BASIC SCUBA LESSON 2

Objective: Apply Boyles Law, Direct Effects of Pressure & Buoyancy.

Universal Gas Law:	**Boyles Law**:
$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$	$P_1 V_1 = P_2 V_2$ $T = k$ (constant) Then Pressure and Volume have an inverse relationship. As pressure increases volume decrease **(P↑, V↓)**

Salt Water		
Depth (ft)	**Pressure (atm)**	**Volume (cu')**
0'	1	1
33'	2	½
66'	3	1/3
99'	4	¼

Fresh Water		
Depth (ft)	**Pressure (atm)**	**Volume (cu')**
0'	1	1
34'	2	½
68'	3	1/3
102'	4	¼

Squeezes: Equipment & Health

	Cause	**Physiological Explanation**	**Symptom**	**Treatment & Prevention**
Mask Squeeze	Not equalizing mask pressure	Pressure gradient (outside > inside)	Blood shot eyes & mask hickey	Exhale thru nose to equalize pressure
Ear	Not equalizing middle ear pressure	Pressure gradient (outside > inside)	Slight to moderate pressure in ear	**Valsalva**/Frenzel/ Toynbee Maneuvers
Sinus	Not equalizing sinus pressure	Pressure gradient (outside > inside)	Pressure and/or pain in sinus	Never dive with sinus congestion
Carotid Artery Squeeze (wet suit)	Improper fit of exposure suit	Pressure gradient (outside > inside) Reduction of O2 to brain	Dry throat, dizziness, difficulty breathing.	• Relieve pressure by unzipping suit, remove hood, rest on back • Proper fitting equipment
Thoracic Squeeze	Deep breath-hold dives w/o a full inhalation.	Pressure gradient (outside > inside) Internal damage to lungs, crushing alveoli & hemorrhaging.	Pain, frothing bleeding from the mouth.	• Ascend, Amin. O2, Rescue breathing & 1st aid. • Full inhalation
Reverse Blocks (sinus and/or tooth	Sinus clog and/or compressed air trapped behind filling	The compressed air expands upon ascent causing pain and/or discomfort Pressure gradient (outside < inside)	Pressure and/or pain in the affected area Small amount of blood in mask after dive	• See dentist following the dive • Never dive with sinus congestion

Buoyancy: Archimedes' Principal

1. Explain Archimedes' principal as it relates to buoyancy.
2. List 3 states of buoyancy and describe each.
3. List 5 factors affecting buoyancy and describe each.
4. List three primary ways a diver controls buoyancy

Archimedes Principle: An object immersed in a fluid is buoyed up by a force equal to the weight of the fluid displaced.

Displacement Tank

- Drop in an object that is 1cu. ft. in volume.
- How much water does it displace? 1 cu. ft.
- How much does the displaced water weigh?
  - 1 cu ft of SEA H_2O = 64 lbs.
  - 1cu ft of FRESH H_2O = 62.4 lbs.

- What if the object weighed (dry) 63 lbs?
  - In seawater (sw) it would float.
  - In fresh water (fw) it would sink.

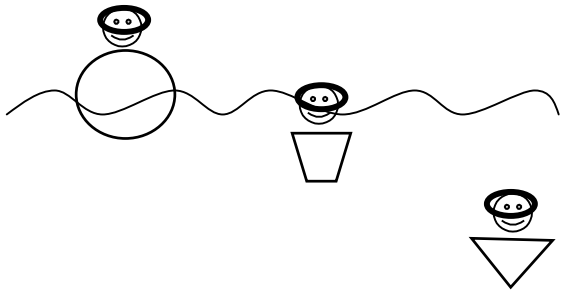
- How does this relate to us as divers? STATE OF BUOYANCY
  - In Sea H_2O what is the object's buoyancy? POSITIVE
  - In Fresh H_2O what is the object's buoyancy? NEGATIVE
  - What buoyancy do we want to have while diving? NEUTRAL
  - What do you think we call that neutral buoyancy? HOVERING

	Factors Affecting Buoyancy	Controlling Buoyancy
1. Size and weight of diver	**X**	
2. Type and amount of equipment	**X**	
3. Amount of weight worn	**X**	**X**
4. Water density	**X**	
5. Amount of air in BC	**X**	**X**
6. Air in lungs	**X**	**X**
7. Suit compression	**X**	

1. If Archimedes displaces 3 cu ft of liquid (salt water), how much does the displaced salt-water weigh?

3 cu' x 64 lbs./cu'sw = 192 lbs.↑ (buoyed up by a force)

2. If each of these divers displace 3 cu' of seawater, what is each divers state of buoyancy in salt water if his dry weight is:

Dry		Weight Buoyancy
180 lbs. = (+)		12 lbs. ↑
192 lbs. = (0)		Neutral
204 lbs. = (-)		12 lbs.↓

3. If Archimedes is neutrally buoyant in salt water (sw), how much weight must he remove from his weight belt to become neutrally buoyant in fresh water (fw)?

3 cu' x 62.4 lbs./cu'fw = 187 lbs.↑ (buoyed up by a force)

192 lbs.↑ - 187 lbs.↑ = remove 5 lbs. from weight belt