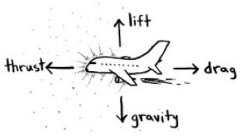

How do airplanes fly?

eslvideo.com Quiz by: anakes

1. Why do airplanes stay in the air?

- ○ There is no net force on them
- ○ They have wings
- ○ They have an engine

2. What four forces must be balanced?

- ○ Thrust, lift, gravity, pull
- ○ Pull, lift, gravity, push
- ○ Thrust, lift, gravity, drag

3. What is a crucial part of flying?

- ○ The engine on the plane
- ○ Getting air molucules to push the plane up
- ○ The wings

4. What part of the wings crash into air molecules more violently?

- ○ The undersides
- ○ The uppersides
- ○ All parts of the wings

5. Low pressure on the top of the plane plus high pressure on the bottom means:

- ○ The plane has lift
- ○ The plane glides
- ○ The plane drops

6. What direction do engines push air?

- ○ Forwards and backwards
- ○ Forwards
- ○ Backwards

7. For the most efficient engine it is good to have:

- ○ A really big propeller and a really small jet
- ○ A really big jet and a really small propeller
- ○ A really big jet and propeller

Transcript

Airplanes stay in the air because of one simple fact: there is no net force on them. And with no net
force, an object at rest stays at rest, and an object in motion stays that way â€“ even if itâ€™s in midair 10
km above the earthâ€™s surface. Now of course itâ€™s not like there arenâ€™t forces acting on the airplane;
gravity pulls down on the plane itself plus all of the people and baggage inside, and every single air
molecule that is shot through the engine or collides with the fuselage or wings pushes on the plane
as well. But if all of these forces are balanced â€“ in particular, if the air molecules push the plane UP
enough to counteract gravity â€“ then the plane stays up. Getting air molecules to push the plane up
is the crucial part of flying, and planes do this by making sure the undersides of the wings crash
into more air molecules more violently than the upper sides of the wings. When a plane is parked on
the ground, air molecules bounce off of the top and bottom of the wings in roughly equal amounts,
or with â€œequal pressure.â€ No lift. But in motion, the curved shape of the wings and their slightly
inclined angle means that the bottoms smash into more air molecules than before (and smash
harder into those molecules), so the pressure on the bottom of the wing goes up. In addition, fewer
air molecules now strike the top of the wing and those that do strike it less forcefully, partly
because itâ€™s being â€œshieldedâ€ by its own forward motion (the way running into the rain keeps your
back drier) and partly because a curving stream of air has lower pressure on the inside of the curve
since the molecules get thrown centripetally to the outside. But whatever the reasons, the pressure

on the top of the wing goes down. So, low pressure on the top plus high pressure on the bottom, and the plane has lift. And if the pressure/force imbalance is big enough, it can lift the plane up into the air against gravity! Now, all this crashing into air molecules to lift the plane also pushes to slow the plane down â€“ which it would, if not for engines. Engines also push air (in this case, backwards), either via a propellor, or a jet, or a jet driving a propellor. For various reasons, it turns out that you want to have a really big propellor driven by a really small jet for the most efficient engine. But even in inefficient engines, the spinning fan blades get their horizontal lift, which we call â€œthrust,â€ by moving quickly through air with a curved shape and a slightly inclined angle â€“ theyâ€™re essentially mini-wings. And so an airplane is essentially a meta-wing: it flies by moving mini-wings fast enough to push air molecules backwards, which moves the plane forward fast enough that its big wings push air molecules down. Whoa. Wingception.