# Clouds and Patterns of the Weather

## INTRODUCTION TO THE AIMS TEACHING MODULE (ATM)



## INTRODUCING *Clouds and Patterns of the Weather*



## PREPARATION FOR VIEWING



## AFTER VIEWING THE PROGRAM

# Congratulations!

You have chosen a learning program that will actively motivate your students and provide you with easily accessible and easily manageable instructional guidelines and tools designed to make your teaching role efficient and rewarding.

The AIMS Teaching Module (ATM) provides you with a video program correlated to your classroom curriculum, instructions and guidelines for use, plus a comprehensive teaching program containing a wide range of activities and ideas for interaction between all content areas. Our authors, educators, and consultants have written and reviewed the AIMS Teaching Modules to align with the Educate America Act: Goals 2000.

This ATM, with its clear definition of manageability, both in the classroom and beyond, allows you to tailor specific activities to meet all of your classroom needs.

## RATIONALE

In today's classrooms, educational pedagogy is often founded on Benjamin S. Bloom's "Six Levels of Cognitive Complexity." The practical application of Bloom's Taxonomy is to evaluate students' thinking skills on these levels, from the simple to the complex:

1. Knowledge (rote memory skills),
2. Comprehension (the ability to relate or retell),
3. Application (the ability to apply knowledge outside its origin),
4. Analysis (relating and differentiating parts of a whole),
5. Synthesis (relating parts to a whole)
6. Evaluation (making a judgment or formulating an opinion).

The AIMS Teaching Module is designed to facilitate these intellectual capabilities, and to integrate classroom experiences and assimilation of learning with the students' life experiences, realities, and expectations. AIMS' learner verification studies prove that our AIMS Teaching Modules help students to absorb, retain, and to demonstrate ability to use new knowledge in their world. Our educational materials are written and designed for today's classroom, which incorporates a wide range of intellectual, cultural, physical, and emotional diversities.

## ORGANIZATION AND MANAGEMENT

To facilitate ease in classroom manageability, the AIMS Teaching Module is organized in three sections:

***I. Introducing this ATM***
will give you the specific information you need to integrate the program into your classroom curriculum.

***II. Preparation for Viewing***
provides suggestions and strategies for motivation, language preparedness, readiness, and focus prior to viewing the program with your students.

***III. After Viewing the Program***
provides suggestions for additional activities plus an assortment of consumable assessment and extended activities, designed to broaden comprehension of the topic and to make connections to other curriculum content areas.

AIMS Teaching Module written by Pat Davies.



AIMS Multimedia is a leading producer and distributor of educational programs serving schools and libraries since 1957. AIMS draws upon the most up-to-date knowledge, existing and emerging technologies, and all of the instructional and pedagogical resources available to develop and distribute educational programs in videocassette and CD-ROM.

Persons or schools interested in obtaining additional copies of this AIMS Teaching Module, please contact:

**AIMS Multimedia at:**
Toll Free: 1-800-367-2467
Fax: 818-341-6700
Web: www.aimsmultimedia.com
Email: info@aimsmultimedia.com

## FEATURES
## INTRODUCING THE ATM

Your AIMS Teaching Module is designed to accompany a video program written and produced by some of the world's most credible and creative writers and producers of educational programming. To facilitate diversity and flexibility in your classroom and to provide assessment tools, your AIMS Teaching Module features these components:

***Themes***
This section tells how the AIMS Teaching Module is correlated to the curriculum. Themes offers suggestions for interaction with other curriculum content areas, enabling teachers to use the teaching module to incorporate the topic into a variety of learning areas.

***Overview***
The Overview provides a synopsis of content covered in the video program. Its purpose is to give you a summary of the subject matter and to enhance your introductory preparation.

***Objectives***
The ATM learning objectives provide guidelines for teachers to assess what learners can be expected to gain from each program. After completion of the AIMS Teaching Module, your students will be able to demonstrate dynamic and applied comprehension of"" the topic.

***Preparation for Viewing***
In preparation for viewing the video program, the AIMS Teaching Module offers activity and/or discussion ideas that you may use in any order or combination.

***Introduction To The Program***
Introduction to the Program is designed to enable students to recall or relate prior knowledge about the topic and to prepare them for what they are about to learn.

***Introduction To Vocabulary***
Introduction to Vocabulary is a review of language used in the program: words, phrases, and usage. This vocabulary introduction is designed to ensure that all learners, including limited English proficiency learners, will have full understanding of the language usage in the content of the program.

***Discussion Ideas***
Discussion Ideas are designed to help you assess students' prior knowledge about the topic and to give students a preview of what they will learn. Active discussion stimulates interest in a subject and can motivate even the most reluctant learner. Listening, as well as speaking, is active participation. Encourage your students to participate at the rate they feel comfortable. Model sharing personal experiences when applicable, and model listening to students' ideas and opinions.

***Focus***
Help learners set a purpose for watching the program with Focus, designed to give students a focal point for comprehension continuity.

***Jump Right In***
Jump Right In provides abbreviated instructions for quick management of the program.

***After Viewing the Program***
After your students have viewed the program, you may introduce any or all of these activities to interact with other curriculum content areas, provide reinforcement, assess comprehension skills, or provide hands-on and in-depth extended study of the topic.

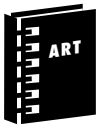
## SUGGESTED ACTIVITIES

The Suggested Activities offer ideas for activities you can direct in the classroom or have your students complete independently, in pairs, or in small work groups after they have viewed the program. To accommodate your range of classroom needs, the activities are organized into skills categories. Their labels will tell you how to identify each activity and help you correlate it into your classroom curriculum. To help you schedule your classroom lesson time, the AIMS hourglass gives you an estimate of the time each activity should require. Some of the activities fall into these categories:

### *Meeting Individual Needs*

These activities are designed to aid in classroom continuity. Reluctant learners and learners acquiring English will benefit from these activities geared to enhance comprehension of language in order to fully grasp content meaning.

### *Curriculum Connections*




Many of the suggested activities are intended to integrate the content of the ATM program into other content areas of the classroom curriculum. These cross-connections turn the classroom teaching experience into a whole learning experience.

### *Critical Thinking*

Critical Thinking activities are designed to stimulate learners' own opinions and ideas. These activities require students to use the thinking process to discern fact from opinion, consider their own problems and formulate possible solutions, draw conclusions, discuss cause and effect, or combine what they already know with what they have learned to make inferences.

### *Cultural Diversity*

Each AIMS Teaching Module has an activity called Cultural Awareness, Cultural Diversity, or Cultural Exchange that encourages students to share their backgrounds, cultures, heritage, or knowledge of other countries, customs, and language.

### *Hands On*

These are experimental or tactile activities that relate directly to the material taught in the program. Your students will have opportunities to make discoveries and formulate ideas on their own, based on what they learn in this unit.

### *Writing*

Every AIMS Teaching Module will contain an activity designed for students to use the writing process to express their ideas about what they have learned. The writing activity may also help them to make the connection between what they are learning in this unit and how it applies to other content areas.

### *In The Newsroom*

Each AIMS Teaching Module contains a newsroom activity designed to help students make the relationship between what they learn in the classroom and how it applies in their world. The purpose of In The Newsroom is to actively involve each class member in a whole learning experience. Each student will have an opportunity to perform all of the tasks involved in production: writing, researching, producing, directing, and interviewing as they create their own classroom news program.

### *Extended Activities*

These activities provide opportunities for students to work separately or together to conduct further research, explore answers to their own questions, or apply what they have learned to other media or content areas.

### *Link to the World*

These activities offer ideas for connecting learners' classroom activities to their community and the rest of the world.

### *Culminating Activity*

To wrap up the unit, AIMS Teaching Modules offer suggestions for ways to reinforce what students have learned and how they can use their new knowledge to enhance their worldview.

## ADDITIONAL ATM FEATURES

### *Vocabulary*

Every ATM contains an activity that reinforces the meaning and usage of the vocabulary words introduced in the program content. Students will read or find the definition of each vocabulary word, then use the word in a written sentence.

### *Checking Comprehension*

Checking Comprehension is designed to help you evaluate how well your students understand, retain, and recall the information presented in the AIMS Teaching Module. Depending on your students' needs, you may direct this activity to the whole group yourself, or you may want to have students work on the activity page independently, in pairs, or in small groups. Students can verify their written answers through discussion or by viewing the video a second time. If you choose, you can reproduce the answers from your Answer Key or write the answer choices in a Word Bank for students to use. Students can use this completed activity as a study guide to prepare for the test.

### *Reproducible Activities*

The AIMS Teaching Module provides a selection of reproducible activities, designed to specifically reinforce the content of this learning unit. Whenever applicable, they are arranged in order from low to high difficulty level, to allow a seamless facilitation of the learning process. You may choose to have students take these activities home or to work on them in the classroom independently, in pairs or in small groups.

### *Checking Vocabulary*

The checking Vocabulary activity provides the opportunity for students to assess their knowledge of new vocabulary with this word game or puzzle. The format of this vocabulary activity allows students to use the related words and phrases in a different context.

### *Test*

The AIMS Teaching Module Test permits you to assess students' understanding of what they have learned. The test is formatted in one of several standard test formats to give your students a range of experiences in test-taking techniques. Be sure to read, or remind students to read, the directions carefully and to read each answer choice before making a selection. Use the Answer Key to check their answers.

### *Additional AIMS Multimedia Programs*

After you have completed this AIMS Teaching Module you may be interested in more of the programs that AIMS offers. This list includes several related AIMS programs.

### *Answer Key*

Reproduces tests and work pages with answers marked.

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## JUMP RIGHT IN

### *Preparation*

- Read Clouds and Patterns of the Weather **Themes, Overview,** and **Objectives** to become familiar with program content and expectations.

- Use **Preparation for Viewing** suggestions to introduce the topic to students.

### *Viewing*

- Set up viewing monitor so that all students have a clear view.

- Depending on your classroom size and learning range, you may choose to have students view Clouds and Patterns of the Weather together or in small groups.

- Some students may benefit from viewing the video more than one time.

### *After Viewing*

- Select Suggested Activities that integrate into your classroom curriculum. If applicable, gather materials or resources.

- Choose the best way for students to work on each activity. Some activities work best for the whole group. Other activities are designed for students to work independently, in pairs, or in small groups. Whenever possible, encourage students to share their work with the rest of the group.

- Duplicate the appropriate number of Vocabulary, Checking Comprehension, and consumable activity pages for your students.

- You may choose to have students take consumable activities home, or complete them in the classroom, independently, or in groups.

- Administer the Test to assess students' comprehension of what they have learned, and to provide them with practice in test-taking procedures.

- Use the Culminating Activity as a forum for students to display, summarize, extend, or share what they have learned with each other, the rest of the school, or a local community organization.

# Clouds and Patterns of the Weather

### Themes

The analysis of factors that influence weather and the explanation of and prediction of weather patterns and storms are major themes within the Earth and Space Science curriculum. Energy in the Earth system is a related theme.

### Overview

In, *Clouds and Patterns of the Weather*, students will learn that clouds are the Earth's source for all forms of precipitation, and that they affect the amount of energy in the Earth system by absorbing and reflecting solar radiation. Although today's meteorologists use technology to measure atmospheric conditions, weather predictions are still based heavily on interpreting the images of cloud patterns provided by orbiting satellites.

Students will gain understanding of clouds' composition, as well as how and where they are formed in the troposphere - the lowest layer of our atmosphere. The collection of atmospheric moisture by air masses is discussed, along with their movements, changes in temperature, and the subsequent condensation of the water vapor they carry.

Students will learn that meteorologists classify clouds according to their basic shapes, the altitude of the clouds' bases above the ground, and the clouds' generation of precipitation. The program details the formation, altitude, and precipitation-causing activity of the many types of stratus, cumulus and cirrus clouds, including their classification into ten types of low-, middle- or high-altitude clouds.

Students will gain insight into relevance of the ever-shifting shapes of clouds - how those changes reflect atmospheric processes at work - and how to read the information that clouds provide us about future weather conditions.

### Objectives

- To explain the atmospheric conditions under which different types of clouds are formed
- To illustrate the shapes of various types of clouds
- To discuss the classification of clouds and the different weather patterns associated with each category
- To provide an expanded understanding of the weather

### Introduction to the Program

To prepare students for, *Clouds and Patterns of the Weather,* discuss with them what comes to mind when they think about clouds, the weather, weather patterns, or predicting the weather. Write on the board any ideas generated by the group; expect them to include such terms as:

*air masses, atmosphere, humidity, phases of the water cycle, seasons, types of clouds, temperature, types of precipitation, weather forecasters/meteorologists, weather satellites, weather systems, wind*

Discuss the list with the class. Explain that they will be viewing a video in which they will see many of the things they mentioned, along with additional facts and details about the atmospheric processes that cause the formation of various types of clouds, and the influence of clouds on the weather.

### Introduction to Vocabulary

Write the following words on the board and explain that they will be referenced in the video. Some students may be unfamiliar with the terms. If the meaning of any word is unclear to the group, ask volunteers to use an appropriate reference source to check the term and report their findings to the class.

*adiabatic(cooling), cirrus clouds, cumulus clouds, dew point, frontal system, inversion layer, relative humidity, stratosphere, stratus clouds, tropopause, troposphere*

### Discussion Ideas

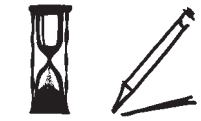
Are there clouds in the sky today? Ask students what they noticed about the sky on their way to school this morning. If there were clouds in the sky, what type do students think they might be? What's today's weather like? How do students think the clouds, or lack of them, affected the current weather pattern? Lead students in a discussion of the current and recent weather, comparing and contrasting it with weather of a week ago, a month ago. Ask students what factors they think might have an effect on the weather. Lead the group into a discussion of what weather reports in the media tell us about present and upcoming conditions. What details do such reports give us? How often do the reports seem to be correct? How frequently are they incorrect? What factors do they think forecasters use as a basis for their predictions?

### Focus

Tell students they are about to view a video that illustrates the influence that clouds have on the weather, as well as the atmospheric conditions that cause clouds to form and to retain or disperse precipitation onto the Earth's surface. Ask them to watch for ways that these factors impact weather patterns for your region as well as other areas. Let them know you will discuss these and other aspects following the screening.

## SUGGESTED ACTIVITIES

### *Writing*




Clouds and the weather systems they bring to us are things we all experience in very physical ways. Ask students to think about how they experience clouds and weather physically. Some examples to get them thinking might include: Sound: the roar of the waves and the hiss of the rain on a storm-tossed beach, the rumble and crack of a thunderstorm, or the muffling silence of fog; Smell: the scent of rain or the bright, clean smell of a morning blanketed with newly fallen snow; Sight: sunset on clouds, rainbows, rain driving into puddles, snow wafting softly to the ground; Touch: the feel of any kind of precipitation on your skin, making "snow angels" in winter; Taste: turning your face open-mouthed up to meet a rainy or snowy sky.

Have students write a paragraph, or one page essay on the topic. Encourage them to be creative and use colorful language.

### *Meeting Individual Needs*


The names for types of clouds come from Latin words that are descriptive of the clouds' appearance. Have students use dictionaries or other references as necessary to determine which types of clouds are indicated by the following cloud descriptions. Have them find the name for the cloud type and also find examples of each. (The second table has the information filled in for your reference.)

| Cloud Description | Latin Name | Example(s) |
|---|---|---|
| curl of hair | | |
| layer | | |
| pile or heap | | |
| rain | | |

| Cloud Description | Latin Name | Example(s) |
|---|---|---|
| curl of hair | cirrus | Cirrus, cirrostratus, cirrocumulus |
| layer | stratus | Stratus, altostratus, stratocumulus |
| pile or heap | cumulus | Cumulus, altocumulus, altocumulus castellanus |
| rain | nimbus | Cumulonimbus, nimbostratus |

### *Connection to Earth and Space Science*


The formation of clouds and precipitation depends on the upward movement of air. Fronts provide a boost for upward movement. Have students work individually or in pairs to research the different types of fronts and their typical effects on air movement and cloud formation. Include:
cold front, dry line, occluded front, stationary front and warm front. Have them compile their data into a short report and request volunteers to share their papers with the class.

### *Connection to Earth and Space Science*


What, in general, is the effect of cloud cover on the daytime temperature of a given region? On the nighttime temperature of that region? How will day and night temperatures vary if the sky is clear versus if the sky is cloudy? Ask the class for suggestions; note suggestions on the board and use as basis for a general discussion.

***Connection to Language Arts/Writing***


60 Minutes

Poets have always used clouds and the many moods of the weather to convey a wide variety of themes. Often the cloud or the rainstorm itself is used as a catalyst to the exploration of a range of emotions. Introduce students to poems such as the following. If unavailable through your school library/media center, you will be able to locate them on the Internet.

*The Clouds* by Thomas M. Disch
*Fog* by Carl Sandburg
*I Wandered Lonely as a Cloud* by William Wordsworth
*Rain in Summer* by Henry Wadsworth Longfellow
*Stopping by Woods on a Snowy Evening* by Robert Frost

Discuss how each poet uses the weather to set a mood. What feeling does Sandburg evoke with his "little cat feet"? Why does Wordsworth describe himself as "lonely as a cloud"? Following a general discussion, ask students to create their own short poems using clouds and other aspects of weather to convey personal themes. Invite volunteers to read their verse to the class. Consider publishing the resulting collection with student-drawn illustrations or photos gathered from the Internet.

***Connection to Earth and Space Science and to Mathematics***


2 Hours

The atmospheric moisture necessary for cloud formation is generated through evaporation from the oceans (80%), as well as from lakes, rivers and soil, and through transpiration from plants (20% combined). Have students work in small groups to research the world's water supply and to calculate:
(Format: Please bullet the following points.)
the amount of water (in gallons) that exists as water vapor in the atmosphere;

the amount (in gallons) of Earth's annual precipitation. (It's more than 30 times the amount of water that Earth's atmosphere can hold at one time.)

Based on their findings, discuss the rate at which the hydrologic, or water, cycle must operate to keep everything in balance. Discuss also the strong effects of latitude and topography in influencing regional amounts of precipitation: many of the planet's deserts average less than an inch of precipitation per year, while tropical rainforests may average over 100 inches.

***Connection to History***


60-90 Minutes

To forecast weather patterns, today's meteorologists observe cloud formations in addition to using their modern technological tools. For thousands of years people have "read the skies" for clues to upcoming weather. Have students work in small groups to research early examples of weather-related sayings and rhymes that evolved over time as people observed and discussed the weather.

Some early examples they might come across include a passage in Shakespeare's poem *Venus* and *Adonis* that refers to the poor weather believed to follow a "red morn", as well as the rhymes from the early 19th century with which we are more familiar, such as

Red sky at night - sailors' delight.
Red sky at morning - sailors take warning.

Have each group compile their examples into a short report and ask for a volunteer to present their findings to the class. As an additional activity, you may wish to ask students to compose their own adages or rhymes to forecast weather, whether serious or humorous, and present them to the group.

***Connection to Chemistry and Physics***


30 Minutes

Discuss with students the processes and circumstances that allow water to exist in the atmosphere in all three phases, as well as the effects its phase changes have on weather patterns. (The phase changes of water in the atmosphere affect how air rises, which in turn affects the formation of clouds and precipitation. Phase changes also provide energy for atmospheric circulation and the generation of storms.)

***Connection to Earth and Space Science and Mathematics***


45 Minutes

A region's topography can significantly affect its average rate of precipitation. Mountains in particular can affect precipitation. Have students work in groups to research the rate at which temperature drops with every 1000 feet of increased altitude. Have them keep that in mind as they determine the orographic effect and the rain shadow effect for a given locale - perhaps a specific region of the Cascades, the Alps, or the Andes. Have the groups plot their results using bar graphs and share their findings with the class.

***Culminating Activity***

Extended

Have students work in small groups to create a multi-media presentation about the geographic information they've learned from the program. Brainstorm with the class the topics that should be covered, as well as the types of materials and media they would like to include in their presentation. Have each group present to the entire class; you may wish to set up a school-wide screening so that the class may show their presentations to the entire student population.

Name _____

## VOCABULARY

The following terms are from *Clouds and Patterns of the Weather.* Read each definition. On the line next to the definition write the letter of the vocabulary word that matches the definition. Then use a separate piece of paper to write each word in a sentence.

A) adiabatic cooling
B) cirrus clouds
C) condensation nuclei
D) convection currents
E) cumulus clouds
F) dew point
G) front
H) inversion layer
I) orographic clouds
J) relative humidity
K) saturation
L) stratosphere
M) stratus clouds
N) tropopause
O) troposphere

1. _____ the lowest layer of the Earth's atmosphere
2. _____ airborne dust or salt particles around which water vapor condenses once the air cools past the dew point
3. _____ clouds whose name comes from a Latin word meaning "to spread out." These clouds form horizontal layers and often form at the boundary of an inversion layer
4. _____ a process in which the temperature of an air mass becomes lower due to expansion (no heat is added or taken away from the air mass)
5. _____ the temperature at which atmospheric moisture condenses into visible forms
6. _____ a transition zone between the troposphere and the stratosphere
7. _____ high altitude clouds that resemble curls of hair; made up primarily of ice crystals; some forms of this type are called mares' tails
8. _____ a generic term for clouds that form as moist air is uplifted over mountains
9. _____ the second lowest layer of the Earth's atmosphere
10. _____ expressed as a percentage, this is the amount of water vapor in the air compared with the amount of vapor needed to saturate the air at the air's current temperature
11. _____ the presence in the air of the maximum amount of water vapor possible at a given temperature
12. _____ a bank of warm air lying above a layer of cool air; this results in an extremely stable condition and inhibits rising air movement
13. _____ the descriptive name for these clouds comes from a Latin word meaning a pile or heap; these are fluffy and resemble large balls of cotton
14. _____ the boundary between two dissimilar air masses, usually a warm air mass (lesser density) and a cold air mass (greater density)
15. _____ upward movement of an air mass, resulting from surface heating; the rising warm air may cause condensation and cloud formation

Name _____

## CHECKING COMPREHENSION

Answer the following questions in the space provided. Use a separate sheet of paper if necessary.

1. Clouds are visible because of their composition; of what are clouds composed?

2. How do clouds affect the Earth's energy budget?

3. Where do nearly all clouds and weather systems occur?

4. What is the name of the transition zone located below the stratosphere?

5. What is adiabatic cooling?

6. Define saturation.

7. Expressed as a percentage, _____ is the amount of water vapor in the air compared with the amount of vapor needed to saturate the air at the air's current temperature.

8. What forms as moist air is uplifted over mountains?

9. The three most basic clouds types are _____.

10. What is the name for stratus clouds that are so low in the troposphere that their bases touch ground?

11. Which of the following types of cloud yield significant amounts of precipitation?

    A) nimbostratus

    B) cumulonimbus

    C) A and B

12. A deep blue cloudless sky is an indication that _____.

Name _____

## WORD SEARCH

Read each vocabulary definition below. On the line before each definition write the appropriate word, then find each in the word search. Look up, down, across, backwards and diagonally to find the words.

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | Z | C | E | N | I | L | L | L | A | U | Q | S | G | V |
| O | R | O | G | R | A | P | H | I | C | N | B | P | C | B |
| V | H | E | N | C | W | W | Z | Q | T | W | K | L | U | B |
| Z | W | Q | Y | S | H | C | D | Z | X | K | V | P | M | W |
| C | S | T | R | A | T | O | S | P | H | E | R | E | U | Y |
| F | T | J | K | T | L | J | Q | B | Z | Q | M | B | L | V |
| N | R | J | P | U | Z | N | G | H | W | K | V | Z | U | Z |
| D | A | O | J | R | T | R | O | P | O | P | A | U | S | E |
| E | T | W | N | A | H | Q | P | I | Q | Z | C | R | Z | W |
| W | U | V | K | T | E | K | L | M | S | X | V | K | M | Z |
| P | S | G | C | I | R | R | U | S | S | R | T | T | C | H |
| O | B | N | Z | O | M | X | B | T | G | M | E | V | C | Z |
| I | W | W | Z | N | A | Q | J | T | C | W | S | V | N | B |
| N | B | Y | K | S | L | E | R | E | K | C | A | M | N | Z |
| T | R | O | P | O | S | P | H | E | R | E | Z | H | X | I |

**WORD BANK**

cirrus
cumulus
dew point
front
inversion layer
mackerel sky
orographic
saturation
squall line
stratosphere
stratus
thermals
tropopause
troposphere

_____ a transition zone between the troposphere and the stratosphere

_____ a pattern of small, high altitude cirrocumulus clouds arranged in rows

_____ the presence in the air of the maximum amount of water vapor possible at a given temperature

_____ the lowest layer of the Earth's atmosphere

_____ type of cloud whose name comes from a Latin word meaning "to spread out." These clouds form horizontal layers and often form at the boundary of an inversion layer

_____ the temperature at which atmospheric moisture condenses into visible forms

_____ a generic term for clouds that form as moist air is uplifted over mountains

_____ type of high altitude cloud that resemble curls of hair; made up primarily of ice crystals; some forms of this type are called mares' tails

_____ a line or narrow band of active thunderstorms often developed from cumulonimbus clouds

_____ a bank of warm air lying above a layer of cool air; this results in an extremely stable condition and inhibits rising air movement

_____ the descriptive name for this type of cloud comes from a Latin word meaning a pile or heap; these clouds are fluffy and resemble large balls of cotton

_____ the boundary between two dissimilar air masses, usually a warm air mass and a cold air mass

_____ upward movement of air masses, resulting from surface heating; the rising warm air may cause condensation and cloud formation, also known as convection currents

_____ the second lowest layer of the Earth's atmosphere

**Name** _____

## HOW THIRSTY ARE YOU?

If you measure all of Earth's water - the oceans, inland waterways, groundwater, water in the atmosphere - *everything*, it comes to 326 million cubic miles of water. That's more than 326 million trillion gallons - yes, we said *326 million trillion gallons.*

In the atmosphere alone, there are 3,100 cubic miles, or 3,100 trillion gallons. To try and visualize 3,100 cubic miles of water, use resources as necessary to find out the area of your state in square miles.

Then, in the space provided, do the math to see how deep the water would be if all 3,100 cubic miles were contained within the borders of your state. With the exception of Delaware and Rhode Island, the depths will be measured in feet.

**An example:** all of Delaware (area: 2,026 sq. mi.) would be covered with water approximately 1.5 miles deep. (Sorry, Delaware students! Would you please figure the water depth for Texas instead.)

State:

Area in Square Miles:

3,100 cubic miles of water covers _____ square miles to a depth of _____.

Name

**TRUE OR FALSE**

Read each statement below and place a T in the space provided if the statement is true, or an F if the statement is false.

1. _____ Clouds both absorb and reflect incoming solar radiation.
2. _____ Nearly all clouds and weather systems occur in the stratosphere.
3. _____ Elemental humidity is the amount of water vapor in the air compared with the amount of vapor needed to saturate the air at the air's current temperature.
4. _____ Frost and dew result from the condensation of water vapor in the atmosphere.
5. _____ Orographic clouds form as dry air passes over the ocean.
6. _____ Meteorologists classify clouds according to their basic shapes, the altitude of their bases above the ground, and what type of precipitation, if any, they generate.
7. _____ The changing shapes of clouds reflect processes operating in the atmosphere.
8. _____ Most stratus clouds form at high altitudes under unstable conditions and are mountainous in shape.
9. _____ Smog sometimes develops as air pollutants are trapped under an inversion layer.
10. _____ The three basic types of low clouds - stratus, stratocumulus and nimbostratus - are usually made up of water droplets and their formation is influenced by surface conditions such as combinations of temperature and topography.
11. _____ Altostratus clouds are middle altitude clouds that often form when warm rides over cool air ahead of a cold front.
12. _____ A display of altocumulus castellanus clouds is a sign that medium level air is moist and unstable; rainy weather may soon follow.
13. _____ The three basic high altitude cloud types are cirruscircus, cirrostradivarius and cirrocumulative.
14. _____ Cirrus clouds followed by a layer of cirrostratus are often a sign of frontal systems and bad weather.
15. _____ When surface air is moist and atmospheric conditions are highly unstable, cumulus clouds form and grow vertically, reaching as high as the bottom of the stratosphere; these then are known as cumulonimbus - or thunderheads.

Name

## VOCABULARY MATCH UP

Draw a line from each vocabulary word below on the left to the appropriate definition to the right.

| | |
|---|---|
| altocumulus clouds | the largest form of cumulus clouds, they may be tower-shaped and very tall; these commonly produce thunderstorms |
| altocumulus castellanus clouds | a pattern of small, high altitude cirrocumulus clouds arranged in rows |
| altocumulus lenticularis clouds | low altitude clouds that are dark in color and yield significant amounts of precipitation |
| altostratus clouds | middle altitude grayish or blue-white cloud layers that may have a striped appearance and are often an indication that a warm front is on its way |
| cirrocumulus clouds | high-level clouds composed mostly of ice crystals often in a thick, even layer; almost transparent, the sun can be seen through them |
| cirrostratus clouds | low altitude clouds that are rounded and lumpy looking with some areas of blue sky in between; may be dark gray in color, but do not yield much precipitation |
| cumulonimbus clouds | middle altitude clouds with a billowy mountainous shape |
| mackerel sky | clouds formed as wind flows over hills or mountains, called wave clouds, they are lens-shaped, remain stationary in the sky while wind speed stays the same, and may appear iridescent near the sun because of the presence of ice crystals |
| nimbostratus clouds | high-level clouds composed mostly of ice crystals with the appearance of a thin white patch of rippled cloud. |
| stratocumulus clouds | middle altitude clouds called "cloud castles" are formed spontaneously as heat is released when condensation occurs, a sign of moisture and instability in the middle altitudes and the possibility of rainy weather |

_____

**Name**

**TEST**

Circle the letter of the correct answer for multiple-choice questions. Write a one-sentence answer for questions that are not multiple choice.

1. The water vapor that collects in the atmosphere comes from _____.

A) solar radiation

B) evaporation and transpiration

C) clouds

2. The troposphere, where nearly all clouds and weather systems occur is _____.

A) the transition zone that exists just above the stratosphere

B) the highest layer of Earth's atmosphere

C) the lowest layer of Earth's atmosphere

3. Where and how does adiabatic cooling occur?

_____

_____

4. Describe why there is generally little cloud formation in the stratosphere.

_____

_____

5. _____ can hold more water vapor than _____.

A) Cold air; warm air

B) Warm air; cold air

C) Clouds; condensation nuclei

6. What is the dew point?

_____

_____

7. Define relative humidity.

_____

_____

8. Thermals are rising bodies of warm air that are generated over heated surfaces, such as the Earth's surface on a hot day. Another name for thermals is _____.

A) concave currents

B) longjohns

C) convection currents

Name

**TEST (CONTINUED)**

9. Clouds that form in layers are called _____ and generally develop under _____.
   A) stratiform; stable conditions
   B) cumuliform; an inversion layer
   C) mackerel tails; the troposphere

10. An inversion layer of warm air lying above cool air results in _____. Because it inhibits rising air movement, this can lead to _____.
   A) extremely stable conditions; a buildup of smog over cities
   B) extremely unstable conditions; tornadoes or other severe weather
   C) moderately unstable conditions; light precipitation

11. Low clouds are generally made up of _____ and their formation is usually influenced by such surface conditions as _____.
   A) pollutants; the Earth's rotation
   B) ice crystals; the tides
   C) water droplets; temperature and topography

12. _____ is/are formed as wind flows over hills or mountains and, once formed, will remain stationary in the sky as long as the _____.
   A) Altocumulus lenticularis clouds; wind speed remains constant
   B) Fog; condensation point remains the same
   C) Cirrocumulus clouds; rain keeps falling

13. Nimbo- and -nimbus appear as prefix and suffix in the names of several clouds that commonly bring precipitation. That is apt, since "nimbus" comes from a Latin word meaning _____.
   A) ice
   B) rain
   C) snow

14. The spontaneous formation of altocumulus castellanus clouds tells us that medium level air is moist and unstable. What is this often a sign of?

_____

_____

15. High winds, heavy rain, lightning, hail and tornadoes can all be generated by a/an _____ which is a _____.
   A) squall line; line or narrow band of active thunderstorms
   B) inversion layer; transition zone between the troposphere and stratosphere
   C) condensation nuclei; large-scale exchange of energy between a cloud's dew point and its adiabatic cooling point

## ADDITIONAL AIMS MULTIMEDIA PROGRAMS

You and your students might also enjoy these other AIMS Multimedia programs:

| | |
|---|---|
| *9085-EN-VID* | *Weather: The Chaos That Surrounds Us* |
| *2652-EN-VID* | *Rivers: Shapers of Earth Landscapes* |
| *2653-EN-VID* | *Waves, Tides and the Coastal Environment* |
| *2649-EN-VID* | *Mountains and Mountain Building Processes* |
| *2650-EN-VID* | *Climate, Landscapes and Life: The Tropics* |
| *2561-EN-VID* | *Climate, Landscapes and Life: Mid-latitude and Polar Regions* |
| *2597-EN-VID* | *Geography of the World Series: Africa: The Land and Resources* |
| *2599-EN-VID* | *Geography of the World Series: South Asia: The Land and Resources* |
| *2628-EN-VID* | *Geography of the World Series: The Middle East and Central Asia: The Land and Resources* |

# ANSWER KEY for page 10

## VOCABULARY

The following terms are from *Clouds and Patterns of the Weather.* Read each definition. On the line next to the definition write the letter of the vocabulary word that matches the definition. Then use a separate piece of paper to write each word in a sentence.

A) adiabatic cooling
B) cirrus clouds
C) condensation nuclei
D) convection currents
E) cumulus clouds
F) dew point
G) front
H) inversion layer
I) orographic clouds
J) relative humidity
K) saturation
L) stratosphere
M) stratus clouds
N) tropopause
O) troposphere

1. **O** the lowest layer of the Earth's atmosphere
2. **C** airborne dust or salt particles around which water vapor condenses once the air cools past the dew point
3. **M** clouds whose name comes from a Latin word meaning "to spread out." These clouds form horizontal layers and often form at the boundary of an inversion layer
4. **A** a process in which the temperature of an air mass becomes lower due to expansion (no heat is added or taken away from the air mass)
5. **F** the temperature at which atmospheric moisture condenses into visible forms
6. **N** a transition zone between the troposphere and the stratosphere
7. **B** high altitude clouds that resemble curls of hair; made up primarily of ice crystals; some forms of this type are called mares' tails
8. **I** a generic term for clouds that form as moist air is uplifted over mountains
9. **L** the second lowest layer of the Earth's atmosphere
10. **J** expressed as a percentage, this is the amount of water vapor in the air compared with the amount of vapor needed to saturate the air at the air's current temperature
11. **K** the presence in the air of the maximum amount of water vapor possible at a given temperature
12. **H** a bank of warm air lying above a layer of cool air; this results in an extremely stable condition and inhibits rising air movement
13. **E** the descriptive name for these clouds comes from a Latin word meaning a pile or heap; these are fluffy and resemble large balls of cotton
14. **G** the boundary between two dissimilar air masses, usually a warm air mass (lesser density) and a cold air mass (greater density)
15. **D** upward movement of an air mass, resulting from surface heating; the rising warm air may cause condensation and cloud formation

# ANSWER KEY for page 11

## CHECKING COMPREHENSION

Answer the following questions in the space provided. Use a separate sheet of paper if necessary.

1. Clouds are visible because of their composition; of what are clouds composed? **They are composed of water droplets, ice particles, or a combination of water droplets and ice particles.**

2. How do clouds affect the Earth's energy budget? **They both absorb and reflect incoming solar radiation.**

3. Where do nearly all clouds and weather systems occur? **in the lowest layer of Earth's atmosphere, called the troposphere.**

4. What is the name of the transition zone located below the stratosphere? **the tropopause**

5. What is adiabatic cooling? **It is a process in which the temperature of an air mass becomes lower due to expansion (no heat is added or taken away from the air mass.**

6. Define saturation. **It is the presence in the air of the maximum amount of water vapor possible at a given temperature.**

7. Expressed as a percentage, **relative humidity** is the amount of water vapor in the air compared with the amount of vapor needed to saturate the air at the air's current temperature.

8. What forms as moist air is uplifted over mountains? **orographic clouds**

9. The three most basic clouds types are **stratus, cumulus and cirrus**.

10. What is the name for stratus clouds that are so low in the troposphere that their bases touch ground? **fog**

11. Which of the following types of cloud yield significant amounts of precipitation?

    A) nimbostratus

    B) cumulonimbus

    (C) A and B

12. A deep blue cloudless sky is an indication that **the atmosphere is probably too dry for cloud formation**.

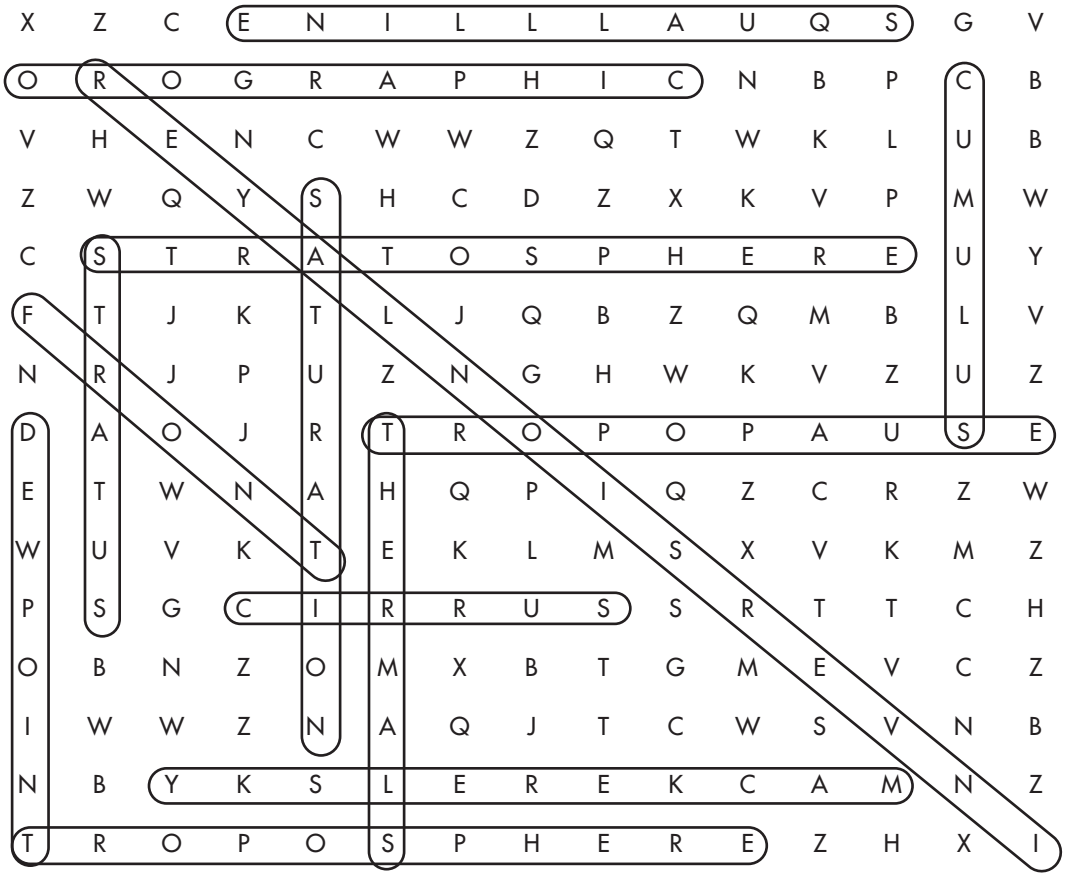
# ANSWER KEY for page 12

## WORD SEARCH

Read each vocabulary definition below. On the line before each definition write the appropriate word, then find each in the word search. Look up, down, across, backwards and diagonally to find the words.

**WORD BANK**

cirrus
cumulus
dew point
front
inversion layer
mackerel sky
orographic
saturation
squall line
stratosphere
stratus
thermals
tropopause
troposphere




**tropopause** — a transition zone between the troposphere and the stratosphere

**mackerel sky** — a pattern of small, high altitude cirrocumulus clouds arranged in rows

**saturation** — the presence in the air of the maximum amount of water vapor possible at a given temperature

**troposphere** — the lowest layer of the Earth's atmosphere

**stratus** — type of cloud whose name comes from a Latin word meaning "to spread out." These clouds form horizontal layers and often form at the boundary of an inversion layer

**dew point** — the temperature at which atmospheric moisture condenses into visible forms

**orographic** — a generic term for clouds that form as moist air is uplifted over mountains

**cirrus** — type of high altitude cloud that resemble curls of hair; made up primarily of ice crystals; some forms of this type are called mares' tails

**squall line** — a line or narrow band of active thunderstorms often developed from cumulonimbus clouds

**inversion layer** — a bank of warm air lying above a layer of cool air; this results in an extremely stable condition and inhibits rising air movement

**cumulus** — the descriptive name for this type of cloud comes from a Latin word meaning a pile or heap; these clouds are fluffy and resemble large balls of cotton

**front** — the boundary between two dissimilar air masses, usually a warm air mass and a cold air mass

**thermals** — upward movement of air masses, resulting from surface heating; the rising warm air may cause condensation and cloud formation, also known as convection currents

**stratosphere** — the second lowest layer of the Earth's atmosphere

# ANSWER KEY for page 13

**HOW THIRSTY ARE YOU?**

If you measure all of Earth's water - the oceans, inland waterways, groundwater, water in the atmosphere - *everything*, it comes to 326 million cubic miles of water. That's more than 326 million trillion gallons - yes, we said *326 million trillion gallons.*

In the atmosphere alone, there are 3,100 cubic miles, or 3,100 trillion gallons. To try and visualize 3,100 cubic miles of water, use resources as necessary to find out the area of your state in square miles.

Then, in the space provided, do the math to see how deep the water would be if all 3,100 cubic miles were contained within the borders of your state. With the exception of Delaware and Rhode Island, the depths will be measured in feet.

**An example:** all of Delaware (area: 2,026 sq. mi.) would be covered with water approximately 1.5 miles deep. (Sorry, Delaware students! Would you please figure the water depth for Texas instead.)

State:

**Students' answers will vary by state; you may wish to do the calculation ahead of time, or do it along with students as a class exercise.**

Area in Square Miles:

3,100 cubic miles of water covers _____ square miles to a depth of _____.

# ANSWER KEY for page 14

**TRUE OR FALSE**

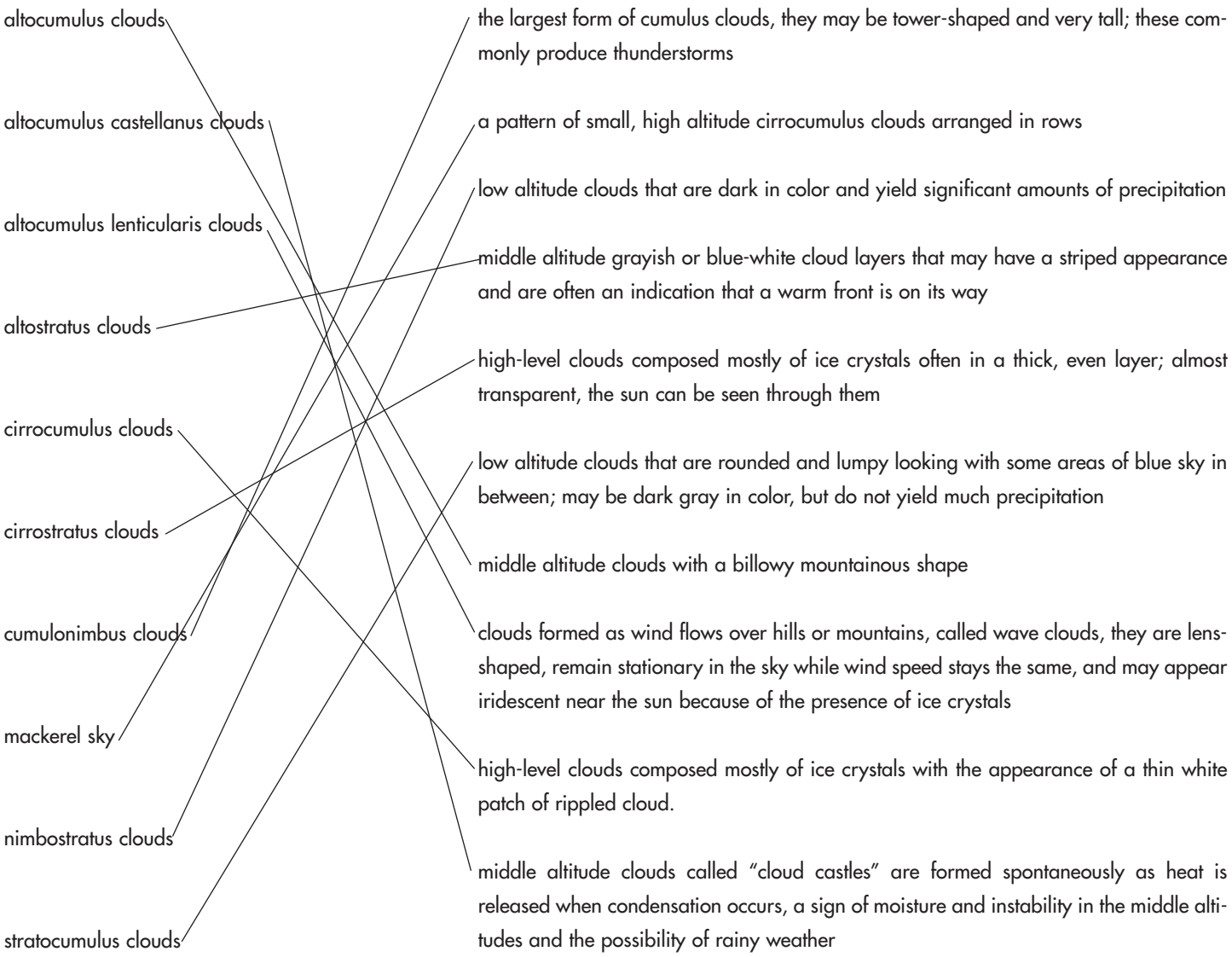
Read each statement below and place a T in the space provided if the statement is true, or an F if the statement is false.

1. **T** Clouds both absorb and reflect incoming solar radiation.
2. **F** Nearly all clouds and weather systems occur in the stratosphere.
3. **F** Elemental humidity is the amount of water vapor in the air compared with the amount of vapor needed to saturate the air at the air's current temperature.
4. **T** Frost and dew result from the condensation of water vapor in the atmosphere.
5. **F** Orographic clouds form as dry air passes over the ocean.
6. **T** Meteorologists classify clouds according to their basic shapes, the altitude of their bases above the ground, and what type of precipitation, if any, they generate.
7. **T** The changing shapes of clouds reflect processes operating in the atmosphere.
8. **F** Most stratus clouds form at high altitudes under unstable conditions and are mountainous in shape.
9. **T** Smog sometimes develops as air pollutants are trapped under an inversion layer.
10. **T** The three basic types of low clouds - stratus, stratocumulus and nimbostratus - are usually made up of water droplets and their formation is influenced by surface conditions such as combinations of temperature and topography.
11. **F** Altostratus clouds are middle altitude clouds that often form when warm rides over cool air ahead of a cold front.
12. **T** A display of altocumulus castellanus clouds is a sign that medium level air is moist and unstable; rainy weather may soon follow.
13. **F** The three basic high altitude cloud types are cirruscircus, cirrostradivarius and cirrocumulative.
14. **T** Cirrus clouds followed by a layer of cirrostratus are often a sign of frontal systems and bad weather.
15. **T** When surface air is moist and atmospheric conditions are highly unstable, cumulus clouds form and grow vertically, reaching as high as the bottom of the stratosphere; these then are known as cumulonimbus - or thunderheads.

# ANSWER KEY for page 15

## VOCABULARY MATCH UP

Draw a line from each vocabulary word below on the left to the appropriate definition to the right.



# ANSWER KEY for page 16

**TEST**

Circle the letter of the correct answer for multiple-choice questions. Write a one-sentence answer for questions that are not multiple choice.

1. The water vapor that collects in the atmosphere comes from _____.

A) solar radiation

(B) evaporation and transpiration

C) clouds

2. The troposphere, where nearly all clouds and weather systems occur is _____.

A) the transition zone that exists just above the stratosphere

B) the highest layer of Earth's atmosphere

(C) the lowest layer of Earth's atmosphere

3. Where and how does adiabatic cooling occur?

**It occurs in the troposphere as an air mass rises and expands and becomes cooler due to expansion; no heat is added or taken away from the air mass.**

4. Describe why there is generally little cloud formation in the stratosphere.

**The thin air of the stratosphere is generally too cold, dry and particle-free to support much cloud formation.**

5. _____ can hold more water vapor than _____.

A) Cold air; warm air

(B) Warm air; cold air

C) Clouds; condensation nuclei

6. What is the dew point?

**The dew point is the temperature at which atmospheric moisture condenses into visible forms.**

7. Define relative humidity.

**Relative humidity is the amount of water vapor in the air compared with the amount of vapor needed to saturate the air at the air's current temperature; it is expressed as a percentage.**

8. Thermals are rising bodies of warm air that are generated over heated surfaces, such as the Earth's surface on a hot day. Another name for thermals is _____.

A) concave currents

B) longjohns

(C) convection currents

# ANSWER KEY for page 17

**TEST (CONTINUED)**

9. Clouds that form in layers are called _____ and generally develop under _____.

(A) stratiform; stable conditions

B) cumuliform; an inversion layer

C) mackerel tails; the troposphere

10. An inversion layer of warm air lying above cool air results in _____. Because it inhibits rising air movement, this can lead to _____.

(A) extremely stable conditions; a buildup of smog over cities

B) extremely unstable conditions; tornadoes or other severe weather

C) moderately unstable conditions; light precipitation

11. Low clouds are generally made up of _____ and their formation is usually influenced by such surface conditions as _____.

A) pollutants; the Earth's rotation

B) ice crystals; the tides

(C) water droplets; temperature and topography

12. _____ is/are formed as wind flows over hills or mountains and, once formed, will remain stationary in the sky as long as the _____.

(A) Altocumulus lenticularis clouds; wind speed remains constant

B) Fog; condensation point remains the same

C) Cirrocumulus clouds; rain keeps falling

13. Nimbo- and -nimbus appear as prefix and suffix in the names of several clouds that commonly bring precipitation. That is apt, since "nimbus" comes from a Latin word meaning _____.

A) ice

(B) rain

C) snow

14. The spontaneous formation of altocumulus castellanus clouds tells us that medium level air is moist and unstable. What is this often a sign of?

**that it may rain soon**

15. High winds, heavy rain, lightning, hail and tornadoes can all be generated by a/an _____ which is a _____.

(A) squall line; line or narrow band of active thunderstorms

B) inversion layer; transition zone between the troposphere and stratosphere

C) condensation nuclei; large-scale exchange of energy between a cloud's dew point and its adiabatic cooling point