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Instructor Test Prep
2021 Edition

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Newcastle, Washington 98059
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Sample Federal Aviation Administration (FAA) questions herein contain information as of: September 2020. Stay informed of changes since the book was printed: asa2fly.com/testupdate

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Important: This Test Prep should be sold with and used in conjunction with *Airman Knowledge Testing Supplement for Flight Instructor, Ground Instructor, and Sport Pilot Instructor* (FAA-CT-8080-5H). ASA reprints the FAA test figures and legends contained within this government document, and it is also sold separately and available from aviation retailers nationwide. Order #ASA-CT-8080-5H.

Cover photo: iStock.com/mgkaya

ASA-TP-CFI-21
ISBN 978-1-61954-971-5

Printed in the United States of America

2021 2020 5 4 3 2 1

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Updates and Practice Tests

Free Test Updates for the One-Year Life Cycle of Test Prep Books

The FAA modifies tests as needed throughout the year. ASA keeps abreast of changes to the tests and posts free Test Updates on the ASA website. Before taking your test, be certain you have the most current information by visiting the ASA Test Updates webpage: asa2fly.com/testupdate. Additionally, sign up for free email notifications, which are sent when new Test Updates are available.

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Introduction

Welcome to the Aviation Supplies & Academics, Inc., (ASA) Test Prep Series. This series has been helping pilots prepare for the FAA Knowledge Tests for more than 60 years with great success. We are confident that with proper use of this book you will score very well on your Flight Instructor certificate test.

Begin your studies with a classroom or home-study ground school course, which will involve reading a comprehensive textbook. Fundamentals of Instructing (FOI) applicants should thoroughly review the most current edition of the *Aviation Instructor's Handbook* (FAA-H-8083-9). Visit the dedicated Reader Resource webpage for this Test Prep (asa2fly.com/reader/TPCFI) and become familiar with the FAA guidance materials available for this certification exam. Then use this Test Prep to prepare for your exam: read the question, select your choice for the correct answer, and then read the explanation. Use the references that conclude each explanation to identify additional resources for further study of a subject. Upon completion of your studies, take practice tests at preppure.com (see inside the front cover for your five free practice tests).

The questions in this book have been arranged into chapters based on subject matter to promote better understanding, aid recall, and provide a more efficient study guide. Place emphasis on questions most likely to be included in your test (identified by the aircraft category above each question). For example, a candidate preparing for the Flight Instructor – Airplane test would focus on the questions marked “ALL” and “AIR,” and a candidate preparing for the Flight Instructor – Rotorcraft test would focus on the questions marked “ALL” and “RTC.” Those preparing for the add-on tests (people who hold a Flight Instructor certificate in one category and are transitioning to another) would focus on the questions marked with that category (AIR, RTC, GLI, LSA, WSC, or PPC). Ground instructors are responsible for all aircraft categories, and therefore need to study all the questions in the database except for Chapter 1, Fundamentals of Instructing—this is a separate test.

Prior to taking an FAA Airman Knowledge Test, all applicants must establish an FAA Tracking Number (FTN) by creating a profile in the Integrated Airman Certification and Rating Application (IACRA) system at iacra.faa.gov. Then visit faa.psiexams.com/faa/login to register for your exam and take FAA-created practice tests to become familiar with the computer testing platform.

It is important to answer every question assigned on your FAA Knowledge Test. If in their ongoing review, the FAA decides a question has no correct answer, is no longer applicable, or is otherwise defective, your answer will be marked correct no matter which one you chose. However, you will not be given the automatic credit if you have not marked an answer. Unlike some other exams you may have taken, there is no penalty for guessing in this instance.

The FAA exams are “closed tests” which means the exact database of questions is not available to the public. The question and answer choices in this book are based on our extensive history and experience with the FAA testing and airman certification process. You might see similarly worded questions on your official FAA exam, or answer stems might be rearranged from the order you see in this book. Therefore, be sure to fully understand the intent of each question and corresponding answer while studying, rather than memorizing the A, B, C answer. You may be asked a question that has unfamiliar wording; studying and understanding the information in this book and the associated references will give you the tools to answer question variations with confidence.

If your study leads you to question an answer choice, we recommend you seek the assistance of a local instructor. We welcome your questions, recommendations, and concerns—send them to:

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ASA Test Prep Layout

Sample FAA questions have been sorted into chapters according to subject matter. Within each chapter, similar questions are grouped together following introductory chapter text. Figures referenced in the chapter text are numbered with the appropriate chapter number, e.g., “Figure 1-1” is Chapter 1’s first chapter text figure.

Some questions refer to Figures or Legends immediately following the question number, e.g., “6201. (Refer to Figure 14.)” These are FAA Figures and Legends which can be found in the separate booklet *Airman Knowledge Testing Supplement* (CT-8080-5H). This supplement is bundled with this Test Prep and is the exact same material you will have access to when you take your computerized test. We provide it separately so you can become accustomed to referring to the FAA Figures and Legends as you would during the test.

Following each sample FAA test question is ASA’s explanation in italics. The last line of the explanation contains a Learning Statement Code (LSC) as well as a reference for further study. Some questions include an explanation for the incorrect answers for added clarity. When you encounter a difficult question, find the LSC in Cross-Reference B, and then look for material relating to the subject description within the given reference(s). Refer to Cross-Reference B for more information on how to use LSCs for effective studying. In the course of working with students, you may see that other ASA Test Preps list Airman Certification Standard (ACS) codes in addition to LSCs. ACS codes will be introduced to the instructor certificate tests once an ACS is available, which will replace the Practical Test Standard (PTS). However, you may encounter ACS codes in your role as an instructor preparing students for Remote, Private, Instrument, Commercial, and Airline Transport Pilot certificates.

Answers to each question are found at the bottom of each page.

EXAMPLE:

Chapter text

Four aerodynamic forces are considered to be basic because they act upon an aircraft during all flight maneuvers. There is the downward-acting force called WEIGHT which must be overcome by the upward-acting force called LIFT, and there is the rearward-acting force called DRAG, which must be overcome by the forward-acting force called THRUST.

Category rating. This question may be found on tests for these ratings.*

ALL, AIR, RTC, GLI, LTA, FOI, PPC, WSC, LSA, MCI

6201. (Refer to Figure 14.) The four forces acting on an airplane in flight are

See separate book *Airman Knowledge Testing Supplement* (CT-8080-XX)

A— lift, weight, thrust, and drag.

B— lift, weight, gravity, and thrust.

C— lift, gravity, power, and friction.

Question and answer choices

Lift, weight, thrust, and drag are the four basic aerodynamic forces acting on an aircraft in flight.

Explanation

(PLT235) — FAA-H-8083-25

Code line. FAA Learning Statement Code in parentheses, followed by references for further study.

Answer (B) is incorrect because the force of gravity is always the same number and reacts with the airplane’s mass to produce a different weight for almost every airplane. Answer (C) is incorrect because weight is the final product of gravity, thrust is the final product of power, and drag is the final product of friction. Power, gravity, and friction are only parts of the aerodynamic forces of flight.

Reasons why answer choices are incorrect explained here.

* **Note:** The FAA does *not* identify which questions are on the different ratings’ tests. Unless the wording of a question is pertinent to only one rating category, it may be found on any of the tests.

ALL = All aircraft **AIR = Airplane** **GLI = Glider** **LTA = Lighter-Than-Air** **FOI = Fundamentals of Instruction**
RTC = Rotorcraft (applies to both helicopter and gyroplane) **PPC = Powered Parachute** **WSC = Weight-Shift Control**
LSA = Light-Sport Aircraft Airplane **MCI = Military Competency Instructor**

Chapter 5

Weather and Weather Services

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The Earth's Atmosphere

The earth's atmosphere is a mixture of gases made up primarily of nitrogen and oxygen. The atmosphere is in layers, with each layer having its own characteristics:

Troposphere—This is the layer nearest the surface. It extends upward for about 7 miles, and it has all of our weather because it contains water vapor. Temperature decreases steadily with altitude in the troposphere.

Tropopause—This is the boundary between the troposphere and the stratosphere. The tropopause slopes from about 20,000 feet over the poles to about 65,000 feet over the equator, and it is higher in summer than in winter.

Stratosphere—This is the layer above the troposphere in which there is relatively little change of temperature with altitude, except for a warming trend near the top.

Energy received from the sun is the primary driving force of the weather on the earth. The earth receives energy from the sun in the form of solar radiation. The earth and its atmosphere reflect about 55% of the radiation and absorb the remaining 45%, converting it to heat. The earth in turn radiates energy, and this outgoing radiation is called "terrestrial radiation."

The standard temperature of the atmosphere at mean sea level is 15°C and 59°F. The standard pressure at mean sea level is 29.92 inches of mercury, 1013.2 millibars, and 14.69 pounds per square inch.

ALL

6161. In what part of the atmosphere does most weather occur?

- A—Tropopause.
- B—Troposphere.
- C—Stratosphere.

Most of the weather occurs in the lower layer of our atmosphere, which is called the troposphere. (PLT203) — AC 00-6

ALL

6162. Which is the primary driving force of weather on the Earth?

- A—The Sun.
- B—Coriolis.
- C—Rotation of the Earth.

Energy received from the sun is the primary driving force of the weather on the earth. (PLT492) — AC 00-6

ALL

6173. What are the standard temperature and pressure values for mean sea level?

- A—15°F and 29.92" Hg.
- B—59°C and 29.92 mb.
- C—59°F and 1013.2 mb.

The standard sea level temperature is 15°C (59°F), and the standard sea level atmospheric pressure is 29.92 inches of mercury, or 1013.2 millibars. (PLT206) — AC 00-6

Answers

6161 [B]

6162 [A]

6173 [C]

Temperature, Pressure, and Density

Almost all weather is caused by heat transferred to the earth by the sun, through solar radiation. Much of this energy is reradiated, but that which is retained is converted into heat.

The temperature of the air in the troposphere decreases with altitude at a rate of 2°C per 1,000 feet. This is called the **average lapse rate**. There are two other lapse rates that are of interest to pilots: dry adiabatic lapse rate and moist adiabatic lapse rate. The dry adiabatic lapse rate is the change in temperature with altitude for unsaturated air; it is 3°C per 1,000 feet. Moist adiabatic lapse rate is the change in temperature with altitude for saturated air. Because of the condensation of moisture from this air, the moist adiabatic lapse rate is less than the dry adiabatic lapse rate. The actual rate depends upon the dew point of the air. When we know the temperature at any given level and the lapse rate, we can find the freezing level:

1. Find the difference between the existing temperature and freezing temperature (0°C).
2. Divide this difference in temperature by 2 to find the number of thousand feet above the existing level at which the temperature will be 0°C.

A **temperature inversion** is a change in temperature in which the air gets warmer as the altitude increases. A surface inversion occurs when terrestrial radiation on a clear night cools the surface of the land and lowers the temperature of the air immediately above the surface. The air temperature increases with altitude for a few hundred feet. An inversion aloft occurs when a current of warm air aloft overruns cold air near the surface. A low-level temperature inversion with high relative humidity will trap fog, smoke, low clouds, and other restrictions to visibility. The air will normally be smooth in an inversion.

Pressure altitude is the altitude measured above the standard pressure level at sea level of 29.92" of mercury (Hg), or 1013.2 millibars (mb). In the lower levels of the troposphere, the atmospheric pressure decreases approximately 1" Hg for each 1,000-foot increase in altitude. We can find the pressure altitude by setting the barometric scale of the altimeter to 29.92" Hg, or 1013.2 mb, and reading the altimeter indication. We can also compute the approximate pressure altitude by using this standard lapse rate of 1" Hg per 1,000 feet. If the altimeter indicates 1,850 feet when the barometric scale is set to 30.18 inches of mercury, it would indicate 260 feet lower if it were set to the standard sea level pressure of 29.92" Hg.

The density of the air is affected by its temperature, pressure, and moisture content. It is the density of the air that determines the performance of an aircraft engine and the aerodynamic forces that are produced by an airfoil. **Density altitude** is the altitude in standard air where the density is the same as that of the existing air. It is found by correcting pressure altitude for nonstandard temperature. As the density of the air decreases because of an increase in temperature or water vapor, or a decrease in pressure, the density altitude increases. An airspeed indicator is a differential pressure indicator which measures the dynamic pressure of the air. When the density of the air decreases, the static pressure will decrease and the true airspeed will increase.

ALL

6163. The average lapse rate in the troposphere is

A—2.0°C per 1,000 feet.

B—3.0°C per 1,000 feet.

C—5.4°C per 1,000 feet.

The average lapse rate (change in temperature with altitude) is 2°C per 1,000 feet. (PLT203) — AC 00-6

Answers

6163 [A]

ALL

6166. If the air temperature is $+6^{\circ}\text{C}$ at an elevation of 700 feet and a standard (average) temperature lapse rate exists, what will be the approximate freezing level?

- A—6,700 feet MSL.
- B—3,700 feet MSL.
- C—2,700 feet MSL.

The air temperature is $+6^{\circ}\text{C}$ at an elevation of 700 feet, and the air cools 2°C each thousand feet. For the moisture to freeze, the air must cool to a temperature of 0°C . Its temperature must drop 6° , which will require 3,000 feet. The freezing level will be $3,000 + 700$ feet, or 3,700 feet MSL. (PLT492) — AC 00-6

ALL

6167. If the air temperature is $+12^{\circ}\text{C}$ at an elevation of 1,250 feet and a standard (average) temperature lapse rate exists, what will be the approximate freezing level?

- A—7,250 feet MSL.
- B—5,250 feet MSL.
- C—4,250 feet MSL.

The air temperature is $+12^{\circ}\text{C}$ at an elevation of 1,250 feet, and the air cools 2°C each thousand feet. For the moisture to freeze, the air must cool to a temperature of 0°C . This will be $12 \div 2 = 6,000$ feet above the surface of 1,250 feet ($6,000 + 1,250$). Therefore, the freezing level is 7,250 feet MSL. (PLT492) — AC 00-6

ALL

6167-1. An increase in temperature with an increase in altitude

- A—is indication of an inversion.
- B—denotes the beginning of the stratosphere.
- C—means a cold front passage.

An increase in temperature with altitude is defined as an inversion; i.e., the lapse rate is inverted. (PLT512) — AC 00-6

ALL

6167-2. A surface inversion can

- A—indicate the chance of gusty winds.
- B—produce poor visibility.
- C—mean an unstable air mass.

A surface inversion can place a strong “lid” above smoke and haze. The result is poor visibility in the lower levels of the atmosphere, especially near industrial areas. (PLT512) — AC 00-6

ALL

6164. The most frequent type of ground- or surface-based temperature inversion is that produced by

- A—terrestrial radiation on a clear, relatively still night.
- B—warm air being lifted rapidly aloft in the vicinity of mountainous terrain.
- C—the movement of colder air under warm air or the movement of warm air over cold air.

Terrestrial radiation on a clear night cools the surface of the land and lowers the temperature of the air immediately above the surface. This causes a surface inversion in which the air temperature increases with altitude for a few hundred feet. (PLT301) — AC 00-6

Answer (B) is incorrect because this describes how upslope fog is produced. Answer (C) is incorrect because this describes temperature inversions aloft.

ALL

6165. Which weather conditions should be expected beneath a low-level temperature inversion layer when the relative humidity is high?

- A—Light wind shear and poor visibility due to light rain.
- B—Smooth air and poor visibility due to fog, haze, or low clouds.
- C—Turbulent air and poor visibility due to fog, low stratus type clouds, and showery precipitation.

A low-level temperature inversion with high relative humidity will trap fog, smoke, low clouds, and other restrictions to visibility. The air will normally be smooth in an inversion. (PLT301) — AC 00-6

ALL

6168. An altimeter indicates 1,850 feet MSL when set to 30.18. What is the approximate pressure altitude?

- A—1,590 feet.
- B—1,824 feet.
- C—2,110 feet.

In the lower levels of the troposphere, the atmospheric pressure decreases approximately 1" Hg for each 1,000-foot increase in altitude, and pressure altitude is based on a sea level pressure of 29.92" Hg. If the altimeter indicates 1,850 feet MSL when it is set to 30.18" Hg, it will indicate 260 feet lower when it is set to 29.92" Hg ($30.18 - 29.92 = .26$). Therefore, the pressure altitude is 1,590 feet ($1,850 - 260 = 1,590$). (PLT041) — AC 00-6

Answers

6166 [B]
6168 [A]

6167 [A]

6167-1 [A]

6167-2 [B]

6164 [A]

6165 [B]

ALL

6169. An aircraft is flying at a constant power setting and constant indicated altitude. If the outside air temperature (OAT) increases, true airspeed will

- A—increase and true altitude will decrease.
- B—increase and true altitude will increase.
- C—decrease and true altitude will increase.

True airspeed and true altitude are based on the existing outside air temperature, which affects the density of the air. While flying at a constant power setting and a constant indicated altitude, an increase in OAT will cause the air to become less dense. Both the true airspeed and the true altitude will increase. (PLT127) — AC 00-6

ALL

6170. An aircraft is flying at a constant power setting and constant indicated altitude. If the outside air temperature (OAT) decreases, true airspeed will

- A—decrease, and true altitude will decrease.
- B—increase, and true altitude will increase.
- C—increase, and true altitude will decrease.

True airspeed and true altitude are based on the existing outside air temperature, which affects the density of the air. While flying at a constant power setting and a constant indicated altitude, a decrease in OAT will cause the air to become more dense, and the true airspeed will decrease and the true altitude will be lower than indicated altitude. (PLT206) — AC 00-6

ALL

6171. As density altitude increases, which will occur if a constant indicated airspeed is maintained in a no-wind condition?

- A—True airspeed increases; groundspeed decreases.
- B—True airspeed decreases; groundspeed decreases.
- C—True airspeed increases; groundspeed increases.

True airspeed is based on the density of the air, which is affected by pressure, temperature, and humidity which together determine air density. While flying at a constant indicated airspeed, an increase in density altitude will indicate that the air has become less dense, and the true airspeed as well as ground speed will increase. (PLT127) — AC 00-6

ALL

6172. Density altitude may be determined by correcting

- A—true altitude for nonstandard temperature.
- B—pressure altitude for nonstandard temperature.
- C—indicated altitude for temperature variations.

Density altitude is the altitude in the standard atmosphere where the air density is the same as where you are. Density altitude is found by correcting pressure altitude for nonstandard temperature. (PLT127) — AC 00-6

Wind

Differences in temperature create differences in pressure, and these pressure differences cause winds to blow. We can tell a lot about the wind by studying weather maps that show lines of equal barometric pressure, called **isobars**. When isobars are close together on a surface weather map, the pressure gradient is steep. There is a large amount of pressure change in a small distance, and the wind velocities are strong. Wind blows from an area of high pressure into an area of low pressure, but it does not cross the isobars at right angles.

The **Coriolis Force**, caused by the rotation of the earth, acts at right angles to the wind, and in the Northern Hemisphere it deflects the wind to the right until it blows parallel to the isobars.

There is a third force that acts on the wind to change its direction. This is **friction** between the wind and the surface over which it is blowing. Friction slows the wind. The rougher the terrain and the stronger the wind speed, the greater the frictional effect. As the frictional force slows the windspeed, the Coriolis Force decreases but friction does not affect the pressure gradient force, and the pressure gradient and Coriolis Forces are no longer in balance. The stronger pressure gradient force turns the wind at an angle across the isobars toward the low pressure area.

Answers

6169 [B]

6170 [A]

6171 [C]

6172 [B]

The winds at altitude pretty much follow the isobars, but because of friction, surface winds flow at an angle across the isobars. In the Northern Hemisphere, the wind flows around a low pressure area in a counterclockwise direction. This is called **cyclonic flow**. When planning a long east to west flight, you can get an advantage from the winds by flying to the north of a low pressure area and to the south of a high pressure area. See Figure 5-1. The wind circulation in the Northern Hemisphere is clockwise out of a high and counterclockwise into a low. When flying from a high-pressure area into a low-pressure area, the wind will blow from the left.

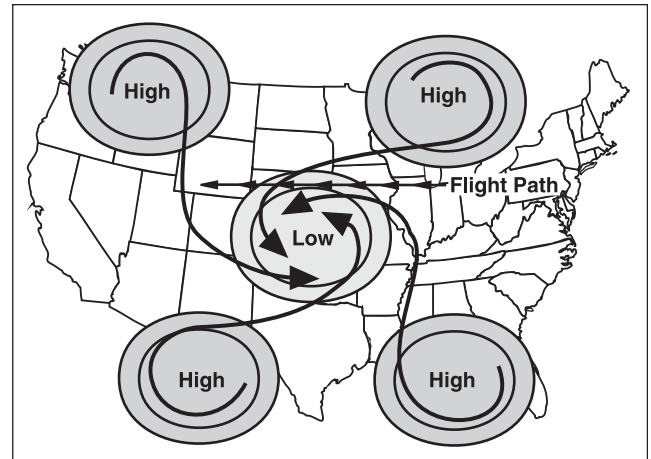


Figure 5-1. Wind circulation in the Northern Hemisphere

The wind velocities are generally greater in a low-pressure area than in a high-pressure area, so when flying from a high pressure into a low, the wind velocities will be increasing. Air flowing counterclockwise into a low-pressure area cannot flow outward against the pressure gradient, nor can it go downward into the ground; it must go upward. Therefore, a low pressure area, or **trough**, is an area of rising air. Air moving out of a high, or **ridge**, flows in a clockwise direction and depletes the quantity of air. Highs and ridges, therefore, are areas of descending air.

Convective circulation patterns associated with sea breezes occur because land surfaces warm and cool more rapidly than do water surfaces. The land is warmer than the sea during the day and wind blows from the cool water to warm land. At night the wind reverses and blows from the cool land to warmer water.

ALL

6174. What causes wind?

- A—Coriolis force.
- B—Pressure differences.
- C—The rotation of the Earth.

Wind, which is the movement of air, is caused by pressure differences in the atmosphere. (PLT516) — AC 00-6

ALL

6175. The windflow around a low pressure is

- A—cyclonic.
- B—adiabatic.
- C—anticyclonic.

Because of the Coriolis Force, the wind flow around a low-pressure area in the Northern Hemisphere is counterclockwise. This direction of flow is called cyclonic flow. (PLT516) — AC 00-6

Answer (B) is incorrect because adiabatic refers to the cooling of air as it rises. Answer (C) is incorrect because anticyclonic refers to a high-pressure system.

ALL

6176. Winds at 5,000 feet AGL on a particular flight are southwesterly while most of the surface winds are southerly. This difference in direction is primarily due to

- A—local terrain effects on pressure.
- B—stronger Coriolis force at the surface.
- C—friction between the wind and the surface.

Friction between the wind and the surface of the earth slows the wind and decreases the effect of the Coriolis Force. Since friction does not decrease the pressure gradient, the Coriolis Force and pressure gradient are not in balance near the surface, and the force of the pressure gradient turns the wind at an angle across the isobars toward the lower pressure. This action explains the shift of wind from southerly near the surface to southwesterly at 5,000 feet. (PLT516) — AC 00-6

Answers

6174 [B]

6175 [A]

6176 [C]

ALL

6177. In the Northern Hemisphere, a pilot making a long distance flight from east to west would most likely find favorable winds associated with high- and low-pressure systems by flying to the

- A—north of a high and a low.
- B—north of a high and to the south of a low.
- C—south of a high and to the north of a low.

In the Northern Hemisphere, the wind blows counterclockwise around a low and clockwise around a high. For this reason, a pilot making a long distance flight from east to west would likely find the best tail winds by flying to the south of a high and north of a low. (PLT517) — AC 00-6

ALL

6178. When flying from a high- to a low-pressure area in the Northern Hemisphere, the wind direction and velocity will be from the

- A—left and increasing.
- B—left and decreasing.
- C—right and increasing.

The wind circulation in the Northern Hemisphere is clockwise out of a high and counterclockwise into a low. When flying from a high-pressure area into a low-pressure area, the wind will blow from the left. The wind velocities are generally higher in a low-pressure area than in a high-pressure area, so on this flight the wind velocities will be increasing. (PLT517) — AC 00-6

ALL

6179. The general circulation of air associated with a high-pressure area in the Northern Hemisphere is

- A—inward, upward, and clockwise.
- B—outward, downward, and clockwise.
- C—outward, upward, and counterclockwise.

In the Northern Hemisphere, the air circulating out of a high-pressure area flows outward in a clockwise direction, and as it leaves, it descends. (PLT517) — AC 00-6

ALL

6180. Which statement is true regarding high- or low-pressure systems?

- A—A high-pressure area or ridge is an area of rising air.
- B—A low-pressure area or trough is an area of rising air.
- C—A high-pressure area is a trough of descending air.

Air flowing counterclockwise into a low-pressure area cannot flow outward against the pressure gradient, nor can it go downward into the ground; it must go upward. Therefore, a low-pressure area, or trough, is an area of rising air. (PLT510) — AC 00-6

Moisture and Precipitation

Relative humidity is the ratio of the amount of water vapor in the air to the amount the air can hold at its present temperature. **Dew point** is the temperature at which a mass of air can no longer hold water in its vapor state. It is the temperature to which the air must be cooled for it to become saturated. The difference between the temperature and the dew point, (the spread), decreases as the relative humidity of the air increases.

Precipitation is a term that includes all types of atmospheric particles that grow in size and weight until they can no longer remain suspended, and they fall. Some rain evaporates before it reaches the ground. This is called virga, which appears as dark streamers hanging below the cloud.

When cold air moves over a warm lake, the warm water adds heat and water vapor to the air. This additional water in the air condenses out as the air is cooled on the lee side of the lake and causes showers. If the air is warmer than the water in the lake, the air may become saturated by evaporation from the water while also becoming cooler in the low levels by contact with the cool water. This causes fog which often becomes extensive and dense to the lee of a lake.

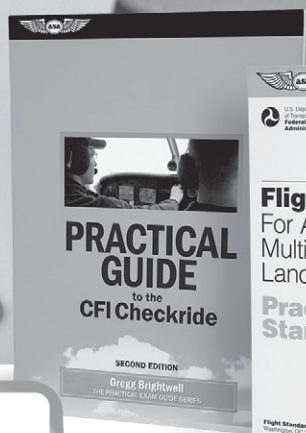
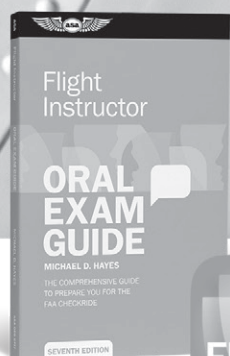
Answers

6177 [C]

6178 [A]

6179 [B]

6180 [B]



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ISBN 978-1-61954-971-5



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