of acute respiratory infections dates back to the 1930s, when cod liver oil was investigated as a means to reduce industrial absenteeism due to the common cold. Meta-analyses of randomised controlled ...
☆ ⓘ Cited by 28 All 9 versions ⓘ

Vitamin d and covid-19 [PDF] springer.com
G Trovas, S Tournis - Hormones, 2020 - Springer
Epidemiological data report that several countries with a high prevalence of hypovitaminosis D may have increased susceptibility to complications and mortality due to **COVID-19** infection. These reports, however, have limitations given that they derive from observational ...
☆ ⓘ Cited by 3 All 6 versions ⓘ

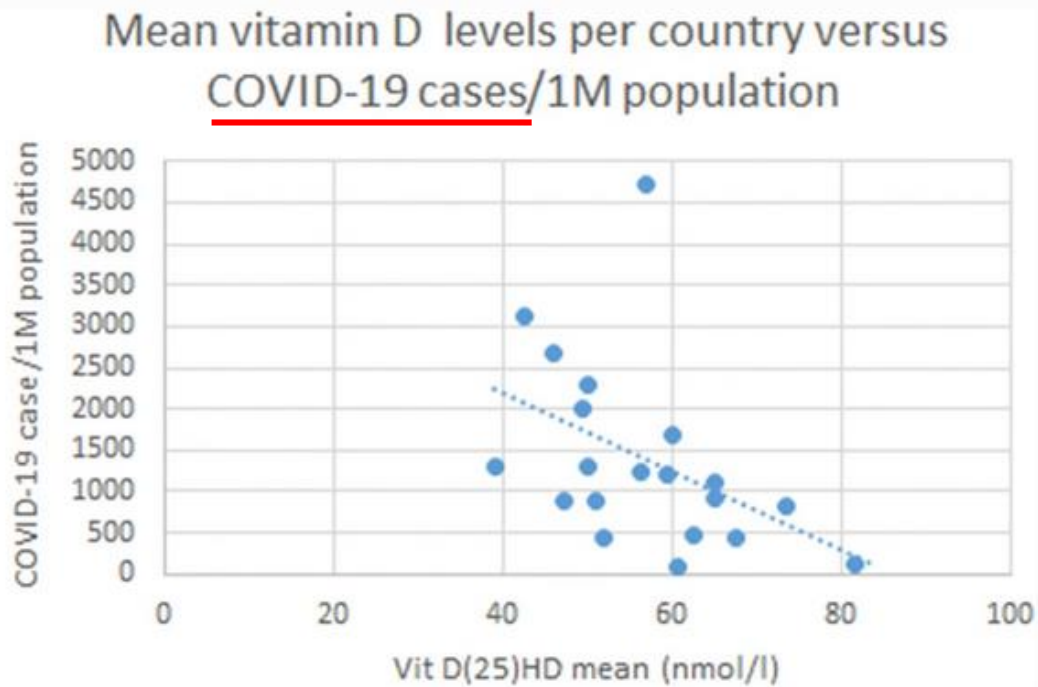
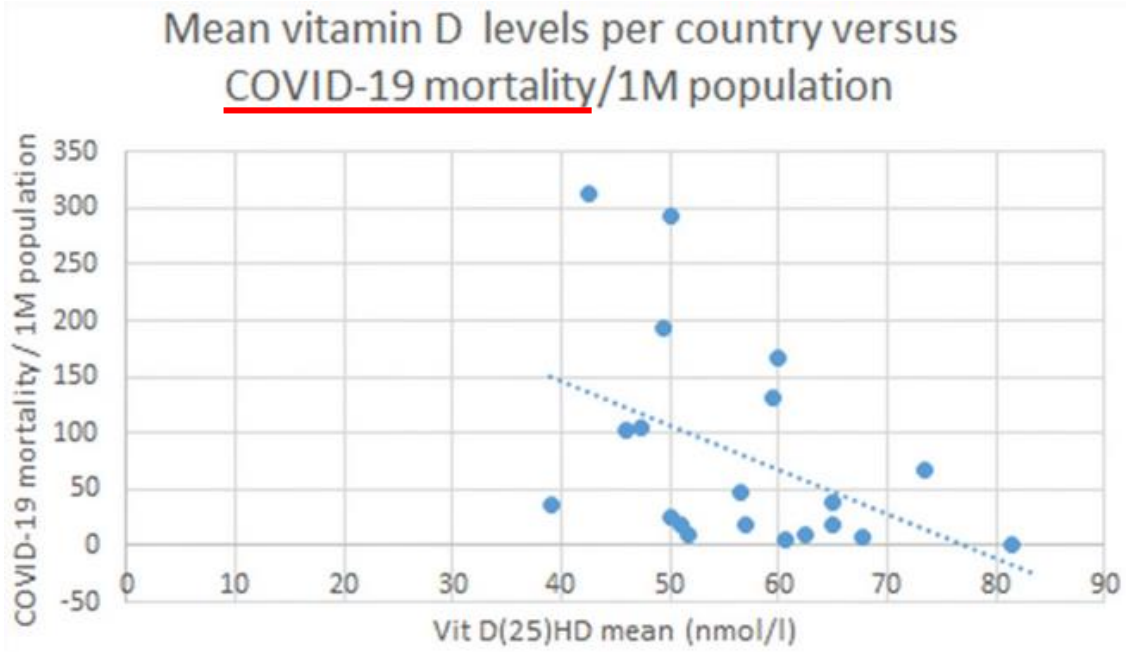
[HTML] Possible role of **vitamin D** in **Covid-19** infection in pediatric population [HTML] springer.com
FM Panfili, M Roversi, P D'Argenio, P Rossi... - Journal of ..., 2020 - Springer
Purpose Covid-19 is a pandemic of unprecedented proportion, whose understanding and management is still under way. In the emergency setting new or available therapies to contrast the spread of COVID-19 are urgently needed. Elderly males, especially those ...
☆ ⓘ Cited by 9 All 7 versions ⓘ

Vitamin D and **Covid-19**: From potential therapeutic effects to unanswered questions
M Teymoori-Rad, SM Marashi - Reviews in medical virology, 2020 - Wiley Online Library
Evidence suggests that **vitamin D** supplementation could potentially be effective either in treatment or prevention of **coronavirus** disease 2019 (**Covid-19**). Indeed, several studies and trials have begun to investigate the impact of **vitamin D** supplementation on patients ...
☆ ⓘ Cited by 3 All 5 versions ⓘ

Association of **vitamin D** status and other clinical characteristics with **COVID-19** test results [HTML] jamanetwork.com
View it @ CTU
DO Meltzer, TJ Best, H Zhang, T Vokes... - JAMA network ..., 2020 - jamanetwork.com
Importance **Vitamin D** treatment has been found to decrease the incidence of viral respiratory tract infection, especially in patients with **vitamin D** deficiency. Whether **vitamin D** is associated with **coronavirus** disease 2019 (**COVID-19**) incidence is unknown. Objective ...
☆ ⓘ Cited by 29 All 20 versions ⓘ

EM (Electromagnetic Radiation)

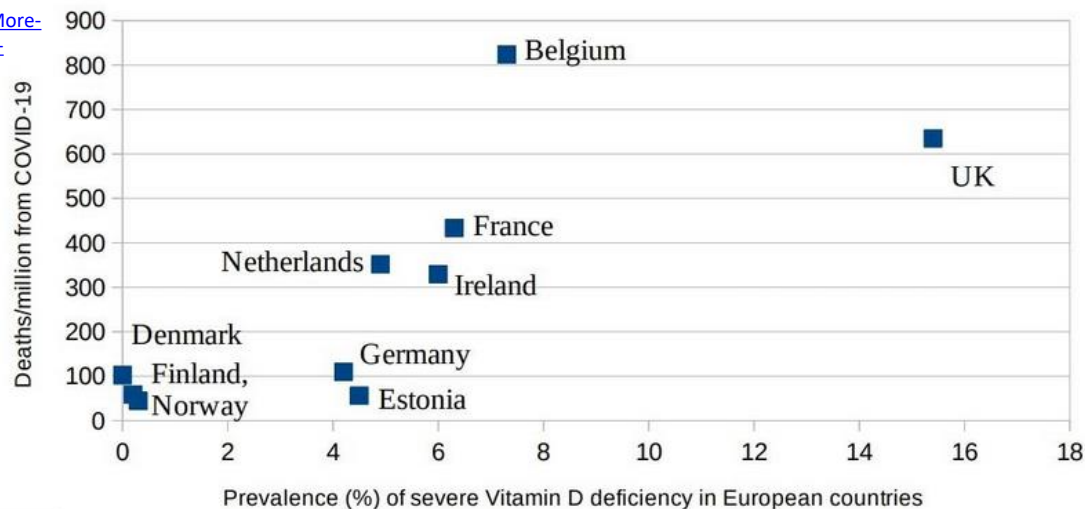
+ UV made into Vitamin D by body's skin *COULD MAYBE* help prevent COVID infection and Mortality



<https://link.springer.com/article/10.1007/s40520-020-01570-8/figures/1>

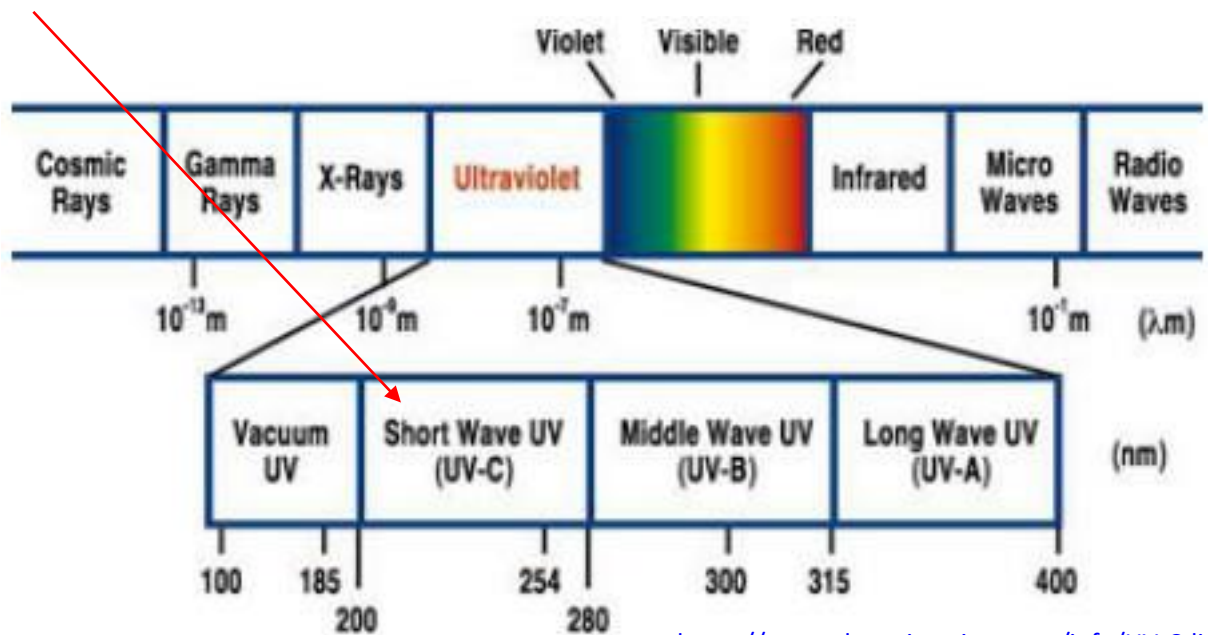
Prevalence of severe Vitamin D deficiency vs COVID-19 deaths/million

<https://www.news-medical.net/news/20200702/More-evidence-on-vitamin-D-deficiency-and-death-rates-from-COVID-19.aspx>



EM (Electromagnetic Radiation)

+ “**UV-C DISINFECTION**” can kill EBOLA! ... and COVID?



<https://www.cleanairoptima.com/info/UV-C-light/>

From JT Wunderlich lecture:

“**HUMANITY?; Human Computer Interaction (HCI), it’s mostly good**”

- [PDF](#)
- Listen outside of class time: [PPTX-w/Audio](#) [MP4](#) [YouTube](#)

CLEAN-UP

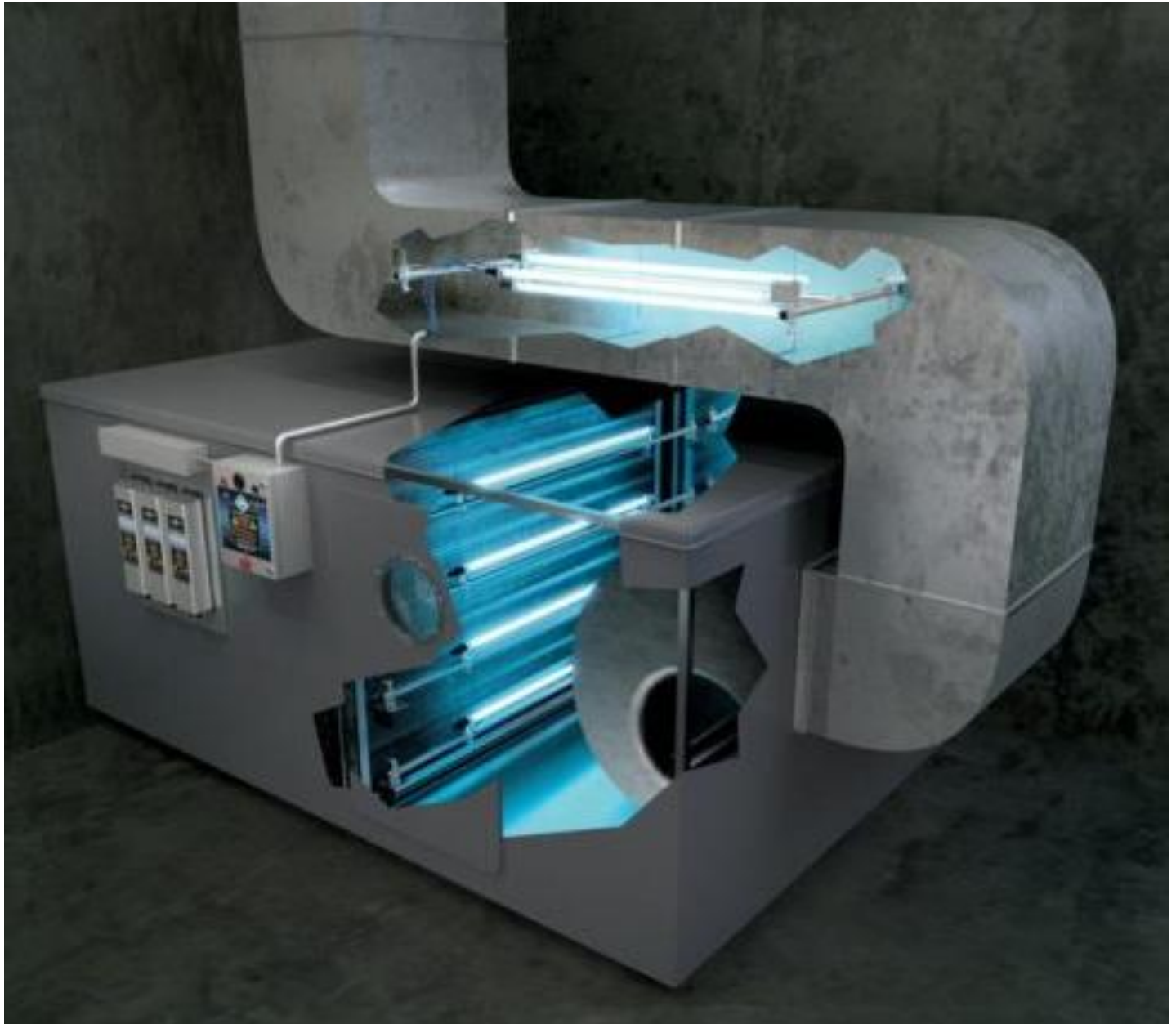
CLEAN-UP of Human or Nature’s Mess

- 2014 US Military robots fight Ebola
- Disinfect in minutes using ultraviolet technology

SOURCE: <http://news.discovery.com/tech/robotics/ebola-zapping-robots-unleashed-in-hospitals-141011.htm>

EM (Electromagnetic Radiation)

+ “**UV-C DISINFECTION**” can kill EBOLA! ... and COVID?



<https://www.achrnews.com/articles/143318-covid-19-reveals-importance-of-uv-c-in-hvac-industry?v=preview>

EM (Electromagnetic Radiation)

+ “UV-C DISINFECTION” can kill COVID-19 ??

As of October 2, 2020:

https://scholar.google.com/scholar?hl=en&as_sdt=0%2C39&q=uv+covid&btnG=

Google Scholar

uvc covid

Articles About 1,480 results (0.08 sec)

Any time
Since 2020
Since 2019
Since 2016
Custom range...

Sort by relevance
Sort by date

include patents
 include citations

Create alert

The importance of the minimum dosage necessary for UVC decontamination of N95 respirators during the COVID-19 pandemic
S Narla, AB Lyons, I Kohli, AE Torres... - *Photodermatology ...*, 2020 - Wiley Online Library
Abstract The World Health Organization (WHO) recently released a press report highlighting the severe shortage of personal protective equipment (PPE) that is endangering healthcare workers worldwide during the COVID-19 pandemic. 1 To meet this urgent need, healthcare ...
☆ Cited by 17 Related articles All 6 versions

Ultraviolet germicidal irradiation: possible method for respirator disinfection to facilitate reuse during COVID-19 pandemic
IH Hamzavi, AB Lyons, I Kohli, S Narla... - *Journal of the American ...*, 2020 - Elsevier
... Key Words: N95; filtering facepiece respirators; ultraviolet germicidal irradiation; sterilize; reuse; ultraviolet C; COVID-19; pandemic Abbreviations used: FFRs = filtering facepiece respirators; UVGI = Ultraviolet germicidal irradiation; UVC = Ultraviolet C; DNA = deoxyribonucleic ...
☆ Cited by 45 Related articles All 9 versions

Recommendations for phototherapy during the COVID-19 pandemic
HW Lim, SR Feldman, AS Van Voorhees... - *Journal of the American ...*, 2020 - Elsevier
... The germicidal property of ultraviolet (UV) light may be helpful in limiting COVID-19 in the phototherapy unit. UVC has been used for decontamination of N95 filtering facepiece respirators during the pandemic (2). Based on extrapolation of 254 nm UVC virus inactivation data ...
☆ Cited by 13 Related articles All 8 versions

[HTML] Fight against COVID-19: ARCI's technologies for disinfection
BV Sarada, R Vijay, R Johnson, TN Rao... - *Transactions of the ...*, 2020 - Springer
... (MIL), has co-developed a UVC disinfection trolley to fight against COVID-19 by a simple physical process where rapid cleaning is possible within few minutes especially in hospital settings avoiding the use of harsh chemicals ...
☆ Cited by 1 All 3 versions

[PDF] Effectiveness Study of Disinfection of Microbes by Innovation Robotic UVC Radiation: Response to COVID-19 Pandemic
P Vorapaluk - *Thai Journal of Anesthesiology*, 2020 - he02.tci-thaijo.org
... Effectiveness Study of Disinfection of Microbes by Innovation Robotic UVC Radiation: Response to COVID-19 Pandemic ... นวัตกรรมหุ่นยนต์ •Original Article Background: During the COVID-19 pandemic, many patients have been quarantined and hospitalized. Healthcare providers thus ...
☆ View as HTML

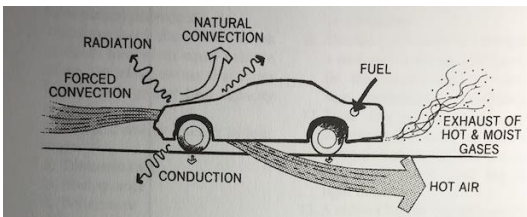


Figure 4.1a Methods of dissipating waste heat from an automobile.

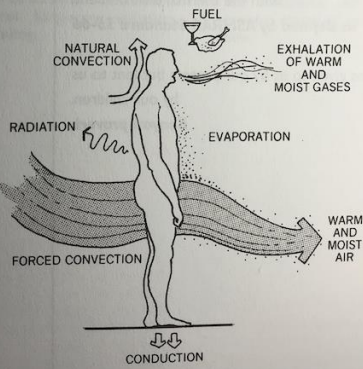


Figure 4.1b Methods of dissipating waste heat from a biological machine.

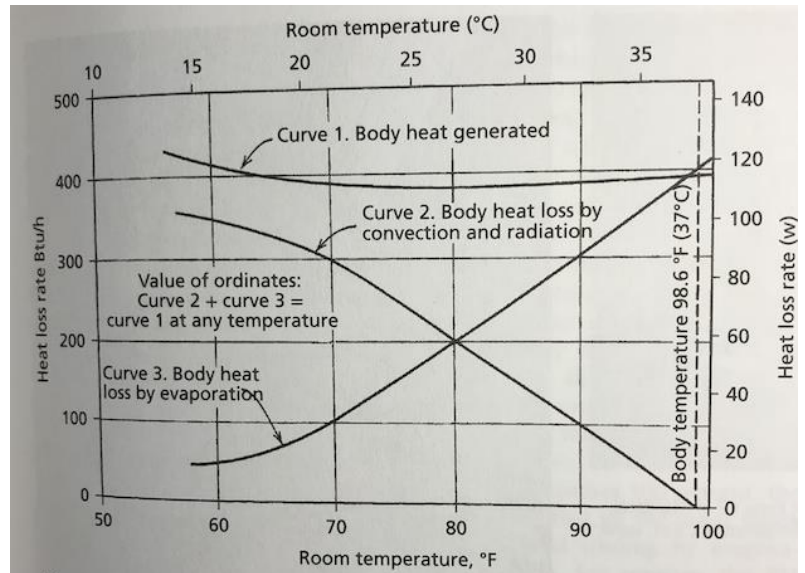


Figure 4.1c The way heat is lost from a body depends on the ambient temperature. This chart assumes the person is at rest and that the relative humidity is 45 percent. (From *Mechanical and Electrical Equipment for Buildings*, 9th ed., Stein and Reynolds, © 2000 John Wiley & Sons, Inc.)

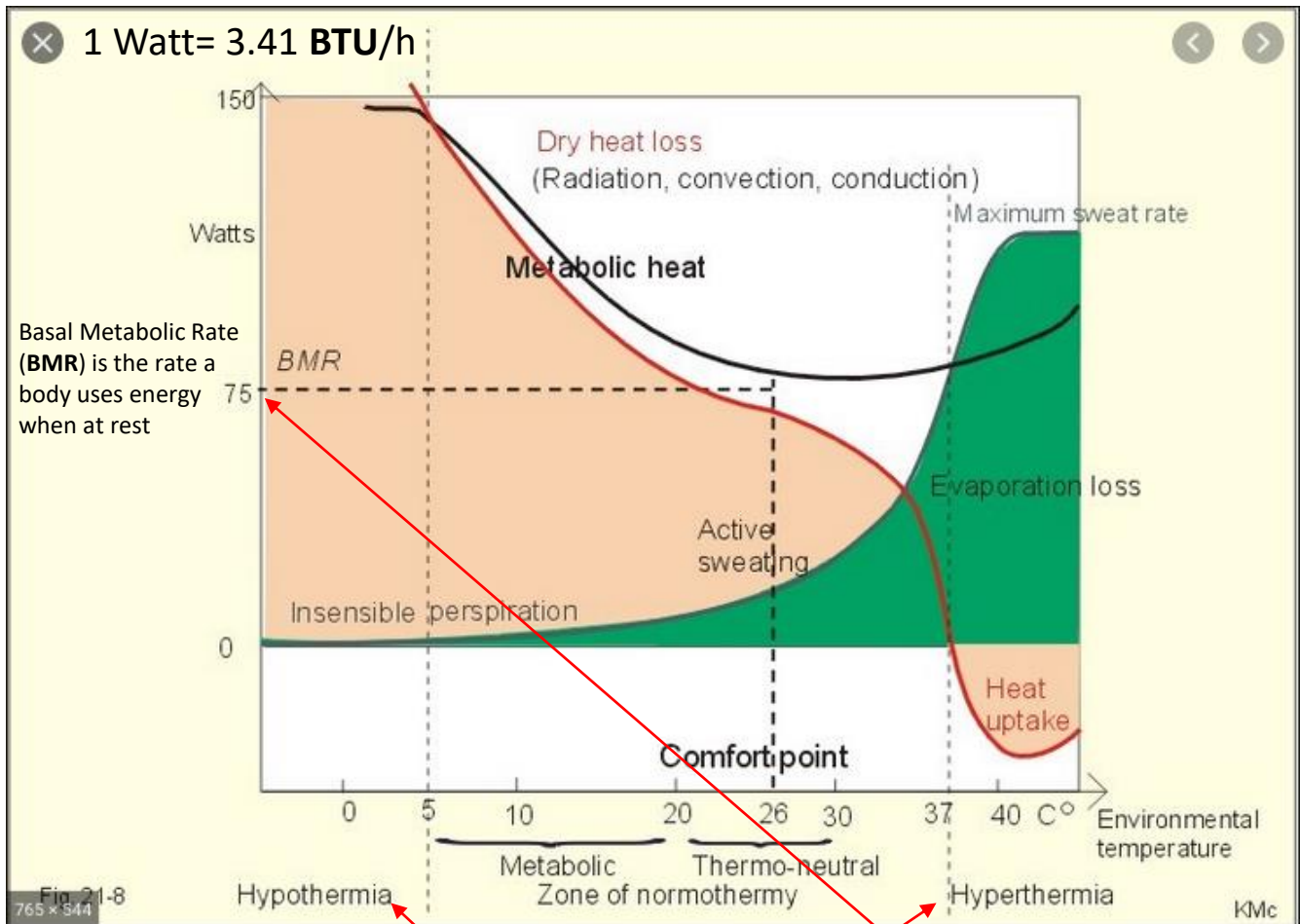


Fig. 21-8: Metabolic rate and environmental temperature in a fasting dressed human at rest.

The wet and the dry heat loss, as well as the metabolic heat and the basal metabolic rate (BMR) is measured in Watts.

In the metabolic zone, the total heat loss rises with falling environmental temperature, but below 5 °C in the environment, the dry heat loss exceeds the metabolic rate, and the body is cooled down (Fig. 21-8). This is the zone of hypothermia, where cold death is inevitable without treatment.

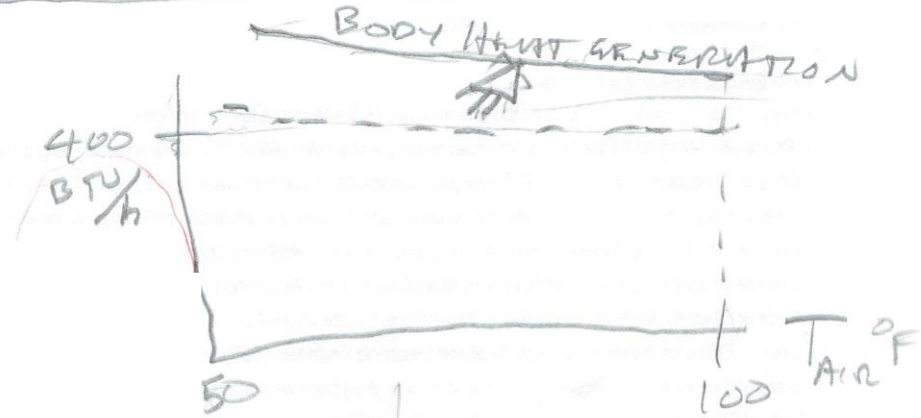
The zone of hyperthermia begins at an environmental temperature of 37 °C, where humans soon reach the maximal capacity for evaporation and there is an unbalanced heat influx to the body ending in heat death.

<https://www.zuniv.net/physiology/book/chapter21>

THERMAL BARRIERS

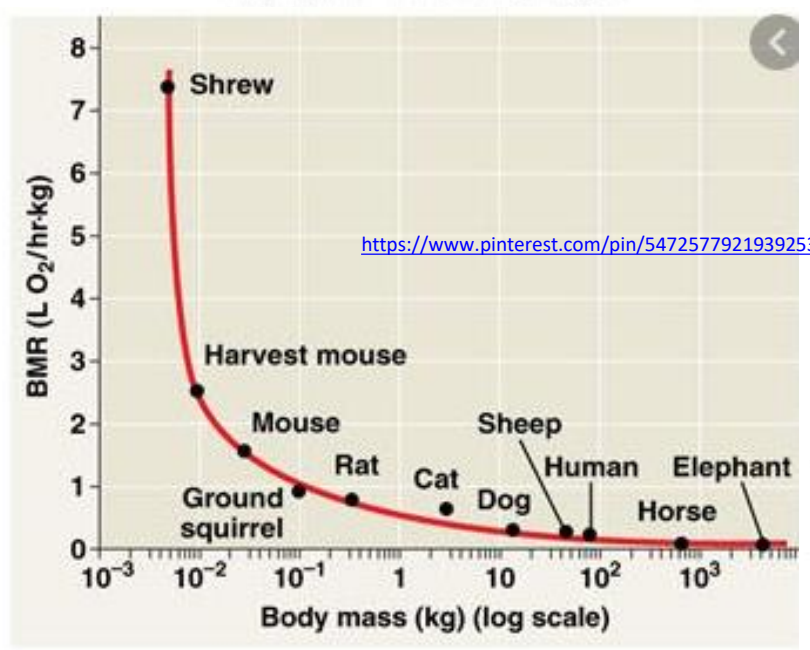
- CLOTHES
- CANOPY BEDS, BLANKETS
- BUILDINGS

"METABOLIC RATE"



	AVE BTU/h
SLEEPING	~340
LIGHT WORK	~680
WALKING	~1020
JOGGING	~2720

Basal Metabolic Rate (**BMR**) is the rate a body uses energy when at rest



(b) Relationship of BMR per kilogram of body mass to body size

" THERMAL CONDITIONS OF ENVIRONMENT "

① AMBIENT AIR TEMP T_{AIR}

Rate of Change of Body Temp with respect to change in time, due to Ambient Air Temp

$$\frac{dT_{BODY}}{dt_{time}} = f(T_{AIR})$$

② RELATIVE HUMIDITY RH

Rate of Change of Body Temp with respect to change in time, due to Ambient Relative Humidity, AND evaporation of Sweat off of body

$$\left(\frac{dT_{BODY}}{dt} \right)_{EVAPORATION} = f(RH)$$

~ COMFORT @: \star

RH SUMMER = ~ 20 TO 60 \star

RH WINTER = ~ 20 TO 80 \star

@ LOW RH:

\star → DRY NOSE, MOUTH, SKIN, EYES

\star → RESPIRATORY ILLNESS

→ STATIC ELECTRICITY

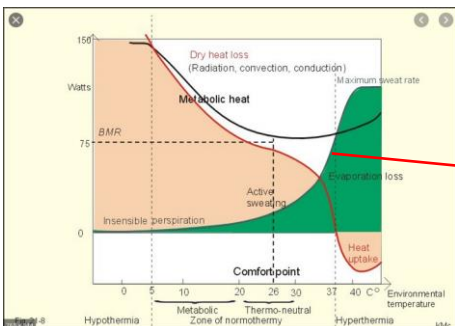
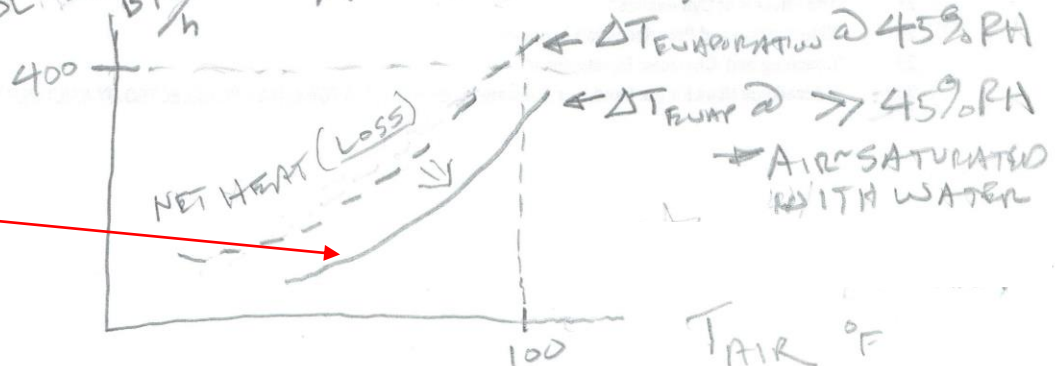
\star → WOOD SHRINKAGE

@ HIGH RH:

\star → HARD TO KEEP COOL

\star → MOLD, MILDEW

EXH COOL BODY BTU/h



"AIR MOVEMENT"

$$\Delta T_{\text{Body}} = f(\text{CONVECTION, EVAPORATION})$$

→ GOOD IN SUMMER

→ BAD IN WINTER

★ → DRAFTS → DON'T PUT BED IN DRAFT

★ → "WIND CHILL FACTOR"

SEE CHAPTER 3 → MRT
EAN TEMP
ADIANT

$$\text{COMFORT} = f(\text{PROXIMITY TO SOURCES})$$

★ → BEST IF HEAT SOURCE ALLOWS EVEN DISTRIBUTION THROUGHOUT HOUSE

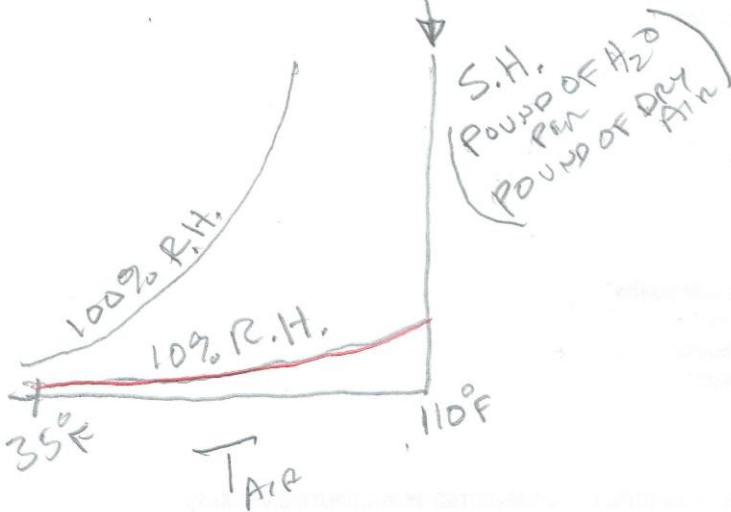
★ → HOT-WATER-LOOP RADIATORS
★ → RADIANT FLOOR HEATING
★ → NOT POT-BELLY STOVES OR ELECTRIC WIRE HEATERS

★ → DON'T PUT BED UNDER WINDOW IN COLD CLIMATES

"PSYCHOMETRIC CHART"

SPECIFIC HUMIDITY (HUMIDITY RATIO)

★ → ACTUAL AMOUNT OF WATER IN AIR = $f(\text{TEMP})$



RELATIVE HUMIDITY (RH)

★ → RH'S ARE CURVED
★ → $= f(\text{TEMP, MAX H}_2\text{O AIR CAN HOLD AT THAT TEMP})$

★ → @ 100% RH SWEAT CAN'T EVAPORATE

PSYCHROMETRIC CHARTS

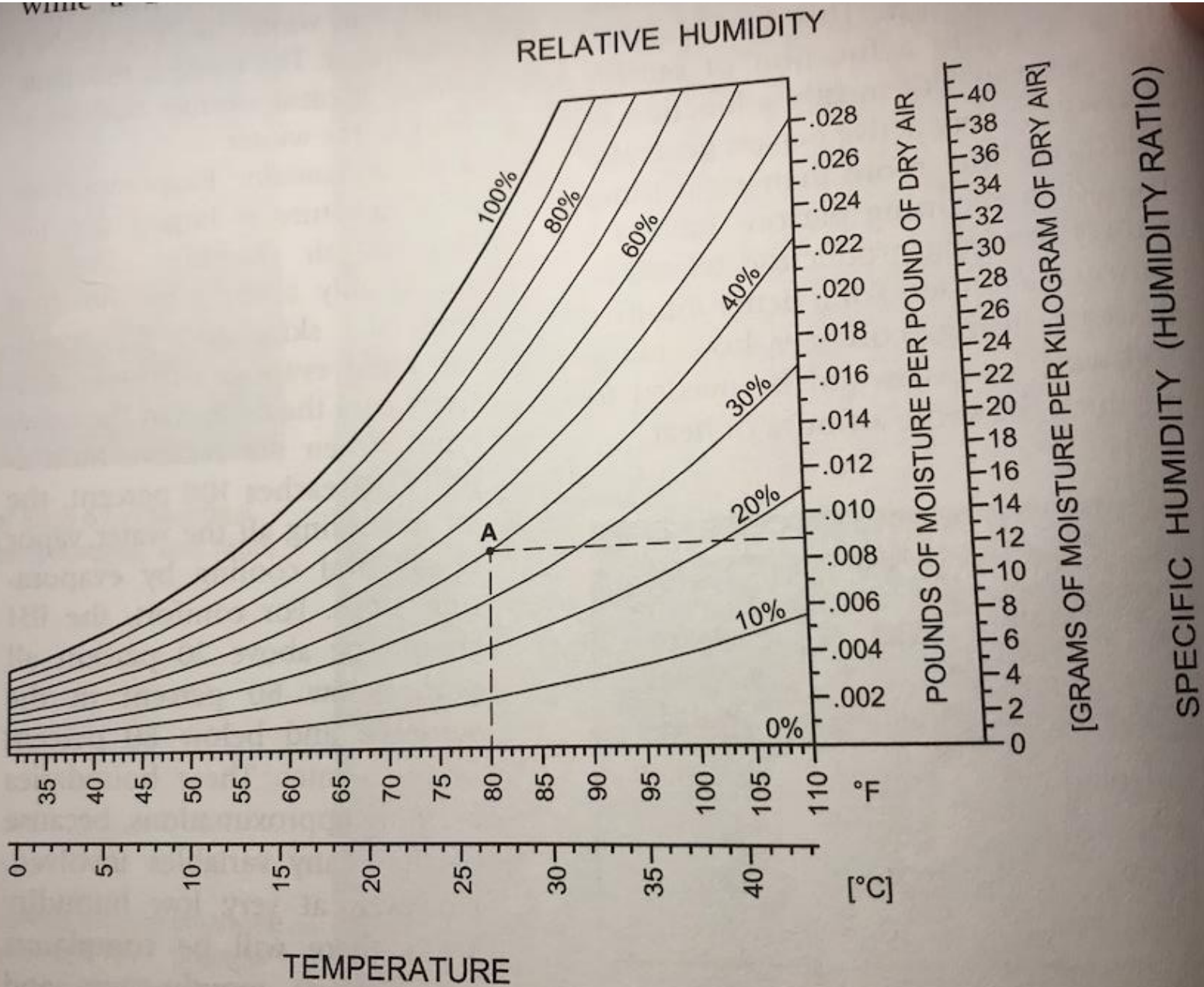


Figure 4.5a Each point on the psychrometric chart represents the properties of a sample of air at a particular temperature and moisture level. At point A, for example, the air sample has a temperature of 80°F (27°C), an RH of 40 percent, and an actual moisture content of about 0.009 lb of water per pound of dry air (12 g of water per kg of dry air).

PSYCHROMETRIC CHARTS

Temperature, Moisture

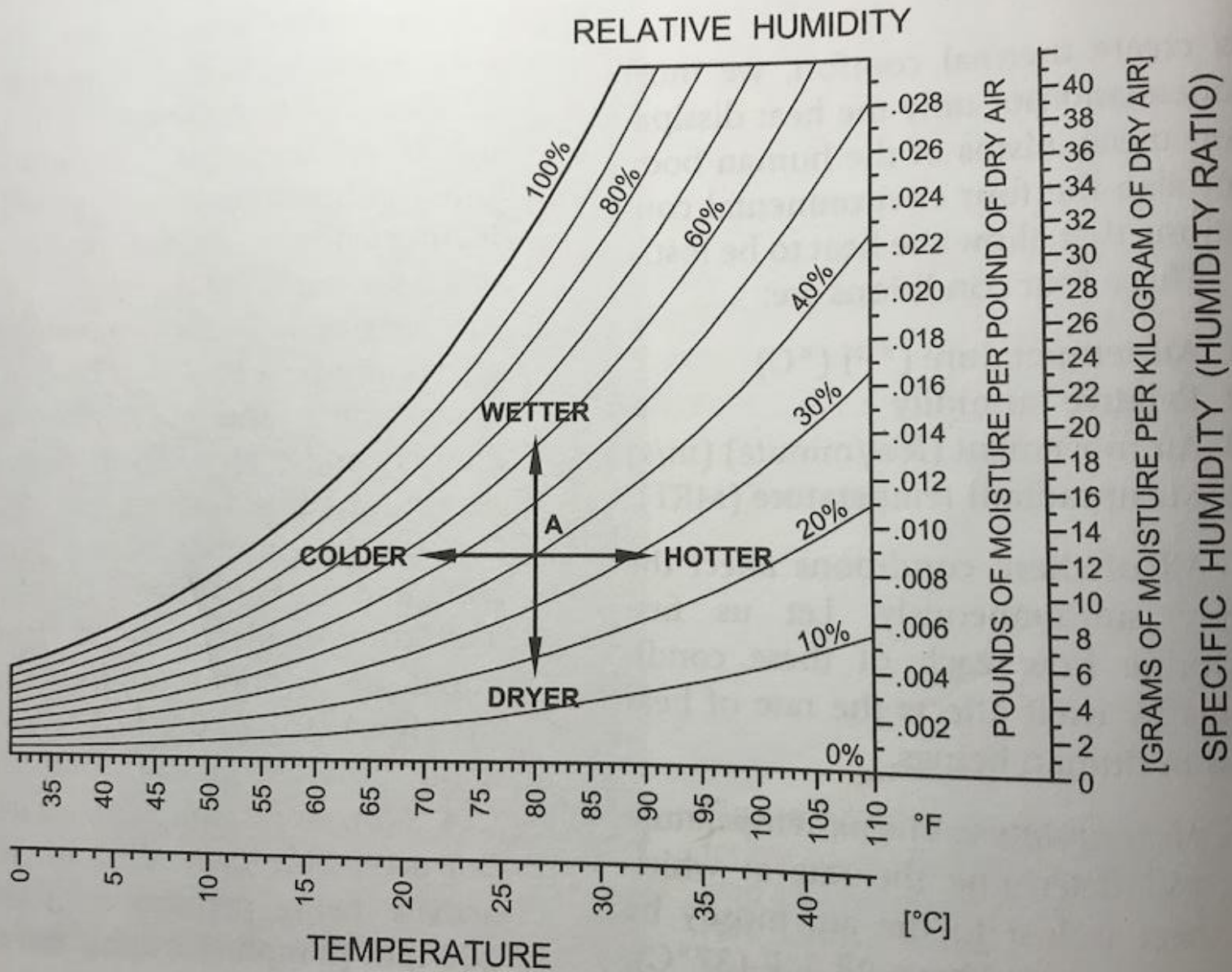


Figure 4.5b Changes in the temperature or moisture of a sample of air are represented by movement on the psychrometric chart.

PSYCHOMETRIC CHARTS

DESIGN: Heating lowers RH w/ no Moisture content change

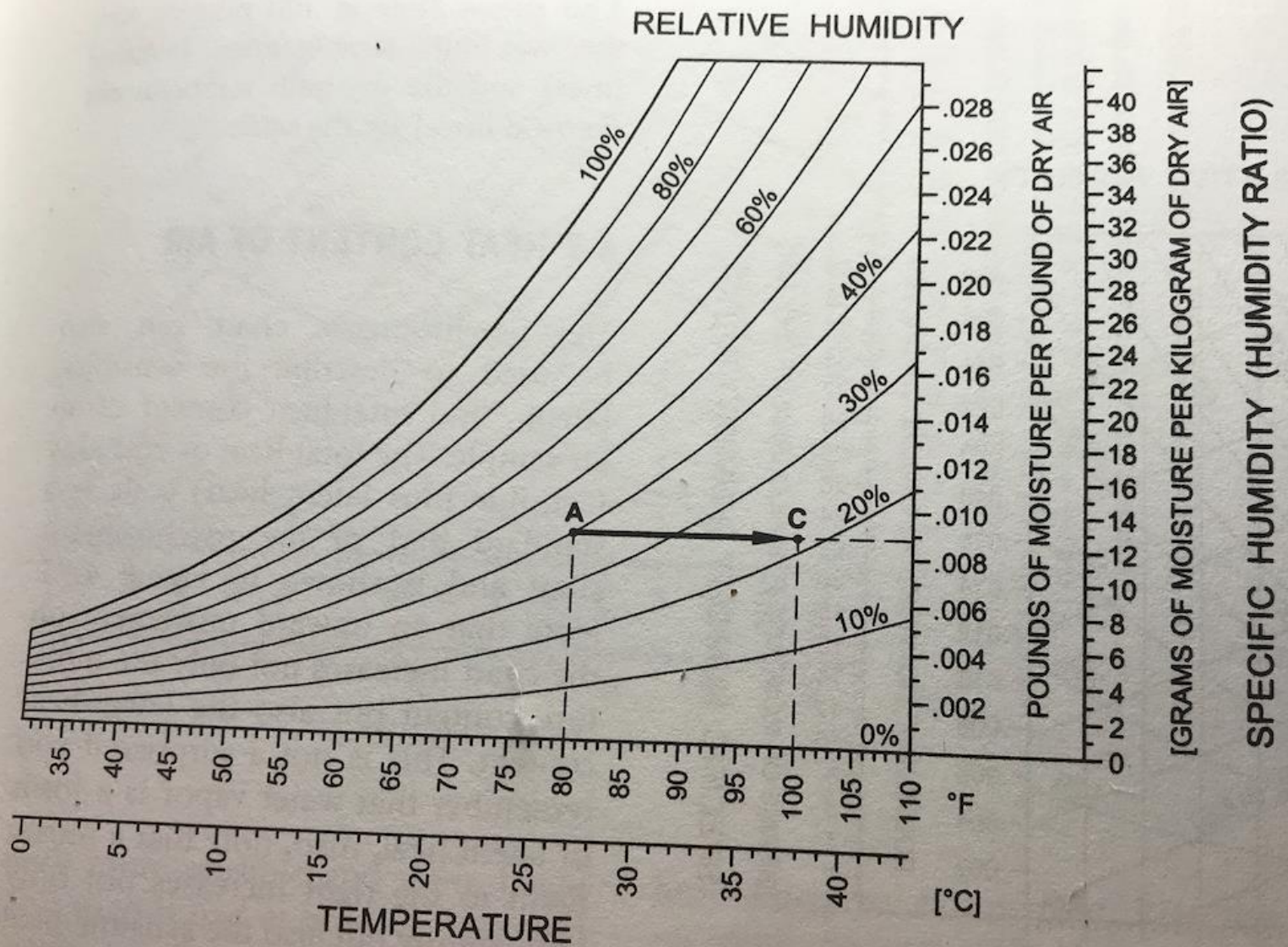


Figure 4.5d If an air sample is heated, its relative humidity will drop even though there was no change in moisture content.

PSYCHOMETRIC CHARTS

DESIGN: Cooling raises RH w/ no Moisture content change

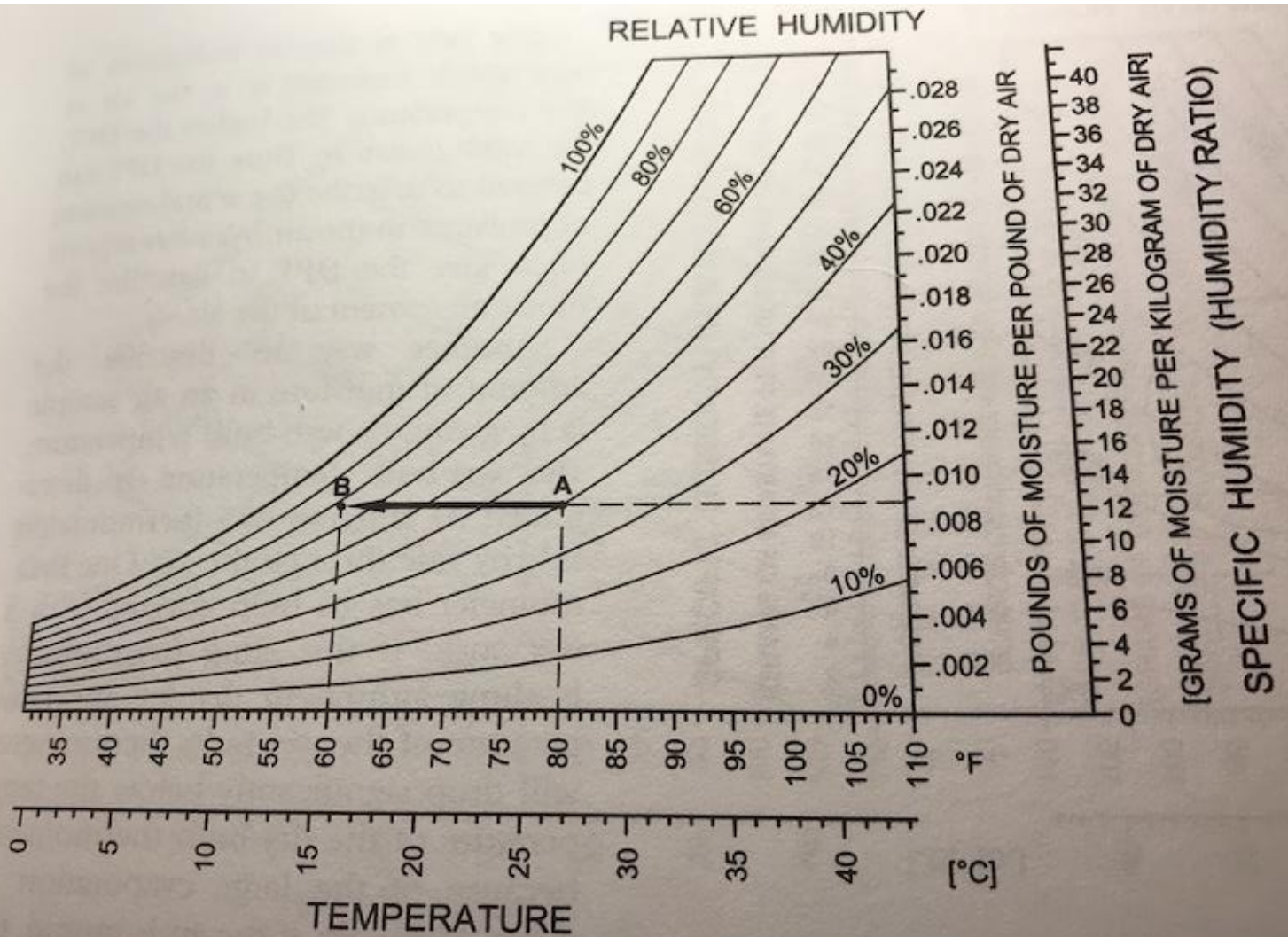
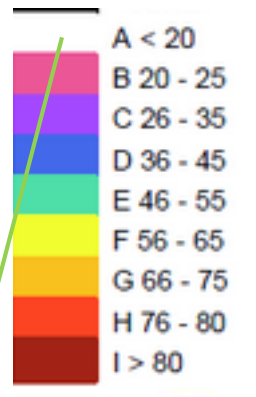


Figure 4.5c If an air sample is cooled, its RH will increase even though there was no change in moisture content.

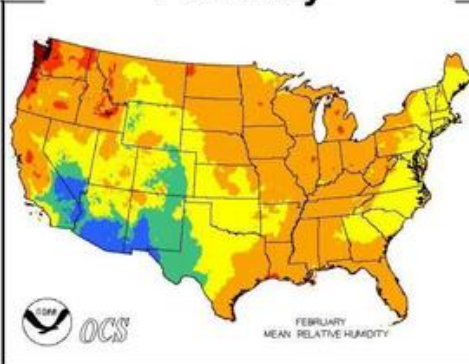
United States Month by Month Mean Relative Humidity



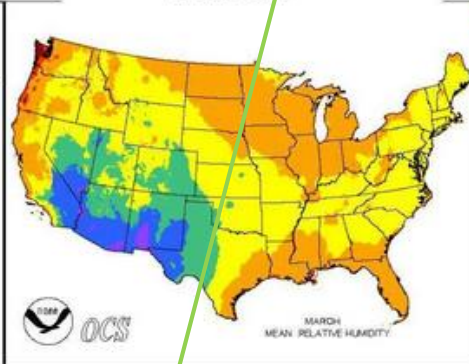
January



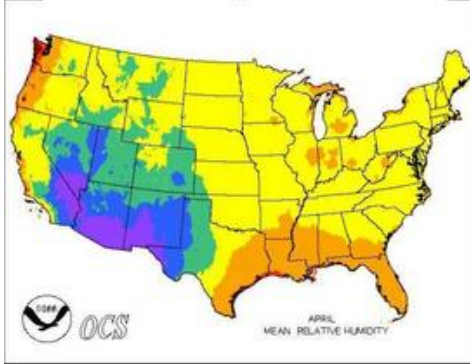
February



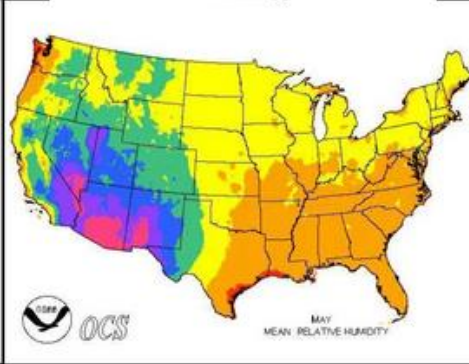
March



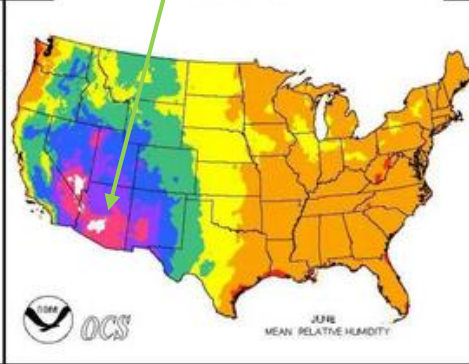
April



May



June



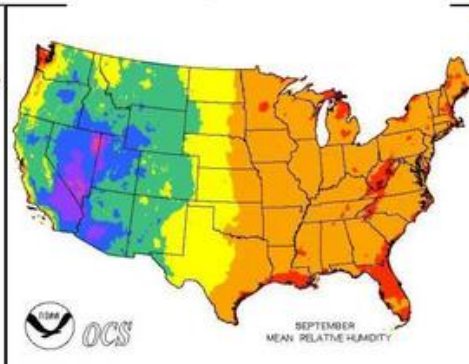
July



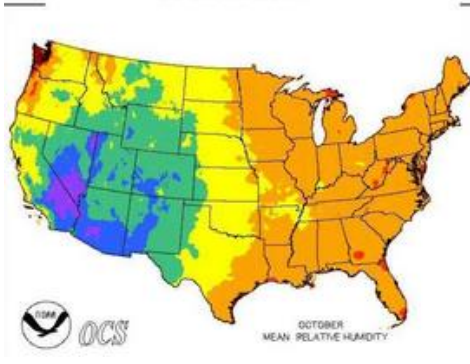
August



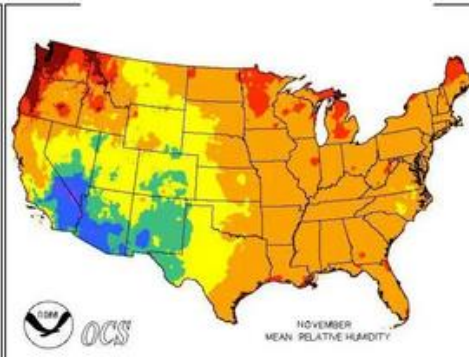
September



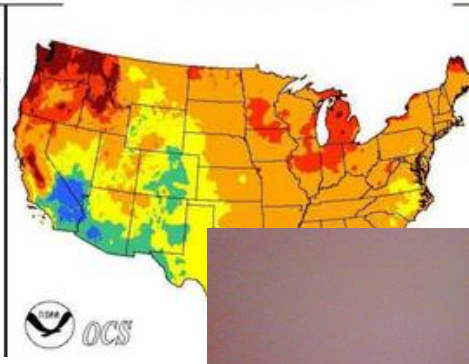
October



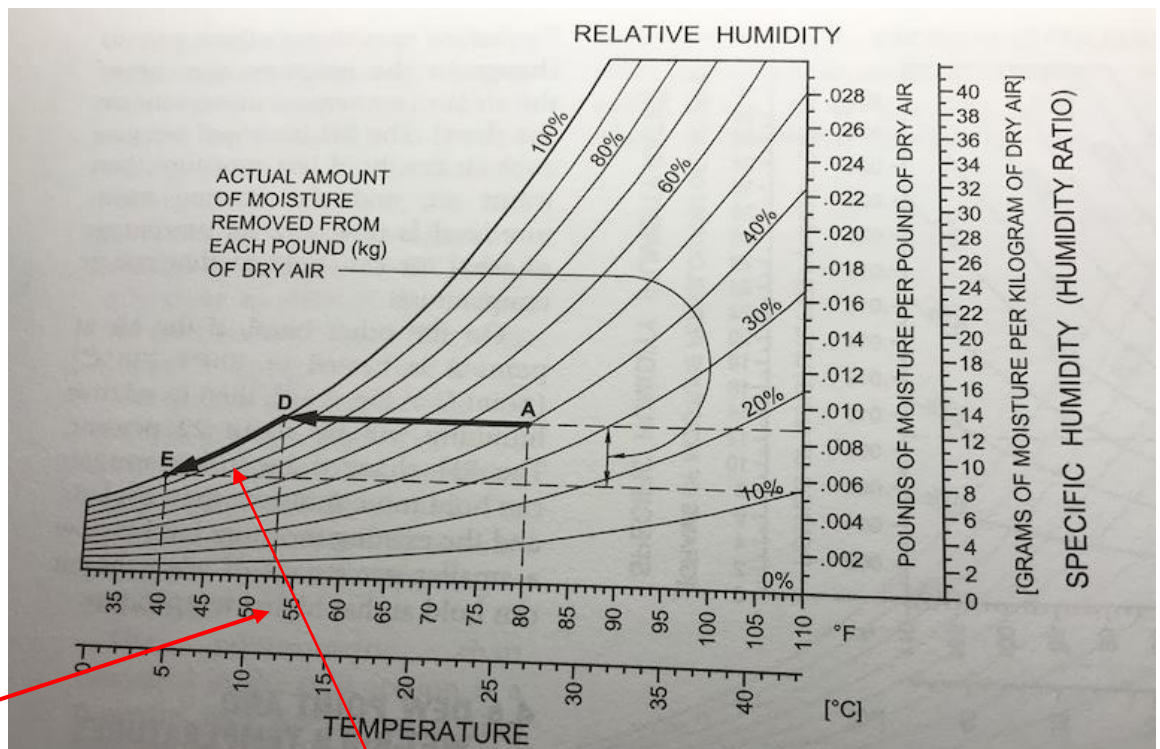
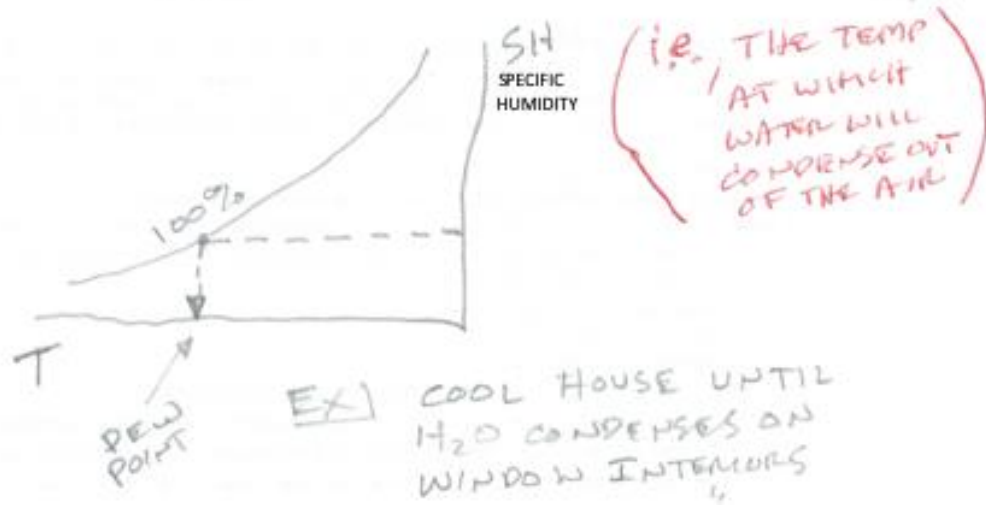
November



December

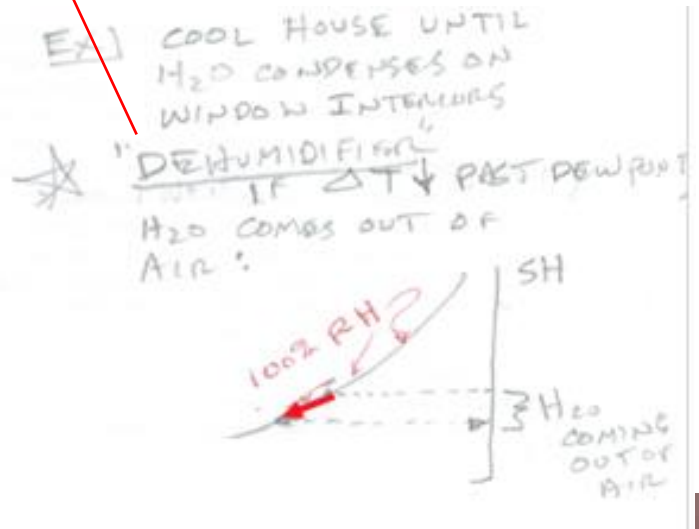


"DEW POINT"
TEMP AT RH=100% FOR A FIXED S.H.



DEW POINT
At 53 degrees Fahrenheit

Figure 4.6a When an air sample is cooled sufficiently, its RH increases until it reaches 100 percent, which is also called the saturation or dew point. Any cooling beyond this point results in moisture condensing out of the air.



WET BULB and DRY BULB Temperature

WATCH: <https://www.youtube.com/watch?v=rb5Zs5IYg9Y>

Measure Relative Humidity



WET BULB TEMP T_{WB} AND "DRY BULB" T_{DB}

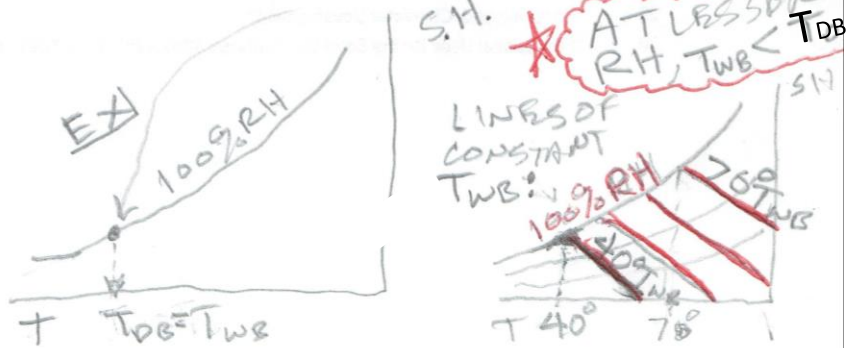
→ SPECIAL TEST USES SLING PSYCHROMETER

→ SPIN IT IN CIRCLE

→ CONTAINS 2 THERMOMETERS

→ ONE COVERED WITH A WET "SOCK" T_{WB} , OTHER OPEN TO AIR

★ @ 100% RH, $T_{WB} = T_{DB}$ BECAUSE AIR IS NOW SATURATED AS WET SOCK



Modern electronic device for measuring Relative Humidity

<https://www.youtube.com/watch?v=s7J6R9wECh8>

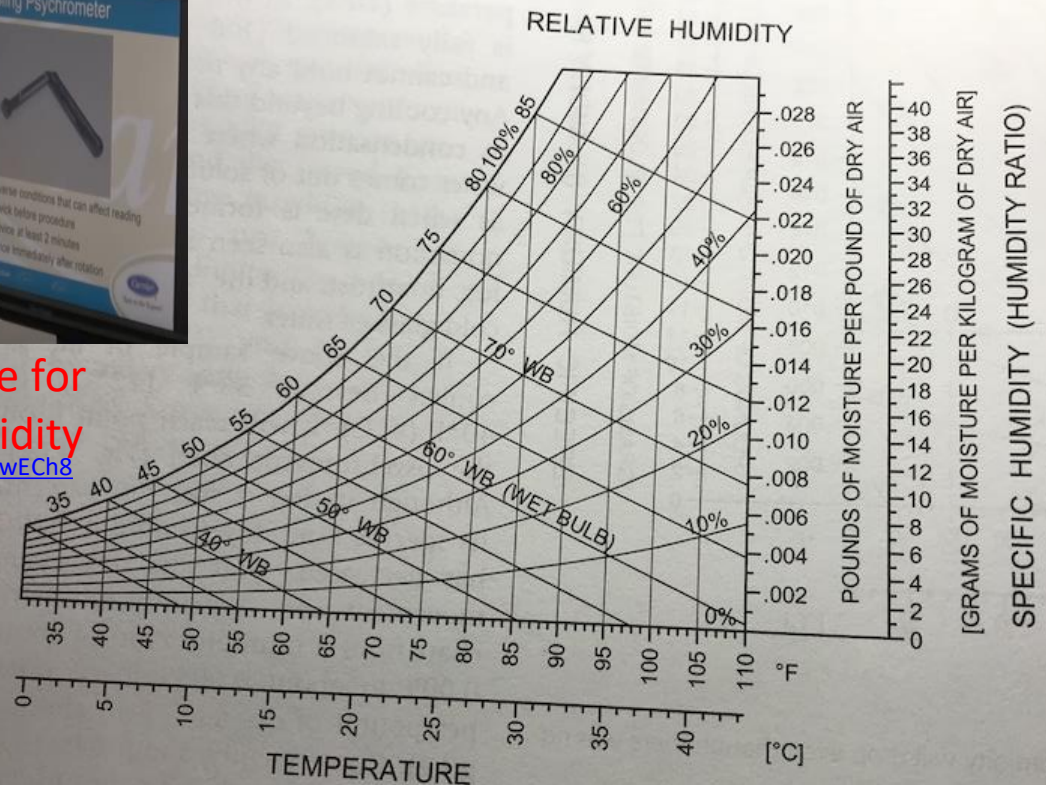


Figure 4.6b The wet-bulb temperature can be measured with a sling psychrometer, and it is an indicator of the RH, the actual moisture content, and the heat content of the air.

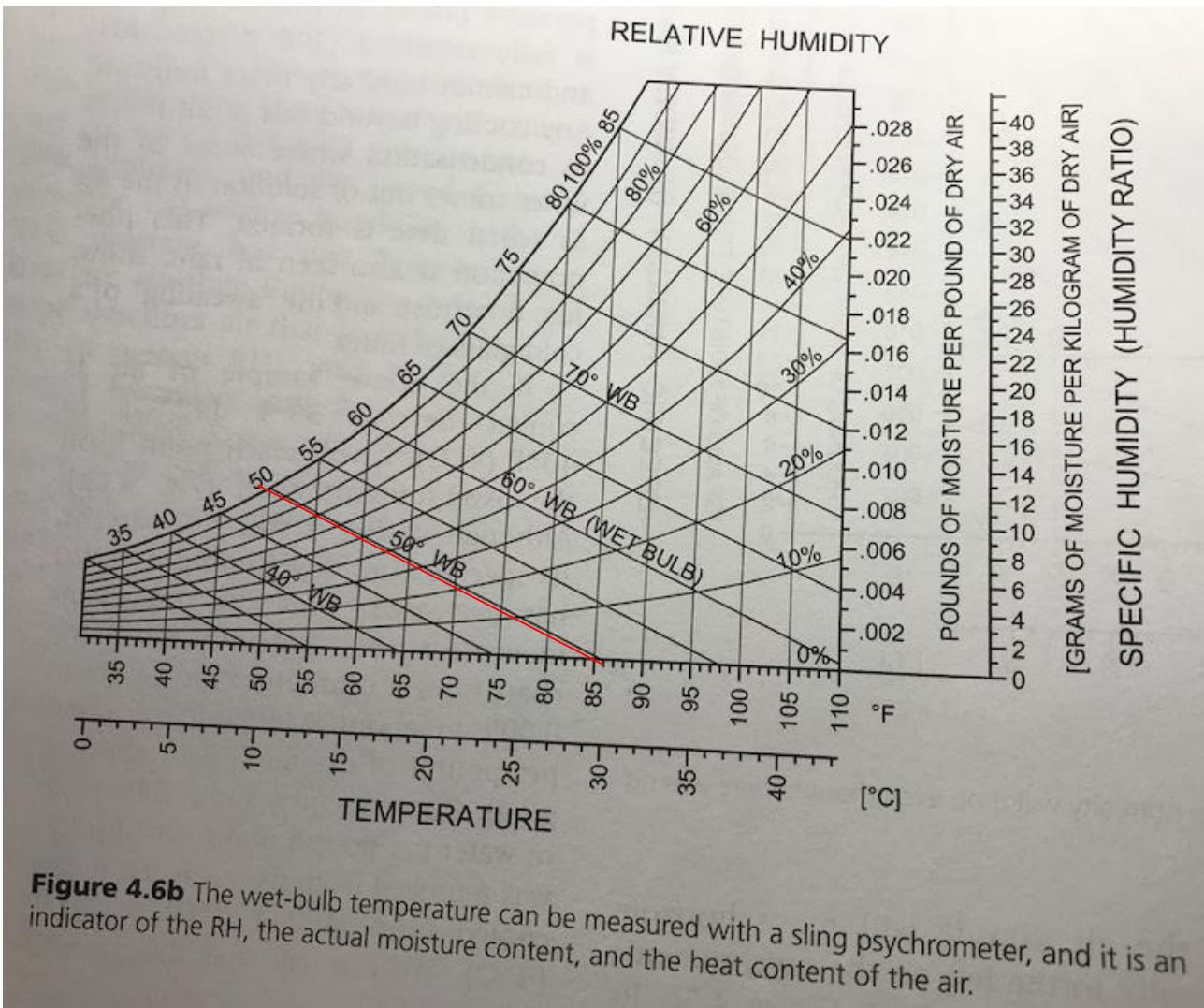


Figure 4.6b The wet-bulb temperature can be measured with a sling psychrometer, and it is an indicator of the RH, the actual moisture content, and the heat content of the air.

~~☆~~ EX | VERY DRY DAY,
 RH = 20%, T_{WB} MEASUREMENT AT 50°F

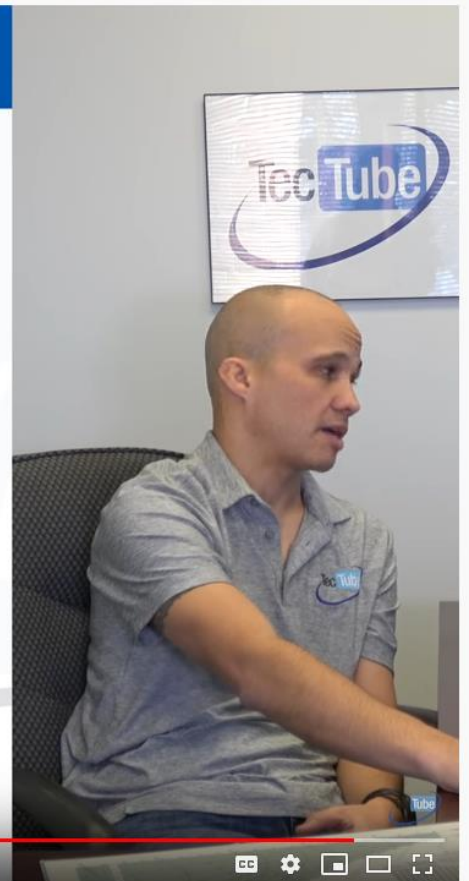
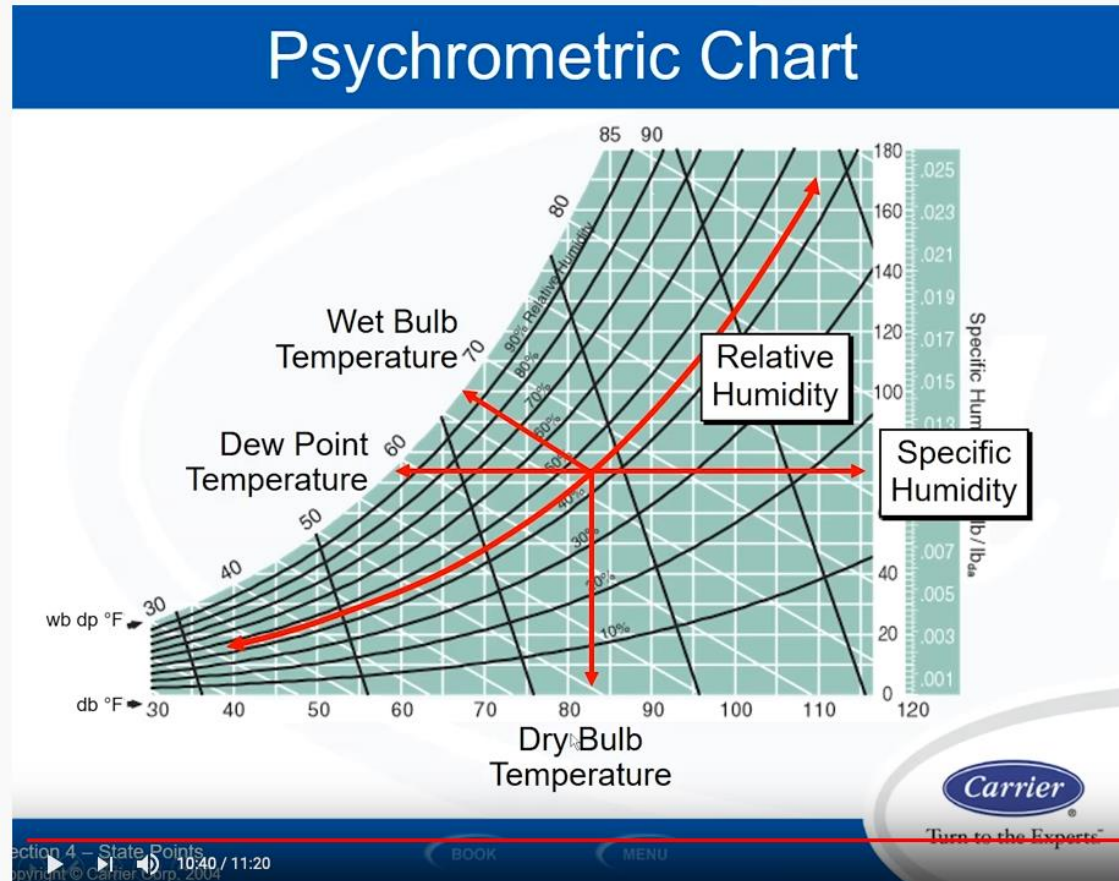
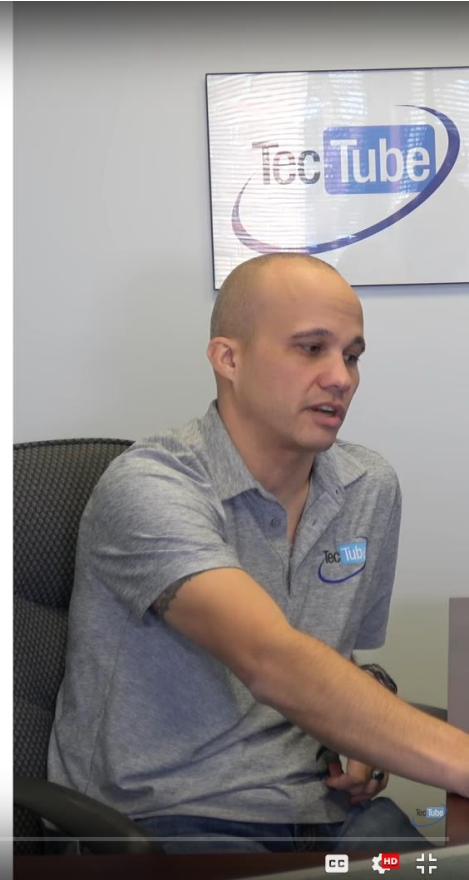
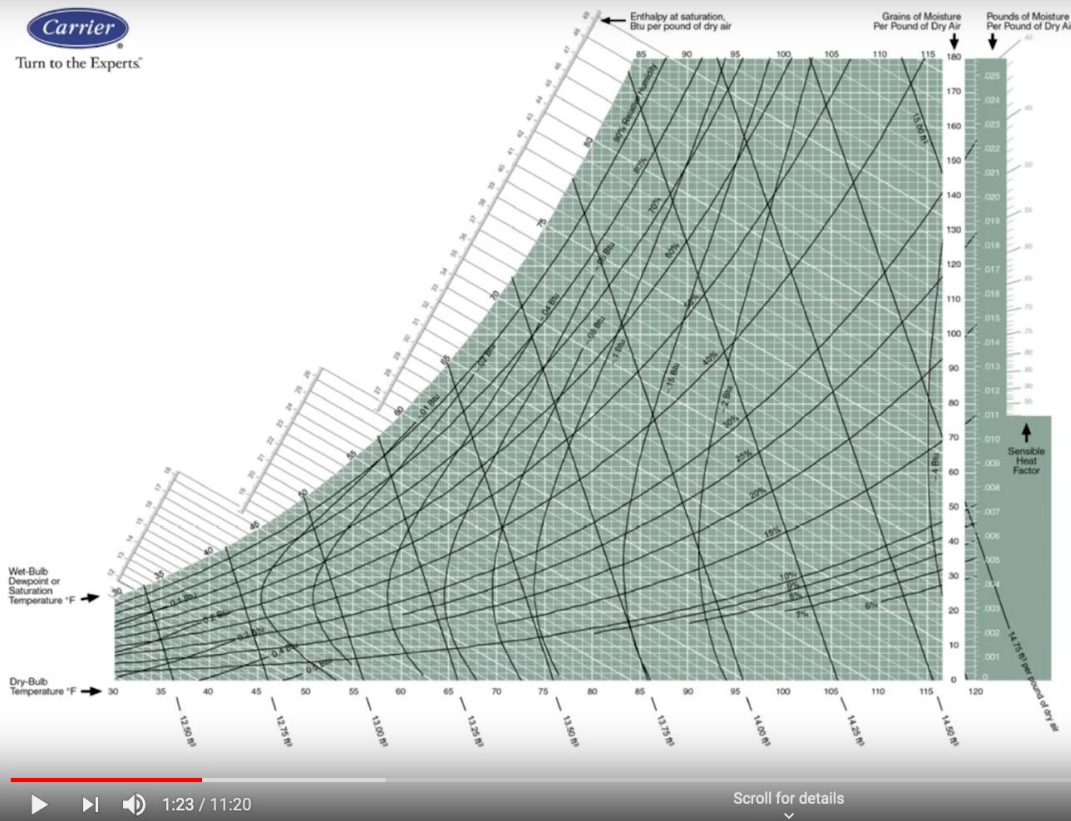
SH → GUESS WHAT T_{DB} SHOULD BE.
 ANSWER

$T_{DB} \gg T_{WB}$ BECAUSE OF LARGE EVAPORATIVE COOLING OF SPINNING THERMOMETER IN WET "SOCK" BUT NOT DRY THERMOMETER WITH LOW THERMAL CONDUCTIVITY DUE TO DRY AIR

WATCH (outside of class time):

<https://www.youtube.com/watch?v=s7J6R9wECh8>

How to Read a Psychrometric Chart



Section 4 - State Points
Copyright © Carrier Corp. 2004

NORTH AURORA

How to Read a Psychrometric Chart

115,071 views • Mar 21, 2018

1.5K 28 SHARE SAVE ...

JT Wunderlich PhD

"HEAT CONTENT OF AIR"

"TOTAL HEAT (ENTHALPY)"

= SENSIBLE HEAT + LATENT HEAT

RECALL "HEAT STORED"
 $= \int (\Delta T)_{AIR}$

RECALL "HEAT NEEDED TO Δ STATE"
 $= \int (\Delta H)_{H_2O}$
 ∴ MOISTURE IN AIR

SO PLOT LINEs OF CONSTANT TOTAL HEAT

ENTHALPY

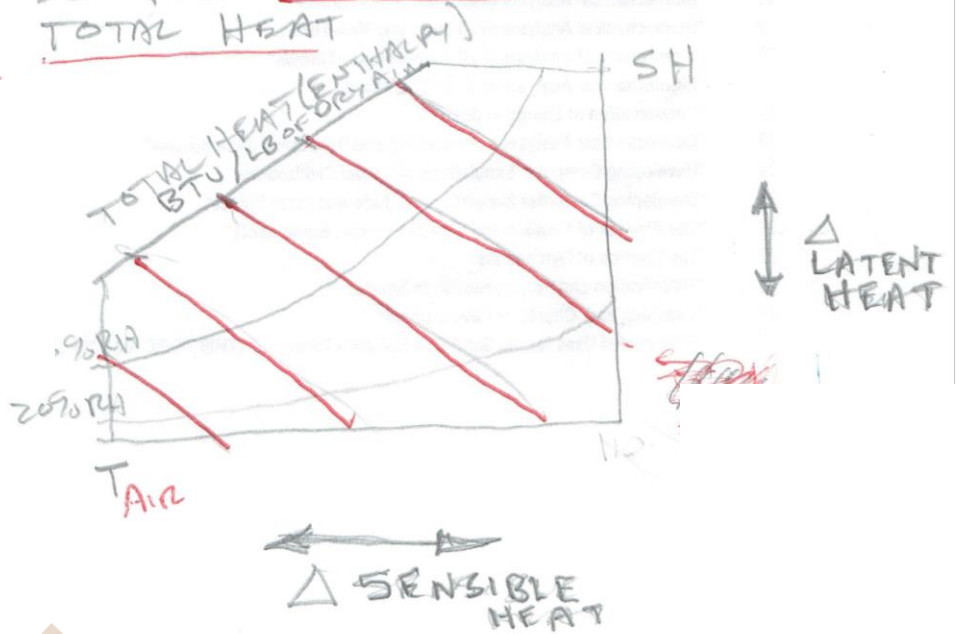
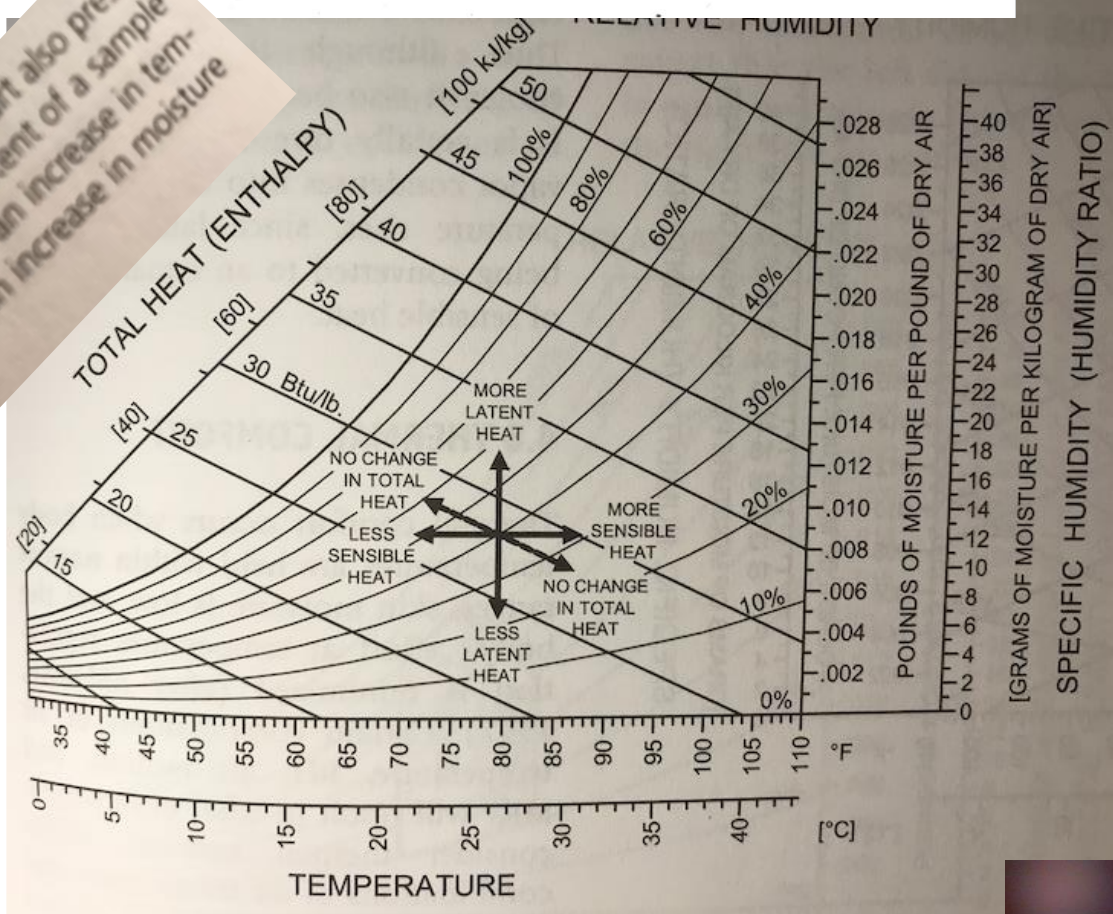


Figure 4.7a The psychrometric chart also presents information on the heat content of a sample of air. Heat is gained by either an increase in temperature (sensible heat) or an increase in moisture (latent heat) or both.



DESIGN: Heat and Humidify Air

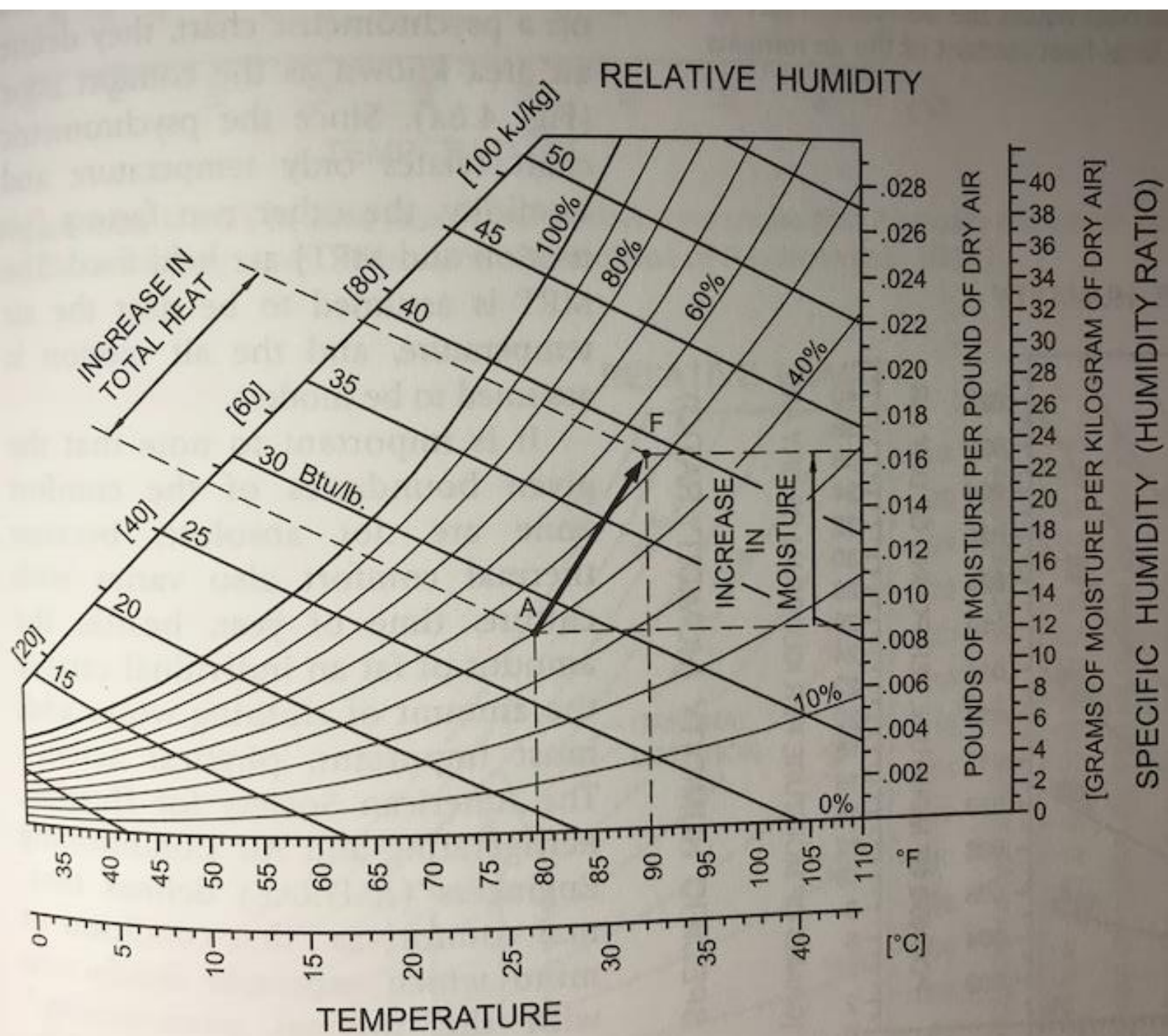


Figure 4.7b Heating and humidifying an air sample increases both its sensible and latent heat. The total-heat gain can be read directly from the enthalpy scale.

DESIGN: Evaporative Cooling

Is **adiabatic** [ad-ee-uh-bat-ik,
i.e., No Enthalpy Change

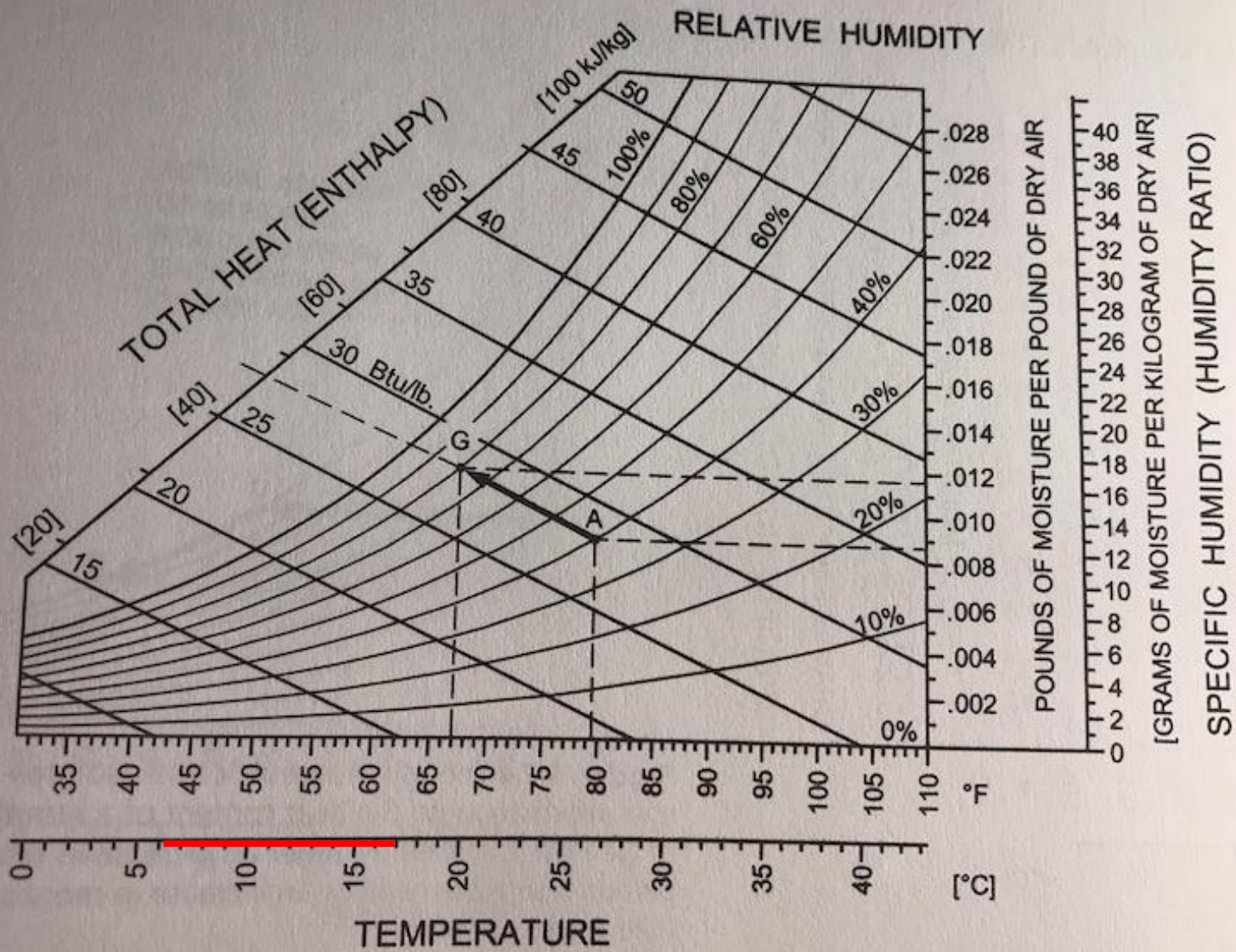
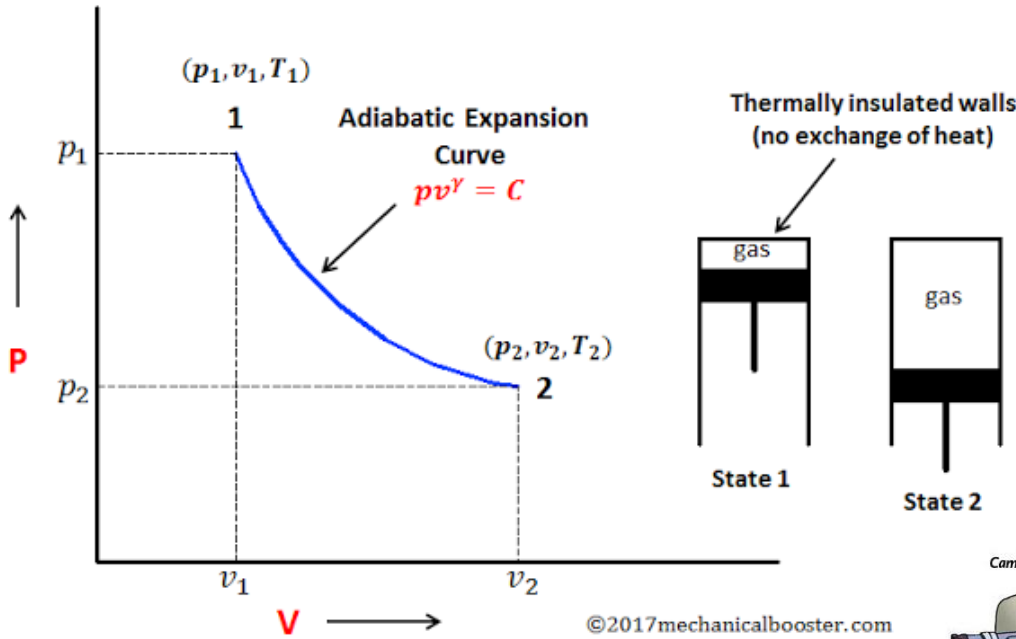


Figure 4.7c In evaporative cooling, the increase in latent heat equals the decrease in sensible heat. An adiabatic change is a change in which the total-heat content of the air remains

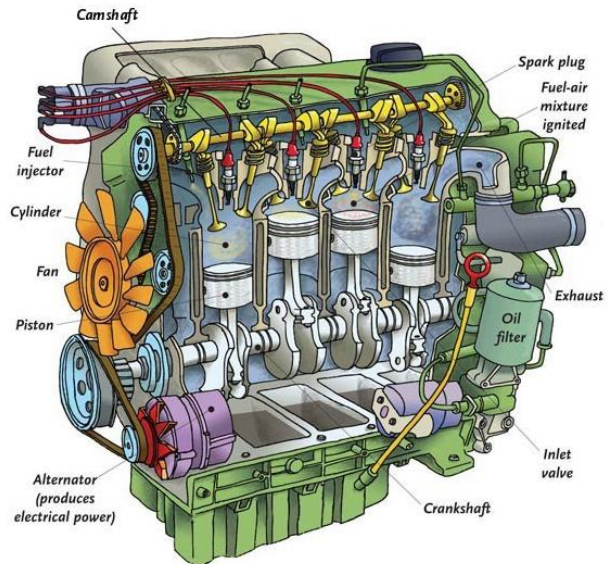
adiabatic [ad-ee-uh-bat-ik, ey-dahy-uh-] [SHOW IPA](#)

adjective

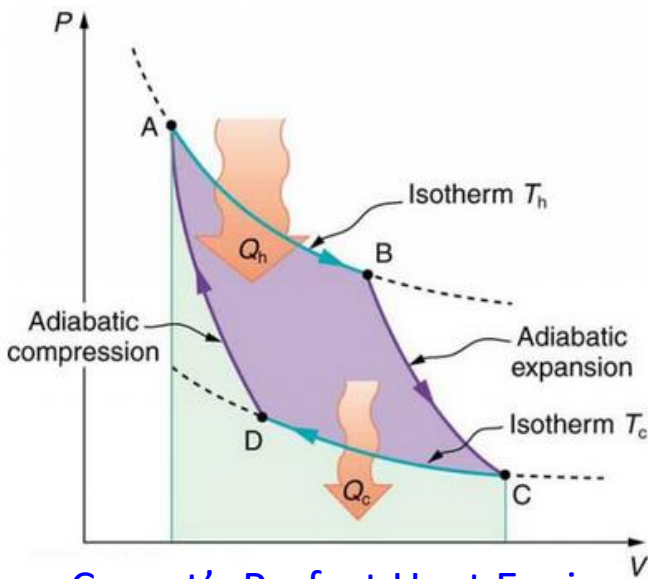
- 1 occurring without gain or loss of heat (opposed to **diabatic**):
an **adiabatic process**.



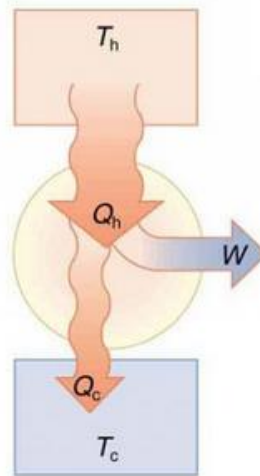
Adiabatic Process



<https://www.q-files.com/technology/road-transport/internal-combustion-engine>



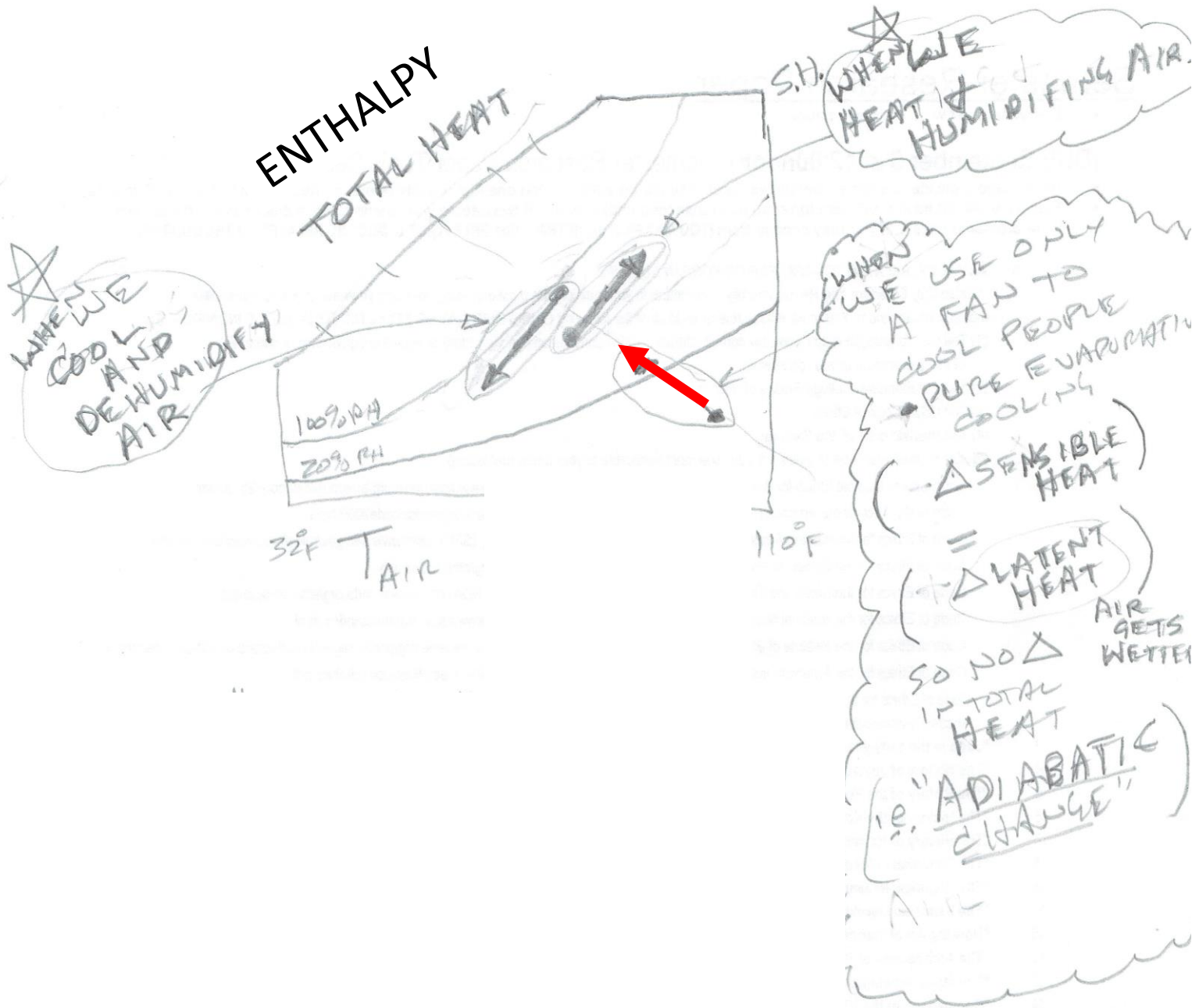
Carnot's Perfect Heat Engine



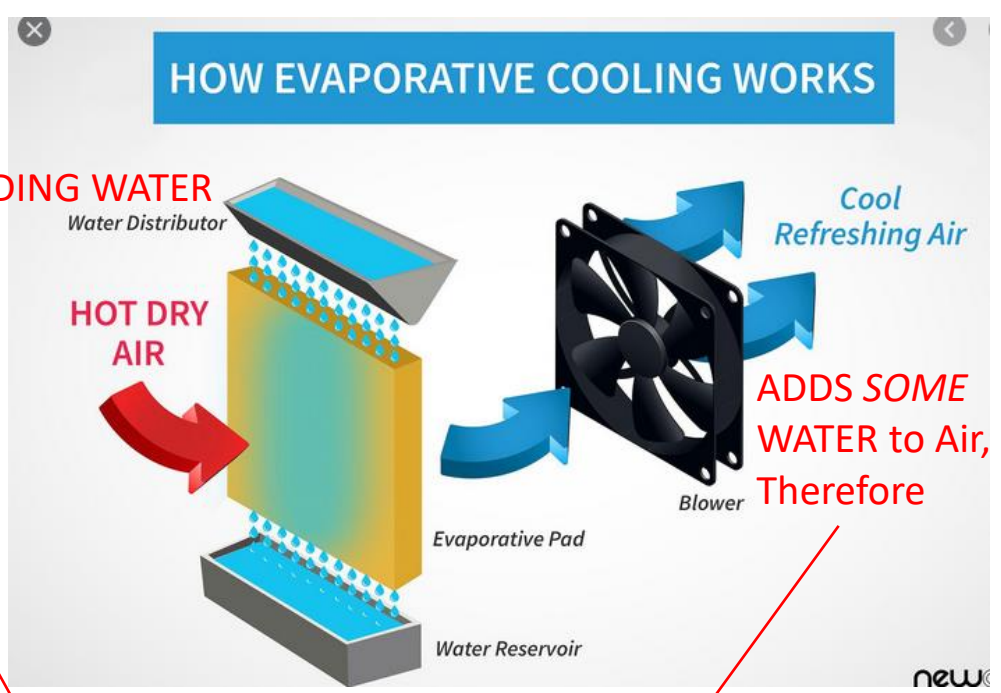
“WORK” e.g., the Mechanical “Work” of a combustion engine

adiabatic

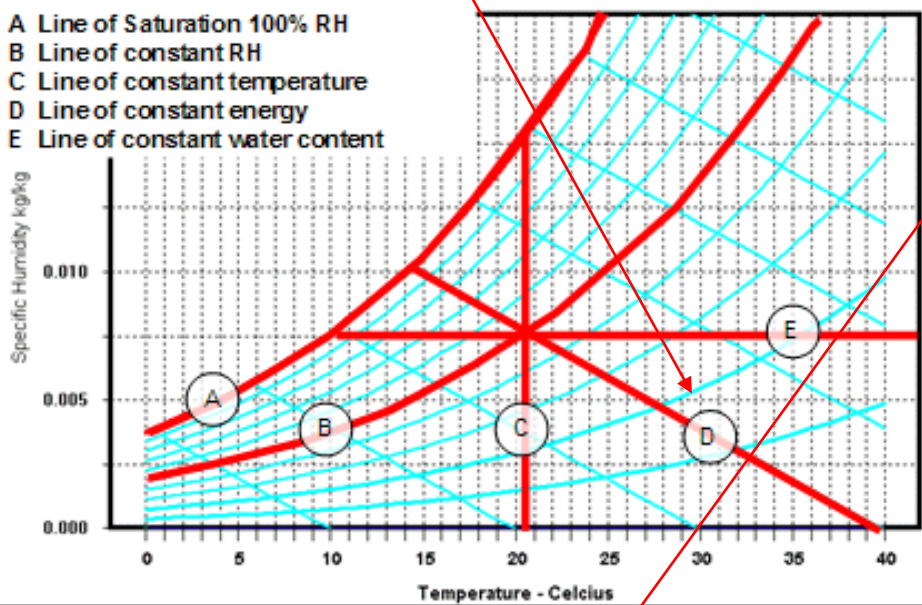
Adiabatic COOLING of PEOPLE Using only a FAN



EVAPORATIVE COOLERS (Adiabatic)

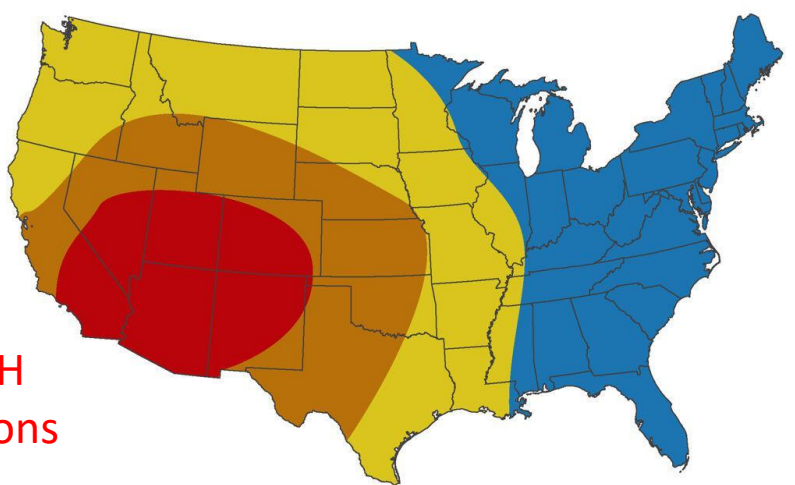


Evaporative Cooling - Psychrometric Chart



NOTE: This is the line of Constant Water Content

Choosing the Right Honeywell Evaporative Air Cooler for your Area



Most suitable for LOW RH (Relative Humidity) Regions

Average Relative Humidity*

- Humidity <20 ~ 25%
- Humidity 26 ~ 45%

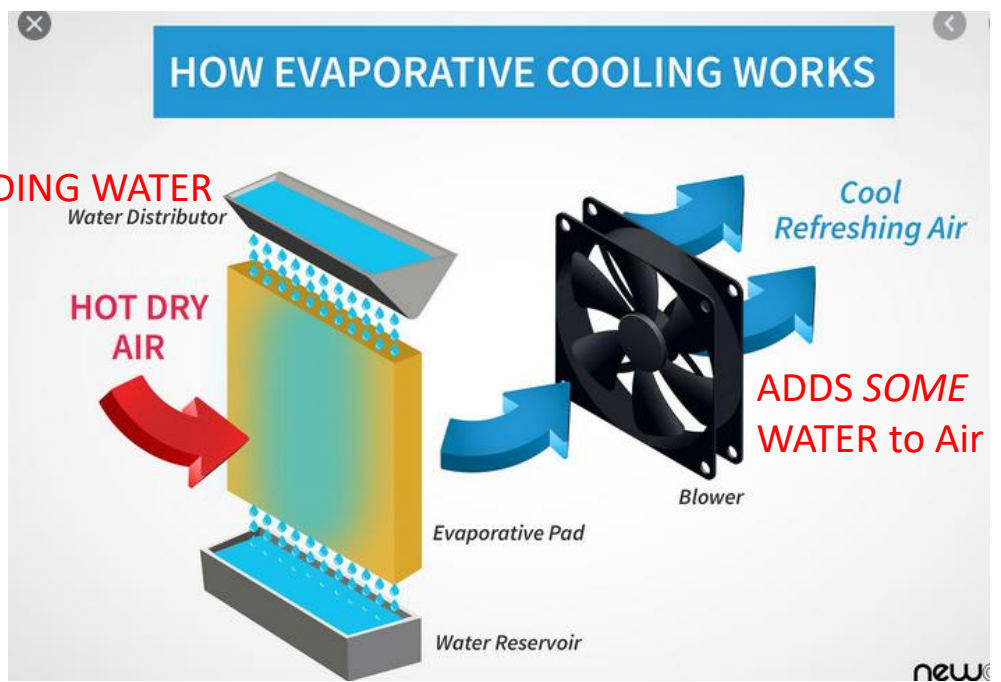
- Humidity 46 ~ 65%
- Humidity 66 ~>80%

Suitable for Honeywell Indoor & Outdoor Air Coolers

Suitable for Honeywell Outdoor Air Coolers & Portable Air Conditioners*

EVAPORATIVE COOLERS (Adiabatic)

Adiabatic COOLING of PEOPLE Using only a FAN and WATER VAPOR



<https://theozonhole.com/the-best-portable-swamp-coolers-for-home.htm>

<https://www.ecocooling.co.uk/what-is-evaporative-cooling/>



Call Us : 01284 810586



HOME PRODUCTS APPLICATIONS INSTALLATION EXAMPLES SAFETY & ENERGY SAVINGS RESOURCES CONTACT



Home > What is evaporative cooling?

What is evaporative cooling?

Evaporative cooling or adiabatic cooling is a natural, cost-effective and environmentally friendly alternative to traditional air conditioning. Cooling through evaporation is a completely natural occurrence which happens in everyday life, an example of this would be sweating.

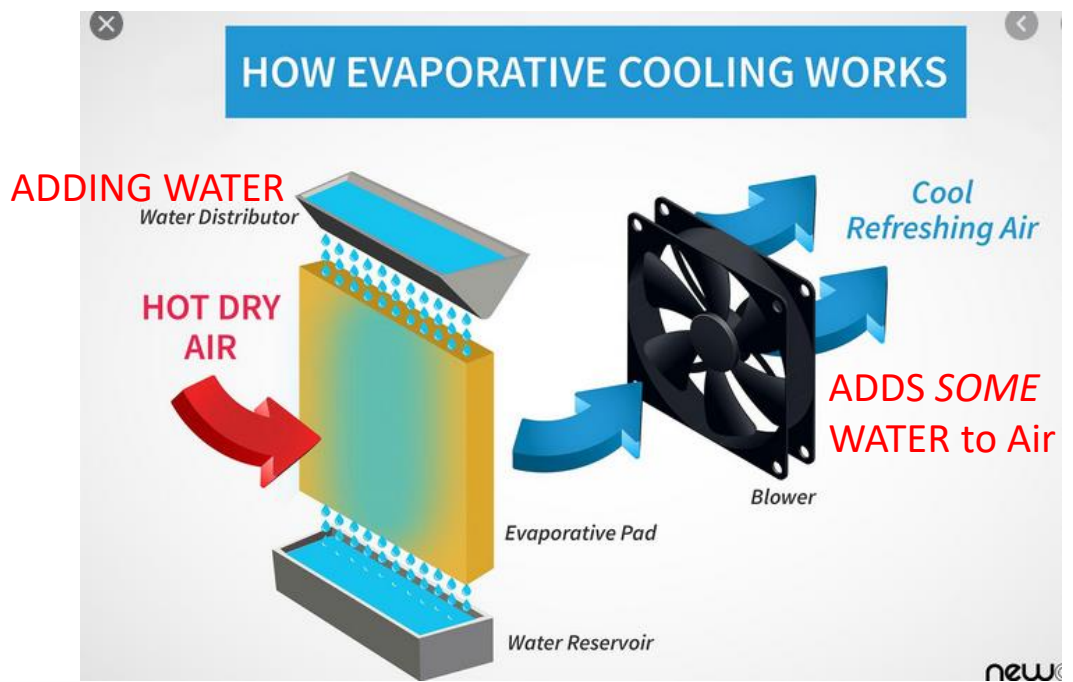
Industrial evaporative air coolers from EcoCooling build on this natural occurrence by installing **EcoCoolers** into ventilation systems to naturally cool the air. Fans draw the ambient outdoor air through saturated cooler pads to produce the evaporative cooling effect. The fresh, cool air is then delivered into the desired environment. As warm air rises and becomes cold it is removed through an extractor fan on the roof.

The evaporative cooling system is a very popular alternative to traditional refrigeration air conditioning for many reasons. The main one being that is incredibly cost effective and in comparison, it could save you over 90% in cooling costs and uses just 10% of the energy. See our [savings and performance](#) page for more detail.

Download our sales brochure

DOWNLOAD

EVAPORATIVE COOLERS (Adiabatic)



<https://theozonhole.com/the-best-portable-swamp-coolers-for-home.htm>

Advantages of Using Direct Evaporative Cooling

- No refrigerants, completely natural cooling process which uses only fresh air.
- Low running and maintenance costs
- Low carbon and energy use
- Exploits the maximum amount of free cooling available
- Low energy use even at partial population
- No use of recycled air

GOOD
FOR
COVID

WATCH: <https://www.youtube.com/user/ecocooling>



COMPUTER DATA CENTER

"THERMAL COMFORT" ★

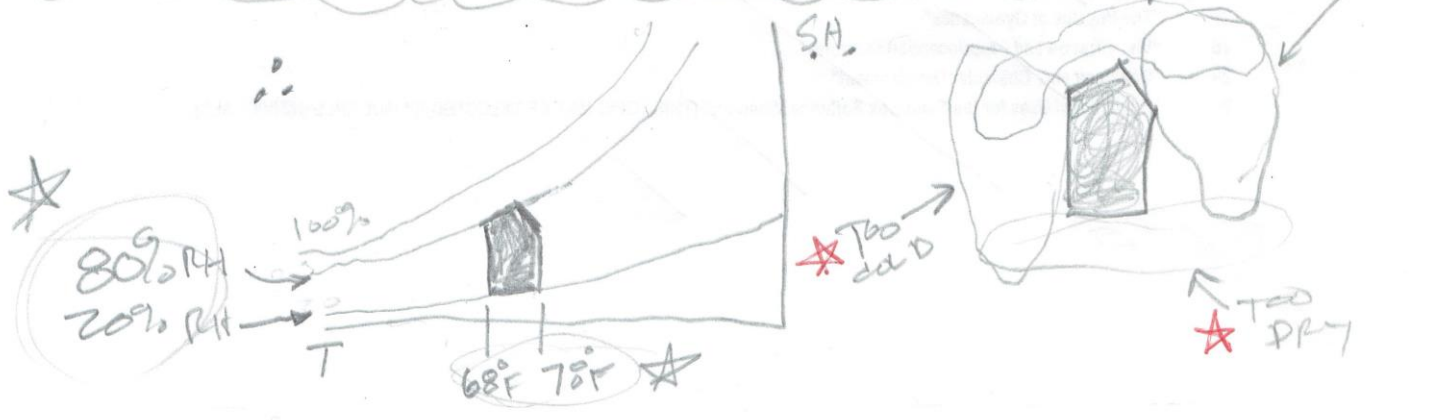
MEAN RADIANT TEMP (COLD)

- INITIALLY
- ASSUME AIR MOTION MINIMAL
- " " MRT CONSTANT
- " " FOR LOW MINIMAL VARIATIONS:

- 1 CULTURE
- 2 FAT ON PEOPLE
- 3 CLOTHES
- 4 PHYSICAL ACTIVITY
- 5 AGE / OVERALL HEALTH
- 6 ADAPTATION TO SEASONS

★★ IF PEOPLE LIKE COMFORTABLE:

- 1 PEOPLE WASTE MORE ENERGY
- 2 ARCHITECTURE MAY FAIL!



The “Comfort Zone” And Discomfort outside that zone

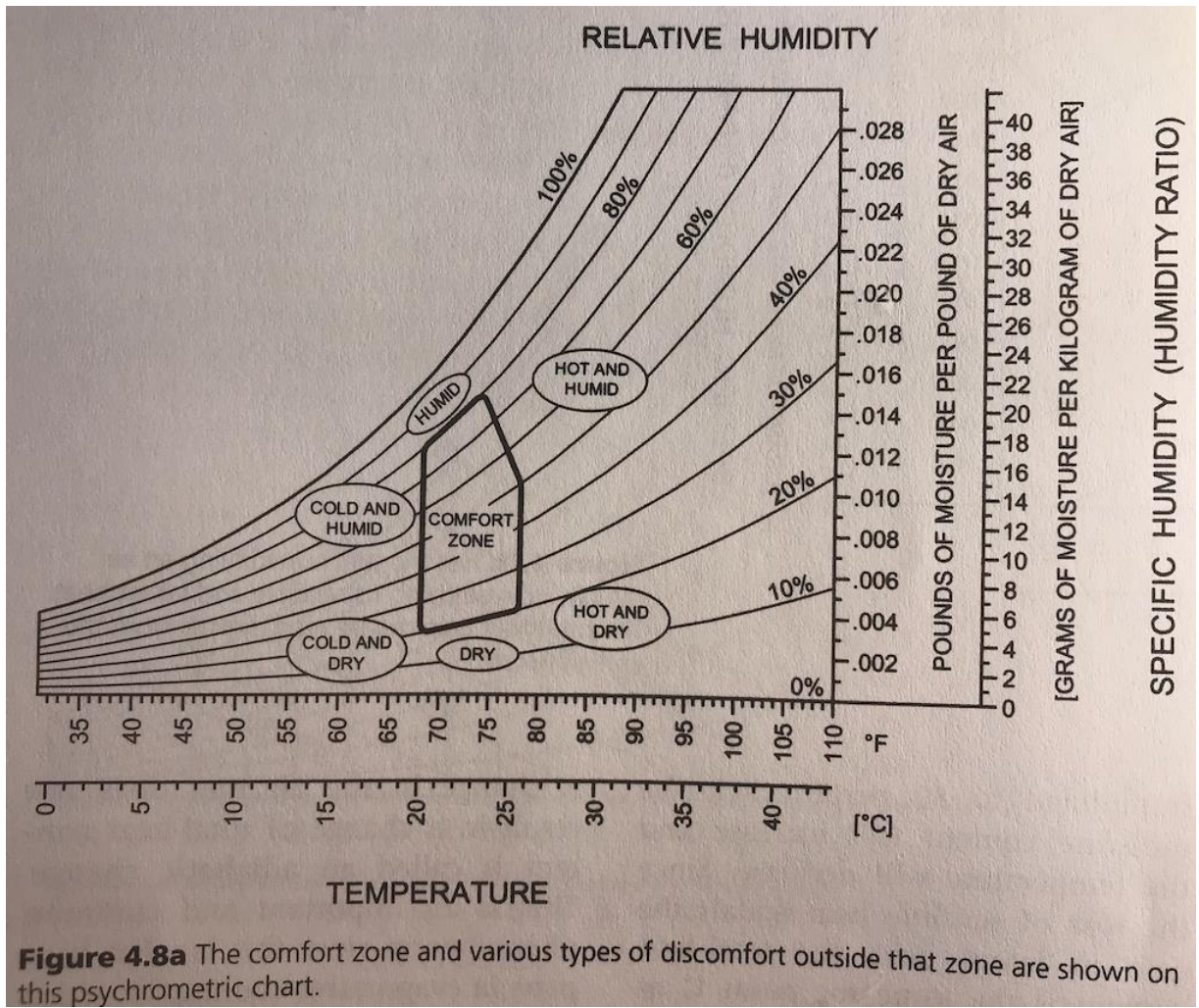


Figure 4.8a The comfort zone and various types of discomfort outside that zone are shown on this psychrometric chart.

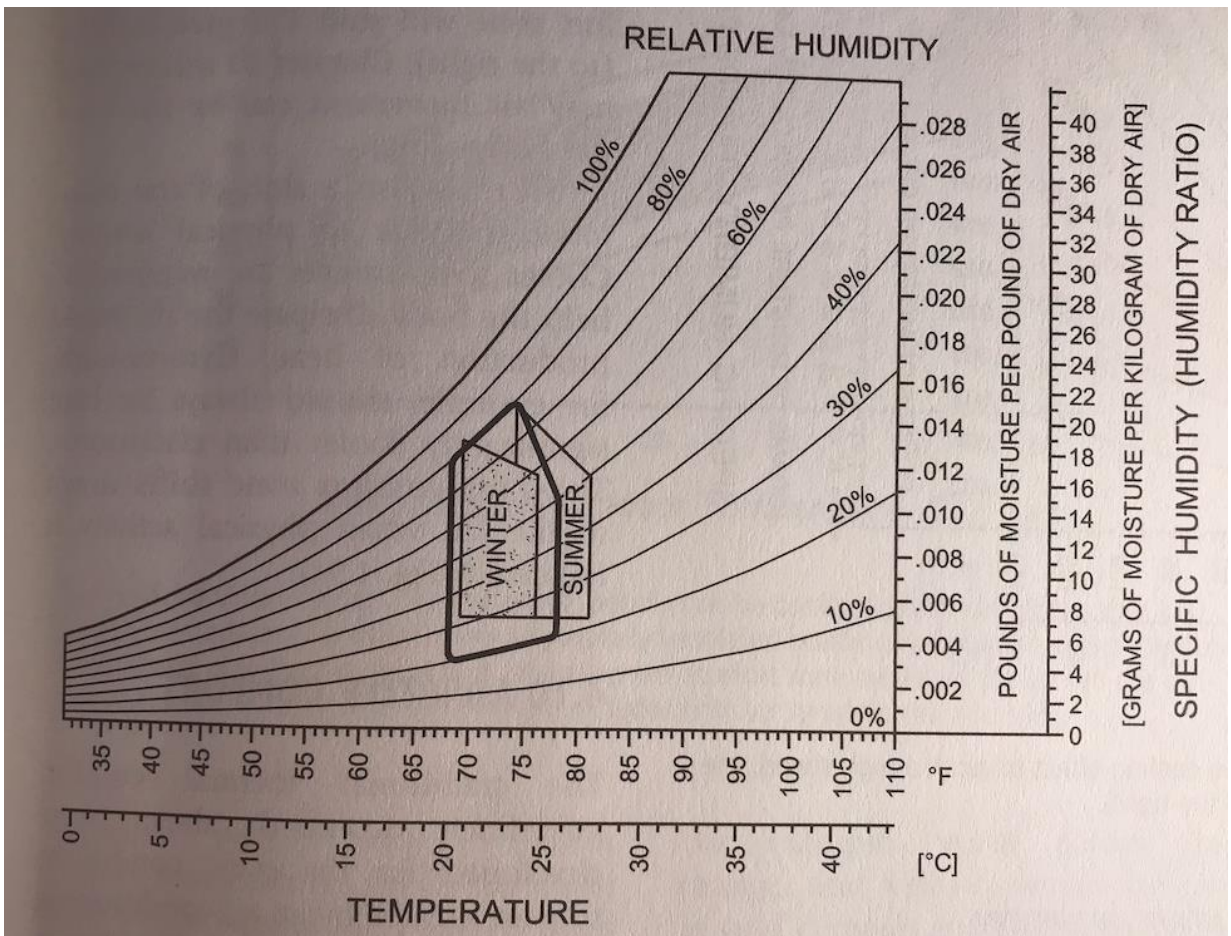


Figure 4.8b A more detailed look at the comfort zone shows that it actually consists of two slightly overlapping zones. (After ASHRAE Handbook of Fundamentals, 1997.)

"SHIFTING OF COMFORT ZONE"

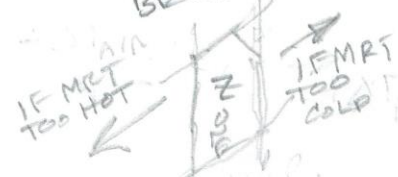
NOW ADDRESS ASSUMPTIONS IN

DESIGN RULES!

★ A FOR EVERY



$\pm 3^{\circ}\text{F} \Rightarrow$ ADJUST AIR TEMP IN OPPOSITE DIRECTION
BECAUSE ZONE SHIFTS



i.e., COMPENSATING FOR OVERLY INTENSE SOURCES OF HOT OR COLD, LIKE:
 → BIG WINDOWS
 → FIRE PLACES

★★ CAN MITIGATE WITH
 → THERMAL DRAPES ON WINDOWS
 → GLASS SCREEN ON FIRE PLACE

★

★ B FOR EVERY

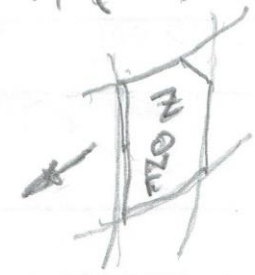


+ 15 ^{FEET PER MINUTE} fpm, COMFORT DROPS 1°F

★★ SO ADJUST AIR TEMP UP 1°F

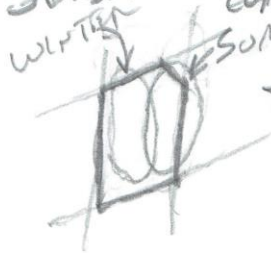
★

★ C FOR INCREASE IN PHYSICAL ACTIVITY (GYM ETC.), MORE COMFORT IF $T_{\text{AIR}} \downarrow$ ★★ MORE



★

★ D SEASONAL VARIATIONS
 COMFORT ZONE = \int (SUMMER ZONE, WINTER ZONE)



★★ SO, GET VERY LOCATION SPECIFIC TO COMPENSATE ... "BIOClimATIC CHARTS" CH.5

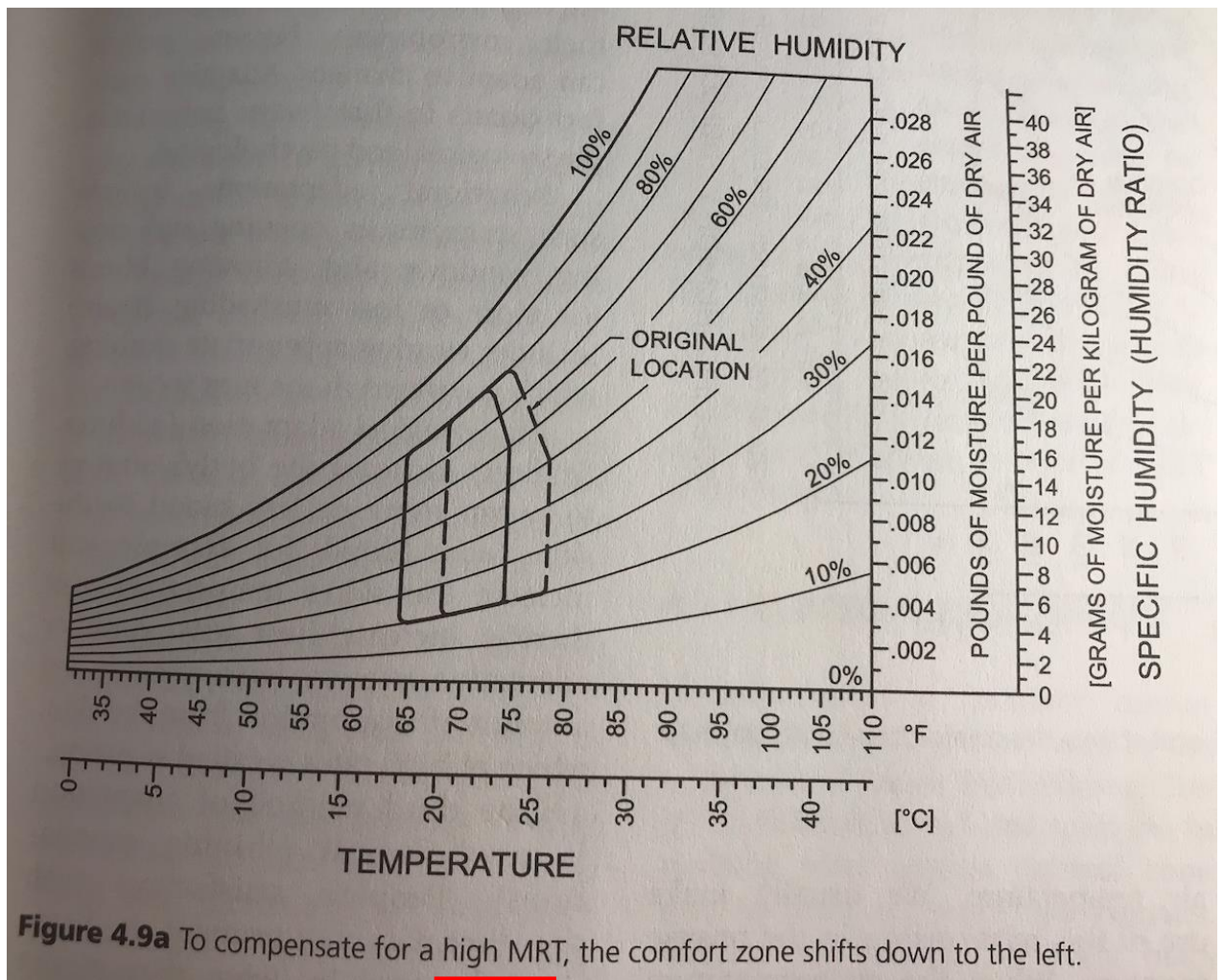


Figure 4.9a To compensate for a high MRT, the comfort zone shifts down to the left.

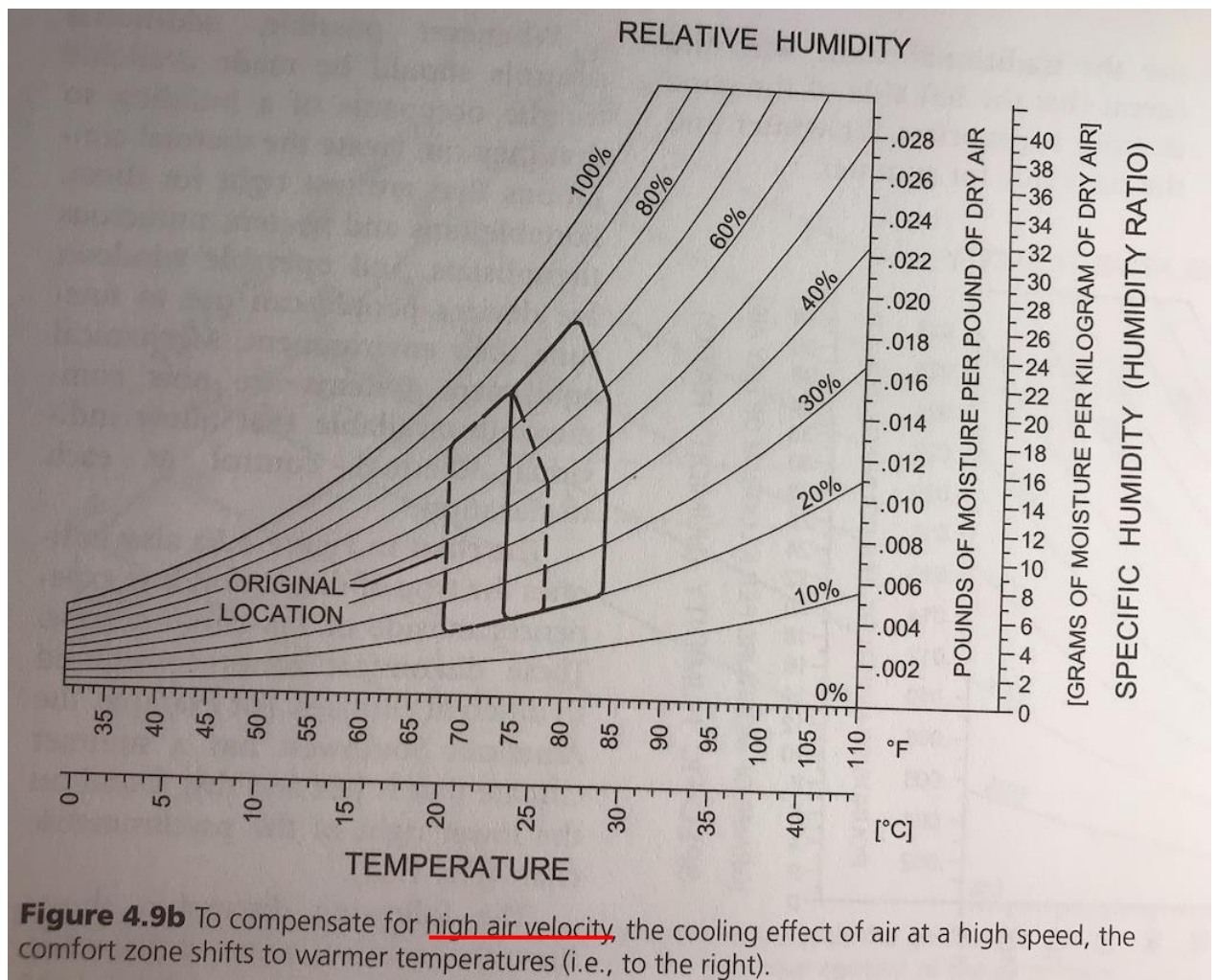
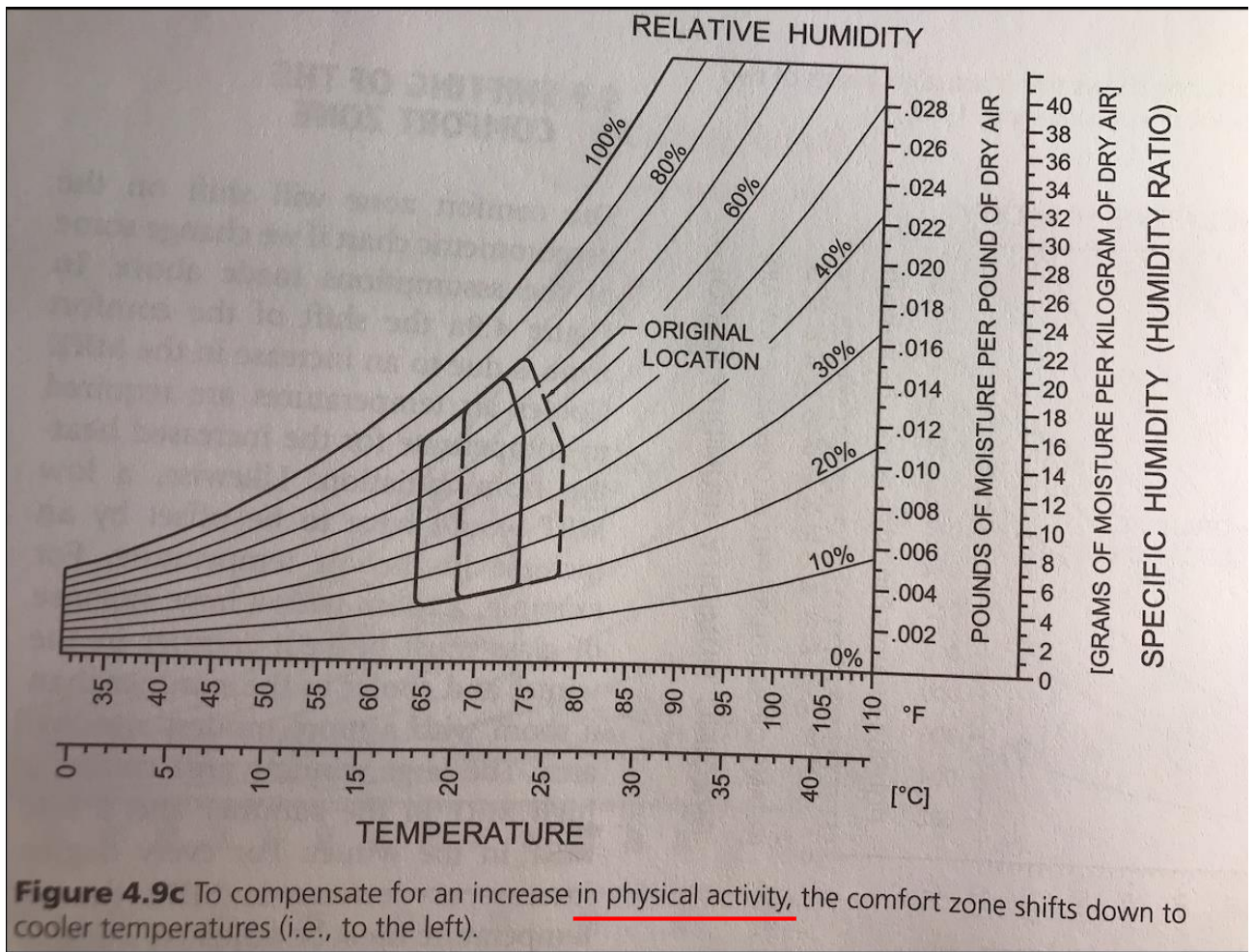


Figure 4.9b To compensate for high air velocity, the cooling effect of air at a high speed, the comfort zone shifts to warmer temperatures (i.e., to the right).



For **PASSIVE HVAC**
and to **MITIGATE COVID**

ADAPTIVE COMFORT

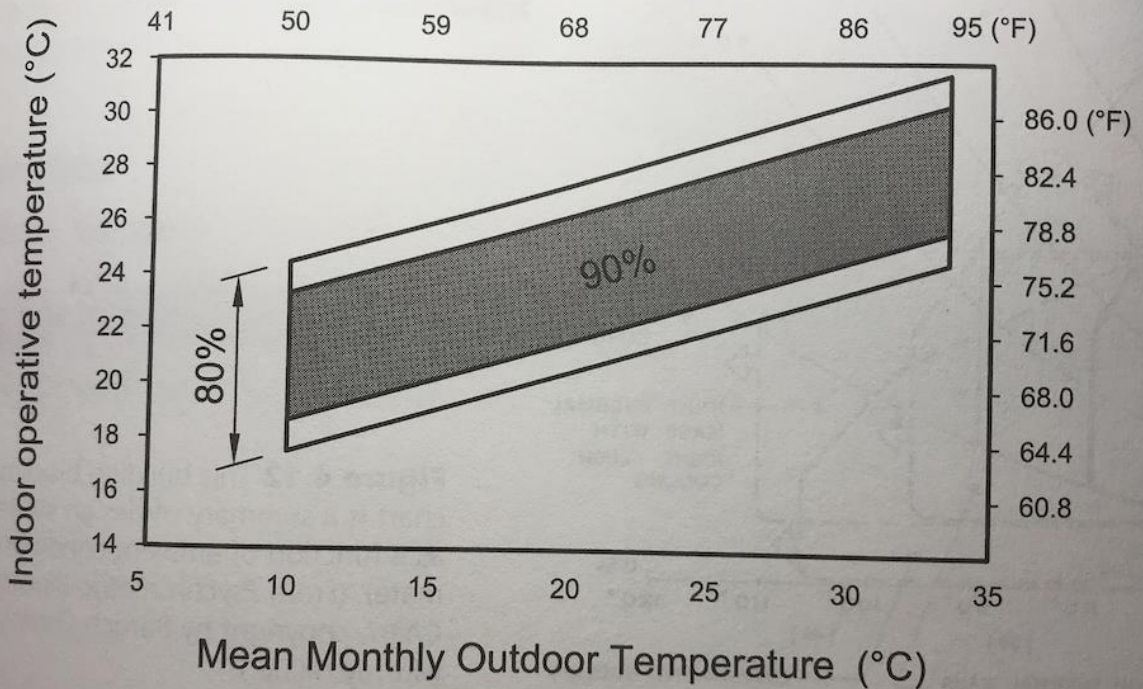
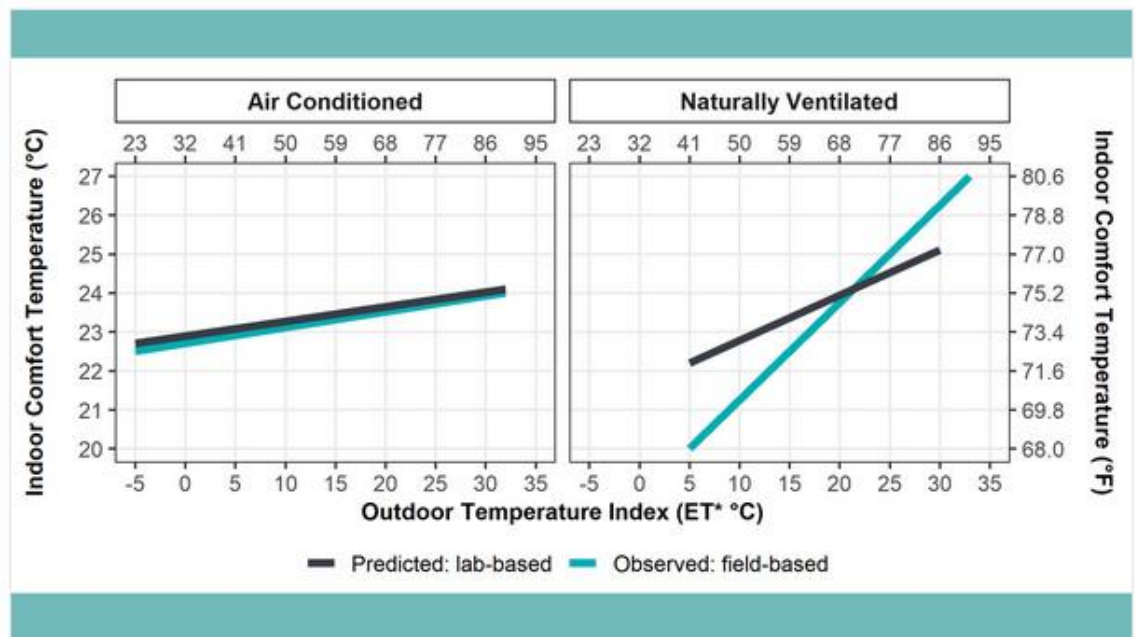


Figure 4.10 Under certain circumstances, people can be comfortable in conditions that fall outside the traditional comfort zone. In naturally ventilated buildings and where occupants have some control over their environment, the adaptive comfort zone increases along with the outdoor temperature. Operative temperature includes both air temperature and MRT.

<https://cbe.berkeley.edu/research/adaptive-comfort-model/>

- RESEARCH**
- Indoor Environmental Quality ^
 - IEQ measurement
 - Productivity
 - Fans
 - Personal comfort systems
 - Thermal comfort
 - Acoustics
 - HVAC Systems v
 - Facade Systems ^
 - Case studies
 - Operable windows
 - Mixed-mode systems
 - Adaptive comfort
 - Natural ventilation
 - Human Interactions v



Adaptive Comfort Model

A standard for thermal comfort in naturally ventilated buildings included in ASHRAE Standard 55.

STATUS: COMPLETED

FUNDING SOURCES: ASHRAE 884-RP

Project Objective

Examine the applicability of Fanger’s predicted mean vote (PMV) model in naturally ventilated buildings, and develop an adaptive comfort model based on world-wide field data.

Project Results

The results of this research form the basis of the Adaptive Comfort Model that was adopted in the 2004 version of the ASHRAE Standard 55.

The Adaptive Comfort Model has become the global standard for designing and operating naturally-ventilated buildings and has led to energy savings worldwide.

Significance to Industry

It was previously very difficult for a naturally ventilated building to stay within the narrow comfort range prescribed by ASHRAE 55, which is based on controlled settings in laboratory conditions that are not representative of many environments in real buildings with operable windows. By creating an alternative comfort model more applicable to real buildings, designers have greater flexibility to design buildings with operable windows that could both enhance comfort and reduce energy use.

The "Comfort Zone"

And Discomfort outside that zone

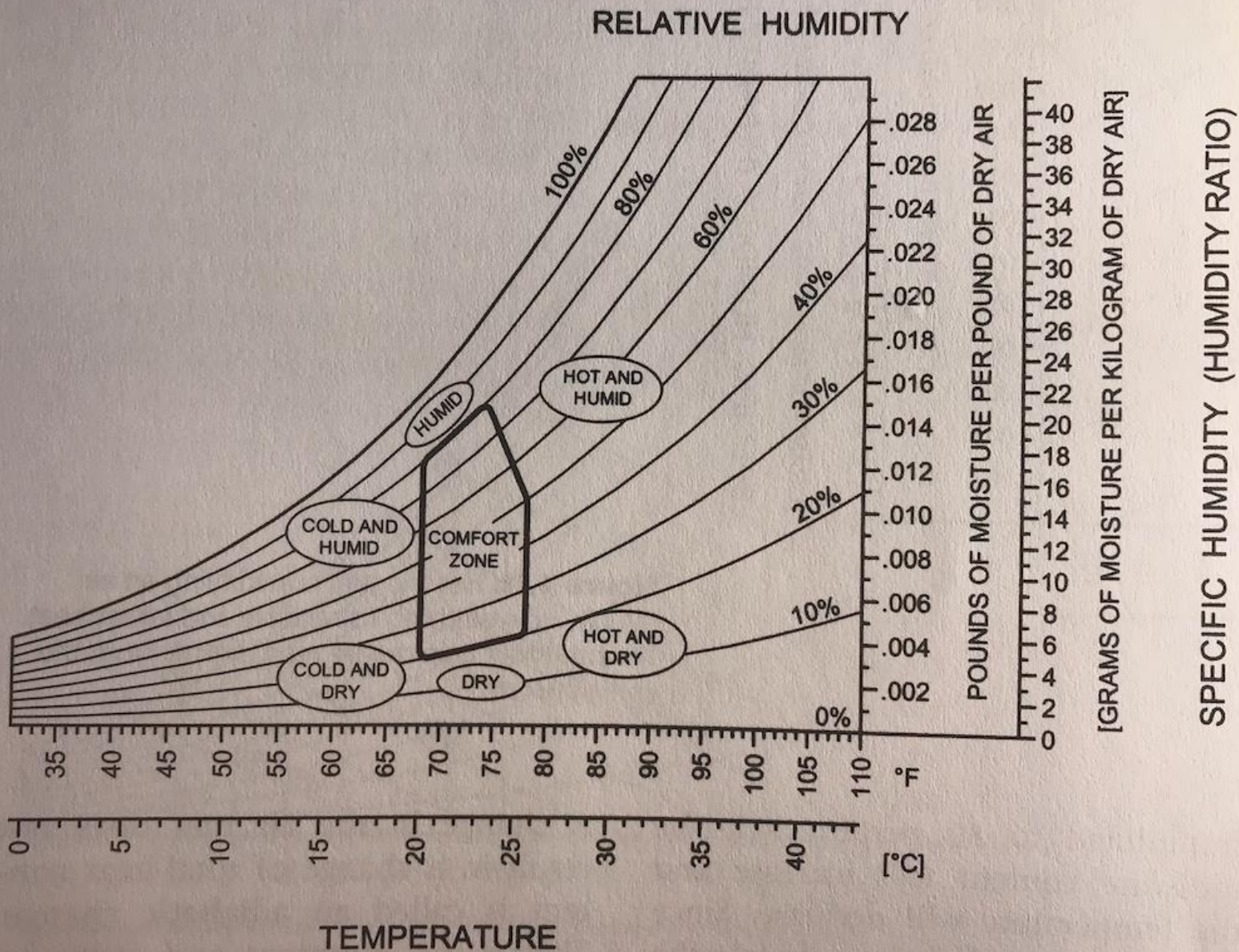
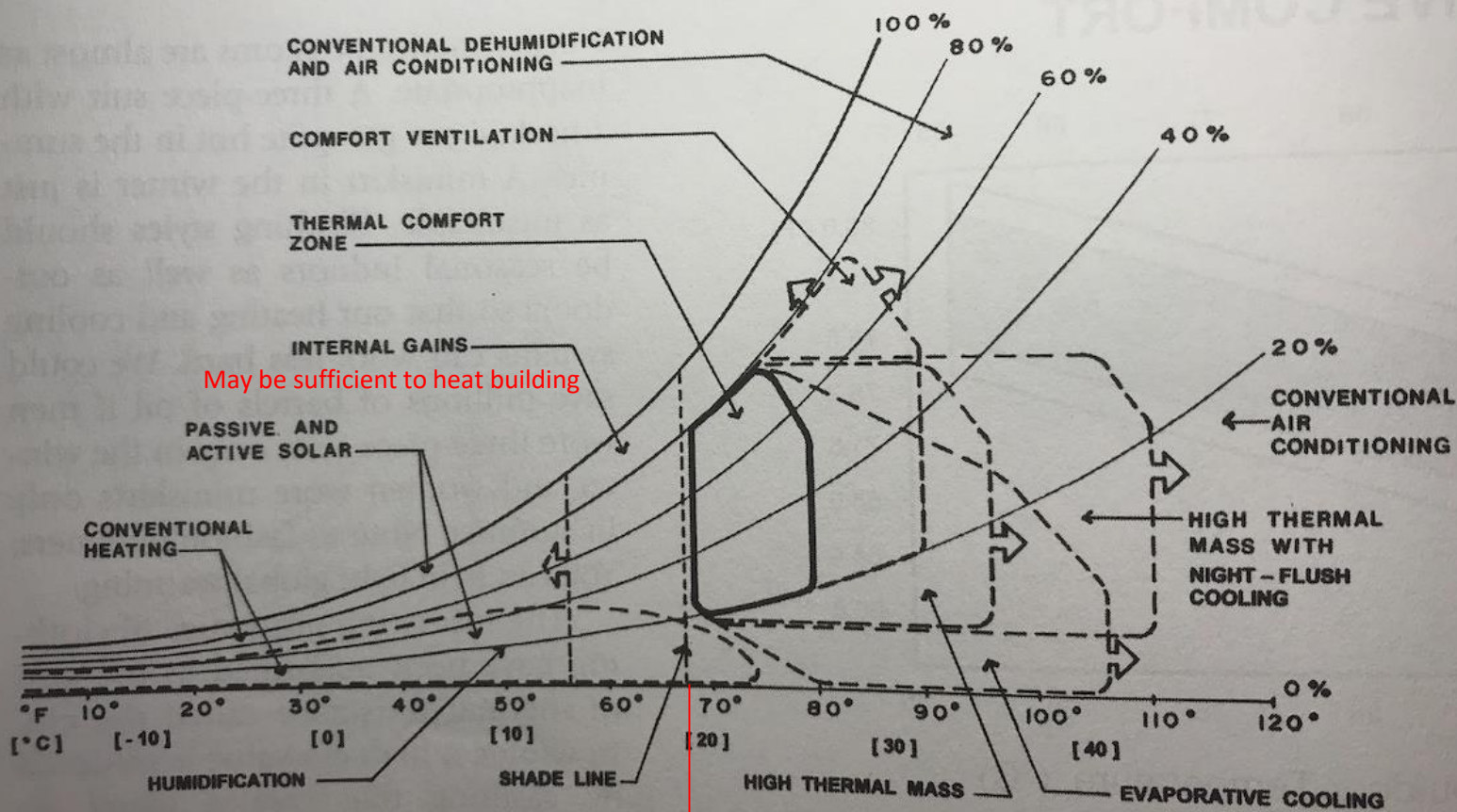


Figure 4.8a The comfort zone and various types of discomfort outside that zone are shown on this psychrometric chart.

The "Comfort Zone"

Design Strategies

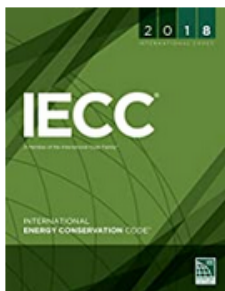


Prevent sun from entering building when temperatures above "Shade Line"

Read more:

[ASHRAE](#)

- American Society of Heating, Refrigeration, and Air-conditioning Engineers
 - [Design Handbooks on-line](#)
 - [Design Handbook Hardcopies:](#)



2018 International Energy Conservation Code with ASHRAE Standard (International Code Council Series)
by International Code Council | Nov 7, 2017

★★★★★ 31

Paperback

\$155⁶² ~~\$166.00~~

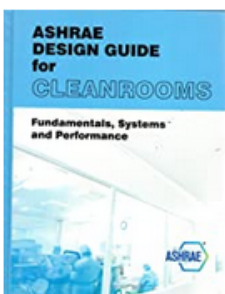
✓prime Get it as soon as **Mon, Oct 5**

FREE Shipping by Amazon

Only 6 left in stock (more on the way).

More Buying Choices

\$148.52 (10 used & new offers)



ASHRAE Design Guide for Cleanrooms: Fundamentals, Systems, and Performance

by Ashrae | Jan 1, 2018

Hardcover

\$171⁰⁰

✓prime Get it as soon as **Tomorrow, Oct 3**

FREE Shipping by Amazon

Only 9 left in stock (more on the way).

More Buying Choices

\$69.00 (6 used & new offers)



2017 ASHRAE Handbook -- Fundamentals (IP) - (includes CD in I-P and SI editions) (Ashrae Handbook Fundamentals Inch-Pound System)

by Ashrae | Jun 5, 2017

★★★★★ 10

Hardcover

\$220⁰⁰

✓prime Get it as soon as **Tomorrow, Oct 3**

FREE Shipping by Amazon

Only 11 left in stock (more on the way).

More Buying Choices

\$178.99 (11 used & new offers)

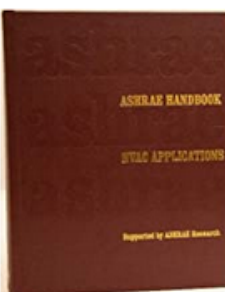
Multimedia CD

\$230⁰⁰

✓prime Get it as soon as **Wed, Oct 7**

FREE Shipping by Amazon

Only 2 left in stock (more on the way).



2019 ASHRAE Handbook -- HVAC Applications (I-P) (ASHRAE Applications Handbook Inch/Pound)

by Ashrae | Jun 1, 2019

Hardcover

\$230⁰⁰

✓prime Get it as soon as **Sun, Oct 4**

FREE Shipping by Amazon

Only 5 left in stock (more on the way).

More Buying Choices

\$152.98 (12 used & new offers)

ASHRAE

- American Society of Heating, Refrigeration, and Air-conditioning Engineers
 - [Design Handbooks on-line](#)
 - [Design Handbook Hardcopies:](#)



2017 ASHRAE Handbook -- Fundamentals (IP) - (includes CD in I-P and SI editions) (Ashrae Handbook Fundamentals Inch-Pound System)

by Ashrae | Jun 5, 2017

★★★★★ ~ 10

Hardcover

\$220⁰⁰

✓prime Get it as soon as Tomorrow, Oct

3

FREE Shipping by Amazon

Only 11 left in stock (more on the way).

A&E Case Study of BOTH Architecture and Engineering:

From Romance to Performance: Assessing the Impacts of Jali Screens on Energy Savings and Daylighting Quality of Office Buildings in Lahore, Pakistan

https://www.researchgate.net/publication/313512852_From_Romance_to_Performance_Assessing_the_Impacts_of_Jali_Screens_on_Energy_Savings_and_Daylighting_Quality_of_Office_Buildings_in_Lahore_Pakistan

December 2014

Conference: 30th INTERNATIONAL PLEA CONFERENCE · At: Ahmedabad, India

Authors:



Ihab Elzeyadi

PhD · University of Oregon



Ayesha Batool

University of Nottingham

↓ Download citation

🔗 Copy link

Citations (6)

References (21)

Figures (1)

Abstract and Figures

Jali Screens are traditional window treatments used in vernacular buildings throughout South Asia and the Middle East. Historically, the screen treatments are successful in providing shade and privacy for building occupants in hot arid and hot humid climates. With interest in traditional building features, recent trends in contemporary buildings design have started to incorporate Jali screens or other screens as decorative façade elements. However, the use of these screens has been widely approached from the aesthetic and romantic attitude representing an architectural fascination with the vernacular. Their impact on overall building energy and daylighting performance, however, has been largely ignored. This paper reports

A&E Case Study of BOTH Architecture and Engineering:

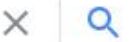
From Romance to Performance: Assessing the Impacts of Jali Screens on Energy Savings and Daylighting Quality of Office Buildings in Lahore, Pakistan

Jali Screens are traditional window treatments used in vernacular buildings throughout South Asia and the Middle East. Historically, the screen treatments are successful in providing shade and privacy for building occupants in hot arid and hot humid climates. With interest in traditional building features, recent trends in contemporary buildings design have started to incorporate Jali screens or other screens as decorative façade elements. However, the use of these screens has been widely approached from the aesthetic and romantic attitude representing an architectural fascination with the vernacular. Their impact on overall building energy and daylighting performance, however, has been largely ignored. This paper reports ...

https://www.researchgate.net/publication/313512852_From_Romance_to_Performance_Assessing_the_Impacts_of_Jali_Screens_on_Energy_Savings_and_Daylighting_Quality_of_Office_Buildings_in_Lahore_Pakistan



Jali screen



All



Shopping



Videos



Images



News



More

Settings

Tools

About 1,220,000 results (0.23 seconds)

Images for Jali screen



modern



marble



contemporary



islamic

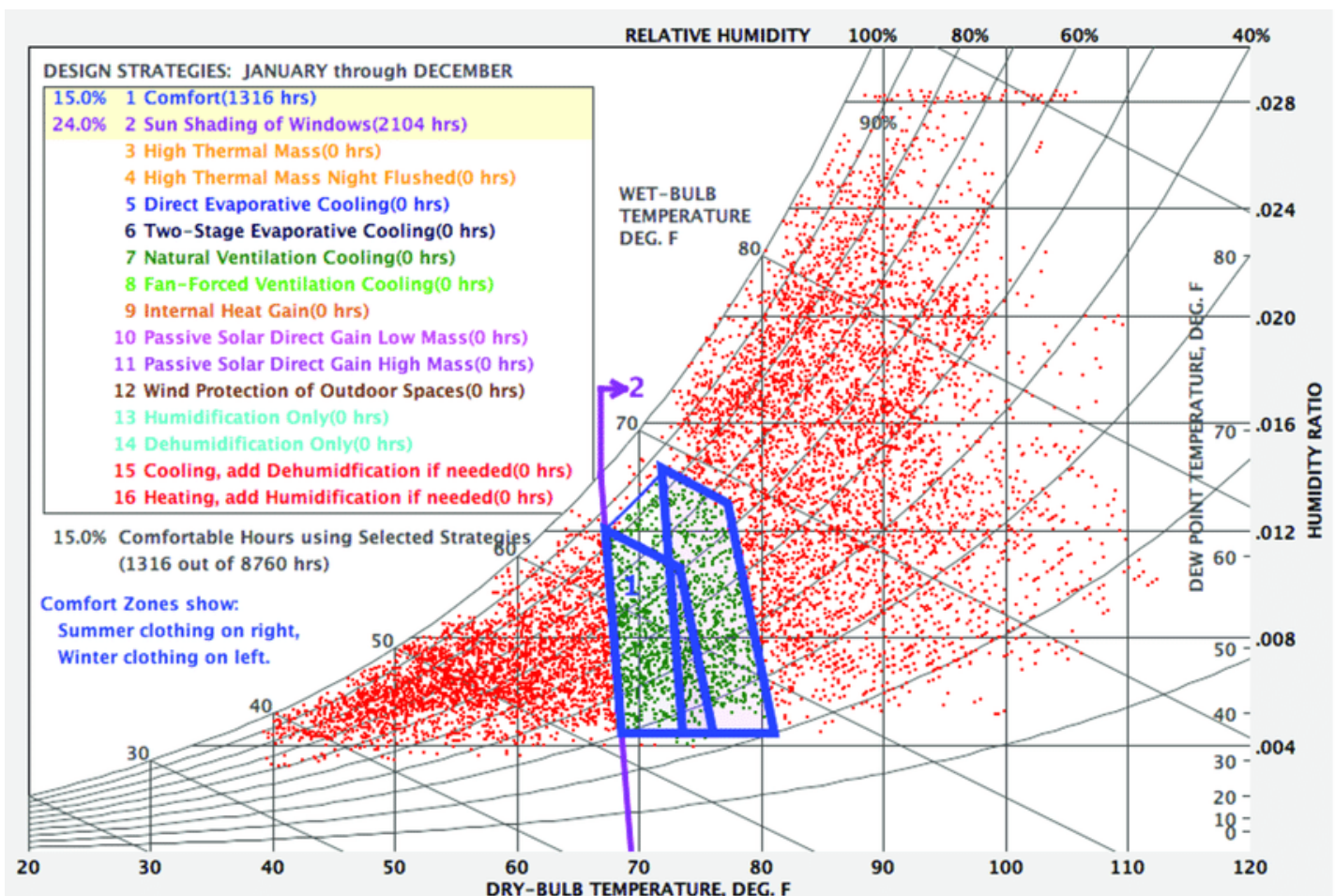


indian



A&E Case Study of BOTH Architecture and Engineering:

From Romance to Performance: Assessing the Impacts of Jali Screens on Energy Savings and Daylighting Quality of Office Buildings in Lahore, Pakistan



GOTO THIS SITE (out of class time) and click on chart, and buttons: <http://www.flycarpet.net/en/PsyOnline>

Basic Process Cycle 1 Cycle 2 Setting Display 简体中文

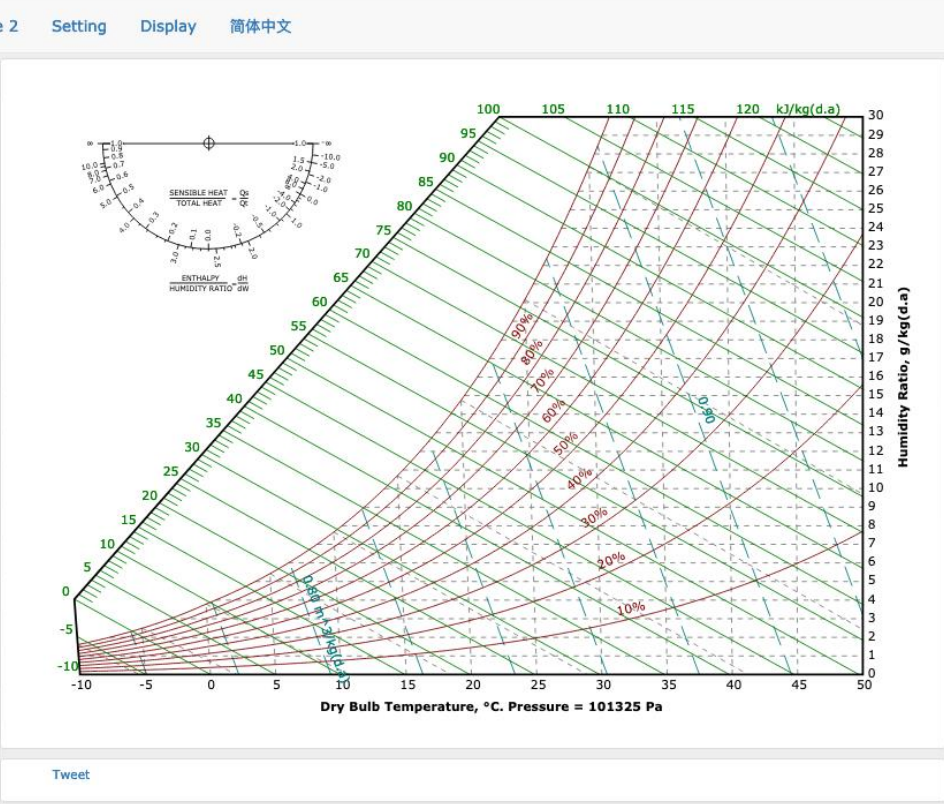
Click on chart for air properties

Or input data for air properties

T.Dry, °C: 25
 Rel.Humid, %: 50

Quantity	Value	Units
P.Ambient		Pa
T.Dry.Bulb		°C
Humid.Ratio		g/kg(d.a)
Rel.Humid		%
T.Wet.Bulb		°C
T.Dew		°C
T.Saturation		°C
Enthalpy		kJ/kg(d.a)
P.Vapour		Pa
P.Sat.Vapour		Pa
Spec.Heat		kJ/(kg.K)
Spec.Volume		m ³ /kg(d.a)
Density		kg/m ³

Submit



Desktop Version

For windows, without network and browser limits. Click following button to download the software with 30 days full functional free trial, or pay \$65 to get up to 3 license keys.

Download V4.41

Buy Now

VISA, MasterCard, American Express

Related Links

[Wikipedia Psychrometrics](#)

Home About Projects - Contact

Free Online Interactive Psychrometric Chart

Basic Process Cycle 1 Cycle 2

Air processing calculation

#	Tdry, °C	Rel.Humid, %
1	35	65
2	26.5	54.9
3	-1	-1

Select 2 point #
 Point A: 1 Point B: 2

State changes from point A to B

Dry air flow: 1000 kg/h
 Delt.H/Delt.d: kJ/g
 Heating load: kW
 Cooling load: kW
 Humidifying: g/s
 Sensible heat: kW
 Latent heat: kW

Mixed air from state A and B

Point A percent: 15 %
 T.Dry.Bulb: °C
 T.Wet.Bulb: °C
 T.Dew.Point: °C
 Rel.Humidity: %
 Spec.Humidity: g/kg(d.a)
 Enthalpy: kJ/kg(d.a)

Compute and draw processing line

Submit

Home About Projects - Contact

Free Online Interactive Psychrometric Chart

Basic Process Cycle 1 Cycle 2

Primary return air cycle

Quantity	Value	Unit
Tdry.Indoor	25	°C
Rel.Humid.Indoor	50	%
Tdry.Outdoor	35	°C
Rel.Humid.Outdoor	65	%
T.Vent.Diff	8	°C
Fresh.Air.Ratio	15	%
Heat.Load	10	kW
Wet.Load	4.5	kg/h
Vent.Flow	3004	kg/h
Vent.temperature	17	°C
Vent.Rel.Humid		%
T.Dew.Apparatus		°C
Cooling Load		kW
Heating Load		kW
Fresh Flow		kg/h
Return Flow		kg/h

Weather: Summer Winter

Max vent temperature difference
 Compute and draw primary cycle

Submit

Home About Projects - Contact

Free Online Interactive Psychrometric Chart

Basic Process Cycle 1 Cycle 2

Secondary return air cycle

Quantity	Value	Unit
Tdry.Indoor	27	°C
Rel.Humid.Indoor	48	%
Tdry.Outdoor	36	°C
Rel.Humid.Outdoor	48	%
T.Vent.Diff	8	°C
Fresh.Air.Ratio	24	%
Heat.Load	10	kW
Wet.Load	4.5	kg/h
Vent.Flow	2600	kg/h
Vent.temperature	18	°C
Primary Flow	1000	kg/h
Secondary Flow		kg/h
Fresh Flow		kg/h
Vent.Rel.Humid		%
T.Dew.Apparatus		°C
Cooling Load		kW
Heating Load		kW

Weather: Summer Winter

Max vent temperature difference
 Compute and draw secondary cycle

Submit

Home About Projects - Contact

Free Online Interactive Psychrometric Chart

Basic Process Cycle 1 Cycle 2 Setting

Parameter settings

Units: Metric(SI) English(I/P)

For I/P units:
 Humidity Ratio: lb/1000lb(d.a)
 Pressure: inHg

Chart limits:

Min.Humid.Ratio: 0 g/kg(d.a)
 Max.Humid.Ratio: 30 g/kg(d.a)
 Min.T.Dry.Bulb: -10 °C
 Max.T.Dry.Bulb: 50 °C
 P.Sea.Level: 101325 Pa
 Altitude: 0 m
 Apparatus dew point humidity: 90 %

Draw enthalpy ruler
 Reset all inputs base on units

Submit