
# AVIATION HIGH SCHOOL

**Instructor Resources** | Answer Keys

Brittany D. Hagen, Sarah K. Anderson, Leslie M. Martin, and Paul R. Snyder

AVIATION SUPPLIES & ACADEMICS, INC.
NEWCASTLE, WASHINGTON

# AVIATION HIGH SCHOOL

**Instructor Resources** | Answer Keys

Brittany D. Hagen, Sarah K. Anderson, Leslie M. Martin, and Paul R. Snyder

*Aviation High School Facilitator Guide—Instructor Resources: Answer Keys*
by Brittany D. Hagen, Sarah K. Anderson, Leslie M. Martin, and Paul R. Snyder

Copyright © 2021 Aviation Supplies & Academics, Inc.

Aviation Supplies & Academics, Inc.
7005 132nd Place SE
Newcastle, Washington 98059
asa@asa2fly.com | 425-235-1500 | asa2fly.com

All rights reserved.

The material contained herein is intended for use in conjunction with the *Aviation High School Facilitator Guide* (ASA-AVHS-FG) and *Aviation High School Student Notebook* (ASA-AVHS-SN) by Brittany D. Hagen, Sarah K. Anderson, Leslie M. Martin, and Paul R. Snyder.

Additional resources for instructors using *Aviation High School* in their classrooms are available at: **www.asa2fly.com/instructor/avhsfg**

Cover images—Top: iStock.com/yongyuan. Bottom row (left to right): iStock.com/Jetlinerimages; iStock.com/Jetlinerimages; Pixabay; iStock.com/Dushlik; Mr. teerapon tiuekhom/Shutterstock.com.

# CONTENTS

# CHAPTER 1

## AVIATION TRAINING REQUIREMENTS

### LESSON 1, Activity 3

### Student versus Private Pilot Questions (Student Notebook)

1. A student pilot is someone who is learning how to become a private pilot. This is very similar to getting a car driver's permit compared to a full driver's license.
2. No.
3. During the day: 3 SM. At night: 5 SM.
4. No.
5. No.
6. No, it is greater than 25 NM, which means it's a cross-country. A student pilot needs a cross-country endorsement to go on a flight greater than 25 NM.
7. A flight instructor must give the student pilot an endorsement to go on this flight.
8. 17 years old
9. An oral exam and a flight exam
10. Total flight time required to become a private pilot: 40 hours (Reference §61.109)
    a. an authorized instructor
        i. cross-country
        ii. night training
        iii. sole reference to instruments
    b. solo flight
        i. cross-country
11. No, you would be operating as a commercial pilot.
12. Carry passengers; fly internationally; go on cross-country flights; fly as pilot-in-command of a flight for charitable, nonprofit, or community events.
13. Aeronautical knowledge areas are listed under 14 CFR §61.105 and flight proficiency items are under 14 CFR §61.107.

    **§61.105 Aeronautical knowledge.**

    (a) General. A person who is applying for a private pilot certificate must receive and log ground training from an authorized instructor or complete a home-study course on the aeronautical knowledge areas of paragraph (b) of this section that apply to the aircraft category and class rating sought.

    (b) Aeronautical knowledge areas.

    (1) Applicable Federal Aviation Regulations of this chapter that relate to private pilot privileges, limitations, and flight operations;

    (2) Accident reporting requirements of the National Transportation Safety Board;

(3) Use of the applicable portions of the "Aeronautical Information Manual" and FAA advisory circulars;

(4) Use of aeronautical charts for VFR navigation using pilotage, dead reckoning, and navigation systems;

(5) Radio communication procedures;

(6) Recognition of critical weather situations from the ground and in flight, windshear avoidance, and the procurement and use of aeronautical weather reports and forecasts;

(7) Safe and efficient operation of aircraft, including collision avoidance, and recognition and avoidance of wake turbulence;

(8) Effects of density altitude on takeoff and climb performance;

(9) Weight and balance computations;

(10) Principles of aerodynamics, powerplants, and aircraft systems;

(11) Stall awareness, spin entry, spins, and spin recovery techniques for the airplane and glider category ratings;

(12) Aeronautical decision making and judgment; and

(13) Preflight action that includes -

(i) How to obtain information on runway lengths at airports of intended use, data on takeoff and landing distances, weather reports and forecasts, and fuel requirements; and

(ii) How to plan for alternatives if the planned flight cannot be completed or delays are encountered.

**§61.107 Flight proficiency.**

(a) General. A person who applies for a private pilot certificate must receive and log ground and flight training from an authorized instructor on the areas of operation of this section that apply to the aircraft category and class rating sought.

(b) Areas of operation.

(1) For an airplane category rating with a single-engine class rating:

(i) Preflight preparation;

(ii) Preflight procedures;

(iii) Airport and seaplane base operations;

(iv) Takeoffs, landings, and go-arounds;

(v) Performance maneuvers;

(vi) Ground reference maneuvers;

(vii) Navigation;

(viii) Slow flight and stalls;

(ix) Basic instrument maneuvers;

(x) Emergency operations;

(xi) Night operations, except as provided in § 61.110 of this part; and

(xii) Postflight procedures.

14. **§61.109 Aeronautical experience.**

    (a) *For an airplane single-engine rating.* Except as provided in paragraph (k) of this section, a person who applies for a private pilot certificate with an airplane category and single-engine class rating must log at least 40 hours of flight time that includes at least 20 hours of flight training from an authorized instructor and 10 hours of solo flight training in the areas of operation listed in §61.107(b)(1) of this part, and the training must include at least—

    (1) 3 hours of cross-country flight training in a single-engine airplane;

    (2) Except as provided in §61.110 of this part, 3 hours of night flight training in a single-engine airplane that includes—

    (i) One cross-country flight of over 100 nautical miles total distance; and

    (ii) 10 takeoffs and 10 landings to a full stop (with each landing involving a flight in the traffic pattern) at an airport.

    (3) 3 hours of flight training in a single-engine airplane on the control and maneuvering of an airplane solely by reference to instruments, including straight and level flight, constant airspeed climbs and descents, turns to a heading, recovery from unusual flight attitudes, radio communications, and the use of navigation systems/facilities and radar services appropriate to instrument flight;

    (4) 3 hours of flight training with an authorized instructor in a single-engine airplane in preparation for the practical test, which must have been performed within the preceding 2 calendar months from the month of the test; and

    (5) 10 hours of solo flight time in a single-engine airplane, consisting of at least—

    (i) 5 hours of solo cross-country time;

    (ii) One solo cross country flight of 150 nautical miles total distance, with full-stop landings at three points, and one segment of the flight consisting of a straight-line distance of more than 50 nautical miles between the takeoff and landing locations; and

    (iii) Three takeoffs and three landings to a full stop (with each landing involving a flight in the traffic pattern) at an airport with an operating control tower.

15. Fixed-base operators at various airports; flight schools; and flight training academies
16. Although it depends on the location, aircraft rental can range from $100–$300 per hour for most single-engine training aircraft. The price range will be impacted by such factors as age of aircraft, complexity of aircraft, technology available, and if fuel is included in the price.
17. Although it depends on the location, flight instructor rates will range from $30 per hour for independent flight instructors to up to $100 per hour, depending on aircraft type and type of instruction provided.

## LESSON 3, Activity 4

### Aviation Medicals Comprehension Questions (Student Notebook)

1. Generally, a first-class medical certificate is designed for the airline transport pilot. Further explanation can be found at 14 CFR §61.23(a)(1).
2. Generally, a second-class medical certificate is designated for the commercial pilot. Further explanation can be found in 14 CFR §61.23(a)(2).
3. Generally, a third-class medical certificate is designated for the student, recreational, and private pilot. Further explanation and exceptions can be found in 14 CFR §61.23.

4. A medical certificate is obtained by passing a physical examination administered by a doctor who is an FAA-authorized AME. There are approximately 6,000 FAA-authorized AMEs in the nation. To find an AME near you, go to the FAA's AME locator at **www.faa.gov/pilots/amelocator/**. Further guidance on how to obtain a medical certificate can be obtained on FAA's Medical Certification webpage.

5. Examples include events such as if you have a heart attack, have a stroke, or get arrested for driving under the influence of alcohol. A summary of medical standards can be found on the FAA's website.

6. Under 14 CFR Part 1, the FAA defines a medical certificate as "acceptable evidence of physical fitness on a form prescribed by the Administrator." The primary goal of the airman medical certification program is to protect not only those who would exercise the privileges of a pilot certificate but also air travelers and the general public. A person who meets FAA airmen medical standards, based on a medical examination and an evaluation of medical history, is entitled to a medical certificate without restriction or limitation other than the prescribed limitation as to its duration. Individuals required to hold a medical certificate must have it in their personal possession at all times when exercising the privileges for which they are licensed.
7. Most pilots must have a valid medical certificate to exercise the privileges of their airman certificates. Glider and free balloon pilots are not required to hold a medical certificate. Sport pilots may hold either a medical certificate or a valid state driver's license. Regardless of whether a medical certificate or driver's license is required, 14 CFR §61.53 requires every pilot not to act as a crewmember if they know, or have reason to know, of any medical condition that would make them unable to operate the aircraft in a safe manner.
8. A summary of medical standards and disqualifying medical conditions can be found on the "Medical Certification" section of the FAA website, **www.faa.gov**.

The FAA medical standards, 14 CFR Part 67, specify fifteen medical conditions that are considered disqualifying by "history or clinical diagnosis." Regardless of when one of these conditions was diagnosed and treated, an airman may not be issued a medical certificate except through a process called a "Special Issuance Authorization," as explained in 14 CFR §67.401. A special issuance is a discretionary issuance by the FAA Federal Air Surgeon and requires satisfactory completion of special testing determined by the FAA to demonstrate that an airman is safe to fly for the duration of the medical certificate issued.

Unless otherwise directed by the FAA, the Examiner must deny or defer if the applicant has a history of: (1) Diabetes mellitus requiring hypoglycemic medication; (2) Angina pectoris; (3) Coronary heart disease that has been treated or, if untreated, that has been symptomatic or clinically significant; (4) Myocardial infarction; (5) Cardiac valve replacement; (6) Permanent cardiac pacemaker; (7) Heart replacement; (8) Psychosis; (9) Bipolar disorder; (10) Personality disorder that is severe enough to have repeatedly manifested itself by overt acts; (11) Substance dependence; (12) Substance abuse; (13) Epilepsy; (14) Disturbance of consciousness and without satisfactory explanation of cause, and (15) Transient loss of control of nervous system function(s) without satisfactory explanation of cause.

However, this list includes only the mandatory disqualifying conditions. There are many other medical conditions that fall into the General Medical Condition section of the regulations that are considered by the FAA to be disqualifying even though they are not stated in the regulations. Conditions such as cancer, kidney stones, neurologic and neuromuscular conditions including Parkinson's disease and multiple sclerosis, certain

blood disorders, and other conditions that may progress over time require review by the FAA before a medical certificate may be issued. The important thing to remember is that with very few exceptions, all disqualifying medical conditions may be considered for special issuance. If you can present satisfactory medical documentation to the FAA that your condition is stable, the chances are good that you will be able to qualify for an Authorization.

9. There are no minimum or maximum ages for obtaining a medical certificate. Any applicant who is able to pass the exam may be issued a medical certificate. However, since 16 years is the minimum age for a student pilot certificate, people under 16 are unlikely to have practical use for an airman medical certificate.
10. No. Effective April 1, 2016, Aviation Medical Examiners (AMEs) are not authorized to issue combination Airman Medical and Student Pilot certificates to applicants.
11. Yes. You are prohibited from acting as pilot-in-command or as a required pilot flight crewmember during any medical deficiency that would be disqualifying or may interfere with the safe operation of an aircraft. For more information, see 14 CFR §61.53.
12. Yes, but you need to let your AME know that you had the surgery.
13. Yes. 14 CFR §67.409 sets forth the appeal process within the FAA for applicants who are denied medical certification. Within 30 days after the date of the denial, you may apply for reconsideration to the FAA Federal Air Surgeon.
14. You can call or write:

    Aerospace Medical Certification Division, AAM-300
    Federal Aviation Administration
    Civil Aerospace Medical Institute
    P.O. Box 25082
    Oklahoma City, OK 73125
    (405) 954-4821

    You can also contact the Regional Flight Surgeons' offices
15. You should submit AC Form 8060-56 (PDF) to:

    Federal Aviation Administration
    Aerospace Medical Certification Division, AAM-331
    ATTN: Duplicate Desk
    PO Box 26200
    Oklahoma City, Oklahoma 73125

    You must include a check or money order for $2.00 made payable to the FAA. The Aerospace Medical Certification Division can fax you a record of your certificate that is valid for no more than 60 days, which should be enough time to receive your replacement certificate. To receive this fax and order a duplicate certificate, call (405) 954-4821 and select option 3 to reach the duplicate certificate desk.

## LESSON 6

### Chapter 1 Exam

1. (b) Only the time when they are flying solo
2. (b) 25 NM
3. (c) 50 NM
4. (b) No
5. (a) Yes
6. (b) No
7. (a) Yes
8. (c) So the pilot can fly into the clouds
9. (b) 40
10. (a) First
11. (a) 12 calendar months
12. (b) False
13. (d) April 30, 2022

# CHAPTER 2

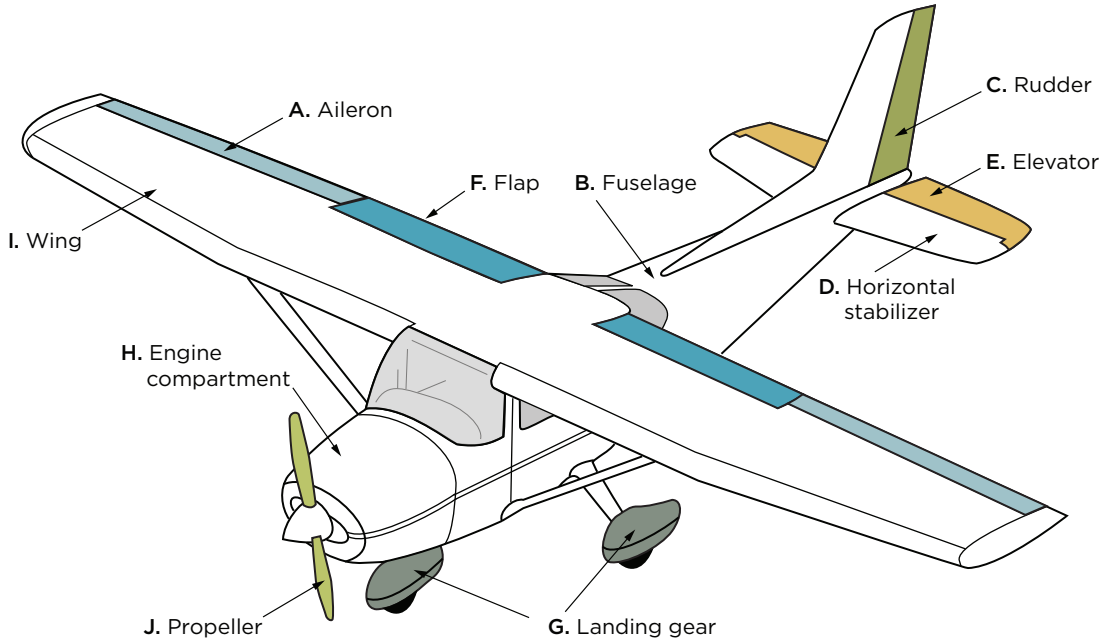
AIRCRAFT BASICS

## LESSON 1, Activity 1 and Activity 3

### Parts of an Airplane Pre-Test and Post-Test (Student Notebook)

1. The fuselage is the section of the airplane that consists of the cabin and/or cockpit, containing seats for the occupants and the controls for the airplane.
   a. Most modern single-engine aircraft feature all-metal construction. For example, in the Piper Archer II, the basic airframe, except for a tubular steel engine mount, steel landing gear struts, and other miscellaneous steel parts, is of aluminum alloy construction. The extremities (wing tips, cowling, tail surfaces) are of fiberglass or ABS thermoplastic.
2. An airfoil is the cross-section of any surface, such as a wing, propeller, rudder, or even a trim tab, which provides aerodynamic force when it interacts with a moving stream of air.
3. Flaps are the hinged portion of the trailing edge of the wing between the ailerons and fuselage. In some aircraft, ailerons and flaps are interconnected to produce full-span "flaperons." In either case, flaps change the lift and drag on the wing.
4. The ailerons are the primary flight control surfaces mounted on the trailing edge of an airplane wing, near the tip. Ailerons control roll about the longitudinal axis.
5. An empennage is the section of the airplane that consists of the vertical stabilizer, the horizontal stabilizer, and the associated control surfaces.
   a. Stabilizer—There are horizontal stabilizers and vertical stabilizers. The vertical stabilizer provides stability for the aircraft, preventing side-to-side (yawing) motion of the aircraft's nose. The rudder can be found on the vertical stabilizer (only the rudder moves). The horizontal stabilizer prevents up-and-down, or pitching, motion of the aircraft's nose. The elevator is found on the rear of the horizontal stabilizer.
   b. Stabilator—A single-piece horizontal tail surface on an airplane that pivots around a central hinge point. A stabilator serves the purposes of both the horizontal stabilizer and the elevators.
   c. Elevator—The horizontal, movable primary control surface in the tail section, or empennage, of an airplane. The elevator is hinged to the trailing edge of the fixed horizontal stabilizer. When the elevator moves, it varies the amount of force generated by the tail surface and is thus used to generate and control the pitching motion of the aircraft.
6. Trim is used to adjust the aerodynamic forces on the control surfaces so that the aircraft maintains the set attitude without any control input.
7. Landing gear supports the weight of the aircraft and supports the aircraft during landing.
8. The two types of landing gear configurations are conventional (tail wheel) and tricycle gear.
9. Rudder pedals

10. The powerplant is a complete engine and propeller combination with accessories.
    a. The powerplant can also serve as a source of heat, source for the vacuum system, alternator for the electrical system.
11. Parts of an airplane.




## LESSON 2, Activity 1

### Aircraft Flight Instruments—Round Dial Cockpit

1. A. Airspeed indicator—A differential pressure gauge that measures the dynamic pressure of the air through which the aircraft is flying. Displays the aircraft's airspeed, typically in knots, to the pilot.
   B. Attitude indicator—The foundation for all instrument flight, this instrument reflects the airplane's attitude in relation to the horizon.
   C. Altimeter—A flight instrument that indicates altitude by sensing pressure changes.
   D. Turn coordinator—A rate gyro that senses both roll and yaw due to the gimbal being canted. Has largely replaced the turn-and-slip indicator in modern aircraft. (The turn-and-slip indicator is a flight instrument consisting of a rate gyro to indicate the rate of yaw and a curved glass inclinometer to indicate the relationship between gravity and centrifugal force. The turn-and-slip indicator indicates the relationship between angle of bank and rate of yaw. Also called a turn-and-bank indicator.)
   E. Heading indicator—An instrument which senses airplane movement and displays heading based on a 360° azimuth, with the final zero omitted. The heading indicator, also called a directional gyro (DG), is fundamentally a mechanical instrument designed to facilitate the use of the magnetic compass. The heading indicator is not affected by the forces that make the magnetic compass difficult to interpret.
   F. Vertical speed indicator (VSI)—A rate-of-pressure change instrument that gives an indication of any deviation from a constant pressure level. The VSI indicates whether the aircraft is climbing, descending, or in level flight.

G. Magnetic compass—displays the current magnetic heading of the aircraft, *i.e.,* the aircraft's directional orientation relative to the Earth's magnetic field. The magnetic heading is used by the pilot for navigational purposes.

2. These instruments are located on the instrument panel in the aircraft's cockpit.
3. See answers to question 1 above.

## LESSON 8

### Chapter 2 Exam

1. Straight-and-level flight, turns, climbs, and descents
2. (c) Attitude indicator, altimeter, airspeed indicator
3. (c) 3,040 feet
4. (a) 075
5. (b) Nose of the aircraft is above the horizon
6. (c) The left wing is below the horizon and the right wing is above the horizon
7. (b) Horizontal component of lift
8. (a) Relieve
9. a. Heading indicator
   b. An instrument which senses airplane movement and displays heading based on a 360° azimuth, with the final zero omitted. The heading indicator, also called a directional gyro (DG), is fundamentally a mechanical instrument designed to facilitate the use of the magnetic compass. The heading indicator is not affected by the forces that make the magnetic compass difficult to interpret.
10. a. Altimeter
    b. A flight instrument that indicates altitude by sensing pressure changes.
11. a. Airspeed indicator
    b. A differential pressure gauge that measures the dynamic pressure of the air through which the aircraft is flying. Displays the aircraft's airspeed, typically in knots, to the pilot.
12. a. Attitude indicator
    b. The foundation for all instrument flight, this instrument reflects the airplane's attitude in relation to the horizon.
13. a. Vertical speed indicator (VSI)
    b. A rate-of-pressure change instrument that gives an indication of any deviation from a constant pressure level. The VSI indicates whether the aircraft is climbing, descending, or in level flight.
14. a. Turn coordinator
    b. A rate gyro that senses both roll and yaw due to the gimbal being canted. Has largely replaced the turn-and-slip indicator in modern aircraft.
15. a. Magnetic compass
    b. A device for determining direction measured from magnetic north

16. a. White arc: Flap operating speeds
    b. Green arc: Normal operating speeds
    c. Yellow arc: Caution range/speeds
    d. Red line: Never exceed speed
17. a. aileron
    b. fuselage
    c. rudder
    d. horizontal stabilizer
    e. elevator
    f. flaps
    g. landing gear
    h. engine compartment
    i. wing
    j. propeller
18. a. collective
    b. throttle
    c. cyclic

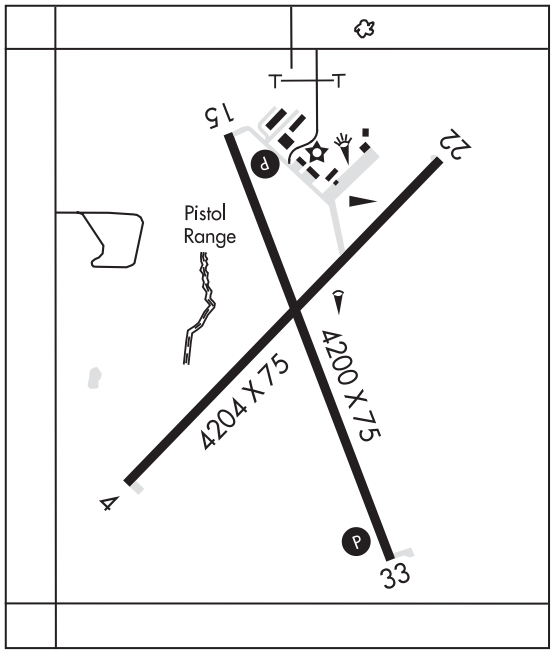
# CHAPTER 3

AIRPORT OPERATIONS

## LESSON 2, Activity 1

### PHAK Airport Operations Questions (Student Notebook)

1. Federal Aviation Regulations, enforced by the Federal Aviation Administration
2. whole numbers; white
3. magnetic
4. 16
5. 04
6. the runway heading
7. magnetic compass, heading indicator
8. three five
9. zero four
10. Runways should appear as shown:



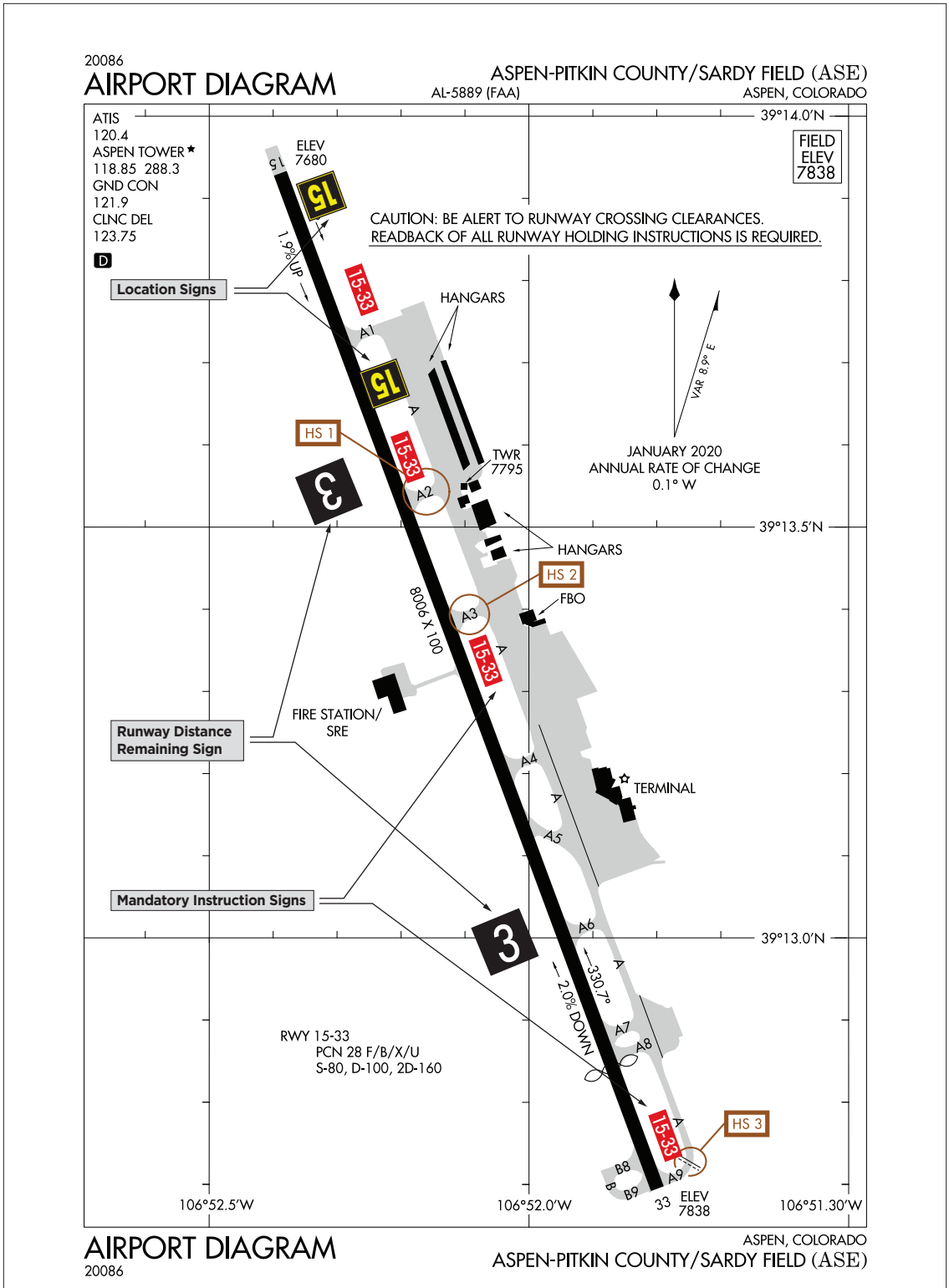

11. white
12. green
13. red
14. red; end
15. in-runway

16. white
17. Letters (e.g., A, B, C)
18. Airport diagram
19. Yellow
20. yellow, solid
21. black
22. black
23. blue; seen from all directions
24. green
25. holding position
26. taxiway side
27. Yes
28. Runway side
29. No
30. the hold short line
31. Common Traffic Advisory Frequency
32. white; red
33. Runway 31
34. is not (this is a blast pad)
35. displaced threshold; this can be used for taxiing, takeoff, emergency operations. It cannot be used for landing.
36. indicate it is night time
37. white; green
38. white; white; green
39. No
40. Yes

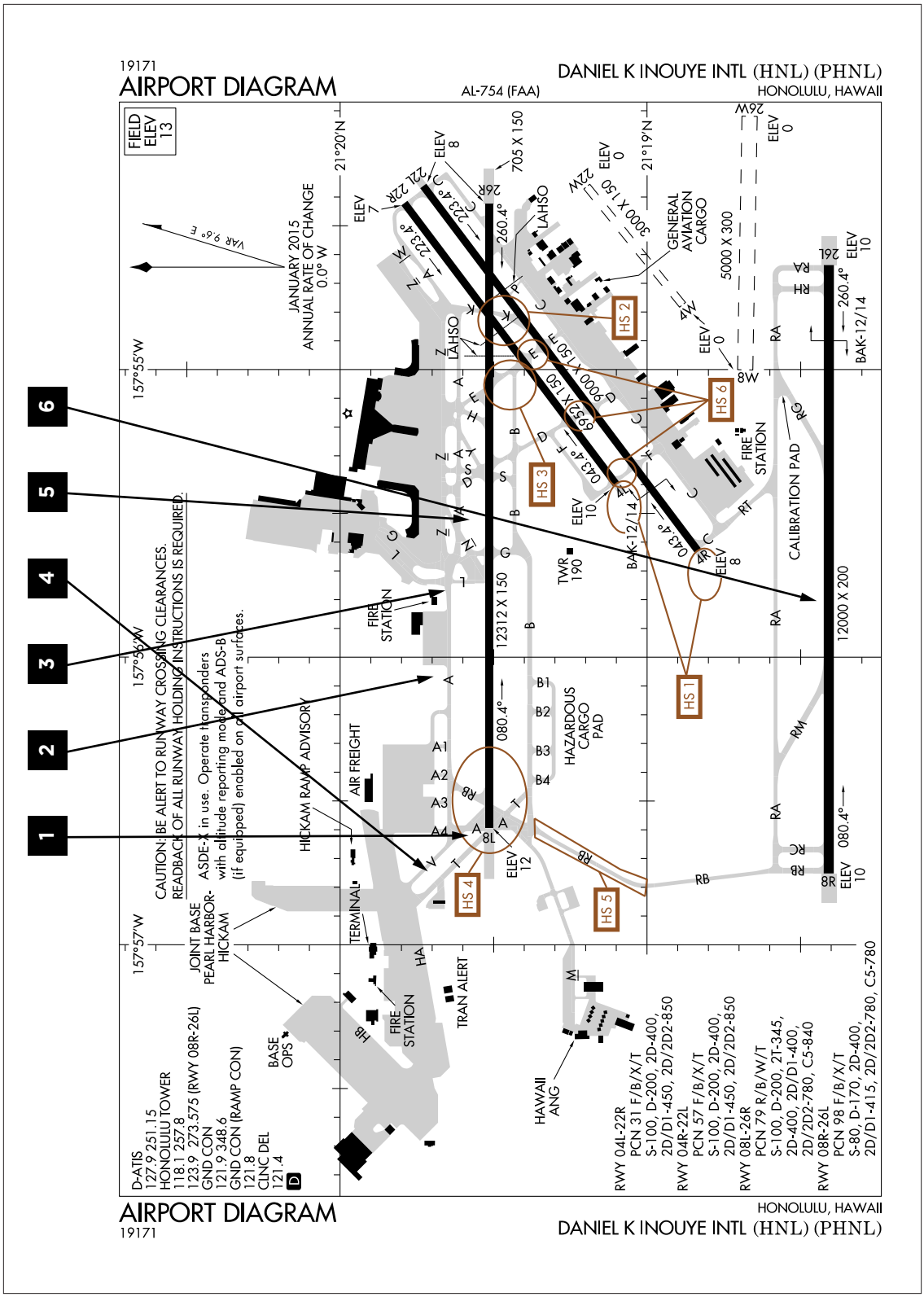
## LESSON 3, Activity 3

### Airport Diagrams (Student Notebook)

1. The student should place the three types of airport signs indicated (see examples in Aspen airport diagram on the next page). Note: there are actually six different types of airport signs: mandatory instruction signs, location signs, direction signs, destination signs, information signs, and runway distance remaining signs. (Reference *AIM* ¶*2-3-7*–¶*2-3-13*)




▶ Airport diagram for Aspen-Pitkin County Airport (KASE). *(FAA)*




▶ Airport diagram for Daniel K. Inouye International Airport (PHNL) in Honolulu, Hawaii. *(FAA)*

2. See the airport diagram for Daniel K. Inouye International Airport (PHNL) on the previous page for possible locations of the following signs. You may also refer to the *Aeronautical Information Manual* (AIM), ¶2-3-7–¶2-3-13, for details about these signs and their possible locations.
    1. Mandatory instruction sign
    2. Location sign
    3. Direction sign
    4. Destination sign
    5. Information sign
    6. Runway distance remaining sign

## LESSON 4, Activity 4

### Chart Supplement Airport Homework (Student Notebook)

1. 912 feet
2. 1,912 feet
3. High intensity
4. 132.4
5. 1,232 feet
6. 2,232 feet
7. High intensity
8. 122.7
9. Left
10. 896 feet
11. (b) Non-standard
12. (a) Standard
13. 3,300 feet (length) × 50 feet (width)
14. 1,896 feet
15. 122.7
16. Low Intensity
17. 3 clicks

## LESSON 9, Activity 1

### Study Guide Questions (Student Notebook)

1. **Departure (Upwind)**—you should continue on the departure leg of the traffic pattern until you are past the departure end of the runway and within 300 feet of traffic pattern altitude.

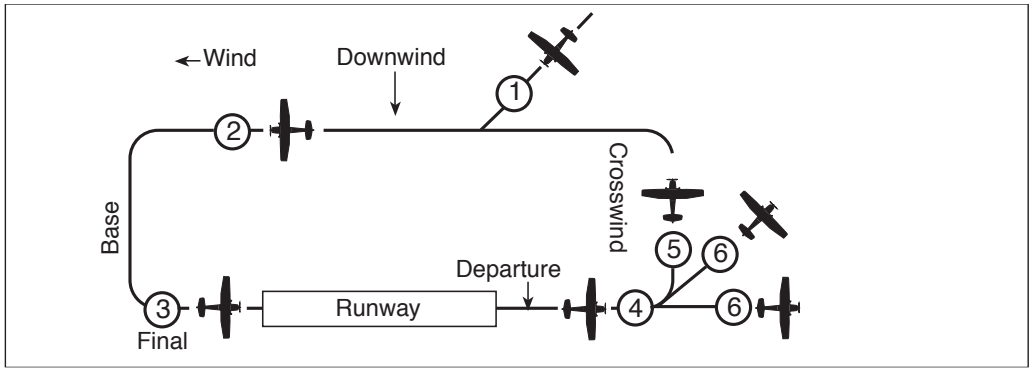
   **Crosswind**—you should be completing your climb to traffic pattern altitude and planning for your downwind leg.

   **Downwind**—you should be level, and at midfield downwind you need to start preparing for the landing. Abeam your touchdown point, you should pull some power out, add the first notch of flaps (depending on weather/wind), and begin a stabilized descent. When 45 degrees from the approach end of the runway, begin your turn onto the base leg.

   **Base leg**—add second notch of flaps and continue your stabilized descent. Your base to final turn should be made no closer than ¼ mile from the runway.

   **Final**—add remaining flaps and continue your stabilized approach to the runway.

   E**ntry Leg**—Entering into the traffic pattern (1) should be made while at traffic pattern altitude at the midfield downwind point on a 45-degree angle or as instructed by ATC.




***Key to traffic pattern operations***

*1. Enter pattern in level flight, abeam the midpoint of the runway, at pattern altitude.*

*2. Maintain pattern altitude until abeam approach end of the landing runway on downwind leg.*

*3. Complete turn to final at least 1/4 mile from the runway.*

*4. Continue straight ahead until beyond departure end of runway.*

*5. If remaining in the traffic pattern, commence turn to crosswind leg beyond the departure end of the runway within 300 feet of pattern altitude.*

*6. If departing the traffic pattern, continue straight out, or exit with a 45 degree turn (to the left when in a left-hand traffic pattern) beyond the departure end of the runway, after reaching pattern altitude.*

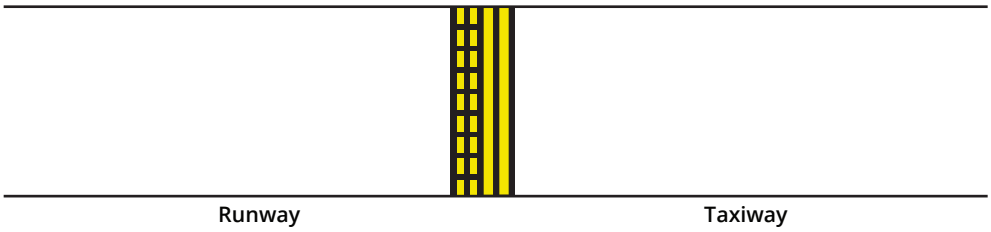
▶ Standard left-hand traffic pattern. *(Adapted from FAA FAR/AIM)*

2. Left
3. 1,000 feet
4. Common Traffic Advisory Frequency
5. 1,500 feet
6. (a) Standard
7. Width 100 feet, length 6,502 feet

8. 2,500 feet
9. Runway 22
10. 123.0
11. (b) 500 feet
12. HIRL (high intensity runway lights)
13. 7 clicks
14. The painted runway marking located at the hold-short point between taxiways and runways.
15. The solid line is the taxiway side and the dashed line is the runway side.
16. Taxi and take off
17. Direction signs: taxiway direction, runway exit, outbound destination, inbound destination
18. Location sign: taxiway location and runway location
19. Runway hold position, runway intersection, runway approach end
20. If weather conditions are less than VFR.
21. White and green
22. White, white, and green
23. You are on glide path.
24. You are too high.
25. Runway end identifier lights
    a. White
26. Blue
27. White
28. Into the wind
    a. We want air to flow over the wings, creating more lift.
29. Into the wind
    a. If landing with a tailwind, the wind will push the aircraft further down the runway.
30. If too slow, the aircraft will not have enough lift to support the weight of the aircraft and then it will stall or settle back down to the ground.
31. If the speed is too slow, the aircraft might stall and there may not be sufficient altitude to recover. If the speed is too fast, the aircraft may overshoot the landing spot on the runway.
32. $V_X$ is best angle-of-climb speed. The airspeed at which an airplane gains the greatest amount of altitude in a given distance. It is used during a short-field takeoff to clear an obstacle.
33. $V_Y$ is best rate-of-climb speed. This airspeed provides the most altitude gain in a given period of time.

## LESSON 11

### Chapter 3 Exam

1. (d) 080 and 260 degrees magnetic
2. (d) Blue
3. (b) Yellow
4. (a) White
5. (b) False
6. (b) The weather at the airport is below basic VFR weather minimums.
7. (a) True
8. 

9. (a) White over white
10. 1,661 feet
11. (a) Standard
12. 8,794 feet (length) × 150 feet (width)
13. 2,445 feet
14. 123.0
15. (b) 500 feet
16. (b) 13
17. (b) 122.8
18. (b) 5 clicks
19. (c) 2,680 feet

# CHAPTER 4

WEIGHT & BALANCE AND PERFORMANCE

## LESSON 2, Activity 3

## Weight and Balance Exercises

### Weight and Balance Exercise 1

| | Weight | Arm | Moment |
|---|---|---|---|
| Basic Empty Weight (BEW) | 1,662.78 | | 146,840.14 |
| Pilot | 125 | 80.5 | 10,062.5 |
| Front Passenger | 110 | 80.5 | 8,855 |
| Rear Passengers | 200 | 118.1 | 23,620 |
| Baggage | 20 | 142.8 | 2,856 |
| Fuel | 288 | 95 | 27,360 |
| Ramp Weight | 2,405.78 | | 219,593.64 |
| Run-up | −8 | 95 | −760 |
| Takeoff Weight | 2,397.78 | | 218,833.64 |

CG = 91.26

*Are you within limits?* Yes.

*Why or why not?* Center of gravity and weights are within limits of the center of gravity envelope.

### Weight and Balance Exercise 2

| | Weight | Arm | Moment |
|---|---|---|---|
| Basic Empty Weight (BEW) | 1,658.4 | | 146,361.59 |
| Pilot | 300 | 80.5 | 24,150 |
| Front Passenger | 200 | 80.5 | 16,100 |
| Rear Passengers | 125 | 118.1 | 14,762.5 |
| Baggage | 50 | 142.8 | 7,140 |
| Fuel | 288 | 95 | 27,360 |
| Ramp Weight | 2,621.4 | | 235,874.09 |
| Run-up | −8 | 95 | −760 |
| Takeoff Weight | 2,613.4 | | 235,114.09 |

CG = 89.96
*Are you within limits?* No.
*Why or why not?* Maximum ramp and takeoff weights have been exceeded.
*If not, what could you do to bring the aircraft back within limits?* Reduce aircraft weight.

### Weight and Balance Exercise 3

| | Weight | Arm | Moment |
|---|---|---|---|
| Basic Empty Weight (BEW) | 1,661.4 | | 146,454.59 |
| Pilot | 125 | 80.5 | 10,062.5 |
| Front Passenger | 125 | 80.5 | 10,062.5 |
| Rear Passenger | 200 | 118.1 | 23,620 |
| Rear Passenger | 175 | 118.1 | 20,667.5 |
| Baggage | 50 | 142.8 | 7,140 |
| Fuel | 180 | 95 | 17,100 |
| Ramp Weight | 2,516.4 | | 235,107.09 |
| Run-up | −8 | 95 | −760 |
| Takeoff Weight | 2,508.4 | | 234,347.09 |

CG = 93.42
*Are you within limits?* No.
*Why or why not?* Center of gravity is aft of limits.
*If not, what could you do to bring the aircraft back within limits?* Reduce aft weight.

## LESSON 4, Activity 4

### Performance Worksheet (Student Notebook)

1. a. 815 feet
   b. 645 feet
   c. 925 feet
2. a. ~1,550 feet
   b. ~1,150 feet
   c. ~1,225 feet
   d. ~1,350 feet
3. a. ~1,750 feet
   b. ~1,950 feet
   c. ~2,200 feet
4. a. ~900 feet
   b. ~1,300 feet
   c. ~1,125 feet
5. a. ~920 feet
   b. ~910 feet
   c. ~910 feet
   d. ~980 feet
6. a. ~1,320 feet
   b. ~1,380 feet
   c. ~1,400 feet
7. a. ~800 feet
   b. ~1,040 feet
   c. ~ 920 feet
   d. ~920 feet

## LESSON 5, Activity 3

### Time, Fuel, Distance to Climb Practice Problems (Student Notebook)

1. a. ~4 minutes
   b. ~1 gallon
   c. ~8.0 miles
2. a. ~6 minutes
   b. ~1 gallon
   c. ~8 miles
3. a. ~12 minutes
   b. ~5 gallons
   c. ~18 minutes

## LESSON 5, Activity 4

### Time, Fuel, Distance to Descend Practice Problems (Student Notebook)

1. a. ~5 minutes
   b. ~0.9 gallons
   c. ~8 miles
2. a. ~20 minutes
   b. ~2.5 gallons
   c. ~38 miles
3. a. ~15 minutes
   b. ~3.0 gallons
   c. ~31 miles

## LESSON 5, Activity 5

### Engine/Cruise Performance Practice Problems (Student Notebook)

1. a. ~2575 RPM
   b. ~123 knots
   c. ~11.0 GPH
2. a. ~2485 RPM
   b. ~118 knots
   c. ~9.5 GPH
3. a. ~2587 RPM
   b. ~125 knots
   c. ~11 GPH

## LESSON 6, Activity 2

### Range, Endurance, and Glide Practice Problems (Student Notebook)

1. ~547 miles
2. ~443 miles
3. ~5.48 hours
4. ~4.0 hours
5. ~8.0 miles
6. ~10 miles

## LESSONS 8 & 9, Activity 1

### Exam Review Problems (Student Notebook)

**Weight and balance for this flight:**

| | Weight | Arm | Moment |
|---|---|---|---|
| Basic Empty Weight (BEW) | 1,658.40 | | 146,518.99 |
| Pilot | 175 | 80.5 | 14,087.5 |
| Front Passenger | 140 | 80.5 | 11,270 |
| Rear Passengers | 190 | 118.1 | 22,439 |
| Baggage | 50 | 142.8 | 7,140 |
| Fuel | 288 | 95 | 27,360 |
| Ramp Weight | 2,501.4 | 91.75 | 228,815.49 |
| Run-up | −8 | | −760 |
| Takeoff Weight | 2,493.4 | | 228,055.49 |

1. Yes
2. ~1,000 feet taking off runway 27
3. ~840 feet
4. ~8 minutes
5. ~1.5 gallons
6. ~10 miles
7. ~11 minutes
8. 1.0 gallon
9. 23 miles
10. ~2,635 RPM
11. ~128 knots
12. ~11.0 gallons
13. ~443 miles
14. 3.6 hours
15. 9 NM

## LESSON 10, Chapter 4 Exam

### Weight & Balance and Performance

1.

| | Weight | Arm/CG | Moment |
|---|---|---|---|
| Basic Empty Weight (BEW) | 1,658.40 | | 146,518.99 |
| Pilot | 180 | 80.5 | 14,490 |
| Front Passenger | 165 | 80.5 | 13,282.5 |
| Rear Passengers | 100 | 118.1 | 11,810 |
| Baggage | 25 | 142.8 | 3,570 |
| Fuel | 288 | 95 | 27,360 |
| Ramp Weight | 2,416.4 | 89.816 | 217,031.49 |
| Run-up | −8 | | −760 |
| Takeoff Weight | 2,408.4 | 89.798 | 216,271.49 |

Are you within limits? Yes

2. 1,122 feet pressure altitude
3. 1,264 feet pressure altitude
4. 1,150 feet
5. 1,150 feet
6. 1,500 feet
7. 1,600 feet
8. 55 knots
9. 900 feet
10. 1,380 feet
11. a. 2,595 RPM
    b. 124.5 KTAS
    c. 11.0 GPH
12. a. 2,430
    d. 115 knots
    e. 9.5 GPH
13. ~500 fpm
14. a. ~5 minutes
    b. ~1.5 gallons
    c. ~7 miles
15. a. ~5 minutes
    b. ~2 gallons
    c. ~14 miles
16. a. ~15 minutes
    b. ~3.0 gallons
    c. ~29 miles
    d. 445 miles
    e. 5.6 hours
17. 10 NM

# CHAPTER 5

COMMUNICATION

## LESSON 1, Activity 3

### ATC History Quiz (Student Notebook)

1. (b) Archie League
2. (a) St. Louis
3. (c) Shrimp boats
4. (c) 1950s
5. (a) An aircraft midair collision
6. (c) A scope
7. (a) Reagan
8. (b) fired
9. (a) IBM
10. (a) By their 56th birthday

## LESSON 3

### ATC Quiz

1. Ground control controls the aircraft and vehicles while in operation on the ground.
2. Tower/local controls the approximately 4–5 NM radius around an airport for landing and departing aircraft at the airport.
3. Approach controls the area approximately 5–40 NM away from an airport for aircraft arriving at the airport.
4. Departure controls the area approximately 5–40 NM from an airport for aircraft departing the airport.
5. A center provides the en route control as well as into and out of airports without a control tower.
6. Flight Service communicates directly with pilots for pilot briefings, flight plans, inflight advisory services, search and rescue initiation, aircraft emergencies, and Notices to Airmen (NOTAMs).

## LESSON 5, Activity 1

### Phonetic Alphabet Pre-Test (Student Notebook)

| | |
|---|---|
| A = Alpha | H = Hotel |
| D = Delta | L = Lima |
| I = India | P = Papa |
| T = Tango | V = Victor |

## LESSON 5, Activity 2

### Phonetic Alphabet Graphic Organizer (Student Notebook)

| | | | |
|---|---|---|---|
| **A** Alpha | **H** Hotel | **O** Oscar | **V** Victor |
| **B** Bravo | **I** India | **P** Papa | **W** Whiskey |
| **C** Charlie | **J** Juliett | **Q** Quebec | **X** Xray |
| **D** Delta | **K** Kilo | **R** Romeo | **Y** Yankee |
| **E** Echo | **L** Lima | **S** Sierra | **Z** Zulu |
| **F** Foxtrot | **M** Mike | **T** Tango | |
| **G** Golf | **N** November | **U** Uniform | |

## LESSON 5, Activity 3

### Phonetic Alphabet Post-Test (Student Notebook)

Triple o is the number to ring for police assistance.

## LESSON 12

### Chapter 5 Exam: Communication

1. (a) High
2. Air Traffic Controllers Organization; strike; 1981; Reagan; pay and working conditions
3. Archie League
4. flags
5. bonfires, railroad tracks
6. scope
7. (b) False
8. Speed, size, destination
9. Tower controller, approach controller, center controller, departure controller, manager
10. (a) By their 56th birthday
11. (b) Oklahoma City
12. Good pay, mandated rest periods, job is always changing, comfortable work conditions
13. Shift work, may be stressful/really busy at times, may be very boring or slow at times
14. (b) 7110.65T
15. (d) All of the above
16. (c) Lifeguard Flight
17. (a) Crew resource management
18. (a) True
19. (b) False

20. a. 235°
    b. 340°
    c. 050°
    d. 110°
    e. 170°
21. In an emergency or when doing so will cause the pilot to break a regulation.
22. It tells the controller that they understand and will follow the instructions.
23. a. L = Lima; F = Foxtrot
    b. U = Uniform; P = Papa
    c. J = Juliet; H = Hotel
24. (d)
25. (b)
26. (e)
27. (a)
28. (c)
29. 160 knots
30. 975 NM

# CHAPTER 6

PEOPLE, EVENTS, AND TRENDS IN AVIATION

## LESSON 12

### Chapter 6 Exam

Questions 1–10: Answers will vary. Refer to the aviation history timeline in Lesson 2.

11. A = Leonardo da Vinci
    B = Montgolfier Brothers
    C = Tower Jumpers
    D = Jean-Pierre Blanchard
    E = Rozier and d'Arlandes
    F = Daedalus
12. It allowed people to fly. First uses include: mail, communication, war benefits such as aerial guns, and better bird's-eye view of areas.
13. People had very little control over where it went. It could not carry a lot of weight.
14. A person could control it. It could carry more passengers/cargo.

# CHAPTER 8

AERODYNAMICS OF FLIGHT

## LESSON 3, Activity 2

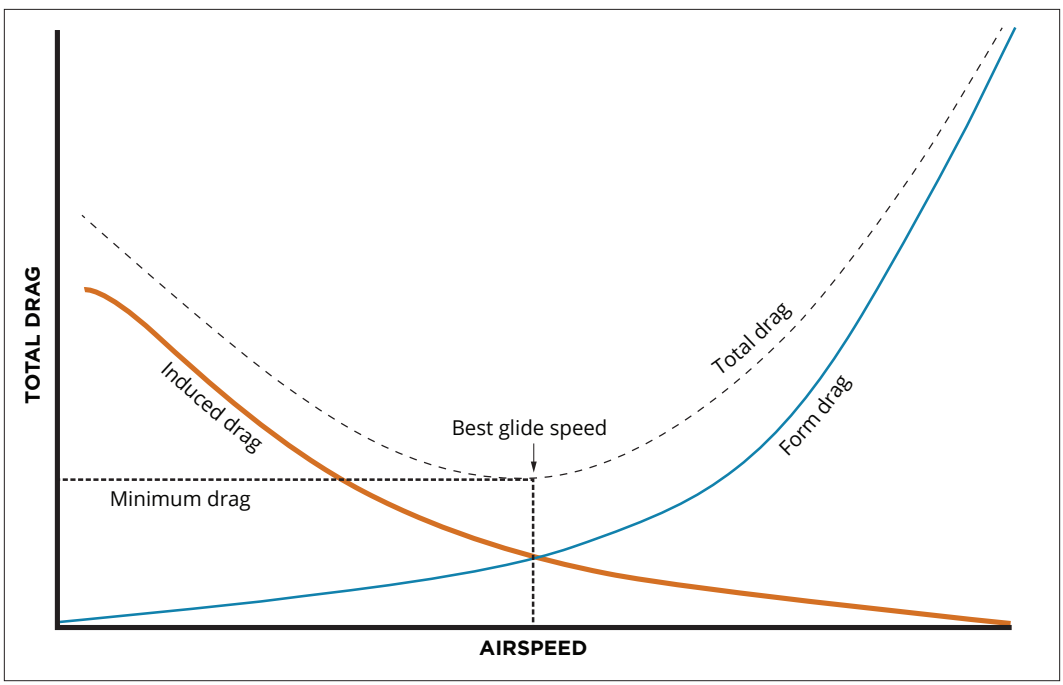
### Comprehension Questions Homework (Student Notebook)

1. (b) Bernoulli
2. (a) Newton
3. Increase throttle or decrease angle of climb.
4. No. If you go into a climb, your thrust and lift must counteract your drag and weight. You will need to increase throttle to equalize the forces and not lose airspeed.
5. Your takeoff distance will increase because it takes longer to overcome opposing forces.
6. (a) increased. Excessive weight reduces the flight performance in almost every respect.

## LESSON 6, Activity 1

### Study Guide (Student Notebook)

1. Flaps are the most common high-lift devices used on aircraft. These surfaces, which are attached to the trailing edge of the wing, increase both lift and induced drag for any given angle of attack (AOA). Flaps allow a compromise between high cruising speed and low landing speed because they may be extended when needed and retracted into the wing's structure when not needed.
2. The rudder is attached to the back of the vertical stabilizer. During flight, it is used to move the airplane's nose left and right.
3. Lift, drag, weight, thrust.
4. For the aircraft to remain in steady, level flight, equilibrium must be obtained by a lift equal to the aircraft weight and a powerplant thrust equal to the aircraft drag.
5. Bernoulli's Principle states that as the velocity of a moving fluid (liquid or gas) increases, the pressure within the fluid decreases. This principle explains what happens to air passing over the curved top of the airplane wing.
6. Newton's Third Law: "For every action, there is an equal and opposite reaction." In an airplane, the propeller moves and pushes back the air; consequently, the air pushes the propeller (and thus the airplane) in the opposite direction—forward. In a jet airplane, the engine pushes a blast of hot gases backward; the force of equal and opposite reaction pushes against the engine and forces the airplane forward.
7. The angle of attack (AOA) is defined as the acute angle between the chord line of the airfoil and the direction of the relative wind.
8. The chord line is an imaginary line drawn through the blade from its leading edge to its trailing edge.
9. The relative wind is the airflow opposite to the flight path of the aircraft.
10. Critical angle of attack.

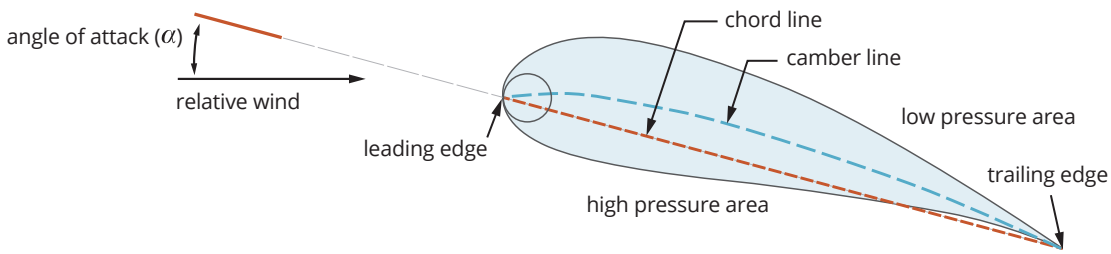
11. Answers may vary—sluggish controls, a buffeting of the aircraft, and stall warning horn may alert the pilot.
12. Reduce the angle of attack, maintain coordination.
13. (a) Root of the wing
14. (a) Power on
15. **Takeoff distance** would be increased. Frost on an aircraft will increase drag and possibly weight, resulting in decreased performance. Frost disrupts the flow of air over the wing and can drastically reduce the production of lift. It also increases drag, which when combined with lowered lift production can adversely affect the ability to take off. An aircraft must be thoroughly cleaned and free of frost prior to beginning a flight. **Cruise flight**—Due to the increased weight and drag and the loss of lift, the aircraft will require more power to maintain normal cruise flight. That increase in power increases fuel flow. **Landing**—Due to the loss in lift, the pilot will need to carry more power into the landing. This will increase the landing distance.
16. Skin friction drag
17. a. Interference drag: The intersection of the wing and the fuselage at the wing root has significant interference drag.
    b. Form drag: Examples include the engine cowlings, antennas, and the aerodynamic shape of other components.
    c. Skin friction drag: Frost or dirt on the wing.
18. Induced drag is drag caused by the same factors that produce lift; its amount varies inversely with airspeed. As airspeed decreases, the angle of attack must increase, in turn increasing induced drag.
19. 

20. The recovery from a stall in any aircraft becomes progressively more difficult as its CG moves aft. The airplane may feel as if it is tail heavy and therefore when trying to recover from a stall it may be difficult to push the nose of the aircraft forward enough to reduce the angle of attack.
21. Torque: It is a left-turning tendency. In the Piper Archer, the propeller rotates to the right or clockwise, so the aircraft has the tendency to roll to the left.
22. Load factor: The ratio of a specified load to the total weight of the aircraft.
23. Turn.
24. Your airspeed will decrease and you could stall.
25. It decreases performance due to drag.
26. You can push the nose forward or down.
27. You will still be able to climb, but the rate at which you can will depend on the thrust you have available to climb. You will be unable to climb with an increase in airspeed without increasing thrust. If you want to fly faster without increasing throttle, you will have to pitch the aircraft's nose down and hold it in a descent.
28. An increase in payload results in a decrease in performance; more lift is required for straight-and-level flight, resulting in more drag.
29. A spin is an aggravated stall that results in an airplane descending in a helical, or corkscrew, path. It may occur when a pilot is distracted during an emergency or during landing when the pilot slows the aircraft down and inadvertently stalls the aircraft while being uncoordinated or causing a yawing force.

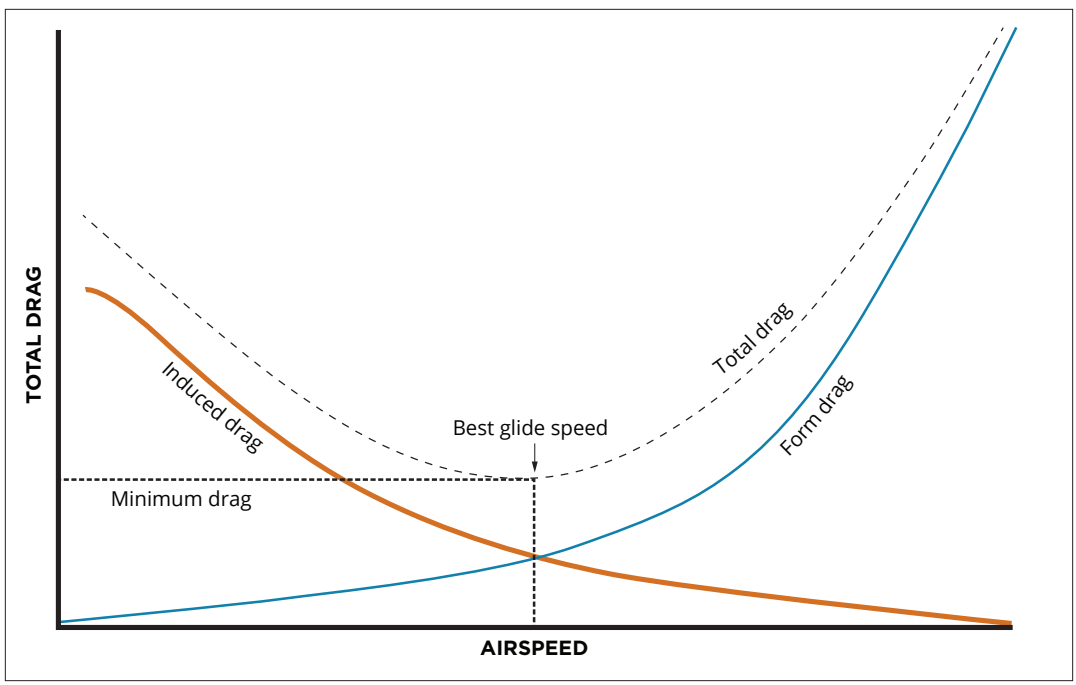
## LESSON 7

### Chapter 8 Exam

1. (a) Lift, weight, thrust, and drag
2. (a) During straight-and-level, unaccelerated flight
3. (b) Bernoulli
4. (a) Newton
5. (b) Leading edge to the trailing edge of the wing
6. Parts of an airfoil.




7. The critical angle of attack is the angle of attack at which a wing stalls regardless of airspeed, flight attitude, or weight.
8. Answers may vary: Stall horn, buffeting of aircraft, sluggish controls.
9. (b) Reduce the angle of attack to less than its critical value.

10. (a) lift
11. Skin friction drag is drag generated between air molecules and the solid surface of the aircraft. Form drag is the portion of parasite drag generated by the aircraft due to its shape and airflow around it. Interference drag comes from the intersection of airstreams that creates eddy currents, turbulence, or restricts smooth airflow.
12. (b) It will decrease.
13. (b) lift, drag
14. (a) True
15. (a) True
16. (a) True
17. (b) False
18. (a) True
19. (b) False
20. Answers may vary: A heavier gross weight results in a longer takeoff run and shallower climb, and a faster touchdown speed and longer landing roll. Even a minor overload may make it impossible for the aircraft to clear an obstacle that normally would not be a problem during takeoff under more favorable conditions. The detrimental effects of overloading on performance are not limited to the immediate hazards involved with takeoffs and landings. Overloading has an adverse effect on all climb and cruise performance, which leads to overheating during climbs, added wear on engine parts, increased fuel consumption, slower cruising speeds, and reduced range.
21. Due to left-turning tendencies of the airplane.
22. (a) elevator
23. (b) dihedral
24. 

25. The aircraft's airspeed will decrease and you could stall. Since you are low to the ground, you don't have room to recover. The best practice for this situation is to add power and adjust pitch as needed and if you still aren't "stabilized," you should plan to go around.
26. (a) increases
27. (a) increases
28. (a) The wing root
29. Answers will vary:
    - The manufacturer could increase the size of the wings. They will most likely produce more lift; however, they will also increase the weight of the aircraft.
    - The manufacturer could increase the size of the fuselage to allow for more people and cargo to be carried onboard the aircraft. This size and shape of the new fuselage could increase the drag and the additional weight will add to the overall weight of the aircraft. A more powerful engine may also be needed.

# CHAPTER 9

AIRCRAFT SYSTEMS

## LESSON 7

### Chapter 9 Exam

1. (b) False
2. (b) False
3. (a) True
4. (a) Variation
5. (b) Blue
6. (e) B and C
7. (a) Primary source of electricity needed during flight
8. (c) Turn coordinator
9. (b) Airspeed indicator
10. (c) Precession
11. (b) Turn the carburetor heat on
12. (a) Pitot heat
13. (a) Better cold weather starts
14. (c) Intake, compression, power, exhaust
15. Red Xs on the airspeed indicator, attitude indicator, altimeter, VSI, heading indicator; depending on the system, you would also not have wind information, temperature information, or TAS.
16. Heading indicator
17. Vacuum air filter
18. Attitude indicator
19. Vacuum pump
20. Mixture control
21. Throttle valve
22. Fuel
23. (b) Rough-running engine
24. (b) 4 cylinders and 8 spark plugs
25. Fuel tank
26. Engine-driven fuel pump
27. fuel-air control unit
28. Cools, cleans, lubricates

29. An increase in oil temperature could indicate the existence of an oil leak, and if there is no oil the engine will cease and quit, there could be low oil pressure, and it could turn into an engine failure if it is not fixed.
30. In a four-stroke engine, the conversion of chemical energy into mechanical energy occurs over a four-stroke operating cycle. The intake, compression, power, and exhaust processes occur in four separate strokes of the piston in the following order.
    1. The intake stroke begins as the piston starts its downward travel. When this happens, the intake valve opens and the fuel-air mixture is drawn into the cylinder.
    2. The compression stroke begins when the intake valve closes, and the piston starts moving back to the top of the cylinder. This phase of the cycle is used to obtain a much greater power output from the fuel-air-mixture once it is ignited.
    3. The power stroke begins when the fuel-air-mixture is ignited. This causes a tremendous pressure increase in the cylinder and forces the piston downward away from the cylinder head, creating the power that turns the crankshaft.
    4. The exhaust stroke is used to purge the cylinder of burned gases. It begins when the exhaust valve opens, and the piston starts to move toward the cylinder head once again.

    *(FAA-H-8083-25)*

# CHAPTER 10

FLIGHT MANEUVERS

## LESSON 1, Activity 1

### Fundamental Maneuvers Worksheet (Student Notebook)

1. Altimeter, airspeed indicator, and heading indicator
2. Altimeter, airspeed indicator, and attitude indicator or turn coordinator
3. Airspeed indicator, heading indicator, and vertical speed indicator
4. Heading indicator and vertical speed indicator
5. Airspeed indicator, heading indicator, and vertical speed indicator
6. Airspeed indicator, heading indicator, and vertical speed indicator
7. Airspeed indicator, turn coordinator, and vertical speed indicator

# CHAPTER 11

AIRSPACE

## LESSON 2, Activity 2

### Comprehension Questions (Student Notebook)

1. Class A airspace
2. 29.92 inHg
3. Controlled airspace
4. Up to and including 60,000 feet MSL
5. (a) True
6. (b) False. Each aircraft must establish two-way radio communications with the air traffic control (ATC) facility providing air traffic services prior to entering the airspace and thereafter must maintain those communications while within the airspace.
7. ATC clearance
8. Prohibited areas contain airspace of defined dimensions within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. Restricted areas are areas where operations are hazardous to nonparticipating aircraft and contain airspace within which the flight of aircraft, while not wholly prohibited, is subject to restrictions.
9. Class D airspace
10. Yes, but it is advised to avoid these areas or contact the controlling agency when operating within an active MOA. MOAs consist of airspace with defined vertical and lateral limits established for the purpose of separating certain military training activities from IFR traffic.

## LESSON 3, Activity 2

### Airspace Worksheet (Student Notebook)

1. Class E
2. Class E starts at the surface and goes up to 18,000 feet MSL.
3. Class E
4. Class E starts at 700 feet AGL and goes up to but not including 18,000 feet MSL.
5. Class G
6. Class E
7. In between Aberdeen and Gettysburg, the Class E starts at 1,200 feet AGL and goes up to, but not including, 18,000 feet MSL.
8. (c) 3,000 feet MSL
9. (c) 8,500 feet MSL. (NOTE: You need to be 1,000 feet above the clouds; however, 7,000 feet is not a VFR cruising altitude. For that direction of flight, the aircraft needs to be at an even +500 foot altitude.)

## LESSON 4, Activity 2

### Airspace Quiz (Student Notebook)

1. a. Class D
   b. At the surface
   c. 3,500 feet MSL
2. a. Class E
   b. 1,200 feet AGL
   c. Up to, but not including, 18,000 feet MSL
3. a. Class G
   b. Surface
   c. Up to, but not including, 700 feet AGL.
4. a. Class E
   b. Surface
   c. Up to, but not including, 18,000 feet MSL
5. (b) 3 SM visibility
6. (a) Clear of clouds
7. (b) 3 SM visibility
8. (b) 500 feet below the clouds, 1,000 feet above the clouds, and 2,000 feet horizontal
9. (c) 5 SM visibility
10. (c) 1,000 feet below the clouds, 1,000 feet above the clouds, and 1 SM horizontal

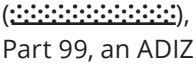
## LESSON 5, Activity 1

### Study Guide Review (Student Notebook)

1. Pilots operating an aircraft in Class A airspace must conduct that operation under IFR and only under an ATC clearance received prior to entering the airspace.
2. All pilots operating an aircraft within a Class B airspace area must receive an ATC clearance from the ATC facility having jurisdiction for that area. The pilot-in-command (PIC) may not take off or land an aircraft at an airport within a Class B airspace unless he or she has met one of the following requirements:
   - A private pilot certificate
   - A recreational pilot certificate and all requirements contained within 14 CFR §61.101(d), or the requirements for a student pilot seeking a recreational pilot certificate in 14 CFR §61.94.
   - A sport pilot certificate and all requirements contained within 14 CFR §61.325, or the requirements for a student pilot seeking a recreational pilot certificate in 14 CFR §61.94, or the aircraft is operated by a student pilot who has met the requirements of 14 CFR §§61.94 and 61.95, as applicable.

Unless otherwise authorized by ATC, all aircraft within Class B airspace must be equipped with the applicable operating transponder and automatic altitude reporting equipment specified in 14 CFR §91.215(a) and an operable two-way radio capable of communications with ATC on appropriate frequencies for that Class B airspace area. Additionally, beginning January 1, 2020, aircraft operating in the Class B airspace described in 14 CFR §91.225, must have ADS-B Out equipment installed, which meets the performance requirements of 14 CFR §91.227.

3. a. Class B: Nothing, you need clearance to enter.
   b. Class C: If your call sign was used, it is considered two-way communication. Continue but maintain two-way communication.
   c. Class D: If your call sign was used, it is considered two-way communication. Continue but maintain two-way communication.
4. (b) Uncontrolled
5. Mean sea level
6. Above ground level
7. (a) True. (While generally true, altitudes may vary. The height of Class D airspace will be depicted on the aeronautical chart in MSL.)
8. (b) False. (Not all controlled airspace requires two-way radio. Class D and C are controlled airspace that does require two-way communication.)
9. (b) 5 SM visibility; 1,000 feet below, 1,000 feet above, 1 SM horizontal distance from clouds
10. Not applicable—Unless otherwise authorized, all operation in Class A airspace is conducted under instrument flight rules (IFR).
11. 3 SM visibility; Clear of clouds
12. 3 SM visibility; 1,000 feet above, 500 feet below, 2,000 feet horizontal distance from clouds
13. 3 SM visibility; 1,000 feet above, 500 feet below, 2,000 feet horizontal distance from clouds
14. 3 SM visibility; 1,000 feet above, 500 feet below, 2,000 feet horizontal distance from clouds
15. 5 SM visibility; 1,000 feet above, 1,000 feet below, 1 statute mile horizontal distance from clouds
16. 1 SM visibility; Clear of clouds
17. 3 SM visibility; 1,000 feet above, 500 feet below, 2,000 feet horizontal distance from clouds
18. (c) 6,100 feet MSL
19. Temporary Flight Restriction

20. Some of the purposes for establishing a TFR are:
    - Protect persons and property in the air or on the surface from an existing or imminent hazard.
    - Provide a safe environment for the operation of disaster relief aircraft.
    - Prevent an unsafe congestion of sightseeing aircraft above an incident or event that may generate a high degree of public interest.
    - Protect declared national disasters for humanitarian reasons in the State of Hawaii.
    - Protect the President, Vice President, or other public figures.
    - Provide a safe environment for space agency operations.
21. Prohibited areas contain airspace of defined dimensions within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. Restricted areas are areas where operations are hazardous to nonparticipating aircraft and contain airspace within which the flight of aircraft, while not wholly prohibited, is subject to restrictions.
22. The restricted area altitude is upward from 500 feet above ground level to, but not including 10,000 feet MSL.
23. The prohibited airspace is up to but not including 4,000 feet MSL.
24. Military Operation Area
25. Yes; use caution.
26. 4,000 feet up to but not including FL180
27. No; it is not an airspace designation but a services available designation.
28. Class D
29. Air Defense Identification Zone
30. Air Defense Identification Zones (ADIZs) are symbolized using the ADIZ symbol (  ), which is purple. As defined in the Code of Federal Regulations, 14 CFR Part 99, an ADIZ is an area in which the ready identification, location, and control of all aircraft is required in the interest of national security. ADIZ boundaries include Alaska, Hawaii, Guam, Canada, and the Contiguous U.S.
31. Class G unless the Class E extension is in effect. If within Class E extension effective hours, you will be in Class E airspace.
32. Class G airspace begins at the surface up to 700 feet AGL. If the Class E extension is in effect, Class E starts at the surface and goes up to 18,000 feet MSL.
33. Assuming you are entering from the south, you are in Class E airspace.
34. Up to, but not including, 18,000 feet MSL
35. 2,000 feet AGL
36. Class G
37. Surface up to, but not including, 700 feet AGL.

## LESSON 6

### Chapter 11 Exam

1. (b) False
2. (a) True
3. (b) False
4. (a) True
5. (b) Class D
6. (b) Warning
7. (b) 2,500 feet MSL
8. Some of the purposes for establishing a TFR are:
   - Protect persons and property in the air or on the surface from an existing or imminent hazard.
   - Provide a safe environment for the operation of disaster relief aircraft.
   - Prevent an unsafe congestion of sightseeing aircraft above an incident or event that may generate a high degree of public interest.
   - Protect declared national disasters for humanitarian reasons in the State of Hawaii.
   - Protect the President, Vice President, or other public figures.
   - Provide a safe environment for space agency operations.
9. Unlike Class G uncontrolled airspace, controlled airspace consists of those areas where some or all aircraft *may* be subject to air traffic control, such as: Class A, Class B, Class C, Class D, and Class E Airspace.
10. Alert areas are depicted on aeronautical charts with an "A" followed by a number (e.g., A-211) to inform nonparticipating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should exercise caution in alert areas. All activity within an alert area shall be conducted in accordance with regulations, without waiver, and pilots of participating aircraft, as well as pilots transiting the area, shall be equally responsible for collision avoidance.
11. Prohibited areas contain airspace of defined dimensions within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts. The area is charted as a "P" followed by a number (e.g., P-40). Examples of prohibited areas include Camp David and the National Mall in Washington, D.C., where the White House and the Congressional buildings are located.
12. (c) Class E
13. (a) Surface
14. (d) 17,999 feet
15. (c) Class E
16. (c) 1,200 feet
17. (d) 17,999 feet
18. Beaver MOA
19. (b) 300 feet
20. (d) 17,999 feet

21. The MOA status will be given via a NOTAM and is scheduled for the following times: 0800–2200 Mon–Fri, 0800–1600 Sat–Sun. Other times may be indicated on the NOTAM.
22. (c) Class E
23. (b) 700 feet
24. (d) 17,999 feet
25. (d) Class G
26. (a) Surface
27. (a) 700 feet
28. It indicates a Military Training Route (MTR). MTRs are routes established for the conduct of low-altitude, high-speed military flight training (generally below 10,000 feet MSL at airspeeds in excess of 250 knots indicated airspeed [IAS]).
29. No, but be aware of it. MTRs with no segment above 1,500 feet AGL are identified by four number characters (e.g., IR1206, VR1207). MTRs that include one or more segments above 1,500 feet AGL are identified by three number characters (e.g., IR206, VR207).
30. (c) Class E
31. (c) 1,200 feet
32. (d) 17,999 feet
33. a. Visibility: 1 SM
    b. Cloud clearance: Clear of clouds
34. a. A Mode C transponder
    b. An operable two-way radio capable of communications with ATC on appropriate frequencies for that Class B airspace area.
    c. ADS-B Out equipment installed that meets the performance requirements of 14 CFR §91.227.
    d. The pilot must receive a clearance to enter the airspace, and must be a private pilot or student pilot with endorsement.
35. a. Visibility: 3 SM
    b. Cloud clearance: Clear of clouds
36. a. Visibility: 3 SM
    b. Cloud clearance: 1,000 feet above, 500 feet below, 2,000 feet horizontal
37. a. Two-way radio
    b. Transponder with altitude reporting capability
38. (a) Class B
39. Standby and do not enter airspace requiring two-way communication.
40. (c) 2,500 feet
41. Air Defense Identification Zone
42. MSL is above sea level and AGL is above ground level.

# CHAPTER 12

WEATHER

## LESSON 3, Activity 3

### METAR Worksheet

1. −10°C
2. Coming from 140 degrees at 7 knots
3. 9 SM
4. Clear
5. −21°C
6. Overcast 2,800 feet
7. Snow
8. Light
9. Coming from 290 at 15 gusting to 18 knots
10. 30.17
11. Overcast at 2,200 feet
12. Calm
13. Rain and mist
14. Heavy rain and moderate mist
15. The 17th of the month at 1355 Zulu
16. It is an automated station
17. Vertical visibility of 500 feet
18. Freezing fog
19. Overcast at 100 feet
20. ¼ SM

## LESSON 6, Activity 1

### Go/No-Go Decision Scenarios

**Scenario 1:** The Environment: The winds are not that far off from the runway; however, they are 16 knots. Sixteen knots is a good amount of wind, so you need to ask yourself what kind of winds you have flown in before—that is the Pilot part of the PAVE model. The sky is clear and you have good visibility. It should be a good day to go fly. You have just conducted a preflight so hopefully the Aircraft is good to go. Are there any External pressures forcing you to go fly this day?

**Scenario 2:** The students' answers should reflect some of the following items using the PAVE Model:

Pilot: Are you comfortable flying today? How are you feeling?

Aircraft: Is everything working in the aircraft today? Are you comfortable with the cockpit configuration and radios? Are you within weight and balance limits for this cross-country flight?

Environment: Do you feel comfortable with the weather? Is it within your personal weather minimums? There are clear skies, good visibility, wind seems fairly light, but it is cold out. The TAF is calling for the clouds to become broken at 2,000 feet between 0700 and 1000 Zulu, and with it being cold there will be ice in the clouds.

External Pressures: Are there any external pressures forcing you to go fly this day?

Go/No-Go decision: depends on what time you will be in the air. If you are able to land before the ceiling comes down you could go.

**Scenario 3:** Pilot: With the low clouds and potential for snow showers, there will most likely be a reduction in flight visibility. Are you instrument rated? Have you flown in low visibility before?

Aircraft: Is your aircraft approved to fly into icing conditions?

Environment: The temperature is below freezing and there are clouds. There is potential for icing.

External Pressures: Are there any external pressures forcing you to go fly this day?

Go/No-Go Decision: Most likely not a good day to go fly.

**Scenario 4:** Pilot: Do you like getting bounced around continually throughout the flight? Most likely not.

Aircraft: Is your aircraft able to climb to a high altitude to distance yourself from the ground and convective turbulence?

Environment: We know that it is warm and the uneven heating of the Earth's surface creates the formation of convective turbulence.

External pressures: Are there any external pressures forcing you to go fly this day?

Go/No-Go Decision: The higher you are, the better to avoid this.

**Scenario 5:** Pilot: What is your experience flying around areas of precipitation? Are you current to fly that aircraft? How are you feeling today?

Aircraft: What kind of aircraft are you flying? Does it have weather radar?

Environment: Heavy rain could mean reduced visibility. If thunderstorms pop up, where will you divert? Thunderstorms have lots of hazards including hail, lightning, strong winds, heavy rain, tornadoes and turbulence. These things could cause damage to the aircraft and make it difficult to complete your flight.

External pressures: Are there any external pressures forcing you to go fly this day?

Go/No-Go Decision: It's not a good day to go fly.

## LESSON 8

### Chapter 12 Exam

1. (a) True
2. (b) False
3. (b) False
4. (a) Troposphere
5. (d) All of the above could be an indication
6. (c) Broken at 2600 feet
7. (b) AGL
8. (c) Haze
9. (b) 30.10
10. (c) 1018.6
11. (b) Greater than 6 SM
12. (b) Cumulonimbus
13. (c) Ceiling less than 1,000 feet and/or less than 3 SM visibility
14. (c) 4,000 to 12,000 feet
15. (c) 8,000 feet
16. (d) 310 degrees at 52 knots, –16 degrees C
17. (a) 310 degrees at 117 knots
18. (b) No winds are forecast within 1,500 feet of the field elevation
19. (b) IFR conditions and mountain obscurations
20. (c) Moderate
21. (c) Below 3,000 feet
22. (c) Volcanic ash

# CHAPTER 13

AEROMEDICAL FACTORS

## LESSON 1, Activity 1 (Before Graphic Organizer) & LESSON 6, Activity 2 (After Graphic Organizer)

| Statement | Agree or Disagree |
|---|---|
| If you want an aviation medical, go see a medical doctor. | Disagree; you must visit an Aviation Medical Examiner (AME) |
| You should not fly if you are taking any medication. | It depends. You need to check with an AME or pharmacist to see how the medication impacts you. |
| The Federal Aviation Regulations require 8 hours between drinking and flying. | Agree, 14 CFR §91.17 |
| The effects of hypoxia can occur at low altitudes. | Agree, hypoxic hypoxia is caused by high altitudes; hypemic, histotoxic, and stagnant hypoxia can occur at any altitude. |
| Hyperventilation is when your body expels too much oxygen. | Disagree, it occurs when your body has too much oxygen and is expelling too much carbon dioxide. |
| Carbon monoxide poisoning is a real concern for pilots while flying. | Agree; if you experience this, there is no way to fix it other than to get on the ground and wait for the side effects to subside. |
| Ear blocks are more painful when climbing than descending. | Disagree, it is more painful when descending, as the air pressure is greater at lower altitudes and there is more pressure pushing on your ear drums. |
| A somatogravic illusion is due to slow bank. | Disagree; it is due to a rapid acceleration. |
| The parts of your eyes that you use at night are called the cones. | Disagree; the rods are the part of the eye used for night vision. |

## LESSON 7

### Chapter 13 Exam

1. (b) False
2. (b) False
3. (a) True
4. (b) False
5. A pilot may not recognize the symptoms, while another pilot on board may help to identify common symptoms. Single-pilot operations are more workload intensive. A single pilot may more quickly become overwhelmed when hypoxic.

6. Hypoxic
7. Stagnant
8. Hypemic hypoxia occurs when the blood is not able to take up and transport a sufficient amount of oxygen to the cells in the body. Hypemic means "not enough blood." This type of hypoxia is a result of oxygen deficiency in the blood, rather than a lack of inhaled oxygen, and can be caused by a variety of factors.
9. The symptoms of hypoxia vary with the individual, but common symptoms include cyanosis (blue fingernails and lips), headache, decreased response to stimuli and increased reaction time, impaired judgment, euphoria, visual impairment, drowsiness, lightheaded or dizzy sensation, tingling in fingers and toes, and numbness.
10. It decreases.
11. Hyperventilation is the excessive rate and depth of respiration leading to abnormal loss of carbon dioxide from the blood.
12. To prevent illusions and their potentially disastrous consequences, pilots can:
    - Understand the causes of these illusions and remain constantly alert for them. Take the opportunity to experience spatial disorientation illusions in a device, such as a Barany chair, a Vertigon, or a Virtual Reality Spatial Disorientation Demonstrator.
    - Always obtain and understand preflight weather briefings.
    - Before flying in marginal visibility (less than 3 miles) or where a visible horizon is not evident, such as flight over open water during the night, obtain training and maintain proficiency in aircraft control by reference to instruments.
    - Do not fly into adverse weather conditions or into dusk or darkness unless proficient in the use of flight instruments. If intending to fly at night, maintain night-flight currency and proficiency. Include cross-country and local operations at various airfields.
    - Ensure that when outside visual references are used, they are reliable, fixed points on the Earth's surface.
    - Avoid sudden head movement, particularly during takeoffs, turns, and approaches to landing.
    - Be physically tuned for flight into reduced visibility. Ensure proper rest, adequate diet, and, if flying at night, allow for night adaptation. Remember that illness, medication, alcohol, fatigue, sleep loss, and mild hypoxia are likely to increase susceptibility to spatial disorientation.
    - Most importantly, become proficient in the use of flight instruments and rely upon them. Trust the instruments and disregard your sensory perceptions.
13. (a) True
14. (a) True
15. A condition called "the leans" is the most common illusion during flight and is caused by a sudden return to level flight following a gradual and prolonged turn that went unnoticed by the pilot.
16. Coriolis illusion
17. Elevator illusion
18. Graveyard spiral
19. Rods
20. Autokinesis

21. (b) False
22. (a) True
23. (b) False
24. Motion sickness or airsickness
25. Focusing on objects outside the airplane that do not appear to be moving and avoiding unnecessary head movements may help alleviate some of the discomfort.
26. Chronic stress can be defined as a level of stress that presents an intolerable burden, exceeds the ability of an individual to cope, and causes individual performance to fall sharply. Unrelenting psychological pressures, such as loneliness, financial worries, and relationship or work problems can produce a cumulative level of stress that exceeds a person's ability to cope with the situation. When stress reaches these levels, performance falls off rapidly. Pilots experiencing this level of stress are not safe and should not exercise their airman privileges. Pilots who suspect they are suffering from chronic stress should consult a physician.
27. Aviation Medical Examiner
28. The recommended waiting time before going to flight altitudes of up to 8,000 feet is at least 12 hours after diving that does not require controlled ascent (nondecompression stop diving), and at least 24 hours after diving that does require controlled ascent (decompression stop diving). The waiting time before going to flight altitudes above 8,000 feet should be at least 24 hours after any scuba dive. These recommended altitudes are actual flight altitudes above mean sea level (MSL) and not pressurized cabin altitudes. This takes into consideration the risk of decompression of the aircraft during flight.
29. The IMSAFE Checklist:
    - Illness—Am I sick? Illness is an obvious pilot risk.
    - Medication—Am I taking any medicines that might affect my judgment or make me drowsy?
    - Stress—Am I under psychological pressure from the job? Do I have money, health, or family problems? Stress causes concentration and performance problems. While the regulations list medical conditions that require grounding, stress is not among them. The pilot should consider the effects of stress on performance.
    - Alcohol—Have I been drinking within 8 hours? Within 24 hours? As little as one ounce of liquor, one bottle of beer, or four ounces of wine can impair flying skills. Alcohol also renders a pilot more susceptible to disorientation and hypoxia.
    - Fatigue—Am I tired and not adequately rested? Fatigue continues to be one of the most insidious hazards to flight safety, as it may not be apparent to a pilot until serious errors are made.
    - Emotion—Am I emotionally upset?

# CHAPTER 14

## NAVIGATION AND CROSS-COUNTRY FLIGHT PLANNING

### LESSON 1, Activity 1

### Using an E6B Flight Computer (Student Notebook)

Time, Speed, Distance Problems:

1. Time: 1 hour, 15 minutes
2. Time: 32 minutes
3. Distance: 20 SM
4. Distance: 97 NM
5. Rate: 150 knots
6. Rate: 103 knots

Fuel Consumption Problems:

7. Time: 36 minutes
8. Time: 21 minutes
9. Gallons: 12 gallons
10. Gallons: 14.5 gallons
11. Rate: 15 gph
12. Rate: 9.6 gph

Wind Correction Angle (WCA) and Ground Speed:

13. WCA: 13° Left; GS: 79 knots
14. WCA: 3° Left; GS: 70 knots
15. WCA: 5° Right; GS: 129 knots

Density Altitude (DA):

16. DA: Approximately 2,800 feet
17. DA: Approximately 600 feet
18. DA: Approximately 2,000 feet
19. DA: Approximately 9,200 feet

## LESSON 3, Activity 2

### Pilotage and Navigation Quiz (Student Notebook)

1. **Pilotage**—Pilotage is navigation by reference to landmarks or checkpoints. It is a method of navigation that can be used on any course that has adequate checkpoints, but it is more commonly used in conjunction with dead reckoning and VFR radio navigation.

   **Dead Reckoning**—Dead reckoning is navigation solely by means of computations based on time, airspeed, distance, and direction. The products derived from these variables, when adjusted by wind speed and velocity, are heading and GS. The predicted heading takes the aircraft along the intended path and the GS establishes the time to arrive at each checkpoint and the destination. Except for flights over water, dead reckoning is usually used with pilotage for cross-country flying. The heading and GS, as calculated, is constantly monitored and corrected by pilotage as observed from checkpoints.

   **Ground-Based Navigation**—Advances in navigational radio receivers installed in aircraft, the development of aeronautical charts that show the exact location of ground transmitting stations and their frequencies, along with refined flight deck instrumentation make it possible for pilots to navigate with precision to almost any point desired. Although precision in navigation is obtainable through the proper use of this equipment, beginning pilots should use this equipment to supplement navigation by visual reference to the ground (pilotage). This method provides the pilot with an effective safeguard against disorientation in the event of radio malfunction. There are three radio navigation systems available for use for VFR navigation. These are: (1) VHF Omnidirectional Range (VOR), (2) Nondirectional Radio Beacon (NDB), and (3) Global Positioning System (GPS). (Content from FAA-H-8083-25)
2. A good checkpoint is readily identified by other features or easy to spot—for example, major roads, lakes, rivers, power lines, and railroad tracks.
3. Things like major roads, lakes, rivers, and railroad tracks—checkpoints can be a little farther from your route line since you are at a higher altitude.
4. Since you are at a lower altitude, good checkpoints include power lines and things very close to your route line.
5. Checkpoints need to have a light on them for use at night; for example, towers with lights, or major roads like an interstate or major highway if lit up.
6. Major roads and lakes.
7. Things very close to your route line and things that would have lights.

## LESSON 5, Activity 2

### Radio Navigation Homework Problems (Student Notebook)

1. 75 knots
2. 30 gallons
3. 8.5 gallons
4. +9,868 feet