

# Chapter 4

## Moisture and Atmospheric Stability



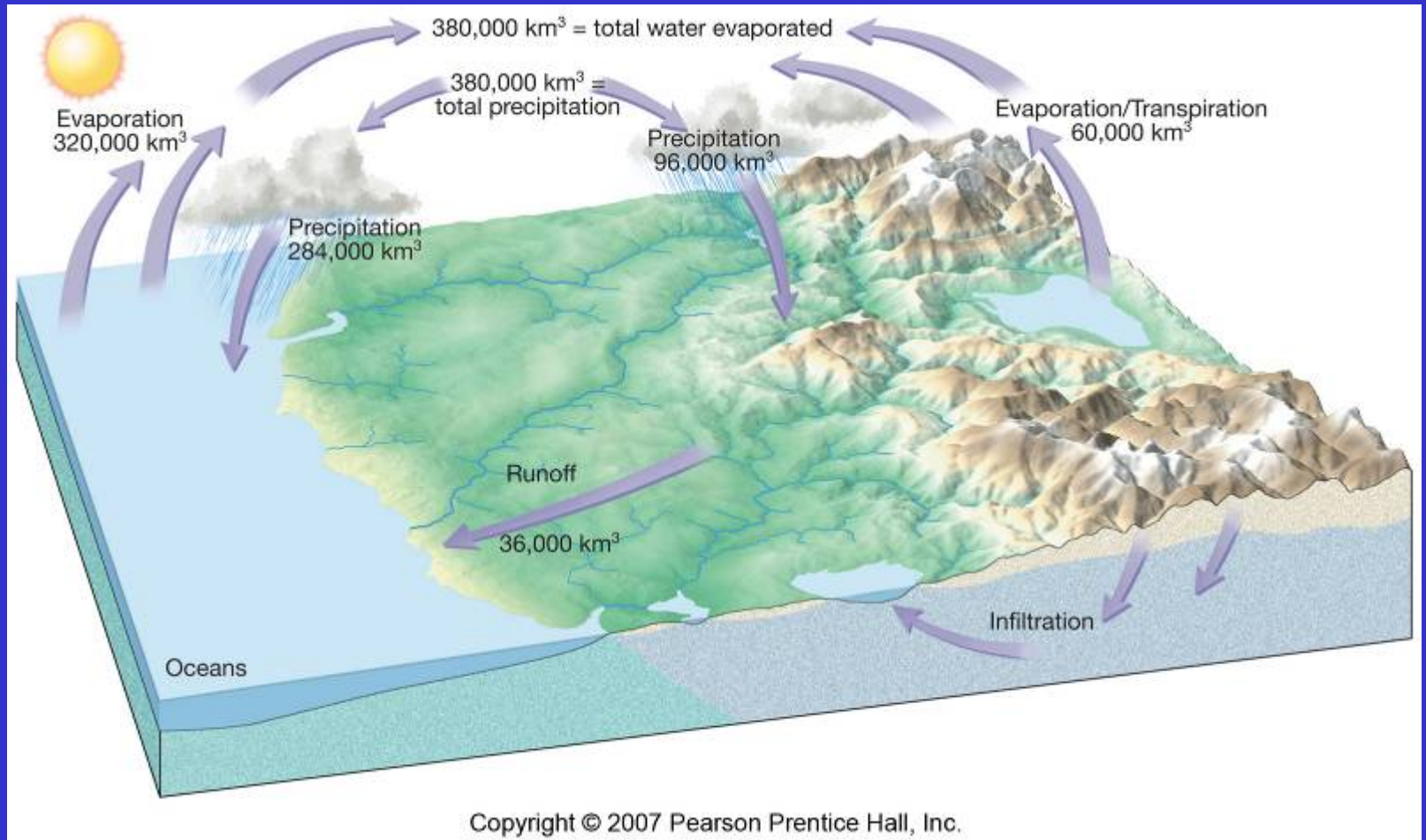
The Atmosphere 10e  
Lutgens & Tarbuck  
Power Point by Michael C. LoPresto



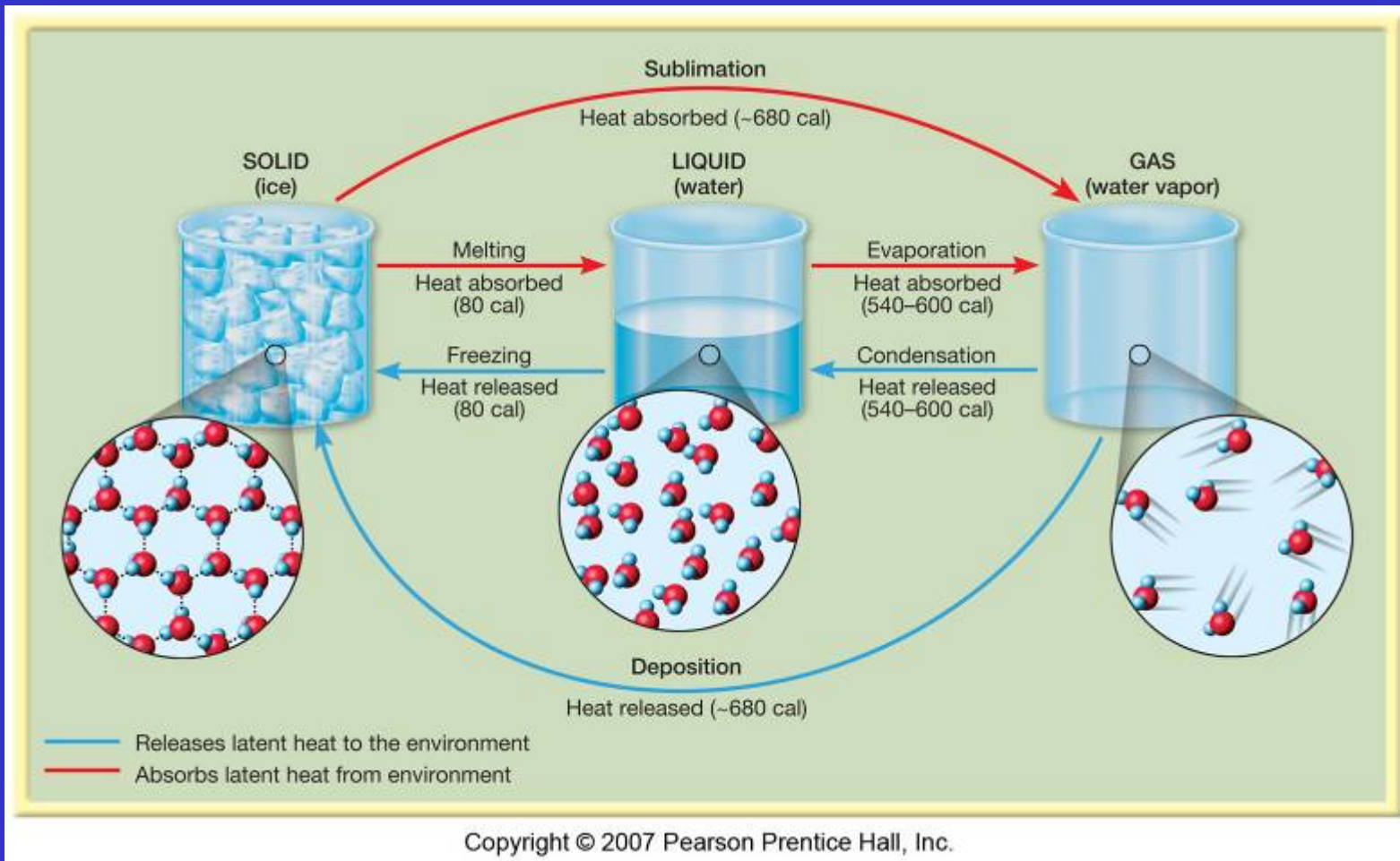
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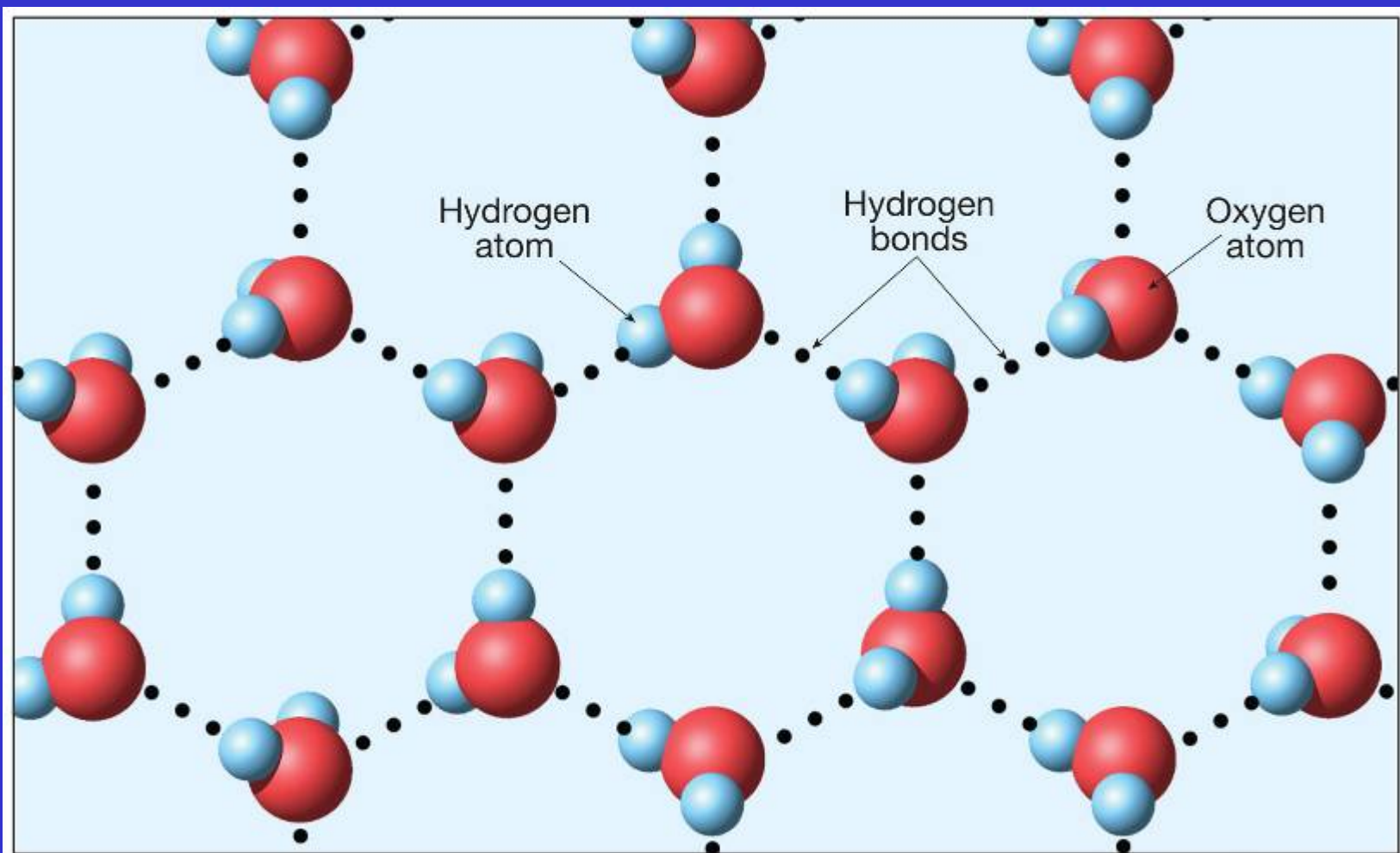
Steam Fog over a Lake

# The Hydrologic Cycle



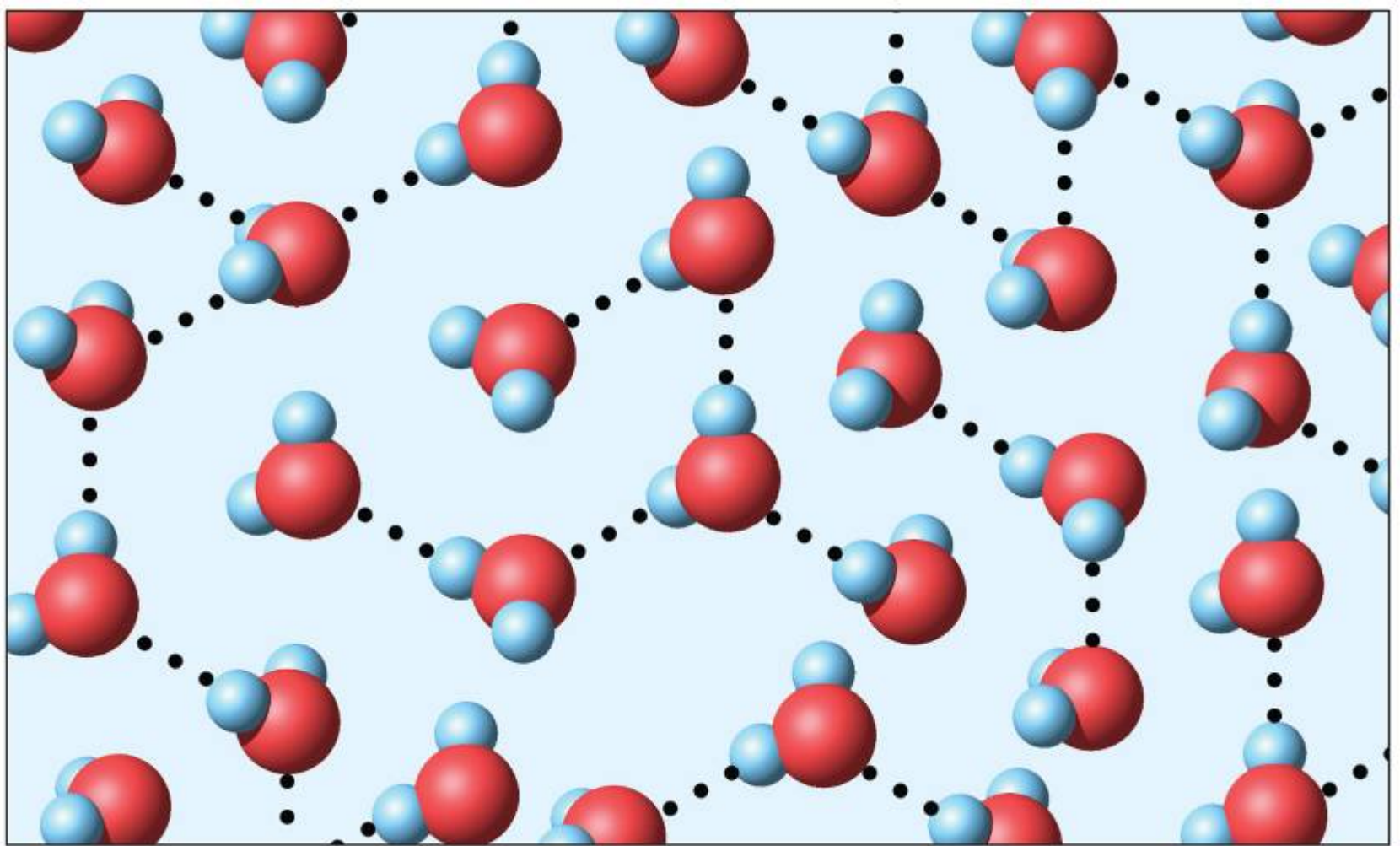
# Water's Changes of State





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Ice



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# Water



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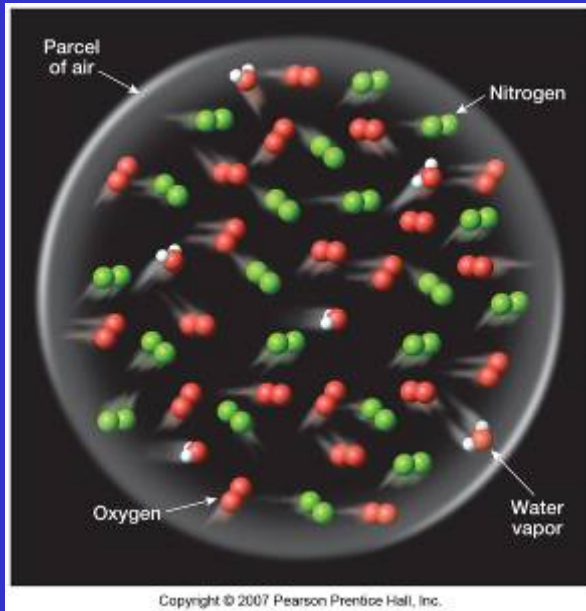
Condensation of Water Vapor  
Generates Fog

# Frost on a Window Pane

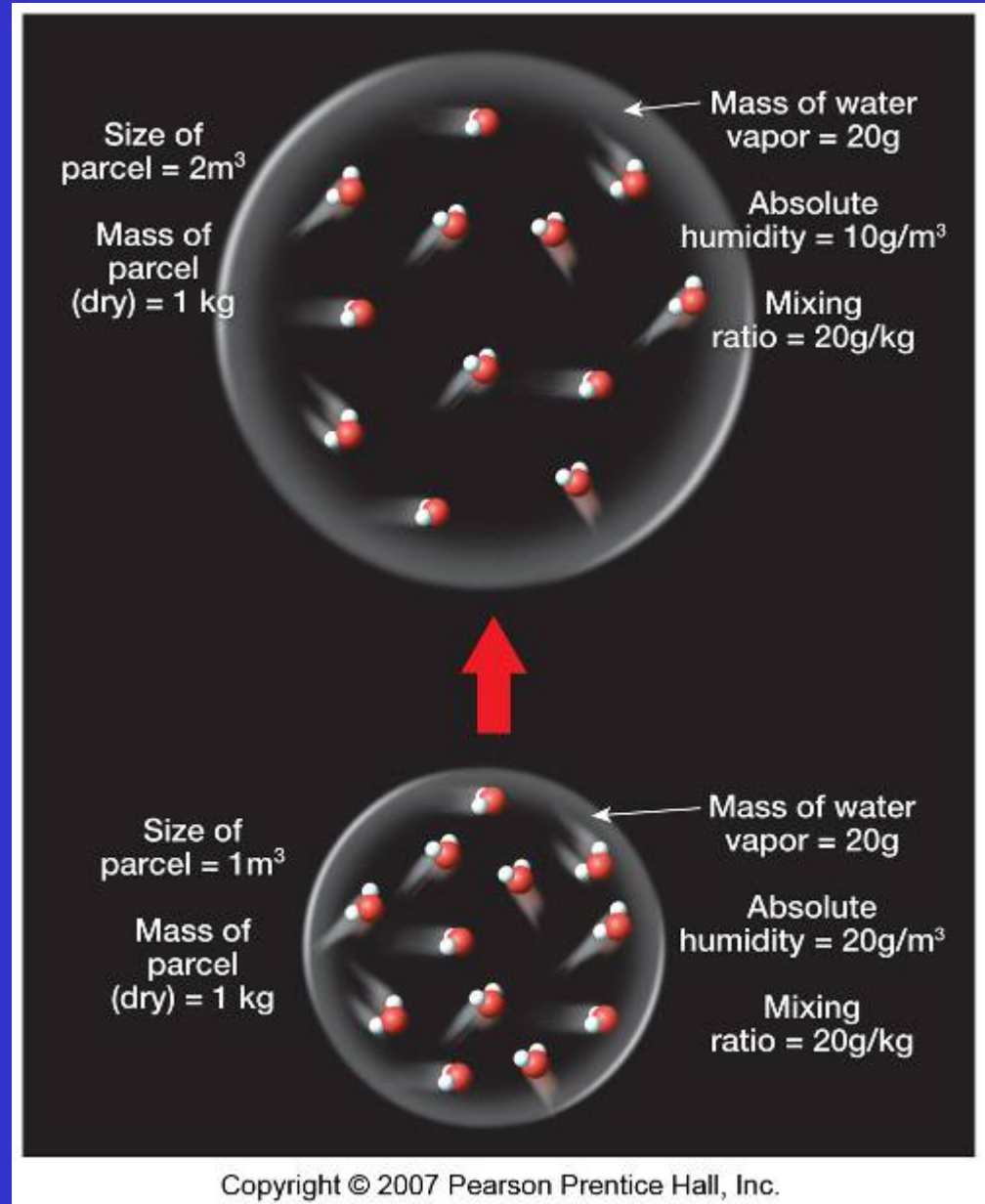


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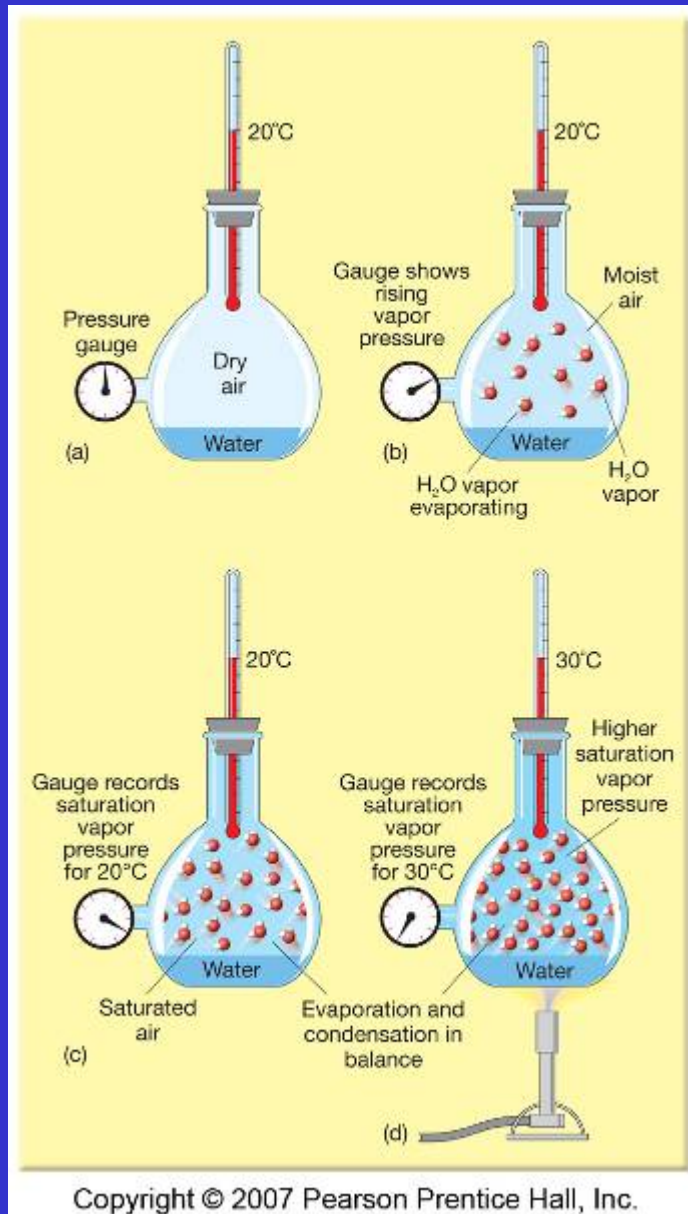




# Humidity Is the Content of Water Vapor in the Air



# Relationship between Vapor Pressure and Saturation

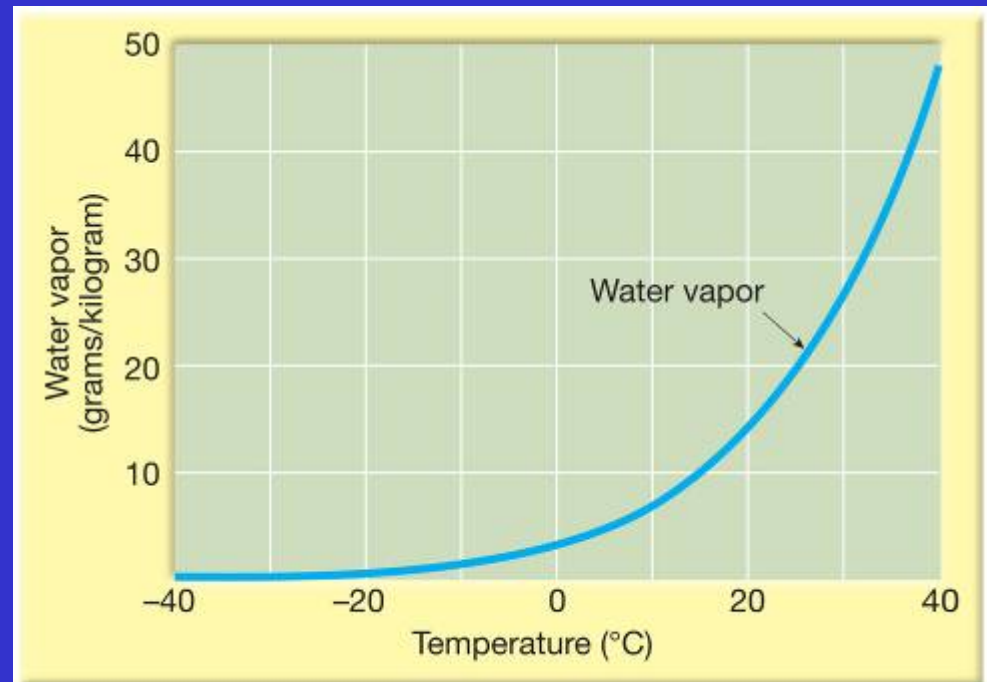


**TABLE 4-1** Saturation mixing ratio (at sea-level pressure)

Temperature °C (°F)	Saturation mixing ratio g/kg
-40 (-40)	0.1
-30 (-22)	0.3
-20 (-4)	0.75
-10 (14)	2
0 (32)	3.5
5 (41)	5
10 (50)	7
15 (59)	10
20 (68)	14
25 (77)	20
30 (86)	26.5
35 (95)	35
40 (104)	47

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# Saturation Vapor Pressure Varies with Temperature



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Hot desert air  
with low  
relative humidity  
will actually  
have a higher  
water vapor-content  
than frigid air  
with high  
relative humidity

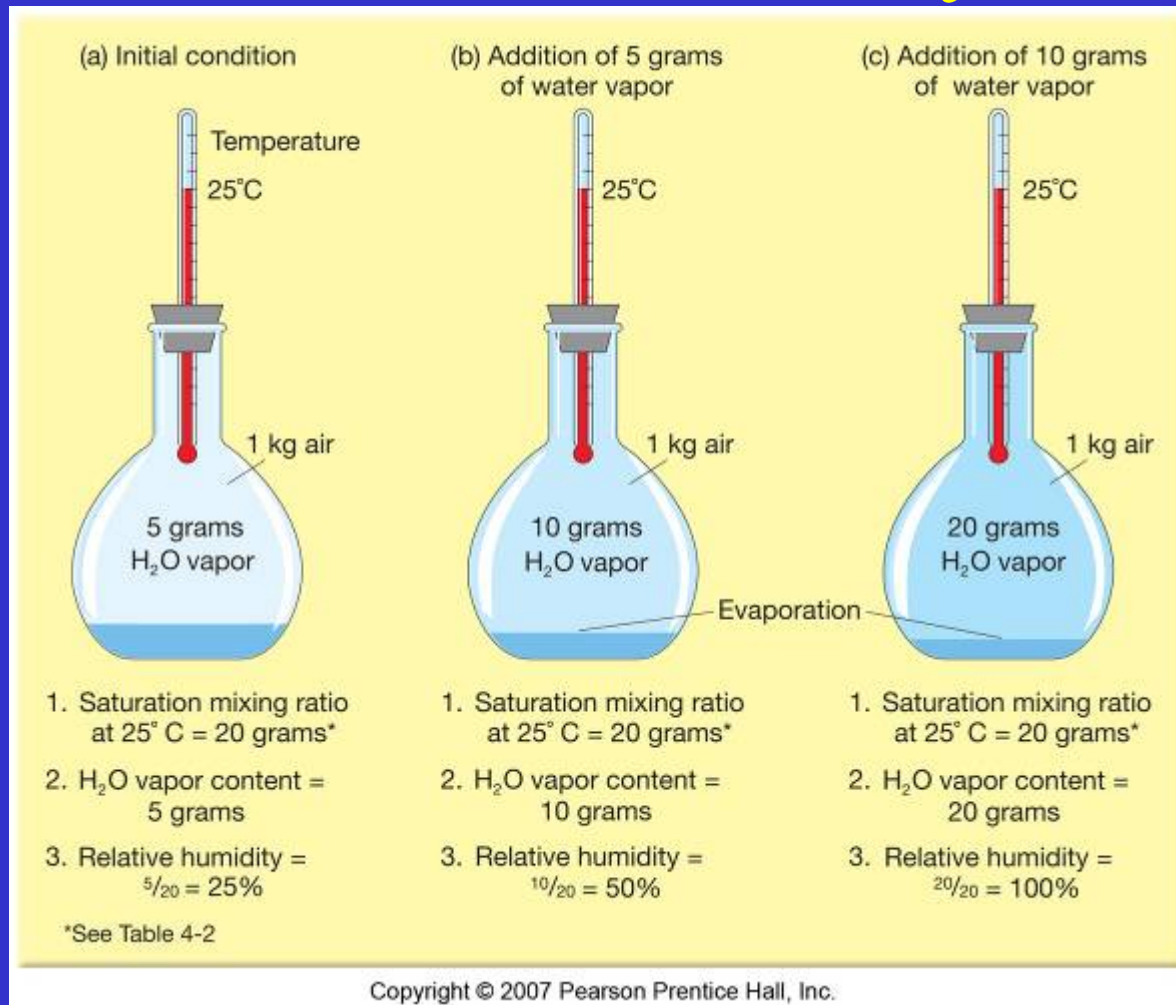


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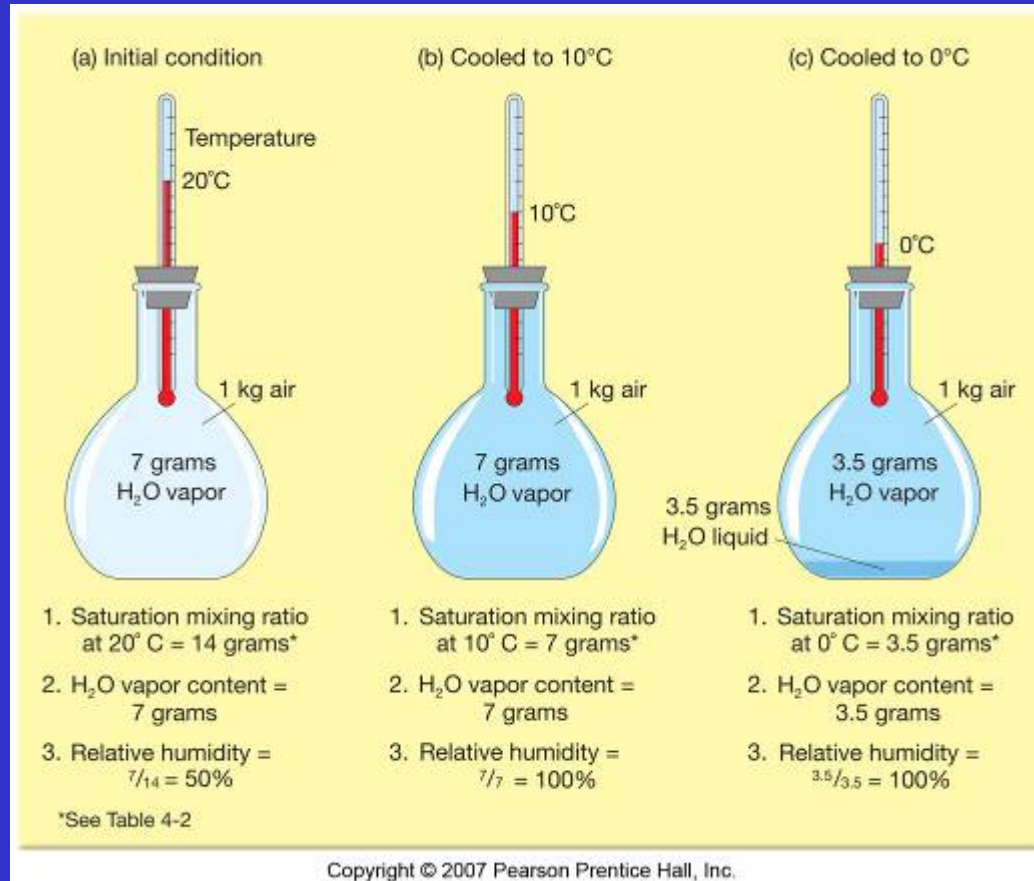
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# Relative Humidity



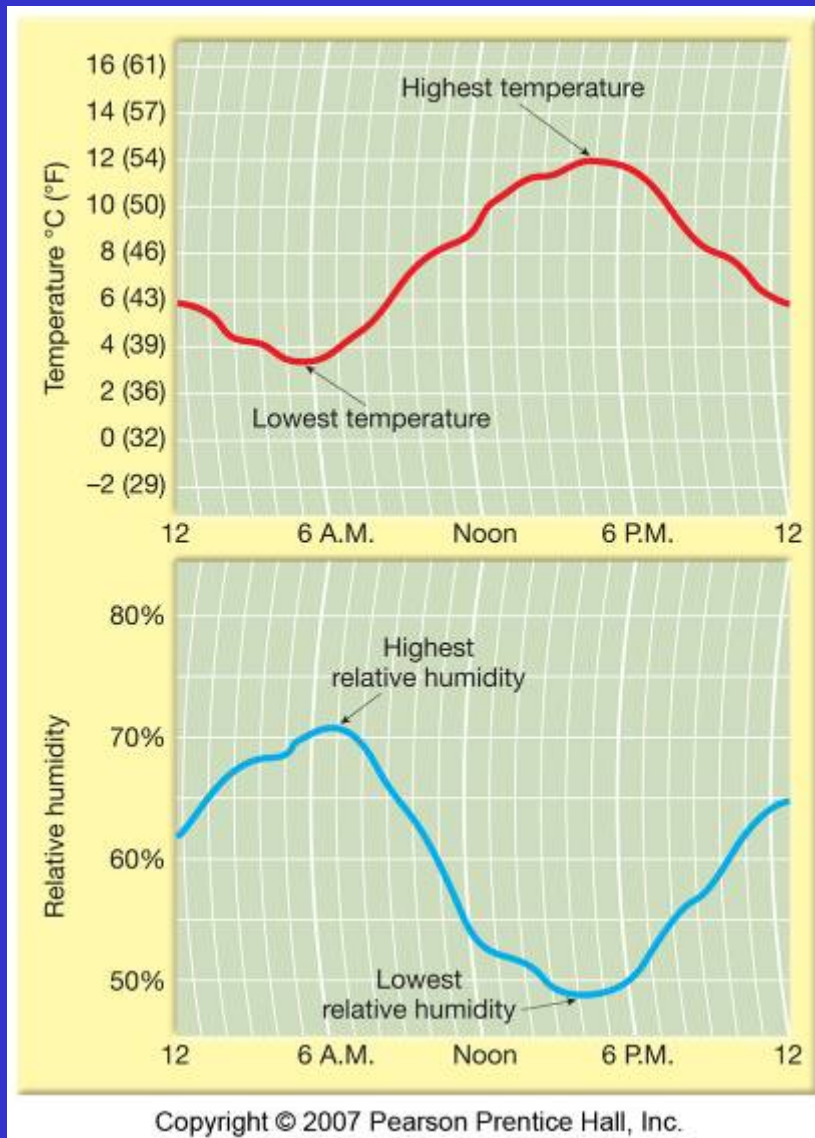
## Changes with Added Moisture

# Relative Humidity



## Changes with Temperature

# Daily Changes in Relative Humidity with Temperature



Cold  
Drinking-glasses  
Chill  
Surrounding  
Air  
to the  
Dew-Point



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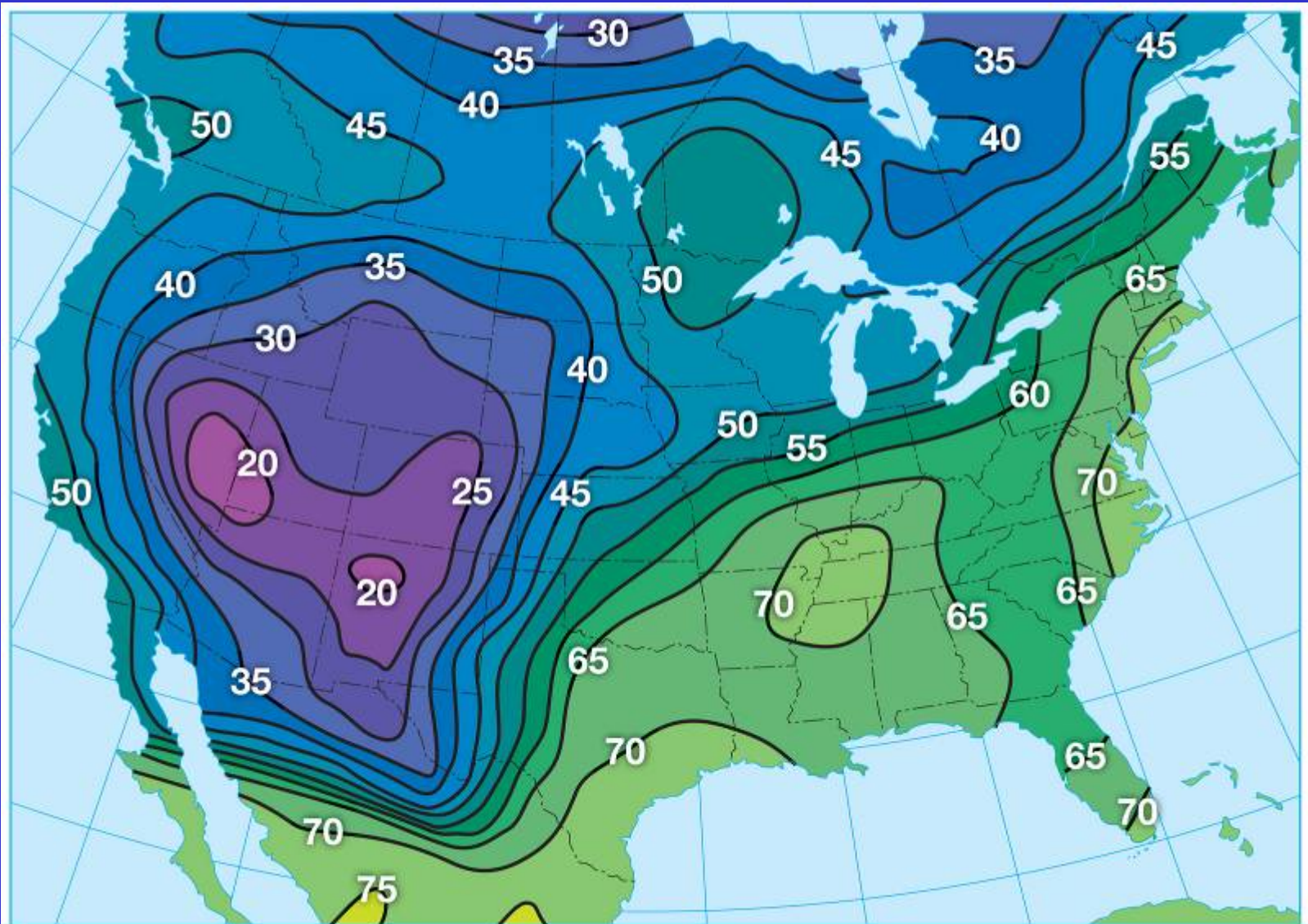
Condensation on Cold Drinking-glasses



**TABLE 4-2** Dew-point thresholds

**Dew-point temperature**

$\leq 10^{\circ}\text{F}$	Significant snowfall is inhibited.
$\geq 55^{\circ}\text{F}$	Minimum for severe thunderstorms to form.
$\geq 65^{\circ}\text{F}$	Considered humid by most people.
$\geq 70^{\circ}\text{F}$	Typical of the rainy tropics.
$\geq 75^{\circ}\text{F}$	Considered oppressive by most.



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# Dew Point Temperatures

**TABLE 4-A** Heat index

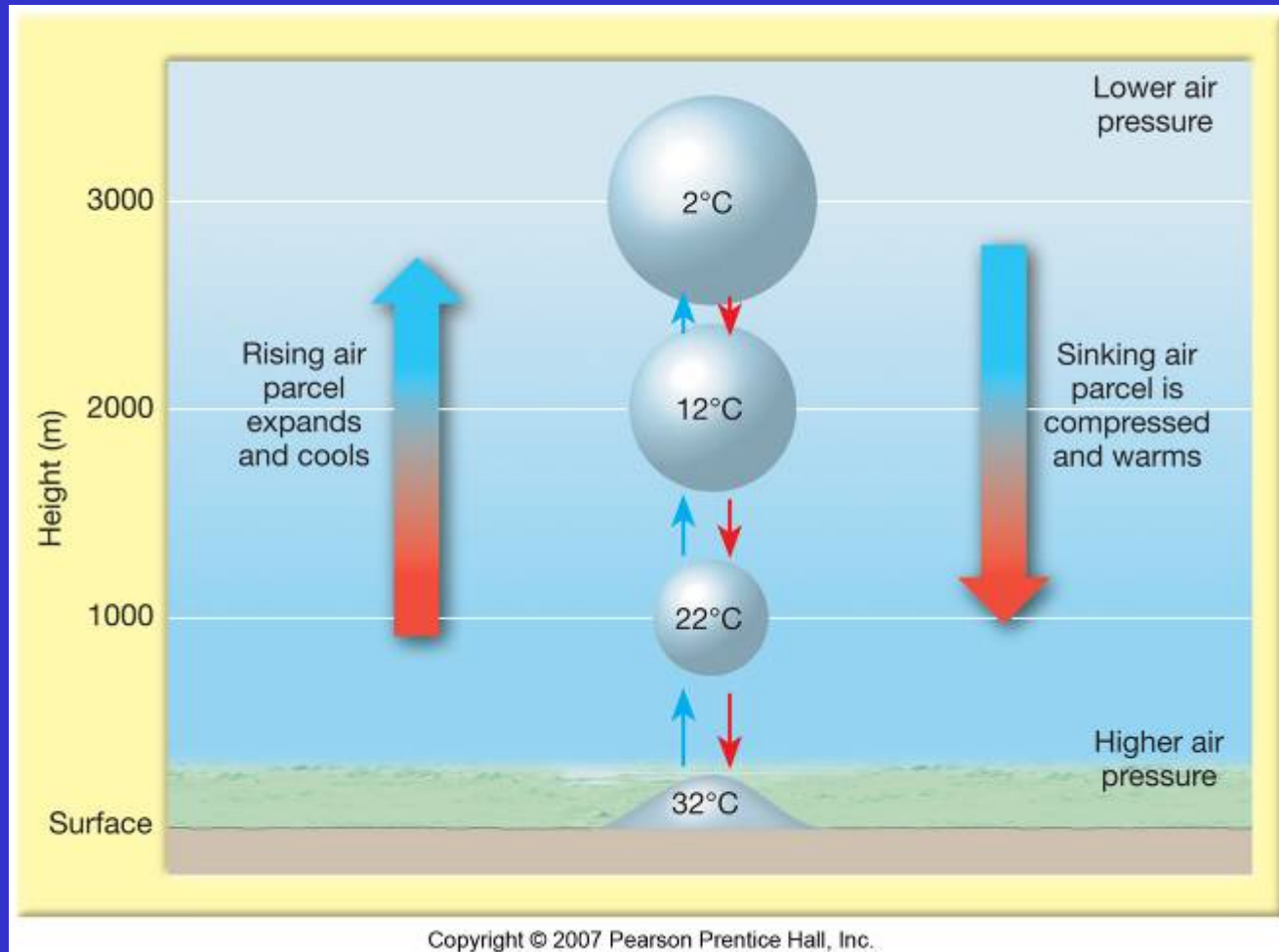
		Relative Humidity (%)													With prolonged exposure and/or physical activity	
		40	45	50	55	60	65	70	75	80	85	90	95	100		
Air Temperature (°F)	110	136														<b>Extreme danger</b> Heat stroke or sunstroke highly likely
	108	130	137													
	106	124	130	137												
	104	119	124	131	137											
	102	114	119	124	130	137										<b>Danger</b> Sunstroke, muscle cramps, and/or heat exhaustion likely
	100	109	114	118	124	129	136									
	98	105	109	113	117	123	128	134								
	96	101	104	108	112	116	121	126	132							
	94	97	100	102	106	110	114	119	124	129	135					<b>Extreme caution</b> Sunstroke, muscle cramps, and/or heat exhaustion possible
	92	94	96	99	101	105	108	112	116	121	126	131				
	90	91	93	95	97	100	103	106	109	113	117	122	127	132		
	88	88	89	91	93	95	98	100	103	106	110	113	117	121		
	86	85	87	88	89	91	93	95	97	100	102	105	108	112		
	84	83	84	85	86	88	89	90	92	94	96	98	100	103		<b>Caution</b> Fatigue possible
	82	81	82	83	84	84	85	86	88	89	90	91	93	95		
	80	80	80	81	81	82	82	83	84	84	85	86	86	87		



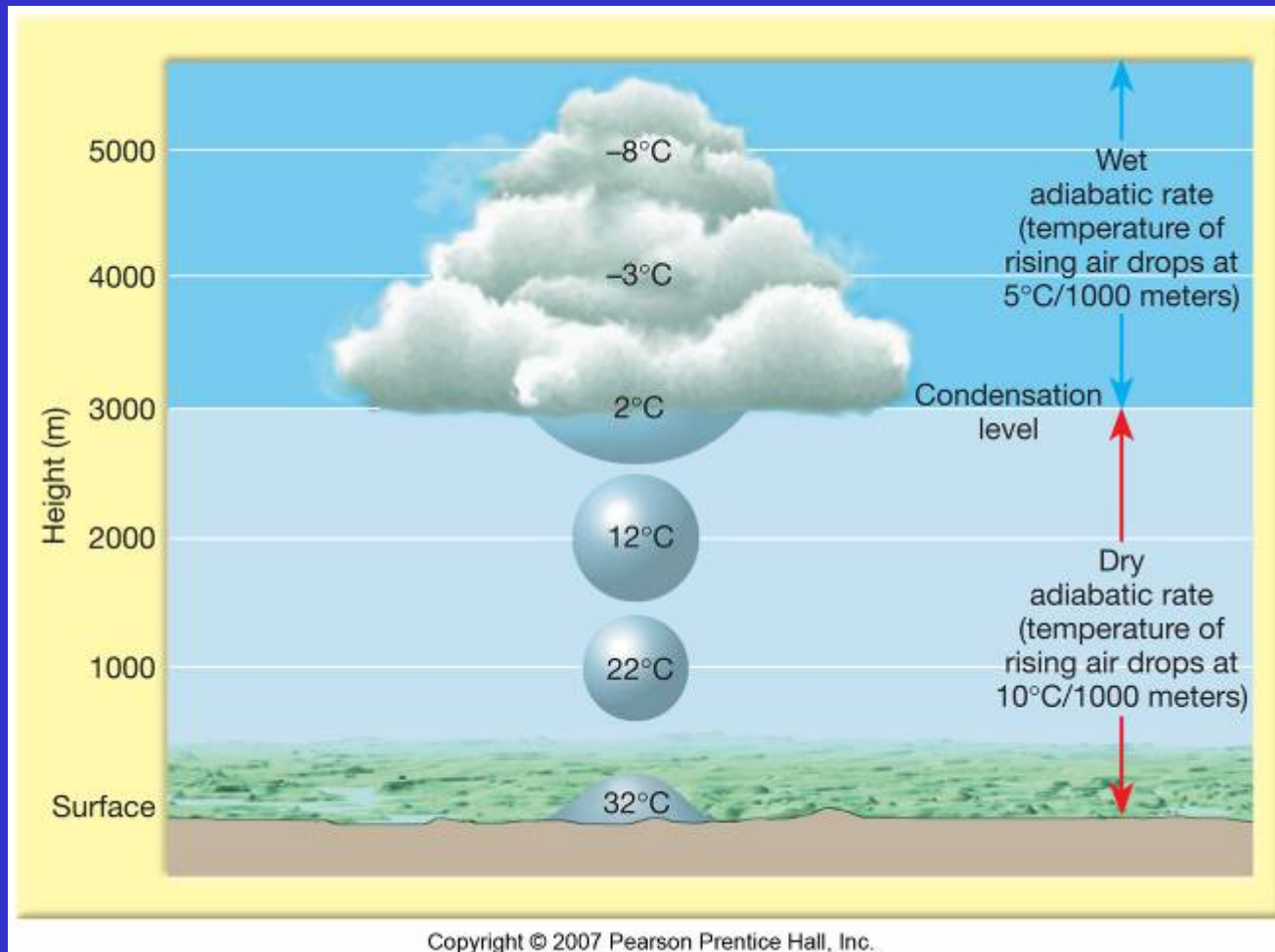
# Sling Psychrometer

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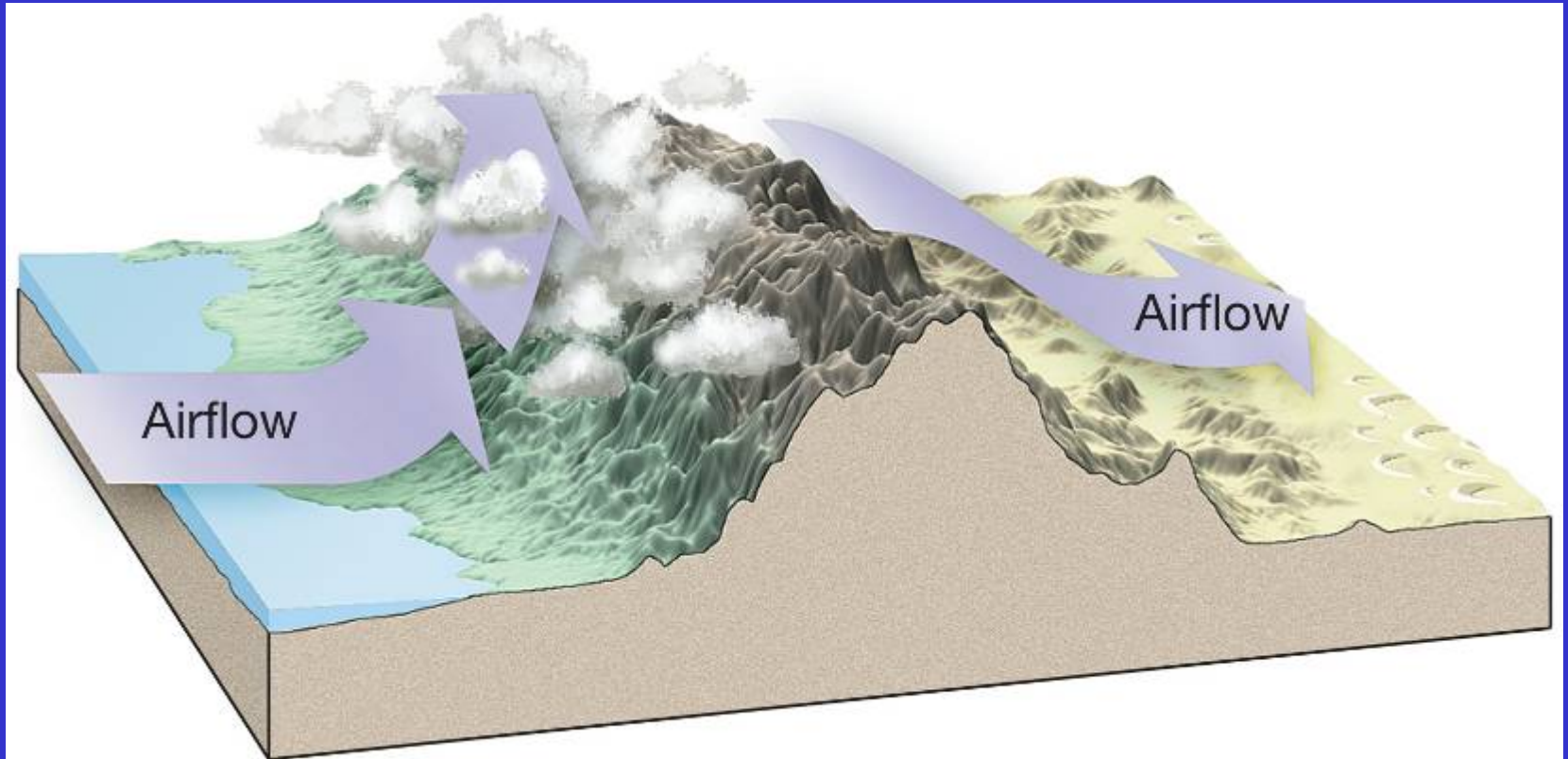
# Adiabatic Temperature Changes



# Dry and Wet Adiabatic Rates



# Lifting Processes



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## Orographic

# Heavy Precipitation in Mountains

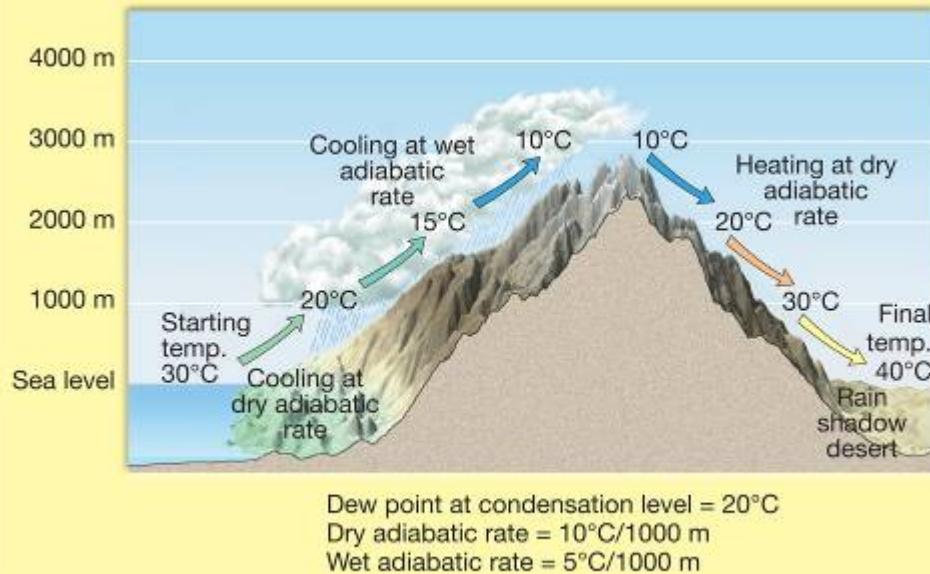


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## Snow Pack in the Rocky Mountains



# Death Valley

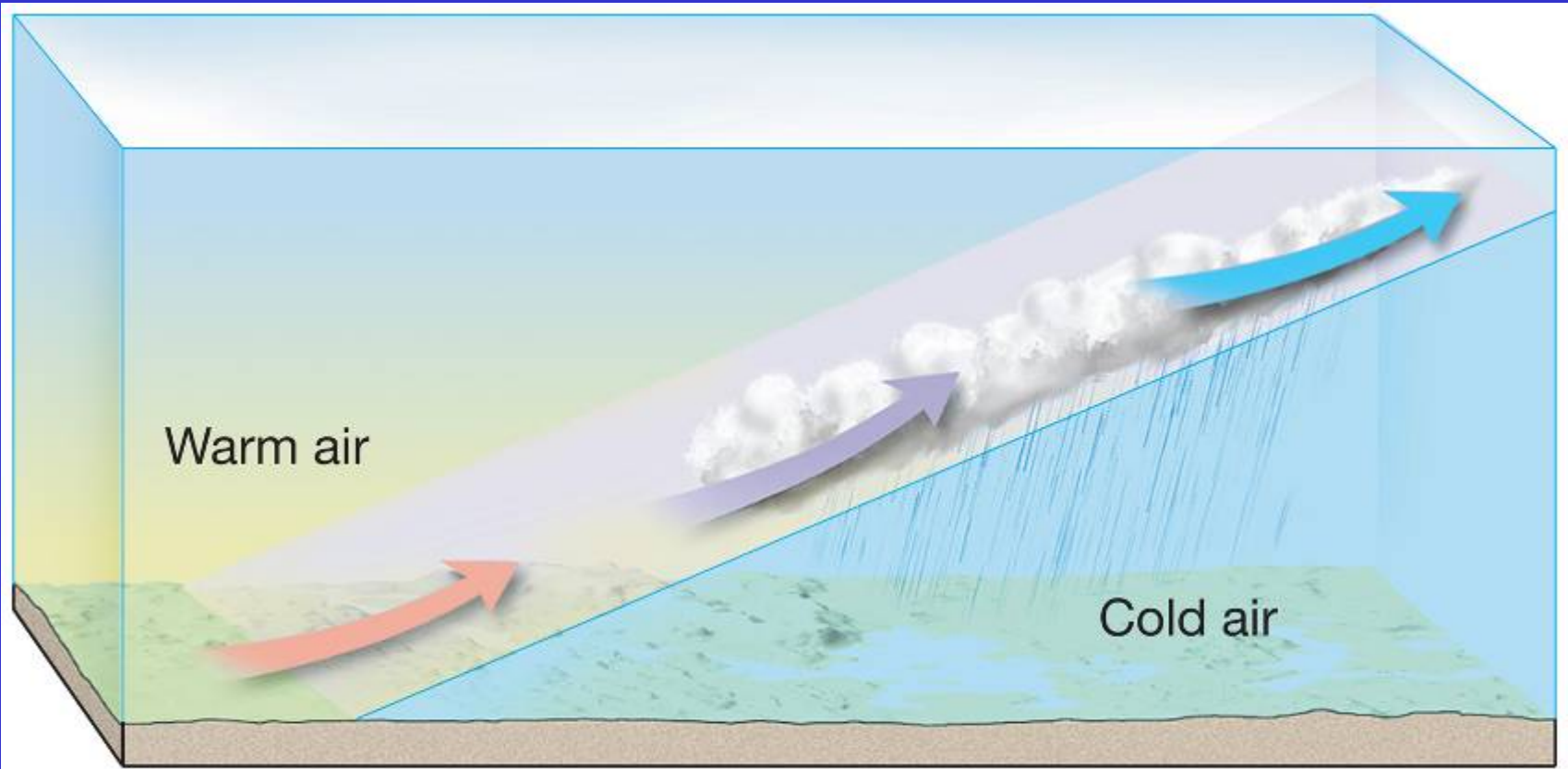


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## Rain Shadow Desert

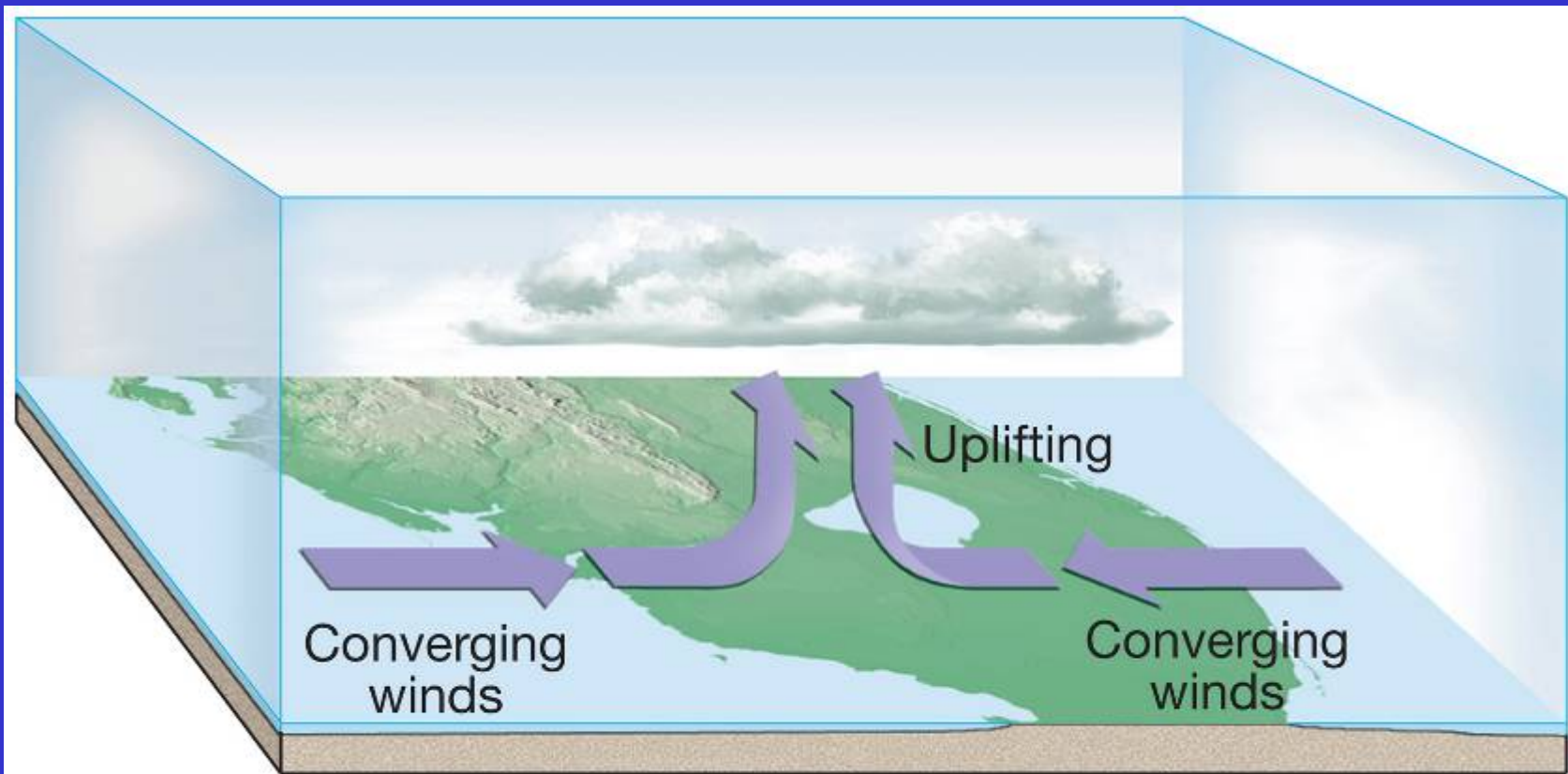


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# Frontal Wedging



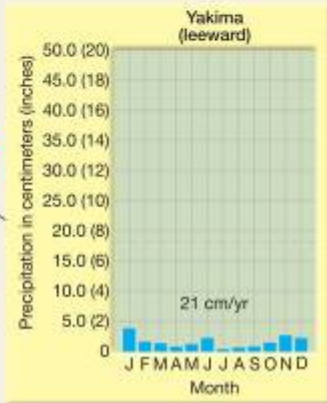
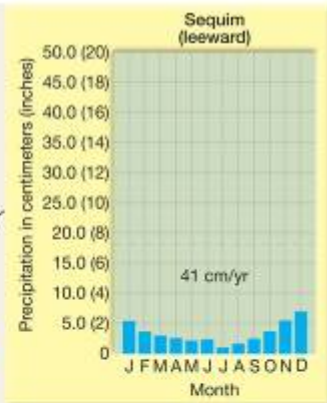
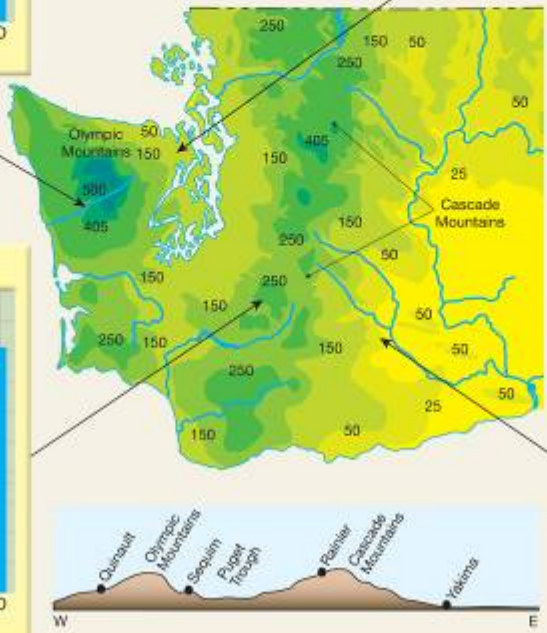
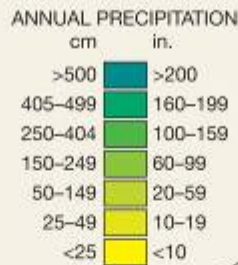
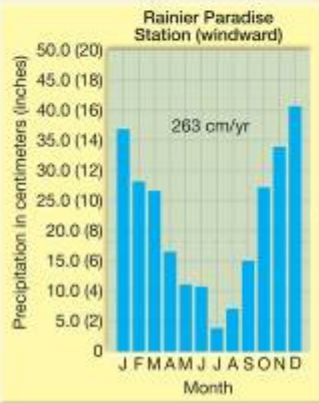
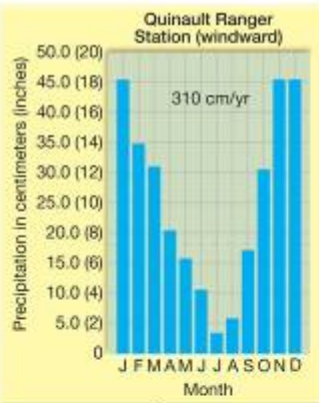
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# Convergence

Convergence  
over  
Southern Florida

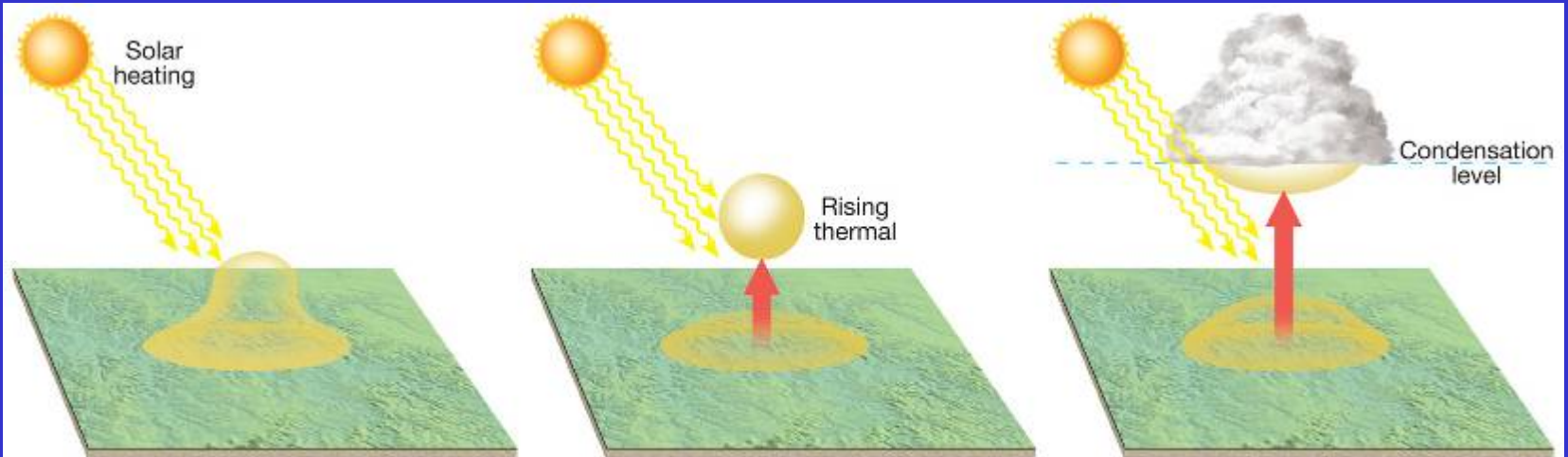


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# Wetter Windward Locations and Leeward Rain Shadows



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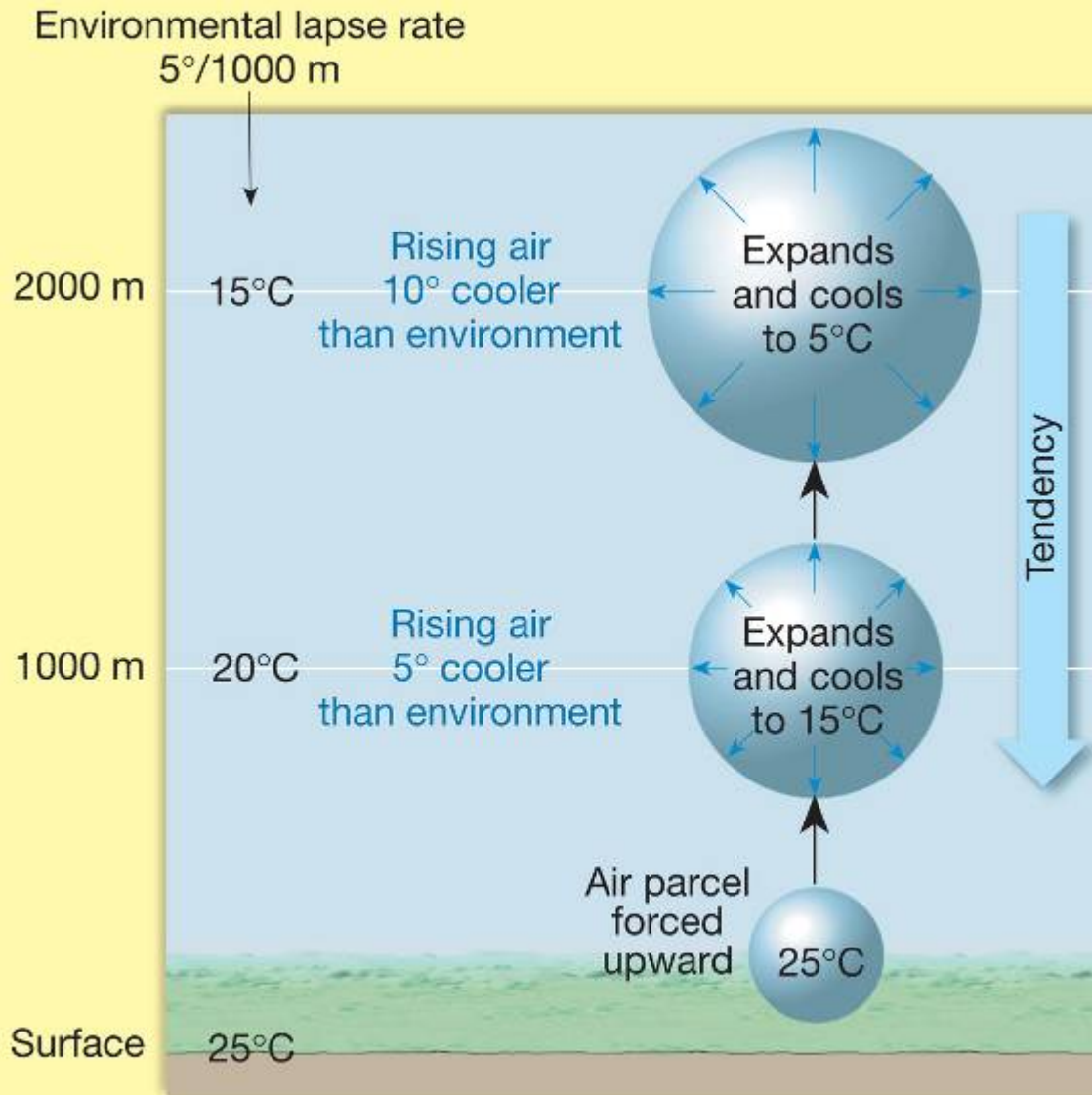
# Convection

As long as  
air  
in a  
balloon  
is  
hotter  
than the  
surrounding air,  
it will rise



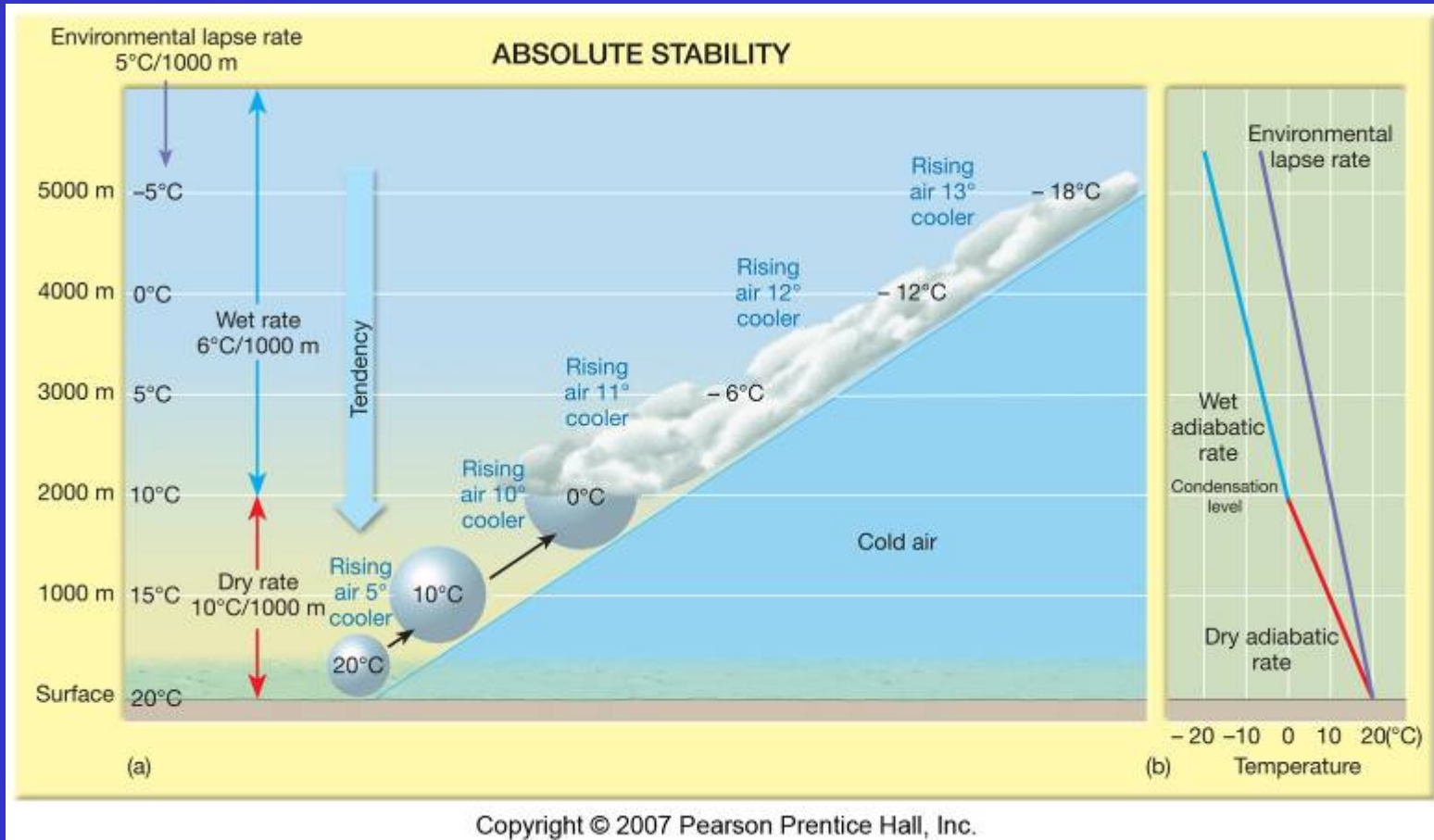
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# Adiabatic Cooling

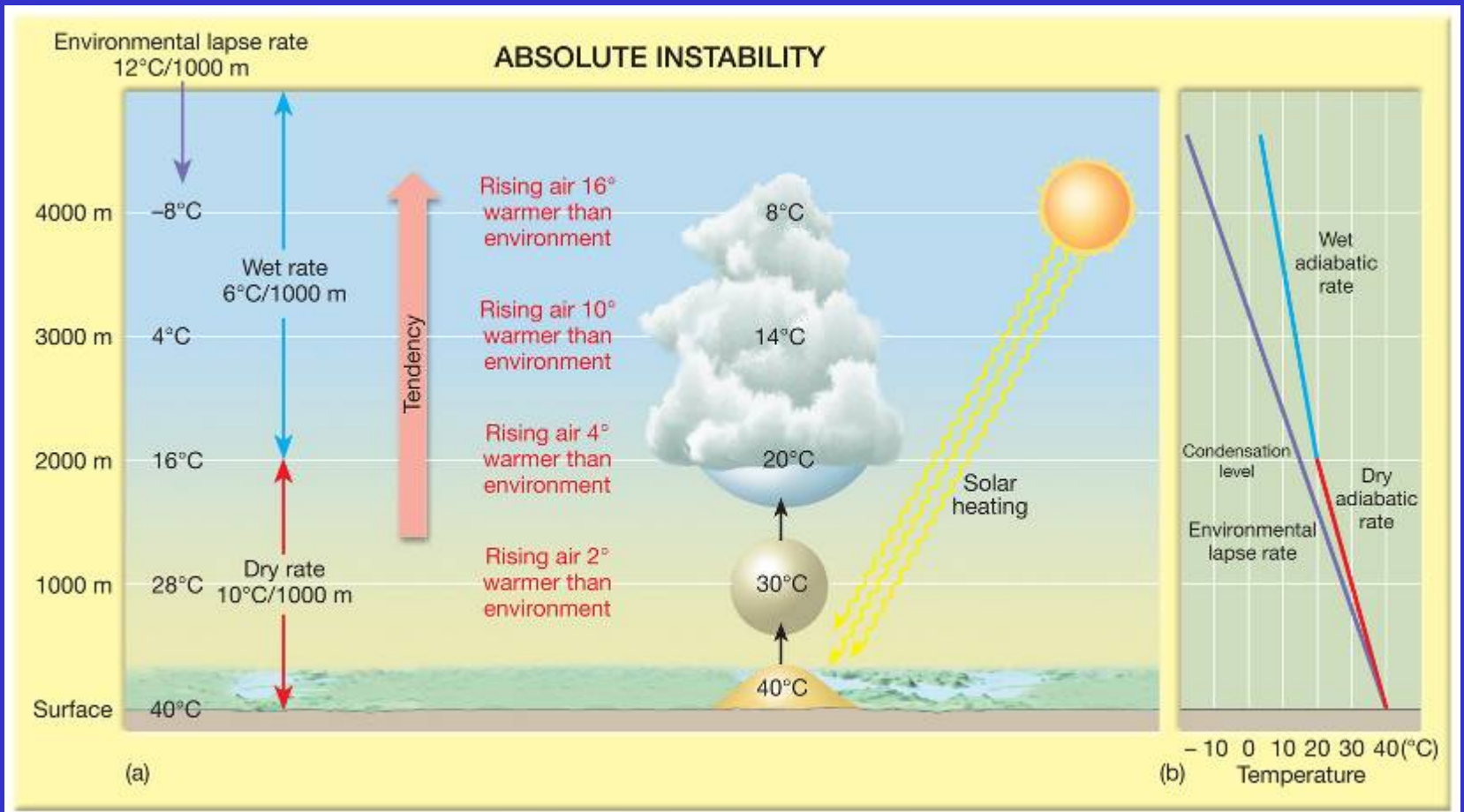




# Atmospheric Stability

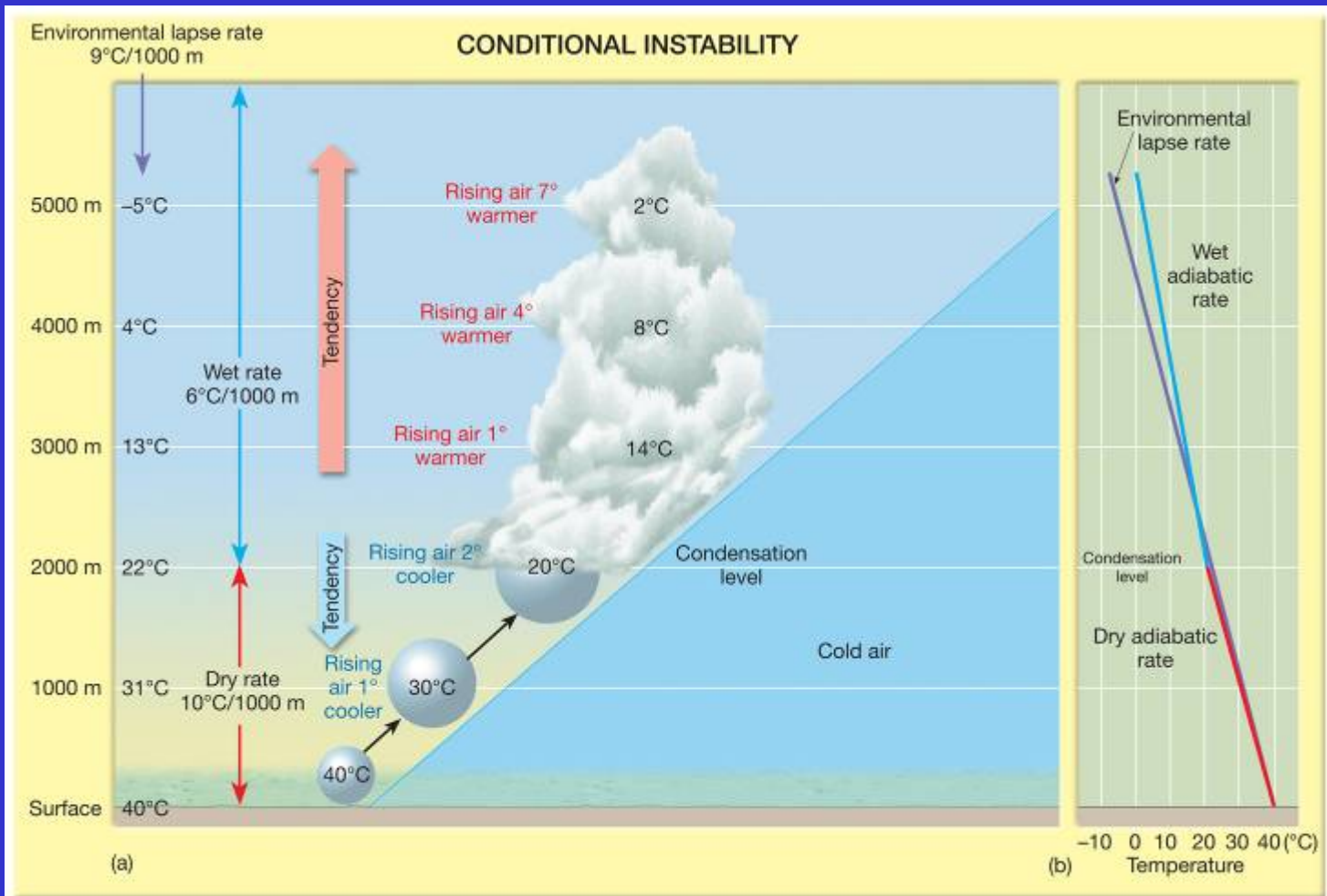


## Absolute Stability



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# Absolute Instability



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# Conditional Stability

# An Unstable Atmosphere



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# Chapter 4

END