

## Private Pilot Ground Lesson: Aeromedical Factors

### Objectives:

1. to understand aeromedical factors including their causes, symptoms, and actions to take

### Justification:

1. in case a situation may arise during flight, it is important to understand the cause, effects, and corrective actions to take
2. knowledge of aeromedical factors is required for the private pilot checkride.

### Schedule:

Activity	Est. Time
Ground	1.0
<b>Total</b>	<b>1.0</b>

### Recommended Readings:

<b>PHAK</b>	Ch 16: ALL
<b>AIM</b>	Ch 8: Section 1
<b>AOPA</b>	<a href="http://www.aopa.org/asf/asquiz/2010/100129aeromedfactors/index.html">http://www.aopa.org/asf/asquiz/2010/100129aeromedfactors/index.html</a>

### Elements Ground:

- hypoxia
- hyperventilation
- middle ear/sinus problems
- spatial disorientation

- motion sickness
- carbon monoxide
- stress and fatigue
- dehydration
- effects of alcohol and drugs
- decompression sickness

### Completion Standards:

1. when the student exhibits knowledge relating to aeromedical factors including their symptoms, causes, and actions to take

## Presentation Ground:

### Hypoxia

1. *:a deficiency in oxygen which impairs the brain functions and other organs*
2. cause
  - (1) as an aircraft gains altitude, the pressure of the atmosphere decreases
  - (2) although the air is still 21% oxygen, the amount of oxygen has decreased.
3. symptoms
  - (1) at as little as 5000 ft, night vision can be impaired
  - (2) from 12,000 to 15,000 ft, judgement, memory, alertness, coordination, and the ability to make calculations are impaired
    - i. within 15 minutes at 15,000 feet, a pilot's performance can seriously deteriorate
  - (3) above 15,000 ft, the periphery of the visual fields gray out to a point where only the central vision remains (tunnel vision)
  - (4) pilots may feel dizziness or drowsiness
  - (5) a sense of well being (euphoria) or belligerence may occur
  - (6) fingernails and lips may turn blue
  - (7) after an extended amount of time, unconsciousness will follow
  - (8) stress, alcohol, smoking, medication may cause the body to be more susceptible to hypoxia
4. corrective actions
  - (1) reduce altitude immediately or
  - (2) start using supplemental oxygen

### Hyperventilation

1. *:an abnormal increase in the volume of air breathed in and out of the lungs, causing too little carbon dioxide*
2. causes
  - (1) can be caused subconsciously when a stressful situation is encountered
3. symptoms
  - (1) light-headed, suffocation, drowsiness, tingling in the extremities, coolness
  - (2) incapacitation can result from uncoordination, disorientation, and painful muscle spasms if allowed to continue
  - (3) if allowed to continue, unconsciousness can occur
4. corrective actions
  - (1) reduce rate of breathing
  - (2) recovery can be sped up by increasing the amount carbon dioxide intake by breathing into a paper bag held over the nose and mouth

### Middle ear and sinus problems

1. *:inability to equalize the pressure differential between the middle ear or sinuses and the outside pressure*
2. causes
  - (1) upper respiratory infection such as a cold or sore throat
  - (2) nasal allergic condition
    - i. can cause enough congestion to block the eustachian tube and make equalization difficult

### 3. symptoms

- (1) discomfort in the ears or sinus
- (2) severe ear pain or loss of hearing
- (3) possible rupture of the ear drum

### 4. corrective action

- (1) equalizing of the pressure can be attempted through yawning, swallowing, and tensing the muscles in the throat
- (2) equalization can be attempted by closing the mouth, pinching the nose, and **gently** blowing out the nostrils
- (3) the only sure way to prevent this is not to fly with any kind of congestion
- (4) note:
  - i. nasal sprays or drops may not be efficient enough to reduce congestion
  - ii. oral decongestants have side effects that can significantly impair a pilots performance

## **Spatial disorientation**

1. *:physiological disorder in which the pilot cannot readily orient the aircraft to the natural horizon*

- (1) illusions rank among the most common factors cited as contributing factors to fatal aircraft accidents

### 2. causes

- (1) sensory illusions
  - i. an abrupt correction of a banked attitude which has been entered too slowly to stimulate the motion sensing system in the inner ear can create the illusion of turning in the opposite direction
  - ii. sloping cloud formations, an obscured horizon, a dark scene spread with ground lights and stars, and certain geometric patterns of ground light can create illusions of not being aligned correctly with the actual horizon
  - iii. a narrow runway or an up-sloping runway can create the illusion that the airplane is high on landing. the opposite is also true
  - iv. an absence of ground features (as when landing over water) or rain on the windscreen can create the illusion of being higher than actual
  - v. atmospheric haze can create the illusion of being farther from the runway than actual
  - vi. lights on a straight path, or on a moving train can be mistaken for a runway and approach lights

### 3. corrective action

- (1) can only be prevented by visual reference to reliable, fixed points on the ground, or to flight instruments

## **Motion Sickness**

1. *:a continuous stimulation to the fluid in the inner ear which controls a persons sense of balance, and thus causing nausea, headaches, etc*

### 2. causes

- (1) over stimulation to the fluid in the inner ear. anyone can get it, and it gets progressively worse.
- (2) with experience, motion sickness is less prominent

### 3. symptoms

- (1) loss of appetite, saliva collecting in the mouth, perspiration, nausea, possible disorientation, headaches

#### 4. corrective action

- (1) open air vents, loosen clothing, and use oxygen if available
- (2) try to keep eyes focused on a point outside the airplane and avoid unnecessary head movements
- (3) terminate flight as soon as practical
- (4) note:
  - i. pilots susceptible to motion sickness should not take drugs to prevent it. these drugs can cause negative side effects

### **Carbon Monoxide**

1. *:potentially fatal situation in which a person takes in carbon monoxide, reducing the body's ability to get oxygen*

- (1) carbon monoxide is an odorless, colorless, tasteless gas contained in exhaust fumes

#### 2. causes

- (1) most heaters in aircraft work by air flowing over the engine exhaust manifold. use of these heaters while exhaust fumes are escape through exhaust manifold cracks and seals can cause CO poisoning

#### 3. symptoms

- (1) detection of exhaust fumes
- (2) headaches, drowsiness, dizziness while using the heater
- (3) symptoms similar to hypoxia

#### 4. corrective actions

- (1) immediately shut off heater
- (2) open all air vents and windows (if allowed by manufacturer)
- (3) if symptoms are severe, discontinue flight immediately, and seek medical attention

### **Stress and Fatigue**

1. stress *:the body's response to demands made upon it by everyday living*

2. fatigue *:a normal occurrence of everyday living in which a feeling of tiredness occurs after long physical or mental strain*

#### 3. causes

- (1) lack of sleep, emotional pressure, heavy mental work, poor health, perception of threat, etc

#### 4. symptoms

- (1) tired, use of poor judgement, lack of performance

#### 5. corrective actions

- (1) best way to deal with it is not to fly

(2) note:

- i. the amount of stress and fatigue must be judged by the pilot as to whether one is fit to fly

### **Dehydration**

1. *:critical loss of water from the body*

#### 2. causes

- (1) flying at high altitudes for extended periods of time (due to dry air)
- (2) exposure to high temperatures for extended periods of time

(3) lack of fluid intake

3. symptoms

(1) fatigue, then

(2) dizziness, weakness, nausea, tingling in hands and feet, cramping, extreme thirst

4. corrective actions

(1) ventilate an overheated cabin

(2) avoid exposure to extreme temperatures for extended periods of time

(3) drink water

(4) reduce altitude if possible

**Effects of alcohol and drugs**

1. alcohol

(1) alcohol can severely impair a pilots ability to fly

(2) it is illegal to fly or perform any crew member duties within eight hours of ANY alcohol consumption or being under the influence

(3) best rule of thumb is to give at *least* 12-24 hours from “bottle to throttle”

2. over-the-counter drugs

(1) a pilot should never fly while taking any over the counter drugs such as decongestants, allergy medicine, etc

(2) they may cause adverse side effects that could significantly reduce a pilot’s ability to fly at peak performance

**Decompression sickness**

1. *evolved gas in the body caused by the change in pressure from being under water, to being at the surface or above*

2. causes

(1) after scuba diving, excess nitrogen is in the body which must be allowed to escape over time

(2) exposure to high altitudes after any dive could cause decompression sickness (“the bends”) and is potentially life threatening

3. symptoms

(1) tingling in the joints

(2) pain in the joints

(3) headache

4. corrective actions

(1) prevention is the key to decompression sickness. if decompression occurs, the victim must be sent to a decompression chamber for medical attention

(2) the recommended waiting period before going to:

i. up to 8,000 feet MSL, at least 24 hours for dives requiring a controlled ascent, otherwise at least 2 hours

ii. for any flight above 8,000 ft, at least 24 hours should be waited before flying.