



Pilot Job Knowledge Test Outline

The job knowledge test administered as part of the pilot interview process consists of questions in four major knowledge areas essential to piloting a commercial aircraft: aerodynamics, aircraft systems engineering, air navigation and meteorology. The questions test a candidate's knowledge and understanding of principles and the application of these principles to commercial aircraft operation. Emphasis is on application and problem solving.

The following outline details the topics covered by the test, as they relate to the four major areas. It is suggested that you invest time studying these areas, up to a level required for an ATP exam, in order to do well on the test.

The outline is followed by a list of sample reference sources for preparing for the test. Comparable references may be substituted for those listed.

Aerodynamics

- Airplane nomenclature and terminology
- The atmosphere
 - Static pressure, density, temperature, humidity and viscosity and relationships to altitude
 - Standard atmosphere: Pressure, temperature and density
- Basic aerodynamic principles
 - Aerodynamic properties and relationships to airflow dynamics
 - Properties of airflow
 - Pitot-static effects
 - Ground speed and effect of wind
 - Mach number, critical Mach, speed of sound, and effects of change of temperature and altitude
- Aerodynamic forces
 - Airfoil nomenclature, properties of airflow about an airfoil, properties of aerodynamic forces
 - Center of gravity, flight path, relative wind
 - Relationship between lift, thrust, relative wind, drag and flight path

- Angle of attack, angle of incidence
- Generation of net lift force, influence of angle of attack
- Aerodynamic force, lift, drag, moment about aerodynamic center and factors affecting
- Effects of changing angle of attack or true airspeed on moment about aerodynamic center
- Forces in a turn, climb and descent
- Lift
 - Lift force—factors affecting
 - Minimum flying speed and stall—factors affecting
 - Ground effect
- Drag: types, causes and effects
- Thrust
 - Power curves
 - AOA
 - Factors affecting
- Stability and control
 - Trimmed flight
 - Relationship between controllability and stability
 - Function of airplane control surfaces
 - Proverse roll and adverse yaw
 - Dutch roll
 - Wake turbulence
 - Engine out aerodynamics
 - Dutch roll
- Flight at high angles of attack
 - Aircraft stall characteristics—factors affecting
 - Stall and stalling angle of attack
 - Fundamental principle of stall recovery
 - Stall speed and effect of gross weight, load factor and altitude
 - Purpose of high lift devices and effect of flap extension
- Operating strength limitations
 - Maneuvering load factor—effect of velocity and gross weight

- V-speeds
- Safe flight envelope
- Takeoff and landing
 - Factors affecting minimum takeoff and landing distances
 - Effect of gross weight, pressure, altitude, temperature, humidity, wind and ground effect of takeoff and landing performance
 - Friction and aerodynamic braking effectiveness—factors affecting
 - Hydroplaning
- Airplane performance
 - Effect of weight, altitude, wind and angle of attack on airplane performance
 - Maximum endurance, range, angle of climb, rate of climb, glide range, glide endurance

Engineering

- Physical principles of gas turbine engines
- Principles of gas turbine operation
 - Basic principles
 - Effect of pressure, temperature, altitude and humidity on thrust in a gas turbine engine
 - Effect of airspeed and ram effect on thrust in a gas turbine engine
 - Engine instrumentation
 - Function of gas turbine compressor
 - Function of turbine section
- Compressor stalls
 - Characteristics and causes of compressor stalls: airflow distortions, mechanical problems
 - Methods to avoid, reduce or resolve compressor stalls
- Hydraulic systems
 - Basic hydraulic theory
 - Basic operation of aircraft hydraulic systems
 - Function of basic hydraulic components used on aircraft
- Electrical systems

- Basic operation of an aircraft electrical system
- Methods of producing electricity in aircraft
- Function of aircraft electrical components
- Aircraft electrical distribution system
- Fuel systems
 - Basic operation of an aircraft fuel system
 - Function of basic fuel system components used on aircraft
 - Fuel flow through basic aircraft fuel system
- Lubrication systems
 - Basic operation of an aircraft lubrication system
 - Function of basic lubrication system components used on aircraft
- Accessory, starter and ignition systems
 - Basic operation of an aircraft accessory, starter and ignition system
 - Types of accessories used on aircraft and how they are driven
 - Starting sequence for a gas turbine engine
 - Types of abnormal starts
- Flap system
 - Types of large aircraft flaps
 - Effects and methods of actuating flaps
- Landing gear system—brakes, tires
- Air conditioning and pressurization systems
 - Basic operations
 - Abnormal situations
- Anti-ice/de-ice systems

Air Navigation

- Introductory air navigation: basic concepts, principles and terminology
- Chart projections and plotting
 - Great circle and relationship to aircraft navigation
 - Heading, course, track, bearing and relationships among them
- Altitudes and airspeeds
 - Relationship among pressure, altitude and airspeed

- Indicated airspeed, calibrated airspeed, true airspeed, ground speed and Mach number
- Winds in flight
 - Evaluating the effect of wind on the path of an aircraft over the ground
 - Windshear—its recognition, considerations and actions
- Rate of descent—considerations and computations
- GMT and conversion to local time
- Electronic navigation
 - Methods used for electronic navigation
 - Electronic navigation aids and instruments
 - Aircraft position and course to navigational aid given magnetic bearing
 - VOR/DME
- Charts and chart symbology
 - Airport charts
 - En route charts
 - Approach charts
 - Navigational aids and distance scales
- Approaches
 - ILS approaches
 - Non-precision approaches
 - Visual approaches
 - Final approach segments
 - Approach minima
 - Landing/missed approach/rejected landing
- Holding
 - Speed and entry rules
 - Endurance speeds and computations
- Ground navigation
 - Runway and taxiway lighting and markings
 - ATC clearances and clearance limits

Meteorology

- Structure of the atmosphere
- Atmospheric pressure and temperature
- Winds and circulations
- Clouds and moisture; fog and low clouds
- Atmospheric stability and turbulence
- Air masses and frontal systems
- Thunderstorms and windshear
- Icing
- Weather depiction charts and radar summary charts—weather maps, winds aloft, prognostic charts, constant pressure charts
- Aviation weather reports
 - Terminal forecasts, area forecasting (ATIS, METAR, etc.)
 - Flight weather advisories, pilot reports
- SIGMETS and AIRMETS
- Weather radar

Sample Reference Sources

FAA Publications:

- Federal Aviation Regulations/Aeronautical Information Manual (FAR/AIM)
- FAA Handbook Series: Instrument Flying Handbook
- Aviation Weather

Textbooks, Reference Materials from Civilian or Military Pilot Training Programs, for example:

- Aerodynamics for Naval Aviators
- Air Force Introduction to Aerodynamics/Takeoff and Landing Performance
- Air Force Weather for Aircrews
- Air Force Academics for Instruments
- Air Force Applied Aerodynamics/Endurance

General Technical References:

- Encyclopedia of Technical Aviation, Gary Bristow
- Private Pilot Workbook, Jeppesen & Co.
- International Encyclopedia of Aviation, David Mondey
- An Invitation to Fly: Basics for the Private Pilot, Dennis Glaeser, Sanford Gum, Bruce Walters

Topic Specific References:

- Aircraft Gas Turbine Technology, Irwin Treager
- The Aircraft Gas Turbine Engine and its Operation, Pratt & Whitney
- Elements of Gas Turbine Propulsion, Jack Mattingly
- Turbine Aircraft Flight Manual/Operating Handbook; or more general: The Turbine Pilot's Flight Manual, Gregory Brown and Mark Holt
- The Aviator's Guide to Navigation, Donald Clausing
- Understanding Mathematics for Aircraft Navigation, James Wolper
- Aviation Meteorology Unscrambled, Kenneth McCool
- Encyclopedia of Weather and Climate, Michael Allaby and Richard Garatt