

Water in the Air

Pages 38-45

Quick Write

- What is the water cycle?
- Draw and label a diagram of the water cycle.

Chapter 2, Section 1

Does this look familiar? Please open your text to page 38 and copy and complete this in your Science notebook. Skip two lines between each main idea so you can note what you already know.

- Topic:
- Main Idea #1:
- Main Idea # 2:
- Main Idea #3:
- Main Idea #4:
- Main Idea #5

Chapter 2, Section 1

- Topic: *Water in the Air*
- Main Idea #1: *The Water Cycle*
- Main Idea # 2: *Humidity*
- Main Idea #3: *Condensation*
- Main Idea #4: *Clouds*
- Main Idea #5: *Precipitation*

Objectives:

You will be able to

- Explain how water moves through the water cycle.
- Describe how relative humidity is affected by temperature and levels of water vapor.
- Describe the relationship between dew point and condensation.
- List 3 types of cloud forms.
- Identify 4 kinds of precipitation.

Weather

- Weather is the condition of the atmosphere at a certain time and place.
- The condition of the atmosphere is affected by the amount of water in the air.

The Water Cycle

The **water cycle** is the continuous movement of water from sources on Earth's surface-such as lakes, oceans, and plants-into the air onto and over land, into the ground, and back to the surface.

What's different on this slide from the image in the book?

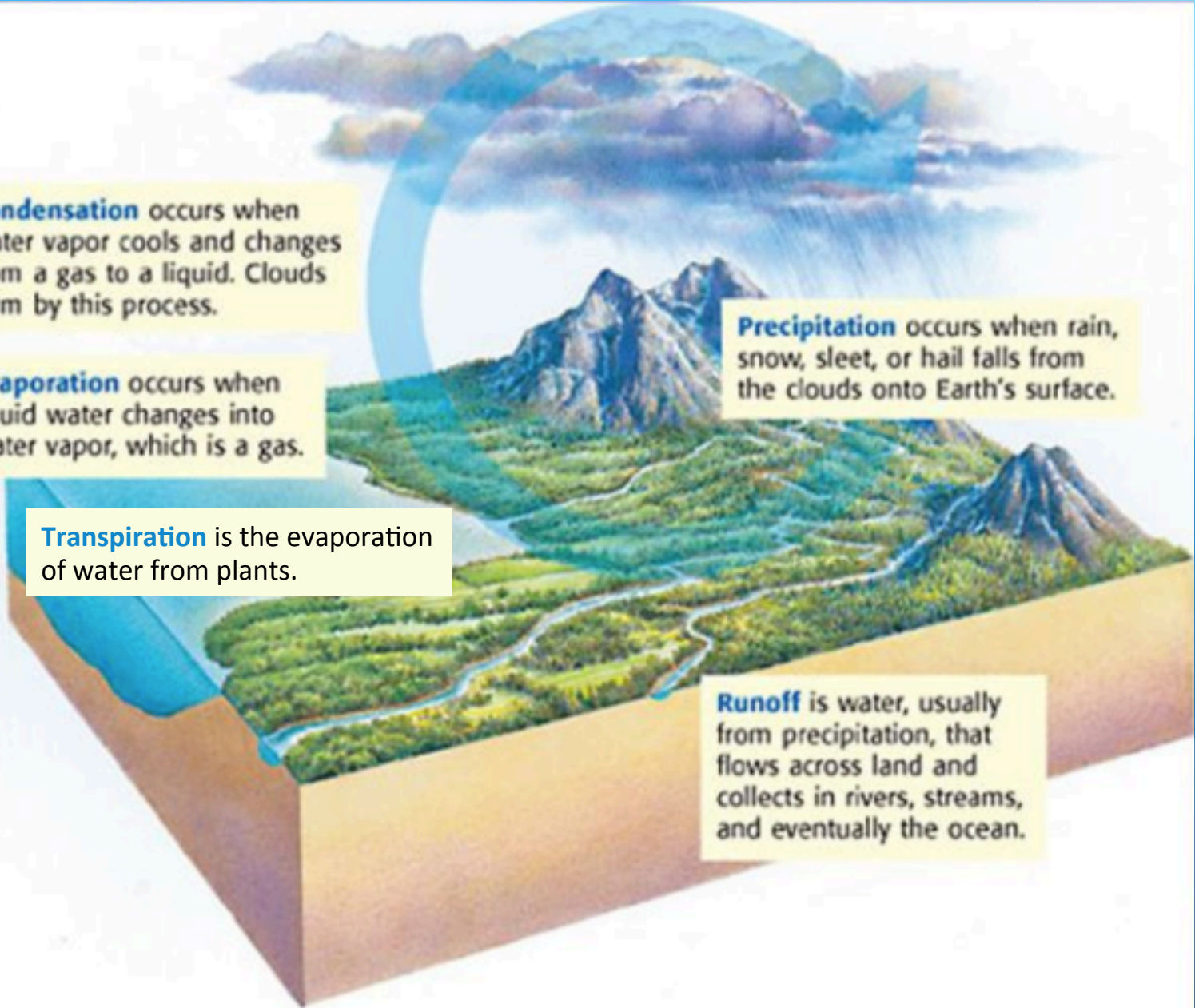
Condensation occurs when water vapor cools and changes from a gas to a liquid. Clouds form by this process.

Evaporation occurs when liquid water changes into water vapor, which is a gas.

Transpiration is the evaporation of water from plants.

Precipitation occurs when rain, snow, sleet, or hail falls from the clouds onto Earth's surface.

Runoff is water, usually from precipitation, that flows across land and collects in rivers, streams, and eventually the ocean.



1

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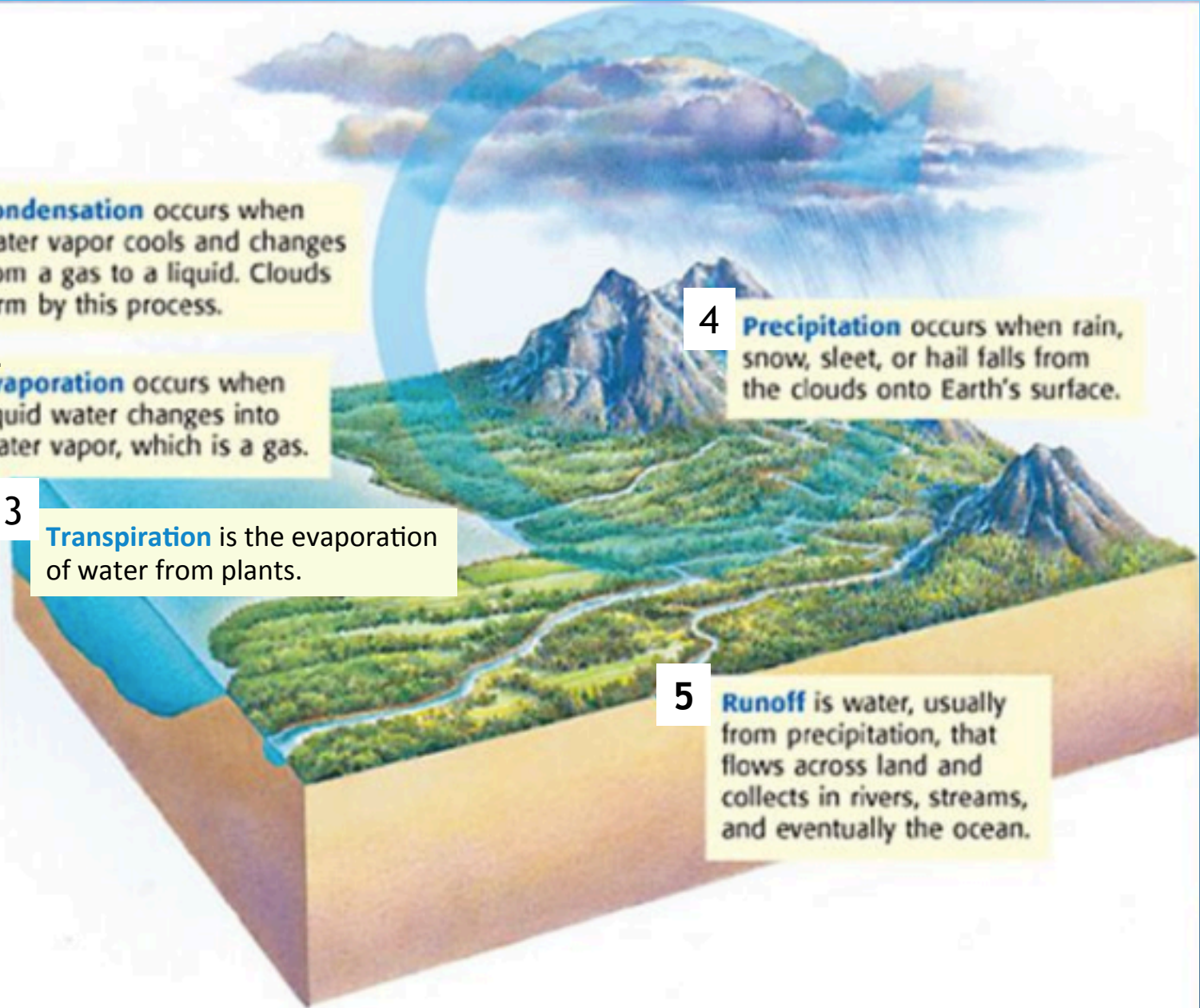
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Snowball Toss!

Find a matching pair.



https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcSlrkd1NFqPEGipXFqB430LcqBpGW5M5FghWL9KIAZH_Ob9Zh-

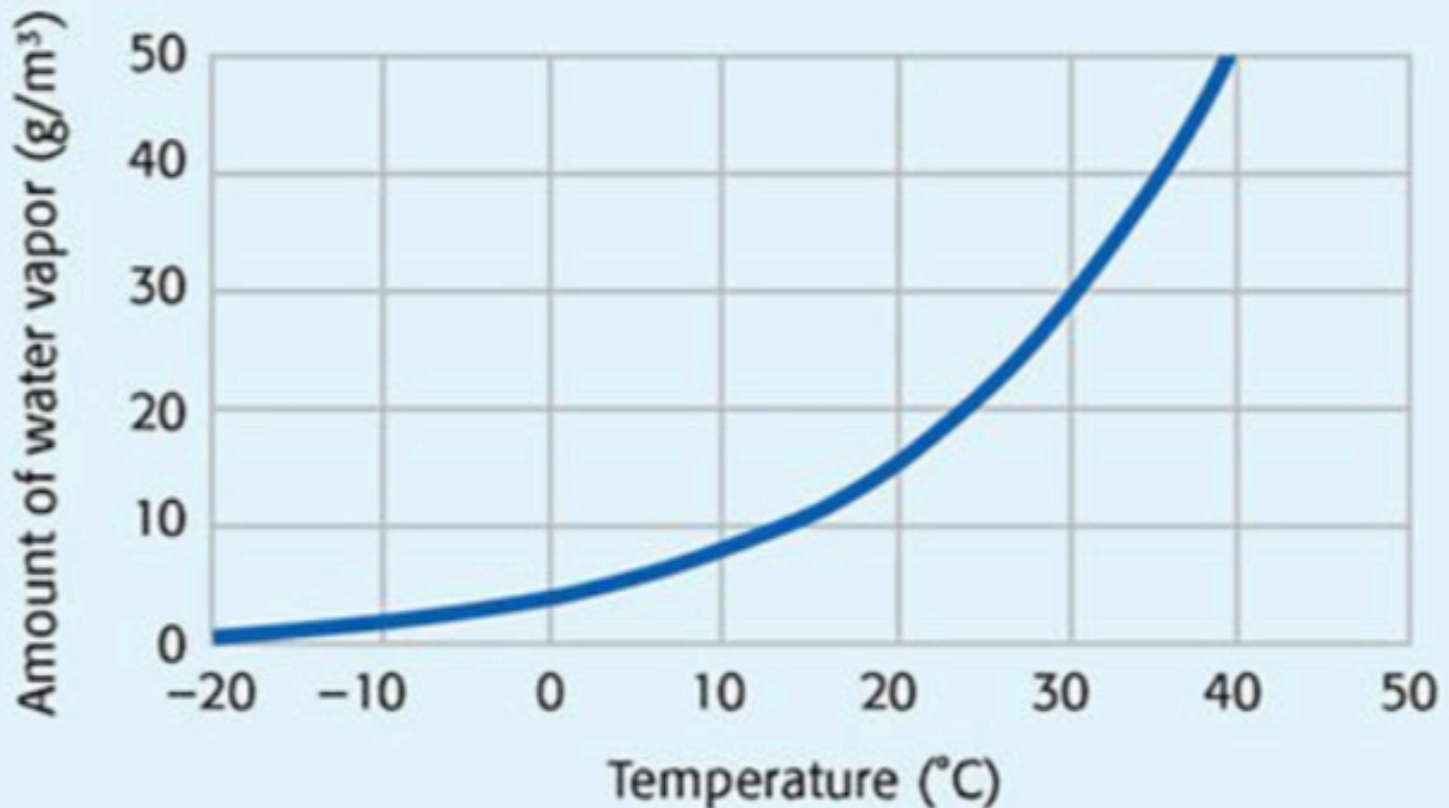
Humidity

- **Humidity** is the amount of water vapor in the air.
- Water vapor is a gas, it is invisible.
- As water vapor in the air increases, the humidity of the air increases.

At what time of year does it feel humid? Why?

As air gets warmer, the amount of water vapor the air can hold increases.
(Colder air holds less water vapor.)

Amount of Water Vapor Air Can Hold at Various Temperatures



Celsius Rhyme

30 is hot, (86°F)

20 is pleasing, (68°F)

10 is cool, (50°F)

0 is freezing. (32°F)

Relative Humidity

- **Relative humidity** is the amount of water vapor in the air compared with the maximum amount of water vapor that the air can hold at a certain temperature. (given as a percentage-%)
- **Saturated** air has a relative humidity of 100%. It is holding all of the water that it can at a given temperature.

What happens when air temperature increases? Decreases?

(Answer in 2 slides!)

Calculating Relative Humidity

actual water vapor content (g/m^3)

divided by

saturation water vapor content (g/m^3)

multiplied by 100

You try it:

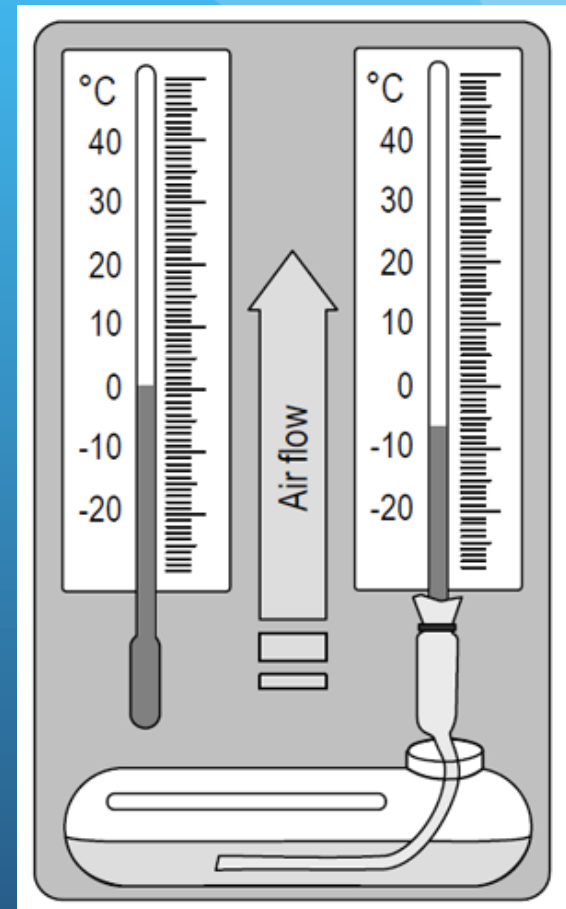
- 1m^3 of air at 25°C contains 11g of water vapor.
- At this temperature, the air can hold $24\text{ g}/\text{m}^3$ of water vapor.
- Calculate the relative humidity.

Factors Affecting Relative Humidity

- Two Factors
 - Amount of water vapor
 - Temperature
- If the amount of water vapor in the air stays the same but the temperature in the air changes, the relative humidity changes.
- The relative humidity decreases as the temperature rises and increases as the temperature drops. **Did you get the question 2 slides back correct?**

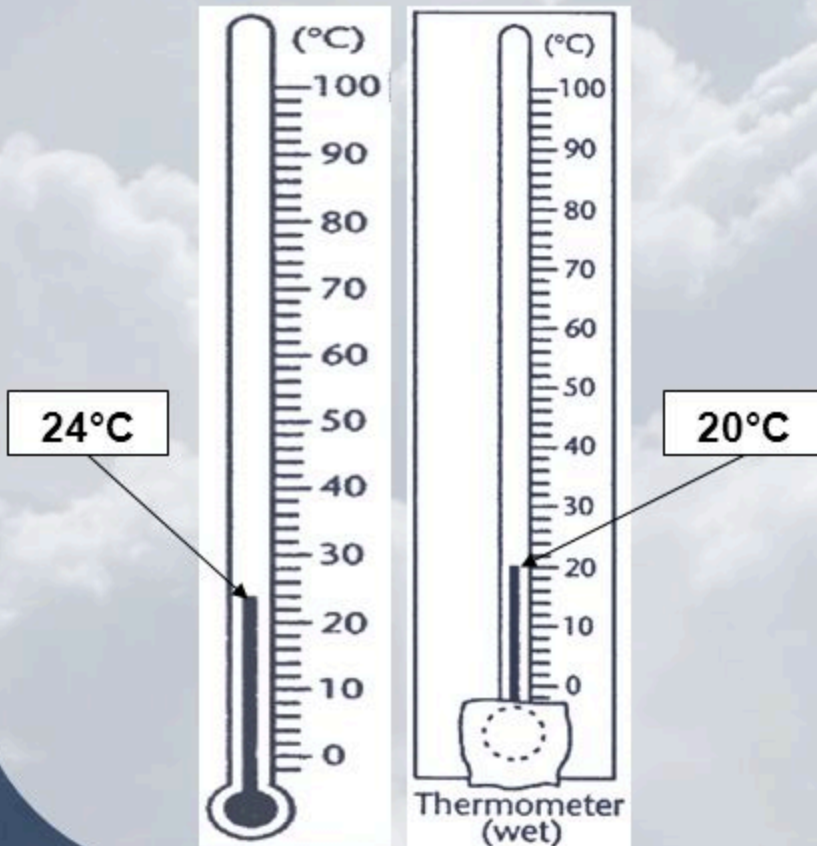
Measuring Relative Humidity

- A psychrometer measures relative humidity by giving temperature readings for a dry and wet-bulb thermometer, which can be compared to a chart.
- As air passes over a wet-bulb thermometer, the water in the cloth evaporates. The cloth cools. If the humidity is low, the water will evaporate more quickly and the temperature reading on the wet-bulb thermometer will drop.



Determining Relative Humidity

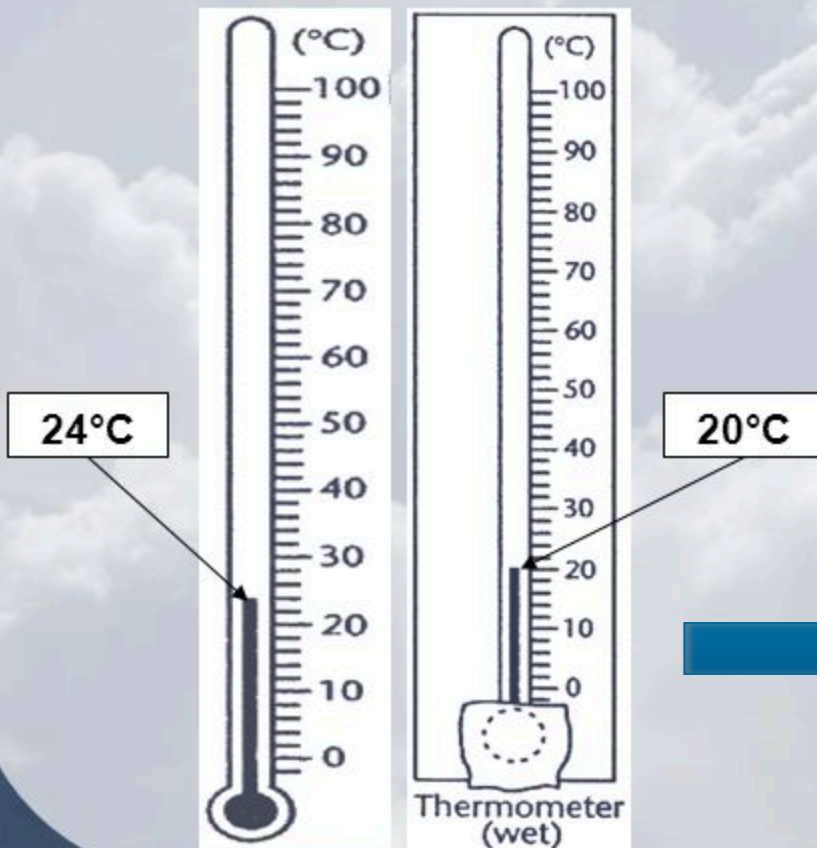
If the dry-bulb thermometer reads 24°C and the wet-bulb thermometer reads 20°C , what's the relative humidity?



Relative Humidity					
Dry-Bulb Reading	Difference between Wet- and Dry- Bulb Readings				
	Called the "Depression"				
	1	2	3	4	5
10	88	76	65	54	43
12	88	78	67	57	48
14	89	79	69	60	50
16	90	80	71	62	54
18	91	81	72	64	56
20	91	82	74	66	58
22	92	82	75	68	60
24	92	84	76	69	62
26	92	85	77	70	64
28	93	86	78	71	65
30	93	86	79	72	66

Determining Relative Humidity

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Condensation

- **Condensation** is the process by which a gas, such as water vapor, becomes a liquid. (It's the change of state from a gas to a liquid.)
- Before condensation can occur, the air must be saturated (have a relative humidity of 100%).
- Condensation occurs when saturated air cools.

Dew Point

- The dew point is the temperature at which a gas condenses into a liquid.
- Before water vapor can condense, it must have a surface to condense on.



No, it didn't rain.

<https://scienceofbeingblog.files.wordpress.com/2015/07/dew-grass-refined.jpg>

Clouds

- A cloud is a collection of millions of tiny water droplets or ice crystals.
- Clouds form as warm air rises and cools.
- As the rising air cools, it becomes saturated.
- When the air is saturated, the water vapor changes to a liquid or a solid depending on the temperature.

Condensation Nuclei

(not in text)

*Average rain drop
size - 2 millimeters*

*Average cloud droplet
size - 0.02 millimeters*



*Average condensation
nucleus size -
0.0002 millimeters*

Cloud condensation nuclei are tiny liquid or solid particles around which water vapor in the air condenses.

Examples:

- Smoke particles from fires or volcanoes
- Ocean spray (sea salt)
- Tiny specks of wind-blown soil
- Microbes/bacteria

Cumulus Clouds

- Puffy, white clouds; look like piles of cotton balls
- Tend to have flat bottoms
- Form when warm air rises
- Generally indicate fair weather



Stratus Clouds

- Form in layers
- Cover large areas of the sky; often block out the sun
- Caused by a gentle lifting of a large body of air



Cirrus Clouds

- Thin, feathery, white clouds
- Made of ice crystals
- Found at high altitudes
- Form when the wind is strong
- When they thicken, it indicates a change in weather is coming



Cloud Types Based on Form and Altitude

High Clouds Because of the cold temperatures at high altitude, high clouds are made up of ice crystals. The prefix *cirro-* is used to describe high clouds.

Middle Clouds Middle clouds can be made up of both water drops and ice crystals. The prefix *alto-* is used to describe middle clouds.

Low Clouds Low clouds are made up of water drops. There is no specific prefix used to describe low clouds.

8,000 m Cirrocumulus

Cirrus

Cirrostratus

6,000 m

Altostratus

Cumulonimbus

4,000 m

Alto cumulus

Cumulus

2,000 m

Stratocumulus

Nimbostratus

Stratus



Cloud Clues

- Cumulus: heap
- Stratus: layer
- Cirrus: curl
- Nimbo-/-nimbus: precipitation
- Cirro-: high clouds
- Alto-: middle level clouds

Try the Cloud Typing activity at:

[http://www.pbs.org/wgbh/nova/labs/lab/cloud/research/
classification/](http://www.pbs.org/wgbh/nova/labs/lab/cloud/research/classification/)

Precipitation-water in solid or liquid form that falls from the air to Earth

Rain

- When a water drop forms on condensation nuclei and grows about 100x in size, it falls as rain

Sleet

- Falling ice that forms when rain falls through a layer of freezing air

Snow

- Falling ice crystals or snowflakes that form when temperatures are so cold that water vapor forms directly to a liquid

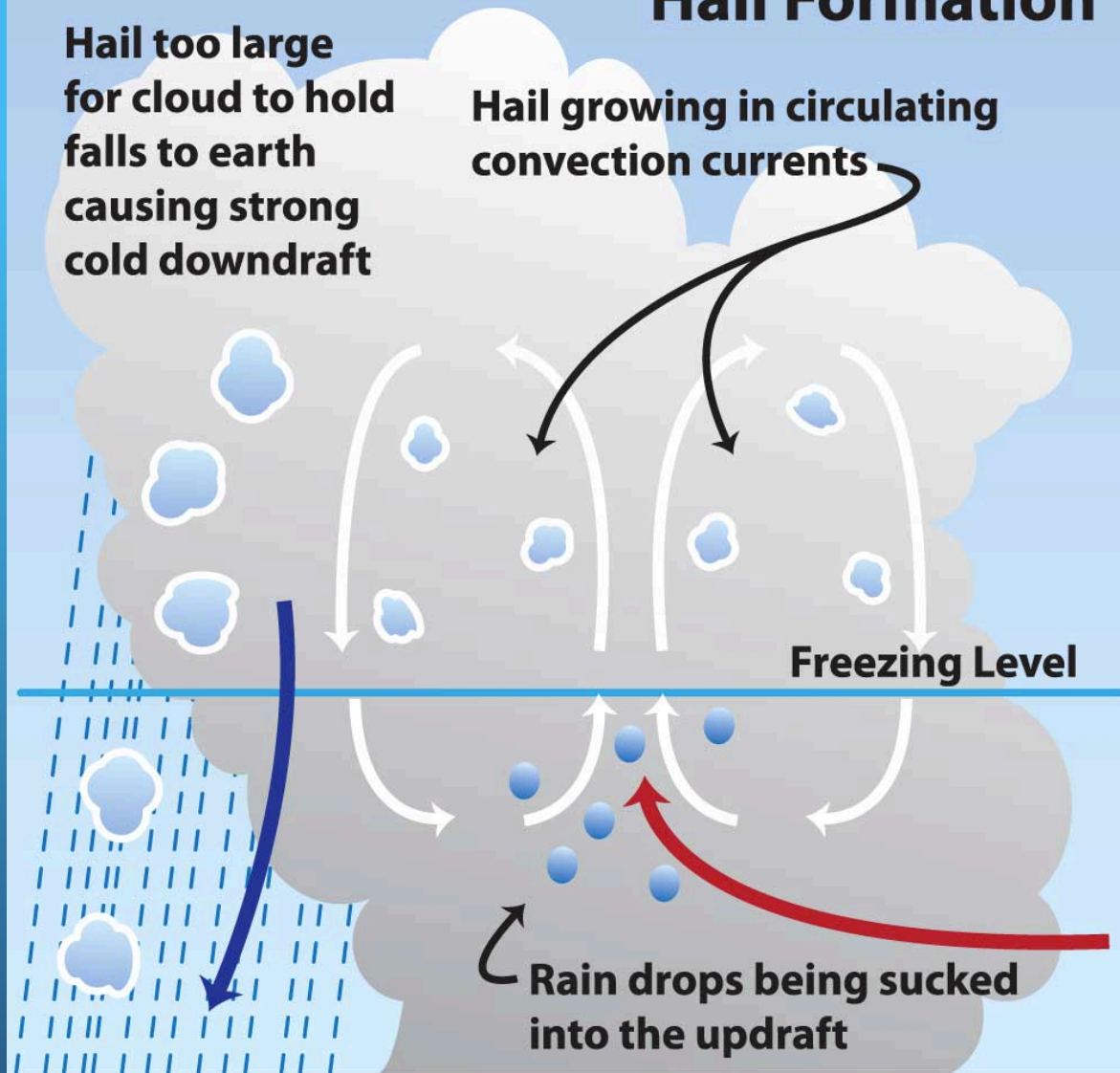
Hail

- Balls or lumps of ice that form in cumulonimbus clouds as updrafts carry raindrops high in the clouds where they freeze and get coated with more water droplets as they fall, which can happen many times (happens in warm weather)

Hail Formation

Hail too large for cloud to hold falls to earth causing strong cold downdraft

Hail growing in circulating convection currents



<https://scijinks.gov/review/rain/hail-formation-large.jpg>