Aerodynamic Forces

1. Aerodynamic forces are generated due to _____
   a) shear and pressure force acting on body
   b) shear effects only
   c) only pressure forces
   d) twisting of beam

Explanation: Shear force and pressure force are most fundamental cause which generates aerodynamic forces. Shear forces typically seen as resisting forces which results in friction. Pressure force or pressure gradient will generate forces as well.

2. For ideal flow, total pressure along streamline will be _____

a) constant b) increases c) decreases d) always decreases by half

Explanation: Bernoulli's theorem is one of the fundamental principles in fluid dynamics and mechanics. It states total pressure along streamline will be constant. Total pressure is sum of static pressure and dynamic pressure.

3. For an incompressible flow, if local area velocity decreases then, the dynamic pressure will _____

a) decrease b) increase c) constant d) independent of velocity

Explanation: Dynamic pressure is defined as the product of density and square of velocity and 0.5. It is pressure exerted by fluid due to motion and the fluid flow. As mentioned, dynamic pressure is proportional to square of velocity and hence, if velocity decreases then, the value of corresponding dynamic pressure is reduced as well.

4.. If static air pressure is 0.5 bar and dynamic pressure is 0.85 bar then, find total pressure acting on a body.
a) 1.35 b) 5 c) 7 d) 8.56
Explanation: Total pressure = static pressure + dynamic pressure = 0.5 + 0.85 = 1.35 bar.

5. Consider an incompressible flow. If static pressure increases then, the local free stream velocity _____
a) decreases b) increase c) remains same d) insufficient data

Explanation: If static pressure is increased then the corresponding value of the dynamic pressure should decrease. Bernoulli's has provided better understanding of pressure acting on the aircraft.

6. Skin friction drag is defined as _____
a) drag due to friction between skin and fluid flow. b) wing lift drag
c) such drag does not exist. d) lift induced

Explanation: Skin friction drag is defined as drag caused by the friction between fluid flow and the skin of an object. Skin friction can lead to aerodynamic heating phenomena. Wing lift drag is affected by the lift produced. Lift induced drag is drag which is Induced due to wing lift in finite wing.

7. Increment in the skin friction drag due to prop-wash is called _____
a) scrubbing drag b) vortex c) swirl d) curling flow
View Answer

Explanation: Scrubbing drag is drag produced due to Increment in skin friction drag as a result of prop wash. Vortex is produced due to pressure difference. Swirling is nothing but the turning of flow. Curling of flow can be seen as change in direction of flow.

8. _____ is one of the sources of drag.
a) Viscous separation b) Drafting c) Signal strength d) Lift only
Explanation: Viscous separation is one of the major factor of the drag generation. Drafting is concerned with drawing. Signal strength is affected by distance between source and target. Lift only is not source of drag. Lift is responsible for lift induced drag.

9. The location of separation point will depend on _____
a) curvature of the body b) body weight c) mass of body d) only on body length
View Answer

Explanation: Curvature of the body will affect the location of separation point.

10. Wave drag is produced due to _____
a) shock wave formation b) incompressible flow
c) fluid is not compressible d) flow separation of incompressible flow
Explanation: Wave drag is primarily result of shock wave formation. Shock waves are very thin layer across which we can observe drastic change in the flow properties. Across shock, pressure and temperature will increase drastically. This sudden change in pressure results in the wave drag.

11. Drag which is **produced due to lift is called?**
a) Induced drag b) Parasite drag c) Weight d) Thrust drag
Explanation: Drag which is produced due to lift is called lift induced or simply induced drag. Induced drag is generated due to downwash phenomena. This downwash induces an additional force component which is acting in the opposite direction of the aircraft forward motion. This induced force is called induced drag or lift induces drag.

12. Induced drag of the airfoil is _____
a) 0.0N b) 1.2N c) 20 N d) 25.8KN
Explanation: Given, an airfoil
Airfoil has infinitely long span.
Now, induced drag coefficient is given by,
$Cdi = S*Cl^2/\pi*e*b2 = S*Cl^2 / \pi*e*\infty = 0$ N.

13. What is interference drag?
a) Drag produced by interaction of different components b) Skin friction drag
c) Lift induced drag d) Drag due to weight of the aircraft only
View Answer

Explanation: Drag produced due to interaction between various components is termed as interference drag. Skin friction drag is due to viscosity effects. Skin friction is one of the parameters which affects aerodynamic heating. Lift induced drag is result of vortices and downwash.

14. If I want to design an aircraft which primary flies in a low speed region then, which type of drag shouldn't be considered?
a) Wave drag b) Parasite drag c) Induced drag d) Form drag only
Explanation: Wave drag is drag produced at high speeds. At supersonic or near supersonic speed due to shock formation, the wave drag is produced. Hence, for low speed aircrafts, the wave drag is not a key parameter.

15. The change in local air flow velocity will produce small change in skin friction drag.
a) True b) False

Explanation: As the lift on the wing changes, the corresponding value of velocity at upper and lower surface will also change. This change in local flow velocity will produce small change at skin friction drag. This effect is called 'super velocity' effect.