Altimeter and Density Altitude Quiz – Answers and Explanation

1) Aircraft altimeters are:
    a) Provided with a temperature compensation table in the POH
    b) Have a knob to compensate for local barometric pressure
    c) Cannot be compensated for temperature or pressure errors

The pressure compensating knob sets the local barometric pressure into the Kollsman window. This provides a correction which allows the altimeter to display MSL altitude. However it does not provide any temperature compensation.

2) The altitude we most commonly observe on our altimeter is:
    a) MSL
    b) AGL
    c) Density

We normally observe either MSL or Pressure Altitude (when flying above 17,999'). Neither AGL (absolute altitude) or density altitude are displayed on an altimeter.

3) The international standard atmosphere (ISA) is:
    a) Only valid at MSL
    b) A representation of what we will observe when flying
    c) A collective vote taken after many years of studying the earth's atmosphere

The ISA atmosphere was developed after studying the atmosphere over many parts of the earth for many years. The International Organization of Standard(s), ISO, established the ISA by votes from representative nations to the ISO. It has been adopted by other organizations, such as ICAO, and the US Bureau of Standards.

4) The international standard atmosphere (ISA) is used to:
    a) Study skew-T charts by meteorologists only
    b) Provide a baseline for aircraft performance determination
    c) Define atmospheric conditions at mean sea level (MSL)

In aviation, most POH performance tables either explicitly or implicitly use the ISA as a baseline for aircraft performance.

5) To read Pressure Altitude from an aircraft altimeter by:
    a) Setting the Kollsman window to local barometric pressure
    b) Setting the Kollsman window to ISA pressure at MSL
    c) It can't be done, PA cannot be read from an aircraft altimeter

ISA pressure at MSL is 29.92" Hg. Setting this into the Kollsman window causes the altimeter to read pressure altitude (PA).

6) The maximum allowable MSL error in an aircraft altimeter is:
    a) +/- 100 feet when compared to field elevation using field pressure
    b) +/- 75 feet when compared to field elevation using field pressure

c) +/- 50 feet when compared to field elevation using field pressure

In accordance with recommendations in the AIM section 7-2-3 if the altimeter disagrees more than +/- 75 feet from a known field elevation it should be put into a maintenance facility.

7) Airplane altimeter reads 7,500' MSL; the local barometric pressure is 29.92" Hg, your outside air temperature is 0 deg C. You can also infer that 7,500' MSL is also:
   a) Pressure altitude
   b) Absolute altitude
   c) True altitude and pressure altitude

At 7,500' MSL the ISA temperature is 0 deg C. The ISA pressure reference is 29.92" Hg so the altimeter is also reading both true altitude and pressure altitude.

8) You are flying at 10,000' MSL with a local field barometer of 30.01". The field elevation is 4,000' and the AWOS is reporting temp/dew point of -20/-25. Your true altitude is about:
   a) 10,570'
   b) 6,570'
   c) 9,430'

   Table 7-2-3 in the AIM gives a error of 570' for these conditions. Because this error is positive, it must be subtracted from your MSL altitude to give an approximation of the true altitude.

9) You fly from an airport with a barometer reading of 30.00" to a destination airport with a reading of 29.90" You neglect to reset your altimeter prior to entering the traffic pattern, the result will be:
   a) You will fly a traffic pattern 50' higher than normal at the destination airport
   b) You will fly a traffic pattern 100' lower than normal at the destination airport
   c) Not much of a change as it is only a 0.1" difference in pressure

   Refer to AIM section 7-2-3, a 1" decrease in pressure will result in your altimeter reading 1,000' higher. Thus your aircraft will be 100' lower by neglecting to reset your altimeter.

10) You fly into an airport at a field elevation of 620'. When you get ready to depart, you note the ATIS is out of service, you would:
   a) Leave the barometric pressure alone, it probably hasn't changed that much anyway
   b) Set the Kollsman knob so that the altimeter reads 620'
   c) Set the barometric pressure to 29.30 in Hg in the Kollsman window

   The only answer that makes sense is b.

11) You climb a 100' vertical ladder on the ramp at KHYI which has a field elevation of 595', your altitude is:
   a) 695' MSL
   b) 100' Absolute
   c) 100' True

Field altitude is not the same for all points on the airport. This is generally true for almost all airports. In fact, the ramp elevation in front of Skyport is closer to 620’ than it is to 595’. Recall that AGL or absolute altitude is the height above ground

12) Air Density increases with an increase in:
   a) Humidity
   b) Temperature
   c) Pressure

As pressure increases, the air density increases; both an increase in temperature and humidity cause a reduction of air density.

13) Density Altitude is:
   a) MSL altitude corrected for non-standard temperature
   b) Pressure altitude corrected for local barometric pressure
   c) Pressure altitude corrected for non-standard temperature

MSL altitude corrected for non-standard temperature is meaningless. b) Would yield MSL altitude. c) Is the textbook definition of density altitude

14) At 20,000’ the ISA temperature is:
   a) - 25 deg F
   b) – 55 deg C
   c) – 25 deg C

At sea level the ISA temperature is 15 deg C. You see a reduction of 2 degrees C for every 1,000’ increase in altitude (standard ISA temperature lapse rate). Hence, 15 deg C + [(20,000/1000) x -2 deg C)] = minus 25 deg C

15) You obtain the following upper air wind/temp for KCLL at 6,000’ as 3512+19. Another way to represent this temperature is: (note: all temps are in deg C)
   a) ISA = 3
   b) ISA + 22
   c) ISA + 16

We see temperature represented in many of the flight planning programs and sometimes in a POH as ‘ISA +/- X’ for a specified pressure altitude

16) For question 15, if your local barometric pressure is 29.95 “Hg, you would expect the density altitude at 6,000’ to be about:
   a) 10,000’
   b) 8,000’
   c) 4,000’

Most easily found by using an E6B.

17) Moist air is:

a) More dense that dry air

b) Less dense than dry air

c) The same density as dry air

Intuitively, adding moisture to air would seem to add weight to the air, yet the molecular weight of H2O, as a gas, is less than that of dry air. Thus, adding gaseous H2O to dry air causes a reduction of air density for the gaseous mixture.

18) You are taking off from an airport at a field elevation of 5,000' with a baro setting of 29.95 and an outside air temperature of about 104 deg F. The density altitude is about:

a) 9,000'

b) 1,000'

c) 5,000'

Use your E6B or else recognize that neither b) nor c) make sense with this temperature. Be sure to convert degrees F to C before you use your E6B

19) As density altitude increases

a) Takeoff distance increases, engine power remains the same, rate of climb increases

b) Takeoff distance increases, engine power decreases, and rate of climb increases

c) Takeoff distance increases, engine power decreases, and rate of climb decreases

With an increase in density altitude there is a decrease in air density; hence, maximum engine horse power and prop efficiency decrease. To get the same amount of lift, you must fly at

20) Density altitude is best operationally described as:

a) Pressure altitude corrected for ISA temperature

b) The altitude the airplane is performing at

c) Pressure altitude corrected for non-standard temperature

Knowing the textbook answer is nice, but knowing the operational answer is going to go a long way to making you a safer pilot. As air density decreases the wing, propeller, and engine 'thinks' they are at a higher altitude. Hence your performance at a lower altitude is like you were at a higher altitude.

21) Density altitude, as a textbook definition, is best described as:

a) The altitude you read with a barometric setting of 29.92" Hg, corrected for non-standard temperature

b) Pressure altitude corrected for ISA temperature

c) An altitude that has an air density corresponding to an ISA profile

Recall altimeters have no temperature compensation. When you set an altimeter to 29.92" Hg it reads pressure altitude at whatever the ambient temperature is. When you then correct pressure altitude for this ambient temperature (non ISA temperature), you obtain density altitude.

22) It is a hot day at KERV and the AWOS is reporting a density altitude of 3,420'. Before taking off, you would: (assumes N810SA or N172JD)

a) Lean the engine for best power in accordance with the POH

b) Set the mixture to rich until you reach 3,000’ MSL
c) Plan for a longer takeoff roll and a greater Vr due to the higher density altitude

Most normally aspirated (non-turbocharged) aircraft engines require leaning when flown at a density altitude greater than 3,000’ for best power. Leaving the mixture rich may reduce the power and make takeoff and climbs problematic in high density altitude conditions. Answer c) is partially correct regarding a longer takeoff roll, but Vr would remain the same since this is an indicated airspeed.