



## COMMERCIAL PILOT

# 2022 TEST PREP

### STUDY & PREPARE

Pass your test and know what is essential to become a safe, competent pilot—from the most trusted source in aviation training

**5** FREE  
ONLINE  
PRACTICE  
TESTS

Activation Code Included

# COMMERCIAL PILOT

# 2022 TEST PREP

## STUDY & PREPARE

Pass your test and know what is essential to become a safe, competent pilot—from the most trusted source in aviation training

### READER TIP

---

The FAA Knowledge Exam Questions can change throughout the year. Stay current with test changes; sign up for ASA's free email update service at [asa2fly.com/testupdate](https://asa2fly.com/testupdate)



AVIATION SUPPLIES & ACADEMICS, INC.  
NEWCASTLE, WASHINGTON

Commercial Pilot Test Prep  
2022 Edition

Aviation Supplies & Academics, Inc.  
7005 132nd Place SE  
Newcastle, Washington 98059  
asa@asa2fly.com | 425.235.1500 | asa2fly.com

© 2021 Aviation Supplies & Academics, Inc.

Visit [asa2fly.com/reader/TPC](https://asa2fly.com/reader/TPC) for the Reader Resources page containing additional information and updates related to this book.

Sample Federal Aviation Administration (FAA) questions herein contain information as of: September 2021. Stay informed of changes since the book was printed: [asa2fly.com/testupdate](https://asa2fly.com/testupdate)

None of the material in this publication supersedes any documents, procedures or regulations issued by the Federal Aviation Administration.

Aviation Supplies & Academics, Inc. (ASA), assumes no responsibility for any errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained herein.

**Important:** This Test Prep should be sold with and used in conjunction with *Airman Knowledge Testing Supplement for Commercial Pilot* (FAA-CT-8080-1E). 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-8080-1E.

Cover photo: [iStock.com/sierrarat](https://iStock.com/sierrarat)

**ASA-TP-C-22**  
ISBN 978-1-64425-155-3

Additional format available:  
eBook PDF ISBN 978-1-64425-156-0

Printed in the United States of America

2022 2021 5 4 3 2 1

## About the Contributors

**Jackie Spanitz**  
General Manager  
Aviation Supplies & Academics, Inc.

As ASA General Manager, Jackie Spanitz oversees maintenance and development of more than 1,000 titles and pilot supplies in the ASA product line. Ms. Spanitz has worked with airman training and testing for more than 25 years, including participation in the Airman Certification Standards (ACS) development committees. Jackie holds a Bachelor of Science in Aviation Technology from Western Michigan University, a Master of Science from Embry-Riddle Aeronautical University, and Instructor and Commercial Pilot certificates. She is the author of *Guide to the Flight Review*, and the technical editor for ASA's Test Prep and FAR/AIM series.

**Aviation Supplies & Academics, Inc. (ASA)** is an industry leader in the development and sale of aviation supplies and publications for pilots, flight instructors, aviation maintenance technicians, aircraft dispatchers, air traffic controllers, flight attendants, and drone operators. We manufacture and publish more than 1,000 products and have been providing trusted and reliable training materials to the aviation industry for over 80 years. Visit [asa2fly.com](https://asa2fly.com) for a free catalog.

Stay informed with ASA online resources.

### Website



[asa2fly.com](https://asa2fly.com)

### Updates



[asa2fly.com/testupdate](https://asa2fly.com/testupdate)

### Follow, like, share.

-  [twitter.com/asa2fly](https://twitter.com/asa2fly)
-  [instagram.com/asa2fly](https://instagram.com/asa2fly)
-  [facebook.com/asa2fly](https://facebook.com/asa2fly)
-  [youtube.com/asa2fly](https://youtube.com/asa2fly)
-  [linkedin.com/company/asa2fly](https://linkedin.com/company/asa2fly)

# Contents

## Instructions

Updates and Practice Tests .....	v
Introduction.....	vi
Description of the Tests .....	vii
<i>Knowledge Test Registration</i> .....	vii
<i>Knowledge Test Eligibility</i> .....	viii
<i>Acceptable Materials</i> .....	ix
<i>Testing Procedures for Applicants</i>	
<i>Requesting Special Accommodations</i> .....	ix
<i>Test Reports</i> .....	x
<i>Retesting Procedures</i> .....	x
<i>Cheating or Other Unauthorized Conduct</i> .....	x
<i>Test-Taking Tips</i> .....	xi
Commercial Pilot Certificate Eligibility	
Requirements .....	xii
Knowledge Exam References .....	xiii
ASA Test Prep Layout.....	xiv

## Chapter 1 Basic Aerodynamics

Aerodynamic Terms.....	1–3
Axes of Rotation and the Four Forces Acting in Flight .....	1–5
<i>Lift</i> .....	1–6
<i>Weight</i> .....	1–7
<i>Thrust</i> .....	1–7
<i>Drag</i> .....	1–7
Lift/Drag Ratios.....	1–11
The $V_G$ Diagram.....	1–13
Stability.....	1–14
Turns, Loads, and Load Factors .....	1–16
Stalls and Spins.....	1–23
Flaps.....	1–24
Wing Shapes .....	1–25
Torque.....	1–26
Ground Effect .....	1–27
Wake Turbulence .....	1–28
Glider Aerodynamics .....	1–30

## Chapter 2 Aircraft Systems

Ignition System.....	2–3
Air/Fuel Mixture.....	2–4
Carburetor Ice.....	2–6
Aviation Fuel.....	2–7
Engine Temperatures.....	2–8
Propellers .....	2–9

Cold Weather Operations .....	2–12
Rotorcraft Systems.....	2–13
Glider Systems .....	2–29
Balloon Operations.....	2–37
Airship Operations .....	2–43
Airship IFR Operations .....	2–45

## Chapter 3 Flight Instruments

Airspeed Indicator.....	3–3
Altitude Definitions.....	3–6
Magnetic Compass.....	3–7
Gyroscopic Instruments and Systems.....	3–8
Attitude Instrument Flying.....	3–9
Electronic Flight Instruments .....	3–10

## Chapter 4 Regulations

Pilot Certificate Types and Privileges .....	4–3
Medical Certificates .....	4–6
Pilot Logbooks.....	4–7
High-Performance, Complex, and Tailwheel Airplanes.....	4–8
Recent Flight Experience: Pilot-In-Command ....	4–10
Change of Address.....	4–11
Towing .....	4–12
Responsibility and Authority of the Pilot-In-Command.....	4–13
Preflight Action .....	4–15
Seatbelts.....	4–17
Portable Electronic Devices.....	4–19
Fuel Requirements .....	4–20
Transponder and ADS-B Requirements .....	4–20
Supplemental Oxygen .....	4–22
Instrument and Equipment Requirements.....	4–23
Restricted, Limited, and Experimental Aircraft: Operating Limitations.....	4–24
Emergency Locator Transmitter (ELT) .....	4–25
Truth in Leasing .....	4–25
Operating Near Other Aircraft and Right-of-Way Rules.....	4–26
Speed Limits.....	4–29
Aircraft Lights.....	4–30
Minimum Altitudes .....	4–31
Maintenance Responsibility.....	4–32
Aircraft Inspections .....	4–33
Maintenance Records.....	4–35

Maintenance, Preventative Maintenance, Rebuilding, and Alteration.....	4–36
NTSB Part 830 .....	4–38
IFR Operations .....	4–41
Rotorcraft Regulations.....	4–42
Glider Regulations .....	4–43
Lighter-Than-Air Regulations.....	4–43
LTA Fundamentals of Instructing .....	4–46

## Chapter 5 **Procedures and Airport Operations**

Airspace.....	5–3
Basic VFR Weather Minimums .....	5–14
Operations on Wet or Slippery Runways.....	5–15
Land and Hold Short Operations (LAHSO) .....	5–16
Airport Marking Aids and Signs.....	5–17
VFR Cruising Altitudes .....	5–22
Collision Avoidance .....	5–22
Fitness Physiology.....	5–25
Aeronautical Decision Making .....	5–29

## Chapter 6 **Weather**

The Earth's Atmosphere.....	6–3
Temperature .....	6–6
Wind .....	6–7
Moisture.....	6–9
Stable and Unstable Air.....	6–10
Clouds .....	6–11
Air Masses and Fronts.....	6–16
Turbulence .....	6–17
Icing.....	6–19
Thunderstorms .....	6–21
Fog .....	6–24
Wind Shear.....	6–26
Soaring Weather.....	6–29

## Chapter 7 **Weather Services**

Aviation Routine Weather Report (METAR).....	7–3
Pilot Report (UA) .....	7–5
Terminal Aerodrome Forecast (TAF) .....	7–8
Graphical Forecasts for Aviation (GFA) .....	7–9
Winds and Temperatures Aloft Forecast (FB).....	7–10
Inflight Weather Advisories (WA, WS, WST).....	7–10
Surface Analysis Chart.....	7–13
Constant Pressure Chart.....	7–14

Tropopause Height/Vertical Wind Shear Prognostic Chart.....	7–14
Significant Weather Prognostics.....	7–15
Lifted Index Chart.....	7–17

## Chapter 8 **Aircraft Performance**

Weight and Balance .....	8–3
<i>Computing Weight and Balance</i> .....	8–4
<i>Graph Weight and Balance Problems</i> .....	8–4
<i>Weight Change</i> .....	8–5
<i>Weight Shift</i> .....	8–6
Rotorcraft Weight and Balance.....	8–12
Glider Weight and Balance .....	8–15
Headwind and Crosswind Components .....	8–17
Density Altitude.....	8–19
Takeoff and Landing Considerations .....	8–20
Takeoff and Landing Distance .....	8–22
Fuel Consumption vs. Brake Horsepower .....	8–26
Time, Fuel, and Distance to Climb .....	8–28
<i>Table Method</i> .....	8–28
<i>Graph Method</i> .....	8–29
Cruise Performance Table .....	8–33
Cruise and Range Performance Table.....	8–35
Maximum Rate of Climb .....	8–36
Glide Distance .....	8–37
Rotorcraft Performance .....	8–38
Glider Performance.....	8–40
Balloon Performance .....	8–43

## Chapter 9 **Navigation**

The Flight Computer.....	9–3
<i>Finding True Course, Time, Rate, Distance,     and Fuel</i> .....	9–3
<i>Finding Density Altitude</i> .....	9–10
<i>Finding Wind Direction and Velocity</i> .....	9–12
VHF Omni-Directional Range (VOR).....	9–14
Horizontal Situation Indicator (HSI) .....	9–18

## **Cross References**

<b>A:</b> Question Number and Page Number .....	A–1
<b>B:</b> Airman Knowledge Test Report Codes and Question Numbers .....	B–1

# 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](http://asa2fly.com/testupdate). Additionally, sign up for free email notifications, which are sent when new Test Updates are available.

## We Invite Your Feedback

After you take your FAA exam, let us know how you did. Were you prepared? Did ASA's products meet your needs and exceed your expectations? We want to continue to improve these products to ensure applicants are prepared and become safe aviators. Send your feedback to: [cfi@asa2fly.com](mailto:cfi@asa2fly.com).

# prepware.com

See inside front cover  
for FREE account!

## Helping you practice for written exams.

As the experts in FAA Knowledge Exam preparation, we want you to have the confidence needed before heading to the testing center, and help eliminate the hassle and expense of retaking exams.

### > Realistic Test Simulation

Test questions and time allowed replicate the official FAA exam

### > Performance Graphs

Review how you did, track your performance and review explanations for the questions you missed

### > Gain Confidence

Go into your exam fully prepared after practicing up to 5 simulated tests

### > Succeed

Pass your exam, achieve your goals, and set new ones



Remote Pilot • Sport Pilot • Private Pilot • Instrument Rating • Commercial Pilot • Flight Instructor • Ground Instructor  
Fundamentals of Instructing • Flight Engineer • Airline Transport Pilot • Aviation Mechanic General • Airframe • Powerplant

Practice tests are also available as an app! [asa2fly.com/apps](http://asa2fly.com/apps)

---

# 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 Commercial Pilot certificate test.

Begin your studies with a classroom or home-study ground school course, which will involve reading a comprehensive textbook. Visit the dedicated Reader Resource webpage for this Test Prep ([asa2fly.com/reader/TPC](http://asa2fly.com/reader/TPC)) 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](http://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 pilot preparing for the Commercial Airplane test would focus on the questions marked “ALL” and “AIR,” and a pilot preparing for the Commercial Helicopter test would focus on the questions marked “ALL” and “RTC.”

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](http://iacra.faa.gov). Then visit [faa.psiexams.com](http://faa.psiexams.com) 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 letter associated with the correct response. 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:

**Aviation Supplies & Academics, Inc.**  
7005 132nd Place SE  
Newcastle, WA 98059-3153  
Voice: 425.235.1500 Fax: 425.235.0128  
Email: [cfi@asa2fly.com](mailto:cfi@asa2fly.com) Website: [asa2fly.com](http://asa2fly.com)

The FAA appreciates testing experience feedback. You can contact them at:

**Federal Aviation Administration**  
AFS-630, Airman Testing Standards Branch  
PO Box 25082  
Oklahoma City, OK 73125  
Email: [afs630comments@faa.gov](mailto:afs630comments@faa.gov)

# 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 sample FAA questions refer to Figures or Legends immediately following the question number, e.g., “5201. (Refer to Figure 14.)” These are FAA Figures and Legends which can be found in the separate booklet *Airman Knowledge Testing Supplement for Commercial Pilot* (CT-8080-1E). This supplement is bundled with this Test Prep and is the exact same material you will have access to when you take your FAA 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), for those tests referencing an FAA Practical Test Standard (PTS), or Airman Certification Standards (ACS) code, for those tests with an ACS, 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 or ACS code 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 or ACS codes for effective studying.

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, MIL

**5201.** (Refer to Figure 14.) The four forces acting on an airplane in flight are

A— lift, weight, thrust, and drag.  
B— lift, weight, gravity, and thrust.  
C— lift, gravity, power, and friction.

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

**Question and answer choices**

*Lift, weight, thrust, and drag are the four basic aerodynamic forces acting on an aircraft in flight. (PLT235, IR.IV.A.K1) — FAA-H-8083-25*

**Explanation**

*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.*

**Code line. FAA LSC and ACS codes in parentheses, followed by references for further study.**

**Incorrect answer explanation. 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 (applies to hot air balloon, gas balloon and airship)  
RTC = Rotorcraft (applies to both helicopter and gyroplane)    MIL = Military Competency**

---

# Chapter 2

## **Aircraft Systems**

Ignition System	<b>2-3</b>
Air/Fuel Mixture	<b>2-4</b>
Carburetor Ice	<b>2-6</b>
Aviation Fuel	<b>2-7</b>
Engine Temperatures	<b>2-8</b>
Propellers	<b>2-9</b>
Cold Weather Operations	<b>2-12</b>
Rotorcraft Systems	<b>2-13</b>
Glider Systems	<b>2-29</b>
Balloon Operations	<b>2-37</b>
Airship Operations	<b>2-43</b>
Airship IFR Operations	<b>2-45</b>

## Ignition System

Most reciprocating engines used to power small aircraft incorporate two separate magneto ignition systems. The primary advantages of the dual ignition system are increased safety and improved engine performance.

A magneto (“mag”) is a self-contained source of electrical energy, so even if an aircraft loses total electric power, the engine will continue to run. For electrical energy, magnetos depend upon a rotating magnet and a coil.

When checking for magneto operation prior to flight, the engine should run smoothly when operating with the magneto selector set on BOTH, and should experience a slight drop in revolutions per minute (RPM) when running on only one or the other magneto. The drop in RPM is caused by reduced efficiency of a single spark plug, as opposed to two.

If the ground wire between the magneto and the ignition switch becomes disconnected or broken, the engine cannot be shut down by turning off the ignition switch.

AIR, RTC

**5169.** Before shutdown, while at idle, the ignition key is momentarily turned OFF. The engine continues to run with no interruption; this

- A—is normal because the engine is usually stopped by moving the mixture to idle cut-off.
- B—should not normally happen. Indicates a magneto not grounding in OFF position.
- C—is an undesirable practice, but indicates that nothing is wrong.

*If the magneto switch ground wire is disconnected, the magneto is ON even though the ignition switch is in the OFF position. The engine could fire if the propeller is moved from outside the airplane. (PLT478, CA.I.G.R1) — FAA-H-8083-25*

*Answer (A) is incorrect because the engine should stop when the ignition key is turned to the OFF position. Answer (C) is incorrect because this indicates there is a faulty ground wire.*

AIR, RTC

**5171.** A way to detect a broken magneto primary grounding lead is to

- A—idle the engine and momentarily turn the ignition off.
- B—add full power, while holding the brakes, and momentarily turn off the ignition.
- C—run on one magneto, lean the mixture, and look for a rise in manifold pressure.

*If the magneto switch ground wire is disconnected, the magneto is ON even though the ignition switch is in the OFF position. The engine could fire if the propeller is moved from outside the airplane. (PLT343, CA.I.G.R1) — FAA-H-8083-25*

*Answer (B) is incorrect because it is not necessary to add full power when performing the check. Answer (C) is incorrect because the way to detect a broken magneto ground wire is to turn the ignition to the OFF position; if the engine continues to run, the problem is confirmed.*

AIR, RTC

**5173.** The most probable reason an engine continues to run after the ignition switch has been turned off is

- A—carbon deposits glowing on the spark plugs.
- B—a magneto ground wire is in contact with the engine casing.
- C—a broken magneto ground wire.

*If the magneto switch ground wire is disconnected, the magneto is ON even though the ignition switch is in the OFF position. The engine could fire if the propeller is moved from outside the airplane. (PLT343, CA.I.G.R1) — FAA-H-8083-25*

*Answer (A) is incorrect because glowing carbon deposits is a result of preignition. Answer (B) is incorrect because a magneto ground wire should be in contact with the engine casing to provide grounding.*

### Answers

5169 [B]

5171 [A]

5173 [C]

AIR, RTC

**5174.** If the ground wire between the magneto and the ignition switch becomes disconnected, the engine

- A—will not operate on one magneto.
- B—cannot be started with the switch in the BOTH position.
- C—could accidentally start if the propeller is moved with fuel in the cylinder.

*If the magneto switch ground wire is disconnected, the magneto is ON even though the ignition switch is in the OFF position. The engine could fire if the propeller is moved from outside the airplane. (PLT343, CA.I.G.R1) — FAA-H-8083-25*

*Answer (A) is incorrect because both magnetos remain on when the ground wire is disconnected. Answer (B) is incorrect because the engine can still be started, and the magnetos cannot be turned off.*

## Air/Fuel Mixture

Carburetors are normally set to deliver the correct air/fuel mixture (air/fuel ratio) at sea level. This air/fuel ratio is the ratio of the weight of fuel to the weight of air entering the cylinder. This ratio is determined by the setting of the mixture control in both fuel injection and carburetor-equipped engines.

When climbing, the mixture control allows the pilot to decrease the fuel flow as altitude increases (air density decreases), thus maintaining the correct mixture (air/fuel ratio). If the fuel flow is allowed to remain constant by not leaning the mixture, the fuel/air ratio becomes too rich, as the density (weight per unit volume) of air decreases with increased altitude, resulting in a loss of efficiency. Operating with an excessively rich mixture may cause fouling of spark plugs.

When descending, air density increases. Unless fuel flow is increased, the mixture may become excessively lean; i.e., the weight of fuel is too low for the weight of air reaching the cylinders. This may result in the creation of high temperatures and pressures.

The best power mixture is the air/fuel ratio from which the most power can be obtained for any given throttle setting.

AIR, RTC, LTA

**5172.** Fouling of spark plugs is more apt to occur if the aircraft

- A—gains altitude with no mixture adjustment.
- B—descends from altitude with no mixture adjustment.
- C—throttle is advanced very abruptly.

*If the fuel/air mixture is too rich, excessive fuel consumption, rough engine operation, and appreciable loss of power will occur. Because of excessive fuel, a cooling effect takes place which causes below normal temperatures in the combustion chambers. This cooling results in spark plug fouling. Unless the mixture is leaned with a gain in altitude, the mixture becomes excessively rich. (PLT343, CA.I.G.R1) — FAA-H-8083-25*

*Answer (B) is incorrect because descending without a mixture adjustment (operating with an excessively lean mixture) would result in overheating, rough engine operation, a loss of power, and detonation. Answer (C) is incorrect because advancing the throttle abruptly may cause the engine to hesitate or stop.*

AIR, RTC, LTA

**5176.** The pilot controls the air/fuel ratio with the

- A—throttle
- B—manifold pressure
- C—mixture control

*The fuel/air ratio of the combustible mixture delivered to the engine is controlled by the mixture control. (PLT249, CA.I.G.K1e) — FAA-H-8083-25*

*Answer (A) is incorrect because the throttle regulates the total volume of fuel and air entering the combustion chamber. Answer (B) is incorrect because the manifold pressure indicates the engine's power output.*

### Answers

5174 [C]

5172 [A]

5176 [C]

AIR, RTC, LTA

**5187.** Fuel/air ratio is the ratio between the

- A—volume of fuel and volume of air entering the cylinder.
- B—weight of fuel and weight of air entering the cylinder.
- C—weight of fuel and weight of air entering the carburetor.

*The mixture control is used to change the fuel to air mixture entering the combustion chamber (cylinder). Fuel-to-air ratio is the weight of fuel to a given weight of air. (PLT249, CA.I.G.K1e) — FAA-H-8083-25*

*Answer (A) is incorrect because, as altitude increases, the amount of air in a fixed volume decreases. Answer (C) is incorrect because the carburetor is where the fuel/air ratio is established prior to entering the cylinders.*

AIR, RTC, LTA

**5188.** The mixture control can be adjusted, which

- A—prevents the fuel/air combination from becoming too rich at higher altitudes.
- B—regulates the amount of air flow through the carburetor's venturi.
- C—prevents the fuel/air combination from becoming lean as the airplane climbs.

*As the aircraft climbs, the fuel/air mixture becomes richer and the excessive fuel causes the engine to lose power and to run rougher. The mixture control provides a means for the pilot to decrease fuel to compensate for this imbalance in mixture as altitude increases. (PLT343, CA.I.G.R1) — FAA-H-8083-25*

*Answer (B) is incorrect because the throttle regulates the airflow through the carburetor's venturi. Answer (C) is incorrect because the fuel/air ratio becomes richer as the aircraft climbs.*

AIR, RTC, LTA

**5298.** The best power mixture is that fuel/air ratio at which

- A—cylinder head temperatures are the coolest.
- B—the most power can be obtained for any given throttle setting.
- C—a given power can be obtained with the highest manifold pressure or throttle setting.

*The throttle setting determines the amount of air flowing into the engine. The mixture control is then adjusted to get the best fuel/air ratio, resulting in the best power the engine can develop at this particular throttle setting. (PLT249, CA.I.G.K1c) — FAA-H-8083-25*

*Answer (A) is incorrect because the cylinder heads will be the coolest when mixture is richest. Answer (C) is incorrect because this describes the highest power setting.*

AIR, RTC, LTA

**5608.** What will occur if no leaning is made with the mixture control as the flight altitude increases?

- A—The volume of air entering the carburetor decreases and the amount of fuel decreases.
- B—The density of air entering the carburetor decreases and the amount of fuel increases.
- C—The density of air entering the carburetor decreases and the amount of fuel remains constant.

*Fuel flow remains constant if no adjustments are made. The same volume of air goes into the carburetor, but the weight and density of the air is less, causing an excessively rich mixture, which causes spark plug fouling and decreased power. (PLT249, CA.I.G.K1c) — FAA-H-8083-25*

AIR, RTC, LTA

**5609.** Unless adjusted, the fuel/air mixture becomes richer with an increase in altitude because the amount of fuel

- A—decreases while the volume of air decreases.
- B—remains constant while the volume of air decreases.
- C—remains constant while the density of air decreases.

*Fuel flow remains constant if no adjustments are made. The same volume of air goes into the carburetor, but the weight and density of the air is less, causing an excessively rich mixture, which causes spark plug fouling and decreased power. (PLT249, CA.I.G.K1c) — FAA-H-8083-25*

AIR, RTC, LTA

**5610.** The basic purpose of adjusting the fuel/air mixture control at altitude is to

- A—decrease the fuel flow to compensate for decreased air density.
- B—decrease the amount of fuel in the mixture to compensate for increased air density.
- C—increase the amount of fuel in the mixture to compensate for the decrease in pressure and density of the air.

*Fuel flow remains constant if no adjustments are made. The same volume of air goes into the carburetor, but the weight and density of the air is less, causing an excessively rich mixture, which causes spark plug fouling and decreased power. (PLT249, CA.I.G.K1c) — FAA-H-8083-25*

**Answers**

5187 [B]

5188 [A]

5298 [B]

5608 [C]

5609 [C]

5610 [A]

AIR, RTC, LTA

**5611.** At high altitudes, an excessively rich mixture will cause the

- A—engine to overheat.
- B—fouling of spark plugs.
- C—engine to operate smoother even though fuel consumption is increased.

*Fuel flow remains constant if no adjustments are made. The same volume of air goes into the carburetor, but the weight and density of the air is less, causing an excessively rich mixture, which causes spark plug fouling and decreased power. (PLT343, CA.I.G.K1c) — FAA-H-8083-25*

*Answer (A) is incorrect because a lean mixture will cause the engine to overheat. Answer (C) is incorrect because an engine runs smoother when the mixture is adjusted for the altitude.*

## Carburetor Ice

As air flows through a carburetor, it expands rapidly. At the same time, fuel entering the airstream is vaporized. Expansion of the air and vaporization of the fuel causes a sudden cooling of the mixture which may cause ice to form inside the carburetor. The possibility of icing should always be considered when operating in conditions where the outside air temperature is between 20°F and 70°F and the relative humidity is high.

Carburetor heat preheats the air before it enters the carburetor and either prevents carburetor ice from forming or melts any ice which may have formed. When carburetor heat is applied, the heated air that enters the carburetor is less dense. This causes the air/fuel mixture to become enriched, and this in turn decreases engine output (less engine horsepower) and increases engine operating temperatures.

During engine run-up, prior to departure from a high-altitude airport, the pilot may notice a slight engine roughness which is not affected by the magneto check but grows worse during the carburetor heat check. In this case the air/fuel mixture may be too rich due to the lower air density at the high altitude, and applying carburetor heat decreases the air density even more. A leaner setting of the mixture control may correct this problem.

In an airplane with a fixed-pitch propeller, the first indication of carburetor ice will likely be a decrease in RPM as the air supply is choked off. Application of carburetor heat will decrease air density, causing the RPM to drop even lower. Then, as the carburetor ice melts, the RPM will rise gradually.

Fuel injection systems, which do not utilize a carburetor, are generally considered to be less susceptible to icing than carburetor systems are.

AIR, RTC, LTA

**5170.** Leaving the carburetor heat on while taking off

- A—leans the mixture for more power on takeoff.
- B—will decrease the takeoff distance.
- C—will increase the ground roll.

*Use of carburetor heat enriches the mixture, which tends to reduce the output of the engine and also increases the operating temperature. Therefore, the heat should not be used when full power is required (such as during takeoff) or during normal engine operations except to check for the presence of, or removal of carburetor ice. A decrease in engine output will increase distance required to reach lift off speed. Therefore, it will increase ground roll. (PLT189, CA.I.G.K1e) — FAA-H-8083-25*

AIR, RTC, LTA

**5189.** Which statement is true concerning the effect of the application of carburetor heat?

- A—It enriches the fuel/air mixture.
- B—It leans the fuel/air mixture.
- C—It has no effect on the fuel/air mixture.

*Use of carburetor heat enriches the mixture which tends to reduce the output of the engine and also increases the operating temperature. (PLT189, CA.I.G.K1e) — FAA-H-8083-25*

### Answers

5611 [B]

5170 [C]

5189 [A]

AIR, RTC, LTA

**5606.** Applying carburetor heat will

- A—not affect the mixture.
- B—lean the fuel/air mixture.
- C—enrich the fuel/air mixture.

*Use of carburetor heat enriches the mixture which tends to reduce the output of the engine and also increases the operating temperature. (PLT343, CA.I.G.K1e) — FAA-H-8083-25*

## Aviation Fuel

Fuel does two things for the engine; it acts both as an agent for combustion and as an agent for cooling (based on the mixture setting of the engine).

Aviation fuel is available in several grades. The proper grade for a specific engine will be listed in the aircraft flight manual. If the proper grade of fuel is not available, it is possible to use the next higher grade. A lower grade of fuel should never be used.

The use of low-grade fuel or a too lean air/fuel mixture may cause detonation, which is the uncontrolled spontaneous explosion of the mixture in the cylinder, instead of burning progressively and evenly. Detonation produces extreme heat.

Preignition is the premature uncontrolled firing of the fuel/air mixture. It is caused by an incandescent area (such as a carbon or lead deposit heated to a red hot glow) serving as an ignitor in advance of normal ignition.

Fuel can be contaminated by water and/or dirt. The air inside the aircraft fuel tanks can cool at night, which allows formation of water droplets (through condensation) on the insides of the fuel tanks. These droplets then fall into the fuel. To avoid this problem, always fill the tanks completely when parking overnight.

Thoroughly drain all of the aircraft's sumps, drains, and strainers before a flight to get rid of any water that may have collected.

Dirt can get into the fuel if refueling equipment is poorly maintained or if the refueling operation is sloppy. Use care when refueling an aircraft.

On aircraft equipped with fuel pumps, the practice of running a fuel tank dry before switching tanks is considered unwise because the engine-driven fuel pump or electric fuel boost pump may draw air into the fuel system and cause vapor lock.

AIR, RTC, LTA

**5185-1.** Detonation may occur at high-power settings when

- A—the fuel mixture ignites instantaneously instead of burning progressively and evenly.
- B—an excessively rich fuel mixture causes an explosive gain in power.
- C—the fuel mixture is ignited too early by hot carbon deposits in the cylinder.

*Detonation or knock is a sudden explosion or shock to a small area of the piston top, rather than the normal smooth burn in the combustion chamber. (PLT115, CA.I.G.K1e) — FAA-H-8083-25*

*Answer (B) is incorrect because detonation may occur with an excessively lean fuel mixture and a loss in power. Answer (C) is incorrect because this describes preignition.*

### Answers

5606 [C]

5185-1 [A]

AIR, RTC, LTA

**5186.** The uncontrolled firing of the fuel/air charge in advance of normal spark ignition is known as

- A—instantaneous combustion.
- B—detonation.
- C—pre-ignition.

*When the cylinder head gets too hot, it can ignite the fuel/air mixture before the spark. This condition is called preignition. (PLT115, CA.I.G.K1e) — FAA-H-8083-25*

*Answers (A) and (B) are incorrect because detonation is an instantaneous combustion of the fuel/air mixture, which is caused by using too lean a mixture, using too low a grade of fuel, or operating with temperatures that are too high.*

AIR, RTC, LTA

**5190.** Detonation occurs in a reciprocating aircraft engine when

- A—there is an explosive increase of fuel caused by too rich a fuel/air mixture.
- B—the spark plugs receive an electrical jolt caused by a short in the wiring.
- C—the unburned fuel/air charge in the cylinders is subjected to instantaneous combustion.

*Detonation is a sudden explosion, or instantaneous combustion, of the fuel/air mixture in the cylinders, producing extreme heat and severe structural stresses on the engine. (PLT115, CA.I.G.K1c) — FAA-H-8083-25*

*Answer (A) is incorrect because detonation is caused by too lean a mixture. Answer (B) is incorrect because detonation does not have anything to do with the wiring.*

AIR, RTC, LTA

**5299.** Consider a reciprocating engine. Detonation can be caused by

- A—a “rich” mixture.
- B—low engine temperatures.
- C—using a lower grade fuel than recommended.

*Detonation is a sudden explosion or shock to a small area of the piston top, rather than the normal smooth burn in the combustion chamber. It can be caused by low grade fuel or a lean mixture. (PLT251, CA.I.G.K1c) — FAA-H-8083-25*

---

## Engine Temperatures

Most light aircraft engines are cooled externally by air. For internal cooling and lubrication, an engine depends on circulating oil. Engine lubricating oil not only prevents direct metal-to-metal contact of moving parts, it also absorbs and dissipates part of the engine heat produced by internal combustion. If the engine oil level is too low, an abnormally high engine oil temperature indication may result.

On the ground or in the air, excessively high engine temperatures can cause excessive oil consumption, loss of power, and possible permanent internal engine damage.

If the engine oil temperature and cylinder head temperature gauges have exceeded their normal operating range, or if the pilot suspects that the engine (with a fixed-pitch propeller) is detonating during climb-out, the pilot may have been operating with either too much power and the mixture set too lean, using fuel of too low a grade, or operating the engine with not enough oil in it. Reducing the rate of climb and increasing airspeed, enriching the fuel mixture, or retarding the throttle will help cool an overheating engine. Also, rapid throttle operation can induce detonation, which may detune the crankshaft.

The most important rule to remember in the event of a power failure after becoming airborne is to maintain safe airspeed.

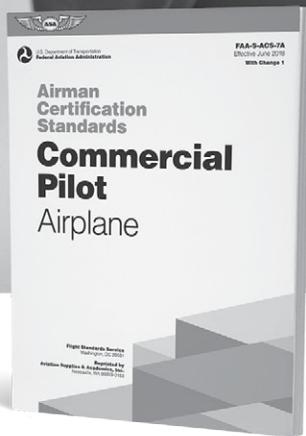
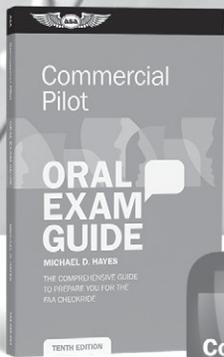
---

### Answers

5186 [C]

5190 [C]

5299 [C]



Also available as  **eBooks**

# You're practically there...

The *Commercial Pilot Oral Exam Guide*, Checkride App, and *Commercial Pilot Airplane Airman Certification Standards* will prepare you for the final exam by providing a review of what you must know, consider, and do to earn your Commercial Pilot certificate.

[asa2fly.com/Checkride](http://asa2fly.com/Checkride)



— Since 1940 —

# COMMERCIAL PILOT 2022 TEST PREP

## STUDY & PREPARE

Pass your test and know what is essential to become a safe, competent pilot—from the most trusted source in aviation training

Rely on the time-proven and dependable *ASA Commercial Pilot Test Prep* to prepare for your FAA Knowledge Exam. Test material is expertly organized into chapters based on subject matter and includes introductory text and illustrations, questions, answer choices, answers, explanations (for correct and incorrect answers), and references for further study. This topical study promotes understanding and aids recall to provide an efficient study guide. When you're done studying, take practice tests and receive your test authorization (endorsement) with ASA's online simulated testing program at no additional cost!

The ASA Test Prep includes the Airman Knowledge Testing Supplement—with the same FAA legends, figures, and full-color charts you'll be issued at the testing center—to help you become familiar with all available information before you take your official test. You can count on ASA to provide you with the latest changes in the FAA Knowledge Exams through a free email subscription service and updates. *ASA's Commercial Pilot Test Prep* is the pilot's best resource for successful test-taking.

Explore more ways to study:



**SOFTWARE | APP | EBOOK**  
available on demand from ASA at  
[asa2fly.com/testprep](https://asa2fly.com/testprep)



**Aviation Supplies & Academics, Inc.**  
7005 132nd Place SE, Newcastle, Washington 98059  
425-235-1500 | [asa2fly.com](https://asa2fly.com)

**ASA-TP-C-22**

Questions included for all Commercial Pilot and Military Competency FAA Knowledge Exams: airplane, rotorcraft, glider, and lighter-than-air

Questions supported with explanations for correct and incorrect answers, FAA references for further study, and airman test report codes for remedial study

Includes the official FAA Airman Knowledge Testing Supplement

Organized by subject with introductory text for efficient and logical study

Commercial Pilot certificate requirements

5 free online practice tests and test authorization

Test-taking tips

Quick cross-references for easy question-finding

Free online updates and free subscription service to stay informed of test changes

TRANSPORTATION USD \$24.95

ISBN 978-1-64425-155-3



9 781644 251553