

# 3. Diving Adjustments

|                | Percentage | Partial pressure at 1 ATA | Partial pressure of gas at 1 ATA (metric) |
|----------------|------------|---------------------------|---|
| Nitrogen       | 78%        | 11.466 psia               | 0.803 kg/cm <sup>2</sup>                  |
| Oxygen         | 21%        | 3.087 psia                | 0.2163 kg/cm <sup>2</sup>                 |
| Argon          | 0.93%      | 0.137 psia                | 0.0095 kg/cm <sup>2</sup>                 |
| Trace gases    | 0.04%      | 0.006 psia                | 0.0004 kg/cm <sup>2</sup>                 |
| Carbon dioxide | 0.03%      | 0.004 psia                | 0.0003 kg/cm <sup>2</sup>                 |
| Totals         | 100%       | 14.7 psia                 | 1.03 kg/cm <sup>2</sup>                   |

| Depth         | Pressure | O <sub>2</sub> *a | CO <sub>2</sub> *b | CO <sub>2</sub> *c |
|---------------|----------|-------------------|--------------------|--------------------|
| 0 ft (0 m)    | 1 ATA    | 20%               | 20 ppm             | 2%                 |
| 33 ft (10 m)  | 2 ATA    | 40%               | 40 ppm             | 4%                 |
| 66 ft (20 m)  | 3 ATA    | 60%               | 60 ppm             | 6%                 |
| 99 ft (30 m)  | 4 ATA    | 80%               | 80 ppm             | 8%                 |
| 132 ft (40 m) | 5 ATA    | 100%              | 100 ppm            | 10%                |

**Losing or retaining excessive heat is dangerous!**

**Radiation**  
Heat waves radiate to surrounding objects without physical contact.

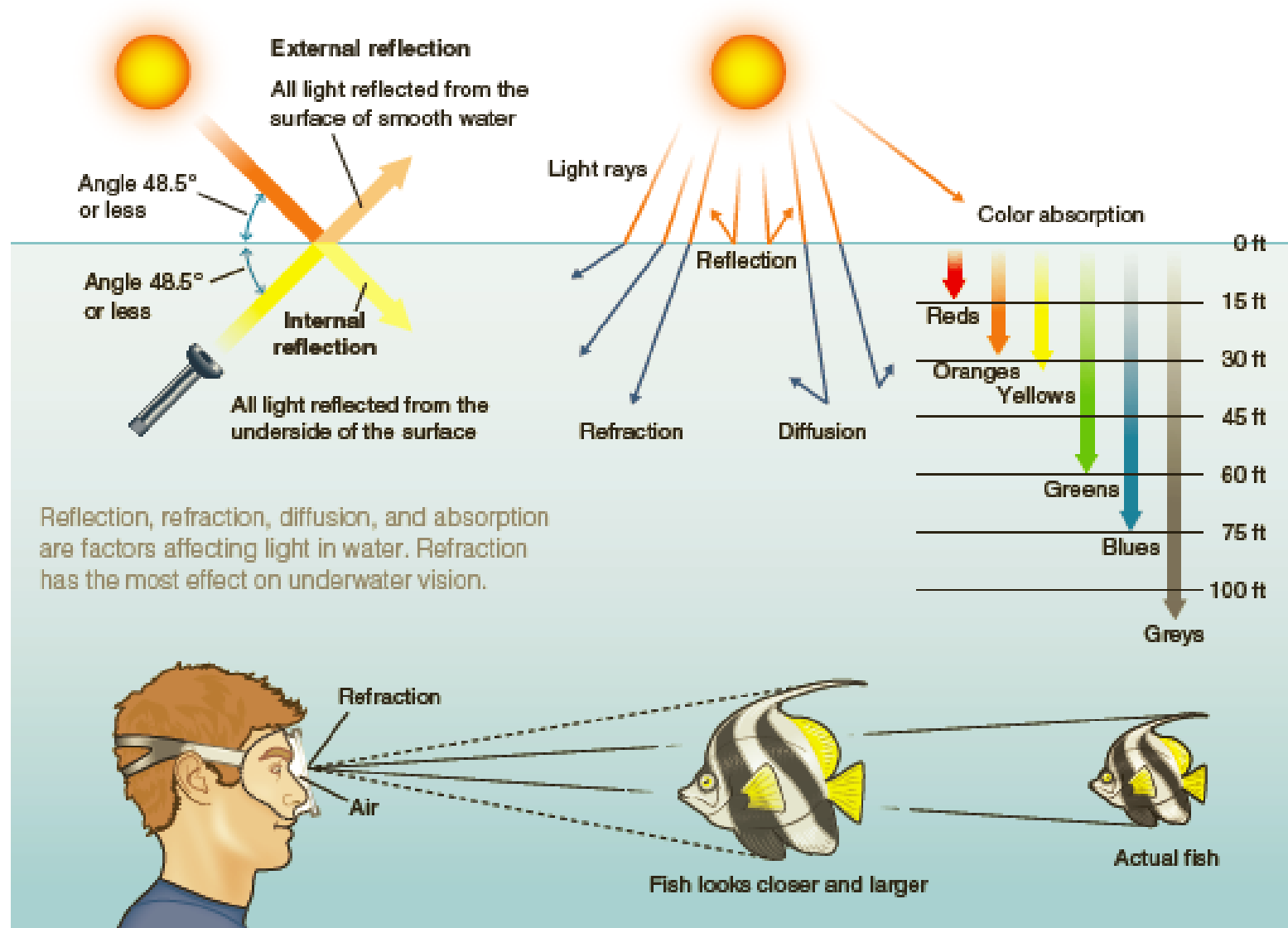
**Convection**  
Heat warms surrounding fluid, which rises and is replaced by cooler fluid.

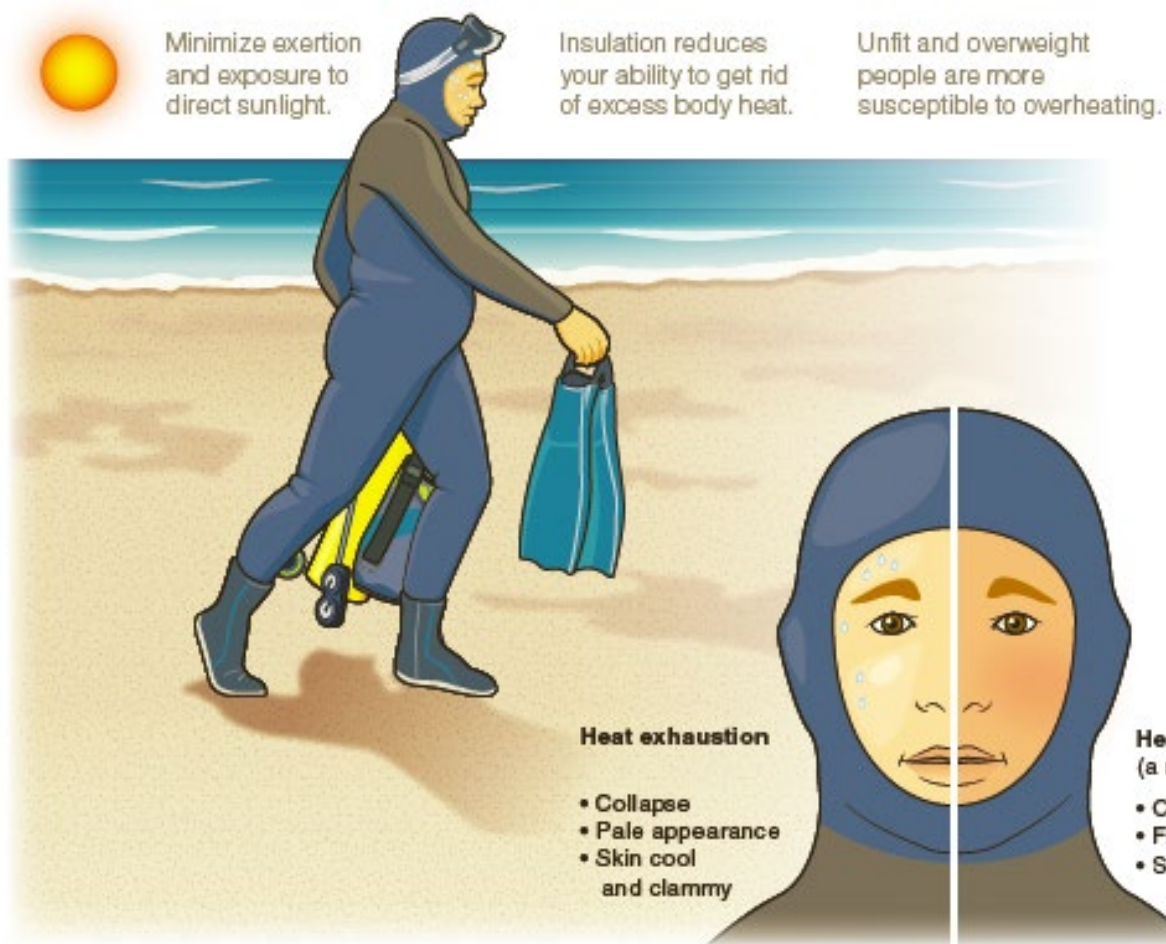
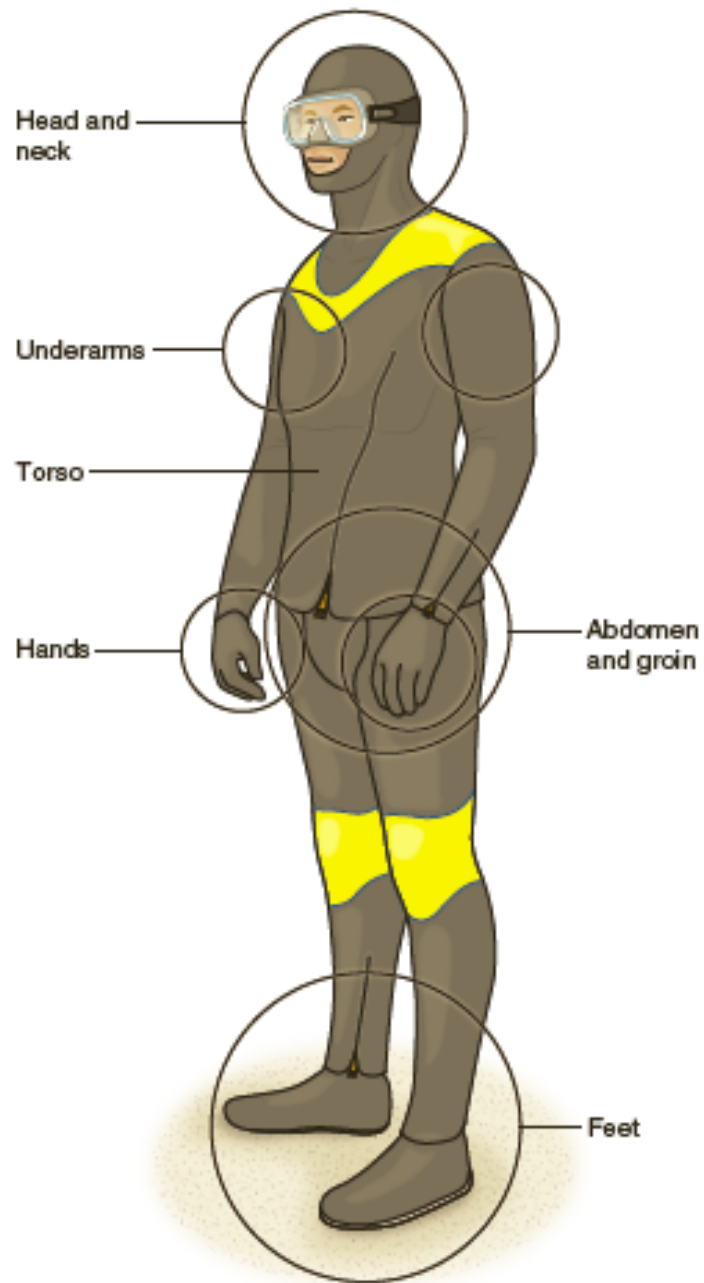


**Conduction**  
Heat lost through direct physical contact. Water conducts 25 times faster than air!

**Evaporation (in air)**  
Perspiration cools when it changes from a liquid to a vapor.

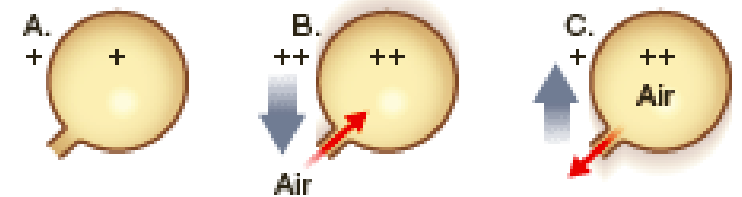
**Respiration**  
Heat added to air in the lungs is lost with exhalation.





| Factor                        | Effect  |
|-------------------------------|---|
| Size and weight of diver      | Obese divers are more buoyant.                                  |
| Type and amount of equipment  | Larger equipment is more buoyant (because of increased volume). |
| Amount of weight worn         | Weights decrease buoyancy.                                      |
| Amount of air in BC           | Increasing volume increases buoyancy.                           |
| Amount of air in tank         | Buoyancy increases as air decreases.                            |
| Amount of air in lungs        | Exertion or excitement increases volume and buoyancy.           |
| Suit compression              | Pressure decreases volume and buoyancy.                         |
| Items carried                 | Added weight decreases buoyancy.                                |
| Type of water (salt or fresh) | Denser water increases buoyancy.                                |

#### Healthy sinus



Air can move freely in and out of a healthy sinus (A), so equalization is automatic during descent (B) and ascent (C).

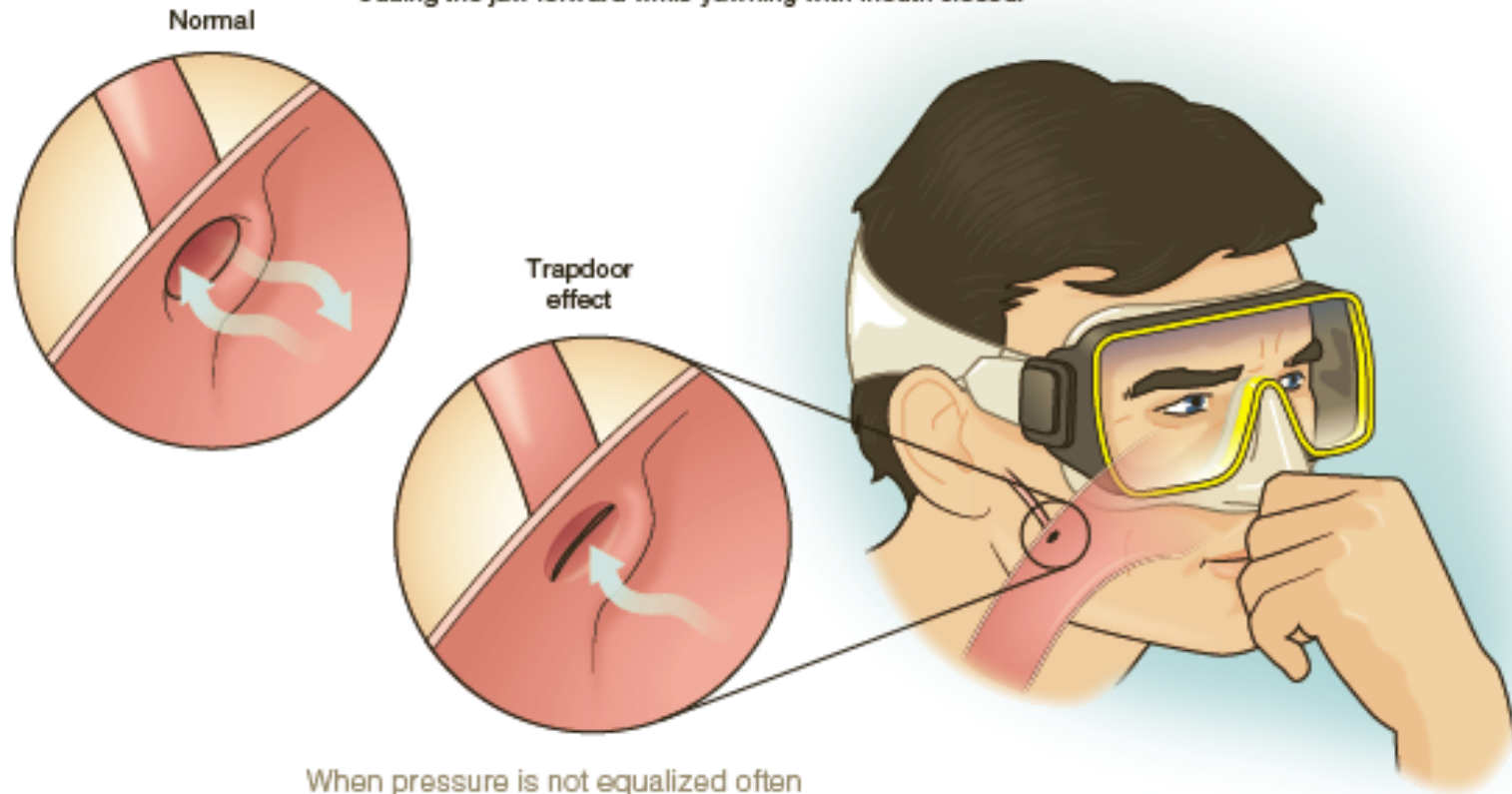
#### Congested sinus



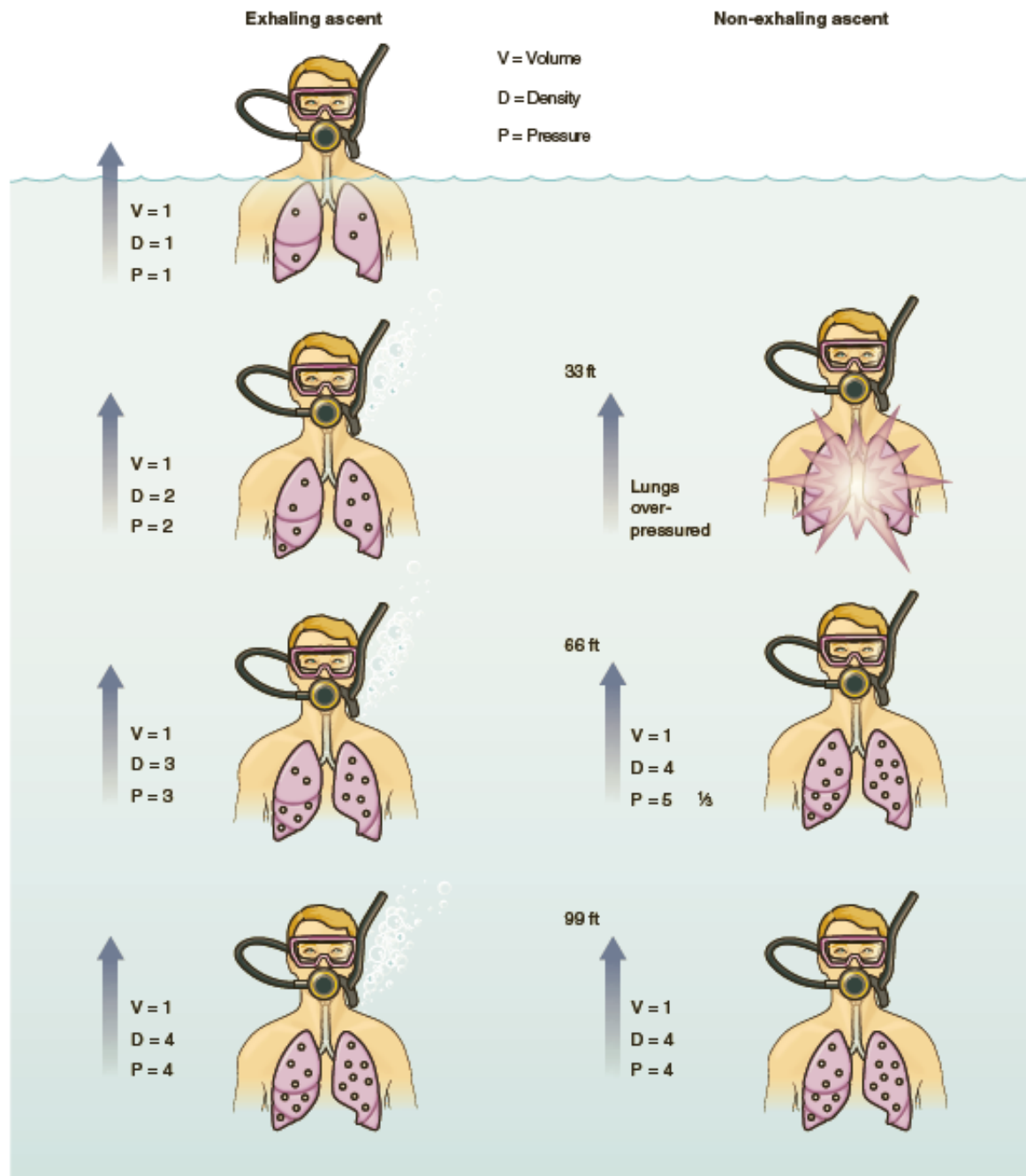
Air cannot get into or out of a congested sinus (A). The body forces fluids into the sinus at depth to equalize the pressure (B). The air in the sinus tries to expand to its original volume during ascent (C).

Methods to equalize pressure:

- Blowing gently with mouth closed and nostrils blocked.
- Swallowing with mouth closed and nostrils blocked.
- Jutting the jaw forward while yawning with mouth closed.

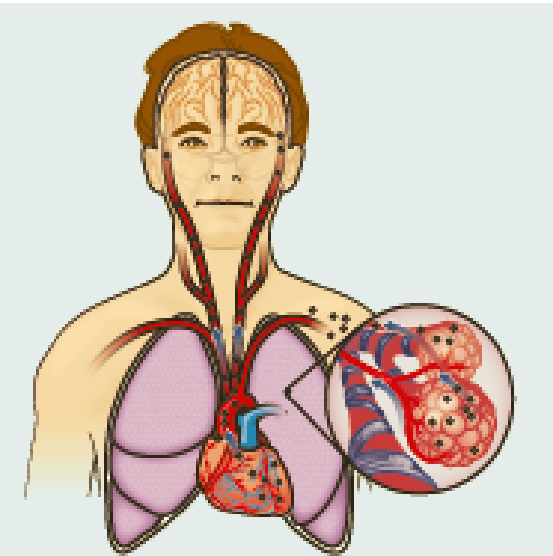


When pressure is not equalized often during descent, the pressure difference holds the end of the eustachian tube closed and prevents any further equalization until the diver ascends enough to relieve the pressure.



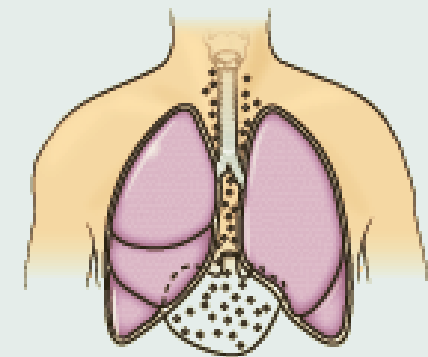
Reference: Graver, D. K. (2016). Scuba Diving 5th Edition. Human Kinetics.



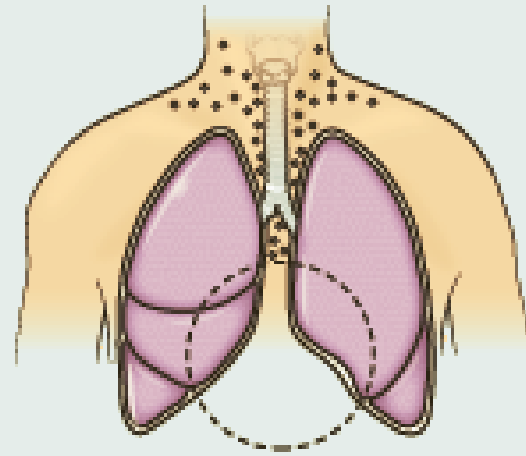


**Air embolism**

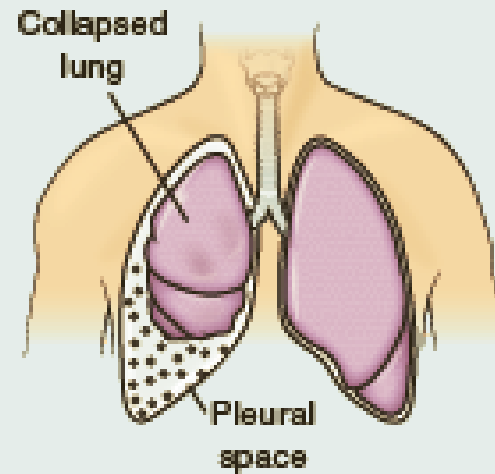
of an airway, such as that  
a prerequisite for diving.



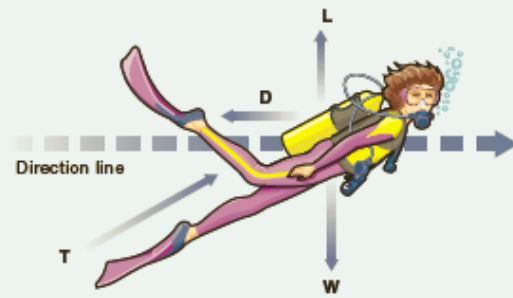
**Mediastinal emphysema**



**Subcutaneous emphysema**



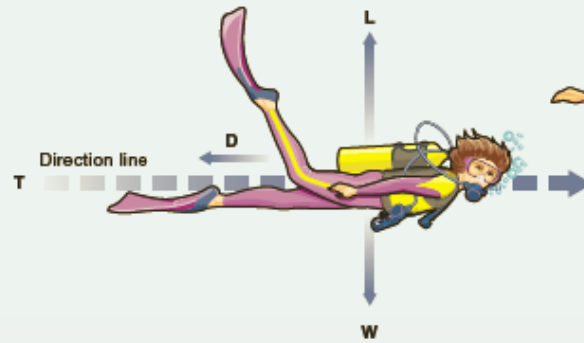
**Pneumothorax**



The forces affecting a swimming diver include weight (W), drag (D), thrust (T), and lift (L) or buoyancy.

If lift and weight forces are not aligned, the diver will not be level. Part of the thrust must be used to overcome the head-up or the head-down position.

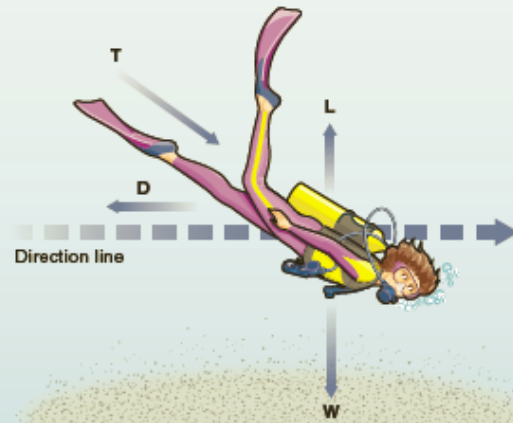
If the diver is weighted and trimmed correctly, as shown in the center illustration, all of the thrust is along the direction line.



**Improper trim and streamlining**



**Proper trim**



Correct trim and streamlining of equipment reduce frontal area and the energy requirements of swimming.

When the bottom is silty, a head-down position is desirable to keep the fins from stirring up silt.



Figure 4.  
cold-water  
water (right)