PRIVATE PILOT · AIRPLANE · ACS FAA-S-ACS-6C

# The Oral Exam *study guide.*

The rules, numbers and mnemonics examiners ask about most — on 15 pages of infographics. ACS-aligned, cited to the regs, and fact-checked against current 14 CFR, the AIM and FAA handbooks (November 2026).

13 oral topics · 200+ must-know facts · real FAA chart excerpts · 40 rapid-fire questions · 2024–25 rule changes included


| | | |
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THE #1 CHECKRIDE TIP

## Don't just read it. *Say it out loud.*

The oral is a spoken, back-and-forth conversation — the examiner asks, you answer, they dig deeper. Practice it the same way: **out loud, back and forth**, until the answers come out smooth.

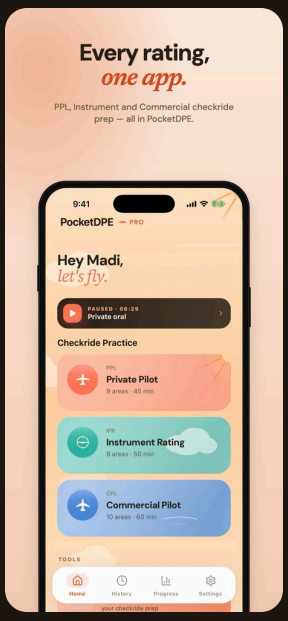
1. **Read it.** One section a day — infographics first.
2. **Quiz yourself.** Cover the "DPE asks" answers and the Rapid-Fire 40.
3. **Say it out loud.** Run a full mock oral on PocketDPE.


**Meet your examiners.** *Every rating, one app.*

**PocketDPE** is a voice AI examiner for your private, instrument & commercial orals — kind, fair, or brutal. It asks out loud, listens, follows up when you're vague, and debriefs every area. **Search "PocketDPE" on the App Store.**








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A study aid — not FAA-approved. Always verify with current 14 CFR, the AIM, your POH/AFM and your CFI.

EVERY NUMBER ON THE ORAL, ON ONE PAGE

# # The Numbers

*If you memorize one page, make it this one.*

## PILOT

| | |
|---|---|
| **17** YEARS | Minimum age — private pilot, airplane §61.103 |
| **40** HOURS | Minimum total time: ≥ 20 dual + ≥ 10 solo §61.109 |
| **3** HOURS | Checkride-prep training within 2 calendar months of the test §61.109 |
| **24** CAL MO | Knowledge test result is good for §61.39 |
| **24** CAL MO | Flight review: ≥ 1 hr ground + ≥ 1 hr flight §61.56 |
| **90** DAYS | 3 takeoffs & landings to carry passengers §61.57(a) |
| **1 hr** AFTER SUNSET | to 1 hr before sunrise: 3 full-stop landings for night passengers §61.57(b) |
| **60/24** CAL MO | Medical for private privileges: under 40 / 40 and over §61.23 |
| **48/24** CAL MO | BasicMed: doctor exam / online course §61.23(c) |
| **30** DAYS | Tell the FAA your new mailing address §61.60 |
| **60** DAYS | Report a DUI/DWI motor-vehicle action §61.15 |
| **8 hr** · 0.04 | Bottle to throttle · BAC must be below §91.17 |
| **200** HP | High-performance = more than §61.31 |

## AIRPLANE

| | |
|---|---|
| **12** CAL MO | Annual inspection §91.409 |
| **100** HOURS | 100-hour — only if for hire (10-hr overfly allowed) §91.409 |
| **24** CAL MO | Transponder test §91.413 |
| **12** CAL MO | ELT inspection · battery after 1 cumulative hr or 50% life §91.207 |
| **24** CAL MO | Altimeter / static check — IFR §91.411 |
| **30** DAYS | VOR check — IFR §91.171 |
| **7** YEARS | Aircraft registration §47.40 |

## OPERATIONS

| | |
|---|---|
| **30/45** MIN | VFR fuel reserve: day / night §91.151 |
| **250** KIAS | Max below 10,000 MSL §91.117 |
| **200** KIAS | At/below 2,500 AGL within 4 NM of a C/D airport · under a Class B shelf §91.117 |
| **12,500** FT MSL | Crew $O_2$ after 30 min above (up to 14,000) §91.211 |
| **14,000** FT MSL | Crew $O_2$ the whole time above §91.211 |
| **15,000** FT MSL | $O_2$ provided for every occupant above §91.211 |
| **1,000** FT | Over congested areas: above the highest obstacle within 2,000 ft §91.119 |
| **500** FT | Other areas: above the surface (sparse/water: from people, vessels, vehicles, structures) §91.119 |
| **3,000** FT AGL | Above this: odd + 500 eastbound, even + 500 westbound (magnetic course) §91.159 |
| **3–152** C · D · E | Below 10,000 MSL: 3 SM · 1,000 above · 500 below · 2,000 horizontal §91.155 |
| **5–111** ≥10,000 MSL | 5 SM · 1,000 above · 1,000 below · 1 SM horizontal §91.155 |
| **1,000/3** FT / SM | Ceiling & ground visibility for VFR in a surface area §91.155 |
| **1** SM | Special VFR: ATC clearance, clear of clouds (sunset–sunrise: IFR pilot & plane) §91.157 |
| **100** NM | Altimeter setting from a station within §91.121 |
| **30** NM | Mode C veil around a Class B airport §91.215 |
| **4** NM | Towered field in Class E/G: call before (≤ 2,500 AGL). Class D: before entering §91.126–.129 |
| **7700** SQUAWK | Emergency · 7600 lost comms · 7500 hijack AIM 6 |
| **121.5** MHZ | Emergency (guard) frequency AIM 6-3 |
| **30** MIN | After ETA, search & rescue starts if your VFR plan is still open AIM 5-1 |
| **10** DAYS | NTSB report after an accident · NASA ASRS window §830.15 · AC 00-46 |
| **60°/30°** BANK / PITCH | Beyond this with non-crew aboard: everyone wears a parachute §91.307 |

## WEATHER · PERFORMANCE · YOU

| | |
|---|---|
| **15 °C** 29.92 | Standard atmosphere at sea level (1013.2 hPa) PHAK |
| **2 °C** /1,000 FT | Standard temperature lapse rate PHAK |
| **÷ 2.5** °C | Cloud base ≈ (temp − dew point) ÷ 2.5 × 1,000 ft PHAK |
| **20** NM | Stay this far from severe thunderstorms AIM 7-1 |
| **2 G** 60° BANK | Stall speed +41% (45°: 1.41 G, +19%) PHAK |
| **3.8** G | Normal-category limit (+3.8 / −1.52) PHAK |
| **6** LB/GAL | Avgas (oil: 7.5 lb/gal) W&B |
| **3°** PER SEC | Standard-rate turn — 360° in 2 min PHAK |
| **30** MIN | Full dark adaptation AIM 8-1 |
| **12/24** HOURS | Scuba: wait before flying (≤ 8,000 ft / above or decompression dive) AIM 8-1 |

# 01 Pilot Qualifications

*Am I legal to fly?*



## AERONAUTICAL EXPERIENCE — 40 HOURS MINIMUM

§61.109(a)

| 20 HRS FLIGHT TRAINING WITH A CFI | | | | | 10 HRS SOLO | | 10 HRS — DUAL OR SOLO |
|---|---|---|---|---|---|---|---|
| 3 XC | 3 NIGHT | 3 INSTR | 3 PREP | 8 more training<br>maneuvers, landings, solo prep… | 5 SOLO XC<br>cross-country | 5 more solo<br>incl. towered T/Os | 10 hrs either way<br>gets you to the 40-hour total |

**Night:** one XC over 100 NM total + 10 takeoffs & 10 full-stop landings

**Prep:** within the 2 calendar months before the test

**Long solo XC:** 150 NM total, full-stop landings at 3 points, one leg more than 50 NM straight-line

**Tower:** 3 takeoffs + 3 full-stop landings at an airport with an operating tower

## ELIGIBILITY

§61.103

- ✓ **17** years old
- ✓ Read, speak, write & understand **English**
- ✓ Hold a **student**, sport, or recreational certificate
- ✓ Knowledge test: endorsement + pass (good 24 cal mo)
- ✓ The 61.109 experience above
- ✓ Practical test: endorsement + pass

## CARRY THESE WHEN YOU FLY

§61.3

| Pilot certificate | Photo ID<br>gov't-issued | Medical<br>or U.S. driver's license (BasicMed) |
|---|---|---|

Show them on request to the **FAA, NTSB, TSA**, or any **law-enforcement** officer. §61.3(l)

## MEDICAL CERTIFICATE

§61.23(d)

| FOR PRIVATE PRIVILEGES | UNDER 40 | 40 + |
|---|---|---|
| **Any class (1st, 2nd, 3rd)** | **60 cal mo** | **24 cal mo** |

Age is your age **on the exam date**. 1st-class privileges last 12 mo (<40) or 6 mo (40+); 2nd-class 12 mo — after that the same certificate still covers lower-class (private) privileges.

## CURRENCY — TO ACT AS PIC & CARRY PASSENGERS

**24**
CALENDAR MONTHS

**Flight review**: ≥1 hr ground + ≥1 hr flight with a CFI. A passed checkride or a WINGS phase also counts.

§61.56

**90**
DAYS

**3 takeoffs & 3 landings** as sole manipulator, same category & class (and type, if required). Tailwheel = full stop, in a tailwheel.

§61.57(a)

**90**
DAYS · NIGHT

**3 takeoffs & 3 full-stop landings** as sole manipulator, between **1 hr after sunset and 1 hr before sunrise**.

§61.57(b)

## BASICMED

§61.113(i) · Part 68

**Need:** an FAA medical held any time after **July 14, 2006** (latest one not denied, suspended or revoked) · U.S. driver's license · exam by a state-licensed doctor (CMEC) every **48 cal mo** · online course every **24 cal mo** · keep both in your logbook.

≤ 6 passengers · ≤ 7 seats · ≤ 12,500 lb · ≤ 18,000 MSL · ≤ 250 KIAS · not for hire · U.S. only*

*unless the foreign country allows it. "7 seats" = aircraft certificated for ≤ 7 occupants.

## PRIVILEGES & LIMITATIONS

§61.113

✗ No PIC **for compensation or hire**, and no carrying passengers or property for hire.

✓ **Share costs** — but pay at least your **pro rata share**, and only of fuel, oil, airport fees, or rental. §61.113(c)

**EXCEPTIONS**

- Flight only incidental to your business — no passengers or cargo for hire
- Charity / community-event flights §91.146
- Search & location cost reimbursement
- Aircraft salesperson with ≥ 200 hrs, demo flights
- Towing a glider or unpowered ultralight §61.69

## ENDORSEMENTS

§61.31

| | |
|---|---|
| **Complex** | Retractable gear + flaps + controllable-pitch prop |
| **High-perf.** | Engine of **more than 200 hp** |
| **Tailwheel** | Conventional landing gear |
| **High-alt.** | Pressurized, ceiling above **25,000 MSL** |
| **Type rating** | Over **12,500 lb**, turbojet, powered-lift, or as the FAA specifies |

Complex, HP, high-alt & tailwheel = one-time CFI endorsements, no minimum hours (tailwheel: flight training only; others: ground + flight). A type rating takes a checkride.

**Category / class / type** — you: *Airplane · Single-Engine Land*. Your aircraft: category *Normal / Utility / Acrobatic…*, make & model = type.

## DPE ASKS

**"Your friend offers to pay for all the fuel on a trip you're both taking. Legal?"**

**No.** You must pay at least your pro rata share — split it, or pay more. §61.113(c)

## ⚠ TRAP

**Calendar months** end on the last day of the month: a flight review on **Mar 3, 2025** is good through **Mar 31, 2027**. **90 days** are exact days.

## SAY IT LIKE THIS

*"I'm legal: private certificate, medical, photo ID, and a flight review within 24 calendar months. To carry passengers: 3 takeoffs and landings in the last 90 days — full-stop, between 1 hour after sunset and 1 hour before sunrise, for night."*

## FEELING SICK?

§61.53

Your medical isn't a free pass: don't act as PIC while you know of a condition — or take a medication — that would make you fail your medical.

## MOVED?

§61.60

Tell the FAA your new permanent mailing address within **30 days** — or you can't use your certificate.

## DUI / DWI?

§61.15(e)

Report any alcohol- or drug-related motor-vehicle action to FAA Security within **60 days**.

## LOGBOOK

§61.51(a)

Required only for training & experience used for a certificate or rating, and for currency — not every flight.

## ⚠ TRAP

**Current ≠ proficient.** Currency is only the legal minimum — recent practice and your own personal minimums are what make the flight safe.

# 02 Airworthiness

*Is the airplane legal?*



## DOCUMENTS ON BOARD — ARROW

§91.203 · §91.9

| | | | | |
|---|---|---|---|---|
| **A** Airworthiness certificate — displayed, legible to passengers/crew | **R** Registration — valid 7 years · print it if it came by email | **R** Radio station license — international flights only (FCC) | **O** Operating limitations — AFM/POH, placards, markings | **W** Weight & balance — current, for this airplane |

**⚠ TRAP**

**Maintenance logbooks** don't have to be in the airplane — the owner keeps them. *Bring them to your checkride anyway.* §91.417

**Owner/operator** maintains airworthiness (incl. ADs) §91.403 · **PIC** decides it's safe to fly §91.7

## INSPECTIONS — AV1ATES

| | INSPECTION | INTERVAL | WHO / WHEN | |
|---|---|---|---|---|
| A | **Annual** | 12 cal mo | Every airplane · by an A&P with Inspection Authorization (IA) or a rated repair station | §91.409(a) |
| V | **VOR check** | 30 days | **IFR only** | §91.171 |
| 1 | **100-hour** | 100 hrs | Only if carrying passengers **for hire** or giving flight instruction **for hire** in an airplane the CFI provides. Up to 10 hrs over to reach a shop — counts toward the next 100. | §91.409(b) |
| A | **Altimeter / encoder** | 24 cal mo | **IFR** in controlled airspace | §91.411 |
| T | **Transponder** | 24 cal mo | Any time you use the transponder | §91.413 |
| E | **ELT** | 12 cal mo | Battery: replace (or recharge) after **more than 1 cumulative hr** of use or at **50%** of its useful life | §91.207 |
| S | **Static system** | 24 cal mo | With the altimeter check · **IFR** | §91.411 |
| + | **ADs** | per AD | One-time or recurring — **mandatory** (SAIBs are only advisory). AD status is an owner record. | Part 39 |

## NEED-TO-KNOW

- An **annual** counts as a 100-hour — a 100-hour never counts as an annual.
- **Calendar months**: an annual done Mar 3 is good through the end of next March.
- **VFR** checkride? The VOR and altimeter/static checks aren't required.
- A **standard** (white) airworthiness certificate stays valid while maintenance follows Parts 43 & 91 and the airplane stays U.S.-registered. **Special** (pink) = experimental, light-sport, restricted, limited, primary, provisional, flight permits.

## SPECIAL FLIGHT PERMIT

§21.197

Ferry permit from the FAA for an airplane that isn't airworthy but can fly safely: to a shop for repairs or storage · delivery or export · production flight tests · evacuating from danger · customer demo flights.

## DAY VFR EQUIPMENT — A TOMATO FLAMES

§91.205(b)

| | | |
|---|---|---|
| **A** Airspeed indicator | **T** Tachometer — each engine | **O** Oil pressure gauge — each pressure-lubed engine |
| **M** Manifold pressure — each altitude engine | **A** Altimeter | **T** Temperature gauge — each liquid-cooled engine |
| **O** Oil temperature — each air-cooled engine | **F** Fuel gauge — each tank | **L** Landing gear position — retractable gear |
| **A** Anticollision lights — certificated after 3/11/1996 | **M** Magnetic compass | **E** ELT — if required (§91.207) |
| **S** Safety belts — each occupant 2+ · shoulder harnesses: front seats after 7/18/1978, all seats after 12/12/1986 | | |

+ flotation gear & a pyrotechnic signal device if operated for hire over water beyond power-off gliding distance from shore.

## NIGHT VFR — ADD FLAPS

§91.205(c)

- **F** Fuses — one spare set (or 3 of each kind), reachable in flight
- **L** Landing light — if operated for hire
- **A** Anticollision lights — aviation red or white
- **P** Position lights — red left · green right · white tail
- **S** Source of power — adequate for all installed equipment

## INOPERATIVE EQUIPMENT — NO MEL

§91.213(d)

**Something's inoperative and there's no MEL. Is it required by…**

1. the **VFR-day type certification** requirements?
2. the aircraft's **equipment list** or **Kinds of Operations Equipment List (KOEL)**?
3. **§91.205** or another rule for this flight (ELT, transponder…)?
4. an **Airworthiness Directive**?

**YES →** **NO-GO.** Fix it — or get a **special flight permit** to ferry it.

**NO →** **GO, after you:** **1) Remove** it (placard the control, log it) *or* **deactivate** it and placard "**INOPERATIVE**", and **2)** a pilot or mechanic decides it's **not a hazard**.

**Airplane has an approved MEL?** Then the MEL + its FAA letter of authorization must be on board, and you follow the MEL instead. §91.213(a)

## PREVENTIVE MAINTENANCE

§43.3(g)

An owner/operator holding a pilot certificate may do simple items — e.g., **tires**, **light bulbs & lenses**, **spark plugs**, **battery service**, **filters/strainers**, **safety wire**, **seat belts**, **lubrication**.
Log it: what, date, name, certificate # & kind, signature. §43.9

## TEST FLIGHT REQUIRED

§91.407(b)

After maintenance that may have changed how it flies: a private-or-higher pilot flies it, **no passengers**, and logs it.

**DPE ASKS**

**"Your nav light is burned out. Can you fly tonight?"**

**No** — position lights are required at night. By day, run the §91.213(d) checklist and placard it.

**SAY IT LIKE THIS**

*"It's airworthy: ARROW is on board, the annual was signed off by an IA in March, the transponder and ELT are current, ADs are complied with, nothing's inoperative — and I'll confirm its condition on preflight."*

# 03 Weather: Reports & Forecasts

*Read it like a pilot.*

## METAR — DECODE IT LEFT TO RIGHT

FAA-H-8083-28

`METAR KJFK 111751Z 31015G25KT 5SM -RA BR BKN012 OVC030 12/09 A2992 RMK AO2`

1 2 3 4 5 6 7 8 9 10

**1 · Routine report**
SPECI = special, unscheduled

**2 · Station**
ICAO identifier

**3 · Day + time**
11th day · 17:51 UTC

**4 · Wind**
310° **true** · 15 kt · gusts 25

**5 · Visibility**
5 statute miles

**6 · Weather**
light rain · mist

**7 · Sky**
broken 1,200 ft AGL (**ceiling**) · overcast 3,000

**8 · Temp / dew point**
12 °C / 9 °C (M = minus)

**9 · Altimeter**
29.92 inHg

**10 · Remarks**
automated, with precip discriminator

## TAF — THE AIRPORT FORECAST

```
TAF KJFK 121730Z 1218/1324 31012G22KT P6SM SCT035 BKN250
  TEMPO 1220/1223 4SM -SHRA BKN030 BKN250
  FM130000 33008KT P6SM FEW250
  PROB30 1306/1310 2SM -RA BR OVC008
```

| | |
|---|---|
| **121730Z** | issued on the 12th at 17:30 UTC |
| **1218/1324** | valid from the 12th at 18Z to the 13th at 24Z (30 hrs) |
| **P6SM** | visibility more than 6 SM |
| **TEMPO** | temporary swings — each under 1 hr, in total less than half the period |
| **FM** | "from" 13th 00:00Z — a rapid, lasting change; replaces everything before it |
| **PROB30** | 30% chance of storms or precipitation, 06Z–10Z on the 13th |
| **BECMG** | gradual change (~2 hrs) — military & international TAFs; NWS TAFs don't use it |

TAFs cover 5 SM around the runway complex · issued 4×/day (00, 06, 12, 18Z) · valid 24 or 30 hrs · AMD = amended.

## SKY COVER



| CLR | FEW | SCT | BKN | OVC | VV |
|---|---|---|---|---|---|
| 0/8 | >0–2/8 | 3–4/8 | 5–7/8 | 8/8 | obscured |

**= CEILING (lowest one)**

A **ceiling** is the lowest layer reported **broken** or **overcast**, or the vertical visibility into an obscuration. §1.1 SKC = clear (human observer); CLR = no clouds at or below 12,000 ft (automated).

## FLIGHT CATEGORIES

| | |
|---|---|
| **VFR** | ceiling > 3,000 AGL **and** vis > 5 SM |
| **MVFR** | ceiling 1,000–3,000 and/or vis 3–5 SM |
| **IFR** | ceiling 500 to <1,000 and/or vis 1 to <3 SM |
| **LIFR** | ceiling < 500 and/or vis < 1 SM |

Colors as on aviationweather.gov.

## WEATHER CODES

| | |
|---|---|
| **Intensity** | **–** light · *(none)* moderate · **+** heavy · **VC** vicinity (5–10 SM) |
| **Descriptor** | **MI** shallow · **BC** patches · **PR** partial · **DR** low drifting · **BL** blowing · **SH** showers · **TS** thunderstorm · **FZ** freezing |
| **Precip** | **RA** rain · **DZ** drizzle · **SN** snow · **SG** snow grains · **IC** ice crystals · **PL** ice pellets · **GR** hail · **GS** small hail · **UP** unknown |
| **Obscuration** | **BR** mist (vis ≥ 5/8 SM) · **FG** fog (vis < 5/8 SM) · **HZ** haze · **FU** smoke · **DU** dust · **SA** sand · **VA** volcanic ash · **PY** spray |
| **Other** | **SQ** squall · **FC** funnel cloud (**+FC** tornado) · **PO** dust whirls · **SS** sandstorm · **DS** duststorm |

## WINDS & TEMPS ALOFT (FB)

| CODE | MEANS |
|---|---|
| **2615** | 260° true at 15 kt (no temp at 3,000 ft) |
| **2621+12** | 260° at 21 kt, +12 °C |
| **9900+05** | light & variable (< 5 kt), +5 °C |
| **731960** | 73 − 50 = **230°**, 19 + 100 = **119 kt**, **−60 °C** |

- Direction 51–86? Subtract 50, add 100 kt to the speed.
- No wind within 1,500 ft of station elevation; no temp at 3,000 ft or within 2,500 ft of the station.
- Above 24,000 ft, temps are negative (sign dropped).

## PIREP

```
DEN UA /OV DEN090020/TM 1630/FL070/TP
C172/SK BKN065-TOP080/TA M04/TB
LGT/IC LGT RIME
```

| | |
|---|---|
| **DEN UA** | station · routine (**UUA** = urgent) |
| **/OV** | 20 NM on the DEN 090° radial |
| **/TM /FL** | 16:30 UTC · 7,000 ft **MSL** |
| **/SK** | broken, base 6,500, tops 8,000 MSL |
| **/TA /TB /IC** | −4 °C · light turbulence · light rime ice |

## TRAP

Winds in METARs, TAFs & winds aloft are **TRUE**; ATIS, the tower & ASOS/AWOS broadcasts give **MAGNETIC**. Heights: **AGL** in METARs/TAFs, **MSL** in PIREPs, AIRMETs & SIGMETs.

## ADVISORIES & PRODUCTS

| | |
|---|---|
| **AIRMET** | Moderate hazards (mostly matter to small airplanes): **Sierra** = IFR & mountain obscuration · **Tango** = moderate turbulence, sustained surface winds > 30 kt, low-level wind shear · **Zulu** = moderate icing & freezing levels. Every 6 hrs; lower 48 = graphical (G-AIRMET). |
| **SIGMET** | Severe/extreme for all aircraft: **severe icing**, **severe or extreme turbulence** (incl. CAT), dust/sandstorms below 3 SM, **volcanic ash**. |
| **CONV. SIGMET** | Hourly at H+55: lines or areas of thunderstorms, embedded storms, or severe storms (tornado, hail ≥ ¾ in, surface wind ≥ 50 kt). Implies severe turbulence, severe icing & wind shear. |
| **GFA** | Graphical Forecasts for Aviation — clouds, weather, turbulence, icing (replaced the text Area Forecast). |
| **CWA** | Center Weather Advisory — short-term "nowcast" from an ARTCC. |
| **ALSO** | Surface analysis · prog charts · radar · satellite · ATIS · ASOS/AWOS. |

## FLIGHT SERVICE BRIEFINGS

AIM 7-1

**Standard** (no prior briefing) · **Abbreviated** (update / specific items) · **Outlook** (departure 6+ hrs away) · **Inflight** (airborne). 1-800-WX-BRIEF A self-brief from FAA/NWS sources counts too.

### STANDARD BRIEFING ORDER

1. Adverse conditions
2. VFR not recommended
3. Synopsis
4. Current conditions
5. En-route forecast
6. Destination forecast
7. Winds & temps aloft
8. NOTAMs
9. ATC delays
10. On request (MOAs, etc.)

## DPE ASKS

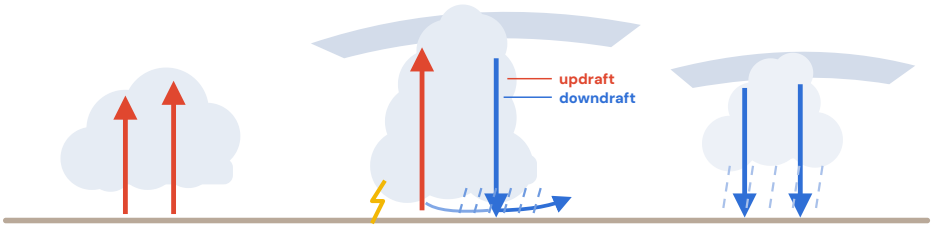
**"The METAR shows BKN012 and 5SM at your Class D airport. Can you depart VFR?"**

Legal in the surface area (ceiling ≥ 1,000 ft, visibility ≥ 3 SM) — but staying 500 ft below a 1,200-ft ceiling caps you at **700 ft AGL**. Legal isn't the same as smart.

# 04 Weather: Theory & Hazards

*Why the sky does what it does.*

## THUNDERSTORM LIFE CYCLE




**1 · CUMULUS**
updrafts build the cloud

**2 · MATURE**
rain hits the ground · up- & downdrafts · worst stage

**3 · DISSIPATING**
downdrafts take over

## 3 INGREDIENTS

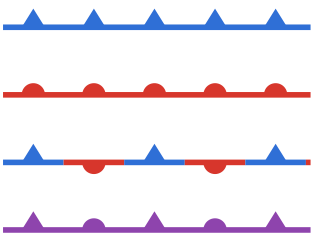
| Moisture | Unstable air | Lifting |
|---|---|---|
| enough water vapor | lapse rate | front, terrain, heating |

## STAY AWAY

- Give a severe storm **20 NM** — hail can fall far from the core.
- Never fly under the anvil or try to out-climb a storm.
- Expect severe turbulence, lightning, hail, icing, wind shear & gusts.
- Datalink NEXRAD can be **15–20 min older** than its time stamp — use it to stay far away, never to pick a path through.



## FRONTS



**Cold front**
blue triangles point the way it moves

**Warm front**
red half-circles

**Stationary**
alternating, on opposite sides

**Occluded**
purple, both symbols, same side

| | COLD FRONT | WARM FRONT |
|---|---|---|
| **Moves** | fast · steep | slow · shallow |
| **Clouds** | cumuliform, towering, thunderstorms | stratiform — low ceilings, fog |
| **Precip** | showers, often heavy | steady, widespread |
| **After** | clears fast · colder · gusty | warmer · muggy |

**Frontal passage:** temperature change · wind shift · pressure change · dew-point change.

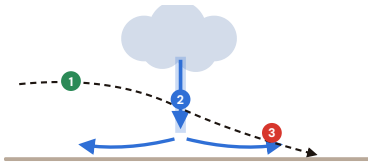
## STABLE VS. UNSTABLE AIR

| | STABLE | UNSTABLE |
|---|---|---|
| **Clouds** | stratiform (layers) | cumuliform (heaps) |
| **Ride** | smooth | turbulent |
| **Visibility** | fair to poor (haze, smoke) | good — except in showers |
| **Precip** | steady | showery |

**Inversion** (temperature *rises* with altitude) = very stable: smooth air, but haze, smoke & fog get trapped underneath.

## MICROBURST

AIM 7-1




1 headwind — performance **up**
2 strong downdraft
3 tailwind — airspeed & lift **drop**

Downdraft usually **< 1 mile** wide, up to **6,000 fpm**; outflow up to ~2½ mi; winds keep building ~5 min after it hits; rarely lasts over **15 min**.

## FOG TYPES

| | |
|---|---|
| **Radiation** | clear, calm nights; ground cools; low spots |
| **Advection** | moist air blows over a colder surface — coasts; can persist in wind |
| **Upslope** | moist, stable air pushed up rising terrain |
| **Steam** | cold air over warmer water |
| **Precip-induced** | warm rain falls through cooler air (fronts) |
| **Ice fog** | very cold air, ice crystals |

Temp/dew-point spread small & shrinking → fog or low clouds coming.

## CLOUDS BY HEIGHT (AGL)

| | | |
|---|---|---|
| **High** | > 20,000 ft | cirrus, cirrostratus, cirrocumulus |
| **Middle** | 6,500–20,000 | altostratus, altocumulus |
| **Low** | sfc–6,500 | stratus, stratocumulus, nimbostratus |
| **Vertical** | all levels | towering cumulus, cumulonimbus |

**cumulo** = heap · **strato** = layer · **nimbo/nimbus** = rain · **alto** = middle · **cirro** = high

Cloud base ≈ (temp − dew point in °C) ÷ 2.5 × 1,000 ft AGL.

## ICING

| Rime | Clear | Mixed |
|---|---|---|
| small droplets freeze instantly — rough, milky | big drops flow back, then freeze — heavy, hard to remove: **worst** | both at once |

- Structural ice needs **visible moisture** + an airframe at **0 °C or colder**.
- **Freezing rain** → warmer air is **above** you. **Ice pellets** → freezing rain above.
- **Frost**: remove all of it — it spoils lift and raises stall speed.
- Intensities: trace · light · moderate · severe.
- **Picking up ice?** Get out of the visible moisture or into above-freezing air — climb, descend, or turn around.

## PRESSURE & WIND




**HIGH**
sinking air
clockwise, outward
usually fair

**LOW**
rising air
counterclockwise, inward · clouds, rain

Wind blows from high to low; Coriolis bends it right (N. hemisphere). **"High to low, look out below"** — your altimeter will read high.

## STANDARD ATMOSPHERE (ISA)

| | |
|---|---|
| **Sea level** | **15 °C** (59 °F) · **29.92 inHg** · 1013.2 hPa |
| **Temp lapse** | -2 °C (3.5 °F) per 1,000 ft |
| **Pressure** | about -1 inHg per 1,000 ft (low altitudes) |
| **Rising air** | dry air cools ~3 °C per 1,000 ft, dew point drops ~0.5 °C → they close 2.5 °C per 1,000 ft (the cloud-base rule) |

## DPE ASKS

**"Towering cumulus are building along your route this afternoon. Now what?"**

Moist, unstable air plus lift — thunderstorms are coming. Give severe cells 20 NM, divert, or land early.

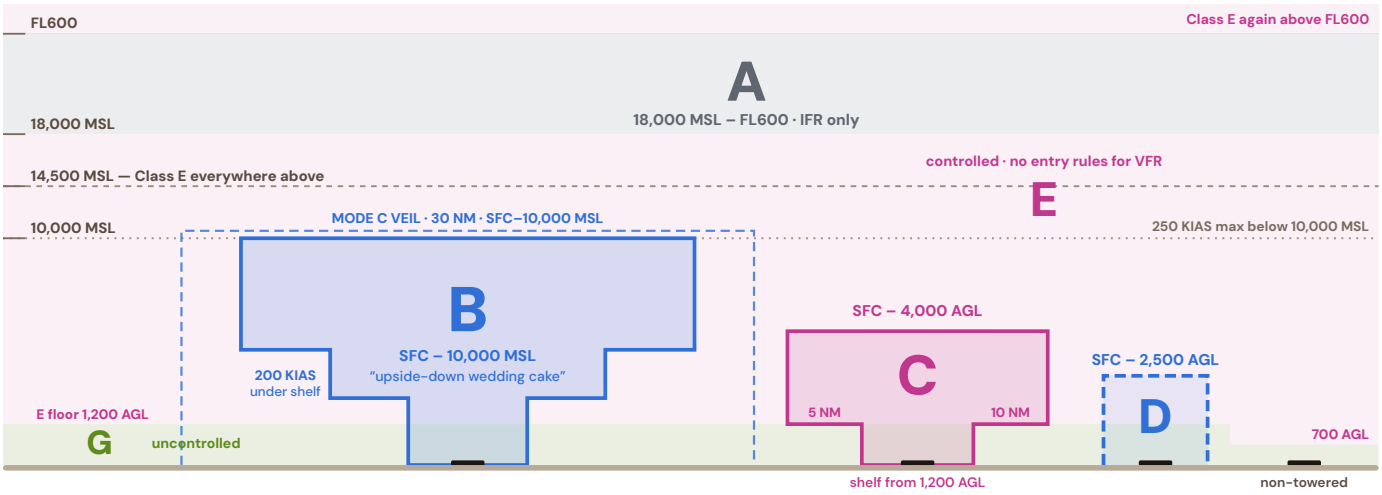
## TRAP

Clear sky + calm wind + a small temp/dew-point spread tonight = **radiation fog** by morning.

# 05 Airspace

*Where can I go — and what do I need?*

## THE NATIONAL AIRSPACE SYSTEM — SIDE VIEW




## ENTRY · EQUIPMENT · VFR WEATHER MINIMUMS

| | TYPICAL SIZE | TO ENTER (VFR) | EQUIPMENT | VFR VISIBILITY · CLOUD CLEARANCE |
|---|---|---|---|---|
| A | 18,000 MSL – FL600 | IFR clearance only | IFR-equipped · Mode C · ADS-B Out | — IFR only |
| B | SFC – 10,000 MSL, layered | **Clearance**: "cleared into the Class Bravo" + private cert (or an endorsed student, sport or recreational pilot) | Two-way radio · Mode C · ADS-B Out | **3 SM · clear of clouds** |
| C | SFC – 4,000 ft above airport · 5 NM core, 10 NM shelf from 1,200 AGL | **Two-way radio contact established** (ATC says your call sign) | Two-way radio · Mode C · ADS-B Out | **3 SM · 152** |
| D | SFC – 2,500 ft above airport (charted in MSL) | **Two-way radio contact established** | Two-way radio | **3 SM · 152** |
| E | Floor at SFC, 700 AGL, 1,200 AGL or 14,500 MSL → up to 17,999 MSL | Nothing for VFR | Nothing for VFR (Mode C + ADS-B at/above 10,000 MSL*) | Below 10,000 MSL: **3 SM · 152**<br>At/above 10,000 MSL: **5 SM · 111** |
| G | SFC up to the Class E floor | Nothing | Nothing | Day: **1 SM · clear of clouds** (≤ 1,200 AGL) — full table ↓ |

152 = 1,000 above · 500 below · 2,000 horizontal  111 = 1,000 above · 1,000 below · 1 SM horizontal

*Except at and below 2,500 ft AGL. Class C & D sizes are typical — always check the chart. §91.155 §91.215 §91.225

## CLASS G MINIMUMS

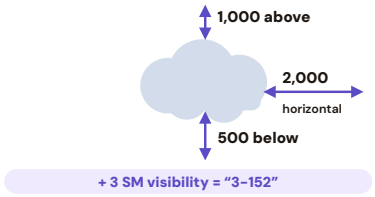
| CLASS G | DAY | NIGHT |
|---|---|---|
| **≤ 1,200 AGL** | **1 SM** · clear of clouds | **3 SM** · 152 |
| **> 1,200 AGL**<br>**< 10,000 MSL** | **1 SM** · 152 | **3 SM** · 152 |
| **> 1,200 AGL**<br>**≥ 10,000 MSL** | **5 SM** · 111 | **5 SM** · 111 |

**Night exception:** 1 SM & clear of clouds in the pattern within ½ SM of the runway. §91.155(b)

## SURFACE AREA OF CONTROLLED AIRSPACE

No VFR beneath a ceiling below **1,000 ft**, and no VFR takeoff, landing, or pattern entry with ground visibility below **3 SM**. Less than that? **Special VFR**: clearance, clear of clouds, 1 SM; sunset to sunrise only if instrument-rated & current, in an IFR-equipped airplane. §91.155(c)-(d) §91.157

## CLOUD CLEARANCE




## MODE C + ADS-B OUT

§91.215 · .225

- Class A, B & C
- Within 30 NM of a Class B primary airport, SFC–10,000 MSL
- Above B or C (within its lateral limits), up to 10,000 MSL
- Class E at/above 10,000 MSL (not within 2,500 AGL)
- ADS-B only: over the Gulf, at/above 3,000 MSL within 12 NM of the coast

If installed, keep the transponder (Mode C) on in controlled airspace and ADS-B Out on at all times.

## SPECIAL USE AIRSPACE

| | |
|---|---|
| **Prohibited** | No flight. (P-56: White House) |
| **Restricted** | Invisible hazards (artillery, missiles) — permission needed when active |
| **Warning** | Restricted-type hazards 3+ NM offshore — no permission needed |
| **MOA** | Military training — VFR allowed; check status, use caution |
| **Alert** | Lots of training or unusual activity — VFR allowed |

**CFA** — not charted; firing stops when aircraft approach · **NSA** — please avoid; can become prohibited by NOTAM.
**Also:** TFRs (check NOTAMs) · MTRs (4-digit = at/below 1,500 AGL) · VFR within 60 NM of DCA needs special awareness training §91.161 · national parks & refuges: please stay 2,000 ft AGL

**DPE ASKS**

**"You call Class C approach and hear "N123AB, standby." Can you enter?"**

**Yes** — they used your call sign, so two-way communication is established. "Aircraft calling, standby" = **no**.

**⚠ TRAP**

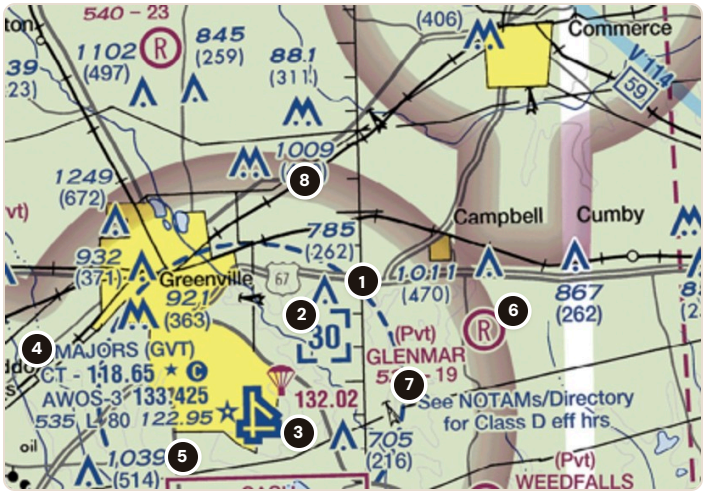
Class C & D need **communication**, not a clearance. Class B needs a **clearance** — "radar contact" is not one.

AIRSPACE

# 06 Reading the Sectional

*Your DPE will hand you one.*

## CLASS D · TOWERED AIRPORT



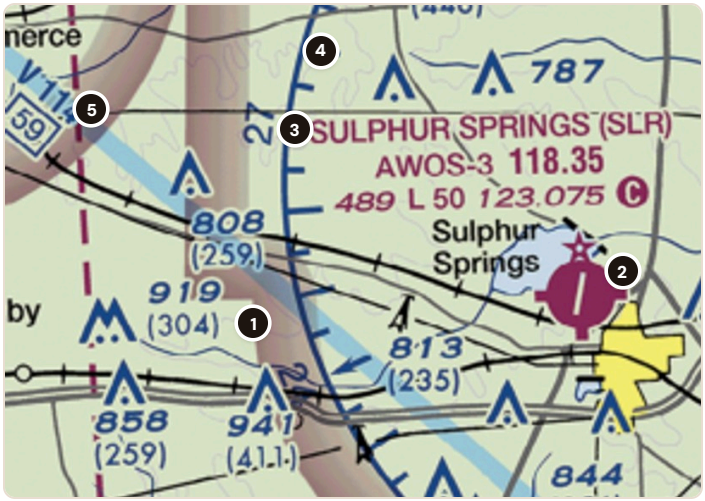

1. **Dashed blue** = Class D boundary
2. **[30]** = Class D ceiling, 3,000 ft MSL
3. **Blue** airport = control tower · ★ beside it = rotating beacon
4. **CT 118.65** tower · ★ after it = **part-time** tower · Ⓒ CTAF · **535** elev MSL · **L** lighting · **80** = 8,000-ft rwy · **122.95** UNICOM
5. **1,039** top of obstacle MSL · **(514)** height AGL
6. **Magenta** airport = no tower · **R** = private
7. "See NOTAMs/Directory" = **part-time tower** (reverts to E or G)
8. **Magenta shading** = Class E starts at 700 ft AGL

## CLASS C



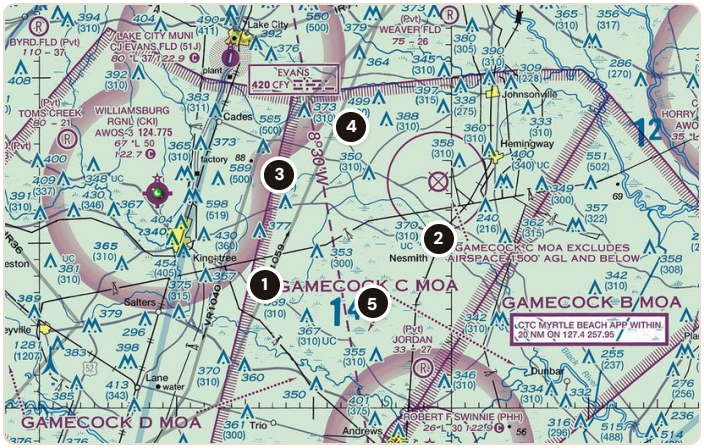

1. **Solid magenta** = Class C boundary
2. **40/SFC** = surface to 4,000 MSL (inner core)
3. **40/23** = 2,300 to 4,000 MSL (shelf)
4. **CTC … APP WITHIN 20 NM** = outer-area frequency
5. **2²** MEF = 2,200 ft MSL — highest terrain/obstacle in the quadrant + a buffer, rounded up
6. **Magenta flag** = VFR checkpoint (VPPVM = waypoint ID)

## CLASS E · NON-TOWERED AIRPORT




1. **Magenta shading** = Class E from 700 AGL (fuzzy side inside); elsewhere from 1,200 AGL
2. **Magenta** airport = non-towered
3. **AWOS-3 118.35** · **489** elev · **L** lights · **50** = 5,000 ft · **123.075** Ⓒ = CTAF
4. **Compass rose** around a VOR — oriented to magnetic north
5. **Victor airway** (V114) — Class E from 1,200 AGL

## MOAS, ROUTES & VARIATION




1. **Magenta hatching** = MOA — VFR OK; check if active
2. MOA floor: **excludes 1,500 AGL & below**
3. **Gray line** = military training route: **VR1059** (4 digits = at/below 1,500 AGL)
4. **Dashed magenta** = isogonic line (8.5° W variation)
5. **1⁴** MEF = 1,400 ft MSL

## LEGEND KEY

- **Class B** — solid blue
- **Class C** — solid magenta
- **Class D** — dashed blue
- **Class E to the surface** — dashed magenta
- **Class E from 700 AGL** — magenta shading
- **Class E from 1,200 AGL** next to Class G — blue shading
- **Prohibited · Restricted · Warning** — blue hatching
- **MOA · Alert area** — magenta hatching
- [-30] **Minus sign** = ceiling up to but *not including* that altitude

Chart excerpts: FAA Airman Knowledge Testing Supplement & FAA sectional charts — not to scale, not for navigation.

**⚠ TRAP**

Numbers on the sectional are **MSL** — except heights in parentheses and anything labeled AGL. A Class D ceiling like **[30]** is MSL, even though the rule says "2,500 ft above the airport."

# 07 Cross-Country & Navigation

*Plan it, then fly the plan.*

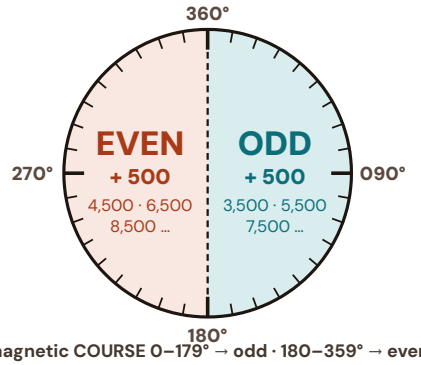
## FROM THE CHART TO THE COMPASS

| TC | ± WCA | TH | ± Variation | MH | ± Deviation | CH |
|---|---|---|---|---|---|---|
| True Course | +5° → | True Heading | 10° E → -10 → | Magnetic Heading | +2 (card) → | Compass Heading |
| 090° | | 095° | | 085° | | 087° |

**"East is least, West is best"** — subtract east variation, add west.

Wind from the right → correct right (+). True course is measured off the chart; deviation comes from the compass card.

## VFR CRUISING ALTITUDES §91.159




**magnetic COURSE 0–179° → odd · 180–359° → even**

Applies **more than 3,000 ft AGL** and below 18,000 MSL. Based on **magnetic course** — not heading.

## PREFLIGHT ACTION — NW KRAFT §91.103

- **N** — **NOTAMs**
- **W** — **Weather** — reports & forecasts
- **K** — **Known ATC delays**
- **R** — **Runway lengths** — at airports of intended use
- **A** — **Alternatives** — if you can't complete the flight
- **F** — **Fuel requirements**
- **T** — **Takeoff & landing** — distance data

Every flight: runway lengths, takeoff/landing data, and all available info (NOTAMs). Weather, delays, alternatives, fuel: IFR or away from the airport.

## VFR FUEL MINIMUMS §91.151

| 30 | 45 |
|---|---|
| MIN · DAY | MIN · NIGHT |

…beyond your first point of intended landing, at normal cruise. Legal minimum — not a plan.

## FLIGHT PLAN & FLIGHT FOLLOWING

- **VFR flight plan**: file with Flight Service, open it after takeoff, **close it** when you land — search & rescue starts if it's still open **30 min after your ETA**. Towers don't automatically open or close VFR plans.
- **Flight following**: radar traffic advisories, workload permitting — you still see & avoid.

## VOR IN 30 SECONDS




- **Radial** = magnetic course **FROM** the station.
- **OBS** picks the course; the **TO/FROM** flag says whether it takes you to or from the station.
- Needle left = course is left: **fly toward the needle**. Here: OBS 060°, TO, 2 dots left.
- Each dot = **2°**; full-scale = **10°**.
- Set the OBS near your heading or the needle **reverse-senses**.
- Identify the Morse code — no ident or "TEST" = don't use it.

## QUICK MATH

| | |
|---|---|
| **Time** | minutes = distance ÷ groundspeed × 60 |
| **Fuel** | time (hr) × fuel burn (GPH) + reserve |
| **1 in 60** | 1° off course ≈ 1 NM off at 60 NM |
| **NM → SM** | × 1.15 |
| **Altimeter** | use a station within 100 NM §91.121 |

**Pilotage** = landmarks · **Dead reckoning** = time, speed, heading · **Radio / GPS** = navaids.

## LOST? THE 5 CS

- **C** — **Climb** — see farther, talk farther
- **C** — **Communicate** — ATC, FSS, 121.5
- **C** — **Confess** — say you're lost
- **C** — **Comply** — with ATC
- **C** — **Conserve** — fuel — pull power back

## DIVERTING

1. Turn toward the alternate **first** — rough heading from the chart.
2. Note the time; estimate distance, time, and fuel.
3. Refine the heading; tell ATC or Flight Service.
4. Check the new airport: runway, weather, airspace.

## DPE ASKS

**"You planned 5,500 ft on a 190° magnetic course. Right altitude?"**

**No** — 180–359° is even + 500: **4,500** or **6,500**.

## TRAP

Cruising altitudes use **magnetic course**, not heading — and only above 3,000 ft AGL.

## WHERE TO FIND IT

| | |
|---|---|
| **Chart Supplement** | Airport details: runways & lengths, lighting, frequencies, pattern, fuel, remarks |
| **NOTAMs** | Temporary changes: closed runways, outages, TFRs, GPS interference testing |
| **Sectional** | Airspace, terrain, obstacles, navaids, checkpoints |
| **POH / AFM** | Performance, limitations, weight & balance, emergency procedures |
| **Weather** | aviationweather.gov · Flight Service (1-800-WX-BRIEF) · ATIS / ASOS / AWOS |

## VOR CHECKS (IFR) §91.171

| | |
|---|---|
| **VOT** | ± 4° |
| **Ground checkpoint** | ± 4° |
| **Airborne checkpoint** | ± 6° |
| **Dual VORs (to each other)** | 4° |

Within the preceding 30 days · log date, place, error, signature.

NAV

# 08 Performance & Limitations

*Will it fly today — and how far?*

## DENSITY ALTITUDE

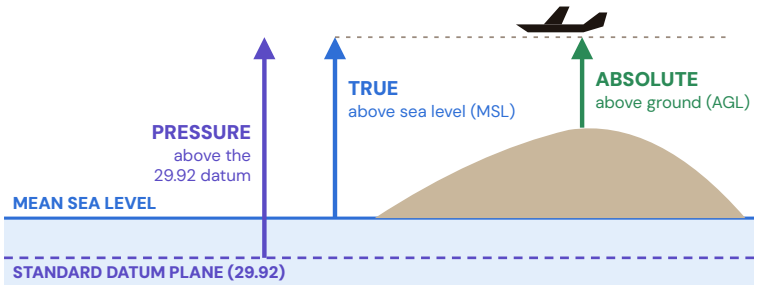
| High | Hot | Humid |
|---|---|---|

…all raise density altitude → **less lift, less power, less prop thrust** → longer takeoff roll, weaker climb, higher true airspeed for the same indicated, longer landing roll.

**Pressure alt.** field elev. + (29.92 − altimeter) × 1,000
**ISA temp** 15 °C − 2 °C per 1,000 ft
**Density alt. ≈** pressure alt. + 120 × (OAT − ISA temp)

**Example:** 5,000-ft field, altimeter 29.92, 30 °C → ISA there is 5 °C → DA ≈ 5,000 + 120 × 25 ≈ **8,000 ft**.

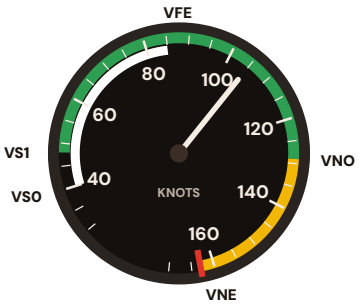
## FIVE ALTITUDES




**Indicated** = what the altimeter reads (set to local pressure) · **Density** = pressure altitude corrected for nonstandard temperature — the one the airplane "feels."

**"High to low, look out below"** — flying into lower pressure or colder air, the altimeter reads **higher** than you really are.

## ASI · C172S EXAMPLE




## ASI MARKINGS & V-SPEEDS

- **White arc** — flap operating range: $V_{SO}$ → $V_{FE}$
- **Green arc** — normal operating: $V_{S1}$ → $V_{NO}$
- **Yellow arc** — caution, smooth air only: $V_{NO}$ → $V_{NE}$
- **Red line** — $V_{NE}$, never exceed

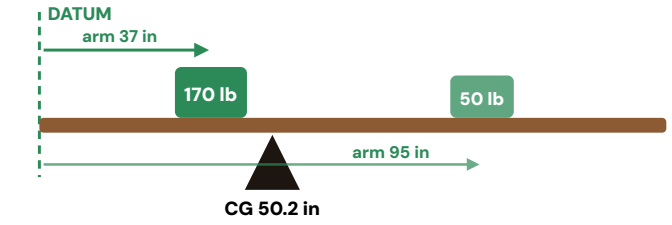
**$V_{SO}$ / $V_{S1}$** stall: landing config / specified (clean)
**$V_X$ / $V_Y$** best **angle** (per distance) / best **rate** (per minute)
**$V_A$** maneuvering — one full input on one axis is safe; combined ones aren't. **Drops with weight**
**$V_G$** best glide (not on the ASI)
**$V_{LE}$ / $V_{LO}$** gear extended / gear operating

## AIRSPEEDS

**IAS** indicated → **CAS** instrument + position error → **TAS** altitude + temperature → **GS** fix for wind

- Fly the POH numbers as **indicated** — stall IAS doesn't change with altitude.
- TAS ≈ IAS + 2% per 1,000 ft — higher & hotter = faster over the ground for the same IAS.
- **$V_X$** rises and **$V_Y$** falls with altitude; they meet at the **absolute ceiling**. **Service ceiling** = where max climb drops to 100 fpm.

## WEIGHT & BALANCE




**Moment** weight × arm (arm = inches from the datum)
**CG** total moment ÷ total weight — inside the envelope from takeoff *to landing*. Above: (170×37 + 50×95) ÷ 220 = **50.2 in**
**Shift** weight moved ÷ total weight = CG change ÷ distance moved

Avgas **6 lb/gal** · oil **7.5 lb/gal** · **basic empty weight** includes unusable fuel & full oil · **useful load** = people, bags, usable fuel.

## CG & WEIGHT EFFECTS

| | FORWARD CG | AFT CG |
|---|---|---|
| **Stall speed** | higher | lower |
| **Cruise** | slower (more tail down-force) | faster |
| **Stability** | more stable | less stable |
| **Handling** | nose-heavy: hard to rotate & flare | stall/spin recovery harder — or impossible past the limit |

**Overweight:** longer takeoff roll, higher takeoff & stall speeds, weaker climb, lower ceiling, shorter range, longer landing roll — and you may bend the airplane.

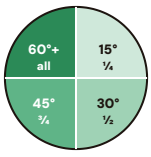
## TAKEOFF & LANDING DISTANCE

Longer with: **weight ↑ · density altitude ↑ · tailwind · upslope** (takeoff) · **grass, wet, soft** runway. Headwind shortens it.

**C172S POH example** (use yours): −10% per 9 kt headwind · +10% per 2 kt tailwind (to 10 kt) · dry grass: **+15%** of takeoff ground roll, **+45%** of landing ground roll.

**Hydroplaning** starts around **9 × √tire psi** knots (36 psi → 54 kt).

## CROSSWIND — CLOCK METHOD




Wind angle off the runway = minutes on a clock. That slice of the hour = that slice of the wind is crosswind. **20 kt at 30° ≈ 10 kt** crosswind.

## DPE ASKS

**"It's 95 °F at a 5,000-ft airport. What changes?"**

Density altitude is sky-high: longer roll, weak climb. Lean for best power per the POH, lighten the load, or go early in the morning.

## ⚠ TRAP

**$V_A$ goes down as weight goes down** — a light airplane needs a slower maneuvering speed.

## READING THE POH CHARTS — THE DPE WILL HAND YOU ONE

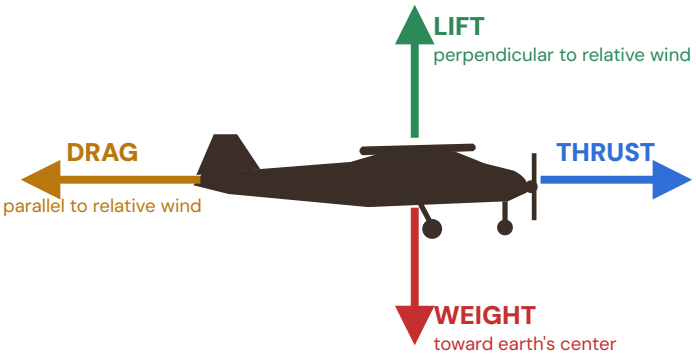
**1** Pressure altitude + temperature → enter the chart **2** Correct for weight **3** Correct for wind (headwind/tailwind lines) **4** Read ground roll *and* distance over a 50-ft obstacle **5** Add the POH corrections (grass, slope) — then a personal safety margin

PERF

# 09 Aerodynamics

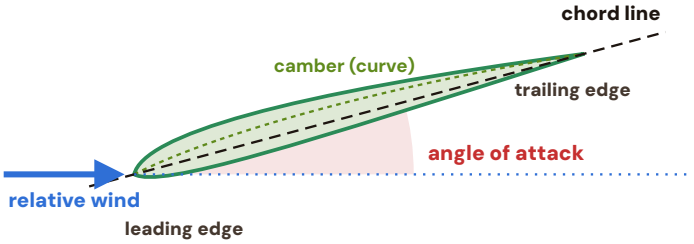
*Why it flies — and why it stops.*

## FOUR FORCES



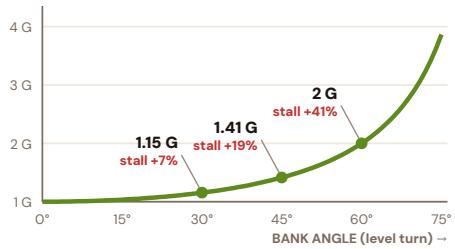

In steady flight the opposing forces cancel — everything up = everything down, everything forward = everything back. Straight-and-level: lift = weight, thrust = drag.

## AIRFOIL & ANGLE OF ATTACK




**AOA** = angle between the chord line and the relative wind. **Angle of incidence** = fixed angle between wing chord and the longitudinal axis. Lift depends on air density, airspeed², wing area, and AOA/camber (flaps).

## LOAD FACTOR

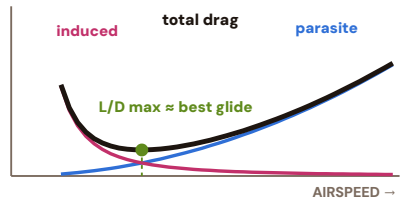



Load factor = 1 ÷ cos(bank). Stall speed rises with √load factor. Limits: normal +3.8 / -1.52 G · utility +4.4 / -1.76 · acrobatic +6 / -3.

## STALLS & SPINS

- A stall is **always** exceeding the **critical angle of attack** — any airspeed, attitude, or power.
- Stall speed goes **up** with weight, bank (load factor), forward CG, frost/ice; **down** with flaps & power.
- **Recover:** lower the AOA (forward pressure), level the wings, add power.
- **Spin** = stall + yaw. Recovery per POH — typically **PARE**: **P**ower idle · **A**ilerons neutral · **R**udder full opposite · **E**levator briskly forward — then recover from the dive.

## DRAG




**Parasite** (form, friction, interference) grows with speed. **Induced** (a by-product of lift — wingtip vortices) shrinks with speed.

## LEFT-TURNING TENDENCIES — STRONGEST AT HIGH POWER, LOW AIRSPEED, HIGH AOA (TAKEOFF & CLIMB)

**1 Torque**
prop turns clockwise (pilot's view) → airplane rolls left

**2 P-factor**
descending right blade takes a bigger bite at high AOA → yaw left

**3 Spiraling slipstream**
corkscrews around and hits the left side of the tail → yaw left

**4 Gyroscopic precession**
force acts 90° ahead in the direction of rotation — raising a taildragger's tail yaws left

**Fix:** right rudder.

## TURNS & COORDINATION (RIGHT TURN SHOWN)



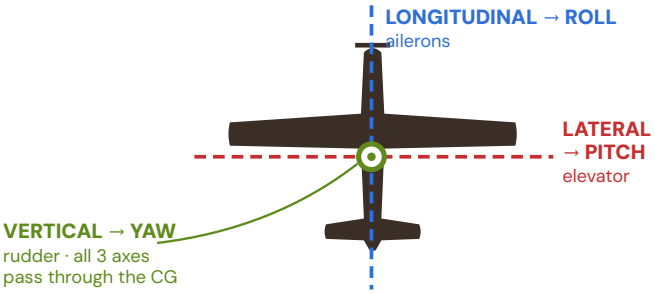
**SLIP** — ball to the inside

**COORDINATED** — ball centered

**SKID** — ball to the outside

- The **horizontal component of lift** turns the airplane — add back pressure to hold altitude.
- **Adverse yaw**: the down aileron (rising wing) makes more drag → nose yaws away from the turn → add rudder. **"Step on the ball."**
- A **skidding** base-to-final turn is the classic cross-controlled stall/spin setup.

## AXES & STABILITY




**Static** stability = first tendency after a disturbance · **Dynamic** = what it does over time (positive, neutral, negative). Pitch stability: CG ahead of the center of lift + tail down-force.

## GROUND EFFECT

Within about **one wingspan** of the surface, wingtip vortices and downwash shrink → **less induced drag**. Landing fast? You float. Taking off? It can lift you off too slow — then sink as you climb out of it.

## FLAPS

More lift **and** more drag → steeper approach without gaining speed, and a **lower stall speed**. Retract them in small steps on a go-around.

## DPE ASKS

**"Can you stall at any airspeed?"**

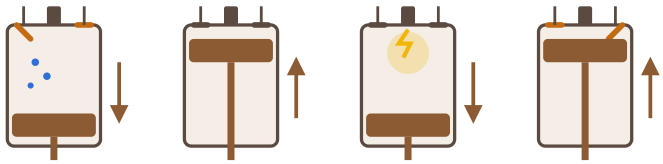
**Yes.** A stall is exceeding the critical AOA — at any airspeed, in any attitude, at any power setting.

AERO

# 10 Aircraft Systems

*Know your airplane cold.*

## ENGINE & IGNITION




- Typical trainer: horizontally opposed, air-cooled, normally aspirated, 4 cylinders.
- **Two magnetos** — engine-driven and self-powered, independent of the battery. Each fires one of the **two spark plugs** in every cylinder: redundancy + a more complete burn.
- **Mag check:** a small RPM drop is normal. **No drop** = possible broken P-lead (mag stays "hot" — don't fly). Big drop or roughness = fouled plug or bad mag.

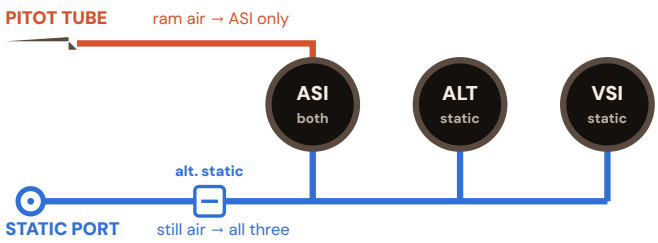
## CARBURETOR ICE

- Fuel vaporizing + the venturi's pressure drop chill the air (as much as 60–70 °F) → ice can form even on a warm day.
- Most likely **20–70 °F** (-7 to 21 °C) with high humidity; possible up to ~100 °F.
- **Fixed-pitch prop:** first sign = **RPM drop**, then roughness.
- **Carb heat** (unfiltered hot air from the exhaust shroud) richens the mixture → RPM drops; if ice was there, RPM then **rises** as it melts.
- Fuel-injected: no carb ice — alternate air if the intake ices up.

## MIXTURE & COMBUSTION

- **Lean** as you climb — thinner air makes the mixture too rich (rough, fouled plugs). Full rich for takeoff at low elevations; lean for best power at high-DA airports per POH.
- **Detonation** = explosive burn *after* the spark (low-grade fuel, too lean, too hot, high power) → enrich, reduce power, cool it.
- **Preignition** = fires *before* the spark from a hot spot (carbon deposit, bad plug).

## PITOT-STATIC SYSTEM




| WHAT'S BLOCKED | AIRSPEED | ALTIMETER | VSI |
|---|---|---|---|
| **Pitot inlet (drain open)** | **drops to zero** | normal | normal |
| **Pitot inlet + drain** | acts like an **altimeter**: up in a climb, down in a descent | normal | normal |
| **Static ports** | reads **low** climbing, **high** descending | **frozen** | **zero** |
| **Alternate static (cabin air)** | reads a bit high | reads a bit high | brief climb |

Static blocked and no alternate source? Breaking the VSI glass vents static to the cabin (the VSI is then useless).

## GYRO INSTRUMENTS

- **Rigidity in space** → attitude & heading indicators. **Precession** → turn coordinator (and why the heading indicator drifts — reset it to the compass about every **15 min**).
- **Turn coordinator**: rate of turn & roll; standard rate = **3°/sec** (2-min 360°). The ball shows coordination.
- Typical trainer: AI & HI on **vacuum**, turn coordinator **electric** — so one failure never takes all three.

## MAGNETIC COMPASS — DV MONA

- **D** **Deviation** — the airplane's own magnetism → compass card
- **V** **Variation** — true vs. magnetic north → isogonic lines
- **M** **Magnetic dip** — causes the N and A errors ↓
- **O** **Oscillation** — bounces in turbulence
- **N** **Northerly turning** — **UNOS**: Undershoot North, Overshoot South
- **A** **Acceleration** — **ANDS**: Accelerate North, Decelerate South (on E/W headings)

N. hemisphere. Self-contained — no power, vacuum or pitot-static needed: your backup heading.

## ELECTRICAL

- 14- or 28-volt DC. Engine-driven **alternator** powers the bus & charges the **battery** (starting + backup).
- Ammeter/loadmeter, low-voltage light, circuit breakers, master & avionics switches.
- **Alternator failure** → discharge / low-voltage warning → shed load, try one reset per checklist, tell ATC, land as soon as practical. The engine keeps running.

## VACUUM, FUEL & OIL

- **Vacuum pump** spins the AI & HI gyros; watch the suction gauge (often 4.5–5.5 inHg — per POH). Failing? Cover them; use the turn coordinator.
- **Fuel**: high wing = gravity feed; low wing = pumps. **100LL is blue**; Jet A is clear/straw — never in an avgas engine. Sump every drain (water sinks).
- **Oil** lubricates, cools, seals, cleans. Low pressure + high temp = land now.

## PROP, GEAR & CABIN

- **Fixed-pitch** (climb or cruise prop) vs. **constant-speed** (governor holds RPM; set manifold pressure with throttle).
- Blades are twisted so the angle of attack stays even along the blade.
- Tricycle gear, nosewheel steered by the rudder pedals, hydraulic toe brakes.
- Cabin heat comes from around the exhaust → a crack means **carbon monoxide**. Carry a CO detector.

## DPE ASKS

**"The alternator quits in cruise. What happens to the engine?"**

**Nothing**, if it has magnetos — they're self-powered. Shed load and land before the battery dies.

## ⚠ TRAP

Turning the **master** off doesn't stop the engine. Treat every prop as **live** — a broken P-lead means the mag is ON even with the key OFF.

## YOUR AIRPLANE'S NUMBERS — FILL THESE IN BEFORE THE CHECKRIDE

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $V_{SO}$ | $V_{S1}$ | $V_R$ | $V_X$ | $V_Y$ | $V_G$ glide | $V_A$ @ gross | $V_{FE}$ |
| $V_{NO}$ | $V_{NE}$ | Max gross | Useful load | Usable fuel | Fuel burn | Oil min / max | Engine & HP |

SYSTEMS

# 11 Human Factors & ADM

*The pilot is part of the airplane.*

## HYPOXIA — 4 TYPES

**1 Hypoxic** — ALTITUDE
not enough $O_2$ pressure in the air you breathe

**2 Hypemic** — BLOOD
blood can't carry $O_2$ — CO poisoning, anemia, recent blood donation

**3 Stagnant** — CIRCULATION
blood isn't moving — high G, cold, shock

**4 Histotoxic** — TISSUE
cells can't use $O_2$ — alcohol, drugs

**Symptoms:** euphoria or belligerence, headache, poor judgment, drowsiness, tunnel/dim vision, tingling, blue lips & fingernails. **Fix:** oxygen and descend. Night vision can suffer from 5,000 ft.

## HYPERVENTILATION

Breathing too fast/deep blows off $CO_2$ → light-headed, tingling, spasms. **Fix:** slow your breathing, talk out loud, breathe into a bag. Unsure if it's hypoxia? Use $O_2$.

## CARBON MONOXIDE

Colorless, odorless — from exhaust leaking through cabin heat. Headache, drowsiness, dizziness. **Fix:** heat off, fresh air on, $O_2$ if you have it, land.

## EARS & SINUSES

Blocks hurt most in descent — worse with a cold. Valsalva; don't fly congested.

## SPATIAL DISORIENTATION (INNER EAR)

| | |
|---|---|
| **The leans** | after you correct an unnoticed bank, you feel banked the other way |
| **Coriolis** | moving your head in a prolonged turn → tumbling; the most overwhelming illusion |
| **Graveyard spiral** | a long coordinated turn feels level; pulling back tightens the descending spiral |
| **Somatogravic** | acceleration feels like nose-up (you push into a dive); deceleration feels nose-down |
| **Inversion** | abrupt climb-to-level feels like tumbling backward → you push nose down |
| **Elevator** | an updraft feels like climbing (you push over); a downdraft like sinking |

**Fix for all of them:** believe your instruments.

## VISUAL ILLUSIONS ON APPROACH

AIM 8-1-5

| ILLUSION | YOU FEEL | YOU TEND TO FLY |
|---|---|---|
| **Narrow runway** | higher than you are | **too low** |
| **Wide runway** | lower | too high |
| **Upsloping runway/terrain** | higher | **too low** |
| **Downsloping runway/terrain** | lower | too high |
| **Featureless ("black hole")** | higher | **too low** |
| **Rain on the windscreen** | higher | **too low** |
| **Haze** | farther away | **too low** |
| **Fog** | nose pitching up | steepen abruptly |
| **Bright runway lights** | closer | too high |

Also: **autokinesis** (a stared-at light at night seems to move) · **false horizon** (sloping clouds, ground lights). Use VASI/PAPI and instruments.

## NIGHT VISION & SCANNING

AIM 8-1-6

- **Cones** (center): color & detail — need light. **Rods** (edges): dim light & motion → a night blind spot dead center: look **5–10° off-center**.
- Full dark adaptation takes **30+ min**; dim red light gets you partway in ~20 min but washes out chart colors. One bright light resets it.
- The AIM encourages $O_2$ above 5,000 ft at night.
- **Day scan:** eye movements ≤ 10°, each area ≥ 1 second.

## FIT TO FLY?

- **Alcohol:** 8 hrs bottle-to-throttle, BAC under 0.04, not impaired §91.17 — a hangover still counts.
- **Meds:** no flying while one impairs you — check it with your AME.
- **Fatigue, stress, dehydration** — all quietly erode judgment.
- **Scuba:** 12 hrs before flying up to 8,000 ft; 24 hrs above 8,000 ft or after a decompression dive. AIM 8-1-2

## 5 HAZARDOUS ATTITUDES

PHAK Ch. 2

| | |
|---|---|
| **Anti-authority** | Follow the rules — they're usually right. |
| **Impulsivity** | Not so fast. Think first. |
| **Invulnerability** | It could happen to me. |
| **Macho** | Taking chances is foolish. |
| **Resignation** | I'm not helpless. I can make a difference. |

## IMSAFE

- **I** Illness
- **M** Medication
- **S** Stress
- **A** Alcohol
- **F** Fatigue
- **E** Emotion / Eating

## PAVE

- **P** Pilot — health, currency, proficiency
- **A** Aircraft — airworthy, equipped, performance
- **V** enVironment — weather, terrain, airports
- **E** External pressures — schedules, people waiting

## 3P

- **P** Perceive — the hazards
- **P** Process — evaluate the risk
- **P** Perform — act — then repeat

**Risk** = likelihood × severity. Set **personal minimums** on the ground.

## DECIDE

- **D** Detect — a change
- **E** Estimate — the need to react
- **C** Choose — the outcome
- **I** Identify — actions
- **D** Do — it
- **E** Evaluate — the result

## DPE ASKS

**"Night approach over water — it looks like you're high. What's going on?"**

Featureless-terrain ("black hole") illusion — you're probably **lower** than you think. Use the VASI/PAPI and your altimeter.

## TRAP

Hypoxia feels **good** — euphoria hides the impairment. Learn your own early symptoms.

HUMAN

# 12 Airport Ops & Rules of the Air

*Who goes first?*

## LIGHT GUN SIGNALS

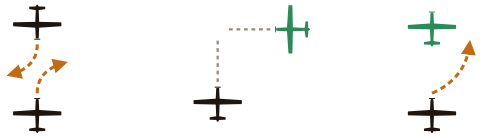
§91.125

| SIGNAL | ON THE GROUND | IN FLIGHT |
|---|---|---|
| Steady green | Cleared for **takeoff** | Cleared to **land** |
| Flashing green | Cleared to **taxi** | **Return for landing** (then steady green) |
| Steady red | **Stop** | Give way & **keep circling** |
| Flashing red | Taxi **clear of the runway** | Airport unsafe — **do not land** |
| Flashing white | Return to **starting point** | — |
| Alternating red/green | **Extreme caution** | **Extreme caution** |

**Acknowledge:** on the ground — move ailerons or rudder (day), blink landing/nav lights (night). In flight — rock your wings (day), blink lights (night).

## RIGHT-OF-WAY

§91.113



**HEAD-ON** both turn right · **CONVERGING** one on the right has it · **OVERTAKING** pass on the right

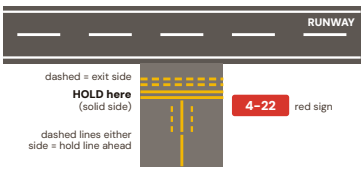
- **Distress** beats everyone.
- Order: **balloon › glider › towing/refueling › airship › other powered aircraft**.
- **Landing**: aircraft on final beat those in flight or on the ground; the **lower** one wins — but don't cut in.

## AIRPORT SIGNS

AIM 2-3-7 – 2-3-13

- **4-22** — **Runway holding position** — mandatory — hold here unless cleared
- **ILS** — **ILS critical area** — mandatory — hold when instructed
- **4-APCH** — **Approach area hold** — mandatory — protects the approach
- **No entry** — aircraft may not enter
- **B** — **Taxiway location** — you are ON taxiway B
- **22** — **Runway location** — you are ON runway 22
- **B →** — **Direction** — taxiway B is to the right
- **FBO ↗** — **Destination** — way to a place on the airport
- **4** — **Distance remaining** — 4,000 ft of runway left
- **Runway boundary** — you're clear of the runway when past it
- **ILS critical area boundary** — clear of the ILS area
- **NO RUNUP** — **Information** — local procedures, frequencies

## MARKINGS



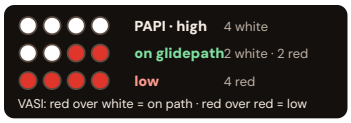

- Runway markings **white**, taxiway markings **yellow**.
- **Displaced threshold** (white arrows): taxi, takeoff either way, landing from the opposite direction — don't touch down on it.
- **Yellow chevrons** (blast pad): no taxi, takeoff, or landing.
- **X** = closed. **ILS critical area** = yellow "ladder."

## LIGHTING

### ROTATING BEACON

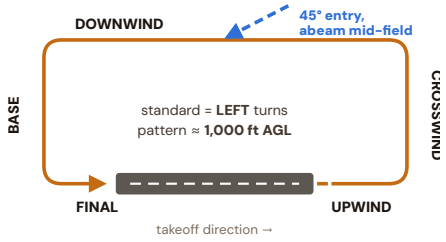
- land airport
- water airport
- heliport
- military (two white flashes)

On in the daytime in a surface area? Often < 3 SM or a ceiling < 1,000 ft — but don't count on it.




- Edge lights **white** (instrument runways: yellow on the last 2,000 ft or half, whichever is less) · threshold **green** · runway end **red** · taxiway edge **blue**, centerline **green**.
- **Pilot-controlled lighting:** key the mic 7× high, 5× medium, 3× low within 5 sec; stays on 15 min. AIM 2-1-8

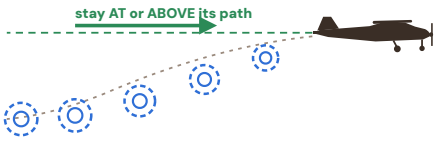
## TRAFFIC PATTERN




Non-towered: self-announce on CTAF from ~10 miles out. AC 90-66C

## WAKE TURBULENCE

AIM 7-4




vortices sink several hundred fpm, leveling off **~500–900 ft below** the flight path · strongest behind **heavy, clean, slow** aircraft

Created by lift: rotation → touchdown. Land **beyond** its touchdown point; take off **before** its rotation point. Worst: a light quartering **tailwind**.

## TALKING TO THE TOWER

- **Class D:** radio contact before entering. Tower in Class E/G: **before 4 NM**, up to 2,500 ft AGL. §91.126–.129
- ATC must get a **readback** of every runway hold-short instruction.
- **LAHSO**: you can always say "unable." Student pilots shouldn't accept.
- Squawk **1200** VFR · report "with information **Bravo**" (ATIS).

## DPE ASKS

**"Flashing red light gun signal while you're on final?"**

Airport unsafe — **do not land**.

## PART 91 RULES THEY LOVE TO ASK

- §91.3 — PIC is the final authority; in an emergency you may deviate from Part 91 as needed (written report if asked).
- §91.7 — PIC decides if it's safe to fly — and ends the flight if it stops being airworthy.
- §91.13 — No careless or reckless operation — in the air or on the ground.
- §91.15 — Dropping objects is OK only if it can't hurt people or property.
- §91.107 — Brief passengers on belts; belts on for taxi, takeoff & landing (under 2 may be held).
- §91.111 — Formation flight only by prior arrangement — never with paying passengers.
- §91.123 — Follow ATC clearances; deviate only in an emergency or for a TCAS resolution advisory — then tell ATC.
- §91.209 — Position lights sunset → sunrise. Anticollision lights on whenever operating (off if safer).
- §91.303 — Aerobatics: not over congested areas or crowds, not in surface areas or within 4 NM of an airway, not below 1,500 ft AGL or under 3 SM visibility.
- §91.307 — Carrying anyone but crew? **Everyone** wears a parachute for intentional maneuvers past 60° bank or 30° pitch (exceptions: flight tests, CFI spin training).
- §91.17 — Alcohol: 8 hrs · BAC < 0.04 · not impaired; don't carry an intoxicated passenger (except a medical patient).
- §91.151 — VFR fuel: +30 min day, +45 min night at normal cruise.

# 13 Emergencies & Night

*Fly the airplane first.*

## ENGINE FAILURE — ABCDE (ALWAYS YOUR POH CHECKLIST)

**A — Airspeed**
pitch for best glide ($V_G$) and trim — first, always

**B — Best field**
pick a spot within glide range, into the wind if you can

**C — Checklist**
restart: fuel selector, mixture rich, carb heat on, mags, fuel pump, primer locked

**D — Declare**
"MAYDAY" on your frequency or 121.5 · squawk 7700 (unless ATC already gave you a code) · brief passengers

**E — Execute**
secure it: fuel off, mixture cutoff, mags off, master off after flaps · doors unlatched · land

## GETTING HELP

AIM 6-1, 6-3

- **MAYDAY** = distress: grave, imminent danger. **PAN-PAN** = urgency: safety concern, not immediate.
- Doubtful about position, fuel or weather? That's already urgency — **ask for help early**.
- Squawk **7700** emergency · **7600** lost comms · **7500** hijack · **121.5** MHz guard.

## AUTHORITY & REPORTS

- In an emergency the PIC may deviate from any Part 91 rule as needed — written report only if the FAA asks. §91.3
- Given ATC priority? You may be asked for a report within **48 hrs**. §91.123(d)
- **NASA ASRS** report within **10 days** of an inadvertent violation: no civil penalty or suspension — if not deliberate, no accident or crime, no competency issue, and no violation in the past 5 years. AC 00-46

## OTHER EMERGENCIES

- **Lost comms (VFR):** squawk 7600, stay VFR, land at the nearest suitable airport; at a tower, watch for light signals.
- **Inadvertent IMC:** trust the instruments, wings level, gentle 180° standard-rate turn back to VFR — ask ATC for help.
- **Fire:** POH memory items. Electrical → master off; engine → fuel & mixture off; land ASAP.
- **Alternator / vacuum failure:** see Systems.

## NTSB PART 830 — ACCIDENTS & INCIDENTS

49 CFR 830

**Accident** = between boarding with intent to fly and everyone getting off: someone dies or is **seriously injured**, or the airplane gets **substantial damage**.

### SERIOUS INJURY

- Hospitalized > 48 hrs (starting within 7 days)
- Any broken bone (except simple finger, toe, or nose fractures)
- Severe bleeding, nerve, muscle, or tendon damage · internal organs
- Any 2nd/3rd-degree burns, or burns over 5% of the body

### NOT "SUBSTANTIAL" DAMAGE

One failed engine, bent fairings/cowling, dented skin, small punctured holes, ground damage to props, gear, wheels, tires, flaps, brakes, wingtips.

### NOTIFY THE NTSB IMMEDIATELY

- Any accident
- Flight-control system malfunction
- A crewmember can't do the job (illness/injury)
- In-flight fire · in-flight collision
- Damage to other property > $25,000
- Overdue aircraft believed in an accident

### WRITTEN REPORT (FORM 6120.1)

Within **10 days** of an accident · **after 7 days** if an overdue aircraft is still missing · incidents only if asked. Don't move the wreckage except to help people or prevent more damage.

## ELT

- Older ELTs: 121.5/243 MHz. **406 MHz** units are the ones satellites detect (with a 121.5 homing signal).
- Test per the manufacturer; analog units only in the first 5 min after the hour, ≤ 3 sweeps. AIM 6-2-4
- Hear an ELT on 121.5 after landing? Check it isn't yours.

## DPE ASKS

**"Ground loop, bent wingtip, nobody hurt. NTSB report?"**

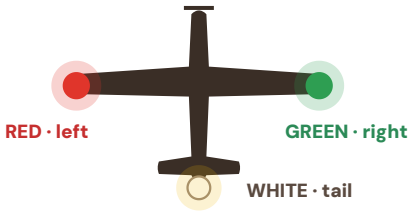
**No** — damage limited to a wingtip isn't "substantial," and with no injuries it isn't an accident.

## THE THREE "NIGHTS"




Anticollision lights (beacon/strobes), if installed, stay on whenever you operate — day or night — unless the PIC turns them off for safety. §91.209(b)

## POSITION LIGHTS




## FLYING AT NIGHT

- Equipment: everything for day + **FLAPS** (fuses, landing light if for hire, anticollision, position lights, power source).
- Illusions: autokinesis, false horizon, **black-hole approach** — fly the VASI/PAPI.
- Pick routes over lit areas & airports; carry a flashlight; brief what you'll do if the engine quits.

## TRAP

"Night" has **three** meanings: **lights** sunset→sunrise, **logging** civil twilight→civil twilight, **passenger landings** 1 hr after sunset → 1 hr before sunrise.

## SCENARIO DRILL — EXAMINERS LOVE "WHAT WOULD YOU DO?"

**"4,500 ft, 15 NM from the nearest airport. Oil pressure is dropping and oil temp is climbing."**

1. Treat it as an engine failure on its way — fly the airplane.
2. Turn toward the nearest suitable airport; keep your altitude — it's glide range.
3. Use only the power you need; pick fields along the route.
4. Declare now (PAN-PAN at least, MAYDAY if it quits); brief passengers; land as soon as possible.

**"Night cross-country. The low-voltage light comes on 30 minutes from home."**

1. Confirm: ammeter discharging = you're on battery alone.
2. Checklist: shed nonessential load; one reset attempt.
3. Tell ATC while the radio works; head for the nearest suitable **lighted** airport.
4. Expect electric flaps, lights & radios to fade — the engine keeps running.

EMERG

THE CLASSIC ORAL QUESTIONS, WITH SHORT ANSWERS

# Rapid-Fire 40

*Cover the right side. Answer out loud.*

Answer each one **out loud, in full sentences** — then add the "why." The examiner will always ask one more question than you expect.

1. **What documents must be on board?**
   ARROW — airworthiness cert, registration, radio license (international only), operating limitations (POH/AFM, placards), weight & balance.
2. **What inspections make it legal for a VFR flight?**
   Annual (12 cal mo), 100-hour if used for hire, transponder (24 cal mo), ELT (12 cal mo), and every applicable AD.
3. **What equipment is required for day VFR?**
   A TOMATO FLAMES — §91.205(b).
4. **...and at night?**
   Everything for day plus FLAPS: fuses, landing light (for hire), anticollision lights, position lights, power source.
5. **Something's inop and there's no MEL. Can you go?**
   Only if it isn't required (type cert, equipment list/KOEL, §91.205, an AD) — then remove or deactivate it, placard it INOP, and decide it's safe.
6. **What can't you do as a private pilot?**
   Act as PIC for compensation or hire. You may share costs — paying at least your pro rata share.
7. **What do you need to carry passengers?**
   3 takeoffs & landings in 90 days; at night, 3 to a full stop between 1 hr after sunset and 1 hr before sunrise.
8. **When is your flight review due?**
   Every 24 calendar months — at least 1 hr ground + 1 hr flight with a CFI.
9. **How long is your medical good for?**
   For private privileges: 60 calendar months if under 40 at the exam, 24 if 40 or older.
10. **What are the BasicMed limits?**
    ≤ 6 passengers, aircraft ≤ 7 seats & ≤ 12,500 lb, ≤ 18,000 MSL, ≤ 250 KIAS, not for hire.
11. **Complex vs. high-performance?**
    Complex: retractable gear + flaps + controllable-pitch prop. High-performance: more than 200 hp. Each needs a one-time endorsement.
12. **VFR fuel requirements?**
    Enough to reach your first landing point + 30 min (day) or 45 min (night) at normal cruise.
13. **What do you need to enter Class C?**
    Two-way radio contact established (ATC uses your call sign), Mode C and ADS-B Out.
14. **...and Class B?**
    A clearance — "cleared into the Class Bravo" — Mode C, ADS-B Out, and a private certificate (or endorsed student).
15. **VFR minimums in Class E below 10,000 MSL?**
    3 SM; 500 below, 1,000 above, 2,000 horizontal.
16. **Class G, day, at or below 1,200 AGL?**
    1 SM and clear of clouds.
17. **Which cruising altitude?**
    Above 3,000 AGL: magnetic course 0–179° = odd thousands + 500; 180–359° = even + 500.
18. **What are the speed limits?**
    250 KIAS below 10,000 MSL; 200 KIAS at/below 2,500 AGL within 4 NM of a C/D airport and under a Class B shelf.
19. **When do you need oxygen?**
    Crew: above 12,500 for more than 30 min, always above 14,000. Above 15,000 everyone must be provided $O_2$.
20. **Minimum altitude over a city?**
    1,000 ft above the highest obstacle within 2,000 ft horizontally.
21. **Steady red light gun signal in flight?**
    Give way to other aircraft and keep circling.
22. **Who has right-of-way when converging?**
    The aircraft on the right. By category: balloon › glider › towing/refueling › airship › other powered aircraft.
23. **What is a ceiling?**
    The lowest broken or overcast layer — or the vertical visibility into an obscuration.
24. **What does a thunderstorm need?**
    Moisture, unstable air, and a lifting action.
25. **The three thunderstorm stages?**
    Cumulus (updrafts) → mature (rain, up- & downdrafts — the worst) → dissipating (downdrafts).
26. **AIRMET Sierra, Tango, Zulu?**
    Sierra: IFR & mountain obscuration · Tango: turbulence, strong surface winds, LLWS · Zulu: icing & freezing levels.
27. **The four kinds of weather briefing?**
    Standard, abbreviated, outlook, inflight.
28. **What raises density altitude — and so what?**
    High elevation, heat, humidity. Longer takeoff roll, weaker climb, longer landing roll.
29. **What is $V_A$?**
    Maneuvering speed — one full, abrupt input in one axis won't overstress it; combined or reversing inputs can. It drops as weight drops.
30. **Effects of a forward CG?**
    More stable, higher stall speed, slower cruise, harder to rotate and flare.
31. **What causes every stall?**
    Exceeding the critical angle of attack — at any airspeed, attitude, or power.
32. **The four left-turning tendencies?**
    Torque, P-factor, spiraling slipstream, gyroscopic precession.
33. **Load factor in a 60° bank?**
    2 G — and stall speed rises about 41%.
34. **The alternator quits — now what?**
    You're on battery: shed load, tell ATC, land soon. With magnetos, the engine keeps running.
35. **Carb ice — symptoms and fix?**
    Fixed-pitch: RPM drops, then roughness. Carb heat: RPM dips further, then rises as the ice melts.
36. **Static port blocked?**
    Altimeter freezes, VSI reads zero, airspeed reads low climbing and high descending.
37. **The four types of hypoxia?**
    Hypoxic, hypemic, stagnant, histotoxic.
38. **IMSAFE and PAVE?**
    Illness, Medication, Stress, Alcohol, Fatigue, Emotion · Pilot, Aircraft, enVironment, External pressures.
39. **Engine fails in cruise — first steps?**
    Airspeed (best glide), Best field, Checklist, Declare, Execute.
40. **When must you notify the NTSB?**
    Immediately after an accident (death, serious injury, substantial damage) or a listed serious incident. Written report within 10 days of an accident (incident: only if asked).

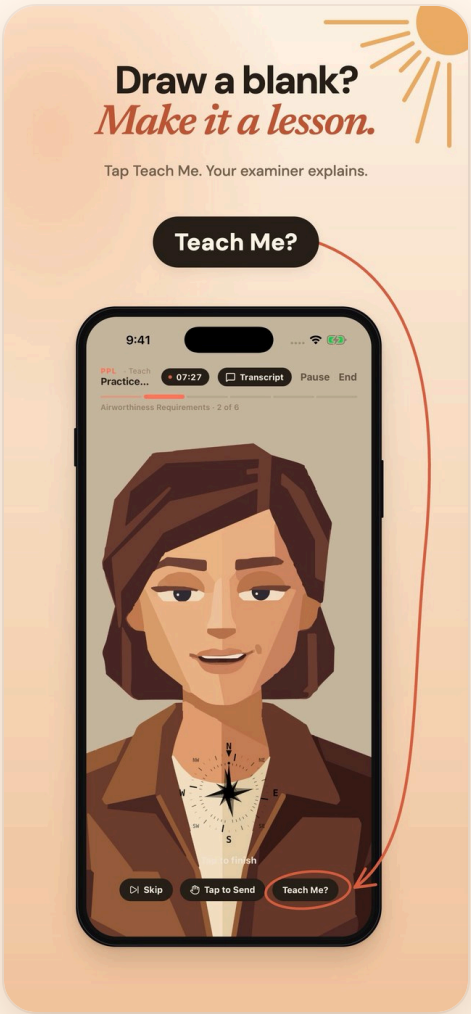
## CHECKRIDE DAY — WHAT TO BRING

- ☐ Government photo ID
- ☐ Logbook with every required endorsement
- ☐ ARROW docs + maintenance logbooks
- ☐ Plotter & E6B (or electronic)
- ☐ Headset · examiner fee · glasses if required
- ☐ Student pilot certificate
- ☐ Knowledge test report
- ☐ POH / AFM
- ☐ Your XC: nav log, weather, W&B, performance
- ☐ Medical — or BasicMed: license + CMEC + course cert
- ☐ IACRA application done (FTN + password)
- ☐ Current sectional & Chart Supplement (or EFB)
- ☐ View-limiting device (hood/foggles) — you supply it

YOUR NEXT STEP

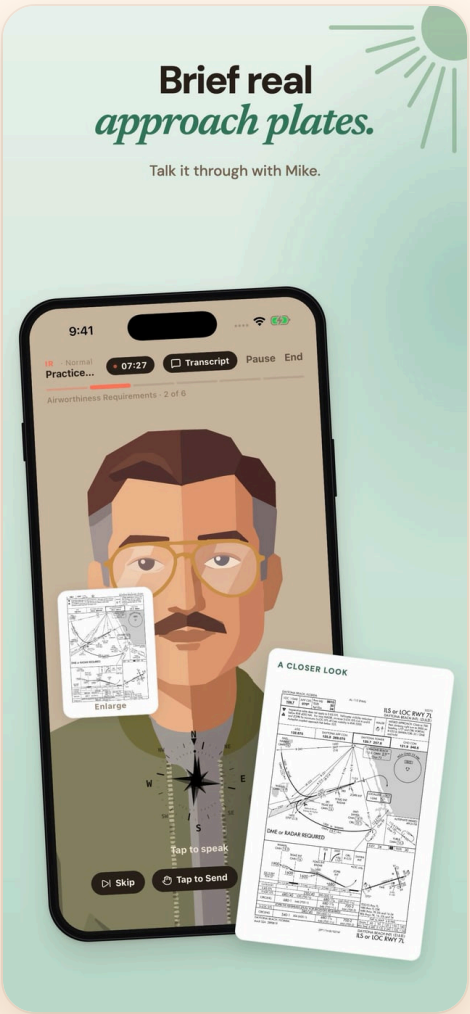
# Reading isn't the checkride. *Talking is.*

Your examiner won't hand you this guide. They'll ask, listen, and dig: *"Why?" "What if?" "Show me where that's written."* The most important thing you can do is practice your oral **out loud, back and forth** — so the answers come out smooth on checkride day. That's why PocketDPE exists.










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