AERODYNAMICS, AIRCRAFT ASSEMBLY, AND RIGGING

ANSWERS

2-1 Answer C.
Aerodynamics is a study of laws, which have been proven to be the physical reasons why an airplane flies. Although it is not necessary for an airframe and powerplant (A&P) mechanic to be as knowledgeable as an aeronautical engineer about aerodynamics, the mechanic must be able to understand the relationships between how an aircraft performs in flight and its reaction to the forces acting on its structural parts. Understanding why aircraft are designed with particular types of primary and secondary control systems and why the surfaces must be aerodynamically smooth becomes essential when maintaining aircraft.
[Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 2]

2-2 Answer B.
Atmospheric pressure is measured with an instrument called a barometer, composed of mercury in a tube that records atmospheric pressure in inches of mercury (Hg). The standard measurement in aviation altimeters and U.S. weather reports has been Hg. However, world-wide weather maps and some non-U.S. manufactured aircraft instruments indicate pressure in millibars (mb), a metric unit.
[Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 2-3]

2-3 Answer B.
The terms "speed" and "velocity" are often used interchangeably, but they do not have the same meaning. Speed is the rate of motion in relation to time, and velocity is the rate of motion in a particular direction in relation to time.
[Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 3]

2-4 Answer C.
Newton’s Third Law states that for every action (force) there is an equal and opposite reaction (force). This law can be illustrated by the example of firing a gun. The action is the forward movement of the bullet while the reaction is the backward recoil of the gun.

2-5 Answer B.
In Bernoulli’s principle states when a fluid (air) flowing through a tube reaches a constriction, or narrowing, of the tube, the speed of the fluid flowing through that constriction is increased and its pressure is decreased.

2-6 Answer B.
Within limits, lift can be increased by increasing the angle of attack (AOA), wing area, velocity, density of the air, or by changing the shape of the airfoil. When the force of lift on an aircraft’s wing equals the force of gravity, the aircraft maintains level flight.
[Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 5]
2-7 AMA001
The angle of incidence is that acute angle formed by
A. a line parallel to the wing from root to tip and a line parallel to the lateral axis of the aircraft
B. a line parallel to the wing chord and a line parallel to the longitudinal axis of the aircraft
C. the angular difference between the setting of the main airfoil and the auxiliary airfoil (horizontal stabilizer) in reference to the longitudinal axis of the aircraft

2-10 AMA001
The chord of a wing is measured from
A. leading edge to trailing edge
B. wingtip to wingtip
C. wing root to the wingtip

2-8 AMA001
The acute angle formed by the chord line of a wing and the relative wind is known as the
A. angle of attack
B. angle of incidence
C. longitudinal dihedral angle

2-11 AMA001
The angle of incidence of an airplane at rest
A. does not change when in flight
B. affects the dihedral of the wings in flight
C. is the same as the angle between the relative wind and the chord of the wing

2-9 AMA001
As the angle of attack of an airfoil increases, the center of pressure will
A. move toward the leading edge
B. remain stationary because both lift and drag components increase proportionally to increased angle of attack
C. move toward the trailing edge

2-12 AMA001
When the lift of an airfoil increases, the drag will
A. increase while the lift is changing but will return to its original value
B. also increase
C. decrease
2-7 Answer B.
The angle of incidence, the acute angle formed between the chord line of an airfoil and the longitudinal axis of the aircraft on which it is mounted.
[Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 6, G-2]

2-10 Answer A.
The chord of an airfoil or wing section is an imaginary straight line that passes through the section from the leading edge to the trailing edge.

2-8 Answer A.
The chord of an airfoil or wing section is an imaginary straight line that passes through the section from the leading edge to the trailing edge. The chord line provides one side of an angle that ultimately forms the AOA. The other side of the angle is formed by a line indicating the direction of the relative airstream. Thus, AOA is defined as the angle between the chord line of the wing and the direction of the relative wind.
[Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 6, G-2]

2-11 Answer A.
The angle of incidence in most cases is a fixed, built-in angle. The acute angle the wing chord makes with the longitudinal axis of the aircraft is called the angle of incidence, or the angle of wing setting.

2-9 Answer A.
The point of intersection of the resultant force line with the chord line of the airfoil is called the center of pressure (CP). The CP moves along the airfoil chord as the AOA changes. Throughout most of the flight range, the CP moves forward with increasing AOA and rearward as the AOA decreases.

2-12 Answer B.
The forces of lift and drag are the direct result of the relationship between the relative wind and the aircraft. The force of lift always acts perpendicular to the relative wind, and the force of drag always acts parallel to and in the same direction as the relative wind. The relative motion of the air over an object that produces lift also produces drag.
[Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 7-8]
2-13 AMA050
An airplane is controlled directionally about its vertical axis by the
A. ailerons
B. elevators
C. rudder

2-16 AMA050
An airplane which has good longitudinal stability should have a minimum tendency to
A. pitch
B. roll
C. yaw

2-14 AMA082
The elevators of a conventional airplane are used to provide rotation about the
A. vertical axis
B. longitudinal axis
C. lateral axis

2-17 AMA001
An airplane that has a tendency to gradually increase a pitching moment that has been set into motion has
A. poor lateral stability
B. poor longitudinal stability
C. good lateral stability

2-15 AMA081
Improper rigging of the elevator trim tab system will affect the balance of the airplane about its
A. vertical axis
B. lateral axis
C. longitudinal axis

2-18 AMA001
Stability about the axis which runs parallel to the line of flight is referred to as
A. longitudinal stability
B. lateral stability
C. directional stability
2-13 Answer C.
The axis that passes through the center, from top to bottom, is called the vertical, or yaw, axis. Yaw is controlled by the rudder located at the rear portion of the vertical tail assembly. [Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 9]

2-16 Answer A.
When an aircraft has a tendency to keep a constant AOA with reference to the relative wind (i.e., it does not tend to put its nose down and dive or lift its nose and stall); it is said to have longitudinal stability. Longitudinal stability refers to motion in pitch. See Figure 1-49 in the text for a table of flight control surfaces and their relationship to aircraft stability. [Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 11]

2-14 Answer C.
The axis that extends crosswise from wing tip to wing tip is the lateral, or pitch, axis. Pitch is affected by the elevators located at the rear portion of the horizontal tail assembly. [Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 9]

2-17 Answer B.
When an aircraft has a tendency to keep a constant AOA with reference to the relative wind (i.e., it does not tend to put its nose down and dive or lift its nose and stall); it is said to have longitudinal stability. Longitudinal stability refers to motion in pitch. See Figure 1-49 in the text for a table of flight control surfaces and their relationship to aircraft stability. [Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 11]

2-15 Answer B.
When an aircraft has a tendency to keep a constant AOA with reference to the relative wind (i.e., it does not tend to put its nose down and dive or lift its nose and stall); it is said to have longitudinal stability. Longitudinal stability refers to motion in pitch. The horizontal stabilizer is the primary surface that controls longitudinal stability. The action of the stabilizer depends upon the speed and AOA of the aircraft. Trim tabs are small airfoils recessed into the trailing edges of the primary control surfaces. Trim tabs can be used to correct any tendency of the aircraft to move toward an undesirable flight attitude. Their purpose is to enable the pilot to trim out any unbalanced condition which may exist during flight, without exerting any pressure on the primary controls. See Figure 1-49 in the text for a table of flight control surfaces and their relationship to aircraft stability. [Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 10-12]

2-18 Answer B.
Motion about the aircraft’s longitudinal (fore and aft) axis is a lateral, or rolling, motion. The tendency to return to the original attitude from such motion is called lateral stability. See Figure 1-49 in the text for a table of flight control surfaces and their relationship to aircraft stability. [Ref: Airframe Handbook H-8083-31A-ATB, Chapter 2 Page 11]