OWD Class Study Guide

- **Rules of Diving**
  - Never Hold Your Breath
  - Always dive with buddy
  - Anyone can thumb a dive
  - Look good

- **Scuba – "Self-Contained Underwater Breathing Apparatus"**

- **Open Water Diver Certification:**
  - Indicates that you are knowledgeable and skillful enough to dive safely in open water in conditions similar to those in which you were trained
  - You must always dive within the limit of your training and experience
  - Any dives undertaken that deviate from your training and experience should always be done under the supervision of a dive professional
  - **You must continue practicing the skills you learned in training – they are simple measures that will save your life- but the skills are highly perishable if not practiced regularly**

- **Regulator**
  - First Stage – Reduces from cylinder pressure to intermediate pressure
  - Second Stage – Reduces pressure from intermediate to ambient pressure
  - Alternate 2nd stage also called Octo or octopus
  - Purge button – on face of 2nd stage manually opens valve to allow free flow of gas to clear regulator of water if necessary
  - Low pressure inflator hose attaches to BCD inflator
  - Submersible Pressure Gage (SPG) provides tank pressure in psi
  - Rinse thoroughly after saltwater exposure
  - Keep water out of first stage: Dust cap in place, don't push purge button (May allow water to enter hose)

- **Rock-Bottom Minimum Gas**
  - Calculate: take current depth, add a zero, then add 500psi
    - e.g. 60 feet, RBM = 60…. 600+500psi = 1100psi

- **Safety Check – MABWRFC**
  - **My Adorable Boy Will Run For Cake**
  - MASK

  - AIR
  - BCD
  - WEIGHTS
  - REGULATORS
  - FINS
  - COMPUTER/COMPASS

- **Dive Brief/Planning**
  - **Dive planning**
    - Choosing site
    - Checking weather
    - Equipment requirements
    - Skill level of divers
    - Underwater environment
    - Emergency response
    - Site survey upon arrival
  - **Briefing - TAG EDGE**
    - TYPE of dive
    - ASSIGNMENTS
    - GEAR review
    - EXPOSURE time & depth
    - DECOMPRESSION or safety stop
    - GAS MANAGEMENT
    - ENVIRONMENT/EMERGENCY procedures
  - **Proper planning and briefing is important:**
    - Prevents confusion – reducing potential stress
    - Complex communication underwater is very difficult
    - Increases safety
    - Clarifies roles
    - Can reveal hazards that might go unnoticed
    - Makes dive more enjoyable and/or productive

- **Decompression Sickness (DCS)**
  - Caused by nitrogen bubble formation in blood & tissues.
  - Result of nitrogen on-gassing at depth and then reducing ambient pressure around the diver too quickly, i.e. rapid ascent
  - **Symptoms include**
    - Localized joint pain
    - Skin “rash”
    - Headache

        - Tingling/numbness in extremities
        - Dizziness
        - Shortness of breath
        - Balance problems
        - Difficulty speaking
        - Vision problems
        - Confusion
        - Anxiety
        - Paralysis
        - Death
    - **Treatment**
        - Immediate administration of 100% oxygen
        - Administration of Nitrox if oxygen unavailable or runs out
        - Call 911/EMS
        - Call DAN
        - Recompression therapy
    - **Prevention**
        - Adhere to max safe ascent rate of 30ft./minute
        - Follow prompts of dive computer/tables

- **Nitrogen Narcosis**
    - Caused by breathing increased amounts of nitrogen at depth
    - When breathing air, onset ~ 80 feet
    - **Symptoms**
        - Similar to alcohol intoxication
        - Difficulty multi-tasking
        - Poor judgement
        - Confusion
        - Auditory/visual distortions
        - Sometimes dread or panic
    - **Response**
        - Reduce depth to reduce amount of nitrogen intake
        - Possibly end dive

- **Residual Nitrogen**
    - Excess nitrogen remaining in the body after a dive and a safe ascent

- **Surface Air Consumption Rate**
    - Quantity of air used on a dive adjusted for one atmosphere of pressure

  - Useful for dive planning/who will use air fastest, etc.
  - To determine how much air you breath at any given depth, simply multiply your SAC rate by the number of atmospheres of pressure
    - e.g., SAC rate 0.5, breathes 2.0 cubic feet of air per minute at 99fsw (4 atmospheres)

- **Buoyancy Compensation Device (BCD/BC)**
  - Used to maintain positive buoyancy at the surface & neutral buoyancy underwater
  - Fit and comfort important for both safety and enjoyment
    - Constricting or loose-fitting could create anxiety – esp. for new divers
  - Air added on descent to control fall
  - Air vented on ascent to prevent runaway ascent
  - Air is **NEVER** added in order to ascend
    - Inflator button used to add air to slow descent/establish neutral buoyancy
    - Air can be released through inflator hose or various "dump valves" on BCD
  - Over-inflation: Modern BCD have an Over Pressure Relief Valve (OPV) that will vent any excess gas to prevent damage
  - CARE: Rinse in fresh water, flush bladder with cleaner periodically, check fasteners, valves, pulls

- **Other Personal Equipment**
  - Wetsuit (Exposure protection suit)
    - Keeps diver warm, protected from scrapes, cuts, stings, etc.
    - Works by trapping thin layer of water near the skin which is warmed by body heat
  - Gloves/Hood/Boots
    - Keeps diver warm, protected from scrapes, cuts, stings, etc.
  - Knife/Cutting tool
    - Allows the diver to free himself or buddy from entanglement/remove fishhooks or other hazards on downlines etc.
  - Surface Marker Buoy (SMB) & Finger Spool
    - Often referred to as "Safety Sausage"
    - Mandatory for drift dives or wherever strong currents are present

        - Allows a diver separated from dive flag to indicate position to surface crew members and boaters in the area
    - Snorkel
        - Not needed on most dives
        - Gets in the way of regulators/hoses, creates additional entanglement hazard
        - Collapsible snorkel recommended
            - Kept in pocket and used when needed, such as very high seas or long surface swims
    - Compass
        - Allows for rudimentary navigation underwater, e.g. a reciprocal course away from and back to, the dive boat or shore
    - Dive computer
        - Greatly extends dive times over use of tables
        - Enhanced safety features including, no decompression limits, ascent rate warnings, real-time depth readings etc.
        - Must never "share" with another diver
            - You will not be at the exact same depths throughout dive
            - You could become separated
            - Other diver's previous profile could also be different from yours – giving an inaccurate starting point for residual nitrogen
    - Dive Logbook
        - Provides a record of dives/conditions for training purposes
            - Certain numbers and types of dives required for various certifications
        - Provides a reference concerning weighting, exposure protection, air usage, and places visited

- **Loss of Breathing Gas**
    - **In order of rapidity in event of failure (fastest to slowest)**
        - Burst Disc failure
        - Low Pressure hose rupture
        - Free flowing second stage
        - High pressure hose rupture

- **Lost Buddy**
    - Look around for one minute

  - Consider getting vertical & look for bubbles
  - Surface after one minute

- **Boyle's Law**
  - With a gas (such as air) the relationship between pressure and volume is inversely proportional, i.e. when one goes up the other goes down
    - More pressure – less volume
    - Less pressure - more volume
  - Max. safe ascent rate = 30ft./minute
  - 1 ATA = 33 Feet of seawater (fsw)
  - Equalize early & often on descent
    - Valsalva maneuver- Pinch nose and gently blow
      - Forces air through **eustachian tube** at back of the throat and into the middle ear (Behind the eardrum)
    - Pressure changes most rapidly in first 33ft
      - DOUBLES from one to two atmospheres
    - **Difficulty Equalizing**: signal buddy, ascend slightly and re-try
      - **DO NOT continue descent** – may cause significant injury to ears
  - React to pressure changes – equalize – add/dump gas from BCD
- **Barotrauma (Pressure Injury) - Lungs**
  - AGE – Arterial Gas Embolism, caused when diver holds breath and ascends, rupturing lung tissue and air escapes into bloodstream
    - **Symptoms**: similar to DCS/Stroke
  - Mediastinal Emphysema/Pneumothorax – air in chest cavity
    - **Symptoms**: labored breathing, cyanosis, slowed heartbeat
      - **Prevention** Don't hold breath – breathe normally
- **Barotrauma – Ears**
  - Pressure increase causes fluid to be drawn into middle ear and/or
  - Painful/Ruptured eardrum
  - Called an "EAR SQUEEZE"
    - **Prevention** – equalize early and often
- **Barotrauma – Sinuses**
    - Called "SINUS SQUEEZE"
    - Pain/bleeding from sinuses
    - Caused by inflammation or congestion preventing sinus cavities from equalizing themselves
- **Buoyancy**

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- Archimedes Principle – An object submerged in water is lifted upwards by a force equal to the weight of the water the object displaces, i.e., the more space you take up, the more buoyant you are

    - Deeper- Pressure increases, shrinking size of air bubble in BCD/Buoyancy *decreases*
        - Add air on descent to control rate
    - Shallower- Pressure decreases, air bubble in BCD expands/Buoyancy *increases*
        - Vent air on ascent for control and prevent runaway ascent
    - Buoyancy control is critical:
        - Safety – must be able to arrest descent and control ascent to avoid injury
            - Also allows you to stay in proper proximity to buddy
        - Prevent ruining visibility
        - Prevent damage to delicate ecosystems
        - Ability to enjoy your dive
    - People/Objects are more buoyant in saltwater because it is denser and heavier than freshwater

- **Weighting (Ballast)**
    - Allows diver to descend by overcoming the inherent buoyancy of the body, wetsuit, boots, or other equipment
    - Should carry the bare minimum required to initiate descent
    - Excess weight results in larger air bubble in BCD and greater swings in buoyancy with changing depth
    - Leads to problems controlling buoyancy and erratic dive profiles

- **Cylinders**
    - Dangerous if not handled properly
    - Lay down when not using/handling
    - Made of either aluminum or steel
    - Stamped on cylinder:
        - Serial number
        - Working pressure
        - Last hydrostatic (pressure) test date, etc.
    - Visual inspection required annually
    - Hydrostatic pressure test required every 5 years
    - Store with some pressure remaining to avoid rust/corrosion inside
    - Pressure increases with heat – 5psi for each 1-degree(F) rise in temp

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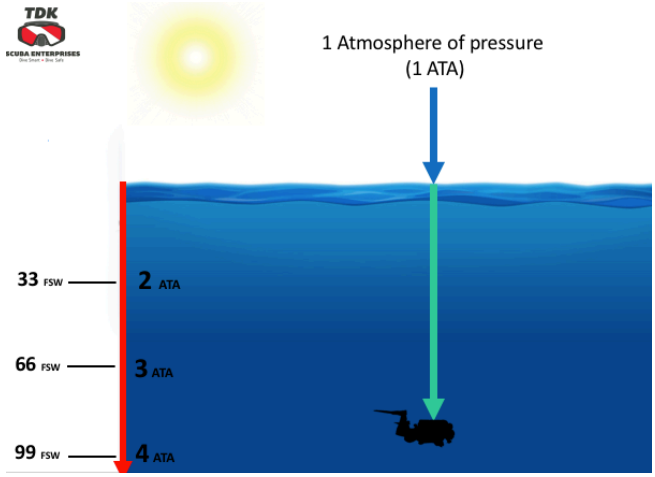
- **Health Considerations**
  - Fitness can prevent over-breathing, fatigue, etc.
  - Hydration very important – diving is very dehydrating as the air is highly filtered
  - Never dive with hangover
    - Changed body chemistry may affect body's reaction to the stresses of diving
  - Never dive with cold or sinus issues
    - Can cause sinus squeeze, ear trauma
  - Never dive after ingesting drugs/marihuana
    - Impaired judgement/altered body chemistry and response

- **Pressure**
  - Divers measure pressure in atmospheres absolute (ATA)
    - This is the total pressure exerted by the water AND air above the diver
  - Normal atmospheric pressure at sea level is 14.7 pounds/square inch
    - Divers simply refer to this as 1 atmosphere of pressure
  - 33 feet of sea water (or 34 feet of freshwater) exerts 1 atmosphere of pressure



- **Breathing**
  - **NEVER** hold your breath
  - Breathe normally and continuously
  - When regulator is out of your mouth, exhale a small continuous stream of bubbles
    - Keeps airway open (See Rule #1 and Boyle's Law)
  - Body's desire to breathe is driven by the amount of carbon dioxide in the bloodstream, NOT a need for oxygen

- Attempting to "skip breathe" or otherwise to use less air will result in CO2 buildup
  - Called HYPERCAPNIA – symptoms are tunnel vision, anxiety, hyperventilation, panic
- "How long does a scuba tank last?"
  - Depends on rate of breathing, any current, and how deep (Boyle's Law means we breath more air with each breath the deeper we go)
- "How long does your oxygen last?"
  - Ordinary Scuba tanks contain air or Nitrox – breathing pure oxygen at depths below 20 feet is toxic/fatal
- You must check your air pressure **regularly** throughout the dive

- **Safety Stop – "No Decompression Diving"**
  - Properly, "Precautionary Safety Stop"
  - Performed at ~**15 feet for 3 minutes**
  - "No Decompression Diving" is a misnomer:
    - All dives involve decompression as a diver ascends safely
    - "No Decompression Diving" means no MANDATORY decompression
      - Occurs when diver overstays his "No Decompression Limit" (NDL) or "No Stop Time" (NST) as indicated on computer or dive table
        - This is referred to as "Going into deco"
      - Means too much nitrogen has been absorbed for a direct ascent to the surface, meaning he or she MUST stop at 15 ft for a certain length of time, or likely get DCS
- **Anxiety/Panic**
  - Remember anxiety is normal
  - If you feel rising anxiety: STOP, BREATHE, THINK, ACT
  - Advise buddy – end dive or perhaps move shallower
  - Don't mentally run from the negative feelings; think about the cause and act to alleviate
  - Prevent anxiety by being prepared, on time, diving within limits, regularly practicing skills
  - DO NOT DIVE if you are feeling unduly anxious
  - Panic is the leading cause of injury among divers

- **Proper Trim/Propulsion**
  - Makes diving easier – less resistance

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- Prevents entanglement/impacting objects
- Prevents stirring up silt/kicking bottom or other divers

- **Environment**
  - Never touch or molest sea life or any part of the underwater environment
  - Take only memories/pictures and leave only bubbles

- **Hand Signals**

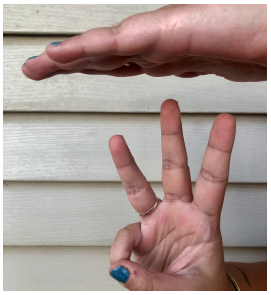

OK (Surface)

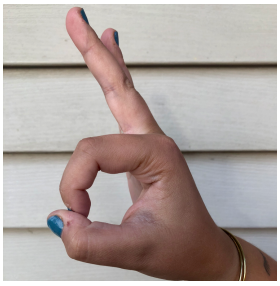

OK (Surface)


Need assistance


Descend


Ascend

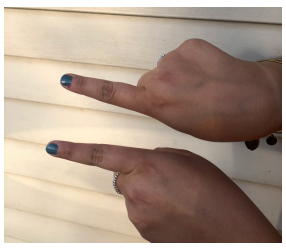

Safety stop

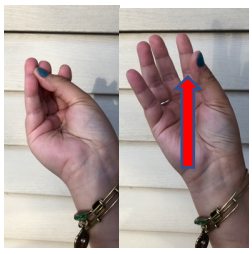

OK

Look


This way


Stop


Buddy up


Bubbles/leak

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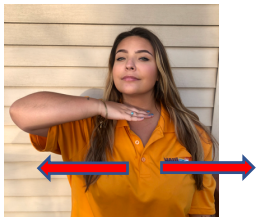
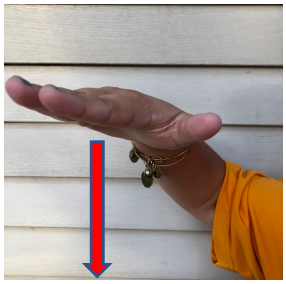


Out of air

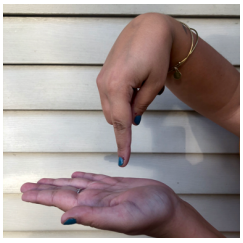
Low on air

I'm cold

Problem (signal then indicate)

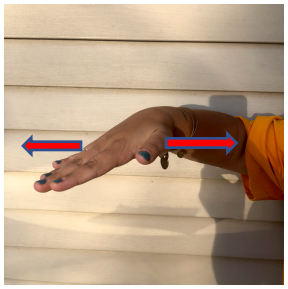


Slow down

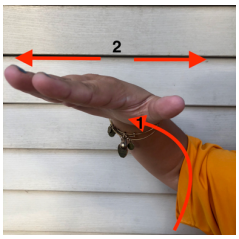


Write it down

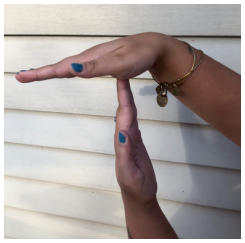
Come this way



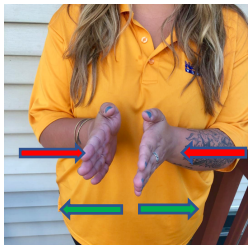
Level off



Level up



Half a tank remaining



Move closer/farther

What's your air pressure?