

LESSON 21

How do we measure relative humidity?

Have you ever tried air-drying clothes on a humid day? It takes a long time. The air already contains many water molecules. The water from the clothes evaporates very slowly. Evaporate means to change to a gas.

How fast evaporation takes place depends on the humidity. When the water does evaporate something happens. The surface that had been wet becomes cooler. For example, when the sweat on your body evaporates, your skin cools down.

Now you know two important facts about evaporation. Water evaporates slowly when the air is damp. It evaporates faster when the air is dry. When water evaporates, the temperature goes down.

These facts make it possible to measure relative humidity. Relative humidity is measured with a **hygrometer** [hy-GRahM-uh-tur]. One kind of hygrometer is the wet-and-dry-bulb thermometer.

A wet-and-dry-bulb thermometer has two thermometers. One of the thermometers has a wet cloth around the bulb. This is the wet bulb. The thermometer without the wet cloth is the dry bulb.

- The dry-bulb thermometer measures the normal air temperature.
- The temperature of the wet-bulb thermometer depends on how fast the water evaporates.

When the air is saturated, no evaporation takes place. The temperature of the wet-bulb thermometer is the same as the dry-bulb thermometer.

When air is not saturated, evaporation does take place. The wet bulb cools down. It has a lower temperature than the dry bulb.

If the wet bulb has a much lower temperature than the dry bulb, it means the air is not very humid.

LESSON 21 | How do we measure relative humidity?

Have you ever tried air-drying clothes on a humid day? It takes a long time. The air already contains many water molecules. The water from the clothes evaporates very slowly. Evaporate means to change to a gas.

How fast evaporation takes place depends on the humidity. When the water does evaporate something happens. The surface that had been wet becomes cooler. For example, when the sweat on your body evaporates, your skin cools down.

Now you know two important facts about evaporation. Water evaporates slowly when the air is damp. It evaporates faster when the air is dry. When water evaporates, the temperature goes down.

These facts make it possible to measure relative humidity. Relative humidity is measured with a **hygrometer** [hy-GRAM-uh-tur]. One kind of hygrometer is the wet-and-dry-bulb thermometer.

A wet-and-dry-bulb thermometer has two thermometers. One of the thermometers has a wet cloth around the bulb. This is the wet bulb. The thermometer without the wet cloth is the dry bulb.

- The dry-bulb thermometer measures the normal air temperature.
- The temperature of the wet-bulb thermometer depends on how fast the water evaporates.

When the air is saturated, no evaporation takes place. The temperature of the wet-bulb thermometer is the same as the dry-bulb thermometer.

When air is not saturated, evaporation does take place. The wet bulb cools down. It has a lower temperature than the dry bulb.

If the wet bulb has a much lower temperature than the dry bulb, it means the air is not very humid.

FIND THE PARTS

Figure A shows a wet-and-dry-bulb thermometer. Find the parts listed below. Then write the letter of each part on the correct line.

- _____ wet-bulb thermometer
_____ dry-bulb thermometer
_____ water
_____ wet cloth

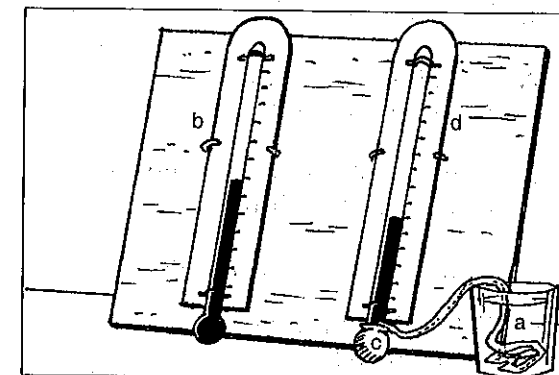


Figure A

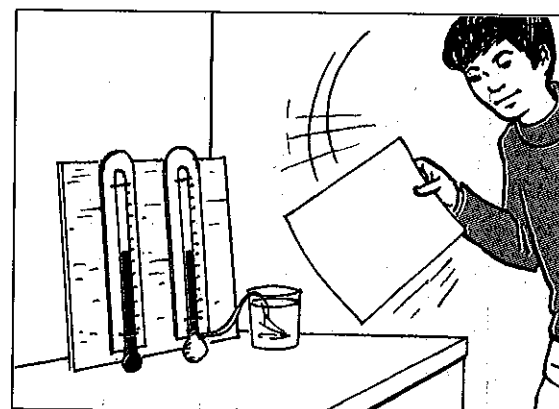


Figure B

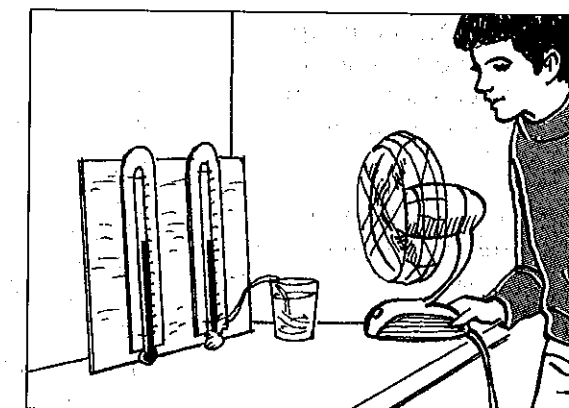


Figure C

You should fan a wet-and-dry-bulb thermometer before you read the temperatures. This keeps air moving around the wet bulb so that the water evaporates.

You can even spin the thermometers. The hygrometer in Figure D is also called a sling psychrometer [sy-KRAHM-uh-tur].

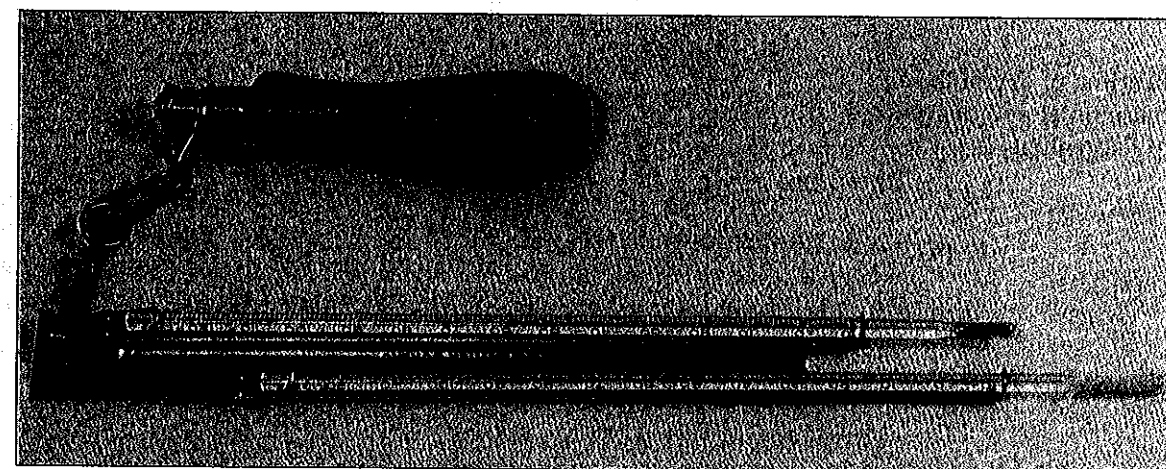


Figure D

HOW TO USE THE WET-AND-DRY THERMOMETER CHART

In order to find out the relative humidity after you read the temperatures, you must use a chart (Figure E).

1. Find the dry-bulb temperature readings on the chart (column A).
2. Find the temperature difference between the wet and dry thermometers on the chart. (Look on line B.)
3. Follow both numbers into the chart. Where the two numbers meet is the percentage of relative humidity.

The chart shows one example.

- IF, the dry thermometer reads 80° F and the wet-bulb thermometer reads 75°
- THEN, the temperature difference between the dry and wet thermometers is 5°.
- THEREFORE, the relative humidity is 79%.

relative humidity in percent
Difference in degrees between
wet-bulb and dry-bulb thermometers

(A)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15 (B)
40°	92	84	76	68	61	53	46	38	31	23	16	9	2		
42°	92	85	77	70	62	55	48	41	34	28	21	14	7		
44°	93	85	78	71	64	57	51	44	37	31	24	18	12	5	
46°	93	86	79	72	65	59	53	46	40	34	28	22	16	10	4
48°	93	87	80	73	67	60	54	48	42	36	31	25	19	14	8
50°	93	87	81	74	68	62	56	50	44	39	33	28	22	17	12
52°	94	88	81	75	69	63	58	52	46	41	36	30	25	20	15
54°	94	88	82	76	70	65	59	54	48	43	38	33	28	23	18
56°	94	88	82	77	71	66	61	55	50	45	40	35	31	26	21
58°	94	89	83	77	72	67	62	57	52	47	42	38	33	28	24
60°	94	89	84	78	73	68	63	58	53	49	44	40	35	31	27
62°	94	89	84	79	74	69	64	60	55	50	46	41	37	33	29
64°	95	90	85	79	75	70	66	61	56	52	48	43	39	35	31
66°	95	90	85	80	76	71	66	62	58	53	49	45	41	37	33
68°	95	90	85	81	76	72	67	63	59	55	51	47	43	39	35
70°	95	90	86	81	77	72	68	64	60	56	52	48	44	40	37
72°	95	91	86	82	78	73	69	65	61	57	53	49	46	42	39
74°	95	91	86	82	78	74	70	66	62	58	54	51	47	44	40
76°	96	91	87	83	78	74	70	67	63	59	55	52	48	45	42
78°	96	91	87	83	79	75	71	67	64	60	57	53	50	46	43
80°	96	91	87	83	79	76	72	68	64	61	57	54	51	47	44
82°	96	91	87	83	79	76	72	69	65	62	58	55	52	49	46
84°	96	92	88	84	80	77	73	70	66	63	59	56	53	50	47
86°	96	92	88	84	80	77	73	70	66	63	60	57	54	51	48
88°	96	92	88	85	81	78	74	71	67	64	61	58	55	52	49
90°	96	92	88	85	81	78	74	71	68	64	61	58	56	53	50

Figure E

Reading of dry-bulb thermometer in degrees of Fahrenheit

HOW TO USE THE WET-AND-DRY THERMOMETER CHART

In order to find out the relative humidity after you read the temperatures, you must use a chart (Figure E).

1. Find the dry-bulb temperature readings on the chart (column A).
2. Find the temperature difference between the wet and dry thermometers on the chart. (Look on line B.)
3. Follow both numbers into the chart. Where the two numbers meet is the percentage of relative humidity.

The chart shows one example.

- IF, the dry thermometer reads 80° F and the wet-bulb thermometer reads 75°
- THEN, the temperature difference between the dry and wet thermometers is 5°.
- THEREFORE, the relative humidity is 79%.

Reading of dry-bulb thermometer in degrees of Fahrenheit	relative humidity in percent															
	Difference in degrees between wet-bulb and dry-bulb thermometers															
(A)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	(B)
40°	92	84	76	68	61	53	46	38	31	23	16	9	2			
42°	92	85	77	70	62	55	48	41	34	28	21	14	7			
44°	93	85	78	71	64	57	51	44	37	31	24	18	12	5		
46°	93	86	79	72	65	59	53	46	40	34	28	22	16	10	4	
48°	93	87	80	73	67	60	54	48	42	36	31	25	19	14	8	
50°	93	87	81	74	68	62	56	50	44	39	33	28	22	17	12	
52°	94	88	81	75	69	63	58	52	46	41	36	30	25	20	15	
54°	94	88	82	76	70	65	59	54	48	43	38	33	28	23	18	
56°	94	88	82	77	71	66	61	55	50	45	40	35	31	26	21	
58°	94	89	83	77	72	67	62	57	52	47	42	38	33	28	24	
60°	94	89	84	78	73	68	63	58	53	49	44	40	35	31	27	
62°	94	89	84	79	74	69	64	60	55	50	46	41	37	33	29	
64°	95	90	85	79	75	70	66	61	56	52	48	43	39	35	31	
66°	95	90	85	80	76	71	66	62	58	53	49	45	41	37	33	
68°	95	90	85	81	76	72	67	63	59	55	51	47	43	39	35	
70°	95	90	86	81	77	72	68	64	60	56	52	48	44	40	37	
72°	95	91	86	82	78	73	69	65	61	57	53	49	46	42	39	
74°	95	91	86	82	78	74	70	66	62	58	54	51	47	44	40	
76°	96	91	87	83	78	74	70	67	63	59	55	52	48	45	42	
78°	96	91	87	83	79	75	71	67	64	60	57	53	50	46	43	
80°	96	91	87	83	79	76	72	68	64	61	57	54	51	47	44	
82°	96	91	87	83	79	76	72	69	65	62	58	55	52	49	46	
84°	96	92	88	84	80	77	73	70	66	63	59	56	53	50	47	
86°	96	92	88	84	80	77	73	70	66	63	60	57	54	51	48	
88°	96	92	88	85	81	78	74	71	67	64	61	58	55	52	49	
90°	96	92	88	85	81	78	74	71	68	64	61	58	56	53	50	

Figure E

FINDING RELATIVE HUMIDITY

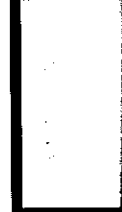
Fill in the missing numbers in the boxes below. Use the chart on the facing page.

	Dry-bulb Temperature °F	Wet-bulb Temperature °F	Temperature Difference	Percentage Relative Humidity
1.	78	73		
2.	54	39		
3.	74	66		
4.	40	29		
5.	90	89		
6.	76	71		
7.	90	75		
8.	62	52		
9.	82	71		
10.	48	37		
11.	80	77		
12.	46	35		

MATCHING

Match each term in Column A with its description in Column B. Write the correct letter in the space provided.

Column A	Column B
_____ 1. water vapor	a) the amount of water vapor in the air compared to the amount it can hold at a given temperature
_____ 2. relative humidity	b) can hold little water vapor
_____ 3. warm air	c) measures relative humidity
_____ 4. cold air	d) can hold a lot of water vapor
_____ 5. hygrometer	e) water in gas form



FILL IN THE BLANK

Complete each statement using a term or terms from the list below. Write your answers in the spaces provided.

- | | | |
|------------|------------------------------|------|
| 100% | percent | spin |
| evaporates | wet-and-dry-bulb thermometer | two |
| cooler | fan | dry |
| hygrometer | air temperature | |

- Any instrument that measures relative humidity is called a _____.
- The _____ is one kind of hygrometer.
- A wet-and-dry-bulb thermometer has _____ thermometers.
- The dry bulb measures _____.
- The wet-bulb temperature depends on how fast the water _____.
- Before we read the temperatures of the wet-and-dry-bulb thermometer, we should first _____ or _____ it.
- Evaporation makes things drier and _____.
- Evaporation happens faster when the air is _____.
- Relative humidity is written as a _____.
- Water does not evaporate when the relative humidity is _____.

REACHING OUT

Modeling You can make your own wet-and-dry-bulb thermometer. Figure F shows what it should look like. Try and make your own and then show it to your classmates. Be careful when using thermometers.

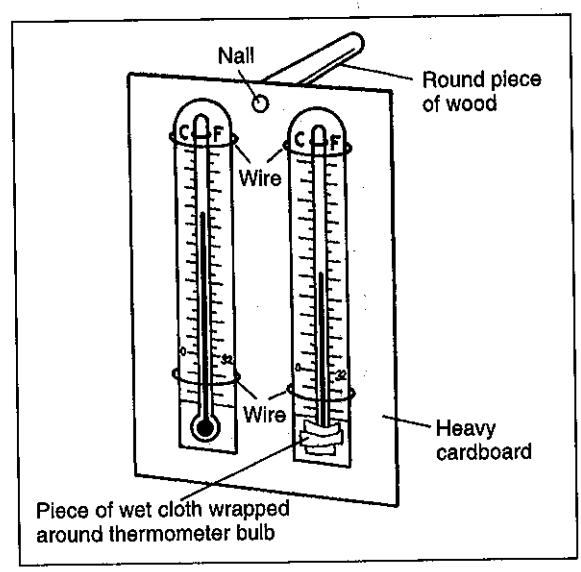


Figure F