

# **PRIVATE PILOT**

## **I. AREA OF OPERATION: PREFLIGHT PREPARATION**

### **J. TASK: AEROMEDICAL FACTORS**

#### **OBJECTIVE**

To determine that the applicant exhibits knowledge of the elements related to aeromedical factors by explaining:

1. The symptoms, causes, effects, and corrective actions of at least three (3) of the following:
  - a. Hypoxia.
  - b. Hyperventilation.
  - c. Middle ear and sinus problems.
  - d. Spatial disorientation.
  - e. Motion sickness.
  - f. Carbon monoxide poisoning.
  - g. Stress and fatigue.
  - h. Dehydration.
2. The effects of alcohol, drugs, and over-the-counter medications.
3. The effect of excess nitrogen from SCUBA dives upon a pilot or passenger in flight.

#### **ELEMENTS**

1. Hypoxia (reduced amount of oxygen). Symptoms include blue fingernails and lips, headache, decreased reaction time, impaired judgment, euphoria, visual impairment, drowsiness, lightheaded or dizzy sensation, tingling in fingers and toes, and numbness.
  - a. Hypoxic hypoxia: Insufficient oxygen available to the lungs (high altitude).
  - b. Hypemic hypoxia: Blood cannot transport oxygen to the body's cells (CO poisoning).
  - c. Stagnant hypoxia: Oxygen-rich blood in the lungs isn't moving (G-forces).
  - d. Histotoxic hypoxia: Inability of the body's cells to use the oxygen (alcohol, meds).
2. Hyperventilation:
  - a. Occurs during emotional stress, fright or pain.
  - b. Breathing rate and depth increases resulting in excessive carbon dioxide loss.
  - c. Can lead to unconsciousness.
  - d. Symptoms include headache, decreased reaction time, impaired judgment, euphoria, visual impairment, drowsiness, lightheaded or dizzy sensation, tingling in fingers and toes, numbness, pale/clammy appearance and muscle spasms.
  - e. Preventative actions should include breathing normally, talking aloud or breathing into a paper bag.
3. Middle ear and sinus problems:
  - a. Climbs and descents produce pressure changes which can cause ear and sinus pain.
  - b. During a climb, local pressure is reduced and the eardrum bulges outward.
  - c. During a descent, local pressure increases and the eardrum bulges inward.
  - d. The Eustachian tube normally allows air pressure to equalize in the middle ear, but sometimes it can be constricted due to a partial vacuum.
  - e. Like clearing the ears, air pressure in the sinuses normally equalizes through nasal passages, but can be blocked due to a sinus block or respiratory infection.
4. Spatial disorientation:
  - a. Three systems working to ascertain orientation and movement in space:
    - i. Eyes
    - ii. Kinesthesia (perception through nerves muscles and tendons).
    - iii. Vestibular (sensations through semicircular canals and fine hairs of inner ear).
  - b. Flying sometimes causes one of the three systems to supply conflicting information.
  - c. Acceleration due to gravity and maneuvering cannot be separated, causing illusions:
    - i. False horizon: Eyes convince kinesthesia and vestibular systems of level flight.
    - ii. Landing illusions:
      1. Runway appears narrower-than-usual when higher-than-normal.
      2. Upsloping terrain makes airplane appear higher.
    - iii. Flicker vertigo: Flashing lights at certain frequencies causing nausea.
    - iv. Autokinesis: When focused on, stationary points appear to move.

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5. Motion sickness:
  - a. Caused by the brain receiving conflicting signals from perception systems.
  - b. Symptoms include discomfort, nausea, dizziness, paleness and sweating.
  - c. Preventative actions include opening air vents and focusing outside the airplane.
6. Carbon monoxide poisoning:
  - a. CO is a colorless and odorless gas produced by internal combustion engines.
  - b. When breathed, it prevents blood hemoglobin from carrying oxygen.
  - c. Heater manifolds and defrost vents may leak CO into the passenger cabin.
  - d. If exhaust gas is detected or CO detector activates, assume CO is present.
  - e. Corrective actions: Turn off heater, open air vents, terminate flight.
7. Stress:
  - a. Results in the body releasing adrenaline and increasing metabolism.
  - b. Examples of stressors can be physical, physiological or psychological.
  - c. Acute stress (short term stress) results in "fight or flight" response mechanism and can be overcome by a trained pilot.
  - d. On-going acute stress can develop into chronic stress and be debilitating.
  - e. Pilots experiencing chronic stress should not fly and should see a physician.
8. Fatigue:
  - a. Degrades attention and concentration. Impairs coordination and decision-making.
  - b. Timing disruption: Pilot performs tasks separately instead of as an integrated activity.
  - c. Disruption of perceptual field: Concentrating only on the center of vision.
  - d. Causes: Lack of sleep, mild hypoxia, physical or psychological stress.
  - e. No amount of training or experience can overcome the effects of fatigue.
9. Dehydration:
  - a. A critical loss of water from the body which causes fatigue.
  - b. Symptoms are dizziness, weakness, nausea, tingling, cramps and extreme thirst.
  - c. Can disable the body's control of temperature and cause heatstroke.
  - d. Water should be carried and used on long flights.
10. Alcohol:
  - a. Can impair judgment, even in small amounts.
  - b. Bloodstream absorbs almost all alcohol in a drink within 30 minutes.
  - c. Altitude multiplies the effect of alcohol on the brain.
  - d. Pilots should be more conservative than the "8 hours after" and "0.04%" rules.
  - e. Impairments in vision and hearing occur at alcohol blood levels as low as 0.01%.
11. Drugs:
  - a. Prescription and over-the-counter drugs can impair judgment, memory, alertness, coordination, vision and the ability to make calculations.
  - b. Frequently taken drugs should be discussed with the Aviation Medical Examiner (AME) at the time of medical certificate renewal.
12. Excess (residual) nitrogen from SCUBA dives:
  - a. Increased pressure allows more nitrogen to dissolve in body tissues.
  - b. Reducing the pressure by ascending to the surface too quickly or flying too quickly after diving allows small bubbles of nitrogen to form in the body.
  - c. The escaping nitrogen causes a harmful and painful condition called "the bends."
  - d. The recommended minimum time between SCUBA diving and flying:
    - i. 12 hours for dives not requiring decompression stops.
    - ii. 24 hours for dives requiring decompression stops.

## **REFERENCES**

1. AC 61-23 / FAA-H-8083-25, Pilot's Handbook of Aeronautical Knowledge, Chapter 15.
2. AIM, Aeronautical Information Manual.