COMMERCIAL PILOT — AIRPLANE

Course Study Guide

How to Use This Document

This guide contains a summary of the Commercial Pilot — Airplane Course flashcard questions, and should be used to evaluate your understanding. When you identify weak areas, mark them for further study. And remember if you get stuck you can always reach out to your course instructor!

Additionally, we have outlined the exact requirements in the Commercial ACS to eliminate any grey area on what exactly you are being evaluated on. The outline includes references to the appropriate source material for your reference.

We recommend the following study strategy:

1. Review your notes, flashcards, and any subject areas in which you already know you're not fully prepared.
2. When you feel like you have a good grasp of general concepts, go through the Course Study Guide (the one *without* the answer key). Write down your answers and mark questions when you don't know the answers.
3. Re-study the problem subject areas identified in step #2.
4. Once you again feel comfortable with all the subject areas, go through this document, (*with* the answer key) and verify you have the correct answers. Where you don't, go back through, study, and make sure you improve your understanding of the subject area(s).

We highly recommend thinking about the content on your own and discussing any questions with your instructor before consulting this guide for the "answers". Although it is not the most enjoyable process, thinking critically about the subject is the best way to encourage long term retention of this information, which is the real goal. Good learning is not always the most "efficient" learning.

This guide is for **informational purposes.** We've designed it to help pilots learn and apply concepts in the real world, and to improve their flight training experience. But it is not a substitute for time in an airplane with a flight instructor.

Revisions Log

- **Ver. 1. Published May 15, 2022**

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Pilot Qualifications

Commercial Pilot Privileges and Limitations

What operations are permitted for commercial pilots purely under part 91?

Acting as PIC of an aircraft for compensation or hire

Your friend asks if you'd be interested in taking several clients on a sightseeing tour from Central California through the Cascades to Sun Valley, OR. Is this legal?

No.

A former student approaches you and asks if you'd be interested in flying with him to pick up his new Piper Cherokee on a flight from Tulsa, OK to Jacksonville, FL. He says he will pay you a flat rate of $200 per day. Is this legal?

Yes.

After earning your commercial pilot certificate a friend offers you a job at her part 135 company as a pilot flying passengers in between islands in a Cessna Caravan, are you able to accept the job?

No, unless you meet the requirements of 14 CFR § 135.243

Recency of Experience

As a commercial pilot you have not made 3 takeoffs and landings to a full stop within the preceding 90 days. Is it legal to transport a passenger in their aircraft for higher during the period beginning from the end of evening civil twilight to the beginning of morning civil twilight?

No.

You fly for a part 135 certificated air carrier have not conducted 6 instrument approaches in the preceding 6 calendar months in simulated or actual instrument conditions. A friend without an instrument rating asks you to fly their 172 to the coast and shoot an approach through a fog layer. Are you legal to do this?

No. Being current for a certificated air carrier (121,135,etc.) does not mean you are current for general aviation. See 14 CFR § 61.57(e).

Medical Requirements

What minimum class of medical is required to exercise commercial pilot privileges?

2nd Class

Required Documents

As a commercial pilot your logbook **IS** required to be in your possession while exercising the privileges of the certificate. (True/False)

False

Airworthiness

Required Certificates

Required Inspections

If operating an aircraft for commercial purposes in Class G airspace under VFR flight rules, a transponder check is required. (True/False)

False

AD's and Service Bulletins

When are service bulletins mandatory?

When operating under Parts 121 or 135

Special Flight Permits

Passengers may be carried onboard while operating an aircraft under a special flight permit. (True/False)

False

Pilot Preventative Maintenance

Advanced Aerodynamics

High Altitude Aerodynamics

At what altitude is 50% of the atmosphere, by density, below your aircraft?

18,000ft

Types of Airspeed

Mach number is a representation of an aircraft's speed as what?

As a percentage of the speed of sound

What happens to the speed of sound as altitude increases? Why?

The speed of sound decreases because the ambient air temperature is decreasing

Indicated vs True Airspeed

Which airspeed will determine how the aircraft responds to abrupt control inputs at altitude?

Indicated airspeed

On average, how much does true airspeed increase per 1,000ft of altitude?

2%

Low Altitude Speed Limit

In high altitude flight, the laws of slow speed high angle of attack stalls still apply. (True/False)

True

High Altitude Speed Limit

In a manner of speaking, an aircraft can “stall” at high altitude due to being at too fast of a velocity. (True/False)

True

The maximum speed of an aircraft at high altitude is generally with relationship to which type of velocity?

Mach Number

With respect to the speed of sound, what value does a mach number represent?

A percentage

The maximum operating mach number of an aircraft is depicted using what notation?

M_{MO}

Aircraft that have a M_{MO} speed do not have a V_{NE} speed. (True/False)

False

Maximum Altitude - Speed

Two identical aircraft are climbing at the same weight, which factor would allow one aircraft to reach a higher altitude than the other?

The aircraft climbing at a lesser FPM would be able to reach a higher altitude

An aircraft is able to climb due to what what physical force?

Excess thrust

Which aircraft has a more stable energy state? An aircraft climbing at a lower or higher FPM assuming both aircraft have the same thrust to weight ratio of excess thrust?

The aircraft climbing at a lesser FPM

While climbing at a constant mach number, what instrument value can be seen decreasing?

Indicated airspeed

Maximum Altitude - Weight

How does weight impact the maximum altitude capability of an aircraft?

Simply put an aircraft is able to climb due to excess thrust. The lighter the weight of the aircraft the greater the thrust to weight ratio at altitude.

Since weight changes throughout a flight, a cruise altitude not attainable at GTOW might be attainable later in the flight. (True/False)

True

Coffin Corner

Coffin corner is the term for the difference between what values?

Overspeed cue and low speed cue

What causes the high speed and low speed cue to become closer together?

At high altitude, decreased air density decreases indicated airspeed dramatically while increasing the indicated stall speed, combined with a decrease in the speed of sound due to the decrease in ambient air temperature

What preventative aircraft feature generally helps increase overspeed/stall protection at altitude?

Half bank, which limits turns to 15º of bank as opposed to 30º

Special care should be taken while turning at altitude for what reason?

The increased load factor could bring the low speed cue up combined with increased lift generating faster airflow over the wings decreasing the high speed cue effectively sandwiching them together at your current speed

Transonic Flight & Mcrit

The speed at which the first molecule of airflow over the wing reaches the speed of sound marks the beginning of what flight regime?

Transonic

The transonic flight regime generally begins around what mach number/ percentage of the speed of sound?

.75M or 75% the speed of sound

Transonic Flight & Shockwaves

Name a factor that the normal shockwave increases on an airfoil

Drag

Shockwaves are created by the pressure differential of what types of airflow?

Supersonic airflow meeting subsonic airflow

Swept Wing Aerodynamics

Name a benefit of swept wings.

An increase in M_{MO}

How do swept wings accomplish this benefit?

Swept wings only accelerate the span wise flow, in other words the amount of air that is traveling perpendicular to the span of the airfoil. This results in a higher mach number required to accelerate the airflow to a supersonic speed (Mcrit) thus delaying the onset of shockwaves

What is a downside of swept wings?

Since swept wings only accelerate span wise flow, takeoff and landing roll is increased due to the greater velocity required to generate lift equal to the weight of the aircraft

High Lift Devices - Slots

How do slots increase lift?

Slots increase lift by providing an alternate path for airflow to travel over a higher cambered surface thus decreasing angle of attack and delaying boundary layer separation. The result is better low speed performance.

High Lift Devices - Slats

How do slats differ from slots?

Slats are generally hydraulically actuated and physically change the shape of the wing, since they are controlled by the pilot in flight they offer increased flexibility at low speeds, but also the ability to configure the airfoil for high speed flight.

Vortex Generators

How do vortex generators increase low speed performance?

VGs convert separated turbulent airflow into laminar, aerodynamically purposeful air by aligning it with the span of the wing thus reattaching the boundary layer.

Mach Tuck

What causes mach tuck?

Mach tuck is caused by the shift of the center of pressure aft on an airfoil and subsequent increase in the shockwave which then creates

aerodynamically dead (turbulent) airflow over the tail section decreasing tail downforce leading to an unrecoverable nose downward pitching moment.

Systems

Oxygen

Beginning at what flight altitude must flight crew begin the use of supplemental oxygen immediately?

14,001FT

If operating a pressurized aircraft, above what flight altitude must the pilot at the controls don and utilize an oxygen mask?

FL350

Turbine Engines

Generally speaking what are the two main types of compressors in turbine engines?

Axial flow and centrifugal flow

What are the 4 main types of gas turbine engines?

Turbojet, turbofan, turboprop, turboshaft

Bleed Air

What does the term “Bleed Air” refer to?

Bleed air is airflow extracted from the compressor section which is utilized to provided pneumatic pressure to various aircraft systems including pressurization and air conditioning. The airflow can be said to be “bleeding” from the engine since it is airflow not being utilized for thrust/propulsion

Pressurization

Pressurization is generally provided by which type of unit?

A PACK or pressurization air conditioning kit provides climate controlling air to the pressurized portion of an aircraft in concert with regulating cabin altitude.

Cabins pressurize by trapping ambient air pressure at the surface and recycling it throughout the flight. (True/False)

False

What component of the pressurization system regulates cabin pressure?

The outflow valve regulates cabin pressure by adjusting how much air is allowed to pass through and exit the cabin. This in turn with the RAM air being forced into the cabin from outside the aircraft fills the pressure vessel.

Advanced Hydraulics

Generally speaking what PSI do nearly all hydraulic systems operate at?

3,000PSI

Provide some examples of systems that are often operated hydraulically on large aircraft?

Flaps, thrust reversers, spoilers, primary flight controls, brakes

Advanced Flight Controls

Describe the purpose of flight spoilers

Flight spoilers are used to help the aircraft reduce speed and descend more efficiently

Describe the purpose of ground spoilers, or ground lift dumping devices.

Ground spoilers or GLDs deploy on touchdown and are inboard on the wing. Their purpose is to eliminate lift on the wing and force the aircraft weight onto the ground for increased braking effectiveness to decrease stopping distance

Human Factors

Watching Yourself

Human Factors - Passengers

Hypoxia

Hyperventilation

Ear & Sinus

Spatial Disorientation

Motion Sickness

CO Poisoning

Stress

Fatigue

Dehydration & Nutrition

Hypothermia

Optical Illusions

Scuba

Alcohol and Drugs

Hazardous Attitudes

Task Management

Managing Pressure

Flight Deck Management

Passenger Briefing

Checklist Use

Portable Electronic Devices (PEDs)

Automation

Commercial Operations

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RVSM and High Altitude Operations

SATR/SFRA

High Altitude Operations

Flight Level Breakdown

Use of Pressurization Systems

Survival

Survival Gear and Planning

Ditching Considerations

ACS References Table

Reference	Title
14 CFR part 39	Airworthiness Directives
14 CFR part 43	Maintenance, Preventative Maintenance, Rebuilding and Alteration
14 CFR part 61	Certification: Pilots, Flight Instructors, and Ground Instructors
14 CFR part 68	Requirements for Operating Certain Small Aircraft Without a Medical Certificate
14 CFR part 71	Designation of Class A, B, C, D, and E Airspace Areas; Air Traffic Service
14 CFR part 91	General Operating and Flight Rules
14 CFR part 93	Special Air Traffic Rules
14 CFR part 119	Certification: Air Carriers and Commercial Operators
AC 00-6	Aviation Weather
AC 00-45	Aviation Weather Services
AC 60-28	English Language Skill Standards Required by 14 CFR parts 61, 63, 65
AC 61-67	Stall and Spin Awareness Training
AC 68-1	Alternative Pilot Physical Examination and Education Requirements
AC 00-54	Pilot Windshear Guide
AC 61-107	Aircraft Operations at Altitude Above 25,000 Feet Mean Sea Level or Mach Numbers Greater Than .75/with Change 1
AC 91.21-1	Use of Portable Electronic Devices Aboard Aircraft
AC 91-73	Parts 91 and 135 Single Pilot, Flight School Procedures During Taxi Operations
AFM	Airplane Flight Manual
AIM	Aeronautical Information Manual
FAA-H-8083-1	Aircraft Weight and Balance Handbook

Reference	Title
FAA-H-8083-2	Risk Management Handbook
FAA-H-8083-3	Airplane Flying Handbook
FAA-H-8083-6	Advanced Avionics Handbook
FAA-H-8083-15	Instrument Flying Handbook
FAA-H-8083-23	Seaplane, Skiplane, and Float/Ski Equipped Helicopter Operations Handbook
FAA-H-8083-25	Pilot's Handbook of Aeronautical Knowledge
FAA-H-8083-66	Flying Light Twins Safely Pamphlet
POH/AFM	Pilot's Operating Handbook/FAA-Approved Airplane Flight Manual
Other	Chart Supplements
	Navigation Charts
	Navigation Equipment Manual
	USCG Navigation Rules, International-Inland
	NOTAMs