Open Water Scuba Diver Instructor Manual

A Comprehensive Guide for the Dive Professional

SCUBA DIVING INTERNATIONAL
tdisdi.com

SDI OPEN WATER SCUBA DIVER INSTRUCTOR MANUAL

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Welcome to the SDI Open Water Scuba Diver Instructor Course!

Congratulations on choosing to take your SDI Dive Leadership training to the next level. We commend you for gaining the knowledge and attaining the experience it takes to reach this level. As an ambassador for SDI, TDI and/or ERDI, your ideas, experiences and abilities are vital parts of who we are as an organization and we value your commitment.

Earning the SDI Open Water Scuba Diver Instructor (OWSDI) rating is one of the most important steps of an SDI, TDI and/or ERDI Dive Professional's career, as it is where you will learn to successfully train new and seasoned divers alike. This course has been meticulously crafted to help further your knowledge and experience with regard to the theories and techniques involved in teaching scuba diving as a whole. In this course you will have the opportunity to delve into how and why people learn; common barriers associated with learning and ways to overcome those barriers; the SDI Teaching Philosophy and why it works; risk management and how it applies to being an industry professional; and new ways to successfully market and sell scuba.

Of course, as with all other SDI, TDI and ERDI courses, we believe it's important that you have the opportunity to fine-tune your current knowledge and skills as well. That's why we present within this course a review of the knowledge and skills we believe are the foundation on which all dive leaders build. This includes brief but concise information regarding diving physics and pertinent gas laws; diving physiology and related concerns; and most importantly, how it all applies to the dive leader. Further, while we don't expect that your skills are poor, you will spend time with an instructor in the pool or confined water to hone scuba skills to match those expected of any SDI Open Water Scuba Diver Instructor.

This program's goal is to provide you with the appropriate tools to be able to transfer knowledge and help shape the experiences of future students. SDI, TDI and ERDI have selected the information that we believe is most vital for you to impart to students and we have gathered proven teaching techniques for delivering that information. In addition, over the duration of this program, you will have the opportunity to gain valuable insights by way of peer education, practice sessions and workshops designed to develop teaching skills. Your instructor trainer will provide feedback based on his knowledge and experiences, and help mold individual teaching style. After all, you are unique and should learn to take advantage of your distinct instructional talents. It will then be up to you — the OWSDI - to deliver this critical core package to the student. Together, this is the fundamental partnership between SDI, TDI, ERDI and the SDI OWSDI.

Over the progression of this course you will experience plenty of opportunities and much room to grow as an SDI OWSDI. There are a host of programs for an OWSDI to teach. Some of them are open water scuba diver, specialties and dive professional levels, to name a few.

A knowledgeable and professional SDI OWSDI is a great asset to the SDI Facility they work with; however, should you decide that you're ready for the next step, you can become an SDI Specialty Instructor. This course more than prepares you for the challenges that presents. Also, after the SDI OWSDI rating is obtained, even further opportunities will open up to you in the form of the ability to gain instructor ratings in the technical diving field with TDI or emergency response diving with ERDI.

The appendix of this manual includes the outlines you will need to conduct the SDI Open Water Scuba Diver course. Specifically, you will find presentation outlines for the academic, pool/confined water and open water presentations in Appendix A. Appendix B contains the questions and answers for the SDI Open Water Scuba Diver Knowledge Review questions. Appendix C is a quick reference guide for the most common mathematical formulas used in scuba diving. In addition to these outlines, the SDI OWSDI Cue Cards should be used in the pool/confined water and open water sessions as a skills reference.

As a final note, please remember that throughout this and future programs you may participate in, the Course Director or SDI Instructor Trainer (IT) is here to help you learn, grow and have valuable experiences. If at any time you have questions, comments, concerns or need more direction, feel free to talk with your ITs/IT.

We welcome you to the SDI OWSDI program and we hope you find it challenging, fun and most importantly…rewarding.

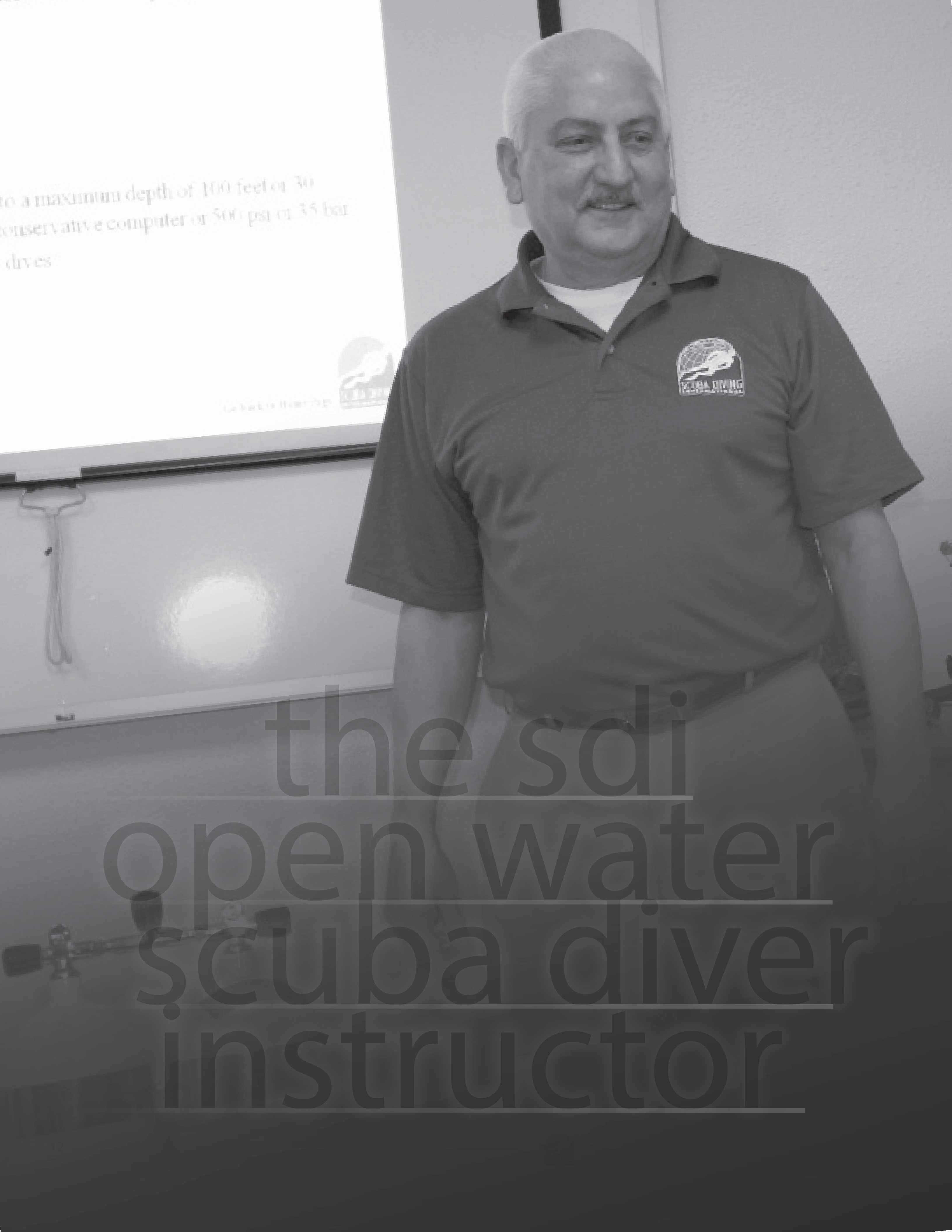
Safe Diving!

chapter 1

The SDI Open Water Scuba Diver Instructor

the sdi open water scuba diver instructor

The SDI Open Water Scuba Diver Instructor



the sdi open water scuba diver instructor

Introduction

This chapter covers a good deal of valuable background information for the OWSDI candidate including: an overview of International Training's history and philosophy; requirements for certification as an SDI OWSDI and the SDI Member's responsibilities after certification; International Training's quality assurance procedures; and finally, a description of the SDI Standards and Procedures Manual and what information it contains. Having a clear understanding of these things will help the candidate understand what is expected of a well-rounded SDI Dive Professional — and in turn, what the dive professional can expect of ITI; this will help establish and promote a long and healthy business relationship.

The History of International Training

From its humble beginning in 1994 to today, the group of training agencies Scuba Diving International (SDI), Technical Diving International (TDI), and Emergency Response Diving International (ERDI) form one of the largest diving certification agencies in the World – International Training Inc (ITI). With 25 Regional Offices servicing more than 100 countries, the company today far exceeds the original vision the founders had when they conceived the idea on a napkin, sitting at a kitchen table in the early 1990's

As with many companies, the original concept for the business was an outgrowth of the recognition that a niche needed to be filled. This niche was providing specialized training for what the industry now calls technical diving, and the founders did so by forming the first agency of the group, Technical Diving International, in 1994.

Technical Diving International was one of the first agencies of its kind. It's focus was and still is on providing training materials and education for specialized diving situations ranging from Nitrox to Closed Circuit Rebreathers, as well as for overhead environments such as caves and wrecks. TDI also provides training in the preparation of gas mixtures for dives up to 100 metres (330 feet).

During TDI's development, there were a few key factors that separated it from its competitors and pioneered the way many people learn to dive today. For one, TDI was at the forefront of the movement that convinced the dive industry to accept technical diving activities.

In the early stages of technical diving there were many industry professionals who felt the average diver was not smart enough to handle the expanded dive planning that goes into doing a technical dive, and that technical diving was far too risky for non-professionals. These two factors were offset at TDI by an extensive education process conducted through

seminars, publications, and TDI's training materials. The average diver realized that the risk in technical diving could be brought to an acceptable level and they were indeed smart enough to conduct technical dives.

Today, the industry not only embraces technical diving, but Nitrox is now the most popular specialty course taken worldwide. Another key event in TDI's history occurred when it pioneered the use of Semi Closed Circuit Rebreathers (SCR) by recreational divers. This opened the door to allow divers to use Closed Circuit Rebreathers (CCR) recreationally and spawned a whole new segment of the dive industry. In short, TDI ushered in an exciting breakthrough in the dive industry that many believe actually prevented the industry from further decline.

In 1998 the membership of TDI could no longer be held back from the demand to create a sport diving division of TDI and thus was born Scuba Diving International (SDI). The primary reason for this expansion was that dive instructors valued dealing with an agency that listened to the instructors in the field and created programs that were, and continue to be, very profitable because they are tailored to the way today's diver wants to learn to dive.

Like TDI, SDI did a number of things that separated it from previously established training agencies. One example is that SDI was the first agency to require the use of Personal Dive Computers (PDC) by all students during all phases of training. This new standard was put in place because PDCs were and are used daily by most divers to make diving safer, more enjoyable and less intimidating. Research showed that the average diver forgot how to use dive tables soon after completion of a course. This fact along with the advancement and increased reliability of dive computers meant they were considered a better alternative to dive tables. SDI recognized this and although dive tables are not required curriculum in the basic diver course, they still can be taught during any course.

Another groundbreaking step taken by SDI was the development of an e-learning platform for dive education. The idea of allowing a student to learn the academic portion of a dive course online rather than requiring additional classroom instruction was a bold yet visionary step. Currently SDI is one of only a few agencies that offer divers the opportunity to learn online.

With the membership now happy about their options for both sport and technical dive training through SDI and TDI, they continued to ask for more specialized training in public safety diving, and thus Emergency Response Diving International (ERDI) was born in 2000. ERDI was and continues to be the only training program that is supported by a major certification agency catering exclusively to public safety diving. Throughout the years ERDI has written programs that have trained very established dive teams such as the Chicago Fire Department, numerous state police dive teams, and several federal agencies.

In 2004, with 10 years of development into the company, the founders of SDI/TDI/ERDI decided it was time to move on and sold the company to a group of investors who quickly expanded the offerings of the company. Immediate changes included applying for and receiving acceptance into the Recreational Scuba Training Council (RSTC) and the European Underwater Federation (EUF). This acceptance was critical because it meant that SDI Standards were evaluated and found to be sound and safe by its competitors. SDI passed with ease and today is actively involved in both organizations, helping maintain diver safety. Other changes came with additional staff and a commitment to embrace electronic technologies to make doing business easier for members.

Although SDI/TDI/ERDI is considered to be one of the newer organizations in the industry, it is viewed as one of the most professional and progressive certification agencies. ITI's history and its reputation as an innovator have built a strong foundation for the future. By listening to its members, building programs that are profitable and addressing scuba diving's inherent risks in a positive way, the future is bright for the organization.

ITI Training Philosophy

International Training is the parent company for Scuba Diving International™ (SDI), Technical Diving International™ (TDI) and Emergency Response Diving International™ (ERDI). Our philosophies for this dedicated family of dive training agencies are based on the simple principles included in our mission statement that we are proud to share with you.

The Mission of International Training

- To advance and extend knowledge, learning and culture as it relates to diving.
- To provide opportunities for those who want to learn to dive and for currently certified divers to develop intellectually, personally and professionally.
- To prepare educated, responsible divers through the education offered by our three agencies; Scuba Diving International™ (SDI), Technical Diving International™ (TDI) and Emergency Response Diving International™ (ERDI).

While keeping with the team structure and family atmosphere that fosters support, mentoring and mutual respect. We will contribute by…

- Earning our customers' business daily by providing superior service and products.
- Growing with our customers to meet their needs.
- Building long-term business relationships on a foundation of customer satisfaction
- Employing cutting edge technologies to maintain a competitive advantage.

When you experience that we have met our mission in interacting with you we sincerely hope you will share your positive experience with others. Should you ever feel that we have fallen short of our mission or more importantly of your expectations, please let us know!

We believe that your diving experience should be exhilarating and personally rewarding at every turn. This includes your experiences with us. As such, we want to ensure that you are well informed about the requirements for certification as an SDI OWSDI, what is expected of you after certification and what your role as an SDI OWSDI will be.

SDI Requirements for Open Water Scuba Diver Instructor Certification

The SDI Open Water Scuba Diver Instructor (OWSDI) program is the next step in a professional diving career. Upon successful completion of this program, the OWSDI will be able to introduce students to the underwater world for the first time and teach all of the SDI core programs. These core programs start with the open water scuba diver and progress through the assistant instructor level. Teaching these new levels will bring more responsibility and new challenges.

The OWSDI is comprised of two parts, the Instructor Development Course (IDC) and the Instructor Evaluation Course (IEC)In order to meet the responsibilities and challenges of the IDC/IEC, it's vital that the OWSDI candidate be prepared to begin the training process. To help ensure the candidate is prepared, an established set of prerequisites must be met to start the program.

The prerequisites include:

- Be at least 18 years of age
- Certified diver for at least six (6) months
- Certified as an SDI Assistant Instructor or Divemaster or equivalent
- Hold a current CPR and first aid certification (ie current and valid CPROX certification)
- Qualified as an oxygen provider
- Have a current medical examination for diving
- Minimum of 100 logged dives completed in various environments with varying depths (a minimum of 25 of which must be using a PDC)
- Possess the minimum instructional equipment as defined in the leadership standards.

In addition to the prerequisites, there are additional requirements that must be met for certification. These requirements are:

The student must teach a minimum of:

- Two (2) classroom presentations in the Instructor Development Course (IDC)
- One (1) classroom presentation at least fifteen (15) minutes long for the Instructor Evaluation Course (IEC)
- Two (2) lessons in confined water (IDC)
- One (1) full lesson in confined water (IEC)
- Two (2) lessons in open water (IDC)
- One (1) full lesson in open water (IEC)

- Show preparation, planning and control in
    - Dive management
    - Diving activities

- Complete a minimum of 100 hours of training (no more than 40 can be credited from the divemaster or assistant instructor program at the instructor trainers discretion). Fifty hours must occur under the direct supervision of a current Course Director or instructor trainer.

- Complete all subject areas as defined in the SDI Standards and Procedures.

- Successfully pass the SDI Instructor exams (IEC)

- Must complete the IEC within six (6) months of completion of the IDC

- Perform the following in-water skills:
    - Ten (10) minute survival float, without the use of swimming aids
    - Swim 400 metres on the surface without any swim aids in less than 10 minutes
    - Swim 800 metres on surface with mask, snorkel and fins non-stop without the use of arms in less than 17 minutes
    - Demonstrate all open water scuba diver skills at an instructor quality level
    - Scuba surface bail-out
        - With all equipment in hand and cylinder tuned off descend to 2.5 metres / 8 ft
        - Turn cylinder on, replace mask, snorkel and scuba unit
        - With all equipment on and mask cleared ascend slowly

- Perform, to demonstration quality, one complete rescue scenario

- Bring a diver, simulating unconscious, up from a depth not greater than 6 metres / 20 ft. At the surface, tow them for 100 metres in less than 4 minutes.

- In a pool or confined water setting
  - Perform, to demonstration quality, all skills listed in the SDI Open Water Scuba Diver course.
  - Pool/confined water problem solving

- In an open water setting:
  - Perform, to demonstration quality, all skills listed in the SDI Open Water Scuba Diver course.

- Open water problem solving

Upon successful completion of the SDI Open Water Scuba Diver Instructor course, the OWSDI is qualified to conduct the following:

- Teach all SDI core levels from open water scuba diver through assistant instructor, where allowed.

- Teach the SDI Advanced Adventure Specialty

- Teach approved specialties after receiving training in those specialties.

As described above, the SDI Open Water Scuba Diver Instructor must have achieved certain requirements before starting — and met the final guidelines, in order to complete the OWSDI course. Once certified, the OWSDI will need to meet and maintain an established set of guidelines in order to remain an active SDI Instructor. Should an SDI member fail to meet the established guidelines for active teaching status, their status may be adjusted accordingly as defined in the following section.

Membership Status

The status of a SDI Dive Leader, along with their qualifications, defines what they are able to do and to whom they are allowed to teach and issue certifications. SDI has established specific guidelines that must be adhered to in order for an SDI OWSDI to become and remain active status.

If a dive leader fails to meet the minimum guidelines, they will be placed on a different status, which may limit or prevent some or all of their abilities as an SDI Dive Leader until the situation is rectified.

The definition, description and abilities of each member's status within the SDI System are defined below, as well as potential reasons a dive leader would be placed on the associated status.

Active Teaching Status

An SDI OWSDI given the designation of active teaching status must adhere to the following criteria: their annual dues and account balances from the previous year must be paid in full, they must submit proof of current liability insurance where required by law, they must have taught or assisted in at least one SDI Open Water Scuba Diver course and have the ability to perform all leadership skills to demonstration quality. Once all criteria have been met, the SDI Open Water Scuba Diver Instructor is authorized to teach SDI courses and certify students for courses in which they are certified to do so as stipulated by the SDI Standards.

Probation Status

An SDI OWSDI may be placed on probation status for any of the following reasons: their account balance is older than 90 days, they have failed to meet the contractual obligations of active teaching status or they have violated teaching standards.

An OWSDI placed on probation status is authorized to teach SDI courses and to certify SDI Divers. However, further standards violations may result in an SDI Open Water Scuba Diver Instructor being moved from probation status to suspended or even expelled status.

Non-Teaching Status

An SDI OWSDI can be placed on non-teaching Status for any of the following reasons: their account balance is older than 90 days, they have been temporarily placed on suspension or they have failed to meet the contractual obligations of active teaching status.

Should the SDI OWSDI be placed in a non-teaching status, they are not authorized to teach SDI courses or to certify SDI divers. Change of the member's status will be provided in writing to the member from International Training's HQ Training Department.

Suspended Status

An SDI OWSDI can be placed on suspended status for any of the following reasons: their account balance is older than 120 days and the SDI OWSDI has made no attempt to rectify the situation, they have failed to meet the contractual obligations of active teaching status or they have violated training standards.

An SDI OWSDI placed on suspended status is not authorized to teach SDI courses or to certify SDI divers. Further standards violations can result in an SDI Open Water Scuba Diver Instructor being moved from suspended status to expelled status. Prior to being placed in a suspended status the open water scuba diving instructor will be notified in writing.

Expelled Status

An SDI OWSDI can be placed on expelled status for any of the following reasons: their account balance is older than 120 days and the SDI OWSDI has made no attempt to rectify the situation, they have been placed on suspended or probation status on more than one occasion, they have failed to meet the contractual obligations of active teaching status, or they have violated teaching standards and have displayed conduct unbecoming a professional SDI OWSDI.

An SDI OWSDI placed on expelled status is no longer authorized to teach SDI courses or certify SDI divers. An SDI OWSDI who has been expelled is no longer considered a member of SDI.

NOTE: ITI reserves the right to suspend, expel or terminate the membership of any member based upon the determination that standards violations have occurred by the individual.

It is in the best interest of all parties that dive leaders remain on active status throughout their career; however, there are specific issues that arise from time to time. Should such a situation arise, the dive professional is encouraged to immediately contact SDI's Training department so they may help solve the issue in the most efficient way possible.Remember, SDI is there to help the SDI Instructor be successful.

Annual Dive Professional Renewal

As described in the previous section, SDI/TDI/ERDI Dive Professionals must renew their membership every year to remain active and able to conduct programs they are qualified to teach. Regardless of when a dive professional first became a member of SDI/TDI/ERDI they must renew by January 1 of each year. A reduced fee is offered if the dive professional renews prior to December 15.

To renew membership, the dive professional can visit the Member Services area of the SDI/TDI/ERDI website and print the renewal form, They must complete the form and send it by fax or mail to the regional office through which they work. Only one form must be completed and only one fee paid, even if the dive professional is a member of SDI, TDI and ERDI.

There are annual renewal requirements the member must meet to renew as an active dive professional. In addition there are renewal requirements that must be met every two years. If an individual does not meet these requirements they will be required to complete an update with a designated SDI/TDI/ERDI Headquarters Representative.

Once the renewal form is received by SDI/TDI/ERDI Headquarters the dive professional's membership will be processed. A sticker indicating the member's new expiration date will be sent. This sticker must be placed on the member's dive professional card in the appropriate location.

An online option is also available on the Member Services page of the SDI/TDI/ERDI website. Click on that option and follow the directions. Not only does the online option allow for a more timely renewal process but also it is eco friendly by not requiring the use of paper.

Please remember that, as mentioned before, SDI is there to help the member be successful. The SDI OWSDI should contact them if they have any questions about anything regarding the collective relationship and responsibilities. Every attempt has been made to make the renewal process easy, and in many cases, what seems to be a major issue can be solved very easily simply by talking to someone at World HQ or your Regional Office.

Professional Responsibilities of the Open Water Scuba Diver Instructor

Now that we know what it takes to become an SDI OWSDI we will discuss the SDI Code of Ethics and Conduct as well as the related professional responsibilities that reinforce the code of ethics. While some of the responsibilities described may seem somewhat general, they are issues often overlooked and worth discussing.

SDI Code of Ethics and Conduct

The following items apply to all SDI Professionals:

- Sport diving is recognized as carrying a degree of risk and responsibility not normally associated with other recreational sports.

- We believe an individual should not be qualified as a SDI diver unless those empowered to qualify the person would allow them to buddy or teach their loved ones recreational diving.

- The professional always maintains their equipment and never begins a dive with defective equipment.

- The professional strives to maintain an attitude of professionalism and objectivity, and supports the concept of safety in recreational diving.

- The professional will not encourage or recruit other individuals to dive recreationally if unqualified.

- The professional will make every effort to pass on their knowledge to novice recreational divers and the diving community if requested to do so, whether through formal instruction, answering questions or via appropriate publication in books, journal and magazines.

- The professional strives to encourage and practice an awareness of conservation of the underwater environment at all times.

- The professional, by virtue of his or her voluntary membership, recognizes a responsibility and obligation to promote SDI and TDI, and support the official decisions as adopted by SDI and TDI; in fulfilling this responsibility and obligation, SDI and TDI members shall:

- Publicly support SDI and TDI as organizations.

- Make every effort to bring about necessary changes in a professional manner by direct contact with those fellow SDI and TDI members who are in positions of authority and responsibility.

- Every member has an obligation to report violations of SDI and/or TDI Standards and the Code of Ethics.

- Every member should strive to set an example of professional behavior and ethical conduct in all activities including, public speaking, articles and books, and various forms of Internet style discourse.

- Unwarranted critical comment and deliberate inflammatory statements of diving is inappropriate and undesirable.

- Unwarranted critical comment and deliberate inflammatory statements of diving peers is inappropriate and undesirable.

The professional responsibilities are more than just the knowledge and experience gained getting to this point; a dive professional is an ambassador to the community for the scuba industry. They must present themselves in a positive, professional manner especially when they are teaching students or have responsibility for a group. To maintain a professional image and meet those professional responsibilities they must adhere to the following guidelines:

Appearance

Wearing appropriate attire for each situation portrays a professional image. If the facility has a staff dress code, all dive professionals must follow that dress code. Many facilities require the dive professional to wear a shirt bearing the store logo while teaching. For the classroom setting, a collared shirt with slacks or casual dress shorts (no cut offs) portrays a professional image, while a T-shirt and casual shorts are more appropriate for the pool/confined water or open water. Certainly when teaching in a resort location, other attire may be appropriate. When all dive staff adhere to a predetermined appearance or dress code, it portrays a cohesive team that is organized and also instills confidence and trust in the customer. This appearance must then be followed up with adherence to other responsibilities, the next of which is punctuality.

Punctuality

Perhaps the most important thing a professional can do is make a good first impression. This impression starts even before the first word is spoken. The dive professional should plan to arrive at least 15 to 30 minutes before class starts depending on how much preparation must be done beforehand. The classroom should be checked to make sure all teaching aids and visual aids are available and working. All equipment that is needed for pool/confined water session must be ready and functioning properly. It is a good idea to have an extra set of equipment available should a problem arise with one in use. If the class is to end on time, it must start when it is scheduled to start. If the class starts late it will end late. Students may have made plans based on the schedule that was posted when they signed up for the class. They may have told family or babysitters when they could be expected home. Should the class get abnormally delayed time after time, they may become upset and the dive professional will quickly lose their credibility.

Remember, if everything is ready to go when the students arrive for the class, pool or open water dives, not only will everything take place on time but the student will leave with a good first impression.

Equipment Use

As discussed in the previous section on appearance, the dive professional and dive staff must maintain a professional image. Since scuba diving involves both above and below water interaction with the customers, it is important that the SDI OWSDI carry over that image to their underwater appearance. Dive professionals must use equipment sold by the store with which they are affiliated. This equipment should be top of the line, fairly new if not brand new and replaced every year or two. Students will look to the dive professionals as experts on equipment. They will want to emulate what they see these individuals using. The equipment must be maintained as required and any visual inspection stickers must be up to date. Old worn out equipment doesn't indicate an experienced diver, it indicates someone who doesn't care about their appearance or well-being. It may also give the impression the dive professional does not believe the newer equipment is as good as the equipment made in the past.

Keeping in mind the first impression and how that builds confidence and trust in the customer, the in-water portion of the course is where the customer needs to have 100% trust in the dive professional. This may be the first time the customer is going for a dive or they may be beginning a new aspect of diving, so having their trust is paramount; and if the SDI OWSDI's equipment is well maintained and looks new this will help establish that trust.

Preparedness

If the dive professional is punctual this will help them to be prepared and if they are neither of these it will be obvious to the customer. The dive professional must prepare for every course they will be conducting. This means knowing what information or skills will be covered for the upcoming lesson. They should try to anticipate questions the students may have and then answer these questions with the information that is presented. Knowing the audience will help in planning. Is the class made up of young students as well as older individuals? If so, what analogies can be used to explain an idea to both age levels so they will all understand?

Anticipate situations that may occur (play the "what if?" game) especially for in-water sessions. Always think ahead. Thinking ahead will allow proper planning and appropriate reaction in the event an unusual situation arises.

A good practice is to mentally prepare for the course by going through all the motions; this is better done in a place where there are no distractions. By being mentally and physically prepared the SDI OWSDI and the students will experience a better course.

Answering Questions

It should be clear by now, there are a lot of elements to cover in order to be prepared for a course. Another crucial element is the instructor's ability to answer questions the students may have in a prompt and confident manner. The OWSDI should be able to answer these questions by drawing from their current knowledge or experience but perhaps the best way to prepare is to read the materials the students read. When an OWSDI has an assistant instructor assisting with a course, it is the instructor's responsibility to tell the assistant when they should and when they should not answer questions asked by the students. The instructor may wish to have all questions directed

to him. If the instructor allows the assistant instructor to answer questions, the assistant instructor must be 'on the same page' as the instructor and not be contradictory with their answer.

It is the instructor's responsibly to make sure the assistant instructor knows exactly what's expected of him.

The more often courses are taught by an OWSDI the easier this process becomes but it is still a very good habit to review the text the students studied, just in case something was forgotten or the text has been updated. The OWSDI will need to learn to think on his feet as all questions asked by students may pertain to the current topic being discussed. This leads us into the need to stay current not only with materials but also certifications.

Staying Current with Certifications

CPR, first aid and oxygen administration are required for certification as an SDI OWSDI. It is the dive professional's responsibility to keep these certifications current; most must be renew every two years. Staying current with CPR, first aid and oxygen administration is not just a matter of adhering to standards; in the unfortunate event an accident does occur the dive professional will know what to do and how to handle the scene. CPR and first aid are an evolving and ever changing science and it is a prudent dive professional that stays abreast of the changes.

Being prepared with the latest techniques and the basic equipment needed for CPR and first aid will not only help alleviate some of the stress associated with a diving accident, it will also produce a more positive outcome for the victim.

Continuing to Learn

Just like any other facet of life there is always more to learn, and no matter how long a dive professional has been involved with diving, they still haven't learned everything there is to know about the sport. Information is constantly changing. By continuing to expand their knowledge they will stay informed of these new ideas and will demonstrate to others that continuing education is needed at all levels. There are many avenues to continuing education from simply auditing a course taught by someone else to enrolling in a course to gain a certification that is not currently held. The simple moral here is: keep the mind open to new ideas, knowledge and techniques; they can all come in handy when a new situation is faced. The experience gained as an instructor will help tremendously when moving through the higher professional levels.

Advancing through the Professional Levels

SDI has many certification levels in-line with and above the OWSDI, each building on the previous and expanding the abilities of the dive professional. The following is a list of the certifications that can be obtained.

Specialty and TDI Instructor

An SDI OWSDI is the professional primarily responsible for training and certifying sport divers. After successful completion of both the Instructor Development Course and the Instructor Evaluation Course, the SDI Instructor may independently conduct all core diver and leadership courses from open water scuba diver through assistant instructor, as well as the Advanced Adventure and computer specialties. An SDI Instructor must be separately qualified and approved for each additional specialty diver course they wish to offer.

A TDI Instructor is the professional primarily responsible for training and certifying technical divers. Naturally, certification as an SDI Instructor (or equivalent) is a prerequisite, as well as certification as a technical diver at the appropriate level. After successfully completing a technical instructor course for each technical level, the TDI Instructor may conduct technical diver and technical divemaster programs at that level.

Course Director

Course Director is an advanced instructor rating within the SDI curriculum. An SDI Course Director at this level may independently conduct the SDI Instructor Development Course (but not the instructor evaluation course). The Course Director may also qualify SDI Instructors and SDI Assistant

Instructors to teach approved SDI Specialties. The prerequisites for SDI Course Director include documented teaching experience in a wide range of SDI Diver and Dive Leadership programs.

It should be noted that there is not a Course Director rating in the TDI curriculum.

Instructor Trainer

Instructor trainer is the highest leadership level in the curriculum of SDI, TDI and ERDI. As this title implies, instructor trainers are responsible for training, evaluating, and certifying SDI, TDI and ERDI Instructors, as well as SDI Course Directors. Prerequisites for instructor trainer include significant and extensive experience as an instructor. SDI has a single Instructor Trainer rating (with the exception of CPR, VIP and Solo ratings), while TDI has an Instructor Trainer rating at each technical level.

These levels of training are what lie ahead for the OWSDI who chooses to advance. Each level provides the ability to pass on more experience and enthusiasm to those divers wanting to learn more. By achieving the higher levels of certification, the dive professional will be able to lead their customers on a journey of exploration and excitement.

To recap, paying attention to one's appearance; being punctual; using well maintained equipment sold by the facility they work for; being very well prepared; answering students' questions correctly; staying current with certifications; and continuing to learn and better oneself are goals that all members should always be certain they accomplish. SDI members who are remiss in any of these areas may end up with quality assurance inquiries and risk losing their active status, or worse — potential expulsion.

International Training takes Quality Assurance very seriously. As previously discussed, members are direct representatives of International Training. As such, members are expected to act professionally and maintain that professionalism throughout their career with International Training. Quality assurance is tested in several different ways, and specific guidelines have been established for responding to quality assurance concerns. The following section describes the quality assurance procedures and action steps.

Quality Assurance

As a professional member of a self-policing organization it is important to understand how the quality of training and the materials used in training are monitored. This section discusses how SDI does this and how feedback from those surveys and other annual administrative tasks can affect a member's status.

All quality assurance matters are handled at SDI/TDI/ERDI World Headquarters by the Training Department. This is to ensure that SDI Regional Offices and Sales Managers remain neutral. The information gleaned during the QA process is used to improve the materials and standards as well as return positive feedback to the dive professionals providing quality training.

General Quality Assurance (QA) Procedures

Quality asurance survey letters, more commonly known as QA letters, are sent out to students who were recently certified by members in good standing. These letters are sent with a self-addressed, return postage paid envelope or electronically via e-mail course survey form to solicit information about the course the student just completed. The questions in the letters might ask about the materials used for the course, the maximum depth achieved during the course, and other information that will help the ITI Training Department understand the student's experience during the course. SDI wants this information so that it can maintain the quality of instruction and ensure that proper training materials were used. In addition to the letters, SDI occasionally receives unsolicited emails and phone calls from students. The feedback from these QA letters, emails or phone calls can be negative or positive and either way the member's file is updated.

Now that we have discussed the potential certifications that lie ahead, various member statuses and quality assurance procedures, it is important to know where to find all this information along with course specific standards. In the next section we will cover how to navigate through the SDI Standards and Procedures Manual and where to locate the answers to most questions that arise during or before training.

Using the SDI Standards and Procedures Manual

The SDI Standards and Procedures Manual is intended to be a guide to providing complete and enjoyable training to divers for the courses the OWSDI is qualified to teach. The SDI Standards and Procedures include not only standards for courses OWSDIs can teach but for all courses SDI/TDI/ERDI Instructors can teach. The OWSDI should reference the Standards and Procedures to achieve consistency and quality. They outline the vital "core knowledge" that each student needs to master to achieve SDI certification. Finally, but no less important, the manual is intended to help effectively deliver the skills and knowledge students will actually need.

The SDI Standards and Procedures Manual is meant to be a "living manual" - updated on a regular basis, it is meant to grow and change throughout the OWSDI's career. From time to time member updates will be received; the OWSDI should be sure to incorporate these updates promptly so that their manual is always up to date.

How to Use the SDI Standards and Procedures Manual

The SDI Standards and Procedures Manual has intentionally been kept brief but concise.

The manual consists of several parts, which are:

1. Introduction
2. Diver Standards
3. Diver Specialties
4. Leadership Standards
5. Appendix

Each part of the SDI Standards and Procedures Manual is designed to have the same look and flow. Parts 2 and 3 have a general course standard followed by the specific standards for each course. The general standards apply to all standards within that section. The course specific standards are listed in a logical order and follow the normal progression of training. When clarification is needed for a specific course, refer to the general standard at the beginning of that part first, then refer to the course specific standard. If the intent of the standard is still not clear, call or email the Training Department of SDI World Headquarters.

Each of these parts also contains the information needed in order to meet minimum standards. Minimum standards ensure proficiency at a given level and stipulate that the course content can be no less than what is required by the standard. The standard for the specific course being taught should be reviewed prior to teaching that particular course and should be reviewed again before completion to ensure the standard was met. If the instructor adheres to the standards, uses the course materials combined with their experience and knowledge they will produce a well-rounded and proficient diver.

All forms necessary to complete the administrative tasks associated with conducting a course will be found in Part Five (5) Appendix.

The following is a more detailed explanation for each section. It is recommended the SDI Open Water Scuba Diver Instructor candidate have their SDI Standards and Procedures Manual out to follow along.

Part 1, Introduction covers:

- The Need for Standardized Instruction
  Explains SDI/TDI/ERDI's progressive approach to consistency and excellence in instruction

- The Role of a Dive Professional
  Emphasizes the important role the SDI Open Water Scuba Diver Instructor plays in the SDI/TDI/ERDI family

- Risk Management
  Directs the dive professional to further information to protect them against a problem that could consume their career; of course, they always want to be the best OWSDI possible

- Tips to Becoming a Great Instructor
  Tips that offer information to help them be a better teacher and a respected professional in dive instruction

- How to Conduct an SDI/TDI/ERDI Scuba Course

- Covers the general approach to scheduling a scuba course and enrolling students: focuses on the logistics and details (medical and legal) of scheduling training sessions, organizing students, collecting class fees and motivating students to attend all of the course sessions

Part 2, Diver Standards covers:

- Part Two (2) contains standards for the core SDI training programs including Snorkeling, Scuba Discovery Program, Inactive Diver Program as well as the Advanced Diver Development and Master Diver certifications. Some of these programs the OWSDI may have the ability to teach. When developing a path for a diver wanting to continue their education, this is the part to refer to.

Part 3, Specialties covers:

- Part Three (3) has all the course specific specialty standards offered by SDI. The SDI OWSDI can teach a number of these specialties (once certified for each specific level). When working with a diver to determine their interests in diving, the OWSDI can refer to this section to inform them of the prerequisites for the courses and what the courses will entail. As noted earlier, this is also where the OWSDI would review what is required during a course prior to teaching it.

Part 4, Leadership Standards covers:

- SDI's Leadership Course standards can be found in Part Four (4) of the Standards and Procedures Manual. After successful completion of the SDI OWSDI course the next step can be mapped out. The OWSDI may wish to gain additional specialty instructor ratings or become a TDI Instructor and this section will make clear what will be expected.

Part 5, Appendix covers:

- All forms necessary for completing administrative tasks can be found in this part, from student registration forms to the proper form to use when reporting an incident/accident. Part Five (5) also contains all of the forms that are required at the beginning of a course such as the general liability release form and the medical history form.

All of the various parts of the SDI Open Water Scuba Diver Instructor Manual can be found in the member section of the website tdisdi.com as well as on the Standards and Procedures CD and the printed version of the SDI Instructor Manual. SDI's Training Department routinely updates these standards and provides member updates quarterly during the year. At the beginning of each year all standards are updated on the website and it is the responsibility of the dive professional to ensure these updates are noted in their SDI Standards and Procedures Manual.

Summary

In this first chapter the history and philosophy of ITI, the parent company of Scuba Diving International (SDI), as well as an overview of what to expect during the SDI Open Water Scuba Diver Instructor course have been provided. The SDI Standards and Procedures Manual was reviewed, covering where to find the standards for courses that the OWSDI can teach and how to maintain an active teaching status. This chapter will serve as a reference point as the course progresses and information is needed to prepare for academic or in-water presentations, or to follow along while assisting with a course.

Review Questions

1. International Training (ITI) is the parent organization for:

☐ **A.** SDI

☐ **B.** TDI

☐ **C.** ERDI

☐ **D.** All of the Above

2. SDI was founded in what year?

☐ **A.** 1998

☐ **B.** 1994

☐ **A.** 2000

☐ **B.** 2008

3. SDI was the first training agency to mandate the use of Personal Dive Computers during all confined and open water training.

☐ True ☐ False

4. ERDI provides specialized training for:

☐ **A.** Public Safety Diving

☐ **B.** Sport Diving

☐ **C.** Technical Diving

☐ **D.** None of the Above

5. To maintain active membership, professional members of SDI/TDI/ERDmust:

- ☐ **A.** Remit annual dues.
- ☐ **B.** Carry appropriate liability insurance where required**.**
- ☐ **C.** Adhere to SDI/TDI/ERDI Standards.
- ☐ **D.** All of the above.

6. SDI Open Water Scuba Diver Instructors must renew by_______________________ each year to maintain their membership.

- ☐ **A.** January 1
- ☐ **B.** June 30
- ☐ **C.** May 1
- ☐ **D.** September 30

7. Prerequisites to begin the SDI Open Water Scuba Diver Instructor course include:

- ☐ **A.** Certification Assistant Instructor or Divemaster or equivalent
- ☐ **B.** 100 Logged Dives
- ☐ **C.** At Least Eighteen (18) Years of Age
- ☐ **D.** All of the Above

8. An SDI Open Water Scuba Diver Instructor may independently teach approved specialties after receiving __________________ in those specialties.

- ☐ **A.** Observations
- ☐ **B.** Student Materials
- ☐ **C.** Training
- ☐ **D.** None of the Above

9. Requirements for certification as an SDI Open Water Scuba Diver Instructor include:

- ☐ **A.** Ten (10) minute survival float, without the use of swimming aids.
- ☐ **B.** Successfully pass the SDI Instructor exams.
- ☐ **C.** Perform to demonstration quality, one complete rescue scenario.
- ☐ **D.** All of the Above

10. An SDI Open Water Scuba Diver Instructor can teach the entire academic portion of an Open Water Scuba Diver course.

☐ True ☐ False

11. Once certified it is required the SDI OWSDI keep their CPR and first aid certifications current.

☐ True ☐ False

12. Professional responsibilities expected of the SDI Open Water Scuba Diver Instructor include:

- ☐ **A.** Being punctual.
- ☐ **B.** Cleaning bathrooms at the store.
- ☐ **C.** Making sure all refreshments are available for the annual sale.
- ☐ **D.** None of the above.

13. Quality Assurance issues are handled by the________________________ Department at SDI World Headquarters.

- ☐ **A.** Training
- ☐ **B.** Sales
- ☐ **C.** Warehouse
- ☐ **D.** All of the Above

14. Which member status prevents the SDI Open Water Scuba Diver Instructor from continuing as a member of ITI?

- ☐ **A.** No Action
- ☐ **B.** Probation
- ☐ **C.** Suspension
- ☐ **D.** Expelled

15. Which of the following is not part of the SDI Standards and Procedures Manual?

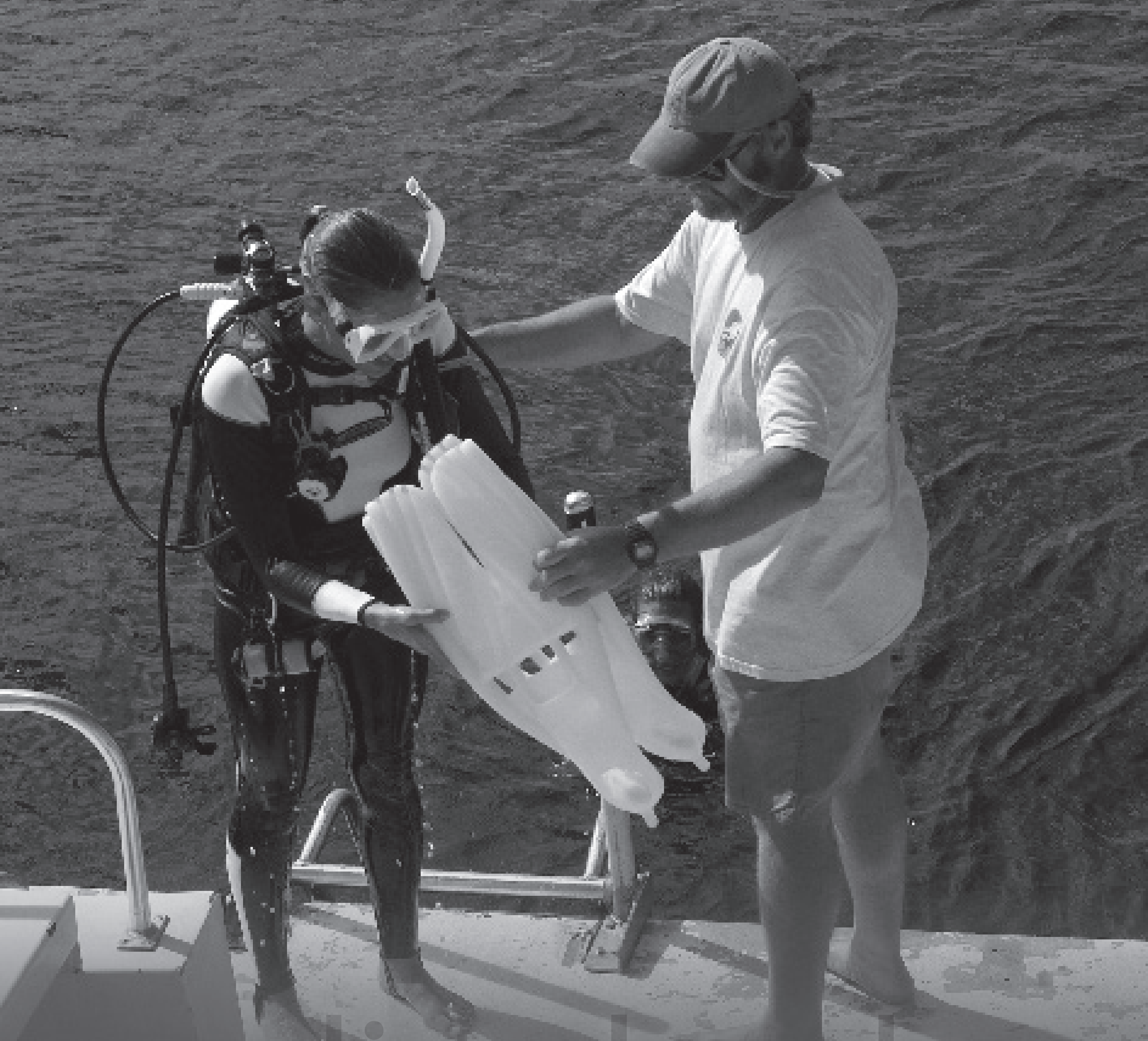
- ☐ **A.** How to Teach an Instructor
- ☐ **B.** Diver Standards
- ☐ **C.** Diver Specialties
- ☐ **D.** Leadership Standards

chapter 2

dive leader risk management

Dive Leader Risk Management

Dive Leader Risk Management



dive leader risk management

Inherent Risks in Scuba Diving

At some point in time, almost every experienced diver has told a family member or interested friend that diving is a safe sport. As a professional dive leader, it is a mistake to make that kind of statement to anyone, especially someone just entering the sport as a student diver. It simply is not an accurate statement. "Safe" literally means "without risk". In fact, few things in life are absolutely safe. Diving, like many other adventure sports, definitely has some inherent risks.

The particular risks associated with diving are detailed in the Diving Physiology chapter of this manual. Among other issues, these risks include decompression sickness and barotraumas, marine-life injuries, physical exertion with increased demands upon the cardio-respiratory system, and the possibility of drowning.

Risk management refers to the various efforts and procedures intended to minimize the inherent risks of scuba diving.

From the perspective of the diver, these inherent risks can be minimized through appropriate prerequisite training for all participants, followed by accurate application of the student's knowledge and skills during all subsequent diving activities.

Nevertheless, despite these precautions, the possibility of injury still exists. Thus there is a clear mandate for all participants to thoroughly understand and accept these risks. Furthermore, in today's litigious society, whenever any injury occurs there also is the distinct possibility of a lawsuit. Accordingly, from the perspective of the dive leader and dive facility, effective risk management further includes appropriate measures and strategies to mitigate the consequences of a participant's injury.

Anatomy of a Lawsuit

A civil lawsuit generally consists of two parties – the plaintiff, who files the suit seeking compensation for damages; and the defendant (or defendants), whom the plaintiff alleges is responsible for those damages. In an injury case the plaintiff is normally the individual who actually suffered the injury, though in the case of a fatal injury it also can be the family or estate of the deceased. In order to be successful in the lawsuit, the plaintiff must demonstrate four elements, as outlined below; and normally, to be successful, each of these elements needs to be established merely by a preponderance of the evidence (which is often interpreted to mean that 51% of the evidence is in favor of the plaintiff).

- The plaintiff must be able to show damages, either financial or physical, or both.

- The plaintiff must be able to show that the defendant (or defendants) had a duty to provide training or supervision in an atmosphere of reasonable safety.

- The plaintiff must be able to show that, by acts of commission or omission, the defendant (or defendants) breached that duty.

- The plaintiff must be able to show that his damages are the direct result of negligent performance by the defendant (or defendants).

In addition to actual damages, some jurisdictions also allow the plaintiff to pursue punitive damages, which are intended to further "punish" the defendant (or defendants) for deliberately injurious actions or other behavior deemed to be unusually egregious in nature.

It is an unfortunate fact that in the legal system within the USA, almost anyone can be sued for anything. The above elements need not be proven in order to file suit; instead, these elements only need to be alleged. Once a suit is filed, both the plaintiff and defendant (or defendants) are entitled to “discovery”, which is a detailed process whereby each gathers evidence through formal demands for information and documents, and also through depositions (examinations under oath) of the involved parties and other witnesses. This discovery process is completed prior to trial, and the relevant information, documents, and testimony obtained during the discovery process may be introduced as evidence at trial.

As a matter of routine in the United States, when first filing suit the plaintiff normally names as a defendant every conceivable party who may be involved in any way, either directly or indirectly, in this matter. It might include the dive leader who was supervising diving activities when the plaintiff's injury occurred. It might include the dive facility that rented or last serviced the plaintiff's equipment. It may also include the instructor or dive center who conducted some diver training program for the plaintiff several years prior to the incident. In some cases a defendant may also file a counter-suit against the plaintiff, or against one or more co-defendants. Eventually, as the discovery process continues, some of these defendants may be dismissed from the suit; however, prior to reaching this point, it is likely that each defendant will have already incurred significant legal expenses related to their own defense.

Though the above comments relate primarily to the legal system in the USA, it is important to note that those dive professionals and dive facilities located outside the USA are not necessarily immune from such lawsuits. The courts in the United States generally extend tremendous latitude to US-based plaintiffs. Further, a plaintiff will often be able to establish a US “presence” for a foreign dive instructor or dive facility by identifying their use of a US-based sales agent or representative, or by simply demonstrating that they directly or indirectly offer their services to USA-based clientele.

Defensive Teaching and Supervising

In any civil lawsuit, ultimately the actions of the dive instructor (as a defendant) will be judged against those of a hypothetical "reasonably prudent" professional – that is, did this individual perform his duties and fulfill his responsibilities in a manner consistent with that which is expected of a competent and capable dive professional?

The dive leader's best defense in any lawsuit is that he acted in full compliance with established protocols. These protocols are detailed in the SDI and TDI Standards and Procedures Manuals. The prudent professional will ensure that every training program is conducted according to standards, that every required topic is appropriately addressed, and that each student becomes proficient in all required skills.

The prudent professional will exercise appropriate judgment and discretion. For example, the SDI and TDI Standards specify maximum student-to-instructor ratios for every training program. It is important to recognize that these are maximums, under ideal conditions. Whenever conditions are less than ideal, these ratios should be reduced.

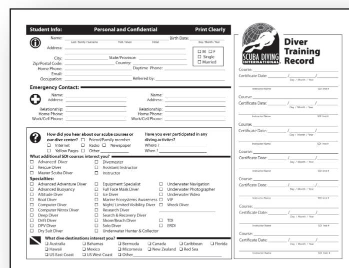
The prudent professional never will allow an individual under his charge to engage in activities for which that individual is not qualified, nor allow an individual under his charge to dive with malfunctioning or inadequate equipment.

While supervising students or certified divers, the prudent professional will expect the unexpected. Though the dive leader may exercise great effort and care in presenting information during a dive briefing, he should never assume that everything will go exactly as planned. The dive leader must recognize that, sooner or later, a student or diver may suddenly divert into some behavior that is exactly opposite of what has been briefed. The prudent professional will anticipate the various contingencies that might occur, and will formulate a plan to quickly and appropriately respond.

Student Training Records

To defend against any later allegations of negligent or inadequate training, it is vitally important to thoroughly document each student's training activities.

The SDI and TDI Student Training Record folders are specially designed to document a student's successful completion of all academic, confined water and open water sessions, as well as all written tests and skills performance. The folder itself includes the medical statement and liability release forms (each of these forms will be addressed in more detail later). Additional documentation that should be inserted into this folder includes the student's completed Knowledge Quest / Scuba IQ Review exercises, written exams, and clearance by a medical professional (if needed).


Student Info: Personal and Confidential Print Clearly
Name: Last / Family / Surname First / Given Initial Birth Date: Day / Month / Year
Address:
City: State/Province:
Zip/Postal Code: Country:
Home Phone: Daytime Phone:
Email:
Occupation: Referred by:
☐ M ☐ F
☐ Single
☐ Married
Emergency Contact:
Name: Address: Relationship: Home Phone: Work/Cell Phone:
Name: Address: Relationship: Home Phone: Work/Cell Phone:
How did you hear about our scuba courses or our dive center? ☐ Friend/Family member ☐ Internet ☐ Radio ☐ Newspaper ☐ Yellow Pages ☐ Other
Have you ever participated in any diving activites? Where ? When ?
What additional SDI courses interest you?
☐ Advanced Diver ☐ Rescue Diver ☐ Master Scuba Diver ☐ Divemaster ☐ Assistant Instructor ☐ Instructor
Specialties:
☐ Advanced Adventure Diver ☐ Advanced Buoyancy ☐ Altitude Diver ☐ Boat Diver ☐ Computer Diver ☐ Computer Nitrox Diver ☐ Deep Diver ☐ Drift Diver ☐ DPV Diver ☐ Dry Suit Diver
☐ Equipment Specialist ☐ Full Face Mask Diver ☐ Ice Diver ☐ Marine Ecosystems Awareness ☐ Night/ Limited Visibility Diver ☐ Research Diver ☐ Search & Recovery Diver ☐ Shore/Beach Diver ☐ Solo Diver ☐ Underwater Hunter & Collector
☐ Underwater Navigation ☐ Underwater Photographer ☐ Underwater Video ☐ VIP ☐ Wreck Diver ☐ TDI ☐ ERDI
What dive destinations interest you?
❑ Australia ❑ Bahamas ❑ Bermuda ❑ Canada ❑ Caribbean ❑ Florida ❑ Hawaii ❑ Mexico ❑ Micornesia ❑ New Zealand ❑ Red Sea ❑ US East Coast ❑ US West Coast ❑ Other
SCUBA DIVING INTERNATIONAL
Diver Training Record
Course: Certificate Date: Day / Month / Year Instructor Name SDI Inst #
Course: Certificate Date: Day / Month / Year Instructor Name SDI Inst #
Course: Certificate Date: Day / Month / Year Instructor Name SDI Inst #
Course: Certificate Date: Day / Month / Year Instructor Name SDI Inst #
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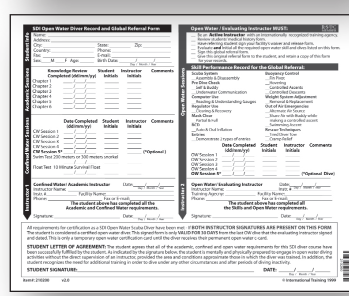

SDI Open Water Diver Record and Global Referral Form
Student Info
Name: Address: City: State: Zip: Country: Phone: Fax: E-mail: Sex: M F Age: Birth Date: Day / Month / Year
Academic Sessions
	Knowledge Review Completed (dd/mm/yy)	Student Initials	Instructor Initials	Comments
Chapter 1	/ /			
Chapter 2	/ /			
Chapter 3	/ /			
Chapter 4	/ /			
Chapter 5	/ /			
Chapter 6	/ /			

Confined Water Sessions
	Date Completed (dd/mm/yy)	Student Initials	Instructor Initials	Comments
CW Session 1	/ /			
CW Session 2	/ /			
CW Session 3	/ /			
CW Session 4	/ /			
CW Session 5*	/ /			(*Optional)
Swim Test 200 meters or 300 meters snorkel	/ /			
Float Test 10 Minute Survival Float	/ /			

Instructor 1
Confined Water/ Academic Instructor Date: Day / Month / Year
Instructor Name:
Instr. # Facility Name:
Phone: Fax or E-mail:
The student above has completed all the Academic and Confined Water requirements.
Signature: Date: Day / Month / Year
Open Water / Evaluating Instructor MUST:
R·S·T·C MEMBER
Be an **Active Instructor** with an internationally recognized training agency.
Review students' medical history form.
Have referring student sign your facility's waiver and release form.
Evaluate **and** Initial all the required open water skill and dives listed on this form.
Sign this global referral form.
Give this original referral form to the student, and retain a copy of this form for your records.
Open Water Sessions
Skill Performance Record for the Global Referral:
Scuba System Assembly & Disassembly
Pre Dive Check Self & Buddy; Underwater Communication
Computer Use Reading & Understanding Gauges
Regulator Use Clearing & Recovery
Mask Clear Partial & Full
BCD Auto & Oral Inflation
Entries Demonstrate 2 types of entries
Buoyancy Control Fin Pivot; Hovering; Controlled Ascents; Controlled Descents
Weight System Adjustment Removal & Replacement
Out of Air Emergencies Alternate Air Source; Share Air with Buddy while making a controlled ascent; Swimming Ascent
Rescue Techniques Tired Diver Tow; Cramp Relief

	Date Completed (dd/mm/yy)	Student Initials	Instructor Initials	Comments
OW Session 1	/ /			
OW Session 2	/ /			
OW Session 3	/ /			
OW Session 4	/ /			
OW Session 5*	/ /			(*Optional Dive)

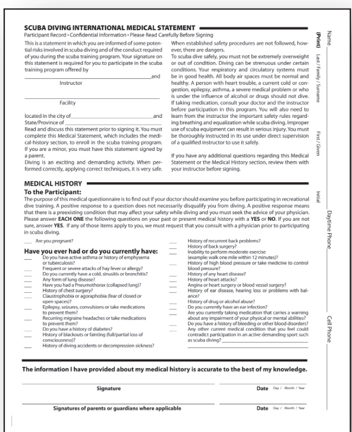
Instructor 2
Open Water/ Evaluating Instructor Date: Day / Month / Year
Instructor Name: Instr. #
Training Agecny: Facility Name:
Phone: Fax or E-mail:
The student above has completed all the Skills and Open Water requirements.
Signature: Date: Day / Month / Year
All requirements for certification as a SDI Open Water Scuba Diver have been met - If **BOTH INSTRUCTOR SIGNATURES ARE PRESENT ON THIS FORM** The student is considered a certified open water diver. This signed form is only **VALID FOR 30 DAYS** from the last OW dive that the evaluating instructor signed and dated. This is only a temporary open water certification card until the diver receives their permanent open water c-card.
STUDENT LETTER OF AGREEMENT: The student agrees that all of the academic, confined and open water requirements for this SDI diver course have been successfully fulfilled by the student. As indicated by the signature below, the student is mentally and physically prepared to engage in open water diving activities without the direct supervision of an instructor, provided the area and conditions approximate those in which the diver was trained. In addition, the student recognizes the need for additional training in order to dive under any other circumstances and after periods of diving inactivity.
STUDENT SIGNATURE: **DATE:** Day / Month / Year
item#: 210200 v2.0 © International Training 1999

As a training program progresses, each student's training records should be appropriately updated following each session. Whenever a student encounters some initial difficulty in mastering a skill or academic concept, the appropriate review and remediation also should be documented to demonstrate that in fact the shortcoming was addressed and that the student subsequently mastered this skill or concept.

Naturally, the training records should identify the instructor who conducted each session. It also will be helpful to note other dive leaders who were involved in the training. As an additional precautionary measure, a copy of the class roster also may be added to the folder, listing all students participating in the program, in the event that someday they may be called upon as witnesses to verify the adequacy of the training activities.

All training records should be preserved for a period of seven years. At some dive facilities it is the responsibility of the individual instructor who conducted the training to maintain these records. In other cases it will be the dive facility itself that maintains these records.

Medical Statement



SCUBA DIVING INTERNATIONAL MEDICAL STATEMENT

Participant Record • Confidential Information • Please Read Carefully Before Signing

Name (Print) ______ Last / Family / Surname ______ First / Given ______ Initial

Daytime Phone ______ Cell Phone ______

This is a statement in which you are informed of some potential risks involved in scuba diving and of the conduct required of you during the scuba training program. Your signature on this statement is required for you to participate in the scuba training program offered by

______________________________ and
Instructor

____
Facility

located in the city of ______________ and State/Province of ______________

Read and discuss this statement prior to signing it. You must complete this Medical Statement, which includes the medical-history section, to enroll in the scuba training program. If you are a minor, you must have this statement signed by a parent.

Diving is an exciting and demanding activity. When performed correctly, applying correct techniques, it is very safe. When established safety procedures are not followed, however, there are dangers.

To scuba dive safely, you must not be extremely overweight or out of condition. Diving can be strenuous under certain conditions. Your respiratory and circulatory systems must be in good health. All body air spaces must be normal and healthy. A person with heart trouble, a current cold or congestion, epilepsy, asthma, a severe medical problem or who is under the influence of alcohol or drugs should not dive. If taking medication, consult your doctor and the instructor before participation in this program. You will also need to learn from the instructor the important safety rules regarding breathing and equalization while scuba diving. Improper use of scuba equipment can result in serious injury. You must be thoroughly instructed in its use under direct supervision of a qualified instructor to use it safely.

If you have any additional questions regarding this Medical Statement or the Medical History section, review them with your instructor before signing.

MEDICAL HISTORY

To the Participant:

The purpose of this medical questionnaire is to find out if your doctor should examine you before participating in recreational dive training. A positive response to a question does not necessarily disqualify you from diving. A positive response means that there is a preexisting condition that may affect your safety while diving and you must seek the advice of your physician. Please answer **EACH ONE** the following questions on your past or present medical history with a **YES** or **NO**. If you are not sure, answer **YES**. If any of those items apply to you, we must request that you consult with a physician prior to participating in scuba diving.

___ Are you pregnant?

Have you ever had or do you currently have:

___ Do you have active asthma or history of emphysema or tuberculosis?
___ Frequent or severe attacks of hay fever or allergy?
___ Do you currently have a cold, sinusitis or bronchitis?
___ Any form of lung disease?
___ Have you had a Pneumothorax (collapsed lung)?
___ History of chest surgery?
___ Claustrophobia or agoraphobia (fear of closed or open spaces)?
___ Epilepsy, seizures, convulsions or take medications to prevent them?
___ Recurring migraine headaches or take medications to prevent them?
___ Do you have a history of diabetes?
___ History of blackouts or fainting (full/partial loss of consciousness)?
___ History of diving accidents or decompression sickness?
___ History of recurrent back problems?
___ History of back surgery?
___ Inability to perform moderate exercise (example: walk one mile within 12 minutes)?
___ History of high blood pressure or take medicine to control blood pressure?
___ History of any heart disease?
___ History of heart attacks?
___ Angina or heart surgery or blood vessel surgery?
___ History of ear disease, hearing loss or problems with balance?
___ History of drug or alcohol abuse?
___ Do you currently have an ear infection?
___ Are you currently taking medication that carries a warning about any impairment of your physical or mental abilities?
___ Do you have a history of bleeding or other blood disorders?
___ Any other current medical condition that you feel could contradict participation in an active demanding sport such as scuba diving? ______________

The information I have provided about my medical history is accurate to the best of my knowledge.

Signature ______________ **Date** Day / Month / Year

Signatures of parents or guardians where applicable ______________ **Date** Day / Month / Year

Diving is a physically demanding activity and, as such, it clearly requires a certain level of health and fitness; lacking appropriate health and fitness, the individual potentially will be placed at increased risk.

Both SDI and TDI have standard medical statement forms that each participant in all SDI and TDI training programs are required to complete. The medical statement is basically a screening tool, to ensure that an individual possesses the prerequisite level of general health and fitness to participate in diving. This form must be completed in its entirety (with no questions left blank), then signed and dated by the student; the medical statement for a minor also must be signed and dated by that student's parent or legal guardian. If a student answers "yes" to any question on this form, it does not necessarily preclude him or her from participation; however, with any "yes" answer the student will be required to obtain written clearance from a medical professional prior to participating in any in-water training activities. It also should be noted that if the student in question happens to be a physician, that student cannot provide his own medical clearance but instead must obtain written clearance from another medical professional.

The instructor conducting the program should review the medical statement with the students and appropriately address any particular issues or concerns that might arise.

The instructor, however, should never coach a student regarding his answers to any of the medical questions, and never create any hint of suggestion that a student should falsely answer "no" to any question on this form.

Students always must be encouraged to answer these questions honestly and accurately, since concealing any applicable medical condition might expose that student to unnecessary risk.

Any "yes" answer on the medical statement requires evaluation by a qualified medical professional, to determine whether an individual possesses the appropriate level of general health and fitness to participate in diving. The instructor, as a layman, clearly lacks the medical qualifications to make this type of evaluation and to authoritatively clear an individual for diving. Despite the fact that a medical condition might appear minor and inconsequential, in no case should the instructor intentionally overlook any "yes" answer on the medical statement and allow that student to participate in in-water activities without medical clearance; doing so can easily lead to a claim of negligence if any injury subsequently occurs. In fact, this requirement for medical clearance, when indicated, is one of the provisions itemized in every standard liability insurance policy within the dive industry, and failure to adhere to this requirement may well void the insurance coverage for both the dive professional and the dive facility.

On occasion, the situation may arise where there is some reason to question a student's health and fitness for diving, even though that student has answered "no" to each question on the medical statement. It might involve something as obvious as a large surgical scar over the center of a student's chest, or something less tangible such as significant overexertion while performing a relatively benign physical task. Whenever any such question arises, the dive leader should address the issue with the student and if any concern lingers the dive leader should request medical clearance prior to further participation. At the same time, even with clearance by a medical professional, the ultimate decision for accepting a student into any training program rests with the instructor.

As a matter of routine, most instructors, assistant instructors, and dive facilities have the students complete their medical statement forms at the beginning of each course.

It is important to recognize that on occasion, especially in the case of entry-level divers enrolled in an SDI Open Water Scuba Diver course, there can be some disappointment and possible resentment when an individual first learns that he will need medical clearance only after they arrive for the initial training session.

To avoid this situation, conscientious dive leaders and dive facilities will make the medical statement available to each student ahead of time – the student might be provided with a photocopy of the medical statement at the time of enrollment in the course, or may be instructed to carefully review a copy of the medical statement, which has been posted on the dive facility's website. When medical clearance is required, the student also should be provided with the appropriate SDI or TDI form for the physician's use.

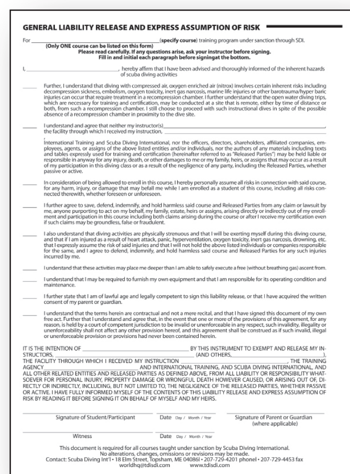
SDI and TDI Standards require each participant to complete a medical statement for all training programs, but do not require a medical statement for participation in other non-training activities. It must be noted, however, that local regulations can vary, and more-restrictive local regulations will supersede the SDI and TDI Standards. For example, in some jurisdictions it may be required that every student obtains medical clearance prior to any in-water training activities, and in other areas a medical statement might be required even for non-training activities.

Liability Releases

The liability release is effectively a legal contract between the participant and the dive leader and/or dive facility, within which the participant acknowledges and accepts the inherent risks of scuba diving and also agrees to hold the dive leader and/or dive facility harmless if injury should occur. In some cases a properly executed liability release will provide sufficient basis for dismissal of a lawsuit. In other cases the liability release will serve to mitigate damages.

SDI and TDI each have standard liability release forms that apply to each of their respective diver training programs; there also is a supplemental liability release form for the SDI Solo Diver course, and additional SDI Liability Release forms for non-training activities including guided dives and boat dives.

In each training program the instructor conducting the program should review the applicable liability release with the students and appropriately address any particular issues or concerns that might arise. Each individual must complete the form in its entirety (with no lines left blank), and under no circumstances should the dive leader allow any of the pre-printed text to be modified in any manner. Each paragraph on the form must be initialed, the form must be signed and dated by the participant, and the form for any minor must also be signed and dated by that student's parent or legal guardian; finally the form should be signed and dated by a third-party witness (such as another student).



GENERAL LIABILITY RELEASE AND EXPRESS ASSUMPTION OF RISK

For ______________________(**specify course**) training program under sanction through SDI.
(Only ONE course can be listed on this form)
Please read carefully. If any questions arise, ask your instructor before signing.
Fill in and initial each paragraph before signingat the bottom.

I, ______________________, hereby affirm that I have been advised and thoroughly informed of the inherent hazards of scuba diving activities

____ Further, I understand that diving with compressed air, oxygen enriched air (nitrox) involves certain inherent risks including decompression sickness, embolism, oxygen toxicity, inert gas narcosis, marine life injuries or other barotrauma/hyper baric injuries can occur that require treatment in a recompression chamber. I further understand that the open water diving trips, which are necessary for training and certification, may be conducted at a site that is remote, either by time of distance or both, from such a recompression chamber. I still choose to proceed with such instructional dives in spite of the possible absence of a recompression chamber in proximity to the dive site.

____ I understand and agree that neither my instructor(s)______________________, the facility through which I received my instruction, ______________________, International Training and Scuba Diving International, nor the officers, directors, shareholders, affiliated companies, employees, agents, or assigns of the above listed entities and/or individuals, nor the authors of any materials including texts and tables expressly used for training and certification (hereinafter referred to as "Released Parties") may be held liable or responsible in anyway for any injury, death, or other damages to me or my family, heirs, or assigns that may occur as a result of my participation in this diving class or as a result of the negligence of any party, including the Released Parties, whether passive or active.

____ In consideration of being allowed to enroll in this course, I hereby personally assume all risks in connection with said course, for any harm, injury, or damage that may befall me while I am enrolled as a student of this course, including all risks connected therewith, whether foreseen or unforeseen.

____ I further agree to save, defend, indemnify, and hold harmless said course and Released Parties from any claim or lawsuit by me, anyone purporting to act on my behalf, my family, estate, heirs or assigns, arising directly or indirectly out of my enrollment and participation in this course including both claims arising during the course or after I receive my certification even if such claims may be groundless, false or fraudulent.

____ I also understand that diving activities are physically strenuous and that I will be exerting myself during this diving course, and that if I am injured as a result of heart attack, panic, hyperventilation, oxygen toxicity, inert gas narcosis, drowning, etc. that I expressly assume the risk of said injuries and that I will not hold the above listed individuals or companies responsible for the same, and I agree to defend, indemnify, and hold harmless said course and Released Parties for any such injuries incurred by me.

____ I understand that these activities may place me deeper than I am able to safely execute a free (without breathing gas) ascent from.

____ I understand that I may be required to furnish my own equipment and that I am responsible for its operating condition and maintenance.

____ I further state that I am of lawful age and legally competent to sign this liability release, or that I have acquired the written consent of my parent or guardian.

____ I understand that the terms herein are contractual and not a mere recital, and that I have signed this document of my own free act. Further that I understand and agree that, in the event that one or more of the provisions of this agreement, for any reason, is held by a court of competent jurisdiction to be invalid or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provision hereof, and this agreement shall be construed as if such invalid, illegal or unenforceable provision or provisions had never been contained herein.

IT IS THE INTENTION OF ______________________ BY THIS INSTRUMENT TO EXEMPT AND RELEASE MY INSTRUCTORS, ______________________ (AND OTHERS,______________________), THE FACILITY THROUGH WHICH I RECEIVED MY INSTRUCTION ______________________, THE TRAINING AGENCY______________________ AND INTERNATIONAL TRAINING, AND SCUBA DIVING INTERNATIONAL, AND ALL OTHER RELATED ENTITIES AND RELEASED PARTIES AS DEFINED ABOVE, FROM ALL LIABILITY OR RESPONSIBILITY WHATSOEVER FOR PERSONAL INJURY, PROPERTY DAMAGE OR WRONGFUL DEATH HOWEVER CAUSED, OR ARISING OUT OF, DIRECTLY OR INDIRECTLY, INCLUDING, BUT NOT LIMITED TO, THE NEGLIGENCE OF THE RELEASED PARTIES, WHETHER PASSIVE OR ACTIVE. I HAVE FULLY INFORMED MYSELF OF THE CONTENTS OF THIS LIABILITY RELEASE AND EXPRESS ASSUMPTION OF RISK BY READING IT BEFORE SIGNING IT ON BEHALF OF MYSELF AND MY HEIRS.

Signature of Student/Participant — Date Day / Month / Year — Signature of Parent or Guardian (where applicable)

Witness — Date Day / Month / Year

This document is required for all courses taught under sanction by Scuba Diving International.
No alterations, changes, omissions or revisions may be made.
Contact: Scuba Diving Int'l • 18 Elm Street, Topsham, ME 04086l • 207-729-4201 phonel • 207-729-4453 fax
worldhq@tdisdi.com www.tdisdi.com

Similarly, in non-training activities the dive leader supervising the activities should review the applicable liability release with the participants and address any issues or concerns. Again, this form should be completed in its entirety, each paragraph should be initialed by the participant, and the form should be signed, dated, and witnessed.

In order for the liability release to be deemed valid, most jurisdictions require that the participant be allowed sufficient time to reflect on its contents. In addition, some jurisdictions also stipulate that the participant be given an opportunity to discuss this document with other family members (who might be impacted by the release) and perhaps to consult with their own legal counsel (when they feel that such is warranted). It might well be argued that duress exists when an individual is asked to sign a liability release at the very last moment, after the class already has started or after the dive boat already has left the dock, especially if there is any suggestion of peer pressure or financial forfeiture associated with a participant's decision to sign or not sign that release. Clearly, any perception of duress might well invalidate the document.

As a matter of routine most instructors, assistant instructors and dive facilities have the students complete their liability release forms at the beginning of each course. However, to avoid any perception of duress, conscientious dive leaders and dive facilities also make the liability release available to each student ahead of time – the student might be provided with a photocopy of the liability release at the time of enrollment in the course, or they may be instructed to carefully review a copy of the liability release, which has been posted on the dive facility's website.

As the students are completing these forms the dive leader should carefully explain that if they have any reservations about participating, they may withdraw without any loss of face and with a full refund.

Liability Insurance for Dive Leaders

Affordable liability insurance for dive leaders, as well as dive centers and dive boats, is available through SDI and TDI. Dive leaders operating in most geographic locations are required to have liability insurance; in some locations it is optional but still highly recommended. As outlined above, even if a dive leader has apparently done nothing wrong, he still can be named as a defendant in a lawsuit, perhaps based solely upon the fact that at some point in time that dive leader has crossed paths with the plaintiff.

In the event that the dive leader is named as a defendant, the liability insurance will provide legal representation and cover the cost of defense.

In the event that the lawsuit results in a judgment against the dive leader, the liability insurance will cover the monetary award. Of course each liability policy specifies the maximum dollar amount of coverage, though increased levels of coverage also are available as an option under the individual policies offered through SDI and TDI.

Currently four types of individual liability insurance policies are available through SDI and TDI. The first is intended for dive leaders operating in the USA, Mexico and the Caribbean. The second is for those in Canada. The third is for those in Australia. The fourth is for other locations but is intended only for those dive leaders who do not interact with citizens of the USA. In each area, coverage is provided according to the dive leader's professional certification – instructor, assistant instructor, or divemaster. Coverage also is available for those dive leaders who are no longer active in the training or supervision of divers. As you might expect, the cost varies according to the dive leader's professional certification and current activities.

The standard liability insurance policies available through SDI and TDI cover only activities at the sport diver level. Additional coverage is available by endorsement (typically at an additional charge) for technical instructors and technical divemasters, to cover activities at the technical diver level. The same liability insurance available through SDI and TDI also can be extended (again, currently at no additional charge for technical activities) to cover any activities conducted under the auspices of another approved diver training organization.

The standard liability insurance policies available through SDI and TDI do not provide coverage when the dive leader's personally owned equipment is rented or loaned to a diver under his charge. Such coverage is available as an option (at an additional charge). Lacking such coverage, the dive leader should recognize that he should never rent or loan personal equipment to a student diver or supervised certified diver. Instead, when the dive leader desires to have back-up equipment on hand during diving activities, it should be equipment from the dive facility's rental inventory (the dive facility normally has insurance coverage for any equipment provided to customers).

As noted, insurance coverage is also available through SDI and TDI for dive centers and dive boats. In some cases, coverage under these policies can also be extended to individual dive leaders. It is important to note, however, that such coverage only applies to those diving activities that are official functions of that particular dive center or dive boat. This coverage will not apply to any activities conducted independently by the dive leader, or to any duties the dive leader performs for another dive center or dive boat.

In the Event of a Dive Accident

Whenever any dive-related accident or injury occurs, there is the possibility of a lawsuit at a later date. It might happen when a supervised certified diver panics at depth, and bolts towards the surface while holding his breath. It might involve a student who accidentally drops a weight belt on his foot. It might even arise from an incident in which the dive leader initially had no involvement, but to which the dive leader responded and rendered assistance.

The primary concern in any incident is to care for the victim. Next, the victim's equipment should be secured; in the event of a serious incident, the local authorities may want to take custody of the equipment for further examination. Finally, the dive leader should begin to gather all relevant information, using the applicable SDI or TDI Accident/Incident Report form as a guide.

Naturally, the dive leader should be sympathetic to the victim and his family or friends. At no time should the dive leader make any comments to the victim, his family and friends, or to the authorities regarding anyone's potential liability. This is no place for opinion or speculation. All information that is reported should be completely factual in nature and should be limited only to those circumstances the dive leader actually observed first-hand. The dive leader should always politely decline any requests by the news media for information regarding the incident.

As soon as possible after the incident, the dive leader should fax the completed accident/incident report to SDI/TDI Headquarters or your regional office. If the incident occurred during training, copies of the student's medical statement, liability release and all training records should be forwarded with the report. If the incident occurred during some other supervised non-training activity, copies of the diver's liability release and any other available information should be forwarded with the report.

If the dive leader has insurance coverage through SDI and TDI, then SDI/TDI Headquarters will forward the report and related documentation to the insurance company. In some cases, on behalf of the insurance company, SDI/TDI Headquarters may initiate its own investigation of the incident. Of course, the dive leader is obliged to respond immediately to any request or further inquiry by SDI/TDI Headquarters.

Without doubt, the dive leader is also obliged to cooperate with any investigation conducted by the local authorities. On occasion, the authorities may request a written report from the dive leader; whenever possible, the dive leader should submit the very same accident/incident report to the authorities as was submitted to SDI/TDI Headquarters.

In general the dive leader should try to avoid the creation of multiple reports, as even a minor variance between the reports may later prove to be problematic at trial.

If by chance the incident occurred during a training program that was conducted under the auspices of another diver training organization, then the appropriate reporting procedures should be followed as specified by that other training organization. Similarly, if the dive leader has his insurance coverage elsewhere, then the appropriate reporting procedures should also be followed as specified by that other insurance company. As is the case with reports submitted to the authorities, as noted above, the dive leader should try to avoid the creation of multiple reports, and whenever possible the same report should be submitted to the other training organization and/or other insurance company as was submitted to SDI/TDI Headquarters.

Emergency Procedures

An accident is the least desired situation a dive professional ever wants to face. Odds are though, the longer a dive professional is actively involved with diving the greater the chance he will experience an accident. It may be a small matter, such as a cut or bruise, or as catastrophic as a fatality. It just can't be helped. What the dive professional can and must do then is try to prevent accidents and be prepared if an accident occurs.

It is important for the dive professional to have an emergency management plan for each dive location he plans to use. This emergency management should include:

- Contact numbers for local Emergency Medical Services (EMS), police or sheriff department, Coast Guard and medical facility.

- Diver's Alert Network (DAN) emergency and non- emergency numbers.
- Checklist of items available at the site such as telephone or radio, oxygen available, first aid kit and a copy of the appropriate incident report form.

It is recommended an incident report be completed any time medical attention is sought or a recommendation made for the diver to seek medical attention. The best precaution to take is to fill out a report for any incident/ accident that takes place.

Should an accident occur, all attention should be immediately focused on the individual involved in the accident.

If they are missing, try to determine where and when the individual was last seen. Next, decide who is qualified to help with a search. Choosing the people to search for a missing diver means making sure they are qualified, willing and that by putting them back in the water you do not jeopardize their safety. Find willing and able divers with the least amount of residual nitrogen in their bodies. Never jeopardize individuals needlessly. It may be better to wait until more qualified help arrives before starting a search. The most qualified individual on the site, which is most likely the dive professional, should take charge as soon as he finds out a diver is missing or has had an accident. If the individual involved is from the dive professional's group of divers then the responsibility to take charge falls to that dive professional.

The individual in charge should direct the management plan upon being made aware of the situation. He should assign someone to:

- Contact Emergency Medical Services
- Control the scene
- Take notes as to what happens and when
- Interview witnesses and document their comments.

Contact Emergency Medical Services

As stated previously, the individual in charge must have an accident management plan for the site he is diving. This should include the person(s) and/or entities to contact if an accident occurs. Contact may be via the phone, radio, sending a bystander or driving for help. In remote areas make sure cell phones work and have coverage, or know where the closest landline is located. Someone may have to be sent to meet EMS and bring them to the dive site if it is located away from common use areas.

Control the Scene

Control the scene by making sure everyone assigned a task is undertaking the task. Assign additional individuals to help if needed. A well-coordinated scene will make everything flow much easier and show preparedness on the dive professional's part.

Once the individual is out of the water their equipment must be secured. The dive professional in charge should have an impartial third party evaluate the equipment with him and document those findings. Take photos of the equipment if a camera is available. These photos should become part of the report to the agency.

- Does the equipment appear to be working properly?
- How much air is left in the cylinder?
- Were the valves on the cylinders open and how many turns did it take to turn them off?
- Do the gauges appear to be functioning properly?
- Is any required item missing?

Once this review is finished, both the dive professional and the third party participant should sign and date the document. Turn the air off (don't forget to count the turns) to prevent the remaining air from leaking out and making it appear the diver may have run out of air thereby causing the accident.

Taking Notes

When taking notes, it is beneficial if a chronological order of events can be documented so that later when the dive professional makes his accident report he has a good idea of what happened, when it happened, and who did what. It is extremely easy to get caught up in what is happening at the moment and forget the sequence of events. Don't rely on memory, have someone write it down. This information comes in very handy should any legal action occur due to the accident. Make sure this is the note taker's only task so he can be completely focused on taking notes. This individual does not need to be a diver.

Interviewing Witnesses

Assign someone to interview witnesses in the area as to what they observed. Make sure their comments are factual and not simply their opinions. It is recommended witnesses be interviewed separately as to not influence each other's recollection of what transpired. In the event someone needs to contact the witnesses later make sure the interviewer collects the witnesses' contact information such as:

- Name
- Address
- Phone number
- Email if possible

It is guaranteed that the more severe the accident, the more probable it is an investigator will contact the witness(es).

Accident Reporting

Once the accident victim has been turned over to the proper authorities and the scene has been secured, the dive professional must collect all of the information gathered by the individuals assigned to take notes and interview witnesses. This information will help the dive professional when he writes the accident report.

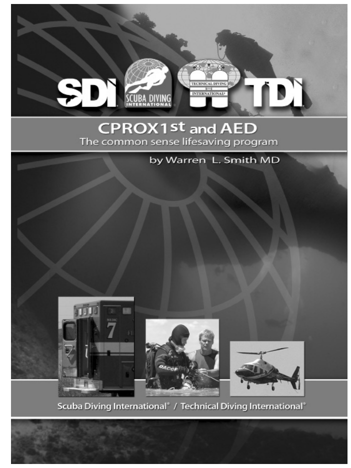
The dive professional should write the report as soon as realistically possible following the accident, while the event is still fresh in his memory. Because most insurance companies require notification of an accident within a certain amount of time, failure to promptly report the accident may create a coverage problem. The sooner the better is the best advice when it comes to completing and providing an accident report.

The dive professional should use the appropriate accident form and provide only the information requested. Dive professionals should not provide any information to anyone other than ITI and their insurance agent. More importantly, dive professionals should not provide any information to a third party. If a statement must be made to the local authorities, only the facts should be provided. The dive professional should be cooperative with them and avoid voicing any judgments, statements or opinions regarding the accident. Talking with the media should be avoided at all costs.

Remember, anyone can be named in a lawsuit at anytime, especially those in charge of a group. In the event of an accident, it's important that the dive professional document as many of the facts as possible to protect him and other responders.

CPR and First Aid

The initial certification as a dive professional requires that proof of current CPR and first aid training be submitted. After the initial certification it is the dive professional's responsibility to maintain this training. Within the SDI/TDI system an individual has the option to take the CPROX1st or the CPROX1st AED program to keep this requirement satisfied.



Summary

This section covered various aspects of risk management and how to teach defensively. If these suggestions and procedures are followed when an accident/incident occurs, the process will be less traumatic and end with a more favorable outcome. Accidents can and will happen. An OWSDI can minimize the negative outcome of those accidents with proper training, proper planning and careful organization. Being prepared for an accident will help prevent accidents.

Review Questions

1. Risks associated with diving may include:

- ☐ **A.** Decompression Sickness
- ☐ **B.** Marine-life Injuries
- ☐ **C.** Physical Exertion
- ☐ **D.** All of the Above

2. Two parties involved in a lawsuit are:

- ☐ **A.** Defender and Protector
- ☐ **B.** Defendant and Plaintiff
- ☐ **C.** Defensive Coordinator and Plaintiff
- ☐ **D.** Defacto and Profacto

3. It's the responsibility of the ______________________ to show that the defendant (or defendants) had a duty to provide training or supervision in an atmosphere of reasonable safety.

- ☐ **A.** Judge
- ☐ **B.** Jury
- ☐ **C.** Plaintiff
- ☐ **D.** Defendant

4. Dive professionals should always expect the unexpected.

☐ True ☐ False

5. The SDI Student Training Record Folder allows the instructor to document a student's training and includes the:

☐ **A.** Medical Statement

☐ **B.** Liability Release

☐ **C.** Progress of Training

☐ **D.** All of the Above

6. For how many years must student training records be preserved?

☐ **A.** One (1)

☐ **B.** Five (5)

☐ **C.** Seven (7)

☐ **D.** Ten (10)

7. Any yes marked on the medical questionnaire requires an evaluation by a qualified medical profession.

☐ True ☐ False

8. The Liability Release is a legal contract involving:

☐ **A.** The Dive Leader

☐ **B.** Participant

☐ **C.** Both A and B

☐ **D.** Neither A or B

9. Dive leaders in the US and Canada, as well as many other locations around the world, are required to carry:

☐ **A.** Car Insurance

☐ **B.** Professional Liability Insurance for Diving

☐ **C.** Home Owner Insurance

☐ **D.** Completed Operations Insurance

10. The primary concern in any incident is care for the:

☐ **A.** Dive Leader

☐ **B.** Bystanders

☐ **C.** Victim

☐ **D.** No One

11. When an accident occurs the best thing a dive leader can do is:

☐ **A.** Accept the blame.

☐ **B.** Talk to everyone about what happened.

☐ **C.** Blame someone else.

☐ **D.** None of the above.

12. The dive leader should fax the completed accident / incident form to SDI Headquarters:

☐ **A.** As soon as possible.

☐ **B.** Within a week.

☐ **C.** Within a month.

☐ **D.** Doesn't matter as long at they eventually get a copy.

13. When an accident occurs individuals should be assigned various duties such as:

- ☐ **A.** Contacting Emergency Medical Services (EMS)
- ☐ **B.** Taking notes as to what happens.
- ☐ **C.** Interviewing witnesses.
- ☐ **D.** All of the above.

14. It is irrelevant what happens to the victim's equipment.

☐ True ☐ False

15. Failure to report an accident to your ____________ may create a coverage problem.

- ☐ **A.** Insurance Company
- ☐ **B.** Local Newspaper
- ☐ **C.** Local Dive Site
- ☐ **D.** Dive Center

chapter 3

diving physics

Diving Physics

Diving Physics

diving physics

Introduction

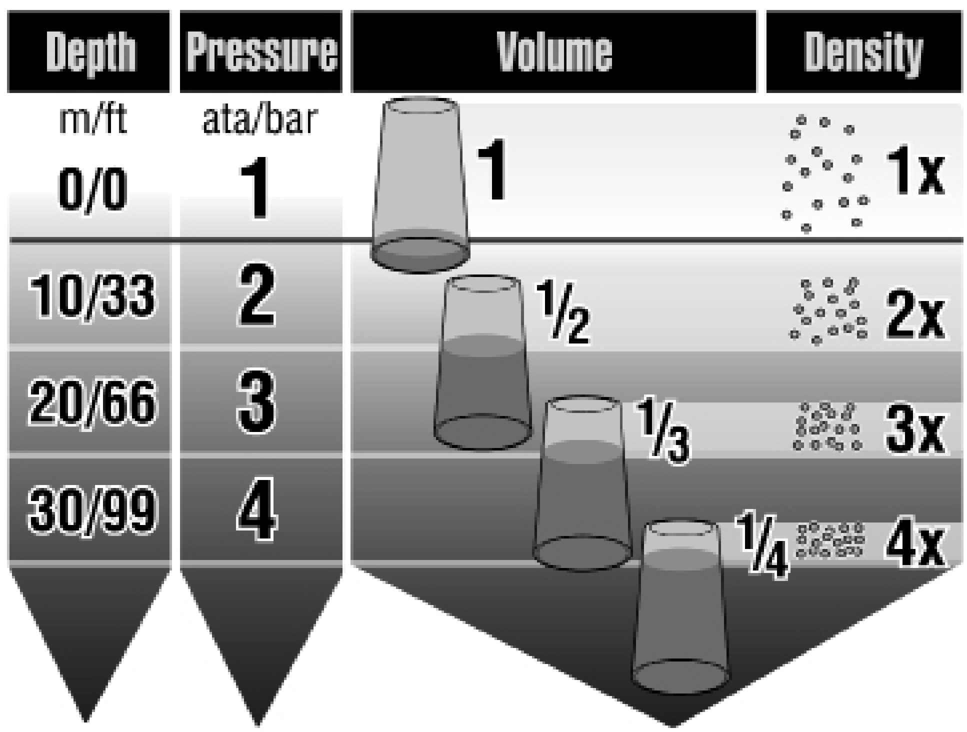
In the SDI Divemaster program, diving physics and physiology were covered in great depth. Here is a brief review of the topics focusing on the most important information. The formulas used in diving and their practical application will also be reviewed. Should an OWSDI candidate have difficulties with any of this information, he should thoroughly review the SDI Divemaster materials. A formulas sheet is provided in the appendix of this manual for use.

A general understanding of physics is a key component in the overall body of knowledge that is expected of a dive professional. The laws of physics are equally applicable both above and below the water's surface. A dive leader should attempt to convey pertinent information to every student with whom he comes into contact; and that knowledge should be tailored according to the recipient's level of training. Any additional information should be reserved for that individual who expresses further interest. A dive leader can never know all there is to know about the science of diving and the theories backing that science up, but the real art is knowing when that knowledge should be shared.

Physical Properties of Water

Density of Water

Water is approximately 800 times denser than air. Therefore the diver will experience more resistance underwater, which may lead to increased workload, breathing and air consumption, shortening available bottom time and contributing greatly to diver fatigue. This is one reason control of a diver's profile or trim and buoyancy are important skills to master.

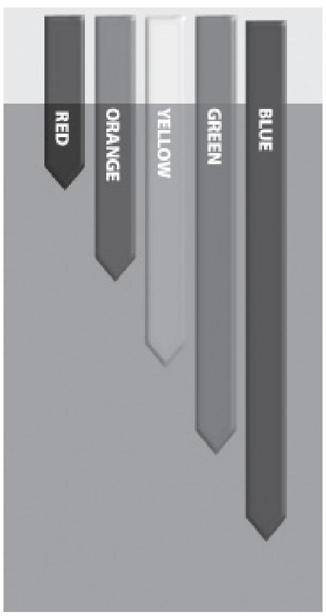


Refraction of Light in Water

Light rays bend, or refract, when they pass from one medium to another of different density. The amount of bending is determined by the refractive indices of the two media. Because the structure of the human eye is adapted to sharply focus light rays entering the eye from air, when light rays enter the eye from water, the degree of refraction generally exceeds the eye's focusing range, and thus the image appears blurry. This is why a mask is used to restore focus underwater. The mask creates additional refraction as light rays pass first from the water through the tempered glass of the faceplate and into the air space within the mask, before entering the eye. Due to this refraction, objects appear about 33% larger and about 25% closer to the diver.

Diffraction of Light in Water

Light rays normally travel in a straight line through a medium. Any minor obstacles encountered along the way will cause the light rays to be deflected and become scattered to some extent. This scattering, or divergence, is known as diffraction. Accordingly, the seemingly contradictory situation arises where refraction continues to make nearby objects appear closer to the diver than they actually are, while at the same time diffraction makes other objects in the middle and long distance appear to be even farther away.

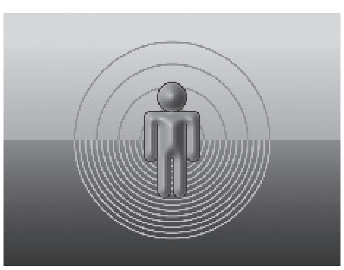


Color Loss in Water

As explained in the divemaster course, as sunlight passes through the denser medium of water, some wavelengths of light are absorbed. The longest wavelengths (red) are absorbed the quickest by water, and this occurs at a relatively shallow depth. To remember the order colors are lost the acronym ROY G BIV can be used: Red (shallowest), orange, yellow, green, blue, indigo and violet (deepest).

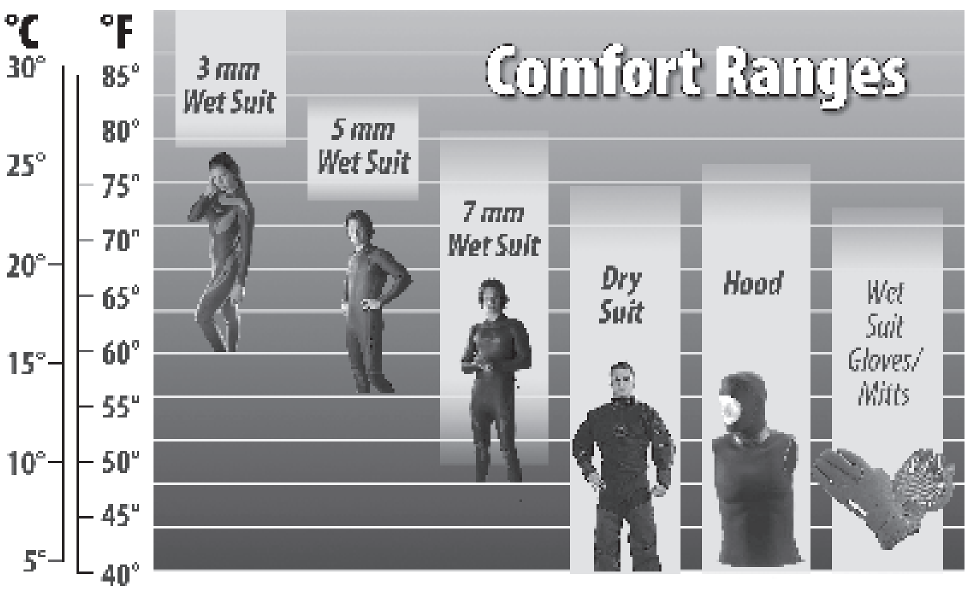
Transmission of Sound in Water

The speed of sound depends upon the medium through which it passes, and sound tends to travel faster in denser mediums. The precise speed of sound in water depends upon pressure, temperature, and salinity, but in general sound travels about four times faster through water than air.



Thermal Conductivity in Water

The thermal conductivity of any substance depends upon a number of variables including its density and overall structure. Water is a far more efficient thermal conductor than air. In fact, the relative thermal conductivity factor for water is about 6.0, while for air it is only about 0.025; thus water will whisk heat away from a diver's body approximately 25 times faster than air. Depending on water temperature divers must plan to use the appropriate exposure suit for conditions.



Ranges are approximate and vary by individual tolerance • Longer exposures and deeper dives may require greater protection • Hoods and gloves are essential below 20°C/68°F and generally used before this • Exposures below 24°C/75°F may require additional insulation in the torso

Archimedes' Principle

Buoyancy

Archimedes of Syracuse (287-212 BC) discovered the principle known in physics as Archimedes' Principle. This principle states: "Any object, wholly or partly immersed in a fluid, is buoyed up by a force equal to the weight of the fluid displaced by the object."

How This Principle Relates to Diving

When an object is placed in water, it displaces an amount of water equal to its own volume. If the object weighs less than the displaced water the object will float and is said to be positively buoyant. Conversely, if the object weighs more than the displaced water, the object will sink, or it is negatively buoyant. If the object weighs exactly the same as the displaced water, it will neither float nor sink, and instead it will simply hover in mid-water; it is neutrally buoyant.

Divers use three items to control their own buoyancy – lead weights, a BCD (buoyancy compensator device), and lung volume. Lead weights offset the positive buoyancy of their exposure suit and personal body composition. Air can be added or removed from the BCD (buoyancy compensator device) to maintain neutral buoyancy. But to fine tune buoyancy the diver must learn how to breathe properly and fine tune buoyancy with their lungs.

Saltwater verses Freshwater

Seawater contains salt and this salt contributes to the water's weight. A volume of seawater weighs more than an equal volume of freshwater. A litre of seawater weighs 1.03 kilograms, while a litre of freshwater weighs 1.0 kilograms. A cubic foot of seawater weighs 64 pounds, while a cubic foot of freshwater weighs 62.4 pounds.

Buoyancy Calculations

To determine the buoyancy of an object, the diver must have several critical pieces of information. First, they must know the weight of the object, in terms of either kilograms or pounds. Next, they need to determine the volume displaced by the object, in terms of either litres or cubic feet. Finally, they must know the specific fluid in which the object is immersed. For diving those fluids are either salt water or fresh water.

Once armed with the above pieces of information, the diver can readily calculate the buoyancy characteristics of an object by first calculating the weight of the displaced water, and then subtracting that weight from the weight of the object.

These calculations are depicted in the following formulas:

Metric

Buoyancy = weight of object -
[(litres displaced) x (kg per litre of water)]

Example: What is the buoyancy of an object in seawater that weighs 20 kg and displaces 15 litres?
Answer: 4.55 kg negatively buoyant: 20 – [15 x 1.03] = 4.55 kg

Example: What is the buoyancy of an object in freshwater that weighs 10 kg and displaces 15 litres?
Answer: 5 kg positively buoyant: 10 – [15 x 1.0] = –5 kg

Imperial

Buoyancy = weight of object –
[(cu ft displaced) x (lbs per cu ft of water)]

Example: What is the buoyancy of an object in seawater object that weighs 55 pounds and displaces 0.75 cubic feet?
Answer: 7 pounds negatively buoyant: 55 – [0.75 x 64] = 7 lbs

Example: What is the buoyancy of an object in freshwater that weighs 40 pounds and displaces 0.75 cubic feet?
Answer: 6.8 pounds positively buoyant: 40 – [0.75 x 62.4] = –6.8 lbs

The OWSDI can use the formulas above and below to either make an object negatively buoyant or lift an object from the bottom, making it positively buoyant.

Metric

litres required = [kg of negative buoyancy] / [kg per litre of water]

Example: How much air must be added to an attached lift bag to achieve neutral buoyancy for an object that is 4 kg negatively buoyant in seawater?
Answer: 3.88 litres: 4 / 1.03 = 3.88 lt

Imperial

cu ft required = [lbs of negative buoyancy] / [lbs per cu ft of water]

Example: How much air must be added to an attached lift bag to achieve neutral buoyancy for an object that is 10 pounds negatively buoyant in seawater?
Answer: 0.156 cubic feet: 10 / 64 = 0.156 cu ft

Principles of Pressure

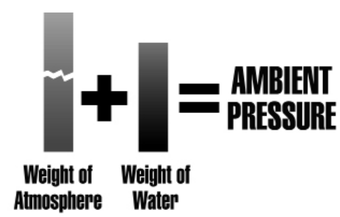
Pressure

Pressure is the force or weight pressing upon a surface. When one considers such a surface, often it is in terms of it being a person or an object. It is important to recognize, however, that pressure may also be exerted upon a gas when that gas is confined within some form of flexible container; here the gas is directly impacted by pressure applied to the exterior surface of the flexible container. In addition, regardless of whether it is in a flexible or rigid container, when gas is confined it also exerts pressure upon the interior surface of its container.

Ambient Pressure

The total force being exerted simultaneously by all existing sources of pressure is absolute pressure; in diving it is more commonly referred to as ambient pressure.

The first source of pressure affecting all things on Earth is the weight of the overhead atmosphere pressing downward. This force will vary somewhat with altitude. However for practical purposes, at or near sea level (up to an altitude of about 300 metres or 1000 feet above sea level) atmospheric pressure may be considered to be a constant.



In the metric system the weight of the overhead atmosphere at sea level is defined as one barometric unit of measure, commonly abbreviated as 1 bar; it is equivalent to one kilogram per square centimetre. In the imperial system this weight is defined as one atmosphere, commonly abbreviated as 1 atm; it is equivalent to 14.7 pounds per square inch. Consequently, 1 bar is equivalent to 1 atm.

The ambient pressure table demonstrates the affects of increasing pressure with the combined weight of atmosphere and seawater.
This table demonstrates the relationship between depth and ambient pressure:

Depth in Seawater		Ambient Pressure
0 m	0 ft	1 bar / atm
10 m	33 ft	2 bar / atm
20 m	66 ft	3 bar / atm
30 m	99 ft	4 bar / atm
40 m	132 ft	5 bar / atm
50 m	165 ft	6 bar / atm

Gauge Pressure

Gauge pressure refers to the manner in which a diver's instruments measure and display certain types of pressure-related information. Gauge pressure disregards atmospheric pressure, and only provides a measurement of the actual force being exerted by another source of pressure.

Gauge pressure is employed in two types of instruments used in diving. The first is the diver's submersible pressure gauge, or air-integrated dive computer, which measures and displays the internal gas pressure within a scuba cylinder. This information is displayed in terms of bar, or in terms of pounds per square inch (abbreviated as "psi"). Remember that 1 bar equals 1 atm, and that 1 atm also equals 14.7 psi. To convert an SPG reading from bar to psi, or from psi to bar, the OWSDI may employ the following formulas:

Imperial to Metric

bar = psi / 14.7

Metric to Imperial

psi = bar x 14.7

Because gauge pressure effectively disregards atmospheric pressure, it must be recognized that when an SPG reads zero, the scuba cylinder is not actually empty; instead it still contains a gas pressure of 1 bar or 14.7 psi.

The second type of instrument employing gauge pressure is the diver's depth gauge or personal dive computer. This type of device measures the ambient pressure being exerted upon the instrument itself, effectively disregards the atmospheric pressure, and indicates only that portion of the ambient pressure that is attributable to the weight of water. This information is displayed in terms of either metres or feet of depth in seawater. To convert a depth gauge reading from metres to feet or from feet to metres, the reader may employ the following formulas:

Imperial to Metric

metres = feet / 3.3

Metric to Imperial

feet = metres x 3.3

The depth gauge or personal dive computer disregards ambient pressure and displays only water pressure. In terms of practical use while diving, gauge pressure is quite effective in identifying depth for the diver. However, as will be demonstrated in subsequent sections of this text, whenever evaluating the effects of pressure the diver always must consider the ambient (total) pressure. To convert depth to ambient pressure or ambient pressure to depth use the following formulas.

Depth-to-Pressure Calculations

The following abbreviations appear within the formulas in this section:

- "P" for pressure
- "D" for depth

It is a fairly straightforward process to convert depth (gauge pressure) to ambient pressure, provided the OWSDI remembers to account for both the weight of the atmosphere and the weight of the water. The appropriate mathematical formulas are depicted below:

Metric

P = [D / 10] + 1 or P = [D + 10] / 10

Example: What is the ambient pressure at a depth of 14 metres in seawater?
Answer: 2.4 bar: [14 / 10] + 1 = 2.4 bar or [14 + 10] / 10 = 2.4 bar

Imperial

P = [D / 33] + 1 or P = [D x 33] / 33

Example: What is the ambient pressure at a depth of 46 feet in seawater?
Answer: 2.39 atm: [46 / 33] + 1 = 2.39 atm or [46 + 33] / 33 = 2.39 atm

Pressure-to-Depth Calculations

It is also a fairly straightforward process to convert ambient pressure to depth, again provided the OWSDI remembers to account for both the weight of the atmosphere and the weight of the water. The appropriate mathematical formulas are depicted below:

Metric

D = [P - 1] x 10 or S = [P x 10] - 10

Example: At what the depth in seawater is the ambient pressure 3.4 bar?
Answer: 24 metres: [3.4 – 1] x 10 = 24 m or ([3.4 x 10] – 10 = 24 m

Imperial

D = [P - 1] x 33 or D = [P x 33] - 33

Example: At what depth in seawater is the ambient pressure 3.4 atm?
Answer: 79.2 feet: [3.4 – 1] x 33 = 79.2 ft or [3.4 x 33] – 33 = 79.2 ft

Freshwater verses Saltwater

The following abbreviations appear within the formulas in this section:

- **"P" for pressure**
- **"D" for Depth**
- **"msw" for metres of seawater**
- **"mfw" for metres of freshwater**
- **"fsw" for feet of seawater**
- **"ffw" for feet of freshwater**

Despite the fact that true freshwater depth might differ slightly from the depth displayed by a diver's instruments, the actual water pressure will still be accurately displayed in terms of metres or feet of seawater. It is important to note, however, that when dealing with pressure-related calculations in a freshwater environment and while identifying the true freshwater depth in some manner other than via standard diving instruments, the above mathematical formulas will require some modification.

For depth-to-pressure calculations, the following formulas will apply to freshwater, but only when the true depth is known:

Metric *(freshwater)*

P = [D / 10.3] + 1 or P = [D + 10.3] /10.3

Imperial *(freshwater)*

P = [D / 34] +1 or P = [D + 34] /34

Similarly, for pressure-to-depth calculations, the following formulas will apply to freshwater, but again only when the true depth is known:

Metric ***(freshwater)***

D = [P - 1] x 10.3 or D = [P x 10.3] -10.3

Imperial ***(freshwater)***

D = [P - 1] x 34 or D = [P x 34] - 34

To calculate true depth in freshwater while relying upon standard diving instruments (which display water pressure in terms of metres or feet of seawater), the OWSDI may simply multiply the instrument's depth reading by a factor of 1.03, as depicted in the following formulas:

Metric

mfw = msw x 1.03

Example: In freshwater, when the diver's depth gauge displays a depth of 20 metres, what will be that diver's true depth?
Answer: 20.6 metres: 20 x 1.03 = 20.6 m

Imperial

ffw = fsw x 1.03

Example: In freshwater, when the diver's depth gauge displays a depth of 60 feet, what will be that diver's true depth?
Answer: 61.8 feet: 60 x 1.03 = 61.8 ft

When the true depth is known in freshwater, it may be converted to gauge pressure (metres or feet of seawater) simply by dividing the true depth by a factor of 1.03, as depicted in the following formulas:

Metric

msw = mfw / 1.03

Example: When a diver is at a true depth of 20 metres in freshwater, what depth will be displayed by his depth gauge?
Answer: 19.4 metres (likely will be rounded off to 19 metres):
20 / 1.03 = 19.4 m

Imperial

fsw = ffw / 1.03

Example: When a diver is at a true depth of 60 feet in freshwater, what depth will be displayed by his depth gauge?
Answer: 58.25 feet (likely will be rounded off to 58 feet): 60/1.03 = 58.25 ft

Boyle's Law

Pressure and Volume

Although Robert Boyle (1627-1692) was not the first to discover this finding he was the first to publish it and that is why it is known as Boyle's Law. This principle states that "Any change in pressure applied upon a fixed amount of gas at a constant temperature will result in a corresponding and inversely proportional change in the volume of that gas." In other words, if the pressure doubles, the volume will decrease by one-half; and if the pressure decreases by one-half, the volume will double.

$P\uparrow = V\downarrow$ and $P\downarrow = V\uparrow$

Though perhaps not specifically recognized due to the state of science at that time, in practice Boyle's Law has since been extended to also encompass the density of a gas. In effect, changes in density are a sort of a by-product of the changes in pressure and volume. Gas is comprised of molecules; when confined within any container, the quantity of gas molecules remains constant. As pressure increases and volume decreases, these molecules are pushed closer together rendering the gas denser. As pressure decreases and volume increases, these molecules move farther apart rendering the gas less dense. The change in density is directly proportional to the change in pressure, and inversely proportional to the change in volume.
Below is a table many entry-level classes use to demonstrate Boyle's Law

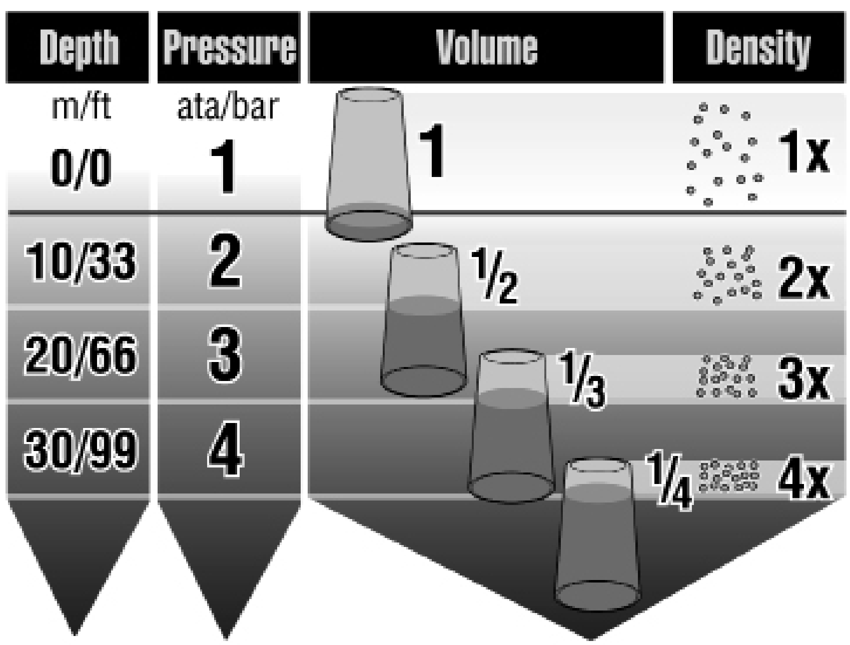
Depth in Seawater		Ambient Pressure	Volume	Density
0 m	0 ft	1 bar / atm	x 1	x 1
10 m	33 ft	2 bar / atm	x 1/2	x 2
20 m	66 ft	3 bar / atm	x 1/3	x 3
30 m	99 ft	4 bar / atm	x 1/4	x 4
40 m	132 ft	5 bar / atm	x 1/5	x 5
50 m	165 ft	6 bar / atm	x 1/6	x 6

In reviewing the above table it is important to understand that, in all cases, the pressure of the gas inside a flexible container will be equal to the ambient pressure exerted upon the exterior of that container.

How this Principle Relates to Diving

The tissues of the human body are primarily liquid, and liquid is non-compressible; thus much of the body is unaffected by pressure. Within the body there are two significant air spaces – the lungs and the interconnected middle ears and nasal sinuses. In addition, a third air space is artificially created over the face and eyes by the diver's mask. These three air spaces are impacted by the pressure-related changes. During descent and ascent, each of these air spaces must be equalized to the ambient pressure in order to avoid discomfort and possible injury.

The most common type of exposure protection worn by sport divers is a neoprene wetsuit. Neoprene is a closed cell foam and relatively light in weight compared to the water it displaces, and therefore neoprene is quite buoyant and is compressible. Changes will be most apparent when the diver is wearing a relatively thick wetsuit. To maintain proper buoyancy control, the diver needs to add air to the BCD during descent, and vent air from the BCD during ascent. Other pieces of equipment that are impacted by Boyle's Law are the BCD and dry suit.



When air is inhaled from the cylinder by the diver, it enters the flexible air space of the respiratory system and immediately becomes subject to the pressure-related changes associated with Boyle's Law. The issues related to the inhaled air are three-fold.

Upon inhalation the pressure of the air inside a diver's lungs will be equal to the ambient pressure. If that diver happens to ascend to a shallower depth while holding his breath, the expanding volume of air inside the lungs can result in a lung rupture.

It should be stressed that a diver should always breathe continuously, never holding his breath.

The second issue with air inhaled at depth relates to the diver's rate of air consumption. When that diver descends to 10 metres or 33 feet (where the ambient pressure is 2 bar / 2 atm), the diver will need to inhale twice as many molecules of air with each breath to fill the lungs. Therefore, the air will last only one-half as long at this depth as it would at the surface.

Air inhaled at depth becomes more dense. At 10 metres or 33 feet, the inhaled air will be twice as dense as it is at the surface, and its density further increases at deeper depths.

The denser air itself generally creates no noticeable problem for a diver within traditional sport diving depths, provided that the diver continues breathing at a normal rate. However, in the event of overexertion the diver's breathing rate will quicken and, when combined with the increased density of inhaled air, may result in turbulence as the air passes down the diver's airway towards the lungs. When turbulence occurs, the diver will likely sense some degree of difficulty in breathing. It is stressed during training that divers always should move slowly and steadily underwater, avoiding overexertion.

The Significance of Relative Changes

Ambient pressure increases by 1 bar for every 10 metres of depth, or by 1 atm for every 33 feet of depth, in seawater. This information seems to suggest that changes in pressure, volume, and density always are uniform over various depths, regardless of the depths involved.

The ambient pressure doubles when the diver descends from the surface to 10 metres or 33 feet (which is an actual change of only one 1 bar / 1 atm), but ambient pressure does not double again until the diver descends from 10 metres or 33 feet to a new depth of 30 metres or 99 feet (which is now an actual change of 2 bar / 2 atm).

As another example, volume increases by only 25% during an ascent from a starting depth of 40 metres or 132 feet to a new depth of 30 metres or 99 feet (which is an actual change of 1 bar / 1 atm), yet volume increases by 100% during an ascent from 10 metres or 33 feet to the surface (which also is an actual change of only 1 bar / 1 atm).

The greatest relative changes occur at shallower depths. This emphasizes the importance of a diver equalizing early during a descent. It helps explain why a new diver may have more difficulty in effectively controlling buoyancy at shallower depths and why he might unexpectedly pop to the surface. It demonstrates the need for vigilance in maintaining a slow rate of ascent throughout the entire ascent, especially as the diver nears the surface.

Pressure and Volume Calculations

The following abbreviations appear within the formulas in this section:

- **"P" for pressure**
- **"V" for volume**
- **subscript "1" for a starting value**
- **subscript "2" for an ending value**

Boyle's Law is depicted mathematically by the following formula:

Metric & Imperial

$$P_1 \times V_1 = P_2 \times V_2$$

The components within this formula may be appropriately rearranged as needed; for instance, to find the new volume following any change in pressure, the following formula will apply:

Metric & Imperial

$$V_2 = [P_1 \times V_1] / P_2$$

Metric Example: If the volume of gas in a flexible container at 2.5 bar is 12 litres, what will its volume be at 4.6 bar?
Answer: 6.52 litres: [2.5 x 12] / 4.6 = 6.52 lt

Imperial Example: If the volume of gas in a flexible container at 5.8 atm is 3.1 cubic feet, what will its volume be at 2.3 atm?
Answer: 7.82 cubic feet: [5.8 x 3.1] / 2.3 = 7.82 cu ft

The original formula again can be appropriately rearranged to find the ending pressure following a specific change in volume. The following formula will apply:

Metric & Imperial

$$P_2 = [P_1 \times V_1] / V_2$$

Metric Example: If the volume of gas in a flexible container is 8.5 litres at 5 bar, and it expands to 10 litres, its pressure will be 4.25 bar: [5 x 8.5] / 10 = 4.25 bar

Imperial Example: If the volume of gas in a flexible container is 5.2 cubic feet at 3 atm, and it compresses to 4 cubic feet, its pressure will be 3.9 atm: [3 x 5.2] / 4 = 3.9 atm

A diver's rate of air consumption directly corresponds to pressure-related changes in gas volume. If a diver knows the amount of time that a certain supply of gas will last at a given depth, he can readily calculate the time at a new depth with the following formula:

Metric & Imperial

$$\text{minutes}_2 = [P_1 \times \text{minutes}_1] / P_2$$

Example: If a supply of gas lasts for 60 minutes at 2 bar or 2 atm, how long will the same supply last at 5 bar or 5 atm?
Answer: 24 minutes: [2 x 60] / 5 = 24 min

If a diver knows the amount of time that a supply of gas will last at a given depth, and he wants to determine the depth at which it will last for some specific period of time, the following formula applies:

Metric & Imperial

$$P_2 = [P_1 \times \text{minutes}_1] / \text{minutes}_2$$

Example: If a supply of gas lasts for 17 minutes at 5 bar or 5 atm, at what pressure will it will last for 30 minutes?
Answer: 2.8 bar or 2.8 atm: [5 x 17] / 30 = 2.8 bar or atm

To determine the relative change in ambient pressure, such as that occurring between two different depths, the following formula may be employed:

Metric & Imperial

relative change = P_2 / P_1

Example: What is the relative change in ambient pressure when an object is taken from a starting pressure of 2.5 bar or 2.5 atm to a new pressure of 3.5 bar or 3.5 atm?
Answer: 1.4 times that of the starting pressure: 3.5 / 2.5 = 1.4x

Example: What is the relative change in ambient pressure when an object is taken from a starting pressure of 4.8 bar or 4.8 atm to a new pressure of 2.2 bar or 2.2 atm?
Answer: 0.46 times that of the starting pressure: 2.2 / 4.8 = 0.46x

Identifying changes in gas density actually requires no further calculation, as this change will be exactly the same as any relative change in ambient pressure; that is, if the pressure is doubled, then the density will also be doubled.

Charles' Law and Gay-Lussac's Law

Temperature and Volume

Jacques Alexandre Cesar Charles (1746-1823) studied the interrelationship of temperature and volume, and discovered the principle of physics that is now known as Charles' Law: " At a constant pressure, the volume of a gas increases or decreases by the same factor as its temperature." If the temperature goes up, then the volume also goes up, and this change is mathematically predicable.

T↑= V↑ and T↓= V↓

Temperature and Pressure

Joseph Louis Gay-Lussac (1778-1850) further advanced the work of Charles. In particular Gay-Lussac addressed the interrelationship between temperature and pressure, and discovered the principle now known in physics as Gay-Lussac's Law: "At a constant volume, the pressure of a gas increases or decreases by the same factor as its temperature." If the temperature goes up, then the pressure also goes up, and this change is mathematically predicable.

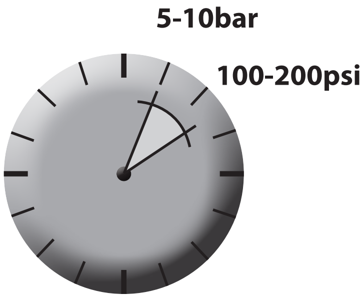
T↑= P↑ and T↓= P↓

This new principle sounds quite similar to Charles' Law. While both deal with the effect of changing temperature, here the focus is on pressure rather than volume.

How These Principles Relate to Diving

Changing temperature may be of little concern in certain tropical environments, where a diver encounters little or no difference between the temperature of seawater at the surface and at depth. In deeper technical diving, or in more temperate environments and especially in some freshwater lakes, the difference in water temperature can be more pronounced. Achieving neutral buoyancy in cold water with a BCD or lift bag still requires exactly the same volume of air as in warm water; but in cold water it will take more molecules of air, drawn from the scuba cylinder, to produce that same volume of air.

Perhaps the most obvious impact of changing temperature involves the scuba cylinder itself. An increase in temperature results in an increase in pressure inside the cylinder, and a decrease in temperature results in a decrease in pressure. When a scuba cylinder is left in the trunk of an automobile on a hot summer day, the pressure rises inside that cylinder (sometimes dangerously so); and when a warm cylinder is immersed in cool



water, the diver might readily detect a drop of perhaps 5 to 10 bar, or 100 to 200 psi, in the cylinder’s internal pressure as displayed by the SPG. This is why when teaching a specialty course, it is best to advise the students to remove the cylinders from a hot car and place them in the shade or cooler area. Should the cylinder pressure increase too much, the burst disc will rupture and the cylinder will be inoperable.

Temperature and Volume Calculations

The following abbreviations appear within the formulas in this section:

- **• “T” for temperature**
- **• “V” for volume**
- **• “°C” for degrees Celsius (or Centigrade)**
- **• “°F” for degrees Fahrenheit**
- **• subscript “1” for a starting value**
- **• subscript “2” for an ending value**

Charles’ Law is depicted mathematically by the following formula:

Metric & Imperial

$$V_1 / T_1 = V_2 / T_2$$

Again, the components within this formula may be appropriately rearranged as needed. For instance, to find the new volume following any change in temperature, the following will apply:

Metric & Imperial

$$V_2 = T_2 \times [V_1 / T_1]$$

It is essential to note that the accuracy of this formula depends upon the above temperature values being expressed in terms of either degrees Kelvin or degrees Rankine. Kelvin and Rankine are temperature scales routinely used within the scientific community. The Kelvin scale is based upon the more common Celsius (or Centigrade) scale and a degree of Kelvin identifies the same unit of measurement for temperature as a degree of Celsius. 0° Kelvin is equal to –273° Celsius. To convert from Celsius to Kelvin simply add 273 degrees. The Rankine scale is based upon the Fahrenheit scale, and a degree of Rankine identifies the same unit of measurement for temperature as a degree of Fahrenheit. 0° Rankine is equal to –460° Fahrenheit. To convert from Fahrenheit to Rankine simply add 460 degrees. When the additional Kelvin or Rankine calculations are incorporated into the above formula, it appears as follows:

Metric

$$V_2 = (C_2 + 273) \times [V_1/(C_1 + 273)]$$

Example: If the volume of a gas is 10 litres at a temperature of 30°C, what will be its volume at 10°C?
Answer: 9.34 litres: (10+273) x [10 / (30 + 273)] = 9.34 L

Imperial

$$V_2 = (F_2 + 460) \times [V_1 / (F_1 + 460)]$$

Example: If the volume of a gas is 10 cubic feet at a temperature of 90°F, what will be its volume at 50°C?
Answer: 9.28 cubic feet: (50+460) x [10 / (90 + 460)] = 9.28 cu ft

Temperature and Pressure Calculations

The abbreviations that appeared above apply within the formulas in this section. Gay-Lussac's Law is depicted mathematically by the following formula:

Metric & Imperial

$$P_1 / T_1 = P_2 / T_2$$

The components within this formula may be appropriately rearranged as needed. For instance, to find the new pressure following any change in temperature, the following will apply:

Metric & Imperial

$$P_2 = T_2 \times (P_1 / T_1)$$

Here too it is necessary to convert temperature values to Kelvin or Rankine. As usual, pressure refers to absolute (total) pressure; here it includes gauge pressure (internal pressure, as measured by an SPG-type device) plus atmospheric pressure. To convert gauge pressure to absolute pressure, just add 1 bar or 14.7 psi. Of course, 1 bar / 14.7 psi also must be subtracted again later in the calculations, to arrive back ultimately at gauge pressure. With these additional calculations incorporated into the formula, it would now appear as follows:

Metric

$$bar_2 = [(C_2 + 273) \times [(bar_1 + 1) / (c1 + 273)]] - 1$$

Example: If the pressure of gas inside a scuba cylinder is 200 bar at a temperature of 30°C, what will be its pressure at 10°C?
Answer: 186.7 bar: {(10+273) x [(200+1)/(30+273)]}-1 =186.7 bar

Imperial

$$psi_2 = [(F2 + 460) \times [(psi_1 + 14.7) / (F_1 + 460)]] - 14.7$$

Example: If the pressure of gas inside a scuba cylinder is 3000 psi at a temperature of 90°F, what will be its pressure at 50°F?
Answer: 2780 psi: {(50+460) x [(3000+14.7)/(90+460)]}-14.7 = 2780 psi

Quick Estimates for Temperature and Pressure

As an alternative, in the real world of diving the effect of temperature upon pressure may also be quickly estimated. A change of 1oC will result in an approximate change of 0.6 bar. A change of 1oF will result in an approximate change of 5 psi. In either case, an increase in temperature will be accompanied by an increase in pressure, and a decrease in temperature will be accompanied by a decrease in pressure. These approximations are depicted as follows:

Metric

1°C = 0.6 bar

Example: What will be the change in pressure inside a scuba cylinder when it is taken from a surface temperature of 30°C to an underwater temperature of 10°C?
Answer: The pressure decreases by about 12 bar: 30° – 10° = 20° change; 20 x 0.6 = 12 bar.

Imperial

1°F = 5 psi

Example: What will be the change in pressure inside a scuba cylinder when it is taken from a surface temperature of 90°F to an underwater temperature of 50°F?
Answer: The pressure decreases by about 200 psi: 90° – 50° = 40° change; 40 x 5 = 200 psi.

Combined and Ideal Gas Laws

Pressure, Volume and Temperature

In the real world, multiple variables may come into play in a given situation – volume can be affected simultaneously by both changing pressure and changing temperature; pressure can be affected simultaneously by both changing volume and changing temperature; and temperature can be affected simultaneously by both changing pressure and changing volume. To effectively address the possible combinations of pressure-volume-temperature variables all at the same time, physicists have adopted the concept of a Combined Gas Law. The Combined Gas Law is a mathematical combination of Boyle's Law, Charles' Law, and Gay-Lussac's Law as depicted by the following formula.

Metric & Imperial

$$(P_1 \times V_1) / T_1 = (P_2 \times V_2) / T_2$$

Within this formula pressure refers to absolute pressure and temperature refers to absolute temperature. This formula may also be rearranged as appropriate for the circumstances. It is noted, though, that once all the rearrangements and inherent conversions are applied to this equation, it can become rather unwieldy for all except the skilled mathematician. This formula is included here primarily for informational purposes rather than actual use.

For the sake of simplicity, the OWSDI might find it easier, when multiple variables are involved, to address those variables one at a time.

On occasion the reader may encounter some reference to a less formal "general gas law" that essentially incorporates the same concepts as the Combined Gas Law; though perhaps not technically accurate, in practice these two terms are sometimes used interchangeably.

Pressure, Volume, Temperature and Mass

The Ideal Gas Law is a distinctly expanded concept beyond the Combined Gas Law. In addition to mathematical pressure-volume-temperature relationships, it incorporates values relating to the number of moles (representing molecules and other atomic and subatomic particles) that constitute a hypothetical ideal gas. The Ideal Gas Law is based upon the hypothesis that the volume of two theoretical "ideal" gases under the same pressure and at the same temperature will have similar mass. It is expressed by the following formula (where "n" is the number of moles, and "R" is a universal gas constant).

Metric & Imperial

P x V = (n x R) x T or PV = nRT

It is noted, however, that the Ideal Gas Law neglects molecular structure and kinetics, which also govern the volume and mass of a gas. Therefore not all gases behave like an "ideal" gas and, in fact, an actual gas might differ significantly from the cited theoretical model. While the Ideal Gas Law certainly has some application within the scientific community, the inherent complexity and variability of this concept far outweigh its practical value within the context of diving. The Ideal Gas Law is included here primarily so that the reader will be able to distinguish it from, and not confuse it with, the Combined Gas Law.

Dalton's Law

Partial Pressure

John Dalton (1766-1844) studied the behavior of individual gases within a gas mixture and discovered the principle now known in physics as Dalton's Law. This principle states that ”The total pressure exerted by a mixture of gases is equal to the sum of the pressures of each of its component gases, with each component gas acting as if it alone were present and occupied the total volume.” In other words, each gas within a mixture has its own pressure and each gas is unaffected by any other gas in the mixture. Air is a mixture of gases containing approximately 21% oxygen and 79% nitrogen. Accordingly, oxygen accounts for 21% of the total pressure of air, and nitrogen accounts for 79% of the total pressure of air. This relationship of ambient (total) pressure and individual partial pressures is depicted in the following table:

Depth in Seawater		Ambient Pressure	Partial Pressures in Air	
			Oxygen (21%)	
0 m	0 ft	1 bar / atm	0.21 bar / atm	0.79 bar / atm
10 m	33 ft	2 bar / atm	0.42 bar / atm	1.58 bar / atm
20 m	66 ft	3 bar / atm	0.63 bar / atm	2.37 bar / atm
30 m	99 ft	4 bar / atm	0.84 bar / atm	3.16 bar / atm
40 m	132 ft	5 bar / atm	1.05 bar / atm	3.95 bar / atm
50 m	165 ft	6 bar / atm	1.26 bar / atm	4.74 bar / atm

A prior discussion of Boyle's Law stated that the pressure of a gas inside a flexible container is equal to ambient pressure. Such also is true when considering partial pressure. As demonstrated in the above table, within a flexible container the percentages of oxygen and nitrogen remain constant in the air mixture, while the partial pressure of each gas varies proportionately with depth.

How This Principle Relates to Diving

Dalton's Law provides the means to examine each of the components within air or any other gas mixture on an individual basis. As demonstrated in the previous table, when a diver is breathing air at a depth of 40 metres or 132 feet, the partial pressure of oxygen is about 21% of the total ambient pressure at that depth (5 bar x 0.21 = 1.05 bar / 1.05 atm) is roughly equivalent to a person breathing 100% oxygen at the surface (where the partial pressure of 100% oxygen would be 1 bar / 1 atm). When breathing air at 40 metres or 132 feet, the partial pressure of nitrogen (3.95 bar / 3.95 atm) is almost five times the "dose" of nitrogen a person would breathe on the surface. This helps explain, at least in part, why a diver's body absorbs additional nitrogen at depth. In fact, it is the partial pressure of a gas that determines its physiological impact. The actual percentage of a gas within any mixture is largely immaterial except as it relates to partial pressure.

The following table depicts the partial pressures of oxygen and nitrogen in air, and also those in a nitrox mixture containing 40% oxygen:

			Partial Pressures in Air			
			Oxygen (21%)	**Nitrogen (79%)**		
0 m	**0 ft**	**1 bar / atm**	**0.21 bar / atm**	**0.79 bar / atm**	**0.40 bar / atm**	**0.60 bar / atm**
10 m	**33 ft**	**2 bar / atm**	**0.42 bar / atm**	**1.58 bar / atm**	**0.80 bar / atm**	**1.20 bar / atm**
20 m	**66 ft**	**3 bar / atm**	**0.63 bar / atm**	**2.37 bar / atm**	**1.20 bar / atm**	**1.80 bar / atm**
30 m	**99 ft**	**4 bar / atm**	**0.84 bar / atm**	**3.16 bar / atm**	**1.60 bar / atm**	**2.40 bar / atm**

Partial Pressure Calculations

The following abbreviations appear within the formulas in this section:

- **"P" for pressure (ambient pressure)**
- **"PO2" for partial pressure of oxygen**
- **"PN2" for partial pressure of nitrogen**
- **"FO2" for fraction of oxygen (such as, 21% = 0.21)**
- **"FN2" for fraction of nitrogen (such as, 79% = 0.79)**
- **"D" for depth**
- **"EAD" for equivalent air depth**

Note: The formulas for converting dept*h to ambient pressure and ambient pressure to depth are addressed in the earlier* section on pressure.

To determine the partial pressure of a component gas in any gas mixture, simply multiply the ambient pressure by the fraction of that gas. In the case of air, the partial pressures of oxygen and nitrogen may be calculated with the following formulas:

Metric & Imperial

$$PO_2 = P \times FO_2 \text{ and } PN_2 = P \times FN_2$$

Example: At an ambient pressure of 3.2 bar / 3.2 atm, what is the partial pressure of nitrogen in air?
Answer: 2.53 bar / 2.53 atm: 3.2 x 0.79 = 2.53 bar (atm)

Example: At an ambient pressure of 2.5 bar / 2.5 atm, what is the partial pressure of oxygen in a nitrox mixture containing 36% oxygen?
Answer: 0.9 bar / 0.9 atm: 2.5 x 0.36 = 0.9 bar (atm)

The following abbreviations appear within the formulas in this section:

- **"P" for pressure (ambient pressure)**
- **"PO2" for partial pressure of oxygen**
- **"PN2" for partial pressure of nitrogen**
- **"FO2" for fraction of oxygen (such as, 21% = 0.21)**
- **"FN2" for fraction of nitrogen (such as, 79% = 0.79)**

As before, the component factors within this formula may be appropriately rearranged as needed. For example, if a diver wants to determine which nitrox mixture provides a specified partial pressure of either oxygen or nitrogen at a given ambient pressure, the following formulas would apply:

Metric & Imperial

$$FO_2 = PO_2 / P \text{ and } FN_2 = PN_2 / P$$

Example: What nitrox mixture is required for an oxygen partial pressure of 1.4 bar / 1.4 atm, at an ambient pressure of 4 bar or 4 atm?
Answer: A nitrox mixture containing 35% oxygen: 1.4 / 4 = 0.35

The above listed abbreviations apply to the formulas in this section.

As emphasized during nitrox training programs, there is a limit to the maximum partial pressure of oxygen to which a diver may be safely exposed. To determine the maximum depth with a given nitrox mixture that does not exceed a specified partial pressure of oxygen, the following formula applies:

Metric & Imperial

$$P = PO_2 / FO_2$$

Example: What is the maximum depth for an oxygen partial pressure of 1.6 bar / 1.6 atm, with a nitrox mixture containing 40% oxygen?
Answer: 4 bar / 4 atm: 1.6 / 0.4 = 4 bar (atm)
In practice, ambient pressure usually will be converted to actual depth, and here that depth is 30 metres: [4 -1] x 10 or 99 feet: [4 - 1] x 33.

The following abbreviations appear within the formulas in this section:

- **"P" for pressure (ambient pressure)**
- **"PO2" for partial pressure of oxygen**
- **"PN2" for partial pressure of nitrogen**
- **"FO2" for fraction of oxygen (such as, 21% = 0.21)**
- **"FN2" for fraction of nitrogen (such as, 79% = 0.79)**
- **"D" for depth**
- **"EAD" for equivalent air depth**

Several of the above formulas can be used in succession to determine equivalent air depth. Alternatively, all of these calculations may be combined into a single equivalent air depth formula, as depicted below:

Metric

$$EAD = [(FN_2 / 0.79) \times (D + 10)] - 10$$

Example: What is the equivalent air depth for a nitrox mixture containing 32% oxygen (and 68% nitrogen) at 30 metres?
Answer: 24.4 metres: [(0.68 / 0.79) x (30 + 10)] – 10 = 24.4 m

Imperial

$$EAD = [(FN_2 / 0.79) \times (D + 33)] - 33$$

Example: What is the equivalent air depth for a nitrox mixture containing 32% oxygen (and 68% nitrogen) at 100 feet?
Answer: 81.5 feet: [(0.68 / 0.79) x (100 + 33)] – 33 = 81.4 ft

Henry's Law

Partial Pressure and Gas Solubility

William Henry (1775-1836) discovered the principle now known as Henry's Law. This principle states that, "At a constant temperature, the quantity of a gas which is dissolved in a given type and volume of liquid is directly proportional to the partial pressure of that gas in equilibrium with that liquid."

When pressure is exerted by a gas upon a liquid, some amount of gas will move into solution within that liquid. It should be noted that, once dissolved, gas continues to exert pressure; here this force is more commonly referred to as tension.

As additional gas enters into solution, it contributes to the overall tension of that gas within the liquid. As cited within the context of this principle, the term "in equilibrium" refers to that point at which partial pressure and tension are equal, and the transition of gas ceases.

Despite the variability related to solubility coefficients, Henry's Law nevertheless dictates that when the partial pressure is doubled, the quantity of gas that can now be dissolved into the liquid is also doubled.

Partial Pressure of Gas	Maximum Quantity of Dissolved Gas
0.25 bar / atm	x .025
0.50 bar / atm	x 0.50
0.75 bar / atm	x 0.75
1 bar / atm	x 1
2 bar / atm	x 2
3 bar / atm	x 3
4 bar / atm	x 4
5 bar / atm	x 5

It is also important to note that when the pressure gradient reverses, the liquid is now supersaturated with gas.

How This Principle Relates to Diving

Earlier it was noted that the body's tissues are primarily liquid in nature, and therefore unaffected by those factors associated with Boyle's Law. Dalton's Law laid the foundation that the physiological impact of a gas is tied to its partial pressure. Henry's Law correlates partial pressure with the solubility of gases in the body's tissues. These three laws are the principal laws that explain: DCS, nitrogen narcosis, arterial gas embolisms and gas expansion or contraction as they relate to temperature.

Haldane's Decompression Model

Theoretical Tissue Compartments

John Scott Haldane (1860-1936) constructed a mathematical model involving multiple theoretical tissue compartments. Each compartment was defined by certain properties. Though these compartments did not directly correspond to actual tissues, Haldane hypothesized that taken together these compartments would mimic the overall behavior of a diver's body in regards to the nitrogen on-gassing and off-gassing processes.

Half-Times

Haldane assigned a half-time to each theoretical tissue compartment, as the rate at which it would both absorb and release nitrogen. A half-time is the time, in minutes, for a compartment to go halfway from its initial level of dissolved nitrogen at a certain depth, to its ultimate level of dissolved nitrogen at a new depth. This exponential rate of on-gassing and off-gassing is demonstrated in the accompanying tables.

60 Minute Compartment Increased Pressure	
Elapsed Time	On-Gassing Completed
Start	**0.0%**
1 hour	**50.0%**
2 hours	**75.0%**
3 hours	**87.5%**
4 hours	**93.8%**
5 hours	**96.9%**
6 hours	**98.5%**

5 Minute Compartment Decreased Pressure	
Elapsed Time	On-Gassing Completed
Start	**0.0%**
5 minutes	**50.0%**
10 minutes	**75.0%**
15 minutes	**87.5%**
20 minutes	**93.8%**
25 minutes	**96.9%**
30 minutes	**98.5%**

M-Values

Haldane conducted various experiments to determine the maximum quantity of excess nitrogen that could be held in solution by each theoretical tissue compartment during an ascent, following time at depth, with a pre-defined rate of ascent. Haldane initially conducted his experiments with goats, and then conducted further experiments with human volunteers, including himself, involving both pressurized chambers and actual open water dives. Through trial and error research he eventually identified the maximum limits for excess nitrogen. This type of limit is now known as an M-value and most often is expressed as a factor, or percentage, above the normal quantity of nitrogen present in a saturated tissue at the surface.

Haldane's Algorithm

Haldane combined all of this information into a complex mathematical computation, or algorithm. In doing so he calculated the relevant information for each theoretical tissue compartment and found that, depending upon the circumstances of a particular dive, different compartments would effectively govern the time limits at different depths. From these calculations he projected a schedule of depths and times that constituted the first dive tables, which then saw widespread use by the Royal Navy and others from 1907 to 1956. While his work was highly theoretical in nature, time has largely proven Haldane's methodology to be valid.

Modern Dive Tables and Dive Computers

Haldane's decompression model provided the essential parameters for subsequent research and refinement. Over the years researchers have continued to build upon Haldane's original efforts, typically expanding the number of theoretical tissue compartments within the mathematical model, recalculating applicable M-values, altering specified ascent rates, assigning dissimilar rates for the on-gassing and off-gassing processes, and/or otherwise modifying the algorithm in some manner. Professor Albert Buhlmann's work with decompression theory during the latter part of the last century has been particularly useful to scuba divers. Today most dive tables and personal dive computers rely upon an algorithm derived from Haldane's original decompression model.

Current decompression algorithms, such as dual-phase or bubble-models, are even more complex than that developed by Haldane and refined over a century of studied application. This complexity clearly precludes any attempt at impromptu decompression calculations. The diver should always rely upon published dive tables and/or a Personal Dive Computer for accurate decompression-related information.

Summary

This chapter was a recap of physics that relate to scuba diving. How these theories apply to scuba diving was also reviewed. It was not intended to be comprehensive but rather to refresh the theory learned in the divemaster course. For a more comprehensive review of physics refer to the SDI Divemaster manual.

Review Questions

1. An object viewed underwater appears ______________than it actually is.

- ☐ **A.** Smaller and Farther Away
- ☐ **B.** Larger and Farther Away
- ☐ **C.** Larger and Closer
- ☐ **D.** Smaller and Closer

2. Sound travels approximately __________ times faster in water than in air.

- ☐ **A.** Four (4)
- ☐ **B.** Six (6)
- ☐ **C.** Ten (10)
- ☐ **D.** Twenty Five (25)

3. An object that is neutrally buoyant displaces a volume of water that is:

- ☐ **A.** Less than the weight of the object.
- ☐ **B.** Equal to the weight of the object.
- ☐ **C.** Greater than the weight of the object.

4. To maintain neutral buoyancy during descent, a diver must:

- ☐ **A.** Add air to his BCD.
- ☐ **B.** Vent air from his BCD.
- ☐ **C.** Swim really hard.
- ☐ **D.** Do nothing.

5. An object that is neutrally buoyant in salt water will float in fresh water.

☐ True ☐ False

6. An object weighing 107kg/236lb is placed in salt water. The object displaces 127l/4.5cf of water. What is the buoyancy of this object?

- ☐ **A.** 23.8kg/52lb Positively Buoyant
- ☐ **B.** 23.8kg/52lb Negatively Buoyant
- ☐ **C.** 19.4kg/42lb Positively Buoyant
- ☐ **D.** 19.4kg/42lb Negatively Buoyant

7. Total force exerted by all sources of pressure is referred to as ____________ or ______________ pressure.

- ☐ **A.** Ambient, Total
- ☐ **B.** Absolute, Ambient
- ☐ **C.** Total, Absolute
- ☐ **D.** Complete, Ambient

8. Pressure increases by 1 bar/atm for every ____________ seawater.

- ☐ **A.** 3.3m/11ft
- ☐ **B.** 8m/26ft
- ☐ **C.** 10m/33ft
- ☐ **D.** 33m/108ft

9. A metric SPG displays a reading of 170bar. What would an imperial SPG read if attached to the same cylinder?

- ☐ **A.** 2499psi
- ☐ **B.** 1999psi
- ☐ **C.** 1550psi
- ☐ **D.** 1090psi

10. A diver at a true depth of 36m/119ft in freshwater would see what reading on his depth gauge?

- ☐ **A.** 30m/98ft
- ☐ **B.** 34m/111
- ☐ **C.** 35m/115ft
- ☐ **D.** No Change

11. According to Boyle's Law, increasing pressure on a fixed volume of gas will result in an increase in that volume of gas.

☐ True ☐ False

12. A cylinder that lasts a diver 30 minutes at the surface will last him how long at 30m/99ft? ________________________

☐ **A.** 6 Minutes

☐ **B.** 7.5 Minutes

☐ **C.** 8.5 Minutes

☐ **D.** 12 Minutes

13. A balloon is filled with 10L/.35cf of air at 3.7bar/atm pressure. If the balloon is taken to 4.3bar/atm, what will the new volume be?

☐ **A.** 4.5L/.16cf

☐ **B.** 5.2L/.18cf

☐ **C.** 6.1L/.22cf

☐ **D.** 8.6L/.3cf

14. What will be the approximate change in the pressure inside a scuba cylinder taken from a surface temperature of 35C/95F to an underwater temperature of 13C/55F? (Use the quick estimate method for temperature and pressure.)

- ☐ **A.** 13.2bar/200psi
- ☐ **B.** 6.6bar/100psi
- ☐ **C.** 3bar/50psi
- ☐ **D.** 11.7.6bar/175psi

15. A gas will move from an area of __________ concentration to an area of ____________ concentration.

- ☐ **A.** Strong, Higher
- ☐ **B.** Weak, Lower
- ☐ **C.** Higher, Lower
- ☐ **D.** Lower, Higher

chapter 4

Diving Physiology

Diving Physiology

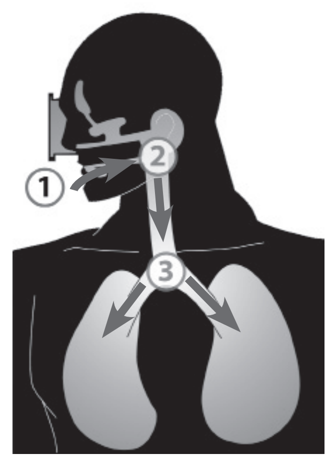
diving physiology

Introduction

Physiology is another key component in the overall body of knowledge a dive professional is expected to possess. We will review the key components and overall body of knowledge that was learned during the SDI Divemaster course. As the OWSDI candidate reviews this information, if they come across a subject that needs more elaboration, they should refer back to the SDI Divemaster manual for a more in-depth discussion. The dive professional should be well versed in all the subjects covered in this chapter. Although most divers will never experience these maladies it is important for the instructor to know how to recognize and address them.

Respiration and Circulation

Pulmonary System



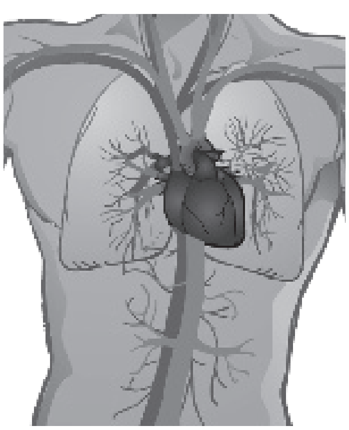
The role of the pulmonary system is the exchange of gases, with certain gases being introduced into the body while other gases are eliminated, the two primary gasses being oxygen and carbon dioxide. Oxygen is a critical ingredient in the body's metabolic process; in a normal environment, air contains 21% oxygen, which is introduced to the body with each inhaled breath. Carbon dioxide is a by-product of metabolism, and at elevated levels it is potentially harmful to the body. Carbon dioxide is expelled from the body with each exhaled breath. Carbon dioxide is also what triggers the receptors in the body to breathe.

Inhalation is controlled primarily by the muscles of the diaphragm. When these muscles contract, the ribcage expands and the contents of the abdomen are moved downward, resulting in increased volume and decreased pressure within the lungs. When more active inhalation is required, other deeper muscles within the chest and neck will supplement the muscles of the diaphragm. Restful exhalation is generally a passive process. As the diaphragm muscles relax following inhalation, the elastic tissues of the lungs recoil and thereby gently push air out of the lungs. More active exhalation requires muscles within the abdomen and chest to contract more quickly, decreasing the volume and increasing pressure within the lungs, moving air more quickly and forcefully out of the lungs.

The movement of oxygen from the lungs through the alveoli into the blood and then to the tissues is the direct result of its partial pressure. The movement of carbon dioxide from the tissues into the blood and through the alveoli into the lungs also is the direct result of its partial pressure. Remember, gas always moves from an area of higher pressure and density to an area of lower pressure and density.

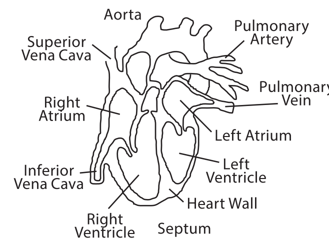
Rather than directly sensing the body's need for oxygen, the breathing reflex is primarily triggered by the buildup of carbon dioxide in the blood.

When additional physical demands are placed upon the body, such as strenuous physical activity, the metabolic rate increases; this also raises the output of carbon dioxide, and thereby the breathing rate quickens. When the breathing reflex is intentionally overridden by an individual deliberately holding his breath, the increasing level of carbon dioxide eventually results in a neuro signal to other parts of the brain triggering a conscious urge to breathe.



Cardio-Vascular System

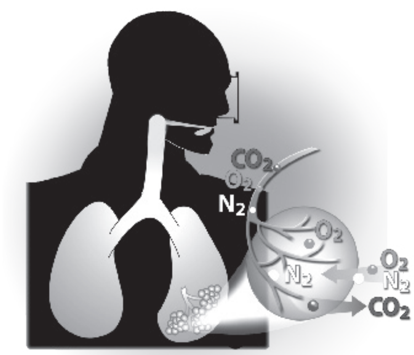
As a review, the role of the body's circulatory system is the movement of gases, nutrients and wastes throughout the body. The circulatory system actually consists of two separate and distinct sub-systems – the cardiovascular system and the lymphatic system. For the purposes of this review, we will focus primarily on the cardiovascular system and more specifically how it transports gasses. The four parts that make up the cardiovascular system are: the heart, arteries, veins and capillaries.



Hemoglobin is the specific component within the blood to which both oxygen and carbon dioxide attach, while being transported by the blood throughout the body.

Starting with pulmonary circulation at the heart, the blood enters and gathers within the right atrium of the heart. An initial contraction of the upper heart muscle moves the blood from the right atrium downward into the right ventricle of the heart. A subsequent contraction of the lower heart muscle then moves the blood from the right ventricle through the pulmonary arteries to those capillaries that surround the alveoli of the lungs. Here carbon dioxide passes from the blood through the permeable membrane of the alveoli and into the lungs, while oxygen passes in the opposite direction from the lungs and into the blood. The oxygen-rich blood then returns to the heart through the pulmonary veins, and now enters the left atrium of the heart. The initial contraction of the upper heart muscle moves the blood from the left atrium downward into the left ventricle, and the subsequent contraction of the lower heart muscle then moves the blood from the left ventricle into the aorta, which is the body's largest systemic artery. From the aorta the blood branches out into the series of smaller systemic arteries leading to capillaries located throughout the tissues. Here oxygen passes from the blood to the tissues, where it is used in the body's metabolic process; and also here carbon dioxide, which is a by-product of metabolism, passes from the tissues to the blood. The oxygen-poor blood returns through the systemic veins towards the heart, where it then re-enters the right atrium of the heart and transitions again into pulmonary circulation.

Decompression Illness



What Is DCI?

Decompression illness, or DCI, is the diagnostic classification for the conditions that a diver may suffer upon ascent to the surface following any time at depth, as the direct result of decompression. More specifically, DCI includes both decompression sickness and arterial gas embolism. The mechanism leading to each of these conditions are distinctly different; nevertheless, each is remarkably similar, making it impossible at times to distinguish between the two. Both conditions are treated exactly the same way in terms of emergency first aid at the scene and follow-up medical care.

Decompression Sickness

Decompression sickness, or DCS (sometimes also referred to as "the bends"), is caused by the formation of nitrogen bubbles within the tissues of a diver's body. Nitrogen is physiologically inert and does not chemically interact with the tissues. A certain amount of nitrogen will be dissolved within the tissues simply because the body is exposed to it. Similar to the movement of oxygen and carbon dioxide in the preceding discussion, nitrogen moves from the lungs through the blood to the tissues and from the tissues through the blood to the lungs, based upon its partial pressure.

Bubbles can form when a diver makes a direct ascent to the surface after remaining too long at a given depth, due to an excessive pressure gradient. Bubbles can also form when a diver makes a rapid ascent from any depth, even while otherwise adhering to established depth and time limits.

DCS is normally associated with bubble formation in the tissues, but it is important to recognize that nitrogen bubbles can also form in the blood. This usually occurs at the same time and for exactly the same reasons. In fact, unlike the tissues, the extent of bubble formation in the blood can be accurately measured through the use of an electronic Doppler stethoscope.

Divers routinely rely upon dive tables and personal dive computers to effectively manage their exposure to excess nitrogen, and thereby minimize their risk of DCS.

It's important to point out, however, that no table or computer can guarantee a completely risk-free dive in terms of DCS.

A number of physiological factors might increase the susceptibility of an individual diver to DCS, even if they adhere to the depth-time profiles specified by that diver's tables or computer. These factors can include:

- Older Age
- Obesity
- Poor Fitness
- Recent Injury or Illness
- Cold Conditions
- Excessive Workload
- Fatigue
- Dehydration
- Prior Occurrence of DCS.

A diver can minimize some of these factors by ensuring proper fitness and health, staying properly hydrated, using appropriate thermal exposure protection, and avoiding over-exertion.
Sport divers can minimize the risk of DCS by:

- Diving conservatively
- Avoiding diving up to the no-decompression limits specified by their tables or computer

- Adhering to the maximum ascent rate indicated by their
- dive tables or computer.
- Ascending at a slow rate
- Completing a safety stop of 3 to 5 minutes during ascent at a depth of 3 to 6 metres or 10 to 20 feet

Remember, when a repetitive dive is made prior to completion of the off-gassing process, residual nitrogen will remain in the diver's tissues and it becomes an additional factor in determining the applicable depth-time limits for the repetitive dive.

DCS can occur if the diver is subjected to a subsequent decrease in ambient pressure, as will be encountered when traveling to a higher altitude or flying in a plane. Accordingly, DAN (Divers Alert Network) currently recommends the following minimum surface intervals before flying: 12 hours after a single dive; 18 hours after multiple dives or multiple days of diving; and 24 hours after any dive requiring staged or emergency decompression. SDI divers, because they are required to use personal dive computers, should follow the recommendation of their dive computer as to when it is safe to fly.

The severity of DCS will depend upon the extent, as well as the location where the bubbles may form. In terms of significance, DCS is often characterized by type – Type I involves skin rash, itching, and localized pain; Type II involves the central nervous system, respiratory system, and/or circulatory system.

The early onset of DCS can be rather subtle, and thus it might be initially overlooked or discounted by the diver.

The signs and symptoms of DCS usually begin to appear within 15 minutes to 2 hours after surfacing, but onset can be delayed for up to 24 hours. Once onset occurs, signs and symptoms may worsen over time, and Type I can transition to Type II. Signs and symptoms do not normally subside on their own and left untreated DCS can cause long-term neurological complications. Early intervention, in regards to both first aid at the scene and subsequent professional medical care, greatly increases an affected diver's chance of a full recovery.

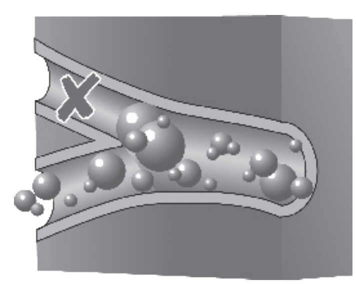
Arterial Gas Embolism

Arterial gas embolism, or AGE, occurs when a gas bubble blocks the arterial flow of blood to a vital organ. It might arise in DCS, when nitrogen comes out of solution and forms nitrogen bubbles within the blood. More often it occurs when over-pressurized air still in its gaseous state passes through the alveoli and enters the bloodstream as an air bubble.

Perhaps the most obvious potential cause of AGE is when a diver holds his breath, which may occur during a panicked ascent following some underwater complication. Another possible cause is lung congestion, as can occur with certain illnesses and allergies where the congestive fluids actually entrap some amount of air within the recesses of the lungs. Asthma-like restriction of the pulmonary airway can also be a possible cause. An excessively rapid ascent, which simply surpasses the equalization process of normal respiration, is another possible cause.

Over-pressurization within the lungs can have two consequences. It may cause a rupture of the lung tissue, with air then escaping into the chest cavity or it can force a bubble of air to pass through the alveoli and enter the blood, leading to arterial gas embolism.

Once in the bloodstream, the bubble passes into systemic circulation and travels through the progressively narrowing network of arteries towards the capillaries. Meanwhile, decreasing ambient pressure (due to a continuing ascent) will cause that bubble to expand in size. Eventually, the bubble will become lodged in an artery, blocking the flow of blood beyond that point.



Blockage in artery

A blockage can occur anywhere throughout the body, but of course the greatest risk occurs when that blockage impacts a vital organ.

When an arterial blockage occurs in the brain, it will produce a sudden stroke; a stroke will manifest in other bodily dysfunction such as weakness or paralysis, respiratory distress or cardiac arrest.

If the blockage occurs in one of the arteries supplying oxygen to the heart, it can also directly result in cardiac arrest.

A diver may employ a few simple precautions to avoid the risk of AGE – never hold one's breath, seek medical advice for any question regarding the overall health of the respiratory system, postpone diving while temporarily congested and always ascend slowly.

The severity of signs and symptoms will depend upon the location of the arterial blockage. Though its signs and symptoms may be quite similar to those of DCS, the onset of AGE is often more rapid and dramatic. Sudden unconsciousness may occur immediately upon surfacing, or even during the ascent. In addition, because of the risk to vital organs, AGE can be more immediately life-threatening.

DCI and Patent Foramen Ovale

Patent Foramen Ovale, or PFO, is a circulatory defect and is believed to be a possible predisposing factor for the onset of DCI.

The foramen ovale is a flap-like valve within the heart. This valve is open during fetal development, and then closes after birth. When the foramen ovale is open it connects the right atrium to the left atrium, thereby shunting blood into systemic circulation while by-passing pulmonary circulation. The foramen ovale closes after birth, when the newborn begins to breathe on its own, and thereby establishes pulmonary circulation and segregates it from systemic circulation. PFO can be identified through special testing procedures, but such is not a part of routine medical screening, and in many cases PFO simply goes undetected. Statistical evidence suggests that it might create an increased risk of DCS or DCI during scuba diving activities.

Signs and Symptoms of DCI

A sign is an outward indication that can be readily observed by another person, while a symptom is an internal indication that is sensed by the patient. Following is a list of common signs and symptoms of DCI:

- Skin rash or itching
- Tingling or numbness
- Joint or limb pain
- Back, abdominal, or chest pain or discomfort
- Unusual headache
- Extreme fatigue
- Weakness or paralysis
- Dizziness, loss of balance, or loss of coordination
- Confusion or disorientation
- Unresponsiveness or unconsciousness
- Memory loss
- Swelling
- Vomiting
- Convulsions
- Difficulty swallowing
- Slurred speech
- Hearing disturbance
- Visual disturbance
- Loss of bladder or bowel control
- Difficulty urinating w/a full bladder
- Unusual coughing
- Rapid, shallow, or distressed breathing
- Blood or froth in mouth
- Rapid, erratic, or weak pulse
- Cardiac arrest
- Nausea
- Uncontrollable shaking

First Aid for Suspected DCI

The primary and immediate patient care always focuses upon the ABC's:

- Airway (open)
- Breathing (present)
- Circulation (present)

Once the ABC's have been confirmed, the following first aid procedures should be implemented whenever DCI is suspected:

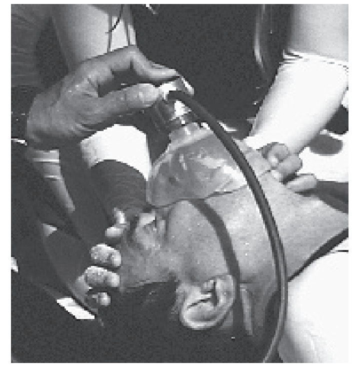
- Activate EMS (emergency medical services), or seek medical care
- Administer 100% oxygen (or highest percentage of oxygen available)
- Have the victim lie down in supine or recovery position
- Monitor the patient
- Treat for shock
- Administer CPR when appropriate

In general DCI does not get better on its own. Left unattended, the signs and symptoms often worsen. Any delay in appropriate care increases the risk of long-term neurological complications. Prompt medical attention is always indicated.

Oxygen administration may:

- Help the diver off-gas excess nitrogen more quickly
- Reduce blood sludging (thickening)
- Reduce nitrogen bubble size
- Increase oxygenated blood flow
- Reduce tissue swelling
- Ease breathing
- Improve the chances of a full recovery

Oro-nasal Mask



To be most effective, the patient should be administered the highest possible concentration of oxygen. In the event that the available oxygen is depleted, a technical diver's decompression gas (with its high content of oxygen) can sometimes be substituted, provided the patient can tolerate breathing through a traditional scuba regulator. In the case of a non-breathing patient, the constant-flow system may be used with an oro-nasal resuscitation mask (sometimes referred to as a "pocket mask") to supplement rescue breaths delivered during CPR.

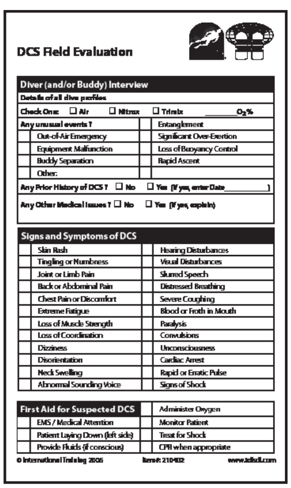
In any case of suspected DCI, once signs or symptoms have been detected, the patient should always be evaluated by a qualified medical professional.

It is important to recognize, however, that there is no need to await the actual onset of DCI before administering oxygen. If a diver has been exposed to a distinct risk of DCI, oxygen may be administered immediately as a precautionary measure. In this case the early administration of oxygen may help to prevent the onset of DCI, or at least lessen its severity.

While administering oxygen, the patient should lie down. Sometimes a patient will resist out of embarrassment or, because of pain or discomfort, the patient might prefer an alternate position. In either case, the more important issue is getting the patient to breath oxygen, rather than the patient's position.

In any case of DCI, initially minor signs and symptoms may quickly and unexpectedly worsen. While awaiting professional medical care, the patient should be carefully monitored. During this time the patient should be kept as comfortable as possible. In regards to shock, the patient will also need to be kept warm. A conscious patient who is able to swallow may be given a non-caffeinated and non-carbonated beverage. While fluids will quench a thirst, more importantly they also help to maintain hydration, which will help to counteract some of the effects of shock and also reduce sludging of the blood.

Five-Minute Field Neurological Evaluation


DCS Field Evaluation

Diver (and/or Buddy) Interview			
Details of all dive profiles			
Check One: ☐ Air ☐ Nitrox ☐ Trimix ________ O_2%			
Any unusual events ?			Entanglement
	Out-of-Air Emergency		Significant Over-Exertion
	Equipment Malfunction		Loss of Buoyancy Control
	Buddy Separation		Rapid Ascent
	Other:		
Any Prior History of DCS ? ☐ No ☐ Yes (If yes, enter Date________)			
Any Other Medical Issues ? ☐ No ☐ Yes (If yes, explain)			

Signs and Symptoms of DCS			
	Skin Rash		Hearing Disturbances
	Tingling or Numbness		Visual Disturbances
	Joint or Limb Pain		Slurred Speech
	Back or Abdominal Pain		Distressed Breathing
	Chest Pain or Discomfort		Severe Coughing
	Extreme Fatigue		Blood or Froth in Mouth
	Loss of Muscle Strength		Paralysis
	Loss of Coordination		Convulsions
	Dizziness		Unconsciousness
	Disorientation		Cardiac Arrest
	Neck Swelling		Rapid or Erratic Pulse
	Abnormal Sounding Voice		Signs of Shock

First Aid for Suspected DCS			Administer Oxygen
	EMS / Medical Attention		Monitor Patient
	Patient Laying Down (left side)		Treat for Shock
	Provide Fluids (if conscious)		CPR when appropriate

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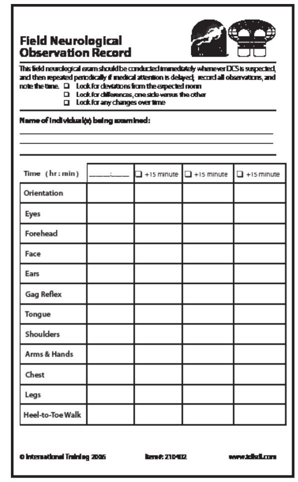
To objectively assess the signs and symptoms in a suspected case of DCI, the dive leader may employ a relatively quick and simple field neurological evaluation. This procedure will be beneficial as part of the initial assessment of the patient; it should also be repeated periodically, perhaps every 15 or 30 minutes, while the patient is awaiting professional medical attention. The time of each evaluation should be noted and all observations should be carefully recorded; this information should then be relayed to EMS and/or the treating physician. In particular, the dive leader should be alert to the following:

- Any deviations from the expected norm
- Any differences from one side of the body to the other
- Any changes over time

The five-minute field neurological evaluation consists of 12 steps, generally progressing from head to toe. Note any abnormality to the following:

- Orientation
- Eyes
- Forehead
- Face
- Ears
- Gag Reflex
- Tongue
- Shoulders
- Arms and Hands
- Chest
- Legs
- Heel-to-Toe Walk



Field Neurological Observation Record

This field neurological exam should be conducted immediately whenever DCS is suspected, and then repeated periodically if medical attention is delayed; record all observations, and note the time.
- ❑ Look for deviations from the expected norm
- ❑ Look for differences, one side versus the other
- ❑ Look for any changes over time

Name of Individual(s) being examined:

Time (hr : min)	____:____	❑ +15 minute	❑ +15 minute	❑ +15 minute
Orientation				
Eyes				
Forehead				
Face				
Ears				
Gag Reflex				
Tongue				
Shoulders				
Arms & Hands				
Chest				
Legs				
Heel-to-Toe Walk				

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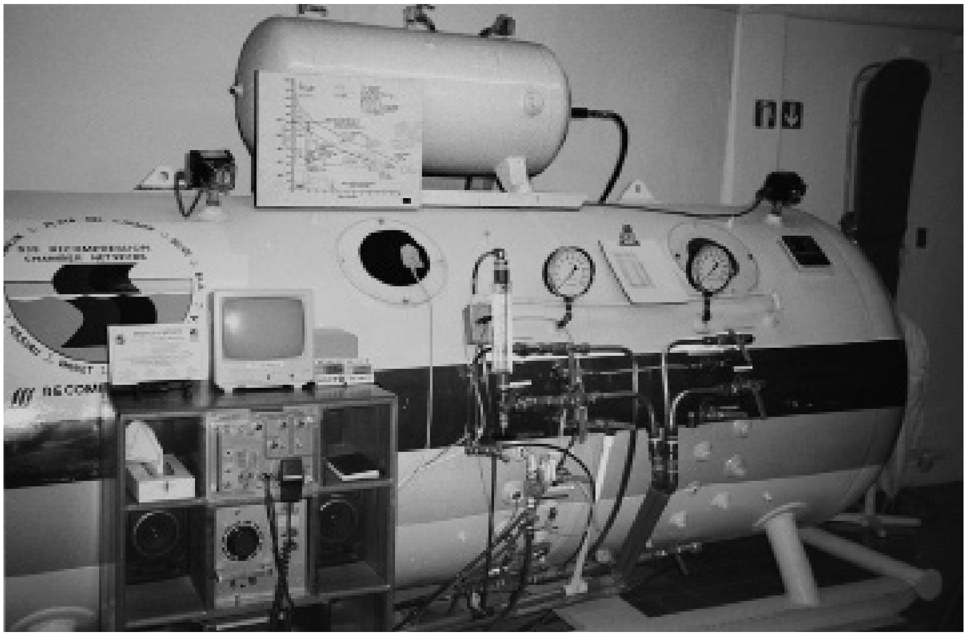
Though beneficial in assessing the signs and symptoms of DCI, the five-minute field neurological evaluation should never take precedence over the patient's primary care; rendering appropriate first aid always remains the priority.

Recompression Therapy

Recompression in a hyperbaric chamber is the standard treatment for DCI. The term "hyperbaric" literally means "high pressure"; thus a hyperbaric chamber is a high pressure chamber. The injured diver is placed inside the chamber and ambient pressure inside the chamber is increased, usually to a pressure of 3 to 6 bar / atm. After an appropriate amount of time the ambient pressure is then slowly decreased, usually in a series of stages or steps, until the diver is finally returned to surface-level ambient pressure.



Recompression therapy might quickly remove the bubble, but there still remains damage to the surrounding tissue. It takes time for the damaged tissues to heal and diving activities should be suspended during this healing process. The US Navy recommends that a diver remain out of the water for at least seven days following resolution of Type I DCS, while DAN recommends a minimum of two to four weeks following subsidence of any neurological signs and symptoms of Type II DCS. More significant cases may require an even longer period of healing. Before resuming diving activities, the injured diver should always be evaluated by a dive medicine physician.

Recompression therapy is most effective when it is initiated quickly after the onset of signs and symptoms. The dive leader should resist the temptation to immediately take an injured diver directly to the closest hyperbaric chamber because appropriate medical care may be lacking at that location. In addition, that chamber might be found to be already in use, unstaffed, or otherwise unavailable. Instead, it is recommended that the injured diver always be transported to the nearest medical facility for evaluation and treatment.

Despite the benefits of recompression, the dive leader should never attempt impromptu in-water recompression of an injured diver as the following may apply:

- May cause the diver to on-gas additional nitrogen.
- It is unlikely that a sufficient air supply will be available to complete the recompression process.
- There is the risk of hypothermia over time, even in relatively warm water, which can create further complications.
- Does not allow effective monitoring of the patient and rendering of first aid procedures.

In all suspected cases of DCI the diver should remain out of the water, and should be administered oxygen and other appropriate first aid, while awaiting further medical care.

Narcosis

What Is Narcosis?

Narcosis is the state of intoxication that can be caused by breathing a high concentration of inert gas, or a lower concentration of inert gas under elevated pressure. The phenomenon of narcosis is not completely understood, but it is believed to occur when an inert gas is absorbed into the membrane of nerve cells and begins to interfere with the electrical signals transmitted by those nerves. The extent of narcosis will vary from one inert gas to another, and will be dependent upon the partial pressure of a particular inert gas at a given point in time. Narcosis is not physiologically harmful; it poses a risk because of its adverse impact upon a diver's overall alertness and performance.

Nitrogen Narcosis

Nitrogen is the most common inert gas encountered by recreational divers and is the primary cause of narcosis in typical sport diving activities.

As a diver descends, the partial pressure of nitrogen increases within the diver's lungs. Its elevated partial pressure causes additional nitrogen to move from the lungs into the diver's body, where it can begin to interfere with the electrical signals transmitted by the nerves. Susceptibility to nitrogen narcosis varies from diver to diver and from day to day, but primarily it is dependent upon depth. The narcotic effect becomes increasingly pronounced at 30 metres or 100 feet, and a diver will exhibit outward signs of nitrogen narcosis. Deeper depths will produce even more severe symptoms.

Narcosis can cause:

- Sense of euphoria
- Lack of concern
- Paranoia
- Diminished coordination
- Impaired thinking
- Foolish behavior
- Hallucinations

The effects of nitrogen narcosis can intensify with physical or psychological stress.

Recent and cumulative deep diving experience appears to help counter, to some degree, the adverse effects of nitrogen narcosis.

Ascending to a shallower depth eliminates the effects of narcosis.

Unlike DCI, nitrogen narcosis poses no lingering concern after surfacing, and requires no subsequent medical intervention.

Inert Gas Narcosis

Other inert gases also are capable of inducing narcosis; the extent of narcosis related to a particular gas is dependent upon a number of factors including its molecular weight. Examples of inert gases would be helium and argon (commonly used as a dry suit gas).

Though oxygen is not an inert gas, it can behave like one at times. This may be encountered with the use of nitrox. At depth, the elevated partial pressure of oxygen may result in more of this gas entering the blood than can readily be used in the metabolic process; when this occurs, some of the excess oxygen will be deposited throughout the tissues including the membrane of nerve cells. Oxygen is similar in weight to nitrogen, and has similar narcotic properties. Therefore the overall effect of inert gas narcosis will be about the same, regardless of whether the diver is breathing nitrox or air, at any given depth.

Gas Toxicity

What Is Toxicity?

Toxicity is the degree to which a particular substance is poisonous to the body. It may refer to the effect upon the body as a whole, as well as upon a specific tissue or process within the body.

Central to this review is the concept of a time-dose exposure. Time refers to the duration of exposure to a given gas, and dose refers to the level (or intensity) of exposure to that gas. The dose is determined by the partial pressure of the gas in question. Below a certain minimum toxic dose, a particular gas will not become toxic despite the duration of exposure; and above a certain maximum toxic dose, a particular gas can immediately become toxic. At intermediate dosage levels, the toxic effect will be cumulative in nature, and the degree of toxicity will be directly dependent upon the duration of exposure to the particular gas at its then current partial pressure.

Central Nervous System Oxygen Toxicity

Oxygen at significantly elevated partial pressures can become toxic. CNS (central nervous system) oxygen toxicity is one of two types of oxygen toxicity, and it is the one with which divers are more concerned. The most significant manifestation of CNS oxygen toxicity is convulsions. When convulsions occur underwater, it is likely the affected diver will lose their regulator and there is a distinct risk of drowning. There are, however, other signs and symptoms of CNS and they can be remembered by the acronym "ConVENTID".

ConVENTID: **Con**vulsions » **V**isual Distrubances » **E**uphoria » **N**ausea » **T**innitus/Tingling or Twitching » **I**rritability » **D**izziness/Dyspnea

In regards to CNS oxygen toxicity, NOAA has identified the maximum oxygen toxic dose to be a partial pressure of 1.6 bar or 1.6 atm for all diving activities. The accompanying table (on the following page) depicts further time dose relationships as established by NOAA.

Oxygen Partial Pressure (bar/atm)	**Single Dive Limit** minutes	**Daily Limit** minutes
1.6	**45**	**150**
1.5	**120**	**180**
1.4	**150**	**180**
1.3	**180**	**210**
1.2	**210**	**240**
1.1	**240**	**270**
1.0	**300**	**300**
0.9	**360**	**360**
0.8	**450**	**450**
0.7	**570**	**570**
0.6	**720**	**720**

The primary factor regarding the onset of CNS oxygen toxicity is the diver's exposure to an elevated partial pressure of oxygen; it should be noted, however, that an elevated level of carbon dioxide within a diver's body may be an additional contributing factor.

If a diver begins to convulse underwater, the diver's buddy should immediately render assistance by taking physical control of the convulsing diver, and then start a controlled ascent to the surface. When the regulator is still in the convulsing diver's mouth, the buddy should attempt to hold it in place. If the regulator is already out of the affected diver's mouth, the buddy should not attempt to replace it. As active convulsions subside, a person will generally enter a sleep-like state prior to regaining consciousness. Once back on the surface and out of the water, the diver's airway, breathing and circulation should be monitored and appropriate first aid should be administered as indicated.

In all cases the affected diver should seek medical attention due to the possibility of inhaled water (even if the regulator was not lost), which later may lead to near-drowning complications.

Pulmonary Oxygen Toxicity

Pulmonary oxygen toxicity is the second type of oxygen toxicity, and it is caused by long-term exposure to elevated partial pressures of oxygen. This form of oxygen toxicity is not normally associated with sport diving activities but can be a concern for commercial saturation divers and divers undergoing hyperbaric treatment.

Carbon Dioxide Toxicity

Carbon dioxide, or CO2, is a by-product of metabolism in animals, plants and other organisms, which is dispersed into the atmospheric air. It is also removed from the air and used by plants in photosynthesis. Carbon dioxide normally comprises only about 0.038% of air and at this low level its presence is negligible in any inhaled breath.

Any elevated level of carbon dioxide in atmospheric air can be problematic in diving when that air is then used to fill a diver's scuba cylinder.

A greater problem stems from carbon dioxide produced by the body itself during the course of a dive. At elevated levels this self-produced carbon dioxide will be equally toxic to the body, and could result in loss of consciousness.

An elevated level of carbon dioxide within the body frequently stems from excessive workload.

Factors such as strenuous activity, cold water, older age, and diminished health or fitness will place increased physical demands upon a diver, increasing the overall workload. Another factor often overlooked is the increased effort of breathing caused by an ill-performing regulator, especially at deeper depths.

An elevated level of carbon dioxide also can be caused by a diver's ineffective breathing pattern, such as shallow breathing or skip-breathing. These breathing patterns are something the OWSDI should monitor while teaching students. An elevated level of carbon dioxide can be a contributing factor in the onset of both decompression sickness and CNS oxygen toxicity.

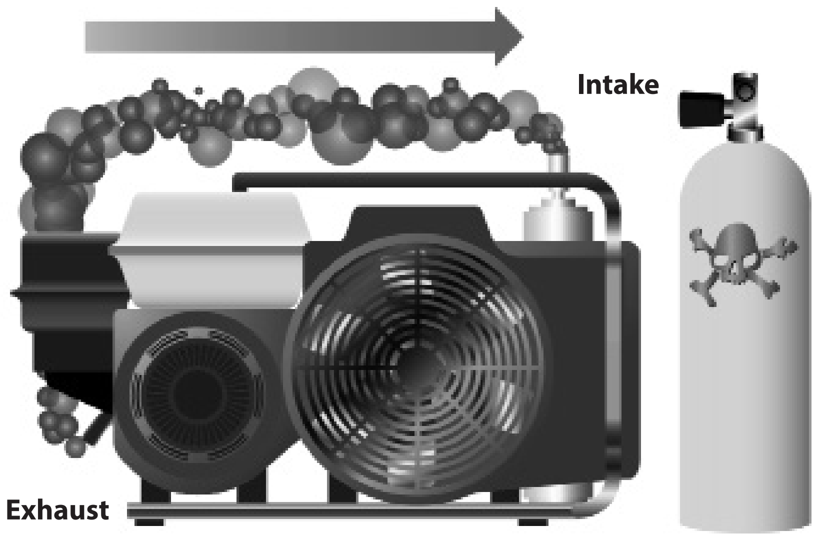
The lesser symptoms of carbon dioxide toxicity generally begin to alleviate on their own, after the increased workload subsides and/or after the affected diver resumes breathing normal atmospheric air, though they can also linger for some period of time. In severe cases, especially those involving respiratory distress or unconsciousness, the affected individual should be monitored and oxygen and other appropriate first aid should be administered while awaiting further medical attention.

Carbon Monoxide Toxicity

$$C \equiv O$$

Carbon monoxide, or CO, is a by-product of inefficient (incomplete) combustion of a carbon-based fuel. It enters the body as a contaminant in inhaled air. Carbon monoxide passes from the lungs into the blood, where it attaches far more readily to the hemoglobin than does oxygen; it also forms a chemical bond that is significantly stronger than the bond between hemoglobin and oxygen. The effects of toxicity are cumulative in nature, and even a very low-level exposure to carbon monoxide can produce a rapid accumulation in the blood. The end result is asphyxiation (oxygen starvation) throughout the body.

The tissues most susceptible to carbon monoxide toxicity are the heart and central nervous system. It may cause a dangerously rapid heart rate and increased blood pressure, headache, dizziness, auditory and visual dysfunction, confusion or dementia, convulsions, unconsciousness, acute renal failure, and both respiratory and cardiac arrest.



Contamination might occur in several different ways. The most common source of carbon monoxide is the exhaust from an internal combustion engine (such as an automobile engine), and contamination will occur if that exhaust is allowed to enter the intake of a compressor system. Contamination can occur within the compressor system itself due to poor maintenance, when filters begin to fail and internal lubricants begin to breakdown. Contamination can also occur with the improper handling of 100% oxygen under high pressure, as may be the case in blending nitrox and trimix, due to internal flashing (momentary ignition) within the compressor lines or cylinder.

Though carbon monoxide itself is odorless and tasteless, it is often accompanied by other contaminates (such as those in an automobile's exhaust), and divers should avoid breathing any gas that has a hint of a smell or taste.

If a diver convulses or becomes unconscious underwater, the diver's buddy should immediately render assistance by taking physical control of the affected diver and then start a controlled ascent to the surface. Upon surfacing administer appropriate first aid measures. Subsequent treatment may include hyperbaric chamber therapy; however, its benefit in helping to flush carbon monoxide from the body remains the subject of debate among medical authorities. Following an acute episode of carbon monoxide toxicity, there is some possibility of subsequent neurological complications arising days, or even weeks, later.

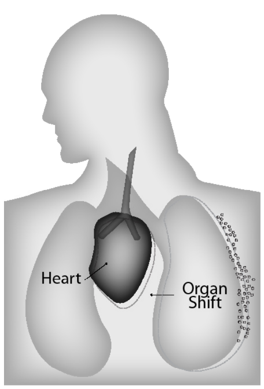
Barotrauma

What Is Barotrauma?

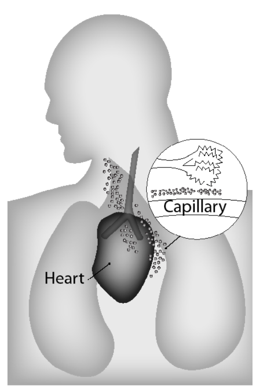
Barotrauma is a pressure-related injury, usually accompanied by discomfort or pain. It may be caused by either increasing or decreasing ambient pressure.

Lung Injuries

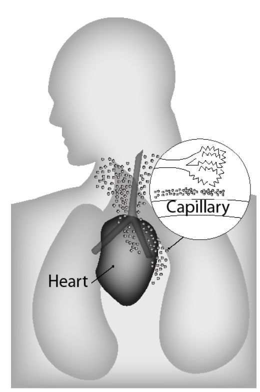
Upon ascent from depth, ambient pressure decreases and volume of air in the lungs will increase if not otherwise vented through normal respiration. If venting is blocked in some way, the expanding gas can exceed the limits of elasticity, causing the lung tissue to rupture. The resulting lung rupture is often referred to as an over-expansion or over-pressurization injury.



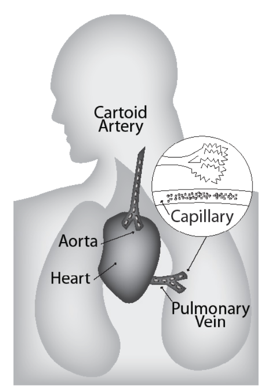
Pneumothorax



Mediastinal Emphysema



Subcutaneous Emphysema

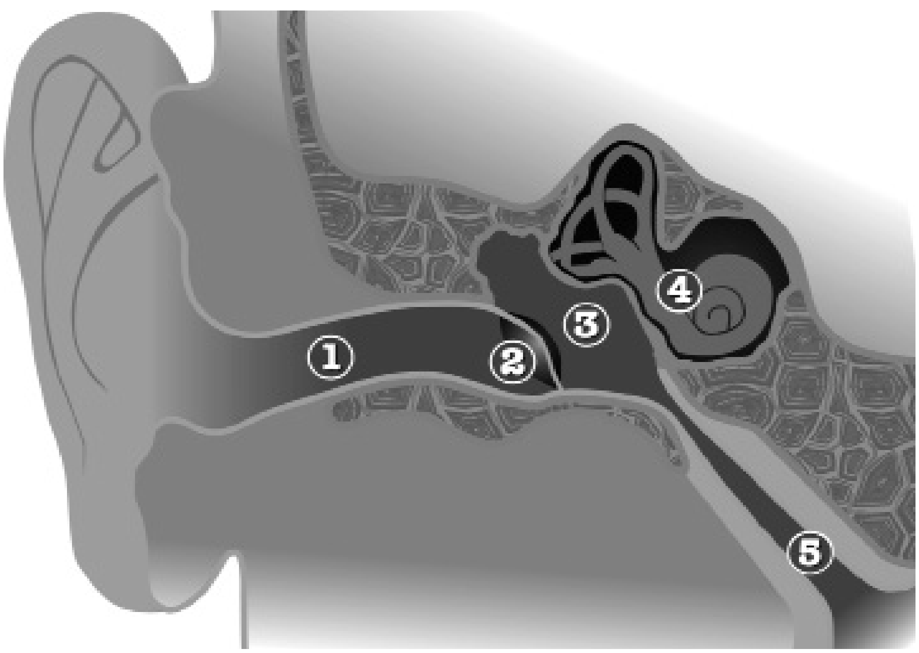


Arterial Gas Embolism

Lung over-expansion injuries are characterized by the location in which the escaping air gathers within the chest, after passing through the ruptured lung tissue. The three primary lung injuries are Pneumothorax (collapsed lung), Mediastinal Emphysema (escaped air gathering in the center of the chest under the sternum) and Subcutaneous Emphysema (escaped air forms bubbles that typically gather around the base of the neck).

Ear Injuries

The eardrum (2), which is also known as the tympanic membrane, is a thin layer of tissue separating the outer ear (1) from the middle ear (3). The middle ear is air-filled and is connected to the throat by the Eustachian tube (5). The Eustachian tube allows air to pass into and out of the middle ear, thereby equalizing the middle ear to ambient pressure.



During routine above-water activities, the middle ears are usually equalized unconsciously by swallowing and/or yawning, both of which help to open the Eustachian tubes. As every new diver learns, changes in pressure occur much more quickly underwater, and it usually takes a conscious effort by the diver to equalize the middle ears during descent. Students should be watched very closely by the OWSDI and advised to equalize early and often.

Outer ear barotrauma can occur if the auditory ear canal is blocked by a tight fitting hood, an accumulation of ear wax, or a non-vented ear plug. Swimmers ear, which also is known as otitis externa, is an inflammation of the outer ear tissues caused by infection rather than barotrauma. Swimmers ear can produce symptoms mimicking those of ear barotraumas.

Ear injuries can be prevented by equalizing early and often, by avoiding attempts at forceful equalization, and by aborting a dive when the ears cannot be readily equalized.

Nasal Sinus Injuries

The nasal sinuses are interconnected with the nasopharynx, and consist of four pairs of air-filled sacs located within the bones of the face and skull. They are the maxillary, frontal, ethmoid and sphenoid sinuses. Like other air spaces, the nasal sinuses must be equalized to changing ambient pressure during both descent and ascent.

Location of the Sinuses

The frontal sinuses appear to be most susceptible to equalization problems, which often manifest as pressure or sharp localized pain in the forehead. Unequalized maxillary sinuses will cause pressure, numbness, or pain in the cheek, and/or pain in the upper teeth. Other indications of nasal sinus barotrauma include a more generalized headache, pressure or pain around an eye, and blood or bloody mucus in the nostrils. Symptoms may appear quickly during the descent or ascent, or more slowly after surfacing.

Additional Concerns

Note: The following information is for review purposes only. Please refer to the SDI Divemaster materials for more in-depth information about the following subjects.

Drowning and Near-Drowning

Drowning is a form of asphyxiation, most often caused when water or another fluid enters the airway and lungs, interrupting the respiratory process.

Near-drowning refers to a similar but initially non-fatal situation where some volume of water is inhaled into the lungs, usually resulting in unconsciousness. Though the victim survives and at first may appear to quickly recover, the intrusion of water can seriously injure the lungs, resulting in both chemical and biological changes within the lung causing problems hours or days later.

Hypothermia and Hyperthermia

Hypothermia is caused by the loss of body heat and most often occurs when a person is exposed to chilly or cold conditions.

Hyperthermia is the opposite of hypothermia, and it occurs when the body produces or absorbs more heat than can be readily dissipated.

If hypothermia or hyperthermia is suspected during a dive, that dive should be terminated. With either hypothermia or hyperthermia, the onset of more significant symptoms requires prompt medical attention. An OWSDI must be prepared to look for both hypothermia and hyperthermia and take the appropriate action to resolve the situation should it occur.

Dehydration

Dehydration refers to a highly reduced level of fluids in the blood and tissues of the body impacting various physiological processes, and it is believed to be a significant pre-disposing factor in the onset of DCS.

It is important for divers to maintain the proper level of hydration. Simply drinking a litre or pint of water will begin to rehydrate the body within about 15 minutes.

Mid-Water Disorientation

On occasion a diver might encounter disorientation due to a lack of visual references. This situation can arise in murky water where the diver can see neither the surface nor the bottom and can occur in clear water, despite the fact that the surface and/or bottom can be seen, because here the brain is unable to accurately interpret distance and perspective.

Seasickness

Like other forms of motion sickness, some individuals are more susceptible to seasickness than others.

Fatigue and dehydration might be additional factors in the onset of seasickness.

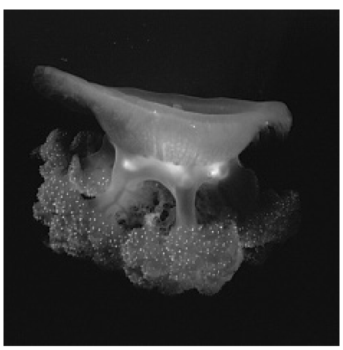
The effects of seasickness can often be minimized if the diver remains above deck in fresh air, near the middle of the boat, with their vision focused upon a fixed object near the horizon or on shore.


SCUBAPRO
SCUBAPRO
SCUBAPRO

Carotid Sinus Reflex

The carotid artery supplies blood to the brain (there are actually two carotid arteries, with one located on each side of the neck). When the neuro sensors within the carotid sinus detect either a high or low pressure in the blood en route to the brain, a signal is transmitted to the heart to modify the heartbeat and blood pressure accordingly. This monitoring and signaling process is known as the carotid sinus reflex.

External pressure applied upon the neck can "fool" the carotid sinus reflex. Any excessively tight item worn around the neck can create this situation. The neuro sensors can mistakenly interpret the external pressure as excessive internal pressure, and then will inappropriately signal the heart to slow and reduce the blood pressure. Ultimately, unconsciousness may occur due to an inadequate supply of blood reaching the brain. When unconsciousness occurs underwater, there is an inherent risk of drowning. To avoid problems related to the carotid sinus reflex, the diver always should avoid use of an under-sized neck seal on a dry suit, an overly-tight collar on a wet suit, or an improperly-fitted hood.



Shallow Water Blackout

The risk of shallow water blackout stems from excessive pre-dive hyperventilation, as in some cases it actually flushes too much carbon dioxide from the body, and thereby overly suppresses the diver's conscious urge to breathe.

Stings, Bites, and Envenomations

The most common marine life injuries are simple surface stings and irritations, such as those caused when an inattentive diver's bare skin comes in contact with the tentacles of a common jellyfish or brushes against certain types of coral. Bites are rare, but when one occurs the result is often a puncture-type wound.

In any case of envenomation, the patient should be closely monitored, as some individuals will have an increased sensitivity to certain toxins and pronounced allergic reactions are possible (much the same as the increased sensitivity of some individuals to bee stings).

General First Aid for Marine Related Injuries

Appropriate Training

A current first aid and CPR certification is a prerequisite for all SDI Leadership programs. It is important to note, however, that once an individual becomes an SDI OWSDI, it becomes a matter of personal responsibility to remain current in these critical skills. SDI offers the following training programs:

- CPROX (CPR and Oxygen)
- CPROX-1st AED (CPR, Oxygen, First Aid, and AED)

Like the similar programs offered by most other organizations, certification following completion of the above SDI programs is valid for two years and re-training then is required.

Most injuries can be prevented or at least mitigated through common sense precautions related to equipment handling and environmental conditions and by ensuring an appropriate level of health and fitness for diving. When any injury occurs, the appropriate first aid procedures for assisting the patient always start with the ABC's:

- Airway (open)
- Breathing (present)
- Circulation (present)

Once the ABC's are confirmed, care can then focus upon the patient's specific injuries. Any suspected fracture should be immobilized. A burn may be cooled with fresh water. If there is bleeding, applying direct pressure to the site can control serious bleeding. Once bleeding is controlled, the wound should then be covered with an appropriate dressing.

The Dive Leader's First Aid Kit

Each dive leader should personally possess a basic first aid kit, readily accessible, that is always carried along as a standard component of his overall dive equipment. At a minimum, it should include the following supplies:

- CPR Barrier / Rescue Breathing Mask
- Surgical Gloves
- Scissors or Shears
- Bandages and Dressings (limited assortment)

Dive boats and dive centers often have a more comprehensive first aid kit, also accessible for use by the dive leader when the need arises. In addition, the dive leader should ensure that emergency oxygen equipment is available on-site for all training dives and supervised diving activities. Where allowed by law, an AED (Automated Eternal Defibrillator) also is highly recommended.

The above information regarding physiology is intended as a review. For more detailed information refer to the SDI Divemaster materials.

Summary

Proper knowledge regarding physiology and how it can affect a diver can help the OWSDI recognize and handle emergencies should they occur. Some general steps to follow in any diving incident are: get the victim to a safe and comfortable place, notify emergency medical service (EMS), get the victim on oxygen (if breathing), and if diving from a boat, activate the emergency recall system and get all other divers aboard so the boat can head to shore. If diving from a boat, follow the instructions of the EMS; they may want the boat to remain stationary. The same would apply if shore diving; the EMS may not want the victim moved. The best course of action is to always have a site assessment plan ready. Thinking ahead saves valuable time, and timely action and treatment can save a life.

Review Questions

1. A build-up of ____________________ is the primary trigger for the breathing mechanism.

- ☐ **A.** Oxygen
- ☐ **B.** Nitrogen
- ☐ **C.** Carbon Dioxide
- ☐ **D.** Inert Gasses

2. Decompression Sickness is caused by the formation of nitrogen ____________________ within the tissues of a diver's body.

- ☐ **A.** Molecules
- ☐ **B.** Bubbles
- ☐ **C.** Hydrocarbons
- ☐ **D.** Polyps

3. Bubbles can form in a diver's tissues as he ascends to the surface, if he:

- ☐ **A.** Stayed too long at depth.
- ☐ **B.** Is low on air.
- ☐ **C.** Ascends too quickly.
- ☐ **D.** Both A and/or C

4. Factors that increase the susceptibility to Decompression Sickness include:

- ☐ **A.** Older age and Obesity
- ☐ **B.** Poor Fitness and Fatigue
- ☐ **C.** Recent Illness or Injury
- ☐ **D.** All of the Above

5. Type I Decompression Sickness may be characterized by which of the following?

☐ **A.** Weakness, Paralysis

☐ **B.** Skin Rash, Localized Pain

☐ **C.** Difficulty Breathing

☐ **D.** None of the Above

6. The onset of symptoms of lung over-expansion injuries is usually delayed and subtle.

☐ True ☐ False

7. The signs and symptoms the mnemonic "ConVENTID" is designed to help the diver recall are:

☐ **A.** Convulsions /Visual Disturbance/ Euphoria/ Nausea/ Tinnitus, Twitching, Tingling/ Irritability/ Dizziness, Dyspnea

☐ **B.** Convulsions /Visual Disturbance/ Euphoria/ Nasal Sinusitis/ Tinnitus, Twitching, Tingling/ Itching/ Dizziness, Dyspnea

☐ **C.** Convulsions /Visual Disturbance/ Euphoria/ Nausea/ Tinnitus, Twitching, Tingling/ Itching/ Dizziness, Dyspnea

8. The most obvious cause of an AGE (Arterial Gas Embolism) is:

☐ **A.** Ascending to fast.

☐ **B.** Staying at depth to long.

☐ **C.** Holding one's breath.

☐ **D.** All of the above.

9. Which of the following are potential lung over-pressurization injuries.

- ☐ **A.** Pneumothorax
- ☐ **B.** Mediastinal Emphysema
- ☐ **C.** Subcutaneous Emphysema
- ☐ **D.** All of the Above

10. The first aid for lung over-expansion injuries is the same as that for ______________________ .

- ☐ **A.** DCS
- ☐ **B.** Nitrogen Narcosis
- ☐ **C.** Ear Squeeze
- ☐ **D.** None of the Above

11. Discomfort in an air space during descent is a ______________________.
Discomfort in an air space during ascent is a ______________________.

- ☐ **A.** Reverse Block, Narcosis
- ☐ **B.** Narcosis, Reverse Block
- ☐ **C.** Reverse Block, Squeeze
- ☐ **D.** Squeeze, Reverse Block

12. The victim of a near-drowning who appears to be completely recovered should go home and rest.

☐ True ☐ False

13. The field neurological exam should be repeated every _____ to ______ minutes while the patient is awaiting professional medical attention.

☐ **A.** 30, 60

☐ **B.** 20, 40

☐ **C.** 15, 30

☐ **D.** 10, 20

14. The standard medical treatment for decompression illness (both DCS and AGE) is in-water recompression.

☐ True ☐ False

15. A Dive Leader should have available at the dive site a(n):

☐ **A.** First Aid Kit

☐ **B.** Oxygen

☐ **C.** AED (if allowed by local law)

☐ **D.** All of the Above

chapter 5

methods of instruction

Methods of Instruction

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Introduction

Educational theory as it applies to explaining and defining 'learning' is an ever-changing and rather complex field of study. It is not the intent of this chapter to delve into such theories and analyze what they entail. Rather, the goal is to discuss the basic elements of teaching and learning processes as they apply to the SDI Open Water Scuba Diver Instructor and form the foundation of scuba education. Building on this foundation, we will incorporate how to properly prepare for and deliver a presentation. And finally, we will discuss how to use assistants properly with the SDI Open Water Scuba Diver program and other continuing education courses.

Learning

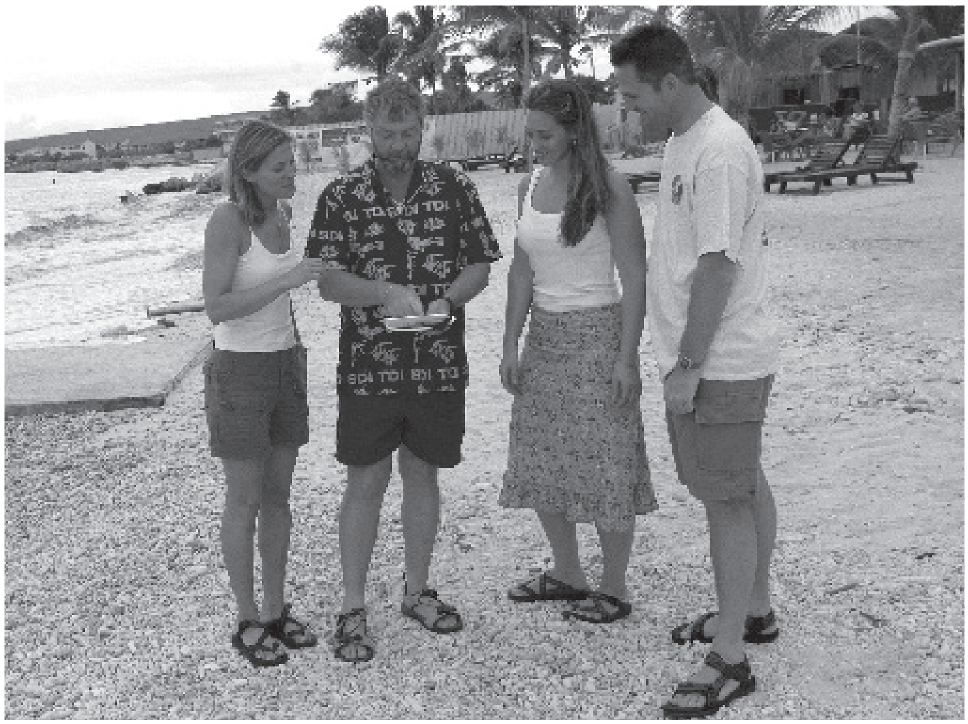
SDI Open Water Scuba Diver Instructors are qualified to teach specific programs as defined in the SDI Instructor Standards. With that in mind, it's important that the open water scuba diver instructor has a basic understanding of how people learn and how to effectively teach the appropriate concepts and skills. There are three key factors regarding learning that need to be discussed:

FIRST — Every person learns differently. Some people read a book once and grasp the subject matter, while others prefer to have the subject read or narrated to them. Still others learn best by applying what they read or hear. Those students need to have "hands on" before they can learn.

SECOND — Learning retention can be identified. When someone learns something new, there is a permanent and observable change in their behavior.

THIRD — Learning retention is quantifiable. There are several ways to measure a student's retention. These include talking to the student about the subject matter, giving the student time to practice what was learned or observed, and by testing the student to evaluate their comprehension.

While this may seem oversimplified, these three factors are what scuba education is basically all about. Now, let's go a little deeper and examine the relevant principles that make up the learning process.



Factors That Affect Learning

Many things can have an impact on an individual's ability to learn. Some of these things may be quite obvious, while others may not be as apparent. What's important is that the educator— the SDI OWSDI - understands the primary principles of learning as they apply to diver education. The learning principles that are relevant to this course are: Readiness, Intensity, Primacy, Exercise and Effect.

Readiness

'Learning Readiness' is simply a term used to describe a student's condition in relation to learning, i.e. their preparedness. This includes both immediate and overall condition.

In regard to their immediate condition, students' readiness can be determined by evaluating whether they are mentally, physically and emotionally prepared to learn.

When evaluating the students' overall condition, one must consider factors such as age, level of education, employment status and to some extent socioeconomic status. These factors can play a major role in the students' combined readiness for a scuba course. For instance, when teaching children and adults simultaneously, the instructor has to consider many different things, first and foremost, the age differences of the participants and how that may affect their preparedness. For instance, the time of day the course is conducted may be a contributing factor. In the morning, an adult may be ready to learn, whereas a child may still want to be in bed sleeping. Conversely, an adult may not be as ready to learn after a long day at work, while a child who is still attending school may already be mentally prepared to learn. While comparing age groups, another consideration is time availability. An adult may be unable to complete a homework assignment due to a hectic work schedule, whereas a child, accustomed to doing homework, may enjoy having a break from the typical homework assignments he gets in school. While this has addressed mental preparedness in relation to students' ages (and additional factors that come with age), there are also physical signs that should be evaluated.

Physical preparedness or the lack thereof (as with hunger and illness) affects both the young and the old. While there is nothing the OWSDI can do about the student being ill — other than to send them home to get some rest - something can be done about hunger. If the course schedule runs through normal meal times, one of two things must take place: meals and refreshments need to be provided or an appropriate break that allows for mealtime should be built into the schedule. If a break is added, ensure that a list of local places to get refreshments or food is provided for those who are unfamiliar with the local area. Another consideration is body temperature; the student may become cold while either in pool/confined water or open water, and this can also be a concern in the classroom. In addition to the obvious concerns about hypothermia, students that are cold will focus only on being cold and not the task at hand.

Evaluating students' readiness is generally a passive exercise on the part of the OWSDI as there is little the OWSDI can do to affect students' overall readiness for a scuba course. However, with proper planning and good judgment, instructors can have an immediate and direct affect on how well the students adapt and progress through the course.

While the SDI Open Water Scuba Diver Instructor may have little control over students' readiness to learn, they have more direct control of the 'intensity' of the course.

Intensity

Simply put, the principle of 'Intensity' is based on the idea that students are more likely to learn skills and gain knowledge from a real situation or a simulated reality situation versus learning from a description or reading about the skills and how knowledge is applied. As such, the progression of becoming an SDI Open Water Scuba Diver is a well-established example of increasing intensity.

First, the student reads the student manual and watches the associated video or takes the online academics. Here the intensity is low since practical application is, for the most part, non-existent. However, in this stage the instructional staff can increase intensity by putting extra effort into making their time out of the water with the student as practical as possible. Using visual aids and utilizing 'workshops' in which the student actively participates in the learning are good examples of ways to increase intensity. A typical example of this is demonstrating the correct way to assemble the scuba equipment in the classroom or on the showroom floor, and then having the student practice it under the guidance of the instructional staff.

Second, the student applies his newly gained knowledge in a controlled in-water situation at the pool or confined water environment. It is here that the student puts into immediate practice the skills he has learned. In this case the student is much more likely to retain the information as they will have applied it in a real situation. Therefore, intensity is much higher in this instance.

Third, the student is placed in an actual open water scuba diving situation to demonstrate that they have retained the material and can successfully apply it to an actual situation.

When considering intensity, ask the following questions: Why is one course more memorable than another? Was the instructor more animated? Were they more dynamic? Did they encourage student participation? All of these may be factors and should be considered when planning and teaching a course. Think about courses you completed that were particularly helpful and fun. What made them so? Chances are good that if you emulate the classes you most enjoyed, your students will enjoy yours as well.

By incorporating intensity into the course, students are likely to have a better experience and are therefore more likely to retain the information.

In addition to incorporating intensity, it's vital that students are taught and perform scuba skills correctly the first time they are introduced to them. This is what is referred to as 'Primacy.'

Primacy

Primacy is basically a fancy word for "do it right the first time." Prior to reaching the dive professional levels of training, courses consisted of repetitive knowledge and skills, all of which were first presented and demonstrated by the instructor to help ensure accuracy the first time they were attempted by the student, with the notable exception of divemaster and assistant instructor courses.

Remember, students will generally attempt to perform a skill for the first time exactly as it was shown to them.

At the very least, that is the image that will burn into their memory. This is why a lot of time is spent during a professional level course ensuring skills are performed to demonstration quality. It's much easier to teach a skill correctly and in the correct order the first time than it is to try to help a student 'unlearn' a skill or skills that they have made habit.

One of the best ways for an instructor to follow a functional and relevant pattern of instruction time after time is to use lesson plans and skills checklists. As such, SDI has made available academic presentation forms for use in the classroom and skills cue cards for use in the pool and open water. Not only do these aides help the instructor follow a logical progression, but they help ensure that knowledge and skills are taught in a logical sequence the first time and every time.

The next principle we will discuss is 'exercise', which in its purist form basically states that skills and applied knowledge become second nature if they are repeated often. As you read the next section, think about the principle of primacy and why it is integral to the principle of exercise.

Exercise

Much of the knowledge and many of the skills involved in scuba diving are unique to the sport. There are very few skills that apply elsewhere, with the exception of certain water sports. As a result, the principle of exercise is a very important part of an SDI Open Water Scuba Diver Instructor's responsibility, since the OWSDI is often responsible for correcting students' errors in practice. Remember, the principle of exercise is basically reinforcing that "perfect practice, makes perfect."

In regard to the academic portion of the course, the student reads the manual or completes the online training, answers the knowledge review questions and finally, reviews this knowledge with the assistant instructor or instructor to ensure comprehension. Throughout the academic sessions, the instructional staff asks redundant questions to reinforce retention.

For the skills or in-water portion of the course, skills are properly demonstrated (remember the principle of primacy) and then are correctly practiced by the student over and over again. It is the OWSDI's role to correct the student should he make a mistake. All of this repetitiveness starts and reinforces the process of making the student's reaction second nature. The end goal is that the new diver will be relaxed and can enjoy dives because they are comfortable in what they are doing, and trust in their ability. This leads us to the final principle, the principle of 'effect.'

Effect

Simply, the principle of effect says that if a student is having a good and enjoyable experience (while learning), then their learning is increased; however, if they are having a bad or negative experience, their learning is decreased.

This is why positive reinforcement is integral to the success of the students and the principle of effect should be observed and evaluated for each student throughout the course.

If the student is not having an enjoyable time, then it is likely that they are not optimizing their learning. This is also another reason negative reinforcement is discouraged. After all, the student is a paying to learn how to scuba dive and should have an enjoyable experience.

In the end, what will be observed is the value of the information provided when it is practiced and applied. Sometimes this doesn't happen during the course but later, after the diver has had an opportunity to apply what they've learned on a pleasure dive. The greatest thing an instructor can hear is "I used what I learned during the course on one of my dives and it worked great."

Generational Differences

The final aspect that can affect learning is the age differences between students. This was discussed briefly in the readiness section; in this section we will go into more detail. There are four different sets of students when it comes to age: Silent Generation, Baby Boomers, Gen Xers and Generation Y, each requiring a slightly different method of teaching.

The Silent Generation describes a group of people born between the early 1920's and early 1940's. While this is a small portion of the students that will appear in the classroom, they do still appear and as such, knowing how they learn and respond is very important. The Silent Generation is known to have a strong work ethic, which carries over into their study habits - they are very disciplined and prefer to schedule courses for the morning hours. Other qualities of the Silent Generation are:

- Respects authority
- Prefers to communicate in a direct and formal manner
- Self motivated and does not require a lot of direction
- Like simple black and white text as opposed to flashy presentations

Baby Boomers are perhaps one of the larger groups of divers. This describes people born between 1945 and 1964. Like the Silent Generation they are hard workers but maybe even more extreme, and can be workaholics. Baby Boomers are very efficient as a generation and can be perfectionists, and therefore may demand the same from their instructor. Some traits that are unique to them include:

- Prefer tactile learning (hands on)
- Are sensitive to temperature of learning environment
- Question authority
- View criticism in a negative way
- Like simple black and white text as opposed to flashy presentations

Gen Xers were born roughly between 1965 and 1980. They also comprise a large percentage of people taking dive courses. Like the previous two generations, Gen Xers are hard workers; however, they like to get the job done fast so they can move onto something new. As a result, a Gen Xer may say they understand something just for the sake of moving on. The learning environment for Gen Xers needs to be fun and have a higher degree of freedom. Other traits to be aware of include:

- Respond best to structured learning objectives with clear goals
- May benefit from having a schedule including when assignments will be due
- Like immediate feedback on all tasks they are asked to perform
- Prefer to have courses scheduled in the evening

The final generation is generation "Y" also known as the "Millennials". They were born between the early 1980's and early 2000. This generation moves in a fast pace world where information is presented in short burst and should be full of action. Colorful PowerPoint® presentations along with videos work well. This is also the generation that will fully embrace online learning technology. They also like to get where they are going fast and if encouraged, will take more courses and move up through the diving ranks. Some characteristics that generation "Y" has include:

- Enjoy humor while learning
- Do their own research
- Tolerant of differences in opinion
- Have limited brand loyalty and will follow a trend or the latest new thing
- Is a team player
- Perform better when rewarded for job well done

All of the above is a generalization and potentially geographically specific. Without a doubt it may not apply to all students even if they fit into the age categories, but it will help the OWSDI candidate understand and prepare for divers that will be taking courses. There are many factors that affect learning and the message here is to keep the mind open to new ideas and always try a different approach if the current one is not working. Once the instructor better understands the students' background based and their applicable generation, the instructor can tailor his delivery methods as appropriate.

Phases of Teaching

Now that we've covered the basics of how people learn, we can examine the phases of teaching and how each is applied in a learning environment. This is effectively 'how to teach.'

The phases of teaching as they relate to this course are: Assessment, Presentation, Application and Evaluation. Each phase is as important as the next, and so is the order in which they are implemented. Each phase and how it relates to the next will be discussed in this section.

Assessment

During the assessment phase the instructional staff evaluates each student's general condition as well as the overall dynamic of the group. While conducting the assessment, it's extremely important that the instructors evaluate the 'big picture' so that each element of the students' readiness is

considered as part of the whole. This is also the phase in which the students' readiness is evaluated (as discussed in the previous section).

When conducting the assessment the following points should be considered:

• First, the instructional staff should assess the students that will be in the course. This is best done during and after the first academic session. Examples of the conditions that should be evaluated include:

Student Age(s) and Maturity Level — Is the class comprised of children, adults or a mixture of both, and what is the age range of the adults? The answers to these questions will help determine the most appropriate way to deliver the academics. For example, adults typically ask questions and probe knowledge with little to no incentive to do so from the instructional staff. This will help gauge what the students already know and what needs to be expanded upon. Alternatively, when teaching children, the instructional staff may need to ask them direct or probing questions, as children are often apprehensive or shy. However, maturity levels in children can be wide ranging. Often, a mature youth will assert himself more and learn and perform better than an adult lacking maturity. So beware of preconceptions when assessing students – they may often surprise you.

PAST WATER EXPERIENCE — What are the students' comfort levels in the water? Have they ever participated in swim classes? Have they dived before? Do they enjoy other water sports? This information will provide valuable insight to the instructional staff as to potential student apprehension that should be addressed.

PARTNER DEPENDENCE — Are there students who are taking the course with a spouse, partner or other family member? If so, do they seem dependant on the other person? Does it help or hinder them? A good example of this is a situation where a father and son take the course together for the first time. In this case, the son may feel dependant on the father's assistance since that's what he has come to learn through his past experiences with his father. If the father is removed from the picture, the child may excel. Of course, often this isn't the best solution. However, a brief and private discussion with the father regarding the situation may open new doors for the child to progress in a more positive manner. Alternatively, an individual may be overly critical of their partner's performance. Again, it's important that the instructors recognize the situation through their assessment and take appropriate action so that each individual can progress in a positive and fun environment.

Remember, in addition to the classroom, this same assessment procedure should be applied before, during and after the first in-water session.

Proper and timely assessment of the students will help ensure that the instructional staff do not bore the students with information they already know or overwhelm them by advancing too quickly. It also helps identify and solve issues that could create or already are learning barriers. At the very least, a good assessment will give the instructors a much clearer picture of who their students are, which ultimately helps in the next phase: the presentation phase.

Presentation

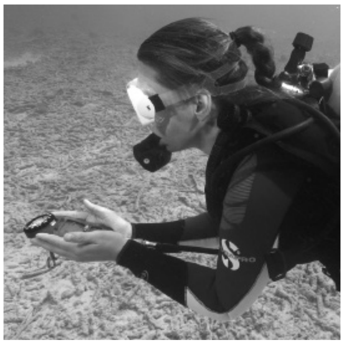
Following the assessment phase, the instructional staff should have a much better idea of whom they will be teaching. As a result, they should be better equipped to formulate and deliver a presentation tailored to the group. The presentation should start with an explanation to the students of what they will be learning. It should be clear and concise and each subject should be separated out into small, manageable portions. Doing so will also help identify logical stopping points in the curriculum, which provides opportunities for the students to ask questions (in private or away from the rest of the class), stretch and get refreshments. For example, when teaching the SDI Underwater Navigation course, the instructor covers the use of mechanical and electronic compasses, what affects them, and how to properly care for and maintain them. Before moving on to the natural navigation presentation, the instructor allows the group to take a five-minute break to "refresh" themselves.

When developing presentations, instructors need to be sure that each subject has a clear objective and well-defined timeline. Breaks should be strategically placed within the timeline, and most importantly, the instructor needs to do their best to stick to it.

In addition, the timeline should be communicated to the students prior to starting, so they know what to expect and won't be wondering when they are going to get a break instead of focusing on the subject matter.

Creating and delivering a good presentation is vital to the overall validity and progression of the course. Naturally, there are many factors such as behavioral objectives and visual aids that must be considered when developing presentations. These considerations are covered later in this chapter.

In terms of scuba education, a presentation generally includes a segment or segments of time when the students will apply their newly gained knowledge. In fact, these practice periods are particularly recommended as the class increases in 'intensity', since this tends to increase retention (as was explained in the previous section).



Application

Very simply, the application phase of learning occurs when students 'apply' what they have learned. Such application can be done in almost any location, but as previously discussed in the primacy section, it's vital that they apply the knowledge in the appropriate sequence and perform skills correctly the first time. Should they fail to perform the skill or apply the knowledge correctly the first time, the SDI OWSDI must be there to correct them in a positive way.

Continuing with the example of the SDI Navigation course: As part of his presentation, the instructor issues each student a compass mounted to a slate. He takes the class outside to the parking lot and gives instruction on how to properly set the bezel while holding the compass level, in order to take a single heading course. He then provides instruction on how to complete a reciprocal course. At the conclusion of his demonstration, he instructs the students to apply the knowledge and complete the same exercise on their own.

Conducting land drills or "dry drills" prior to performing anything in-water will help the divers better understand what is required of them underwater. This same application of theory can be used in the academic setting as well. For example, when teaching the SDI Marine Eco System Awareness course an instructor could ask the divers to identify benthic (bottom dwelling) and pelagic (mid-water) marine life from a book. By doing so, the students have to practically apply what they have learned about the definitions of benthic and pelagic marine life.

As with any learning situation, there should be an evaluation phase to test how much of the information taught was retained.

Evaluation

Once the subject has been presented and the students have had an opportunity to apply and reapply what they have learned, their knowledge retention will need to be evaluated. Of the many ways to test the retention and understanding of subjects that were presented, the most common methods are by examination or skill performance or a combination of both.

Examinations are not always written — although this is ideal for record keeping; they can also be verbal. Throughout the course students should be asked questions. If the answer is correct, the student experiences positive reinforcement; however, if the answer is incorrect, the explanation the instructor provides should serve as an additional opportunity for all students to grasp the concept. This is a form of examination and is best used at the end of each lecture session. To ensure that all students retain and understand what was discussed, questions should be asked of each student in an even distribution.

The written exam is more straightforward. Each student answers the questions to the best of their ability, and hands it in to be corrected. Generally speaking, most SDI written exams have a minimum passing score. However, all of the questions that the student answered incorrectly are to be reviewed together by the student and instructor to ensure that the student has 100% understanding of what they missed.

Skill performance exams are also pretty straightforward. In this case, the student is asked to perform a skill or a series of skills with a predetermined degree of accuracy. How accurately the student performs the skill(s) determines if they will successfully pass or not.

Returning to the SDI Navigation course scenario for an example of a typical skill performance exam: To test the students' skill performance for completing a reciprocal course, the instructor asks the students to swim out 50 kick cycles and return to within 3m /10 feet of where they started. When performing the skill, one diver of the buddy team is to hold the compass and set the direction, while the other is to monitor depth and watch out for obstacles in their path. If the buddy team returns within 3m/10 feet of the location they left from, they have passed the exam.

The final and perhaps most important 'test' is the OWSDI's assessment of the students' comfort level in the water. The OWSDI should observe each student through all phases of the dive and evaluate whether their comfort has increased or they are still nervous. Students who continue to be nervous may need additional time with the OWSDI, possibly on a one-on-one basis.

Ultimately, each phase of teaching is necessary for the next to be successful.

Learning Objectives

Learning objectives (objectives) are a core part of every presentation, and usually are used in the introduction of new subjects. In some cases the objectives may be described as performance-based outcomes, or behavioral objectives. In other words, they are what the student will understand, be able to describe or be able to do at the conclusion of the presentation, and in the case of behavioral objectives, what behavior will be elicited from the student or subject. By establishing the objectives, an instructor knows what he must teach and the students know what is expected of them. Objectives should be brief, concise and have a measurable outcome, and should be provided in both theory and skill presentations.

When creating objectives, the instructor should evaluate his audience and what they should be able to describe or do at the conclusion of the presentation. In addition, the objective should define any specific conditions under which the objective must be met and how well it must be done. A simple way to remember how to write an objective is the 'ABCD' format.

Audience – Who?

Behavior – What should the student be able to do?

Condition – Under what conditions is the student being asked to perform this?

Degree – How well must it be done?

For example, when performing CPR during the CPROX1stAED course, students are asked to maintain a constant rate of compressions per minute and administer two breaths every thirty seconds for a specified period of time. Using the above 'ABCD' format, a good example of the objective would be:

"By the end of this exercise, using a mannequin, the student will be able to maintain 100 compressions per minute for one minute, pausing every 30 seconds to administer two breaths. The student will continue this cycle for five minutes."

In this example we established the Audience — the student; the Behavior — maintain 100 compressions per minute for one minute, pausing every 30 seconds to administer two breaths; the Condition — using a mannequin; and the Degree — continue this cycle for five minutes.

Writing objectives using this format helps ensure that there is little to no ambiguity as to what is expected of the student or instructor. It creates specific, measurable goals that can be quickly and easily evaluated by both the student and the instructor.

Instructional Theory — Phases of Learning

There are four basic phases of learning as they relate to instructional theory. They are: Stimulus, Response, Reinforcement and Motivation. We will discuss each of these phases and provide examples of how to use and recognize them.

Stimulus

Stimulus is also known as an attention-getting step. At the beginning of a presentation, a statement combined with the appropriate body language should be made to get the students' attention and encourage them to listen to what is being said or demonstrated. An effective attention-getting step will cause a response.

Because presentations will be done above and below the water, ways to get the students' attention in both environments should be considered. On the surface, such an action could be a verbal statement such as: "Have you ever been looking through a magazine or watching a movie and wondered what the marine life was that you were seeing?" This would be a good attention-getting step when teaching the SDI Marine Eco System course.

The attention-getting step may have a few elements that could be included. For instance, it is best if the subject can be related to something the students already know; in the example above it was "magazine or movie." It should also relate to the subject "marine life." While not all attention-getting steps have to relate to the subject, they should at a minimum relate to something the students already know. They should also be easy to apply to the subject that will be presented.

Underwater, the attention-getting step is relatively simple. A sound should be made either by clapping hands together or by using a mechanical noise-making device followed by hand signals advising the students to watch the demonstration.

Response

Depending on the type of opening stimulus or attention-getting step, there should be a visual or verbal response from the students indicating that their focus has been established. In a classroom or academic setting students may

respond in kind, or visually turn their attention to the presenter. In an underwater setting the students generally respond by physically and visually recognizing the attention-getting step. In most cases, the instructor asks if the students are “OK” to proceed by directing the “OK” hand signal in their direction and waiting to receive the signal in return.

Reinforcement

Now that the students have listened to the presentation or performed the skill, it is time to reinforce their response. There will be a difference in how the response is reinforced depending on whether the students and instructor are in or above the water.

Above the water, questions should be asked about the subject that was presented. In the best case scenario the student understands what was presented and answers the question correctly. This would deserve positive reinforcement such as: “that is correct, very good.” Should the student answer the question incorrectly, they must be provided with an explanation of the correct answer.

Underwater, if the student performs the skill but not within the acceptable range of success, the SDI OWSDI should demonstrate the skill again, emphasizing the portion of the skill the student did not successfully complete. Once the student performs the skill correctly the positive reinforcement can be as simple as an ok sign or an over-emphasized clap or a handshake. This confirms for the student that they were successful.

Sincere reinforcement will increase the likelihood of additional positive responses from the students. As such, it is critical that the OWSDI respond to a positive student outcome with genuine sincerity. This is one of the most important aspects of reinforcement.

Motivation

Motivation is an essential part of learning. In most cases, students come to learn. Why are they there? Is it because they want to be or does someone else want them there? Are they enthusiastic and raring to go or not at all sure they are ready to venture into the underwater world? These are important points to consider whenever you begin a new class. A dive educator must ensure the students not only learn the concepts but are eager to perfect the knowledge and skills that will enable them to enjoy diving from their very first experience in the water. With proper and straightforward motivation, students will gain the skills and confidence to master the task at hand, and thereby be ready to progress and have fun. Motivation can be delivered several ways: through continual positive reinforcement of proper behavior; by guiding students down a successful and rewarding path; and by providing them with a strong understanding of why they need to know the skill, or why the knowledge is important. An additional simple form of motivation is 'cause and effect.' For example, educating students as to why they should not hold their breath underwater is a form of motivation. In this case, the motivation is the non-effect: to be able to dive another day.

Returning to our SDI Navigation class, an example of motivation would be to provide a value statement to the students: "By knowing how to navigate underwater the student will easily be able to return to their entry point, therefore making the dive more enjoyable."

As we've said, motivation comes in many forms. In fact, examples can be found almost anywhere. It is the OWSDI's job to find or create appropriate examples, and use them to the students' benefit.

General Teaching Methods

Simply put, teaching is the conveyance of information from one person to another. One responsibility of the teacher is to assess what the student knows already and build upon the existing knowledge. There are a few ways a student can obtain additional knowledge - through oral presentations, online training, Internet forums, guided discussion or doing pleasure dives. In this section, oral presentations, guided discussion and online training will be discussed.

Oral Presentations

Perhaps one of the longest standing and best-tested forms of teaching is oral presentation. This form of teaching appeals to a wide range of students and teachers alike. In face-to-face lectures, the students can ask questions as subjects are presented and interact with the instructor one-on-one.

Additionally, the instructor has the opportunity to verbally test the students, as well as see and respond to their reactions. The other large benefit is the building of rapport between both parties (this will be discussed later in Factors That Influence Communication).

Presenting information to a group of students is the fundamental basis of scuba instruction. As such, it is important for the dive professional to overcome any fear of public speaking they may have. While there are tricks to controlling this fear, a little nervousness is not a bad thing. Being nervous indicates that the presenter cares about the impression they make, and that the information they are providing is correct and in a logical order.

Another important part of a presentation is the use of visual aids. In some cases, visual aids are nothing more than handouts of the information that will be discussed. As an example, when giving a presentation using PowerPoint ®, students can be handed an outline so that they may follow along. Simply print out the slides using the "handouts" feature in the program. Providing the outline to the students will help them stay focused on what's being taught, as well as give them a handy place to take notes.

As was discussed in earlier sections, utilizing the equipment the students are learning about during a presentation is highly recommended, and a great way to implement the use of training aids. For example, when teaching the SDI Underwater Navigation course and discussing compasses, compasses can be handed out for the students to hold and look at. Many people learn better by touching and doing.

Oral presentation is an age-old, tried and tested method of information delivery. However, over time many modifications have been made to the traditional format of the teacher addressing a group. One such modification is bringing the group together for discussion under the guidance of the teacher/instructor.

Guided Discussion

Guided discussion can be a great way for the instructor to answer any questions the students have, while at the same time assessing how much information the students have retained. In this format, students get a chance to interact with each other and discuss the topics that were covered. In this scenario, it's important that the instructor only listen and interact or interject when needed. However, it is the instructor's responsibility to keep the discussion on track. The two key factors the instructor should constantly monitor and maintain are topics and time. The topics under discussion should relate to the course and not go beyond its scope. It's easy for anyone to get off on a tangent, and it's human nature to follow along. Stopping these distractions when they start is the instructor's responsibility and will keep the discussion on track. In reference to time, open or guided discussions tend to go on too long without proper guidance; therefore, the duration of the discussion should be just long enough for all of the relevant questions to be answered and for the objective to be met. Managing guided discussions takes practice, but if done properly, they can be very effective and more fun for the student.

Online Training

One of the latest advents to the scuba diving industry is online training, also known as blended learning. While this is not a new concept in many other industries, it may take some time to get used to.

Online training does not replace the need for face-to-face interaction; it does however, give the dive professional a chance to apply what they would normally do in the classroom in a new way. When using online training, the dive professional can watch the progress of the students, send them emails or call them to discuss the course and answer questions.

When students complete the academics online, they are essentially cutting out the 'fat.' Doing so facilitates a more efficient face-to-face interaction between the student and instructional staff because the majority of the time can now be spent on hands–on training and knowledge and skill application. This is very valuable time because the student builds trust with the professional earlier and the professional has a chance to assess the student sooner.

Currently SDI offers many of its courses online and will continue to develop and adapt more of them as time progresses.

Factors That Influence Communication

This section looks at factors that influence effective communication as they apply to the instructor. These factors and principles should be considered and applied where necessary when giving presentations and interacting with students.

Vocal Expression

Vocal expression is one of the most important tools a presenter has in his arsenal. The key elements of vocal expression are pitch, volume and rate of speech. Pitch, commonly referred to as 'voice inflection', is the tone or modulation of the voice as it goes from high to low, or vice versa. The use of inflection allows us to show emotion through speech. It helps convey the excitement or importance of a topic. It also helps keep the students engaged in the presentation. The presenter who speaks in a monotone fashion quickly looses the interest of their audience.

When speaking to a group, presenters must be constantly aware of the volume of their voice. If they are too loud, students may focus on the volume rather than the information. If they are too quiet, the students won't be able to hear the information and in many cases, students won't inform the presenter they can't hear unless asked. Therefore, it's in the presenter's best interest to ask the group if his volume is sufficient. Volume can also be used in combination with pitch to inject excitement and gain the attention of the group. However, excessive volume can also be mistakenly interpreted as a negative emotion such as anger. To help avoid this, it's recommended that presenters practice their delivery and solicit input from the group.

The speed or rate at which a presenter speaks also has an impact on the way the information is interpreted. In fact, the rate of speech should be appropriately adjusted if there are any special circumstances. For instance, are there children in the class? If so, they may benefit from a decreased rate of speech, as would a translator or someone with a learning disability. This information may not be known prior to class, so it is up to the dive professional to monitor the group and make adjustments if anyone is struggling to keep up. Others, such as translators or those with learning disabilities, may need additional one-on-one time with the presenter to help ensure that they understand the subject matter.

Proper vocal expression is important if the students are to correctly interpret and understand the information being presented; however, if the students can't get past the appearance of the presenter, their vocal expression will make little difference.

Image

An instructor who stands before a group of students and looks well put together will gain the respect and trust of the students faster and more easily than one who looks like they just fell out of bed. In most cases, first impressions are based on overall appearance. They are long lasting and difficult to change. That is why it is vital that the instructor look the part. This includes wearing appropriate clothing that is characteristic of the dive facility they represent and avoiding any clothing that is damaged, ripped or torn. Also, as a general rule, it's not appropriate for a presenter to wear a hat indoors unless it is part of the approved uniform.

When addressing the group, the presenter should appear relaxed even if they are feeling nervous. They should stand in an upright position and avoid

pacing at the front of the room. In a casual classroom setting it is ok for the instructor to sit amongst the students, but he should avoid slouching in the chair or putting his feet up. Either way — sitting or standing - the presenter should keep his head high, project his voice and keep constant eye contact with the class.

Nervousness

As stated earlier, a little bit of nervousness is expected and should go away a few minutes after beginning the presentation. However, there are a few things a presenter can do to help minimize the impact of nervousness.

PRACTICE, PRACTICE AND PRACTICE— It's highly recommended that the instructor practice their presentation a few times. This can be done with no one around, in front of a video camera or in front of select family and friends who are willing to provide honest input. If using a video camera, the presenter should review the presentation, take notes on areas he can improve on, and implement the changes in the next practice presentation.

USE VISUAL AIDS — While the use of visual aids is recommended, the presenter should be sure to use visual aids that he is familiar with. When using a PowerPoint® or custom presentation, it's important that the presenter review it completely several times to help ensure there are no surprises. In addition, the presenter should check for typos and make a list of questions and topics that may come up.

SOME FINAL TRICKS OF THE TRADE — The presenter may benefit from taking a few quiet minutes before starting the presentation. During this time he should take a few deep, slow breaths and think about the subject and how he will deliver the presentation to the group.

With all of this said, the most important thing for the presenter to do is focus on getting the information to the students clearly, not quickly.

Teaching Tools

There is a wide range of teaching tools available from SDI for the SDI Open Water Scuba Diver Instructor to use in his presentations. These include diver manuals, instructor guides, PowerPoint® presentations, cue cards and posters. Of course, any piece of scuba equipment or scuba related item might be used as a teaching tool as well.

When properly used, teaching tools can act as a guide for the instructor to follow. Take a scuba mask for example: The instructor could begin with what type of mask is it, high or low volume; what the mask skirt is made out of, and why that's important; and what options are important to consider when choosing a mask.

Used as a teaching tool, PowerPoint® is both interactive and helps the presenter manage his time. PowerPoint® helps the presenter keep the presentation on track and cover all the points that need to be discussed.

Additionally, after using the presentation a few times, the presenter will have a good idea how long the presentation takes from start to finish. Also, the slides should augment the verbal presentation but not be a written version of it. Presenters must use their own words, experiences and perspective to bring what's in the PowerPoint® to life.

When using digital systems, it's recommended that the presenter set up the equipment prior to class and go through one or two "dry runs." By doing so, unpleasant surprises will be avoided and the overall presentation will be more professional.

Visual Aids

Visual aids enhance communication and can be a valuable part of any lesson. As discussed earlier, each person learns differently and the visual aid helps those that learn better by seeing and perhaps touching. For example, when teaching the SDI Underwater Video course, imagine trying to explain how to clean and inspect an O-ring without having one? What if you needed to show how a latch locks a video housing shut in order to keep it watertight? This would make perfect sense to the student if a video housing were available for the student to see and feel.

Visual training aids can also serve as a distraction. When teaching an open water scuba diver course or buoyancy course it's a good idea for the instructor to bring along some water toys. The students will start playing with the toys — adults and children alike; this takes their mind off buoyancy and suddenly their buoyancy improves.

Always have the training aids available before the course begins. Valuable time can be wasted looking for training aids at the last minute.

Proper preparation before any segment will help the instructor minimize potential problems and increase their confidence level knowing they are prepared.

Reading Body Language

Reading body language is an art that takes time and practice to master. However, there are some basic signs that we can all recognize. When teaching classes later in the evening or after mealtime, it is fairly easy to recognize signs of fatigue such as eyes closing or heads nodding. This generally indicates that it is time for a break so the students can get up and move around. A less obvious sign would be students' eyes drifting around the classroom. This may be a sign of boredom and is a good indication that it is time to get that student engaged in the presentation. This can be done by asking them a question or redirecting their attention to a training aid.

Reading students' body language in the water is important since it applies to easing their nervousness. For example, relaxed students will swim along and observe their surroundings while nervous students may not let go of the low-pressure inflator or take their eyes off of their buddy. The instructor must immediately address a nervous student when he observes the signs. In this case, the instructor should gain the attention of the student by giving them the "OK" signal. If the student fails to respond, he should be brought to the surface where the instructor can make sure he is OK.

Additional signs of nervousness that may be observed in a student include constant fidgeting; an individual who is abnormally quiet or abnormally talkative; or unwarranted anxiety. The instructor should observe the students before, during, and after a dive and help students resolve any issues if they appear nervous or anxious.

Trust

A strong rapport is built on trust — the more trust there is in a relationship, the better the rapport will be. Students have a basic level of trust in their dive leader(s) or they would not have enrolled in the course. However, it is up to the dive professional to nurture and grow that trust. This can be done several ways and at different times. For instance, the dive professional can contact the student before the course begins to introduce himself, answer

any questions the student may have and describe the course progression. During the course, the dive professional should be friendly, helpful and approachable.The professional must follow through with requests made of him, and above all — treat every student with respect. Once a good rapport is established, the student will likely come back to take additional courses as well as recommend the dive professional and dive facility to their friends and family.

Effective communication is not an innate human trait. It must be learned, practiced and carefully applied. All of these considerations require that the dive professional do a self-assessment and review their own performance prior to conducting a course. It is very important that the OWSDI looks and feels professional and prepares appropriately so that trust is established with the students.

Lesson Preparation

Up to this point, a great deal of information from learning theory to presentation considerations has been covered. In this section, it all comes together. Here we will discuss how to prepare for classroom and water sessions as well as how to deal with and avoid potential issues that may arise in each. We will start in the classroom.

Classroom

It is very important to understand how to effectively use and prepare for an academic or classroom session. The academic session, although traditionally conducted in a "classroom", can be done at the dive site. In fact, for continuing education or refresher courses this may be an ideal setting. Whichever setting is used, proper preparation is required for each.

First, make sure all supplies needed for the course are easily accessible. The best thing to do is prepare a list of what is needed for every class. This list may include a computer, digital projector, and whiteboard with markers, instructor materials and visual aids. Make sure all electrical equipment is working properly and ensure there are extra materials for students — such as pencils, answer sheets or course materials. Ensure the classroom or area is clean, organized and presentable to the students. Pick up any trash or clutter that may be lying around. Remove any training aids that were used in previous courses. Make sure the lights are on and if there is a video of the underwater world available, make sure it is running and the volume is set at a moderate level.

When preparing to conduct the academic session at the dive site, ensure there is a shaded or covered area so the divers can get out of the sun or rain. The same general supplies will be needed; the only additional item that may be needed is some form of ground cover such as a tarp or blanket. The advantage of covering the academics onsite is that the students can apply what was discussed immediately.

A lesson plan should be prepared that includes all the subjects that will be covered as well as the estimated time to cover each subject.

When planning a class session, be sure to include breaks every so often. If the session is in the morning, the lectures can go a little longer. However, if the session is in the evening, it is better to include frequent short breaks. While a lesson plan outlines all the topics that will be covered, an academic presentation form like the one below helps present each topic individually. The academic presentation form brings together all the elements that were previously discussed in the Teaching Theory and Methods section.

The academic session of a course is the time to cover subjects in detail and answer all of the questions the students may have. This is the students' learning phase and it is the instructor's responsibility to ensure they are learning and understanding all that is presented.

At the end of the academic session a brief explanation should be given of what to expect during the next academic session or what the students can expect at the pool/confined water or open water session. Be sure to provide details such as time, address, directions, where to park and what to do once they arrive.

Sample SDI Academic Presentation Form:

Academic Presentation
18 Elm Street, Topsham, Maine 04086
Phone: (207) 729-4201 Fax: (207) 729-4453

Topic: "Today we're going to talk about all of the pieces scuba equipment we will need to dive with"

Introduction: (Put your Name and Cert # SDI – xx, on the white board) – let students introduce themselves)

Time for presentation itself, Hours: 1 **Minutes:** 00

Attention getting step: "How many times have you been in the water and had to hold your breath to dive underwater and wish you could stay for awhile instead of coming right back up?" Today we are going to talk the equipment that will allow us to go below the surface and bring our air supply with us so we can stay for awhile.

Objective: By the end of this lesson you will be able to identify two different sizes of scuba cylinders, the parts of a regulator and the required inspections a scuba cylinder must undergo.

Value: "By knowing this information you will be able to select the appropriate scuba system that will meet your needs"

Importance: "Because we all have different interests in diving we all must make the decision as to which scuba equipment will best fit those needs."

Outline: "Each one of you has s a complete scuba system in front of them. As we talk about each component be sure to thoroughly look at it and hold it. Be sure to interrupt me at any time during the presentation if you have a question."

Key Points: Regulator, Cylinder, BCD, Gauges

Presentation Body:
(NOTE: For the purposes of this sample form, this presentation body is bullet points that prompt a subject to be covered, these bullet points should follow the flow of a presentation or handouts)

Regulator
- Components- First and second stages
- Types- Balanced and unbalance, piston diaphragm
- Purpose

Cylinders
- Materials- steel aluminum
- Sizes- Standard sizes 80, 63
- Valves- DIN, K
- Inspections- visual, hydrostatic

BCD
- Components-Inflation/deflation, pockets, cylinder bands
- Use- Descents, ascents, neutral buoyancy

Gauges
- Submersible Pressure Gauge (SPG) monitor air
- Depth Gauge- monitor depth
- Personal Dive Computer (PDC)

Academic Presentation
18 Elm Street, Topsham, Maine 04086
Phone: (207) 729-4201 Fax: (207) 729-4453

Summary:

Review Key Points: "Areas discussed were: scuba equipment, regulator, cylinders, BCD and gauge)"

Restate Importance: "It is important you understand what to look for when buying your scuba equipment. By knowing this information you will be able to select the equipment that will best meet your needs".

Challenge:
How many stages does a regulator have?
Does anyone remember what materials cylinders are made from?
What is the difference between a diaphragm and a piston regulator?
Who can name two standard sizes of scuba cylinders?
Can anyone describe what a BCD is used for?

Any questions?

Knowledge quest review:
(Review to 100% comprehension.)

ADVANCED CLASSES
"I will be starting a class on equipment specialist the first of next month if anyone is interested."

END SESSION
"In our next session we will be covering how to use the scuba equipment underwater."

Be Friendly And Professional?

Pool/Confined Water

The pool or confined water session of the course is the time when students are exposed to and practice skills in a controlled environment. Unlike the academic session, the "practical" session is more about doing and less about lecture.

One of the biggest considerations when preparing for the pool/confined water session is the site. What site will be used? Will there be lifeguards or other surface support? If using a pool, is the pool reserved and what section of the pool will be needed, shallow or deep? Just as was done for the academic session, a list of supplies should be created. The confined water list should include: weights, extra cylinders, extra scuba equipment, first aid supplies, oxygen kit and dive flag if using a confined water site that is exposed to open water. Be sure to bring along any training aids that may be needed such as objects to photograph when teaching a photo or video course and floating hoops for the buoyancy course.

When the students arrive at the pool/confined water site a briefing should be conducted that covers emergency procedures, a review of the knowledge and skills that will be covered during the session and finally, what hand signals will be used. The in-water presentation form can be completed and used by the instructor along with the cue cards.
Sample SDI In-Water Presentation Form:

In Water Presentation

18 Elm Street, Topsham, Maine 04086
Phone: (207) 729-4201 Fax: (207) 729-4453

Introductions (Your Name, Your Divemaster's Name – Dive Teams)

Time for presentation itself, Hours: 1 Minutes: 30

1. Do a Surface Demonstration (to illustrate the skill(s)
2. Review Signs (for example: "OK", "Go Down", "Your turn to do the skill", "Stop", "Re-do", "Surface", "I Have a Problem", "Equalize Ear Problem")
3. Go down together == Students on their knees == Get an "OK" sign from each student == Watch Me Demo!
4. Demonstrate the Skill(s) == Remember, Slow and Exaggerated.
5. Evaluate each student performing the skill(s) == Get an OK from the student == Shake Their Hand
6. Surface With Students
7. Re-state the Skill(s) == Discuss Problems and Solutions == Praise and Critique == Challenge
8. Thank the Divemaster

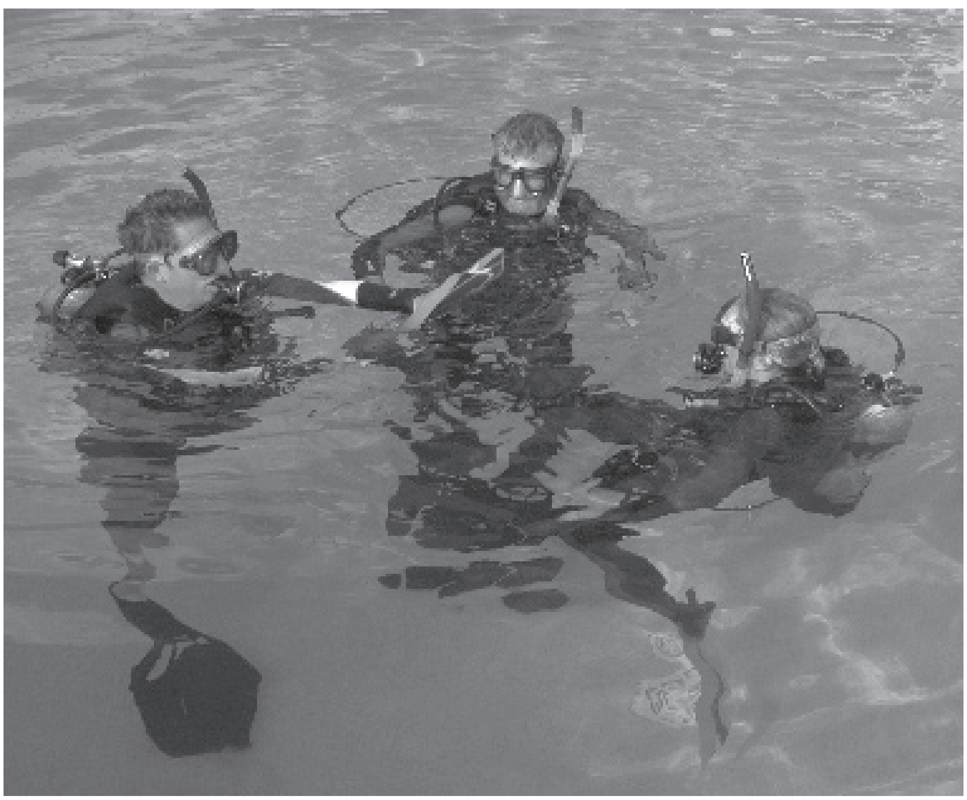
#	Skill	Value / Importance / Objective / Outline / Key-points
1	Scuba Assembly	**Value:** Be able to assemble their own equipment **Importance:** know the steps when assembling their equipment **Objective:** Assemble equipment in proper order **Outline:** Assemble the complete scuba unit and make sure it is working properly **Key-points:** Scuba unit assembled in proper order and working
2	Breathing from scuba unit	**Value:** To how to breathe from scuba **Importance:** able to breathe and not hold their breath while using scuba **Objective:** properly breathe form scuba unit **Outline:** low deep breaths exhale fully **Key-points:** breathe normally don't hold breath
3	Cleaning Regulator	**Value:** Able to clear a second stage when water enters **Importance:** Must be able to clear water before taking a breath **Objective:** able to clear regulator by two different methods **Outline:** describe proper breathing and clearing methods of the second stage **Key-points:** take a breath, remove second stage, exhale blow small bubbles replace second stage and clear by blowing or purging
4	Recovering Regulator	**Value:** Able to locate and recover the second stage to be able to breathe **Importance:** Know how to recover your second stage **Objective:** to locate second stage, clear and continue to breathe from second stage **Outline:** Perform the sweeping and reaching methods for regulator recovery **Key-points:** Indentify two methods of recovering second stage regulator. List important steps in recovering regulator

Re-State: "Very good job, everybody did a great job assembling the scube unit and breathing from the regulator with nice slow easy breaths. You experienced what it would feel like if the second stage was removed from your mouth and it filled with water. And you were able to not only clear the second stage but you were able to recover the second stage and clear it. You found out how to control your exhalation so you had enough air to clear the regulator evne though you were exhaling while the second stage was out of your mouth. Any questions?"

Challenge: What must you do while the second stage is out of your mouth? Describe two methods to clear the second stage regulator. Describe two methods of recovering the second stage regulator.

By using the in-water presentation form and the cue cards the instructor should not overlook anything. The primary purpose of the pool/confined water session is to get the students in the water so they can apply what they have learned. This provides the instructor an opportunity to assess comfort level and retention of knowledge. The key here is to maximize the time in the water.

Skills must be briefed and demonstrated by the instructor so that the students have a clear understanding of what is expected. After every skill performance an evaluation should be conducted explaining how well the student did or correcting any poor skill performances. If a correction is needed, try to start and end the evaluation of students with a positive element, putting the negative or correction in the middle.



The pool/confined water session should be wrapped up with what can be expected in the next confined water session or what to expect during the open water session.

Open Water

Preparing for the open water session is similar to that of the pool/confined water. The biggest difference is that open water is used for final assessment. This is where the students get to demonstrate what they have learned and apply their skills in a "real world" environment.

If this is the first time that the students are getting into the water (since not all specialties require a confined or pool session) start them off slowly and in a shallow area if possible. By taking it slow, the instructor gets a chance to familiarize themselves with the students' abilities prior to getting into deep water.

Some areas that differ from confined or pool sites and should be noted are: tides, currents and boat traffic. When conducting the open water dives it is also good to have an assistant to help with control and any equipment issues that may arise.

Training Materials

Now that the various portions of how to prepare for the course have been covered, it's time to discuss what materials the students have the option to use and how to use those materials effectively. In this section traditional materials (printed manuals) and online training (also known as blended learning) will be discussed.

Traditional Training Materials

In the early days of diving, the instructor had to directly convey information to the students since there were no training materials available. Generally, instructors taught diving the same way they had been taught, which in many cases was the "military way." The challenge for the instructors was to make the training enjoyable.

As years passed, various scuba training agencies were formed and with them, their own brand of training materials. Initially, the training material supported what the instructor was teaching. However, over time training material was standardized, and it became the instructor who supported the training material. In essence, the traditional method consists of the student reviewing the academic material prior to practical training with the instructor. As we have come to find, this method has been successful and has established a proven track record.

With the SDI System, the student first reads the manual and completes the knowledge quest answers. In addition they watch the CD or DVD. By using these materials the student is exposed to the information several times before they attend class. The repetition this system provides helps the student to retain the information.

During the class, the instructor reviews what the students have previously read and watched and increases the intensity by interjecting personal experiences. Additionally, he has the opportunity to begin teaching the students hand signals and to build a rapport with them.

As stated above, the student completes the knowledge quest booklet prior to the academic session. The instructor and students review the questions together to ensure the students have 100 percent comprehension of the information each question is testing. Following the review, the instructor collects the students' booklets and they become part of the students' training record. While this traditional method has been used successfully for many years, an alternate option is online learning.

Online Training

Though the name "online training" implies that the course is completed solely online, a better name for this style of learning is blended learning. Online training simply replaces a "hard copy" student manual. And, just like students taking a traditional class, online students must complete required sections prior to attending class.

To start, students log into the TDI/SDI website (tdisdi.com) or SDI Online Training website (www.sdi-onlinetraining.com), set up their personal profile and begin their academics. This method is very convenient for students who have Internet access.

During the sign up process the student must designate a facility with which they will be completing their training. After the student has set up their profile, the store they have designated will be notified. One of the major differences between traditional and online instruction is that the instructor can monitor the online student's progress in real time. This gives the instructor or dive center the chance to send emails noting the student's good work, send dive center news letters or inform them of when the next classroom or pool session will be.

As students progress through the online program, they read sections of information and complete a short quiz at the end of the sections. The students must have a one hundred (100) percent understanding of the information tested in each quiz. In the event they do not score one hundred (100) percent, the system prompts them to reread the section and retake the quiz. Quiz questions are taken from a large question pool and change each time the student retakes the quiz. Students who take the online course read, watch videos and have portions of the academics narrated to them, which utilizes more senses then reading alone, making for an better academically prepared student.

Once the students have completed the online academics, they are prompted to print out a detailed report to give to the instructor as verification that they have completed the online training.

Note: Within the United States anyone under the age of thirteen (13) cannot complete the online training due to federal law.

After students complete the online academics, they schedule a time to go to the dive center and meet with an instructor. The SDI OWSDI now has an opportunity to meet the student face to face, get to know them, show them around the dive center and introduce them to the staff. The instructor has the opportunity to review the detailed report and answer any questions the student has, and ensure the student understands the subject. As stated previously, even though the SDI Online Training is set up to ensure 100 percent remediation, it is still important that the instructor ensures the student is comfortable with the subject matter.

Both the traditional and online learning have unique benefits; however, both accomplish the same goal — to educate the student about scuba. It is simply how each is used that makes the difference. Some students learn better by interacting with an instructor while others prefer to learn on their own and at their pace.

Course Planning

This section will cover overall preparation and planning for a course, including dive management and various diving activities as they pertain to proper procedures for the water portion of a course. The information in this section is broad in scope and can be applied to any course the SDI Instructor may be teaching.

Preparation, Planning and Control in Dive Management and Diving Activities

Preparing and planning for a course begins long before the students ever set foot in the dive center. There are a lot of aspects the dive professional has to consider and many of them need to be planned well in advance of teaching a course. Examples of these include ensuring the proper dive equipment is available and that it has been serviced; checking that all membership fees

and insurance premiums are paid; creating a course schedule for the next 12 months and being sure the pool/confined water and open water sites and boats will be available when needed. While it may seem premature to be thinking about these details, none of this is easy to deal with at the last minute. The SDI Dive Center will likely have established procedures and prepared many of these items; in fact, contracts may already be established for the pools or boats.

When planning the season's course schedule, a logical order should be followed. There should be a set of courses that flow through the season starting with the open water scuba diver course and ending with assistant instructor course. It is important that each year's schedule has professional level courses like assistant instructor because a critical part of dive management is proper support. At various points along the schedule there should be continuing education courses, rescue and non-training fun dives.

Fun dives that involve the customers and dive center staff are a great way to get to know customers and build a social network for the divers where they can find dive buddies and learn about opportunities to continue diving. During a diving event that is sponsored by the dive center there should be as many trained professionals on site as possible to serve as eyes, ears or dive buddies.

Proper support during diving activities is invaluable and a great risk management tool, even for the fun dives.

Assistant instructors and divemasters can be an extra set of eyes and quite commonly an extra set of ears. It is not uncommon for the students to confide in the assistant about their confusion or lack of understanding about subjects or skills. The assistant can then bring this information back to the instructor so the subject can be reviewed or the skill demonstrated again. Assistants are also invaluable when it comes to clerical or administrative tasks.

There is a lot of paperwork that goes into teaching a course and having an extra set of eyes to review that paperwork will ensure it is completed properly. If all the paperwork is completed and the students have been registered, this all adds up to great customer service and reduced liability.

Pool/Confined and Open Water Procedures

Planning for the in-water portion of a course is no easy task but there are some things that can be done to smooth that process. As discussed earlier, knowing that the pool, open water and boats are available is a big relief but alternative sites still need to be considered. One factor that cannot be controlled is the weather; because of weather, alternate sites need to be planned for and available. If there are no alternate sites then extra days need to be built into the course schedule.

When thinking of alternate sites, one must look beyond open water sites. Outdoor pools and confined water sites can also be affected by the weather. While it may be harder to find an alternate pool or confined water site, it is not impossible. When looking for an alternate site, think of normal weather patterns and the typical way a storm comes in. This will indicate which way the waves will hit the shoreline during both good and bad weather. Always have a backup plan ahead of time so that if something happens, a change of plan takes place and the course runs smoothly.

Another important matter to address is emergency procedures. When teaching from a boat or at a pool, much of the required emergency equipment should already be available: phone or radio, oxygen kit, AED and trained personnel. However, when teaching at a remote site, each of these needs to be considered and addressed. Have an emergency management plan prepared for each dive location. This plan should include local emergency contact details, evacuation plan, and location of nearest medical facility. An onsite first aid kit and an oxygen kit should be available. If the dive site does not have cell phone coverage then the nearest phone needs to be located. Each site's emergency management plan needs to be in writing and communicated to all support staff.

The final item to consider is whether the site is appropriate for the course that will be taught. When teaching a Marine Eco System course a site with the widest range of marine life is the best choice. And when planning a boat specialty, remember to plan it for a date and/or season when a boat will be available.

All that is left are the last minute details, which are inevitable but manageable if all the larger details have been worked out. Remember, a successful dive professional follows the six P's — Proper Prior Planning Prevents Poor Performance.

If all foreseeable logistics have been thought out and planned for, courses will run smoothly and the students will have an enjoyable experience.

Using Assistants While Teaching Courses

Using an assistant while teaching courses can be a huge time saver and reduce the normal stress levels of running a course. During the classroom portion of the training the SDI Assistant Instructor can conduct the Knowledge Quest review under the guidance of an active OWSDI. The assistant is also a second set of eyes to look over all the paperwork the OWSDI will need to review. The assistant can check that all forms are signed and initialed, verify that knowledge quest review sheets are turned in and ensure that medical history forms have been completed.

During the pool/confined water and open water portions of the training the SDI Assistant Instructor lends an extra set of eyes and ears that can watch and listen for worrisome situations that may occur and help eliminate those situations before they can cause problems.

Either in the pool/confined water or during the dives, the assistant can watch the rest of the group while the OWSDI works one-on-one with a student. The SDI Assistant Instructor can also lead dives 3 and 4 during the open water dives under the indirect supervision of the instructor, so long as the SDI OWSDI has evaluated and approved all of the skills and the students are proficient with them prior to the start of dives 3 and 4.

The assistant instructor cannot evaluate any skill required for certification either above or below the surface of the water whether in the pool/confined water or during the open water dives.

How an assistant handles a problem either above or below water will largely depend on whether or not the OWSDI is present. Prior to the dive, the assistant and the OWSDI should discuss how to handle the various situations that could occur. Just as it is for the divers, it is very important for the assistant and the instructor to establish a clear set of hand signals. These hand signals should include an emergency signal that would indicate the divers need to surface or that the OWSDI will be surfacing with a diver and the assistant should bring all the other divers to the surface in a controlled manner.

Using assistants during courses is also a great way to train them. An assistant under the watchful eye of an OWSDI can learn a lot and be exposed to students in "real world" situations. An assistant that has worked with various instructors learns different styles of teaching and different problem solving methods. This will smooth their transition into higher levels of professional training.

The more an assistant and OWSDI work together the more they will know what to expect of each other should a situation arise. A good assistant is invaluable to an instructor.

While it is difficult to establish a procedure to handle every situation that may occur, it is recommended that each facility try to establish a standard procedure for the most common scenarios. For this reason, it is highly recommended that facilities conduct an annual dive professional training session prior to the diving season.

Summary

This section covered everything from the basics of learning, and the phases of teaching to lesson preparation and course planning. Various methods of communication and the potential pitfalls to be aware of when delivering a presentation were discussed. Armed with this and the remainder of the information that was covered in the chapter, the SDI OWSDI should be able to successfully create and deliver a well-rounded presentation. In fact, after reading this chapter, one could say that the goal is to increase the 'intensity' by applying what has been learned from this chapter in a practical, hands-on setting, thus increasing learning retention.

Review Questions

1. When a person learns, there is a __________________ in their behavior.

☐ **A.** Permanent Change

☐ **B.** Observable Change

☐ **C.** Both A and B

☐ **D.** Neither A or B

2. Each student learns differently.

☐ True ☐ False

3. Factors that affect learning may include:

☐ **A.** Readiness and Exercise

☐ **B.** Intensity and Effect

☐ **C.** Primacy

☐ **D.** All of the Above

4. Teaching adults and children is the same.

☐ True ☐ False

5. The reason one course may be remembered by students over another is probably the__________________ the instructor showed during the course.

☐ **A.** Lack of Being Prepared

☐ **B.** Intensity

☐ **C.** Color of the Classroom

☐ **D.** All of the Above

6. _________________ is a fancy word for do it right the first time.

- ☐ **A.** Exercise
- ☐ **B.** Intensity
- ☐ **C.** Primacy
- ☐ **D.** None of the Above

7. Teaching occurs in _________________ .

- ☐ **A.** Phases
- ☐ **B.** Semesters
- ☐ **C.** Cycles
- ☐ **D.** The Fall

8. Phases of Teaching may include:

- ☐ **A.** Assessment
- ☐ **B.** Evaluation
- ☐ **C.** Presentation
- ☐ **D.** All of the Above

9. The _________________ Phase is where the student applies what they have learned.

- ☐ **A.** Application
- ☐ **B.** Second
- ☐ **C.** Evaluation
- ☐ **D.** Primacy

10. During the Evaluation Phase, ___________ can be either written or oral.

- ☐ **A.** Reports
- ☐ **B.** Applications
- ☐ **C.** Examinations
- ☐ **D.** All of the Above

11. _________________ inform the student what they should know by the end of the presentation.

- ☐ **A.** Manual
- ☐ **B.** Objectives
- ☐ **C.** DVD
- ☐ **D.** None of the Above

12. Phases of Learning as they relate to Instructional Theory may include:

- ☐ **A.** Motivation
- ☐ **B.** Reinforcement
- ☐ **C.** Response
- ☐ **D.** All of the Above

13. A presenter can gain the attention of the class by changing the _________________ of their voice during the presentation.

- ☐ **A.** Accent
- ☐ **B.** Tone
- ☐ **C.** Volume
- ☐ **D.** All of the Above

14. The _________________ form helps the OWSDI organize and formalize their classroom presentation.

- ☐ **A.** Academic Presentation
- ☐ **B.** Confined / Open Water Presentation
- ☐ **C.** Cue Cards
- ☐ **D.** None of the Above

15. Many students learn visually, therefore ________________ help the students learn by seeing.

- ☐ **A.** Visual Training Aids
- ☐ **B.** Looking Out the Window
- ☐ **C.** Drawing the Subject
- ☐ **D.** All of the Above

16. When planning to use an open water site it is always a good idea to have a (an) ____________ site planned in case the weather does not cooperate.

- ☐ **A.** Secluded
- ☐ **B.** Alternate
- ☐ **C.** Single
- ☐ **D.** None of the Above

17. The OWSDI can teach the SDI Open Water Scuba Diver academic sessions.

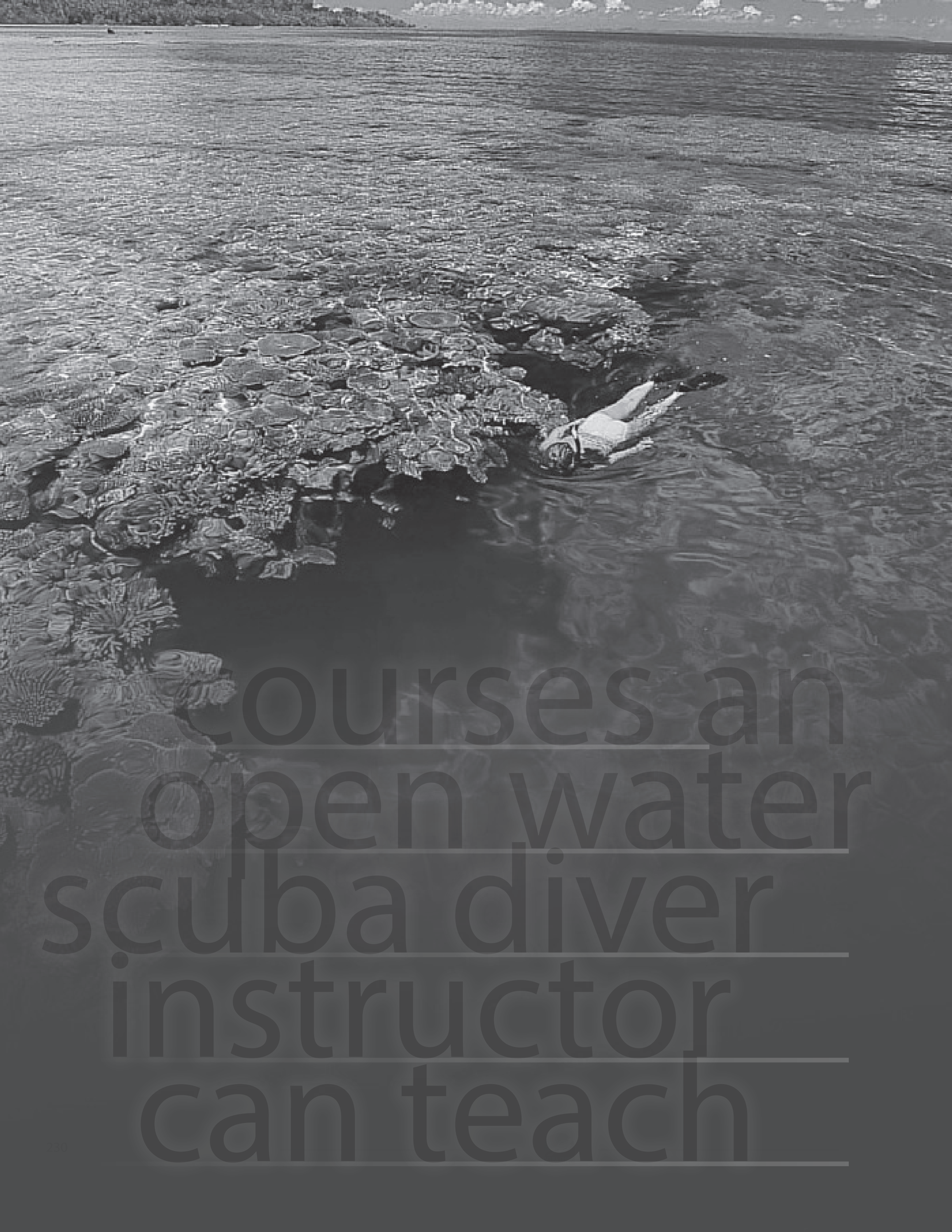
☐ True ☐ False

chapter 6

Courses an Open Water Scuba Diver Instructor Can Teach

courses an open water scuba diver instructor can teach

Courses an Open Water Scuba Diver Instructor Can Teach



courses an open water scuba diver instructor can teach

Introduction

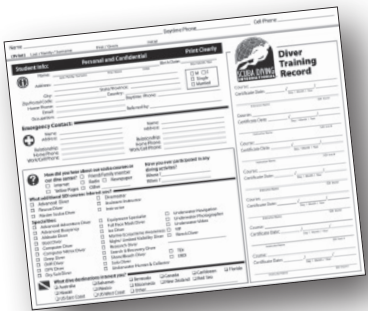
From the entry level open water scuba diver course through the dive professional training including the divemaster and assistant instructor program the SDI Open Water Scuba Diver Instructor is qualified to teach them all. In Chapter 6 all programs an SDI OWSDI is qualified to teach will be discussed. Let's start with the open water scuba diver program.

SDI Open Water Scuba Diver Program

The underwater adventure begins when an individual enrolls in the SDI Open Water Scuba Diver program. This course informs the new diver about the underwater environment, diving equipment and basic diving physics and physiology. During the pool /confined water portion of their training they will learn basic diving skills, how to use scuba diving equipment, as well as self- and buddy-aid techniques. When the student is comfortable and confident with their skills, they move on to a series of open water dives under the supervision of an instructor, in which the instructor conducts a final evaluation of their skills. Upon successful completion of the open water dives, candidates become certified SDI Open Water Scuba Divers and are "licensed" to dive with their buddy anywhere in the world without the supervision of a dive leader.

The open water scuba diver course academics can be completed online or via a standard student kit. Depending on how the course is structured the student may need to complete the entire online academic course or read the entire student manual and complete the knowledge quest before they attend their first skill development session.

Other support materials for the SDI Open Water Scuba Diver program include a knowledge quest, CD or DVD, PowerPoint® and instructor guide. The OWSDI guide is located in the appendix of this manual. The SDI Instructor Trainer will review this guide in detail during the SDI OWSDI course.

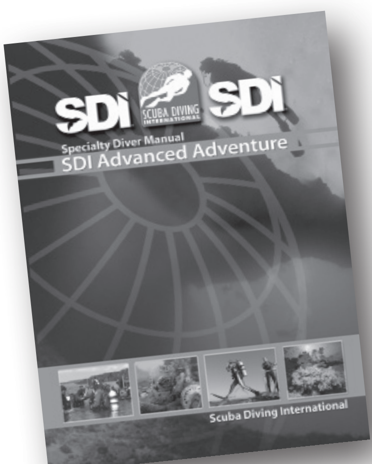


The paperwork required for the OWSD program includes the SDI Student Training Folder. This folder contains the personal information, liability waiver and medical questionnaire. Should a student be under the age of eighteen (18) they must have written approval from a parent or legal guardian.

The instructor should refer to the current SDI Open Water Scuba Diver standards for a complete and up-to-date listing of requirements.

Many divers are excited, and want to learn more after they complete their open water scuba diver course. To quench that desire, SDI Open Water Scuba Diver Instructors have many options to offer them, starting with the SDI Advanced Adventure Diver program.

SDI Advanced Adventure Diver Specialty



Because SDI's Advanced Diver level requires 25 logged dives and the completion of four (4) specialties, SDI developed the Advanced Adventure program to compete with other agencies advanced diver level programs. The Advanced Adventure program requires five (5) specialty dives. Two (2) programs, navigation and deep diving, are the core-required dives. The other three (3) elective specialties can be selected from a group of specialties included in the student manual. Teaching this program is similar to teaching any specialty with the exception that each topic should only be an overview of the applicable specialty. By covering the basic academics and conducting the required skills associated with the first dive of the chosen specialty, students can get a better understanding of what to expect should they choose to complete the full specialty course. One (1) dive from each of the specialties may be applied towards the full specialty certification.

The support materials for this program include the student manual, instructor guide and a PowerPoint® presentation. Normal SDI paperwork including the waiver and medical release are required and must be retained in the student training folder.

Upon completion of the program the diver receives an SDI Advanced Adventure card. If the diver wishes to continue on and receive their SDI Advanced Open Water Scuba Diver rating they can receive credit for one (1) specialty towards the four (4) required for the Advanced Open Water Scuba Diver rating.

Teaching Speciality Courses

Divers who wish to take specialties or the rescue diver course are obviously interested in continuing their diving education. Initially, they may only be interested in a specific specialty; however, while taking the specialty course, they may quickly learn the value and benefit of completing additional specialty training.

During the assistant instructor program the SDI Specialties that an SDI Assistant Instructor can teach were discussed. In contrast to the limited number of specialties the assistant instructor can teach, an SDI OWSDI can become qualified to teach any and all of the specialties that SDI offers. In fact, if there is a specialty SDI does not offer, SDI Instructors have the option to submit a unique specialty outline for approval.

There are several specialties within the SDI system that an SDI OWSDI may become qualified to teach. These specialties include:

- Advanced Buoyancy
- Altitude
- Boat
- Computer
- Computer Nitrox
- Deep
- Diver Propulsion Vehicle (DPV)
- Drift
- Dry Suit
- Equipment Specialist
- Full Face Mask
- Ice Diver
- Marine Ecosystems Awareness
- Night and Low Visibility
- Research
- Search and Recovery
- Shore/Beach Diver
- Underwater Hunter and Collector
- Underwater Navigation
- Underwater Photographer
- Underwater Video
- Wreck
- Solo Diver
- Visual Inspection Procedure (VIP)
- SDI/TDI CPROX Administrator
- SDI/TDI CPROX1st Administrator
- SDI/TDI CPROX1stAED Administrator

SDI Instructors have several options available in order to become qualified to teach these specialties.

OPTION ONE — Complete the specialty class with an SDI Instructor Trainer for that specialty and purchase the appropriate instructor materials. During the course, the instructor trainer will review: all of the materials available for the specialty; how to use those materials; how to conduct a typical specialty course; and what paperwork must be completed during a specialty program. The specialty instructor candidate must provide proof of 10 logged dives in the specialty area. By choosing this option the instructor has the opportunity to learn some of the tricks of the trade from someone who has taught the specialty.

OPTION TWO— This option is available for instructors who have a vast amount of experience in a specialty and do not wish to complete a specialty instructor program with an SDI Instructor Trainer. To qualify, the specialty instructor candidate must: provide documentation of experience; purchase the appropriate instructor materials; and provide proof of 25 logged dives in the specialty area.

OPTION THREE — This option allows the Instructor the latitude to design and write a "Unique Specialty." In other words, create a specialty that SDI does not have on the current list of approved specialties. In order to do this, the specialty instructor candidate must: provide documentation of 25 logged dives in the specialty; and write and submit a complete outline defining the academic information to be covered and all in-water skill training to be completed in pool/confined water and / or open water. Unique specialties are commonly submitted to address local diving practices or needs.

Regardless of which option the instructor uses they must complete an SDI Specialty Instructor Upgrade form for each specialty they want to apply for and submit it along with the appropriate fees to SDI Headquarters or their local regional office.

When teaching an SDI specialty program the instructor must use all support materials for the specialties that have materials available. The materials used to teach a specialty may include: a student manual, knowledge quest, instructor guide and a PowerPoint® presentation. An on-line training option is also available for some of the SDI specialty courses. The student should review and complete all of the required materials before attending the class. This allows the instructor to focus more on the students' questions and practical application. In reality, however, students do not always follow through with this preparation, so it's recommended that the instructor plan time to review the academics the student has not completed.

Requirements for participation in specialties vary. SDI has compiled the following matrix to quickly the show the prerequisites, number of dives required and minimum age for the different specialties. This is only a quick reference matrix; for more detailed requirements please see the course specific standards.

Specialty Overview Matrix

	Specialty Name	Min. Age	No. Req. Dives	Student/ Instructor Ratio in Open Water	Pre-req. Certification/ requirements	Certification Card must be issued by SDI
1	Advanced Adventure	*	5	8 or lower*	Open Water	Yes
2	Advanced Buoyancy Control	10	2	8	Open Water	Yes
3	Altitude Diver	10	2	8	Open Water	Yes
4	Boat Diver	10	2	8	Open Water	Yes
5	Computer Diver	10	2	8	Open Water	Yes
6	Computer Nitrox Diver (22-40%)	10	None	n/a	Open Water**	Yes
7	Deep Diver	15	2	4	Open Water	Yes
8	Diver Propulsion Vehicle Diver	15	2	2	Open Water	Yes
9	Drift Diver	10	2	8	Open Water	Yes
10	Dry Suit Diver	15	2	4	Open Water	Yes
11	Equipment Specialist Diver	10	None	n/a	n/a	Yes
12	Full Face Mask Diver	15	2	8	Open Water	Yes
13	Ice Diver	18	2	2	Open Water	Yes
14	Marine Ecosystems Awareness Diver	10	2	8	Open Water	Yes
15	Night/Limited Visibility Diver	10	2	4	Open Water	Yes
16	Research Diver	15	2	8	Open Water	Yes
17	Search and Recovery Diver	15	2	8	Open Water	Yes
18	Shore/Beach Diver	10	2	8	Open Water	Yes
19	U/W Hunter and Collector Diver	10	2	8	Open Water	Yes
20	U/W Navigation Diver	10	2	8	Open Water	Yes
21	U/W Photographer Diver	10	2	8	Open Water	Yes
22	U/W Video Diver	10	2	8	Open Water	Yes
23a	Wreck Diver - No penetration	10	2	8	Open Water	Yes
23b	Wreck Diver - Limited penetration	15	3	8-2***	Deep Diver•	Yes
24	Solo Diver	21	2	8	AOW & 100 Dives	Yes
25	Visual Inspection Procedure (VIP)	18	None	n/a	n/a	Yes
26	SDI/TDI CPROX Administrator	10	None	n/a	n/a	Yes
27	SDI/TDI CPR1st Administrator	10	None	n/a	n/a	Yes
28	SDI/TDI CPROX1st AED Administrator	10	None	n/a	n/a	Yes

* See chosen specialties ** Open Water or enrollment in Open Water diver course *** During penetration • if >60ft

The most current standards for specialties can be found on-line in the member's section of tdisdi.com or in the SDI Standards and Procedures Manual. These standards provide information such as student to instructor ratios, depth limits for dives and minimum age for participation in the various specialties.

As with any SDI program, there is required paperwork that must be completed for specialty training. The required paperwork consists of the SDI training folder, a waiver/release, a medical questionnaire and a parental liability release if the student is younger than 18 years of age.

The instructor can structure the specialty several different ways:

- A thorough academic review can be conducted followed by a pool session and the open water dives.

- The academic session can be designed as a review instead of in-depth lecture.

- If the specialty does not require a pool/confined water session, the open water dives can follow immediately after the academic session.

- The academic review can be conducted as a review at the open water site followed immediately by the open water dives. This option can be very beneficial to the student as it provides a more casual learning environment and allows them to apply what was just learned.

There are a few specialties that may benefit from a pool/confined water session. These include the dry suit, photography and video specialties. Even if the specialty does not require a pool/confined water session the instructor has the flexibility to conduct a pool/confined water session as a skill refresher. Students who have successfully completed the course should be rewarded with their certification card and diploma.

To process a specialty card, the instructor must register the student either on-line or by sending the appropriate paperwork to SDI Headquarters or the appropriate Regional Office. However, many facilities have the option to print certification cards in the store.

In order to promote specialties, everyone within the store should know when specialties are offered and have some information about them. Most specialties should be promoted during the SDI Open Water Scuba Diver course. Specialty courses should be cross promoted in conjunction with other specialty courses. A calendar indicating the dates and times of every scheduled specialty should be readily available to all staff members affiliated with a dive center. That way, everyone can promote all specialties. Remember, one of the responsibilities of every staff member is to recognize the interests of the customers and educate them on the services available to them at the dive center including courses. This will be covered in more detail in the Successfully Selling Scuba section of this manual.

A complete calendar for six months, or better yet a year, listing all specialties is a great way to inform all possible students when they can plan on signing up for and taking that specialty program they're interested in. Also, it's important to remember that most specialties can be taught in conjunction with either local diving or exotic trips.

Specialty training not only improves a diver's skills and knowledge, but also keeps them involved with diving. It gives the instructor a variety of classes he can teach so he will not get tired of teaching the same class all of the time. Additionally, specialty classes usually don't take as much time to teach, so instructors have the opportunity to make more money per hour teaching a specialty.

Just as it's recommended for divers to continue their dive education, dive leaders are encouraged to do the same. Dive leaders who actively participate in specialty or technical training set a good example for others and are more likely to pass their enthusiasm for the sport on to their students.

SDI Rescue Diver Course

As previously stated an SDI Open Water Scuba Diver Instructor is qualified to teach several core programs without being required to take additional training beyond that of the instructor course. The SDI Open Water Scuba Diver course, the Advanced Adventure Diver, Rescue Diver, Divemaster and Assistant Instructor make up the core programs. Each program is fun, interesting and challenging to teach. The SDI Open Water Scuba Diver program introduces the new diver to the underwater world. The Advanced Adventure diver course allows them to try several specialties to better decide which area(s) of diving they may wish to explore. The Rescue Diver program will provide the student insight into how to become more self-sufficient and recognize and address problem situations before a rescue is required. Should a rescue be required, the course will train them for that as well.

During the open water scuba diver course some basic self-help and buddy aid skills were introduced to the students. The rescue diver program will expand on what to look for in oneself and one's buddy to help eliminate a potential accident from occurring. Students will learn how to handle an accident should it occur and what steps should be undertaken to properly attend to a diving accident victim.

No matter what area(s) of diving interest a student has they should all be encouraged to complete the SDI Rescue Diver program when they are eligible.

Often students have stated that the SDI Rescue Diver program was one of the most demanding yet enjoyable courses they have taken.

The SDI Rescue Diver course is a prerequisite for the SDI Master Diver (non-leadership) level as well as the SDI Divemaster (entry level leadership) level. To begin the SDI Rescue Diver Course the student must be a minimum of 18 years of age (15 with parental approval) and either an advanced diver or an open water scuba diver with a minimum of 40 logged dives. Additionally, the rescue student must have documentation of current CPR and first aid training. Student materials for the rescue diver course include a student manual, knowledge quest manual and the diver's slates. Instructor materials consist of the instructor guide, resource CD and rescue scenario slates. The suggested hours for the rescue course are twelve (12), with a recommended minimum of eight (8) in the open water.

As with most SDI courses, the waiver / release and medical questionnaire must be completed prior to starting the course. Students under the age of eighteen (18) must have parent or legal guardian approval prior to beginning the course. Once the course is completed all paperwork must be retained in the student's SDI Student Record Folder. If this is the first course an individual has taken through the facility, a new training record folder should be completed and used for the course.

Similar to other SDI programs, the student completes the student manual and knowledge quest prior to the academic session, during which the instructor reviews the materials and answers any questions the students may have. Pool/confined water is not required but it may help to streamline the open water sessions. During the in-water training portion of the rescue course the student is introduced to buddy aid and assistance skills. They practice these skills until they are proficient in them. During the final portion of the rescue program, students are exposed to various scenarios for which they must make the appropriate decisions on handing and executing a thorough rescue. The SDI Rescue Instructor Guide and Rescue Instructor Resource CD are great resources for information about how to structure the course.

After the students have completed the rescue diver training they should be presented with a SDI Rescue Diver certification card and diploma. The card can be requested through the normal channels from SDI Headquarters or the local Regional Office.

The rescue course helps build not only the student's skills, but also helps build confidence by demonstrating to them that they have the ability to handle a rescue. As the diver continues down the path of their diving career, their rescue training will help them be more aware of potential rescue situations and be able to handle and hopefully eliminate rescue situations.

Up to this point the diver level programs an SDI OWSDI is qualified to teach have been discussed. The next levels an OWSDI is qualified to teach are the dive professional levels including SDI Divemaster and SDI Assistant Instructor. It is recommended the SDI OWSDI gain knowledge and experience teaching the diver levels before they begin teaching dive professionals. With that in mind, the SDI OWSDI needs to ensure that his knowledge and skill levels are the highest possible quality before he passes the knowledge on to or demonstrates skills to professional level candidates as discussed in the next section.

Teaching Dive Professionals

One may think that teaching dive professionals is like teaching any other course, which to some extent is true. However, there is a lot more preparation for the dive professional programs and the instructor must employ a different mindset when presenting dive professional level information. The SDI Open Water Scuba Diver Instructor must change their information delivery from simply teaching a new skill to a diver, to teaching a dive leader how to teach and supervise divers. In this section the difference between teaching divers and dive professionals will be discussed as well as how to prepare for a professional level course, and what added liability comes with training dive professionals.

Divers vs. Dive Professionals

When teaching a diver level course, the instructor's primary goals are to convey the information and skills to the students so they can be proficient at a given level of certification. This is accomplished through academics, in-water practice and a final in-water evaluation. The end result is that the diver has comprehended the information they learned and should be able

to execute the skills long after the completion of the course. This is also true when teaching dive professionals; however, the candidates must be able to execute skills and display teaching abilities once certified.

Dive professionals must meet established prerequisites prior to enrolling in a dive leader course. In fact, dive leader candidates should already have a firm understanding of basic diving theory and application. In the professional level course, they will be taught the "why" behind the theory and application. For example, SDI Divemaster candidates have been taught buddy- and self-rescue; however, in the SDI Divemaster course they must refine those techniques, and more importantly, learn how to anticipate a problem and address it before a rescue is needed.

Theory

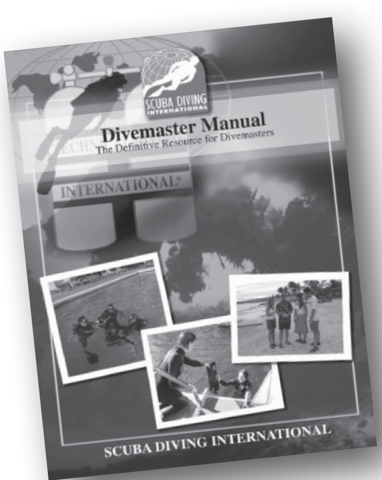
One of the largest differences when teaching a dive leader candidate versus a diver is the way the academic knowledge is presented. Dive professionals must have a more in–depth understanding so they are able to answer questions asked by student divers. This is not to say that dive professionals are expected to have all the answers, but they should know where to find answers to questions that they cannot immediately answer. A dive professional must know how to convey information to student divers so as not to overwhelm them with too much information. Also, the level of information given by the dive professional should be appropriate for the level of the student diver.

For example, an open water diver asks an assistant:
"How would I plan a dive to 40m/130ft?"

A good response from the assistant might be:
"There are several points to consider when planning dives to those depths. I would suggest taking the SDI Deep Diver specialty which will provide you with a better understanding of how to safely and properly plan and complete a dive to that depth."

Even though the divemaster or assistant instructor may be perfectly capable of answering this question, they need to remember that this dive plan is beyond the certification level of the open water diver.

Divemasters and assistant instructors must understand what their primary responsibilities are when assisting an instructor with a course. These responsibilities may include ensuring that students' forms and training records have been properly completed and preparing the classroom and training aids. When a dive professional candidate has an understanding of how to convey their knowledge and how to assist with courses, it is time to teach them how to supervise dives and handle emergency situations.



Supervising Dives

Once a diver has met the prerequisites and made the decision to enroll in a dive leader course, it is likely that they have already assisted in a course or at least observed supervised divers. As such, the diver should have a general idea of what is involved with managing and supervising other divers. To build on this general understanding, the instructor should review with the candidates how to deliver dive briefings and how to monitor and supervise other divers.

When presenting dive briefings, the dive leader should discuss dive site information (water temperature, visibility, etc); pertinent safety information; the expected dive profile and what the divers may see during the dive. Additional information regarding dive briefings can be found in the SDI Divemaster and Assistant Instructor Manuals and their corresponding instructor guides.

Supervision of divers from the surface is a three-step process:

1. Checking the dive teams into the water. During the checkout, the dive leader should verify that the dive teams have all the necessary equipment; that they have air and the valve is open; and that they have conducted their pre-entry buddy check.

2. Monitoring the site from the surface. While the dive is in progress the dive leader should keep an eye out for lost or panicked divers and assist divers should they surface unexpectedly.

3. Checking the dive teams back in. During the check-in, the dive leader should welcome the divers back; log their time out of the water, their depth and dive time; and check them back in on the dive-team roster.

Every dive professional must understand that it is their job to balance diver safety while at the same time making dives fun. However, dives do not always go as planned — accidents may happen, and it is the dive professional's responsibility to properly manage such situations should they occur.

Emergency Situations

A major portion of a dive professional's responsibilities includes anticipating potential problems and addressing them before they happen. Early signs of diver nervousness, which include constant chatter, abnormal silence or the inability to complete a simple task, should normally trigger a seasoned professional to approach the diver and ask if there is anything they can do to help. Conversely, someone who has never been responsible for supervising divers may not be looking for these early signs. As such, it is important to discuss with the candidates how to recognize the early signs of stress and potential ways to address them. A good method is to have the candidates observe divers at a local dive site. The group should be discreet during this exercise and try not to draw attention to themselves as this may create additional stress for the divers they are observing. The candidates should observe the individuals preparing to dive and assess their demeanor. Do the divers appear nervous and if so, what are the indicators? As a follow up to their assessment, the candidates should explain how they, as the dive leader, would handle the situation.

Another method the candidates can utilize to practice recognizing stress and potential problems would be to allow them to observe an actual course. Since they are not yet certified dive leaders, they must act solely as observers. During the course, the candidates should observe the students and take notes. This information can then be discussed at a later time.

It is almost inevitable that, at some point over their professional career, a dive leader will have to rescue a diver. Of course, the extent of the actions they take during the rescue will vary from something as simple as calming a diver down while on the surface, to recovering an unconscious diver from depth. With that, it is important that a new dive leader be informed on how to address the wide range of possibilities they may encounter. During the rescue diver course they are taught to lend assistance to a diver in distress if it will not cause them harm. As a dive professional who is responsible for a diver they have an increased level of responsibility to lend assistance. The SDI Divemaster Manual examines many different emergency situations and is a great reference for the professional candidate.

Preparing to Teach a Professional Level Course

Teaching dive professionals requires thorough planning and follow through. Just like teaching a diver level course, there must be a schedule; the equipment and any visual aids must be ready to use; and the candidates must have their materials ahead of time so they can prepare. Before a candidate can assist with a class they must have covered and understand the applicable information. For example, as part of the assistant instructor course, a candidate is required to assist with the confined water portion of an open water scuba diver course. Before they can assist with this course, they must have already covered the academics, control techniques and what is expected of them as an assistant.

A prudent instructor will schedule dive leader and diver courses in a manner that will allow the dive leader to have already completed the required portions of their course in order to be able to assist with the diver courses.

As previously mentioned, the instructor's primary goal when teaching a diver level course is to convey the information and skills to the students so they can be proficient to a degree that warrants certification at a given level.. As such, the dive leader accepts liability for the training or supervision of the divers. However, the liability when training dive leaders is not as readily apparent.

Liability of Teaching Professionals

Just as the newly certified dive professional assumes added liability for training or supervising divers, so too does the instructor who certified them to do so. Very simply, instructors who train dive leaders assume not only the liability for the dive leader's training, but may assume some liability for any divers that dive leader may subsequently supervise or train. To help mitigate this liability the instructor must follow SDI Training Standards; use all available training materials, including liability release forms; and ensure 100% comprehension of subjects and skills by the dive professional candidate during their training. While this is clearly a very serious responsibility, it is quite easy to accomplish by following the guidelines and procedures as outlined in the SDI training and support materials. Procedures for obtaining these materials will be covered in the following sections.

SDI Products and Procedures

Every dive professional and dive center staff member plays an important role in the future of the dive center and the health of the scuba diving industry. While the primary interest of the dive professional may be educating and creating new divers, this by itself will not support the dive center or the industry as a whole. In order to maintain a healthy business all members of the staff must take part in selling equipment, promoting classes, encouraging customers to have their equipment serviced annually and promoting dive travel. If everybody contributes to each of these facets then everybody can also enjoy a prosperous and long career in the dive industry.

The dive professional, along with the dive center, will need to interact with International Training to purchase product for the courses they offer and to register divers from entry level through dive professional levels. Anytime the dive professional or dive center has recommendations for new products or programs their comments or suggestions are welcome at ITI. The following information will help the dive professional better understand the purchasing of product and registration of students with ITI. While most dive centers will purchase product and register divers, the dive professional may be called on at some point to perform these duties.

How to Purchase SDI Products

There are several ways to purchase product from Scuba Diving international, Technical Diving International and Emergency Response Diving International. Which of these methods is used is a matter of personal preference or convenience. While some may enjoy speaking with a person to get a better understanding of what they are ordering, others may like ordering the product online. ITI has allowed for both of these options.

REGIONAL SALES MANAGER — Dive centers and professional members should always feel free to contact their SDI Regional Sales Manager to place an order, ask them about on-going specials or simply discuss "what's new?" Regional sales managers are quick to pass that order on to the regional office and it will be shipped out as soon as possible. This is a great option if the business hours or time zone differs from that of the regional office the dive professional works through. It is also a good opportunity to just catch up or share ideas and observations of what is happening in the local market.

REGIONAL OFFICE — Contacting the SDI Regional Office directly is another way products can be ordered. With terrific customer service, an actual person who is happy to assist the customer will be reached on the other end of the line without going to voice mail or automated menus. If it's after hours, send the order form via fax and the order will be processed first thing the next working day.

ONLINE CATALOGUE — Go online, create an account, log on and shop! Facilities and professional members in the North American region may purchase materials at any time 24/7 – ITI is always open with the online catalogue. Facilities and professional members outside of the North American region should contact their regional office for more information. For each product there is a product description and a list of other support materials if available. Take time and browse for materials whenever your schedule permits and finalize the order when ready. This method is safe, private, quick and efficient.

Most products are available online.

Associate members and non-members may make purchases of certain items by visiting their local SDI-TDI-ERDI Dive Center, calling the regional office directly or in North America, by opening up an online account through the website. Because associate members and non-members are not professional divemasters, assistant instructors, instructors or instructor trainers (professional members) they are restricted to purchasing certain materials. Cool clothing, stickers and certain books are available to anyone, while manuals and other instructor materials are restricted for professional members only.

Please contact the SDI Regional Office or World Headquarters with any questions or comments, or to place an order — ITI staff will be happy to assist. A list of all SDI Regional Offices is available 24 hours a day, seven days a week online at tdisdi.com.

Registration Procedures

Once a student has successfully completed a course, the next step is to register the diver. Perhaps one of the most exciting moments — for the diver and the instructor alike - is when a diver is handed their certification card. For the diver, there is a sense of accomplishment and for the instructor there is the satisfaction of having passed on their knowledge and experience.

In order to maintain the professional image the instructor has established, and that of SDI/TDI/ERDI, it's important to register the student's record of course completion correctly and in a timely manner so the registration form can be processed quickly and the diver's credentials returned as soon as possible.

Diver registrations may be submitted via written form, pre-paid form or using the online registration system.

When completing a written Diver Registration form (found in the appendix section of the Standards and Procedures Manual) and pre-paid form, please keep the following in mind to avoid processing delays:

- Write legibly.
- Use the correct form for the course that was taught.
- Fill out the form completely.
- A separate form is required for each course that was taught.
- Sign forms where indicated.

To register a student online, simply log in to the members area of tdisdi.com and choose either "Have HQ Print" or "Print at Facility", which can be found under the heading "Student Registrations." The latter option (Print at Facility) is only available if your dive facility has a C-Card printer and is authorized by ITI Headquarters to print cards. With either choice, it's critical to follow the on-screen instructions to ensure proper processing.

It's important to follow the established guidelines to ensure processing is completed in a timely manner. ITI prides itself on customer service and timely turnaround on certification cards. Working together, a high level of customer service can be achieved.

As outlined above there are several times a dive professional may need to interact with ITI. Knowing the procedures and process will help streamline the transaction. Please don't hesitate to contact the local SDI Regional Sales Manager, Regional Office or ITI Headquarters if should any questions arise. They're there to help!

Before any training begins students have to be acquired. The instructor, along with every other dive professional affiliated with the dive center, has a responsibility to help the dive center acquire students to fill classes. Full classes equal active divers, which promote equipment sales and travel.

Summary

Chapter six has shown there are several opportunities for an instructor to gain experience applying what they have learned during their course and why it is important for the instructor to understand the entire process of scheduling, marketing and conducting a course.

Review Questions

1. The academic section for the SDI Open Water Scuba Diver course can be completed either online or by using a standards student kit.

   ☐ True ☐ False

2. If a student is under ____________________ years of age they must have written approval from a parent or legal guardian before participation in the open water scuba diver program.

   ☐ **A.** Ten (10)

   ☐ **B.** Twelve (12)

   ☐ **C.** Eighteen (18)

   ☐ **D.** Twenty one (21)

3. The_________________________ program was developed by SDI to compete with other agencies advanced programs.

   ☐ **A.** Advanced Open Water Diver

   ☐ **B.** Rescue Diver

   ☐ **C.** Advanced Adventure

   ☐ **D.** Deep Diving

4. Night diving and navigation are the two required core programs for the SDI Advanced Adventure program.

   ☐ True ☐ False

5. ___________________________ is written by an instructor for a specialty that SDI does not offer.

- ☐ **A.** Unique Specialty
- ☐ **B.** Rescue Diver
- ☐ **C.** Assistant Instructor program
- ☐ **D.** All of the above

6. An instructor can obtain a specialty instructor rating by:

- ☐ **A.** Attending a seminar conducted by a qualified SDI Instructor Trainer
- ☐ **B.** Completing an application with the appropriate amount of experience
- ☐ **C.** Both A and B
- ☐ **D.** Neither A or B

7. When qualifying to teach a unique specialty the instructor must provide proof of ______________________ logged dives in that specialty:

- ☐ **A.** Ten (10)
- ☐ **B.** Fifteen (15)
- ☐ **C.** Twenty Five (25)
- ☐ **D.** Fifty (50)

8. In order to attend a specialty instructor seminar an SDI Open Water Scuba Diver Instructor must provide proof of ___________________ logged dives in that specialty.

- ☐ **A.** Five (5)
- ☐ **B.** Ten (10)
- ☐ **C.** Fifteen (15)
- ☐ **D.** Twenty (20)

9. The SDI Rescue Diver course is a prerequisite for the _____________ level.

- ☐ **A.** Master Diver
- ☐ **B.** Divemaster
- ☐ **C.** Open Water Scuba Diver
- ☐ **D.** Both A and B

10. The minimum age to participate in the SDI Rescue Diver program with parental approval is:

- ☐ **A.** Ten (10)
- ☐ **B.** Twelve (12)
- ☐ **C.** Fifteen (15)
- ☐ **D.** Seventeen (17)

11. One major difference between teaching divers and dive professionals is how the academic information is presented.

☐ True ☐ False

12. A major part of a dive professional's role in either teaching or supervising divers is ______________________ .

- ☐ **A.** Planning lunch
- ☐ **B.** Recognizing potential problems
- ☐ **C.** Assigning buddy teams by color of hair
- ☐ **D.** All of the Above

13. To help mitigate liability the instructor should:

- ☐ **A.** Follow SDI Standards.
- ☐ **B.** Use all available training materials including formss.
- ☐ **C.** Ensure 100% comprehension of the materials by the student.
- ☐ **D.** All of the Above

14. There are several ways to purchase products form SDI. They may include:

- ☐ **A.** Regional Managers
- ☐ **B.** Regional Offices
- ☐ **C.** Online Catalogue
- ☐ **D.** All of the Above

15. Diver registrations may be completed by:

- ☐ **A.** Written Form
- ☐ **B.** Prepaid Form
- ☐ **C.** Online Registration
- ☐ **D.** All of the Above

chapter 7

The Business Side of Diving

The Business Side of Diving

The Dive Professional's Role

The Impact of Diving Education

Recruiting New Divers

Diver Retention

The Dive Professional's Role in Sales

Creating and Maintaining an Inviting Center of Activity

Expanding Beyond the Open Water Scuba Diver Instructor

Review Questions

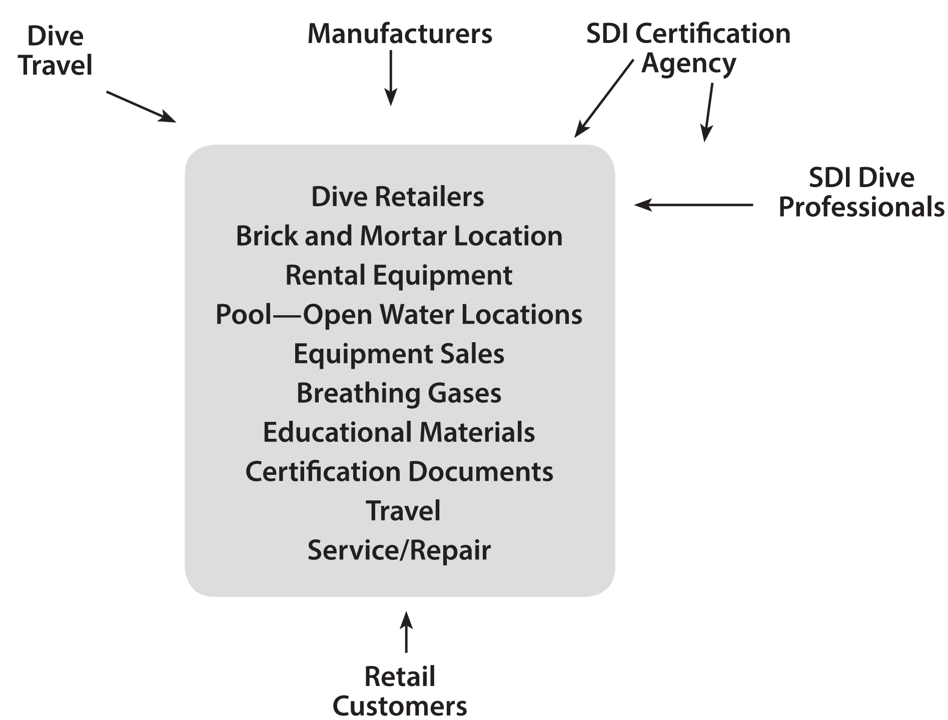
the business side of diving

The Dive Professional's Role

After the Assistant Instructor rating the next step in a dive professional's career is becoming an SDI Open Water Scuba Diver Instructor (OWSDI). The OWSDI must have an understanding of the scuba industry, the business of diving, and what role they play within it.

At the hub of the scuba industry is the retail dive center. The retail dive center is the central location for certification agencies, scuba manufacturers, dive travel agencies and dive professionals to connect with the customers. Without dive centers, all industry players including dive resorts and charter boats would suffer. In such a scenario, the customer would have to connect the dots themselves, which is an arduous task and pales in comparison to other "one-stop" recreational shopping outlets consumers have come to embrace. The bottom line is that the majority of the diving industry revolves around the dive retailer.

Here's an illustration of how the process of providing diving services and products comes together.



As this diagram illustrates, the dive retailer is the hub for the majority of scuba diving services and activities. While it's clear that dive retailers are a central location for related products and services, it's important to remember that they support the most basic services a diver requires including cylinder maintenance and gas fills, rental equipment availability and organized diving opportunities. The key element in this system is the SDI Dive Professional, as it's their responsibility to ensure the customer understands that the SDI Dive Retailer is their all-encompassing resource for everything related to scuba diving. As such, it's important that the customer feels welcome at, and with, their local SDI Dive Retailer.

The Impact of Diving Education

There are two ways for divers to learn new skills and expand their knowledge.

The first is the "learn as you go" method, also known to some as "the school of hard knocks." Through this approach, divers learn by way of first-hand experience with no previous knowledge or formal education regarding the task. This approach tends to be high-anxiety and often leads to accidents and high dropout rates. While this approach works for a select group of individuals, it's not recommended for most.

The second and more acceptable approach is to undergo some form of formal training in which the student gains knowledge and experience under the guidance of an experienced and trained dive professional who is well versed in the type of diving the student wishes to learn. While some divers may experience some anxiety participating in this approach, it will likely be far less because they are under the supervision of a professional. As such, the diver(s) will be more comfortable and have more confidence in their knowledge and ability. This increases diver retention, supports sales and travel and encourages divers to keep diving with their local SDI Dive Retailer.


SDI Open Water Scuba Course
Dive Planning

Most new divers today enter the sport by way of the formal training approach; however, many divers attempt to continue their education and gain additional skills by learning as they go. This is not an ideal situation for the diver since it can be intimidating or in some cases dangerous, and again, leads to an increase in diver dropout.

This is why it's important that the SDI Dive Retailer has continuing education readily available for divers of all levels. Remember, a comfortable confident diver will continue with the sport and remain loyal to their SDI Dive Retailer and Dive Professional. In addition, a continuing education program is an excellent source of revenue for an OWSDI and dive retailer. For these reasons, it's vital that the SDI Open Water Scuba Diver Instructor be well versed in promoting and explaining the continuing education opportunities available at their SDI Dive Retailer.

Developing a continuing education program is not a complicated task. It only takes a few simple steps and vigilance. A staff member or a team of members at the SDI Dive Center should be responsible for coordinating the program. Elements of a successful program that must be carefully planned well in advance (at least six months) include:

- Course Name and Description
- Course Prerequisites
- Required Equipment
- Cost/Fees

- Dates, Times and Locations of Pool/Confined Water and Open Water Sessions
- Primary Instructor, Assistant Instructor and Alternates
- Certification(s) Earned

Dive leaders should consistently refer back to these learning opportunities when teaching other courses, especially during the open water scuba diver course. This sets the stage in the students' minds as to where, when and how to get involved in continuing education.

There are several ways to promote continuing education courses when teaching other programs:

- When talking about navigation, night diving, boat diving and other types of specialty diving, let the students know that the dive store has courses such as these available, and that the dive center staff is ready to answer questions about specialty courses as well as help them when they are ready to enroll in one or more of the courses.
- During the open water scuba diver course, students should be consistently encouraged to further their education and become advanced divers.
- Note which specialty courses a student shows interest in. On the front of the SDI Diver Training folder a student can indicate which specialties they may be interested in. After the first meeting, review this information and then during the open water diver academics presentations use examples of the specialties the students have expressed interest in. Always come from the attitude that students 'will" take a class. Use "when" and "during" instead of "if" when referring to continuing education classes. For example, "During the dry suit class you will find that you are able to stay warm longer and not suffer from the cold after you exit from the dive like you do when you are diving in a wetsuit."
- A staff member should follow up with the student after the course to let them know when the course(s) they're interested in are scheduled, and answer any questions the student may have.

It's a good idea to talk to other instructors who actively conduct specialty courses. They may have some great tips to share, and be able to help you put together a successful continuing education program based on their experiences.

Finally, remember that most new divers want to continue their education with a dive professional they know, trust and have built a bond with. If the student had fun while learning in the open water scuba diver course — or any other course - that student is much more likely to enroll in a specialty course that will be taught by the same dive professional. While this is a major part of being a successful dive professional, one must be able to recruit new students as well.

Recruiting New Divers

Successful businesses are very good at two things. First, they know how to attract new customers. Second, they know how to keep the customers they have. Keeping customers is as simple as offering them the products and services they need in a friendly and convenient manner, as was covered earlier. However, in order to recruit new customers, a business must start by informing potential customers about their products and services and why these are the best solutions to fit their customer's needs. It is here that the dive professional has awesome potential.

Scuba diving is more than a sport. It is a passion. Every diver, and more importantly every dive professional knows the pure emotion that scuba diving elicits. It is this emotion that the dive professional can and should use to gain the attention of potential new divers. When a dive professional transfers this emotion onto their students, they then become the dive professional's best recruitment tool because they, too, are now excited and want to share it.

Over the years industry surveys have shown that most individuals take a diving certification course because of word of mouth referral. Properly trained divers are the best recruiting tool and should be utilized to their fullest potential. Many businesses worry about where to spend their advertising dollars. If they would simply invest in a great customer service process the word of mouth advertising would reap benefits over and over.

The amount and type of referrals the dive professional and the dive store receive will be based on the students' perception of their complete scuba experiences. If the individual has a good experience, they are more likely to refer others. Conversely, marketing experts tell us if an individual has a bad experience they will tell at least ten other people about that bad experience, and those people will tell others. Therefore, the key to gaining the most from word of mouth referrals is ensuring that the customers have a great experience and that they have a vehicle by which they can refer others.

Develop a system to gather referral information from customers and students. The information should include the referral contact's name, address, phone number, e-mail and relationship to the customer. A professional looking and feeling form or card with these fields will do the trick. Address this as part of the debriefing following a successful and fun pool/confined water session. Ask the students if they know anyone who might be interested in becoming a diver, or a non-certified person they would like to have as a dive buddy. Make sure to get the student's approval to contact that person. The information gathered should be entered into the dive center's database for future follow up.

The first contact should be made by phone. The staff member making the call should introduce himself and explain why he is calling. The referral candidate should be told who referred them and why they were chosen (dive buddy - someone they travel with – a significant other). Additionally, the caller should answer any questions, invite the potential student to come into the store, and ask if it's okay to send them information from time to time. Most importantly, the caller should respect the referral's wishes.

If the referral candidate does not want more information, or to take the call, the caller should thank them and leave them be.

However, if the referral candidate agrees to receive more information, the dive center should immediately follow up. Timely follow-through is critical and is the only opportunity for a good first impression. The follow-up should include a hand written thank you note in addition to the requested information. Whether it is an invitation for a free personal orientation or a free introduction to scuba, it's always a good idea to include some type of an incentive for the referral candidate to visit the dive center in person. The dive center staff should also create an incentive for divers who provide referrals and an additional "thank you" incentive if referral candidates sign up for a class.

Dive professionals should always bear in mind that every person they come in contact with daily is a potential new diver. Your co-workers, parents at a children's sporting activity, or someone you meet in line at the store could be your next student. Or, they may be a certified diver who want to provide a referral. Ideas for recruiting new potential divers are limited only by one's imagination, so put that imagination to work.

In addition to word of mouth, there are countless other ways to attract new students. A few ideas include:

BUSINESS CARDS — One side of the business card has the dive center's contact information and the dive professional's name. On the other side is an offer for a free introduction to scuba: "Simply bring this card into the store to make an appointment for a FREE try scuba."

TRY SCUBA "TOKENS" — Find a source that can custom print on wooden nickels or generic casino chips or tokens. Again, one side of the "token" has the dive center's logo and contact information and on the other side is an offer for a free introduction to scuba: "Simply bring this token into the store to make an appointment for a FREE try scuba." The custom business cards and tokens are great tools to have when talking to individuals. When the subject of scuba diving comes up, hand them a business card or a token to try scuba for FREE.

TRAVEL AGENCIES — Build a relationship with one or several travel agencies and together design an incentive package for the travel agencies to refer new divers to the dive center. For example, travel agencies sell a lot of cruises. Offer the travel agency a coupon to give their customers for a free snorkel session.

FREE SCUBA CLASSES — Offer free scuba classes to travel agents, radio and TV personalities, and other individuals who reach large audiences. It's vital that these individuals have the best time of their life. Otherwise, they won't promote the dive center, or worse will tell people to avoid it.

Attracting new customers is an ever-changing art form and successful businesses know that they must employ a wide range of customer acquisition tactics to continue to be successful. However, successful businesses also know that retaining the customers they have is equally important.

Diver Retention

Simply put, the word retention means "the continued possession, use or control" of something. Therefore, "diver retention" refers to a diver's loyal (continued) patronization of a dive center. High diver retention usually goes hand-in-hand with good customer service and leads to an increase in word of mouth referrals. However, in order to keep diver retention at high levels, dive centers and professionals must be able to offer their current customers what they want including dive travel opportunities, new equipment, equipment service, and most important to the dive professional — additional training.

It is the dive professional's responsibility to nurture the diver's need for additional training. Remember, comfortable and confident divers generally have a good rapport with dive professionals who have previously trained them. Divers listen to their dive leaders and trust what they say. This trust comes through a bond that has been established between the diver and their instructor. This bond takes some time to establish and it does not come easy. To establish this bond the instructor has to gain the respect of the students by being open and honest with them. The instructor must be available before and after class to answer the students' questions individually. Never lead them astray. Additionally, the dive professional has a responsibility to relate the importance of owning properly maintained equipment, and obtaining the proper training for its use.

With this in mind, how does a dive professional influence a diver's retention and keep them an active diver? While there are many specific answers to this question the first step is to listen to what they want or need. Then the dive professional should keep the fire ignited in divers by consistently showing them that they and the dive center are ready and willing to address those needs and desires so they can advance their hobby or turn it into a potential career. Diving is as much about social activities as it is about diving activities, so a dive professional needs to help divers stay involved in both.

Individuals want to be a part of something that is fun, where they meet other individuals who share their interests. Here are a few examples of how to keep divers involved in diving:

- **Promote Local Diving Opportunities:** Plan and conduct group diving events in the surrounding area. Diving is done all over the world, but too often diving is only associated with clear blue water in a tropical location. Of course, most of the population does not live in such locations, so it is imperative to promote the diving that can be done right down the road from a diver's home. In fact, some of the best diving can be had in one's local area.

- **Pool Parties:** Pool parties are an excellent way for divers to try out new equipment, practice skills, and just get in the water during the winter months.

- **Dive Travel:** Promote trips to different diving destinations. A number of dive travel companies exist within the industry such as Scuba Travel International; contact one to find out how to get involved. Prior to a trip, hold a presentation about the location, the local nightlife, the weather, what to pack, marine life commonly encountered, etc.

- **Post Trip Party:** After a dive trip or a weekend of local diving, schedule a social at the dive center. Divers love to talk about their experiences and show pictures and video from the diving they did. In fact, the dive center may choose to create a special DVD or slide show highlighting the experience.

- **Observation:** Invite divers to come to the local dive site when instructors are conducting training. Note: While these divers cannot be involved in any of the training, they can assist with equipment and dive on their own.

- **Holiday Party:** Schedule a holiday party for the customers of the dive store. Halloween costume parties and New Year's events are popular and offer an escape from tradition.

- **Be Creative:** The opportunities to keep customers coming back are limitless. Remember, the goal is to keep customers involved with the dive center so that when they are ready to buy new equipment or enroll in a course, there's no question as to who they will buy from.

It is the dive professional's responsibility to make divers feel like they are part of the dive center. But remember, it's not only diving that will keep divers interested in the sport, but also the social side of meeting new people and enjoying everything the sport has to offer.

Social activities that revolve around diving keep the "diving bug" deeply imbedded in the customer's mind, but it also serves a secondary purpose. If customers are thinking about diving, they are likely visualizing themselves diving, which is an outstanding opportunity to subtly introduce them to the new equipment the dive center has to offer. After all, they may as well be visualizing themselves in the latest and greatest equipment available.

The Dive Professional's Role in Sales

Many dive professionals prefer to consider themselves educators rather than sales people. This is true; SDI Dive Professionals are educators, plain and simple. The fact is that good scuba educators don't need to be the stereotypical "sales person" as their demeanor and delivery of information conveys the importance of owning and maintaining scuba equipment. This "No Sales" approach is simple to implement, and should come naturally for SDI Dive Professionals if they themselves believe it. In this sense, the SDI Dive Professional is simply practicing what they preach.

In the eyes of the student, the SDI Dive Professional is the expert and the person they trust. The student depends on the dive professional to teach them about what equipment and skills are necessary to be a comfortable, confident scuba diver.

The words the dive professional uses and the equipment they wear in class makes a lasting impression on the students. In fact, many students will buy the exact same equipment the instructor is wearing simply because the student believes, and rightly so, that the instructor wears what he thinks is best. For this reason, it is vital that all dive professionals use only the equipment that the dive center sells when training divers under the auspices of that dive center.

However, during academic presentations, some dive professionals may still feel uncomfortable with "sales." That is okay! In this situation, let students know that the dive center has an individual who is an expert at identifying a diver's equipment needs. During the first equipment familiarization session, the dive professional should invite one of the dive center's equipment experts to the session to deliver a brief but coordinated presentation. Throughout the course, the dive professional should "create the need" for a diver to own their equipment by clearly explaining the benefits of ownership. Explain that divers who own their equipment will dive more often because they are comfortable. Reinforce that it's a good idea for the students to make an appointment or otherwise get advice from a dive center equipment expert on what equipment may best fit their unique needs. This approach creates two experts, one who teaches diving and one who knows and sells equipment.

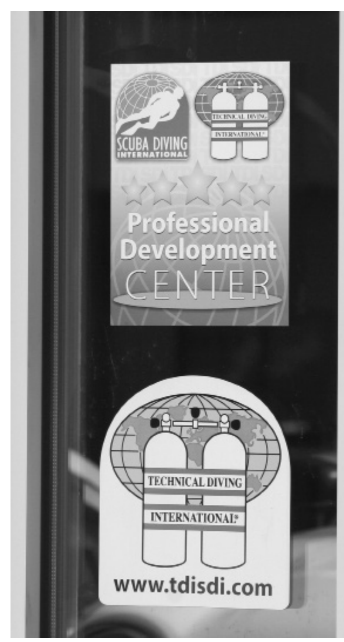
An SDI Dive Professional may be expert at many things, but no single person is an expert at everything. It's okay to refer students to another person who is an expert in another field such as equipment sales, and doing so simply reinforces the mantra of an SDI Dive Center — that the SDI Dive Center is the customers' all-encompassing resource for everything related to scuba diving: an inviting and comfortable "center of activity."

Creating and Maintaining an Inviting Center of Activity

A dive center only has one opportunity to make a great first impression on a potential customer or student. That first impression is imprinted when the customer walks into the dive center. The second impression, while not as indelible as the first, is as important and is made when they are greeted. Obviously, every staff member should take responsibility for doing whatever it takes to help make each and every customer's first and second impressions as good as possible.

It's recommended that one or more dive center staff meetings are devoted to discussing what should be done to help mold customers' first and second impressions so that they are lasting, consistent, and above all good. Some topics to discuss include:

- What do other businesses do to help create a good impression?
- What do other businesses do that creates a poor impression?
- What are appropriate and inviting greetings? What should be avoided?
- What do other businesses do to create a welcoming atmosphere? What are turn-offs?



Through this discussion, it should be easy to identify things that work and those that do not, as well as what's appropriate and what isn't. However, this effort will be fruitless without follow through. Dive center staff and dive professionals must do everything they can to implement new ideas and constantly seek ways to improve.

Here are a few things to consider when making the dive center atmosphere more inviting to customers:

Create a daily checklist that should be completed before the dive center opens:

- Clean the glass front door.
- Clean up the parking area.
- Clean the store, especially sales counters and areas a customer can see or will be exposed to.
- Clean the dressing and bathrooms. Make sure there are toilet and hand paper, and if it needs to be replaced frequently, check it often.
- Clean the floors.
- Check and fix displays.
- Check and fix lighting. Make sure showroom and displays are well lit.
- Additional items as they apply to the dive center's configuration.

Create inviting areas of activity within the dive center:

- Have a TV with underwater activities playing.
- Create a CLEAN and SECURE area for children to play.
- Have a travel center with travel brochures and posted dates of upcoming trips.
- Have a training center with training materials and posted dates of upcoming courses. Have available a printed brochure of all the courses being conducted in the next six to twelve months.

Ensure the staff appears and acts consistently:

- Every staff member should be in a dive center "uniform" and wear a name tag.
- Use a comfortable and brief greeting for in-store and phone customers.

The important thing to remember is that the dive center should be inviting to the customer and provide easy access to the equipment and information they seek.

If a customer has a pleasant experience, they will not only come back but may also bring family members, friends and co-workers with them — other potential customers with whom the dive center only has one opportunity to make a great first impression.

Expanding Beyond the Open Water Scuba Diver Instructor

Becoming and working as an SDI Open Water Scuba Diver Instructor is just one option in the huge array of opportunities available in the dive industry, some of which include part time or full time employment as an instructor, equipment sales expert or repair technician. There are also opportunities to work for various equipment manufacturers, destination resorts, charter boats, exotic dive centers and training agencies. If a career in the diving industry is of interest there are logical steps to follow.

- Do the necessary homework and research in order to find what opportunities are available.
- Find out what training, skills and tools are required for the job.
- Research where the needed training, skills and tools can be obtained.
- Identify the cost of acquiring the training, skills and tools.
- Develop a step-by-step plan that includes a time line to completion, a budget and the milestones along the way in order to reach the end goal.

As you've seen, an SDI Open Water Scuba Diver Instructor has many important roles; however, it's every industry professional's responsibility to properly promote our sport to others who show interest in the underwater world. We believe that you understand this commitment, and thank you for choosing International Training and SDI as your certification agency of choice and good luck.

Review Questions

1. The ____________________ is the central location for certification agencies, scuba manufacturers, dive travel agencies and instructors to connect with the customer.

- ☐ **A.** Dive Center
- ☐ **B.** Instructor
- ☐ **C.** Pool / Confined Water Location
- ☐ **D.** None of the Above

2. Participating in Continuing Education courses is ____________________ for certified divers that want to learn new diving skills and information.

- ☐ **A.** The Only Way to Learn
- ☐ **B.** The Hardest Way to Learn
- ☐ **C.** Recommended
- ☐ **D.** None of the Above

3. Students want to continue their education with a dive professional they ____________________ .

- ☐ **A.** Know and Trust
- ☐ **B.** Have Never Met
- ☐ **C.** Meet at a Resort
- ☐ **D.** None of the Above

4. ____________________ is a/are potential customer acquisition tools.

- ☐ **A.** Custom Business Cards
- ☐ **B.** Try Scuba Tokens
- ☐ **C.** Incentive Packages
- ☐ **D.** All of the Above

5. If a student has a good experience during training they are more likely to ___________________ that dive center to their family and friends for scuba training.

- ☐ **A.** Recommend
- ☐ **B.** Not recommend
- ☐ **C.** Complain About
- ☐ **D.** None of the Above

6. Timely follow-through is ______________ and is often the only opportunity for a good first impression:

- ☐ **A.** Critical
- ☐ **B.** A Myth
- ☐ **C.** Subjective
- ☐ **D.** None of the Above

7. High diver retention usually goes hand-in-hand with good customer service and leads to an ________________ in word of mouth referrals.

☐ **A.** Increase

☐ **B.** Decrease

☐ **C.** Stabilization

☐ **D.** All of the Above

8. During the first equipment familiarization session, the dive professional should invite one of the dive center's ____________________ to the session to deliver a brief but coordinated presentation.

☐ **A.** Equipment Experts

☐ **B.** Trip Coordinators

☐ **C.** Managers

☐ **D.** None of the Above

9. A dive center only has one opportunity to make a great ___________________ on a potential customer or student.

☐ **A.** First Impression

☐ **B.** Second Impression

☐ **C.** Third Impression

Any Questions?

Appendix

Appendix

About The Open Water Scuba Diver Course

The Scuba Diving International Open Water Scuba Diver Course provides the appropriate training for the entry-level recreational diver.

The SDI Open Water Scuba Diver course is the beginning of a new adventure and gives participants the ability to explore the underwater world. It is here that an individual learns about the equipment needed to dive, how the underwater world affects the human body, how to perform basic scuba skills as well as self aid and basic buddy aid skills. Completion of this program is not intended to be the end of training for scuba divers but a starting point. During this program the student will come to appreciate the value and benefit of diving with quality equipment and continuing their scuba training by taking specialty training.

About This Instructor Guide

The material within this instructor guide addresses the required academic pool / confined and open water material for the SDI Open Water Scuba Diver program. It follows the flow of information as it is presented in the student manual; however, for easy reference, the material is presented here in an outline format precisely matching that information as it is detailed in the PowerPoint® presentations.

This instructor guide is also built on the pretence that the open water scuba diver student has completed all the required pre-course work and is ready to begin their training.

Naturally, this information may be supplemented by the instructor based upon past experience combined with local customs and the local diving environment.

Using the OWSDI Cue Cards and the SDI Student Skills Checklist Slate

SDI Open Water Scuba Diver Instructors should use the confined and open water five (5) slate series, referred to in this manual as 'Instructor Cue Cards,' as references for the skills to be taught or reviewed in each water session. This instructor guide indicates which cue card the instructor should use at the beginning of each water session outline.

An additional slate that can be used is the SDI Student Skills Checklist Slate. This slate is an excellent tool for courses that have multiple instructors. It can also be used by assistants to keep track of which students have completed which skills, so that the instructor can focus on the demonstration and final evaluation of the skill itself.

Additional Training Activities

In addition to the academic material addressed in the student manual and this instructor guide, the SDI Open Water Scuba Diver Course includes required training activities in pool / confined water and open water. Accordingly, the reader is directed to the current SDI Standards for additional information regarding the requirements for the SDI Open Water Scuba Diver certification.

Appendix A
Open Water Scuba Diver Academic Presentation Outlines

Welcome and Course Orientation

Paperwork

Student Training Record

- Personal Information
- Liability Release
- Medical Statement

Let's Get to Know Each Other

Professional Staff

Participants

- Your name?
- Do you have any diving experience?
- Why are you interested in becoming a diver?
- Have you thought about which diving activities may interest you?

About International Training

SDI: Scuba Diving International®
TDI: Technical Diving International®
ERDI: Emergency Response Diving International®

About This Program

Course Objective

- Develop the appropriate knowledge and skills that every SDI Open Water Scuba Diver must master so that they may dive in the open water without supervision.

Subject Areas

- The Underwater Environment
- Physics and Physiology
- Scuba Equipment
- Skills Development
- Planning Your Dive

Structure and Schedule

- Independent Study
- Classroom Presentations
- Confined Water Training
- Open Water Training

Required Equipment

- Items you'll need for this course

Note to Instructor: Prepare a complete list for discussion, including those items specified by SDI standards, as well as any other items locally required.

Any Questions?

Open Water Scuba Diver Academic Presentation Quick Reference Outline

The following outlines are a quick reference of the topics that should be covered in each academic session. For a more detailed version please refer to the complete Presentation Outlines following this section.

Depending on the time allotment, the chapters can be combined into single session presentations. While the chapters in this outline have been combined into three presentations, they are only suggested combinations and can be adjusted based on the needs of the instructor or the specific course structure.

The estimated time for each presentation is approximately 4 hours. This time is generalized and will vary based on the size of the class and the amount of student interaction.

Presentation One

Chapter 1: The Underwater Environment

- History
- Scuba Diving International
- Adapting to the Underwater world
    - Vision
    - Light
    - Sound
    - Heat Loss
- Oceanography
    - Tides
    - Current
    - Waves
    - Surge
    - Marine Life
    - Marine Life Injuries

Chapter 2: Physics and Physiology

- Physics and Physiology Overview
- Buoyancy
    - Positive Buoyancy
    - Neutral Buoyancy
    - Negative Buoyancy
- Pressure
    - Boyles' Law and Increasing Pressure
    - Available Cylinder Time
- Physiology
    - Air Spaces
    - Squeeze
    - Equalization Techniques
    - Mask Squeeze
    - Tooth Squeeze
    - Reverse Block
- Boyle's Law and Decreasing Pressure
    - Lung Over-expansion Injuries
- Breathing Air Under Pressure
    - Density
    - Nitrogen
    - Decompression Sickness
        - Signs and Symptoms of Decompression Sickness
        - Decompression Illness
    - Nitrogen Narcosis
    - Oxygen Toxicity
    - Carbon Monoxide Poisoning
    - Mixed Gases

Presentation Two

Chapter 3: Scuba Equipment

- Personal (Snorkeling) Equipment
  - Mask
  - Snorkel
  - Fins
- Exposure Protection
  - Body Suit (Skin)
  - Wet Suit
  - Dry Suit
  - Boots and Gloves
  - Hoods
- Scuba Equipment
  - Buoyancy Compensator Device (BCD)
  - Regulator
    - First Stage
    - Second Stage
- Alternate Air Source
- Cylinder
  - Cylinder Valves
- Weight System
- Underwater Instruments
  - Submersible Pressure Gauge (SPG)
  - Dive Computers
- Other Instruments
  - Dive Watch
  - Depth Gauge
  - Compass
- Accessories
  - Rescue Signal
  - Knife
  - Equipment Bag
  - Dive Flag
  - Slate

Presentation Two (Cont.)

Chapter 4: Skills Development

- Setting Up
- Scuba Assembly
  - Cylinder Check
  - BCD Attachment
  - Regulator Attachment
  - BCD Inflator Hose Attachment
  - Regulator Test
  - Streamline Hoses
- Putting On the Scuba Unit
  - Exposure Protection
  - Weight Belts
  - Donning the Scuba Unit
- Pre-dive Briefing
  - Review the ABCs
- Entries
  - Giant Stride
  - Controlled Seated
  - Back Roll
  - Shore Entry
  - Surf Entry
- In-water Skills
  - BCD Inflation and Deflation
  - Weight (Buoyancy Check)
  - Descents
  - Regulator Clearing
  - Regulator Recovery
  - Hovering
  - Free Flow Breathing
  - Mask Flood and Clear
  - Mask Removal and Replacement
  - Swimming Techniques
  - Cramp Relief
  - BCD Removal Underwater
  - Compass Navigation (Definitions)
  - Snorkel Clearing
  - Underwater Communications
  - Ascents and Out-of-Air Emergencies
  - Normal Ascent
  - Alternate Air Source Ascent
  - Controlled Swimming Ascent
  - Buoyant Ascent
- Scuba Disassembly

Presentation Three

Chapter 5: Planning Your Dive

- Awareness
- Diver Fitness
- Buddy System
- Dive Planning
    - Repetitive Dives
    - Safety Stop
    - Emergency or Omitted Decompression
    - Computer Failure
- In-Water Emergencies
    - Overexertion
    - Problems at the Surface
    - Tired Diver Tow
    - Entanglement
    - Missing Diver
- Rescue Diver Program
- First Aid for Open Water Divers
    - Seasickness
    - Decompression Illness
    - CPROX/ CPROX1st/ CPROX1stAED
- Additional
    - Academic Course Wrap-up
    - Equipment Fitting
    - Paperwork

Open Water Scuba Diver Complete Academic Outlines

Presentation Outline
Chapter 1: The Underwater Environment

History

Scuba Diving International

The Aquatic Environment

Adapting to the Underwater World

Vision

Light

Sound

Heat Loss

Oceanography

Tides

Currents

Waves

Surge

Marine Life

Marine Life Injuries

History

Early reported diving attempts

Key Points

- Cousteau and Gagnon invent demand regulator in 1943.
- Navy Tables published in 1957.
- First dive computers available in 1959.
- "Tech" diving gains acceptance in the diving community.

Scuba Diving International

- First Agency to require the use of personal dive computers for the entry-level (Open Water Scuba Diver) program
- Recognizes need for updated diver training methods

Adapting to the Underwater world

Omni-directional
Weightlessness

Vision

Key Points

- Refraction also causes objects to appear larger and closer underwater than on land
- In order for the eye to focus there must be an airspace, the mask
- Visibility is expressed in horizontal distance and is reduced in water depending on available light, water turbidity and distance.

Light

Key Points

- Light colors are absorbed red, green, and blue (R.O.Y.G.B.I.V) as they go deeper.
- Artificial light (using a flashlight) can let us see natural color underwater.
- Turbidity decreases visibility.

Sound

Key Points

- Water is approximately 800 times denser
- Sound moves four (4) times faster in water.
- Divers can't determine which direction a sound comes from.

Heat Loss

Key Points

- Water absorbs heat from our bodies twenty-five (25) times faster than air does.
- Divers should not dive when cold.
- Thermoclines can be unexpected and dramatic.
- Be prepared with the right exposure protection for all the conditions that might reasonably be expected on a given dive.

Oceanography

Key Points

- Seventy Five percent (75%) of earth's surface is water.
- Understanding water forces, such as current, can turn them into useful tools (e.g. drift diving).
- Use good common sense in dealing with the forces of water in motion.

Tides

Key Points

- Caused by gravitational pull of the moon
- Slack time between low and high tide is the best time to dive near shorelines.
- Plan dives around the tides.
- Check local tide tables prior to diving

Current

Key Points

- Global currents are fixed while local currents fluctuate.
- Long shore currents run parallel to shore
- Rip currents are water funneled through a narrow area back to sea
- Don't fight currents; swim parallel to exit.

Waves

Key Points

- Waves caused by wind primarily
- Wave height measured from crest to trough.
- Wave length is measured from one wave crest to the crest of the next wave
- Waves can be dangerous to divers when shore diving or trying to enter or exit from a boat.

Surge

Key Points

- Surge is a back and forth motion underwater that can injure you against an object.
- Move away from objects that may cause problems in surge and get into deeper water
- Try to use surge to your advantage when swimming.

Marine Life

Key Points

- Most marine injuries come from a marine animal's defensive response
- The marine world is extremely fragile – look but don't touch.
- Avoid touching anything underwater

Marine Life Injuries

Key Points

- Most injuries are temporary but painful stings or abrasions.
- Jelly fish or Portuguese Man-O-War stings.
- Scorpion fish and urchin stings.
- First aid for simple injuries includes meat tenderizer, hot water or vinegar.
- Divers are subject to the laws of the locality where they are diving, spear-fishing or performing any other activity whether they know those laws or not.

Summary

- History
- Scuba Diving International
- The Aquatic Environment
- Adapting to the Underwater World
    - Vision
    - Light
    - Sound
    - Heat Loss
- Oceanography
    - Tides
    - Currents
    - Waves
    - Surge
- Marine Life
    - Marine Life Injuries

Complete Student Training Record for Chapter One (1)

Any Questions?

Presentation Outline
Chapter 2: Physics and Physiology

Physics

Buoyancy
Positive
Neutral
Negative

Pressure
Boyle's Law

Physiology

Air Spaces
Equalization Techniques
Boyle's Law and Decreasing Pressure
Lung Over-Expansion Injuries

Breathing Air Under Pressure
Decompression Sickness
Nitrogen Narcosis
Oxygen Toxicity
Mixed Gases

Physics and Physiology Overview

Key Points:
- Physics studies how matter and energy behave
- Physiology studies our bodies' response to physical force

Buoyancy

Key Points:
- The laws of physics control buoyancy and understanding buoyancy is vital to divers.
- Archimedes Principle explains why some objects float and others don't, even when they are the same size

Positive Buoyancy

Key Points:
- Most important for resting on the surface.
- Establish each time you are at the surface
- Conserves energy while on the surface

Neutral Buoyancy

Key Points:
- Does not sink or float
- Protects the environment and conserves air.
- The ability to maintain neutral buoyancy is a characteristic of accomplished divers.

Negative Buoyancy

Key Points:
- Important for descent and stabilizing on the bottom.
- Differences in salt and fresh water

Pressure

Key Points:
- Water is approximately 800 times more dense than air
- Ten (10) m / thirty three (33) ft exerts as much weight as the entire atmosphere above.
- A person at sea level has one (1) bar/atm or 14.7 psi of pressure on them
- Every 10 m/33 ft the pressure increase by one (1) bar/atm

Boyle's Law and Increasing Pressure

Key Points:
- As pressure goes up, volume goes down by the same ratio.
- Density of air increases as the surrounding pressure increases

Available Cylinder Time

Key Points:
- Dive plans must consider the affect of depth on cylinder time.
- Watch the SPG even closer at deeper depths.

Physiology

Air Spaces

Key points:
- Body is two-thirds water and therefore not affected by pressure
- Air spaces affected include ears, lungs, sinuses and artificial air spaces

Squeeze

Key Points:
- Squeeze is a practical application of Boyle's Law that you can feel and have control over.

Equalization Techniques

Key Points:

- Any gentle method of equalization that works is OK to use.
  - Valsalva Maneuver
  - Frenzel Maneuver
- Equalize at the surface and every few decimeters / feet during descent.
- Ascend a few feet if needed.
- Avoid diving with a cold or congestion
- May have to abort dive if equalization cannot be accomplished

Mask Squeeze

Key Points:

- Feeling pressure from their mask is the first indication of a mask squeeze.
- Exhale through nose into the mask airspace to prevent/eliminate mask squeeze.
- Note that excessive blowing through the nose can contribute to mask fogging.

Tooth Squeeze

Key Points:

- Not very common
- No equalization technique for this type of squeeze
- See your dentist.

Reverse Block

Key Points:

- Occurs during ascent when air does not escape naturally
- Stop, descend, and wait for discomfort to pass

Boyle's Law and Decreasing Pressure

Key Points:

- As divers near the surface, pressure and volume changes occur more rapidly and slower ascent rates are needed to vent the more rapidly expanding gasses – don't forget the safety stop.

Lung Over-expansion Injuries

Key Points:

- Rare, but can be fatal.
- Caused by breath holding on ascent.
- Can occur at swimming pool depths.
- If suspected, give O2 and get medical help.
- Always breathe continuously and never hold your breath.
- Use
  - Computerize
  - Your
  - Ascent
- Air Embolism
  - Blocks blood flow to brain
  - Sign and symptoms include unconsciousness and paralysis

Breathing Air Under Pressure

Key Points:

- Gas percentages don't change with pressure.
- Total gas density (concentration) increases with pressure yielding a higher "dose" to the diver at depth.

Density

Key Points:

- Since our lungs need to expand to normal volume with each breath irrespective of density, greater depths mean progressively higher doses of O2 and N2 with each breath.

Nitrogen

Key Points:

- Deeper depths and long dive times mean more N2 is absorbed.
- Repetitive dives mean more N2 absorption.
- NDLs are based on N2 absorption and off gassing.

Decompression Sickness

Key Points:

- Coming up slowly lets us breathe off the excess N2 and avoids bubbles.
- Rapid ascents can cause the bends.

Signs and Symptoms of Decompression Sickness

Key Points:

- Joint pain is the most common symptom of DCS.
- Shortness of breath, numbness or tingling is some of the other signs.
- Untreated DCS can become deadly.
- The treatment is the same for all decompression related injuries - breathe one hundred percent (100%) oxygen and seek help.
- If symptoms are severe or persist - go to a chamber.

Decompression Illness

Key Points:

- The treatment is the same for all decompression related injuries - breathe one hundred percent (100%) oxygen and seek help (worth repeating).

No-Fly Time

Key Points:

- After diving you must wait to fly
- Monitor dive computer for safe fly time
- General rule wait 12 to 24 hours before flying

Nitrogen Narcosis

Key Points:

• Nitrogen narcosis is typically related to depths over thirty (30) m/one hundred (100) ft.

• Nitrogen narcosis will go away immediately with ascent to shallower depths.

• Divers may not recognize they have it.

Oxygen Toxicity

Key Points:

• The oxygen in air is not harmful to divers at sport diving depths (42 m/130 ft).

• Students should never use oxygen-enriched air (nitrox) without the appropriate training.

Carbon Monoxide Poisoning

Key Points:

• Get air fills from a reputable source.

• Never use air that has a smell or taste.

• A diver that has an unexplained headache or feels badly for no apparent reason should alert his buddy and surface.

Mixed Gases

Key Points:

• Never use NITROX or other special breathing mixtures without specialized training.

Summary

- Physics
    - Buoyancy
    - Positive
    - Neutral
- Negative
- Pressure
    - Boyle's Law
- Physiology
- Air Spaces
    - Equalization Techniques
    - Boyle's Law and Decreasing Pressure
    - Lung Over-Expansion Injuries
- Breathing Air Under Pressure
    - Decompression Sickness
    - Nitrogen Narcosis
    - Oxygen Toxicity
    - Mixed Gases

Complete Student Training Record for Chapter Two (2)

Any Questions

Presentation Outline
Chapter 3: Scuba Equipment

Personal Equipment
Mask, Fins, Snorkel
Exposure Protection

Scuba Equipment
Buoyancy Compensator Device
Regulator
Cylinder
Weight Systems

Underwater Instruments
Dive Computers
Other Instruments
Dive Watch
Depth Gauge
Compass

Accessories
Rescue Signal
Knife
Dive Lights
Equipment Bag
Dive Flag
Logbook
Slate

Scuba Equipment

Key Points:

- Scuba is an equipment intensive sport.
- Each piece of scuba equipment is an important part of a functional unit.
- Fit is usually the most important factor.

Personal (Snorkeling) Equipment

Mask

Key Points:

- A mask creates airspace between the diver's eyes and the water.
- Fit and comfort are the most important factors in selection.
- Low volume = less to equalize.
- High volume = better peripheral vision.
- Can be fitted with corrective lenses.
- Purge valve optional but is good if a diver has a tendency to exhale through the nose a lot.

Snorkel

Key Points:

- Allows a diver to conserve cylinder air while swimming on the surface.
- Select for comfort and unobtrusive design.
- One way exhaust valves
- Wet and dry snorkels
- Attached on the left side of the mask strap

Fins

Key Points:

- Increases swimming efficiency by increasing the surface area of divers' feet.
- Two basic types, open-heel and full-foot
- Open-heel style allows boot.
- Fit is most important.

Exposure Protection

Body Suit (Skin)

Key Points:

- Protects against sun, wind and abrasions.
- Adds minimal thermal protection, best in warm water

Wet Suit

Key Points:

- Primarily used for thermal protection.
- Should fit snug enough to slow the flow of water over the skin.
- Discuss the various styles and thicknesses.
- Best in cool to cold water.

Dry Suit

Key Points:

- Intended to keep all the water out.
- Under garments worn to provide extra warmth
- Holds a layer of air between the inside of the suit and the diver's skin.
- Requires specialized training.
- Best in cold to very cold waters.

Boots and Gloves

Key Points:

- Boots should fit like a shoe – prefer a good sole.
- Gloves should have a snug fit, but not prohibit dexterity.
- Gloves should be thinnest material that still provides adequate warmth.

Hoods

Key Points:

- Greatest heat loss is from the head.
- Comfortable fit not constricting neck or jaw (carotid sinus pressure).

Scuba Equipment

Buoyancy Compensator Device (BCD)

Key Points:

- Harness ("tech") BCDs have more lift and are most often used in more advanced diving.
- Vest style (recreational) BCDs are more compact and streamlined.
- Can be inflated with air from cylinder (power inflation) or from diver's lungs (oral inflation)
- BCD is deflated from various spots depending on type of BCD
- Weight integrated BCDs have pockets for weights that have a quick release for emergencies

Regulator

Key Points:

- Function with extreme internal pressures and a harsh external environment.
- Require good care and annual service.

First Stage

Key Points:

- Converts hundreds (100s) of bar / several thousand (1000s) psi to about ten (10) bar / one hundred forty (140) psi above surrounding pressure for the 2nd stage.
- Available in DIN or yoke style, balanced or unbalanced.
- Allows connection of SPG and other equipment (dry-suit, alternate air source and BCD).

Second Stage

Key Points:

- Converts pressure to ambient pressure.
- All 2nd stages have a purge button.
- How a second stage works to deliver air
- Explain fail-safe design (free-flow).

Alternate Air Source

Key Points:

- Several types; octopus, BCD inflator-integrated or redundant "Spare Air" type.
- Hose is generally slightly longer
- Second stage is generally a different and brighter color
- Regular maintenance and testing is important.
- Emphasize placement in the "triangle".

Cylinder

Key Points:

- Materials
- Working pressures and volumes
- You should never allow a cylinder to become completely empty of air.
- Aluminum cylinders are never filled over their service pressure.
- Required inspections (VIP and Hydro)
- Cylinder markings

Example of the manufacturer's stamp on a Luxfer aluminum cylinder

CTC/DOT-3AL3000-S80
P123456 LUXFER 9A09

- CTC/DOT = Canadian Transport Commission (Transport Canada)/ US Department of Transportation
- 3AL = Type of material (code for aluminum alloy)
- 3000 = Service pressure (in psi)
- S80 = Scuba 80 cubic feet
- P123456 = Cylinder serial number
- LUXFER = Cylinder manufacturer
- 9A09 = Hydrostatic test date (September 2009)
- A = Inspector's symbol

Example of a manufacturer's stamp on a Pressed Steel galvanized steel cylinder

G CTC/DOT - E9791 - 3500 TP5250 1-09
12345 PST GALVANIZED

- CTC/DOT = Transport Canada / US Department of Transportation
- E9791 = DOT exemption number, steel alloy indicator
- 3500 = Service pressure
- TP = Test pressure
- 1-09 = Hydrostatic test date
- 12345 = Cylinder serial number
- PST = Manufacturer (Pressed Steel)

Cylinder Valves

Key Points:

- "K" valve is the modern standard type without a reserve.
- Yoke style is the most common for pressures up to two hundred and six (206) bar / three thousand (3000) psi.
- Din style is another common valve and handles pressures to three hundred and ten (310) bar / four thousand five hundred (4500) psi.
- DOT and CTC valves have a burst disc.
- O-Rings should be checked every time the first stage is attached to the cylinder valve.

Weight System

Key Points:

- All weight systems should have a quick release mechanism.
- Caution divers not to entrap weight systems by donning equipment over them.
- Weight belts should be right hand release.

Underwater Instruments

Submersible Pressure Gauge (SPG)

Key Points:

- Monitors air in cylinder
- Types: analog or digital
- Periodic maintenance
- Where to locate SPG

Dive Computers

Key Points:

- Dive computers reduce the likelihood of human error when planning a dive.
- Dive computers allow longer dives because they credit NDLs for multilevel diving.
- Because computers are different in their features and operation, divers must familiarize themselves with their computer before they go diving.
- Since no two (2) divers can ever have the exact same dive, a dive computer cannot be "shared" by two divers.
- Dive computers usually track in .1 m / one (1) foot increments thus making it "impossible" to use a buddy's dive computer as a replacement for a personal one.
- Features and functions of a dive computer
    - No-stop time, depth, dive time, ascent rate, required decompression, surface interval, time to fly, logbook
- There is no absolute guarantee of safety even with a PDC.

Other Instruments

Dive Watch

Key Points:

- Provides a redundant timer in case of computer failure.
- Vary from a simple timepiece to a downloadable computer.

Depth Gauge

Key Points:

- Select for ease of reading.
- Digital style often easiest to read.
- May have backlight.
- Analog style generally doesn't require batteries.

Compass

Key Points:

- Using a compass effectively is one of the marks of an accomplished diver.
- No specific feature is as important as knowing how to use it.
- Stress, "Keep rehearsing and train yourself" in compass usage – can be done in, for example, a parking lot or a back yard.
- Big metal objects like a wreck negatively impacts the accuracy of a compass.

Accessories

Rescue Signal

Key Points:

- A whistle is basic but the best type; depends on the dive circumstances.
- A long inflatable “sausage” can be seen from a long distance.
- Air powered units used above and below surface

Knife

Key Points:

- Intended as a tool, not a weapon.
- Like any tool, its selection should be based upon its likely use.
- Should be attached where it can be easily reached but is not likely to snag.

Scissors or Cutting Device

Key Points:

- Safer than a dive knife because they are less likely to stab or cut the wrong things.

Dive Lights

Key Points:

- Restores natural color underwater.
- Check batteries before diving
- Two (2) lights are standard on a night dive.
- The larger light is the primary and the smaller light is the backup.
- Avoid blinding buddies – don’t point the light in their eyes!

Equipment Bag

Key Points:

- Select for size, function and durability.

Dive Flag

Key Points:

- Types of dive flags
- Protect yourself; use a dive flag when appropriate and required by law.

Logbook

Key Points:

- Log every dive.

Slate

Key Points:

- A slate is both an underwater notebook and communications device.

Summary

- Personal Equipment
  - Mask, fins, snorkel
  - Exposure Protection
- Scuba Equipment
  - Buoyancy Compensator Device
  - Regulator
  - Cylinder
  - Weight Systems
- Underwater Instruments
  - Dive Computers
  - Other Instruments
  - Dive Watch
  - Depth Gauge
  - Compass
- Accessories
  - Rescue Signal
  - Knife
  - Dive Lights
  - Equipment Bag
  - Dive Flag
  - Logbook
  - Slate

Complete Student Training Record for Chapter Three (3)

Any Questions?

Presentation Outline
Chapter 4: Skills Development

Setting Up
Scuba Assembly
Putting On the Scuba System
Pre-dive briefing
Review ABCs

Entries
Giant Stride
Controlled Seated
Back Roll
Shore
Surf

In-water Skills
BCD Inflation/Deflation
Weight Check
Descents
Regulator Clearing
Regulator Recovery
Fin Pivot
Hovering
Breathing from a
Free-Flow Regulator
Mask Clearing
Swimming Techniques
Cramp Removal
BCD Removal Underwater
Compass Navigation
Snorkel Clearing

Communications

Hand Signals

Ascents and Out-of-Air
Emergencies
Normal Ascent
Alternate-Air Assisted Ascent
Controlled Swimming Ascent
Buoyant Ascent
Scuba Disassembly

Setting Up

Scuba Assembly

Cylinder Check

Key Points:

- Check cylinders before using.
- Makes sure all inspections have been completed
- Smell air

BCD Attachment

Key Points:

- Divers must be familiar with the features and functions of the BCD they are using.
- Check to ensure BCD is tightly attached to cylinder.

Regulator Attachment

Key Points:

- Regulators should be inspected for damage.
- Naturally, the type, DIN or yoke, should match the type of valve on the cylinder.
- Emphasize that the air hole in the valve must point into the hole in the first stage inlet, as students will commonly try to put them on backwards.
- Explain why the power inflator hose and the SPG hose are on the left and the regulator is on the right.
- Make sure to caution against over-tightening the first (1st) stage to the valve.
- Explain the purpose of the dust cover for the first stage and the fresh water rinse at the end of every dive day.

BCD Inflator Hose Attachment

Key Points:

- Show where the power inflator hose connects to the inflator valve.
- Explain the proper sequence of pressurization while holding the purge in with gauge diverted away.
- Then turn the valve completely on and one-fourth (1/4) turn back.
- Listen for leaks and check the SPG.

Regulator Test

Key Points:

- It is important that students test their equipment before they use it
- They should not dive if they feel uncomfortable with the equipment

Streamline Hoses

Key Points:

- When divers streamline their equipment, they are automatically organizing it. It helps them know where everything is and encourages a sense of pride in their "setup".
- Reduces chance of entanglement and damaging equipment

Care and Maintenance of equipment

Key Points:

- All equipment should be rinsed with fresh water
- Equipment should be dried out of direct sunlight
- Equipment should be completely dry before storage
- Putting On the Scuba Unit

Exposure Protection

(This information is an FYI for the instructor to share not in student manual.)

Key Points:

- Relate timing of donning exposure suits to weather conditions and surface comfort.

Weight Belts

Key Points:

- Knowing the release or buckle position and avoiding belt entrapment by other equipment are concepts that need special emphasis.
- Right Hand Release

Donning the Scuba Unit

Key Points:

- Talk about the buddy system.

Pre-dive Briefing

Key Points:

- Overlook this step and all your efforts can deteriorate into disorganization and confusion.

Review the ABCs

- A good pre-dive checklist is the ultimate save-a-dive kit. Emphasize the buddy system and let your buddy help check your setup and equipment. One useful mnemonic is the ABC's.
- **A**ir on
- **B**CD inflated
- **C**omputer on
- **D**ive equipment complete (personal equipment and scuba equipment)
- **E**nter the water

Entries

Key Points:

- Divers keep second stage in mouth until they have stabilized on the surface
- BCD inflated
- All entries should be followed by the hand(s) over head OK signal

Giant Stride

Key Points:

- Emphasize holding mask and regulator, looking into the horizon and "stepping out" but do not jump.
- Check to ensure entry area is clear.

Controlled Seated

Key Points:

- Emphasize leaning to one side and swinging backside around and out.

Back Roll

Key Points:

- Avoid dangling equipment and losing masks.

Shore Entry

Key Points:

- Fins go on after entry to waist level.

Surf Entry

Key Points:

- Fins on at surf-line, then walk backwards into the waves.
- Buddies should be close to assist each other in this type of entry.

In-water Skills

Note: *In-water skills are best taught by demonstration with students participating in the water. During the academic sessions you should introduce the skills they will be performing in confined water and explain their value. This introduction helps to minimize the learning curve students will feel in the confined water sessions. If you have already taken them to confined water, this "academic" review of what they were doing (and why) will reinforce their skills.*

BCD Inflation and Deflation

Key Points:

- Use of the power inflator and the oral inflator
- Add or vent small amounts of air to the BCD.
- You may need to wait a few seconds and take a few breaths before a change in buoyancy becomes apparent.
- Don't over-inflate BCD and risk uncontrolled ascent!

Weight (Buoyancy Check)

Key Points:

- Verify power inflator function
- Deflate BCD completely (so all of its lift is available)
- Float at eye level with a full breathe of air
- Exhale and sink slowly keeping the inflator in hand
- Proper buoyancy at the surface helps divers have a streamlined and comfortable dive.
- Important to perform with changes in equipment or a long layoff from diving.

Descents

Key Points:

Controlled - physically holding the line or other fixed object.

With reference- visual contact with a line or other fixed reference.

Free - without a line to hold onto or fixed visual reference.

- Should always be "under control"
- Equalize at the surface and frequently on the way down – "early and often".
- Keep the power inflator in hand.
- Descend upright and in visual contact with buddy.

Regulator Clearing

Key Points:

- Explain the two methods (oral and purge) of clearing a flooded regulator and the importance of tongue positioning for airway protection.

Regulator Recovery

Discuss the sweep and reach methods of regulator recovery.
Most divers find the sweep method to be the most convenient.

Key Points:

- Exhale (bubbles) continuously whenever the regulator is out of the mouth.
- Exaggerate the lean

Hovering

Key Points:

- Don't breath-hold on rising – breathe on the top (or bottom) of lung capacity.

Free Flow Breathing

Key Points:

- Don't close mouth around the mouthpiece – excess air must escape freely.
- Breathe slowly and shallow.
- Ascend with control.

Mask Flood and Clear

Key Points:

- Inhale through mouth – exhale through nose.
- Pressure on top of mask helps with either type of purge method.
- Blow gently and steadily, excessive blowing fogs masks.
- Divers with contact lenses need to adjust technique.

Mask Removal and Replacement

Key Points:

- Emphasize holding onto the mask and controlling the strap.
- Divers with contact lenses need to adjust technique.

Swimming Techniques

Key Points:

- There are different kinds of underwater swimming kicks that can be useful in differing circumstances.

Cramp Relief

Key Points:

- Relieve a cramp on your own
- Relieve a cramp with help of a buddy

BCD Removal Underwater

Key Points:

- Emphasize diver negative and BCD neutral or positive.
- Loosen but don't unsnap shoulder straps.
- Keep regulator in mouth and remove BCD to the right, left arm out first.

Compass Navigation

Definitions:

Lubber line - aligned with your body in the direction of travel
Magnetic needle - points north
Index marks - set index marks on magnetic needle point with 1 lubber line positioned in direction of travel
Reciprocal- as above but turn until the tail of the needle is in the index marks
Bezel- proper adjustment and alignment

Key Points:

- A compass is only useful if the diver knows how to use it.

Snorkel Clearing

Key Points:

- Blast method
- Displacement method

Underwater Communications

Key Points:

- Review key hand signals (page 81 student manual)
- Hand signals are important to know and use.
- Emphasize slow and exaggerated.
- Remind students that a thumb up means "go up" and not "OK".
- Waving to the boat means they're in trouble.

Ascents and Out-of-Air Emergencies

Key Points:

- Follow same procedure on each ascent to minimize problems
- Five ways to ascend

Normal Ascent

Key Points:

- Maintain control of the BCD inflator.
- Look up and breathe normally with ascent.
- Ascend slowly (discuss ascent rates) CYA)).
- Always complete the safety stop.

Alternate Air Source Ascent

Key Points:

- Signal need and intent to share air – communicate.
- Locate donor's *alternate* regulator.
- Solid hook-up and eye contact between buddies.
- Ascend at a normal rate (CYA).

Controlled Swimming Ascent

Key Points:

- Controlled rate at about thirty (30) centimeters/one (1) foot a second.
- Recommended rate is fifteen (15) centimeters/one-half (1/2) foot per second.
- Exhale with ascent.
- Establish buoyancy on the surface.

Buoyant Ascent

Key Points:

- Never practice this skill!
- Last ditch but preferable to drowning.
- Control ascent rate as much as possible.
- Exhale all the way up.

Scuba Disassembly

The reverse of assembly, but they need to know why the system must be depressurized to remove the regulator.

Key Points:

- Remove weights and accessories
- Dry dust cap before replacing.
- Avoid wetting the 1st stage internals during the fresh water rinse.
- Stow cylinders safely with dust cap off of used cylinders

Summary

- Setting Up
    - Scuba Assembly
    - Putting On the Scuba System
    - Pre-dive briefing
    - Review ABCs
- In-water Skills
    - BCD Inflation/Deflation
    - Weight Check
    - Descents
    - Regulator Clearing
    - Regulator Recovery
    - Fin Pivot
    - Hovering
    - Breathing from a Free-Flow Regulator
    - Mask Clearing
    - Swimming Techniques
    - Cramp Removal
    - BCD Removal Underwater
    - Compass Navigation
    - Snorkel Clearing
- Communications
- Hand Signals
- Ascents and Out-of-Air Emergencies
    - Normal Ascent
    - Alternate-Air Assisted Ascent
    - Controlled Swimming Ascent
    - Buoyant Ascent
- Scuba Disassembly

Complete Student Training Record for Chapter Four (4)

Any Questions?

Presentation Outline
Chapter 5: Planning Your Dive

Awareness
Diver Fitness

Buddy System

Dive Planning
Repetitive Dives
Safety Stop
Emergency or Omitted Decompression
Computer Failure

In-Water Emergencies
Overexertion
Problems at the Surface
Tired Diver Tow
Entanglement
Missing Diver

First Aid
Seasickness
Decompression Sickness
CPROX/CPROX1st/CPROX1stAED

Introduction

Risk management is a means of preventing problems and planning a response for possible emergencies that may arise.

Awareness

Key Points:
- Personal awareness
- Mental and physical abilities
- Dive within your experience level

Diver Fitness

Key Points:
- Stay hydrated when diving.
- No alcohol or drugs prior to a dive.
- Avoid smoking, especially before and immediately after a scuba dive.
- There is no data to support the safety of diving while pregnant, so don't.

Buddy System

Key Points:
- Diving alone is not considered safe at the sport level. Requires special training.
- Be familiar with each other's dive equipment
- Review hand signals
- If buddies get separated look for no more than three (3) minutes.
- When qualified complete the SDI Solo Diver program

Dive Planning

Key Points:
- Even when using a computer, plan dives.
- Parameters to plan.

Repetitive Dives

Key Points:
- The repetitive dive requires more planning – not less.
- Deepest dive first.

Any dive made within more than ten (10) minutes but less than twelve (12) hours of another is a repetitive dive

Safety Stop

Key Points:
- Treat safety stops with respect and so will your students.
- Suggested for any dive up to 30 m/100 ft. Over 30 /100 ft it is mandatory.
- Make sure to stay between three (3) m – six (6) m/ten (10) ft - twenty (20) ft for three (3) minutes.
- If possible maintain contact with a line

Emergency or Omitted Decompression

Key Points:
- Don't panic; follow your computer instructions.
- Come up before you run out of air.
- Inform the divemaster or instructor.
- Follow first aid procedures for decompression sickness

Computer Failure

Key Points:
- Abort the dive in a controlled manner.
- Complete safety stop if available air
- Do not resume computer controlled diving for twenty four (24) hours.

In-Water Emergencies

Key Points:
- Think about problems and solutions before they happen
- Practice emergency techniques (tired diver tow).
- Training and practice prevent panic.
- Promote the rescue diver course.

Overexertion

Key Points:
- Should overexertion occur, STOP, REST, THINK and BREATHE
- Communicate situation to others.

Problems at the Surface

Key Points:
- Establish positive buoyancy. (Inflate BCD)
- Keep air supply in mouth.
- Signal for help. (Carry surface signaling device)

Tired Diver Tow

Key Points:
- Don't get within reach of a panicked diver unless trained.
- Establish positive buoyancy for both divers
- Pace yourself
- First stage pull or fin push

Entanglement

Key Points:
- Don't struggle.
- Stop, think and act if necessary.
- Assist one another if possible before taking any other action

Missing Diver

Key Points:

- Surface within three (3) minutes of being separated from your buddy.
- Notify dive supervisor immediately

Rescue Diver Program

Key Points:

- Teaches how to recognize and reduce chances of diving accidents.
- Advanced Diver rating or forty (40) logged dives.

First Aid for Open Water Divers

Key Points:

- Be prepared
- Complete an SDI CPROX1stAED program.

Seasickness

Key Points:

- Methods that help to avoid seasickness.

Decompression Illness

Key Points:

Recompression in a hyperbaric chamber usually required

EMERGENCY PROCEDURES FOR DCI:

- Move the afflicted diver out of danger
- Activate the Emergency Medical System (EMS)
- Monitor life support signs (pulse and respiration) and provide CPR if necessary
- Provide 100% oxygen via demand regulator if the diver is breathing
- Evacuate if necessary.

CPROX/ CPROX1st/CPROX1stAED

Key Points:

- Designed to teach divers how to properly administer aid in a diving emergency

Summary

- Awareness
  - Diver Fitness
- Buddy System
- Dive Planning
  - Repetitive Dives
  - Safety Stop
  - Emergency or Omitted Decompression
  - Computer Failure
- In-Water Emergencies
  - Overexertion
  - Problems at the Surface
  - Tired Diver Tow
  - Entanglement
  - Missing Diver
- First Aid
  - Seasickness
  - Decompression Sickness
  - CPROX/CPROX1st/CPROX1stAED

Complete Student Training Record for Chapter Five (5)

Review Questions

Any Questions?

Presentation Outline
Pool/Confined Water – Dive 1

Use Cue Card: 'CW1-Confined Water 1'

Swimming Skills Assessment

(200m / 218y Swim and 10 min. Tread Water)
Must be performed prior to any scuba skill being taught. The first confined water session is often the most convenient time and setting. Students must perform each of these skills non-stop. "Style" is not important but they should demonstrate reasonable comfort in the water and be in control throughout the exercises. Any combination of strokes is acceptable for the two hundred (200) metre/two hundred eighteen (218)yard swim.

Buddy Teams (Assign and Discuss)

Emphasize the importance of staying with their buddy and following the three (3) minute rule to surface for a lost buddy. Encourage buddy teams to swim side by side so that they can see each other at all times. Vary buddy teams when possible, students should experience a variety of dive buddies. It is sometimes helpful to separate "couples" during in-water training to help foster independence and self-reliance.

Communication - Hand Signals

Demonstrate basic hand signals - OK, go up, go down, stop, level off, low on air, out of air, need air, something's wrong. Ask students to return the signal to you when you demonstrate to them. Use exaggerated demonstration quality technique.

Weights System/Mask Defog

When using a belt, emphasize buckle opens to right. Putting their belt on first may be easier but they must not trap their belt under other equipment such that it could not be dropped if necessary.

Scuba System Assembly

Demonstrate assembly, explain as you go and let students assemble theirs along with you. Help them where needed.

- *Cylinder check – check cylinder and O-ring.*
- *BCD attachment – watch for BCD backwards or too loose.*
- *Regulator attachment – watch for 1st stage of regulator upside down.*
- *BCD inflator hose attachment – before pressurization.*
- *Turn on the air – with purge slightly depressed.*
- *Test the regulator, BCD inflator and computer / SPG.*

Donning Scuba System

Teach standing, right arm first with assistant lifting system for them. Review SDI Open Water Scuba Diver Manual for technique description. Buddies should help each other.

Briefing

It is important to give your students a thorough pre-dive briefing before each dive, even in confined water exercises. The pre-dive briefing removes confusion and reduces anxiety for pool and open water dives. It provides an atmosphere of control and makes you look more professional. It also helps to establish a lifelong habit of advance thinking and organization for your students.

Points to emphasize include:

- A description of the dive site (even if it's a swimming pool).
- If the pool has special features, describe them.

- The dive profile including planned depth, bottom time and minimum air pressure for ascent.
- Review hand signals and safety considerations.
- Discuss the method of entering and exiting the water.
- Remind students to check their air supply and signal you every thirty four (34) bar / five hundred (500) psi. Do this even in confined water to initiate the habit of checking their air supply and help make it automatic in open water.

ABCDE's

Emphasize the importance of checklists much like those used by pilots.

A*ir on*

B*CD inflated*

C*omputer on*

D*ive equipment on*

E*nter on go*

Equalization

Emphasize starting equalization at the surface and continuously.

Demonstrate nose pinch (Valsalva), head wobble, yawn and ear lobe pull.

Any gentle method or combination of methods is acceptable.

Entry

Try to use a different entry at each session in order to expose students to all common types of entries. Often the first session will be at the shallow end of a pool making the controlled seated entry ideal.

Objective: *"You will be able to" enter the water using the controlled seated method*

Why: *"You'll be" a more confident diver being able to enter the water the easiest way from any setting. This method is especially useful at the shallow end of a pool.*

Demo: *Enter water using correct controlled seated method.*

Problems: *Didn't rotate with push-off so as to end up facing side of pool.Didn't partially fill BCD before entry.*
Regulator or mask not in place.

BCD Inflation and Deflation

Teach both power and manual methods of BCD inflation. Make sure students understand clearly which button serves which function.

Objective: *"You will be able to" orally inflate a BCD to about half full and then fully deflate it at the surface or underwater.*

Why: *"You can" inflate your BCD either orally or by using the low pressure inflator so you can relax on the surface, descend or ascend whenever you want to.*

Demo: Oral and auto inflation.
Demonstrate proper positioning for complete deflation.
Deflation.

Problems: *Pushing the wrong button,*
Too little or too much inflation.
Not opening the valve while attempting to orally inflate.
Incorrect body position for deflation.

Regulator Breathing

Often taken for granted by instructors, many of your students will be anxious or claustrophobic about breathing through a regulator. You will also have students ask you if they can get AIDS or other dread diseases from the regulator mouthpiece. Tell students that mouthpieces should be thoroughly rinsed between users and providing that is done, there is no risk of contagion. For those still in doubt, recommend they purchase their own mouthpiece or regulator.

Objective: *"You will be able to" breath in a relaxed and efficient manner while on scuba.*

Why: *"You will enjoy" increased comfort and enjoyment of the underwater environment.*

Demo: *Demonstrate slow, deep, relaxed, regulator breathing.*

Problems: *Inhaling through the nose.*
Exhaling through the nose (fogs mask).
Not purging regulator before first inhalation.

Regulator Purge - Mechanical and Oral

Regulator purging should be practiced until it is second nature to your students. This skill gives them a vital boost in confidence because their regulator is literally their lifeline underwater. Inhaling even a few drops of water can result in choking.

Objective: *"You will be able to" clear your regulator by the purge and exhalation methods while underwater.*

Why: *"In the event" your regulator should become flooded, you will be able to clear it by two different methods.*

Demo: *Demonstrate purge and exhalation methods.*
Emphasize exhaling slowly while regulator is out of mouth.

Problems: *No air left in lungs to clear by exhaling.*
Failure to protect airway by lifting tongue while purging.
Didn't exhale while regulator was out of mouth.

Regulator Recovery - Sweep and Reach

Just as important as regulator purging, the ability to act quickly and replace a displaced regulator is important to your students' confidence and safety. Remind them that in the event they cannot promptly locate their primary regulator, they should know how to locate their alternate second stage and use it to allow a more relaxed search for their primary.

Objective: *"You will be able to" recover your regulator should it become displaced from your mouth while underwater.*

Why: *"In the event" your regulator is displaced from your mouth while underwater, you will be able to recover it.*

Demo: *Demonstrate both the sweep and the cylinder lift methods of regulator recovery.*
Emphasize proper positioning for the cylinder lift and reach method.
Clear regulator as previously instructed.
Exhale slowly while regulator is out of mouth.

Problems: *Failure to keep arm straight and close to cylinder while sweeping.*
Inadequate cylinder "lift for reach" method.
Didn't exhale while regulator was out of mouth.

Mask Flood and Clear (Partial)

Mask management is taught in three stages. First, students are introduced to partially flooding their masks and then clearing - much as they will in order to defog their masks. In the next session they are taught to completely flood and clear - a skill that will be useful when their mask is knocked ajar in open water. In the last session, they will graduate to complete removal and replacement underwater - finally achieving complete comfort with their masks in all situations.

Objective: *"You will be able to" clear a partially flooded mask while underwater.*

Why: *"In the event" your mask should become partially filled with water, you can clear it easily and continue your dive.*

Demo: *Partially flood mask letting the water trickle in from the top.*
Emphasize head and hand positions and exhaling through nose.
Ask about contact lenses!

Problems: *Didn't look up to clear.*
Students often flood from bottom - gets in nose, remind them to trickle from top.
Exhaled too little or through mouth instead of nose.
Blows in one big blast - tell them to do it slowly and deliberately
Mask skirt not close enough to face and sealed against forehead.
Contact lenses (student's eyes closed - tap them on shoulder when mask is clear and they can open their eyes).

Teaching Tools: *Mask flood and clear is the skill most often associated with anxiety and subsequent failure in the open water course. One helpful method of teaching this skill is outlined here:*

1. *With their heads above water, masks off and regulators in mouth, have students practice the breathing cycle - in through the mouth - out through the nose.*

2. With their masks off but regulators in mouth, dip heads under-water for several breathing cycles as above.

3. *Masks on but not flooded, have them repeat step 2 while pushing top of mask against their forehead (non-purge style) or center of mask to face (purge style).*

4. Partially flood masks from top and repeat step three (3).

5. Now teach mask partial flood and clear as usual.

Fin Kick - Flutter, Modified Flutter and Frog Kicks

Demonstrate each of these kicks. The advantages of each of these were discussed in the classroom sessions and should be briefly reviewed again here. This is a good time to re-emphasize control of diving technique and respect for the underwater environment in choosing the "best kick for the job." Remind students that appropriate choice and control of kicking is a highly visible attribute of accomplished divers.

Weight System Removal and Replacement (Surface)

Demonstrate proper method of weight system removal and replacement on the surface in a horizontal position. When using a weight belt teach them to start face up and "roll" the belt on. Make sure students have second stage in their mouth so they can breathe. Have students practice this skill until proficient.

BCD Removal and Replacement (Surface)

Demonstrate proper method of BCD removal and replacement on the surface in a horizontal position. There are several ways to complete this exercise. Select the one that best fits the student's needs. Demonstrate, and then have students practice until proficient.

Under Water Swim and Practice Time

Let students' just "play" in confined water. They need the opportunity to work on the skills you have just taught them. Try to avoid excessive correcting of them unless they are having difficulty or developing a bad habit.

Exit

Exit by the appropriate method. Encourage buddy assistance.

Check Air

Check the student's air at the end of each pool/confined water session to make sure they are completing the class with plenty of air. This will get them in the habit of checking their air throughout the class and later when they start to dive on their own.

Disassemble Scuba System

Emphasize keeping first stage dry, rinsing equipment thoroughly, stowing out of walkways.

Debriefing

After positive corrections, congratulations and encouragement are a component of the debriefing. Positive peer recognition is the most important reward to your students, especially from YOU, their instructor. Never make fun of your students - your remarks may be taken more seriously than you intended.

Complete Student Training Record for pool / confined water session One (1)

Log and Sign Dive Books

Logging the confined water dives lends confirmation and importance to your teaching and what they are learning. It also "imprints" the "log your dive" habit in your students right from the start.

Pool/Confined Water – Dive 2

Use Cue Card: 'CW2-Confined Water 2'

Briefing (As In Session #1)
Pre-dive briefings are very important, even in confined water sessions! It demonstrates the pattern of thoughtful planning that you have been trying to communicate to your students. It's time to encourage them to think and begin participating in making decisions. For example, ask them what kind of entry they think would work best.

Weight System/Mask Defog (As In Session #1)

Scuba System - Assemble and Don as Instructed
Let students attempt the assembly on their own, only assist and guide as needed. Be positive in correcting their errors. Even instructors sometimes try to assemble their scuba unit backwards.

ABCDE's
As in confined water #1

Water Entries
As noted in session one, try to use a different entry every time. For example, if they used a controlled - seated entry in confined water #1, use the giant stride or back-roll into the deep end of the pool this time. Emphasize thinking about the appropriateness of each type of entry for the site.

Objective: *"You will be able to" enter the water by both giant stride and back-roll methods.*

Why: *"You will be" a more confident diver knowing that you are able to enter the water the easiest way from any setting.*

Demo: *Enter water using correct giant stride and back-roll methods.*

Problems: *Failed to use scissors technique on giant stride.*
"Hopped" on giant stride.
Allowed equipment to become entangled with deck or boat on back-roll.

6 Point Descending Technique (ORCESD)

Just as take-off and landing are important skills in flying an airplane, ascents and descents are very important parts of a scuba dive. The "checklist" is a useful tool to help you remember the steps in a proper descent.

Objective: *"You will be able to" demonstrate a descent using the appropriate step-wise method.*

Why: *"It's important to know" a simple procedure that helps you remember all the important steps to follow when you're ready to descend.*

Demo: *Demonstrate proper descent techniques.*
Orient
Regulator in the Mouth
Computer On
Equalize
Signal Buddy
Deflate & Descend

Computer Use

Students should start to learn how to read and interpret information while using a dive computer.

Breathing From a Free-Flowing Regulator

Remind students that regulators are designed fail-safe and may free flow. Make sure they understand that this is a manageable situation and they will be able to breathe while surfacing in a controlled manner. Emphasize that there will be so much available air that they cannot inhale it all, in fact they must not put the mouthpiece in their mouth, but instead, breathe slowly and shallowly from the blast of air.

Objective: *"You will be able to" breathe effectively from a free flowing regulator for approximately 30 seconds in shallow water.*

Why: *"Isn't it nice to know" that in the unlikely event of a regulator malfunction that results in a free flow of air, you can breathe only the air you need and let the rest escape into the water as you make a safe controlled ascent?*

Demo: *Demonstrate by pressing regulator mouthpiece against your upper teeth with your mouth partially opened below so that excess air can escape and pressing purge button to simulate free flow.*
Stress not sealing lips on mouthpiece and using tongue as a splashguard.

Problems: *Incorrectly or inadequately pressing purge valve.*
Sealing lips around mouthpiece.
Poor airway control - Incautious breathing.
Improper head position to breathe comfortably and see out of dive mask.

Mask Flood and Clear

This is step two (2) of the three (3) step mask management group of skills.

Objective: *"You will be able to" flood and clear your mask while underwater.*

Why: *"In the event" you should get water inside of your mask, you can clear it easily and continue your dive.*

Demo: *Fully flood mask*

Emphasize head and hand positions and exhaling through nose.

Ask about contact lenses!

Problems: *Didn't look up to clear.*

Exhaled through mouth instead of nose or too little.

Mask seal must be close to face and touching on top.

Contact lenses (student's eyes closed - tap them on shoulder when mask is clear and they can open their eyes).

Stress proper positioning of their mask.

Weight System Removal and Replacement (On the Bottom)

Demonstrate the proper technique for weight system removal and replacement on the bottom of the pool in deep water. Students with integrated BCDs should practice with a weighted belt in addition to their BCD. Emphasize the need to completely empty the BCD of air before unbuckling their belt.

Snorkel Use, Clearing and Exchange

Divers often minimize the importance of snorkel skills because snorkels are not perceived as part of "real" dive equipment. Actually, the snorkel is an important piece of safety equipment and it would be hard to find an experienced diver who has not, at one time or another, turned to the snorkel to help them out of an exhausting situation.

Objective: *"You will be able to" clear a snorkel of water by using the blast method and resume breathing through it without lifting the face from the water.*

Why: *"Isn't it nice to know" that there is an easy way to get that unwanted water out of your snorkel after you've done a dive or inadvertently dipped the end of the snorkel under water and allowed water to enter it?*

Demo: *Fill and blast clear snorkel.*

Students should develop airway control allowing them to keep their faces in the water while breathing.

Stress proper snorkel position and the need to be cautious on initial breaths.

Problems: *Improper head or snorkel position to breathe easily.*

Insufficient exhalation to clear snorkel.

Lifting face out of water to clear snorkel.

Poor airway control – in-cautious first breath after clearing.

Tired Diver Tow

This simple rescue technique is fun to teach and its importance is easy for students to appreciate. It's the one skill that all divers want their buddies to know.

Objective: *"You will be able to" safely tow a tired or incapacitated diver on the surface for at least 25 yards.*

Why: *"In the event" you should encounter a diver who is unable to swim on the surface, you will be able to assist them to a boat or shore.*

Demo: *Show proper position of rescuer behind tired diver, both on back.*
Make tired diver buoyant.
Emphasize staying out of reach of tired diver in case of panic.

Problems: *Failure to make tired diver buoyant.*

Cramp Relief

Demonstrate proper method of self cramp relief and assisting a buddy with cramp relief.

Deep Water Exit

Use the exit method that is most appropriate for the site. Emphasize removal of weights and other awkward and heavy pieces of gear before trying to get out of the water. Encourage buddies to help each other.

Check Air

Continue to stress checking their air at the end of each pool/confined water session.

Disassemble Scuba System

As before, rinse, dry and store.

Debriefing (As in pool/confined water session #1)

After positive corrections, congratulations and encouragement are a component of the debriefing Make sure they understand the correct method of completing a skill. Extra time during a water session or a one-on-one session can be set to make sure the student is comfortable.

Complete Student Training Record for pool/confined water session Two (2)

Log and Sign Dive Books

Pool/Confined Water – Dive 3

Use Cue Card: 'CW3-Confined Water 3'

Briefing

By now, students are beginning to expect the briefing and will organize themselves around it. Be sure you always brief what you intend for them to do and do what you have briefed (plan your dive - dive your plan).

Weight System/Mask Defog (As in Sessions #1 and 2)

Scuba System - Assemble and Don

Let them do it and assist them only as needed.

ABCDE's

Continue to emphasize the importance of checklists much like those used by pilots.

Entry

Try to use a different entry at each session in order to expose students to all common types of entries.

Surface Navigation Run

Briefly review compass reading during the briefing for this session; students (and divers) have a lot of trouble with compass use. Make this exercise short (confined water) and fun.

6 Point Descent (ORCESD)

As described in Ascents and Descents above. Of course, all descents should be "under control." Controlled descent means holding on to a fixed object.

Hovering

Tell students it is another visible marker of an accomplished diver. They should know that hovering is especially difficult in shallow water and they shouldn't be discouraged, but keep practicing. Emphasize continuous breathing.

Objective: *"You will be able to" hover motionless (without kicking or sculling) in the water for at least thirty (30) seconds using buoyancy control.*

Why: *"Isn't it nice to know" that you can avoid damaging sensitive coral or stirring up silt on the bottom simply by fine-tuning your buoyancy through your breathing?*

Demo: *Stress breath control to make final adjustments but avoid breath holding.*

Problems: *Too much/too little inflation/deflation of BCD.*
Failure to allow sufficient time before adding/depleting air from BCD.
Failure to breathe slowly and deeply - fine tune breath control
Using hands/legs to maintain position - sculling.
Removing regulator from mouth.

Mask Removal and Replacement

The third step in mask management. Once they are comfortable with mask removal and replacement, they will be comfortable with their masks. Encourage students to practice seeing underwater without their masks (unless they are wearing contacts).

Objective: *"You will be able to" remove, replace and clear your mask while underwater.*

Why: *"In the event" your mask should become displaced while underwater, you will be able to replace and clear it easily and continue your dive.*

Demo: *Fully flood mask, then remove, replace and clear.*
Emphasize head and hand positions and exhaling through nose.
Ask about contact lenses!

Problems: *Contact lenses.*
Poor breathing control - inhaling water through nose.
Hair, hood or strap caught under skirt on replacement.
Improper head or hand position for clearing
Inability to exhale through nose or exhaling through mouth.
Inadequate exhalation to clear.
Mask skirt too far from face or failure to seal back to face.
Disorientation.

No Mask Breathe and Swim

This is really the fourth step in mask management - learning to get along without one at all! If a student is wearing contacts, they should keep their eyes closed and let their buddy lead them in the swim.

Objective: *"You will be able to"*

(1) *breathe under water for not less than one minute while not wearing a mask. While stationary and while swimming at least fifteen (15) meters / fifty (50) feet and*

(2) *completely remove, replace and clear the mask of water while under water.*

Why: *"In the unlikely event" your mask floods with water, is lost or cannot be worn because a strap has broken, you can replace and clear it or swim to the surface without it while breathing normally.*

Demo: *Demonstrate kneeling in shallow water.*

Stress airway control and need to exhale through nose. Tell students not to pinch their noses.

Proceed from partial clear first.

Problems: *Contact lenses.*

Poor breathing control - inhaling water through nose.

Hair, hood or strap caught under skirt on replacement.

Improper head or hand position for clearing.

Inability to exhale through nose or exhaling through mouth.

Inadequate exhalation to clear.

Mask skirt too far from face or failure to seal back to face.

Disorientation.

BCD Removal and Replacement Underwater

This can be an anxiety provoking exercise. Emphasize regulator control and taking their time. The procedure is outlined in a simple and easy method in the SDI Open Water Scuba Diver Manual.

Objective: *"You will be able to" remove, replace, adjust and secure the scuba unit on the bottom, with minimal assistance, in water too deep to stand up in.*

Why: *"Isn't it nice to know" that if you have to remove your scuba unit because something has become entangled in it, you can remove it, correct the problem and replace it easily underwater?*

Demo: *Stress that the unit must not be over-inflated and that all maneuversshould be accomplished by feel.*
Left arm out first – left arm in last.

Problems: *Difficulty finding and releasing straps.*
Pulling regulator out of mouth on removal.
Failure to hold onto or control scuba unit once removed.
Difficulty replacing and securing scuba unit - entanglement.
Trapping hoses upon replacement.

Controlled Ascent (Computer Monitored)

Confined water may make this a limited experience. Emphasize the importance of knowing how their computer works and what the arrows mean.

Skills Practice

This is where students can play and "iron out the wrinkles." Correct only as necessary or to head off bad habits.

Exit

Check Air (As in Session #1 and 2)

Important they monitor for when they start to dive on their own.

Disassemble Scuba System

As in previous sessions.

Debriefing

As in previous sessions.

Complete Student Training Record for pool/confined water session Three (3)

Log and Sign Dive Books

Pool/Confined Water – Dive 4

Use Cue Card: 'CW4-Confined Water 4'

Briefing
Brief as in earlier sessions. This confined water session is oriented to emergency skills. Emphasize the satisfaction students will feel in knowing how to rescue others.

Weight System/Mask Defog
This is the last scheduled pool / confined water session before they attend their open water dives. This should be becoming second nature by now.

Scuba System - Assemble and Don
Begin to emphasize the fine points of scuba assembly such as regulator purge while pressurizing and facing the SPG away from the diver when pressurizing.

Entry
Try to rotate through all types.

ABCDE's
Continue to stress buddies help each other.

6 point Descent (ORCESD) On A Line
If logistics permit in the confined water setting, use a line to demonstrate how they can control a descent using a line.

Alternate-Air Sharing Ascent

Have students practice sharing air on the bottom until they are comfortable before they ascend, then instruct this procedure as outlined in the SDI Open Water Scuba Diver Manual. Make sure both buddies participate as donor and recipient. Emphasize exhaling a bubble stream when the regulator is out of their mouths, having a firm hookup with each other on ascent and maintaining good eye contact.

Objective: *"You will be able to" locate, secure and breathe from an alternate air source supplied by a buddy for one minute, both in a stationary and a swimming position while under water.*

Why: *"Isn't it nice to know" that in the unlikely event you run out of air, you can use your buddy's alternate air source to provide you with air while you both make a safe controlled ascent?*

Demo: *Demonstrate locating, securing and breathing from an alternate air source (stationary and swimming).*

Students to switch roles as donor and receiver.

Stress no breath holding.

Stress looking up and holding deflator valve in hand.

Problems: *Failure to signal and secure alternate air source from buddy.*

Difficulty securing, clearing or breathing from alternate air supply.

Failure to make continuous "aaaahhh" sound or exhale when regulator is out of mouth.

Lack of secure contact between buddies (right arm hook up).

Insufficient coordination/communication between buddies while swimming/ascending.

Controlled Swimming Ascent (CSA)

Controlled Swimming Ascent or CSA is the "last resort" controlled self-rescue. The diver who must resort to CSA is caught between the need to surface quickly enough to avoid drowning but slowly enough to avoid DCS. Remind divers that the volume of air in their lungs will steadily increase as they surface; so, they must exhale slowly (or hum) to let the excess air out and avoid lung expansion injury. Since this is an out of air ascent, they will need to orally inflate their BCD on the surface.

Objective: *"You will be able to" simulate a controlled emergency swimming ascent by swimming horizontally underwater for at least 9 m / 30 ft while continuously exhaling and emitting a continuous sound.*

Why: *"Isn't nice to know" that in the unlikely event you run out of air and your dive buddy is unable to quickly provide you with an alternate air source, you can make a safe swimming ascent to the surface while continuously exhaling and not exceeding the maximum safe ascent rate (18 m / 60 ft per minute)?*

Demo: *Demo in shallow water - lead divers to deep water and watch them continuously.*
Hold diver's console when he adds air to BCD to achieve neutral buoyancy (Signal).

Grip ascent line between your hand and diver's BCD.
1. *Neutral buoyancy*
2. *Look up and inhale*
3. *Slowly kick up saying "Ah"*

Oral inflation at surface (2 breaths).
"If you feel air deprivation or I signal you to stop, just resume normal breathing through your regulator."

Problems: *Improper hand/body position for swim.*
Removing regulator from mouth.
Failure to make a continuous sound.
Exhales too fast and runs out of air too soon (no bubbles)
Swimming too fast/slow or lack of buoyancy control.

Compass Navigation (Underwater)

Review again the components of a compass and their use. Give students a simple direction and reciprocal to navigate in confined water. This exercise is fun and gives them a great sense of achievement when they perform a satisfactory run. It also represents their first underwater "mission" and as they concentrate on it they will be performing their scuba skills naturally.

Skills Practice

This is the student's time to play and polish their skills in anticipation of open water. Watch out for bad habits and look for marginal students who may need more confined water work.

Exit

By appropriate method, using buddies.

Check Air

As in previous sessions

Disassemble Scuba System

Rinse, dry and store.

Debriefing

The students should be ready to go to open water dives by this time.

Complete Student Training Record for pool/confined water session Four (4)

Log and Sign Dive Books

Open Water – Dive 1

Use Cue Card: 'OW1-Open Water 1'

Briefing
Begin every open water dive with a thorough instructor briefing. Review computer use and make sure that your students have a clear picture of the dive environment and dive plan. Brief them on the skills they will perform following the open water presentation form format. Do not overly caution students at this point as they are already anxious and task loaded. Your students will be extremely attuned to your mood and attitude at this critical time and they want to be able to dive like you. At this point, they are learning more from watching you than listening to you - be relaxed, positive and show them how much you enjoy diving!

Weights Adjustment and Mask Defog
Emphasize the importance of balance and knowing how to drop diver and buddy's weight system.

Scuba System Assembly
Students should be fairly proficient at this by now but they are in a new setting and may be anxious. They will make the same simple mistakes (putting the regulator on backwards, etc.) as they made in confined water. Try to have fun with this (even instructors make simple mistakes) and take advantage of this opportunity to emphasize the value of buddies checking each other's equipment.

Don Scuba System
Buddy assistance during preparation reinforces the buddy system during the dive.

Review ABCDE's

This is the last opportunity for a thorough recheck of the divers' and buddies' equipment.

Entry, Weights Check and Bubble Check

Entry can be an anxiety-provoking event. Enter by the simplest method appropriate to the dive setting. Give everyone surface time to relax and get comfortable. Performing weight checks and buddy bubble checks helps keep divers minds on tasks and gives them a sense of self-control. It also reinforces the buddy system. Consider having students try no mask breathing on surface to get their faces used to the water for the breathing exercises. Remind them to signal you when their cylinder pressure reaches the minimum pressure limit you have established.

ORCESD (Holding on to Buoyed Line)

Make sure everyone is really ready before you go down so you don't find yourself in the awkward situation of having some divers down on the line while others are still on the surface struggling with their equipment. The line is for control only - descend by buoyancy - no "pull downs".

Remove/Recover/Clear Regulator

Use any combination of methods learned in confined water. Follow the format of the open water presentation form.

Mask Flood and Clear (Partial)

Follow the format of the open water presentation form.

Fin Pivot (LPI)

Follow the format of the open water presentation form.

Tour - Neutral Buoyancy
Emphasize neutral buoyancy - for experience and underwater observation. This is their "reward" for many hours of study and practice - they're finally diving! Try to orient the dive and site so there are a couple of interesting features to show them. If they like this dive, they'll probably do well from here on out.

Controlled Ascent (On a Line)
You should caution divers to use good buoyancy to achieve their ascent. The line is meant to be a reference and help them fine-tune their ascent. However, you should "give them permission" to hold on firmly if necessary to avoid an uncontrolled ascent.

Safety Stop
If you want your students to accept the importance of safety stops, you must make sure that you and they make a safety stop on every training dive.

Exit (appropriate method)

Debrief Dive
Since this is their first open water dive they want to know how they did. Remember to evaluate their abilities in a positive manner. If they feel they've done well and had fun during the first open water dive they'll be ready to come back again.

Complete Student Training Record for Open Water Session One (1)

Log and Sign Dive Books
Your students are learning by watching you - log your dive in your logbook and sign their logbooks.

Open Water – Dive 2

Use Cue Card: 'OW2-Open Water 2'

Brief and Prepare for Dive
Begin every open water dive with a thorough instructor briefing. Review computer use and be sure that your students have a clear picture of the dive environment and dive plan. Brief them on the skills they will perform following the open water presentation form format. Do not overly caution students at this point as they are already anxious and task loaded. Your students will be extremely attuned to your mood and attitude at this critical time and they want to be able to dive like you

Weight System/Mask Defog
Stress key points again from open water session one.

Scuba Unit Assembly
Students should be able to assemble their equipment without many problems by now. Keep an eye open for those who may be under some stress. Again, emphasize the value of buddies checking each other's equipment.

Don Scuba Unit
Continue the importance of using the buddy system before during and after a dive.

Review ABCDE's
Continue to stress checklists

Entry
Use the appropriate entry for conditions. If possible, choose a different entry than was used in Open Dive 1 to expose the students to various entry methods during their open water divers.

ORCESD with Reference
(To a Buoyed Line or Other Fixed Object)
Divers should look at but not hold onto the fixed reference. This adds a new layer of complexity and self-control. Be sure you "give them permission" to grab the line if they need to in order to control their descent.

Flood and Clear Mask
Follow the format of the open water presentation form.

Alternate Air Assisted Ascent
Rotate and repeat. Follow the format of the open water presentation form.

Tour - Neutral Buoyancy
For experience and underwater observation, make it interesting!

Controlled Ascent with Reference
You should caution divers to use good buoyancy to achieve their ascent. The line is meant to be a reference and help them fine-tune their ascent. However, you should "give them permission" to hold on firmly if necessary to avoid an uncontrolled ascent.

Safety Stop
Safety Stop on every dive! We teach by doing.

Tired Diver Tow

This may be the last time they practice it before they need it!

Exit (appropriate method)

Debrief Dive

Debrief the dive.

Complete Student Training Record for Open Water Session Two (2)

Log and Sign Dive Books

Your students are learning by watching you - log your dive in your logbook and sign their logbooks.

Open Water – Dive 3

Use Cue Card: 'OW3-Open Water 3'

Brief and Prepare for Dive
Begin every open water dive with a thorough instructor briefing. Review computer use and be sure that your students have a clear picture of the dive environment and dive plan. Brief them on the skills they will perform following the open water presentation form format. Do not overly caution students at this point as they are already anxious and task loaded. Your students will be extremely attuned to your mood and attitude at this critical time and they want to be able to dive like you

Weight System/Mask Defog
As in previous sessions

Scuba Unit Assembly
As in previous sessions, allow them to assemble with their buddy. Watch for signs of stress.

Don Scuba Unit
As in previous sessions

Review ABCDE's
Reinforce checklists

Entry
As in previous sessions

Weight System Removal and Replacement (Surface)
When using a belt, watch for "right hand release" and equipment entanglement.

Surface Navigation Run

Use at least 3 points (i.e., a triangle)

ORCESD without Reference (No Line To Hold On To Or Look At)

This is their first open water "free descent". Emphasize using other cues (bubbles, underwater objects, etc.) to gauge their rate and direction.

Hover (LPI)

Follow the format of the open water presentation form.

Tour - Neutral Buoyancy

Use the tour for experience and U/W observation. Learning to dive is fun! So is teaching.

Controlled Swimming Ascent

(With Instructor on a buoyed line)

Watch for anxiousness on the part of the student. Be sure to fully explain skill before they attempt it. Reiterate they must make the "ah" sound as they ascend.

Safety Stop

Safety Stop on every dive! We teach by doing.

Exit (appropriate method)

Debrief Dive

Use format on open water presentation form.

Complete Student Training Record for Open Water Session Three (3)

Log and Sign Dive Books

Your students are learning by watching you - log your dive in your logbook and sign their logbooks.

Open Water – Dive 4

Use Cue Card: 'OW1-Open Water 4'

Brief and Prepare for Dive

Begin every open water dive with a thorough instructor briefing. Review computer use and be sure that your students have a clear picture of the dive environment and dive plan. Brief them on the skills they will perform following the open water presentation form format. Do not overly caution students at this point as they are already anxious and task loaded. Your students will be extremely attuned to your mood and attitude at this critical time and they want to be able to dive like you.

Weight System/Mask Defog

As in previous sessions

Scuba Unit Assembly

By now they should be able to completely assemble the unit without problems.

Don Scuba Unit

Last chance to emphasize the buddy system before they become certified diver.

Review ABCDE's

Last chance stress the use of checklists

Entry

As in previous session use the most appropriate entry for conditions.

BCD Removal and Replacement
This exercise should only be performed on the surface in open water.

ORCESD without Reference
Hold line only in case of a problem. Make sure divers know the pros and cons between using a surface buoyed or bottom fixed line.

Weight System Removal and Replacement (underwater)
Watch for ascents due to no weight or students dropping the weight from the weight belt.

Compass Run with Reciprocal
Follow the format of the open water presentation form.

Slate Tour
Make notations of marine life to discuss with instructor. Now you're adding a new task by asking them to dive and make notes on their slates. This adds interest and builds confidence.

Controlled Ascent
You should caution divers to use good buoyancy to achieve their ascent. The line is meant to be a reference and help them fine-tune their ascent. However, you should "give them permission" to hold on firmly if necessary to avoid an uncontrolled ascent.

Safety Stop

Safety Stop on every dive! We teach by doing.

Exit (appropriate method)

Debrief Dive

Use format on open water presentation form.

Complete Student Training Record for Open Water Session Four (4)

Log and Sign Dive Books

This is a Big Signature to your students!

Open Water Certification

You can be justifiably proud of your students and yourself. You have taken a group of non-divers and turned them into certifiably safe and competent divers! Your students probably had different personality types and reasons for diving, and teaching conditions may have been less than ideal. In spite of these challenging circumstances, you exposed them to a carefully chosen package of core knowledge and skills. And you did it in a remarkably short amount of time. SDI is proud of you and your students will admire you for the rest of their diving careers.

Certification Ceremony

Your students should be proud of themselves too, but simply being told they have passed and are certified can be notably anti-climactic. Completing the last dive and being certified should be the climax of the entire scuba course. Where logistics permit, try to hold a post-dive ceremony at the end of the course. This may be very casual and can even be carried out on the dive boat or at the dive shop, but you should "make a fuss" over their success. For example, consider giving them a "diploma" of some diving related artifact or make awards for fun categories like "best entry." This serves as formal recognition of the newly certified divers' accomplishment and allows relaxed camaraderie to replace the air of anxiety that may have been present in the class.

Orientation To Advanced And Technical Diving

The certification ceremony embellishes your role as instructor and is an opportune time to encourage your new divers to sign up for their next training course. You can also tell them that they are now on the path that leads to even more adventure and excitement with, for example, Nitrox and technical diving. As your newly certified divers can see, there is a world of diving excitement waiting for the adventurous diver starting with SDI Open Water Scuba Diver and progressing through TDI's technical courses.

SDI – Open Water Referral Procedures

SDI Instructor to Any Active SDI Instructor - Procedure

- A SDI Instructor sends a student that has completed the academic and confined water portion of the SDI Open Water Scuba Diver course to a second SDI Instructor to complete the open water requirements with a GLOBAL REFERRAL FORM.

- Once the student has completed the open water requirements, the SDI Open Water Scuba Diver Instructor signs off that the skills listed on the back of the referral form have been completed.

- The student takes the signed form back to the original SDI Confined Water Instructor to have their card issued.

- The SDI Open Water Scuba Diver Instructor fills out the SDI Student Registration Form with the names of both instructors and sends it to SDI Headquarters to have the certification card issued with both instructor names on the card. The SDI Instructor may also use the online registration system, or in-store card printing system if available.

SDI Instructor to Any Active Instructor – Procedure

- A SDI Open Water Scuba Diver Instructor sends a student that has completed the academic and confined water portion of the open water course to any other active instructor from any dive training agency to complete the open water requirements with GLOBAL REFERRAL FORM.

- The open water instructor signs off that the skills listed on the back of the referral form have been completed.

• The student takes the signed form back to the original SDI Confined Water Instructor to have their card issued.

• The SDI Confined Water instructor fills out the SDI student registration form with the names of both instructors and sends it to SDI Headquarters to have the certification card issued with both instructor names on the card. The SDI Instructor may also use the online registration system, or in-store card printing system if available.

Any Instructor to an Active SDI Instructor – Procedure

• The SDI Instructor must teach the student how a personal dive computer works and have them wear a personal dive computer during the open water dives.

• The SDI Instructor ***MUST*** make sure the student completes all the skills required in the SDI Open Water Scuba Diver standards (a short list is found on the back of the GLOBAL REFERRAL FORM).

• Upon successful completion of the skills, the SDI Open Water Scuba Diver Instructor fills out and sends the SDI Student Registration form to SDI Headquarters to process the certification cards where both the confined and open water instructor name will appear on the card. The SDI Instructor may also use the online registration system, or in-store card printing system if available.

• SDI also requires the SDI Open Water Scuba Diver Instructor to make a copy of the referral letter that accompanied the student and file it with the student training record. SDI recommends that if a student comes with a Universal Referral Form, they not only issue a SDI certification card but also sign the Universal Referral form and give it back to the student so they may go back to their original instructor.

Appendix B
Open Water Scuba Diver Knowledge Quest Answers

AppendixB–
Open Water Scuba Diver Knowledge Quest Answers

Chapter 1: The Underwater Environment

1. What does SCUBA stand for?

- The Self-Contained Underwater Breathing Apparatus (S.C.U.B.A) gave a diver freedom to descend underwater without relying on an air umbilical to the surface.

2. List the two important changes that occurred in the 1950s.

- The publishing of dive tables in the 1957 U. S. Navy Diving Manual to allow for repetitive scuba dives.
- Manufacturers made dramatic improvements in both the design and workmanship of scuba equipment.
- Dive computers commercially available

3. Name three (3) different devices that modern dive computers replace.

Personal Dive Computers have made separate gauges to measure the following practically obsolete:

- Depth
- Time
- Pressure

4. What sets Scuba Diving International apart from other training agencies?

The properly equipped SDI student will use a personal dive computer (PDC) during all their in-water instruction and certification dives.

5. How much closer do objects appear underwater and why?

- When looking through a dive mask underwater everything appears larger than normal. This is because light bends as it enters the airspace between your eyes and the mask lens, magnifying objects by about twenty five percent (25%).
- Objects also appear about twenty five percent (25%) closer.
- You will also notice that you cannot see as far as you can above the water. Divers express visibility, how far they can see horizontally, in distance (e.g. feet).
- Available light, water turbidity, and distance are factors that influence how far a diver can see and how objects appear underwater.

6. What is the first color to be absorbed underwater?

Red objects appear brown starting at about 20 feet and green in much deeper water. The order that colors are absorbed is red, orange, yellow, green, blue, and violet, but the entire spectrum of color is gradually absorbed (gradually changing the colors) until all light energy is totally absorbed at depths beyond the range a scuba diver can dive.

7. How much faster does sound move through water than air and why?

- Sound travels fastest through dense mediums. Because water is about eight hundred (800) times denser than air, sound moves approximately four (4) times faster in water than in air.
- Sound moves so fast underwater that there is not enough time delay from one ear to the other for the human brain to determine the direction sound comes from. Not in the student information
- When you hear the crunching sound of a parrotfish feeding or your buddy tapping on their cylinder to get your attention, it will be difficult to tell exactly where the sound is coming from.

8. When diving from shore, the best time to dive is when there is the least amount of tidal current _________ tide is when the water is neither rising nor falling and there is the least amount of tidal current.

- The period of time between tides when there is no vertical movement of water is called a slack. This means the water level is neither rising nor falling, but there may still be horizontal motion or current.

9. If you are caught in a rip current, first swim _____________ to the current to get out of it before swimming towards shore.

- If you are caught in a rip current, swim across it (or perpendicular) to get out, never against it.
- Or you can float and let it carry you out to where it dies out and then swim back to shore away from the rip.

10. Waves are usually caused by ________________.

- Waves are a form of energy that is primarily generated by wind.

11. Anticipate surge action to avoid contact with stationary objects. True or False?

- True. When swimming through an area with strong surge, kick when the force is pushing you in the direction you wish to go. Grab hold of a rock or stick your hand in the sand to prevent being pulled backward when the force opposes your heading. When diving a shallow water reef with many coral formations, surge can push you into an object you wish to avoid contact with. Under such conditions it is best to increase your distance from natural obstructions by either moving farther off to the side or into deeper water where the surge is weaker.

12. What types of marine life cause most diving injuries?

- Most marine life injuries amount to no more than a temporary, yet painful sting.

13. What should you do if you see a potentially dangerous animal underwater and it does not leave the area?

- If you see a shark, or any other potentially dangerous marine animal, remain still and calm.

14. List three different reasons that it is advisable to check with your local dive center before conducting a dive in an area you are unfamiliar with.

- Some areas are prone to rip currents. A rip current, or run-out, is a narrow flow of swiftly moving water running seaward from the shore.
- When deciding on the thermal protection, find out if the area you plan to dive at typically has thermoclines.
- Be advised that laws in some locations may prohibit certain diving activities, such as harvesting live shells, ornamental fish, food fish, and other game while using scuba equipment.

Chapter 2: Physics and Physiology

1. What is the absolute pressure (in atmospheres/bars) at 20 metres / 66 fsw?

- As a diver descends the pressure surrounding them increases. It increases at a rate equal to one (1) atmosphere or 14.7 psi every 10msw/33fsw or 10.3mfw/34ffw. Thus, at 10msw/33fsw the pressure is 2atm, at 20msw/66fsw it is 3atm, at 30msw/99fsw it is 4atm, at 40msw/132fsw it is 5atm, and so on.

2. What will be the volume in a balloon that is filled with two (2) liters/ cubic feet. of air at 30 metres/ 99 fsw when it is taken to the surface?

- If a balloon is filled with two (2) cubic feet of air at ninety (99) fsw, then it will be eight (8) cubic feet at the surface. The reason air volume decreases with increases in ambient pressure is because the air inside the balloon is being compressed.

3. How many more times dense is the air in a balloon at four (4) atm/ bar compared to its density at the surface?

- The pressure and volume relationship of Boyle's Law influences gas density. As air becomes compressed the gas molecules move closer together making the air denser. Air density increases in direct proportion with increases in ambient pressure. Therefore, the density of air in a balloon at 10msw/33fsw will be double what it is at the surface. If the balloon is taken down to a depth of 66fsw, the air inside will be three times as dense as its density at the surface, and at 30msw/99fsw (4ata) it will be four times as dense.

4. If a scuba cylinder lasts two hours at sea level, how long will it last at 20 msw/66 fsw?

- If it takes one (1) hour for a diver to breathe all the air from their cylinder at the surface (1 atmosphere), the same cylinder will last only 30 minutes at 10msw/33fsw, and will only last 20 minutes at twenty 20msw/66fsw, everything else being equal. Therefore, if the cylinder lasts two (2) hours at the surface it will last 40 minutes at 20msw/66fsw.

5. How often should a scuba diver equalize during a descent?

- To prevent injury, it is very important to perform an equalization maneuver at the surface just before beginning your descent and then every couple of feet before you feel any discomfort.

6. What should you do if you experience discomfort in your ears upon descending?

- If you experience discomfort or pain during descent, immediately stop descending and ascend a few decimeters/feet to a shallower depth where you no longer feel any discomfort.

7. What is a reverse block?

- A reverse block occurs when air cannot expand or escape freely upon ascending.

8. What should you do if you experience a reverse block upon ascending?

- Descend a couple of decimeters/feet to the depth where the discomfort goes away and remain there until the expanding air has time to vent, or as time and air supply permit.

9. What is the most important rule in scuba diving?

- Breathe continuously; never hold your breath.

10. What is the most serious injury that a diver could suffer from if they hold their breath upon ascending?

- The most serious consequences of violating Boyle's Law are lung over-expansion injuries.

11. Which gas component in air causes decompression sickness and narcosis?

- Nitrogen narcosis and decompression sickness are the two (2) most common problems associated with absorbing nitrogen.

12. What medical problem can occur if a diver ascends much too rapidly for nitrogen to be slowly released?

- Decompression Sickness

13. List at least five (5) factors that can predispose a diver to decompression sickness.

- If a scuba diver ascends too fast, the pressure change will be too rapid to permit the slow release of dissolved nitrogen from the tissues into the blood stream. Instead it may come out of solution in the form of bubbles and block blood flow. This physiological problem is called decompression sickness (DCS). The list includes:

- Obesity
- Older age
- Illness
- Past/present injuries
- Prior history of DCS
- Fatigue
- Dehydration
- Smoke inhalation
- Ingestion of drugs
- Bounce dives or saw-tooth profiles
- Performing deeper dives after shallower dives
- Over exertion during or soon after a dive
- Chilling during the dive
- Ascending to altitude too soon after diving by driving into the mountains or flying.

14. Describe the symptoms of DCS, including mild to severe signs and symptoms.

- A diver may have a rash if bubbles occur in the capillaries near the skin.
- Joint pain is the most common symptom because bubbles typically coalesce and collect in and around joints, causing the joint to bend, hence the nickname, "bends."
- Difficulty inhaling and/or a frequent dry non-productive cough may indicate the diver's lungs are affected.
- A loss of sensation, loss of bladder or bowel control, or paralysis may occur if bubbles form in the spinal cord or other areas of the peripheral nervous system.
- Dizziness, numbness, tingling, paralysis, temporary blindness, and unconsciousness can occur if bubbles go to the brain or affect the central nervous system.
- Severe decompression sickness can result in permanent disability or death.

15. What is the depth threshold where most scuba divers generally begin to be affected by nitrogen narcosis?

Most divers are not affected until a depth of thirty 30msw/100fsw and greater, so narcosis should not be a problem for beginning scuba divers whose certification limits them to a maximum depth of eighteen 18msw/60fsw.

16. List two possible ways a diver may feel if they become affected by Nitrogen Narcosis.

A diver experiencing nitrogen narcosis may feel euphoric or anxious. In either case, their ability to think clearly and act appropriately will be diminished if not completely compromised. What is worse is that they may not perceive themselves to be impaired and this is likely to endanger them and their dive partner depending on the circumstances.

17. What should a diver do to alleviate the symptoms of nitrogen narcosis?

If you feel strange or believe you are "narked", simply ascend normally until you no longer feel the effects. You may only have to ascend a half a meter/few feet, but how much you have to ascend will depend on your personal tolerance or susceptibility, which can vary from day to day.

18. Which gas causes extreme headache and nausea, and in high enough concentrations causes unconsciousness and the lips and fingernail beds to turn bright red?

Bright red lips and finger nail beds are indications of exceptionally high CO (Carbon Monoxide) levels and pending unconsciousness.

19. What may indicate the air in a scuba cylinder is harmful to consume?

The air has an odor or taste to it. Do not use air that has an odor or taste.

20. What should you do if you suddenly feel sick during a scuba dive?

If you ever begin to feel ill at depth, immediately abort the dive by making a controlled ascent to the surface. Breathe fresh air or oxygen if it is available. The symptoms should clear up, but if they do not, seek medical attention.

Chapter 3: Scuba Equipment

1. How do you know if a mask fits correctly?

Place the mask on your face without using the mask strap. Be sure you do not have any hair under the skirt. Inhale through your nose to create suction and then hold your breath. The mask fits if it tightens against your face and does not fall off. The mask does not fit if you must continue to inhale to keep it on or air leaks in under the skirt.

2. What is the main purpose of a snorkel?

Using a snorkel allows a diver to conserve air from their scuba cylinder while swimming at the surface.

3. Name at least one (1) visual and one (1) audible rescue signaling device.

Every scuba diver needs to carry at least one (1) signaling device for use at the surface.

- A yellow or red colored inflatable device, such as a narrow tube or lift bag, is preferable visual signals.
- Audible signals are also useful. A whistle or air horn make very loud sounds that will attract the attention of boats or divers on the surface.

4. Name two (2) basic fin designs and describe the main features of each.

- A full-foot fin encloses your entire foot inside the foot pocket, just as a typical shoe does.
- An open-heel fin has a foot-pocket that is open in the heel area

5. What is the main difference between a wet suit and a dry suit?

- A wet suit is necessary for colder conditions and for long dives.
- A dry suit becomes mandatory when water temperatures are about 10°C/50°F and below.

6. What extra attire can enhance a diver's warmth when worn with a wet or dry suit?

You can increase thermal protection by wearing a neoprene cap, hood and/or gloves.

7. Name two (2) functions of wet suit boots.

Feet are another area that requires protection from both (1) heat loss and (2) incidental injury when not wearing fins. Wet suit boots provide both.

8. List four (4) functions of a dive computer.

- Depth
- Dive Time
- Ascent Rate
- No-Decompression timer / No-Stop time
- Required Decompression
- Surface Interval Timer
- Time to Fly
- Logbook.

9. Define maximum dive depth.

- Maximum Depth is the deepest point reached during the dive.

10. Define no-stop time.

The no-stop time is the amount of time that is remaining, at any point during a dive, before a diver is incurring a mandatory decompression stop.

11. What are two (2) ways a PDC may alert a diver that he is ascending too fast?

Most PDCs display visual warnings when a diver ascends too fast, but they may also have an audible alarm to alert the diver to slow down.

12. How do you determine the time limit for a repetitive dive from a PDC?

When the dive computer is in the Surface Mode (or Plan Mode depending on the Computer model), the display will scroll through a range of depths (in even three (3) meter/ten (10) feet increments) showing the no-stop time limit or the adjusted no-stop time limit for repetitive dive depths based on the credit derived from the surface interval time.

13. What are the two (2) main modes of operation of a dive computer?

A personal dive computer has (at least) two (2) distinct modes of operation that you will use to regulate your dive:

- Surface mode
- Dive mode.

14. What are two (2) types of weight systems?

There are two (2) different types of weight systems that are defined by how the diver carries the weight.

- Weight-belt
- Weight-integrated.

15. What are the two (2) types of dive flags that are commonly flown from a dive boat?

There are two (2) types of dive flags, one (1) for diving from a boat that is restricted in its ability to maneuver and one (1) for conducting dives from shore.

- The international flag is a rigid replica of the white and blue Alpha flag. Must be flown from a dive boat.
- The diver down flag is a rectangular red flag with a white diagonal stripe from the top left to the bottom right

16. Describe the function of a scuba regulator first-stage and second-stage.

A scuba regulator delivers breathing gas from a compressed gas cylinder to a diver on demand.

17. A cylinder should be visually inspected at least ________________ a year and hydrostatically tested every ________________ years in the United States.

- Currently it is standard practice for scuba cylinders to receive a visual inspection at least once a year.
- A scuba cylinder must be hydrostatically tested every five (5) years at a certified testing facility.

18. List three (3) components of a compass?

- An analog compass consists of a plastic housing filled with oil and a free spinning needle (or card) that points to the north.
- It also has a lubber line that is a stationary line of reference that is used to align with the centerline of the diver's body.
- Some compasses may have index marks on a rotating bezel which, when aligned with the needle, help keep the diver traveling in the desired direction.

19. What does the abbreviation BCD stands for?

To support their scuba cylinder and to give them the capability to float, sink, or maintain a constant depth in the water, a diver wears a Buoyancy Compensator Device.

20. State the gauges that a console might hold.

A three (3) gauge console would have:

- A Submersible Pressure Gauge (SPG),
- A Depth Gauge
- A Compass.

Chapter 4: Skills Development

1. Describe all the steps to assemble a BCD and regulator to a scuba cylinder.

- Step 1: Before attaching your BCD to a cylinder, be sure the cylinder band(s) is threaded through the CAM buckle(s) correctly.
- Step 2: With the valve orifice facing you, place the BCD band(s) over the top of the cylinder so that the front of the BCD is facing you and the top of the neck is at least the same height as the cylinder valve.
- Step 3: Position the band so that it is perpendicular to the cylinder hand or pressing your knee against it. Then push the buckle until it closes flat against the cylinder band.
- Step 4: If there is a second cylinder band, follow these same steps, but always secure the top band before securing the bottom to make sure the BCD height and alignment is correct.
- Step 5: Stand behind the cylinder so that it is in front of your legs and you are facing the same direction as the BCD as if you were wearing it.
- This simple tactic is an easy way to avoid confusion when connecting the first-stage to the valve outlet and determining the correct sides the hoses go on.
- Step 6: Loosen and remove the dust cap from the first-stage air inlet.
- Step 7: Hold the first-stage in your left hand and the second-stage hoses in your right hand. Mate the first-stage air inlet to the valve outlet. The first-stage body should be between the valve and the back of the D. Screw the yoke attachment knob clockwise until it is snug or toghtened with your thumb and two fingers.
- Step 8: Connect the Low Power Inflator on the BCD.
- Step 9: Open for the air and listen for any leaks.

2. How should you go about checking that your BCD is attached securely to your cylinder?

To check that your BCD is secured around the cylinder, push downward on the buckle and on the top of the BCD directly opposite of the buckle. Alternatively, pick up on the buckle and the top of the BCD. If the BCD slips or if the buckle moves, retighten the cylinder bands.

3. What is the purpose of streamlining your hoses and accessories?

During a dive it is a good idea to have your hoses and gauges close to your body for easy access, to avoid entanglement, and to prevent damaging delicate aquatic life.

4. Describe from start to finish the steps to disassemble your scuba system.

- Step 1: Turn the cylinder valve knob completely clockwise to close the valve to turn the air off. Unless the BCD is positioned on the cylinder differently than described in the assembly section, the on/off knob will always be on the right side, coinciding with the right side of the BCD, and the knob for the first-stage yoke will be directly behind the valve and the BCD.
- Step 2: Depress one of the second-stage purge buttons or the auto-inflator button to vent air that is remaining in the hoses.
- Step 3: Detach the LP hose from the inflator

5. Describe two (2) important features of a weight system.

- Must have a quick release mechanism
- Must have evenly dispersed lead.

6. What should you do anytime the second-stage is out of your mouth?

Exhale tiny bubbles because you should never hold your breath.

7. Describe two (2) ways to clear a flooded second-stage.

- To mechanically purge the second-stage, place the mouthpiece in your mouth, block the mouthpiece opening with your tongue or place your tongue against the roof of your mouth and press the purge button.
- To orally purge the second-stage, you supply the airflow by exhaling into the mouthpiece until the water is removed.

8. What is the hand signal for out-of-air?

Hand across throat (Refer to the hand signal chart.)

9. The thumbs up signal means OK. True or False?

False. Refer to the hand signal chart.

10. Describe two (2) different ways to indicate OK.

- Circle with Fingers
- Hand on Head.

11. Describe how to perform a giant stride entry off a boat.

- Stand on the dive platform with your feet at the edge (and the blades of your fins protruding off the platform).
- Hold your mask, regulator, and hoses as described in the back-roll entry.
- Stand straight and look directly ahead
- Step out with one leg while pointing its fin tip up.

12. Name four (4) different water entries.

- Controlled seated entry is an easy way to enter calm water from a low platform
- Back roll entry is the most common water entry from a small boat that does not have a large dive platform.
- Giant stride entry is probably the most common deep-water entry, especially from large dive boats. It can be conducted from a low or high platform and in practically any sea state.
- Shore entry is appropriate when diving in a confined area that has a gradual slopping bottom.

13. Describe the two (2) unassisted emergency out-of-air ascents.

The two types of unassisted emergency ascents are

- Swimming Ascent
- Buoyant Ascent.

14. How do you vent air from a BCD?

To vent your BCD, hold the end of the BCD deflator over your head (if you are vertical). The deflator orifice (exhaust-valve outlet) must be higher than the BCD bladder to enable all the air to escape while you depress the deflator button.

15. A properly weighted scuba diver should float at ________________ when his BCD is deflated and lungs are fully inflated.

You should float at eye level when your BCD is deflated but your lungs are fully inflated.

16. How do you relieve a leg cramp?

To relieve a leg cramp, stop swimming and bend forward at the waist to grasp the fin tip of the afflicted leg. Pull it toward you as hard as you can as you straighten your leg. Maintain this position until the pain is relieved or repeat this procedure between momentary rest intervals.

17. What is the reciprocal of a two hundred degree (200°) heading?

To determine the reciprocal heading (for a straight line), add one hundred eighty degrees (180°) to a bearing that is less than one hundred eighty degrees (180°), but subtract one hundred eighty degrees (180°) from a bearing that is greater than one hundred eighty degrees (180°). So to get the reciprocal of a two hundred degree (200°), subtract one hundred eighty degrees (180°) and the answer is 20°.

Chapter 5: Planning Your Dive

1. Define Risk Management.

It is a means of preventing problems and planning a response to any emergency that arises.

2. Why should you avoid consuming drugs or alcohol prior to a dive?

Consuming drugs or alcohol prior to diving greatly increases your risk of decompression sickness. It also impairs your judgment.

3. What elements should you and your buddy agree on before the dive?

You and your buddy should:

- Familiarize yourselves with each other's equipment.
- Formulate your dive plan together.
- Go over the objectives of the dive.
- Review underwater communications.
- Review out-of-air emergency plan.

4. Describe what to do if you and your buddy become separated during a dive.

Buddies must employ the same search procedure.

- Look around for three (3) minutes.
- Then ascend a half a meter / few feet to look for rising bubbles.
- Rap on your cylinder and listen for a reply.
- If you are reunited underwater, check each other's air supplies and remaining no-stop time to decide how to continue.
- If you do not find your buddy after three (3) minutes, do a normal ascent to the surface and wait there until your buddy ascends.

5. When planning a repetitive dive, the __________________ dive should be made first.

Deepest.

6. Describe the procedure recommended for a safety stop.

A safety stop should be conducted between three (3) and six (6) msw/ ten (10) and twenty (20) fsw for three (3) to five (5) minutes before coming up to the surface. It is recommended on any dive under and mandatory for dives over thirty (30) msw/one hundred (100) fsw.

7. Describe what to do if you exceed the no-deco time registered on your computer.

Most modern computers will give an audible and /or visual alarm if you enter decompression. The computer will display each decompression stop depth and time. If this happens,

- Ascend at a normal rate and stop at the first decompression depth.
- Stay at the depth for the time required.
- Once the mandatory time at this stop has elapses, the computer will display the next shallower depth and time required.
- Perform all stops until the computer clears you to ascend to the surface.

8. What should you do if you become entangled underwater?

Do not struggle to free yourself. Figure out how to get untangled or carefully use your knife to cut the line away or get your buddy to help.

9. What is the emergency procedure for suspected decompression sickness?

- Move the afflicted diver out of danger.
- Activate the Emergency Medical System (EMS).
- Monitor life support signs (pulse and respiration) and provide CPR if necessary.
- Provide one hundred percent (100%) O2.
- Contact Divers Alert Network (DAN).

Appendix C
SDI/TDI Gas Laws Equations Worksheet

International Training

Leading the dive industry into the 21st century

SDI/TDI Gas Laws Equations Worksheet

The following abbreviations appear within the formulas on this document:

- "P" for Pressure
- "D" for Depth
- "T" for Temperature
- "V" for Volume
- "°C" for Degrees Celsius (or Centigrade)
- "°F" for Degrees Fahrenheit
- Subscript "1" for a Starting Value
- Subscript "2" for an Ending Value
- "msw" for Metres of Seawater
- "mfw" for Metres of Freshwater
- "fsw" for Feet of Seawater
- "ffw" for Feet of Freshwater

Buoyancy Calculations

Buoyancy Characteristics of an Object

Metric:
Buoyancy = weight of object - [(litres displaced) x (kg per litre of water)]

Imperial:
Buoyancy = weight of object - [(cu ft displaced) x (lbs per cu ft of water)]

Offsetting Negative Buoyancy

Metric:
litres required = [kg of negative buoyancy] / [kg per litre of water]

Imperial:
cu ft required = [lbs of negative buoyancy] / [lbs per cu ft of water]

Pressure and Depth Conversions

Gauge Pressure

psi to bar:
bar = psi / 14.7

bar to psi:
psi = bar x 14.7

Depth

Imperial to Metric:
metres = feet / 3.3

Metric to Imperial:
feet = metres x 3.3

Depth-to-Pressure (Seawater)

Metric:
P = [D / 10] + 1 or P = [D + 10] / 10

Imperial:
P = [D / 33] + 1 or P = [D + 33] / 33

Pressure-to-Depth (Seawater)

Metric:
D = [P - 1] x 10 or D = [P x 10] - 10

Imperial:
D = [P - 1] x 33 or D = [P x 33] - 33

Depth-to-Pressure (Freshwater)

Metric:
P = [D / 10.3] + 1 or P = [D + 10.3] /10.3

Imperial:
P = [D / 34] +1 or P = [D + 34] /34

Pressure-to-Depth (Freshwater)

Metric:
D = [P - 1] x 10.3 or D = [P x 10.3] -10.3

Imperial:
D = [P - 1] x 34 or D = [P x 34] - 34

Depth Seawater-to-Freshwater

Metric:
mfw = msw x 1.03

Imperial:
ffw = fsw x 1.03

Depth Freshwater-to-Seawater

Metric:
msw = mfw / 1.03

Imperial:
fsw = ffw / 1.03

International Training

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SDI/TDI Gas Laws Equations Worksheet

Pressure and Volume Calculations

Calculating Volume Following Change in Pressure

Metric and Imperial:

$$V2 = [P1 \times V1] / P2$$

Calculating Pressure Following Change in Volume

Metric and Imperial:

$$P2 = [P1 \times V1] / V2$$

Calculating Gas Consumption Time Based on Known Consumption at a Specific Depth

Metric and Imperial:

$$minutes2 = [P1 \times minutes1] / P2$$

Calculating Depth at which a Gas Supply will Last Based on Known Consumption at a Specific Depth

Metric and Imperial:

$$P2 = [P1 \times minutes1] / minutes2$$

Calculating Relative Change in Ambient Pressure

Metric and Imperial:

$$\text{relative change} = P2 / P1$$

Temperature, Volume and Pressure Calculations

Calculating Volume Following Change in Temperature

Metric:

$$V2 = (C2 + 273) \times [V1/(C1 + 273)]$$

Imperial:

$$V2 = (F2 + 460) \times [V1 / (F1 + 460)]$$

Calculating Pressure Following Change in Temperature

Metric:

$$bar2 = [(C2 + 273) \times [(bar1 + 1) / (C1 + 273)]] - 1$$

Imperial:

$$psi2 = [(F2 + 460) \times [(psi1 + 14.7) / (F1 + 460)]] - 14.7$$

Quick Estimates for Temperature and Pressure

Metric:

$$1°C = 0.6 \text{ bar}$$

Imperial:

$$1°F = 5 \text{ psi}$$

Combined Gas Law

Metric and Imperial:

$$(P1 \times V1) / T1 = (P2 \times V2) / T2$$

Ideal Gas Law

Metric and Imperial:

$$P \times V = (n \times R) \times T \text{ or } PV = nRT$$

Partial Pressure Calculations

Calculating PO2 and PN2

Metric and Imperial:

$$PO2 = P \times FO2 \text{ and } PN2 = P \times FN2$$

Calculating FO2 and FN2

Metric and Imperial:

$$FO2 = PO2 / P \text{ and } FN2 = PN2 / P$$

Calculating Max Depth of a Nitrox Mixture that does not Exceed a Specified PO2

Metric and Imperial:

$$P = PO2 / FO2$$

Equivalent Air Depth

Metric:

$$EAD = [(FN2 / 0.79) \times (D + 10)] - 10$$

Imperial:

$$EAD = [(FN2 / 0.79) \times (D + 33)] - 33$$