PROGRAMED TEXT
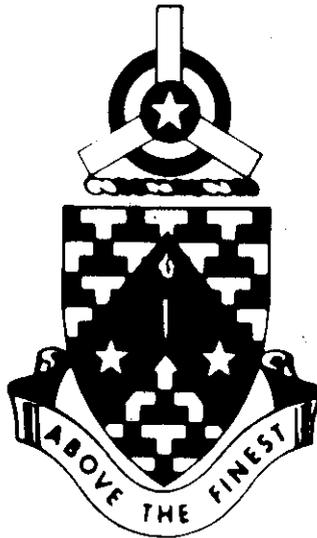
DENSITY ALTITUDE

AM-65

DECEMBER 1968

UNITED STATES ARMY
PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

PROGRAMED TEXT

PROGRAM TEXT

FILE NO:	**PROGRAM TITLE**
AM-65	DENSITY ALTITUDE

POI SCOPE: Explanation of the effect of density altitude on the lift producing capabilities of an airfoil. Determine density altitude by the chart method

INSTRUCTOR REFERENCES:

TM 1-300
TM 1-260

PREPARED BY:	**DATE:**
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PREFACE

This programed text has been designed to teach the effects of density altitude.

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

Upon completion of this programed text, you will be able
to:

1. Determine the effect density altitude has upon the lift
    producing capabilities of a helicopter.

2. Determine density altitude from the chart found in Army
    Aircraft Operator's Manual when given the pressure alti-
    tude and free air temperature.

FRAME 1

The efficiency of the lift producing capability of a rotor blade is in direct proportion to the density of air. Lift is INCREASED with an INCREASE in the density of air; lift is DECREASED with a DECREASE in the density of air.

Recall your high school general science and answer the following.

An increase in altitude causes_____in the density of air.

    a. an increase
    (b) a decrease

An increase in temperature causes_____in the density of air.

    a. an increase
    (b) a decrease

An increase in humidity causes_____in the density of air.

    a. an increase
    (b) a decrease

1

FRAME 6

To compute density altitude using the chart on page 6, follow the simple a.b.c. method listed below.

a.   Read up the vertical temperature line from the bottom of chart.

b.   From the right hand side of the chart, read left diagonally at the pressure altitude line.

c.   Where your temperature line and pressure altitude line meet, go horizontally to the left and read density altitude on left side of chart. (Listed in thousands of feet)

FRAME 2

As stated in previous weather courses, a standard day at sea level is a barometer reading of 29.92 and a temperature of 15°C. Temperature decreases as altitude increases. Determine from the diagram below the STANDARD TEMPERATURE LAPSE RATE.
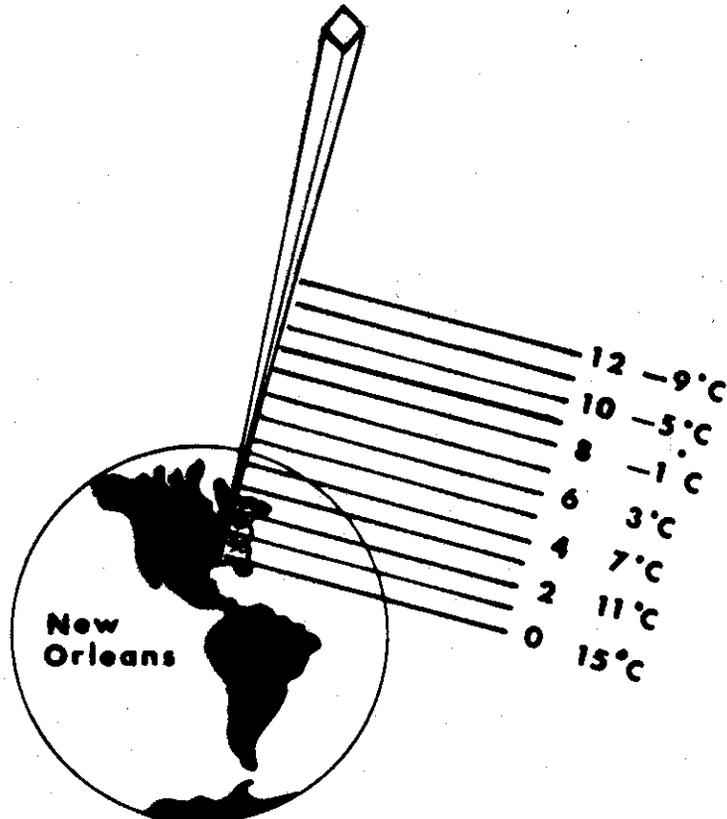
STANDARD TEMPERATURE LAPSE RATE PER 1000 FOOT INTERVAL

The standard temperature lapse is __2__ °C per 1000 foot increase in altitude.

The main point to remember is that the more dense the air, the more lift the rotor blades will produce.

Which of the atmospheric conditions described below will permit the heavier load to be lifted?

a. 35°C; 80% humidity; sea level
b. 35°C; 80% humidity; 5000 feet

3

The fast simple method to compute density altitude is the density altitude chart found in every Army aircraft operator's manual. See page 6. To use the chart determine the pressure altitude from your altimeter by dialing____in the Kollsman window. Read the temperature from the free air temperature gage in the cockpit. Study the sample problem on the chart.

Using the chart on page 6 find the following DAs.

Pressure Altitude	Temperature	Density Altitude
a. 1000	0°C	0,500'
b. 6000	30°C	9,000'
c. 11,000	15°C	13,500'

Check your answers on page 8 and then continue to the Self Evaluation Exercise on page 10.
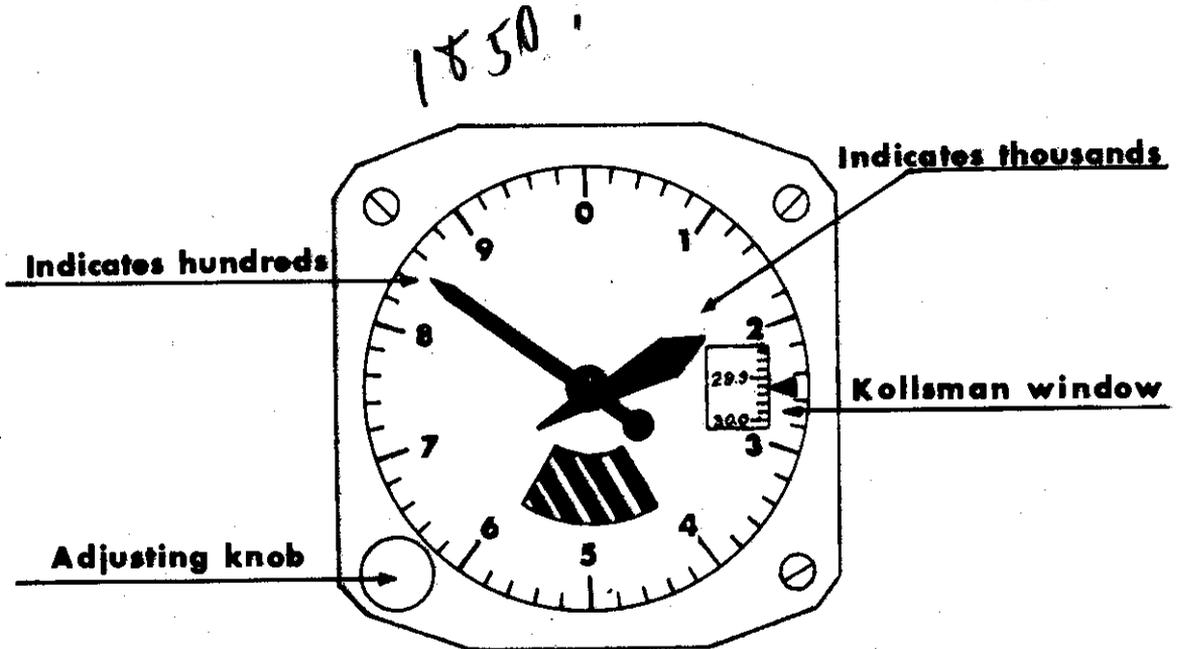
FRAME 3

PRESSURE ALTITUDE is the distance measured from the standard day pressure level of 29.92" (the standard datum plane).

To determine the PRESSURE ALTITUDE of a particular airfield or landing zone, dial 29.92 in the Kollsman window of the altimeter and read the pressure altitude indicated on the altimeter.

What is the PRESSURE ALTITUDE indicated on the altimeter below?

1850'

Indicates thousands

Indicates hundreds

Kollsman window

Adjusting knob

DENSITY ALTITUDE CHART

EXAMPLE: IF AMBIENT TEMP IS -15°C AND
PRESSURE ALT IS 6,000 FEET, THE
DENSITY ALT IS 4,000 FEET

DENSITY ALTITUDE — 1000 FT

ALTITUDE PRESSURE

TEMPERATURE - °C

6
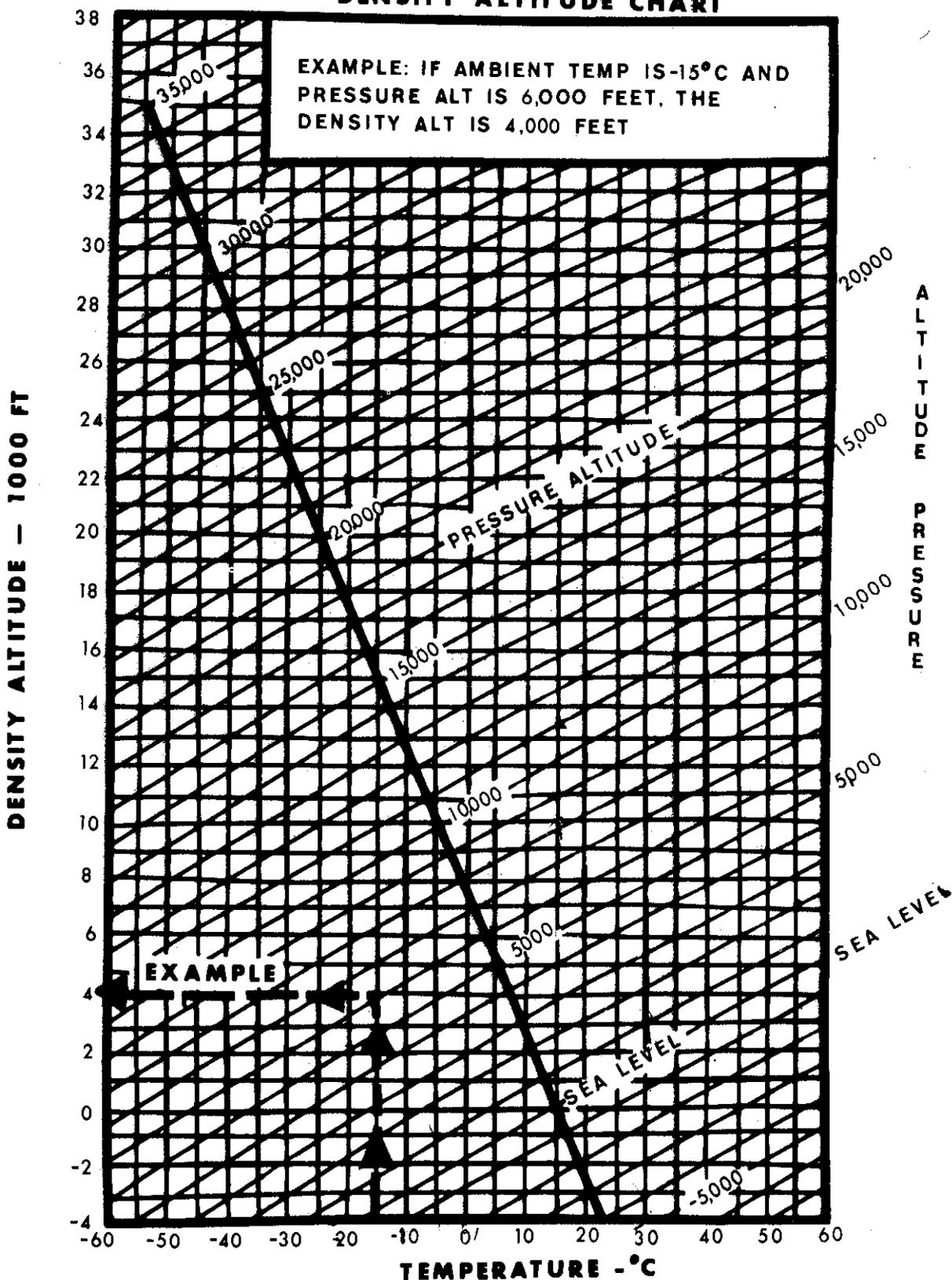
ANSWER: 1850'

FRAME 4

TEMPERATURE VARIATION has a great effect on the density of air. DENSITY ALTITUDE is defined as pressure altitude corrected for TEMPERATURE. An increase in temperature will increase density altitude.

SITUATION:

An aviator departs a base camp at 0700 hours. The field elevation is 2350' and the temperature is 20°C. He returns at 1500 hours and the temperature is 30°C.

The density altitude at the base camp will be _a_ when he lands as compared to his take-off.

   a) higher
   b. lower

ANSWERS: a. 29.92,   b. 8900,   c. 13,500
          See chart below for confirmation.

DENSITY ALTITUDE CHART

EXAMPLE: IF AMBIENT TEMP. IS –15°C AND PRESSURE
ALT IS 6,000 FEET, THE DENSITY ALT IS 4,000 FEET

TEMPERATURE - °C

DENSITY ALTITUDE - 1000 FT
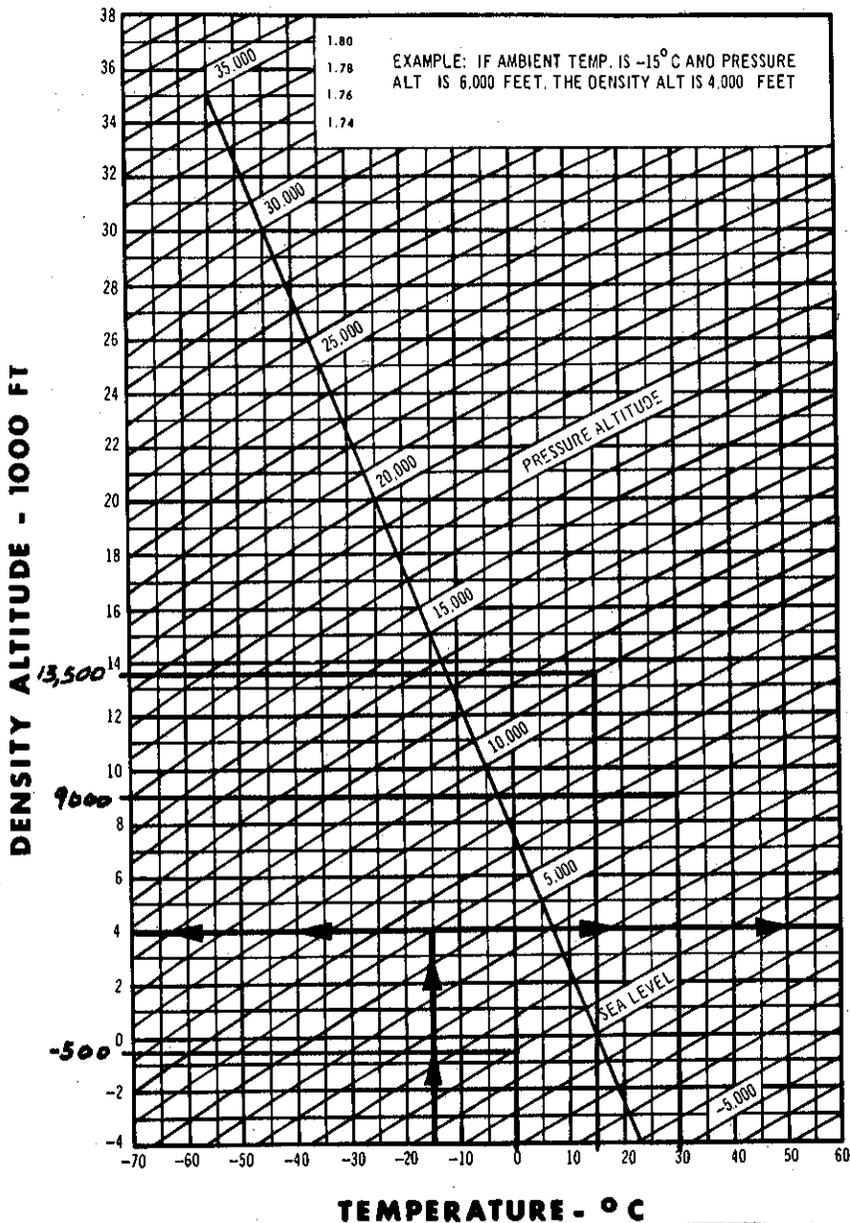
   Rule to remember: As the density altitude increases, the lift producing
capability of the rotor blades decreases; therefore, density altitude direct-
ly effects the load carrying capability of any helicopter.

ANSWER: a.   higher

FRAME 5

   DENSITY ALTITUDE is PRESSURE ALTITUDE corrected for TEMPERATURE;
therefore, the higher the density altitude, the lower the density of air
and lift capability is reduced. As an example, an airfield may be located
at sea level but due to high temperature the density altitude may be 3000'.

   No instrument is available for computing density altitude. It must be
computed from the temperature and pressure at the particular altitude under
consideration.
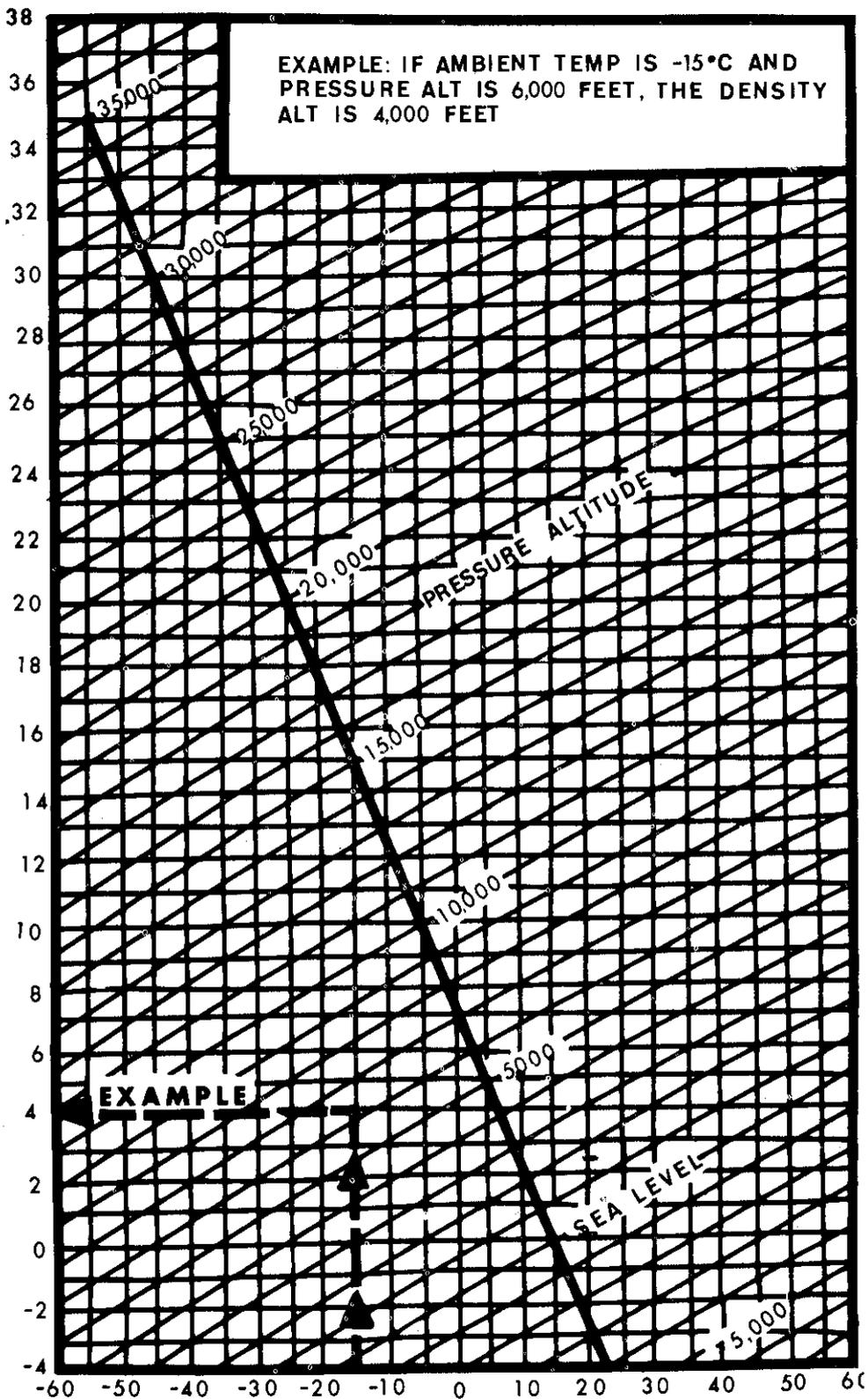
   The two methods of computing density altitude are:

   1.   Use of navigation computer

   2.   Density altitude charts

DENSITY ALTITUDE
SELF EVALUATION EXERCISE

1. An increase in altitude will cause

    a. an increase in temperature.
    b. a decrease in the density of air.
    c. an increase in the density of air.

2. The lift producing capability of rotor blades is increased by

    a. an increase in the density of air.
    b. a decrease in the density of air.

3. Density altitude is pressure altitude corrected for

    a. temperature.
    b. altitude.
    c. humidity.

4. To obtain the pressure altitude of a landing zone, you must first dial 29.92 in the Kollsman window of the altimeter.

5. The higher the density altitude,

    a. the lower the density of air.
    b. the higher the density of air.

6. Density altitude is a critical factor in flight planning because a

    a. high density altitude decreases helicopter lift capability.
    b. low density altitude decreases helicopter lift capability.

7. Use the chart on page 11 to determine the density altitude of an airfield if the free air temperature is 20°C and the pressure altitude is 1500'.

    a. 1900
    b. 2400
    c. -1000
    d. 3600

10

EXAMPLE: IF AMBIENT TEMP IS -15°C AND PRESSURE ALT IS 6,000 FEET, THE DENSITY ALT IS 4,000 FEET

DENSITY ALTITUDE - 1000 FT

TEMPERATURE —°C

ANSWERS TO SELF EVALUATION EXERCISE

1. b

2. a

3. a

4. 29.92

5. a

6. a

7. b

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