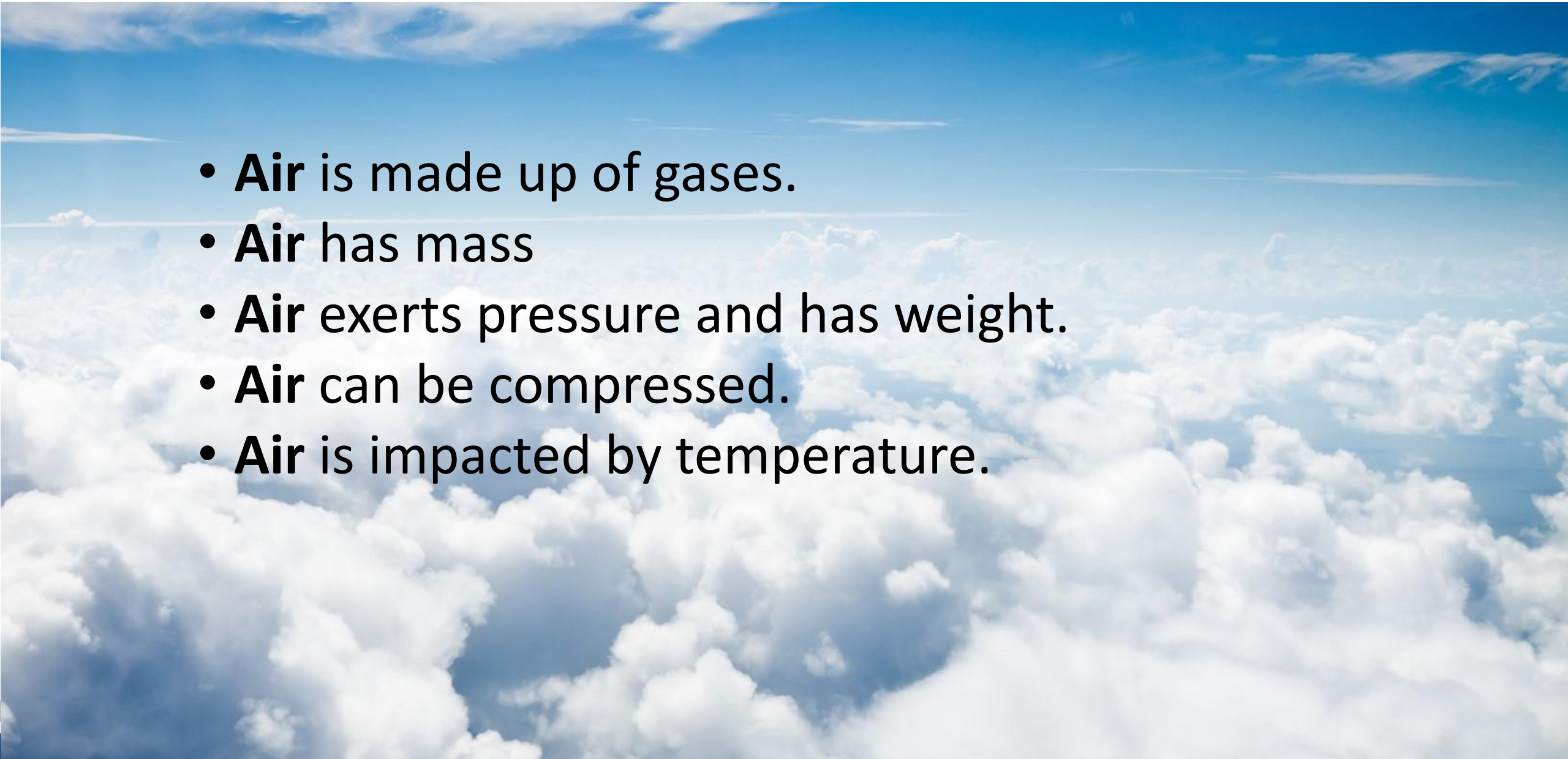
PRIVATE PILOT COURSE

PRINCIPLES OF FLIGHT

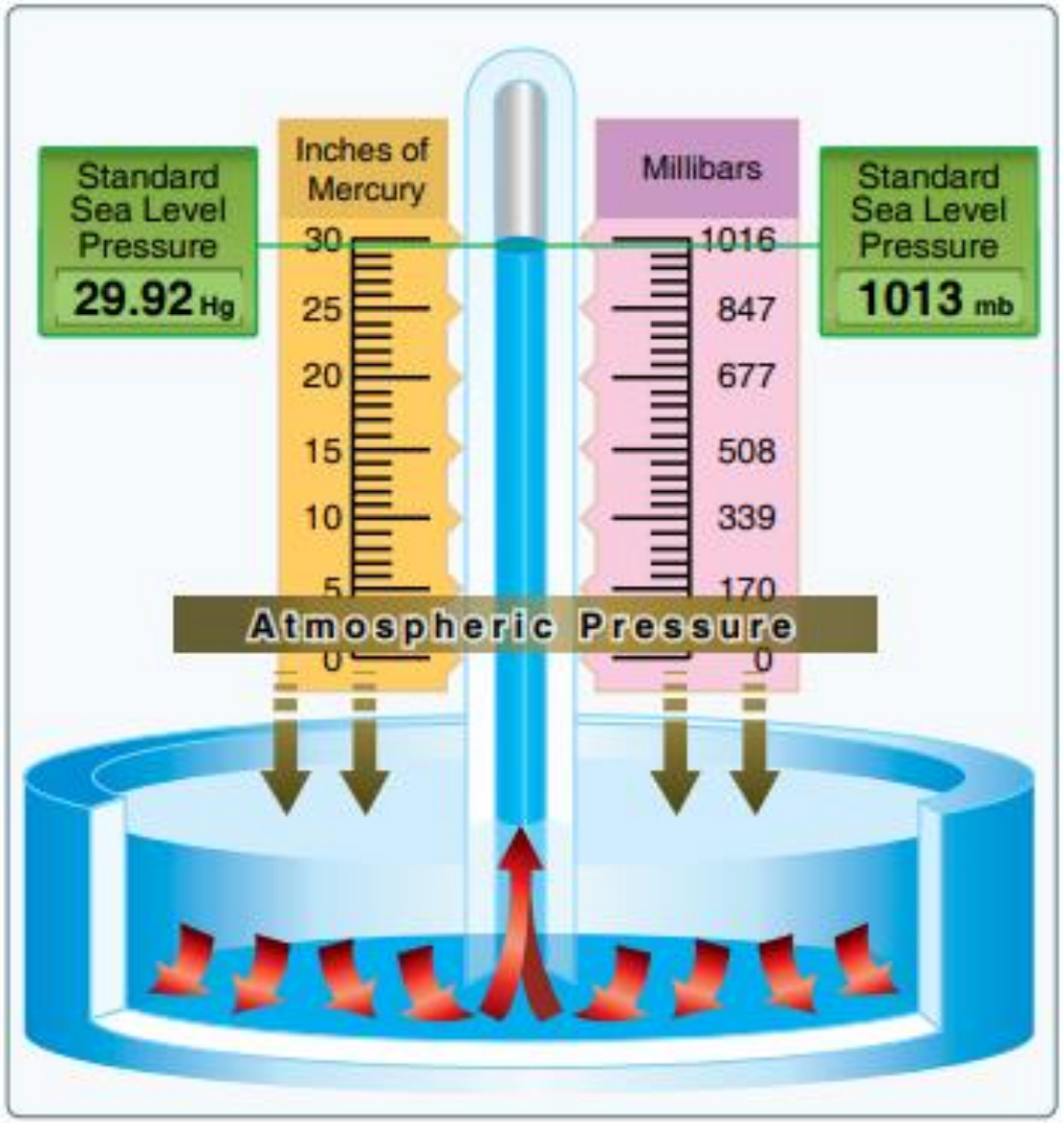
RAINIER
FLIGHT SERVICE

AIR



- **Air** is made up of gases.
- **Air** has mass
- **Air** exerts pressure and has weight.
- **Air** can be compressed.
- **Air** is impacted by temperature.

ATMOSPHERIC PRESSURE



Standard Atmosphere			
Altitude (ft)	Pressure (Hg)	Temperature	
		(°C)	(°F)
0	29.92	15.0	59.0
1,000	28.86	13.0	55.4
2,000	27.82	11.0	51.9
3,000	26.82	9.1	48.3
4,000	25.84	7.1	44.7
5,000	24.89	5.1	41.2
6,000	23.98	3.1	37.6
7,000	23.09	1.1	34.0
8,000	22.22	-0.9	30.5
9,000	21.38	-2.8	26.9
10,000	20.57	-4.8	23.3
11,000	19.79	-6.8	19.8
12,000	19.02	-8.8	16.2
13,000	18.29	-10.8	12.6
14,000	17.57	-12.7	9.1
15,000	16.88	-14.7	5.5
16,000	16.21	-16.7	1.9
17,000	15.56	-18.7	-1.6
18,000	14.94	-20.7	-5.2
19,000	14.33	-22.6	-8.8
20,000	13.74	-24.6	-12.3

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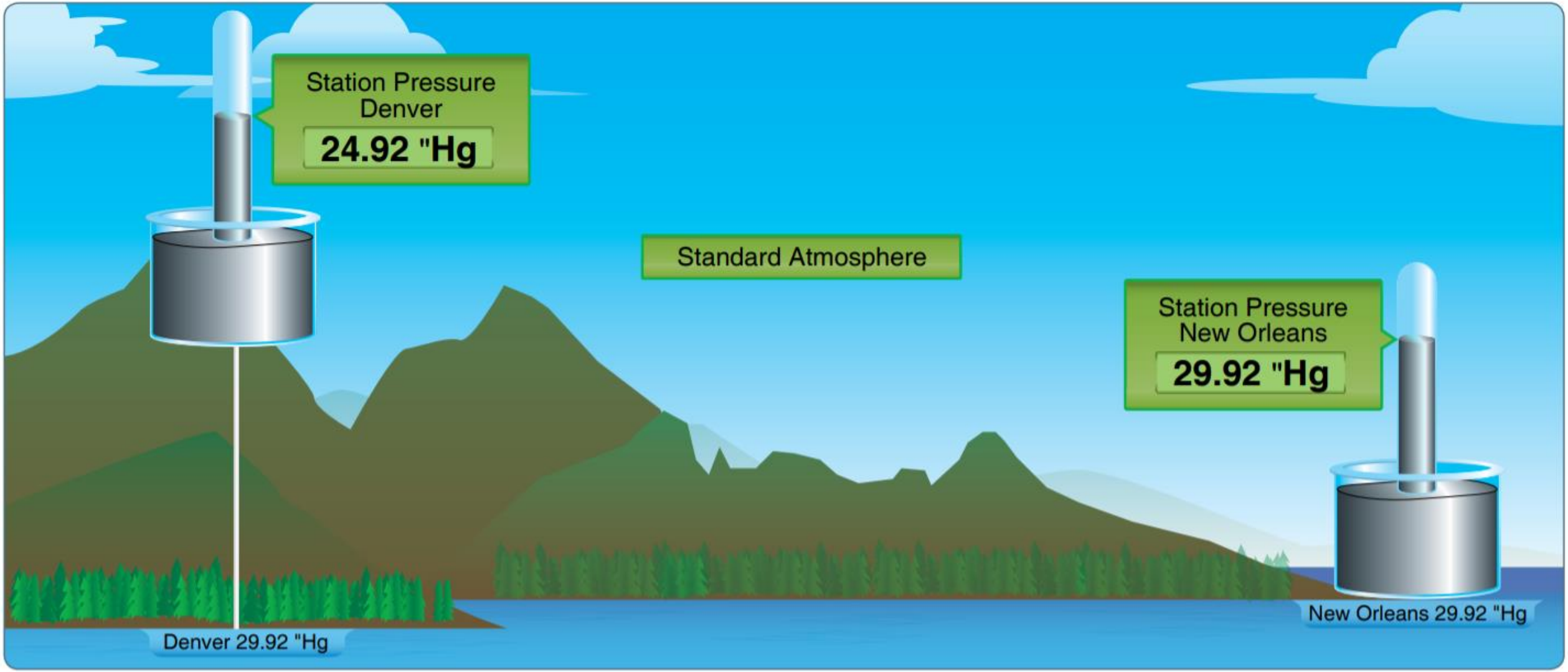
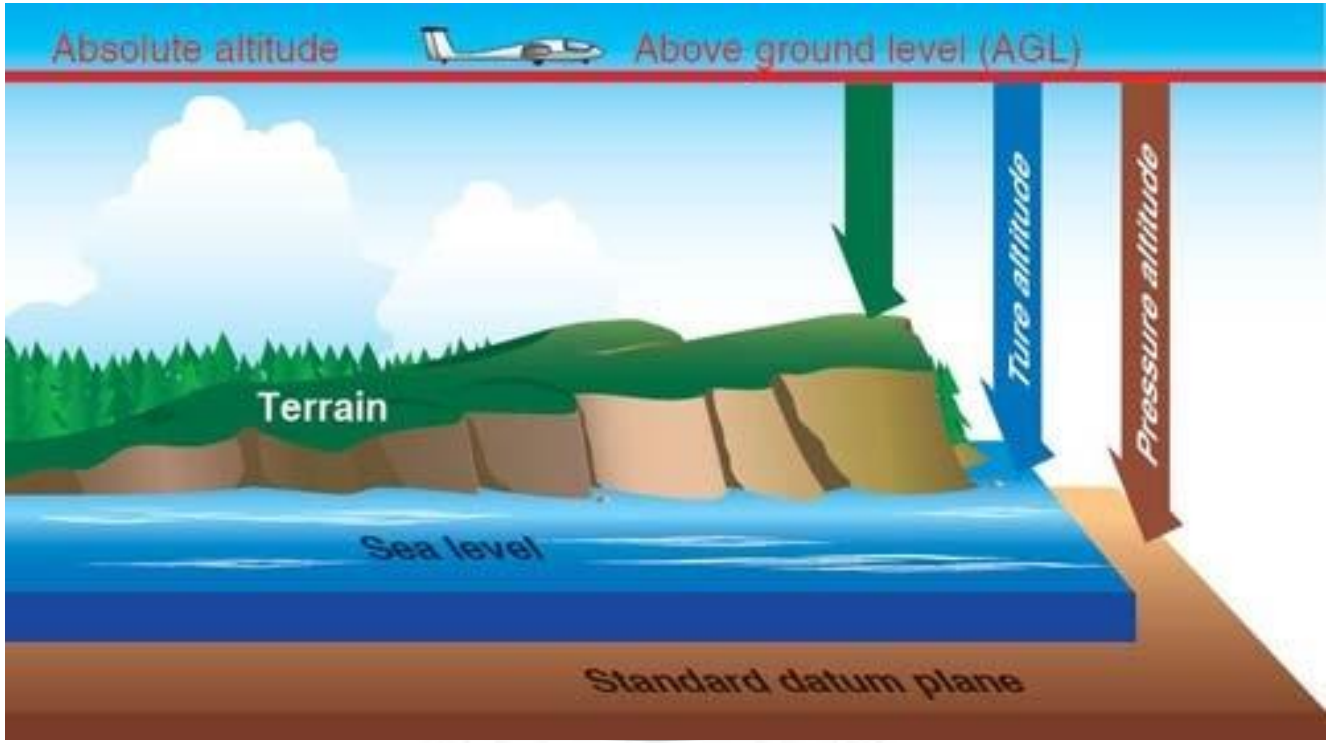
ATMOSPHERIC PRESSURE



5 TYPES OF ALTITUDE

- Indicated Altitude
- Absolute Altitude
- True Altitude
- Pressure Altitude
- Density Altitude



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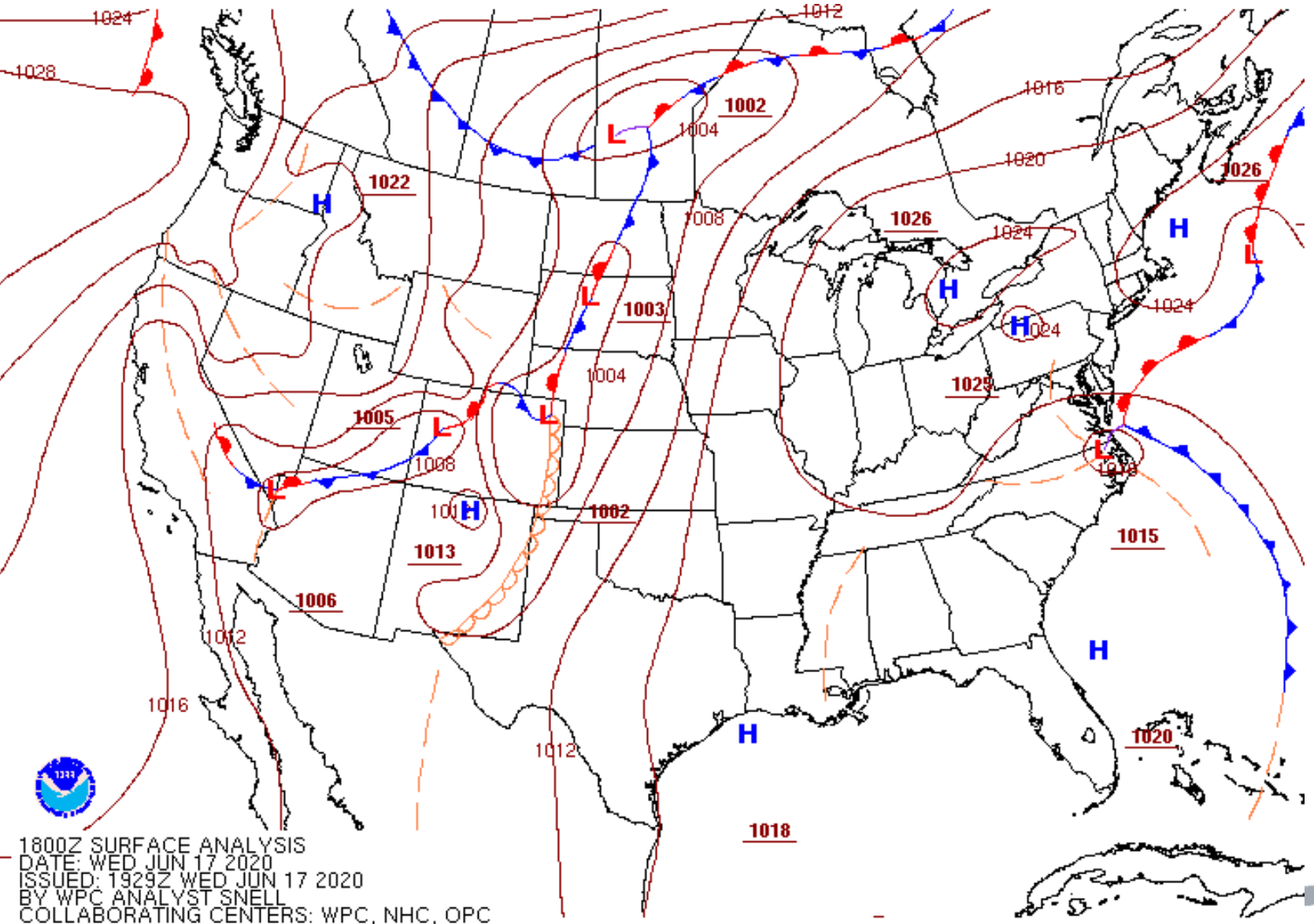
PRESSURE



What is standard atmospheric pressure?

29.92"

1013 mb

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PRESSURE ALTITUDE

How do we find Pressure Altitude?

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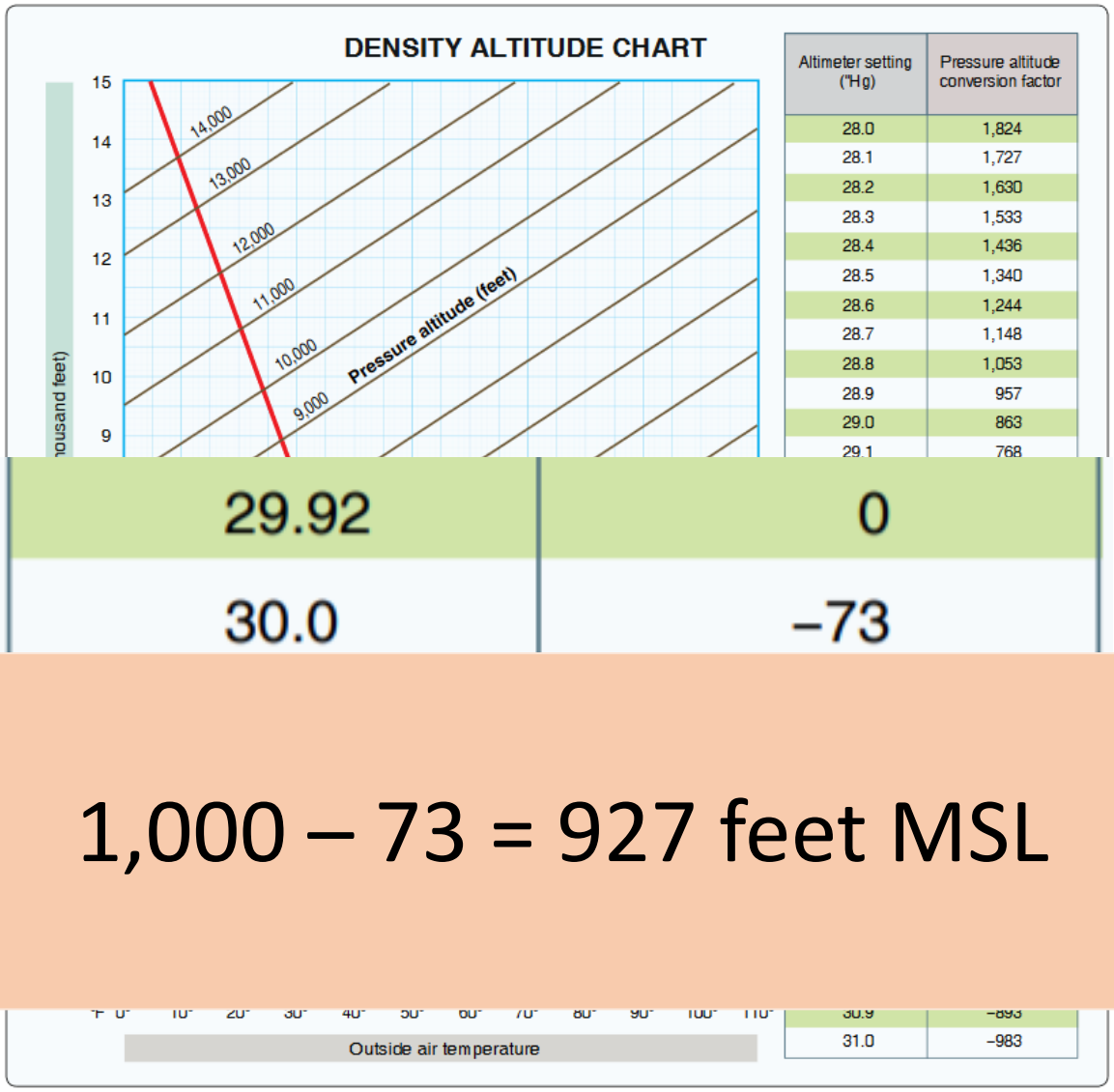
CALCULATING PRESSURE ALTITUDE



Altimeter setting ("Hg)	Pressure altitude conversion factor
28.0	1,824
28.1	1,727
28.2	1,630
28.3	1,533
28.4	1,436
28.5	1,340
28.6	1,244
28.7	1,148
28.8	1,053
28.9	957
29.0	863
29.1	768
29.92	0
30.0	–73
30.9	–893
31.0	–983

(Refer to figure 8.) Determine the pressure altitude at an airport that is 1,000 feet MSL with an altimeter setting of 30.00

1,000 – 73 = 927 feet MSL

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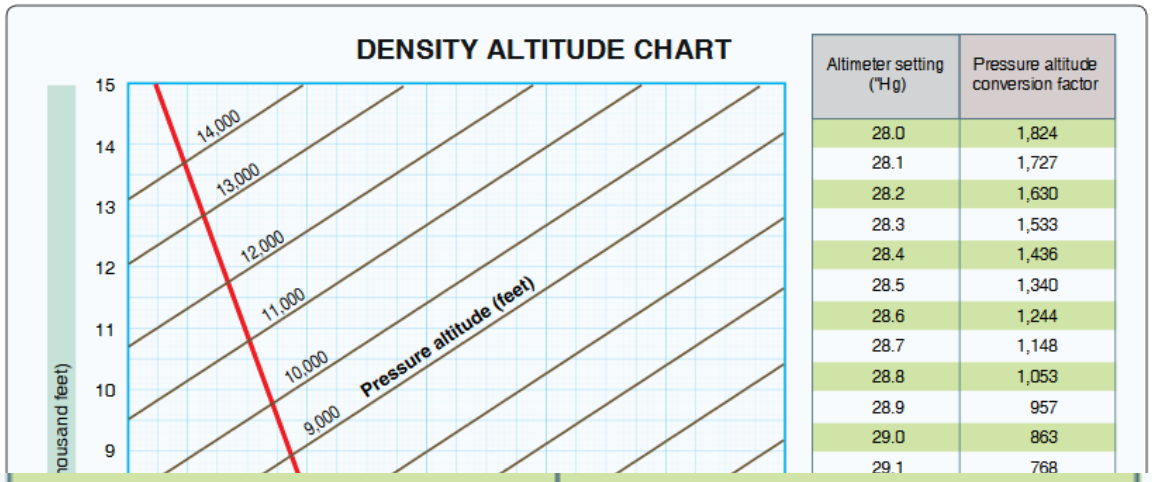
CALCULATING PRESSURE ALTITUDE



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28.8	1,053
28.9	957
29.0	863
29.1	768
29.92	0
30.0	–73

(Refer to figure 8.) Determine the pressure altitude at an airport that is 3,563 feet MSL with an altimeter setting of 29.96.

a) 3,556 feet MSL
b) 3,527 feet MSL
c) 3,6[illegible] MSL

.01 = -9

29.96 - 29.92 = .04

4 X –9 = -36

3,563 – 36 = 3,527 feet MSL

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CALCULATING PRESSURE ALTITUDE

Rule of Thumb
1" = 1,000 feet

(Refer to figure 8.) Determine the pressure altitude at an airport that is 3,563 feet MSL with an altimeter setting of 29.96.

a) 3,556 feet MSL
b) 3,527 feet MSL
c) 3,639 feet MSL

MATH

29.96 - 29.92 = .04

.04 X 1,000 = 40 feet

3,563 - 40 = **3,523 feet**

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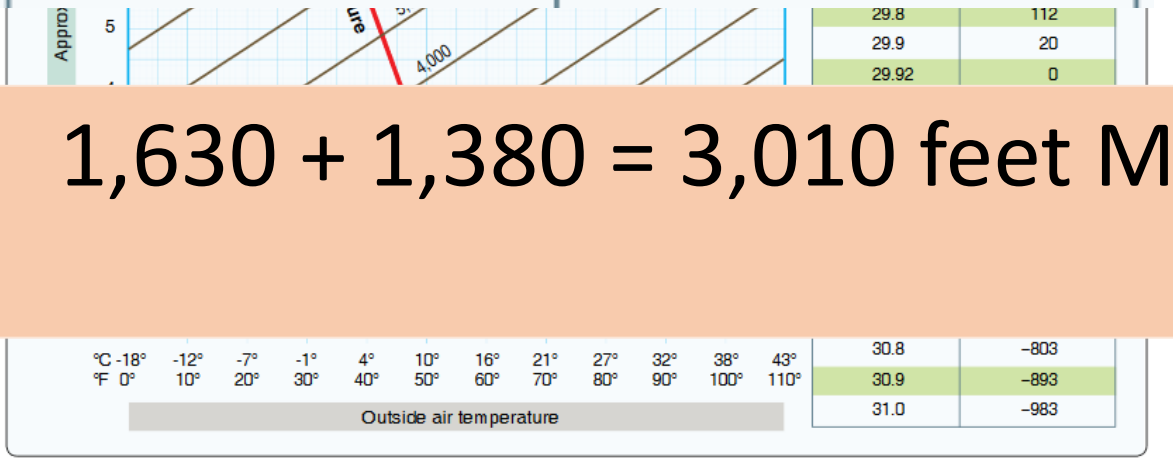
CALCULATING PRESSURE ALTITUDE

Altimeter setting ("Hg)	Pressure altitude conversion factor
28.0	1,824
28.1	1,727
28.2	1,630



Determine the pressure altitude with an indicated altitude of 1,380 feet MSL with an altimeter setting of 28.22 at standard temperature.

a) 3,010 feet MSL.
b) 2,991 feet MSL.
c) 2,913 feet MSL.

1,630 + 1,380 = 3,010 feet MSL

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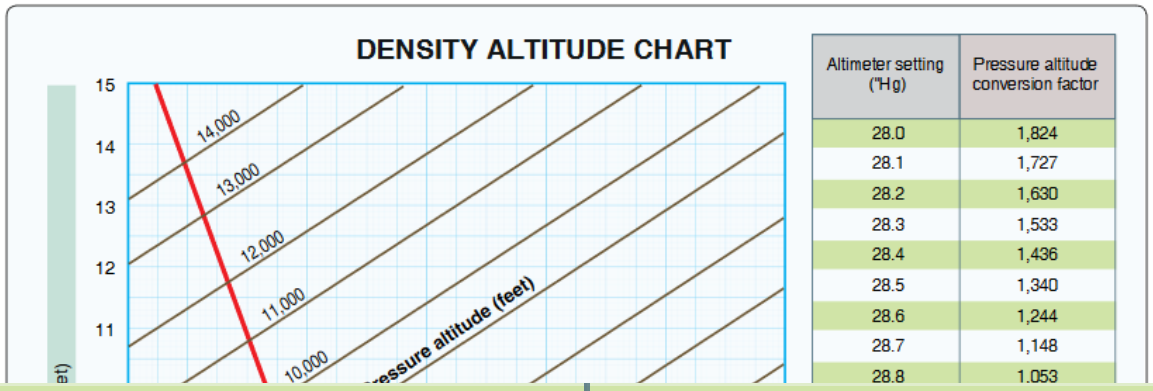
CALCULATING PRESSURE ALTITUDE



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28.4	1,436
28.5	1,340
28.6	1,244
28.7	1,148
28.8	1,053

29.92	0
30.0	–73

.01 = -9

29.97 - 29.92 = .05

5 X –9 = -45

1,386 – 45 = 1,341 feet MSL

(Refer to figure 8.) Determine the pressure altitude at an airport that is 1,386 feet MSL with an altimeter setting of 29.97.

a) 1,451 feet MSL.
b) 1,341 feet MSL.
c) 1,562 feet MSL.

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DENSITY ALTITUDE

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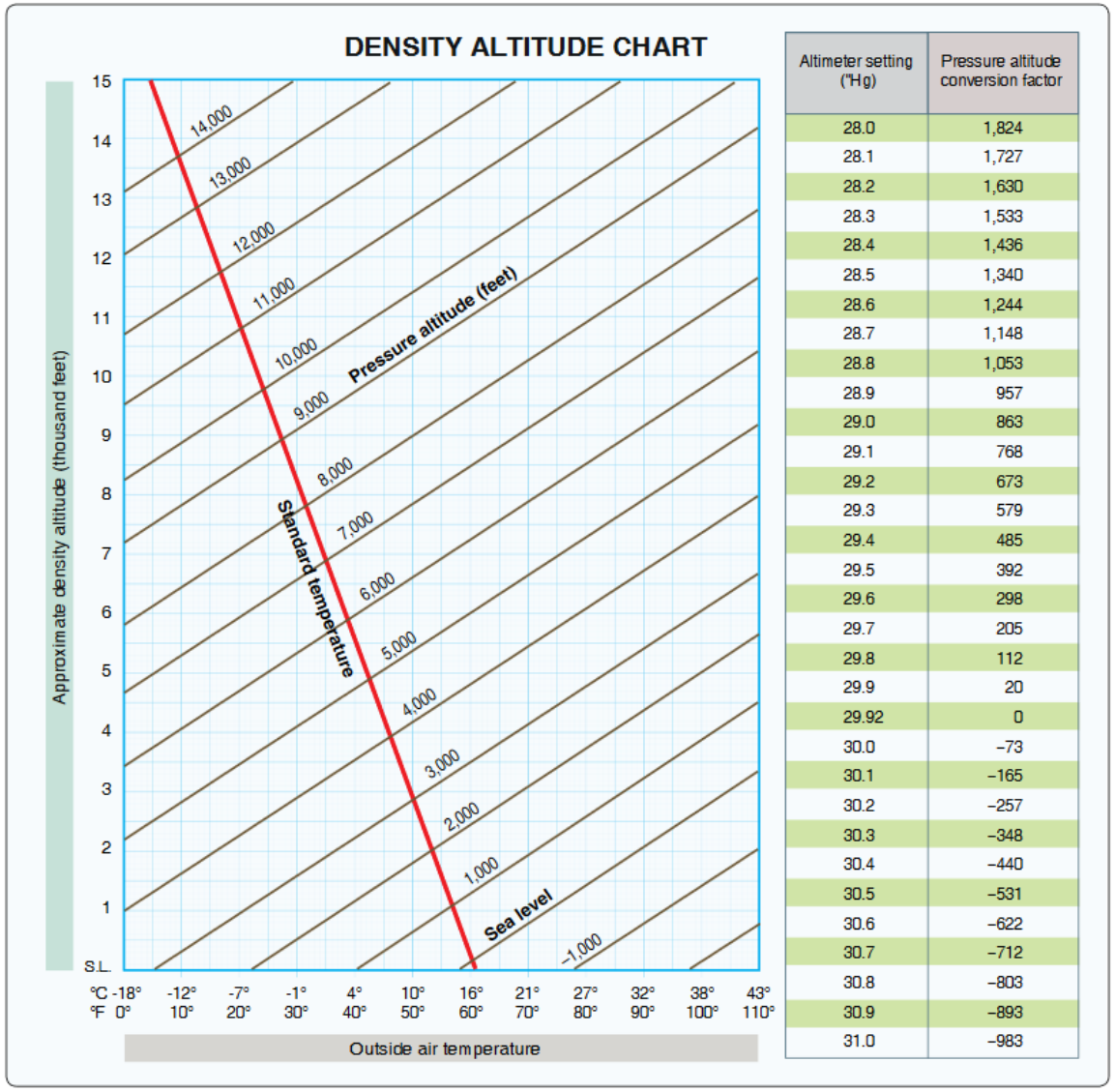
CALCULATING DENSITY ALTITUDE



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28.5	1,340
28.6	1,244
28.7	1,148
28.8	1,053
28.9	957
29.0	863
29.1	768
29.2	673
29.3	579
29.4	485
29.5	392
29.6	298
29.7	205
29.8	112
29.9	20
29.92	0
30.0	−73
30.1	−165
30.2	−257
30.3	−348
30.4	−440
30.5	−531
30.6	−622
30.7	−712
30.8	−803
30.9	−893
31.0	−983

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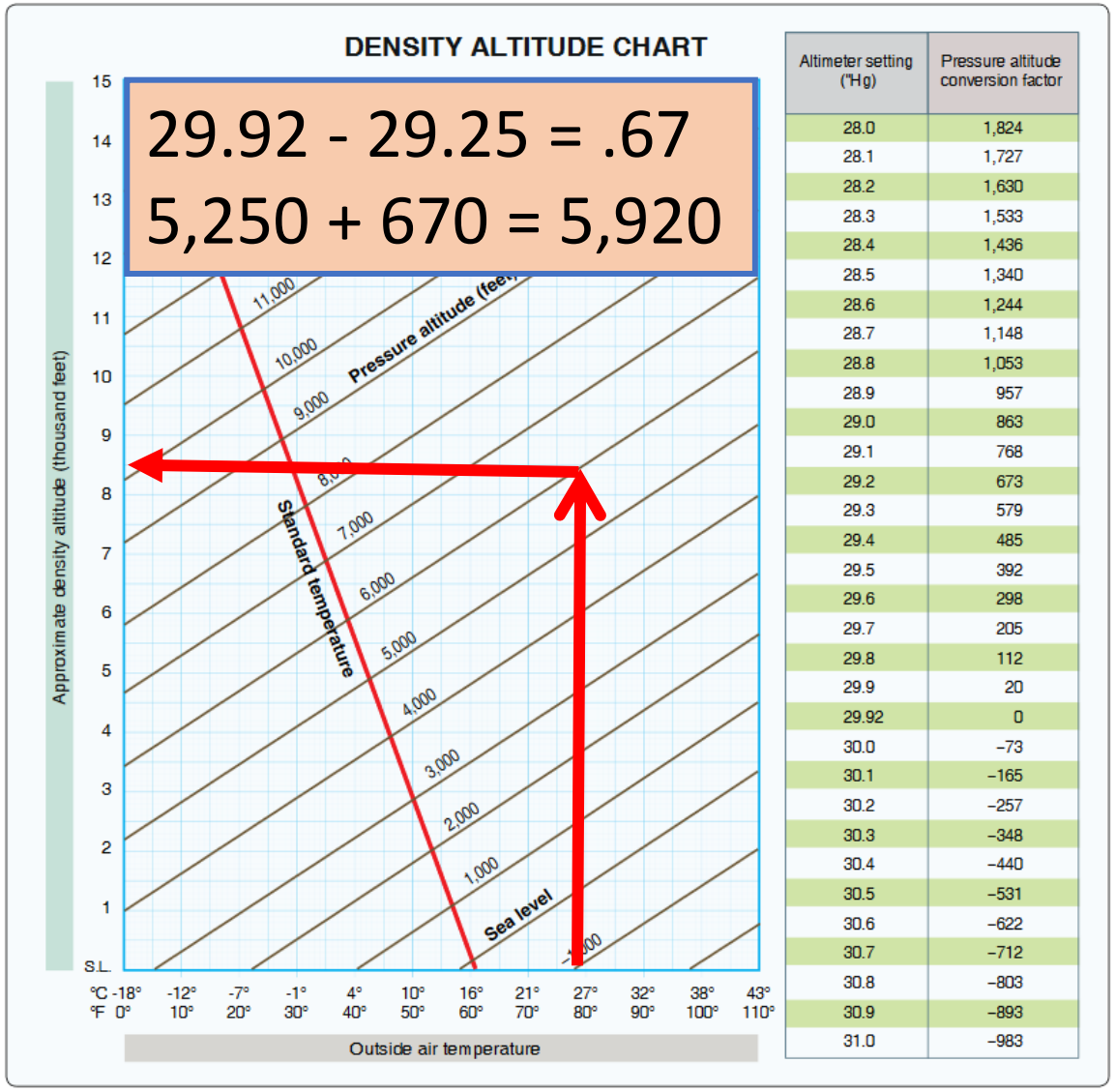
32° C
5000 FT.
1:50
2:00
2:30
DENSITY
ALTITUDE
12
13
14
KM
US GAL
+50
0
-50
5
10
ON

CALCULATING DENSITY ALTITUDE



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29.92	0
30.0	–73
30.1	–165
30.2	–257
30.3	–348
30.4	–440
30.5	–531
30.6	–622
30.7	–712
30.8	–803
30.9	–893
31.0	–983

(Refer to figure 8.) Determine the density altitude for these conditions:
Altimeter setting 29.25
Runway temperature +81 °F
Airport elevation 5,250 ft MSL

a) 8,500 feet MSL
b) 5,877 feet MSL
c) 4,600 feet MSL.

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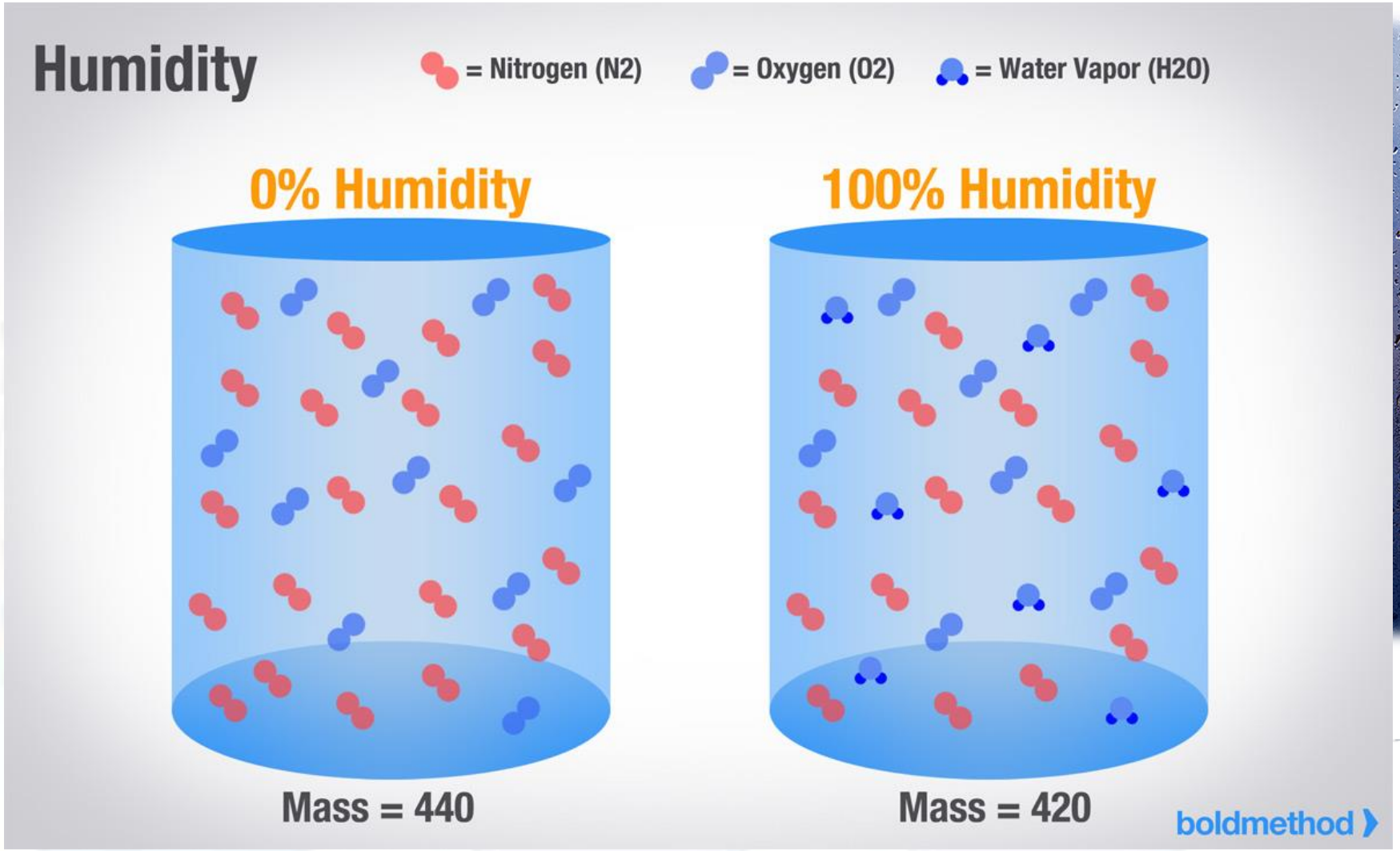
HUMIDITY



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DENSITY ALTITUDE

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FLIGHT SERVICE

Newton's Laws of Motion

Newton's laws of motion in physics	
LAW #1	A body at rest will remain at rest, and a body in motion will remain in motion unless it is acted upon by an external force.
LAW #2	The force acting on an object is equal to the mass of that object times its acceleration, F = ma.
LAW #3	For every action, there is an equal and opposite reaction.

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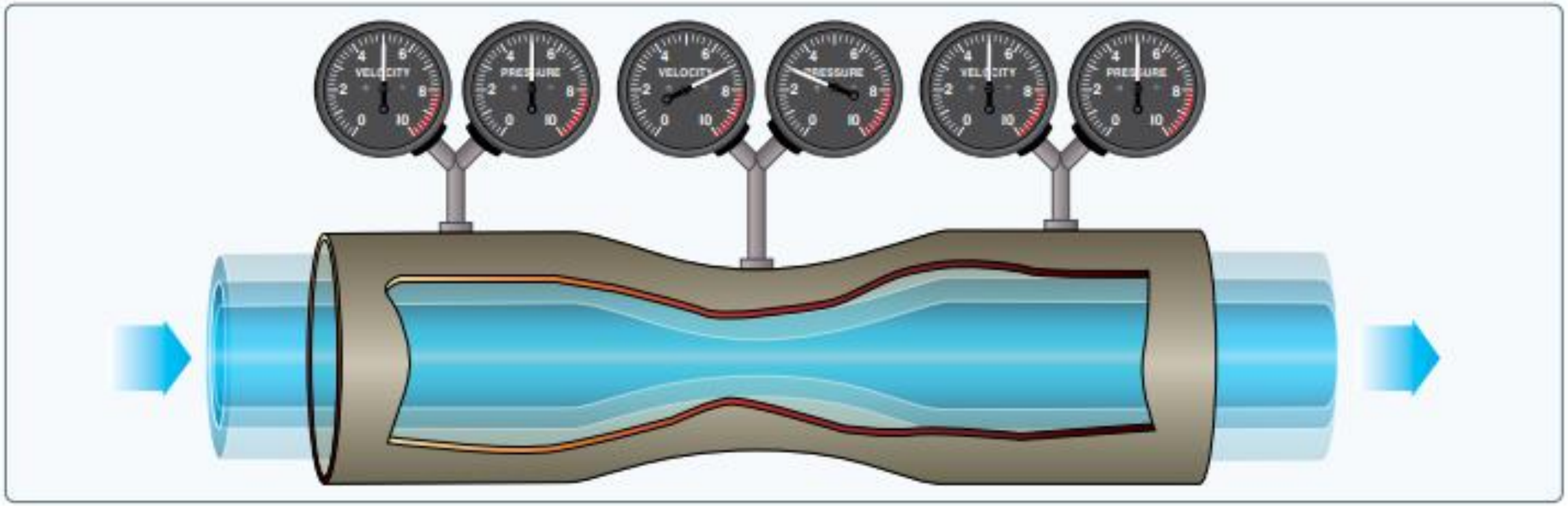
Bernoulli’s Principle



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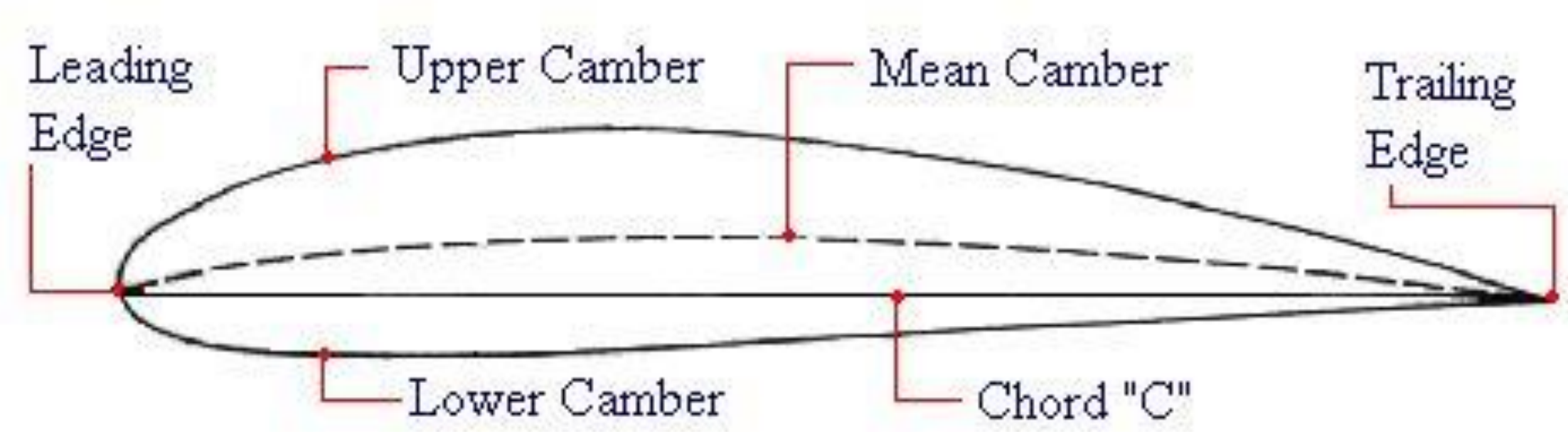
Airfoil Design



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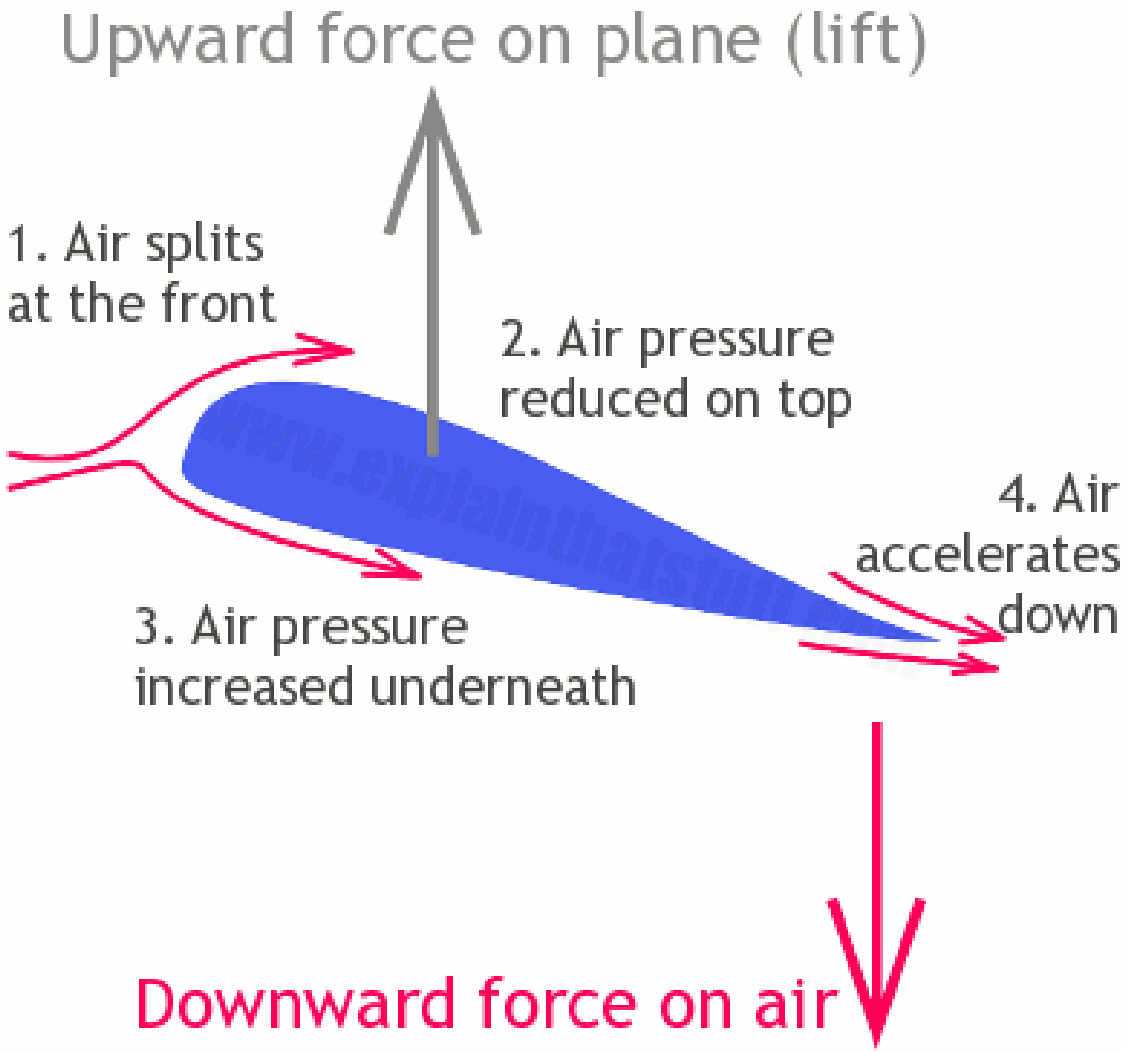
Bernoulli's Principle



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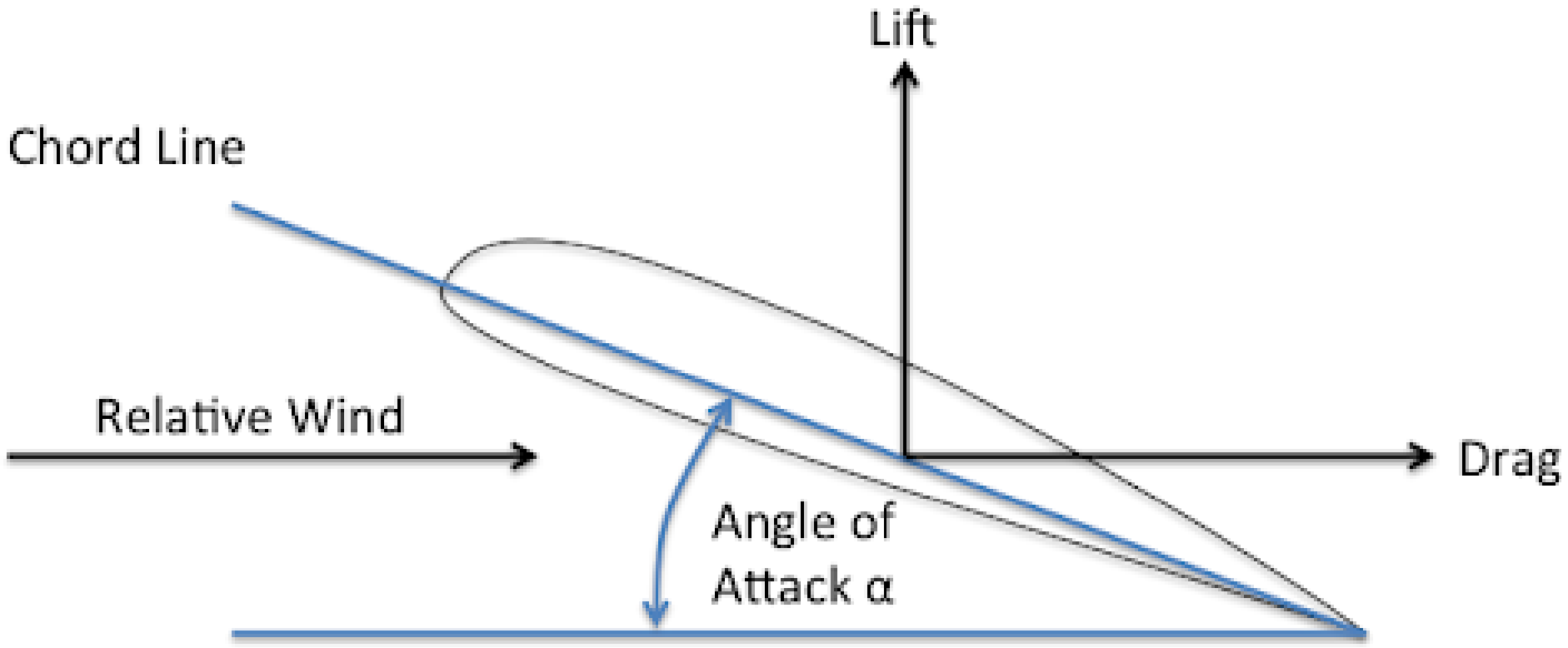
Angle of Attack



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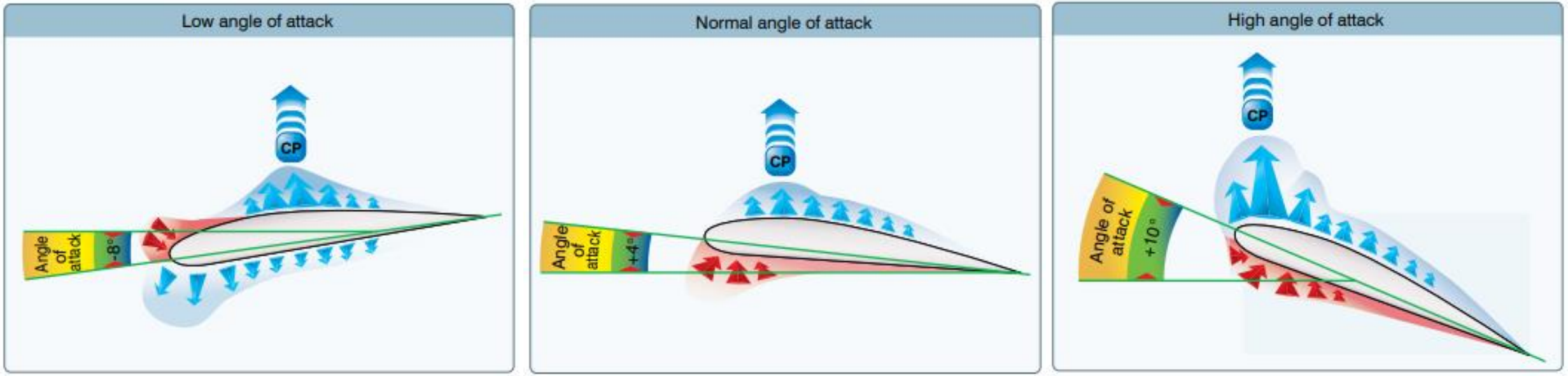
Angle of Attack – Pressure Distribution



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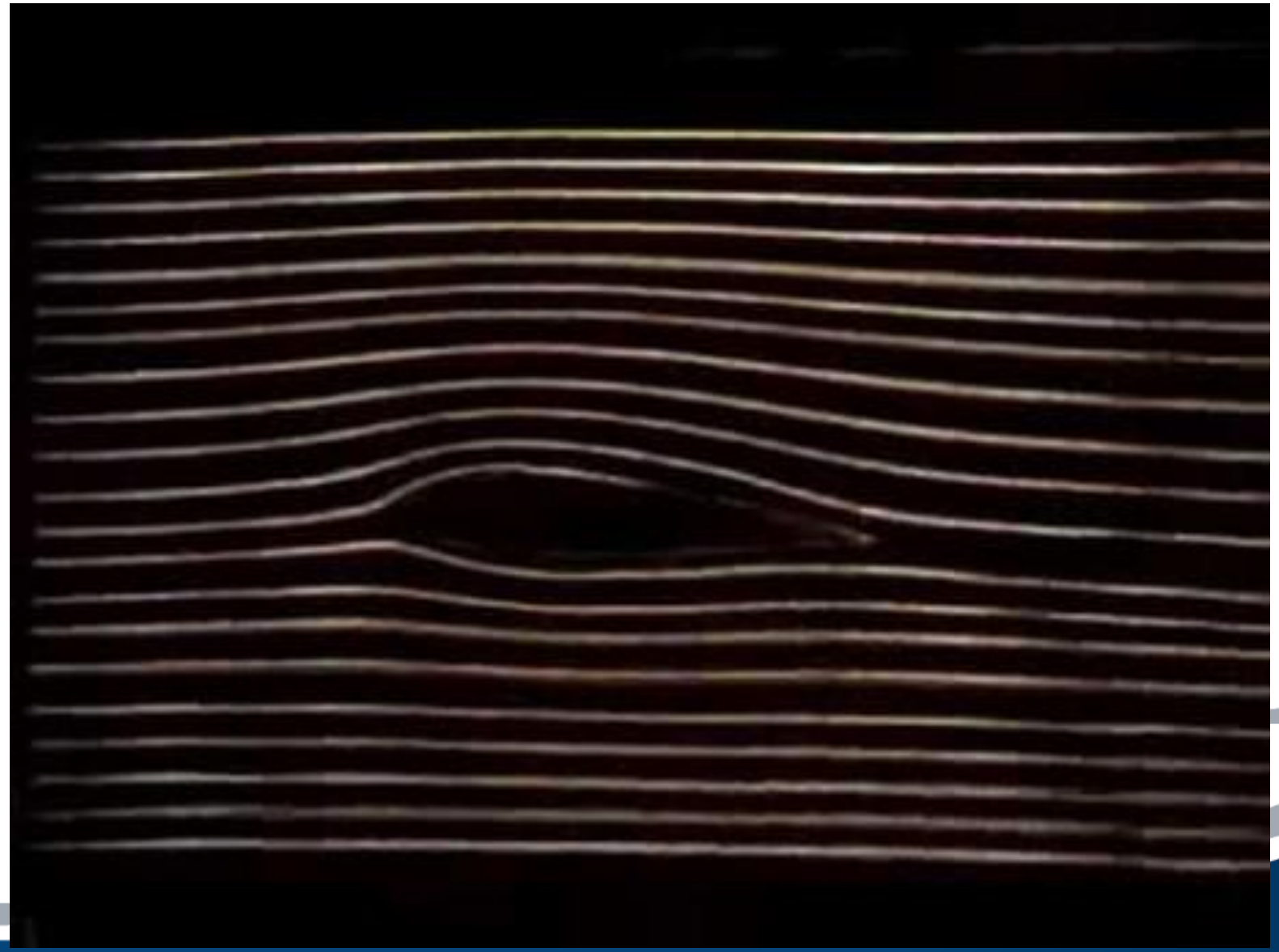
Wind Tunnel Demo



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SHAPE

Early airfoil	
Later airfoil	
Clark 'Y' airfoil (Subsonic)	
Laminar flow airfoil (Subsonic)	
Circular arc airfoil (Supersonic)	
Double wedge airfoil (Supersonic)	

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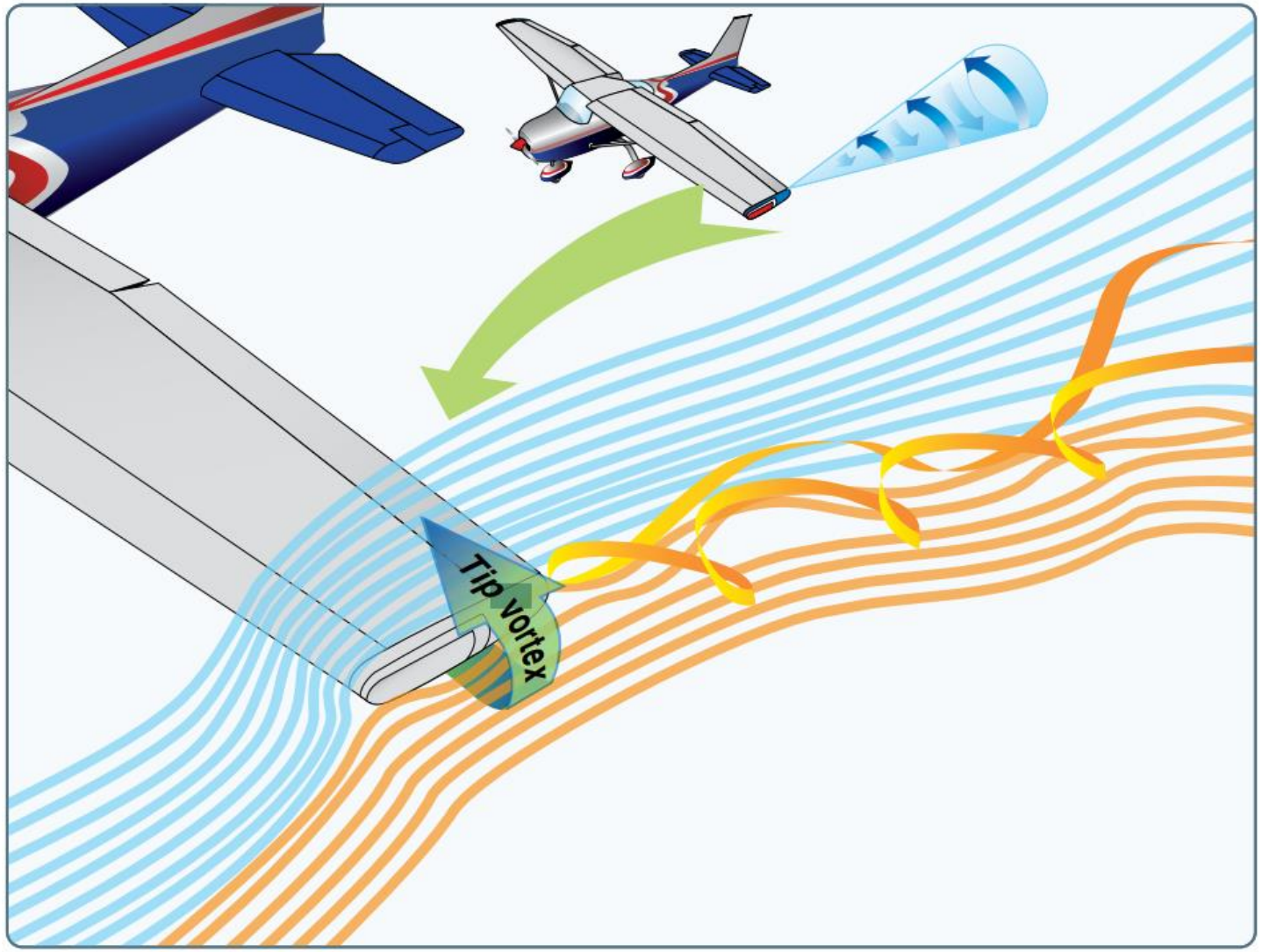
Wingtip Vortices



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