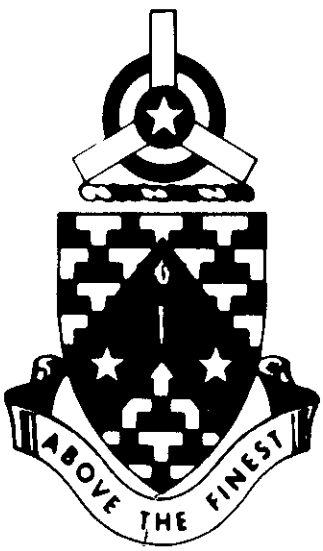
# PROGRAMED TEXT

AVIATION TOXICOLOGY

AM-49

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UNITED STATES ARMY
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FORT WOLTERS, TEXAS

# PROGRAMED TEXT

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| **FILE NO:** | **PROGRAM TITLE** |
|---|---|
| AM-49 | AVIATION TOXICOLOGY |

**POI SCOPE:** The effect of hypoxia, hyperventilation and toxic gases or chemicals that are frequently encountered in army aviation duty. The source of toxic elements encountered and methods for eliminating or minimizing associated hazards.

**INSTRUCTOR REFERENCES:**

Armstrong: Aerospace Medicine
Aero-Medical Association: Aviation Toxicology
Flight Surgeon Notes

| **PREPARED BY:** | **DATE:** |
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AVIATION TOXICOLOGY

# PREFACE

Aviation toxicology deals with poisonous gases, chemicals, and their effect on the human body. Your knowledge of these hazards and your ability to correctly react when necessary may save your life.

Start with frame 1 and work each frame in succession. Each frame will usually ask you a question. The correct answer is printed on the top of the next frame. If you were incorrect turn back and restudy the information before continuing on to the next frame. When you have finished the text, complete the self evaluation exercise. Now, begin by studying the performance objectives on page iv.

# PERFORMANCE OBJECTIVES

Without references you will be able to:

1. Identify proper first-aid treatment in the event of chemical contact with the eyes or skin.

2. Identify causes, symptoms and first-aid treatment for hypoxia.

3. Identify causes, sumptoms and first-aid treatment for hyperventilation.

4. Identify causes, symptoms and first-aid treatment for carbon monoxide poisoning.

FRAME 1

The chemicals which you will be exposed to and which are potentially dangerous to your skin, eyes and lungs are:

1. Battery acid.
2. Chemicals in fuels.
3. Chemicals in lubricants.
4. Chemicals in fire extinguishers.

When changing batteries, re-fueling or adding oil to your helicopter, exercise caution to avoid prolonged contact with the substance involved. If you get battery acid, fuel or oil in your eyes, flush your eyes out immediately with water and see the flight surgeon. Wash any skin surface that comes into contact with these chemicals with soap and water and see the flight surgeon if burning or redness persists.

Fire extinguishers are relatively safe until used on a fire. Short term exposure to high concentrations of fire extinguishants can be dangerous. The bromines and chlorines, when released and exposed to flames, can be extremely irritating to the eyes and lungs. If contact is unavoidable see your flight surgeon.

Which accident(s) require additional action regardless of continued irritations?

a. Battery acid on the hands and washed off with soap and water.
b. Fuel in the eyes and flushed out with water.
c. Irritation of the lungs and saw flight surgeon.

ANSWER: b. Hyperventilation - Receiving fire and flying in bad weather can cause anxiety and tension.

c. a, and then b, if necessary.

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FRAME 4

Carbon monoxide is a poisonous gas expelled from reciprocating engines and is incapacitating and deadly. Aviators on duty encounter carbon monoxide poisoning from aircraft, support vehicle engines and from exhaust heaters.

Your blood will absorb carbon monoxide approximately 200 times faster than oxygen, even to the point of excluding oxygen.

Carbon monoxide in arterial blood acts to prevent liberation of oxygen from the blood to the tissues.

| CONDITION | SYMPTOMS | FIRST AID ACTION |
|---|---|---|
| Carbon Monoxide | Action comparable to intoxication, headache, dizzy, tired and sleepy. | Increase ventilation of fresh air. Restore breathing if necessary. Assign observer and take victim to hospital or flight surgeon. |

If a member of your crew developed a severe headache and became sleepy during the pre-flight check prior to take off which of the following actions would you take.

a. Have crew member get out of aircraft and walk around in the fresh air.
b. Ventilate the aircraft.
c. Take crew member to flight surgeon.

ANSWER: b. fuel in the eyes and flush with water
See the flight surgeon.

---

FRAME 2

Undesireable effects created by exposure to chemicals are easily seen and felt and can be treated immediately. However, poisonous gases such as carbon monoxide are hazardous when airborne because the brain is affected.

When the brain receives insufficient oxygen or too much oxygen from the blood stream, dangerous and even fatal conditions can arise.

Insufficient oxygen to the brain is hypoxia. Too much oxygen to the brain is hyperventilation.

| HYPOXIA | HYPERVENTILATION |
|---|---|
| Insufficient oxygen due to breathing gases or flying above 14,000 feet without supplemental oxygen | Over-breathing due to fear, anxiety, tension or stress. |
| Symptoms - Loss of mental alertness, reduced vision, headache and throbbing in temples, nausea, vomiting and collapse. | Symptoms - Same |

If a member of your helicopter crew started vomiting and had a severe headache when airborne, what condition(s) could he be suffering from?

a. Hypoxia
b. Hyperventilation
c. Both of the above

ANSWER: c. Take crewmember to flight surgeon.

---

FRAME 5

To summarize, match the following:

| CONDITION | | TREATMENT |
|---|---|---|
| d | Hypoxia | a. Wash with soap and water |
| a | Gasoline on hands | b. Relax-breath normally |
| c | Battery acid in eyes | c. Flush with water. |
| b | Hyperventilation | d. Ventilate aircraft. |
| d | Carbon monoxide poisoning | |
| a | Exposure to fire extinguishants | |

Under which condition should you see the flight surgeon?

a. Chemical burns that persist. ✓
b. Hypoxia. ✓
c. Gasoline in an eye that has been cleaned. ✓
d. Headaches caused by continued tension. ✓
e. All of the above.

ANSWER: c both of the above. You may be unable to immediately determine the condition as the symptoms are the same.

---

FRAME 3.

Since the symptoms are identical, you must be able to counter either condition.

| HYPOXIA | HYPERVENTILATION |
|---|---|
| Increase ventilation of the aircraft. If flying at high altitude, descend below 14,000 ft. Persons affected see the flight surgeon after landing. | Relax and decrease rate of breathing to normal and breathe into cupped hands to increase intake of carbon dioxide. persons affected see flight surgeon after landing. |

Hypoxia is more dangerous than Hyperventilation, as it could possibly cause permanent brain damage. Because of this, you should always ventilate the aircraft as your first action. Even if you suspect Hyperventilation, ventilate the aircraft first, then if still sick, treat for Hyperventilation.

If flying just above the trees in bad weather and receiving occasional gunfire which condition would be most likely?

a. Hypoxia
b Hyperventilation

What would you do to minimize the condition?

a. Ventilate the aircraft
b. Relax and increase the intake of carbon dioxide
c a. and then b. if necessary

GO BACK TO PAGE 2, FRAME 4

ANSWER:
d Hypoxia
a Gasoline on hands
c Battery acid in eyes
b Hyperventilation
d Carbon monoxide poisoning
d Exposure to fire extinguishants
e All of the above.

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FRAME 6

If you feel that you understand the material in this program, take the short quiz without reference to the program. If not, study the areas that you are confused on and see an intstuctor if you are still confused prior to taking the quiz.

## SELF-EVALUATION EXERCISE

1. You are on a re-supply mission in the mountains (8,000 ft) with marginal (bad) weather and are having difficulty locating your landing zone. Due to the cold weather all windows and doors are closed. Although you both felt fine at take-off, the co-pilot is complaining of a bad headache and you are getting a very upset stomach. These are symptoms of:

   a. Insufficient oxygen ✔
   b. Over-breathing
   c. Both
   d. Neither

2. First, you decide to open the windows. This should be the first action if suffering from:

   a. Hyperventilation only
   b. Hypoxia only
   c. Both hypoxia and hyperventilation
   d. Neither

3. You have been flying for 30 more minutes now with plenty of ventilation, still are unable to locate the landing zone, and although your stomach feels better, the co-pilot says his headache is worse. He is probably suffering from:

   a. Hypoxia only
   b. Hyperventilation only
   c. Both hypoxia and hyperventilation
   d. Neither

4. Because of his headache, the co-pilot cups his hands over his mouth in an attempt to

   a. increase his carbon dioxide intake.
   b. decrease his carbon dioxide intake.
   c. increase his rate of breathing.
   d. warm his hands to relax.

5. You sight the landing zone and land the aircraft. The co-pilot states that his headache is less severe now. What follow up action should occur?

   a. You check in at operations while the co-pilot looks for some aspirin.
   b. Both check in at operations and no medical action is necessary.
   c. Both see the flight surgeon before taking off again.
   d. Rest before departure to base camp.

6. On your trip you must take another route over higher mountains. You check the maximum elevation on your route because:

   a. Flying above 12,000 ft may cause hypoxia.
   b. Flying above 14,000 ft may cause hypoxia.
   c. Flying above 12,000 ft may cause hyperventilation.
   d. **Flying above 14,000 ft may cause hyperventilation.**

7. Before the return trip, your crew chief is draining the fuel sump and gets fuel (JP-4) in his eyes. What should he do?

   a. Flush his eyes with soap and water.
   b. Nothing, JP-4 won't bother him.
   c. Flush his eyes with water.
   d. Blink his eyes rapidly and prepare for departure if no burning develops

8. After returning to base camp, you notice a crew chief carrying a battery on an OH-13. He stumbles and gets battery acid on his hands.

   a. Install the battery, wash his hands with soap and water if any redness appears, and see the flight surgeon if the redness persists.
   b. Wash his hands with fuel from the OH-13.
   c. Go immediately to the flight surgeon.
   d. Wash his hands with soap and water immediately and see the flight surgeon if burning persists.

9. While in flight one of your crew members complains of a headache dizziness and feels sleepy. What is the first action that you as a pilot should take.

   a. Do not disturb him so he can go to sleep.
   b. Force him to drink liquids.
   c. Ventilate the aircraft.
   d. Give him drops.

10. While in flight you experience a fire in the aircraft. You extinguish the fire but in doing so you are exposed to the chemicals and gases produced by the fire extinguishants. What action or actions should you take.

a. Ventilate the aircraft as soon as practical.
b. Land as soon as feasible.
c. See your flight surgeon.
d. Each of the above, in the sequence listed.

## ANSWERS TO SELF-EVALUATION EXERCISE

1. c
2. c
3. b
4. a
5. c
6. b
7. c
8. d
9. c
10. d

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