

# AEROMEDICAL FACTORS

## HYPOXIA AND HYPERVENTILATION

1. Hypoxia results from a lack of oxygen in the bloodstream and causes a lack of clear thinking, fatigue, euphoria, and, shortly thereafter, unconsciousness.
2. The following are four types of hypoxia based on their causes:
  - a. **Hypoxic hypoxia** is a result of insufficient oxygen available to the body as a whole.
    - 1) EXAMPLE: Reduction of partial pressure at high altitude, a blocked airway, or drowning
  - b. **Hypemic hypoxia** occurs when the blood is not able to take up and transport a sufficient amount of oxygen to the cells in the body. The result is oxygen deficiency in the blood rather than a lack of inhaled oxygen.
    - 1) EXAMPLE: Carbon monoxide poisoning
  - c. **Stagnant hypoxia** results when oxygen-rich blood in the lungs is not moving.
    - 1) EXAMPLE: Shock, reduced circulation due to extreme cold, or pulling excessive Gs in flight
  - d. **Histotoxic hypoxia** is the inability of cells to effectively use oxygen.
    - 1) EXAMPLE: Impairment due to alcohol and drugs
3. Symptoms of hypoxia include an initial feeling of euphoria but lead to more serious concerns such as headache, delayed reaction time, visual impairment, tunnel vision, bluing of fingernails and lips (cyanosis), and eventual unconsciousness.
  - a. Symptoms of hypoxia are difficult to detect before the pilot's reactions are affected.
4. The correct response to counteracting feelings of hypoxia is to lower altitude or use supplemental oxygen.
5. Hyperventilation occurs when an excessive amount of air is breathed into the lungs at an excessive rate.
  - a. EXAMPLE: When one becomes excited as a result of stress, fear, or anxiety
  - b. Ways to overcome hyperventilation include
    - 1) Placing a paper bag over your nose and mouth and breathing into it,
    - 2) Talking aloud, and
    - 3) Slowing the breathing rate.

## **SPATIAL DISORIENTATION**

1. Spatial disorientation (sometimes called vertigo) is a state of temporary confusion resulting from misleading information sent to the brain by various sensory organs.
2. The best way to overcome the effects of spatial disorientation is to rely on the airplane instruments and ignore body (kinesthetic) signals.
3. The nervous system often interprets centrifugal force as vertical movement, i.e., rising or falling.
4. Coriolis illusion is caused by an abrupt head movement in a prolonged constant-rate turn.
  - a. This can cause spatial disorientation.
5. An abrupt change from a climb to straight-and-level flight can create the illusion of tumbling backwards.
6. A rapid acceleration during takeoff can create the illusion of being in a nose-up attitude.
7. False horizon is an illusion that is caused by a sloping cloud formation, an obscured horizon, or a dark scene spread with ground lights and stars.
8. The vestibular system in the inner ear is responsible for most of the illusions leading to spatial disorientation. The vestibular sense (motion sensing) can confuse the pilot.

## **VISION AND VISUAL ILLUSION**

1. Pilots should adapt their eyes for night flying by avoiding bright white lights for 30 min. prior to flight.
  - a. Thereafter, white light must be avoided because it will cause temporary night blindness and impair night vision adaptation.
2. The most effective way to scan for other aircraft in daylight is to use a series of short, regularly spaced eye movements that bring successive areas of the sky into your central vision field.
  - a. Each movement should not exceed 10°, and each area should be observed for at least 1 second to enable detection.
  - b. Only a very small center area of the eye has the ability to send clear, sharply focused messages to the brain. All other areas provide less detail.
  - c. At night, however, the eyes are most effective at seeing objects off center. Accordingly, pilots should scan slowly back and forth to facilitate off-center viewing.
3. Haze can also create the illusion of being a greater distance from the runway, resulting in the pilot's flying a lower-than-normal approach.

4. A narrower-than-usual runway may create the illusion that the airplane is higher than it actually is.
  - a. This illusion results in a lower-than-normal approach.
  - b. A wider-than-usual runway creates the opposite illusion and problem.
5. An upward-sloping runway may create the illusion that the airplane is at a higher-than-actual altitude.
  - a. This illusion results in a lower-than-normal approach.
  - b. A downward-sloping runway creates the opposite illusion and problem.

## **FATIGUE**

1. Fatigue is one of the most treacherous hazards to flight safety.
2. The nature of fatigue is such that pilots may not be aware they are feeling the effects of fatigue until after they have committed serious errors.
3. Fatigue can be either acute (short-term) or chronic (long-term).