BRIEFLY…

- When you breathe, you inhale oxygen and exhale carbon dioxide.
- With each normal breath, you inhale about one-half liter of air, 20% of which is oxygen.
- At 18,000’ MSL, you have half the sea level air pressure; hence, only half the oxygen.
- Oxygen starvation first affects the brain; judgment is impaired, so you may not know you are in trouble.
- We all react differently to the effects of hypoxia. Only physiological training can safely “break the code” for you.

PHYSIOLOGICAL TRAINING CLASSES FOR PILOTS

The effects of hypoxia can be safely experienced under professional supervision at the Civil Aeromedical Institute (CAMI) in Oklahoma City, or at selected WINGS hypoxia demonstration events.

If you are interested in taking a one-day aviation physiological training course with altitude chamber and vertigo demonstrations or a one-day survival course, learn about how to sign up for these courses that are offered CAMI by visiting this FAA Web site: https://www.faa.gov/go/aerophys

You’ll learn to recognize your symptoms of hypoxia. It could mean the difference between life and death.

Provided by
Aerospace Medical Education Division, AAM-400

To obtain copies of this brochure online:
https://www.faa.gov/pilots/safety/pilotsafetybrochures/

or contact:

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Federal Aviation Administration

HYPOXIA

The Higher You Fly…
The Less Air In The Sky

Breathing is one of the most automatic things we do – over 20,000 times a day. Each breath does two things for our body. It expels carbon dioxide when we exhale, and takes in oxygen when we inhale. It's a delicate balance.

Exercise or stress increases the production of carbon dioxide so we breathe faster to eliminate it and take in more oxygen at a greater rate.

Because of the effects of gravity, the amount of air containing oxygen is greater at sea level. For example, the pressure at sea level is twice that found at 18,000 feet mean sea level (MSL).

Although the percentage of oxygen contained in air at 18,000 feet is identical to that at sea level (a little over 20%), the amount of air our lungs take in with each breath contains half the oxygen found at sea level. Breathing faster or more deeply doesn't help. In fact, because you're consciously over-riding a system that is normally automatic, you'll be compounding the problem by exhaling too much carbon dioxide.

SUPPLEMENTAL OXYGEN

For Part 91 General Aviation operations the required flight crew must use supplemental oxygen for any portion of the flight that exceeds 30 minutes above a cabin pressure altitude of 12,500 feet mean sea level MSL up to and including 14,000 feet MSL. The flight crew must use supplemental oxygen for the entire duration of flight operations above a cabin pressure altitude of 14,000 feet MSL (14 CFR § 91.211).

In Part 135 Commuter and On Demand or Part 121 Air Carrier operations in unpressurized aircraft the required minimum flight crew must use supplemental oxygen for that part of the flight that exceeds 30 minutes above 10,000 feet through 12,000 feet MSL. Above 12,000 feet MSL each member of the flight deck crew must use supplemental oxygen during the entire portion of the flight at those altitudes (14 CFR § 135.89, § 135.157, § 121.327, & § 121.329).

For best protection, you are encouraged to use supplemental oxygen above 10,000 feet MSL.

At night, because vision is particularly sensitive to diminished oxygen, a prudent rule is to use supplemental oxygen when flying above 6,000 feet MSL.

So, when you fly at high altitudes, supplemental oxygen is the only solution. That's because supplemental oxygen satisfies the twin demands of having enough oxygen to meet your body's demands and a breathing rate that excretes the right amount of carbon dioxide.

HYPOXIA

Unfortunately, our body doesn't give us reliable signals at the onset of hypoxia – oxygen starvation – unless we have received special training to recognize the symptoms. In fact, it's quite the contrary. The brain is the first part of the body to reflect a diminished oxygen supply, and the evidence of that is usually a loss of judgment.

HYPOXIA TESTS

Altitude chamber tests, in which high altitude flight conditions are duplicated, have shown that some people in an oxygen deficient environment actually experience a sense of euphoria – a feeling of increased well-being. These subjects can't write their name intelligibly, or even sort a deck of cards by suits…yet, they think they're doing just fine!

Such is the insidious nature of oxygen deprivation. It sneaks up on the unwary and steals the first line of sensory protection – the sense that something is wrong – dreadfully wrong.

THE HIGHER YOU GO

Bear in mind, the progressive reduction of oxygen per breath will continue the higher you go. Flying above a layer of clouds that doesn't look too high, or flying in the mountains on a clear day – are the very environments that have caused many good "flat-land" pilots to get into trouble.

SYMPTOMS

Everyone's response to hypoxia varies. Unless, as we've stated, you've had special training to recognize its symptoms, hypoxia doesn't give you much warning. It steals up on you, giving your body subtle clues. The order of symptoms varies among individuals: increased breathing rate, headache, lightheadedness, dizziness, tingling or warm sensations, sweating, poor coordination, impaired judgment, tunnel vision, and euphoria. Unless detected early and dealt with, hypoxia can be a real killer.

CAUTION AND SAFETY

So, don't decide you'll try to fly over that range of mountains, thinking you'll turn back if you start to feel badly. You may feel great…until it's too late! Use supplemental oxygen.

SMOKING AND ALTITUDE

A Western state pilot lived to tell about this one. Cruising at 13,500 feet MSL over mountainous terrain in his light single, he took a deep drag on his cigarette and next remembered being in a screaming dive with just enough altitude left in which to pull out! That deep drag replaced precious oxygen in his brain with carbon monoxide…and he passed out.