Private Pilot Airplane Aeronautical Knowledge Review

by Frank Phillips, Jr.

"It's a beautiful day! Let's go fly!"

How many times have you heard or said these words? Before you go, here's a refresher list of things you should remember from your student pilot days. It's also a good reminder of the many facts needed to pass the private pilot-airplane practical test.

Remember, for any flight, determine runway lengths, weather, fuel, and alternate courses of action.

WEATHER

BRIEFING Call 1-800-WXBRIEF, give aircraft number, route, etc. Request NOTAM's.

TERMS

Airmet: Issued for moderate icing and turbulence, winds 30+ knots, visibility less than 3 miles, ceilings below 1,000'

Sigmet: Issued for all aircraft for severe/extreme turbulence, icing, obstructions to visibility

Convective Sigmet: Issued for tornadoes, lines of thunderstorms; embedded thunderstorms; hail 3/4"+

Ceilings: Height AGL of lowest reported layer of clouds (broken, obscuration, or overcast)

Cumulonimbus: Clouds with the greatest turbulence—avoid by 20 NM.

Dewpoint: Temperature at which visible moisture forms

Fog:

Advection or upslope fog depends on wind to form.

Radiation fog forms when warm, moist air flows over low, flat land on clear, calm nights.

Front: Boundary between two air masses, indicated by a wind shift.

Warm Front: Temperature inversions (goes up with altitude); poor visibility; smooth/stable air; stratiform clouds; drizzle; fog (from evaporation)

Cold Front: Temperature goes down with altitude; good visibility; turbulence/unstable air; cumuliform clouds

Structural Icing: forms in freezing rain

Thunderstorms: lifting, moist, unstable air and lightning (always); develop/cumulous stage = updrafts; mature stage = rain; dissipating = downdrafts

Squall Line Thunderstorms: narrow band of thunderstorms, most intense hazard to aircraft

Winds: aloft reported true, in knots; on ground reported as magnetic

PILOT

I'M SAFE?

Illness?
Medication?
Stress?
Alcohol?
Fatigue?
Eating?

Alcohol: Do not fly within 8 hours of consumption; while under the influence; with more than 0.04% BAC

To act as PIC: Need pilot, medical certificates, and a flight review within 24 calendar months (WINGS Program can substitute for flight review)

To carry passengers: Preceding 90 days 3 takeoffs and 3 landings in class; and for night (1 hour after/before sunset/sunrise) or tail wheel airplane must be to full stop

AIRPLANE AND FLIGHT

A R O W

Airworthiness certificate
Registration certificate
Operating limitations
Weight and Balance

Airplane inspections Airplane must have annual inspection, plus 100 hour if used for hire, and AD compliance

Airplane airworthiness Owner/operator maintains, but **PIC** (operator) is responsible to determine

Angle of attack (AOA) Angle between relative wind and chord. Increase AOA, increase lift & drag. [NOTE: Increasing weight or wing loading will require additional lift]

Stalls Can occur at given angle of attack, at any airspeed, any attitude
Stall speed increases with weight (higher angle of attack for more lift)
Turns increase stall speed (higher load factor or effective weight in turn)

Spins Airplane must be stalled to spin (a spin is an aggravated stall)

Fuel (required for VFR) To intended destination with 30 minutes reserve (45 at night) at normal cruise

Emergencies Pilot may deviate from any rule to meet an emergency

PERFORMANCE

Basic empty weight Unusable fuel plus optional equipment, found in airplane documents

Center of Gravity ***AFT*** **-** worse stability, lower stall speed, better performance
FORE **-** better stability, higher stall speed, worse performance

Density altitude (DA) Determines performance; goes up with hot temperatures and low air pressure

Pressure altitude Set altimeter to 29.92" or calculate (one inch equals approximately 1,000')

OPERATION

Aircraft position lights Right – **green;** left – **red;** tail – **white;** turn lights on sunset to sunrise

Seatbelts Brief occupants *on use* and notify *to fasten* before takeoff or landing

Crosswind taxi *From front*: aileron up into wind
From rear: aileron and elevator down

Airspeed Indicator *White arc* shows flap range
Green arc shows normal range
Yellow arc shows caution
Red line shows never exceed speed

Magnetic compass Lag North of E/W; lead South of E/W
On E/W heading, **A**ccelerate **N**orth; **D**ecelerate **S**outh (ANDS)

Ground effect Airplane may become airborne before normal take off speed

P-factor High pitch and power causes left yaw (rotation at takeoff gives noticeable P-factor)

V_x Speed for *best angle of climb* - achieves the *most altitude gain* over *distance*

V_y Speed for *best rate of climb* - achieves the *most altitude gain* over *time*

High engine speeds/ high pitch attitudes Will cause *high engine temperatures*

Float Type Carburetor Prone to *induction icing* in high humidity at 20°-70°F.

Carburetor heat Enriches mixture.

Power loss Fly the airplane, then establish best glide speed, look for field to land, use emergency checklists

Severe turbulence Maintain level flight attitude and use **V_a** (*maneuvering speed*) or lower

V_a Not shown on airspeed indicator; varies with-weight: weight goes down, V_a goes down

ENVIRONMENT

Airspace *Class A*: (18,000' MSL and above) set altimeter to 29.92", and requires IFR flight plan
Class B: (blue line) *clearance required to enter*, need Mode C within 30NM
Class C: (magenta line) 2-way communication and Mode C required
Class D: (dashed blue line) has operating control tower, 2-way communication required
Class E: starts 1,200' AGL, but within magenta tint line starts at 700' AGL and within dashed magenta line (surface area Class E) starts at surface
Class G: is not depicted on charts (uncontrolled airspace)

Operating control tower In Class ***E*** or ***G*** (blue) 4 NM, 2500' AGL; must communicate

MOA Use caution.

Restricted Area Contact controlling agency.

Prohibited Area NO, NO!

Gray line Military training routes with aircraft at 250+ knots; 4 digits, at and below 1,500' AGL; 3 digits, 0' and up; VR=VFR; IR = IFR

Federal Airway 4 NM either side of blue (Victor airway) line, from 1,200'AGL to FL180

Traffic pattern indicators Depicts direction of turns in traffic pattern

VASI "All red, you're dead; red over white, you're all right."

Airport lights Taxiways are outlined with blue lights. Runways are outlined with white lights.

Transponder **7700** = emergency
7600 = no radio

	7**500** = hijack **1200** = VFR
Mode C	Over 10,000' MSL; A,B, & C airspace; above C; and in mode C veil (30 NM of B)
Oxygen	Crew 12,500' to 14,000' over 30 min; crew all time above 14,000'; all occupants over 15,000'
ELT	Test during first 5 minutes after hour and replace battery after one hour cumulative use or 50% of shelf life
Emergency	Broadcast on *121.5 MHz* or *243 MHz,* FSS EFAS on *122.0 MHz*.
Right of Way (ROW)	*Aircraft in distress* over all other aircraft *Balloons* over other aircraft *Gliders* over airplanes, rotorcraft, and airships *Aircraft towing or refueling* over other powered aircraft. When head-on, go right. Overtake to right. Landing aircraft has ROW. Lower aircraft on final has ROW.
No aerobatics	Over *congested area* or *open air assembly* of persons; on Federal Airways, *below 1,500'* AGL; with *less than 3 miles visibility*.
Emergency priority	If requested by ATC manager, submit *detailed report* within *48 hours*.
Light signals	On *GROUND*: **Green** – takeoff **Flashing Green** – taxi **Red** – stop **Flashing Red** - clear runway **Flashing White** - return to starting point; In *FLIGHT*: **Flashing green** - return for landing **Red** - give way/circle **Green** – land **Flashing Red** - airport unsafe **Red/Green** - use caution.
Minimum safe altitudes	*Anywhere:* If power unit fails, emergency landing without undue hazard. *Sparsely populated areas:* 500' AGL. No hazard to and 500' from persons/property. *Congested areas:* 1,000' above highest obstacle within 2,000' radius.
Altimeter setting	Use barometric pressure; if none, use field elevation. Over 18,000' set to 29.92".
VFR cruising altitudes	Above 3,000' AGL Magnetic course 0° - 179° odd 1,000's plus 500' Magnetic course 180° - 359° even 1,000's plus 500'

MEDICAL

Carbon monoxide	Exhaust fumes. Headaches, drowsiness, dizziness. Open air vents.
Hyperventilation	Caused by rapid breathing (often from stress). Hold breath or breath into bag.
Hypoxia	Oxygen deficiency. Go lower or use O_2. Smoking and night increase effect.
Scanning	Scan in segments of 10° for at least one second to allow eye to focus.
Spatial disorientation	Temporary confusion; rely on instrument indications, not body signals.
Vision at night	Scan slowly to permit off center viewing.

WAKE TURBULENCE

Vortices	Be alert for the trailing wing tip vortices of large aircraft. *Landing behind*: Stay at or above its flight path and land beyond its touch down point. When it is taking off, land before its rotation point**.** *Departing behind:* Rotate before its rotation point and stay above its flight path until turning clear of its wake. *Low approaches:* When large aircraft is making low approaches or touch and goes, *wait at least two minutes.* *Wind drift:* Make adjustment for. Vortices will drift with wind. Vortices settle and move laterally near the ground. *Wait at least two minutes.* *When in doubt***,** *wait at least two minutes* before taking off or landing. *While en route:* Avoid flight below and behind its flight path.

ACCIDENTS/ INCIDENTS

NTSB	Report immediately in-flight fire, overdue aircraft, flight control system malfunction or failure, incapacity of a crewmember to perform duty due to injury or sickness, damage to property (other than aircraft) exceeding $25,000 (estimated). *Accidents:* Report within 10 days. *Incidents*: Report on request.

VFR MINIMUMS IN AIRSPACE CLASSES

Class	A	B	C and D E (under 10,000' MSL) G (at night)	E (over 10,000' MSL) G (over 10,000' MSL and under 2,500' AGL)	G (day time under 1,200' AGL)	G (day time over 1,200' under 10,000'
Visibility	**No***	3 statute miles	3 statute miles	5 statute miles	1 statute mile	1 statute mile
Clouds	**No***	Clear of clouds	1,000' above 2,000' from 500' below	1,000' above 1 statute mile from 1,000' below	Clear of clouds	1,000' above 2,000' from 500' below

** No VFR in Class A Airspace unless authorized by Air Traffic Control facility with jurisdiction.*

Have a safe flight! Don't forget to fill tanks at night to prevent water from forming.

Frank Phillips, Jr., is an FAA Aviation Safety Inspector in the Operations and Safety Program Support Branch, General Aviation and Commercial Division, Flight Standards Service.