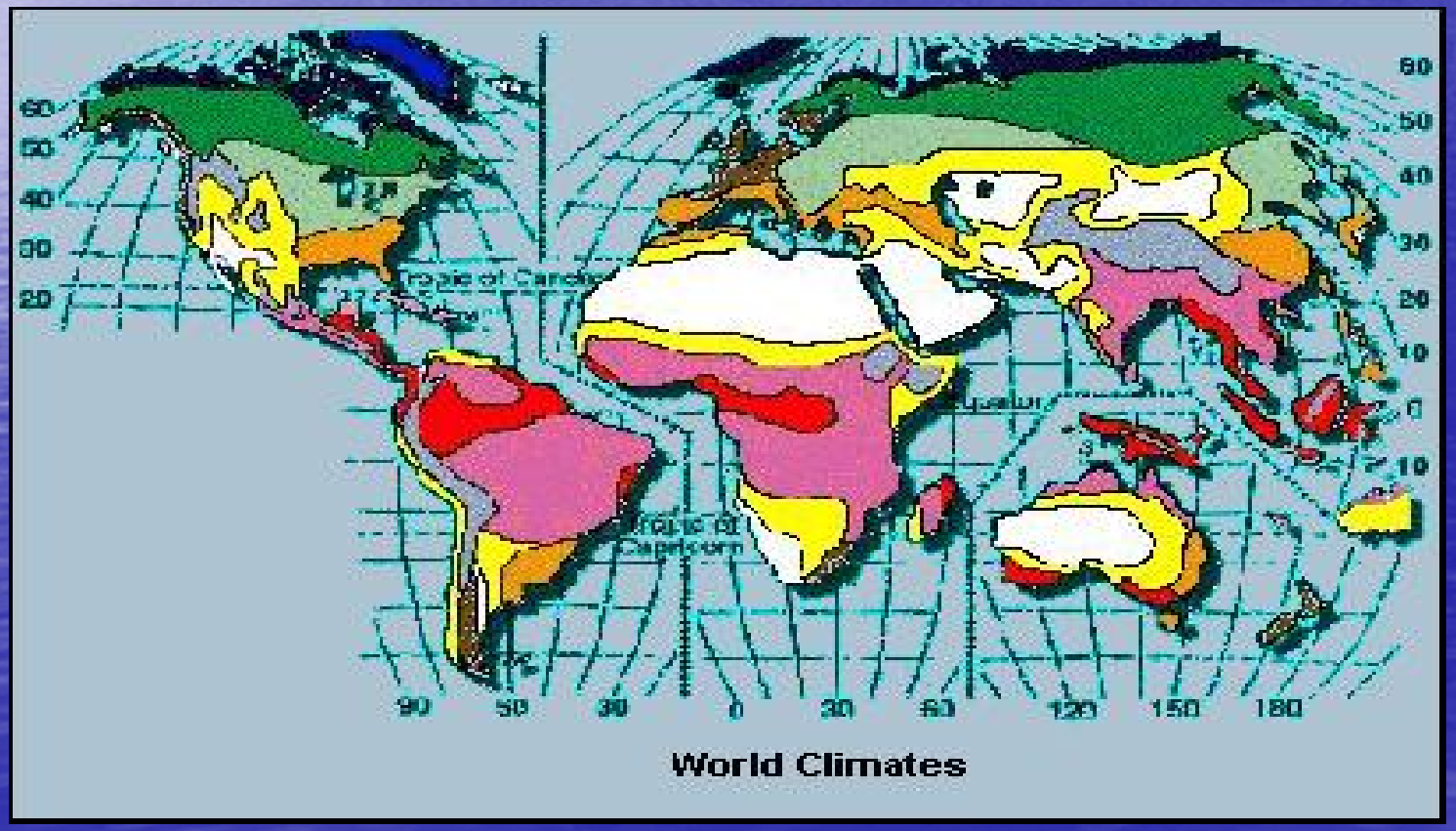
Weather

What Is Weather?

- Weather refers to the present state of the atmosphere and describes current conditions.
- The interaction of air, water and the sun causes weather.

- Climate – the pattern of weather in a particular region over a period of many years.
  - Determined by temperature, precipitation, and latitude.



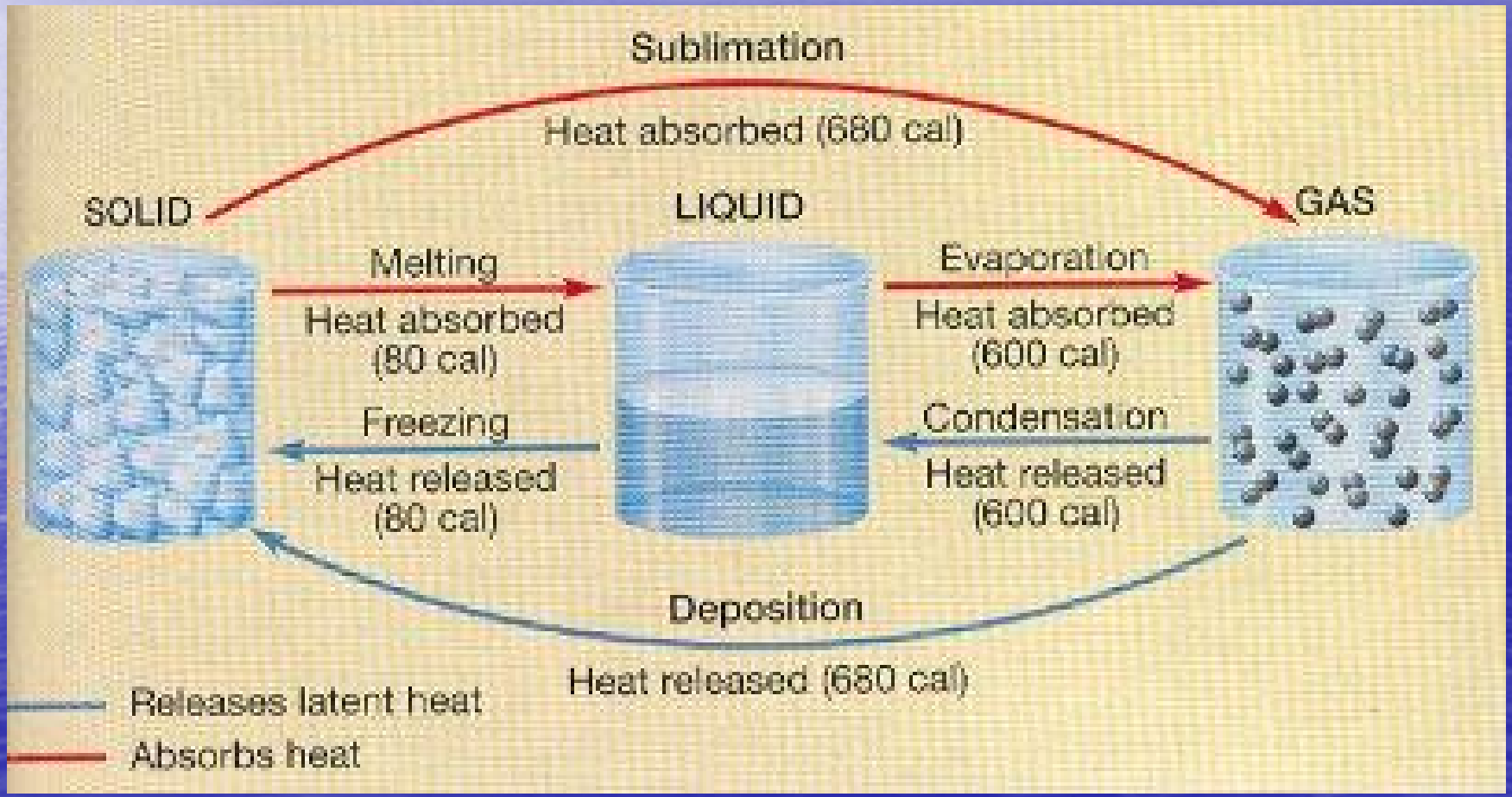
Heat Energy and Ice

- If heat (solar radiation) is added to ice, will change from a solid to a liquid to a gas.
  - The added heat causes molecules to move more quickly and break from their fixed positions, causing the ice to melt.
- Sublimation – process by which solid changes directly to vapor.
  - This occurs when the air is dry and temperatures are below freezing.
- Frost – the process of water vapor turning directly to ice (deposition).

Heat Energy and Water

- If heat (solar radiation) is added to water, the random movement of the molecules speeds up and causes them to collide with one another.
  - Such collisions can cause the molecules to move rapidly enough to evaporate.
    - Most of the water in the air comes from evaporation
    - Most evaporation occurs near the equator, where the largest amount of solar radiation is received.
    - The ocean is the main source of atmospheric moisture (billions of kg per day).
- Latent Heat – the energy that is absorbed by molecules (hidden).

Latent Heat

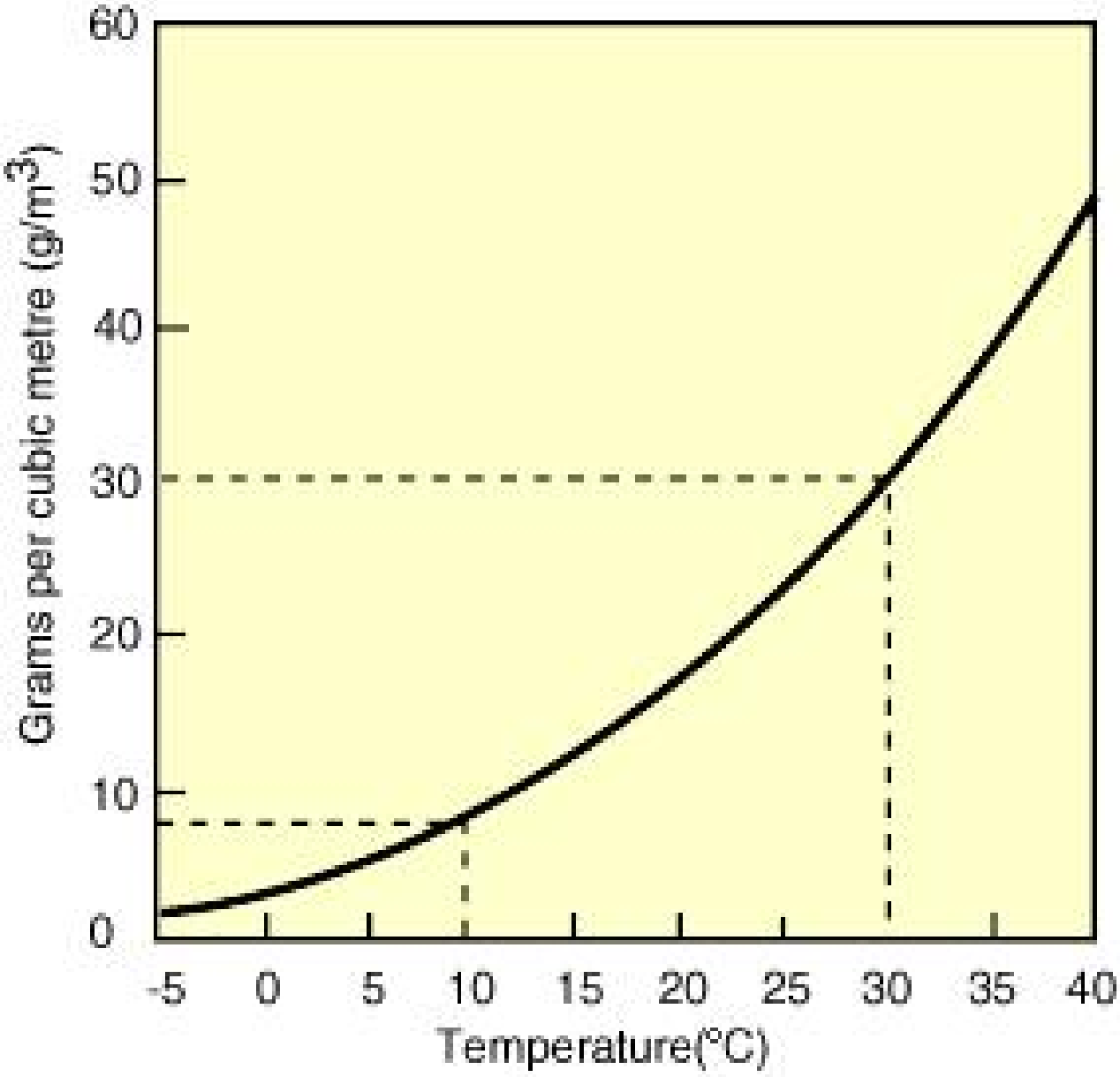

Sublimation
Heat absorbed (680 cal)
SOLID
LIQUID
GAS
Melting
Heat absorbed
(80 cal)
Evaporation
Heat absorbed
(600 cal)
Freezing
Heat released
(80 cal)
Condensation
Heat released
(600 cal)
Deposition
Heat released (680 cal)
Releases latent heat
Absorbs heat

Humidity

- Humidity is defined as the amount of water vapor in the atmosphere (air).
- Air acts like a sponge and holds water vapor
- Cold air can hold less water vapor
  - The molecules move slowly and are able to condense.
  - Warm air holds more water vapor because the molecules move too fast and can't condense.
  - Thus, it stays as water vapor in warm air.

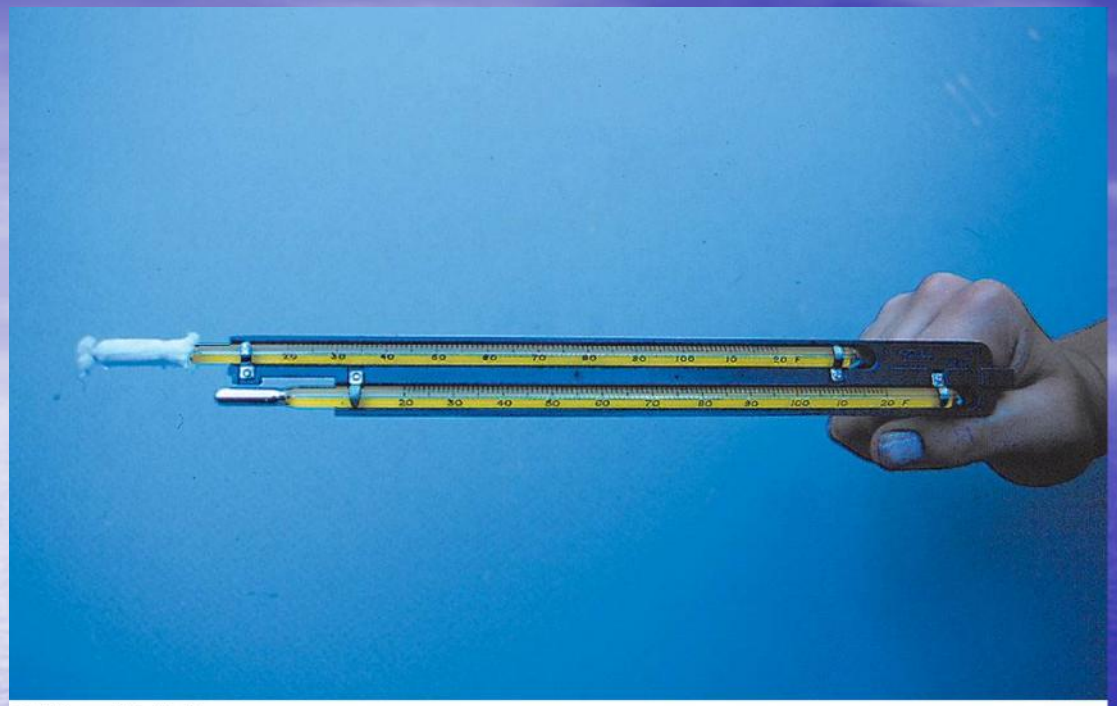
Relative Humidity

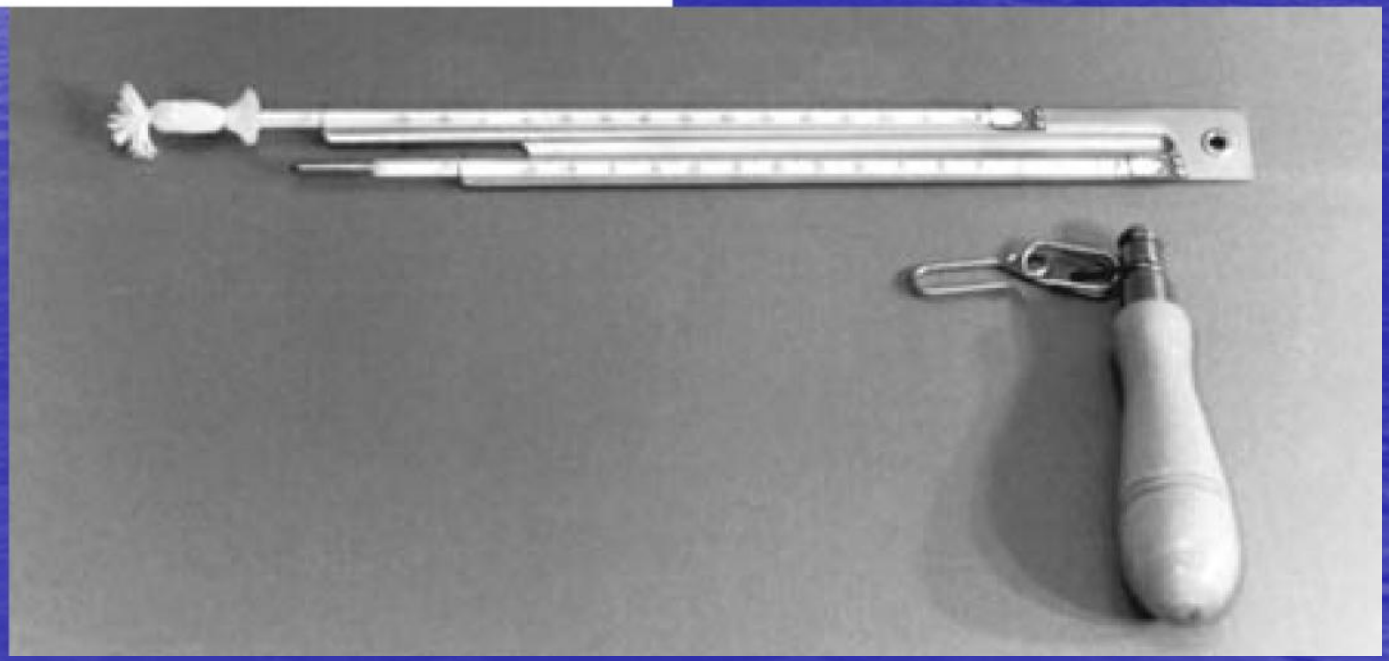
- Relative Humidity is defined as the amount of water vapor the air is holding compared to the amount it can hold at a specific temperature.
  - $R.H. = \left(\frac{mass\ of\ water\ vapor\ in\ the\ air}{mass\ water\ vapor\ the\ air\ can\ hold}\right)(100)$
- Saturated air – when it contains as much moisture as possible at a specific temperature.
  - Saturated air has a relative humidity of 100%


60
50
40
30
20
10
0
Grams per cubic metre (g/m3)
-5
0
5
10
15
20
25
30
35
40
Temperature(°C)

Measuring Relative Humidity

- A sling psychrometer is used to measure relative humidity. It consists of two identical thermometers.
  - The bulb of one thermometer is covered with a wet cloth while the other bulb remains dry.
  - The psychrometer is whirled around; the water on the wet-bulb begins to evaporate.
    - Evaporation needs heat, so the temperature drops
      - Dry air allows for more evaporation then wet
    - The temperature reading will either the same as the dry-bulb or lower.
  - The Approximate relative humidity can be determined by using the table below.





Relative Humidity (%)

Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
−20	100	28														
−18	100	40														
−16	100	48														
−14	100	55	11													
−12	100	61	23													
−10	100	66	33													
−8	100	71	41	13												
−6	100	73	48	20												
−4	100	77	54	32	11											
−2	100	79	58	37	20	1										
0	100	81	63	45	28	11										
2	100	83	67	51	36	20	6									
4	100	85	70	56	42	27	14									
6	100	86	72	59	46	35	22	10								
8	100	87	74	62	51	39	28	17	6							
10	100	88	76	65	54	43	33	24	13	4						
12	100	88	78	67	57	48	38	28	19	10	2					
14	100	89	79	69	60	50	41	33	25	16	8	1				
16	100	90	80	71	62	54	45	37	29	21	14	7	1			
18	100	91	81	72	64	56	48	40	33	26	19	12	6			
20	100	91	82	74	66	58	51	44	36	30	23	17	11	5		
22	100	92	83	75	68	60	53	46	40	33	27	21	15	10	4	
24	100	92	84	76	69	62	55	49	42	36	30	25	20	14	9	4
26	100	92	85	77	70	64	57	51	45	39	34	28	23	18	13	9
28	100	93	86	78	71	65	59	53	47	42	36	31	26	21	17	12
30	100	93	86	79	72	66	61	55	49	44	39	34	29	25	20	16

Specific humidity

- Meteorologists use specific humidity to express the actual amount of moisture in the air.
- It is the grams of water vapor per 1 kg of air.
  - Example:
    - Tropical regions can have a specific humidity of about 18 g/kg.
    - Polar regions can have a specific humidity of less than 1 g/kg.
- It is not affected by changes in temperature because the humidity is only measured in units of mass.

Dew Point

- Dew point is defined as the temperature at which air must be cooled to reach saturation.
  - condensation takes place at this temperature

Dew Point

- Dew
  - Surface temperatures often drop to the dew point of the surrounding air at night.
  - Air, normally remains warmer than the surfaces near the ground.
  - When the air contacts the cooler objects (grass or leaves), the process of conductions causes the water vapor to condense and form dew.
- Frost forms when temperatures are below freezing.

Fun Facts About Weather

- According to the National Public Health Newsletter of January, 1922, the chances of being hit by lightning is 1:28,500.
- In one day a hurricane can release enough energy to supply all of the nation's electrical needs for about six months
- It takes about one million cloud droplets to provide enough water for one raindrop