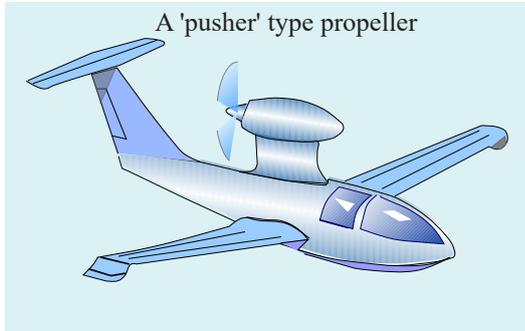


Whether the propelling device is a propeller or a jet, a few basic facts always apply to the amount of thrust required in flight:

- 1 In level flight at constant speed, thrust must always be exactly equal to drag.
- 2 In a climb at constant speed, thrust must always be greater than drag.
- 3 In a descent at constant speed, thrust must always be less than drag.



EXERCISE A3

Try these questions on DRAG

Question No 1

Drag is that component of the total reaction which acts

- [a] at right angles to the relative airflow
- [b] opposite to the direction of motion and parallel to the relative airflow
- [c] at right angles to the chord line
- [d] in the same direction as motion and parallel to the relative airflow

Question No 2

The chief source of drag on an aircraft flying level at low airspeed is

- [a] lift is no longer acting at right angles to the relative airflow
- [b] air spilling over the wingtips producing vortices and eddies
- [c] the angle of attack being lower than at normal cruising speed
- [d] the elevator requiring a large degree of deflection

Question No 3

The form of drag which predominates at low airspeed is called

- [a] parasite drag
- [b] total drag
- [c] airflow drag
- [d] induced drag

Question No 4

The form of drag which predominates at high airspeed is called

- [a] parasite drag
- [b] total drag
- [c] airflow drag
- [d] induced drag

Question No 5

As airspeed is increased in level flight from just above stalling speed to maximum speed, the induced drag acting

- [a] increases continuously
- [b] decreases continuously
- [c] increases then decreases
- [d] decreases then increases

Question No 6

As airspeed is increased in level flight from just above stalling speed to maximum speed, the parasite drag acting

- [a] increases continuously
- [b] decreases continuously
- [c] increases then decreases
- [d] decreases then increases

Question No 7

The combined effect of induced drag and parasite drag gives rise to total drag. The *least* total drag occurs

- [a] at low airspeed when parasite drag is lowest
- [b] at high airspeed when induced drag is lowest
- [c] at an intermediate airspeed when both induced and parasite drag are fairly low
- [d] at the stalling speed when the speed of the relative airflow is lowest

Question No 8

As speed is reduced in level flight from maximum speed to the stalling speed, the total drag acting

- [a] increases continuously
- [b] decreases continuously
- [c] increases then decreases
- [d] decreases then increases

Question No 9

A wing enjoys its maximum efficiency in level flight when

- [a] airspeed is highest [b] airspeed is lowest
[c] total drag is least [d] lift is greatest

Question No 10

The best lift/drag ratio occurs

- [a] at the stalling angle where maximum lift is being produced
[b] at the smallest possible angle of attack where minimum drag is being produced
[c] at a medium angle of attack where the required lift is accompanied by least drag
[d] at the lowest airspeed where the least disturbance to the airflow occurs

ANSWERS TO EXERCISE A3

Question No	Comment
1 [b]	That component of the total reaction which acts to oppose motion is called drag. It is represented by a vector which acts parallel to the relative airflow and against the direction of motion.
2 [b]	The spillage of air over the wingtips and the resulting vortices and eddies are the source of induced drag. Air spills over the wingtips because the pressure above the wing is lower than the pressure beneath it. Since this pressure difference is necessary in order to generate lift, induced drag can be thought of as a by-product of lift. The only way to eliminate induced drag is to stop making lift!
3 [d]	You must be familiar with the terms used. The drag described in question two above is called induced drag.
4 [a]	Parasite drag is the drag that any object moving through the air experiences. The simplest way to think of it is the effort required to push the air out of the way as the object moves. It depends upon the shape of the object and the speed at which it is moving. Small streamlined shapes produce least parasite drag. The higher the speed, the greater the parasite drag.
5 [b]	Induced drag is highest when speed is lowest. The faster the speed, the less time there is for air to flow around the wingtip.
6 [a]	The effort required to push air out of the way becomes greater as speed is increased. Consider the bicycle rider illustration. At very high speed [above about 300 kt], considerable drag is produced simply by friction as the air runs across the aircraft surfaces. This is called skin friction and it is part of parasite drag.
7 [c]	It actually occurs when induced drag and parasite drag are equal. [See Fig 3.16]
8 [d]	At maximum speed, the total drag is high because of the high parasite drag. As speed is reduced, total drag reduces until the rising induced drag causes it to rise again.
9 [c]	In level flight, when total drag is least, the lift/drag ratio is at its best. Lift/drag ratio is the best measure of efficiency .
10 [c]	In level flight, the force of lift is not negotiable, it must equal weight. The value of lift÷drag therefore, must be greatest when drag is least. The best lift/drag ratio occurs at the speed where total drag is least.