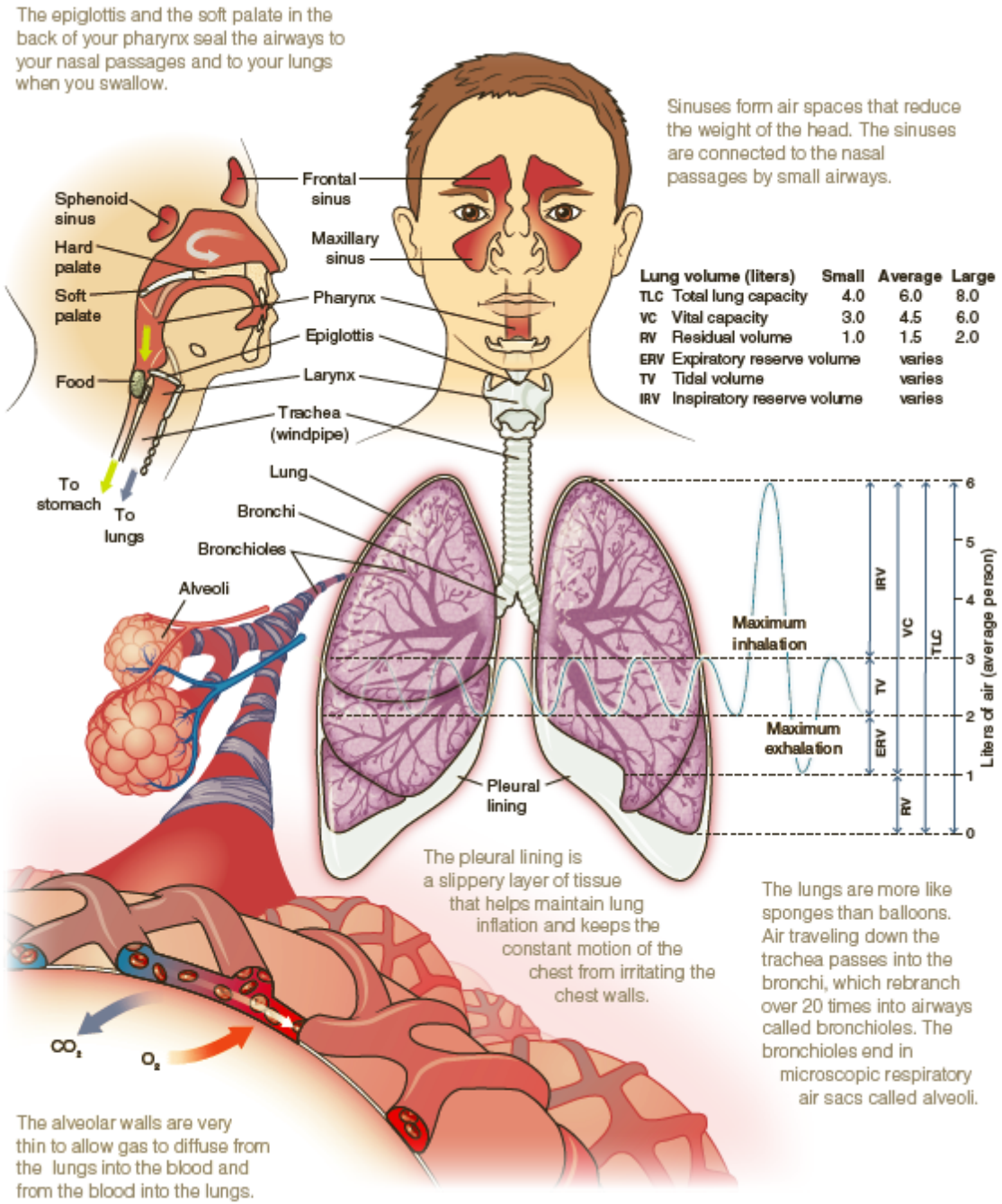
2. Diving Science



Reference: Graver, D. K. (2016). Scuba Diving 5th Edition. Human Kinetics.

Abbreviations

✓	ATA	atmospheres absolute	✓ FSW	feet of seawater
✓	atm	atmospheres	✓ ft	feet
✓	CO	carbon monoxide	✓ m	meters
✓	CO_2	carbon dioxide	✓ O_2	oxygen
✓	°C	degrees Celsius	✓ psia	pounds per square inch absolute
✓	°F	degrees Fahrenheit	✓ psig	pounds per square inch gauge
✓	FFW	feet of freshwater		

Reference: Graver, D. K. (2016). Scuba Diving 5th Edition. Human Kinetics.

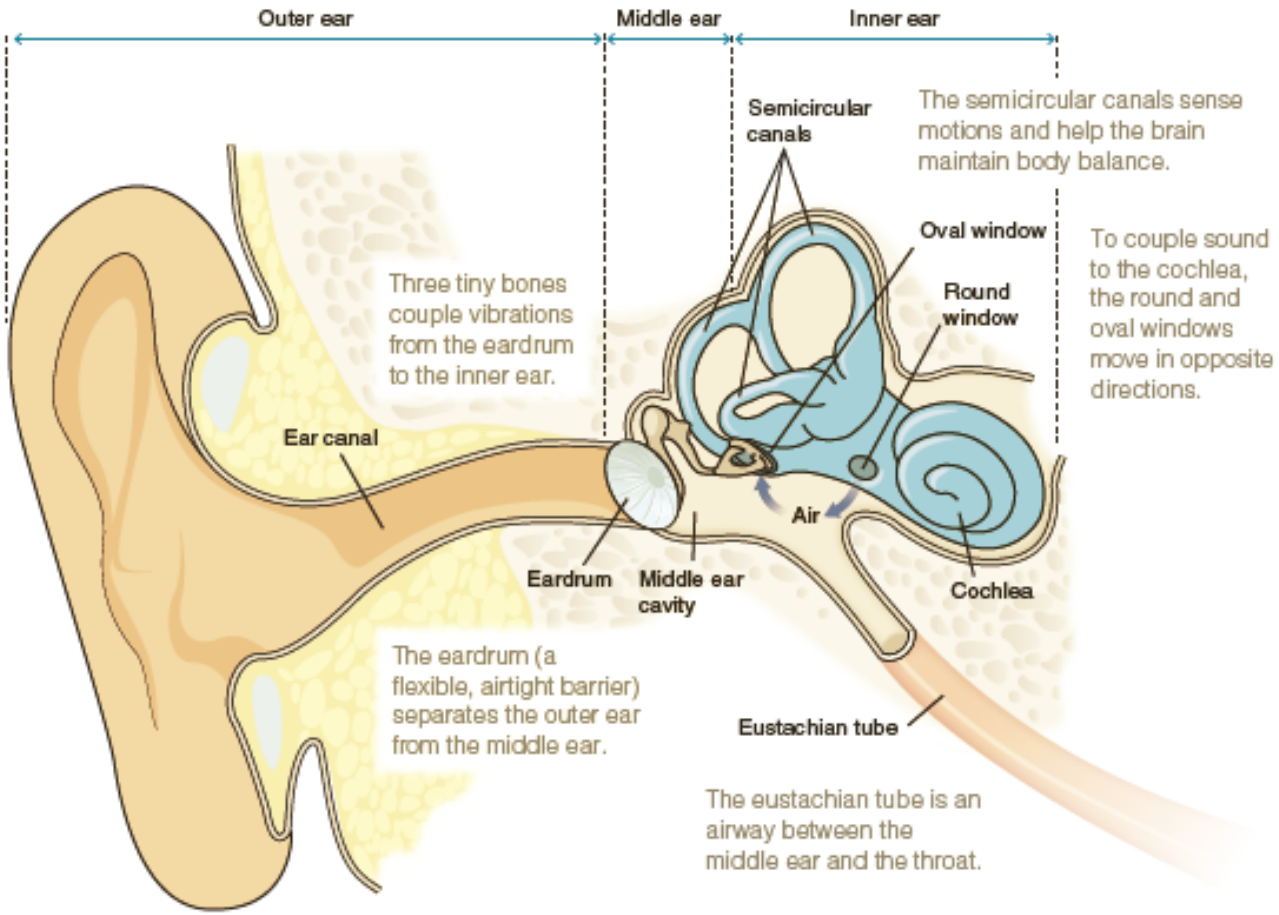
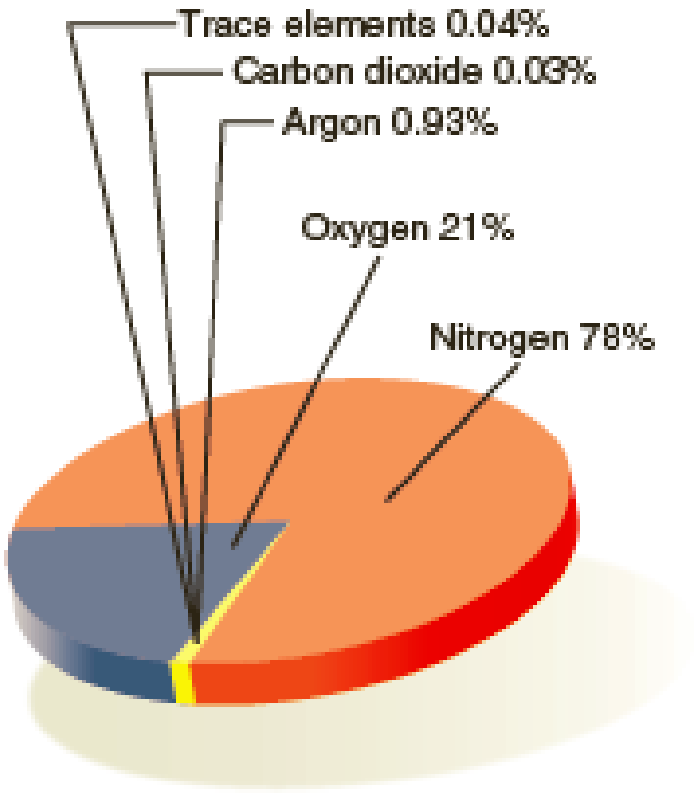


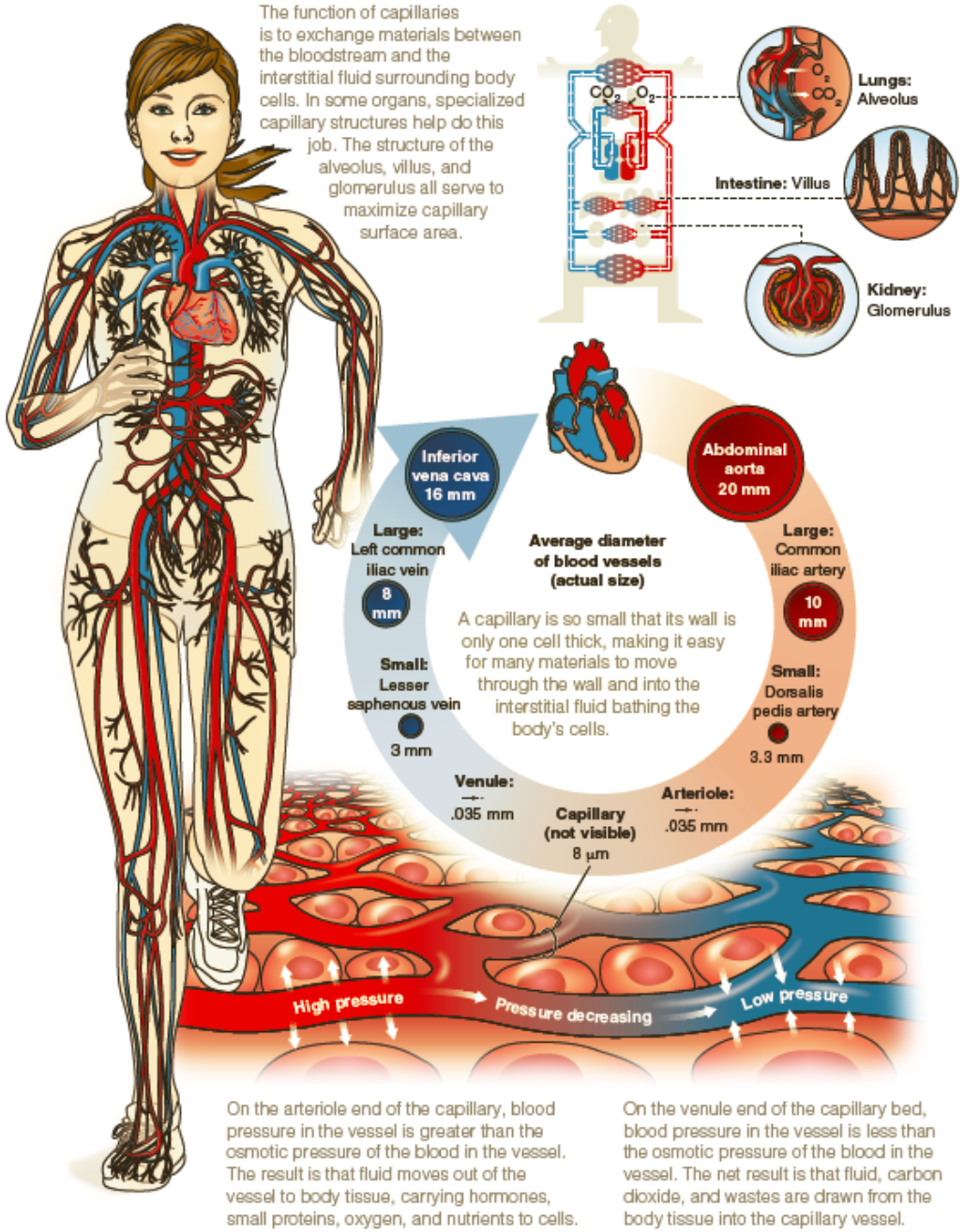
Figure 2.2 Process of hearing in air.

Reference: Graver, D. K. (2016). Scuba Diving 5th Edition. Human Kinetics.

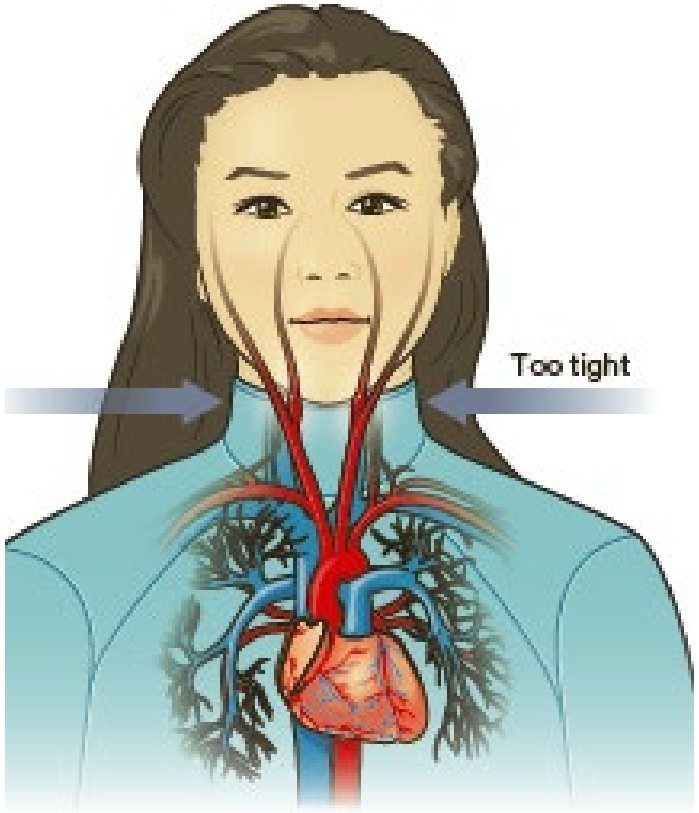


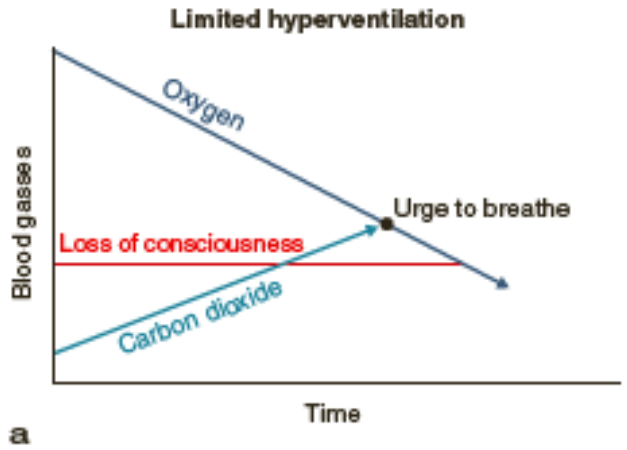
Oxygen (O_2) is the gas that supports human life. Any other gas mixed with oxygen serves only as a vehicle for oxygen to be inspired. Approximately 21 percent of air is oxygen (see figure 2.3). You need to breathe at least 10 percent oxygen to remain conscious. However, oxygen breathed under high pressure is poisonous and causes convulsions because oxygen at increased pressure affects your nervous system. You usually have compressed air—not pure oxygen—in your scuba tanks. A specialty form of diving uses a nitrogen and oxygen mixture with a higher percentage of oxygen than is found in air. The mixture, which reduces the effects of nitrogen at depth, is called **nitrox**. The use of special mixed gases, including nitrox, requires special training, equipment, and procedures.

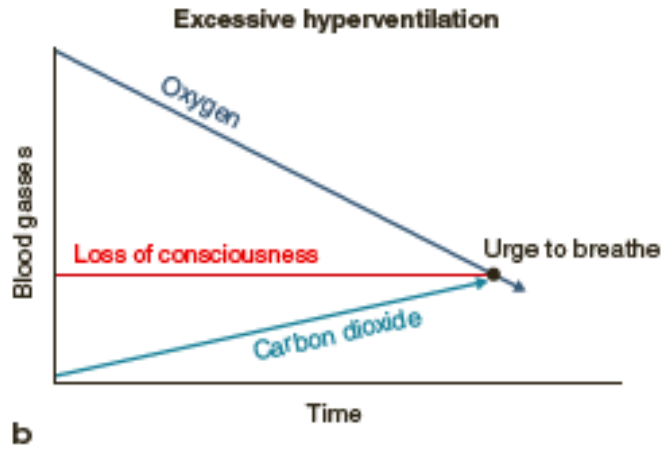
Reference: Graver, D. K. (2016). Scuba Diving 5th Edition. Human Kinetics.



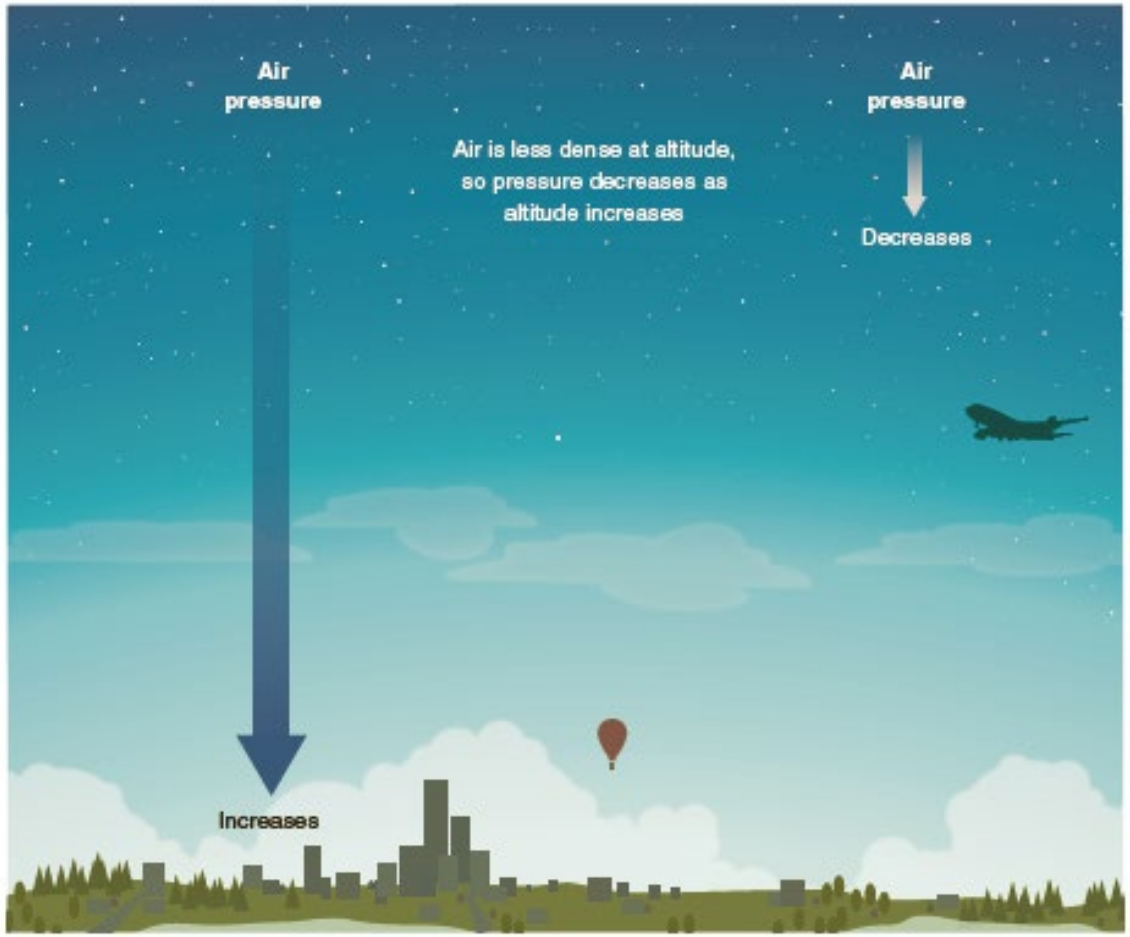
Reference: Graver, D. K. (2016). Scuba Diving 5th Edition. Human Kinetics.





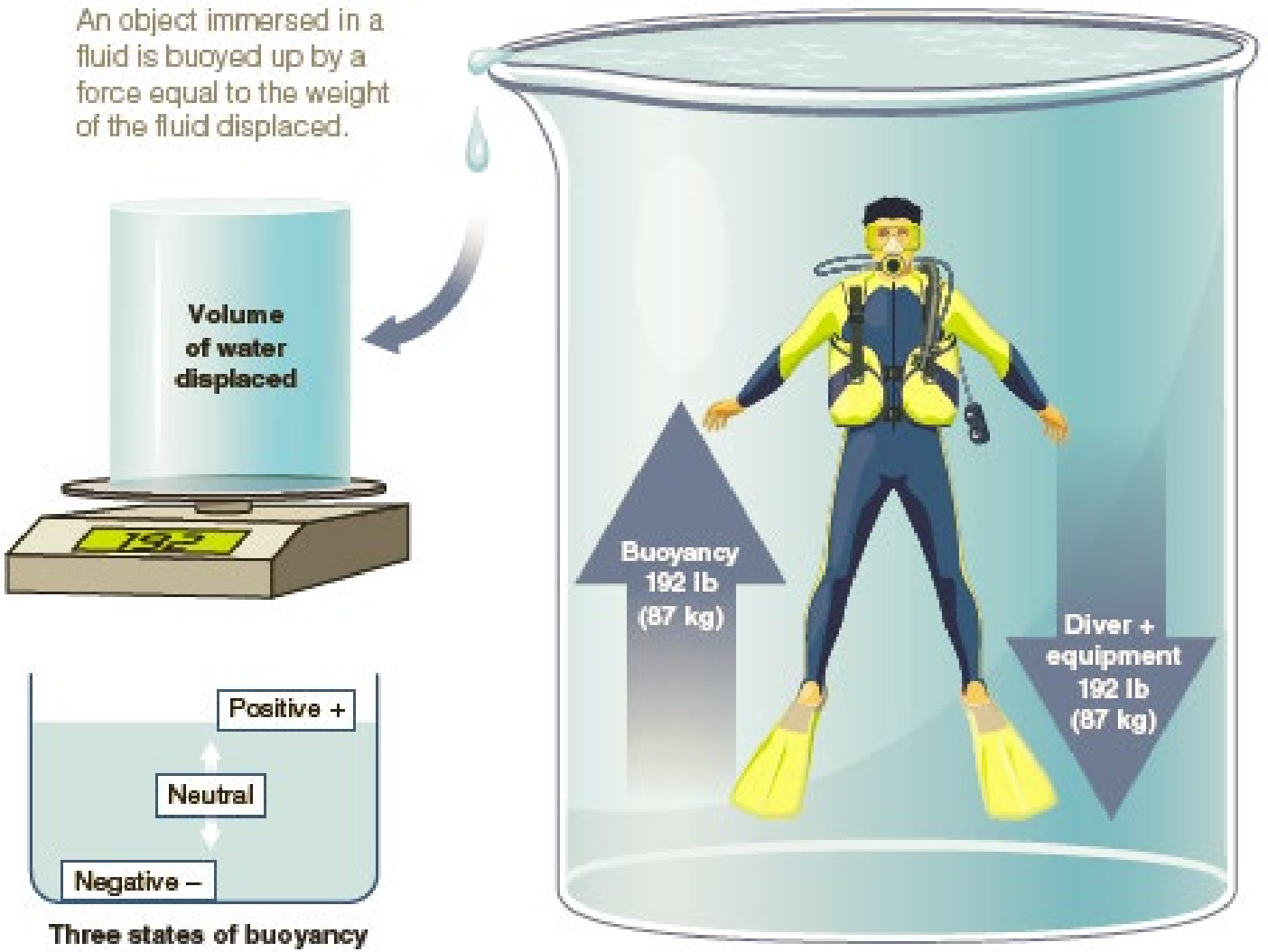


Reference: Graver, D. K. (2016). Scuba Diving 5th Edition. Human Kinetics.



Property	Air	Water	Comparison	Effects
Density	0.08 lb/ft³ (1.3 kg/m³)	62.4 to 64 lb/ft³ (1,000 kg/m³)	Water is 800 times denser than air.	Resistance to movement
Compressibility	Yes	No	Air density varies; water density is constant (at dive pressures).	Affects body & attached air spaces
Speed of light	186,000 mi/s (300,000 km/s)	140,000 mi/s (225,400 km/s)	Light travels 27% more slowly in water.	Affects vision
Light absorption	Low	High	Water absorbs color quickly.	Light & color loss
Speed of sound	1,125 ft/s (340 m/s)	4,900 ft/s (1,400 m/s)	Sound travels 4 times faster in water.	Unable to determine source
Conductivity	0.17	3.86 to 4.12	Heat loss is 22 to 24 times faster in water than in air.	Rapid loss of body heat
Heat capacity	0.24	0.94 to 1.0	The heat capacity of water is 4 times greater than air.	Absorbs heat quickly

Reference: Graver, D. K. (2016). Scuba Diving 5th Edition. Human Kinetics.



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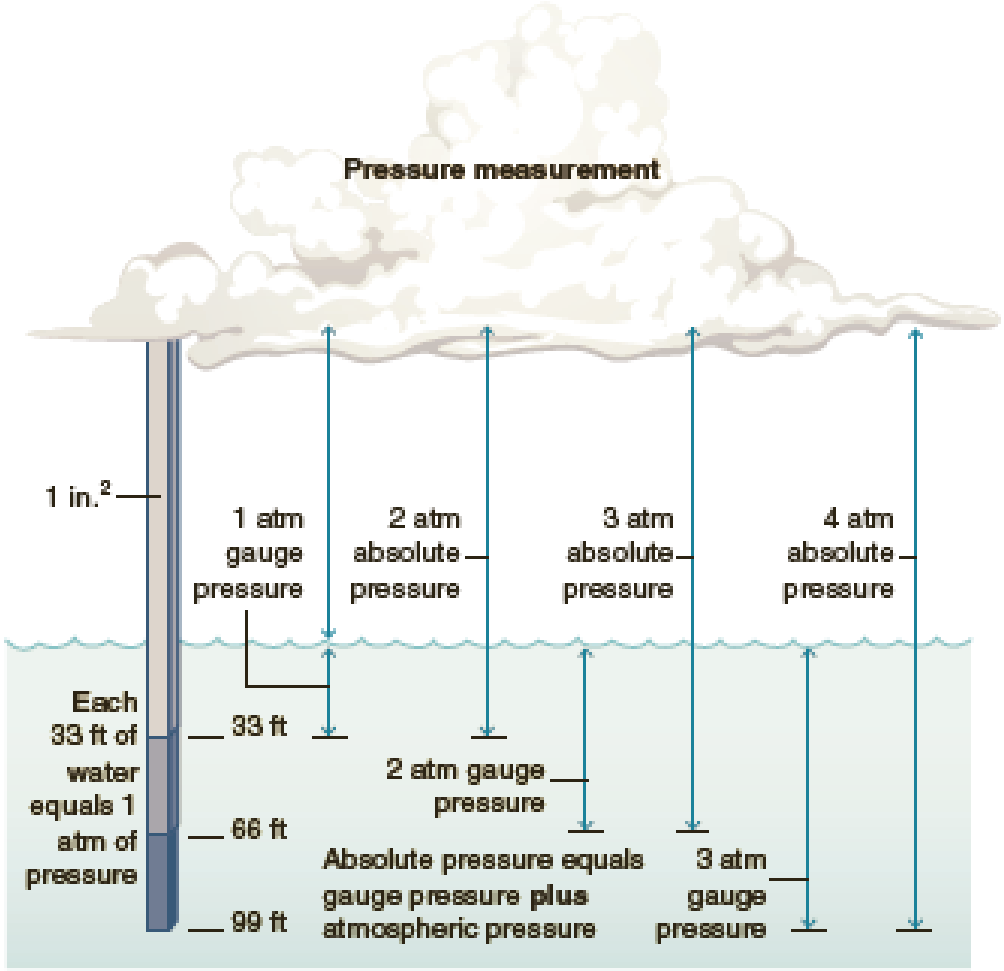
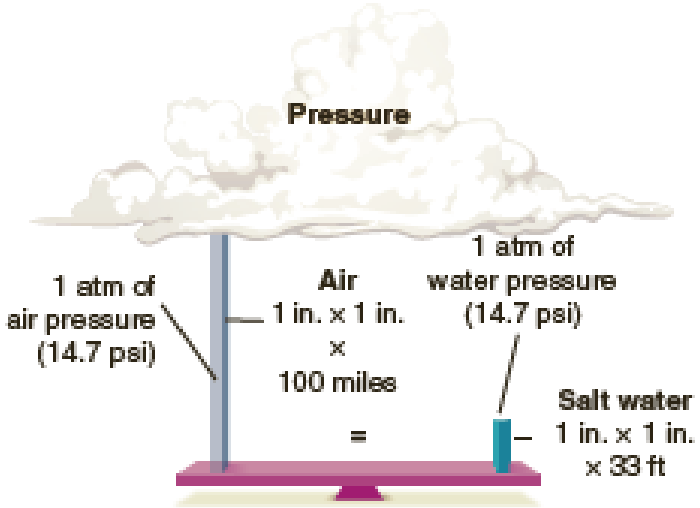
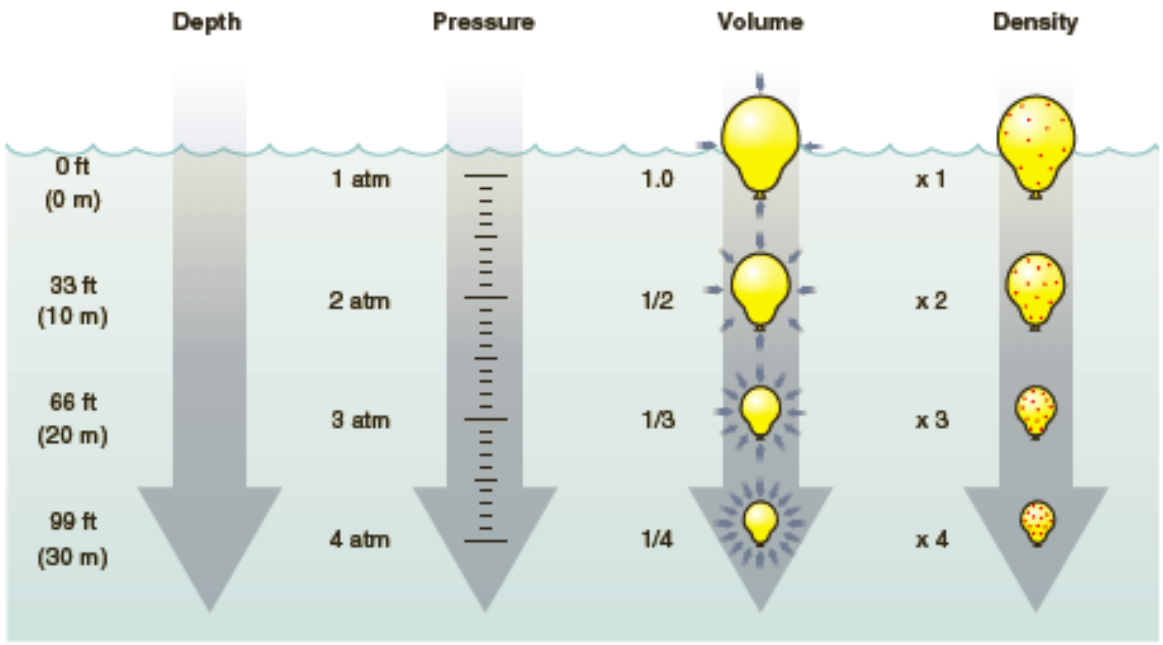




Depth		Gauge pressure			Absolute pressure		
FSW	FFW	In atm		In psig	In ATA		In psia
0	0	0	=	0.0	1 ATA	=	14.7
33	34	1	=	14.7	2 ATA	=	29.4
66	68	2	=	29.4	3 ATA	=	44.1
99	102	3	=	44.1	4 ATA	=	58.8
132	136	4	=	58.8	5 ATA	=	73.5

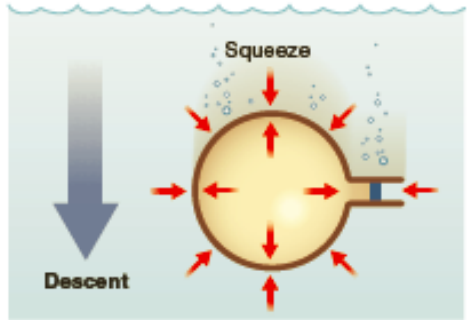
Gauge pressure compared to absolute pressure in fresh and salt water.

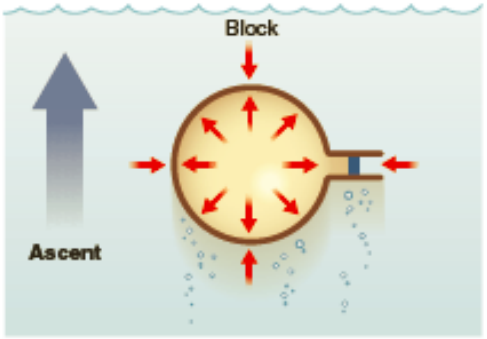
Reference: Graver, D. K. (2016). Scuba Diving 5th Edition. Human Kinetics.



If the pressure inside an air space is less than the surrounding water pressure, the outside pressure attempts to compress the air space. This condition is a "squeeze."

During descent, squeezes may occur in ears, sinuses, the mask, and other air spaces in or attached to the body.

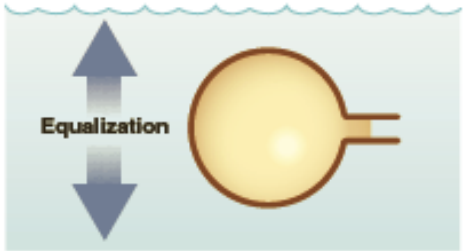




During ascent, the pressure surrounding an air space decreases. If the air inside the space, which was equalized to a higher pressure during descent, cannot escape, a situation that is the reverse of a squeeze occurs. When the pressure inside an air space is greater than the surrounding pressure, the condition is a "reverse block."

A "block" describes a situation where some form of blockage prevents compressed air from entering.

Prevention of both squeezes and blocks involves keeping the pressure within an air space equalized with the surrounding pressure.



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