

SESSION 8: WEATHER HAZARDS — THUNDERSTORMS, MICROBURSTS, AND CONVECTIVE SIGMETS

1. Three conditions must be present simultaneously for thunderstorm development. Which set is correct?
 - A. Stable air, calm winds, and high pressure
 - B. Sufficient moisture, a lifting mechanism, and atmospheric instability
 - C. Low humidity, a temperature inversion, and clear skies
 - D. Cold surface temperatures, descending air, and dry conditions

2. During the cumulus stage of a thunderstorm, the dominant air motion is:
 - A. Downdrafts throughout the cell
 - B. Updrafts throughout the cell
 - C. Equal updrafts and downdrafts
 - D. Horizontal outflow at the surface

3. The most intense and dangerous phase of a thunderstorm's life cycle is the:
 - A. Mature stage, with simultaneous updrafts and downdrafts
 - B. Cumulus stage, with rapid vertical growth
 - C. Dissipating stage, with lingering anvil
 - D. Pre-cumulus stage, before any cloud forms

4. Surface precipitation first reaches the ground at the beginning of which stage?

- A. The mature stage
- B. The cumulus stage
- C. The dissipating stage
- D. The pre-storm stage

5. A microburst on an approach produces which dangerous encounter sequence?

- A. Steady tailwind throughout the entire encounter
- B. Constant updraft with no airspeed change
- C. Increasing headwind only, with no downdraft
- D. Initial headwind increase, then downdraft, then tailwind component

6. The FAA recommends avoiding a thunderstorm by at least:

- A. 5 nautical miles
- B. 10 nautical miles
- C. 20 nautical miles
- D. 50 nautical miles

7. Hail can be ejected from a thunderstorm and fall in clear air several miles away because:

- A. Hail forms outside the cloud in the surrounding clear air
- B. Hail is light enough to drift on surface winds
- C. The upper-level outflow jet from the anvil carries it away from the cell
- D. Hail only falls directly beneath the storm core

8. An embedded thunderstorm is especially hazardous to IFR pilots because it is:

- A. Visually obscured within a larger stratiform cloud layer
- B. Always located above the aircraft's service ceiling
- C. Confined to the dissipating stage only
- D. Detectable by the naked eye in all conditions

9. During the mature stage, updrafts in an intense cell may reach:

- A. 500 to 1,000 feet per minute
- B. 1,000 to 2,000 feet per minute
- C. 6,000 to 8,000 feet per minute
- D. Less than 500 feet per minute

10. Low-level wind shear associated with a thunderstorm is produced at the:

- A. Anvil top as it spreads downwind
- B. Center of the updraft column
- C. Gust front, the leading edge of the cold downdraft outflow
- D. Top of the cumulonimbus during the cumulus stage

11. When the anvil of a thunderstorm points downwind, it generally indicates:

- A. A vigorous cell with active updrafts still supporting the anvil
- B. The cell is in its dissipating stage
- C. The storm poses no remaining hazard
- D. The cell has not yet reached the mature stage

12. Severe turbulence capable of structural failure can exist:

- A. Only directly within the visible cloud
- B. Within several miles of a mature cell, even in clear air
- C. Only beneath the storm's precipitation core
- D. Exclusively in the dissipating stage

13. A Convective SIGMET is issued for thunderstorms covering at least what portion of a 3,000-square-mile area?

- A. 25%
- B. 40%
- C. 60%
- D. 75%

14. The dissipating stage of a thunderstorm begins when:

- A. Updrafts first exceed downdrafts in strength
- B. Precipitation first reaches the surface
- C. Downdrafts dominate throughout the cell, cutting off the moisture supply
- D. The anvil first becomes visible

15. Why is the transition from headwind to tailwind during a microburst encounter so dangerous on approach?

- A. It causes the engine to lose power immediately
- B. The loss of headwind reduces lift when the aircraft can least afford it
- C. It triggers an automatic autopilot disconnect
- D. It has no aerodynamic significance at approach speeds

16. Icing within the supercooled liquid water region of a cumulonimbus is:

- A. Negligible due to the high temperatures inside the cell
- B. Limited to light rime only
- C. Present only during the dissipating stage
- D. Among the most intense icing rates anywhere in the atmosphere

17. The regulatory standard regarding thunderstorm penetration is that no pilot shall:

- A. Fly into a thunderstorm
- B. Fly within 50 miles of any cumulus cloud
- C. Operate IFR when any AIRMET is active
- D. Climb above 10,000 feet in convective conditions

18. A microburst is typically less than how wide in horizontal extent?

- A. 10 nautical miles
- B. 5 nautical miles
- C. 7.5 nautical miles
- D. 2.5 nautical miles

19. Lightning in a thunderstorm is most intense during the:

- A. Cumulus stage
- B. Pre-storm stage
- C. Mature stage
- D. Dissipating stage

20. When PIREPs, SIGMETs, or other products indicate embedded convective activity along a route, the appropriate response is:

- A. Penetrate the area at reduced airspeed
- B. Climb above the cloud layer to avoid the embedded cells
- C. Use the weather radar to thread between the cells
- D. Divert or delay rather than penetrate

21. A tornado, as a thunderstorm hazard, is most associated with which storm type?

- A. A fair-weather cumulus cloud
- B. A supercell thunderstorm
- C. A dissipating stratiform layer
- D. A stable, layered overcast

22. Downdrafts produced by precipitation drag and evaporative cooling in a mature cell can reach:

- A. Less than 200 feet per minute
- B. About 500 feet per minute
- C. Approximately 1,000 feet per minute
- D. 2,500 feet per minute or more

23. A complete answer to "what hazards does a thunderstorm produce?" should include:

- A. Severe turbulence, hail, lightning, icing, microbursts, tornadoes, and wind shear
- B. Only severe turbulence and lightning
- C. Only hail and heavy precipitation
- D. Only low-level wind shear at the surface

24. An anvil-top thunderstorm is NOT necessarily dissipating because:

- A. Anvils form only during the dissipating stage
- B. A downwind-pointing anvil can indicate active updrafts still feeding the cell
- C. Anvils always indicate the storm is weakening
- D. The presence of an anvil means precipitation has ceased

25. The fundamental rule for any thunderstorm, regardless of its apparent stage, is to:

- A. Penetrate only the dissipating cells
- B. Fly directly beneath the anvil to avoid the core
- C. Maintain altitude and ride through the turbulence
- D. Never attempt to penetrate it

ANSWER KEY & EXPLANATIONS – SESSION 8

1. B. Moisture/lift/instability — Thunderstorms require sufficient moisture, a lifting mechanism, and atmospheric instability simultaneously.

2. B. Updrafts dominant — In the cumulus stage, updrafts dominate throughout the cell.

3. A. Mature stage — The mature stage, with simultaneous updrafts and downdrafts, is the most intense and dangerous phase.

4. A. Mature stage — Surface precipitation reaching the ground marks the beginning of the mature stage.

5. D. Headwind/downdraft/tailwind — A microburst encounter produces an initial headwind increase, then a downdraft, then a tailwind component.

6. C. 20 NM — The FAA recommends avoiding thunderstorms by at least 20 nautical miles.

7. C. Anvil outflow jet — The upper-level outflow jet from the anvil can eject hail several miles from the cell into clear air.
8. A. Obscured in stratiform — An embedded thunderstorm is visually obscured within a larger stratiform layer, making it invisible without radar or datalink.
9. C. 6,000–8,000 fpm — Updrafts in an intense mature cell may reach 6,000 to 8,000 feet per minute.
10. C. Gust front — Low-level wind shear is produced at the gust front, the leading edge of the cold downdraft outflow.
11. A. Vigorous, active updrafts — A downwind-pointing anvil indicates a vigorous cell with active updrafts still supporting it.
12. B. Within miles, clear air — Structural-failure-level turbulence can exist within several miles of a mature cell, even in clear air.
13. B. 40% — A Convective SIGMET is issued for thunderstorms covering at least 40% of a 3,000-square-mile area.
14. C. Downdrafts dominate — The dissipating stage begins when downdrafts dominate throughout the cell, cutting off the moisture supply.
15. B. Lift loss on approach — The headwind-to-tailwind transition reduces lift when the aircraft can least afford it during approach.
16. D. Most intense icing — Icing in the supercooled liquid water region of a cumulonimbus is among the most intense anywhere in the atmosphere.
17. A. No flight into TS — The regulatory standard is that no pilot shall fly into a thunderstorm.

18. D. Under 2.5 NM — A microburst is typically less than 2.5 nautical miles in horizontal extent.
19. C. Mature stage — Lightning is most intense during the mature stage.
20. D. Divert or delay — Indications of embedded convection call for diversion or delay rather than penetration.
21. B. Supercell — Tornadoes are most associated with supercell thunderstorms.
22. D. 2,500 fpm or more — Mature-cell downdrafts can reach 2,500 feet per minute or more.
23. A. Full inventory — A complete answer includes severe turbulence, hail, lightning, icing, microbursts, tornadoes, and wind shear.
24. B. Active updrafts possible — An anvil-top storm may still have active updrafts (downwind-pointing anvil), so it is not necessarily dissipating.
25. D. Never penetrate — The fundamental rule is never to attempt to penetrate a thunderstorm regardless of its apparent stage.